

Instruction Manual

DS-2000 Series

Reflecting and Refracting Telescopes

AutoStar® — LNT™ — SmartFinder™



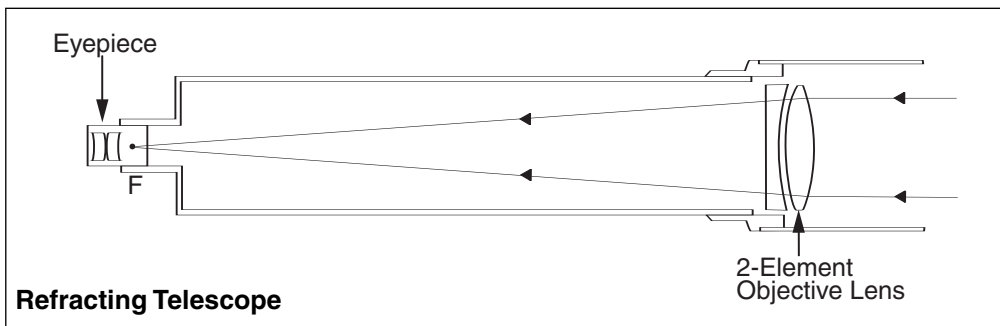
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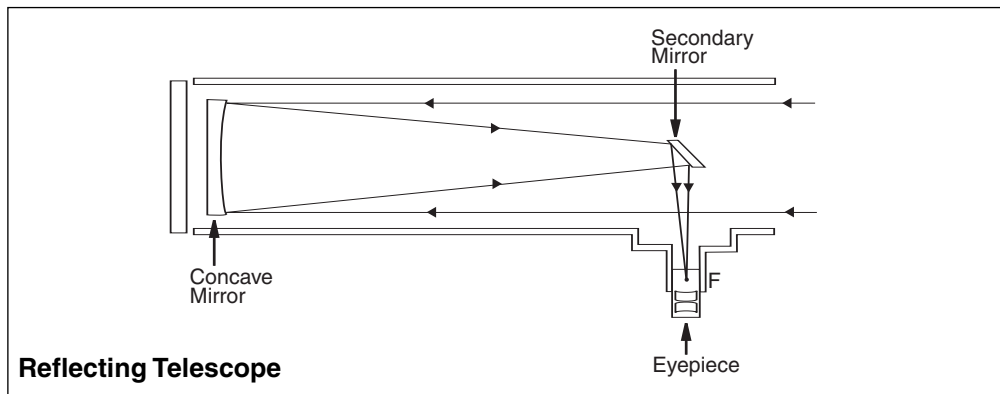
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Refracting Telescopes use a large objective lens as their primary light-collecting element. Meade refractors, in all models and apertures, include achromatic (2-element) objective lenses in order to reduce or virtually eliminate the false color (chromatic aberration) that results in the telescopic image when light passes through a lens.

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.



In the refracting telescope, light is collected by a 2-element objective lens and brought to a focus at F.



In contrast, the reflecting telescope uses a concave mirror for this purpose.



WARNING!

Never use a Meade® 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 Astro Telescope for the first time, before a thorough reading of this instruction manual, see the QUICK-START GUIDE on page 4.

IMPORTANT NOTE:

DS-2000EC users, see APPENDIX E, page 41, for information about your supplied Electronic Controller. Autostar information does not apply.
DS-2000EC users may obtain the #494 Autostar handbox as an optional accessory. See page 42 for more information.

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Patents:
 US 6,392,799
 Other Patent Pending

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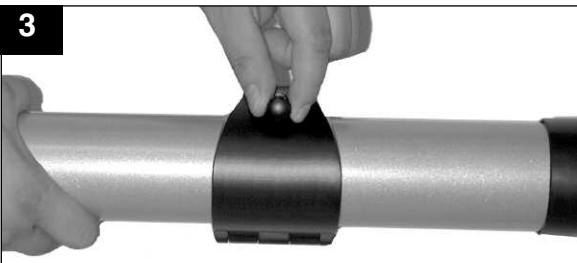
QUICK-START GUIDE



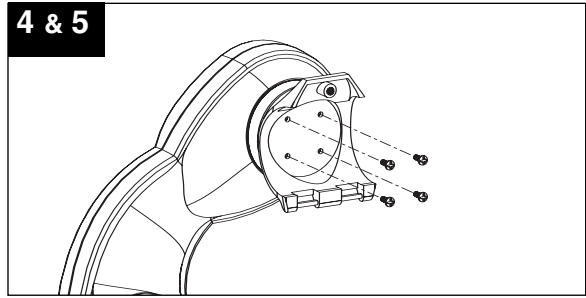
1. **Open the tripod:** Remove the tripod from the gift-box and stand vertically. Gently pull the legs apart to a fully open position. Turn the center tripod lock knob to secure and stabilize the tripod. Tighten to a firm feel. **Caution: Make sure you loosen the tripod lock knob before collapsing the tripod at the end of your viewing session.**



2. **Attach the mounting arm assembly:** Place the mounting arm assembly into the tripod base. Reach underneath and thread the mounting knob through the tripod base and into the mounting arm assembly. Tighten to a firm feel only, do not overtighten. While observing, you may wish to slightly loosen this knob and rotate the mounting arm assembly with attached optical tube (see step #6 below) around the horizontal axis.



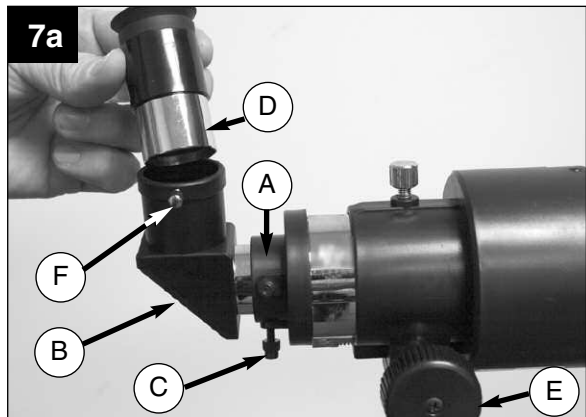
3. **Remove the optical tube assembly from the cradle rings:** The optical tube assembly is shipped with the cradle rings attached. The rings need to be removed so they can be attached to the mounting arm. Loosen the cradle lock knob until you can open the cradle rings. Remove the optical tube assembly from the cradle rings.

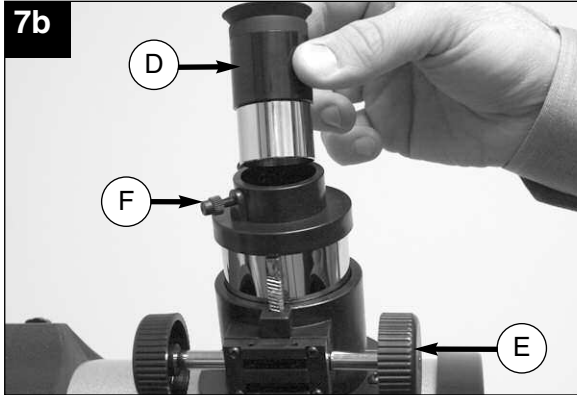


4. **Remove 4 screws from the mounting arm shaft:** Locate the four screws on the mounting shaft. Remove the screws using a "+" (Phillips head) screwdriver.
5. **Attach the cradle to the mounting arm:** Line up the cradle with the mounting arm shaft. The cradle contains a molded "key" that fits into a slot on the shaft. Line up the key and the slot, and slide the cradle onto the shaft. This automatically lines up the mating threads on the cradle with the ones on the shaft. Replace the four screws you removed in step #4 into the mating threads as depicted in the diagram above.



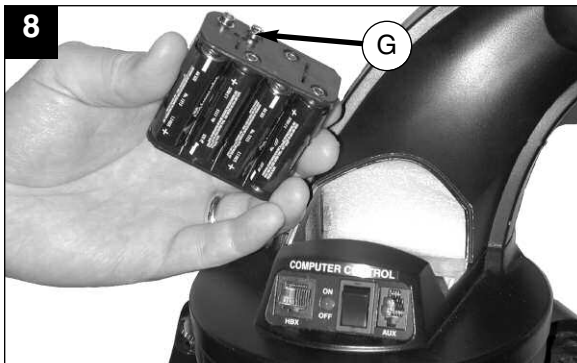
6. **Attach and balance the optical tube:** Replace the optical tube into the cradle ring. Tighten the cradle rings lock knob so that it holds the optical tube loosely; do not tighten the cradle ring lock knob at this point. Slide the tube back and forth until you find a position where the tube remains horizontal (i.e., without tipping up and down). Tighten the cradle rings lock knob to a firm feel.





7a. **Attach the 90° diagonal prism** (*refractor models only, see inside front cover*): Pull out to remove the plastic dust cover from the eyepiece holder (A). Slide the tube of the diagonal prism (B) into the telescope's eyepiece-holder and tighten the thumbscrews (C) to a firm feel only to secure.

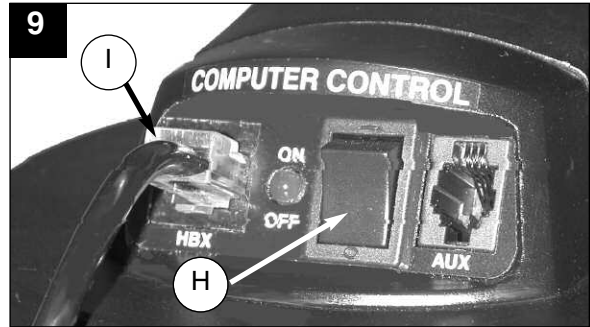
7b. **Insert the eyepiece:** Remove the supplied 25mm or 26mm eyepiece (D) from its container and place it in the diagonal prism (*refractor models only, see Fig. 7a*) or directly into the eyepiece holder (*reflector models only, see Fig. 7b*). Tighten the thumbscrews (F) to a firm feel only. Remove the dust cover from the end of optical tube assembly. Use the focus knobs (E) to bring objects into focus.



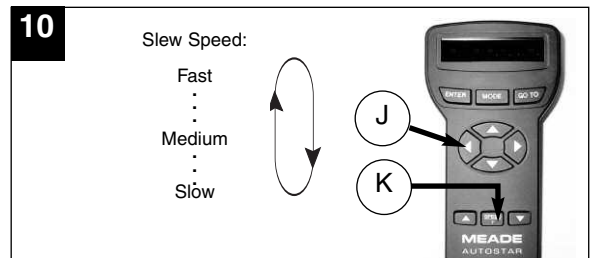
8. **Insert batteries:** Open the battery compartment by lifting the cover and pulling it away from the drive base.

Remove the battery holder from the compartment and carefully lift the 9v connector out from the compartment. Whenever you replace the batteries, to safeguard the wires, disconnect the 9v connector (G) from the battery holder before removing the batteries.

Insert eight AA-size batteries into the battery holder, oriented as shown on the diagram on the battery slots of the battery holder. Connect the 9v connector plug to the battery holder. Carefully replace the battery holder back into the battery compartment. Replace the cover.



9. **Connect Autostar:** Be certain that the power switch (H) on the computer control panel is in the OFF position. Plug the coil cord of the Autostar Controller into the HBX port (I). Turn on the computer panel; the red LED lights when power is supplied to the panel.



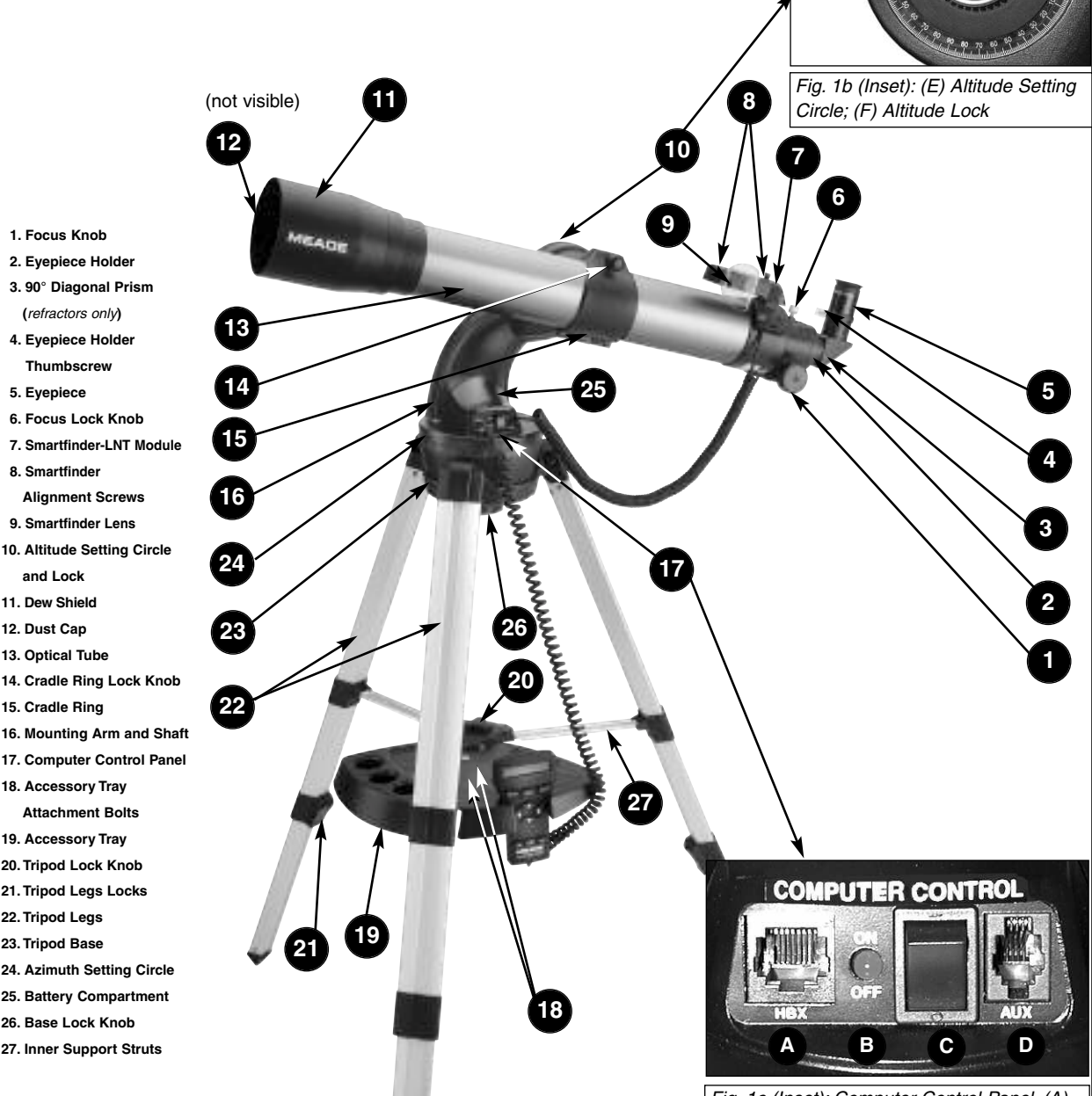
10. **Change Speeds:** Press the key prompted by Autostar to accept the Sun warning. You can now use the Arrow keys (J) to move the telescope up, down, right, or left. To change one of the telescope's nine slew speeds, briefly press the SPEED/? key (K). Each press decreases the slew speed down one level, and then will cycle back to the fastest speed.



11. **Sight along the tube:** Sight along the side of the telescope's main tube to locate an object. Practice using the Autostar Arrow keys to center an object in the telescope's field of view.

If you wish to attach Smartfinder, see page 11.
If you wish to initialize Autostar, see page 17.
If you wish to align the telescope, go to page 18.
If you wish to use Autostar to view Saturn, go to page 19.

Features of the DS-2000 Series telescopes are virtually identical. Certain features of your telescope may look different than, or be positioned slightly different than the one pictured here, but the functionality of the features is the same.



- 1. Focus Knob
- 2. Eyepiece Holder
- 3. 90° Diagonal Prism
(refractors only)
- 4. Eyepiece Holder
Thumbscrew
- 5. Eyepiece
- 6. Focus Lock Knob
- 7. Smartfinder-LNT Module
- 8. Smartfinder
Alignment Screws
- 9. Smartfinder Lens
- 10. Altitude Setting Circle
and Lock
- 11. Dew Shield
- 12. Dust Cap
- 13. Optical Tube
- 14. Cradle Ring Lock Knob
- 15. Cradle Ring
- 16. Mounting Arm and Shaft
- 17. Computer Control Panel
- 18. Accessory Tray
Attachment Bolts
- 19. Accessory Tray
- 20. Tripod Lock Knob
- 21. Tripod Legs Locks
- 22. Tripod Legs
- 23. Tripod Base
- 24. Azimuth Setting Circle
- 25. Battery Compartment
- 26. Base Lock Knob
- 27. Inner Support Struts

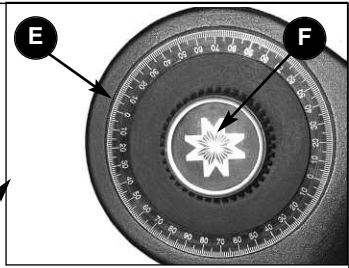


Fig. 1b (Inset): (E) Altitude Setting Circle; (F) Altitude Lock

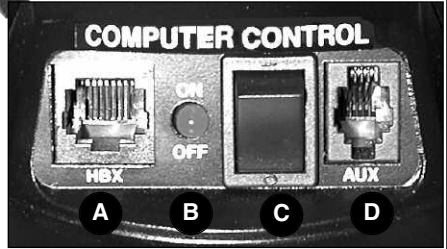


Fig. 1c (Inset): Computer Control Panel. (A)

Fig. 1: DS-2000 Series Telescope.

TELESCOPE FEATURES

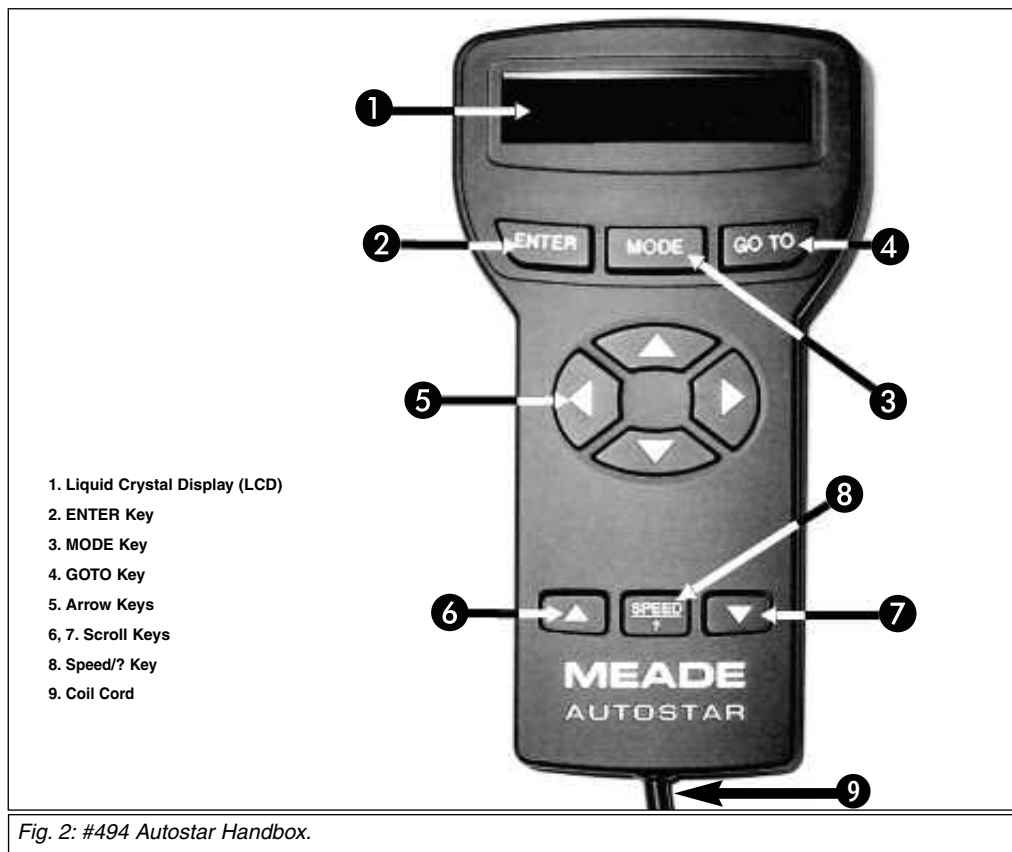
Take the time to become acquainted with all of these controls before attempting observations through the telescope.

- 1 **Focus Knob:** Moves the telescope's focus drawtube in a finely-controlled motion to achieve precise image focus. Rotate the focus knob clockwise to focus on distant objects, and counterclockwise to focus on nearby objects.
- 2 **Eyepiece Holder:** Holds the eyepiece in place. On refractor models, also holds the 90° diagonal prism in place.
- 3 **90° Diagonal Prism (refractor models only):** Holds the eyepiece upright for easy viewing. Results in an upright, but reversed viewing of land objects.
- 4 **Eyepiece Holder Thumbscrew:** Tightens the eyepiece in place. Tighten to a firm feel only.
- 5 **Eyepiece:** Place the supplied eyepiece into the eyepiece holder (*reflector models only*) or the 90° Diagonal Prism (*refractor models only*, **3, Fig. 1**) and tighten in place with thumb-screw (**4, Fig.1**).
- 6 **Focus Lock Knob:** Designed to prevent the focuser drawtube from moving when a heavy accessory, such as a camera, is attached to the focuser assembly. For normal observing with an eyepiece and diagonal prism, it is not necessary to use the lock knob.
- 7 **Smartfinder - LNT Module:** Provides an easier way to initially sight objects than the main telescope eyepiece which has a narrower field of view. You may blink the red dot off and on. See pages 12-13.
- 8 **Smartfinder Alignment Screws:** Adjust these screws to align the Smartfinder. See page 13 for more information.
- 9 **Smartfinder Lens:** The red dot is projected onto this lens.
- 10 **Altitude Setting Circle and Lock**
 - A) **Altitude Setting Circle:** Displays Altitude (vertical) coordinates (**A, Fig. 1b**).
 - B) **Altitude Lock:** Controls the manual vertical movement of the telescope. Turning the Altitude lock counterclockwise unlocks the telescope enabling it to be freely tilted by hand on the vertical axis. Turning the Altitude lock clockwise (to a firm feel only) prevents the telescope from being moved manually and engages the vertical motor drive clutch for Autostar operation (**B, Fig. 1b**).
- 11 **Dew Shield:** Reduces dew formation on the telescope's primary lens (refractor models only).
- 12 **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 before replacing the dust cap.
- 13 **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.
- 14 **Cradle Ring Lock Knob:** Tighten to a firm feel to hold the optical tube securely in place.
- 15 **Cradle Ring:** Holds optical tube in place. Attaches to the mounting arm shaft (**16, Fig. 1**)
- 16 **Mounting Arm and Shaft:** Holds the optical tube assembly. Attaches to the tripod base (**23, Fig. 1**).
- 17 **Computer Control Panel (Fig. 1c)**
 - A. **Handbox (HBX) Port:** Plug the #494 Autostar handbox (AT models) or the Electronic Controller (EC models) into this port.
 - B. **LED:** The red power indicator light illuminates when power is supplied to the connected handbox and to the telescope's motor drive.
 - C. **ON Switch:** Press to turn the Computer Control Panel and Autostar ON or OFF.

Note: Always remove the batteries if they are not to be used for a long period of time.
 - D. **Auxiliary (AUX) Port:** Provides connection for current and future Meade accessories. See **OPTIONAL ACCESSORIES**, page 29.

- 18 **Accessory Tray Attachment Bolts** - Attach to wing nuts to fasten tray to the tripod. See page 11 for more information.
Note: It is not necessary to remove the tray each time you collapse the tripod. The tray is designed to be collapsed with the legs.
- 19 **Accessory Tray** - Conveniently holds extra eyepieces, Autostar handbox, and other accessories.
- 20 **Tripod Lock Knob** - Tighten to a firm feel to secure tripod legs.
Caution: Loosen the tripod lock knob before collapsing tripod at the end of a viewing session.
- 21 **Tripod Legs Locks (3)** - Lift the lock up to loosen inner section of a tripod leg and extend the inner leg to desired height. Press the lock down to lock the leg in place.
- 22 **Tripod Legs** - Spread the legs out as far as they will open for a secure viewing platform.
- 23 **Tripod Base** - Holds the mounting arm assembly (16, Fig. 1) in place.
- 24 **Azimuth Setting Circle** - Displays Azimuth (horizontal) coordinates.
- 25 **Battery Compartment** - Install eight user-supplied AA batteries in this compartment. See page 12 for more information.
- 26 **Base Lock Knob (not visible in photo)** - Attaches mounting arm assembly to tripod base. Loosen before moving the optical tube on the horizontal axis. See page 11 for more information.
- 27 **Inner Support Struts (3)** - Make the tripod more secure and stable.



AUTOSTAR FEATURES

NOTE:
DS-2000EC users,
see **APPENDIX E,**
page 39, for informa-
tion about your sup-
plied Electronic
Controller. Autostar
information does not
apply.

DS-2000EC users
may obtain the #494
Autostar handbook as
an optional accesso-
ry. See page 42 for
more information.

The #494 Autostar controls the DS-2000AT Series Telescopes. Nearly all telescope operations are accomplished 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.

The Autostar Computer Controller provides control of virtually every telescope operation. Autostar has soft-touch keys designed to have a positive feel. The LCD (Liquid Crystal Display) is backlit with a red LED (Light Emitting Diode) for easy viewing in the dark. The backlit display, key arrangement, and sequential database make Autostar extremely user friendly.

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

1 2-Line LCD Display - Provides an visual interface between Autostar and the telescope.

- **Top line:** Displays a menu.
- **Bottom line:** Displays a menu option or information about an object or subject, depending on what operation is being performed.

2 ENTER Key - Selects a choice or accesses the next menu or level. This is similar to a Return key on a computer. See **MOVING THROUGH AUTOSTAR'S MENUS,** page 16 and **MENUS AND MENU OPTIONS,** page 22.

NOTE: If ENTER is pressed and held for two seconds or more and then released, Autostar emits a beep and "ENTER to Sync" is displayed. "ENTER to Sync" can only be used after the telescope has been aligned and is pointing at an object. If the "ENTER to Sync" feature is accessed by mistake, press MODE to return to the previous screen. See **HIGH PRECISION,** page 27, for more details about this feature.

3 MODE Key - Returns to the previous menu or level. The MODE key is similar to the ESCAPE key on a computer.

NOTE: Pressing MODE while in the "Select Item" level moves Autostar to the topmost screen: "Select Item: Object."

NOTE: If MODE is pressed and held for two seconds or more, the following information displays :

- Azimuth and Altitude
(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 - Slews (moves) the telescope to a selected object. While the



DS-2000 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 see examples of their art, but you may even be able to pick up some "tricks of the trade" to try out on your DS-2000 telescope.

Many groups also hold regularly scheduled Star Parties at which you can check out and observe with many different telescopes and 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.

DEFINITION:

Throughout this manual, you will notice the term "Alt/Az." Alt/Az (short for **altazimuth**) just means that your telescope moves up and down and from side to side. Alt/Az is one of many methods used by amateur astronomers to locate celestial objects.

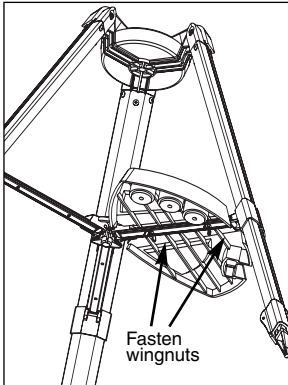


Fig. 3 Attach Tray to the tripod: Thread the wingnuts to the bolts (bottom view).



Fig. 4: Secure the tripod: turn the tripod lock knob.



Fig. 5: Attach the mounting arm to the tripod base.

telescope is slewing, the operation may be aborted at any time by pressing any key except GO TO. Pressing GO TO again resumes the slew to the object.

The GO TO key also allows you to perform a "spiral search." A spiral search is useful during alignment after the telescope slews to an alignment star, but the star is not visible in the eyepiece when the telescope finishes its search. 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 Arrow Keys - Move the telescope in a specific direction (up, down, left, and right), at any one of nine different speeds. Speed selection is explained in **SLEW SPEEDS**, page 15. The following operations are also available with the Arrow keys:

- **Data Entry** - Use the Up and Down Arrow keys 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 are used to move the cursor left and right across the LCD display.
- **Alt/Az Alignment** - Use the Up and Down Arrow keys to move the telescope vertically up and down. The Left Arrow key moves the telescope horizontally counterclockwise, while the Right Arrow key moves it clockwise.

6, 7 Scroll Keys - Allows you to scroll through menu options. The menu is displayed on the top line of the screen and the options within the menu are displayed, one at a time, on the second line. Press and hold a Scroll key to move quickly through the options.

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

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.

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.

8 Speed/? Key - Pressing the Speed/? key cycles through the nine slew speeds that move the telescope. Each time the Speed/? key is pressed briefly, the current slew speed is shown for about two seconds on the display. See **SLEW SPEEDS**, page 15.

The Speed/? key also accesses the "Help" file. "Help" provides on-screen information on how to accomplish 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 (not shown) - Plug the Autostar coil cord into the HBX port (**A, Fig. 1c**) of the telescope computer control panel.

GETTING STARTED

Packing List

Getting the telescope ready for first observations 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 in this configuration moves up and down and from side to side.

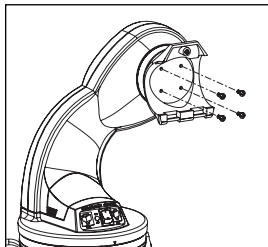


Fig. 6: Attach cradle to mounting arm.



Fig. 7: Attach and balance the optical tube.



Fig. 8a: Attach Smartfinder to the reflector optical tube assembly.



Fig. 8b: Attach Smartfinder to the reflector optical tube assembly.

1. **Open the tripod:** After removing the field tripod from its shipping carton, stand the tripod vertically, with the tripod feet down and with the tripod still fully collapsed. Gently pull the legs apart to a fully open position.
2. **Attach the tray to the tripod:** Place the tray (19, Fig. 1) over the inner support strut that contains two bolt holes. Line up the bolts holes on the tray with the bolt holes on the strut. Slide the two included bolts through the top of bolt holes (18, Fig. 1) and tighten the bolts with the included wing nuts on the bottom side of the tray (Fig. 3). Tighten to a firm feel only.

Note: The tray does not have to be removed when you collapse the tripod at the end of a viewing session— just loosen the tray’s center lock knob.

3. **Secure the tripod:** Turn the center tripod lock knob (Fig. 4) to help stabilize and secure the tripod.

Caution: Make sure that you loosen the tripod lock knob before collapsing the tripod.

4. **Attach the mounting arm assembly to the tripod base:** There are three pads in the tripod base (23, Fig. 1) and three pads on the mounting arm assembly (16, Fig. 1). These pads allow the mounting arm assembly to move more easily inside the base.

Place the mounting arm assembly into the tripod base and continue to hold onto the arm assembly. With your other hand, reach underneath the base and thread the mounting lock knob (26, Fig. 1) through the tripod base and into the mounting arm assembly base. Tighten to a firm feel only; do not overtighten. While observing, you may wish to loosen this knob and rotate the mounting arm assembly and optical tube (see step #8) on the horizontal axis.

5. **Remove the optical tube assembly from the cradle rings:** The optical tube assembly is shipped with the cradle rings attached. The rings need to be removed before they can be attached to the mounting arm. Loosen the cradle lock knob (14, Fig. 1) until you can open the cradle rings. Remove the optical tube assembly (13, Fig. 1) from the cradle rings.
6. **Remove 4 screws from the mounting arm shaft:** Locate the four screws on the mounting shaft. Remove the screws using a “+” (Phillips head) screwdriver. Set the screws aside.
7. **Attach the cradle to the mounting arm:** Line up the cradle with the mounting arm shaft. The cradle contains a molded “key” that fits into a slot on the shaft. Line up the key and the slot, and slide the cradle onto the shaft. This automatically lines up the mating threads on the cradle with the ones on the shaft. Replace the four screws into the mating threads using the Phillips head screwdriver (Fig. 6). The key and slot on the shaft set limit stops for the telescope so that it doesn’t strike the base or pass beyond approximately 90° upright when you use the Autostar handbox.
8. **Attach and balance the optical tube:** Replace the optical tube into the cradle ring. Tighten the cradle ring lock knob so that it holds the optical tube loosely; do not tighten the cradle ring lock knob at this point. Slide the tube back and forth until you find a position where the tube remains horizontal (i.e., without slightly tipping up or down). Tighten the cradle rings lock knob to a firm feel. See Fig. 7. Adjust the length of the tripod legs to a comfortable viewing height using the leg locks (21, Fig. 1).
9. **Attach Smartfinder:** Using a Phillips head screwdriver, thread the two attachment screws in the bracket into the mating threads located on the optical tube. See Figs. 8a and 8b.

The lens for the SmartFinder is shipped with a protective film to protect the lens coating. Do not remove this film until Step d) of this procedure.

- a) First peel back the film from just the “tongue” of the SmartFinder lens.

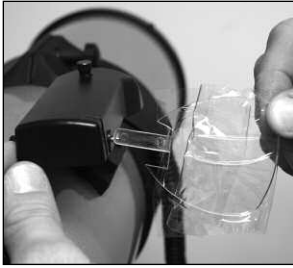


Fig. 9: Attach Smartfinder lens; slide "tongue" into slot.

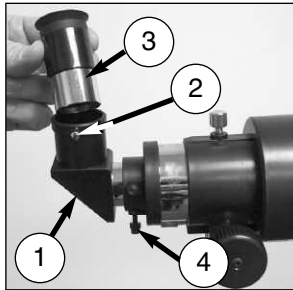


Fig. 10: Attach the diagonal prism (1), tighten prism thumbscrews (2), insert the eyepiece (3), tighten eyepiece thumbscrews (4) (Reflector models).

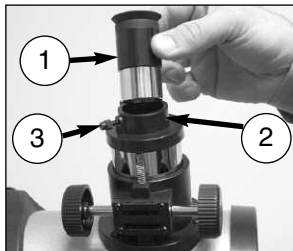


Fig. 11: Insert the eyepiece (1) into the eyepiece holder (2), tighten eyepiece thumbscrew (3) (Reflector models).

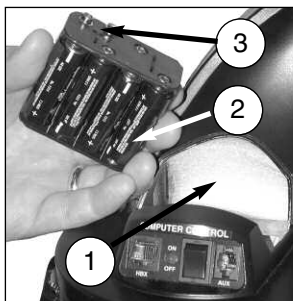


Fig. 12: Insert eight AA-size batteries inside the battery compartment:
(1) Battery compartment
(2) Battery holder
(3) 9v connector

- b). Insert the tongue into the SmartFinder slot. Angle the tongue towards the front of the LNT module as you slide it into place. See **Fig. 9**.
 - c) You may need to wiggle the lens/tongue a bit to slide the tongue into place. You will hear it "click" in place. For a view of the underside of the LNT. Notice that the tongue has slid in over the small plastic molded post.
 - d) Remove the remainder of the plastic film from the lens, but avoid touching the lens as you do so—you may scratch the lens or leave fingerprints.
10. **Attach the 90° diagonal prism (refractor models only):** Pull out to remove the plastic dust cover from the eyepiece holder. Slide the tube of the diagonal prism (**3, Fig. 1**) into the telescope's eyepiece-holder (**2, Fig. 1**) and tighten the thumbscrews (to a firm feel only) to secure the diagonal prism in place.

11. **Insert the eyepiece:** Remove the supplied eyepiece (**3, Fig. 10**) from its container and place it in the diagonal prism (*refractor models only; 1, Fig. 10*) or directly into the eyepiece holder (**2, Fig. 11, reflector models only**). Tighten the thumbscrews (**2 and 4, Fig. 10, refractor models only**) to a firm feel only. Tighten the thumbscrew (**3, Fig. 11, reflector models only**) to a firm feel only.
12. **Insert batteries:** The telescope's battery compartment (**1, Fig. 12**) is located on top of the drive base. Open the battery compartment by lifting the cover and pulling it away from the drive base.

Remove the battery holder from the compartment and carefully lift the 9v connector out from the compartment. Take care not to accidentally detach the wires of the battery connector from the base. Whenever you replace the batteries, to safeguard the wires, disconnect the 9v connector from the battery holder before removing the batteries.

Insert eight AA-size batteries into the battery holder, oriented as shown on the diagram on the battery slots of the battery holder. Connect the 9v connector plug to the battery holder. Carefully replace the battery holder back into the battery compartment. Replace the cover.

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.

14. **Connect Autostar and Smartfinder:** Be certain that the power switch on the computer control panel (**C, Fig. 1c**) is in the OFF position. Plug the coil cord of the Autostar Controller into the HBX port (**A, Fig. 1c**). Plug the coil cord of the Smartfinder into the AUX port (**D, Fig. 1c**). Turn on the power switch; the red LED lights when power is supplied to the panel. Also see **Fig. 13**.

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

15. **Remove the dust cover:** Pull out the dust cover (**12, Fig. 1**) from the optical tube assembly (**13, Fig. 1**).

Assembly of the basic telescope is now complete.

Using SmartFinder

As with most astronomical telescopes, an eyepiece presents a narrow field of view to the observer. As a result it is sometimes difficult to locate objects just using your eyepiece. The SmartFinder has a projected red dot that helps you to locate objects as you move your telescope.

To turn on SmartFinder's red dot (continuous, without blinking):

1. Press and hold MODE for two seconds. R.A and Dec. coordinates display.
2. Keep pressing the Scroll Down key until "Finder Set: Set" displays.
3. Press ENTER. "Finder Set: Intensity" displays.



Fig. 13: Connect Autostar to the HBX port and Smartfinder to AUX port.

4. Press the Scroll Down key. "Finder: Blink On" displays.
5. Press ENTER. A time value, in seconds, displays. For example, "00.5" may display. "00.5" is the amount of time, in seconds, that the red dot will blink "on." (For this example, you may select or enter any value except "00.0.") Press ENTER.
6. Press the Scroll Down key. "Finder: Blink Off" displays.
7. Press ENTER. Use the Number keys to enter "00.0" or press the Scroll Down key until "00.0" displays. "00.0" is the amount of time in seconds that the red dot will remain "off." This value, along with the value you chose in the "Finder: Blink On" menu, allows the red dot to remain on without blinking. "00.0" means there is no "off" time, so the dot will remain on continuously, without blinking.
8. Use these menus to set other blink rates. For example, If you select "00.1" in the Blink Off menu, and "00.2" in the Blink On menu, the red dot will blink on for .2 seconds and then blink off for .1 second, and then repeat the cycle until you change the values again.
9. Press and hold MODE to exit this function.

Aligning Smartfinder

Because the main telescope has a fairly narrow field of view, locating objects directly in the main telescope can sometimes be difficult. Smartfinder (7, Fig. 1) projects a small red dot that permits you to more easily locate objects. When Smartfinder 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 in the eyepiece of the main telescope.

To align Smartfinder:

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

1. Loosen the tripod base lock knob (26, Fig. 1) and the Altitude lock (10, Fig. 1), so that the telescope can move freely.
2. If you have not already done so, place a low-power (e.g., 25mm) eyepiece in the diagonal prism of the main telescope (3, Fig. 1) and point the telescope at an easy-to-find land object (e.g., the top of a telephone pole or sign). Turn the focuser knob (1, Fig. 1) to focus the image in the eyepiece. Center the object precisely.
3. Re-tighten the tripod base lock knob (26, Fig. 1) and the Altitude lock (10, Fig. 1) so that the telescope does not move during the procedure.
4. Looking through Smartfinder. Turn the Smartfinder's two alignment screws (8, Fig. 1) until Smartfinder's red dot points precisely at the same object as centered in the eyepiece. Smartfinder is now aligned to the main telescope.
5. Check this alignment on a celestial object, such as the Moon or a bright star, and make any necessary refinements.



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. 15: 25mm and 9mm eyepieces.

DS-2000 TIPS

Too Much Power?

Can you ever have too much power? If you're referring to eyepiece power (magnification), yes, you can! The most common beginner's mistake is to "overpower" a telescope by using too high of a magnification, 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-2000 telescopes. See "OPTIONAL ACCESSORIES," page 29.

Fig. 14a & 14b: Jupiter; example of too much magnification.

Important Note: When you look through your telescope's eyepiece, the image might look strange at first.

If you have a **refracting telescope**, objects will appear right-side-up, but reversed left-for-right. This will not make a difference when observing astronomical objects, and in fact, all astronomical telescopes present inverted images.

During terrestrial observing, when a corrected image (right-side up and correct left-for-right) is desirable, an optional Meade 45° Erecting Prism is available. See the **OPTIONAL ACCESSORIES**, page 29, or consult the Meade Telescope Catalog.

No means of correcting the image is available for **reflecting telescopes**—the image will appear upside down and reversed left-for-right.

Choosing an Eyepiece

A telescope's eyepiece magnifies the light gathered by the optical tube. 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 or 26mm eyepiece which gives a wide, comfortable field of view with high image resolution. Always begin your observations with this eyepiece.

Low power eyepieces offer a wide field of view, bright, high-contrast images, and eye relief during long observing sessions. After an object is located and centered in the eyepiece, try switching to a higher power eyepiece to enlarge the image.

NOTE: Viewing conditions vary from night-to-night and from site-to-site. Turbulence in the air, even on an apparently clear night, can distort images. If an image appears fuzzy and ill-defined, return 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 with the DS-2000 model DS-2114S. Look up the focal length of the DS-2114S under **SPECIFICATIONS: DS-2114S, page 33**. The focal length is listed as 1000mm.

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

$$1000 \div 25 = 40$$

The eyepiece power, or magnification is therefore 40X (approximately).

The Barlow Lens

Some Meade telescopes include a power multiplier called a Barlow lens. Consisting of a lens mounted in a 4"-long (10cm) tube, the Barlow doubles or triples the power obtained when an eyepiece is used alone. In the example above, a 25mm eyepiece results in 40X magnification with the DS-2114S telescope; when this same eyepiece is used in conjunction with a 2x Barlow lens, power is doubled to 80X. To use the Barlow, insert it into the diagonal prism (*refractor models only*) or eyepiece holder, followed by the eyepiece.

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 tripod base lock knob (**26, Fig. 1**) and Altitude lock (**6, Fig. 1**), so that the telescope can move freely.
2. Point your telescope at distant street signs, mountains, trees, and other structures. Use Smartfinder to help site-in on an object.
3. Center the object using Smartfinder and then in the telescope eyepiece. When the object is centered in your eyepiece, re-tighten the base and Altitude 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 **TO TRACK AN OBJECT AUTOMATICALLY**, page 18), or by using Autostar's GO TO capabilities (see **GO TO SATURN**, page 19).

NOTE:

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

Terrestrial Observing

DS-2000 refracting telescopes are excellent high-resolution, terrestrial (land) telescopes (reflecting telescopes are designed primarily for astronomical observations). 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 Altitude lock (**10, Fig. 1**) and tripod base lock knob (**26, Fig. 1**).
2. Make sure the telescope power switch is in the OFF position. Plug Autostar into the HBX port of the Control Panel.
3. Flip the telescope power switch to the ON position.
Autostar 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.
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. Each time you press this key, the speed will change. See **SLEW SPEEDS**, page 15, for more information.
7. Use the red dot viewfinder (**7, 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 (this is the speed at which stars move) and have been calculated to accomplish specific functions. Pressing the SPEED/? key changes the slew speed, which is then 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)

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.

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.

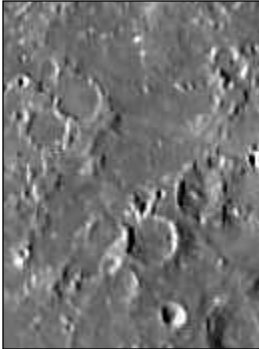


Fig. 16: The Moon is an excellent object for beginners to observe.

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.

To Track 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 setup your telescope to move at the sidereal rate so that it automatically "tracks" the stars and other objects in the night sky. In other words, 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 track objects, you must first initialize Autostar and then 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.

Moving Through Autostar's Menus

Autostar's menus are organized 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 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.



DS-2000 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.

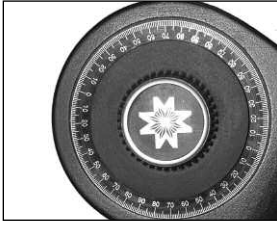


Fig. 17: Altitude lock and setting circle.

DEFINITION:

Initialization is a procedure that ensures that Autostar operates correctly. When you first use Autostar, it doesn't yet know where the observation location site is .

Time and Date information is set at the factory (and do not need to be entered by the observer). This information is held by a long-life battery. See **APPENDIX E**, page 39, for more information.

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

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 28).

1. **Tighten Locks:** Tighten the Altitude lock (**10, Fig. 1**) and tripod base lock knob (**26, Fig. 1**).
2. **Plug in Autostar:** Make sure the telescope power switch is in the OFF position. Plug Autostar into the HBX port of the Control Panel.
3. **Turn on Autostar:** Flip the telescope power switch to the ON position.
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. **Bypass Getting Started:** The Getting Started menu displays a scrolling message. Press ENTER (**2, Fig. 2**) to bypass the Help tutorial.
6. **Daylight Savings Time:** The next screen requests the status of Daylight Savings Time. Press one of the Scroll keys to toggle between the YES/NO settings. When the desired setting displays, press ENTER.

***NOTE:** When multiple choices are available within a menu option, the current option is usually displayed first and highlighted by a right pointing Arrow (>).*
7. **Set Your Location or Zip Code:** The Location screen displays. This screen asks you if you wish to choose either the zip code of your observing location or the location (*i.e.*, entering the city and state or country of your observing location). Press Up to select the zip code option or down to enter the city and state.

***Note:** The location settings (country/state/province and city, or zip code) are only asked for the first time you turn on the control panel. If you wish to change this setting later on, use the Site menu. See **SITE**, page 28, for more information.*

 - a. If you chose the zip code option, the leftmost "0" is highlighted. Use the Scroll keys to scroll through the digits. When you reach the desired number, use the Right Arrow key to move to the next digit position. Repeat this process until all 5 digits of your zip code are entered. Press ENTER.
 - b. If you chose the location option, the next screen asks for the country or state/province (listed alphabetically) of the observing site. Use the Scroll keys to scroll through the list of countries, states, and provinces. Press ENTER when the correct location displays. The next screen asks for the city (listed alphabetically) closest to the observing site. Use the Scroll keys to scroll through the list of cities. Press ENTER when the correct city appears on screen.
8. AutoStar then requests the telescope model number. Use the Scroll keys to cycle through the database of models. Press ENTER when your model number displays.
9. **System initialization is complete.** The Easy Alignment feature begins automatically after the control panel is initialized.

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.

1. **Set in Home Position:** Level the optical tube and point it North. Make sure that the Altitude Lock (**9, Fig. 1**) and tripod base lock knob (**26, Fig. 1**) are secured as described previously.
2. **Plug in Autostar:** Make sure the telescope power switch is in the OFF position. Plug Autostar into the HBX port of the Control Panel.
3. **Turn on Autostar:** Flip the telescope power switch to the ON position.
4. **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.
5. **Select Daylight Savings:** Set Daylight Savings, if prompted.
6. **Select Setup: Align Option:** Press MODE (**2, Fig. 2**). "Setup: Align" displays.

IMPORTANT NOTE:

Autostar requests the Zip Code or 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 pages 26 and 27 for more information.

IMPORTANT NOTE:

While performing the automatic tracking procedure, only use the Arrow keys to move the telescope. Once the telescope has been set in the Alt/Az home position, do not loosen the telescope locks (10 and 26, Fig. 1), or move the base manually, or alignment will be lost.

7. **Select Setup: Targets Option:** Press the Scroll Down key repeatedly until "Setup: Targets" displays. Press ENTER (2, Fig. 2).
8. **Select Targets: Astronomical Option:** "Targets: Terrestrial" displays. Press either of the Scroll keys once (6 or 7, Fig. 2). "Targets: Astronomical" now displays.
9. **Locate a Bright Star:** Use the Arrow keys (5, Fig. 2) to locate a bright star in the night sky. Use Smartfinder (15, Fig. 1) to help line up on the star. You may choose any unobstructed, bright star for the purposes of this example. Use Autostar's Arrow keys to center the star in the eyepiece.
10. **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.
11. **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.

Automatic Alignment

The fastest and easiest way to locate objects with Autostar's GO TO capabilities is to use Automatic Alignment.

Autostar automatically picks two stars from its database for the Automatic Alignment 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 17, has been performed. See **MOVING THROUGH AUTOSTAR'S MENUS**, page 16, if you wish to learn how to operate Autostar's keys.

How to Automatically Align the Telescope

If you have just applied power to Autostar, perform steps 1 through 3. If you have already performed the initialization procedure, go to step 4.

1. **Sun Warning:** Press the key prompted by Autostar to accept.
2. **Getting Started:** Press ENTER to continue.
3. **Daylight Savings:** Select "Yes" or "No," then press ENTER.
4. **Alignment Option Screen:** "Setup: Align" displays. Press ENTER.
5. **Select Alignment :** "Align: Automatic" displays. Press ENTER.
6. **Autostar Detects North and Level:** When you press Enter, Autostar calculates North and where level is for the telescope. While it is calculating, it displays "Calc North" and "Calc Level." While it is calculating, it does not necessarily move to point North or actually level the telescope—it is just detecting where these positions are. When it is finished calculating, "Searching..." displays as it begins Star Alignment.
7. **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.

Three other methods of alignment are available to the observer: Easy, Two-Star and One-Star. These methods are included in case the observer prefers to pick out his or her own alignment stars. See page 25 for more information.

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 telescope locks (**10 and 26, 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 visible all the time 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 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.

BASIC AUTOSTAR OPERATION

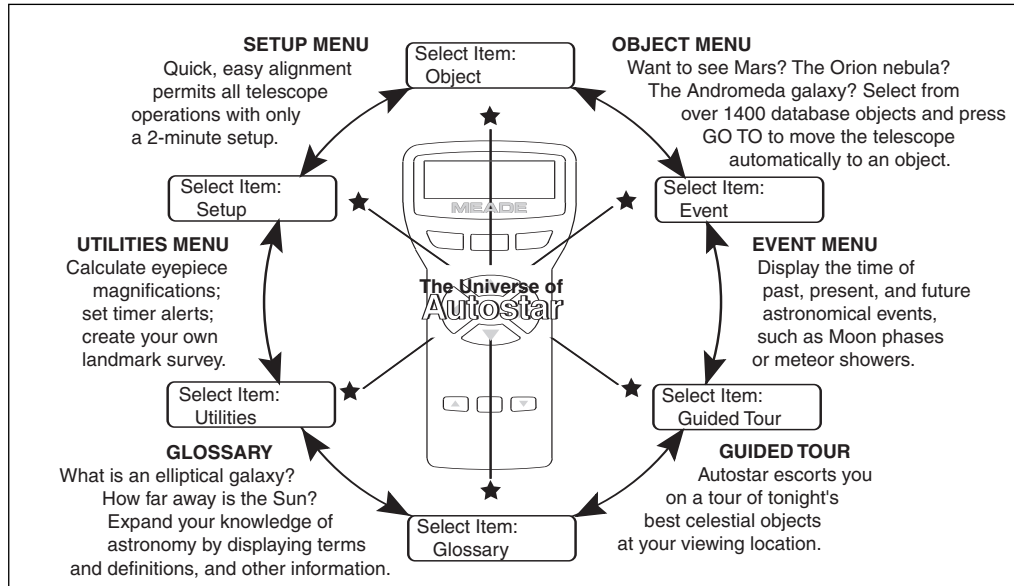


Fig. 18: The Autostar Universe: The six primary categories listed in the Select Item menu of Autostar.

It is important to understand that menu selections are set in a loop (Fig. 19). 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.

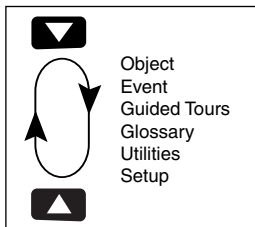


Fig. 19: Menus set in a loop.

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."

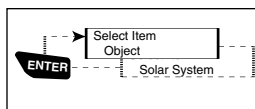


Fig. 20: Autostar levels.

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 17, 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 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 to move up and down through the options or lists
- Press the Arrow keys to move the cursor across the display.
- Press the Help (?) key to access on-line help.

Adjusting the Speed of a Scrolling Message

- Press and hold the Scroll Up key to increase the scrolling speed when a message is scrolling across the display.
- Press and hold the Scroll Down 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 (>).



DS-2000 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 37 for more information. You'll find our website at:

<http://www.meade.com/>
<http://www.meade4M.org>

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
- Hubble Space Telescope Public Pictures <http://opposite.stsci.edu/pubinfo/pictures.html>

MENUS AND MENU OPTIONS

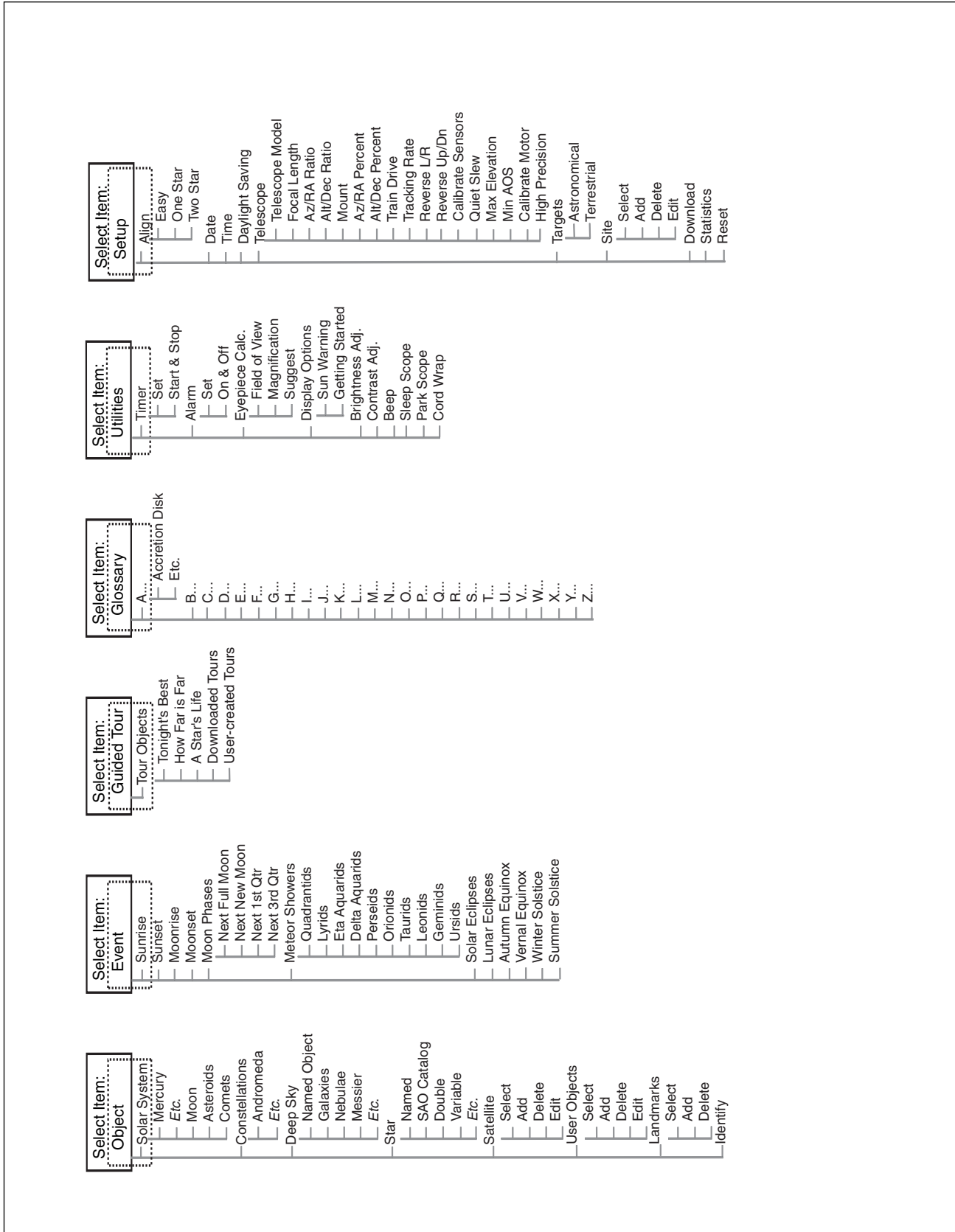


Fig. 21: The Complete Autostar Menu Structure.

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 **TAKE A 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.

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 26.

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 26.

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:** Meteor showers cover large areas of the sky and are usually best observed with the naked eye.*

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!" to the left.

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 37. 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.



WARNING!
Never use a
Meade DS-

2000 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.

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.*

Beep: Turns the beep on or off.

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.*



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.

Cord Wrap, when set to "On," moves the telescope in such a way as to prevent the cords and cables attached to your telescope assembly from getting wound around the assembly and tangled as the telescope slews to objects. "Off" is the default setting.

Setup Menu

Manual Alignment Menus: The telescope must be initialized and aligned before Autostar can find stars in the sky. If you wish to align the telescope manually, you may do by choosing Easy Two Star Align, Two Star Align or One Star Align from the Set up menu. Otherwise Autostar performs the default alignment, Automatic Alignment. See **page 18**.

Unlike the Automatic Alignment procedure, the observer must set the telescope into the home position before choosing one of the manual alignment methods:

1. Loosen the telescope's Altitude lock.
2. Level the optical tube: Line up 0° on the Altitude setting circle with the molded triangular pointer next to the circle. See **Fig. 1b (inset)**.
3. Tighten the Altitude lock (**Fig. 17**) to a firm feel only.
4. Point the telescope North. Use a compass or the North Star, Polaris as a guide to locating North. See **Fig. 31, page 35**. Also, See **Fig. 22**.

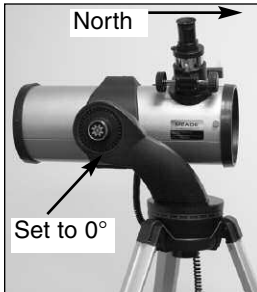


Fig. 22: To set the telescope in the home position, first line up zero with the molded pointer to level the optical tube. Then point the telescope North.

During **EASY TWO-STAR ALIGN**, Autostar automatically chooses two bright stars from its database. The user is then requested to center the stars in the eyepiece and press ENTER.

Two-Star Alignment requires some knowledge of the night sky. Autostar displays a database of bright stars and *two* stars are chosen by the observer from the database for alignment. It is recommended that you choose stars with which you are familiar the first trying out this method.

One-Star Alignment also requires some knowledge of the night sky. One-Star Alignment is identical to Easy: Align (see **EASY (TWO-STAR) ALIGN**, above), except Autostar displays a database of bright stars and only *one* star is chosen by the observer. 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. 16**). Because the Two-Star Alignment methods use two stars to align upon, they are more precise than One-Star Alignment.

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 24.

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. Check local time to verify.*

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.

Note: The time and date information is kept by a high precision internal clock, which is set at the factory and held by a long-life lithium battery.

Replace the internal clock's battery with a CR2023 lithium battery. This battery is located in the battery compartment.

Both batteries are available from Meade, photographic supply houses or any place lithium batteries are sold.

- **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 **APPENDIX D: TRAINING THE DRIVE**, page 38, 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 Sensors:** This menu allows you to improve your telescope's pointing accuracy to alignment stars. It calibrates to correct slight mechanical misalignment due to transport, vibration, or aging. It is recommended that calibration be performed after the LNT Module batteries are changed (see **page 39** for more information).
When this menu is selected, the telescope slews to Polaris. AutoStar then prompts you to center Polaris and to press ENTER. AutoStar uses the position of Polaris to fine tune the position of North and also for detecting level.
- **Quiet Slew:** Sets the maximum slew rate to 1.5° for quieter operation.
- **Max Elevation:** Allows you to enter a value in degrees that sets a limit as to how far the optical tube can swing upward during a programmed slew. (Note that it does not prevent you from performing a manual slew past this limit.) This is useful when you have a camera or other peripheral attached to the telescope—you can prevent it from striking the telescope base.
- **Min AOS (Acquisition of Signal):** Allows you enter a value in degrees. This value represents the altitude at which your telescope begins to slew when acquiring a satellite track. This is useful when you are observing satellites, but a tall tree or building is obstructing the telescope. For example, you might begin to track the satellite at 15° altitude, instead of 5°. See **OBSERVING SATELLITES**, page 37, for more information about satellites.
- **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 18**.

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.
- **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 26.

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 29.

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 17.

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.

OPTIONAL ACCESSORIES

A wide assortment of professional Meade accessories is available for the DS-2000 Series Telescopes. The premium quality of these accessories is well-suited to the quality of the instrument itself. **Consult the Meade General Catalog or www.meade.com for complete details on these and other accessories.**

Eyepieces: For higher and lower magnifications, Meade Series 4000 Super Plössl (SP) yield high-resolution imaging with all DS2000 telescope models. A useful selection includes the SP 9.7mm and SP 12.4mm eyepieces.

#126 2x Barlow Lens (1.25"): Doubles each eyepiece power while maintaining excellent image corrections. For example, a 9mm eyepiece used with the model DS-2060 yields a power of 78X; when used in conjunction with the #126 Barlow lens, the same eyepiece yields 156X.

#937 2" Diagonal Mirror: Large-barrel 2" eyepieces (e.g., MH 50mm, below) permit wide fields of view impossible to achieve with eyepieces of smaller barrel diameter. The focusers of all DS-2000 Series telescopes, except for the DS-2060 models, include 2" eyepiece-holders to accept the over-size #937 Diagonal Mirror, which in turn accepts eyepieces of 2" barrel diameter. An adapter is included to allow for the use of standard 1.25"-barrel eyepieces in the 2" Diagonal Mirror as well. (Note that the #937 is required only on DS-2000 refracting telescopes (e.g., DS-2070, etc.); DS-2000 reflecting telescopes (e.g., DS-2114S) do not require a diagonal mirror for the use of 2" eyepieces.)

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-2000 Series Telescopes (except for the DS-2060mm models, which cannot accept large-barrel eyepieces). On the DS-2070, for example, the MH 50mm ocular yields an actual field of view of 2.5° at 14X. On DS-2000 refractors, use with the #937 Diagonal Mirror.

#928 45° Erecting Prism: The 90° diagonal provided with DS-2000 Series refractors results in upright-but-reversed viewing of land subjects. The #928 45° Erecting Prism (1.25") orients the image correctly in terrestrial applications and results in a comfortable 45° viewing angle. For use with refractors only.

Camera Adapter: DS-2000 Series 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").

#1240 Electric Focuser: Attaches easily and quickly to any DS-2000 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 15,000 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 any DS-2000 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.

Electronic Eyepiece™: Now everyone can easily share views from an eyepiece – of the Moon, planets, stars, and land objects – on a television screen and allows for direct connection to monitors, VCR's, and camcorders. 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.

The AutoStar Suite with Meade LPI™ (Lunar Planetary Imager) turns your DS2000 telescope, AutoStar and PC into even more powerful and easy-to-use astronomical instrument. Capture great images of the the Moon, planets, and brighter deep-sky objects, plus terrestrial targets first time out. With Magic Eye software-assisted focusing. The AutoStar Suite Software includes imaging and planetarium tools. Includes a cable to connect your telescope to your PC.

Atomic Time Updater Module (ATUM). Plug in the cable of the Atomic Time Update Module into the ATUM port of your telescope's LNT Module. The Atomic Time Updater Module allows your telescope to update the LNT Module with the signal from the NIST atomic clock in Fort Collins, Colorado.

CARING FOR YOUR TELESCOPE

Your DS-2000 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.

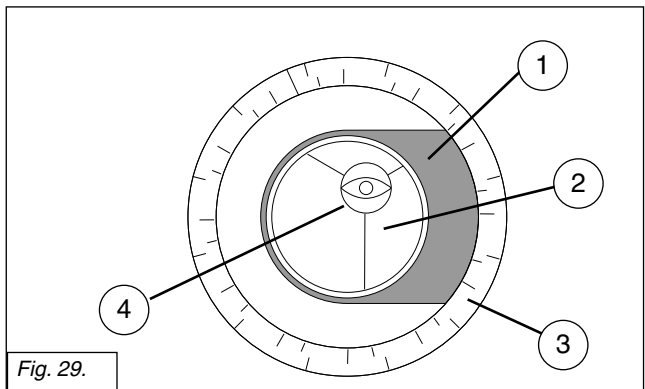
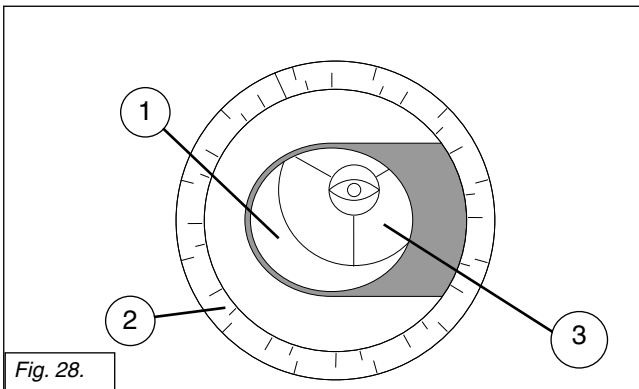
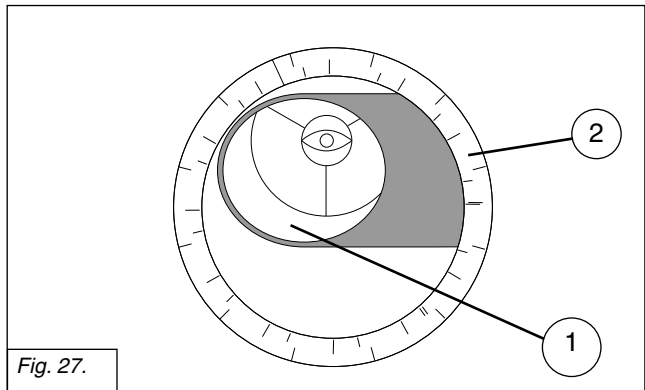
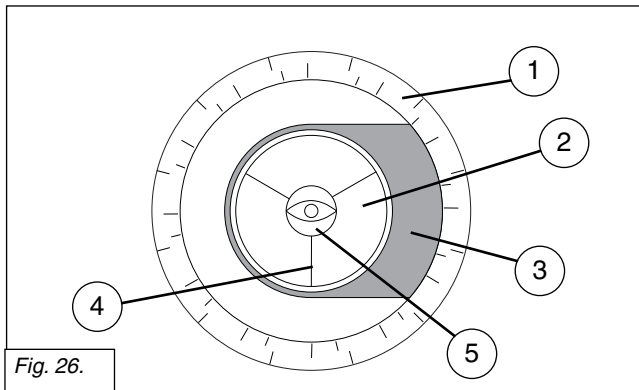
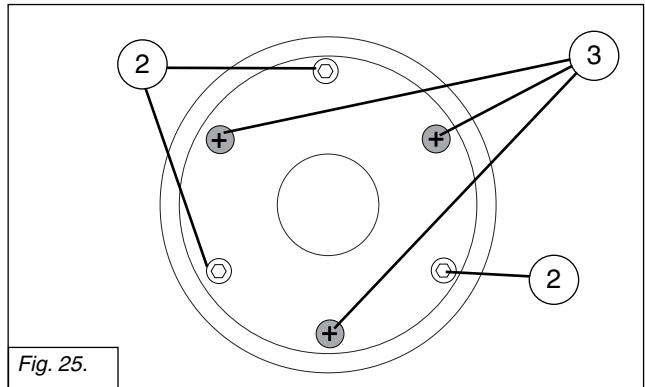
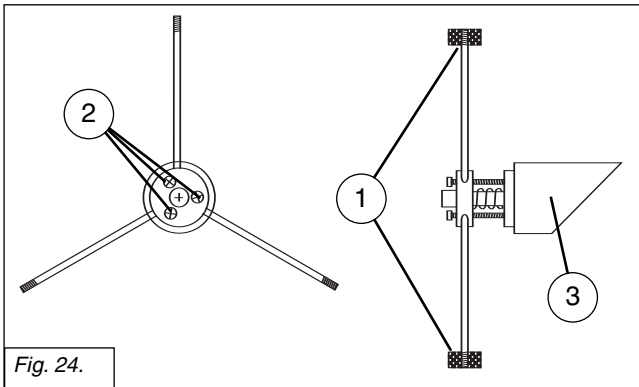
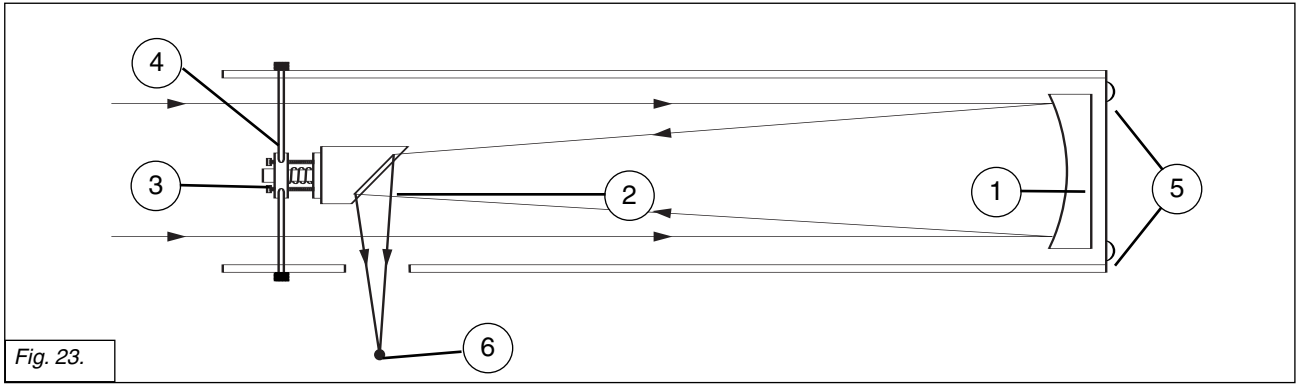
- d. If used outdoors on a humid night, water condensation on the telescope surfaces will probably result. While such condensation does not normally cause any damage to the telescope, it is recommended that the entire telescope be wiped down with a dry cloth before the telescope is packed away. Do not, 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 telescope. Batteries left in the telescope for prolonged periods may leak, causing damage to the telescope's electronic circuitry.
- 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

DS-2000 refracting telescopes are optically aligned (collimated) at the factory prior to shipment, and it is never necessary to re-collimate the optics of these models. Meade DS-2114mm and DS-2130mm reflecting telescope models are also factory-aligned, but may occasionally require re-alignment, particularly if the telescope has received rough handling in shipment. Before using one of these models for the first time, check the alignment of the optics as outlined in this section. Good optical alignment is essential for telescope performance, and in any case the alignment procedure is not difficult to follow.

The optical systems of Meade DS-2000 reflecting telescopes include the following parts: primary mirror (1, Fig. 23); secondary mirror (2, Fig. 23); secondary mirror-holder (3, Fig. 23); secondary mirror-vanes (4, Fig. 23) and (1, Fig. 24); primary mirror-tilt screws (5, Fig. 23). The telescope's image is brought to a focus at (6, Fig. 23).

1. **Confirm alignment** - To confirm optical alignment look down the focuser drawtube (1, Fig. 26) with the eyepiece removed. The edge of the focuser drawtube frames reflections of the primary mirror (2, Fig. 26), the secondary mirror (3, Fig. 26), the three ("spider") vanes (4, Fig. 26) holding the secondary mirror, and the observer's eye (5, Fig. 26). With the optics properly aligned, all of these reflections appear concentric (centered), as shown in Fig. 26. Any deviation from concentricity of any of these telescope parts with the eye requires adjustments to the secondary mirror-holder (Fig. 24) and/or the primary mirror cell (Fig. 25), as described below.
2. **Secondary mirror-vane adjustments:** If the secondary mirror (1, Fig. 27) is left or right of center within the drawtube (2, Fig. 27), slightly loosen the 3-vane adjustment/lock knobs (1, Fig. 24) 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. 27) is above- or below-center within the drawtube,



thread inward one of the adjustment/lock knobs (**1, Fig. 24**) while unthreading another of these knobs. Only make adjustments to two knobs at a time until the secondary mirror appears as in **Fig. 28**.

3. *Secondary mirror-holder adjustments:* If the secondary mirror (**1, Fig. 28**) is centered in the focuser drawtube (**2, Fig. 28**), but the primary mirror is only partially visible in the reflection (**3, Fig. 28**), the three “+” (Phillips head) secondary mirror-tilt screws (**2, Fig. 24**) should be slightly unthreaded to the point where the secondary mirror-holder (**3, Fig. 24**) 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. 24**) 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. 29**.

4. *Primary mirror adjustments:* If the secondary mirror (**1, Fig. 29**) and the reflection of the primary mirror (**2, Fig. 29**) appear centered within the drawtube (**3, Fig. 29**), but the reflection of your eye and the reflection of the secondary mirror (**4, Fig. 29**) appear off-center, then the primary mirror tilt requires adjusting, using the Phillips head screws of the primary mirror cell (**3, Fig. 25**). These primary mirror-tilt screws are located behind the primary mirror, at the lower end of the main tube. See **Fig. 25**. 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. 25**) 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. 26**, turn the three hex head primary mirror lock screws (**2, Fig. 25**) 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.

Meade Customer Service

If you have a question concerning your DS-2000 Telescope, contact the Meade Instruments Customer Service Department at:

Telephone: (800) 626-3233

Customer Service hours are 8:00 AM to 5:00 PM, Pacific Time, Monday through Friday. In the unlikely event that your DS-2000 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 day-time telephone number. The great majority of servicing issues can be resolved by telephone, avoiding return of the telescope to the factory.

SPECIFICATIONS

DS-2060

Optical design.....	Refractor
Clear aperture .....	.60mm
Focal length .....	.700mm
Focal ratio	f/11.7
Resolving power.....	1.9 arc secs
Max power	200X
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	2.5" x 27"
Batteries (user-supplied)	8 x AA

DS-2070

Optical design.....	Refractor
Clear aperture .....	.70mm
Focal length .....	.700mm
Focal ratio	f/10
Resolving power.....	1.6 arc secs
Max power	250X
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	3.0" x 27"
Batteries (user-supplied)	8 x AA

DS-2080

Optical design.....	Refractor
Clear aperture .....	.80mm
Focal length .....	.900mm
Focal ratio	f/11.3
Resolving power.....	1.4 arc secs
Max power	275X
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	3.25" x 34"
Batteries (user-supplied)	8 x AA

DS-2090

Optical design.....	Refractor
Clear aperture .....	.90mm
Focal length .....	.800mm
Focal ratio	f/8.8
Resolving power.....	1.3 arc secs
Max power	300X
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	3.5" x 31"
Batteries (user-supplied)	8 x AA

DS-2114

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)	8 x AA

DS-2114S

Optical design.....	Reflector
Clear aperture .....	.114mm
Focal length	1000mm
Focal ratio	f/8.8
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 18"
Batteries (user-supplied)	8 x AA

DS-2130

Optical design.....	Reflector
Clear aperture .....	.130mm
Focal length	1020mm
Focal ratio	f/7.9
Resolving power.....	0.9 arc secs
Max power .....	.350X
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	5.7" x 38"
Batteries (user-supplied)	8 x AA

DS-2130S

Optical design.....	Reflector
Clear aperture .....	.127mm
Focal length	1000mm
Focal ratio	f/7.9
Resolving power.....	0.9 arc secs
Max power .....	.350X
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	5.7" x 18"
Batteries (user-supplied)	8 x AA

#494 Autostar

Processor .....	.68HC11, 8MHz
Flash Memory .....	.512KB, reloadable
Keypad .....	.10 key alphanumeric
Display .....	.2 line, 16 character LCD
Backlight.....	.Red LED
RS-232 .....	.Yes
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)

APPENDIX A

Celestial Coordinates

It is helpful to understand how to locate celestial objects as they move across the sky.

A celestial coordinate system was created that maps an imaginary sphere surrounding the Earth upon which all stars appear to be placed. This mapping system is similar to the system of latitude and longitude on Earth surface maps.

In mapping the surface of the Earth, lines of longitude are drawn between the North and South Poles, and lines of latitude are drawn in an East-West direction, parallel to the Earth's equator. Similarly, imaginary lines have been drawn to form a latitude and longitude grid on the celestial sphere. These lines are known as **Right Ascension** and **Declination**.

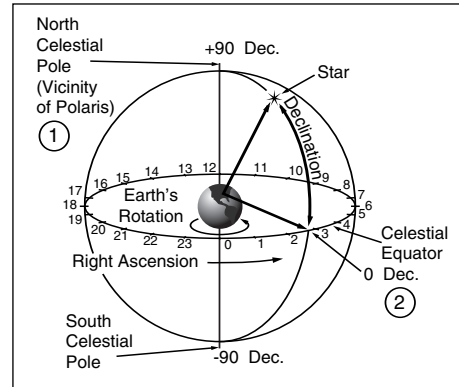


Fig. 30: Celestial Sphere.

The celestial map also contains two poles and an equator just like a map of the Earth. The poles of this coordinate system are defined as those two points where the Earth's north and south poles (*i.e.*, the Earth's axis), if extended to infinity, would cross the celestial sphere. Thus, the North Celestial Pole (1, Fig. 30) is that point in the sky where an extension of the North Pole intersects the celestial sphere. This point in the sky is located very near the North Star, Polaris. The celestial equator (2, Fig. 30) is a projection of the Earth's equator onto the celestial sphere.

So just as an object's position on the Earth's surface can be located by its latitude and longitude, celestial objects may also be located using Right Ascension and Declination. For example, you could locate Los Angeles, California, by its latitude (+34°) and longitude (118°). Similarly, you could locate the constellation Ursa Major (the Big Dipper) by its Right Ascension (11hr) and its Declination (+50°).

- **Right Ascension (R.A.):** This celestial version of longitude is measured in units of hours (hr), minutes (min) and seconds (sec) on a 24-hour "clock" (similar to how Earth's time zones are determined by longitude lines). The "zero" line was arbitrarily chosen to pass through the constellation Pegasus — a sort of cosmic Greenwich meridian. R.A. coordinates range from 0hr 0min 0sec to 23hr 59min 59sec. There are 24 primary lines of R.A., located at 15-degree intervals along the celestial equator. Objects located further and further East of the zero R.A. grid line (0hr 0min 0sec) carry higher R.A. coordinates.
- **Declination (Altitude):** This celestial version of latitude is measured in degrees, minutes, and seconds (*e.g.*, 15° 27' 33"). Dec. locations north of the celestial equator are indicated with a plus (+) sign (*e.g.*, the Dec. of the North celestial pole is +90°). Dec. locations south of the celestial equator are indicated with a minus (-) sign (*e.g.*, the Dec. of the South celestial pole is -90°). Any point on the celestial equator (such as the constellations of Orion, Virgo, and Aquarius) is said to have a Declination of zero, shown as 0° 0' 0."

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. 31).

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.

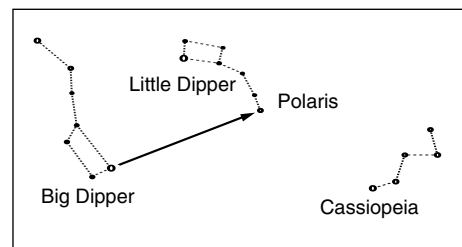


Fig. 31: Locating Polaris.

APPENDIX B

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.

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 aligned 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.

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) 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 29.

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.*

APPENDIX D

Training the Drive

Train the telescope motors using Autostar. Perform this procedure if you are experiencing any pointing accuracy problems. **Fig. 32** depicts the complete Drive Training procedure.

NOTE: Use a terrestrial object, such as a telephone pole or lamp post, to train the drive. Complete this exercise once every 3 to 6 months to maintain the highest level of telescope pointing accuracy.

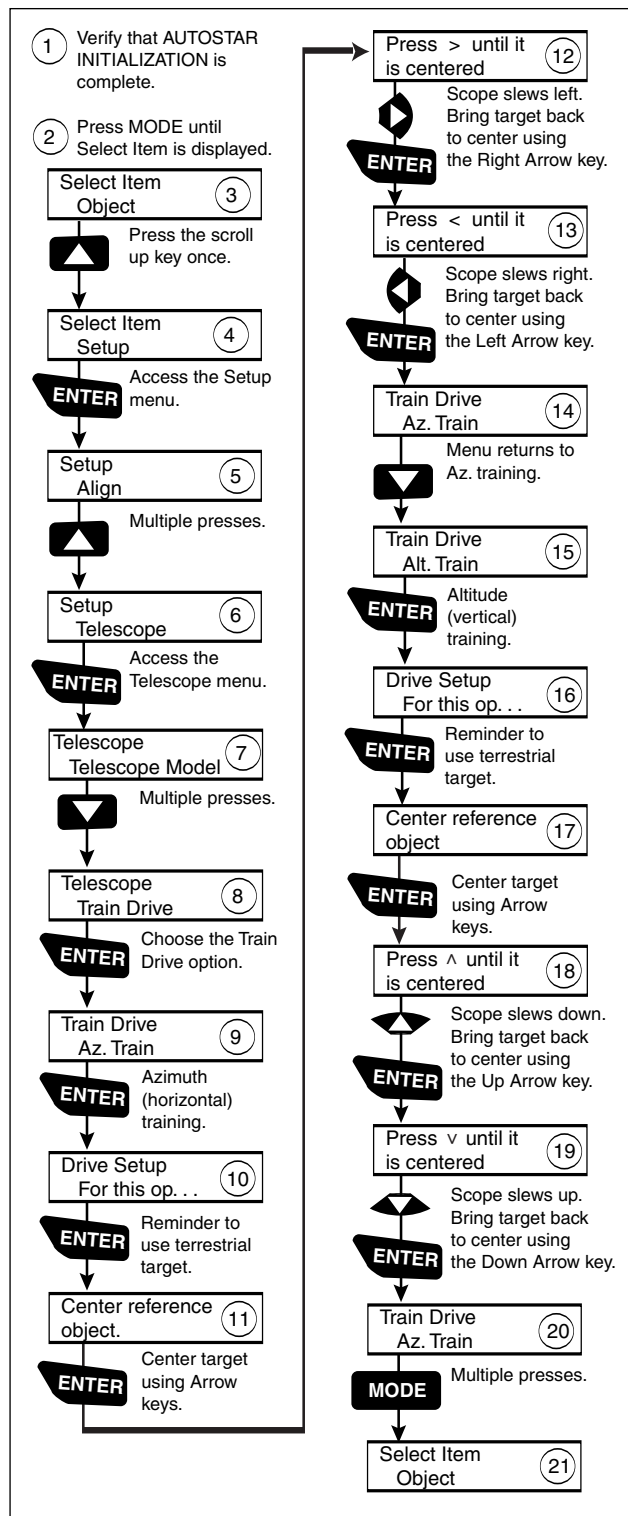


Fig. 32: Training the Drive Procedure.

DS-2000 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 Meade 4M Community
www.meade4M.org.

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

APPENDIX E

Changing the LNT Battery

The LNT Module uses a lithium coin CR2023 battery that will last about 5 years and is installed with the original LNT Module assembly. After you replace the battery, you will need to recalibrate the telescope's sensors and reset the time and date. You will need a new battery. Also, you may use Meade's optional Atomic Time Update Module, although this is not necessary.

To replace the battery:

1. Remove the top alignment screw cap/long bolt from the LNT Module. See **Fig. 33**.
2. Remove the side alignment screw cap/long bolt from the LNT Module. Take note that there are two springs inside the LNT. One spring sits between the top and bottom of the unit. The second spring is on the side of the unit that rests between the bottom and the top sections. One long bolt passes through the top spring and the other long bolt passes through the side spring. Set the springs aside as you will need to replace it later in this assembly. See **Fig. 33 and 34**.

Important Note: Note there is some wiring inside the LNT Module. Be careful not to pull on the wiring. If it is necessary to move the wiring aside, do so carefully.

3. Carefully lift the top section of the unit from the bottom section. Do not remove the bottom section or disassemble the rest of the unit.
4. Remove the old battery. Note the spring.
5. Insert the new (user-supplied) battery. Take care to orient the battery so that the side with the battery markings is facing the top.
6. Replace the top spring in place and the LNT Module cover.
7. Replace the top bolt and tighten the cap to a firm feel.
8. Hold the side spring in place with your fingers and slide the spring between the top and bottom sections. The spring should line up with the mounting holes for the side long bolt. Slide the long bolt through the side hole, then through the spring and finally through the bottom of the LNT Module and tighten to a firm feel.
9. Next, follow the instructions included with the Atomic Time Update Module optional accessory to reset the clock.

OR

Enter the date and time manually using the Date and Time options in the Setup menu.

Note: You may find it useful to recalibrate the LNT Module sensors after changing the battery. You will find the Calibrate Sensors in the Setup: Telescope menu.

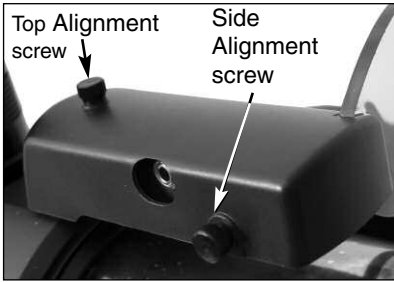


Fig. 33: The LNT Module, with alignment screws and Atomic Time Update port visible.

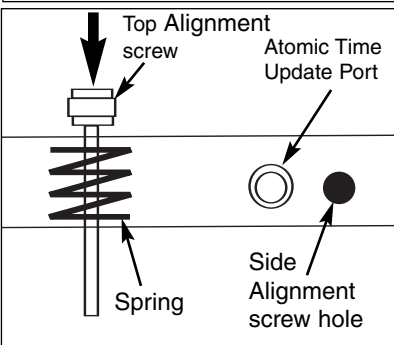


Fig. 34: Interior side view of LNT Module.

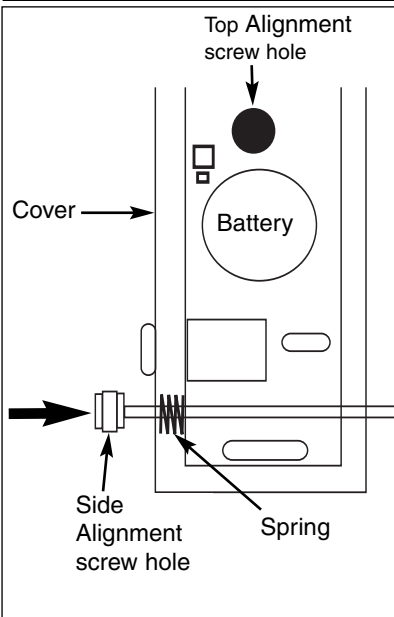


Fig. 35 Interior top view of SmartFinder unit.

APPENDIX F

How to manually set the date to March 6, 2005:

1. Press ON/OFF to turn on the control panel.
2. Press the button prompted by the control panel to show that the Sun warning has been read and understood. Press ENTER to bypass Getting Started message.
3. Keep pressing MODE until "Select Item: Object" displays.
4. Keep pressing the Scroll Down key until "Select Item: Setup" displays. Press ENTER.
5. Keep pressing the Scroll Down key until "Setup: Date" displays. Press ENTER.
6. "Enter Date: 01-JAN-2003" displays. "0" is highlighted by a blinking cursor. Press the Right Arrow key to move to the next position.
7. "1" is now highlighted. Press the Scroll Up key until "6" displays in this position. Press the Right Arrow key to move to the next position.
8. "JAN" is now highlighted. Press the Scroll Up key until "MAR" displays. Press the Right Arrow key to move to the next position.
9. "2" is now highlighted. The date display now reads "06 MAR 2003." Press the Right Arrow key three times until the "3" is highlighted.
10. Press the Scroll Up key until "5" displays in this position. Press ENTER. The date is now entered.

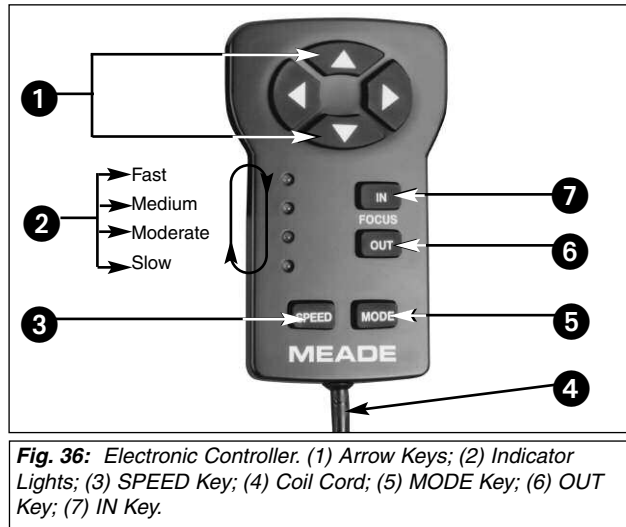
How to manually set the time to 11:30 p.m.:

If you have just set the date, "Setup: Date" displays. Press DOWN once and "Setup: Time" displays. Then proceed to step #6. below.

If you have not yet turned on your control panel, begin with step #1.

1. Press ON/OFF to turn on the control panel.
2. Press the button prompted by the control panel to show that the Sun warning has been read and understood. Press ENTER to bypass Getting Started message.
3. Keep pressing MODE until "Select Item: Object" displays.
4. Keep pressing the Scroll Down key until "Select Item: Setup" displays. Press ENTER.
5. Keep pressing the Scroll Down key until "Setup: Time" displays. Press ENTER.
6. "Enter Time: 08:00:00AM" displays. The leftmost "0" is highlighted. Press the Scroll Up key until "1" displays. Press the Right Arrow key to move to the next position.
7. "8" is highlighted. Press the Scroll Up key until "1" displays. Press the Right Arrow key to move to the next position.
8. "0" is highlighted. Press the Scroll Up key until "3" displays.
9. Keep pressing the Right Arrow key until "AM" is highlighted. Press the Scroll Up key until "PM" displays. Press ENTER.
10. The time display now reads "11:30:00PM." The time is now entered.

APPENDIX G



Electronic Controller (DS-2000EC Users Only)

DS-2000 "EC" models come equipped with an Electronic Controller handbox, rather than the Autostar Handbox. The Electronic Controller provides you with the means to control the telescope motors from a compact handbox. The Electronic Controller (**Fig. 36**) has soft-touch keys designed to have a positive feel, even through gloves.

Functions of the Electronic Controller include:

- Slewing (moving) the telescope's optical tube assembly to an object.
- When used with the optional #1240 Electric Focuser, moves the focus of the eyepiece. See the #1240 Electric Focuser Instruction Sheet for more information.
- ❶ **Arrow Keys (1, Fig. 36):** Press one of the four Arrow keys to slew the telescope (*i.e.*, up, down, left, and right) at any one of four slew speeds (see **SPEED KEY** below).

Important Note: If you reverse directions while using the Arrow keys to slew to objects, there may be a slight pause as the telescope motors compensate for the reversal of the internal gears.
- ❷ **Indicator Lights (2, Fig. 36):** The four red LED (Light Emitting Diode) lights indicate the current slew speed of the telescope.
- ❸ **SPEED Key (3, Fig. 36):** Press the SPEED key to change the speed at which the telescope slews to an object. Each press of the SPEED key changes the slew speed to the next *slower* setting. If the controller is already on the slowest slew speed (light 4), pressing the SPEED key cycles back to the highest speed (light 1). Slew speeds are signified by the indicator lights (**2, Fig. 36**).
- ❹ **Coil Cord:** Plug into the HBX connector of the Computer Control Panel.
- ❺ **MODE Key (5, Fig. 36):** Not used with the DS-2000 telescopes.
- ❻ **OUT Key (6, Fig. 36):** When using the optional #1240 Electric Focuser (see **OPTIONAL ACCESSORIES**, page 29), press the OUT key to move the focus point outward.
- ❼ **IN Key (7, Fig. 36):** When using the optional #1240 Electric Focuser (see **OPTIONAL ACCESSORIES**, page 29), press the IN key to move the focus point inward.

Telescope Mounting

A mount allows a telescope to move on its axes. All DS-2000 telescopes use an Altazimuth mounting. The Electronic Controller is factory pre-set to the Alt/Az mode.

Altazimuth (Alt/Az) mounting permits movement of the telescope tube in vertical (altitude) and horizontal (azimuth) directions, and is ideal for terrestrial applications and for casual astronomical observation. The Electronic Controller Arrow keys permit pushbutton movements (slewing) of the telescope. To manually track objects with the telescope in the Altazimuth configuration, press the Arrow keys of the Electronic Controller as necessary to keep an object centered.

Slew Speeds

The Electronic Controller has four slew speeds that are directly proportional to the sidereal rate (see **page 15** for more information). Press the Speed key to change the slew speed. Note each slew speed corresponds to one of the four LED's of the Electronic Controller.

Light 1 (top LED): The fastest speed. Use to move the telescope quickly from one point in the sky to another.

Light 2: Best for centering an object in the viewfinder.

Light 3: Best for centering an object in the field of a low-to-moderate-power eyepiece, such as the standard SP 26mm.

Light 4: The slowest speed. Use to center an object in the field of view of high-power eyepieces, such as a 9mm eyepiece.

The four available speeds are:

- Light 1 = 1200 x sidereal (300 arc-min/sec or 5°/sec)
- Light 2 = 180 x sidereal (45 arc-min/sec or 0.75°/sec)
- Light 3 = 32 x sidereal (8 arc-min/sec or 0.13°/sec)
- Light 4 = 8 x sidereal (2 arc-min/sec or 0.034°/sec)

The two slowest speeds (8x and 32x sidereal) can be used for pushbutton (manual) tracking of astronomical objects while observing through the eyepiece.

To move the telescope using the Electronic Controller:

1. Set the telescope on a level surface.
2. Insert a low-power eyepiece (e.g., 25mm) into the eyepiece holder (**2, Fig. 1**) or diagonal prism (**3, Fig. 1**) and tighten the eyepiece thumbscrew.
3. Tighten the Altitude lock (**10, Fig. 1**) and the tripod base lock knob (**26, Fig. 1**), if necessary.
4. Verify that the power switch (**C, Fig. 1c**) on the telescope's Computer Control panel is OFF.
5. Plug in the Electronic Controller coil cord (**4, Fig. 36**) to the HBX port (**A, Fig. 1c**) on the Computer Control panel.
6. Flip the power switch to ON. The power indicator (**B, Fig. 1c**) on the Computer Control panel lights and all four speed indicators (**2, Fig. 36**) blink rapidly.
7. Press any key on the Electronic Controller and the telescope slews momentarily in the vertical and horizontal directions to test the motors.
8. When the test is complete, light 1 remains on; lights 2, 3, and 4 turn off.
9. Use the four Arrow keys (**1, Fig. 36**) to slew the telescope to the desired object. To change the slew speed, press the SPEED key.
10. Fine-adjust the position of the object with the Electronic Controller Arrow keys so that it is centered in the viewfinder. The object is now ready to be viewed through the telescope's eyepiece.

Optional #494 Autostar™ Computer Controller for DS-2000EC Users

One of the most important advances in telescope control in the past 25 years, the Meade #494 Autostar Computer Controller turns your DS-2000EC model into an automatic celestial object locating system. Just plug Autostar into the telescope's HBX port in place of the standard-equipment Electronic Controller, do a quick telescope alignment, and you are ready to observe any object in the Autostar's 1400-object database.

Best of all, the Meade Autostar is easy to use. Even the most novice observer will locate dozens of fascinating celestial objects the very first night out. Study Saturn and its ring system; the primary cloud belts of Jupiter as well as its four major satellites; the moon-like phases of Mercury and Venus; prominent features on Mars. The Moon stands out in stark, almost three-dimensional detail — craters, mountain ranges, and fault lines. In our galaxy, the telescope displays hundreds of nebulae, star clusters, double and multiple stars, and variable stars — plus dozens of external galaxies in all their variation of form and structure.

Any of Autostar's database objects can be called up and entered on the hand controller display in seconds. The observer then simply presses the GO TO pushbutton and watches as the telescope automatically slews to the object and places it in the field of view. Autostar moves the telescope to automatically track (follow) the object across the sky. Autostar brings into easy access objects that were previously unreachable for all but the most dedicated of amateur astronomers.

BASIC ASTRONOMY

In the early 17th century Italian Scientist Galileo, using a telescope smaller than your DS-2000 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-2000 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. 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-2000 Series Telescope:

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. 37**). 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.

Twelve Apollo astronauts left their bootprints on the Moon in the late 1960's and early 1970's. However, no telescope on Earth is able to see these footprints or any other artifacts. In fact, the smallest lunar features that may be seen with the largest telescope on Earth are about one-half mile across.



*Fig. 37: The Moon.
Note the deep shadows in the craters.*

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*. You can also consult Autostar for information about planets. Scroll to the "Object: Solar System" menu and scroll through the lists of planets. When a planet you are interested in displays, press ENTER. Use the Scroll keys to display information about the planet, such as the planet's coordinates, and the rise and set times (**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-2000 Series.



Fig. 38: Jupiter and its four largest moons. The moons can be observed in a different position every night.



Fig. 39: Saturn has the most extensive ring structure in our Solar System.



Fig. 40: The Pleiades is one of the most beautiful open clusters.

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. It may be possible to see a hint of white at one of the planet's Polar ice caps. Approximately every two years, when Mars is closest to Earth in its orbit, additional detail and coloring on the planet's surface may be visible.

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 moons (Io, Europa, Ganymede, and Callisto) can be seen as "star-like" points of light when using even the lowest magnification (**Fig. 38**). These moons orbit Jupiter so that the number of moons visible on any given night changes as they circle around the giant planet.

Saturn is nine times the diameter of Earth and appears as a small, round disk with rings extending out from either side (**Fig. 39**). In 1610, Galileo, the first person to observe Saturn through a telescope, did not understand that what he was seeing were rings. Instead, he believed that Saturn had "ears." Saturn's rings are composed of billions of ice particles ranging in size from a speck of dust to the size of a house. The major division in Saturn's rings, called the Cassini Division, is occasionally visible. Titan, the largest of Saturn's 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.

Nebulae are vast interstellar clouds of gas and dust where stars are formed. Most impressive of these is the Great Nebula in Orion (M42), a diffuse nebula that appears as a faint wispy gray cloud. M42 is 1600 light years from Earth.

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. 40**).

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.

Galaxies are large assemblies of stars, nebulae, and star clusters that are bound by gravity. The most common shape is spiral (such as our own Milky Way), but galaxies can also be elliptical, or even irregular blobs. The Andromeda Galaxy (M31) is the closest spiral-type galaxy to our own. This galaxy appears fuzzy and cigar-shaped. It is 2.2 million light years away in the constellation Andromeda, located between the large "W" of Cassiopeia and the great square of Pegasus.



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 (800) 626-3233. 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.

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