

# Instruction Manual

8", 10", 12", 14", 16" LX200®R  
Advanced Ritchey-Chrétien Telescopes  
with GPS and AutoStar® II Hand Controller



**MEADE®**

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## **WARNING!**

**Never use a Meade® LX200R™ 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 at or near the Sun. Do not look through the telescope or SmartFinder™ as it is moving. Children should always have adult supervision while observing.



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**Caution:** Use care to install batteries in the orientation indicated by illustration in the battery slots of the battery holder. 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.

**If you are anxious to use your telescope for the first time,** read the **QUICK-START GUIDE** on pages 4 and 5.

**16" LX200®R Users:** See **APPENDIX F**, page 64, for features unique to the 16" model.

**14" LX200®R Users:** See **APPENDIX G**, page 68, for features unique to the 14" model.

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Patents:

US 7,092,156  
 US 7,079,317  
 US 6,304,376  
 US 6,392,799  
 US 6,563,636  
 D 422,610  
 Patent Pending.

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# QUICK-START GUIDE

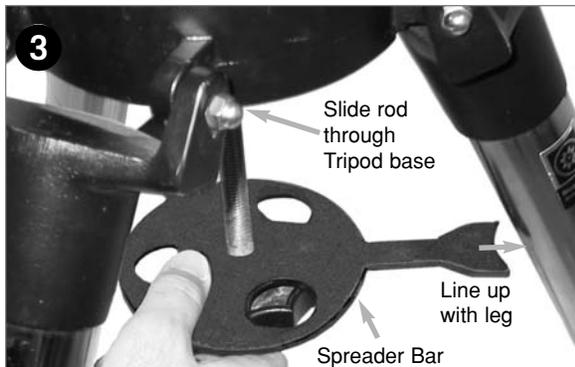
It is recommended that you attach the supplied tripod to the LX200R for observing. Perform the telescope and AutoStar II setup indoors in the light so that you become familiar with the parts and operation before moving the telescope outside into the dark for observing. The setup is the same for the standard field tripod and the giant field tripod.



1. Remove the field tripod from the shipping carton. Stand the tripod vertically with the tripod feet down and with the tripod still fully collapsed. Grasp two of the tripod legs and, with the full weight of the tripod on the third leg, gently pull the legs apart to a fully open position.

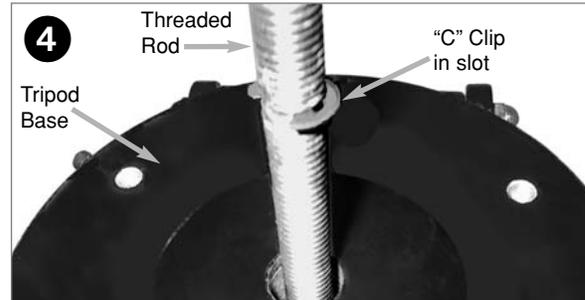


2. Thread in two lock-knobs on each leg (six total) near the foot of each tripod leg. Use the lock-knobs to vary the height of the inner, extendible tripod leg sections. Tighten the locks to a firm feel only; do not overtighten.



3. Remove the threaded rod from the tripod head. A small piece of plastic holds the threaded rod in place. Remove the small plastic bag that is stapled to the threaded rod. This bag contains the "C" clip retainer and an extra clip.

Remove the spreader bar (see above figure) from the shipping carton. Slide the spreader bar onto the threaded rod. Slide the rod through the tripod base. Position the spreader bar so that its three arms line up with the three tripod legs.



4. Place the "C" clip into the slot in the threaded rod above the tripod head—this clip holds the threaded rod in place.

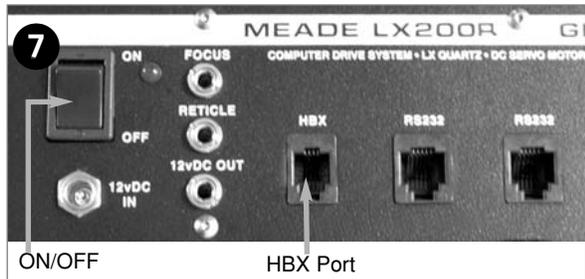


5. Take the LX200R from its packaging and place the entire telescope onto the top of the tripod head, inserting the threaded rod into the central hole in the bottom of the drive base of the telescope. Tighten the tension knob (see above figure) to a firm feel only; firm tightening of the tension knob is sufficient to result in rigid positioning of the tripod legs.

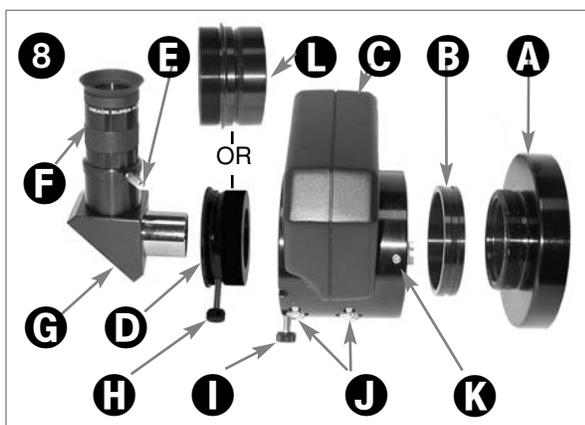


6. Remove the covers of the battery compartments located on the fork arms (one on each fork arm) and carefully lift the battery holders from their compartments, being mindful of the connector wires. Insert four (user-supplied) C-cell batteries into each battery holder, oriented as shown on the diagram on the battery holder. Return the battery holders to their respective compartments. Replace the covers when you are done.





- Press the computer control panel power switch to OFF, if necessary. Remove the AutoStar II hand-box and the AutoStar II coil cord from the packing materials. Plug one end into the HBX port of the telescope's computer control panel and plug the other end into the coil cord port on the AutoStar II handbox.



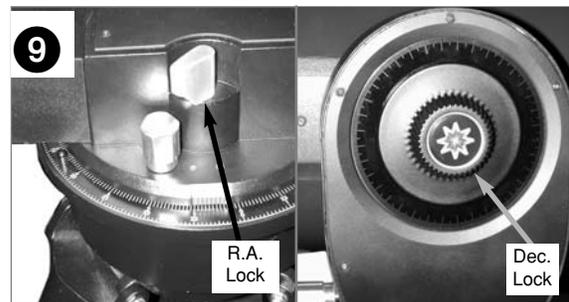
- Attach microfocus:** Remove the dust cap from the rear cell port (A) of the telescope (Note: Telescope not shown for clarity). Thread the microfocus adapter (B) into the rear cell port thread. Slide the microfocus (C) over the microfocus adapter and tighten the three hex screws on the microfocus (K) using the provided hex keys.

**Important Note:**

The Microfocus is shipped with the microfocus adapter (B) threaded to the SC accessory adapter (L). Unthread the adapters from each other before attaching the microfocus. Set aside the SC accessory adapter. For more information about the SC accessory adapter, see **SC OPTIONAL ACCESSORY USERS**, page 14.

**1.25" Diagonal Prism Users:** If using the 1.25" diagonal prism (G), slide the 1.25" adapter (D) into the microfocus. Line up the thumbscrew into the groove in the microfocus (I, also see **Fig. 7a and 7b**, page 14). Slide the 1.25" diagonal prism into the adapter (D). Tighten the adapter thumbscrew (H) to a firm feel only. Tighten the microfocus thumbscrews (I) to a firm feel only.

**2.0" Diagonal Mirror Users:** If using the 2.0" diagonal mirror, slide the mirror directly into the microfocus (C). Tighten the microfocus thumb-screws (I) to a firm feel only.



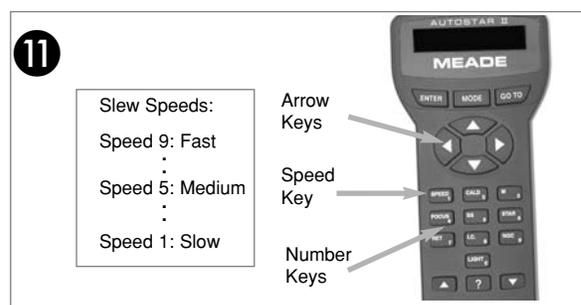
- Tighten, to a firm feel only, the R.A. and Dec. locks. Remove the dust cover from the end of the telescope tube.

Place the 26mm eyepiece (F) into the diagonal prism (G) and tighten the attachment thumbscrew (E) to a firm feel only.

Sight along the side of the telescope's main tube to locate an object. Rotate the mirror lock knob (9, **Fig. 1**) towards the "Unlock" position, until it feels loose—the telescope is shipped with the mirror locked. Use the telescope's coarse focus knob (6, **Fig. 1**) to bring the object into focus. Practice using the AutoStar II Arrow keys to center an object in the telescope's field of view.



- Press the Power Switch on the computer control panel to the ON position. The copyright message lights on AutoStar II's LCD display.



- "Press 0 to align or Mode for Menu" displays. You can use the Arrow keys to slew (move) the telescope up, down, right, or left. To change the telescope's slew speed, press the Speed key and then the Number keys. "9" is the fastest speed and "1" is the slowest speed. See page 17 for more details. Or you can Press "0" to begin Automatic Alignment. See page 18 for more information.



# TELESCOPE FEATURES

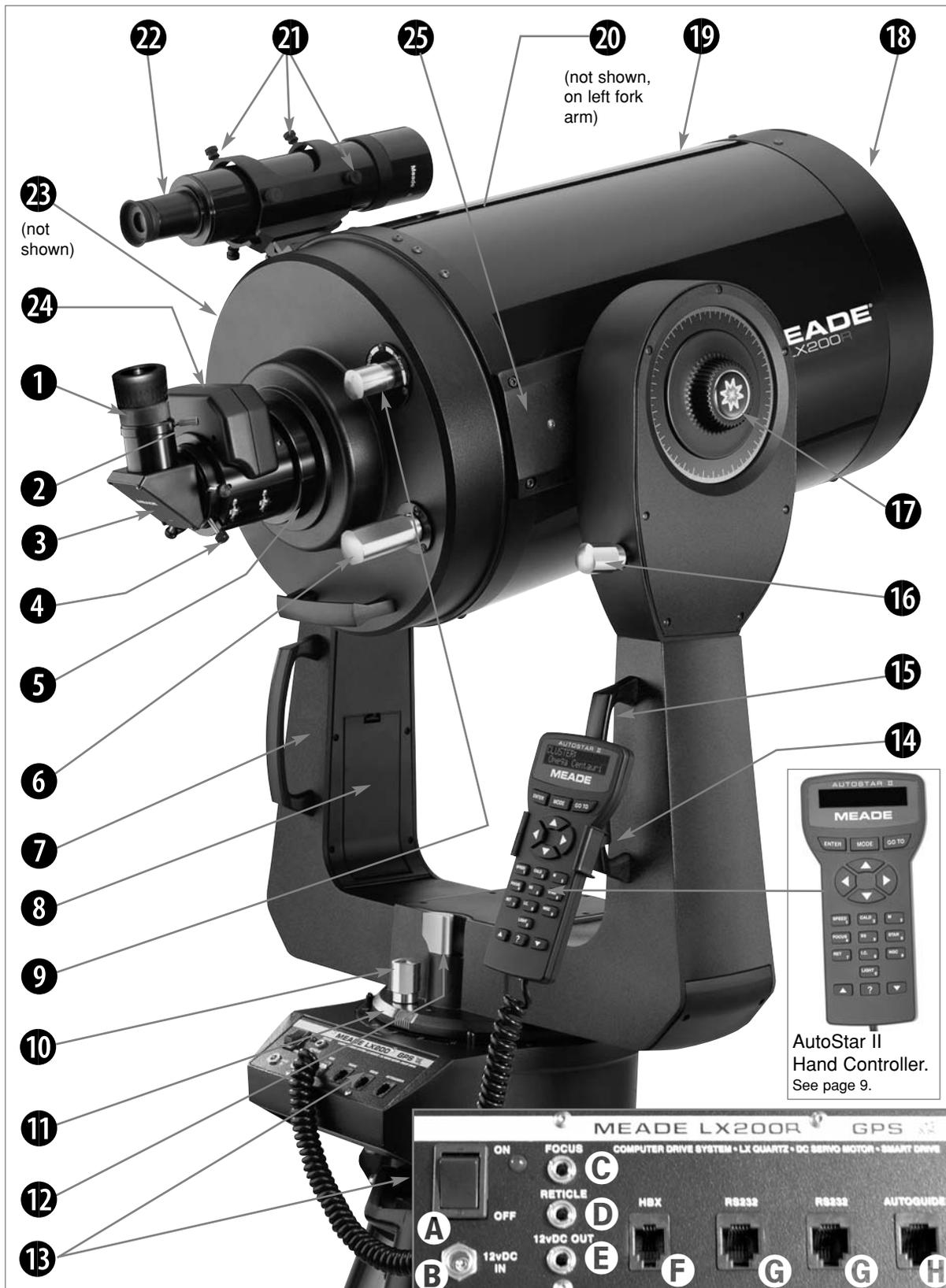


Fig. 1: The LX200R Telescope; Computer Control Panel (inset); AutoStar II Handbox (inset).



Looking at or near the **Sun** will cause **irreversible** damage to your eye. Do not point this telescope at or near the Sun. Do not look through the telescope as it is moving.

# LX200R: YOUR PERSONAL WINDOW TO THE UNIVERSE

The Meade LX200R models are extremely versatile, high-resolution telescopes. With pushbutton controls, precision GPS alignment, zero image-shift microfocusing, true-level and North electronic sensors, automatic tracking of celestial objects, periodic error correction for both axes, and a library of 145,000+ objects in the AutoStar II database, the LX200R models offer unmatched state-of-the-art performance.

Observe the feather structure of an eagle from 50 yards or study the rings of the planet Saturn from a distance of 800 million miles. Focus beyond the Solar System on ancient star clusters, remote galaxies, and stars recently discovered to have planets orbiting about them. Meade LX200R telescopes are capable of growing with your interest and can meet the requirements of the most demanding advanced observer.

## Caution:

Using products other than standard Meade accessories may cause damage to the telescope's internal electronics and may void the Meade warranty.

1 Want to learn more about the **eyepieces available for your LX200R telescope**? See **OPTIONAL ACCESSORIES**, pages 43, 44, and 45.

5 Want to learn how to attach the microfocuser assembly to the rear cell port of your **LX200R telescope**? See **HOW TO ASSEMBLE YOUR TELESCOPE**, pages 13 and 14.

6 Want to learn more about **focusing your telescope**? See pages 17 and 31. See page X.

8 Want to learn how to **install the batteries**? See page 13.

9 Want to learn more about the primary mirror lock? See **MIRROR MIRROR**, page 37.

11 Want to learn more about the **Right Ascension and Declination setting circles**? See page 55.

- 1 **Eyepiece:** Place the Series 5000 26mm 5-element Plössl eyepiece into the 90° diagonal prism (3, Fig. 1) and tighten in place with the eyepiece thumbscrew (2, Fig. 1). The eyepiece magnifies the image collected in the optical tube.
  - 2 **Eyepiece Thumbscrew:** Tightens the eyepiece (1, Fig. 1) in place. Tighten to a firm feel only.
  - 3 **1.25" Diagonal Prism (or 2" Mirror):** Provides a more comfortable right angle viewing position. A 2" diagonal mirror with a 1.25" adapter is standard with the 12" model. See page 14 for information about attaching the prism or mirror to the microfocuser.
  - 4 **Diagonal Prism Thumbscrew:** Tightens the diagonal prism in place. Tighten to a firm feel only.
  - 5 **Rear Cell Port:** The microfocuser assembly threads onto this port.
  - 6 **Coarse Manual Focus Knob:** Moves the telescope's primary mirror in a finely-controlled motion to achieve coarse image focus. The LX200R telescopes can be focused on objects from a distance of about 25 ft. to infinity. Rotate the focus knob counterclockwise to focus on distant objects, and clockwise to focus on nearby objects.
  - 7 **Fork Arms:** This heavy-duty mount holds the optical tube securely in place.
  - 8 **Battery Compartments:** Insert four user-supplied C-cell batteries into each compartment (one compartment on each fork arm; eight batteries total).
  - 9 **Primary Mirror Lock:** Rotate this knob towards the "Lock" position and adjust the tension to a firm feel; this action serves to lock in the coarse focus and also to prevent mirror flop. Use in conjunction with the Zero Image-Shift Microfocuser (see 4).
  - 10 **Right Ascension (R.A.) Slow-Motion Control:** Make fine adjustments in the Right Ascension, *i.e.*, the horizontal axis, by turning this control with the R.A. Lock (see 12 below) in the unlocked position. Set the R.A. Lock to a "partially locked" position to create a comfortable drag for the R.A. Slow Motion Control.
- Caution:** Do not operate the R.A. Slow Motion Control with the R.A. Lock in the fully locked position, as such operation may result in damage to the internal gear system and also cause you to lose alignment.
- 11 **Right Ascension (R.A.) Setting Circle:** See APPENDIX A, page 55, for detailed information.
  - 12 **Right Ascension (R.A.) Lock:** Controls the manual horizontal rotation of the telescope. Turning the R.A. lock counterclockwise unlocks the telescope, enabling it to be freely rotated by hand about the horizontal axis. Turning the R.A. lock clockwise locks the telescope, prevents the telescope from being rotated manually, and engages the horizontal motor drive for AutoStar II operation.
  - 13 **Computer Control Panel (see Fig. 1 inset):**

A. **ON/OFF Switch:** Turns the computer control panel and AutoStar II ON or OFF. The red power indicator LED next to the switch illuminates when power is supplied to the AutoStar II handbox, the microfocuser, and to the telescope's motor drives (the LED can be turned off in the Panel Light menu; see page 27).



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### Definitions

Throughout this manual, you will notice the terms "Alt/Az," "Right Ascension," and "Declination." Alt/Az or more properly, altazimuth, is frequently used to refer to altitude or Declination (the up-and-down vertical movement of the telescope) and azimuth or Right Ascension (the side-to-side horizontal movement of the telescope). Right Ascension is abbreviated as "R.A." and Declination

### Important Note:

After the telescope is aligned (see page 18), the Dec. slow motion control **16** may be used and the telescope will remain in alignment. However, if the R.A. slow motion control **10** is used after the telescope has been aligned, alignment will be lost and the telescope will need to be realigned.

### Caution:

When loosening the Dec. lock, be sure to support the optical tube (**19**, Fig. 1). The weight of the tube could cause the tube to swing through the fork arms suddenly.

**21** Want to learn more about attaching and aligning the viewfinder? See page 15.

**24** Want to learn more about the Zero Image Shift Microfocuser? See pages 13, 14, and 30.

**B. 12vDC Power Connector:** Provides a connection so that the telescope assembly may be powered from a standard 115v AC home outlet using the optional #547 Power Adapter with Cable or the optional 12v DC #607 Cigarette Lighter Adapter. See **OPTIONAL ACCESSORIES**, page 44.

**C. Focus Port:** Plug the microfocuser into this port. Control the microfocuser through the AutoStar II menus. See **HOT BUTTON MENUS**, page 31, and **24** below.

**D. Reticle Port:** Plug the optional reticle eyepiece into this port. Control the reticle through the AutoStar II menus. See **HOT BUTTON MENUS** page 31. Also see **OPTIONAL ACCESSORIES**, page 44.

**Note:** See the instruction sheets that are included with the focuser, the reticle, and the autoguider for more details.

**E. 12vDC Output:** Use the 12vDC output to power telescope accessories.

**F. Handbox (HBX) Port:** Plug the AutoStar II coil cord into this port.

**G. RS232 Ports (2):** Provides connection with a PC and for current and future Meade accessories. Your PC can control your LX200R telescope using serial commands. Go to the Meade website ([www.meade.com](http://www.meade.com)) to download the latest serial commands and device pinouts.

**H. Autoguider Port:** Plug the optional autoguider into this port. See the instruction sheet that came with your autoguider for more information.

**14 Tilttable AutoStar II Holder:** Attach to fork handles (see **15** below). Holds your handbox in a convenient location.

**15 Fork Handles:** Use to lift optical tube assembly or to rotate the telescope when attached to the tripod.

**16 Declination (Dec.) Slow-Motion Control:** Make fine adjustments in Declination (altitude) by turning this control with the Dec. Lock (see **17** below) in the locked position. In order for this control to operate properly, power must be off.

**17 Dec. Lock:** Controls the manual vertical movement of the telescope. Turning the Dec. lock counterclockwise unlocks the telescope enabling it to be freely rotated by hand about the vertical axis. Turning the Dec. lock clockwise (to a firm feel only) prevents the telescope from being moved manually, but engages the vertical motor drive for AutoStar II operation.

**18 Dust Cover:** Gently pry the dust cover from the front lens of the telescope.

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

**19 Optical Tube:** The main optical component that gathers the light from distant objects and brings this light to a focus for examination through the eyepiece.

**20 Declination (Dec.) Setting Circle** (on left fork arm): See **APPENDIX A**, page 55, for detailed information.

**21 Viewfinder Collimation Screws:** Use these six screws to adjust the alignment of the viewfinder.

**22 8 x 50mm Viewfinder:** A low-power, wide-field sighting scope with crosshairs that enables easy centering of objects in the telescope eyepiece.

**23 GPS Receiver (see page 21 for photo):** Receives information transmitted from Global Positioning System satellites. See pages 18, 19, and 21 for more information.

**24 4-Speed Zero Image-Shift Microfocuser:** Allows precise image focus during visual, CCD, and astrophotographic applications. Maintains precise image centering on even the smallest CCD chips. Operates at four speeds: Fine to fast using the Arrow keys of the AutoStar II hand controller. Plug microfocuser into the Focus port (**13C**, Fig. 1).

**25 Tube Adapters:** The optical and mechanical axes of the LX200R telescope have been carefully aligned at the factory to ensure accurate object pointing. Do not loosen or remove the optical tube assembly from the tube adapters. The resulting misalignment of the axes will result in inaccurate slewing of the telescope in the GO TO mode.



# AUTOSTAR II FEATURES

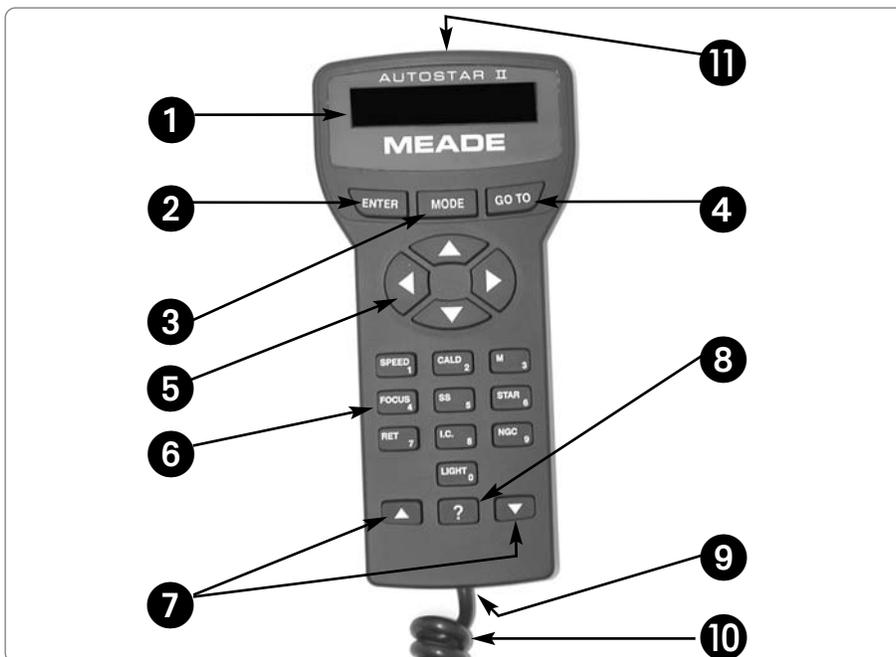


Fig. 2: The AutoStar II Handbox.

Want to learn more about **downloading the latest updates of AutoStar II software from the Meade website**? See page 30.

## Tour the Cosmos with Just the Push of a Button

Control of the LX200R telescope models is through the operation of the standard AutoStar II system. Nearly all functions of the telescope are accomplished with just a few pushes of AutoStar II's buttons.

Because the AutoStar II system uses flash (rewritable) memory, your system will be able to grow when new features and enhancements become available. Download the latest satellite data, star and object catalogs, tours, serial commands list, and software revisions, directly from the Meade website ([www.meade.com](http://www.meade.com)). (Requires the optional LX200 Interface Cable. See **OPTIONAL ACCESSORIES**, page 45.)

Some of the major features of the AutoStar II system are:

- Automatically move the telescope to any of the more than 145,000 objects stored in the object library, including:

Library	# of Objects
New General Catalog (NGC):	7,840
Index Catalog (IC):	5,386
Messier Catalog (M):	110
Caldwell Catalog:	109
Named Objects:	227
Herschel Catalog:	400
Abell Catalog of Galaxy Clusters:	2,712
Arp Catalog of Irregular Galaxies:	645
Uppsala Galaxy Catalog:	12,940
Morphological Catalog of Galaxies:	12,939
General Catalog of Variable Stars:	28,484
SAO:	17,191
Hipparcos Star Catalog:	17,325

- Take a guided tour of the best celestial objects to view on any given night of the year.
- Control your LX200R with your PC using an RS232 interface.
- Align your telescope automatically using GPS (Global Positioning System).
- Access a glossary of astronomical terms.
- Mount the telescope in the "Alt/Az" mode (altitude—azimuth, or vertical—horizontal) for fully automatic tracking of celestial objects.



The AutoStar II system provides control of virtually every telescope function. The AutoStar II handbox has soft-touch keys designed to have a positive feel. The LCD (Liquid Crystal Display) is backlit with red LEDs (Light Emitting Diodes) for easy viewing in the dark. The backlit display, key arrangement, and sequential menu structure make AutoStar II extremely user friendly.

**1 2-Line LCD Display:** This screen displays AutoStar II's menus and information about the telescope.

- **Top line:** Lists the primary menu.
- **Bottom line:** Displays other menus that may be chosen, menu options, telescope status, or information about a function that is being performed.

**2 ENTER Key:** Press to go to the next menu level or to choose an option in a menu. The ENTER key is similar to the RETURN or ENTER key on a computer. See **MOVING THROUGH AUTOSTAR II'S MENUS**, page 18 and **AUTOSTAR II MENUS**, page 24.

**3 MODE Key:** Press to return to the previous menu or data level. The top menu level is "Select Item." The MODE key is similar to the ESCAPE key on a computer.

*Note: Pressing MODE repeatedly while in the "Select Item" level moves AutoStar II to the topmost screen: "Select Item: Object."*

*Note: If MODE is pressed and held for two seconds or more, information about the telescope's status displays. When the status displays, press the Scroll keys (7, Fig. 2) to display the following information:*

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

*Press MODE again to return to the previous menu.*

**4 GO TO Key:** Press to slew (move) the telescope to the coordinates of the currently selected object. While the 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. Also, press during the alignment or GO TO procedures to activate a "spiral search."

**5 Arrow Keys:** The Arrow keys have several functions. Press an Arrow key to slew the telescope in a specific direction (up, down, left, and right), at any one of nine different speeds. See **SLEW SPEEDS**, page 17. Use the Up and Down Arrow keys to move the telescope vertically up and down. The Left Arrow key rotates the telescope horizontally counterclockwise, while the Right Arrow key rotates it clockwise (unless reversed for Southern Hemisphere use).

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

Additionally, use the Arrow keys 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.

**6 Number Keys:** Press to input digits 0 to 9. Each Number key also has a specific function, which is printed on each key (these are commonly known as "hot buttons"—see page 31):

**1 SPEED:** Changes the slew speeds. To operate, press Speed and then a Number key (1 is the slowest speed, 9 is highest speed).

**2 CALD** (Caldwell): Press to display the Caldwell catalog on the AutoStar II handbox.

**3 M** (Messier): Press to display the Messier catalog library.

**4 FOCUS:** Press to display the Focus Control menu.

**4** Want to learn more about using the **GO TO function**? See page 20.

Want to learn how to perform a **spiral search**? See page 20.

**SPEED 1** Want to learn more about **changing slew**

**FOCUS 4** Want to learn more about the **Focus menu**? See page 31.



RET  
7

Want to learn more about the **Reticle menu**? See page 31.

**Tip:**

When an **astronomical term** appears in [brackets], press ENTER for a definition or more detailed information. Press MODE to return to the scrolling AutoStar II Help display.

If a **celestial object's name** appears in brackets (and your telescope is aligned), press ENTER and then GO TO to slew the telescope to the object.

**5 SS:** Press to display the Solar System library.

**6 STAR:** Press to display the Star library.

**7 RET (Reticle):** Press to display the Reticle Control menu.

**8 IC:** Press to display the Index Catalog library.

**9 NGC (New General Catalog):** Press to display the NGC catalog library.

**0 LIGHT:** Press to turn on and off the red utility light on the top of the hand-box.

- 7 Scroll Keys:** Press to access options within a selected menu. The menu is displayed on the first line of the screen. Options in the menu are displayed, one at a time, on the second line. Press the Scroll keys to move through the options. Press and hold a Scroll key to move quickly through the options.

The Scroll keys also control the speed of text scrolling on the AutoStar II display. When text is scrolling, press and hold the Up Scroll key for a faster display speed and the Down Scroll key for a slower display speed.

- 8 ? Key:** Press to access the "Help" file. "Help" provides on-screen information on how to accomplish whatever task is currently active.

Press the ? key and then follow the prompts on the display to access details of AutoStar II functions in the Help feature. The Help system is essentially an on-screen instruction manual.

If you have a question about an AutoStar II operation, e.g., INITIALIZATION, ALIGNMENT, etc., press the ? key and follow the directions that scroll on the second line. When satisfied with the Help provided, press MODE to return to the original screen and continue with the chosen procedure.

- 9 Coil Cord Port:** Plug one end of the AutoStar II coil cord (**10, Fig. 2**) into this port located at the bottom of the AutoStar II handbox.
- 10 Coil Cord:** Plug one end of the AutoStar II coil cord into the HBX port (**13F, Fig. 1**) of the computer control panel of the telescope and the other end into the AutoStar II coil cord port. See **9** above.
- 11 Utility Light:** Use this built-in red light to illuminate star charts and accessories without disturbing your eye's adaptation to darkness. Press "0" to turn the light on and off.

## LX200R TIPS

### Join an Astronomy Club, Attend a Star Party

One of the best ways to increase your knowledge of astronomy is to join an astronomy club. Check your local newspaper, school, library, or telescope dealer/store 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 with your LX200R telescope. See page 41 for more information about photography with the LX200R.

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.



# GETTING STARTED

## Parts Listing

Getting the telescope ready for first observations requires only a few minutes. When first opening the packing box, note carefully the following parts:

- LX200R Telescope with fork mount system
- AutoStar II handbook and interface coil cord; handbook holder
- Microfocuser assembly
- 8 x 50mm viewfinder assembly
- Eyepiece holder and 1.25" diagonal prism ( 8", and 10" models)
- 1.25" Adapter and 2" diagonal mirror (12" model only)
- Series 5000 26mm 5-element Plössl eyepiece, in a plastic storage container
- Variable height tripod and mounting base (12" model only: Giant variable tripod)
- Set of hex keys

## How to Attach the Tripod to the Telescope Assembly

The telescope's fork mount base (also called a drive base) attaches directly to the field tripod. The telescope in this way is mounted in an "altazimuth" ("altitude-azimuth," or "vertical-horizontal") format.

The field tripod also can be used in conjunction with the optional equatorial wedge (see **EQUATORIAL WEDGE**, page 56) for long exposure astrophotography. The equatorial wedge permits alignment of the telescope's polar axis with the Celestial Pole (or North Star).

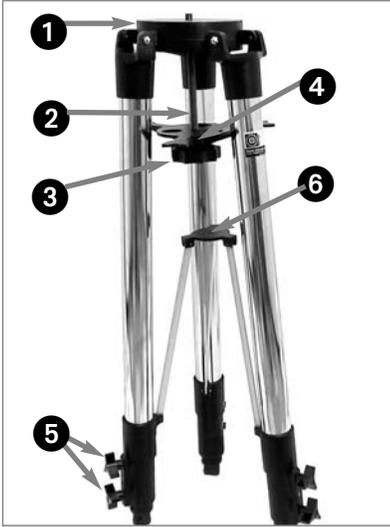
1. Remove the field tripod from the shipping carton. Stand the tripod vertically with the tripod feet down and with the tripod still fully collapsed. Grasp two of the tripod legs and, with the full weight of the tripod on the third leg, gently pull the legs apart to a fully open position.
2. Thread in the 6 lock-knobs (2 on each tripod leg) near the foot of each tripod leg (**5, Fig. 3**). These lock-knobs are used to fix the height of the inner, extendible tripod leg sections.

**Note:** *Tightening to a firm-feel is sufficient; over-tightening may result in stripping of the knob threads or damage to the tripod legs, and results in no additional strength.*

3. The spreader bar has been removed for shipment. To install, first remove the threaded rod (**2, Fig. 3**) from the tripod head (**1, Fig. 3**); a small piece of plastic holds the threaded rod in place. Remove the small plastic bag that is stapled to the threaded rod. This bag contains the "C" clip retainer and an extra clip.
4. Slide the spreader bar (**4, Fig. 3**) onto the threaded rod (note the correct orientation as shown in **Fig. 4**) and position the threaded rod back through the tripod head. Place the clip retainer ( a "C" clip) into the slot in the threaded rod above the tripod head. This clip holds the threaded rod in place.
5. Position the spreader bar so that the 3 arms of the spreader bar line up with the 3 tripod legs.
6. Place the entire telescope onto the top of the tripod head, and insert the threaded rod into the central hole in the bottom of the drive base of the telescope. Tighten the tension knob (**Fig. 4**); firm tightening of the tension knob is sufficient to result in rigid positioning of the tripod legs.
7. To vary the tripod height, loosen the 6 leg lock-knobs, slide the 3 inner tripod leg sections out to the desired height, and firmly re-tighten (but do not overtighten) the 6 lock-knobs.

**To collapse the tripod** (after removing the telescope and equatorial wedge, if applicable) for storage, follow these steps:

1. Rotate the spreader bar 60° from its assembled position, so that one spreader bar arm is located between each adjacent pair of tripod legs.
2. At the base of the tripod is a 3-vane extension strut system, with a circular hub at its center (**6, Fig. 3**). Grasp the tripod head (**1, Fig. 3**) with one hand and, with the



**Fig. 3:** Tripod components: (1) Tripod Head; (2) Threaded Rod; (3) Tension Knob; (4) Spreader Bar; (5) Lock Knobs; (6) Strut Hub



**Fig. 4:** Attaching the telescope to the tripod. Note the orientation of the spreader bar.



**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.



Fig. 5: Battery installation.

**Note:**

The microfocuser is shipped with the microfocuser adapter (B) threaded to the SC accessory adapter (L). Unthread the adapters from each other before attaching the microfocuser.

**Tip:**

Although you can set up the telescope to face any direction to perform Automatic Alignment, you will achieve optimal performance when the computer control panel faces South.

other hand, pull directly "up" on the central hub of the extension strut system. This operation will cause the tripod legs to move inward to a collapsed position.

**Notes Concerning the Tripod:**

If the tripod does not seem to extend or collapse easily, do not force the tripod legs in or out. By following the instructions above, the tripod will function properly, but if you are unclear on the proper procedure, forcing the tripod into an incorrect position may damage the extension strut system.

Do not overtighten the 6 lock-knobs used to fix the inner tripod leg sections at various heights. Tighten to a firm feel only.

Be sure the spreader bar (4, Fig. 3) is not upside-down on the threaded rod.

## How to Assemble Your Telescope

Assembly of the LX200R telescope requires eight C-cell (user-supplied) batteries or the optional #547 Power Adapter with Cable connected to a standard 115v home outlet or to an optional #607 Cigarette Lighter Adapter (see **OPTIONAL ACCESSORIES**, page 45). Plug an adapter into the 12vDC In port of the computer control panel (13B, Fig. 1).

**To install batteries:**

1. **Position the optical tube:** Turn the Dec. lock (17, Fig. 1) counterclockwise to unlock the the optical tube (19, Fig. 1) and move it through the fork arms. Move the optical tube to the position depicted in Fig. 1 and turn the Dec. lock clockwise to a firm feel to relock the position of the optical tube.
2. **Install batteries:** Remove the battery compartment covers (8, Fig. 1) and carefully remove the battery holders, being mindful of the connector wires. Insert four user-supplied C-cell batteries into each battery holder, oriented as shown on the diagram on the battery slots inside the battery holder. Return the battery holders to their respective compartments and replace the covers. (See Fig. 5.)
3. **Plug in the AutoStar II handbox:** Be certain that the power switch on the computer control panel (13A, Fig. 1) is in the OFF position. Plug the coil cord of the

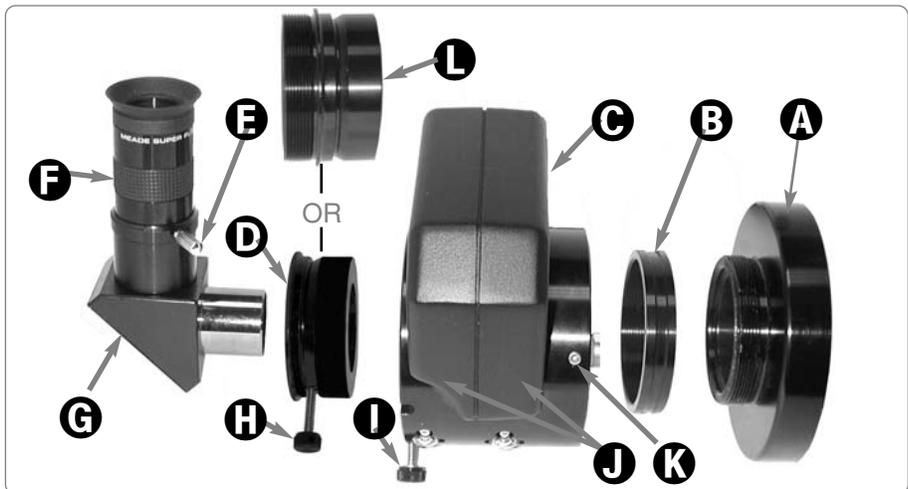


Fig. 6: Microfocuser and eyepiece assembly. (A) Rear cell of telescope (shown separate from the telescope assembly for the sake of clarity, see 5, Fig. 1); (B) Microfocuser adapter; (C) Microfocuser; (D) 1.25" accessory adapter. SC accessory adapter (L) may be used in this position instead if the telescope accessories are being used. Do not use either adapter if using a 2" diagonal diagonal mirror; (E) Eyepiece holder thumbscrew; (F) Eyepiece (Note: Your eyepiece make look different than the one pictured here); (G) 1.25 "Diagonal Prism. 2" diagonal mirror may also be used in this position (12" models); (H) Adapter Thumbscrew; (I) Microfocuser Thumbscrews; (J) Microfocuser bearings; (K) Hex screws; (L) Microfocuser SC Accessory Adapter (see margin note).

AutoStar II handbox into the HBX port (13F, Fig. 1).



Looking at or near the **Sun** will cause **irreversible** damage to your eye. Do not point this telescope at or near the Sun. Do not look through the telescope as it is moving.

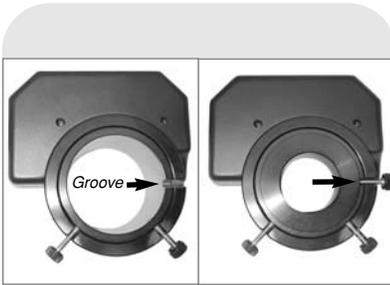


Fig. 7a: Microfocuser groove.  
Fig. 7b: Microfocuser adapter thumbscrew in groove.

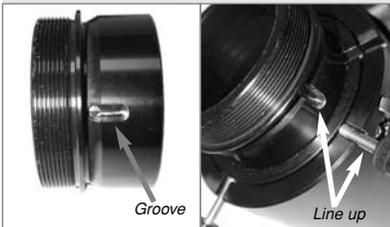


Fig. 8a: SC adapter groove.  
Fig. 8b: Line up SC adapter groove with microfocuser thumbscrew groove.



Fig. 9: Microfocuser and 1.25 diagonal prism with eyepiece completely assembled.

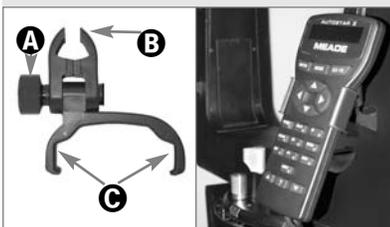


Fig. 10a: Handbox holder: (A) Lock knob; (B) Clamp; (C) Holder.  
Fig. 10b: Handbox holder attached to fork arm handle.

**Note:** The AutoStar II handbox and the microfocuser do not require batteries; the telescope supplies their power.

4. **Attach microfocuser:** Remove the dust cap from the rear cell port (5, Fig. 1) of the telescope. Thread the microfocuser adapter (B, Fig. 6) onto the rear cell port thread. Slide the microfocuser (C, Fig. 6) over the microfocuser adapter and tighten the three hex screws (K, Fig. 6) using the provided hex key.
5. **Attach Diagonal (or accessories)**

**1.25" Diagonal Prism Users:** If using the 1.25" diagonal prism (G, Fig. 6), slide the 1.25" adapter (D, Fig. 6) into the microfocuser. Line up the thumbscrew into the groove in the microfocuser (Fig. 7a and 7b). Tighten the microfocuser thumbscrews (I, Fig. 6) to a firm feel only. Slide the 1.25" diagonal prism into the adapter (D, Fig. 6). Tighten the accessory adapter thumbscrew (H, Fig. 6) to a firm feel only.

**SC Optional Accessory Users:** If using any of the optional accessories (such as the Off-Axis Guider, T-Adapter, etc.; see page 44) with the LX200R SC models, slide the supplied SC accessory adapter (L, Fig. 6) into the microfocuser. Line up the groove on the side of the adapter with either of the microfocuser thumbscrews (Fig. 8a and 8b) and tighten that thumbscrew to a firm feel only. Slide the optional accessory into the accessory adapter. Tighten the other microfocuser thumbscrew to a firm feel only.

**2.0" Diagonal Mirror Users:** If using the 2.0" diagonal mirror, slide the mirror directly into the microfocuser. The adapters (H and L, Fig. 6) are not required. Tighten the thumbscrews (I, Fig. 6) to a firm feel only.

**Plug in the microfocuser:** Plug the microfocuser into the Focus port (13C, Fig. 1).

**Note:** If you wish to mount a camera directly to the microfocuser, you need to attach an optional T-Adapter to the microfocuser. See **OPTIONAL ACCESSORIES**, page 44.

**Important Note:** The microfocuser is carefully adjusted at the factory. If it become necessary to adjust the microfocuser, it must be performed by factory trained technicians. If the microfocuser is improperly adjusted, performance will degrade and damage will result. Damage due to improper adjustments not authorized by the factory will not be covered under warranty.

6. **Insert eyepiece:** Remove the Series 5000 26mm 5-element Plössl eyepiece (1, Fig. 1) from its container and place it in the diagonal prism (G, Fig. 6) or diagonal mirror. Tighten the eyepiece holder thumbscrew (2, Fig. 1) to a firm feel only. Rotate the mirror lock knob (9, Fig. 1) towards the "Unlock" position, until it feels loose—the telescope is shipped with the mirror locked.
7. **Remove dust cover:** Remove the dust cover (18, Fig. 1) from the optical tube assembly (19, Fig. 1) by gently prying it off.
8. **Attach the handbox holder:** Remove the handbox holder from the plastic bag. If necessary, loosen the lock knob (A, Fig. 10a) and place the clamp (B, Fig. 10a) about one of the fork arm handles (15, Fig. 1). Tighten the lock knob to a firm feel. Slide the AutoStar II handbox into the holder (C, Fig. 10a). You may also snap the handbox into the holder: Slide one side of the handbox into the holder and then firmly press the other side of the handbox into the holder until it snaps in place. Adjust the tilt of of the holder by loosening the lock knob and then moving the holder clamp to the desired angle. Retighten the lock knob.

## Choosing an Eyepiece

A telescope's eyepiece magnifies the image formed by the telescope's main optics. Each eyepiece has a focal length, expressed in millimeters, or "mm." The smaller the focal length, the higher the magnification. *For example:* An eyepiece with a focal length of 9mm has a higher magnification than an eyepiece with a focal length of 26mm.

Your telescope comes supplied with a Series 5000 26mm 5-element Plössl eyepiece which gives a wide, comfortable field of view with high image resolution.

Low power eyepieces offer a wide field of view, bright, high-contrast images, and eye relief during long observing sessions. To find an object with a telescope, always start



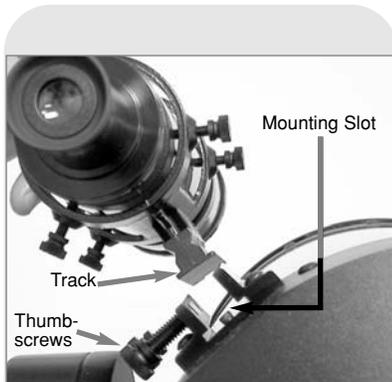


Fig. 11: Viewfinder Assembly.

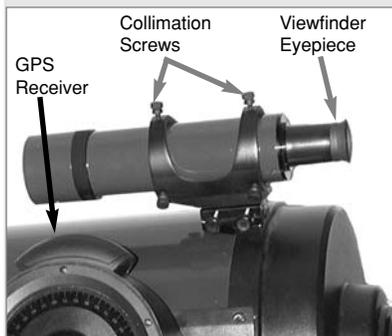


Fig. 12: Viewfinder collimation screws and eyepiece.

**Tip:**

Because the space between the GPS receiver and the viewfinder is a bit tight, it is helpful if you tighten the front, bottom viewfinder collimation thumbscrew first and use the other screws to set the alignment. However, if you determine you need to adjust the front thumbscrew, choose an alignment object that allows you to slightly elevate or rotate the telescope to a convenient position for adjustment of this thumbscrew.

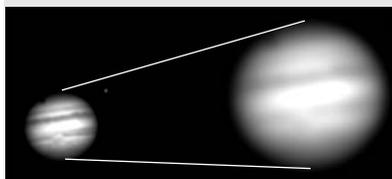


Fig. 13a & 13b: Jupiter; examples of the right amount of magnification and too much magnification.

with a lower power eyepiece such as the 26mm Plössl. When the object is located and centered in the eyepiece, you may wish to switch to a higher power eyepiece to enlarge the image as much as practical for prevailing seeing conditions. For information about optional eyepieces for the your telescope, see **OPTIONAL ACCESSORIES**, page 43.

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 (an eyepiece's focal length is printed on the side of the eyepiece). To calculate eyepiece power, divide the telescope's focal length by the eyepiece's focal length. *For example:* A 26mm eyepiece is supplied with LX200R models. The focal length of the 8" f/10 LX200R is 2000mm (see **SPECIFICATIONS**, pages 46 through 48).

$$\text{Eyepiece Power} = \text{Telescope focal length} \div \text{Eyepiece focal length}$$

$$\text{Eyepiece Power} = 2000\text{mm} \div 26\text{mm}$$

$$\text{Eyepiece Power} = 77$$

The eyepiece power, or magnification is therefore 77X.

**Note:** For a list of magnification ratings of the eyepieces available for the LX200R telescopes, see **OPTIONAL ACCESSORIES**, page 43.

### Mounting and Adjusting the Viewfinder

To align the viewfinder, perform steps 1 through 5 during the daytime; perform step 6 at night.

1. Slide the track on the bottom of the viewfinder into the slot in the viewfinder mounting assembly. See **Fig. 11**. To secure the viewfinder to the mounting assembly, tighten the two thumbscrews (**Fig. 11**) to a firm feel only.
2. If you have not already done so, insert the Super Plössl 26mm eyepiece into the diagonal prism.
3. Unlock the R.A. (**12, Fig. 1**) and Dec. (**17, Fig. 1**) locks so that the telescope moves freely on both axes.
4. Point the telescope at some well-defined and stationary land object at least 200 yards distant, such as the top of a telephone pole or street sign. Center the object in the telescope eyepiece. Re-tighten the R.A. and Dec. locks.
5. Look through the viewfinder eyepiece (**Fig. 12**) and loosen or tighten, as appropriate, one or more of the viewfinder collimation screws (**Fig. 12**) until the viewfinder crosshairs are precisely centered on the object you previously centered in the telescope eyepiece.
6. Check this alignment on a celestial object, such as the Moon or a bright star, and make any necessary refinements, using the method outlined in steps 3 through 5.

**Note:** Seeing conditions vary widely from night-to-night and site-to-site. Turbulence in the air, even on an apparently clear night, can distort images. If an image appears fuzzy and ill-defined, back off to a lower power eyepiece for a more well-resolved image (see **Fig. 13a and 13b**).

### LX200R TIPS

#### Too Much Power?

Can you ever have too much power? If the type of power you're referring to is eyepiece magnification, yes, you can! The most common mistake of the beginning observer is to "overpower" a telescope by using high magnifications which the telescope's aperture and atmospheric conditions cannot reasonably support. Keep in mind that a smaller, but bright and well-resolved image is far superior to one that is larger, but dim and poorly resolved (see Figs. 13a and 13b). Powers above 400X should be employed only under the steadiest atmospheric conditions.

AutoStar II 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 LX200R telescopes. See **OPTIONAL ACCESSORIES**, page 43.



# OBSERVING

## **Important Note:**

Objects appear upside-down and reversed left-for-right when observed in the viewfinder. Objects viewed through the telescope eyepiece when inserted into the diagonal prism and microfocuser assembly appear right-side-up, but reversed left-for-right.

This image inversion is of no consequence when observing astronomical objects and, in fact, all astronomical telescopes yield inverted images.

During terrestrial observing, where a fully-correctly-oriented image (right-side-up and correct left-for-right) is desirable, an optional #928 45° Erecting Prism is available. See **OPTIONAL ACCESSORIES**, page 44.

## **Note:**

Viewing conditions vary widely from night-to-night and site-to-site. Turbulence in the air, even on an apparently clear night, can distort images. Low-power eyepieces, such as the 26mm Plössl supplied with your telescope, are better suited to resolving images in poor viewing conditions.



**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.**

## **Warning:**

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

Want to learn more about **Slew Speeds**? See **Slew Speeds**, this page.

## 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 R.A. lock (**12, Fig. 1**) and Dec. lock (**17, Fig. 1**).
2. Move your telescope to observe distant street signs, mountains, trees, and other structures. Use your viewfinder to help site-in on an object.
3. Center the object in the viewfinder's crosshairs and then in the telescope eyepiece. When the object is centered in your eyepiece, remember to re-tighten the R.A. and Dec. locks.
4. To move telescope in the R.A. and Dec. axes again, remember to loosen the R.A. lock and tighten the Dec. lock. Then rotate the manual slow motion control knobs (**10, Fig. 1**) and (**16, Fig. 1**).
5. Practice focusing objects using the coarse focus knob (**6, Fig. 1**).

**Important Note:** The telescope is shipped with the mirror locked. Before using the coarse focus knob, rotate the mirror lock knob (**9, Fig. 1**) towards the "unlock" position, until it feels loose.

For more precise focusing, see **FOCUSING THE EYEPIECE**, page 17.

6. 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 II handbox operation, you can counteract the drift using the automatic tracking feature in the AutoStar II Setup menu (see **TO TRACK AN OBJECT AUTOMATICALLY**, page 18), or by using AutoStar II's GO TO capabilities (see **GO TO SATURN**, page 20).

## Terrestrial Observing

The LX200R models are excellent high-resolution terrestrial (land) telescopes. Viewing terrestrial objects requires looking along the Earth's surface through heat waves. These heat waves often cause degradation of image quality. Lower power eyepieces, like the Series 5000 26mm 5-element Plössl 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 II's Arrow Keys

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

1. Tighten the R.A. and Dec. locks (**12 and 17, Fig. 1**).
2. Verify that AutoStar II is properly connected to your telescope. See **HOW TO ASSEMBLE YOUR TELESCOPE**, page 13.
3. Flip the telescope power switch to the ON position.  
The AutoStar II screen is activated and a copyright message displays briefly, followed by a short beep. Then AutoStar II 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 II to signify that the message has been read and understood.
5. "Automatic Alignment" displays. Press any AutoStar II key to abort automatic alignment.
6. The Arrow keys are now activated. Press the Arrow keys (**5, Fig. 2**) to slew (move) the telescope up, down, right, or left.
7. Press the Speed key (Number key "1") and then a Number key (**6, Fig. 2**) to change the telescope's slew speed. ("1" is the slowest speed, "9" is highest speed.)
8. Use the viewfinder (**22, Fig. 1**) to locate an object and practice using the AutoStar II's Arrow keys to center the object in the telescope's field of view.



See **MIRROR MIRROR**, page 38, for more information about the microfocuser and the primary mirror lock.

- Bring the object into focus (see below).

## Focusing the Eyepiece Using the Microfocuser

The LX200R zero image-shift microfocuser (**24, Fig. 1**) allows you to obtain the most precise image focus possible during visual, photographic, and CCD applications, maintaining precise and "jiggle-free" image centering on even the smallest CCD chips.

### To use the microfocuser:

- Perform this part of the procedure during the daytime, without the eyepiece assembly (eyepiece, diagonal, etc.) attached to the microfocuser. Press the AutoStar II Focus button and then the Up and Down Arrow keys. Observe the microfocuser drawtube as it travels in and out. When the drawtube reaches the furthest extension of its travel, listen for a change in the pitch of the motor. Notice that the drawtube's maximum extension is about a half-inch out from the microfocuser. Set the drawtube so that it extends about a quarter-inch (about halfway).
- When you begin your viewing session, attach the eyepiece assembly. See pages 13 and 14 for details.
- Make sure that the microfocuser is plugged into the computer control panel focus port (**13C, Fig. 1**).
- Point the telescope at a bright star.
- Rotate the mirror lock knob (**9, Fig. 1**) towards the "unlock" position, until it feels loose. Use the coarse focus control (**6, Fig. 1**) to achieve a rough focus of the star.
- Rotate the mirror lock knob towards the "lock" position and adjust the tension to a firm feel; this action serves to lock in the coarse focus.

**Important Note:** Do not use or bump the coarse focus knob once you have set the coarse focus. If you do so, repeat steps 5 and 6 above to reset the coarse focus.

- Press the Focus key (Number key "4"). "Focus Control: Speed: Fast" displays. Press the Up or Down Scroll keys to cycle through the four speed options. Press ENTER to select the desired speed. Or press one of the following Number keys after pressing the Focus key to change the speed:

Key #	Speed	Key #	Speed
1 or 2	Fine	6 or 7	Medium
3, 4, or 5	Slow	8 or 9	Fastest

- Use the Arrow keys to bring the star into fine focus.
- You may need to repeat this procedure when you change eyepieces.

## Slew Speeds

AutoStar II has nine slew speeds that move the optical tube at rates that are directly proportional to the sidereal rate and have been calculated to accomplish specific functions. Press the Speed key (Number key "1") and then press a Number key to change the slew speed, which is shown for about two seconds on AutoStar II's display.

The nine available speeds are:

Number Key 1	=	1x =	Guide Rate, programmable (see <b>Tip</b> at left)
Number Key 2	=	2x =	2 x sidereal (0.5 arc-min/sec or 0.008°/sec)
Number Key 3	=	8x =	8 x sidereal (2 arc-min/sec or 0.033°/sec)
Number Key 4	=	16x =	16 x sidereal (4 arc-min/sec or 0.067°/sec)
Number Key 5	=	64x =	64 x sidereal (16 arc-min/sec or 0.27°/sec)
Number Key 6	=	128x =	30 arc-min/sec or 0.5°/sec
Number Key 7	=	1.5° =	90 arc-min/sec or 1.5°/sec
Number Key 8	=	3° =	180 arc-min/sec or 3°/sec
Number Key 9	=	Max =	480 arc-min/sec or 8°/sec

**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:** Enable centering of an object in the field of a low-to-moderate power eyepiece, such as the standard Super Plössl 26mm.

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

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

### Tip:

The slowest speed, 1x, may be changed using the Guiding Rate menu. This menu allows you to change the speed by entering a percentage of the speed (either more or less than 100%). This function may be useful in guiding the telescope during CCD and long-exposure photography. See **GUIDING RATE**, page 29, for more information.



**Definition:**

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

During the **automatic alignment** procedure, the system calculates these parameters automatically.

AutoStar II uses this information to precisely calculate the location of celestial objects (such as stars and planets) and to move your telescope correctly for various operations.

**Tip:**

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

**Important Note:**

Press any key on the AutoStar II handbox to abort the GPS fix.

Press MODE repeatedly until "Select Item" displays and use the AutoStar menu options to choose a manual alignment or to find an AutoStar option, such as "Brightness."

## Observe the Moon

Point your telescope at the Moon (note that the Moon is not visible every night) and practice using the Arrow keys, the microfocuser 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, making the overly bright surface to appear flat and rather uninteresting. Consider the use of a neutral density Moon filter when observing the Moon. See page 45. 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 electro-mechanical capabilities. It is in astronomical applications where the high level of optical performance is readily visible. The range of observable astronomical objects is limited only by the observer's motivation.

## 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 (follows) the stars and other objects in the night sky. If the telescope is not tracking an astronomical object, the object will drift out of the eyepiece field of view. The tracking function automatically keeps an object centered in the telescope's eyepiece.

To automatically track objects, you need to learn how the AutoStar II keypad operates in order to move through its menus. You'll need to initialize and align your telescope.

## Moving Through AutoStar II's Menus

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

- Press ENTER (2, Fig. 2) to go deeper into AutoStar II's menu levels.
- Press MODE (3, Fig. 2) to move back toward the top menu level.
- Press the Scroll keys (7, Fig. 2) to move up and down through the options available for each level.
- Press the Arrow keys (5, Fig. 2) to enter characters and digits. The Arrow keys are also used to move the telescope.
- Use the Number keys to enter digits.

## Automatic Alignment (Auto Align™) Feature

AutoStar II offers four methods of altazimuth (alt/az) alignment; this section describes how to initialize and align your telescope using **Automatic Alignment**. (For a description of the other alt/az alignment methods, see pages 37 and 38. For information about equatorial (polar) alignment, see **APPENDIX A**, page 52.)

### To prepare your telescope for Automatic Alignment:

1. Tighten the R.A. and Dec. locks (12 and 17, Fig. 1).
2. Verify that AutoStar II is properly connected to your telescope. See **HOW TO ASSEMBLE YOUR TELESCOPE**, page 13.
3. Flip the telescope power switch to the ON position.  
When you slide the On/Off switch to "On" on your telescope's computer control panel, a version screen briefly appears, followed by "Welcome to AutoStar."
4. "Press 0 to align or Mode for Menu." displays. Press "0" to begin Automatic Alignment. (If you wish to choose a manual alignment method, keep pressing Mode to go through the menus to find other alignments.)

**Note:** AutoStar II initializes the Smart Drive if "On" has been previously performed PEC training and you have "parked" the telescope. If you have parked it, AutoStar II will remember its position on the worm gear. If you do not park the scope and turn it off, it will not remember its position. See **PARKING THE TELESCOPE**, page 28 and **PEC TRAINING**, page 39.



**Important Note:**

Once the telescope is aligned, only use the Arrow keys to move the telescope. Once the telescope has been aligned, do not loosen the telescope locks (12 and 17, Fig. 1), or move the base manually, or alignment will be lost.

**Important Notes:**

It is recommended that you do not attempt a GPS fix indoors.

It is also recommended that you **CALIBRATE SENSORS** the first time your telescope takes a GPS fix. See page 29 for more information.

**Important Note:**

The **Daylight Saving** menu enables or disables the Daylight Savings Time setting: Remember to turn this setting off or on the two days a year when Daylight Saving changes. See **TIMING IS EVERYTHING**, page 28.

5. "Automatic Alignment" displays. The system now performs the following routines (press any AutoStar II key to abort Automatic Alignment; see **IMPORTANT NOTE**, at the bottom left of page 18.) :

**Caution:** As the telescope performs the following operations, it will swing and rotate. Keep a safe distance from the telescope. The telescope now finds the level and tilt position of the telescope, and also detects where true North is. It may not actually level or tilt the telescope or point to North—it is just detecting these positions. This may take a minute or two.

- a. **Finds the home position.** Moves the telescope to find the "home" position. When the home position is found, the system knows the limiting positions of the telescope and can avoid tangling cables and over-rotating the telescope.
- b. **Detects "level" of the base of the telescope; finds tilt and tip.** To detect level, AutoStar II must calculate "level" at three compass points. See **FINDING TRUE LEVEL** in on page 21.

AutoStar II also determines the positioning (*i.e.*, tilt and tip) of the optical tube.

- c. **Finds North.** Locates magnetic North, then calculates true North. See **FINDING TRUE NORTH**, page 21.
- d. **Attempts a "GPS Fix."** The GPS receiver attempts to acquire and sync up with signals from GPS satellite system. "Getting GPS Fix" displays. See **THE GLOBAL POSITIONING SYSTEM** on page 21.

After performing these operations, AutoStar II now knows:

- The telescope's limiting positions
- Where level is for the telescope
- The location of true North
- The observing site's location
- The date and time

**Note:** Press any key to abort the GPS fix. You will then be prompted to enter the time, date and location.

- e. Once the level, tilt and North are detected, the telescope will "Go To" 2 alignment stars. The telescope will go to these stars in order to orient itself to the sky. Once it has done this, it will be able to point to any of the more than 145,000 stars in its database.

"Automatic Alignment: Selecting Star" and "Slewing" display. Finally, when it is close to the alignment star "Center Brightest Star: Press ENTER" displays. Use the Arrow keys to center the alignment star in the eyepiece. The alignment star will be the brightest star in that area of the sky (and hence, "brightest star"). When the alignment star is entered, press ENTER.

**Note:** If you press the "?" key while "Ctr Brightest Star" displays, the alignment star that AutoStar has chosen will display. For example, "Arcturus: Press ENTER" may display.

**Note:** 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.

**LX200R TIPS**

**Which One's the Alignment Star?**

If AutoStar II 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. If you perform a GO TO to an alignment star and you're not sure if you have located the alignment star or it isn't in the eyepiece, look through your viewfinder. When you view an alignment star in the viewfinder, it stands out dramatically from the rest of the stars in that portion of the sky. The viewfinder will help you locate a star more quickly than the eyepiece, because it has a much wider field of view than the eyepiece. Using AutoStar II, set the slew speed to 6 or higher and use the Arrow keys to center the alignment star in the viewfinder. If your viewfinder has been aligned with the telescope, the alignment star should now be in the eyepiece. Set the slew speed to 4 or less and center the star in the eyepiece. Also see the "Spiral Search" tip, page 20.



**Tip:**

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 telescope stops slewing. The telescope begins to move 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.

**Important Note:**

While performing the automatic tracking procedure, only use the Arrow keys to move the telescope. Once the telescope has been aligned, do not loosen the telescope locks (12 and 17, Fig. 1), or move the base manually, or alignment will be lost.

**Tip:**

**To manually enter the R.A. and Dec. coordinates of an object:** Press and hold MODE for two seconds or more. The R.A. and Dec. coordinates display. Press GO TO. "Object Position" and a set of coordinates displays. Then enter the R.A. and Dec. coordinates of any celestial object using Number keys. As soon as the coordinates are entered, AutoStar II slews the telescope to the coordinates. Note that the telescope must be initialized for this procedure to operate properly.

- The telescope now slews to the second alignment star. AutoStar displays "Center Brightest Star: Press ENTER" displays. Use the Arrow keys to center the alignment star in the eyepiece. When the second alignment star is centered, press ENTER.
- "Alignment successful" displays. If "Alignment Unsuccessful" displays, perform the procedure over again.

## Observe a Star using the Automatic Tracking Feature

Now that your telescope has been aligned, you are able to track celestial objects. In this example, the AutoStar II Arrow keys are used to find a star, and then AutoStar II's tracking capability automatically keeps the star centered in your telescope's eyepiece.

- When Automatic Alignment is completed (as described in the previous section), "Select: Object" displays on AutoStar II.
- Select a bright star from one of the Object menus. You may choose any unobstructed, bright star for the purposes of this example. Use the viewfinder (22, Fig. 1) to help line up on the star. Use AutoStar II's Arrow keys to center the star in the eyepiece. The tracking motors will then keep the star you have chosen in the center of the eyepiece.

## Go To Saturn

This exercise demonstrates how to select a celestial object, the planet Saturn, for viewing from AutoStar II's Solar System library. Objects in the eyepiece should maintain their position even though the Earth is rotating beneath the stars. In other words, the telescope tracks the chosen objects.

**Note:** Saturn is not visible the entire year; you may need to choose another object from any of AutoStar II's many object libraries; however, the procedure, as described below, remains the same.

- After the telescope is aligned, press Number key "5."
- "Solar System: Mercury" displays. Keep pressing the Scroll Down key until "Solar System: Saturn" displays.
- Press ENTER. "Calculating" displays. Then "Saturn" and a set of coordinates displays. Note that Saturn's (and other planets') coordinates change throughout the year.
- 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 II 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.

## Using the Guided Tour

The Guided Tour feature is an easy and fun method of exploring AutoStar II's GO TO capabilities. This example demonstrates using "Tonight's Best" Guided Tour.

- After observing Saturn, keep pressing MODE until "Select Item: Object" displays again.
- Press the Scroll Down key twice. "Select Item: Guided Tour" displays.
- 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.

- "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 leave the Guided Tour menu.

Other Guided Tours are available, such as "How Far is Far" and "A Star's Life." If you have programming skills, you may wish to create a custom Guided Tour. See **CREATE YOUR OWN GUIDED TOUR**, page 58.



Fig. 14: LX200R GPS Receiver.

## LX200R INFO

### Global Positioning System

The Global Positioning System (GPS) is comprised of 24 satellites orbiting the Earth that are constantly transmitting their precise position and time. The system provides highly accurate, worldwide positioning and navigation information for any number of applications.

GPS receivers on the Earth acquire signals from three to twelve satellites to determine the precise latitude, longitude, and time of the receiver. (Accuracy of the receiver's position may be within 10 to 15 feet.) As AutoStar II uses latitude, longitude, and time information to calculate the positions of celestial objects, GPS is an ideal tool for aligning your LX200R telescope.

### Detecting True Level

To detect level of the base of the telescope, AutoStar II must calculate the tip and tilt of the telescope at three compass points and then compensate for it. Finding level involves the geometric calculations of a "plane." In order to define a plane, three positions are necessary. This is not unlike building a table: For a table to stand level and solid, it must have a minimum of three legs. AutoStar II makes gravitational measurements to make a precise determination of true level.

### Finding True North

Locating True North is one of the most important ingredients in the alignment of a telescope. True North is the axis—the pole—which the Earth spins about and is a key reference for the motion of the Earth.

As you look at the night sky, the stars seem to move; in fact, if you watched long enough or took a long time-exposure photograph, you'd realize that the stars seem to revolve around one point—the pole or True North. When AutoStar II knows where True North is and also knows the time, it can calculate the location of all the other objects in the sky.

One traditional way to find True North is to locate the North Star, Polaris, which lies very close to True North. Another way to calculate True North is to use gyroscopes or accelerometers.

The LX200R determines True North by using a magnetic North sensor. The sensor locates magnetic North. Magnetic North is not True North, but a measurement of the magnetic lines of the Earth. Magnetic North may deviate several degrees from True North. But AutoStar II, using the observation site location determined by the GPS and magnetic North information, can calculate the position of True North.

Some areas are subject to magnetic disturbances, and the magnetic field of the Earth changes slightly from year to year. AutoStar II allows you to adjust for discrepancies in the local magnetic field using the "Calibrate Sensors" option in the Telescope menu. See page 29 for more information.



# BASIC AUTOSTAR II

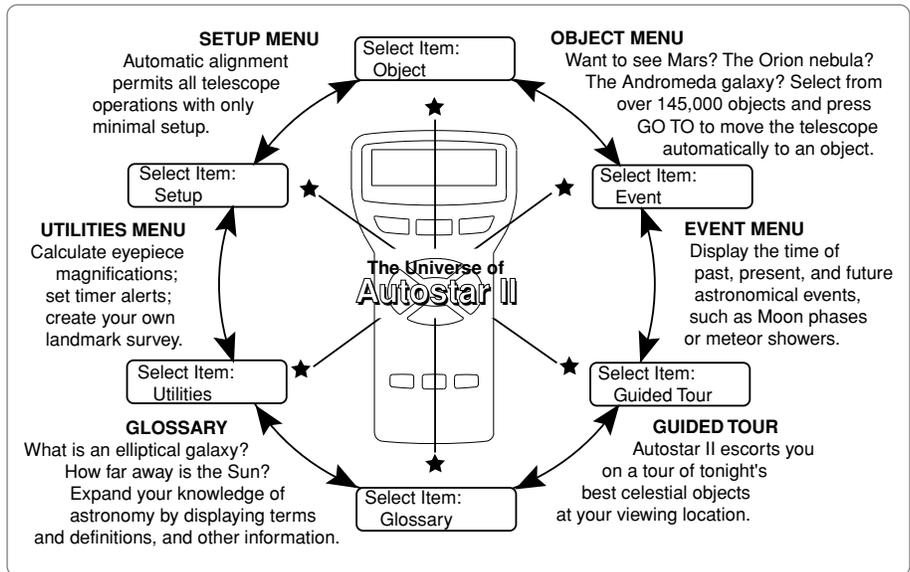


Fig. 15: The AutoStar II Universe: The six primary categories listed in the Select Item menu of AutoStar II.

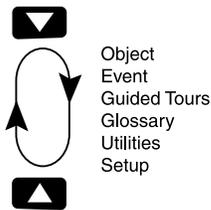


Fig. 16: Menus set in a loop.



Fig. 17: Menu options display on the second line. Use the Scroll keys to move up or down through the list of options. Press ENTER to select the desired option.

It is important to understand that menu selections are set in a loop (Fig. 16).

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 (7, 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.

### Example:

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

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

The screen in Fig. 17 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 II 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."

## AutoStar II Navigation Exercise

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

### 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 II calculates the Sunset time based on the current date, time, and location. AutoStar II then displays the results of the calculation.
7. Press MODE once to start moving back up through the AutoStar II 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."

### Navigating AutoStar II

AutoStar II's menus are organized for quick and easy navigation:

- Press ENTER to go deeper into AutoStar II's menu levels.
- Press MODE to move back toward the top menu level.
- Press Number key "1" to engage the Speed mode, and then press Number keys 1 through 9 to change speeds.
- Press Number key "4" to access the Focus menu.
- Press Number key "7" to access the Reticule menu.
- 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.

**Tip:**

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

### LX200R TIPS

#### Look into the Future

The AutoStar II Date option in the Setup menu is much more than just an entry of today's date; with it you can look far into the future or learn about past events. AutoStar II can calculate the date and times of future events and, except for eclipses, past events as well (based on the current calendar system). *E.g.*, a Sunrise on March 6, 2043 A.D. or the Vernal Equinox in 1776 A.D. To use this feature, enter the desired date in the Setup menu or select an option in the Event menu.

AutoStar II, using the Event menu, can calculate dates and times for Sunrises, Sunsets, Moonrises, Moonsets, Moonphases, Solar and Lunar Eclipses (for the next 100 years), meteor showers, equinoxes and solstices, and the minimums of Algol.

One very practical use of the Event menu is to check the Sunset option to determine when you can begin your astronomical observing session.



# AUTOSTAR II's MENUS

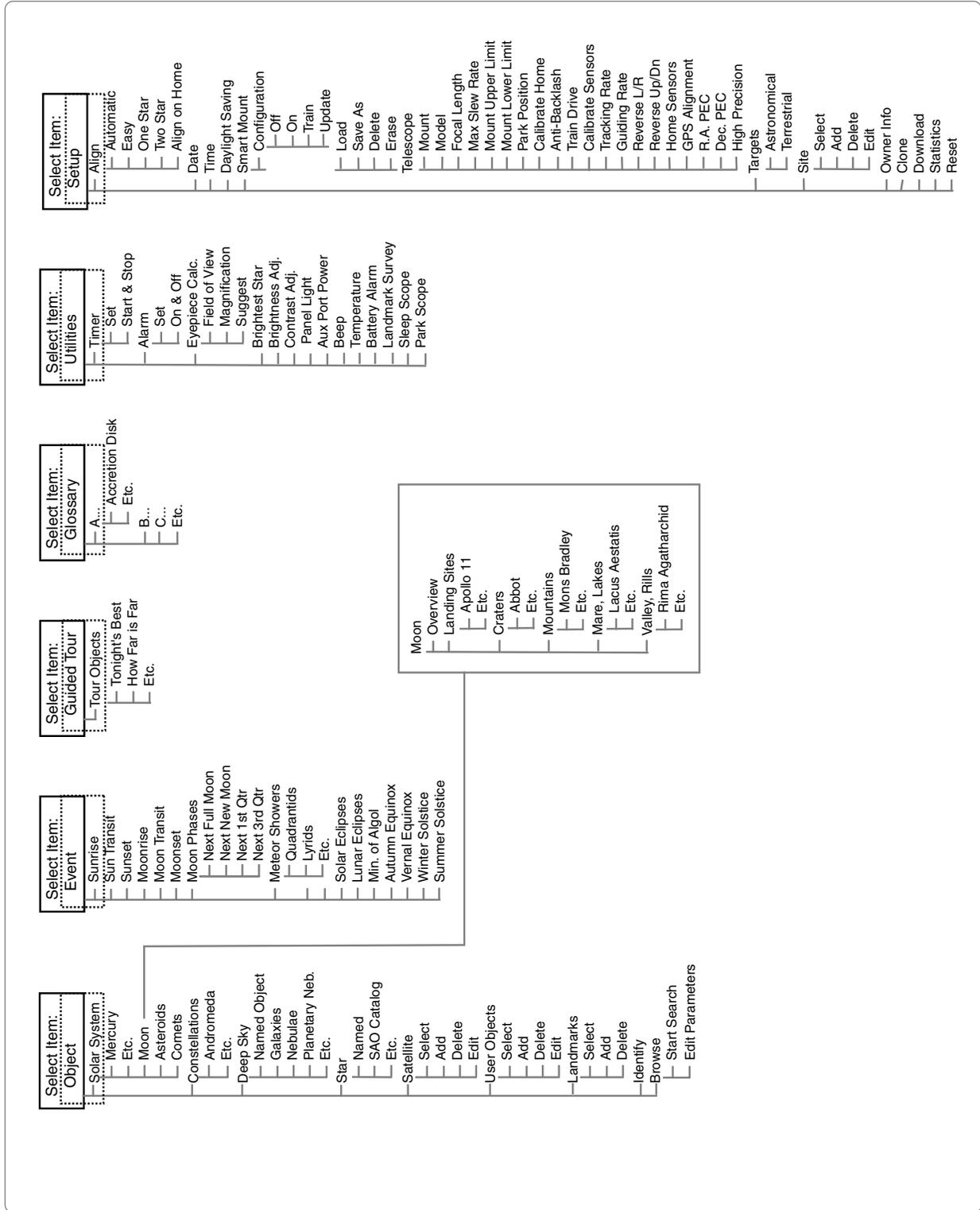


Figure 18: The Complete AutoStar II Menu Tree Structure.



Want to learn more about **Observing Satellites?** See page 33.

Want to learn more about **Landmarks?** See page 32.

## Object Menu

Almost all observing with AutoStar II is performed using the Object menu category. (**Note:** Exceptions include *Guided Tour* and *Landmark Survey*.) See **GO TO SATURN**, page 20, for an example of observing using the Object menu. Also see **USING THE GUIDED TOUR**, page 20.

AutoStar II contains many libraries of viewable objects, such as stars, planets, comets, nebulae and so forth. When one of these objects is selected from a library, AutoStar II moves your telescope (if properly aligned) and points it at the selected object. Six of the most popular libraries can be accessed directly using the hot buttons.

The Object Menu options include:

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

**Constellation:** A library 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:** A library of objects outside our Solar System such as nebulae, star clusters, galaxies, and quasars.

**Star:** A catalog of stars listed in different categories such as named, double, variable, or nearby. Also included are the Hipparcos, SAO, HD, and HR catalogs. The Star catalog may also be accessed directly by pressing the Number key "6."

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

Other **Catalogs** are accessed directly using the AutoStar II "hot keys": Caldwell (key "2"), Messier catalog ("3"), Solar System ("5"), IC ("8"), and NGC ("9").

### To slew the telescope to catalog objects:

Enter the catalog number of the object using the Number keys and then press ENTER. *For example:* To slew to NGC 6720, press Number Key "9," then using the Number keys, enter the digits "6-7-2-0." Then press ENTER.

AutoStar II displays the common name and alternate names of the object, if available. Press one of the Scroll keys to display some or all of the following information about that object: Type of object (galaxy, nebula, etc.), Dec. and R.A. coordinates, constellation it is located within, magnitude, size, distance, and star-type classification, if the object is a star. If further information is available, it displays as scrolling text.

Press GO TO. The telescope, if aligned (see **AUTOMATIC ALIGNMENT**, page 18), will slew to that chosen object. Press MODE repeatedly to return to previous menu levels.

**User Objects:** Allows the user to define and store in memory deep-sky objects of specific interest that are not currently in the AutoStar II libraries. See **CREATING USER OBJECTS**, page 33, for more information.

**Landmarks:** Stores the location of terrestrial points of interest in the permanent AutoStar II database. This function works with a telescope that remains in one fixed spot or can be setup in the exact same spot each time it is used.

- **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.

**Important Note:** To add objects to the Landmark database, the telescope must be located and aligned exactly as when the original objects were added to the database.



Want to learn more about using the **Browse menu**? See page 35.

Want to learn more about using the **Date menu**? See the **LX200R TIPS** box page 23.

**Definition:**  
**Transit** is the time when the Sun, Moon, or other celestial object crosses an observer's meridian, i.e., the time when an object is at its highest point in the sky on any given date.



**WARNING!**  
Never use your Meade® LX200R

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.

**Identify:** 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 II 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 II searches the libraries for the identity of the object being observed.
4. If the telescope is not directly on an AutoStar II library object, the nearest library object is located and displayed on the screen. Press GO TO and the telescope slews to that object.

**Browse:** Allows you to search the library for objects with certain parameters, much like a search engine. "Edit Parameters" lets you set various parameters for the search, such as: Object Type, Minimum Elevation, Largest, etc. Once you have set the parameters of the search, select "Start Search" and press ENTER. AutoStar II will display the results of the search.

## Event Menu

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

**Sunrise, Sun Transit, and Sunset:** Calculate the time of Sun rise, Sun transit, or Sun set on the current date. Find rise and set times for other dates by entering a new date into the "Setup: Date" menu.

**Moonrise, Moon Transit, and Moonset:** Calculate the time of Moon rise, Moon transit, or Moon set on the current date. Find rise and set times for other dates by entering a new date into the "Setup: Date" menu.

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

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

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

**Solar Eclipse:** Lists upcoming Solar Eclipses, including the date and type (total, annular, or partial) of eclipse. 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:** Displays 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 II calculates minimum magnitude time at mid-eclipse.

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

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



Looking at or near the **Sun** will cause **irreversible** damage to your eye. Do not point this telescope at or near the Sun. Do not look through the telescope as it is moving.

## Glossary Menu

The Glossary menu provides an alphabetical listing of definitions and descriptions for common astronomical terms and AutoStar II functions. Access directly through the Glossary menu or through hypertext words embedded in AutoStar II. A *hypertext word* is any word in [brackets], usually found when using the AutoStar II 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 II goes to the glossary entry for that word.

To access directly from within 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 II, 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. To use the Timer, press ENTER, then choose "Set" or "Start/Stop."

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

**Alarm:** Selects a time for an alarm signal to sound 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 II beeps. Press ENTER to deactivate the alarm.

**Eyepiece Calc:** Calculates information about an eyepiece for the specific telescope to which AutoStar II 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 II calculates and suggests the best eyepiece for viewing, based on the telescope and the object being viewed.

**Brightest Star:** If turned on, displays the phrase "Center Brightest Star" instead of the name of the alignment star during the alignment procedure. If turned off, will display the actual name of the alignment star (e.g., "Sirius").

**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.

**Panel Light:** Allows you to turn off LED panel light.

**Aux Port Power:** Allows you turn off and on the 12vDC OUT power port.

**Beep:** Turns the beep alerts on or off.

**Temperature:** Gives a temperature reading of the ambient air. Reading isn't always available.

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

### Tip:

*The Contrast Adjustment feature is usually only required in very cold weather.*

**If you adjust the contrast so that you can no longer read the display, turn off the power and turn it on again. When Version appears on the display (the initial display screens are not affected by the Contrast control), press MODE.**

*Want to learn more about Landmarks? See page 33.*



Want to learn more about using the new **Smart Mount Feature**? See **Appendix I: Smart Mount** s 67 and 68.

Want to learn more about using the **Date menu**? See the **LX200R TIPS** box, page 23.

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

**Park Scope:** Designed for a telescope that is not moved between observing sessions. Align the telescope one time, then use this function to park the telescope. The next time it is powered up, pressing ENTER causes the telescope to move to its predetermined 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 II is unable to be returned to operation without turning the power off and then back on.

## Setup Menu

The Setup menu's primary function is used for manual telescope alignment (see **MANUAL ALT/AZ ALIGNMENTS**, pages 36 and 37). However, there are numerous other features available within the Setup menu, including:

**Align on Home:** For permanently mounted telescopes only. If Calibrate Home has been performed, power up your telescope and select this menu to return the previously calibrated home position. In other words, the telescope is fully aligned according to the setting that were stored in AutoStar II's memory during the Calibrate Home procedure. See **CALIBRATE HOME**, page 29, for more information.

**Date:** Changes the date used by AutoStar II. 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 26.

**Time:** Changes the time entered into AutoStar II. Setting the correct time is critical for AutoStar II to properly calculate locations and events. Time may be set to "AM," "PM," or 24-hour mode (military time). To select the 24-hour mode, press ENTER when the the "blank" option displays (*i.e.*, neither "AM" nor "PM" is displayed).

**Daylight Saving:** Enables or disables the Daylight Savings time setting.

**Note:** See **TIMING IS EVERYTHING** below.

**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:

- **Mount:** Set this option to "Alt/Az" if using alt/az alignment and to "Polar" if using polar alignment. "Alt/Az" is the default value.
- **Model:** Allows you to select the telescope model connected to AutoStar II.
- **Focal Length:** Displays the focal length of the selected telescope.
- **Max Slew Rate:** Sets the upper limit for the slew rate. 8 degrees per second is the fastest setting.
- **Mount Upper Limit:** Allows you enter a number from 0 to 90 that sets an upper limit as to how far the optical tube can swing upward during a programmed slew.

## LX200R TIPS

### Timing is Everything

Your telescope receives the precise time when it synchs with the GPS. Precise time is important in aligning your telescope so that it can accurately locate celestial objects.

AutoStar II receives time data in the Universal Time format. However, if you wish to display the correct time in your local time zone, use the Daylight Saving menu (see above) to turn the Daylight Saving option on or off. Keep in mind that the telescope is receiving the correct time whether or not you set this option to display your local time.



(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. 90 (straight up) is the maximum value that can be entered.

- **Mount Lower Limit:** Allows you enter a number from 0 to 90 that sets a lower limit as to how far the optical tube can swing downward 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 large optical tube (12" model) or have a dewshield attached to the telescope—you can prevent it from striking the telescope base. -90 (straight down) is the maximum value that can be entered.
- **Park Position:** For permanently mounted telescopes only. After aligning your telescope, select this menu and power down the telescope. The alignment settings—level, North, time, alignment stars—are stored in AutoStar II's memory and are remembered after you power off the telescope. When you power on the telescope, "Automatic Alignment" displays after the start up routine. Press MODE (do not press ENTER). The telescope remembers its alignment and you can continue viewing or performing other operations without aligning the telescope again. Park Position provides two options. Use Current Position uses the last position set by the user. Use Default Position levels telescope and points it North.
- **Calibrate Home:** For permanently mounted telescopes only. After aligning your telescope, select this menu and the alignment settings—level, North, time, alignment stars—are stored in AutoStar II's memory and are remembered after you power off the telescope. You can enable AutoStar II to retrieve and automatically align your telescope using these settings the next time you power up by choosing the Align on Home menu. See **ALIGN ON HOME**, page 28, for more information. **Note:** *This method is not as precise as **PARK POSITION** (see above).*
- **Anti-Backlash:** This option allows you to change the backlash along either the R.A. and the Dec. axes by entering a number from 0% to 199%. This sets the backlash in the way the Arrow keys move the telescope along an axis. If you enter a value near 199%, telescope responds more quickly as you hold down an Arrow key. If you enter a value near 0%, it takes longer for the tube to respond as you hold down an Arrow key. Experiment with this option: Try changing the values until the motion of the telescope (while holding down an Arrow key) feels comfortable to you.
- **Train Drive:** All telescopes have a certain amount of "backlash" (looseness in the interplay of gears). This menu allows you to compensate for the backlash in the the Altitude and Azimuth motors—which helps locate objects with more precision.
- **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 once on a new telescope after the user initially assembles it. When this menu is selected, the telescope slews to Polaris. AutoStar II then prompts you to center Polaris and to press ENTER. AutoStar II uses the position of Polaris to fine tune the position of North and also detects level for the base of the telescope.
- **Tracking Rate:** Changes the speed at which the telescope tracks targets in the sky.
  - a. **Sidereal:** The default setting for AutoStar II; 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.
- **Guiding Rate:** Allows you to change the base slew speed, 1x. Enter a percentage of the speed (less than 100%) and press ENTER. This function may be useful in guiding the telescope during CCD and long-exposure photography. See **SLEW SPEEDS**, page 17, for more information.
- **Reverse L/R:** Reverses the functions of the Left and Right Arrow keys for controlling the telescope's motion (*i.e.*, the Right key moves the telescope to the left).

**Note:**  
**Custom Tracking Rate** allows you to enter values from -999 (stands for -99.9%) to 999 (stand for +99.9%). The lower the number, the slower the rate; the higher the number the faster the rate. If you enter -999, the telescope will move so slow as to appear to be stopped. If you enter 999, the telescope will be moving at approximately twice the tracking rate.



Do you want to learn how to perform the **periodic error correction procedure**? See **PERIODIC ERROR CORRECTION**, page 38.

**Tip:**

If the "ENTER to Sync" feature is accessed by mistake (holding the ENTER key for more than 2 seconds), press MODE to return to the previous screen.

**Important Note:**

The Site information is stored in the Site menu. If you move the telescope outside of a 5 miles area of your initial observing location, AutoStar II automatically determines your location when it gets a GPS Fix, and adds the new location to the Site menu.

Want to learn more about **adding and editing sites**? See page 31.

Time Zone	Shift
Atlantic	-4 Hours
Eastern	-5 Hours
Central	-6 Hours
Mountain	-7 Hours
Pacific	-8 Hours
Alaska	-9 Hours
Hawaii	-10 Hours

**Table 1:** Time Zone Shift. Calculations are for standard time.

- **Reverse U/D:** Reverses the functions of the Up and Down Arrow keys for controlling the telescope's motion (*i.e.*, the Up key moves the telescope down).
- **Home Sensors:** Turns off or on the True North and True Level sensors, if preferred, for Easy, One-Star, and Two-Star alignment. User must then manually level the telescope and point the telescope to True North during alignment. Default setting is "On."
- **GPS Alignment: GPS:** Select "Off" to turn off the GPS function—you will be prompted to manually enter the time, date and location. Select "Start Up" to have the GPS function begin when you turn on AutoStar. Select "When Needed" to have the GPS function begin only when it's needed. For example, you have not performed the GPS fix yet and you have select Sunrise. AutoStar needs to know time, date and location to calculate Sunrise times, so the GPX fix will begin when you select press ENTER after selecting Sunrise.
- **Dec. PEC:** Allows you to perform periodic error correction on the Dec. drive worm gear. Must be performed with a high-power reticle (*eg.*, 9mm).
- **R.A. PEC:** Allows you to perform periodic error correction on the R.A. drive worm gear. Must be performed with a high-power reticle (*eg.*, 9mm).
- **High Precision:** If High Precision is turned on, when looking for a faint celestial object (*e.g.*, a nebula or galaxy), AutoStar II 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. See **TO TRACK AN OBJECT AUTOMATICALLY**, 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. 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. However, when the GPS signal is received, the site is normally selected automatically and the site list is updated automatically. Use of this option is not necessary and is included for the convenience of those users who may wish to enter a site manually. You may edit the name of a site using the Edit option (see below).
- **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 II compensates for daylight savings time, if selected. See **SETUP MENU: DAYLIGHT SAVING**, page 28.

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

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

**Clone:** Uploads information from one AutoStar II handbox to another. Three options are available:

- **Catalogs:** Sends only user-defined object information, such as new satellite orbits or comet data to another AutoStar II handbox.
- **Software:** Sends only the basic AutoStar II software. This is useful if one user has downloaded a new version of AutoStar II software from the Meade website ([www.meade.com](http://www.meade.com)) and wants to pass this software along to friends.



**Note:**

The Download function requires the optional LX200 Interface Cable. See the instruction sheet included with the cable for more information on how to download. Also see **OPTIONAL ACCESSORIES**, page 44.

**Important Note:**

If your download fails in the middle of the download attempt (e.g., your PC crashes), turn off the telescope. Turn the telescope back on and as soon as the AutoStar II display lights up, press "999." Then attempt the download again

**Focus Speeds:**

Key #	Speed
1 or 2	Fine
3, 4, or 5	Slow
6 or 7	Medium
8 or 9	Fast

- **All:** Everything—user-defined information and AutoStar II software—is sent to another AutoStar II.

**Download:** Transfers information from a personal computer or another AutoStar II. During the operation, the warning "Downloading Do Not Turn Off" appears.

- **Catalogs:** Receives only user-defined object information, such as new satellite orbits or comet data to another AutoStar II handbox.

- **Software:** Receives only the basic AutoStar II software. This is useful if one user has downloaded a new version of AutoStar II software from the Meade website ([www.meade.com](http://www.meade.com)) and wants to pass this software along to friends.

- **All:** Everything—user-defined information and AutoStar II software—is received by another AutoStar II handbox.

**Statistics:** Provides basic statistical data about AutoStar II, including:

- **Characters Free:** Displays how much room is available in user-defined object memory.
- **Version:** Displays the current version of the AutoStar II software.
- **Serial Number:** Displays the unit's serial number.

**Reset:** Completely resets AutoStar II. Most values entered into the menus revert to factory defaults. AutoStar II requires initialization again after a Reset before proceeding with observations. See **AUTOMATIC ALIGNMENT**, page 18.

### "Hot Button" Menus

Two menus, six object libraries and two functions can be accessed directly using the Number keys (commonly referred to as "hot buttons"). The two functions, the Speed mode and the Utility light are described earlier in the manual.

**Focus Control Menu:** Press Number key "4" to select this menu directly from AutoStar II's keypad. Press the Up or Down Scroll keys to cycle through the four focus speed options and then press ENTER to select the desired speed. Or press a Number key after pressing the Focus key to change the speed (see chart to the left). Use the Up or Down Arrow keys to achieve fine focus of the object. See page 17 for more information.

**Reticle Control Menu:** Press Number key "7" to select this menu directly from AutoStar II's keypad. "Reticle Control: Set Intensity" displays. Press ENTER. The Intensity menu allows you to change the intensity of the Reticle Eyepiece Illuminator. Use the Scroll keys to change the value. As you change the value, look through the reticle to note how the Intensity changes.

***Note:** You may continue to change the values using the Scroll keys (and thus changing the intensity) until you press ENTER again. This allows you to experiment with the intensity level until you decide which intensity level works best for you. This feature operates in the same manner in the Rate and Duty Cycle menus.*

When you have finished adjusting the intensity, press ENTER. Press Number key "7" again and the Rate menu displays. Press ENTER again. Use the Scroll keys to change the value of the the rate at which the Reticle Eyepiece blinks. As you change the value, look through the reticle to note how the Blink Rate changes.

When you have finished adjusting the rate, press ENTER. Next, Press Number key "7" again and the Duty Cycle menu displays. Press ENTER again. The Duty Cycle menu controls how long the Reticle Eyepiece Illuminator is on during a blink cycle. Use the Scroll keys to change the value. As you change the value, look through the reticle to note how the Duty Cycle changes. When you have decided on a Duty Cycle value, press ENTER.

To exit the Reticle menu, press MODE once.

**Object Catalogs:** See page 25 for more information.



## ADVANCED AUTOSTAR II FEATURES

Before trying out the examples in this section, familiarize yourself with the basic operations of AutoStar II described earlier in this manual. The following examples assume that you have a basic knowledge of AutoStar II and understand how to scroll to a desired menu or menu option, and how to enter numbers and text. It also assumes that you have initialized and aligned your telescope.

### Adding Observing Sites

If you plan to observe using AutoStar II at different geographic locations, you can store observation sites in AutoStar II's memory to help simplify your telescope setup. Perform these procedures using the Site options (Add, Select, Delete, Edit) of the Setup menu.

#### To Add a Site to the user-defined site list:

In this example, you will choose a city and add it to the database list. You will then select the site to enable it.

1. Navigate to the "Setup: Site" menu. Press ENTER,
2. Scroll through the options until "Site: Add" displays. Press ENTER.
3. Scroll through the list of countries/states. Press ENTER when the country/state you wish to add displays.
4. Scroll through the list of cities. Press ENTER when the city you wish to add displays. The Site is now added to the database. You may add sites using this method.
5. To choose a site, navigate to "Setup: Select." Press ENTER. Scroll through the list of sites. When the desired site displays, press ENTER.

#### To Edit a Site:

In this procedure, you will enter a location that is not available in the AutoStar II database by editing data of a nearby site. You will edit the location's name, latitude, longitude, and the time zone shift. You will then select the site to enable it.

You will need to know the latitude and longitude of your location to perform this procedure.

1. Using the Add option, choose a site on the list that is closest to your observing site and press ENTER so that the site is added to your observing sites list. Choosing a site already on the list (as opposed to using the "Custom" feature) makes it easier to edit, as the "Time Zone" value may not need to be changed.
2. Scroll to "Site: Edit" and press ENTER. "Edit: Name" displays. Press ENTER.
3. The name of the site you have just entered to your list displays; if it does not, scroll to the site.
4. Using the Arrow keys, change the name of the site so that it now reads the name of your observing location. Press ENTER. "Edit: Name" displays again.
5. Press the Scroll Down key and "Edit: Latitude" displays. Press ENTER.
6. Using the Number Keys, enter the latitude of your observing site and then press ENTER. "Edit: Latitude" displays again.
7. Press the Scroll Down key and "Edit: Longitude" displays. Press ENTER.
8. Using the Number Keys, enter the longitude of your observing site and then press ENTER. "Edit: Longitude" displays again.
9. Press the Scroll Down key and "Edit: Time Zone" displays. Press ENTER. (If the site you chose from the list in step 1 has the same Time Zone as the site you are editing, just press ENTER again to go on to the next step.) "Time Zone" refers to the Greenwich Time Zone shift. Users West of Greenwich, use "-" hours (one hour per time zone) and users East of Greenwich use "+" hours. For the United States, look up the shift in **TABLE 1**, page 30.
10. After entering the shift, press ENTER. "Edit Time Zone" displays.

#### Tip:

#### Using AutoStar II to find objects not in the libraries:

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 Number keys, overwriting the coordinates currently displayed. As soon as the coordinates are entered, AutoStar II slews the telescope to the coordinates. Note that the telescope must be aligned (see page 18).

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



11. Press MODE. "Site: Edit" displays.
12. Using the Arrow keys, scroll to "Site: Select." The site you have just edited displays. Press ENTER to select the site.

## Creating User Objects

In this procedure, you will enter coordinates of celestial objects that do not appear in any of the AutoStar II libraries. You will enter the object's name and R.A. and Dec. coordinates (required information). You may also enter the object's magnitude and size (optional information).

Although AutoStar II contains an extensive database of celestial objects (stars, nebulae, planets, etc.) that you can observe, you may eventually want to view objects that are not part of a library. AutoStar II 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 your local library, computer store, or bookstore for astronomy books, CD Roms, 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 II 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 Number 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 Number 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 II then prompts you to enter the size of the object. This step is optional. Use the Number 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 II then prompts you to enter the magnitude of the object. This step is also optional. Use the Number 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.



## Observing Satellites

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

1. Navigate 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 II 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 II 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 II 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 II Arrow keys to center the object in the viewfinder, then look through the eyepiece to view the object.

Satellite orbits change and new satellites (including the Space Shuttle) are launched. Visit the Meade website ([www.meade.com](http://www.meade.com)) approximately once a month to get updated information and instructions on how to download this data to AutoStar II. If orbital parameters are more than one month old, the satellite pass may not happen at the time predicted by AutoStar II. Downloading requires the optional LX200 Interface Cable. See **OPTIONAL ACCESSORIES**, page 44.

**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 II 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 a satellite may pass overhead, but not be visible as it is in the Earth's shadow.*

## Landmarks

This menu option allows you to define and store terrestrial objects in the Landmark database. First, a landmark needs to be stored in memory using the "Landmark: Add" option. To view a landmark, use the "Landmark: Select" option. Landmarks may also be viewed using the "Landmark Survey" option in the Utilities menu.

### To Add a landmark to the database:

In this procedure, you will store the location of terrestrial landmarks in AutoStar II's memory.

1. Note for future reference where the telescope is located and if you have aligned the telescope, which alignment method is used.
2. Display the "Setup: Targets" menu option. Chose "Terrestrial" and press ENTER. "Setup: Targets" displays again. Choosing this option turns off tracking for astronomical objects which is not useful for the viewing of terrestrial objects such as

### Tips:

*To use the Landmark function, the telescope must be located and aligned exactly as when the landmark(s) was added to the database.*

*To add objects to the Landmark database, the telescope must be located and aligned exactly as when the original objects were added to the database.*



those in the Landmark database. Be sure to change this option back to "Astronomical" when you wish to view celestial objects again.

3. Press MODE once. "Select Item: Setup" displays.
4. Press the Scroll Down key once and "Select Item: Object" displays. Press ENTER. "Object: Solar System" displays.
5. Press the Scroll Up key twice and "Object: Landmarks" displays. Press ENTER. "Landmark: Select" displays.
6. Press the Scroll Down key once. "Landmark: Add" displays. Press ENTER.
7. "Landmark Name" displays. Using Arrow keys, enter a name for the landmark you wish to add to the database. When finished, press ENTER.
8. "Center Landmark. Press Enter" displays. Using only the Arrow keys (do not manually move the telescope), move the telescope to the desired landmark and center the object in the eyepiece. Press ENTER. The object is now stored in memory.
9. "Landmark: Add" displays. If you wish to add more landmarks, repeat steps 5 through 8.

**To Select a landmark from the database:**

1. Make sure the telescope is located and aligned exactly as when the desired landmark was entered into memory.
2. Display the "Landmark: Select" menu option. Press ENTER.
3. Use the Scroll keys to scroll through the list of objects you have previously entered. When the desired object displays, press ENTER to select the object.

Use the Scroll keys to scroll through location information about the object, if desired. Press GO TO to slew the telescope to the landmark.

4. Press MODE to exit.

**To perform a Landmark Survey:**

This procedure allows you to perform a tour of the objects entered in the "Object: Landmark" menu option—note that the Landmark Survey will function only if you have previously entered objects in the Landmark menu.

1. Navigate to "Utilities: Landmark Survey" menu and press ENTER.
2. "Landmark Survey: Slewing..." displays. The telescope moves to the first object on the Survey list and displays the name of the object.
3. Press MODE to stop the Survey. Press ENTER to restart the survey at the first object of the survey.

**To check on the available amount of memory in AutoStar II:**

AutoStar II has a limited amount of memory. Once you begin to store Landmarks, user objects and other bits of information in AutoStar II, you will begin to use up memory. This procedure allows you to check on how much memory is still available.

1. Navigate to the "Setup: Statistics" menu option and press ENTER.
2. "Statistics: 37.2K Char. Free" displays. This is the amount of memory that is still available to the user.

**Identify**

This procedure allows you to use AutoStar II to identify objects you have found in the night sky using the Arrow keys. If the object is not in AutoStar II's database, AutoStar II displays information about an object in its database that is closest to the one you queried about.

***Important Note:** For this function to operate properly, you must first initialize and align AutoStar II. If you physically move the telescope after initialization, this function will fail to operate properly.*



In this procedure, you will center an object you wish to have identified by AutoStar II in the telescope eyepiece and use the "Identify" menu to find out information about the object or the nearest object to it in the AutoStar II database.

1. Center the object you wish to have identified in the telescope's eyepiece.
2. Navigate to the "Object: Identify" option and press ENTER.
3. "Searching..." displays. When AutoStar II finishes calculating, the name of the closest object displays.
4. Press a Scroll key to display information about this object. AutoStar II displays some or all of the following information about the object with each press of a Scroll key:

<b>Displayed information:</b>	<b>Example:</b>
Catalog or common name of object etc	Messier 107, NGC6171, Orion Nebula, etc
Type of object	Globular Cluster, Nebula, Black Hole, etc.
Right Ascension	16:32:4
Declination	13°03'
Constellation	Virgo, Orion, etc.
Magnitude	3
Size	2'
Scrolling message years	"This Globular Cluster is 10,000 light away...."

## **Browse**

This menu allows you to search the libraries for objects with certain parameters, much like a search engine. "Edit Parameters" lets you set various parameters for the search, and "Start Search" activates the search. A typical search might be performed as follows:

1. Select "Browse" from the Object menu. Press ENTER. "Browse: Start Search" displays.
2. Press one of the Scroll Keys and "Browse: Edit Parameters" displays. Press ENTER.
3. "Edit Parameters: Largest (mins)" displays. "Mins" stands for arc-minutes. Press ENTER.
4. "Largest (mins)" and a value displays. Using the Number keys, enter a size in arc-minutes. AutoStar II will search for objects *up to* this size and no larger. Press ENTER.
5. "Edit Parameters: Largest (mins)" displays again. Press the Scroll Down key. "Edit Parameters: Smallest (mins)" displays. Enter the value for the smallest size of an object that AutoStar II will search for in the database. Continue with "Brightest," "Faintest," and "Minimum Elevation," using the procedure described in steps 3 and 4.
6. After "Minimum Elevation," "Object Type" displays. Press ENTER. "+Black Hole" displays. If you do *not* wish to have "Black Holes" in your search, press ENTER and the "+" changes to a "-." Press the Scroll Down key to scroll to the next item. "+Diffuse Nebula" displays. Continue to scroll through the list and press ENTER if you wish to change the "+" to a "-" or vice-versa.
7. After you have scrolled to the last item on the "Object Type" list, press MODE twice and the Scroll Down key once. "Browse: Start Search" displays. Press ENTER. "Start Search: Next" displays. Press ENTER. AutoStar II searches the database and displays the first object that matches the search parameters you have entered. Use the scroll keys to display information about the object. Press MODE and "Start Search: Next" displays again. Press ENTER and the next item matching the parameters displays. Repeat this procedure to display all the objects. Press GO TO to slew telescope to a displayed object.
8. Press MODE repeatedly to leave this menu.



**Important Note:**

If you disable the automatic alignment/GPS function and then use the alternate alignments described in this section, you will be prompted to enter the Time, Date, and Daylight Savings status.

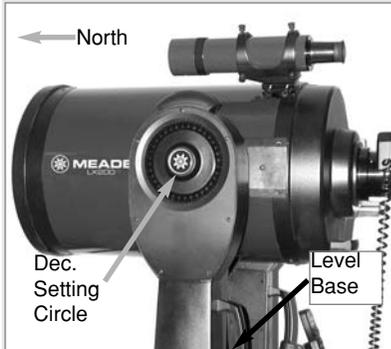


Fig. 19: Alt/Az Home Position.



Fig. 20: Dec. Setting Circle at 0°.

## Alternate Alt/Az Alignments

If you would rather set up your telescope without using automatic alignment, AutoStar II offers alternative alignment methods for both alt/az and equatorial mounting. During the One-Star and Two-Star alt/az alignment procedures, you will (unlike the Automatic and Easy alignment procedures) manually place the telescope in the home position.

The procedures for equatorial (polar) alignment are discussed in **APPENDIX A**, page 52; the three alternative alt/az alignment methods are discussed below.

## Easy (Two-Star) Alignment

In this method, AutoStar II automatically sets the home position, and also automatically picks two stars from its libraries for alignment. During the procedure, AutoStar II 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.

### How to perform the Easy Align Procedure

1. **Select Alignment.** Select "Align: Easy" from the Setup menu. Press ENTER.
2. **Home Position.** The telescope automatically sets the following positions: home, level, North, and True North. If so desired, you may turn off the sensors and manually set these positions. See **CALIBRATE SENSORS**, page 29 for more information.
3. **Star Alignment.** AutoStar II chooses two stars to align upon. The telescope slews to the first star for alignment. Should the alignment star not appear in the field of view in the eyepiece, it should be easily recognized: It will 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 the procedure for the second alignment star.

*Note:* See **WHICH ONE'S THE ALIGNMENT STAR**, page 19, for some important tips concerning alignments stars and using your viewfinder.

When the procedure is performed correctly, "Alignment Successful" displays. If AutoStar does not display this message, perform this procedure again. (Keep pressing MODE until "Align: Easy" displays and repeat the procedure.)

## LX200R TIPS

### Mirror, Mirror...

The LX200R telescopes provide features that allow you to control the primary optical mirror and focus functions for more precise viewing capability.

One control feature is the primary mirror lock (9, Fig. 1). The primary mirror lock helps eliminate mirror flop. Mirror flop can sometimes occur when the optical tube slews to opposite sides of the sky and the primary mirror shifts out of position, causing the loss of focus and pointing precision. To prevent mirror flop: Rotate the primary mirror lock knob toward the "lock" position and adjust the tension to a firm feel.

Another control feature is the zero-shift microfocuser (24, Fig. 1). The microfocuser allows for "jiggle-free" focusing. It also allows you to achieve focus without causing a viewed object to move out of position in the eyepiece.

Some tips to help you make the most out of your microfocuser (see **FOCUSING THE EYEPIECE USING THE MICROFOCUSER**, page 17, for more detailed instructions):

1. Set the "travel" (extension) of the drawtube of the microfocuser to about halfway.
2. Rotate the mirror lock knob towards the "unlock" position, until it feels loose.
3. Use the coarse focus control (6, Fig. 1) to achieve a rough focus of a bright star.
4. Rotate the mirror lock knob towards the "lock" position and adjust the tension to a firm feel; this action serves to lock in the coarse focus. **But make sure that you don't adjust or bump the coarse focus knob once you have tightened tension on the mirror. If you do, reset the coarse focus as described above.**
5. Press the AutoStar II Focus key and then use the Up and Down keys to control the microfocuser. If desired, you may change the focus speed.
6. You may need to repeat this procedure when you change eyepieces.



**Note:**

*AutoStar II 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.*

**Tip:**

**Try a Spiral Search**

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

## Two-Star Alt/Az Alignment

Two-Star Alignment requires some knowledge of the night sky. AutoStar II provides a library of bright stars and two stars from this library are chosen **by the observer** for alignment. In this procedure, AutoStar II **does not** automatically find home, level, or North.

1. **Select Alignment.** Select "Align: Two Star" from the Setup menu. Press ENTER.
2. **Set Home Position.** Place the telescope in the home position.
3. **To Set the Home Position Manually:**
  - a. See **Figs. 19 and 20**. Loosen the telescope's Dec. lock (**17, Fig. 1**). Set the optical tube to 0° on the Dec. setting circle (**20, Fig. 1**).
  - b. Tighten the Dec. lock (**17, Fig. 1**) to a firm feel only.
  - c. Level the tripod base.
  - d. Move the base of the telescope so that the computer control panel (**13, Fig. 1**) approximately faces South.
  - e. Unlock the R.A. lock (**12, Fig. 1**) and turn the telescope's optical tube horizontally until it points North.
  - f. Re-lock the R.A. lock (**12, Fig. 1**). Press ENTER.
  - g. Press ENTER.
4. **Star Alignment.** "Select Star" displays. AutoStar II then displays a library of stars for the observer to choose from. Use the Scroll keys to scroll to a star on the list that you wish to align upon—select a star that you can easily locate in the night sky. Press ENTER.
5. **Center Star.** The telescope slews to the star. Use the Arrow keys to move the telescope until the star is centered in the eyepiece. Press ENTER.
6. **Center Star.** Repeat procedure for a second alignment star. Once ENTER is pressed, the telescope is aligned and you are now ready to use AutoStar's II GO TO capabilities for a night of observing.

## One-Star Alt/Az Alignment

One-Star Alignment requires some knowledge of the night sky. AutoStar II provides a library of bright stars. One-Star Alignment is identical to Two-Star Alt/Az: Alignment (see **TWO-STAR ALT/AZ ALIGNMENT**, page 37), except only one star from the database is chosen by the observer for alignment.



## Periodic Error Correction

If you wish to perform high-precision astrophotography, you may wish to "train" your telescope in order to keep objects that you are imaging dead center in the telescope's mirror during the photographic exposure. Periodic error correction (PEC) helps to remove the slight perturbations from center that occur due to the mechanical nature of a telescope. To perform this procedure, you need to use a high-power reticle, such as the 9mm reticle (see **OPTIONAL ACCESSORIES**, page 44). PEC training is available for both drives.

### Train Menu Option

If you perform this procedure in alt/az alignment, you can train the telescope in both the R.A. and the Dec. axes; in polar alignment, you need only train the telescope's R.A. axis. If you train the telescope in polar alignment, make sure that "Polar" is selected in the "Telescope: Mount" menu ("Alt/Az" is the default setting).

To perform the procedure on the Dec. axis, pick a bright star in the East or West that is about about 20° above the horizon.

To perform the procedure on the R.A. axis, pick a bright star in the South that has minimal movement and is about 30° above the horizon (**Note:** *If in the Southern hemisphere, pick a star in the North that is about 30° above the horizon.*)

**Important Note:** *The Train option overwrites any previous PEC data.*

1. Select "Train" from the Dec. PEC menu (in the "Setup: Telescope" menu) and press ENTER.
2. Look through the reticle. Use the Arrow keys to keep the star centered in the reticle cross-hairs. AutoStar II displays a count of the 200 positions of the worm gear. When the count reaches 200, one cycle is complete. A full cycle takes about 8 minutes.
3. Select "Train" from the R.A. PEC menu (in the "Setup: Telescope" menu) and press ENTER.
4. Look through the reticle. Use the Arrow keys to keep the star centered in the reticle cross-hairs. AutoStar II displays a count of the 200 positions of the worm gear. When the count reaches 600, one cycle is complete. A full cycle takes about 24 minutes.
5. Press MODE to exit.

### Update Menu Option

Use the Update option to further refine your training; it is recommended that you update your original training two or three times when first using your telescope. Update does not overwrite the data, but updates the training using information gathered from both the last and the current training sessions. Press the MODE key to exit from this option. If you wish to further refine your training, select this menu again and repeat the procedure.

### Erase Menu Option

Select this option to erase all PEC training data.

### On and Off Menu Options

Select "On" when you want the telescope to use the training information. Select "Off" when you do not want for the telescope to use the training information. Select "On" to enable the Smart Drive.



# PHOTOGRAPHY

You may perform through-the-telescope photography with any 35mm camera body with a removable lens. You may connect a camera to a #62 T-Adapter which is then connected to the microfocuser assembly. See **Fig. 21**. Using this method, the telescope effectively becomes the lens of the camera.

The #62 T-Adapter (**1, Fig. 21**) connects to the microfocuser assembly, followed by a T-Mount (**2, Fig. 21**) for the particular brand of 35mm camera being used, followed by the camera body (**3, Fig. 21**).

To orient an object in the viewfinder of the 35mm camera body, use a small jeweler's screwdriver to slightly loosen three adjustment screws around the outer knurled ring of the T-Mount. Rotate the camera body to achieve proper orientation of the object; then re-tighten the adjustment screws.

The #62 T-Adapter permits close-coupling of a camera body to the telescope. In this format vignetting occurs: The photographic image appears on film with a slight darkening (vignetting) at the corners of the 35mm frame (**Fig. 22**).

Photography through a long lens such as the LX200R requires special technique for good results, and the photographer should probably expect to waste a roll or two of film in acquiring this technique. Long-lens photography has its own rewards, however, rewards that short-focus lenses cannot duplicate.

## A few tips on photography with the LX200R telescopes:

1. Use the Field Tripod for the telescope. At an effective focal length of 2000mm, even small external vibrations can easily ruin an otherwise good photo.

For best results in photographing celestial objects, a wedge and One-Star polar alignment is recommended. See **APPENDIX A**, pages 50 through 54.

**Caution:** With the #62 T-Adapter and a camera body mounted to the LX200R photo port, the telescope can only be rotated vertically about 45°. Moving past this point may damage the telescope and camera.

2. Use a cable-operated shutter release. Touching the camera body to initiate shutter operation almost certainly introduces undesirable vibrations.
3. Focus the image with extreme care. While observing the subject through the camera's reflex viewfinder, turn the telescope's focus knob (**6, Fig. 1**) to achieve the sharpest possible focus. Note that some 35mm cameras may have an optional focusing screen (available from the manufacturer) for use with a long telephoto lens. This screen provides a brighter and clearer image to focus, and is highly recommended.
4. Correct shutter speeds vary widely, depending on lighting conditions and film used. Trial-and-error is the best way to determine proper shutter speed in any given application.

**Note:** The camera used with your telescope may have an exposure meter that is still active when the standard lens is removed and the body is connected to the telescope with the T-Mount. If used for terrestrial photography, the camera meter should be acceptable. If used for astrophotography, the meter probably will not provide good results since camera meters are not made to compensate for a dark sky.

5. Terrestrial photography through the LX200R is sensitive to heat waves rising from the Earth's surface. Long distance photography is best accomplished in the early morning hours before the Earth has had time to build up heat.
6. Photography of the Moon and planets through the LX200R can be especially gratifying, but points 1 through 4 should be particularly noted in this case. If you wish to take photographs using polar alignment, see **APPENDIX A**, page 52.

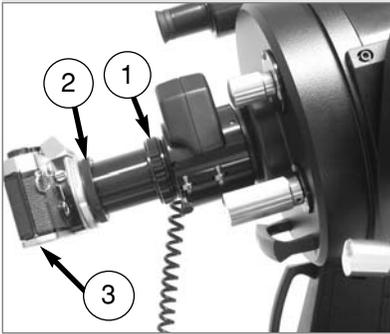
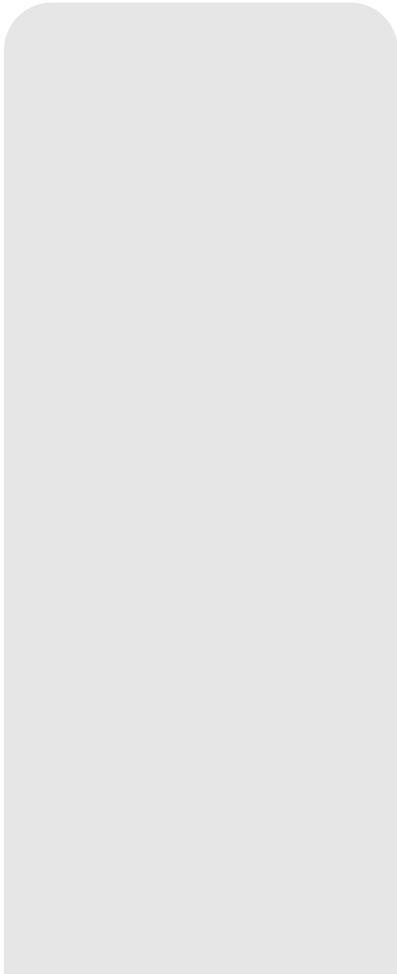


Fig. 21: LX200R with #62 T-Adapter: (1) camera adapter, (2) T-mount, (3) camera body.



Fig. 22: Example of vignetting.





**Fig. 23:** The Lunar Planetary Imager.



**Fig.24:** The Deep Sky Imager.

### Photography with a Digital Camera

Although digital cameras still cannot match the quality of images provided by traditional 35mm cameras, they provide some significant advantages to the casual astrophotographer: You do not have to develop the images (instant images), lower costs, computer and internet readiness. And because unwanted photos are easily discarded, they provide the freedom to experiment.

Digital cameras present some problems for the astrophotographer: Many models have lenses that cannot be removed, difficulties in attaching to a telescope, possible vignetting, lack manual focusing and shorter exposure times.

Shorter exposure times is one of the biggest drawback. Long exposures with digital cameras introduce undesirable noise and artifacts into a digital image. This limits the range of astro images to the Moon, planets and bright stars.

Some tips for better photos:

- If you cannot remove the lens to your camera, look for a commercially available digital T-adapter. New solutions for attaching a digital camera to a telescope are becoming available as time goes by.
- If the camera is not directly coupled to the eyepiece, keep it as close to the eyepiece as possible and center the image to be photographed to minimize vignetting (darkening of the edges of the photo).
- Try to block ambient light (from street lights, house, etc.) from the eyepiece and the camera with a piece of cardboard, a screen, etc.
- Keep extra (charged) batteries on hand for your camera as digital cameras often drain batteries in a short period of time. Rechargeable Lithium batteries provide power for a longer period than non-rechargeable batteries. If practical, use an AC adapter.
- Avoid short-focus eyepieces. They present many difficulties for digital cameras.
- If using manual focus, set to infinity. Otherwise, using the camera's autofocus is OK.
- Experiment with your camera's exposure, brightness and /or contrast settings. Keep notes for future reference.
- Clean eyepieces and camera lens as needed.
- Many digital cameras have a manual ISO setting. Short exposures times work the best.
- Use your camera's highest image quality and lowest compression settings. Although this fills up your camera's memory more quickly, it produces the best quality photos.
- Use the camera's timer or remote shutter release (if available for your camera) to minimize vibration. Wireless shutter releases may be available for some model digital cameras. If you do not have a shutter release, use the camera's timer (sometimes called "self-timer"), which is available with most digital cameras. The timer may also minimize vibration.

### Photography with Meade's AutoStar Suite™

The AutoStar Suite with Meade LPI™ (Lunar Planetary Imager) or Meade Deep Sky Imager™ turns your Meade LX200R telescope, AutoStar and PC into even more powerful and easy-to-use astronomical instrument.

LPI (**Fig. 23**) and Deep Sky Imager (**Fig. 24**) combine the power of an electronic astronomical imager with the simplicity of a web cam. Check out the following imager features:

- Achieve great results the first time out on the Moon, planets, brighter deep-sky objects and terrestrial targets.
- Easy to use with real-time display of object on your PC screen. Just center, focus and shoot.





**Fig. 25:** Image of M13 captured with the Deep Sky Imager.



**Fig. 26:** Image of M51 captured with the Deep Sky Imager.

- Magic Eye software-assisted focusing.
- Automatic and manual exposure control from .001 to 15 seconds (up to 450x longer than web cams).
- Automatically takes multiple exposures.

The AutoStar Suite Software includes powerful tools to help you get the most from your Meade LX200R telescope:

- Sophisticated planetarium program with over 19 million objects.
- Select objects from the planetarium display and the telescope slews to those objects.
- Create time-lapse movies of objects, such as Jupiter
- Create your own Guided Tours.
- Advanced Image Processing Software including Unsharp Masking, Convolution Filtering and many other features.
- Control all AutoStar functions from your PC.
- Talking Telescope software translates AutoStar text to synthesized speech through PC speaker.
- Includes a cable to connect your LX200R model to your PC.

See the CD Rom that is included with AutoStar Suite for more information and instruction manual.

## LX200R TIPS

### Star Charts

Even with the AutoStar II's massive 145,000 object library, star charts and planispheres are still useful for a variety of reasons. In particular, they are a great aid in planning a night of celestial viewing.

A wide variety of star charts are available in books, in magazines, on the internet and on CD Roms. Meade offers Epoch 2000sk™ and other star locator software. Contact your Meade dealer or Meade's Customer Service department for more information.

*Astronomy and Sky and Telescope* magazines print star charts each month for up-to-the-minute maps of the heavens.



## OPTIONAL ACCESSORIES

A wide assortment of professional Meade accessories is available for the LX200R telescope models. The premium quality of these accessories is well-suited to the quality of the instrument itself. **Consult the Meade General Catalog for complete details on these and other accessories.**

### Meade Series 4000 Eyepieces:



Fig. 27: Series 4000 Eyepieces.

Eyepiece	7" f/15	8" f/6.3	10" f/6.3
	Power/Actual Field	Power/Actual Field	Power/Actual Field
<b>Super Plössl Eyepieces (4-elements; 1.25" O.D., except as noted)</b>			
6.4mm	417/0.12°	200/0.26°	250/0.21°
9.7mm	275/0.19°	132/0.39°	165/0.32°
12.4mm	215/0.24°	103/0.50°	129/0.40°
15mm	178/0.29°	85/0.61°	107/0.49°
20mm	134/0.39°	64/0.81°	80/0.65°
26mm	103/0.50°	49/1.06°	62/0.84°
32mm	83/0.63°	40/1.30°	50/1.04°
40mm	67/0.66°	32/1.69°	40/1.35°
56mm (2" O.D.)	48/1.08°	23/2.27°	29/1.82°
<b>Super Wide Angle Eyepieces (6-elements; 1.25" O.D., except as noted)</b>			
13.8mm	193/0.35°	93/0.72°	116/0.58°
18mm	148/0.45°	71/0.94°	89/0.75°
24.5mm	109/0.61°	52/1.28°	65/1.03°
32mm (2" O.D.)	83/0.81°	40/1.67°	50/1.34°
40mm (2" O.D.)	67/1.00°	32/2.09°	40/1.67°
<b>Ultra Wide Angle Eyepieces (8-elements; 1.25" O.D., except as noted)</b>			
4.7mm	568/0.15°	272/0.31°	340/0.25°
6.7mm	399/0.21°	191/0.44°	239/0.35°
8.8mm (1.25" - 2" O.D.)	303/0.28°	145/0.58°	182/0.46°
14mm (1.25" - 2" O.D.)	199/0.44°	91/0.92°	114/0.73°

Eyepiece	8" f/10	10" f/10	12" f/10
	Power/Actual Field	Power/Actual Field	Power/Actual Field
<b>Super Plössl Eyepieces (4-elements; 1.25" O.D., except as noted)</b>			
6.4mm	313/0.17°	391/0.13°	476/0.11°
9.7mm	206/0.25°	258/0.20°	314/0.17°
12.4mm	161/0.32°	202/0.26°	246/0.21°
15mm	133/0.39°	167/0.31°	203/0.26°
20mm	100/0.52°	125/0.42°	152/0.34°
26mm	77/0.68°	96/0.54°	117/0.44°
32mm	63/0.83°	78/0.67°	95/0.55°
40mm	50/0.88°	63/0.70°	76/0.53°
56mm (2" O.D.)	36/1.46°	45/1.16°	54/1.04°
<b>Super Wide Angle Eyepieces (6-elements; 1.25" O.D., except as noted)</b>			
13.8mm	145/0.46°	181/0.37°	221/0.30°
18mm	111/0.60°	139/0.48°	169/0.40°
24.5mm	82/0.82°	102/0.66°	124/0.54°
32mm (2" O.D.)	63/1.07°	78/0.86°	95/0.71°
40mm (2" O.D.)	50/1.34°	63/1.07°	76/0.88°
<b>Ultra Wide Angle Eyepieces (8-elements; 1.25" O.D., except as noted)</b>			
4.7mm	426/0.20°	532/0.16°	649/0.13°
6.7mm	299/0.28°	373/0.23°	455/0.18°
8.8mm (1.25" - 2" O.D.)	227/0.37°	284/0.30°	346/0.24°
14mm (1.25" - 2" O.D.)	143/0.59°	179/0.47°	218/0.39°





Fig. 28: Series 4000 8 - 24mm Zoom Eyepiece.



Fig. 29: #140 2x Barlow Lens.



Fig. 30: #905 Variable Polarizer and #1A Skylight Filter.



Fig. 31: #929 2" Diagonal Mirror and #928 45° Erect-Image Diagonal Prism.

**Series 4000 8 - 24mm Zoom Eyepiece:** The internal zoom optics of this eyepiece move on smooth, precisely machined surfaces which maintain optical collimation at all zoom settings. A scale graduated in 1mm units indicates the zoom focal length in operation. An excellent addition to any eyepiece set.

**#140 2x Barlow Lens:** A 3-element design, doubles each eyepiece power while maintaining uncompromised image resolution, color correction, and contrast. Insert the #140 into the telescope's eyepiece-holder first, followed by the diagonal prism and eyepiece. The **#126 2x Barlow Lens**, a compact 2-element alternative to the #140, may also be employed with any LX200R-Series telescope.

**Series 4000 Photo-Visual Color Filters:** Color filters significantly enhance visual and photographic image contrast of the Moon and planets. Each filter threads into the barrel of any Meade 1.25" eyepiece, and into the barrels of virtually all other eyepiece brands as well. Meade filters are available in 12 colors for lunar and planetary applications, and in Neutral Density as a lunar glare-reduction filter.

**Series 4000 Nebular Filters:** A modern boon to the city-dwelling deep-space observer, the interference nebular filter effectively cancels out the effects of most urban light pollution, while leaving the light of deep-space nebular emissions virtually unattenuated. Meade Series 4000 Nebular Filters utilize the very latest in coating technology, and are available with threaded cells for eyepieces or for attachment to the rear cells of Meade Advanced Ritchey-Chrétien Telescopes models.

**Variable Tele-Extender:** For eyepiece-projection photography of the Moon and the planets, a Tele-Extender is required. The variable Tele-Extender threads onto the telescope's eyepiece-holder, into which is inserted an eyepiece of typically about 26mm focal length; the 35mm camera body couples to the tele-extender by means of a T-Mount. The Meade Variable Tele-Extender permits a range of projection images.

**#929 2" Diagonal Mirror; #928 45° Erect-Image Diagonal Prism:** The #929 2" Diagonal Mirror (provided as standard equipment on the 12" LX200R, available optionally on other models) attaches to the rear cell of all LX200R telescopes and permits the use of wide-field 2" O.D. eyepieces (e.g., Meade Series 4000 Super Wide 32mm and 40mm eyepieces and others). Each diagonal includes a Meade optical-flat mirror of Pyrex<sup>®</sup> glass, aluminized and multi-coated. Diagonal mirrors and prisms result in images that are correctly oriented up-and-down but reversed left-for-right. For terrestrial observing a fully correctly oriented telescopic image is desirable; the **#928 Diagonal Prism** accomplishes this image correction and places the eyepiece at a convenient 45° viewing angle. The #928 is for use with the 1.25" Eyepiece-Holder.

**Series 4000 Plössl 9mm Illuminated Reticle Eyepiece:** The most advanced commercially-available illuminated reticle eyepiece, this Series 4000 Plössl 9mm model, powered by an internal battery, includes micrometric x-y positioning controls which greatly facilitate locking onto the guide star: Turn the finely-threaded controls and place the reticle's crossline pattern precisely at the desired position in the field. The sharp, high-power imaging of the 4-element, multi-coated Plössl optical system is complemented by a rubber eyecup (foldable for eyeglass wearers) that shuts out distracting stray light from the observer's eye. The upper (lens) section of the eyepiece rotates on a fine thread for precise diopter adjustment to the user's eye. Reticle pattern is a double crossline with two concentric circles.

**#62 T-Adapter:** The T-Adapter is the basic means of prime-focus photography through all Meade Schmidt-Cassegrain models. Thread the T-Adapter on to the rear cell of your telescope, followed by a T-Mount for your 35mm camera, and the camera body is rigidly coupled to the telescope.

**#777 Off-Axis Guider:** The Off-Axis Guider provides a means during long-exposure astrophotography for the photographer to monitor the tracking of the telescope to assure that the telescope remains precisely positioned on the object being photographed. Like the T-Adapter, the Off-Axis Guider couples the camera body to the telescope but it also causes a small amount of the guidestar's incoming light to be diverted at a right angle, where the star's position can be examined for tracking errors with an illuminated reticle eyepiece; position corrections can then be effected using AutoStar II.





Fig. 32: Illuminated Reticle Eyepiece.

**Piggyback Brackets:** Piggyback photography is one of the most popular and easiest ways to get started in astrophotography. Attach your 35mm camera, with its own 35mm-to-250mm lens, atop your LX200R in equatorial mode, and guiding the camera through the main telescope, wide-field photos of the Milky Way of remarkable detail and clarity can be taken.

**Dew Shields:** In moist climates, water particles suspended in the atmosphere may condense on the front surface of the telescope's correcting plate. This dew formation may be inhibited to a significant extent by the addition of a dew shield, essentially an extension tube attaching to the front-cell of the telescope. **#608** for Meade 8" Advanced Ritchey-Chrétien Telescopes models; **#610** for all 10" Advanced Ritchey-Chrétien Telescopes models; **#612** for all 12" Advanced Ritchey-Chrétien Telescopes models.

**#905 Variable Polarizer (1.25"):** **#1A Skylight Filter:** The #905 system includes 2 Polarizer filters mounted in a specially-machined cell, for glare-reduction in observing the Moon. Rotate the thumbscrew at the side of the unit to achieve light transmission between 5% and 25% of its original value. The #905 inserts into the diagonal prism of the telescope, followed by an eyepiece. The #1A Skylight Filter threads onto the rear cells of all Meade Advanced Ritchey-Chrétien Telescopes and effectively seals the interior of the telescope from dust. All other rear cell accessories may then be threaded to the #1A filter. The filter increases visual and photographic contrast, decreases glare, and helps to penetrate haze.

**#1220 Field De-rotater:** For use with the 8", 10" and 12" LX200R models in the altazimuth mode, the field de-rotater attaches to the rear cell of the telescope and plugs into an RS232 port. Digital data fed from the telescope's microprocessor to the field de-rotater permit precise and continuous update of the de-rotation required to maintain pinpoint star images throughout the field. The effect is that even during the longest CCD or photographic exposures, the telescope acts as if it were precisely equatorially mounted. **#1222 Field De-rotater:** For use with the 16" LX200R. Plugs into a special connector on the control panel.

**LX200 Interface Cable:** With Meade Epoch 2000sk loaded into your PC, AutoStar II-equipped telescopes, such as the LX200R, may be remotely controlled from the PC display. Used to download the latest satellite data, star and object catalogs, tours, serial commands list, and software revisions, directly from the Meade website ([www.meade.com](http://www.meade.com)).

**#547 Power Adapter with Cable (all models except 16" LX200R):** Includes a 25 ft. cord and permits powering from a standard home (115v AC) outlet.

**#607 Cigarette Lighter Adapter:** Powering the LX200R telescope by means of an automobile cigarette lighter plug. The LX200R may be powered for a full night's observing without risk of car-battery drain.

**Deep Sky Imager Series:** This high-performance, easy-to-use and affordable color CCD camera (**Fig. 24**) suppresses electronic noise and does not compress data from the sensor to increase picture quality. The Deep Sky Imager uses a full 16-bit analog-to-digital converter to enhance picture depth, contrast and dynamic range. It is USB compatible for easy interface with most Windows-based laptop computers. Includes AutoStar Suite which automatically sorts, aligns and combines the best images, resulting in a highly detailed color image.

The following Deep Sky Imagers models and accessories are available:

- Deep Sky Imager II (DSI II) w/AutoStar Suite
- Deep Sky Imager Pro II (DSI PRO II), w/AutoStar Suite
- Deep Sky Imager Pro II (DSI PRO II), w/RGB Color Filter Set & AutoStar Suite
- Deep Sky Imager (DSI) w/AutoStar Suite
- Deep Sky Imager PRO (DSI PRO), w/AutoStar Suite
- Deep Sky Imager PRO (DSI PRO), w/RGB Color Filter Set & AutoStar Suite
- Lunar Planetary Imager (LPI™) w/AutoStar Suite

- Deep Sky Imager Fan Accessory, for all DSI cameras
- Deep Sky Imager RGB Color Filter Set, for DSI PRO and DSI PRO II

To find out more about these and other accessories available for your telescope, check out the Meade General Catalog or contact your local Meade dealer.



Fig. 33: Meade Deep Sky Imager



Looking at or near the **Sun** will cause **irreversible** damage to your eye. Do not point this telescope at or near the Sun. Do not look through the telescope as it is moving.

## MAINTENANCE

LX200R telescopes are precision optical instruments designed to yield a lifetime of rewarding applications. Given the care and respect due any precision instrument, your LX200R 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. Do not, for any reason, remove the correcting plate from its machined housing for cleaning or other purposes. You will almost certainly not be able to replace the corrector in its proper rotational orientation and serious degradation of optical performance will result. Meade Instruments assumes no liability for damage incurred to the telescope in this way.
- e. If the LX200R is 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.
- f. If your LX200R 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.
- g. Do not leave your LX200R inside a sealed car on a warm summer day; excessive ambient temperatures can damage the telescope's internal lubrication and electronic circuitry.
- h. The microfocuser is carefully adjusted at the factory. If it becomes necessary to adjust the microfocuser ball bearings (see **Fig. 34**), it must be performed by factory trained technicians. If the microfocuser is improperly adjusted, performance will degrade and damage will result. Damage due to improper adjustments not authorized by the factory will not be covered under warranty.

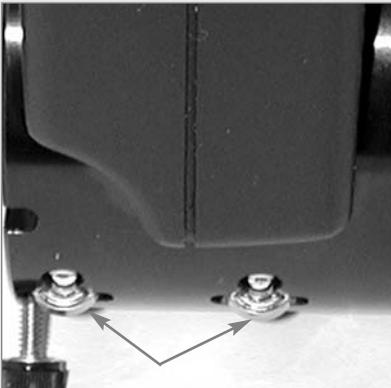


Fig. 34: Microfocuser ball bearings.

## Collimation

The optical collimation (alignment) of any astronomical telescope used for serious purposes is important, but in the case of the Advanced Ritchey-Chrétien telescope design of the LX200R models, such collimation is absolutely essential for good performance. Take special care to read and understand this section well so that your LX200R will give you the best optical performance.

As part of final optical testing, every Meade Advanced Ritchey-Chrétien telescope is precisely collimated at the Meade factory before shipment. However, vibrations in shipping can cause the optical system to become misaligned. Re-aligning the optics is, however, a straightforward process.

To check the collimation of your LX200R, center a bright star that is overhead, or use a "hot spot" of reflected Sunlight from a chrome car bumper, with the supplied 26mm eyepiece. Allow the telescope to adjust to the temperature of your observation site before proceeding; temperature differences between the optics and the outside air can cause distortion in the images.



With the star or hot spot centered, de-focus the image. You will notice that the out of focus star image looks like a ring of light surrounding a dark central spot; the dark central spot is in fact the shadow of the secondary mirror. Turn the focus knob until the ring of light fills about 10% of the eyepiece field-diameter. If the dark central spot is offset in (*i.e.*, not concentric with) the ring of light, your telescope's optical system is misaligned and requires collimation.

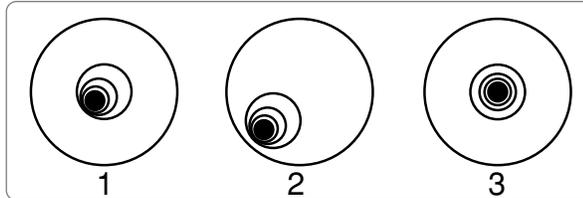


Fig. 35a: Defocused star images. Misaligned (1, 2), Aligned (3).

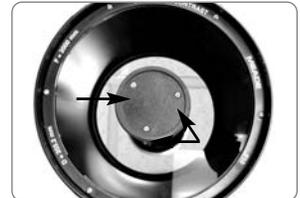


Fig. 35b: Collimation screws.

**Caution:**

It is recommended that you begin collimating by first **tightening** the collimation screws. When you reach a point where you encounter resistance while tightening, then attempt collimation by loosening the screw(s). While loosening, be careful that you do not remove the screw(s) from the secondary mirror housing assembly .

Follow these steps for collimation of the optical system:

- a. The only adjustments possible, or necessary, on the Advanced Ritchey-Chrétien Telescopes LX200R models are from the three screws (**Fig. 35b**) located at the edge of the outer surface of the secondary mirror housing.

**Caution:** Do not force the three collimation screws past their normal travel and do not loosen them more than two full turns in a counterclockwise direction or the secondary mirror may come loose from its support. You will find that the adjustments are very sensitive, usually requiring only one-half turn or less to produce the desired result.

- b. While looking at the defocused star image, notice which direction the darker shadow is offset in the ring of light or notice which part of the ring is the thinnest (**1, Fig. 35a**). Place your index finger in front of the telescope so that it touches one of the collimation set screws. You will see the shadow of your finger in the ring of light. Move your finger around the edge of the black plastic secondary mirror support until you see the shadow of the finger crossing the thinnest part of the ring of light. At this point, look at the front of the telescope where your finger is aiming. It will either be pointing directly at a set screw, or it will be between two set screws aiming at the set screw on the far side of the black plastic secondary mirror support. This is the set screw that you will adjust.
- c. Using the AutoStar II's Arrow keys at the slowest slew speed, move the defocused image to the edge of the eyepiece field of view (**2, Fig. 35a**), in the same direction as the darker shadow is offset in the ring of light.
- d. Turn the set screw that you found with the pointing exercise while looking in the eyepiece. You will notice that the star image will move across the field. If while turning the defocused star image flies out of the eyepiece field, then you are turning the screw the wrong way. Turn the opposite direction and bring the image back to the center of the field.
- e. If the screw you are turning becomes very loose, tighten the other two screws by even amounts. If the screw you are turning gets too tight, unthread the other two by even amounts.
- f. When you bring the image to center (**3, Fig. 35a**), carefully examine the evenness of the ring of light (concentricity). If you find that the dark center is still off in the same direction, continue to make the adjustment in the original turning direction. If it is now off in the opposite direction, you have turned too far and you need to turn in the opposite direction. Always double check the image in the center of the field of the eyepiece.
- g. You may find after your initial adjustment that the dark center is off in a new direction (e.g., instead of being off side-to-side it is now off in an up-and-down direction). In this case repeat steps b through f to find the new adjustment screw.
- h. Now try a higher power eyepiece (e.g., 9mm or less) and repeat the above tests. Any lack of collimation at this point will require only very slight adjustments of the three set screws. You now have good collimation of the optics.



Looking at or near the **Sun** will cause **irreversible** damage to your eye. Do not point this telescope at or near the Sun. Do not look through the telescope as it is moving.



Fig. 36: R.A. Lock.



Fig. 37: Dec Lock.

- i. As a final check of alignment, examine the star image in focus with the higher power eyepiece as suggested (j), under good viewing conditions. The star point should appear as a small central dot (commonly referred to as an “Airy disc”) with a diffraction ring surrounding it. To give a final precision collimation, make extremely slight adjustments of the three set screws, if necessary, to center the Airy disc in the diffraction ring. You now have the best alignment of the optics possible with this telescope.

### Inspecting the Optics

**A Note about the “Flashlight Test:”** If a flashlight or other high-intensity light source is pointed down the main telescope tube, the view (depending upon the observer’s line of sight and the angle of the light) may reveal what appear to be scratches, dark or bright spots, or just generally uneven coatings, giving the appearance of poor quality optics. These effects are only seen when a high intensity light is transmitted through lenses or reflected off the mirrors, and can be seen on any high quality optical system, including giant research telescopes.

The optical quality of a telescope cannot be judged by the “flashlight test;” the true test of optical quality can only be conducted through careful star testing.

### Gauging the Movement of the Telescope

A common complaint of many first-time motorized telescope owners is that they cannot see the telescope “move” when the motor drive is engaged. In fact, when the batteries are installed, the power is on and the R.A. lock (Fig. 36) engaged, the telescope is moving. However, the movement is at the same speed as the hour hand of a 24-hour clock; as such, the movement is difficult to discern visually.

To check the movement of your telescope, look at an astronomical object through the telescope’s eyepiece with the telescope aligned and with the motor drive on. If the object remains stationary in the field of view, your telescope is operating properly. If not, check to ensure that you have engaged the R.A. lock and that the power switch on the control panel is on.

### Meade Consumer Solutions Service

If you have a question concerning your LX200R, contact the Meade Instruments Consumer Solutions 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 LX200R requires factory servicing or repairs, write or call the Meade Consumer Solutions Department first, before returning the telescope to the factory, giving full particulars as to the nature of the problem, as well as your name, address, and daytime telephone number. The great majority of servicing issues can be resolved by telephone, avoiding return of the telescope to the factory. If factory service is required, you will be assigned a Return Goods Authorization (RGA) number prior to return.

### LX200R TIPS

#### What is Smart Drive?

Smart Drive is a feature that allows you to train almost all of the periodic error from the R.A. and Dec. motor drive worm gears. Periodic error is brought about by tiny gear imperfections. These imperfections exist in all manufactured worm gears. These imperfections tend to ever so slightly speed up or slow down the drive tracking speed during each rotation of the worm gear. This inconsistency in the tracking rate can have a negative effect on astrophotography. Smart drive lets you train your telescope system to compensate for these inconsistencies and, as a result, perform more accurate tracking during astrophotography. Smart Drive remembers the training even after the telescope is turned off.

If you’d like to learn more about about Periodic Error Correction, see page 39.



# SPECIFICATIONS

## 8" f/10 LX200R Specifications

Optical design.....	Advanced Ritchey-Chrétien telescope
Clear aperture.....	203mm (8")
Focal length .....	2000mm
Focal ratio (photographic speed) .....	f/10
Resolving power .....	0.56 arc sec
Coatings .....	Meade EMC Super Multi-Coatings (UHTC optional)
Mounting .....	Cast-aluminum, double-tine forks
Gears .....	5.75"-dia. worm gears, both axes
Periodic Error Correction .....	Both axes
Alignment .....	Altazimuth or equatorial w/optional wedge
Slew Speeds.....	1x sidereal to 8°/sec in 9 increments
Power .....	8 C-cell (user-supplied) batteries or optional 12v power supply
Tripod .....	Variable-height field tripod
Accessories .....	8 x 50mm viewfinder 1.25" diagonal prism Series 5000 26mm 5-element Plössl 4-speed zero image-shift microfocuser 16-channel GPS receiver True-level electronic sensor
Net telescope weight .....	46 lbs.
Net tripod weight.....	20 lbs.

## 10" f/10 LX200R Specifications

Optical design.....	Advanced Ritchey-Chrétien telescope
Clear aperture.....	254mm (10")
Focal length .....	2500mm
Focal ratio (photographic speed) .....	f/10
Resolving power .....	0.45 arc sec
Coatings .....	Meade EMC Super Multi-Coatings (UHTC optional)
Mounting .....	Cast-aluminum, double-tine forks
Gears .....	5.75"-dia. worm gears, both axes
Periodic Error Correction .....	Both axes
Alignment .....	Altazimuth or equatorial w/optional wedge
Slew Speeds.....	1x sidereal to 8°/sec in 9 increments
Power .....	8 C-cell (user-supplied) batteries or optional 12v power supply
Tripod .....	Variable-height field tripod
Accessories .....	8 x 50mm viewfinder 1.25" diagonal prism Series 5000 26mm 5-element Plössl 4-speed zero image-shift microfocuser 16-channel GPS receiver True-level electronic sensor
Net telescope weight .....	62 lbs.
Net tripod weight.....	20 lbs.



## 12" f/10 LX200R Specifications

Optical design	Advanced Ritchey-Chrétien telescope
Clear aperture	305mm (12")
Focal length	3048mm
Focal ratio (photographic speed)	f/10
Resolving power	0.375 arc sec
Coatings	Meade EMC Super Multi-Coatings (UHTC optional)
Mounting	Cast-aluminum, double-tine forks
Gears	5.75"-dia. worm gears, both axes
Periodic Error Correction	Both axes
Alignment	Altazimuth or equatorial w/optional wedge
Slew Speeds	1x sidereal to 8°/sec in 9 increments
Power	8 C-cell (user-supplied) batteries or optional 12v power supply
Tripod	Variable-height giant field tripod
Accessories	8 x 50mm viewfinder 2" diagonal prism, with 1.25" adapter Series 5000 26mm 5-element Plössl 4-speed zero image-shift microfocuser 16-channel GPS receiver True-level electronic sensor
Net telescope weight	73 lbs.
Net tripod weight	50 lbs.

## 14" f/10 LX200R Specifications

Optical design	Advanced Ritchey-Chrétien telescope
Clear aperture	356mm (14")
Focal length	3556mm
Focal ratio (photographic speed)	f/10
Resolving power	0.321 arc sec
Coatings	Meade EMC Super Multi-Coatings (UHTC optional)
Mounting	Cast-aluminum, double-tine forks
Gears	5.75"-dia. worm gears, both axes
Periodic Error Correction	Both axes
Alignment	Altazimuth
Slew Speeds	1x sidereal to 8°/sec in 9 increments
Power	8 C-cell (user-supplied) batteries or optional 12v power supply
Tripod	Variable-height giant field tripod
Accessories	8 x 50mm viewfinder 2" diagonal prism, with 1.25" adapter Series 5000 26mm 5-element Plössl 4-speed zero image-shift microfocuser 16-channel GPS receiver True-level electronic sensor
Net telescope weight	110 lbs.
Net tripod weight	50 lbs.



## 16" f/10 LX200R Specifications

Optical design .....	Advanced Ritchey-Chrétien telescope
Clear aperture .....	406.4mm (16")
Focal length .....	4064mm
Focal ratio (photographic speed) .....	f/10
Resolving power .....	0.28 arc sec
Coatings .....	Meade EMC Super Multi-Coatings (UHTC optional)
Mounting .....	Heavy-duty double-tine forks
Gears .....	11"-dia. worm gears, both axes
Periodic Error Correction .....	Both axes
Alignment .....	Altazimuth or equatorial w/optional pier
Slew Speeds .....	1x sidereal to 8°/sec in 9 increments
Power .....	18v power supply
Tripod .....	Variable-height super giant field tripod
Accessories .....	8 x 50mm viewfinder 2" diagonal prism with 1.25" adapter Series 5000 26mm 5-element Plössl 4-speed zero image-shift microfocuser 16-channel GPS receiver True-level electronic sensor
Net telescope weight .....	318 lbs.
Net tripod weight .....	88 lbs.

## AutoStar II System Specifications

Processors .....	10 processors arranged in a Distributed Intelligent Network Architecture to facilitate parallel task management (U.S. Patent 6,304,376)
Flash Memory .....	3.5MB, reloadable
Database .....	145,000 objects

## AutoStar II Handbox Specifications

Keypad .....	20 key alphanumeric
Display .....	2 line, 16 character LCD
Backlight .....	Red LED
Utility Light .....	Yes
Coil Cord .....	24"
Length .....	6.56" (16.6cm)
Width (LCD end) .....	3.19" (80cm)
Width (Connector end) .....	2.25" (57cm)
Depth .....	0.81" (21cm)
AutoStar II net weight .....	1.12 lbs (0.51kg)



# APPENDIX A: EQUATORIAL (POLAR) ALIGNMENT

## Equatorial Alignment

In equatorial (or "polar") Alignment, the telescope is oriented so that the horizontal and vertical axes of the telescope are lined up with the celestial coordinate system.

In order to equatorially align your telescope, it is essential to have an understanding of how and where to locate celestial objects as they move across the sky. This section provides a basic introduction to the terminology of equatorially-aligned astronomy, and includes instructions for finding the celestial pole and for finding objects in the night sky using Declination and Right Ascension.

## Celestial Coordinates

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 for the celestial sphere. These lines are known as **Right Ascension** and **Declination**.

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. 38**) is that point in the sky where an extension of the North Pole intersects the celestial sphere. The North Star, Polaris, is located very near the North Celestial Pole (**1, Fig. 38**). The celestial equator (**2, Fig. 38**) 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 Ring Nebula (M57) by its Right Ascension (18hr) and its Declination (+33°).

- **Right Ascension (R.A.):** This celestial version of longitude is measured in units of hours (hr), minutes (min), and seconds (sec) on a 24-hour "clock" (similar to how Earth's time zones are determined by longitude lines). The "zero" line was arbitrarily chosen to pass through the constellation Pegasus, a sort of cosmic Greenwich meridian. R.A. coordinates range from 0hr 0min 0sec to 23hr 59min 59sec. There are 24 primary lines of R.A., located at 15-degree intervals along the celestial equator. Objects located further and further East of the zero R.A. grid line (0hr 0min 0sec) carry higher R.A. coordinates.

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

## Setting Circles

Setting circles included with the LX200R models permit the location of faint celestial objects not easily found by direct visual observation. The R.A. circle (**11, Fig. 1** and **Fig. 40**) is located on the top surface of the telescope's drive base. The Declination circle (**Fig. 39**) is located at the top of the fork tube. With the telescope pointed at the North Celestial Pole, the Dec. circle should read 90° (understood to mean +90°). Objects located below the 0-0 line of the Dec. circle carry minus Declination coordinates. Each division of the Dec. circle represents a 1° increment. The R.A. circle runs from 0<sup>hr</sup> to (but not including) 24<sup>hr</sup>, and reads in increments of 5<sup>min</sup>.

### Important Note:

The "Telescope: Mount" option of the Setup menu is set to "Alt/Az" as the default mount by the factory. The example presented in this section assumes that you are performing an alignment procedure for the first time with your telescope and therefore, the "Telescope: Mount" option does not need to be selected.

If the telescope is equatorially mounted, you must choose the "Polar" option from the AutoStar II "Telescope Mount" menu.

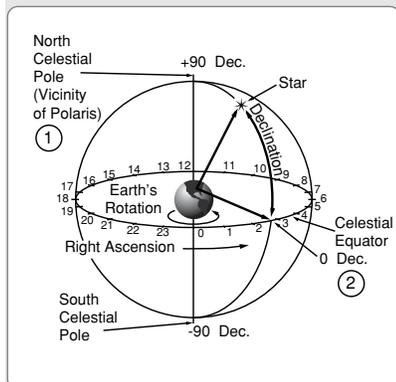


Fig. 38: Celestial Sphere.





Fig. 39: Declination Setting Circle.

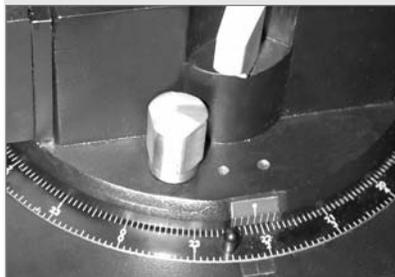


Fig. 40: Section of Right Ascension Setting Circle.

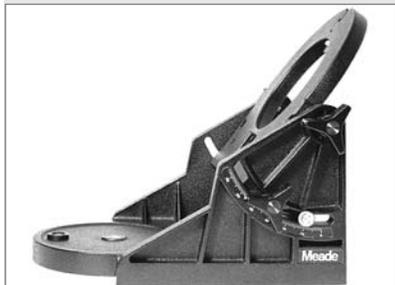


Fig. 41a: Equatorial Wedge for 8" LX200R models.



Fig. 41b: The Ultrawedge is available for larger LX200R models.

Using setting circles requires a developed technique. When using the circles for the first time, try hopping from one bright star (the calibration star) to another bright star of known coordinates. Practice moving the telescope from one easy-to-find object to another. In this way, the precision required for accurate object location becomes evident.

**Note** You may also enter an object's R.A. and Dec. coordinates using the "User: Objects" option of AutoStar II's Object menu. AutoStar II then automatically slews the telescope to the entered coordinates.

Note that the R.A. circle is double-indexed (i.e., there are two series of numbers running in opposite directions around the circumference of the R.A. circle). The upper series of numbers (increasing counterclockwise) applies to observers located in the Earth's Northern Hemisphere; the lower series of numbers (increasing clockwise) applies to observers located in the Earth's Southern Hemisphere.

**To use the setting circles to locate an object not easily found by direct visual observation:**

With the telescope aligned to the Celestial Pole, first look up the celestial coordinates (R.A. and Dec.) of the object in a star atlas. Then loosen the R.A. lock and move the telescope to read the correct R.A. of the desired object; lock the R.A. lock onto the coordinate. Next, move the telescope in Declination to read the correct Declination of the object. If the procedure has been followed carefully, and if the telescope was well-aligned with the pole, the desired object should now be in the telescopic field of a low-power eyepiece.

If you do not immediately see the object you are seeking, try searching the adjacent sky area. Keep in mind that, with the 26mm eyepiece, the field of view of the LX200R is about 0.5°. Because of its much wider field, the viewfinder may be of significant assistance in locating and centering objects, after the setting circles have been used to locate the approximate position of the object.

Pinpoint application of the setting circles requires that the telescope be precisely aligned with the pole. See **PRECISE POLAR ALIGNMENTS**, page 55.

**Equatorial Wedge**

An optional equatorial wedge is required for equatorial (polar) alignment.

**Note:** The Meade Ultra wedge is recommended for the 10" to 14" models.

The equatorial wedge permits use in an astronomical, or "equatorial," mode. The wedge fits onto the field tripod. Equatorial alignment allows you to take longer exposure photographs with your LX200R.

See the instruction sheet supplied with the wedge for installation and setup information.

**Note:** For almost all astronomical observing requirements, approximate settings of the telescope's latitude and polar axis are acceptable. Do not allow undue attention to precise polar alignment of the telescope to interfere with your basic enjoyment of the instrument.

**Note:** The Meade equatorial wedge is designed solely for use in conjunction with your Meade tripod. The wedge should never be used without the tripod (e.g., by placing the wedge alone on a table top and then mounting the telescope on the wedge—the wedge may become seriously unbalanced, to the point where the telescope may actually tip over.

Included features:

- Attachment of the wedge to the tripod by means of only one manual knob.
- Quick azimuth adjustment by loosening the manual knob.
- Bubble level for rapid tripod/wedge leveling.
- Etched latitude scale for fast adjustment of the latitude angle.



Looking at or near the **Sun** will cause **irreversible** damage to your eye. Do not point this telescope at or near the Sun. Do not look through the telescope as it is moving.

## Lining Up with the Celestial Pole

Objects in the sky appear to revolve around the celestial pole. (Actually, celestial objects are essentially “fixed.” Their apparent motion is caused by the Earth’s rotation). During any 24 hour period, stars make one complete revolution about the pole, making concentric circles with the pole at the center. By lining up the telescope’s polar axis with the North Celestial Pole (or for observers located in Earth’s Southern Hemisphere, with the South Celestial Pole), astronomical objects may be followed, or tracked, simply by moving the telescope about one axis, the polar axis. This tracking may be accomplished automatically with the LX200R electric motor drive.

If the telescope is reasonably well aligned with the pole, very little use of the telescope’s Declination slow motion control is necessary. Virtually all of the required telescope tracking will be in Right Ascension. (If the telescope were perfectly aligned with the pole, no Declination tracking of celestial objects would be required.) For the purposes of casual telescopic observations, lining up the telescope’s polar axis to within a degree or two of the pole is more than sufficient: with this level of pointing accuracy, the telescope’s motor drive will track accurately and keep objects in the telescopic field of view for perhaps 20 to 30 minutes.

Begin polar aligning the telescope by locating Polaris. Finding Polaris is simple. Most people recognize the “Big Dipper.” The Big Dipper has two stars that point the way to Polaris (**Fig. 42**). Once Polaris is found, it is a straightforward procedure to obtain a rough polar alignment.

To line up with Polaris, follow the procedure described below. Refer to the instruction sheet included with your equatorial wedge for information about attaching the wedge to the telescope and also about using the azimuth and latitude controls.

1. Select "Setup: Telescope" from the AutoStar II menus. Press ENTER. Scroll to "Telescope: Mount" and press ENTER. Scroll to "Scope Mounting: Polar" and press ENTER. The telescope mount is now set to the polar mode.
2. Press MODE until "Select Item: Setup" displays. Press ENTER. "Setup: Align" displays. Press ENTER. "Align: Easy" displays. Scroll to "Align: One-Star" and press ENTER. AutoStar II now prompts you to set the telescope in the polar home position.
  - a. Using the bubble level of the wedge, adjust the tripod legs so that the bubble is level.
  - b. Set the wedge to your observing latitude.
  - c. Using the Up and Down Arrow keys, rotate the telescope tube in Declination so that the telescope’s Declination reads  $90^\circ$ . See **SETTING CIRCLES**, page 55.
  - d. Loosen the R.A. lock, and rotate the fork arms to the 00 position H. A. : Move the forks arms so that center tick mark on fork arm base (**A**, **Fig. 43**) aligns with the tick mark on the base (**B**, **Fig. 43**).
  - e. Press ENTER. The telescope slews to Polaris.
  - f. Use the azimuth and latitude controls on the wedge to center Polaris in the field of view. Do not use the AutoStar II handbox during this process. When Polaris is centered, press ENTER. The telescope is now polar aligned. See **AUTOSTAR II POLAR ALIGNMENT**, page 56, for more information.

At this point, your polar alignment is good enough for casual observations. There are times, however, when you will need to have precise polar alignment, such as when making fine astrophotographs.

Once the latitude angle of the wedge has been fixed and locked-in according to the above procedure, it is not necessary to repeat this operation each time the telescope is used, unless you move a considerable distance North or South from your original observing position. (Approximately 70 miles movement in North-South observing position is equivalent to  $1^\circ$  in latitude change.) The wedge may be detached from the field tripod and, as long as the latitude angle setting is not altered and the field tripod is leveled, it will retain the correct latitude setting when replaced on the tripod.

The first time you polar align the telescope, check the calibration of the Declination setting circle (**Fig. 39**). After performing the polar alignment procedure, center the star Polaris in the telescope field. Remove the knurled central hub of the Declination set-

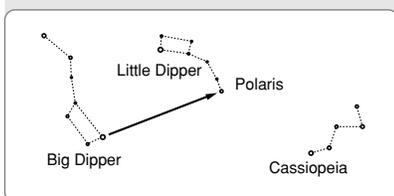


Fig. 42: Locating Polaris.

### Tip:

You can check if the declination is set at true  $90^\circ$  in step 2c. Look through the eyepiece and rapidly slew the optical tube on the R.A. axis. If all the stars rotate around the center of the field of view, the Declination is set at  $90^\circ$ . If the stars arc out of the field of view, slew the optical tube on the Declination axis until you achieve the centering effect.

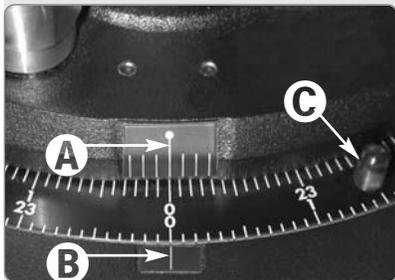


Fig. 43: Align tick marks to set the fork arms to 00 H.A. position.





Fig. 44: LX200R mounted on an equatorial wedge.

ting circle and slightly loosen the two bolts located under the knob. Now turn the circle unit until it reads  $89.2^\circ$ , the Declination of Polaris. Then tighten down the two bolts and replace the knurled knob.

Should you wish to use the manual setting circles, the R.A. setting circle (**Fig. 40**) must be calibrated manually on the Right Ascension of a star every time the telescope is set up. (The R.A. setting circle has two sets of numbers, the inner set is for Southern hemisphere use, while the other is for Northern hemisphere use.) Locate a star with which you're familiar. Look up the R.A. for the star in a star chart or other aid. With the star centered in the telescope's eyepiece, move the R.A. setting circle, using one of knobs (**C, Fig. 43**), so that the R.A. of the star lines up with the tick mark on the base of the telescope (**B, Fig. 43**).

### Precise Polar Alignment

It should be emphasized that while doing casual observing, precise alignment of the telescope's polar axis to the celestial pole is not necessary. Don't allow a time-consuming effort at lining up with the pole to interfere with your basic enjoyment of the telescope. For long-exposure photography, however, the ground rules are quite different, and precise polar alignment is not only advisable, but almost essential.

Even though the LX200R telescopes offers a very precise and sophisticated drive system, the fewer tracking corrections required during the course of a long-exposure photograph, the better. ("Long-exposure" means any photograph of a celestial object that last for 10 minutes or longer). In particular, the number of Declination corrections required is a direct function of the precision of polar alignment.

Precise polar alignment requires the use of a crosshair eyepiece. The Meade Illuminated Reticle Eyepiece (see **OPTIONAL ACCESSORIES**, page 44) is well-suited in this application, but it is also preferable to increase the effective magnification through the use of a 2X or 3X Barlow lens as well. Follow this procedure (particularly if the pole star is not visible), sometimes better known as the "Drift" method:

1. Obtain a rough polar alignment as described earlier. Place the illuminated reticle eyepiece (or eyepiece/Barlow combination) into the eyepiece holder of the telescope.
2. Point the telescope, with the motor drive running, at a moderately bright star near where the meridian (the North-South line passing through your local zenith) and the celestial equator intersect. For best results, the star should be located within  $\pm 30$  minutes in R.A. of the meridian and within  $\pm 5^\circ$  of the celestial equator (see **CELESTIAL COORDINATES**, page 52). Pointing the telescope at a star that is straight up, with the Declination set to  $0^\circ$ , will point the telescope in the right direction.
3. Note the extent of the star's drift in Declination (disregard drift in Right Ascension):
  - a. If the star drifts South (or down), the telescope's polar axis is pointing too far East.
  - b. If the star drifts North (or up), the telescope's polar axis is pointing too far West.
4. Move the wedge in azimuth (horizontally) to effect the appropriate change in polar alignment. Reposition the telescope's East-West polar axis orientation until there is no further North-South drift by the star. Track the star for a period of time to be certain that its Declination drift has ceased.
5. Next, point the telescope at another moderately bright star near the Eastern horizon, but still near the celestial equator. For best results, the star should be about  $20^\circ$  or  $30^\circ$  above the Eastern horizon and within  $\pm 5^\circ$  of the celestial equator.
6. Again note the extent of the star's drift in Declination:
  - a. If the star drifts South, (or down) the telescope's polar axis is pointing too low.
  - b. If the star drifts North, (or up) the telescope's polar axis is pointing too high.
7. Use the altitude adjust control on the wedge to make appropriate changes in altitude, based on your observations above. Again, track the star for a period of time to be certain that Declination drift has ceased.

The above procedure results in very accurate polar alignment, and minimizes the need for tracking corrections during astrophotography.



**Important Note:**

*In order to select any of AutoStar II's three polar alignment options, you must first select "Polar" in the "Mount" option of the "Setup: Telescope" menu.*

## AutoStar II Polar Alignment

AutoStar II provides three different (manual) methods for polar alignment: Easy, One-Star and Two-Star.

### Easy Polar Alignment

Two alignment stars are chosen by AutoStar II based on the date, time, and location. First, choose "Polar" from the "Setup: Telescope: Mount" menu. The rest of the procedure is identical to the (Alt/Az) **EASY (TWO-STAR) ALIGN**, page 37.

### One-Star Polar Alignment

Polar One-Star Alignment requires some knowledge of the night sky. AutoStar II provides a library of bright stars and one star from this library is chosen by the observer for alignment. Polaris is chosen by AutoStar II. First, choose "Polar" from the "Setup: Telescope: Mount" menu. The rest of the procedure is almost identical to the (Alt/Az) **ONE STAR ALT/AZ ALIGNMENT**, page 37, except that AutoStar II prompts you to point the telescope at Polaris and center it in the telescope eyepiece.

### Two-Star Polar Alignment

Polar Two-Star Alignment requires some knowledge of the night sky. AutoStar II provides a library of bright stars and two stars from this library are chosen by the observer for alignment. First, choose "Polar" from the "Setup: Telescope: Mount" menu. The rest of the procedure is almost identical to the (Alt/Az) **TWO STAR ALT/AZ ALIGNMENT**, page 37.

## LX200R 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.

On the internet, you can find websites for almost any topic relating to astronomy. Try the following key word searches: NASA, Hubble, HST, astronomy, Messier, satellite, nebula, black hole, variable stars, etc.

Check 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 your AutoStar II handset. See page 31 for more information. You'll find our website at:

[www.meade.com/](http://www.meade.com/)

Here are some other sites you might find interesting:

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



# APPENDIX B: LATITUDE CHART

## Latitude Chart for Major Cities of the World

To aid in the polar alignment procedure (see page 54), latitudes of major cities around the world are listed below. To determine the latitude of an observing site not listed on the chart, locate the city closest to your site. Then follow the procedure below:

**Northern hemisphere observers (N):** If the site is over 70 miles (110 km) North of the listed city, add one degree for every 70 miles. If the site is over 70 miles South of the listed city, subtract one degree per 70 miles.

**Southern Hemisphere observers (S):** If the site is over 70 miles (110 km) North of the listed city, subtract one degree for every 70 miles. If the site is over 70 miles South of the listed city, add one degree per 70 miles.

NORTH AMERICA			SOUTH AMERICA		
City	State/Prov./Country	Latitude	City	Country	Latitude
Albuquerque	New Mexico	35° N	Bogotá	Colombia	4° N
Anchorage	Alaska	61° N	São Paulo	Brazil	23° S
Atlanta	Georgia	34° N	Buenos Aires	Argentina	35° S
Boston	Massachusetts	42° N	Montevideo	Uruguay	35° S
Calgary	Alberta	51° N	Santiago	Chile	34° S
Chicago	Illinois	42° N	Caracas	Venezuela	10° N
Cleveland	Ohio	41° N			
Dallas	Texas	33° N	ASIA		
Denver	Colorado	40° N	City	Country	Latitude
Detroit	Michigan	42° N	Beijing	China	40° N
Honolulu	Hawaii	21° N	Hong Kong	China	23° N
Jackson	Mississippi	32° N	Seoul	South Korea	37° N
Kansas City	Missouri	39° N	Taipei	Taiwan	25° N
Kenosha	Wisconsin	45° N	Tokyo	Japan	36° N
Las Vegas	Nevada	36° N	Sapporo	Japan	43° N
Little Rock	Arkansas	35° N	Bombay	India	19° N
Los Angeles	California	34° N	Calcutta	India	22° N
Mexico City	Mexico	19° N	Hanoi	Vietnam	21° N
Miami	Florida	26° N	Jedda	Saudi Arabia	21° N
Minneapolis	Minnesota	45° N			
Nashville	Tennessee	36° N	AFRICA		
New Orleans	Louisiana	30° N	City	Country	Latitude
New York	New York	41° N	Cairo	Egypt	30° N
Oklahoma City	Oklahoma	35° N	Cape Town	South Africa	34° S
Ottawa	Ontario	45° N	Rabat	Morocco	34° N
Philadelphia	Pennsylvania	40° N	Tunis	Tunisia	37° N
Phoenix	Arizona	33° N	Windhoek	Namibia	23° S
Portland	Oregon	46° N			
Salt Lake City	Utah	41° N	AUSTRALIA AND OCEANIA		
San Antonio	Texas	29° N	City	State/Country	Latitude
San Diego	California	33° N	Adelaide	South Australia	35° S
San Francisco	California	38° N	Brisbane	Queensland	27° S
Seattle	Washington	47° N	Canberra	New South Wales	35° S
Washington	District of Columbia	39° N	Alice Springs	Northern Territory	24° S
			Hobart	Tasmania	43° S
			Perth	Western Australia	32° S
			Sydney	New South Wales	34° S
			Melbourne	Victoria	38° S
			Auckland	New Zealand	37° S
EUROPE					
City	Country	Latitude			
Amsterdam	Netherlands	52° N			
Athens	Greece	38° N			
Bern	Switzerland	47° N			
Copenhagen	Denmark	56° N			
Dublin	Ireland	53° N			
Frankfurt	Germany	50° N			
Glasgow	Scotland	56° N			
Helsinki	Finland	60° N			
Lisbon	Portugal	39° N			
London	England	51° N			
Madrid	Spain	40° N			
Oslo	Norway	60° N			
Paris	France	49° N			
Rome	Italy	42° N			
Stockholm	Sweden	59° N			
Vienna	Austria	48° N			
Warsaw	Poland	52° N			



# APPENDIX C: CREATE YOUR OWN GUIDED TOUR

Creating your own Guided Tour can be an extremely useful tool. You can preprogram a script of objects you wish to view and study on any given night. You can also create a viewing script for students or for a friend.

More commands will be added from time-to-time to the list below. Periodically visit Meade's website ([www.meade.com](http://www.meade.com)) for future additions.

When a Guided Tour is selected, AutoStar II slews your telescope to a predetermined list of objects and displays information about each object, such as type of object, constellation location, R.A. and Dec. coordinates, and so forth. AutoStar II contains a few Guided Tours which are programmed at the factory. But it is also possible for an observer to create a custom Guided Tour.

A tour is basically an ASCII text file that contains a list of directions and descriptions. Each line of a tour is either a comment line, a command line, or a description.

## What you will need:

- A PC with text editor or word processing software installed (the tour must be saved as a "text only" or as a "MS-DOS text" file).
- The optional Meade LX200 Interface Cable to download tour information to the AutoStar II handbox.

## Tour Modes

The objects chosen for a tour list are selected from AutoStar II's database or by entering the object's R.A. and Dec. coordinates. The tour is presented in one of two modes:

*Automatic Mode:* The title of an object appears on first line and descriptive text scrolls on line 2.

*Interactive Mode:* Tour name appears on the first line of the AutoStar II display and the name of the object displays on line 2. To display descriptive text in this mode, the user must press ENTER.

## Comment Line

Information in the Tour program that is not displayed, such as authorship, revision history, copyrights, etc. All comments begin with a "/" character in column 1 of the line. *For example:*

```
/ Extreme Objects  
/ (c) 2002 Meade Instruments Corporation
```

## Command Line

This line contains programming commands, including: R.A. and Dec. coordinates, a title string, a description string, and a keyword.

**R.A.:** Enter the Right Ascension of an object in the following format: HH:MM:SS. *Eg.,* 18:51:05

**Dec.:** Enter the Declination of an object in the following format: DDdMMmSSs. *Eg.,* -06d16m00s

**Title String:** Text within a title string is displayed as the title of the object. A title string can contain up to 16 characters and must be surrounded by quotation marks. *For example:* "M64" or "My Favorite Star."

In *Interactive Mode*, the title string appears on line 2 until it is selected with the ENTER key.

In *Automatic Mode*, or after Interactive Mode selection, the title string appears on line 1 while the description scrolls across line 2.

**Keywords:** Action to be performed during a tour. AutoStar II recognizes the following keywords:



TITLE	TEXT	USER	NGC
IC	SAO	MESSIER	CALDWELL
PLANET	MOON	SATELLITE	ASTEROID
COMET	LUNAR ECLIPSE	METEOR SHOWER	DEEP SKY
CONSTELLATION	STAR	LANDMARK	DEFINE
PICK ONE/PICK END	AUTO SLEW	ON/OFF	#END

**Description String:** Description of an object. Must be surrounded by quotation marks. If the description is longer than one line, each line must end with a quotation mark and a hard return. Begin the next description line with a quotation mark.

If quotation marks are to be displayed in the on-screen description, use two quote marks at the beginning and end of the desired phrase. *For example:* "The Orion Nebula is considered ""awesome"" by many who view it."

### Writing a Tour

Using the list of commands listed above, a custom tour can be created. Placing the word AUTO SELECT before any of the command lines activates Automatic Mode and, when selected, AutoStar II automatically searches and finds the designated object.

The following is a list of command lines, complete with keywords and necessary strings:

#### TITLE

Title must be the first keyword in your tour after any comment lines and must be 15 characters or less. AutoStar II displays this title when "Guided Tour" is selected from the menus.

*For example:* TITLE "A Star's Life"

#### TEXT "title string" "description string"

This command allows you to display a text title and description.

#### USER ra dec "title string" "description string"

This command line allows you to access a specific object with your own description. Enter USER, then the R.A. and Dec. of a desired object, and its title and description. Use the format described in the Command Line section.

The following commands specify objects that are already in the AutoStar II database. If these commands follow the command AUTO SELECT, the object's title displays on line 1 and its description scrolls across line 2.

Do not add a description string after the following command lines; these commands access objects with existing description in the AutoStar II database.

#### NGC xxxx

Enter NGC followed by the desired New General Catalog number and AutoStar II provides the user with a description of the object from its database. *For example:* NGC 4256

#### IC xxxx

Enter IC followed by the desired Index Catalog number and AutoStar II provides the user with a description of the object from its database. *For example:* IC 1217

#### SAO xxxxxx

Enter SAO followed by the desired SAO number and AutoStar II provides the user with a description of the object from its database. *For example:* SAO 30200

#### Messier xxx

Enter MESSIER followed by the desired Messier number and AutoStar II provides the user with a description of the object from its database. *For example:* M 101

#### CALDWELL xxx

Enter CALDWELL followed by the Caldwell number and AutoStar II provides the user with a description of the object from its database. *For example:* CALDWELL 17



#### PLANET "name"

Enter PLANET and then the name of the desired planet in quotes. AutoStar II provides the user with a description of the selected planet from its database. *For example:* PLANET "Pluto"

#### MOON

This command accesses information about the Moon from the AutoStar II database.

#### SATELLITE "name"

Enter SATELLITE and then the name of the desired satellite in quotes. AutoStar II displays information about the satellite from its database. *For example:* SATELLITE: "Intl Space Stn"

#### ASTEROID "name"

Enter ASTEROID and then the name of the desired asteroid in quotes. AutoStar II displays information about the asteroid from its database. *For example:* ASTEROID: "Ceres"

#### COMET "name"

Enter COMET and then the name of the desired comet in quotes. AutoStar II displays information about the comet from its database. *For example:* COMET: "Halley"

#### LUNAR ECLIPSE

If LUNAR ECLIPSE is part of the tour, AutoStar II checks its database every time the tour is activated to see if a lunar eclipse is visible that evening. If no eclipse is visible, this option is skipped and the tour proceeds on to the next object.

#### METEOR SHOWER

If METEOR SHOWER is part of the tour, AutoStar II checks its database every time the tour is activated to see if a meteor shower is visible that evening. If no meteor shower is visible, this option is skipped and the tour proceeds on to the next object.

#### DEEP SKY "name"

Enter DEEP SKY followed by the name of the desired object in quotes. *For example:* DEEP SKY "Small Magellanic Cloud"

#### CONSTELLATION "name"

Enter CONSTELLATION followed by the name of the desired constellation in quotes. *For example:* CONSTELLATION "Leo Major"

#### STAR "name"

Enter STAR followed by the name of the desired star in quotes. *For example:* STAR "Vega"

#### LANDMARK az alt "title" "description"

Enter the azimuth (az) for the desired object in the following format: xxxdxxmxxs. *For example:* 123d27m00s. Then enter the altitude of the desired object in the following format: xdxmxxs. Then enter the title string and description string in quotes. *For example:*

LANDMARK 123d27m00s 57d20m20s "Landmark 1" "North corner of apartment building"

#### PICK ONE / PICK END

These two statements are used to surround a list of items that AutoStar II can choose from during a tour. AutoStar II begins at the top of the PICK ONE list and displays the first object from the list that is above the horizon and ignores the rest.

This statement is useful for developing tours that can be presented year-round. For each object type you wish to use to illustrate in your tour, pick 10 to 12 examples spaced across the range of right ascension. Bracket them by the PICK ONE / PICK END statements. One current example displays for the user. *For example:*

AUTO SELECT TEXT "Globular Cluster" "Globular clusters are huge balls of stars."  
"They contain 50,000 to 100,000 stars and are located on the fringes of our galaxy."



PICK ONE

AUTO SELECT MESSIER 13

AUTO SELECT MESSIER 15

AUTO SELECT MESSIER 92

AUTO SELECT MESSIER 4

AUTO SELECT MESSIER 68

AUTO SELECT NGC 1234

AUTO SELECT TEXT "None Available" "I'm sorry. There are no bright globular"  
"clusters visible at this time."

PICK END

AUTO SLEW ON / AUTO SLEW OFF

With AUTO SLEW ON enabled in the tour, AutoStar II automatically slews the telescope to objects first before displaying the text description. This feature is useful when designing tours in which observing certain objects is required. *For example:* An astronomy professor may require his students to observe six objects, four of which AutoStar II automatically slews to in a tour. The students would have to manually slew to the last two objects. He would then place AUTO SLEW ON before his first required object and AUTO SLEW OFF after the fourth object.

#END

To end a tour, type the command #END on a separate line at the very end of the tour.

#### **Downloading Tours**

Once a tour is written and stored as an ASCII file (saved either as a "text only" or "MS DOS text" file), load it into AutoStar II using the AutoStar II Update Utility on your PC. As tours are downloaded into the handbox, AutoStar II examines the programming. If it doesn't understand the terminology used within a tour, it flags questionable areas and displays them in a pop-up window on your computer screen. Make the necessary corrections and try to download again. See the instruction sheet with your LX200 Interface Cable for more information about downloading data to and interfacing with AutoStar II.



# APPENDIX D: TRAINING THE DRIVE

Train the telescope motors using AutoStar II. Perform this procedure if you are experiencing any pointing accuracy problems. **Fig. 41** 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.

## LX200R TIPS

### Further Study...

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

Also included 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? Is there water under the surface of the Moon?
4. What is a black hole? A neutron star? A quark star? A gamma burster? An Einstein lens?
5. What are stars made of? Why are stars different colors? How is the elemental composition of a star determined? What is an Lyman Alpha forest?
6. What is the difference between a Type 1 and a Type II supernova?
7. What is the importance of studying the composition of comets? Where do comets come from?
8. How old is our Sun? Will our Sun evolve into a planetary nebula or go supernova?
9. What is the Inflationary Big Bang? What is dark matter? What are MACHO's?
10. How are extrasolar planets discovered? What is an accretion (or protoplanetary) disk?
11. What are the differences between elliptical, spiral, and irregular galaxies? Can globular clusters be older than the universe itself?

#### 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*  
49 Bay St., Cambridge, MA 02138
2. *Astronomy*  
Box 1612, Waukesha, WI 53187

#### Organizations:

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

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

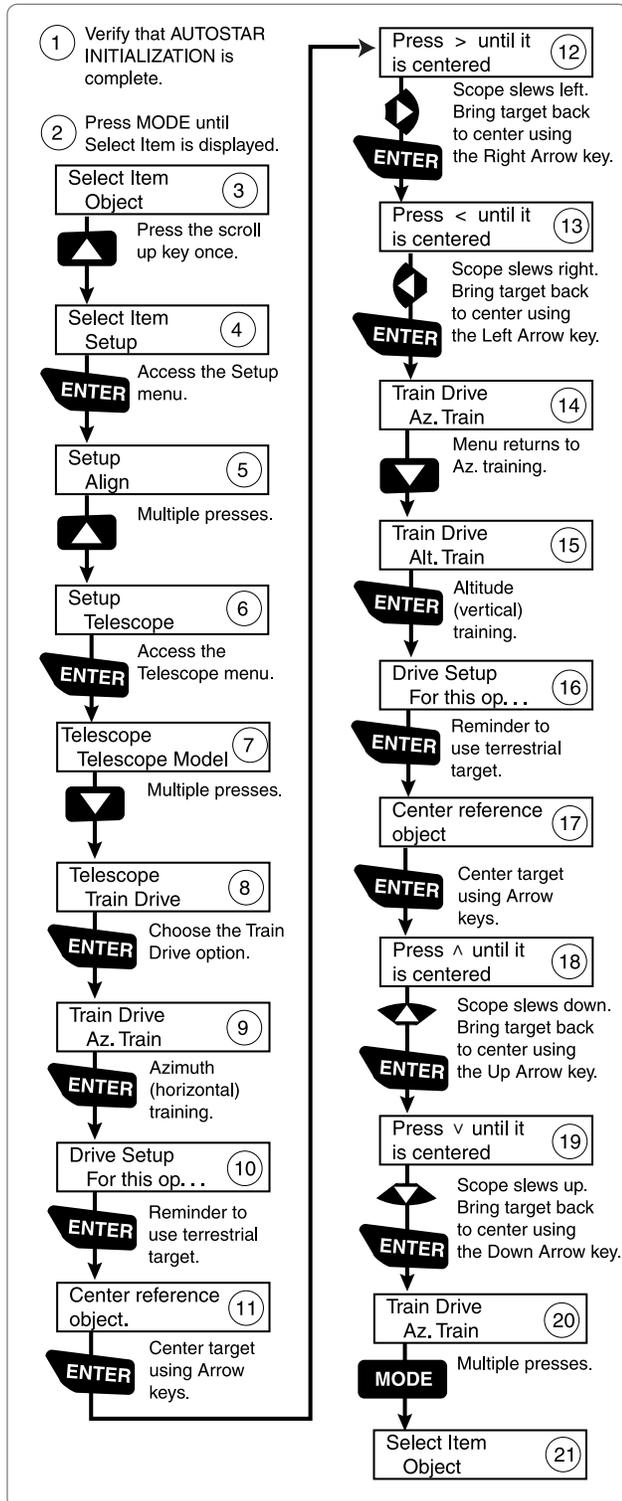


Figure 45: Training the Drive Procedure.



## APPENDIX E: THE MOON MENU

The Moon option of the Object menu allows you to observe the moon in a way never possible before. You will be able locate many specific features of the lunar surface, including hundreds of craters, mare, valleys, and mountains. One special feature allows you to view all six Apollo landing sites. While you won't be able to see details such as any of the lunar landers or lunar excursion modules left behind by the astronauts (the best earth-based telescopes can only resolve features of about a half-mile across), you'll be able pinpoint the landing sites and study the terrain surrounding these sites.

When AutoStar II synchs to a lunar feature, the telescope switches to Selenographic coordinates, *i.e.*, lunar latitude and longitude.

### To observe the Apollo 15 landing site using the Moon option:

1. Initialize and align the telescope system as previously described.
2. Press "5" on the AutoStar II keypad. "Solar System: Mercury" displays.
3. Press a Scroll key until "Solar System: Moon" displays. Press ENTER.
4. "Moon: Overview" displays. Press GO TO. The telescope slews to the Moon.
5. With "Moon: Overview" on AutoStar II's display, use the Scroll keys to browse through the menu options. Five categories of features are available: Landing Sites, Craters, Mountains, Mare and Lakes, and Valleys and Rills.
6. Select a distinct lunar crater with which you are familiar, such as Copernicus or Kepler, from the Craters option and press ENTER.
7. Then press GO TO to slew to that feature. Center the feature in the eyepiece and hold down ENTER for more than two seconds to ENTER TO SYNC. The telescope is now synched to Selenographic coordinates.
8. Press MODE twice to return to the features list. Press a Scroll key until "Moon: Landing Sites" displays.
9. Press ENTER. "Landing Sites: Apollo 11" displays.
10. Press a Scroll key until "Landing Sites: Apollo 15" displays.
11. Press GO TO. The telescope slews to the Apollo 15 site.
12. Press MODE to return to the previous menu option. Continue to press MODE to exit this menu.

Use this method to find other lunar features and points of interest. When you have selected a feature, press the "?" key or use the Scroll keys to display detailed information about the feature. Press MODE to return to the menu options.

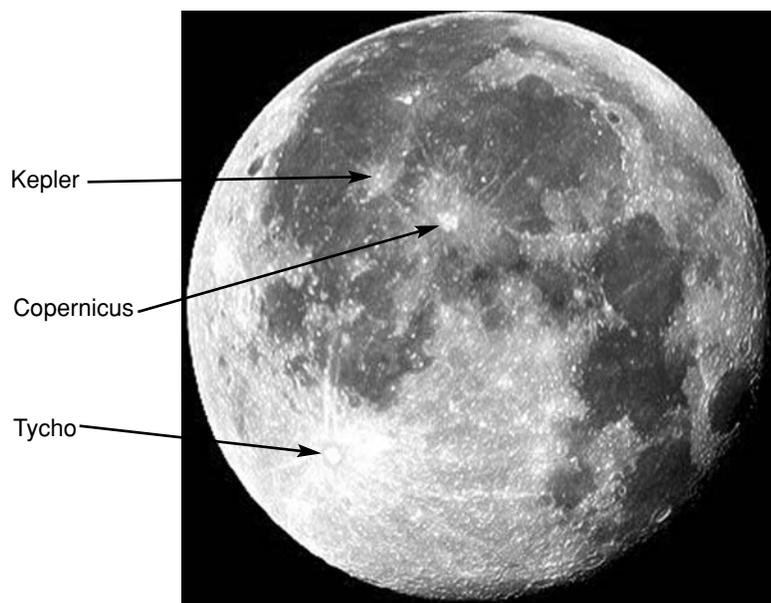


Figure 46: Some easily recognized lunar craters.



# APPENDIX F: 16" LX200R FEATURES



Figure 47: 16" LX200R Computer Control Panel.

### Caution:

Due to the weight and size of the 14" and the 16" LX200R models, please use extreme caution whenever assembling, disassembling, lifting, transporting or storing this product. Two or more persons should always be used whenever performing any of the above tasks. Disregard for the above warning could result in serious injury or death.

## 16" LX200R Unique Features

The 16" LX200R contains, for the most part, the same features (covered earlier in this manual) as all other LX200R telescope models. The following features are unique to the 16" model.

### Control Panel Features:

**18vDC Power Connector (B, Fig. 47):** Provides a connection so that the telescope assembly may be powered from a standard 115v AC home outlet using the supplied Power Adapter.

**The De-Rotater port (G, Fig. 47),** for use in altazimuth alignment, allows you connect the optional #1222 Field De-Rotater for long-exposure astrophotography by eliminating the image rotation inherent in altazimuth tracking. See **OPTIONAL ACCESSORIES**, page 45.

The "De-Rotater" menu option in the Utilities menu allows you to turn the De-rotater on or off using the AutoStar II handbook.

**12 vDC Output (Fan) Port (E, Fig. 47)** is used to power the fans located on the optical tube assembly (OTA). The fans evacuate the warm air trapped inside the tube, allowing for faster cool-down.

The fan takes warm air from the OTA so that cool air can enter the OTA through the filtered hole on the side of the OTA. The input filter prevents dust from entering the OTA. Periodically replace the filter by removing the four bolts holding the grill. The fan also has a filter, but this filter keeps dust out of the OTA while the fan is off; it should not need replacing.

The "AUX Power" option in the Utilities menu allows you to turn the fan on or off. Select "Yes" to turn on.

## Commercial Shipping

**Caution:** Serious damage to the drive gears may result from shock in handling. During transport or commercial shipping, the R.A. lock (12, Fig. 1) and/or the Dec. lock (17, Fig. 1) must not be engaged. Always release the locks when storing in the case or when crating for commercial shipment. This allows the telescope to give if the case or crate is sharply jarred or dropped.

The optical and mechanical axes of the 16" LX200R telescope have been carefully aligned at the factory to ensure accurate object pointing. Do not loosen or remove the optical tube assembly from the tube adapters (25, Fig 1). The resulting misalignment of the axes will result in inaccurate slewing of the telescope in the GO TO mode. Do not attempt to turn the focus knob of the optical tube (6, Fig. 1) until you have read the following note.



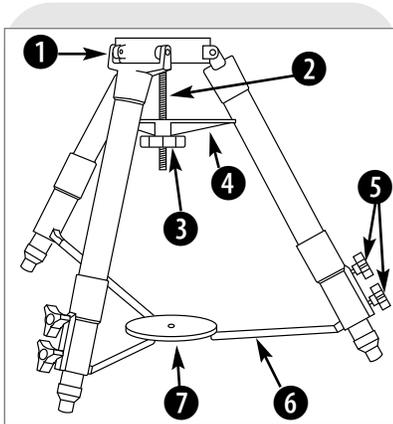


Fig. 48: The Super Giant Field Tripod:  
 (1) Tripod head;  
 (2) Threaded rod; (3) Tension knob;  
 (4) Spreader bar; (5) Lock knobs;  
 (6) Extension strut; (7) Tension hub.

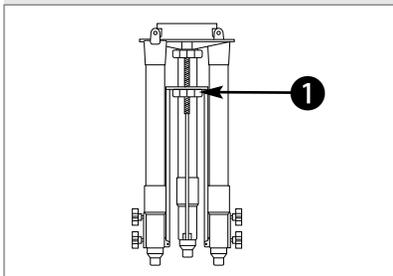


Fig. 49: The Super Giant Field Tripod collapsed.



Fig. 50: Tighten the tripod spreader bar with the tension knob.



Fig. 51: Remove the pointed bolts from the drive base.

**Caution:** Next to the focus assembly are two red slot-head bolts, used only for safety reasons in shipment. Remove these bolts before attempting to turn the focus knob. In its place, insert the rubber plugs provided as a dust protector (these rubber plugs are included with your hardware package).

The 16" LX200R should never be commercially shipped without the red bolts in place. This is essential during commercial transport, where rough handling may occur. Your transport and storage of the telescope never requires these bolts.

**To re-ship the 16" LX200R commercially, be sure to follow this procedure:**

1. Turn the focus knob clockwise until it stops so that it moves the primary mirror all the way back in the tube.
2. Remove the rubber plug and insert the red bolt. Thread it in to a firm feel (if you have misplaced the red bolt, you may use any bolt that is 1/4-20x1" long).
3. When packaging the 16" LX200R, be sure to release the R.A. lock (12, Fig. 1) and Dec. lock (17, Fig. 1) to prevent shock to the gears in the motor assemblies should the package suffer rough handling.

Commercial shipment of the 16" LX200R telescope without the red safety bolt in place as described above is done at the owner's risk and your warranty may be voided if shipping damage results.

**16" TELESCOPE ASSEMBLY**

Use the following procedure to assemble your telescope:

**To Assemble the 16" Super Field Tripod**

The 16" Super Field Tripod (Figs. 48 and 49) for the Meade 16" LX200R telescope is supplied as a completely assembled unit, except for the spreader bar (4, Fig. 48) and the six lock-knobs (5, Fig. 48). There are two knobs for each of the three tripod legs. They are used to adjust the level of the tripod. These knobs are packed separately for safety in shipment.

For most observations, the drive base of the telescope's fork mount is attached directly to the super giant field tripod, in the altazimuth (altitude-azimuth or vertical-horizontal) format.

The telescope also can be mounted on a permanent pier in the equatorial format, which is set for the latitude of the observing location (see APPENDIX A, pages 52 through 54, for instructions on using the telescope in equatorial mode). The equatorial mode permits alignment of the telescope's polar axis with the celestial pole.

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 (Fig. 49). Remove the lower knob (1, Fig. 45), releasing the tension hub (7, Fig. 47). This knob is used only when storing the field tripod. Moving one leg at a time, gently pull the legs apart. As the legs are opened, the tension hub will move down the threaded rod (2, Fig. 48) until it is free from the threaded rod. Continue to move the legs apart to a fully open position.

Thread in the two lock-knobs (5, Fig. 48) for each tripod leg, near the foot of each leg. These lock-knobs are used to fix the position of the inner tripod leg sections. These sections are used to level the telescope (described below).

**Note:** Tightening to a firm-feel is sufficient. Over-tightening may result in stripping of the knob threads or damage to the tripod legs; it provides no additional strength.

Loosen the tension knob (3, Fig. 48), holding the spreader bar (4, Fig. 48), and slide the spreader bar down the threaded rod until you can rotate it so that the three arms align with the three tripod legs. Tighten the tension knob ( Fig. 50) to a firm feel; firm tightening of the tension knob is sufficient to result in rigid positioning of the legs. **Do not use force in tightening this knob.**



Looking at or near the **Sun** will cause **irreversible** damage to your eye. Do not point this telescope at or near the Sun. Do not look through the telescope as it is moving.



Fig. 56: Position the holes over the shoulder bolts. When they are in place, slide the OTA back so that the shoulder bolts lock into the slots.



Fig. 57: Tighten the fork arm assembly using the provided hex key.



Fig. 58: Plug in the DB-9 connectors to provide power from the Dec. motor to the fork arms.

**To collapse the tripod (after removing the telescope) for storage, follow these steps:**

- a. Loosen the tension knob and rotate the spreader bar 60° from its assembled position, so that one spreader bar arm is located between each adjacent pair of tripod legs.
- b. Move the spreader bar to the top of the threaded rod. Tighten the tension knob, locking the bar.
- c. Working one leg at a time, gradually collapse the legs of the field tripod until the tension hub is positioned onto the threaded rod. Use the second tension knob to secure the tension hub in place.

**Attaching the 16" Drive Base**

- a. Remove the three pointed bolts that hold the packing material in place. These bolts are used only for shipping purposes and not used in the telescope assembly procedure. See Fig. 51.
- b. Rotate the field tripod so that one leg is pointing approximately South (it need not point exactly South).
- c. Position the 16" drive base onto the field tripod, with the power panel facing South. Secure the drive base using the three 1/2"-13x1-1/2" long bolts. Thread these bolts up through the underside of the tripod head into the drive base using the supplied hex key. Firmly tighten these bolts. See Fig. 52.
- c. Level the drive base by loosening the six lock-knobs (5, Fig. 48) and sliding out the inner tripod legs.
- d. Note the DB-15 connector at the center of the base.

**Attaching the Fork**

- a. Place the single-piece fork onto the top of the drive base. One side of the base of the fork has a cutout to allow clearance for the R.A. lock (12, Fig. 1) and R.A. slow-motion control (10, Fig. 1), which are located on top of the drive base.
- b. Bolt the fork to the drive base using the four 3/8"-16x3/4" long bolts (Fig. 53). Using the supplied hex key, tighten to a firm feel only.
- c. Unscrew and remove the four thumbscrews from the rectangular plate (Fig. 54) in the center of the fork base. Remove the plate. Note the DB-15 plug under the fork base.
- d. Connect the DB-15 plug to the DB-15 connector underneath the plate. Tighten the two thumbscrews onto the connector to a firm feel. See Fig. 55.
- e. A fifth 3/8"-16x3/4" long bolt is supplied with the telescope. Just using your fingers, loosely tighten this bolt under the plate. See Fig. 55. This bolt acts as a safety feature to prevent the DB-15 connector and cable from being damaged when you disassemble the telescope. You will not be able to disassemble the telescope until the bolt is removed. The bolt is located near the DB-15 assembly in the base as a reminder to unplug the connector before removing the fork from the drive base.

**Mounting the Optical Tube Assembly (OTA)**

This step requires two people who can lift up to 70 pounds each (**Note: See Caution on page 65**). The optical tube assembly (OTA) weighs about 125 lbs. and it must be positioned accurately in order to mount to the fork.

- a. Located on the two top surfaces of the fork are two shoulder bolts. These two bolts function as locating pins for the OTA. On the inside edge of the Dec. castings are two matching holes (with slots). Before trying to mount the OTA, be sure to locate these two bolts and holes. Notice that the bolts and holes are located on one side of the castings, requiring the OTA to be mounted one way only.
- b. Tighten the Dec. lock (12, Fig. 1) to a firm feel only. With you on one side of the OTA and your assistant on the other side, grasp the two handles on each side and lift the OTA onto the top of the fork. Position the holes over the shoulder bolts. When they are in place, slide the OTA back so that the shoulder bolts lock into the slots (Fig. 56).



Looking at or near the **Sun** will cause **irreversible** damage to your eye. Do not point this telescope at or near the Sun. Do not look through the telescope as it is moving.

- c. Lock the OTA in place using the four 3/8"-16x3/4" bolts. Thread up the four bolts into the bottom of the Dec. castings, two on each side. Using the supplied hex key, tighten to a firm feel only (**Fig. 57**).

#### Attaching the Power and Data Cords

Several power and data cords are supplied with the 16" LX200R. These should all be attached before powering up the telescope.

- a. Confirm that the power switch (**A, Fig. 47**) on the power panel is in the OFF position. Connect the power adapter to the 18vDC connector (**B, Fig. 47**).
- b. 2 short cords (8" long) with DB-9 connectors are supplied to provide power to the Dec. system, the GPS, and the level sensor. Plug into the two DB-9 connectors located at the top of the sides of the fork and the Dec. casting (**Fig. 58**).
- c. Connect the AutoStar II handbox to the HBX connector (**F, Fig. 47**) on the control panel.
- d. Connect the supplied coil cord from the fan to the 12vDC output jack (**E, Fig. 47**) on the control panel.

#### LX200R TIPS

##### 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 eyestrain.
- Try not to use a standard flashlight. Experienced observers use red LED flashlights, the red utility light on the AutoStar II handbox, or tape red cellophane over their flashlights to use 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. Do not shine a flashlight into the telescope while someone is observing!
- Dress warmly. It gets chilly when you're sitting for prolonged periods.
- 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 26mm eyepiece to view terrestrial objects and wider areas of space, such as open star clusters. Use optional higher power eyepieces, such as a 9mm eyepiece (see **OPTIONAL ACCESSORIES**, page 43 for more details), when you wish to view something up close, such as craters on the Moon or the rings of Saturn.



# APPENDIX G: 14" LX200R FEATURES

## 14" LX200R Unique Features

The 14" LX200R contains, for the most part, the same features (covered earlier in this manual) as all other LX200R telescope models.

The following features are unique to the 14" model:

### Battery Compartment

On newer models, the battery compartment is the same as the compartment described on page 13. For older models, the battery compartments for the 14" LX200R are located under the horizontal beam of the fork arms (**Fig. 59a**). Each compartment has an indentation below it (**Fig. 59b**) to allow you to slide out the compartment easily.

**Important Note:** The compartments are designed to hold batteries only. **Do not** use these compartments to store any other items.

Two button-head screws are provided to secure the battery compartments when using the telescope in equatorial alignment. The telescope ships with the screws installed. To install the batteries, first remove the screws with the supplied hex key. See **Fig. 59c** for location of the screws. Next, remove the battery holder and install the batteries as described in step #2 on page 13. Replace the holder and close the compartment. Replace the screws if you plan to use the telescope in equatorial alignment. These screws are not necessary when using the telescope in altazimuth alignment.

### 2" Diagonal Mirror with 1.25" Adapter

The 14" LX200R comes equipped with a 2" diagonal mirror with a 1.25" adapter. See pages 13 and 14 for information on how to install these devices to the microfocuser assembly.

### Optical Tube Assembly

**Important Note:** Attaching the 14" LX200R optical tube assembly to the tripod is identical to the procedure described on pages 12 and 13.

**Caution:** Due to the weight and size of this product please use extreme caution whenever assembling, disassembling, lifting, transporting or storing this product. Two or more persons should always be used whenever performing any of the above tasks. Disregard for the above warning could result in serious injury or death.

**Caution:** On the rear section of the optical tube is a red slot-head bolt, used only for safety reasons in shipment. Remove this bolt before attempting to turn the focus knob. In its place, insert the rubber plug provided as a dust protector (this rubber plug is included with your hardware package).

The 14" LX200R should never be commercially shipped without the red bolt in place. This is essential during commercial transport, where rough handling may occur. Your transport and storage of the telescope never requires this bolt.

### Auxiliary Jacks

The 14" model provides auxiliary focus and reticle jacks on the left fork arm (**Fig. 60**) for your convenience. Use of the auxiliary jacks eliminates the cord tangle which sometimes occurs when using the jacks located on the control panel

### Collimation

The 14" LX200R can be collimated using the procedure described in the Collimation section, pages 46 - 47, with one exception: When tightening a collimation screw, it is **not** necessary to loosen the other two collimation screws, or vice versa. In other words, the screws may be tightened or loosened independently of each other.

A hex wrench is included in the accessory kit for collimation (use the smaller of the two included hex wrenches; the smaller wrench is only included with the 14" model). Insert the hex wrench into the slots in the plate of the secondary mirror housing to access the collimation screws which are housed below the plate. See **Fig. 61** for the position of the slots.



Fig. 59a: One of the two 14" LX200R battery compartments (older models).

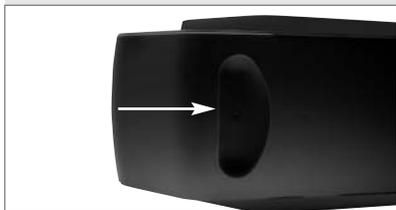


Fig. 59b: An indentation on the underside of one of the 14" LX200R battery compartments (older models).



Fig. 59c: Location of one of the battery compartment screws. The other is located on the opposite end of the horizontal beam of the fork arms near the other battery compartment (older models).



Fig. 60: 14" model auxiliary focus and reticle jacks are located on the inner left fork arm.

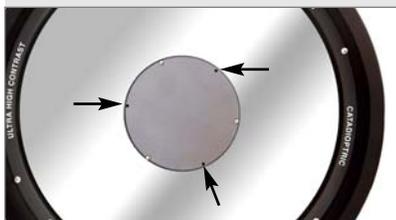


Fig. 61: Insert the included hex wrench into the slots in the plate of secondary mirror housing to access the collimation screws (14" model only).



## APPENDIX H: DE-ROTATER AND MICROFOCUSER ASSEMBLY

When using a de-rotator, it is important to attach the microfocuser so that it is backed off slightly from the de-rotater. If the microfocuser is flush against the de-rotater, the assembly will not work properly. This is true also with other accessories that may attach up flush against the de-rotater housing. The diagonal mirror (if used without the microfocuser) may be attached tightly as it does not rub up against the de-rotater housing.

### To attach the microfocuser to the de-rotater:

Refer to **Fig. 6**, page 13, for an exploded view of the microfocuser assembly. Perform this assembly on a flat surface (such as a desk or a table) before you attach the de-rotater and microfocuser to the telescope.

1. With the de-rotater on a flat surface, thread on the adapter ring (**B**, **Fig. 6**) until it just touches the housing; then back off the adapter ring (*i.e.*, turn it counter-clockwise) one full revolution as shown in **Fig. 62**.
2. Place the microfocuser over the ring with the "hump" of the microfocuser in the 12:00 position as shown in **Fig. 63**.
3. Using the provided hex key, tighten to a firm feel one of the three microfocuser hex screws (**K**, **Fig. 6**) up against the adapter ring as shown in **Fig. 64**. Take care not to tighten or loosen the adapter ring as you position and tighten the microfocuser in place.
4. Tighten to a firm feel the other two microfocuser hex screws.
5. Attach the de-rotater to the rear cell of the telescope.



*Fig. 62: Back off the adapter ring one full revolution.*



*Fig. 63: Place the microfocuser over the adapter ring. Notice the orientation of the microfocuser.*



*Fig. 64: Tighten the three microfocuser hex screws to a firm feel.*



# APPENDIX I: Smart Mount

## Introduction

Smart Mount improves the pointing accuracy of your LX200R telescope's "Go to" system. Despite careful efforts to calibrate and align telescopes, they may fail to precisely center objects. Smart Mount allows your telescope to learn about, and then correct for, any systematic pointing errors, regardless of the cause.

Because training your mount takes some time, we recommend that it be primarily used on permanently mounted instruments or when imaging requires very accurate pointing. Once Smart Mount training has been performed, the scope will benefit from it so long as you carefully park the telescope at the end of each session and do not modify the mounting.

For portable instruments, we recommend training Smart Mount each time you set up your telescope to insure best results.

We recommend that you use an *illuminated reticle* during the training procedure. An illuminated reticle allows you to precisely center celestial objects in a telescope's eyepiece. The more precisely you center objects during Smart Mount training, the more pointing precision your telescope will be able to achieve. If you do not have an illuminated reticle, see **OPTIONAL ACCESSORIES**, page 44 for more information.

## Operation

The Smart Mount feature is located in the AutoStar II Setup menu.

In order to use Smart Mount, create a model that allows Smart Mount to improve your telescope's accuracy. This is normally done by training Smart Mount. Once training has been completed, you will save your model. AutoStar II allows you to save several models under different names. This allows you to, for example, save one model for a heavy imaging camera configuration on a permanently aligned scope, and another when you have a lighter load on the mount.

## Training

In order to obtain solid, repeatable results, perform the following procedures *before* you create a model:

- Setup and align your telescope.
- Perform both RA/Az and Dec/Alt drive training calibration.

Once you have calibrated and aligned your telescope, if you wish to start a new model, go to the Smart Mount main menu. Locate and select "Erase" to clear the current model. Next, proceed with the steps below:

**Note:** *If you do not erase the current model, the training session will refine the current model.*

- Locate "Train" in the Smart Mount Configuration menu and press enter.
- The telescope will select and slew to several (over 40) stars.
- When requested to do so, carefully center each star and then press ENTER.

If you find that you cannot see a star because there is an obstruction blocking your view:

- Press MODE briefly to skip this star. Another star will be chosen.

To exit the training sequence before it is completed:

- Press and hold MODE for about two seconds and then release it.

When you have completed training:

- Save your model, using a good, descriptive name, using the "Save As" menu. Upon completion of the training, Smart Mount is enabled and *remains on* until you choose "Off" from the Smart Mount Configuration menu.

Want to learn more about **Alignment**?  
See pages 18 - 20.

Want to learn more about **training your drive**? See page 62.



### **Permanently Mounted Scopes**

For permanently mounted telescopes, it is not necessary to have more than one model unless the weight and balance of auxiliary equipment introduces balance or flexure changes that significantly affect pointing. The best practice is to train the Smart Mount and then run a couple of sessions with Update enabled. Thereafter, simply leave Smart Mount On as the installation default.

### **Other Menus Options**

#### **Save As and Load**

The Smart Mount system allows you to save several models you have created (see **TRAINING** on the previous page) using the Save As command. Choose which model will be the "Current Model" using the Load command.

#### **Update**

The Update mode allows you to update training for the current model you have enabled. You will sync on several stars as previously described, which will further refine the pointing of your telescope. Save your model after running in update mode, otherwise the update will be lost when the telescope is powered off.

#### **On**

Load a model from memory (see **SAVE AS AND LOAD** above) and then Select Smart On. When Smart Mount is "On," the telescope will use the currently loaded model to refine you telescope's pointing, but will not update the model (see **SMART MOUNT UPDATE** above). If Smart Mount was "On" when you last powered off your telescope, it will be "On" when you start the next session.

#### **Off**

When Smart Mount is "Off," the telescope will not use any model you have created to refine pointing accuracy.

#### **Erase**

The Erase command clears the Current Smart Mount table values to allow a new model to be created.

#### **Delete**

The Delete command allows you to delete any model from memory. To delete a model, just scroll through the names and select the model to you wish to delete and press ENTER. You will be asked to confirm your choice. Press ENTER again and it will be removed from memory.



# BASIC ASTRONOMY

In the early 17th century Italian Scientist Galileo, using a telescope smaller than your LX200R, 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, double and variable stars, the Moon, and our solar system comes from observations made by amateur astronomers. So as you look through your Meade LX200R 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 of incredible discovery.

## AutoStar II Glossary

Be sure to make use of AutoStar II'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 II. See **GLOSSARY MENU**, page 27, for more information.

## Objects in Space

Listed below are some of the many astronomical objects that can be seen with your LX200R:

### 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. 65**). 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.

Using your LX200R, 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. 65: The Moon. Note the deep shadows in the craters.



Fig. 66: The planet Jupiter. Jupiter's four largest moons can be observed in a different position every night.

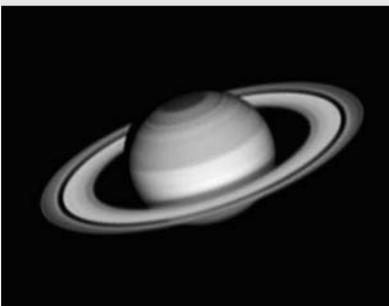


Fig. 67: Saturn has the most extensive ring structure in our Solar System.



**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.



Fig. 68: A favorite winter sight—the great nebula in Orion.



Fig. 69: The Pleiades is one of the most beautiful open clusters.

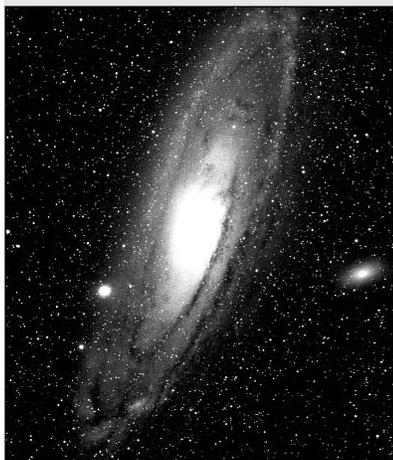


Fig. 70: The Andromeda Galaxy, the largest galaxy of our local group.

**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 II 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. Listed below are the best planets for viewing through the LX200R.

**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. Jupiter (Fig. 66) 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. 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. 67). 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 through the LX200R. 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 just some of the deep-sky objects you'll be able to observe with your LX200R 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 pin-points 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) (Fig. 68), 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. 69). Through the LX200R, numerous stars are visible.

**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) (Fig. 70) 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. This warranty supercedes all previous Meade product warranties.



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