

EQUATORIAL (POLAR) ALIGNMENT

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.

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 counter clockwise) 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.

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 centre. 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 LX200GPS electric motor drive. If the telescope is reasonably well aligned with the pole, very little use of the telescope's Declination

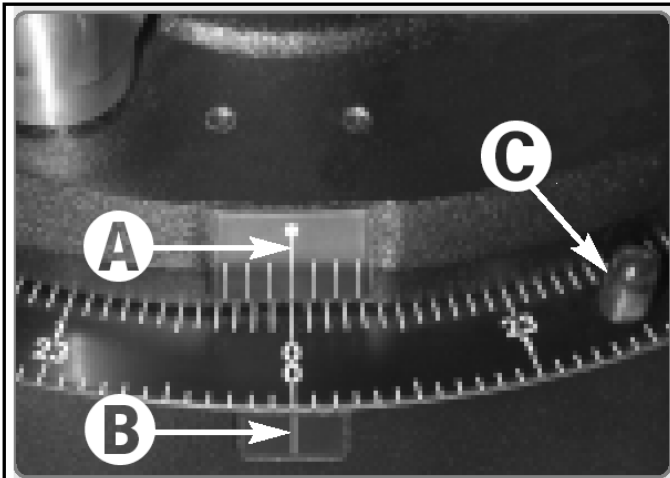


Fig. 39: Align tick marks to set the fork arms to 00 H.A. position.

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. 38). 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° . See **SETTING CIRCLES**, page 50.
- d. Loosen the R.A. lock, and rotate the fork arms to the 00 position H. A. : Move the forks arms so that centre tick mark on fork arm base (**A, Fig. 39**) aligns with the tick mark on the base (**B, Fig. 39**).
- e. Press ENTER. The telescope slews to Polaris.
- f. Use the azimuth and latitude controls on the wedge to centre Polaris in the field of view. Do not use the Autostar II handbox during this process. When Polaris is centred, press ENTER. The telescope is now polar aligned. See **AUTOSTAR II POLAR ALIGNMENT**, page 54, for more information.

Tip:

You can check if the declination is set at true 90° 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 centre of the field of view, the Declination is set at 90° . If the stars arc out of the field of view, slew the optical tube on the Declination axis until you achieve the centring effect.

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



Fig. 35: Declination Setting Circle.

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° 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 levelled, 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. 35**). After performing the polar alignment procedure, centre the star Polaris in the telescope field. Remove the knurled central hub of the Declination setting circle and slightly loosen the two bolts located under the knob. Now turn the circle unit until it reads 89.2° , 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. 36**) 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 centred in the telescope's eyepiece, move the R.A. setting circle, using one of knobs (**C, Fig. 39 above**), so that the R.A. of the star lines up with the tick mark on the base of the telescope (**B, Fig. 39 above**).

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 LX200GPS telescope 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 Reticule Eyepiece (see **OPTIONAL ACCESSORIES**, page 42) 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 reticule 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 ± 30 minutes in R.A. of the meridian and within $\pm 5^\circ$ of the celestial equator (see **CELESTIAL COORDINATES**, page 50). Pointing the telescope at a star that is straight up, with the Declination set to 0° , 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° or 30° 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.

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Easy (Two-Star) Alignment

In this method, Autostar II 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 centre the star in the eyepiece. The process is repeated with a second star to complete the alignment.

Note: *Before performing this procedure, first verify that **INITIALIZE AUTOSTAR II**, above, has been performed.*

How to perform the Easy Align Procedure

1. **Alignment Option Screen.** Following initialization, "Align: Automatic" displays.
2. **Select Alignment.** Press the Scroll keys until "Align: Easy" displays. Press ENTER.
3. **Home Position.** The telescope automatically sets the following positions: home, level, North, and True North. You may turn off the sensors and manually set these positions. See **HOME SENSORS**, page 30 for more information.
4. **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 centred 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 II does not display this message, perform this procedure again. (Keep pressing MODE until "Align: Easy" displays and repeat the procedure.)

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 38, except that Autostar II prompts you to point the telescope at Polaris and centre it in the telescope eyepiece.

Page 38 text**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.

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.

Page 37 text**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. **Alignment Option Screen.** "Align: Automatic" displays.
2. **Select Alignment.** Press the Scroll keys until "Align: Two Star" displays. Press ENTER.
3. **Set Home Position.** Place the telescope in the home position.

To Set the Home Position Manually:

- a. See **Figs. 19 and 20**, page 37. Loosen the telescope's Dec. lock (**17, Fig. 1**). Set the optical tube to 0° on the Dec. setting circle (**Fig. 20**).
- 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. See **Fig. 37**, page 52, for more information.
 - 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. **Centre Star.** The telescope slews to the star. Use the Arrow keys to move the telescope until the star is centred in the eyepiece. Press ENTER.
 6. **Centre Star.** Repeat procedure for the second alignment star. The telescope is aligned and you are now ready to use Autostar II's GO TO capabilities for a night of observing.