

Finding the North Celestial Pole

In each hemisphere, there is a point in the sky around which all the other stars appear to rotate. These points are called the celestial poles and are named for the hemisphere in which they reside. For example, in the northern hemisphere all stars move around the north celestial pole. When the telescope's polar axis is pointed at the celestial pole, it is parallel to the Earth's rotational axis.

Many methods of polar alignment require that you know how to find the celestial pole by identifying stars in the area. For those in the northern hemisphere, finding the celestial pole is not too difficult. Fortunately, we have a naked eye star less than a degree away. This star, Polaris, is the end star in the handle of the Little Dipper. Since the Little Dipper (technically called Ursa Minor) is not one of the brightest constellations in the sky, it may be difficult to locate from urban areas. If this is the case, use the two end stars in the bowl of the Big Dipper (the pointer stars). Draw an imaginary line through them toward the Little Dipper. They

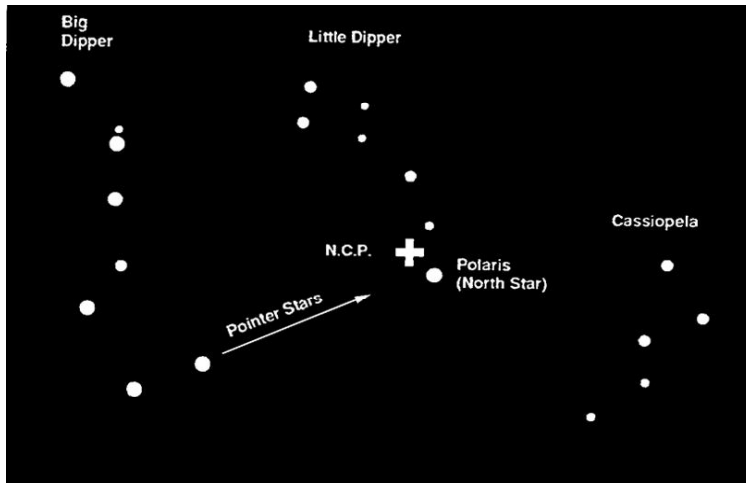


Figure 5-5

The two stars in the front of the bowl of the Big Dipper point to Polaris which is less than one degree from the true (north) celestial pole. Cassiopeia, the "W" shaped constellation, is on the opposite side of the pole from the Big Dipper. The North Celestial Pole (N.C.P.) is marked by the "+" sign.

point to Polaris (see Figure 5-5). The position of the Big Dipper changes during the year and throughout the course of the night (see Figure 5-4). When the Big Dipper is low in the sky (i.e., near the horizon), it may be difficult to locate. During these times, look for Cassiopeia (see Figure 5-5). Observers in the southern hemisphere are not as fortunate as those in the northern hemisphere. The stars around the south celestial pole are not nearly as bright as those around the north. The closest star that is relatively bright is Sigma Octantis. This star is just within naked eye limit (magnitude 5.5) and lies about 59 arc minutes from the pole.

Definition

The north celestial pole is the point in the northern hemisphere around which all stars appear to rotate. The counterpart in the southern hemisphere is referred to as the south celestial pole.

Polar Aligning the Mount

Latitude Scales

The easiest way to polar align a telescope is with a latitude scale. Unlike other methods that require you to find the celestial pole by identifying certain stars near it, this method works off of a known constant to determine how high the polar axis should be pointed. The CGE Pro mount can be adjusted from 15 to 65 degrees (see figure 5-3).

The constant, mentioned above, is a relationship between your latitude and the angular distance the celestial pole is above the northern (or southern) horizon; The angular distance from the northern horizon to the north celestial pole is always equal to your latitude. To illustrate this, imagine that you are standing on the north pole, latitude $+90^\circ$. The north celestial pole, which has a declination of $+90^\circ$, would be directly overhead (i.e., 90° above the horizon). Now, let's say that you move one degree south — your latitude is now $+89^\circ$ and the celestial pole is no longer directly overhead. It has moved one degree closer toward the northern horizon. This means the pole is now 89° above the northern horizon. If you move one degree further south, the same thing happens again. You would have to travel 70 miles north or south to change your latitude by one degree. As you can see from this example, the distance from the northern horizon to the celestial pole is always equal to your latitude.

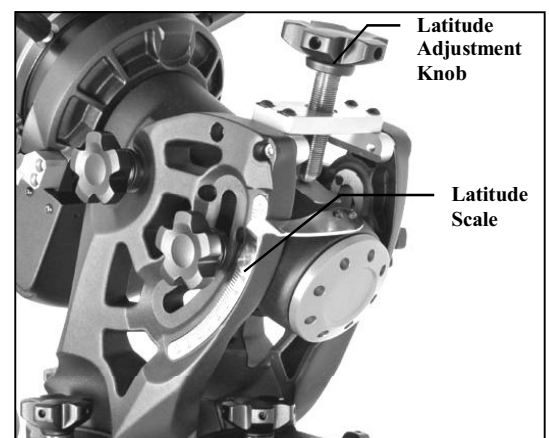


Figure 5-3

If you are observing from Los Angeles, which has a latitude of 34°, then the celestial pole is 34° above the northern horizon. All a latitude scale does then is to point the polar axis of the telescope at the right elevation above the northern (or southern) horizon. To align your telescope:

1. Make sure the polar axis of the mount is pointing due north. Use a landmark that you know faces north.
2. Level the tripod. There is a bubble level built into the mount for this purpose.
3. Adjust the mount in altitude until the latitude indicator points to your latitude. Moving the mount affects the angle the polar axis is pointing. For specific information on adjusting the equatorial mount, please see the section "Adjusting the Mount."

This method can be done in daylight, thus eliminating the need to fumble around in the dark. Although this method does **NOT** put you directly on the pole, it will limit the number of corrections you will make when tracking an object. It will also be accurate enough for short exposure prime focus planetary photography (a couple of seconds) and short exposure piggyback astrophotography (a couple of minutes).

All-Star Polar Alignment

The CGE Pro hand control has a polar alignment function called "All-Star" polar alignment that will help you polar align your telescope for increased tracking precision and astrophotography. This feature allows you to choose any bright alignment star to assist in accurately aligning your telescope's mount with the North Celestial Pole. Before using the Polar Align feature, the scope must first be roughly pointed towards North and should be aligned with two stars in the sky. See the "*Latitude Scale*" section for help with finding north and adjusting the mounts latitude.

Once your telescope is aligned on two stars and at least one additional calibration star, slew the telescope to any bright star in its Named Star database list. For best results choose a polar alignment star that is high in the sky and near the Meridian. Try to avoid stars that are close to the west/east horizon, directly overhead or too near the celestial pole. Once there, press the Align button and use the Up/Down buttons on the hand controller to select *Polar Align* from the list.

The Polar Align feature has two options: *Align Mount* and *Display Mount*

Align Mount- After performing a two star alignment and slewing your telescope to any bright star in the telescope's database, select the "Align Mount" option. The telescope will then re-slew to the same star.

1. Center the star in the finderscope and press ENTER.
2. Then accurately center the star in your eyepiece and press ALIGN. The telescope will then "sync" on this star and slew to the position that the star should be if it were accurately polar aligned.

For the most accurate alignment it is best to use a reticle eyepiece (see *Optional Accessories*) or a high power eyepiece to precisely center the star in the field of view.

3. Use the mounts latitude and azimuth adjustments (see figure 2-15) to place the star in the center of the eyepiece. **Do not use the direction buttons on the hand control to position the star.** Once the star is centered in the eyepiece, press ENTER; the polar axis should now be pointed towards the North Celestial Pole.

Updating your Star Alignment

After polar alignment it's a good idea to check the pointing accuracy of the telescope to see how much it may have been affected by moving the mount. Since the polar alignment process requires you to "sync" the telescope on a bright star before you begin, it will be necessary to undo the sync before re-aligning. To undo the sync:

1. Press the *Align* button and use the Up/Down buttons on the hand controller to select *Undo Sync* from the list, and press *Enter*. The message *Complete* will display on the LCD.

To re-align your telescope:

2. Slew the telescope to one of the original alignment stars, or another bright star if the original alignment stars are no longer in a convenient location. Press the *Align* button and use the Up/Down buttons on the hand controller to select *Alignment Stars* from the list.
3. The hand control will ask you which of the original alignment stars you wish to replace. Use the Up/Down buttons to select the desired star and press *Enter*.
4. Once again center the star in the finderscope and press *Enter*.
5. Then center the star in the eyepiece and Press *Align*.
6. Repeat the process on a second alignment star.

For additional all sky pointing accuracy, it's a good idea to align on at least one additional calibration star located on the opposite side of the Meridian. To add calibration stars:

1. Slew the telescope to a bright star on the opposite of the Meridian from your two alignment stars.
2. Press the *Align* button and use the Up/Down buttons on the hand controller to select *Calib. Stars* from the list, and press *Enter*.
3. Align the star in the finderscope and then the eyepiece as you did with the alignment stars.

Display Align – the user can now display the polar alignment error in the RA and DEC axes. These values show how close the mount is pointed at the celestial pole base on how accurately the user centered the alignment star with the hand control and with the mount adjustment. To display the alignment error:

1. Press the *Align* button and use the Up/Down buttons on the hand controller to select *Display Align* from the list, and press *Enter*.