The Importance of the Initial NGC Alignment

Accuracy is Critical with the Initial Mechanical Alignment of the Telescope

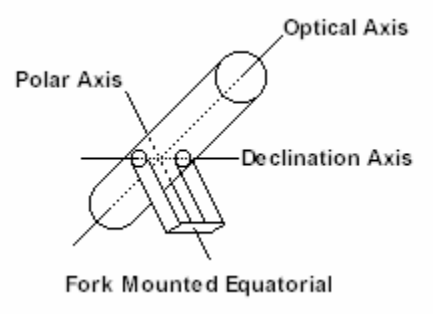
The following instructions are written for the Northern Hemisphere. If you are in the Southern Hemisphere you will need to reverse some angles (signs) and directions.

When using the two-star alignment mode with an NGC computer, a request is made for a mechanical alignment of the telescope. The computer will display the message "Set Dec=0", "Level Me" or "Vertical", prompting the user to move the telescope to this position. The alignment places the telescope in a particular starting position so that the computer knows the orientation of the optical tube.

The most common mistake at this step is for the user to point the telescope at a star near the celestial equator and assume this is the Dec=0 location. While that may be acceptable if the telescope is on a perfectly polar aligned equatorial mount and the star is located exactly on the celestial equator, the reason for the two-star alignment is to be able to guide to objects without being perfectly polar aligned.

Aligning the Three Axes

The purpose of this initial alignment step is to mechanically align the optical tube with respect to the mount, not the earth or sky. The three axes must be placed perpendicular or at right angles (90º) to each other, or in some cases parallel. When this is true, the telescope is said to be orthogonal. For an equatorial mount, the three axes are polar or right ascension, declination and optical. On an altitude/azimuth (alt/az) mount the axes are azimuth, altitude and optical.

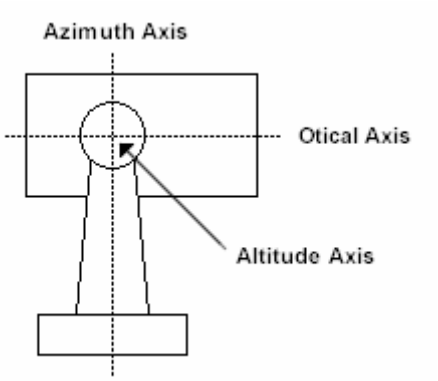


The only way the right ascension/azimuth and declination/altitude axes would not automatically be perpendicular would be from poor quality manufacturing. The optical axis, however, can be moved freely and must be placed correctly at the perpendicular position. With many of today's telescopes it is possible to rotate the mechanical declination circle such that it may not be relied on to find this unique position.

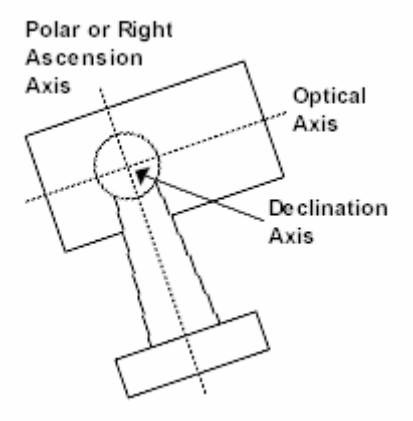
The initial alignment is vital to proper performance and a change of a few thousandths of an inch can greatly affect the guiding accuracy of the unit either beneficially or detrimentally. This can happen without the computer showing a change in the warp factor, which only measures the accuracy of the distance between the two alignment stars.

Identifying Each Axis

If you have an Alt/Az mount, you will see "Level Me" indicating that the optical axis should be perpendicular to the azimuth axis or "Vertical" indicating that the optical axis should be parallel to the azimuth axis. Rotating around the azimuth axis will move the telescope optics left or right. Rotating on the altitude axis moves the optics up or down.



The "Set Dec=0" message will be seen if your telescope is on an equatorial mount, in which case the optical axis should be set perpendicular to the polar axis. An equatorial mount is essentially an alt/az mount that is tilted to match the latitude. This allows the telescope to track the stars with a simple clock drive.



Finding the Position

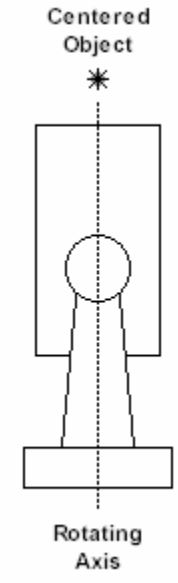
If you have a properly set declination setting circle or other positioning mark, you can use it to align the telescope. If not, you can find it using a carpenter's

square. On a fork mount you will align the optical tube perpendicular to the center line of the fork arms. With a Dobsonian you will align with the rocker box.

If there are straight edges on the base of the mount and on the optical tube, a level can be used. If you have the proper type of level, it can be used both vertically for the "Vertical" setting and horizontally for the "Level Me" and "Dec=0" settings. First level the base of the telescope. Next level the optical tube either horizontally or vertically depending on the computer prompt. You can now mark the position. Since both are now level they are also parallel (with an alt/az mount) or perpendicular (with an equatorial mount) to each other.

In some cases carpenter squares and levels are useless because there are no straight edges on the mount. In this situation you can use the following method to find the vertical position for alt/az mounts or +90º declination for equatorial mounts. (Once you know the +90º declination you can use the mechanical setting circle, or digital setting circles in encoder mode, to find 0º declination.)

Using a carpenters square, visual observation or whatever method you can, place the optical axis as close to vertical or +90º declination as you can (relative to the base of the mount) then lock it into position. Look through the optics at a terrestrial object and center it in the field of view without adjusting altitude or declination (hereafter designated as declination). This will require moving the orientation of the entire scope to allow viewing a terrestrial object since the declination is locked into place pointing upward. While we do not recommend using a stellar object, because of continual drifting relative to the earth, a bright star can be used for a good approximation of the position.



Slowly turn the azimuth or right ascension axis (hereafter designated as right ascension) without changing the declination setting. First, adjust the orientation of the entire telescope until the object circles around the center of the field of view (remaining at the same distance from the center or perfectly in the center) while rotating in right ascension. Next, make adjustments to the declination as necessary to center the object in the eyepiece through a full 360º revolution. Once you can turn the mount in a full circle in right ascension without the object moving from the center of the field of view, you will know you have found the vertical (for alt/az) or +90º declination (for equatorial) position.

For equatorial mounts, the next step is to place the mechanical setting circle so that it reads +90, secure it, then move the optics so that it reads 0. Immediately mark this position so you can return to it as needed in the future. If you have a German Equatorial mount, you may wish to refer to our document entitled "Star Alignments with a German Equatorial Mount" for more information.

As mentioned before, for the best alignment, the telescope must be placed at the proper position within a few thousandths of an inch. Since the mark you just made, as well as marks made by the factory, are likely to be off by that amount, you may wish to fine tune it by doing the following procedure.

Adjusting for Better Guiding

First, adjust the initial alignment position in one direction a few thousandths of an inch, then finish the alignment and test the guiding accuracy. If guiding is worse, try adjusting the initial alignment in the other direction. Do several more adjustments in the direction that shows improvement until you see the most accurate guiding. This process is a little time consuming but well worth the effort.

Summary

Understanding these alignment procedures will allow you to take full advantage of the power of the computer and will help in finding and identifying objects.