

HOW TO EQUATORIALLY MOUNT AND POLAR ALIGN YOUR NEXSTAR 8i TELESCOPE

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Disclaimer I have no vested interest in any of the manufacturers or products identified in this article. All equipment discussed in this article was obtained through normal commercial channels. I would like to thank cloudy nights for this opportunity to present some of my impressions about polar alignment of this scope to the amateur astronomy community.

Reasons for writing this article In an earlier review published right here on cloudy nights, I provided some of my impressions about the Celestron Nexstar 8i scope. I noted, based on my own experience, that the tracking and GOTO features on the scope when mounted in the alt-az mode are excellent. Why then, would you want to equatorially mount and polar align this scope, when alt-az mounting works so well in tracking celestial objects? There are three main reasons for equatorially mounting and using this fine instrument in polar mode:

- Equatorial mounting and precise polar alignment allows the object to stay in the same orientation within the field of view. In other words, field rotation is minimized using equatorial mounting, but is an inherent issue using alt-az mounting.
- Tracking can be accomplished using movements in one axis only. In other words, the scope is tracking in one axis of movement (right ascension) only, with minimal adjustments needed in the other axis (declination) by the user.
- For piggyback, or through the scope prime focus astrophotography, precise polar alignment is a must, and is HIGHLY recommended even for short exposure planetary and lunar astrophotography at high powers.

Most importantly, I believe that an article such as this one, will help others avoid the frustration and mistakes which I had to go through as I underwent a trial and error approach to using the Nexstar 8i mounted equatorially.

Equipment needed Since the Nexstar 8i is a single fork arm design, an equatorial wedge mount will be necessary. Celestron manufactures a dedicated wedge-mount for both the Nexstar 8i and Nexstar 5i. I bought mine through Anacortes Telescope, for around 180 bucks. The mount is exactly what the name implies.....a wedge, as shown in the stock photo from Celestron (**Figure 1**). It weighs 8 pounds, and has a nice latitude scale to reasonably accurately “dial-in” your observing latitude. The wedge can be used between latitudes of 25 degrees to 90 degrees, North.

The function of the equatorial wedge is to allow your scope to be mounted in such a fashion, that the right ascension axis (the scope base) and the axis of rotation of

the earth can be made exactly parallel. In this way, when the clock drive in the scope base is turned on, one can effectively cancel out the apparent motion of the stars across the sky. Unfortunately, the instructions (one small sheet) which come with the wedge are, well, practically useless. A newbie would encounter some serious frustration (case in point, yours truly) when trying to equatorially mount and polar align this scope using these instructions supplied with the wedge. For example, the first time I set up the scope on the wedge mount, I had the wedge pointed to the south, and I could not understand why I could not achieve a successful Polar Alignment, and why objects would just zoom out of the field of view within seconds, even at the lowest possible magnification. This is a mistake which I would like others to avoid, and hence, this is another reason for writing this article.



Figure 1: Equatorial wedge mount for the Nexstar 8i.

Mounting the scope on the equatorial wedge I would strongly advise people to mount the equatorial base firmly onto the base of the Nexstar, before heading out for dark skies. First, find a nice soft surface to lay the Nexstar down on. Then snuggle the equatorial wedge into contact with the scope base. Use the three supplied screws to fasten the wedge to the rubber feet of the scope base. At this stage, go ahead and use the latitude adjustment knob and the latitude scale to tilt the scope on the wedge mount to the latitude of your observing site. You can get your latitude and longitude from the Nexstar 8i instructions or the internet. That's it..... you have succeeded in the first step. Your scope and the attached wedge should look like the set up in **Figure 2**.

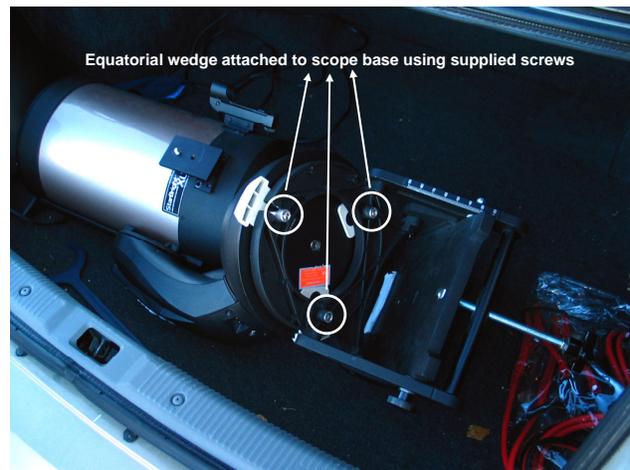


Figure 2: Equatorial wedge attached to the base of the Nexstar 8i.

Aligning the field tripod The next step is to align the tripod, so that a minimum of effort will be required when seating the wedge mount and the attached scope on it. **Set up the tripod so that one foot is pointed roughly towards the North, say, right at Polaris (Figure 3).** This will get you close to the North Celestial pole right after mounting the scope and wedge on the tripod, saving you some effort in picking up the heavy assembly and turning it towards the North after assembly. It is also a good idea to leave the legs in the unextended position, to minimize

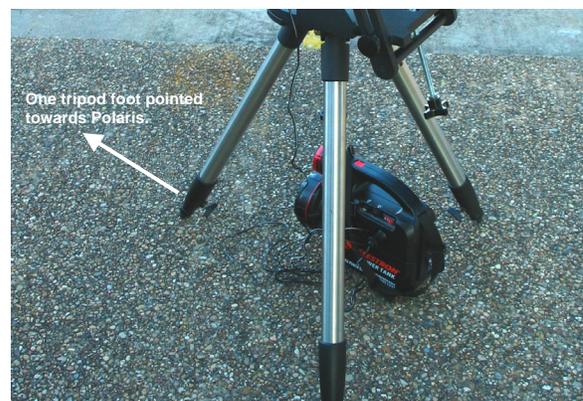


Figure 3: Tripod arrangement.

tuning-fork vibration, a common problem with the lightweight equatorial mount and the single fork arm design of the Nexstar 8i. You will gain some height with the wedge mount, but it will not be enough to keep you from bending down to look into the eyepiece. Take a foot stool to sit on when viewing near the zenith, and save your back.

Mounting the equatorial wedge + scope onto the field tripod This is the trickiest

step, but with practice, it will be possible to do it quickly even in the dark. Position the base of the wedge mount right above the tripod, and turn it so that the three holes on the wedge mount base are right above the three holes on the tripod top, and the central hole on the wedge mount is right above the central pin which juts straight upwards from the tripod top. In addition, ensure that the fork arm of the scope is on the west of the foot which is pointed towards Polaris. If your arrangement is correct, the latitude adjustment knob on the wedge mount will be positioned exactly between the other two tripod legs. Now seat the wedge mount with the attached Nexstar on the tripod, and fasten the three long screws supplied to firmly attach the wedge mount & scope to the field tripod. Position the OTA along the fork arm axis to ensure that it is pointed towards Polaris. Congratulations, the hard part is done!! If everything was done as suggested, the assembly should now look like that in **Figure 4**.



Figure 4: Equatorially mounted Nexstar 8i. This arrangement of the tripod legs, OTA and the wedge allow easy initial polar alignment.

Initial Rough Polar alignment At this stage you are ready to begin the polar alignment procedure. Go ahead and power up the Nexstar. You will be greeted by the familiar message, "Nexstar ready, press enter for alignment options" displayed on the GOTO

hand controller. Go ahead and press enter, and select “EQ North Align”. The hand controller will display the message “Set Alt to Index”. At this point, use the arrow (direction) keys, either UP or DOWN depending on your key configuration, to move the OTA down towards the ground. Stop when the two ALT marks, one on the OTA mounting bar and the other on the Fork Arm are aligned perfectly. The scope configuration will now look like that shown in **Figure 5**.

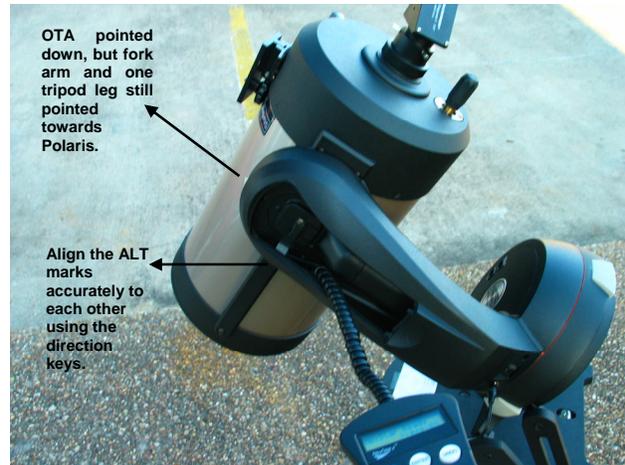


Figure 5: The initial rough Polar Alignment step is to set the ALT marks on the OTA and fork arms together with OTA pointed down.

Press enter. You will then get the message “Find Meridian” on the GOTA hand controller display. The meridian is the imaginary line which runs from North to South through the zenith and through the celestial equator. With this in mind, try to imagine a North-South line in the sky and simply rotate the tube in Right ascension, clockwise, so that the front of the OTA is pointed approximately (the closer, the better) at this line. For this, all you do is use the LEFT or RIGHT arrow (direction) keys only, depending on your key configuration, and turn the OTA clockwise, so that it is pointed up at the meridian. DO NOT use the other two Keys. Now, if you look at the OTA from the front, such that your back is to Polaris, you will see the OTA parallel to the leg of the tripod pointed towards Polaris, and exactly bisecting the other two tripod legs. The scope configuration should therefore, now look like that in **Figure 6**.



Figure 6: The next step in the initial polar alignment procedure is to point the OTA at the Meridian.

Press enter, and the hand controller will ask you to choose between “two star align” and “EQ Autoalign”. Choose “Two Star Align” if you know the positions of two stars which are at least 60 degrees apart in the sky, or use “EQ Autoalign”, input time and date, zone and latitude and longitude information. The Nexstar will choose two stars to align itself to, and you use the hand controller to get these into the center of the eyepiece. Once you get the “Align Success, Starpointer Off” message at the end, you are roughly polar aligned. You may stop at this stage and use GOTO to slew the scope to your favorite object, and begin visual observations, if that is your primary goal for the night.

For example, at f/10 (no focal reducer used), using the 25 mm E-Lux eyepiece which came with the scope, I have observed that objects stay near the center of the field of view (51X) upwards of 15 minutes, and even then, every 20 or so minutes, all I need to do is hit a SINGLE direction key to bring the object back in the center of the eyepiece. In addition, the object maintains its orientation usually up to an hour without noticeable rotation in its visual perspective.

In fact, you can take long exposure (approximately 20 minutes, or more for lenses of less than 50 mm, and up to 8 minutes for lenses less than 135 mm) unguided wide-field piggy back shots of entire constellations and asterisms, by simply getting to this stage. You can also take short (less than 1 minute) unguided exposures using a telephoto lens of greater than 400 mm, or image at the prime focus of the main scope, with negligible star trailing evident. As an example, **Figure 7**, is a 10 minute unguided exposure of the Orion Constellation region using a piggy backed Minolta SRT 101 manual SLR film camera loaded with generic (Walgreens brand, horrible reciprocity failure issues, dismally large large grain size for ISO 100, horrible H_{α} sensitivity, but excellent blue sensitivity, not too bad for recording blue reflection nebulae) ISO 100 film, and using a 50 mm lens. As you can see, no trailing is evident in the stars, with only this rough initial polar alignment.



Figure 8: 10 minute unguided piggyback shot of the Orion constellation region on a roughly polar aligned N8i.

Precise Polar Alignment For serious prime focus long exposure astrophotography, with or without focal reducers, however, you need to precisely polar align the scope. Think of the steps performed up until now as the launching point for what needs to be done next. After the rough polar alignment is successful, you will need to perform a drift alignment to get the scope precisely polar aligned. This is a straightforward, but somewhat time-consuming and tedious technique. However, the rewards are well worth the effort. The steps to follow are:

1. Insert an illuminated reticle eyepiece into the diagonal. Both Meade and Celestron make short focal length (around 10 mm) excellent illuminated reticle eyepieces for this purpose. Use a Barlow lens to get a high magnification of around 150 to 200 X.
2. Choose a star near the celestial meridian, close to the celestial equator (within 20 degrees NORTH of it, give or take). Put the star ON a horizontal cross-hair line in the illuminated reticle eyepiece. It must not be between lines, but must be directly on the line, so that it is bisected. Until this time you will use the hand controller to get the star on the line. The diagonal must be rotated so that as you observe the star in the eyepiece, your back is to the north of the scope.

3. Watch the star for a few seconds and you will see it drift off the line. If it drifts UP (NORTH), move the scope only in azimuth using tripod and azimuth knob adjustments to your left (EAST). If the star drifts DOWN (SOUTH) move the tripod and azimuth knobs only to your right (WEST). In all of this, ignore any EAST – WEST movement of the star in the eyepiece. Bring the star back on the line (hand controller) and watch the drift. It should take longer to drift off the line now. Repeat this step several times, until the star stays centered on the line for 5 minutes or longer.
4. Choose a second star near the celestial equator (within 20 degrees NORTH of it, give or take). Once again, rotate the diagonal, so that you are standing to the WEST of the scope, put the star ON a vertical cross-hair line in the illuminated reticle eyepiece field of view, and observe the star drift. This time you will note the LEFT-RIGHT drift of the star only, and ignore any UP-DOWN drift. If the star drifts LEFT (NORTH), use only the latitude adjustment knob and adjust the latitude to a lower number on the scale. If the star drifts RIGHT (SOUTH), use only the latitude adjustment knob and adjust the latitude to a higher number on the scale. Bring the star back on the line (hand controller) and repeat this step several times, until the star stays centered on the line for 5 minutes or longer.

After this tedious drift alignment position, you are accurately polar aligned. GO TO your favorite object, and you can take VERY LONG exposure astrophotos at prime focus, with minimal guiding corrections necessary, say once every five or so minutes, using a manual off-axis guider or through the use of an autoguider.

I myself am still mastering the art of precise polar alignment using the drift alignment technique with my equatorially mounted Nexstar 8i, and it will be a while before I will have the ability to obtain decent quality very long exposure astrophotos without star trailing evident. However, already my prime focus shots look much better than before with only the rough polar alignment.

Conclusion: With either the rough polar alignment or the more precise drift alignment, the versatility of an observing session with your favorite Nexstar 8i can be greatly enhanced over a simple alt-az mounting scheme. One caveat to be aware of, is that the wedge mount will increase the vibration dampening time substantially, especially at higher powers, from 2 seconds to upwards of 5 to 6 seconds. However, despite the (moderate) tedium of the equatorial mounting and alignment process, and increased vibration dampening time, the reward of no field rotation and the tantalizing possibility of deep-sky long exposure astrophotography, is IMHO just too good to pass up by using simple Alt-az mounting.

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