COLLIMATING THE ASTROTRAC POLAR SCOPE
By Darryl Hedges

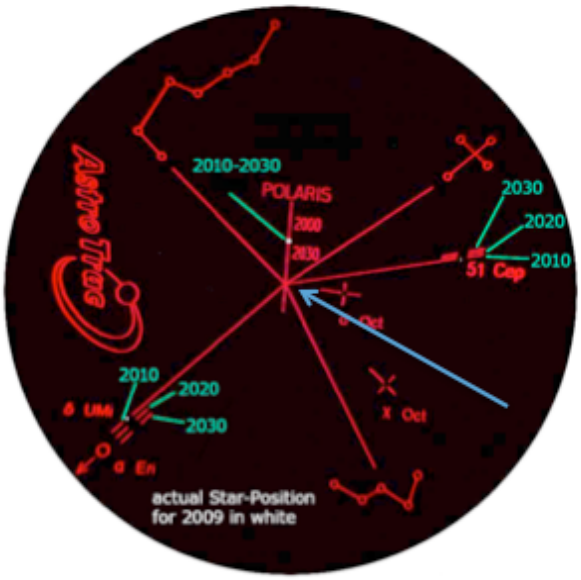
Why Collimate The AstroTrac Polar Scope?

The word “collimate” means “to accurately align”, typically used when talking about light. The purpose of collimating your polar scope is to ensure that it is operating in the most accurate manner possible, which in turn, will help you to achieve the most accurate polar alignment possible. After all you wouldn’t want to play a piano that was out of tune would you?

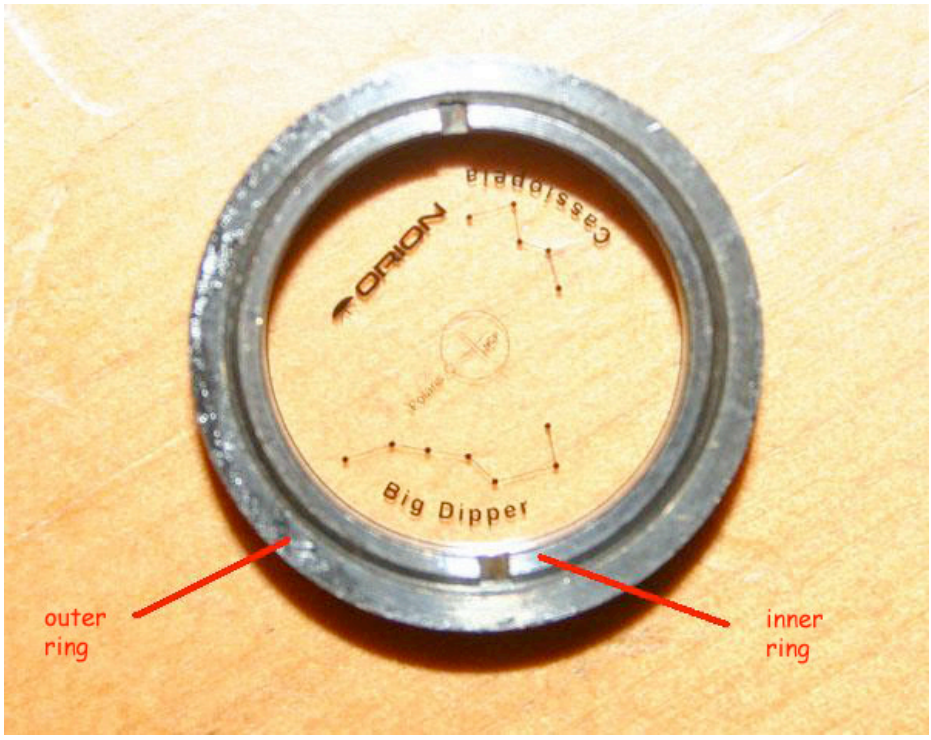
How Do We Collimate The Polar Scope?

There are several things we need to do to properly collimate the polar scope.

Inside the polar scope there is a small round metal disc that holds a piece of glass with a “reticle” or alignment pattern etched onto it. As you can see in the picture below, the center of the disc is where six (6) straight lines intersect (blue arrow).

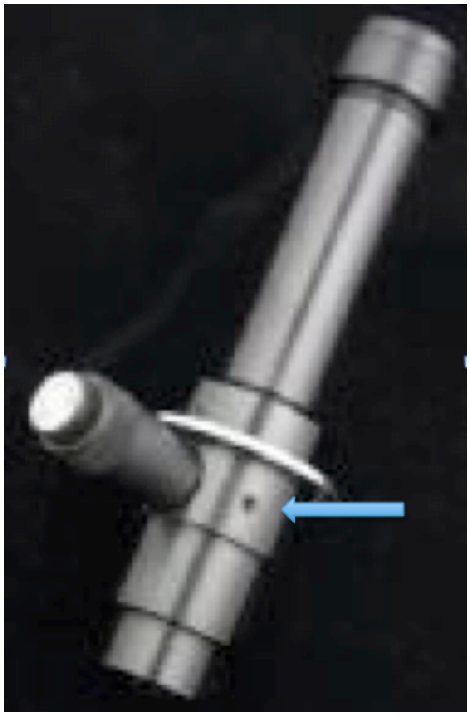


Here is what the actual physical reticle disc inside a polar scope looks like. This one is from an Orion polar scope:



The disc is held in position inside the tube of the polar scope by three (3) “grub” screws — tiny 3mm metric set screws. They look like these:

This is where they are located on the AstroTrac Polar Scope (blue arrow):



The three (3) screws are spaced 120 degrees apart. Working with these screws requires a tiny metric allen wrench and is virtually impossible. We need to replace these screws so we can make adjustments quickly and easily using only our fingers.

First:
Order three (3) new 3mm "thumbscrews" from McMaster-Carr. I doubt that you will be able to find these at your local Ace Hardware Store. I would recommend ordering this one:

Here is the McMaster-Carr part number and description:

Part #: 92545A123 ***Price: $ 2.63 each***

Description:

Metric 18-8 Stainless Steel Knurled-Head Thumb Screw, M3 Size, 13mm Length, 8mm Head Diameter, 5mm Head Height

I ordered five (5) thumbscrews so I would have a couple as spares in case I ever needed them.

Second:
Once you receive your new thumbscrews, use a tiny metric allen wrench to remove the three (3) metric setscrews that are in your scope now.

As you remove each one, replace it with one of your new thumbscrews.

This is what your scope should look like after replacing the three setscrews:

Third:
While you're waiting for your thumbscrews to arrive from McMaster-Carr, go to your local Ace Hardware store and buy a "Slip Joint Washer":

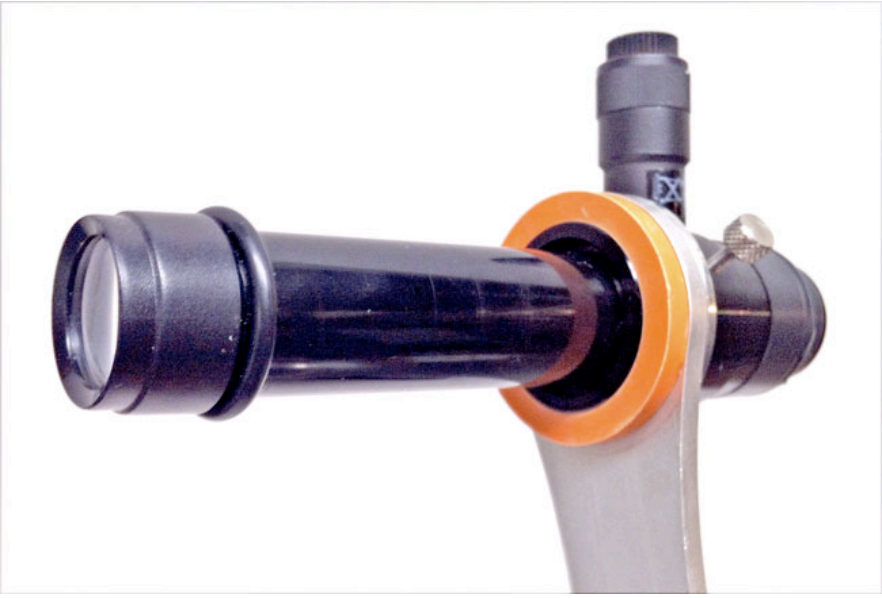
Stock # 36647B — 1-23/32" O.D. x 1-7/32" I.D. x 3/16" H
Slip Joint Washer

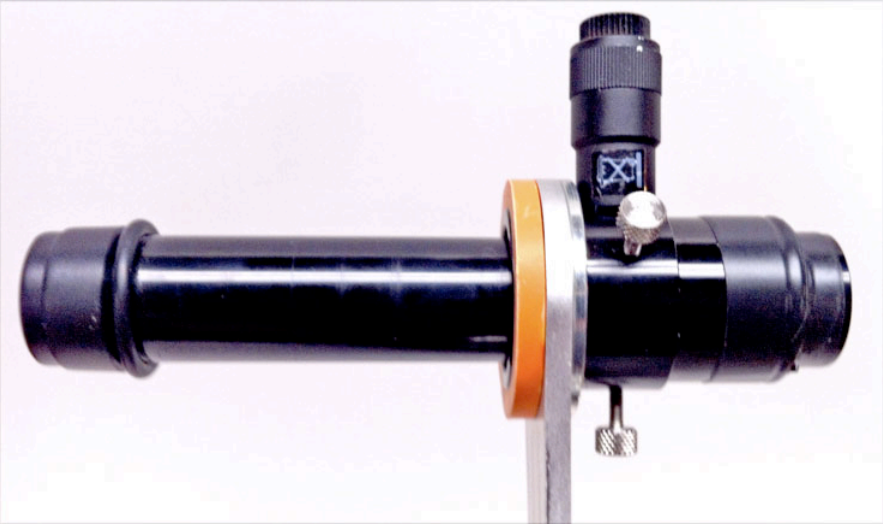
It looks like this:

The reason for using the Slip Joint Washer is this — the AstroTrac polar scope is held to the swing-out polar scope arm by several small magnets. As you rotate the polar scope in its mounting hole to do your polar alignment, the scope can easily become dislodged and drop out of the hole.

The Slip Joint Washer, when placed over the portion of the polar scope's body that protrudes through the mounting hole, will firmly hold the scope in place and yet allow you to easily rotate it 360 degrees. Adding the Slip Joint Washer to your set-up is a good idea even if you don't choose to collimate your polar scope.

Here is what the polar scope looks like with the Slip Joint Washer in place:





Fourth:
Now you're ready to actually collimate your polar scope.

The idea behind the collimation process is to adjust the three (3) new metric thumbscrews that you installed, in very tiny increments, until the reticle disc is perfectly centered in the polar scope tube.

We do this by setting-up our tripod and AstroTrac tracker, just as we would on any night that we are imaging. Place the polar scope in the polar scope arm and press the Slip Joint Washer over the portion of the polar scope that protrudes through the mounting hole. Refer to the pictures above.

Be sure that the polar scope can rotate smoothly through a complete 360 degrees.

Now, locate Polaris in the night sky. Polaris is the only fixed point of light in the night sky that we can use for this procedure. Choosing any other star (that is moving) will not work. Using the altitude and azimuth controls on your tripod or wedge, center Polaris at the intersection of the six (6) straight lines that you saw in the picture of the reticle on the first page.

While looking through the polar scope, slowly rotate the polar scope and watch to see if the point of intersection stays perfectly centered over Polaris, or if it "walks" around Polaris.

If the point of intersection stays perfectly centered over Polaris and does not move as you slowly rotate the polar scope around its axis, then you just won the Lottery. You must have one of the few that ever left the factory with everything in perfect alignment.

Tighten your three (3) thumbscrews and walk away knowing that you have a collimated polar scope!

However, if you're like most AstroTrac owners, I'm guessing that as you rotated your polar scope, the point of intersection did "walk" in an arc around Polaris. The larger the deviation or circle it made around Polaris, the more off-center your polar scope is. The smaller the deviation, the closer you are to having a collimated polar scope.

Now the real work begins!
Start by rotating the polar scope just a 1/4 of a turn and see which way the point of intersection moves in relation to Polaris. Turn the polar scope back and forth several times to reinforce the image in your head.

Now look at the three (3) thumbscrews and determine which one you need to loosen slightly so the reticle disc will move in the direction you want — toward the center of the scope — when you tighten the other two thumbscrews.

Loosen the thumbscrew closest to the direction that the disc needs to move toward (do this in very tiny increments, just enough to loosen the screw).

Now tighten the other two thumbscrews, and repeat the process. Keep loosening and tightening the thumbscrews until you see the size of the arc start to diminish and the point of intersection get closer and closer to Polaris when you rotate it 360 degrees.

When I went through this procedure the first time with my polar scope, I was amazed. As I rotated the scope 360 degrees, I could see the intersection point trace a large circle around Polaris.

Collimating is a trial and error process. There is no quick or easy way to do this job.

How do you know when you're done?
When you can finally rotate your polar scope a full 360 degrees and have Polaris stay perfectly centered behind the intersection point in the middle of your polar scope — you're done! Tighten your thumbscrews down enough to hold the reticle disc firmly in place, and feel good about the job you've done.

Problems You May Encounter Along The Way — #1
The AstroTrac polar scope has an adjustable battery-powered illuminator that shines a red light down into the reticle disc so you can see the alignment pattern on the disc at night. If you unscrew and remove the illuminator, you can look into the hole it screws into and see the slot.

The red light from the illuminator passes through a slot milled into the top of the reticle disc. If, during the process of changing out the factory set screws for your new easy-to-use thumbscrews, you accidentally moved the reticle disc so that the slot is no longer located directly under the red illuminator, you are going to have a problem. Light will not be able to enter the disc as it was designed to do.

To get it back in alignment, simply unscrew and remove the eyepiece, and then loosen the three thumbscrews enough so that you can tilt the polar scope and the reticle disc will fall into your hand. Locate the slot on the disc and gently drop the disc back into the polar scope tube, with the slot located under the hole that the red light illuminator screws into. You can use a small paper clip to rotate the reticle disc using the milled slot.

Tighten down the three thumbscrews, and begin your collimation process.

Well, that's about it! If you have questions, please contact me at darrylray@mac.com. Good luck!