

Robot AZ/ZN Axis Tightening Guide

If you find that your Sun Photometer system is not pointing, tracking, or moving properly, the problem could be that the zenith drive (ZN) or azimuth drive (AZ) bolt is not sufficiently tightened. Fixing this issue is a somewhat complicated procedure; as such it is best to not attempt until you have exhausted other options such as:

- checking date, time, and location
- ensuring robot is level
- checking battery voltages and connections
- speaking to a member of the AERONET Instrument Technical Support team (http://aeronet.gsfc.nasa.gov/new_web/contacts.html)

Once these options have been exhausted, the issue may in fact be that the AZ or ZN drive is not tight enough. Checking this is simple. If you attempt to turn robot head with your finger, in either the AZ or ZN direction, you should feel resistance from the gears (more if the robot is connected to a powered control box). If the head pivots with ease, the problem is likely in the tightness of the respective nut. To perform this procedure you will need a 13mm socket wrench (possibly with an extension), a small 9mm wrench, a 2mm allen wrench, and a 4mm allen wrench.

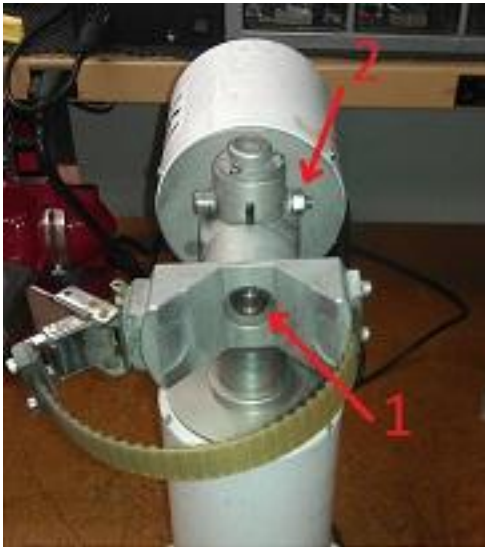
If the problem is only with the AZ drive, or with both the AZ and ZN drive, you should start on step 1. If the problem is only with the ZN drive, proceed to step 6.

1. To reach the AZ nut, we must first remove the ZN drive. This procedure varies slightly by type of robot.

a) On newer-model robots, this can be done by simply removing the 2 screws from the bottom of the ZN clamp, indicated below. You will then be able to easily remove the clamp and the entire ZN drive as a whole component.



b) On older-model robots, you will need to first remove the horizontal clamp bolt (marked as 2 below), and ZN axis nut (marked as 1 below). After removing both, you should be able to pull off the sensor-head arm, and then pull the ZN drive from the shaft.



2. You should now remove the AZ drive by removing the 6 small screws on the vertical portion of the base. Upon removal, you will be able to pull the AZ drive from the base. It is important that you remove it gently, as the wire connecting the base to the motor is short. If you pull too hard, you could pull the connector from the socket and damage the pins. On some robots this can be difficult, as the AZ drive fits very tightly into the base. Work it up gently, one side at a time if need be. Do not attempt to pry the drive from the base. Upon removal, disconnect the 6-wire connector from the socket on the motor. This step is similar in both robot models.



3. a) We now proceed to tightening the AZ drive. The bolt runs the length of the drive, and is secured on either end by the nuts shown below. Accessing nut 1 is the only difference between robot models. On newer models, accessing this nut is straight-forward, as shown below.



3. b) On the older model robot, you will need to remove the bubble level in order to access nut 1. Simply remove the three small screws holding it in place and it will come off. You may also need an extension to the socket wrench to reach nut 1, as shown below. Nut 2 can be accessed in the same manner on both models.



4. It is nut 1 that needs to be tightened. However, while doing this nut 2 must be held in place in order for nut 1 to tighten sufficiently. The best strategy is to use the 9mm wrench to hold the nut 2 in place. There should be a gap, in most cases between the switch and one of the large posts, large enough for the wrench to pass through. Once it is gripping the nut, rotate the drive so that the wrench makes contact with that post, and then becomes wedged against it. Make sure that the wrench is wedged against this post and not the switch or one of the gears!



You should then be able to grip the clamp portion of the drive and tighten nut 1 with the socket wrench, with the 9mm wrench against the post holding nut 2 in place. This will cause both nuts to become tight as you tighten nut 1. Tightening as much as possible by hand should be sufficient. Remove the small wrench that you have holding nut 2, and you should now notice significantly more resistance if you try to rotate the drive.



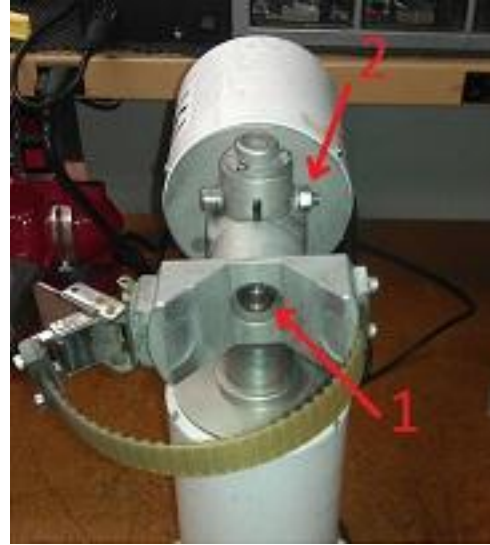
As you tighten nut 1, nut 2 will attempt to turn counter-clockwise, but will be braced by the wrench and the post

Hold end of clamp firmly with one hand

Turn socket-wrench clockwise to tighten nut 1

5. You may now put the AZ drive back into the robot base (remember to reconnect the 6-wire connector), then replace and tighten the 6 small screws around the vertical portion of the base. You may also replace the bubble level if you removed it. **If you have a newer-model robot and do not need to tighten the ZN axis as well, then proceed to step 8.** If you are having problems with the ZN axis as well, we will need to perform the same procedure on that axis. Also, unfortunately, on older model robots, when we removed nut 1 in step 1.b we inadvertently loosened the ZN drive bolt, so **it will need to be tightened again** (even if it was not initially loose), as follows below.

Replace the ZN drive, robot clamp, and all nuts and bolts that you removed in step 1.a or b. However, DO NOT fully tighten the bottom bolts (on newer robots) or nut 2 (on older robots) shown below.



6. If you skipped here from the beginning of the guide, consult the pictures above and slightly loosen the circled nut (and the corresponding nut on the other side of the robot) OR the nut marked as 2, depending on your type of robot.

Now remove the three small screws around the ZN-axis casing (marked as A below). You also need to unscrew the plastic nut at the base of the ZN wire (marked as B below) so that the wire can move freely as you remove the casing.



7. Now remove the casing, slowly and gently, though it may take some force. We will now tighten the ZN axis bolt as follows (this is the same method we used for the AZ axis in step 4). **This should be done while the ZN axis is still mounted to the robot!** You do not need to remove it from the robot body as

you did with the AZ axis. The ZN axis bolt runs the length of the drive, and is secured on either end by the nuts shown below.



It is nut 1 that needs to be tightened. However, while doing this nut 2 must be held in place in order for nut 1 to tighten adequately. The best strategy is to use the 9mm wrench to hold nut 2 in place. There should be a gap, in most cases between the switch and one of the large posts, large enough for the wrench to pass through. Once it is gripping the nut, rotate the drive so that the wrench makes contact with that post, and then becomes wedged against it. Make sure that the wrench is wedged against this post, and not the switch or one of the gears!



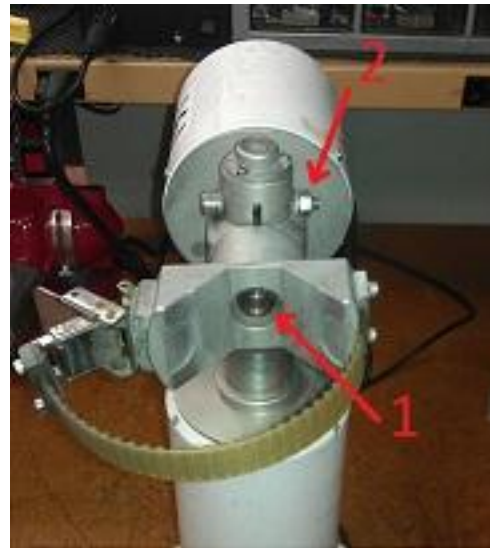
You should then be able to grip the clamp portion of the drive and tighten nut 1 with the socket wrench, with the 9mm wrench against the post holding nut 2 in place. This will cause both nuts to become tight as you tighten nut 1. Tightening as much as possible by hand should be sufficient. Remove the small wrench that you have holding nut 2, and you should now notice significantly more resistance if you try to rotate the drive.



8. Now that the ZN axis is also tight, you may replace the drive casing, and tighten the plastic nut around the wire. All that remains is to make sure that the robot is level. First insure that the base of the robot is level by adjusting the two set screws. Next perform a PARK scenario. Put a level on top of the sensor-head arm, and then turn the drive casing with your hand as shown below until the arm becomes level. It is essential that you adjust the level by turning the drive casing and not the clamp itself, as turning the clamp independently of the drive casing will cause the motor to move out of the 'park' position, and thus not be truly level.



9. Once it is level, you should fully tighten the two underneath nuts of the newer robots, or nut 2 of the older robots, shown below:



If the leveling was done successfully, you should be able to perform the PARK scenario again and the clamp will park in the level position. If you have trouble, please download the video here for a more detailed alignment demonstration: http://aeronet.gsfc.nasa.gov/new_web/training_videos/Setup.mov (beginning at 3:00 minutes)

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