Adjusting Gear Mesh (Backlash) in the Orion Atlas EQ-G Mount

If you are experiencing a problem with your mount's tracking or guiding performance, a gear mesh adjustment may be in order. Try to isolate which axis is having problems and focus on that one only.

Physical Check of Backlash, or "Play"

RA: With counterweights and telescope removed from the mount, but counterweight shaft fully extended, make sure the RA clutch is tightened. Grasp the counterweight shaft and gently tug it back and forth in the plane of RA axis rotation. You should feel the ever-so-slightest bit of play in the RA axis as you do this, and hear a faint clicking. If you don't, the gear mesh may be too tight (it's a possibility, not a certainty). If you feel a rather pronounced "knocking" and can see significant rocking of the EQ head, there is likely too much play and the gear mesh needs to be tightened up a bit.

DEC: It is helpful to install a long dovetail bar in the mount's saddle for this test, then grasp one end of it for leverage and tug it back and forth in the plane of Dec rotation; this makes it easier to feel any "knocking." Again, you should feel the ever-so-slightest bit of play and hear a faint clicking in the Dec axis as you do this. If you don't, the gear mesh may be too tight (it's a possibility, not a certainty). If you feel a rather pronounced "knocking" and can see significant movement of the EQ head, there is likely too much play and the gear mesh needs to be tightened up a bit.

Take an *Un*balanced Approach

A little bit of RA backlash shouldn't be cause for worry, especially if you unbalance the RA axis so there's a little more weight on the EAST side of the meridian. This slight east-heavy imbalance insures that the RA worm and ring gear remain meshed at all times as the motor drive pulls the scope from east to west. Gravity takes up the slack, as it were.

The same concept can be applied to the Declination. Typically Dec drift occurs in only one direction anyway, but by unbalancing the Dec axis slightly you help insure that any drift will occur in one direction only, which is easier for the autoguider to guide out.

DEC Gear Mesh Adjustment

1. With a 5mm Allen wrench, loosen the four socket head cap screws on the worm gear housing adjacent to the Dec axis about 1/2 turn (**Figure 1,** circled). Then gently re-engage them until the point at which they just begin to tighten – no further.
2. Locate the two mesh adjustment setscrews: one is on the top side of the worm housing (**Figure 2**) and the other is underneath on the bottom side (**Figure 1**). The top setscrew tightens the mesh between the worm gear and ring gear, while the setscrew on the bottom loosens the mesh between the two. (keep this straight by remembering that "Top Tightens".) You will need a 2mm Allen wrench to adjust them.

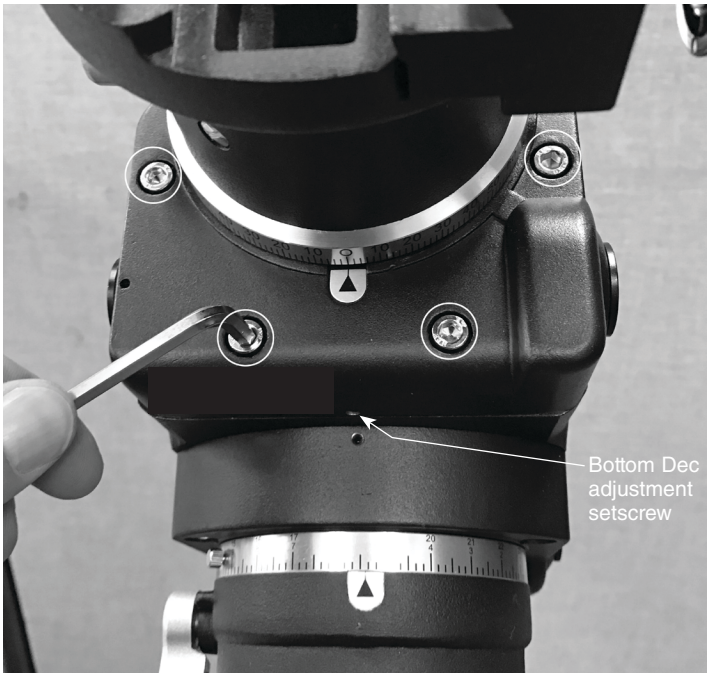


Figure 1.

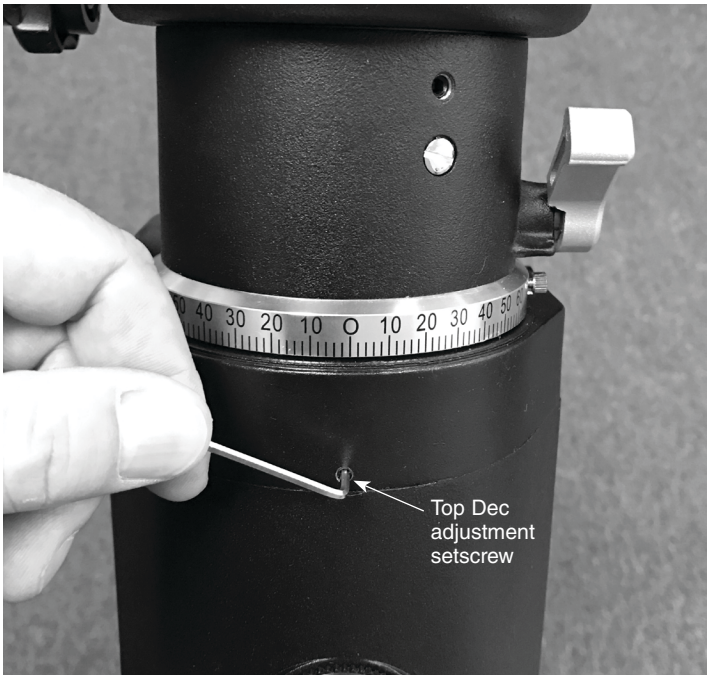
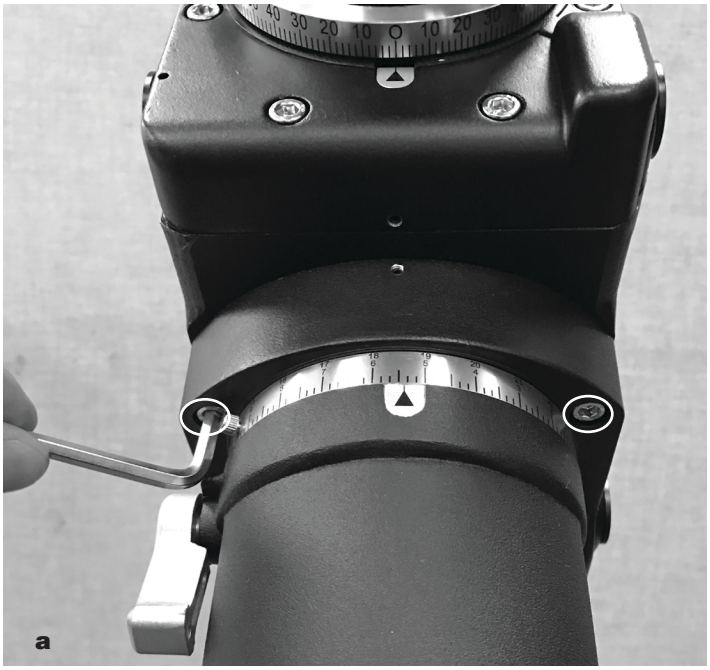


Figure 2.



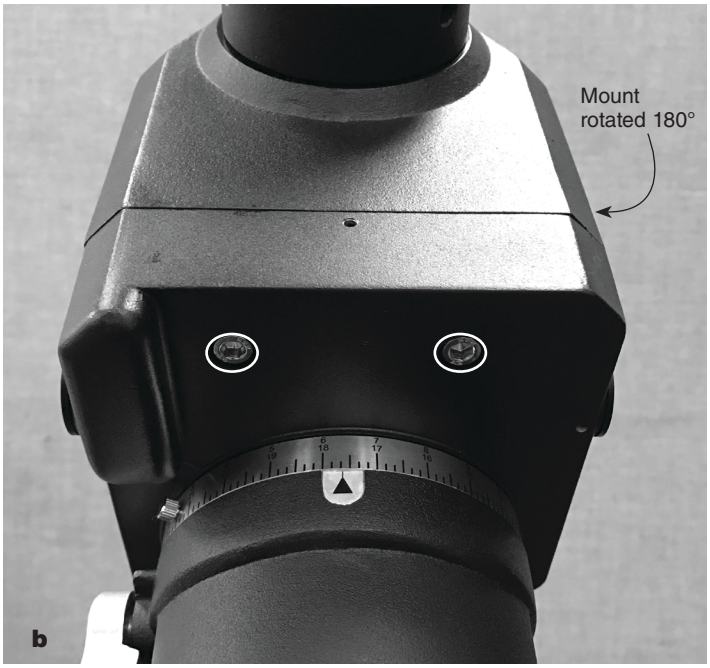


Figure 3

3. If the Dec mesh is too tight, first turn the top setscrew outward (counterclockwise) by 1/4 turn, then turn the bottom setscrew inward (clockwise) 1/4 turn.
4. Now grasp the dovetail bar and yank it gently back and forth. Can you hear a slight clicking and feel and tiny bit of knocking? If so, you may be done. If you still cannot hear/feel any movement, repeat Step 3 to loosen the gear mesh some more.
5. If your Dec mesh was too loose to begin with, turn the bottom setscrew outward (counterclockwise) 1/4 turn, then turn the top setscrew inward (clockwise) by the same amount.
6. Now grasp the dovetail bar again and yank it gently back and forth. Has the amount of play lessened to just being barely perceptible? If so, great! If there's still too much play, repeat Step 5. If you can't feel any play, backtrack a little by turning the top setscrew counterclockwise and the bottom setscrew clockwise by about 1/8 turn.
7. When the amount of play feels right, retighten the four housing screws incrementally in round robin fashion until all are tight.
8. Now test the mesh again by pulling the dovetail bar back and forth. Sometimes retightening the housing screws can alter the mesh tension. If that happened you will need to loosen them again and tweak the two adjustment screws accordingly before retightening the housing screws.
9. As a final check, use the SynScan hand controller on slew speed 9 and slew the Dec axis 360 degrees. If at any point the motor binds up, that means that is a place where the worm and rings gears are meshed too tightly. You will need to go through the Dec mesh adjustment procedure again and loosen the mesh a little. Then conduct another 360-degree slew. When you can go the full rotation without any binding, the gear mesh is correctly set.

RA Gear Mesh Adjustment

1. With a 5mm Allen wrench, loosen the four socket head cap screws on the worm gear housing adjacent to the RA axis about 1/2 turn (**Figure 3a and b**). Then gently re-engage them until the point at which they just begin to tighten – no further.
2. Locate the two mesh adjustment setscrews: one is on the top side of the worm housing and the other is underneath on the bottom side (**Figure 4a and b**). The top setscrew tightens the mesh between the worm gear and ring gear, while the setscrew on the bottom loosens the mesh between the two. (keep this straight by remembering that "Top Tightens".) You will need a 2mm Allen wrench to adjust them.
3. If the RA mesh is too tight, turn the top setscrew outward (counterclockwise) by 1/4 turn, then turn the bottom setscrew inward (clockwise) 1/4 turn.
4. Now grasp the extended counterweight shaft and yank it gently back and forth. Can you hear a slight clicking and feel and tiny bit of knocking? If so, you may be done. If you still cannot hear/feel any movement, repeat Step 3 to loosen the gear mesh some more.
5. If your RA mesh was too loose to begin with, turn the bottom setscrew outward (counterclockwise) 1/4 turn, then turn the top setscrew inward (clockwise) by the same amount.
6. Now grasp the dovetail bar again and yank it gently back and forth. Has the amount of play lessened to a degree that's barely perceptible? If so, great! If there's still too much play, repeat Step 5. If you can't feel any play, backtrack a little by turning the top setscrew counterclockwise and the bottom setscrew clockwise by about 1/8 turn.
7. When the amount of play feels right, retighten the four housing screws incrementally in round robin fashion until all are tight.

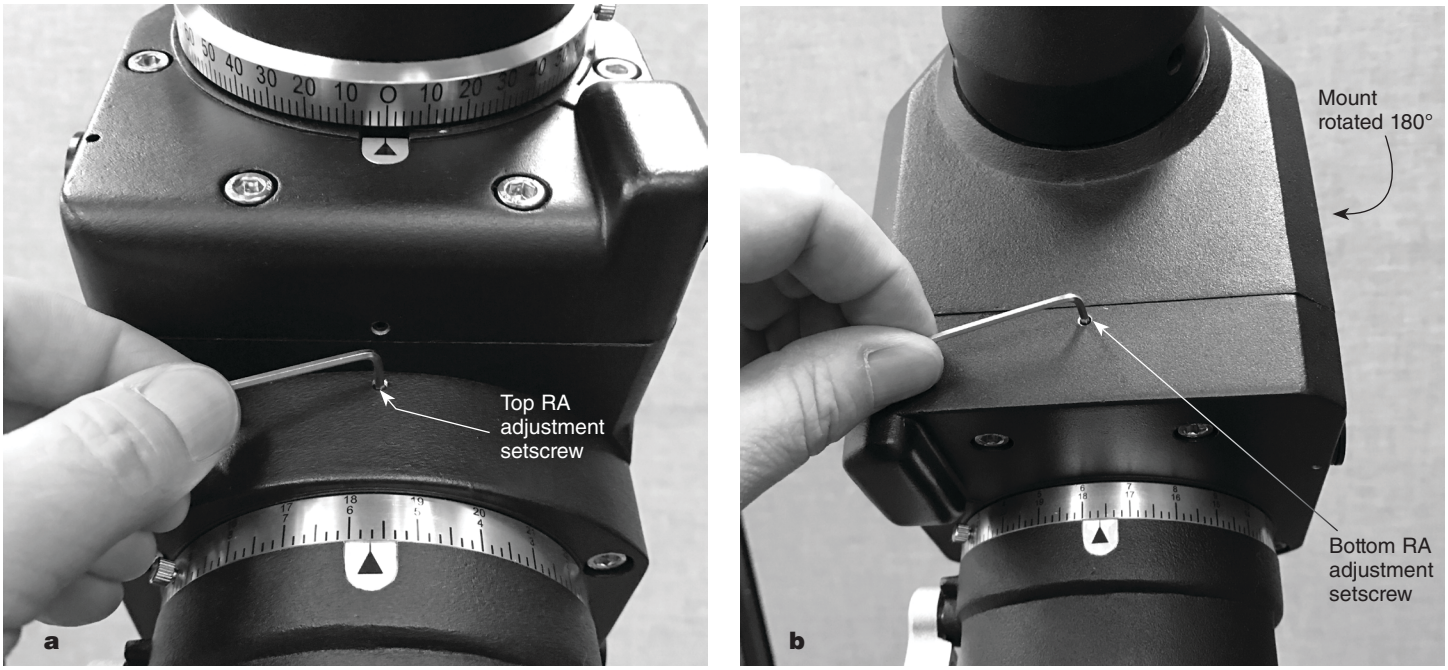


Figure 4.

8. Now retighten the four gearbox screws that you loosened in step 2.
9. Check the amount of play in the axis, like you did in step 1. Is there more play, or less? If you had too much play to begin with and now there is less – great! You can decide if you need to adjust it to be tighter still, or maybe need to back off a bit. In either case, you would again loosen the four gearbox screws and make fine adjustments to the mesh adjustment setscrews – loosening one and then tightening the other by the same amount. When the amount of play feels just right, i.e., there is a very small but perceptible amount, then you're done. Be sure to retighten the four gearbox screws.

If you had too little or no play in the axis to start with, then hopefully you'll feel some now. If you don't, then either you didn't loosen the gears enough, or you tightened them further. In the latter case you'll need to make the opposite adjustments to the two setscrews.

It may take two or three rounds of adjustment to set the gear mesh the proper amount. Then, of course, you'll want to check it by using the mount in the field.

If you have any questions about this procedure, call Orion Customer Support at 800-676-1343, or send an email to support@telescope.com.