Sky-Watcher EQ6 Pro Modifications

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1 Introduction

I have found that the Sky-Watcher EQ6 Pro mount is a pretty good mount for the money, but there are some questions concerning certain aspects of its design that have been the subject of much modifications and tune up by their owners.

This document describes the following two very common procedures that are routinely carried out by owners of the EQ6 and that I repeated with very encouraging results.

- Minimize backlash (RA and Dec) and reduce the EQ6 'coffee grinder' gear meshing sound on slewing by dismantling, adjusting, cleaning and re-lubricating the gear trains;

- Add a secondary Altitude adjustment tab to the mount to vastly ease altitude adjustment at more northernly latitudes;

Also see my website www.astroworkbench.co.uk for various other articles and associated video clips.

2 RA and Dec adjustment

2.1 Motor and Gear Assemblies

Most owners of the EQ6 mount find that when a slew operation is performed at high speed it is often associated with a brief start up noise rather like a coffee grinder, which suggests a case of poor gear mesh, but then quickly dissipates to a 'normal' gear meshing slew sound.

Although this noise appears to be very common behaviour (which some people have reported as being fixed via a board replacement) I decided to strip down, adjust, clean and re-grease the gears using a Teflon grease.

Also ensure that your mount is balanced, not overloaded and the power supply is good

This procedure definitely made a difference to the sound and backlash (measured via PHD2) although I still have some start up noise, but as it is not affecting the slew accuracy, I deem this maintenance to be highly worthwhile.

The photos below show the procedure.

Figure 1 – Remove the four front plate corner screws

Figure 2 – Ease off the front plate

Figure 3 – The two motors are revealed

When removing the two cap head bolts on each motor plate it is well worth having a pair of long nose plyers to hold the bolts and lift them out very carefully as you don't want to lose them or their washers inside the casing.

Figure 4 – Undo the two cap head bolts on each motor mounting bracket

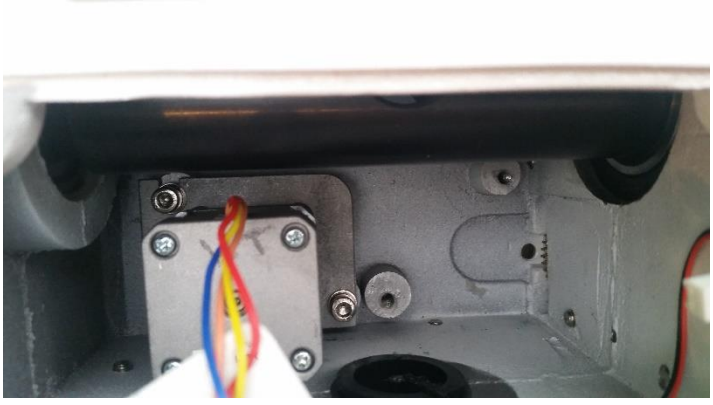

Figure 5 - Dec motor removed

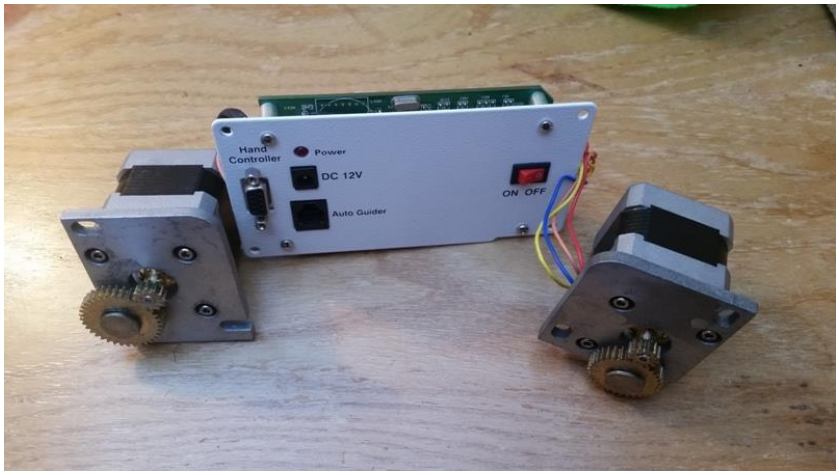

Figure 6 – Lift out the complete assembly

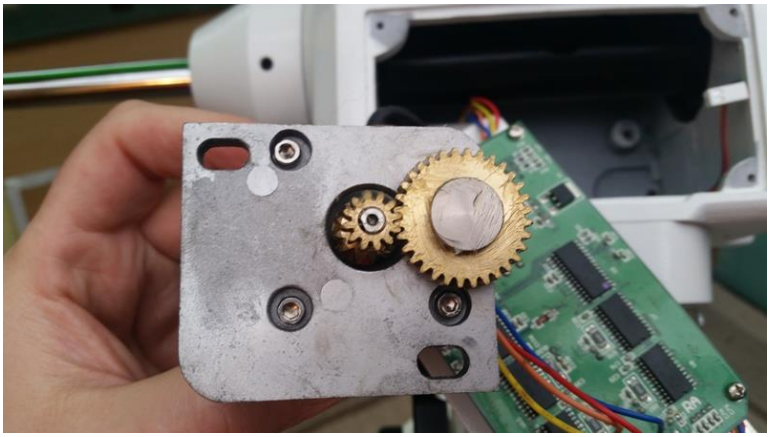

Figure 7 – Clean up gears

If the gears are not vertically aligned correctly as shown in the example below the two grub screws can be used (one is visible in the photo below) to loosen the smaller gear and move it up or down on the shaft.

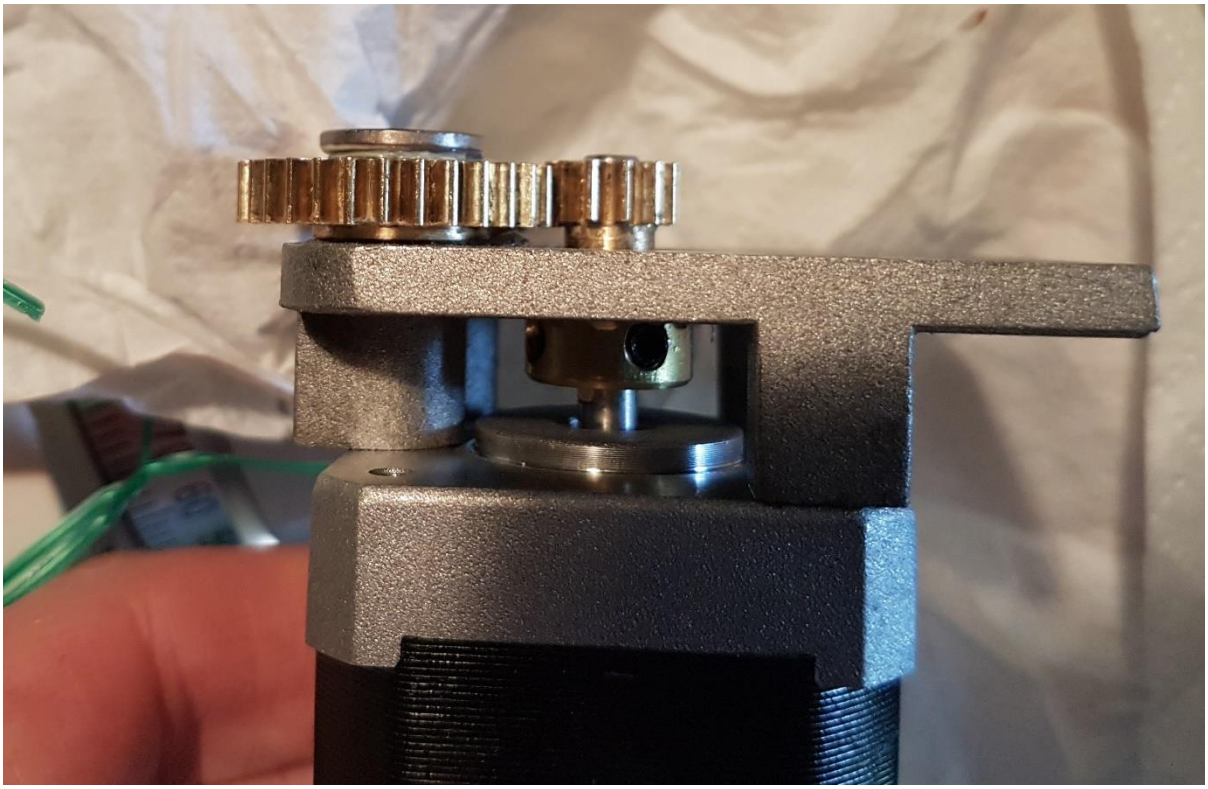

Figure 8 - Adjust vertical gear mesh gear position if required

To adjust the horizonal mesh of the gears loosen the three cap head bolts shown in the photo below so that you can now simply push the plate holding the larger gear so that they mesh more snugly together. It will be trial and error to get a fit that is good enough to remove backlash but not too tight to cause the motor to stall and excessive wear.

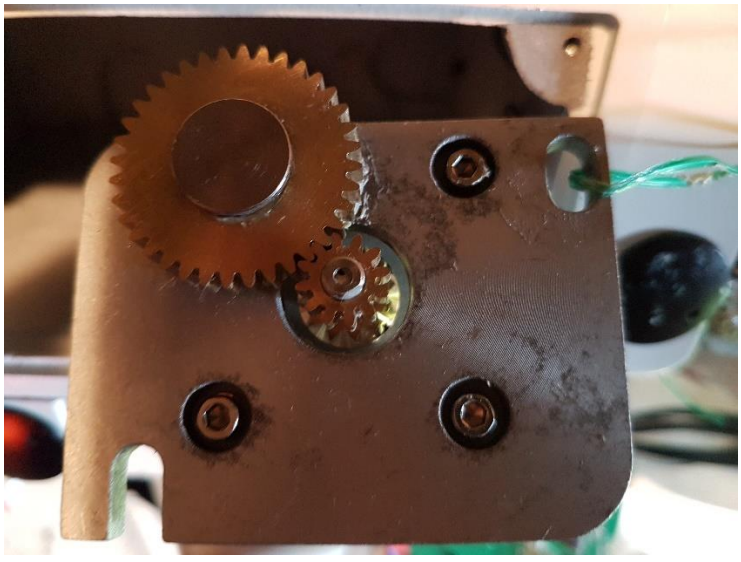

Figure 9 - Adjust horizontal gear mesh if required

Test the gear train by powering up your scope and slewing in all directions before refitting the assemblies so as to ensure that are moving freely with minimal backlash. See my website ww.astroworkbenh.co.uk for some video snippets showing these tests.

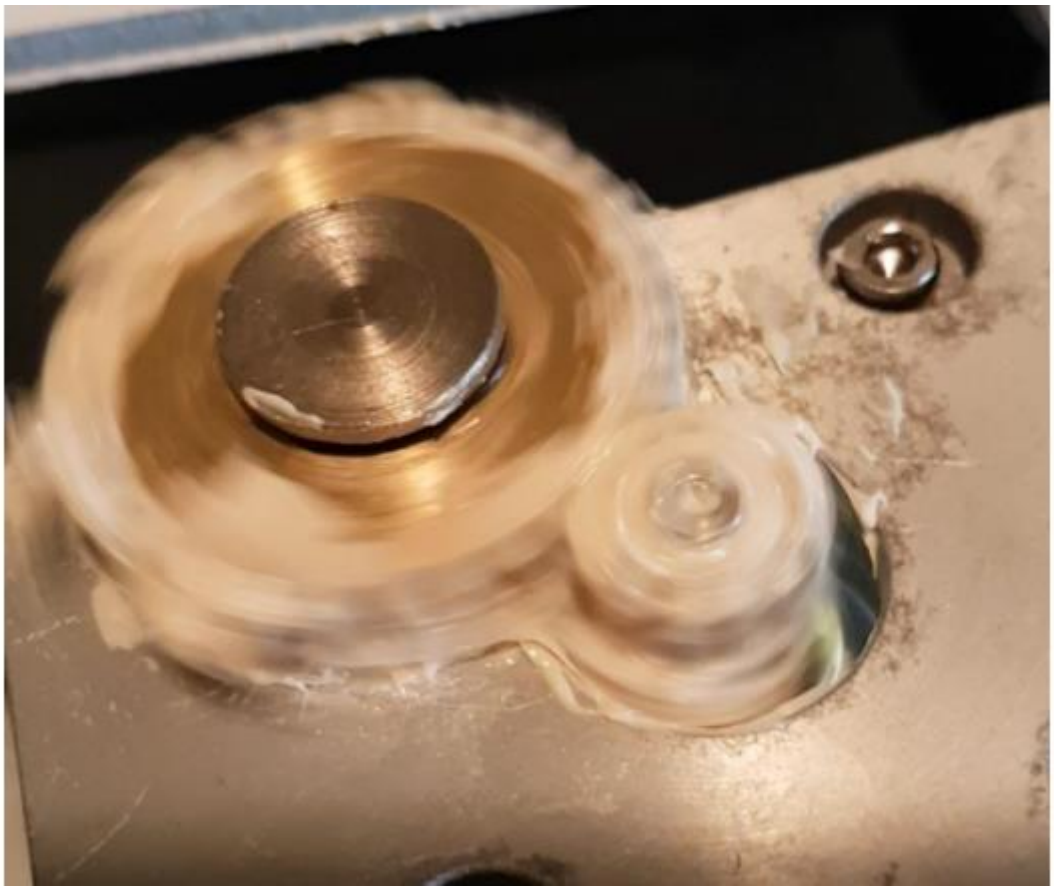

Figure 10 - Grease and test gears

The refit procedure is the same as above but in reverse.

2.2 Additional worm wheel adjustment

If you still have backlash you can further adjust the RA and Dec worm wheel engagement. They both work on a principle of using antagonistic screws pushing against the wheel mounting block to engage it into the worm. The images below show this for the Dec axis, but the same principle is also used for the RA Axis. Ensure that you make very small adjustments to each antagonistic screw and always loosen one and then tighten the other.

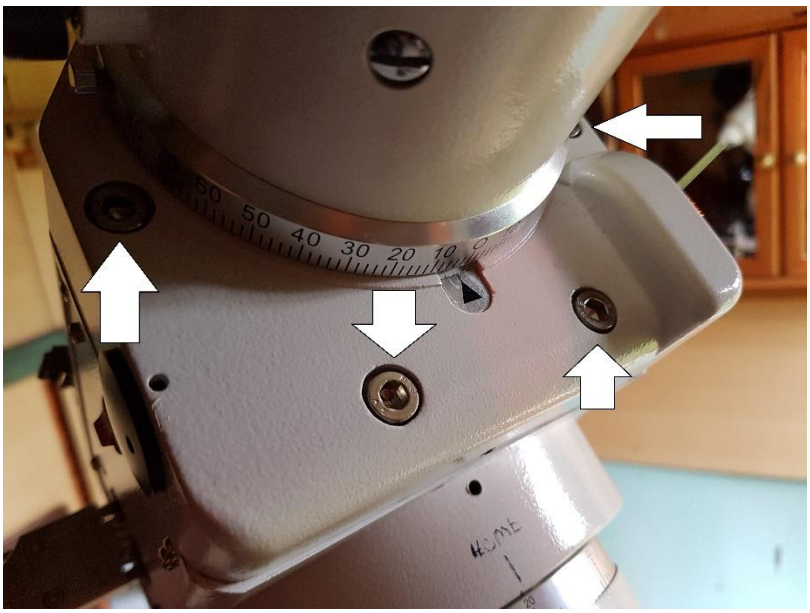

Figure 11 - Loosen the four Dec Axis cover bolts slightly

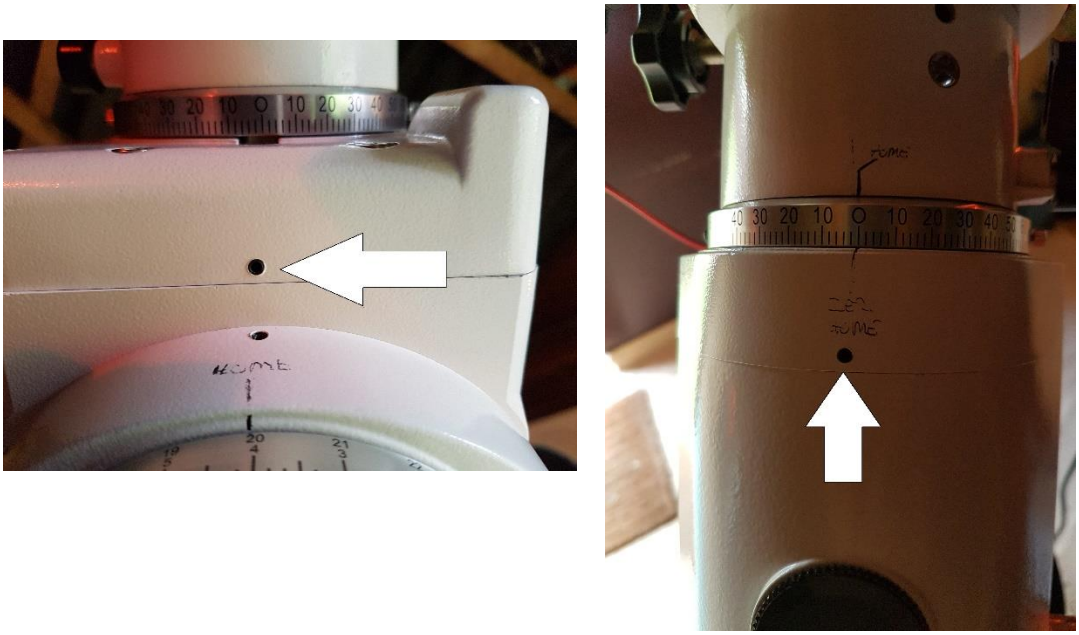

Figure 12 - Adjust the antagonistic opposite screws

Once adjusted re-tighten the four cover bolts and test the slew, re-adjust until happy that the mesh and hence backlash is a good as possible without being overtight.

3 Re-engineering the EQ6 Altitude Adjustment

I found that the EQ6 antagonistic bolts mechanism used for the Azimuth adjustment on the EQ6 work adequately. However, the Altitude adjustment on my EQ6 was a whole different ball game: it was locked solid when I obtained the mount. This meant that the Altitude adjustment bolts were in danger of bending or thread stripping during use.

The two photos below show the 'out of the box' adjustments bolts for the EQ6. Note that for a 52 degrees Altitude setting the 'B' bolt has to be wound in a long way– the reason for this becomes apparent in the subsequent photos.

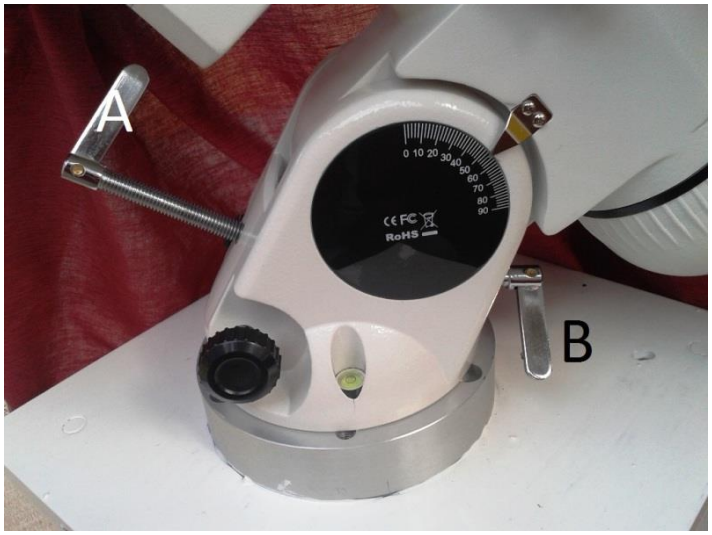

Figure 13 – Standard Altitude Adjustment bolts (set for 52 degrees)

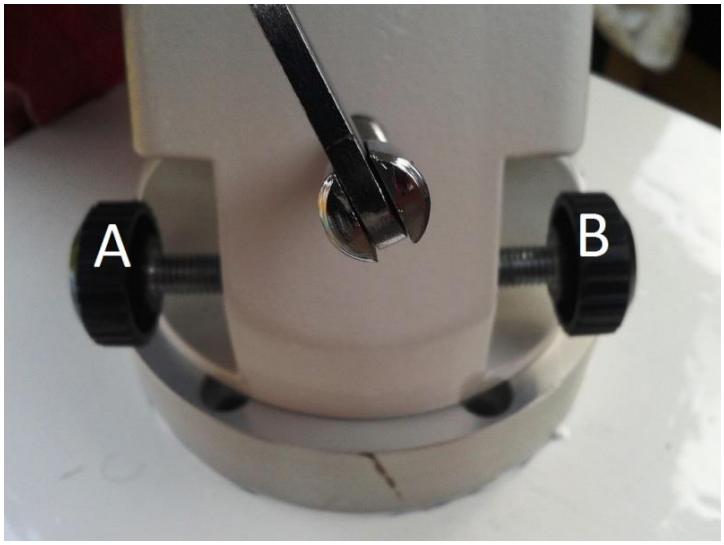

Figure 14 – Standard Azimuth Adjustment bolts

After a little investigation I found that there is a central bolt and three associated grub screws used to lock the two mount segments together. All of these were extremely tight on my mount making it virtually impossible to make any Altitude adjustment via the two Altitude antagonistic bolts without major risk of bending them or stripping the thread.

To rectify this situation, I had to loosen the central bolt and the three grub screws so that the Altitude bolts could be used for adjustment. To do this you will have to prise off the two plastic covers to reveal the central bolt and three grub screws. The plastic covers are just glued on so a gentle prising with a thing screwdriver blade did it for me. This is shown below which also shows that I have replaced the factory supplied Altitude adjustment bolts with a far more user-friendly pair purchased via the web.

Figure 15 – Ease off the glued on covers

Figure 16 – EQ6 central bolt and three grub screws revealed

The EQ6 features an internal plastic cover on one side (shown in Figure 17 below) and a circular metal thrust plate (shown on the left in Figure 19 below) on the other side which the three grub screws press against.

I found that there where burrs left inside the casing from manufacture, so by removing those with a file and greasing the plastic and metal thrust plate it also helped with a smoother Altitude adjustment.

Figure 19 below also shows how the Altitude antagonistic bolts work against the protruding cast tab shown in Figure 17 and Figure 18.

Note: One other thing to check is the bubble level on the mount. On my EQ6 mount it was a mile out of square in the casing and therefore useless – I used a separate spirit level on the mounting plate to ensure the mount was level.

Figure 17 – EQ6 Mount separated - section 1

Figure 18 – Cast Tab used for antagonistic altitude adjustments

The photo above and below shows why, for mid (52-degrees in my case) Altitude, one of the bolts has to be wound in so far. This shows that for this kind of latitude adjustment the design is not particularly great which leads to the infamous bent bolt syndrome as the bolt does not meet the cast tab square on and hence causes additional stress and flexure when adjusting.

Figure 19 – EQ6 mount separated – section 2

Figure 20 – Showing just how far the Altitude bolt has to be wound in for some latitudes

One solution to rectify this issue is to add a second tab on the mount so that each bolt only has to protrude in a short distance and can meet their respective tabs square on and hence reduce the stress on the bolt.

I implemented this common fix by purchasing a piece if aluminium block (eBay) and drilling four clearances holed for 5mm Cap head bolts. I then drilled and tapped the casing and attached the block.

The crucial part of this is to ensure that the new block is positioned close to the vertical for your latitude so that the Altitude adjustment bolt on that side meets it close to 90 degrees.

Figure 21 – Four clearance holes for 5mm cap head bolts

Figure 22 – Drill four holes in the mount (first one shown)

Figure 23 – Tap holes to 5mm (first one shown)

Figure 24 – Attach block and make certain its square

The photo below shows the mount re-assembled. Note that I have also replaced the three grub screws with knurled handled knobs to make life easier.

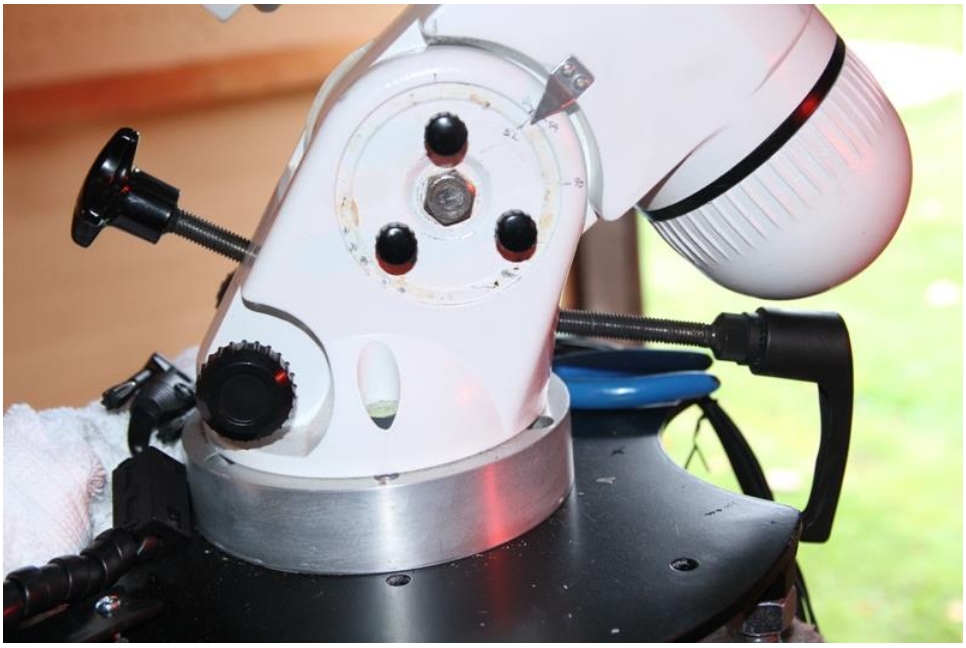

Figure 25 – Reassembled

Note in the image above how much further out the right hand adjustment bolt now is as it is engaged against the new block. This could obviously be replaced by a shorted bolt (or cut down the original) as desired.

These changes make Altitude adjustments hugely easier, and the process is now easy and smooth with no juddering when making adjustments. This makes sub arc minute adjustments easy during precise polar alignment. Also remember that the scope must also be well balanced on the mount to ensure smooth adjustment.

November 2017 Update.

A new version of the EQ6 has been released called the EQ6-R. Among the changes are new Altitude bolts, so it seems that Sky-Watcher may have addressed that issue, BUT if it still relies on the same cast tab antagonistic bolt approach with a central bolt and grub screws etc it will be interesting to see just how easy and smooth that process is, or whether all of the other issues I detailed above still remain.