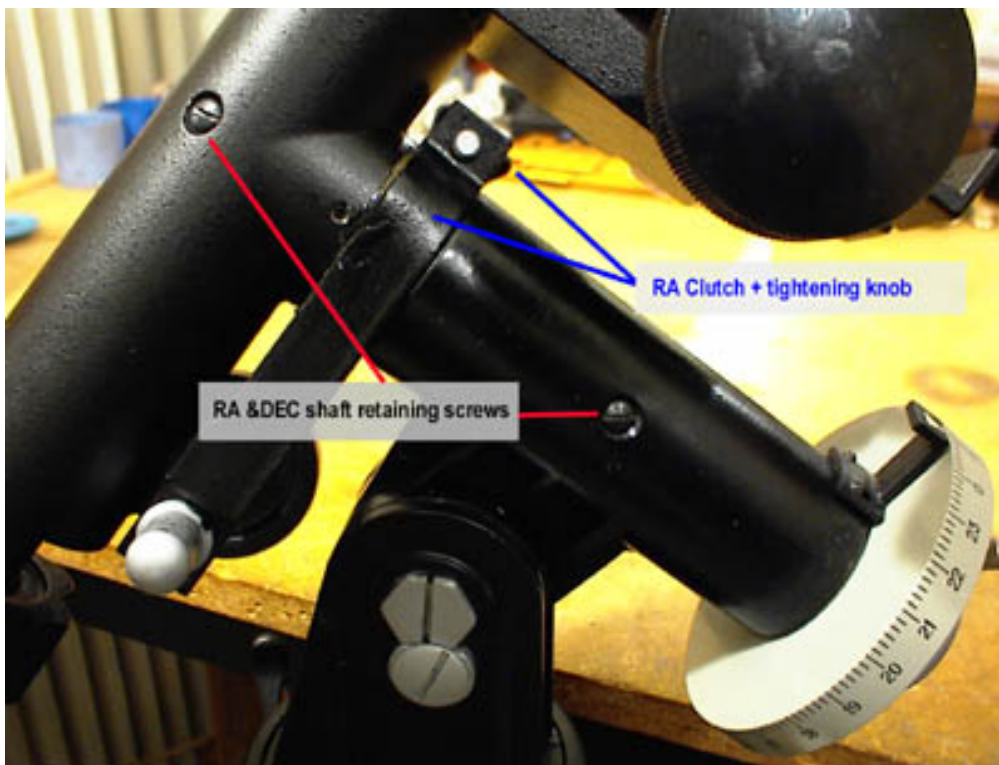


General

The TAL GEM-1 manual mount supplied with the 100R, is of all metal construction with ± 4 degrees manual slow-motion on both axes via hand wheels. The mount is supported on a wooden tripod and the appearance of the mount is handsome and very promising in terms of quality and performance. However, after these initial impressions, many users find that the mount is somewhat shaky, which compromises the scope's performance at high magnifications. Tracking an object with the telescope tube in some orientations, causes the telescope tube to vibrate so strongly and for as long as eight or more seconds until vibrations die, making observing whilst tracking an object impossible. Following, is a brief description of my own experiences with the mount, as well as the cure that I was finally able to come up with for this problem. I have since tested the scope using magnifications as high as 320 X, and now only minor - and certainly not annoying - vibrations occur, as their amplitude is drastically reduced as well as their duration.

Removing and cleaning the RA/Dec shafts.

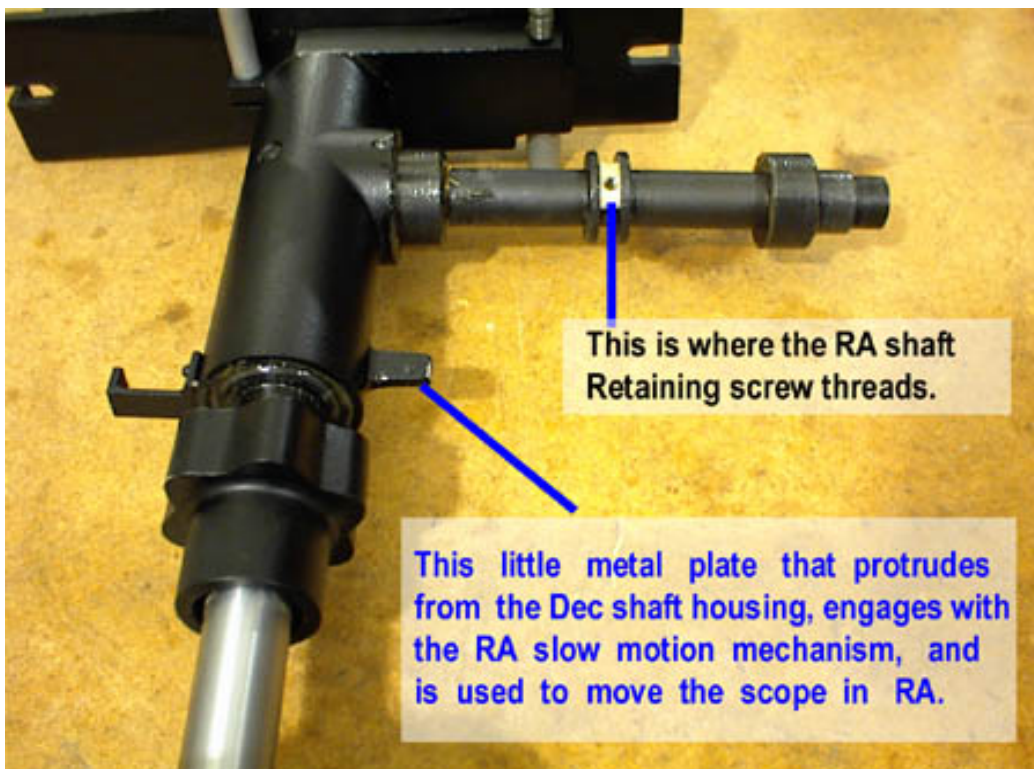
There are no ball bearings or gears of any kind in this mount. Both shafts, - RA and Dec - run on sleeve type bearings. Before doing anything else, you should remove both shafts from their housings, remove the old sticky Russian grease ([PW: the manual refers to it as "slushing"](#)), and apply fresh lubricant. I will briefly describe how to remove the RA shaft. You can then remove the Declination shaft in a similar fashion.



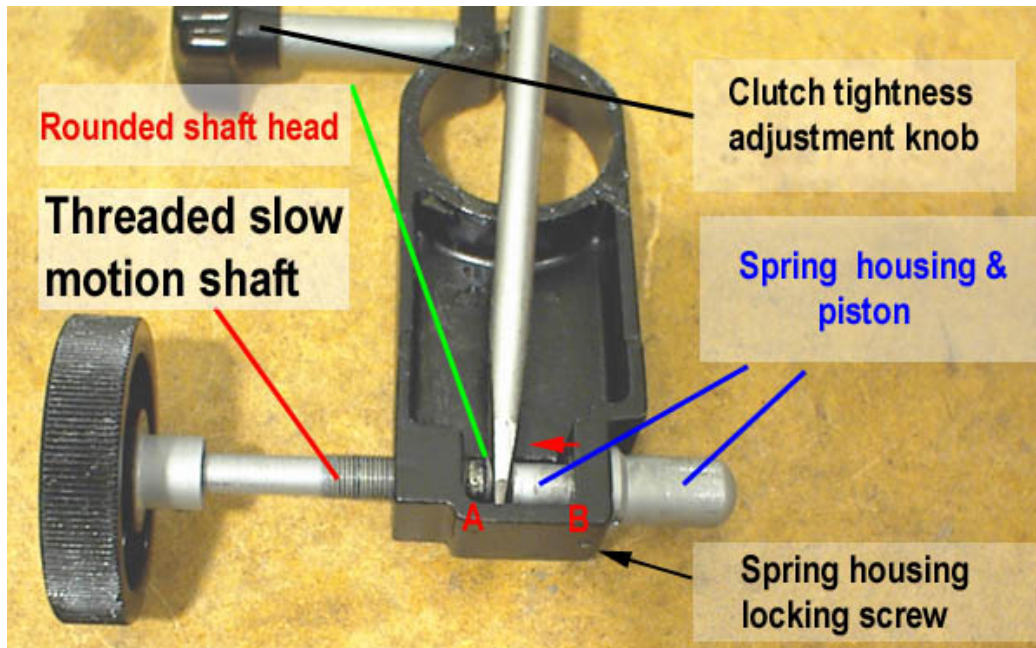
Remove the RA shaft retaining screw and loosen the clutch. Remove the large silver knob and the RA setting circle from the back end of the shaft. Gently pull the shaft out of its housing, as shown in the next picture.



As you pull the shaft out of its housing, the RA slow motion mech will disengage from the housing as well. Take care not to loose the little brass slider that the retaining screw screws into. The following picture shows the RA shaft complete with the Dec shaft assembly, removed from its housing.



Wipe out the old sticky grease and clean all bearing surfaces with alcohol or a suitable solvent. Apply a preferably thick, high quality grease to all bearing surfaces. Reinstalling the shaft back into its housing, is the reverse of the above procedure. The only tricky part is engaging the little metal plate back into the slow motion mech. Before going on, let's see how the slow motion mechanism works.



In the above picture the screwdriver tip sits right where the metal plate should go when everything is in its place. The rotation in RA is controlled by the force applied to the metal plate by the combined action of the threaded slow motion shaft and an opposing spring that is situated inside a housing that screws onto the slow-motion mechanism. The spring is under compression and pushes against a piston which can move in and out of the spring housing. Provided that the clutch (which fastens the slow motion mech onto the RA shaft housing) is tight enough, the metal plate can move from point A (Shaft fully out, spring fully decompressed) to point B (Shaft fully in, spring fully compressed). This motion of the metal plate gives a rotation in RA of about 8 angular degrees, or 32 minutes. When turning the slow motion knob anticlockwise, the scope moves with the force applied by the spring. While turning it clockwise, the spring recedes and is compressed. The difficult part while putting back the RA shaft into its housing, is to engage the metal plate between the shaft head and the piston, as one has to overcome the spring's force and push the piston away from the shaft head to allow the metal plate to sit in. The easiest way to do this is to remove the spring/piston housing from the mech. But first, let's see how can it be done without removing it.

Put the slow-motion mechanism back into its position on the RA housing and tighten the clutch. Turn the slow motion knob anticlockwise, until the slow motion shaft is fully out. Now insert the RA shaft into the RA housing and situate the metal plate just above the contact point of the slow motion shaft head and the piston. Holding the RA-shaft/Dec assembly with your left hand, use your right hand to centre the other end of the RA shaft to its bearing in the housing. It won't go completely in, as the metal

plate is not engaged yet. Apply some force to see if you can overcome the action of the spring. If you cannot, insert a screwdriver into the slow motion mech from the spring side and try to pull the piston back, simultaneously as you try to push the RA shaft fully in. With a little patience, it can be done!

Removing the spring housing.

Locate the tiny spring-housing locking grub screw, indicated in the previous image. Use a jeweller's screwdriver and remove it. Be careful as the slot in the head can be easily damaged! Hold the spring housing with a pair of pliers - utilising some hard cardboard or rubber between the pliers and the housing if scratching is an issue - and turning it anti-clockwise, unscrew and remove it from the slow-motion mechanism housing. Now you can insert the RA-shaft back into its place easily. Next turn the slow-motion knob fully anti clockwise, and screw in the spring housing back into its place, simultaneously holding the Dec housing and hence the metal plate as far as possible from the spring side of the slow-motion mechanism:



This will make things a bit easier, as the spring force will be less. Finally, screw in the locking screw and you're done.

Why does it vibrate?

After many hours of experimenting, I concluded that most intense vibrations occur when the declination plate (and hence the telescope) is situated perpendicularly to the RA axis, as shown in the next picture. (PW – the vibrations are worst in this configuration when the telescope – weight plane is parallel to the ground, as in this case gravity has no damping effect.)



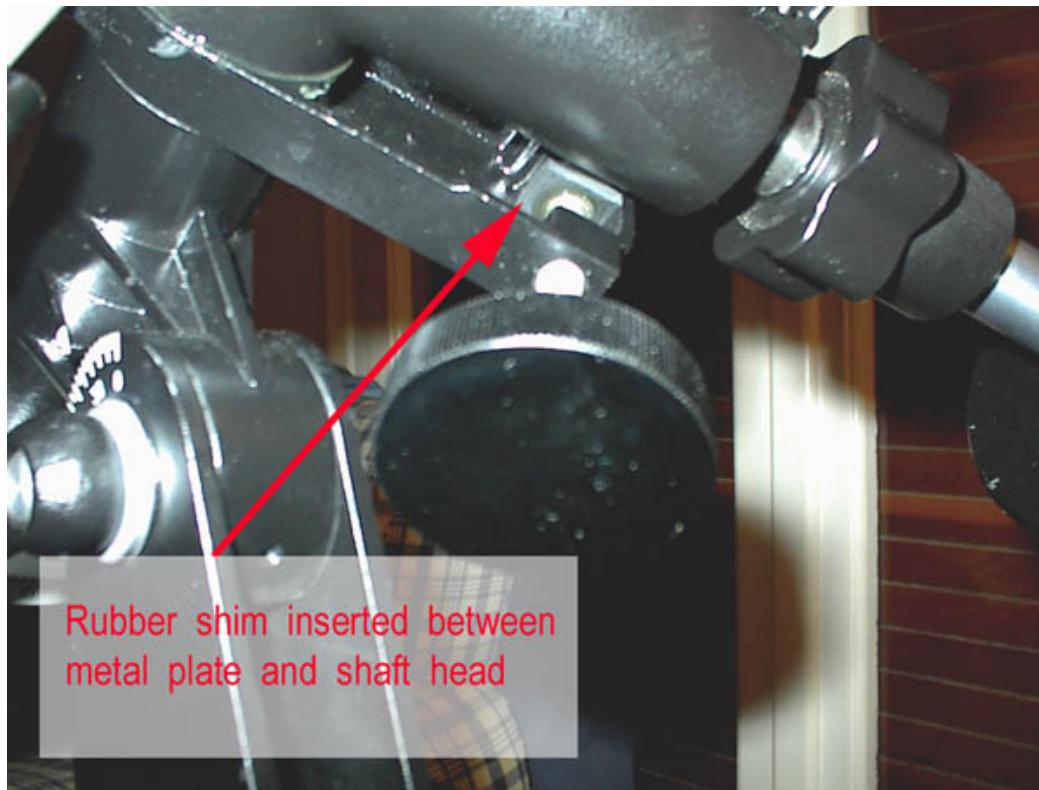
Vibrations are most intense when turning the slow motion knob counterclockwise. Rotating the knob clockwise, induces some vibrations as well, but nothing you can't live with, but unfortunately to track an object you need to move the knob anticlockwise. Actually, when the slow-motion knob is turned anticlockwise from an idle position, there's a very brief time gap that the slow motion shaft head and the metal plate are not in full contact. This occurs due to the inertia of the telescope – counterweight assembly which initially resists to the change of its kinetic state induced by the force of the spring piston. I guess a much stronger spring would improve things a bit, but it would also make the slow motion knob harder to turn. When the whole assembly finally moves, the metal plate catches up with the receding shaft head and the impact causes it to start moving again towards the opposite direction, until the spring briefly compressed from this action, starts decompressing again. This vibration goes on continuously as one rotates the slow-motion knob anticlockwise, hence the "tick-tick-tick" feeling one gets on the knob, every time the metal plate hits the shaft head.

When the declination plate (and hence the telescope) is situated perpendicularly to the RA-axis, (PW: and especially when this axis is horizontal) the vibrations are most intense. In this state, the whole length of the telescope tube is in the rotation plane. Turning the RA-Knob just a little, causes the telescope / declination shaft / counterweight assembly to oscillate back and forth around the red axis, presumably because when the metal plate hits the slow motion shaft head, the inertia of the most distant parts of the tube (lens, eyepiece) applies greater force to the pivot point of the oscillation (= RA axis) than in any other position of the scope, as the full telescope tube length acts as a lever (PW: in physics terms the turning moment around the axis is at its largest value). What is needed, in order to avoid any vibration to starting at all, is the addition of a rubber shim, about 5mm thick between the metal plate and the slow – motion shaft head. This should be quite hard, but soft enough to be partially compressed when idle (about to 3/4 of its free-standing thickness), so that it decompresses just a tad during the time gap

to take up the slack between the receding shaft head and the metal plate and thus damp the vibration. The shim must be square and cut to fit into the inner corner of the mech housing, to keep it from rotating. It should also be of good quality rubber, to withstand the friction from the rotating shaft head without wearing out too quickly. I used pure rubber (= natural latex). After using the scope for many days, I removed and inspected it. To my delight, it had not worn out at all. ([PW:A soft rubber as used in a pencil eraser works well too](#)).

Although I will describe a simple way to provide a more permanent solution, you can check this solution quickly as follows:

Cut a square shaped rubber approx. 1,6cm X 1,3cm and 4-5 mm thick. Using a sharp tool with a fine tip (I used a surgical lancet), scrape off some material from one of its faces to provide a recess for the round shaft head to sit in. Position the declination plate with the scope in its place perpendicular to the RA axis, as shown in the picture above. Check for the presence of vibrations, particularly when turning the slow motion knob anticlockwise. Now, fully tighten the RA clutch, so that rotating the scope in RA is impossible. Turn the slow motion knob anticlockwise, until the shaft is fully out. Now, by pushing the counterweight shaft, you can compress the spring, and make room for the shim between the slow motion shaft head and the metal plate. Use a pair of fine tweezers and insert the shim. It should look something like this:



Position the scope as before, and check for the presence of vibrations again. If you see any significant improvement, keep reading.

The problem with the simple trick above, is the likelihood of the rubber shim falling out of its place. Below is the description of the modification I applied, although there are many other that could be applicable.

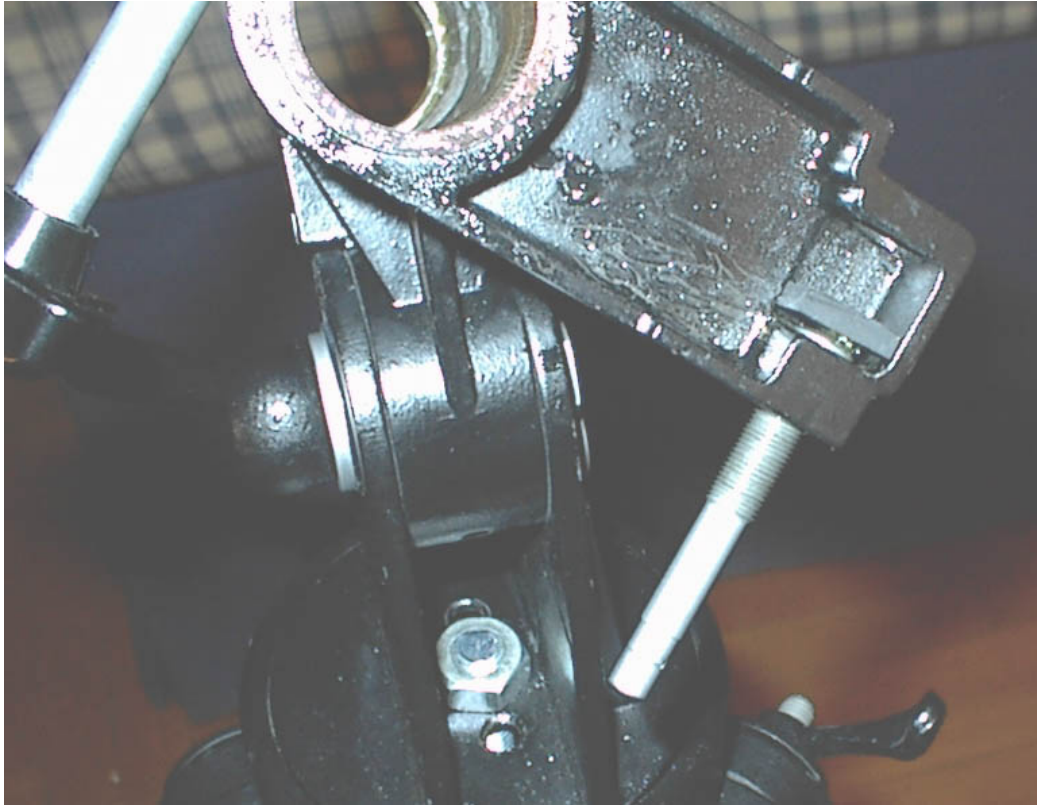
Remove the spring housing from the RA slow motion mech assembly as already described. Remove the knob from the slow motion shaft by first removing the little locking screw. Screw the shaft fully in, until it comes out from the spring side, as pictured below:



Put the shaft in a vice as pictured below. Find a nail about 1mm thick and drill a hole of equal or slightly larger diameter into the shaft head. Cut the nail about 8 – 10mm long. The drilling depth should be the same or a bit more. Cut a suitable recess on the face of the rubber shim, to allow the nail head to sit in.



Put the shaft back into the slow-motion mech housing. Grease the shaft head. It is going to rotate onto the rubber shim, so you want to decrease friction and thus prevent the shim from wearing out quickly. Position the mech in its place on the RA-shaft housing and insert the shim. Tighten the clutch and put back in the RA-shaft/Dec assembly.



Screw the spring housing back into its place last, only after having inserted the RA-shaft back into its housing. Don't forget to grease it. That's all!

Let me add, that the shim face touching the metal plate, should not by any means rotate! Initially I cut a round shim. It would stick onto the slow-motion shaft head and rotate with it. The result was that although somewhat reduced, there were still considerable vibrations. So take care for it to be square and fit exactly into the inner walls of the mech housing.

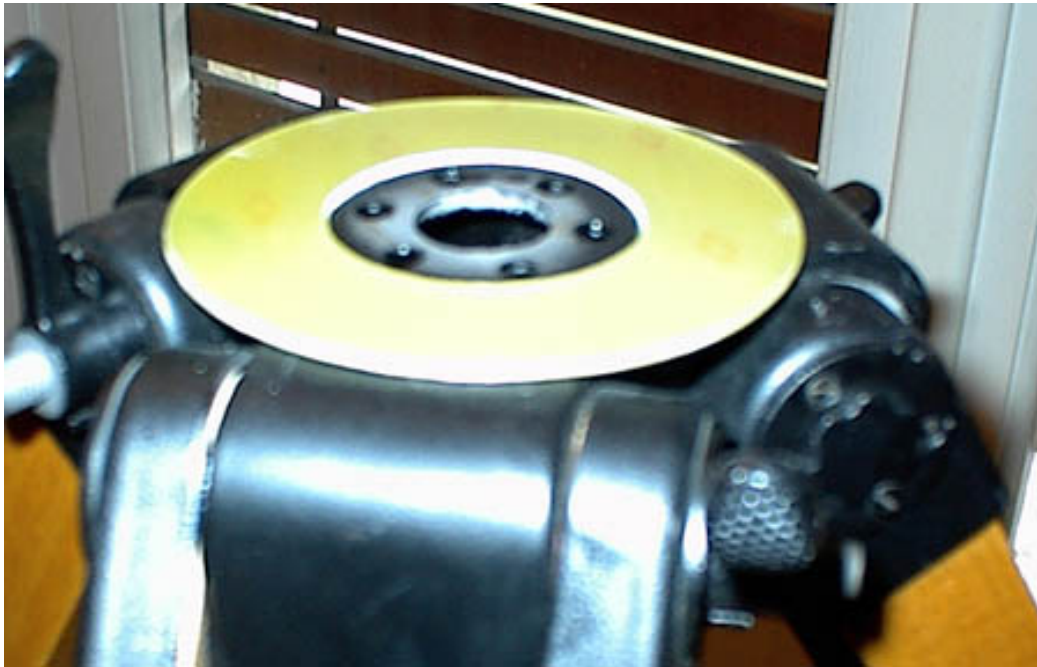
Don't be discouraged by the thickness of the shim. Don't forget it's rubber, thus able to be compressed. In my case it provides about 27 minutes of travel in RA, or 5 minutes' loss compared to the original 32. This is nothing when you consider that the scope is now usable, with vibrations significantly reduced in duration and amplitude.

If you don't get any significant improvement, try different types of rubber before quitting. I tried three different types of rubber and varying shapes, until I found this little natural latex rubber piece in my tools which gave the best result.

Whatever applies to the slow motion mechanism of the RA axis, applies to the slow-motion mechanism of the declination axis as well. In this case though, inserting a shim must be done by removing the spring housing and the declination shaft as access is very limited.

There have been other reasons suggested for the source of vibrations with this mount. Initially, like others, I thought the reason was poor matching of bearing surfaces on the RA axis, as moving the shaft up and down when in place (holding it by the large metal knob on its back), reveals significant play. However, this does not seem to affect the mount's stability, at least after the addition of the rubber shim. Another improvement

suggested has to do with the way the "cup" that the mount base sits in is mounted to the tripod head. This cup sits onto a boss located on the tripod head, only a few centimetres wide. It is suggested to shim the boss, increasing the bearing area. I have done this as well, cutting a shim from PCB (printed circuit board). This is made of fibrous epoxy and is quite hard but easy to cut with a hacksaw, like the ones scale modellers use. I guess other methods and materials could be utilised as well. To remove the cup, you will have to remove three screws located underneath the tripod head. Below is a picture of the shim, placed around the boss. Its outer diameter is the same as the cup. Its thickness is about 0,3 mm greater than the boss' height or so to say, they are almost level.



This did not seem to improve things very much by itself. However, it's almost certain that it further improves the stability when used with the rubber shim, or in cases when a heavier motorised mount sits on the top of the tripod. Finally, although the illustrated modifications require only limited engineering skills, I do not accept any responsibility for any damage you may do to your mount. Whatever you do, you do it at your own risk! Let me add though, that harming such a beefy mount is almost impossible, except perhaps for the small locking screws that are fairly easy to damage or lose.

For questions and feedback, you can contact me at vanos1@otenet.gr although it is suggested to use the Talscopes group so that other readers may benefit from what is written as well. Let me also thank fellow Talscopes group member and TAL-100R owner Phil Webber, for trial testing most of what is written here and his own suggestions about mount stability.

Vangelis Markopoulos