

Xephius's **Updated** Repair Guide To the ETX-70AT

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Preface:

A few years ago I purchased a used Meade ETX-70AT on eBay to give me a portable scope. It needed a little repair, so I cobbled together a document showing what I did incase someone else could use it. I am so grateful that I did, and that I included my e-mail address. I have been contacted by someone on every continent except Antarctica, and have discovered that this document has been translated into Spanish, French, Korean, Mandarin and German that I know of. I have had the good fortune of speaking with so many ETX-60/70/80 owners because of this guide and Mike's website, Thank you all.

Since that time I have purchases a couple of these units, including a brand new "floor" model that had the same popped through focuser rod. All said, this has proved to be one of my favorite little scopes. The very lightweight nature of the rig allows you to take it just about anyplace without any reservation. I am never really worried about the scope getting damaged (relatively low investment), it is very light, very easy to setup, and it all stores easily. While I have had much larger and more expensive scopes, including a great 80mm APO I regret to this day getting rid of, this has been among my favorites.

I recently picked up the photography bug again and thought I would attach my little ETX-70at to my Canon XSi (12mp) and see what I could get the little scope to do. After pulling the scope out and cleaning it up, I realized the scope has a lot of internal reflective surfaces. The baffles are all very nice, but they are all shinny plastic, the lenses are not blacked out, and the rear mirror assembly has lots of shinny chrome and edges. To make it have better internal contrast, I thought I would tune it up and have added that information to this document.

Most of the pictures below will show the disassembly, cleaning and modifications of the scope. The walk through it really designed to give you and idea how the unit comes apart and goes back together. All of the mechanisms inside the telescope are very easy to adjust, or repair.



Focuser Repair Note:

Let me begin by apologizing about the poor picture quality. I was using a digital camera on an old Sony Palm Pilot in a hotel room at the time. ☺ So on to the damage.



Ouch!!!

From what I can tell the scope must have been dropped on the objective lens shoving the focus shaft out of the OTA. The “step” in the rod broke out the plastic thus creating a situation where the

focuser would not function. In short, it punched a hole right out of the plastic back.

Focuser Operation:

The focuser on the ETX 60/70AT works by moving the objective lens in and out on a threaded shaft. The focusing rod has a step (the rod has a slightly smaller diameter at the end allowing it to fit through the hole only about 1 inch) on the end of the rod that stick out and the focusing knob is attached. When you turn the focus knob the step presses on the plastic inside the scope moving the objective lens away from the knob. Focusing in causes the knob to be pulled to towards the objective lens until it presses against the plastic outside the scope then pulling the lens in. The slop in the focuser is caused by the small gap between the knob, plastic, and step on the rod.



If you don't want to, or are not comfortable completely disassembling your scope but need to repair a focusing shaft pushed through the plastic, I recommend you use the 1/8 X 1 fender washer with one edge trimmed to fit the scope. The larger surface area will provide a better bond for the epoxy. This method only has a washer on the outside of the scope, while this will fix the problem, you do have a bit more slop in the focuser compared to the complete fix. If you wish to install a second washer on the inside of the scope, it will take a great deal of slop out of the focus and protect against another drop....



Notice the small washer glued over the hole on the left. It has been painted over a bit with flat black paint, but you can see here how it is attached.

Vertical Clutch Repair Notes:

I have had a few people contact me about the scope not locking into the up/down position using the locking hand wheel/nut on the right fork. So far, this has been due to three issues:

- 1) The clutch has grease/oil/contaminates on it
- 2) Spring compensator on the left fork is broken (only happened once)
- 3) Cracked Nut

This clutch works by squeezing a white nylon (I think) clutch disc and the drive gear between the scope-mounting arm on the OTA and the black plastic clutch disk-retaining ring. 99% of the time, a droopy scope can be fixed by taking the clutch assembly apart, cleaning it, sanding the clutch and gear mating surfaces and reassembling.



Horizontal Clutch Repair Notes:



This seems to be a slightly larger problem. And to be honest, I found a much easier way to adjust this on my last disassembly. This clutch works similarly to the vertical with a few extras. The large lever turns bolt that squeezes down on a 3-pronged washer that in turn puts pressure on the horizontal drive clutch. The adjustment of this bolt, and the breaking of the internal castle nut are the critical elements.

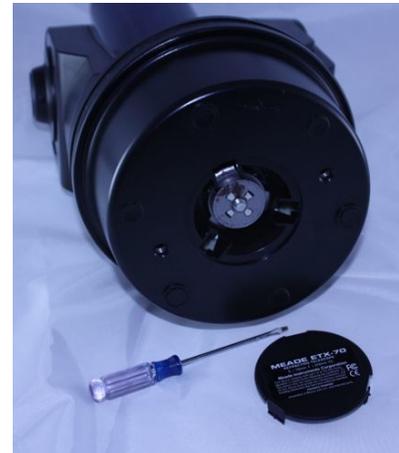


The key to getting this clutch to work right requires proper assembly and setup. First, remove the set screw that holds the chrome plastic lever onto the bolt. You can see the set screw by moving the lever to the right.



After removing the lever cap, flip over the scope and remove the bottom access cover. Remove the locking bolt and the clutch assembly will fall free leaving the white castle nut. Carefully remove the white plastic nut.

To reassemble, replace the bottom black base, gently working it around a little until the gears settle onto the drive worm-gear teeth. Then replace the white castle nut under the scope and insert the clutch assembly as show above. You will notice the bottom round "nut" sits inside the 4 raised ears. Tighten the white castle nut up hand tight, firm. Don't over torque it, just make sure it doesn't back out. Then reassemble the clutch in reverse order. Before you reattach the lever, adjust the clutch engagement point by tightening and loosening the bolt at the top. I suggest running the bolt up snug with the bottom access cover off. Use the lever as a wrench to adjust bolt until it locks the base when to the left and locks to the right. You will find the sweet spot after just a little playing with it.



NOTE: It is not necessary to remove the clutch assembly to tighten it. Just follow the last 4 lines of the above paragraph.

White Castle Nut Repair Notes:

If for some reason your ears are broken off, or sheared off we will need to repair the nut. As far as I know, Meade has "Stopped supporting" this product and has no more spare parts. I called to one of my scope in for repair and was told they no longer repair or have parts for this scope... So we have to fix the nut. There are several ways to do this.

- a) Find a replacement
- b) Make a replacement on a mill/late
- c) Drill 4 small holes where the ears were at, glue pins made from a paper clip into the holes to make new ears. There is plenty of clearance under the access door for this.

I don't have any photos' of the last idea, but I gave the idea to a gentleman in England and it seemed to work. He carefully drilled out the top of the nut, made new pins out of some wire and epoxied them in place. Just be sure that the round "nut" with the 4 holes slides easily up and down the new pins.

Flip-Mirror Repair Notes:

The flip mirror can be replaced with a little work. Remove the rear cell from the OTA, chip out the old mirror carefully. Buy a used, or get a small (but larger than the original) surface-reflecting mirror. Most Amateur Telescope Making supply companies will have this. We had a spare bit from another project and had it cut by a local glass guy. Glued right in. If you use regular mirror glass you will get double images in your scope!

Equipment:

To start find a sacrificial white towel to work on. This is an excellent surface to keep small screw from rolling around and dropped parts from bouncing off the hard tabletop.

Tools:

- Philips screwdrivers
- Allen wrench set
- Small standard (flat) screwdriver
- Side Cutters
- 600 Grit sandpaper
- Cotton balls
- Q-tips
- Mineral spirits
- White lithium grease
- Gloves
- Microfiber/lens cloth

Focuser Repair:

- 1/8 X 1 fender washer
- #6 flat cut washer
- Plastic-Fusion Epoxy glue

Tune Up

- Flat Black Model Paint
- Brush

Disassembly:



As a note to remember, the scope comes apart and goes back together very easily. If you find yourself having to put ANY force on the scope (other than where I make a note) you will probably break something. If you find it difficult to assemble, STOP, LOOK, then try again. If you are still stumped e-mail me and I will *try* to walk you through it. Forcing the plastic bits will only cause damage, and that sucks. Please read all the steps before you begin this.

- 1) Start by removing the focusing knob. It is held in place with a single set screw.
- 2) Gently pull on the objective lens assembly. The entire assembly should slide out as seen above. If the focuser rod was shoved out as mine was, it might take a little pressure to slide it out.
- 3) Remove the friction sleeve from inside the OTA. (Below the scope in picture above)



- 4) Flip the scope over and pop off the access plate in the middle of the drive base
- 5) On the top of the scope, remove the setscrew that holds the chrome plastic lever onto the horizontal clutch-locking bolt. You can see the setscrew by moving the lever to the right. After the

- setscrew is removed, loosen the clutch locking bolt. Keep your hand over the bottom of the clutch to catch it as you loosen the clutch-locking bolt from the top. Remove the clutch assembly and set it aside in a clean area.
- 6) Gently pull the base away from the scope; it will slide off the center shaft once cleared from the drive gear. Set the 2 nylon bushings aside if they slide off the central shaft.
 - 7) Remove the 3 large Phillips screws located opposite the drive motor. These screws hold the left (looking down on the scope with the objective lens pointing away from you) support arm in place.
 - 8) Remove the left locking nut on the outside of the support arm. It has the Meade star on it and a plate with numbers. It will spin off.
 - 9) Loosen the right locking bolt on the outside of the support arm. Once you begin to loosen this bolt the scope will begin to shift. Do not completely remove the nut yet.
 - 10) You should now have more than enough play to slide the left support out and set it aside. Finish removing the right nut and set it and the drive base aside.
 - 11) Remove the gear clutch plate and pressure bushing off the right side of the scope and set them aside.
 - 12) Remove the 2 Philips screws located under the mounting shaft on each side of the OTA.
 - 13) Remove the 4 Allen screws on the back of the OTA on either side of the eyepiece holder. (One screw is used to hold the finder scope in place, but remove it anyway)
 - 14) Slide the eyepiece holder assembly (black) off the OTA (blue) and set aside.
 - 15) OPTIONAL. Remove the 3 Philips screws from around the back of the OTA to slide the baffles out. Do this only if you want to cover them with flocking or do additional light dampening inside the tube.
 - 16) Take a #6 washer and make sure it stops on the step of the focusing shaft. Do the same with a fender washer.
 - 17) TEST FIT!! Put a #6 washer on the focuser shaft then slide it into its hole on the eyepiece holder. Make sure you have enough room to attach the focusing knob.
 - 18) TEST IT AGAIN!! Be sure you are fitting the correct hole. It should be the center hole (between 2 others) on the left side looking into the assembly.
 - 19) Epoxy the #6 washer inside the eyepiece holder assembly. Clean up any extra epoxy and let it dry.
 - 20) Apply a small amount of lithium grease to the washer.
 - 21) Follow steps in reverse order to replace the eyepiece holder.
 - 22) Apply a THIN layer of lithium grease to the inside of the friction sleeve. This will allow the focuser to move smoothly and have constant load from the grease. My focus performance is smooth and easy compared to a new ETX.
 - 23) Clean the old grease off the threads on the focuser shaft with mineral spirits, dry and apply a thin layer of lithium grease. IMPORTANT, run the shaft in and out several times and remove any extra grease as you don't want it falling in and hitting the objective lens.
 - 24) Match the friction sleeve to the objective lens assembly. You will notice a guide notch only allows it to fit in one position. Make sure the collar on the sleeve is facing towards lens.
 - 25) With the collar held about half way on the lens assembly line up the notch on the outside of the friction sleeve with the hole on the OTA. Slide assembly together.
 - 26) You will need to press the friction ring into the OTA making the little notch pop into the hole on the OTA before you push the lens down into position.



27) Slide the objective lens all the way down the OTA. You might need to wiggle the lens a bit to get the shaft to come out the back of the eyepiece holder assembly.



28) Here we have a couple of options. You can use another #6 washer on the outside of the assembly to remove the slope in the focuser. I found that the #6 was too thin and wanted a thicker washer. I found a 1/8" X 1 fender washer was the perfect thickness but was a bit too large. I cut one side down with a pair of side cutters and sanded it smooth. This also provides another layer of protection from the shaft being shoved out again. Test fit the outside washer with the knob attached before you epoxy it in place. When you are ready to glue, just slide the lens back a little bit to pull the shaft inside the OTA. Once dried slide the lens back, guide the shaft through the hole and attach the focusing knob. Set the OTA aside.



29) CLEAN CLEAN CLEAN!! Next carefully remove all the old grease from the scope and support braces. Use the mineral spirits and cotton balls to clean them up nice, then dry it completely

30) Sand both sides of the white nylon clutch bushing. Make sure it is free from grease. Apply a small amount of lithium grease to the teeth of the OTA gear then slide it onto the right OTA shaft followed by the clutch plate and black plastic bushing. The bushing has a guide notch and only fits in one way. Apply a small amount of grease to the outside of the bushing. Only the areas pointed to in red above should have any grease on them, this is very important if you want your scope to track accurately.



31) Apply a small amount of grease to the worm gear inside the right support brace, and then replace the cover plate and 5 screws.



32) Remove the bushing on the left riser brace, clean it, and reapply new lithium grease. Make note of the 3 plastic pins that match up to the holes on the left side of the OTA.

33) Replace the OTA into the right fork, loosely threading on the right large plastic bolt to hold the OTA in place. Take note to align the left side brace properly to the OTA. The pins (circled in red) on the left bushing must line up with the holes on the OTA if the stops are going to work properly. Rotate the left brace into its original position and replace the left locking bolt snugly. Snug up the right nut, and then replace the 3 large screws that hold the left brace in place from below the scope base. Set upper assembly aside.



34) Pick up the lower base, remove the 3 screws holding the large gear and clutch plate in place.

35) Sand both sides of the clutch plate and degrease the drive gear. Reassemble and apply grease only to the outside teeth.



36) Apply a small amount of grease to the worm gear under the base. Apply a small amount of grease to the metal shaft, and then replace one of the nylon bushings.

37) Carefully slide the lower base into the upper assembly. Be careful to make sure the lower drive assembly is all the way back. It is spring loaded to keep it engaged to the large gear. I angled the base slightly towards the drive assembly and wiggled the base down without any force. It might take a couple tries, but DON'T FORCE IT, it will break, and you will be in real trouble. Once in place insert the lower nylon bushing, it will wiggle into place.



38) To reassemble, replace the bottom black base, gently working it around a little until the gears settle onto the drive worm-gear teeth. Then replace the white castle nut under the scope and insert the clutch assembly as show above. You will notice the bottom round "nut" sits inside the 4 raised ears. Tighten the white castle nut up hand tight, firm. Don't over torque it, just make sure it doesn't back out. Then reassemble the clutch in reverse order. Before you reattach the lever, adjust the clutch engagement point by

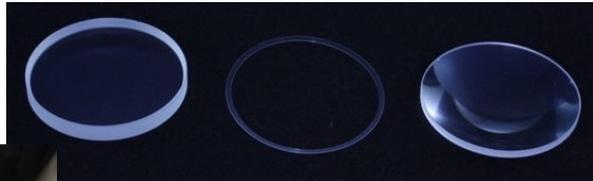
tightening and loosening the bolt at the top. I suggest running the bolt up snug with the bottom access cover off. Use the lever as a wrench to adjust bolt until it locks the base when to the left and locks to the right. You will find the sweet spot after just a little playing with it.

NOTE: It is not necessary to remove the clutch assembly to tighten it. Just follow the last 4 lines of the above paragraph.

- 39) Plug in your Autostar and give the scope a give your scope a new slew test drive. I found mine moved much smother than the unmodified new 70AT I tested against.

Optical Tune-up and Astrophotography Prep:

I plan to use this as a “Fast Wide-field” digital lens. I will probably shoot mostly in IR, but that will come later. For now, I need to reduce the internal reflections and get the

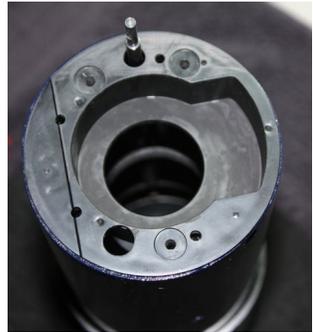
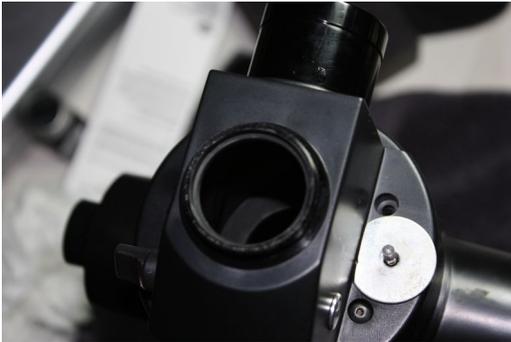


mount stable and ready for use. For now, I will outline what I have done and why. This is based on my latest readings of forums, magazines and journals. I don't claim to be an optical engineer, I am just using logic and coping what the higher end scopes are doing.

The two things that make the biggest difference in the scope is A) Sanding/mattting the surfaces and B) Blacking out the lens edges. I started by sanding every surface inside the scope that saw light. Everything is shiny black plastic, so

this cut down a lot of bouncing light. Next I used Testors Flat Black model paint to paint the edge of all the baffles and any reflections inside the flip mirror chamber. Finally, I used the black paint to carefully edge the lens. The result: A noticeably higher performing scope when it comes to internal contrast. You can really see it using a light source in a dark room when comparing two scopes side by side. Also, after taking a picture of the parts with the flash, I was able to see areas of less sanding and toughed it up. It looked almost uniform to the naked eye but the flash really caught the plastics natural reflective nature. Below is a photo-essay on what I did to my scope.





Closing:

If for whatever reason you have any questions about the process described above, please feel free to email me. I will do my best to help answer any questions you have. Next I will be preparing a guide to using the ETX-60/70/80 as a fast wide field digital lens for DSLR photography. With the drop in price of these scopes and DSLR's, there is a great opportunity for an inexpensive guided wide field lens. I will show how I have modified the mount, tripod and scope to better meet these needs.

Thanks for reading this, and if you have found this useful drop me a line so I know my rambling have not fallen on deaf ears. Thanks!

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