400GTO Lubrication Guide

Lubrication Guidelines for the following equatorial mounting:

400GTO Servo with GTOCP2 or CP3 Controller

For other 400 models please review other postings as they become available.

The bearing surfaces engaged in manual rotation of the mount are not always the same as those used in motorized rotation. Manual movement is where the stiffening of rotation is normally first found. These instructions however cover all the plane bearing surfaces for both manual and motor rotation. This guide covers all parts of the mount that can be accessed for re-lubrication. Ball bearings on the mount are sealed and require no lubrication. It is best to do the full lubrication job at one time.

Lubrication of the 400 requires that the worms of both axes be removed from the worm wheels and that bearing pre-load rings be removed. If you do not feel comfortable meshing the gears or setting the bearing pre-loads after reviewing these instructions, the mount can be sent back to Astro-Physics after consultation with customer service. If the mount is returned, a return authorization number must be obtained.

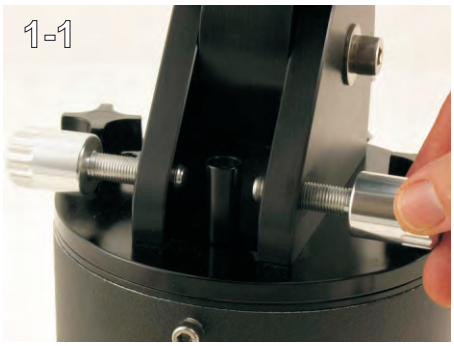
Helpful web sites:
Please note that if your 400 mount has the encoder option, their removal is not detailed in this guide. See the following document, pages 12 and 13 for information on these components. http://www.astro-physics.com/tech_support/mounts/400-GTOCP2.pdf You will also find it useful to review the backlash removal guidelines as they will be used in the lubrication procedure. http://www.astro-physics.com/tech_support/mounts/400gto/400backlash.htm

To perform these operations you will need to do and acquire the following:

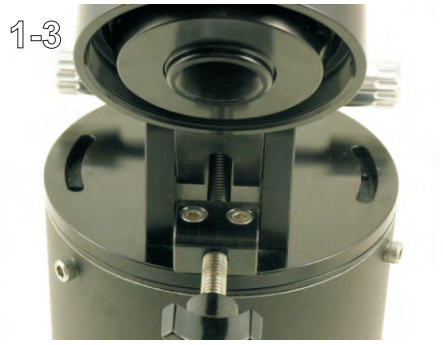
Attach the mount to a tripod or pedestal.
Remove the cradle plate from the declination axis.

Lubriplate No.105 Motor assembly grease (obtained at automotive supply stores)
5/16 inch hex key.
3/16 inch ball end hex key, sleeved or taped
1/16 inch hex key
3/32 inch hex key
9/64 inch flat end hex key
5/64 inch hex key
Rags and paper towels.
Light degreasing agent if needed like “simple green” etc. (obtained at Menards, Home Depot)
Small artists paint brush

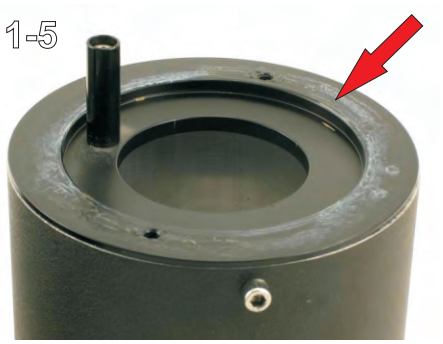
POLAR FORK COMPONENTS



Back both azimuth screws out and clear of the azimuth pin. (1-1)

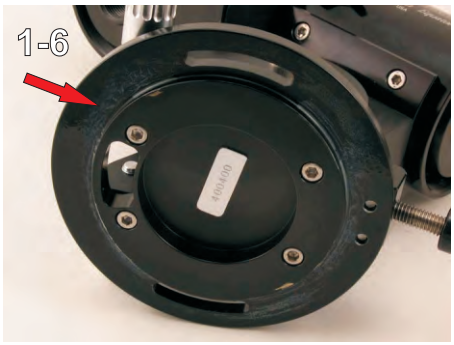


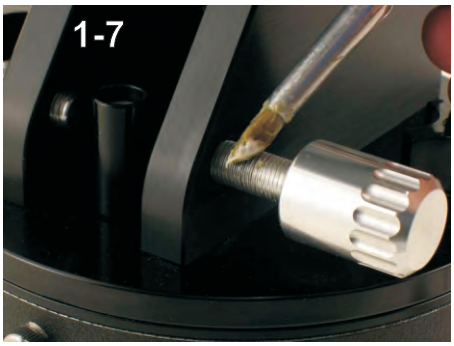
Remove the azimuth lock knobs from both sides. (1-2, 1-3)



Pull the mount and polar fork assembly directly up from the base, clearing the pin. (1-4)

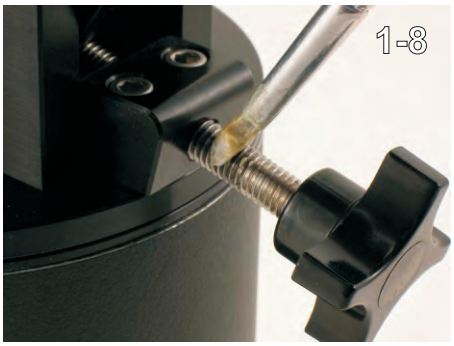
Clean both surfaces of the azimuth bearing. Lubricate with Lubriplate No. 105 or lithium grease. (1-5-1-6)





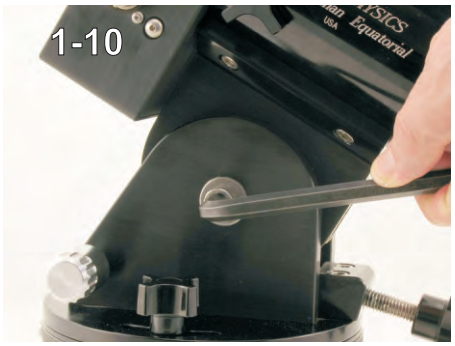
Reassemble the azimuth bearing.

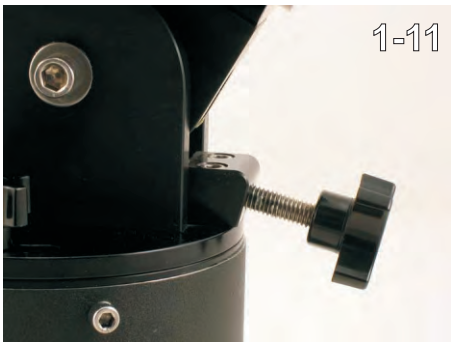
Lubricate the threads of the azimuth screws before rotating them back in. (1-7)



Back out the altitude rod to grease its travel surface in the altitude block. (1-8)

You can also lube the tip of the rod now or later if the altitude bearings are to be lubricated. (1-9)

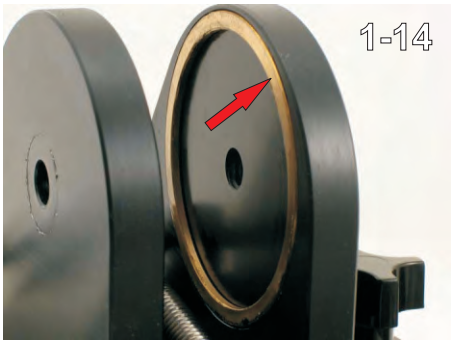


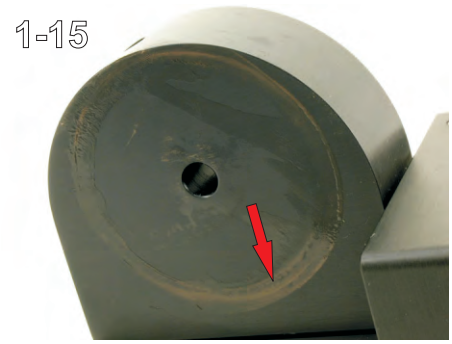


To expose the altitude bearing, use a 5/16th inch hex key to release and remove the center pivot socket head cap screw. (SHCS) (1-10)

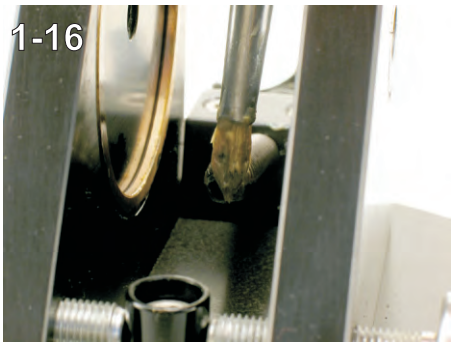
Have the altitude screw set to approximately 40 degrees. It will help support the mount once the pivot screw has been removed. (1-11)

Grab the mount firmly with the clutch knobs engaged and lift it straight up out of the forks. (1-12, 1-13)





Clean and lubricate the bearing rings and the surface they engage on the center plate. (1-14, 1-15)



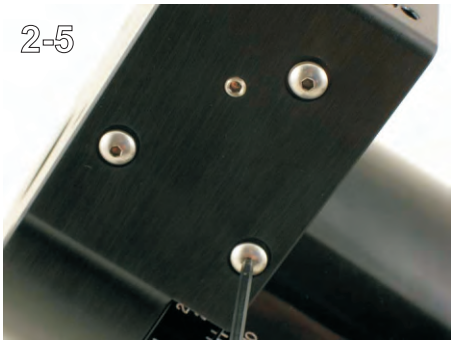
Lubricate the tip of the altitude rod if not already done as well as the pocket it rotates in. (1-16, 1-17)

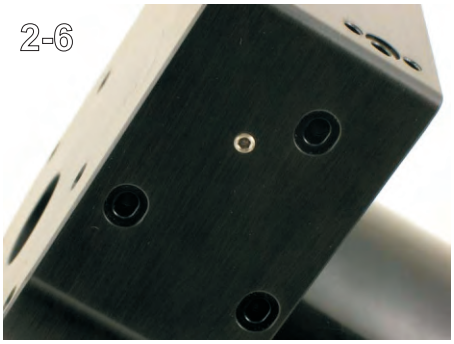
Place the mount back in the forks. It will meet the altitude rod at some point which will help you to support the weight. Line up the holes and insert the SHCS. (1-18, 1-19)

RIGHT ASCENSION HOUSING

At any time and to make servicing the right-ascension axis easier, you can remove the declination housing. Use a 3/16 inch long arm hex key with a ball end. Sleeve the wrench with a plastic tube or tape to avoid marring the housing. (2-1, 2-2)

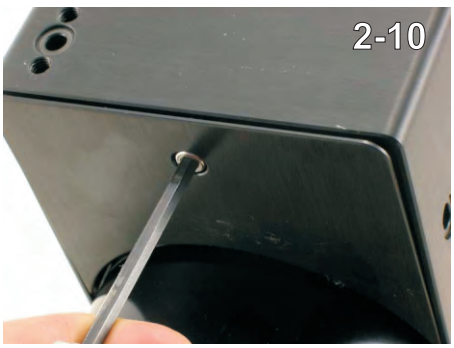
Start the right-ascension housing disassembly with the removal of the three push pull screws. Use a 3/32 hex key. (2-3, 2-4)





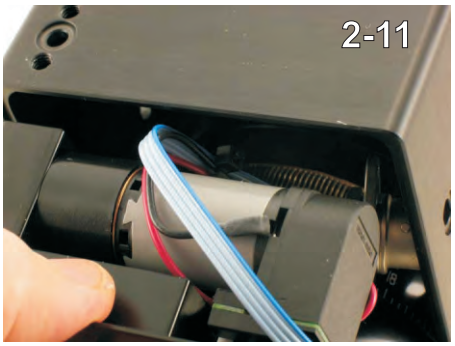
You must also remove the five button head screws retaining the worm drive. Three are on one side of the housing (2-5, 2-6) and the other two are on the opposite side near the plug receptacle. (2-7)

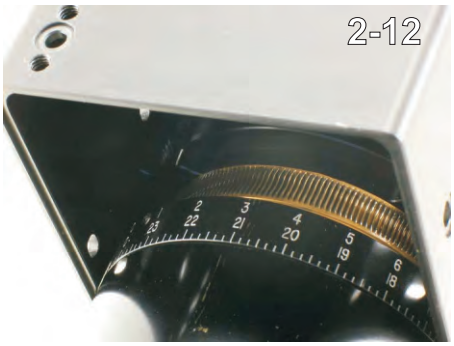
Remove the two button head screws retaining the receptacle. Use a 1/16 inch hex key. (2-8)



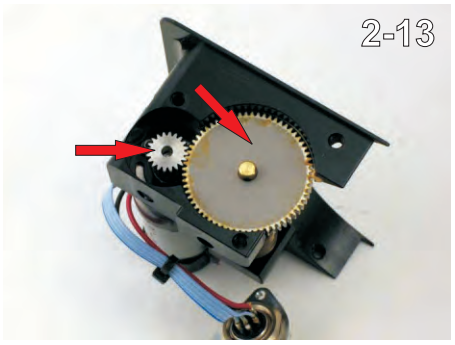
Push the receptacle into the housing. (2-9)

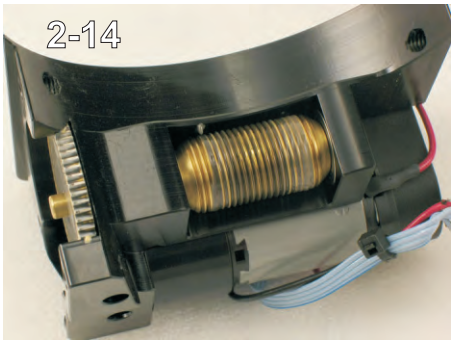
Use a regular 9/64 flat end hex key to loosen the worm drive assembly. Pull out, while lifting up, to remove the worm drive. (2-10)





Remove the worm drive assembly completely from the right-ascension housing. (2-11, 2-12)

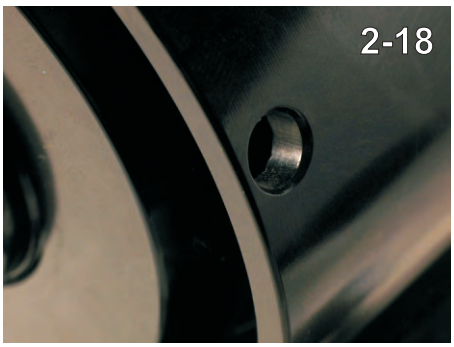




The two spur gears can be cleaned and greased. (2-13)

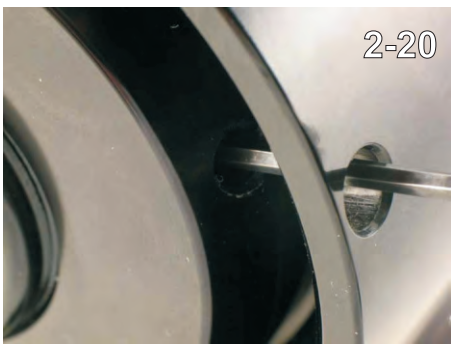
The worm can be cleaned, but greasing is not really needed as it will pick up its grease from the worm wheel. (2-14)

Remove both clutch knobs. There is a Delrin plug between the knob and the worm wheel gear it mates with. It can stick to the knob as it comes out or may hang up inside. It can usually be captured by touching the tip of the knob to it. (2-15, 2-16, 2-17)



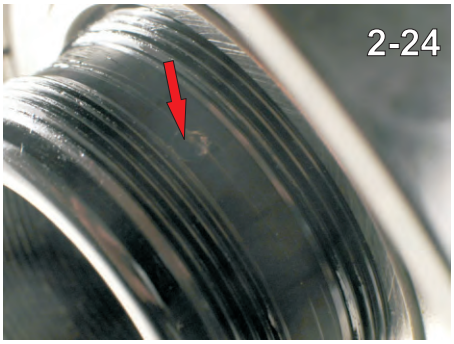
The right-ascension end shaft knob has to be removed next. A hole is provided in the housing to allow access to the set screws in the knob. (2-18)

Before releasing the screws, rotate the shaft by hand so that you can feel the dampened resistance that was set at Astro-Physics. You will need to reset the mount to this same feel later.



Using a 5/64 inch hex key, back off all three of the set screws in the knob rotating the axis to line the screw hole up with access hole. (2-19, 2-20) You must rotate the screws several rotations. Please see 2-24 and 2-25 on the next page for why this is important.

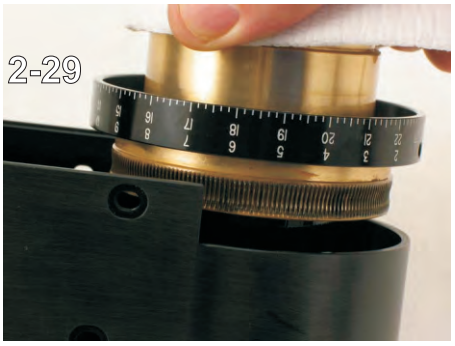
With the screws backed off sufficiently, completely remove the knob. (2-21, 2-22)

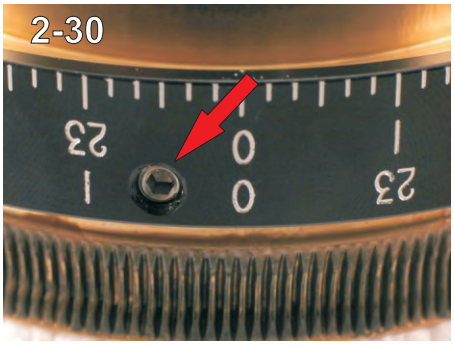


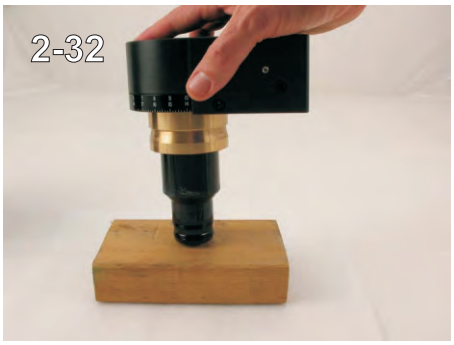
With the knob removed, it is now possible to see that the three set screws have brass tips. They make contact with a groove cut into the shaft in the thread zone. This prevents thread damage when the screw is tightened down. If not backed off sufficiently, they will remain trapped in the grove preventing removal of the knob. (2-23, 2-24, 2-25)

Grab the end of the shaft assembly and pull the shaft and worm wheel straight out of the housing. (2-26, 2-27, 2-28)

The worm wheel acts as a plain bearing for the shaft in manual movement of the mount and needs to be removed for cleaning and greasing. You must remove the gear by grabbing it directly. Do not lift by the R. A. setting circle as the grease suction between the gear and shaft is stronger than the spring and ball (2-31) that holds the circle in place under the set screw seen in 2-30. (2-29)

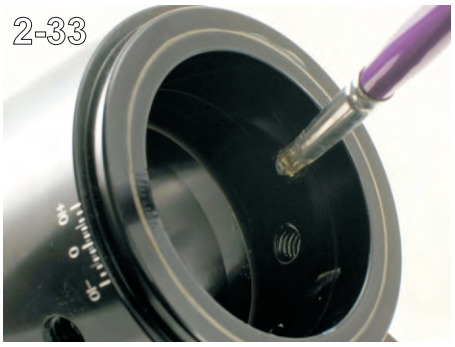


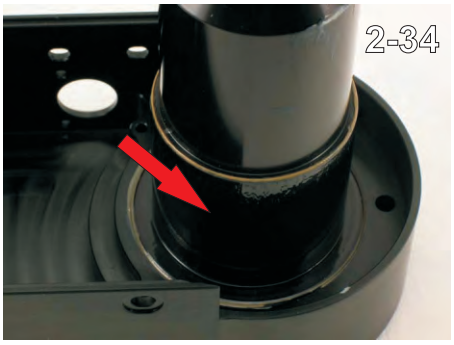




Spring and ball that are behind the set screw in the R. A. circle. (2-31)

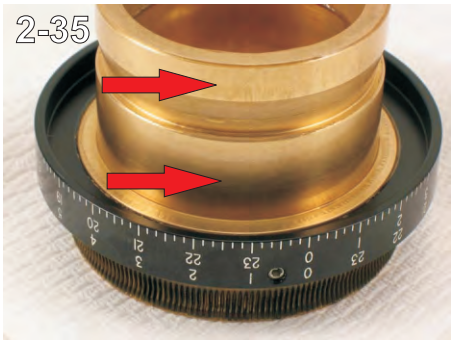
If you cannot get the gear free by pulling then give gravity a try. Invert the assembly and rap it against a piece of wood on a solid table or the floor. (2-32)



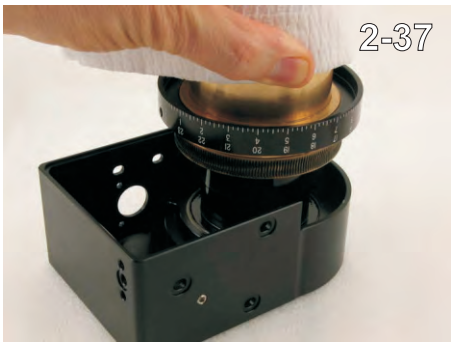


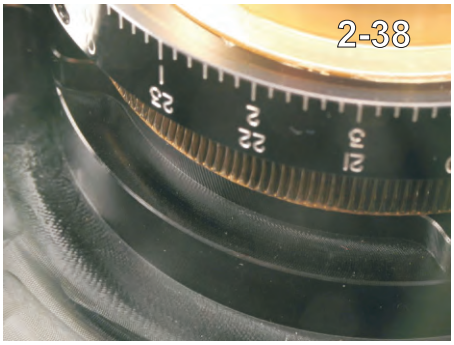
Clean and grease the inside diameter of the housing. (2-33)

Clean and grease the shaft bearing surface. (2-34)

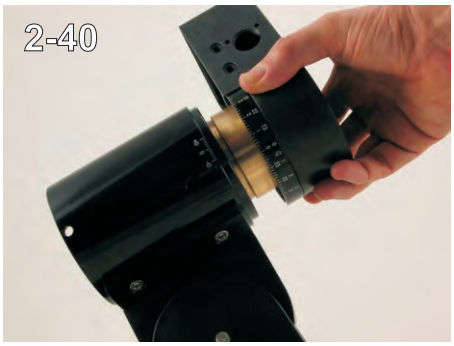


Clean and grease the outer bearing surfaces of the gear as well as the inside and face. The teeth can also be re-lubricated with Lubriplate No. 105. (2-35, 2-36)

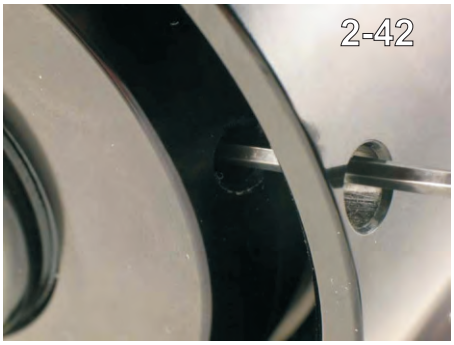




Place the worm wheel back on the shaft and push it all the way down to a firm stop. Rotate several times to distribute the grease and confirm that it is down. (2-37, 2-38)

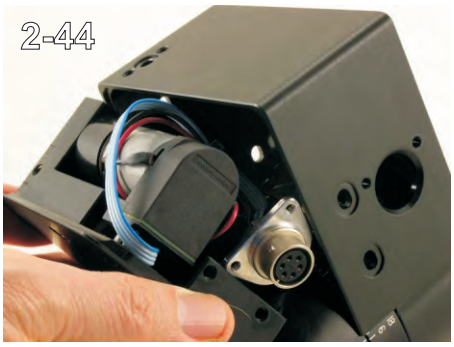


Place the shaft assembly back into the housing. Make as certain you can that the gear enters squarely with the housing or it will seize up or lock instead of going in. (2-39, 2-40)



Rotate the shaft end cap until it comes to a stop and then back it off approximately 5 degrees.(2-41)

Rotate the shaft to allow alignment with the access hole. Tighten the set screw lightly. (2-42)

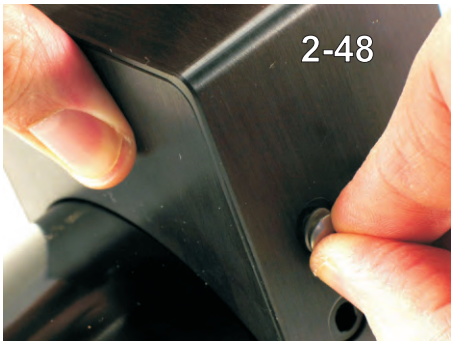


Continue to rotate the shaft until all three screws have been engaged.(2-43)

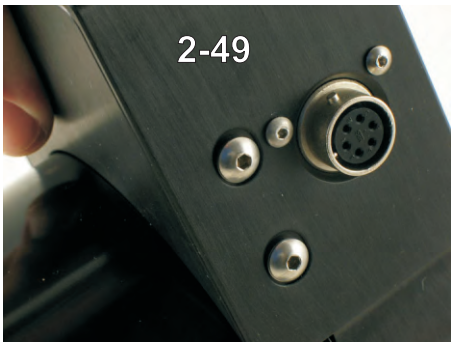
Rotate the shaft to feel how much resistance is present. If equal to the original setting, (that you will remember from when you took it apart in 2-18) then equally tighten all three screws.

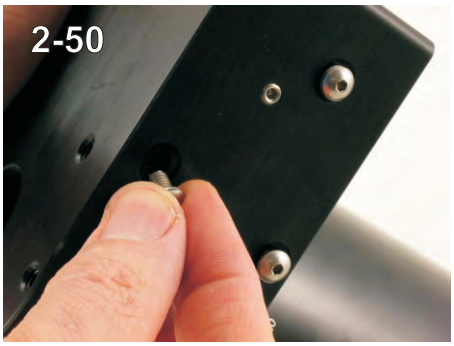
Place the worm drive into the housing, taking care to not pinch or snag the wiring harness. (2-44)

Capture the receptacle with a needle nose pliers and finish closing the gap of the housing. It is helpful to have assistance at this stage in the form of a extra pair of hands. (2-45, 2-46)

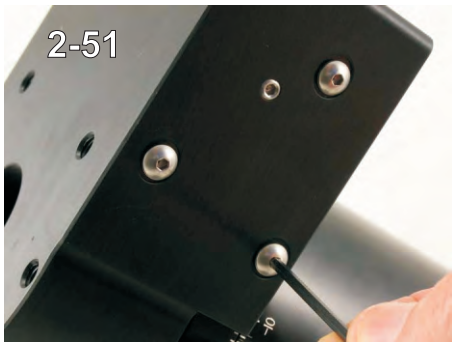


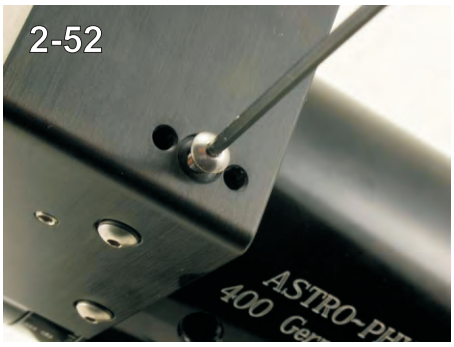
Rotate the receptacle to line it up with the two screw holes and fasten with the two button head screws. (2-47, 2-49)





With pressure applied to the worm drive assembly, insert and lightly tighten the five drive retaining screws. (2-48,2-49, 2-50, 2-51))



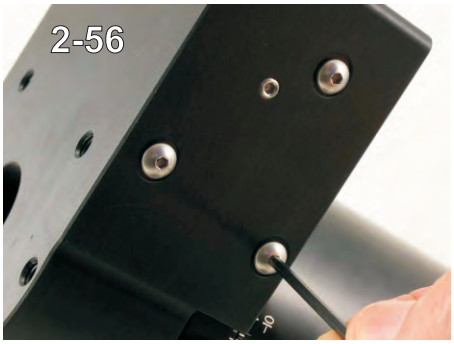


With the housing retaining screws still lightly engaged, insert the center screw of the push-pull arrangement. (2-52)

Next insert the two long set screws. (2-53) You will adjust the position of the screws to remove the backlash a little later.

Return and tighten the two clutch knobs. Make certain that the Delrin tip is still in front of the knob. (2-54, 2-55)

Take hold of the motor housing and make back and forth rotation motions of the R.A. axis. You will find either that the worm mesh is too tight, no backlash or too loose, backlash present. If you have no backlash then adjust the pull (center screw) and push (outer set screws) screw arrangement until you have some. (2-53)

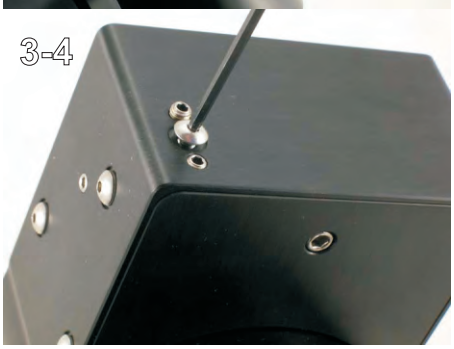


NOTE: Go to www. astro-physics.com and review the document “400GTO-Adjustments to Remove Worm Gear Backlash” in the Technical Support section. This will provide you with the basics of the worm engagement procedure.

Tighten up the 5 housing retaining screws to preserve your worm adjustment setting. Be aware that a small change may occur when doing this. Tighten evenly. (2-56)

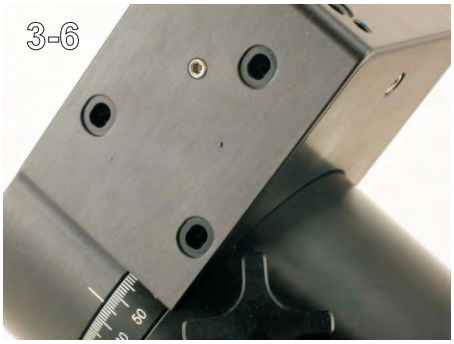
DECLINATION HOUSING

Return the declination housing to the RA housing for continuation of servicing, or you can remove the declination housing and work on it separately if you wish. Use a 3/16 inch long arm hex key with a ball end. Sleeve the wrench with a plastic tube or tape to avoid marring the housing. (3-1, 3-2, 3-3)



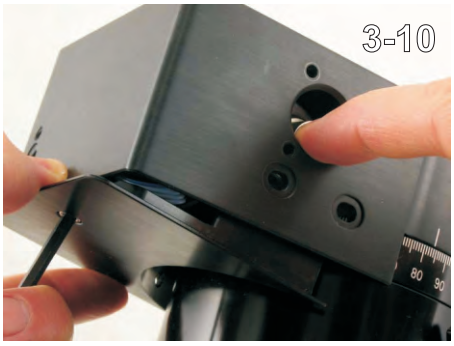
NOTE: If for some reason you are only working on the declination axis, please review the R. A. portion of this manual before proceeding. Many of the procedures are the same and are covered in more detail.

Remove the three push-pull screws. (3-4) Use a 3/32 inch hex key.

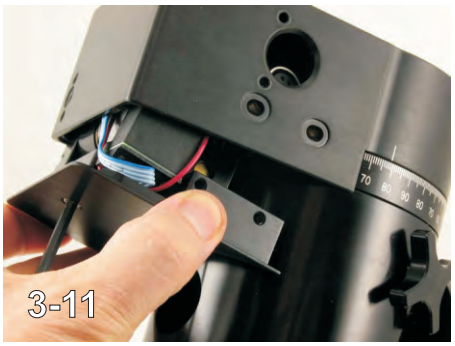


Remove the five worm drive retaining screws from each side of the mount. (3-5, 3-6, 3-7) Use a 3/32 inch hex key.

Remove the two screws retaining the receptacle. (3-8)



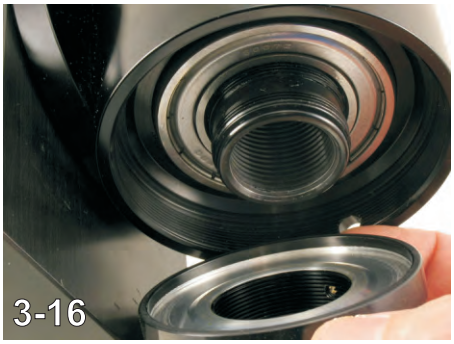
Use a flat end 9/64th hex key to break the worm drive free. Push in the receptacle to free the harness. (3-10)



Remove the worm drive from the declination housing. (3-11, 3-12)

Remove both clutch knobs. (3-13) See also images 2-16 and 2-17.

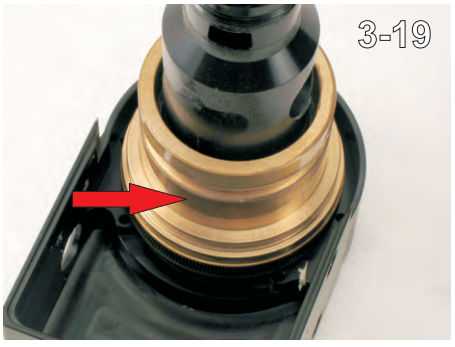
Rotate the declination shaft to align the screw holes with the access hole. Back off the three screws with enough turns to clear the threads. (3-14) Also see images 2-23 to 2-25.



Remove the shaft end cap. (3-15, 3-16)

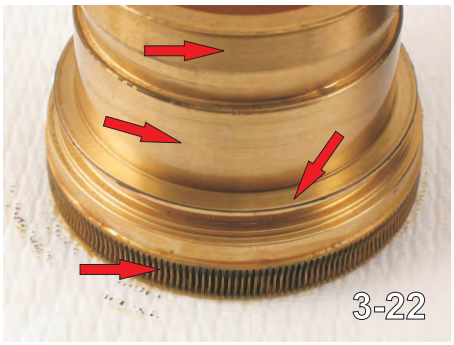
Pull the declination shaft from the declination housing. (3-17)

Clean and grease the plain bearing of the declination housing. (3-18)



Pull the declination worm wheel from the shaft. If the gear will not pull off then use the gravity method detailed in image 2-32. (3-19)

Clean and grease the plain bearing of the worm shaft. (3-20)



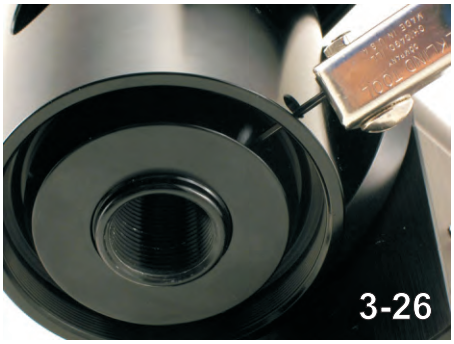
Clean and grease the inside plain bearing of the worm wheel. (3-21)

Clean and grease the outside plain bearings of the worm wheel, as well as the gear teeth. (3-22)

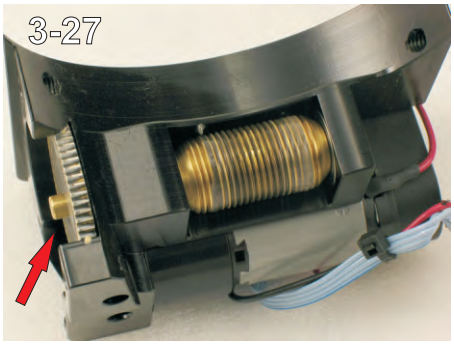
Place the shaft assembly back into the housing. Be sure that the gear enters squarely with the housing, or it will seize up or lock instead of going in. (3-23, 3-24)

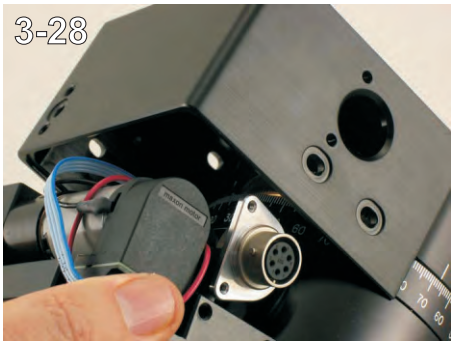
Rotate the shaft end cap until it comes to a stop and then back it off approx 5 degrees.(3-25)

Rotate the shaft to allow alignment with the access hole. Tighten the set screw lightly. Continue to rotate the shaft until all three screws have been engaged. (3-26)
Rotate the shaft to feel how much resistance is present. If equal to the original setting, then equally tighten all three screws.



The two spur gears can be cleaned and greased. The worm can be cleaned; but greasing is not really needed, as it will pick up its grease from the worm wheel. (3-27)



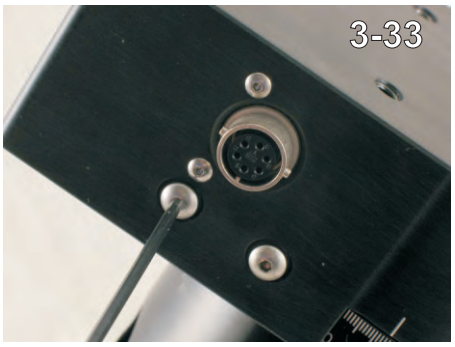


Place the worm drive into the housing. Take care to not pinch or snag the wiring harness. (3-29)

Capture the receptacle with needle nose pliers and finish closing the gap of the housing. It is helpful to have assistance at this stage to keep the receptacle aligned with the screw holes. (3-30)
Rotate the receptacle to line it up with the two screw holes and fasten with the two button-head screws.

With pressure applied to the worm drive assembly, insert and lightly tighten the five drive-retaining screws. (3-31,3-32, 3-33)

With the housing retaining screws still lightly engaged, insert the center screw of the push-pull arrangement. (3-34)



Next insert the two long set screws. You will adjust the position of the screws to remove backlash a little later.
(3-35)

Return and tighten the two clutch knobs making certain that the Delrin tip is still in front of the knob. (3-36)

Take hold of the motor housing and make back and forth rotation motions of the Dec. axis. You will find either that the worm mesh is too tight, no backlash or too loose, backlash present. If you have no backlash then adjust the pull (center screw) and push (outer set screws) screw arrangement until you have some.

NOTE: Go to www. astro-physics.com and review the document “400GTO-Adjustments to Remove Worm Gear Backlash” in the Technical Support section. This will provide you with the basics of the worm engagement procedure.

Tighten up the 5 housing retaining screws to preserve your worm adjustment setting. Be aware that a small change may occur when doing this. Tighten evenly. (3-32,3-33)