Astro-Physics Inc.
400QMD Lubrication/Maintenance Guide

The following guidelines should be followed to lubricate the three main parts of the 400QMD mount. The QMD stands for Quartz Micro-Drive controller. This guide can also be used for the 400 mount that had an earlier controller, the Quartz Controller. The guide is broken into three main sections; the right ascension axis, declination axis and polar forks. Although you can work on any part at any time, it would be best to rework the entire mount at one time and not have to worry about it again for many years.

Besides greasing information, additional maintenance data is provided with this document. Motor replacement adjustments, clutch assembly adjustments and encoder removal are also addressed.

Lubrication of the 400QMD mount requires that the worm of the right ascension and declination axes be removed from the worm wheel and that the 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:

If you no longer have your original mount instructions or just wish to review some of the original materials you can find them with the following shortcut:
http://www.astro-physics.com/tech_support/previous/400_mounts/400QMD.pdf

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

Separate the declination housing from the right ascension housing.
Remove the right ascension housing from the polar forks.

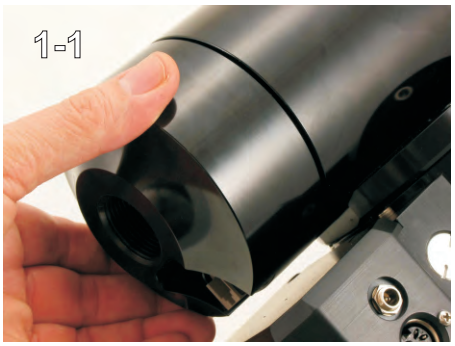
Lubriplate No.105 motor assembly grease (available at automotive supply stores)
De-greasing agent like “Simple Green”
Small artists paint brush

1/16 inch hex key	5/16 hex key	5/64 hex key
3/32 inch hex key	5/32 hex key	7/64 hex key
3/16 long arm hex key	3/16 hex key (modified per guide image 2-1, page 3)	

Only if motor is to be removed: 5/32 hex key (modified per guide image 2-73, page 10)

May 25, 2010

ENCODER HOUSING REMOVAL:



Declination Axis

If the mount is equipped with digital setting circles, unscrew the encoder housing. Pull the housing free if it still remains attached after being unscrewed. (1-1, 1-2))

Unscrew the encoder disk. (1-3)

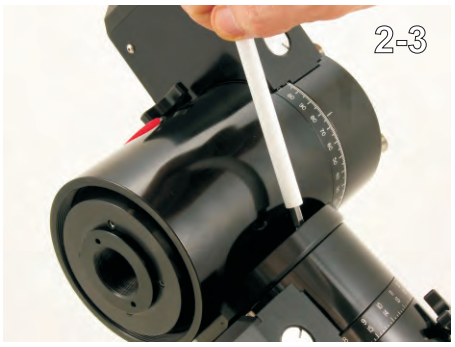
Right Ascension Axis

Unscrew the encoder housing. Pull the housing free if it still remains attached after being unscrewed.
(1-4, 1-5)

Unscrew the encoder disk. (1-6)

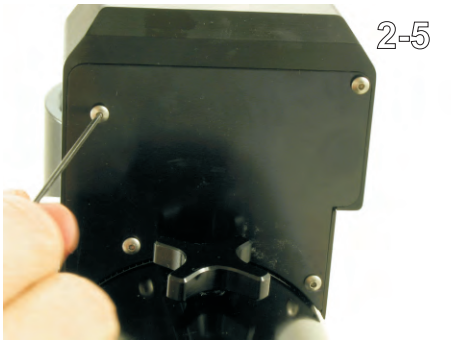
RIGHT ASCENSION AXIS:

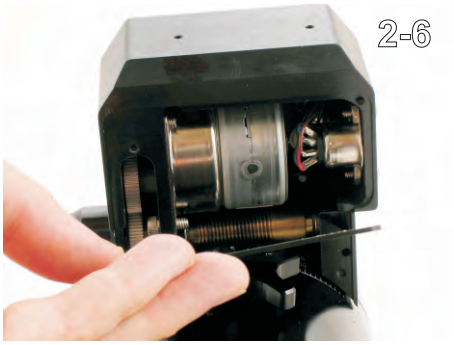
To service the right ascension axis you will need to remove the declination axis. Do this with a 3/16 inch hex key. This key must be modified to prevent damage to the mount surface. Reduce the length to an overall 5/8 inch. You may need to apply some hammer force. (2-1, 2-2)



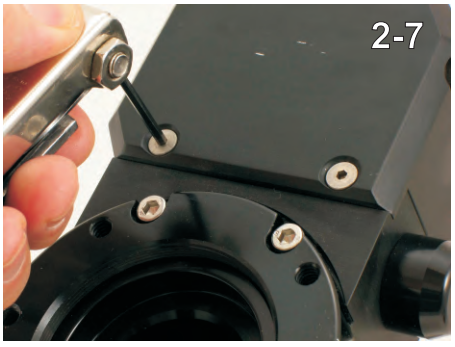
Once the screw is free to rotate, use a standard 3/16 inch long arm ball end hex key to remove it. Sleeve or tape the key to prevent scratching the housing. (2-3)

Remove the declination axis. (2-4)

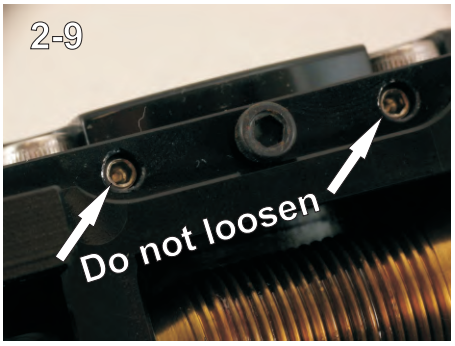


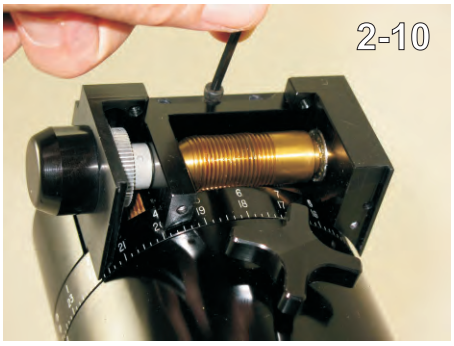


Remove the motor housing cover. Use a 1/16 inch hex key. If the cover will not come free form a paper clip to act as a hook. Slip it under the plate near the setting circle and pull out. (2-5, 2-6)



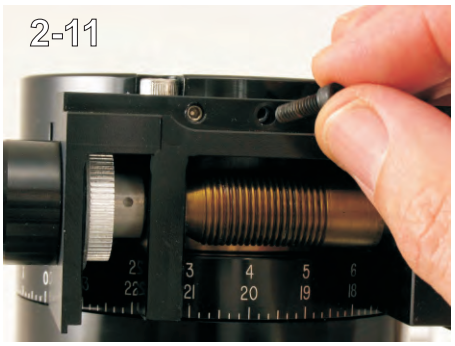
Remove the motor housing. Two flat head screws require a 3/32 inch hex key. (2-7, 2-8)

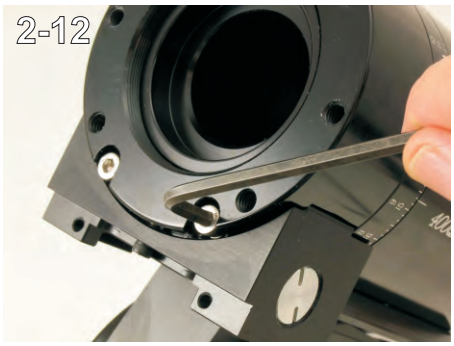




Start removing the worm box by unscrewing the black center screw. (2-10)

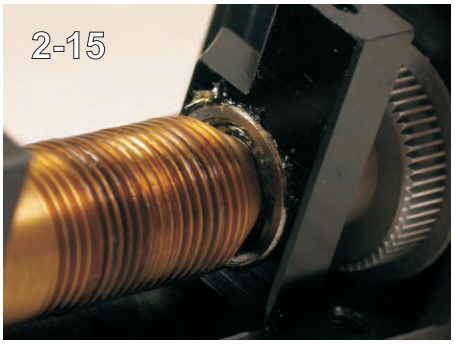
DO NOT touch the two recessed set screws on either side of the black cap screw. (2-9) If these are left alone the worm mesh distance should be easily reestablished upon reassembly.

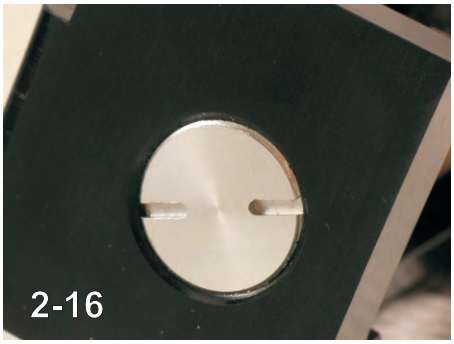




Finish the worm housing removal by pulling out the black center screw and loosening the two screws in image 2-12 enough to pull the housing away. (2-11, 2-12, 2-13)

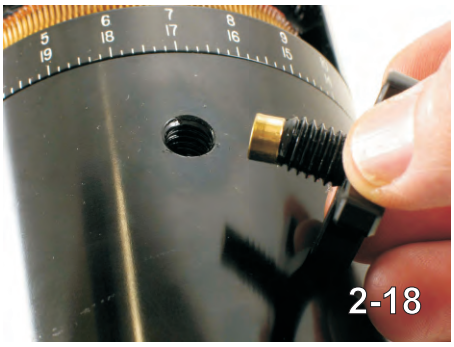
Clean the worm if required but use only a soft cloth and tooth brush. (2-14)





Check the worm bearings and apply some Lubriplate No. 105 grease with a tooth pick. (2-15)

<u>For information only:</u>
The bearings are pre-loaded with the special ‘nut’ seen in 2-16. There is no need to touch this unless the worm is able to move back and forth within the bearings.



Remove the right ascension clutch knob. (2-17)

Be aware that a brass plug is under the knob and should be retrieved upon removal before it falls away. (2-18)

Remove the polar scope adapter ring. (1-19)

Start the removal of the shaft pre-load ring by first loosening the four set screws. No need to remove. Use a 5/64 inch hex key.

Unscrew the ring as you would a hex nut on a screw and remove. (2-21, 2-22)

Pull the right ascension shaft and worm wheel/setting circle assembly out of the housing. Grab and pull on setting circle. Once up, reach underneath the setting circle to pull the assembly out.
(2-23, 2-24)

Release the worm wheel gear from the shaft by tapping the assembly against a block of wood. (2-25, 2-26)

Remove all old grease from the shaft and apply a new coating of Lubriplate No 105. (2-27, 2-28)

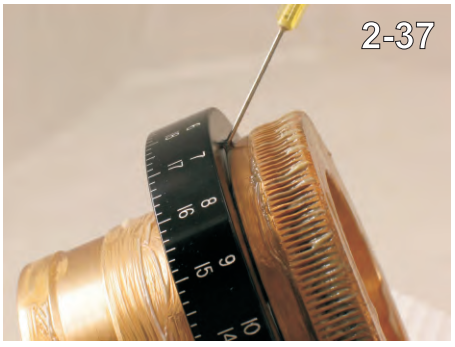
Free the plain bearing from the housing. A razor etc. may be needed to break it free.
(2-29)

Clean the bearing, bearing seat and apply new grease. (2-30)

Apply new Lubriplate No. 105 to the bearing on both sides and remount. (2-31, 2-32)

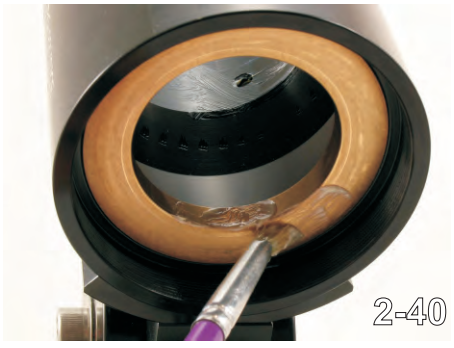
Clean the inside of the housing on both ends and apply new grease. (2-33)

Clean the worm wheel and apply new grease to bearing surfaces inside and out. Also coat all the teeth. (2-34, 2-35, 2-36)

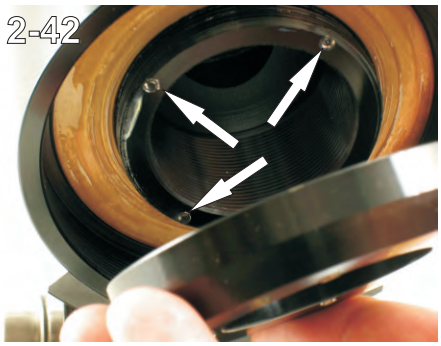


There is no need to remove the setting circle but put a drop or two of 10W-30 weight oil to ease rotation if needed. (2-37)

Put the worm wheel back in place and rotate a few times. (2-38, 2-39)

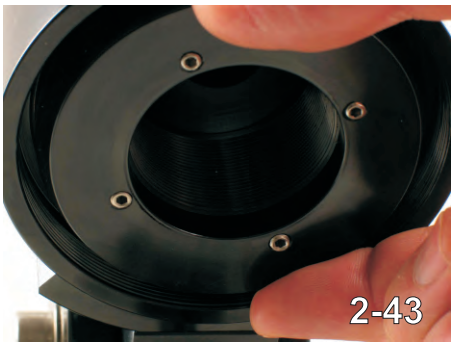


Apply Lubriplate No. 105 to the rear bearing. No need to remove this bearing. (2-40)

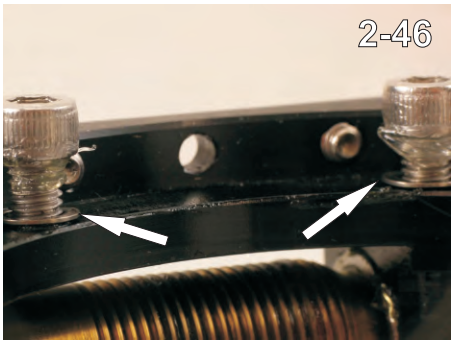


Put the greased shaft back into place. (2-41)

Remount the shaft retaining ring and screw it in until snug. You can try to match the original position by looking into the holes with some of the set screws removed.
You may also just make the ring tight and then back it off just enough, while rotating the shaft, to feel a smooth but still under tension, feel.

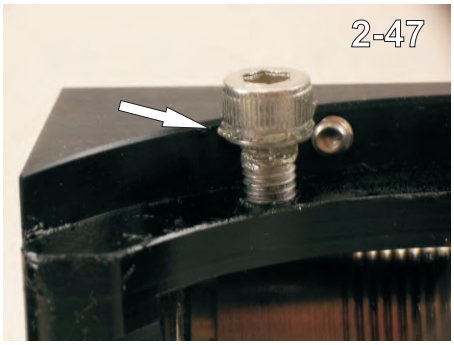


Tighten all four screws with the same amount of tightness.
(2-42, 2-43, 2-44)



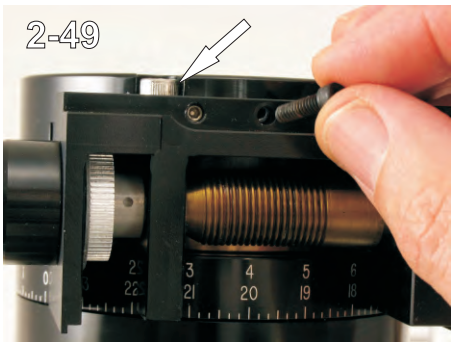
Put the polar scope adaptor back in place. (2-45)

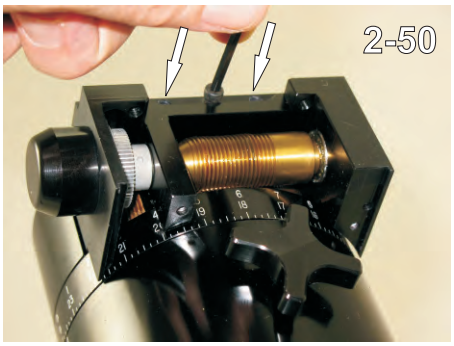
Before the worm housing is put back in place, it is helpful to have the washers ‘glued’ to the heads of the screws. Use thick grease to accomplish this.
(2-46, 2-47)



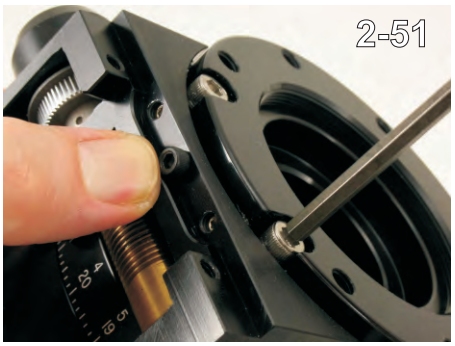
With the screws sitting up high as in image 2-47 fit the housing back into place. (2-48)

Put the black socket head cap screw back in place and tighten lightly the two stainless screws and washers from 2-46. (2-49)





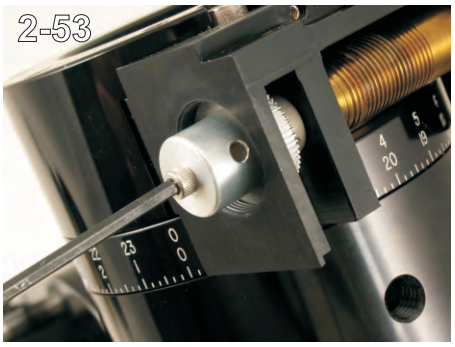
As the black screw is tightened, the two set screws, left untouched when the housing was removed (2-9), should allow the worm to stop in the original position. Minimizing adjustment time. (2-49, 2-50)

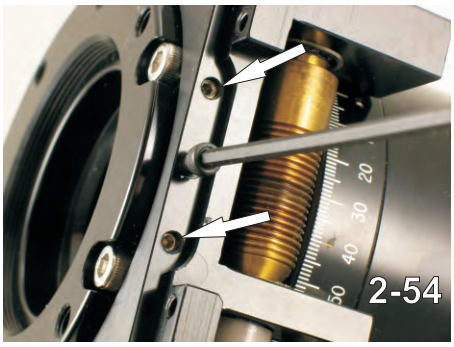


Tighten up on the two stainless cap screws to hold the worm housing in place.

Worm adjustments, if needed will still be possible. (2-51)

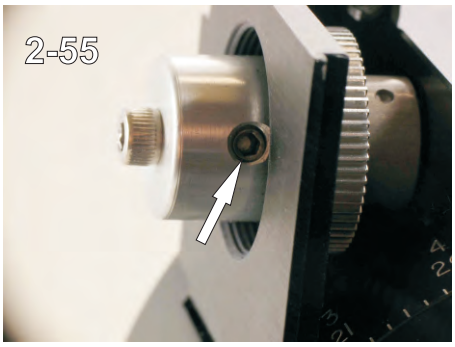
Please Note: The mesh between the worm and the worm wheel is a delicate setting. Too much play produces backlash, while too little will jam the drive.





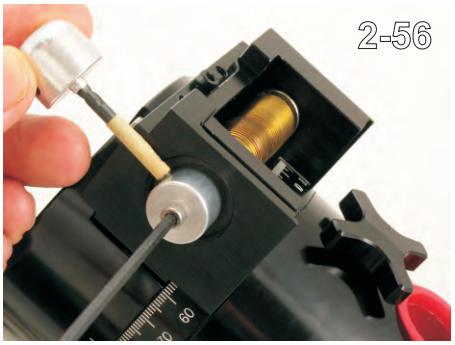
Adequate measures have been provided to make adjustments. The black center screw provides more engagement and either of the recessed set screws on each side of it provide less engagement. (2-54)

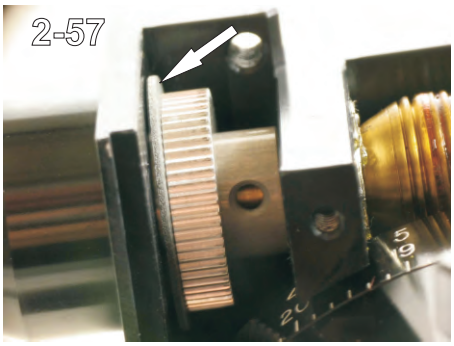
Determine if the worm is properly meshed by removing the black cover cap (2-52) and rotating the aluminum cylinder with a hex key. (2-53) Make adjustments as needed using screws in 2-54.

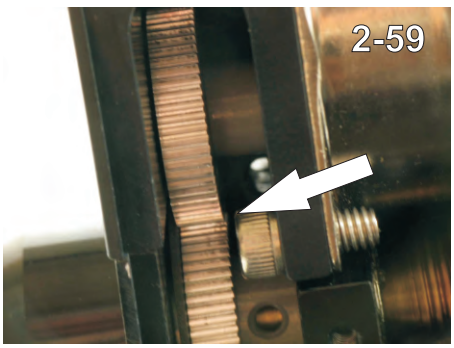


The following is for information only. You need to concern yourself with this only if this clutch has become too loose. Which is not likely.

Shown in images 2-55 through 2-57 is the clutch, which is set fairly tight. If the set screw, marked in 2-55, is loose and the cylinder held fast with a tool, 2-56, the cylinder can be pressed against the spur gear. There is a black fiber pad between the two. The pressure applied to this pad allows the worm spur gear to be turned by the motor spur.



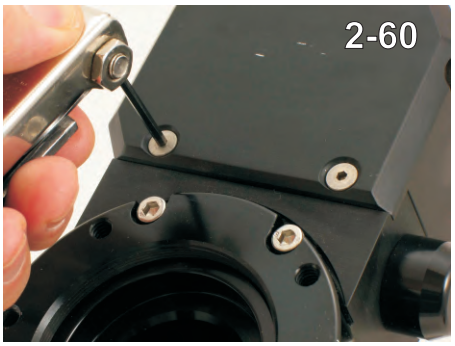


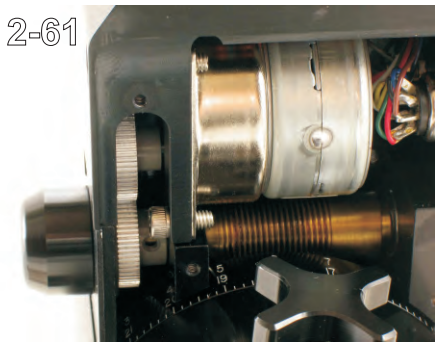


Mounting the motor housing is next.

As you put it into place the two spur gears need to mesh. (2-59) Some play between the gears is ok and even necessary for proper function.

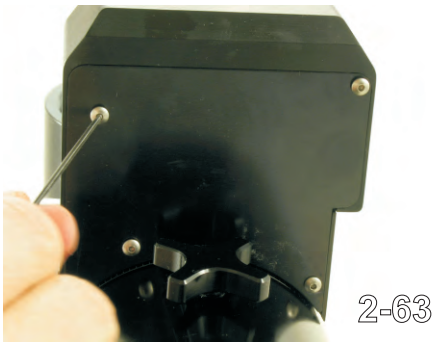
If you have not loosened the motor mounting screws, the gear mesh will return to the factory setting.





Lock down the motor box with the two flat head screws provided. (2-60)

Plug in and try the motor before closing up the drive. If none of the motor mounting screws were loosened then there should be no spur gear engagement issues. DO NOT attempt to rotate the worm as in 2-53 or you will damage the motor.

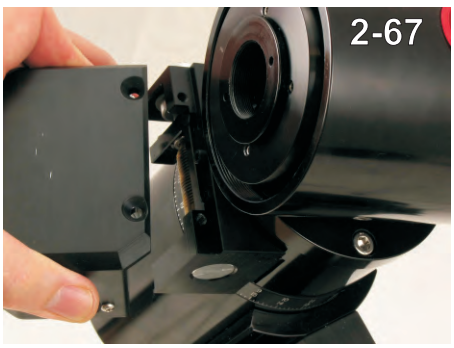


Put the cover back on and retain with the 4 screws provided. (2-62, 2-63)

Put the declination housing back on and tighten with a sleeved or taped long arm ball driver hex key.

<u>Please Note:</u>
It is possible for the action of mounting the declination axis to cause the right ascension worm to tighten up or loosen.

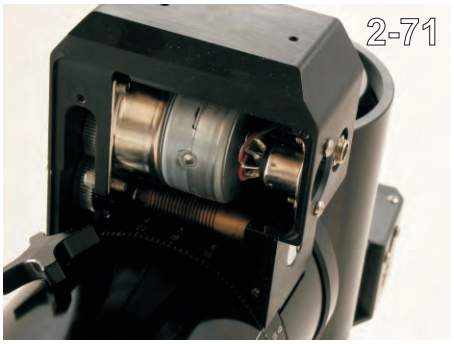
If the motor cannot rotate the axis or there is more backlash than desired, do the following steps.



Remove again the cap and flat cover from 2-52 and 2-63. Using a long ball driver hex key take off the motor box.
(2-66, 2-67)

Use the push-pull screws again to reset the worm mesh and test with a manual rotation of the worm. Remounting the motor after this adjustment will not disturb the worm setting. (2-68, 2-69)

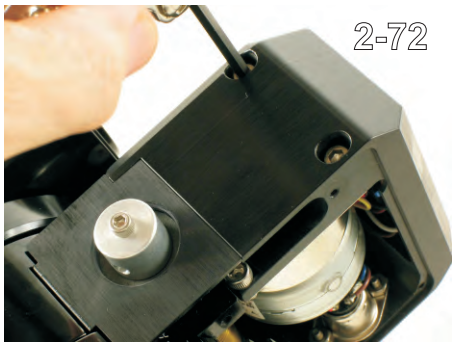
THE FOLLOWING NOTES ARE NOT PART OF THE GREASING PROCESS BUT ARE OFFERED HERE SO YOU CAN BETTER UNDERSTAND YOUR MOUNT.

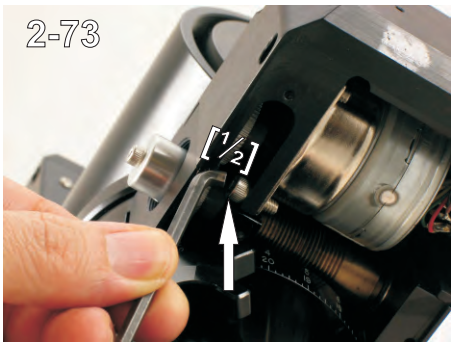


<u>Motor positioning and lock down:</u>

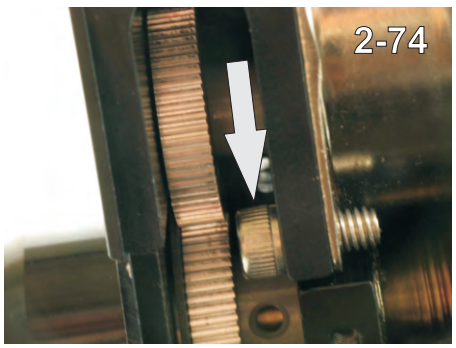
Should it become necessary to move or replace the motor, the following steps should be reviewed.

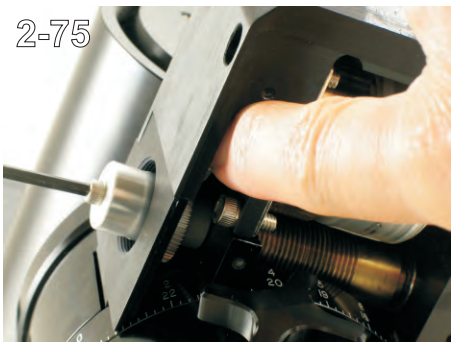
You will need to remove the worm cap and flat cover. (2-70, 2-71)





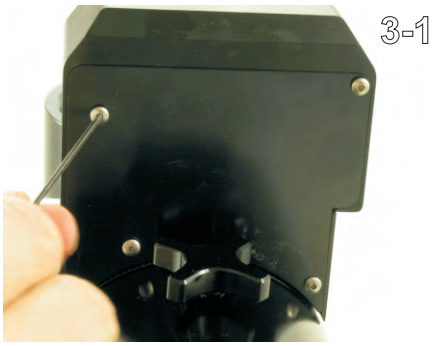
The motor is held in place by three cap screws. Two are easily accessed from the outside (2-72), but the inner third requires a modified 5/32 inch hex key. The key must be ground down to an overall length of ½ inch. (2-73), to work with the screw in 2-74.



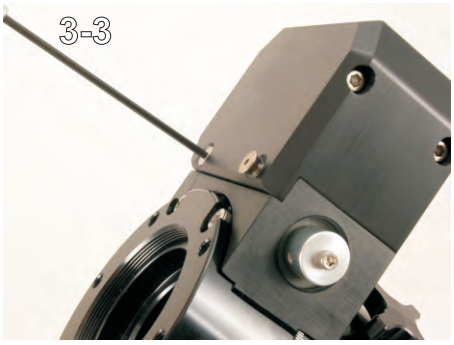


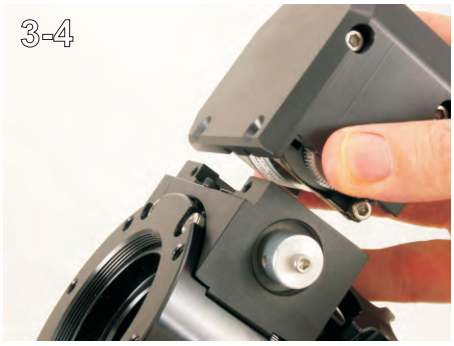
When positioning the motor to drive the axis it is very important not to have the two spur gears too close together. At some point during their rotation they will lock up.
To prevent this, find a spot where, with the worm held firm, you can still move the motor spur back and forth. This is possible because of the backlash in the

DECLINATION AXIS:

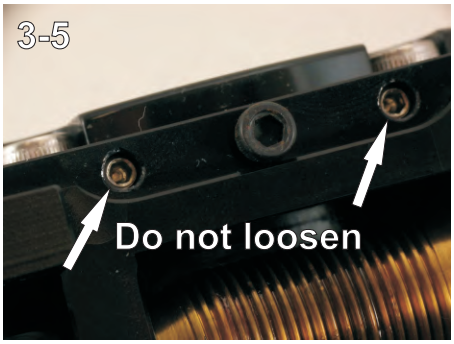


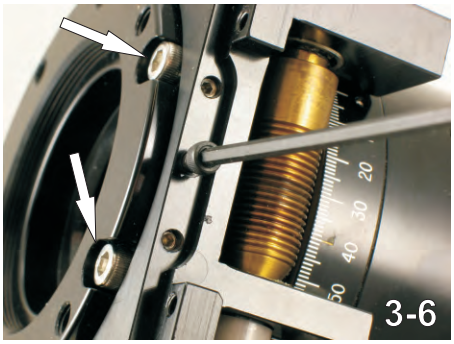
Remove the motor housing cover. Use a 1/16 inch hex key. If the cover will not come free form a paper clip to act as a hook. Slip it under the plate near the setting circle and pull out. (3-1, 3-2)





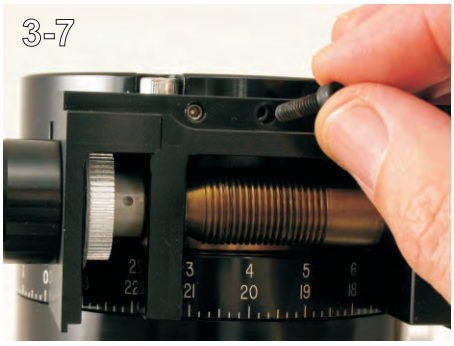
Remove the motor housing. Two flat head screws require a 3/32 inch hex key. (3-3, 3-4)



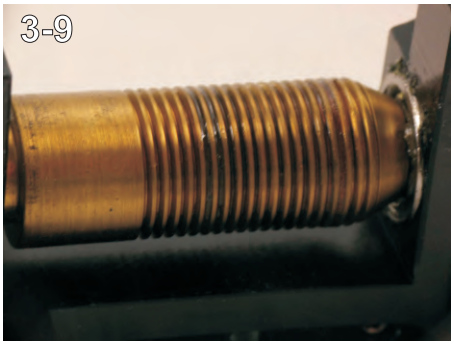


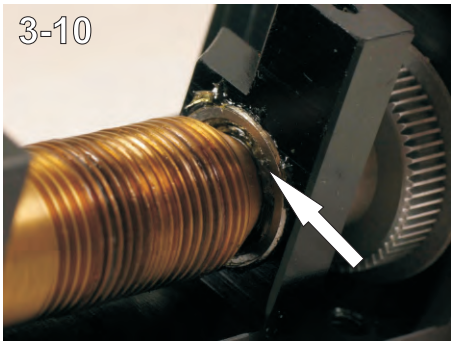
Start removing the worm box by unscrewing the black center screw. (3-6)

DO NOT touch the two recessed set screws on either side of the black cap screw. (3-5) If these are left alone the worm mesh distance should be easily reestablished upon reassembly.



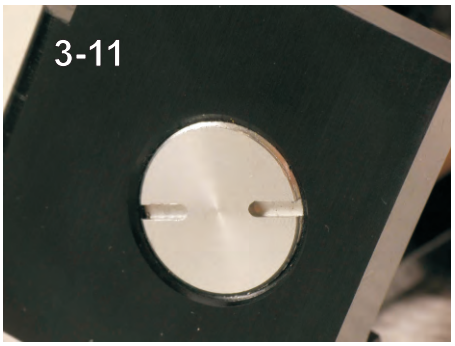
Finish the worm housing removal by pulling out the black center screw and loosening the two screws in (3-8) enough to pull the housing away.
(3-7, 3-8)

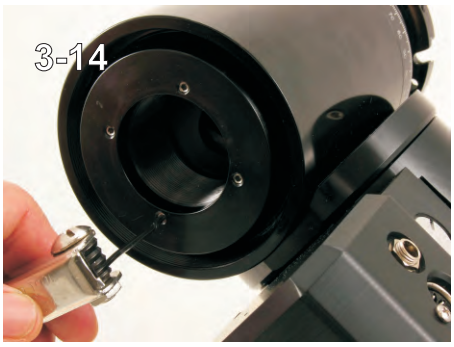




Clean the worm if required but use only a soft cloth and tooth brush. (3-9)

Check the worm bearings and apply some Lubriplate No. 105 grease with a tooth pick. (3-10)





<u>For information only:</u>
The bearings are pre-loaded with the special ‘nut’ seen in 3-11. There is no need to touch this unless the worm is able to move within the bearings.

Remove the declination clutch knob.

Be aware that a brass plug is under the knob and should be retrieved upon removal before it falls away. (3-12)

Remove the polar scope adapter ring. (3-13)

Start the removal of the shaft pre-load ring by first loosening the four set screws. No need to remove. Use a 5/64 inch hex key.
(3-14)

Unscrew the ring as you would a hex nut on a screw and remove. (3-15)

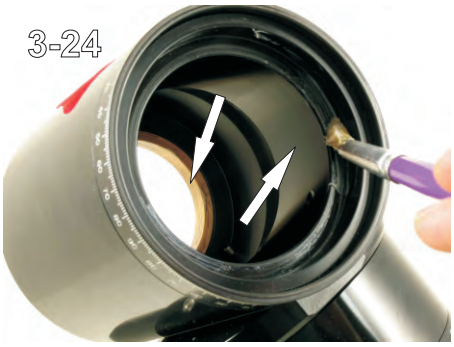
Pull the declination shaft out of the housing by grabbing both the end of the shaft and the setting circle. (3-16)

Release the worm wheel gear from the shaft by tapping the assembly against a block of wood. (3-17, 3-18)

Remove all old grease from the shaft and apply a new coating of Lubriplate No 105. (3-19, 3-20)

Free the plain bearing from the housing. A razor may be needed to break it free.

Clean the bearing, bearing seat and apply new grease. (3-21, 3-22)



Apply new Lubriplate No. 105 to the bearing on both sides and remount. (3-23, 3-25)

Clean the inside of the housing on both ends and apply new grease. (3-24)

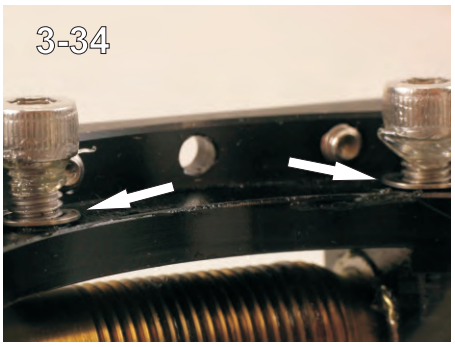
Clean the worm wheel and apply new grease to bearing surfaces inside and out. Also coat all the teeth. (3-26, 3-27)

Put the worm wheel back in place and rotate a few times. (3-28)

Reinstall the declination shaft. (3-29)

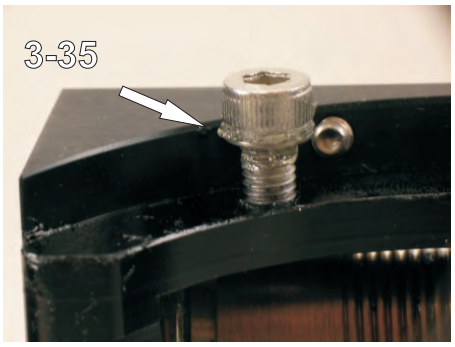
Apply Lubriplate No. 105 to the rear bearing. (3-30)

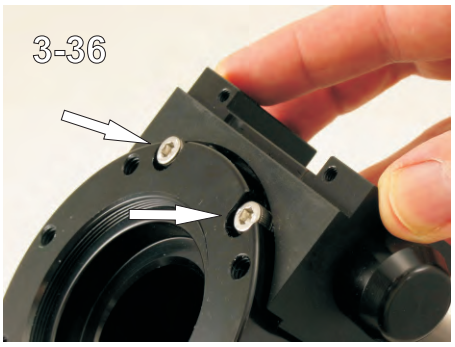
Remount the shaft retaining ring and screw it in until snug. (3-31) You can try to match the original position by looking into the holes with some of the set screws removed.
You may also just make the ring tight and then back it off just enough, while rotating the shaft, to feel a smooth, but still under tension, feel.



Tighten all four screws with the same amount of tightness.
(You may wish to review 2-42, 2-43, 2-44 from the right ascension section)

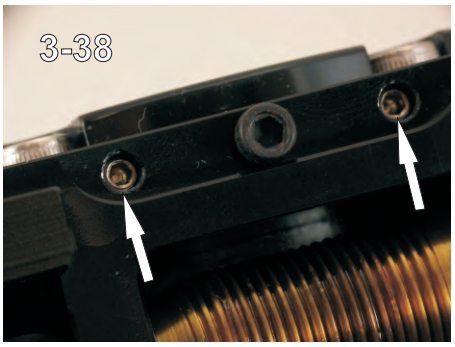
Put the counterweight shaft adaptor back in place. Tighten with a hex key or rubber pad.
(3-32, 3-33)





Before the worm housing is put back in place, it is helpful to have the washers 'glued' to the heads of the screws. Use thick grease to accomplish this.
(3-34, 3-35)

With the screws sitting up as high as in image 3-35, fit the housing back into place. (3-36)



Put the black socket head cap screw back in place and tighten lightly the two stainless screws and washers from 3-36. (3-37)

As the black screw is tightened, the two set screws, left untouched when the housing was removed (3-5), will allow the worm to stop in the original position. Minimizing adjustment time.
(3-38)

Tighten up on the two stainless cap screws to hold the worm housing in place.

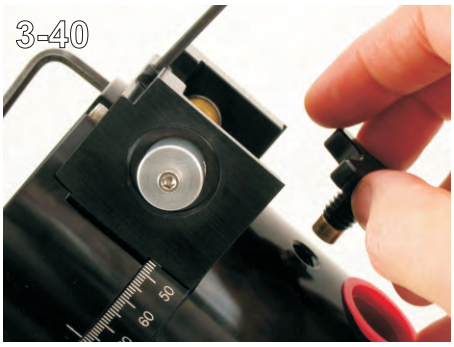
Worm adjustments, if needed, will still be possible. (3-39)

Please Note: The mesh between the worm and the worm wheel is a delicate setting. Too much play produces backlash, while too little will jam the drive.

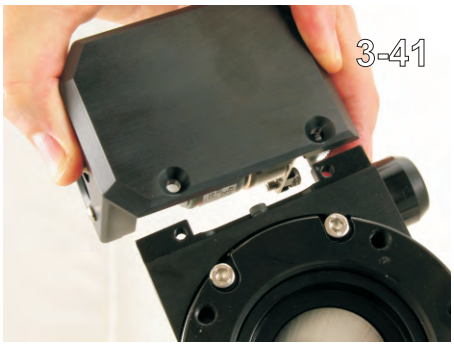
Adequate measures have been provided to make adjustments. The black center screw provides more engagement and either of the recessed set screws on each side of it provide less engagement.

Please review the details provided on this in the right ascension section 2-52 through 2-54. Both axes are the same in this respect.

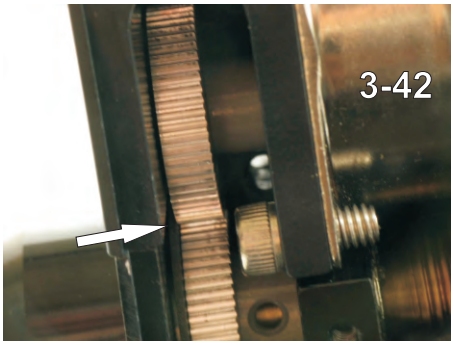
Put the clutch knob back in place with brass pin. (3-40)



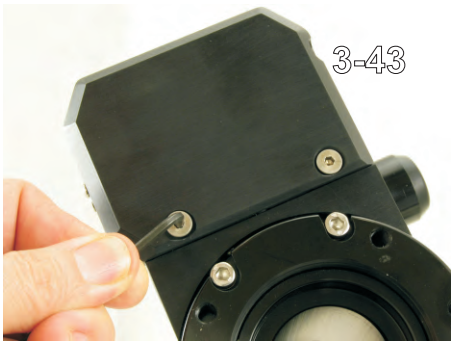
Mounting the motor housing is next.(3-41)



As you put it into place the two spur gears need to mesh. (3-42) Some play between the gears is ok and even necessary for proper function.

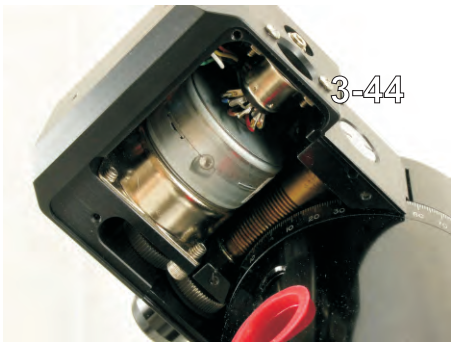


If you have not loosened the motor mounting screws, you will find that the gear mesh will be the same as when you took it apart. No adjustment will be required.



Lock down the motor box with the two flat head screws provided. (3-43)

Plug in and try the motor before closing up the drive. If none of the motor mounting screws were loosened then there should be no spur gear engagement issues. DO NOT attempt to rotate the worm with a hex key on the silver domed knob or you will damage the motor.



Put the cover back on and retain with the 4 screws provided. (2-62, 2-63)

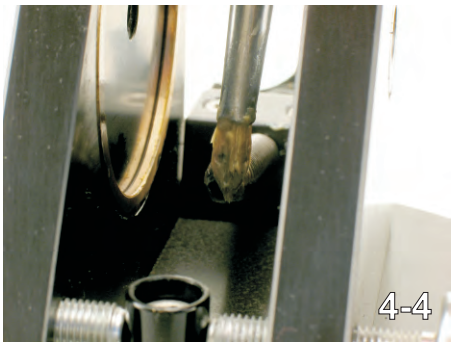
POLAR FORK AND AZIMUTH BEARING

4-1


4-2

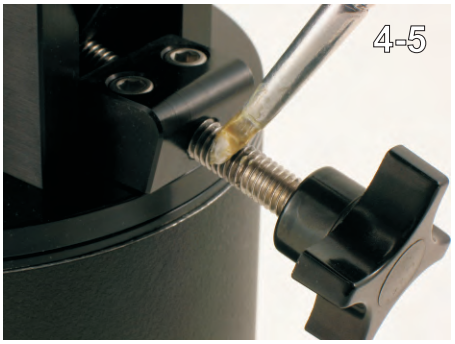
To re-grease the polar fork assembly, start by loosening and removing the large center pivot bolt. (4-1, 4-2)

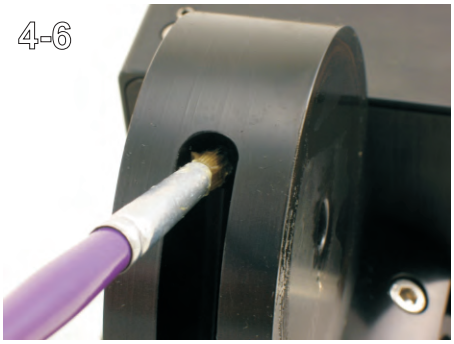

4-3


4-4

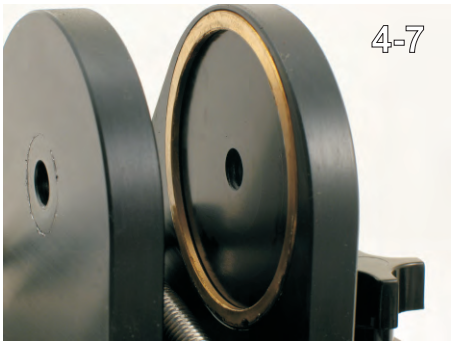
Carefully lift the mount out of the forks. (4-3)

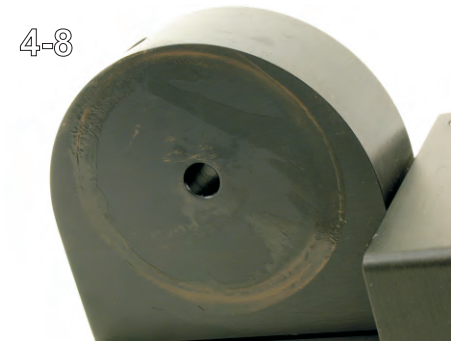
Use Lubriplate No. 105 on the re-greasing of the following assemblies.


4-5

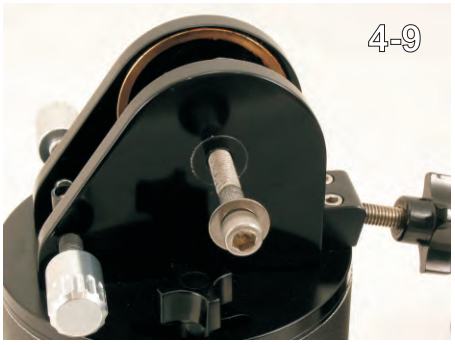

4-6

Clean and grease the altitude rod tip and working zone. (4-4, 4-5) Apply some to the catch pocket of the altitude pivot block. (4-6)


4-7


4-8

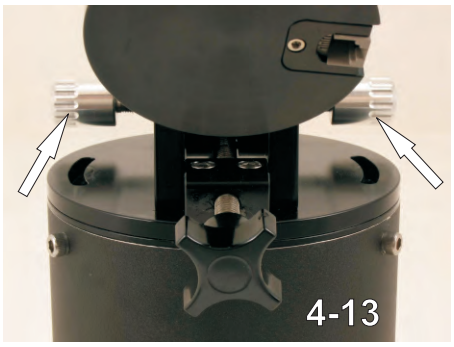
Clean and re-grease the altitude ring bearing and mating surface of the altitude pivot block. (4-7, 4-8)


4-9

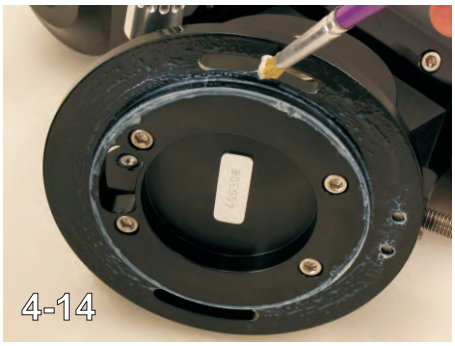

4-10

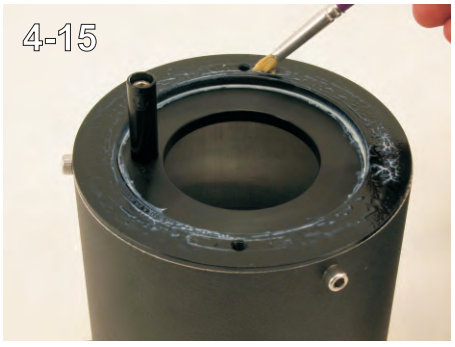
Prepare the forks for reassembly by placing the pivot screw in place and carefully inserting the pivot block back in. Feed the screw through the hole. (4-9, 4-10)

Tighten the screw enough to keep the mount from moving until later use in polar alignment. (4-11)

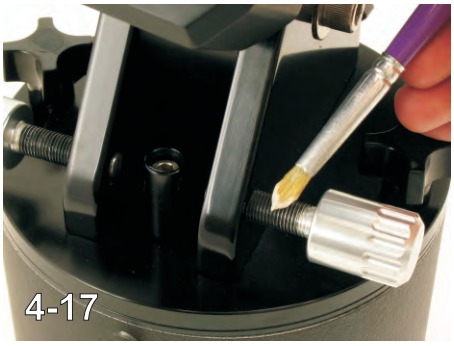


To clean and re-grease the azimuth bearing, start by removing the two black retaining knobs. Rotate out both silver azimuth knobs to clear the azimuth pin. (4-12, 4-13)





Lift the mount off its base. Clean the plain bearing surfaces and apply a new application of Lubriplate No. 105. (4-13, 4-14, 4-15)



Place the mount back on its base, feeding the azimuth pin through the hole between the forks. (4-16)

Apply some Lubriplate No. 105 to the working threads of the azimuth knobs. (4-17)