

# **Procedure for servicing the zenith prism mechanical drive system in a Mk IV Brewer spectrophotometer**

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## **Introduction**

In order to select the geometric light path for the variety of scans that the instrument is capable of performing the Brewer uses a prism assembly which rotates via a set of ball bearing races on a drive shaft. The shaft is clamped via a collar to the main drive gear. The main drive gear is rotated by a secondary gear which is in contact with a stepper motor. The stepper motor is controlled by the Brewer computer via internal electronic boards and ribbon cables.

The zenith prism has a range of 270 degrees. It can be turned from the full sky UV prism for UV scans to the internal test lamps for diagnostic routines. The prism can be set anywhere between these two positions for taking direct sun ozone measurements.

As the Brewer ages the ball bearings may eventually freeze up, making it necessary to remove the assembly to apply lubrication to the inner and outer bearings. Grit and dust will accumulate on the focusing lens positioned just above the internal lamps as well as on the UV and zenith prisms. These prisms and lens may be cleaned using spectroscopic grade methanol and lens tissues.

## **Equipment**

Mk IV Brewer spectrophotometer  
Hex wrench set (English sizes)  
Retaining ring "C-clip" wrench (small size)  
Krytox grease  
Spectroscopic grade methanol  
Lens tissues  
Spare AC power cable (optional)  
Spare data cable (optional)

## **Purpose**

This Standard Operating Procedure (SOP) outlines the NUVMC technique for servicing the zenith prism drive mechanical assembly in a Mk IV Brewer.

## **Procedure**

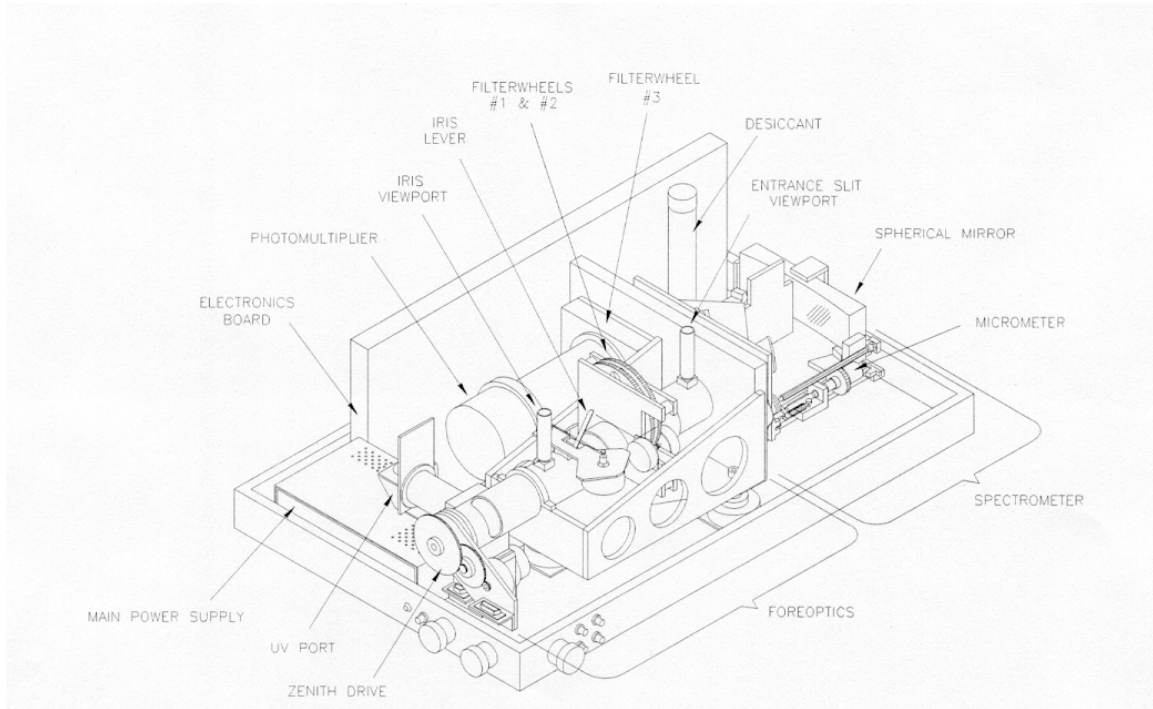
1. If the Brewer is still running in schedule exit the schedule by pressing the Home key when the message "Press Home to abort schedule" appears on the computer screen.
2. If possible perform a spectral response calibration on the Brewer using the 1000W lamps. If this is not possible run at least three 50W lamps to use as a reference for any change that may take place to the instrument's sensitivity due to the removal of the zenith prism assembly. Follow the procedure in the document "Procedure for 50W lamp calibrations" available from the NUVMC.

3. Power off the Brewer by pressing the push button located on the edge of the instrument near the zenith prism window.
4. Place a protective cover on the quartz dome on the top of the Brewer outer cover.
5. Remove the circular connectors for the zenith drive, power and data cables which are connected from the tracker into the side of the Brewer.
6. Remove the 4 hex bolts connecting the Brewer feet to the tracker unit.
7. Lift the Brewer off the tracker and move it indoors to a clean working environment.
8. Connect the AC power and data cables to the Brewer and initialize communication between the Brewer and computer. If the cables that are normally used to control the instrument cannot be easily rerouted to the inside work space, it may be necessary to use spare cables.
9. Remove the Brewer outer cover by loosening the four latches and lifting the cover up.
10. Refer to Figure 1 for the location of the zenith prism assembly inside the instrument.
11. Loosen the 7/64" hex head bolt which inserts into the face of the brass zenith prism drive gear through its center. It is not necessary to completely remove this screw.
12. Loosen the 7/64" hex bolt which secures the main drive gear collar to the zenith prism shaft.
13. Remove the main drive gear from the zenith prism shaft by pulling it along the shaft.
14. Remove the retaining c-clip from the zenith prism shaft via the c-clip wrench.
15. Remove the three 1/16" hex head bolts which secure the zenith gear plate to the end of the foreoptics tube.
16. Remove the zenith gear plate from the instrument and set it aside.

17. Remove the three 5/64" hex head bolts securing the drive bearing plate to the foreoptics tube.
18. Loosen the 3/32" collar bolt which secures the bearing assembly to the foreoptics tube.
19. Remove the bearing assembly from the foreoptics tube by gently pulling it away from the end of the tube.
20. Remove the zenith prism assembly from its housing. Note the position of the floppy washer on the zenith prism shaft.
21. Clean the internal lamp lens and the zenith prism using methanol and lens tissues.
22. Lubricate the inner and outer ball bearings with Krytox grease.
23. Reinsert the zenith prism shaft into the bearing housing taking care to insert the hard stop pin into the groove. The zenith prism should be able to rotate from the full sky UV position to the internal lamp position and should hit hard stops at both of these positions.
24. Remount the drive bearing plate into the end of the foreoptics tube.
25. Reinsert the three 5/64" hex bolts holding the bearing plate to the foreoptics tube.
26. Remount the zenith gear plate to the drive bearing plate and reinsert the three 1/16" hex bolts.
27. Tighten the 3/32" collar bolt which clamps the zenith prism assembly to the foreoptics tube.
28. Reinsert the c-clip onto the zenith prism shaft making sure that the clip engages into the groove on the shaft. It may be necessary to bend the c-clip to tighten it before it will engage into the groove.
29. Replace the main drive gear onto the drive shaft being sure the gear meshes with the brass drive gear.
30. Secure the 7/64" collar bolt which clamps the main drive gear to the drive shaft.

31. Tighten the 7/64" bolt which secures the brass drive gear to the zenith gear plate.
32. Loosen the two 7/64" hex bolts holding the full sky UV prism onto the foreoptics side tube.
33. Remove the prism assembly from the foreoptics side tube.
34. Clean the UV prism using methanol and tissue.
35. Reinsert the UV prism assembly into the foreoptics side tube and tighten the two 7/64" hex bolts.
36. Reconnect the AC power and data cables and reinitialize communication between the Brewer and computer.
37. Follow the NUVMC procedure "Procedure for zenith prism alignment" for adjusting the alignment of the zenith prism as it will have been compromised due to the removal of the assembly.
38. After the zenith prism alignment is corrected, disconnect the AC power and data cables and move the Brewer back to its position outside on the tracker.
39. Reinsert the four hex bolts securing the Brewer feet to the tracker.
40. Remove the quartz dome protector.
41. Reconnect the power and data cables and reinitialize communication with the computer.
42. Perform lamp scans on the same 50W lamps that were run prior to moving the Brewer or perform another spectral response calibration using 1000W lamps.
43. Perform a tracker steps per revolution (SR) test followed by a sun sighting (SI) per the procedure in the Operators SOP. This will ensure that the Brewer optical path is reoriented properly if the zenith prism was realigned. The date and time on the computer should be verified to be correct for this step.
44. Enter an electronic comment (CM or CO command) describing briefly if the zenith prism was adjusted or if any other work was performed. Also enter a brief entry in the paper station log form.

45. Place the Brewer back into schedule by giving the command "skc" at the command line. When prompted for schedule, enter the name of the current network schedule (epa96d for the US EPA/UGA network as of December 2002).



**Figure 1: Brewer components**

**For further information or advice concerning this SOP please contact the NUVMC at the University of Georgia at <http://oz.physast.uga.edu>**