

## Replacement of Chopper Servo

The servo that positions the chopper wheel will eventually need replacement after continued use, typically 1 to 1-1/2 years of use. This document describes the procedure and identifies important issues concerned with the replacement of this unit.

The servo should be replaced with a Hitech brand model HS-81 available at most RC hobby shops or on line, see [http://www.servocity.com/html/hs-81\\_micro.html](http://www.servocity.com/html/hs-81_micro.html).

The servo has three leads, black (GND), red (3.25-3.5V power) and yellow or white, the control signal. The servo is controlled by a pulse width modulated signal that originates from the AMS software/NI boards which is applied to this line. This signal is a 50 Hz TTL pulse with a variable high pulse period of ~1-2 ms. The duration of the pulse sets the rotational position of the servo.

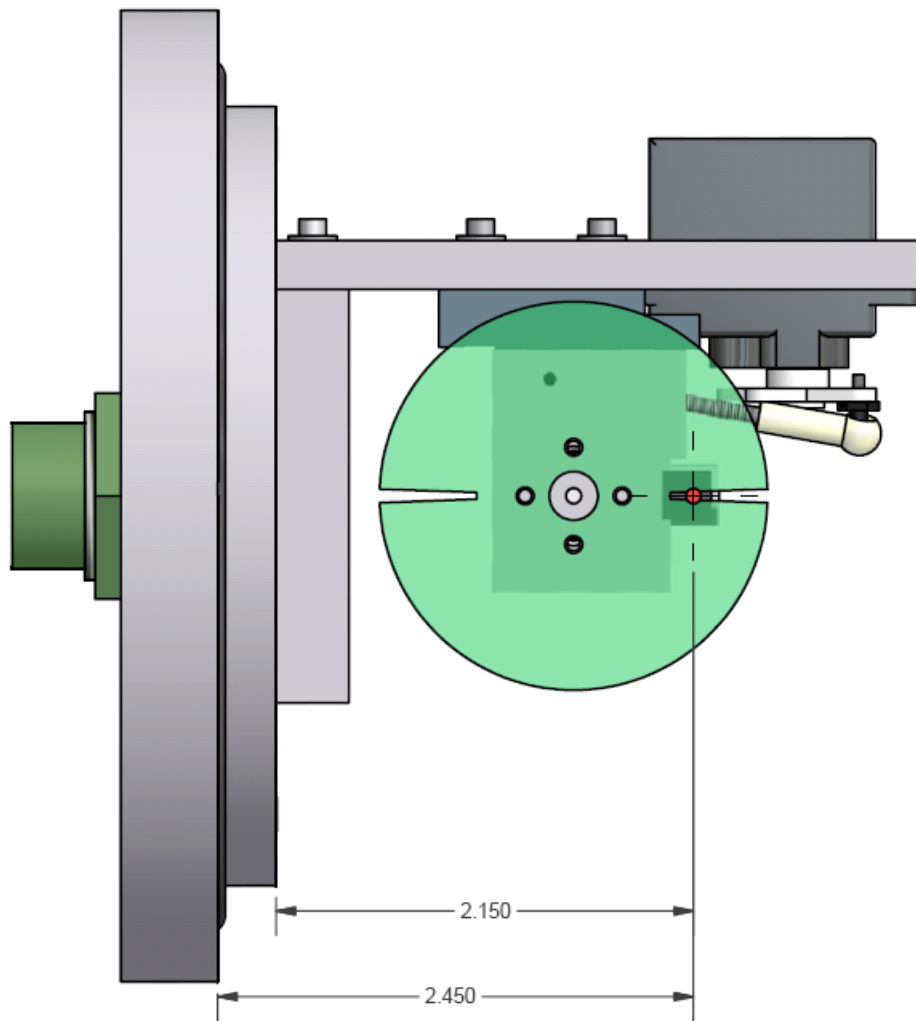
To replace the servo follow these steps:

- 1) Vent the system and remove the chopper flange. Note the alignment mark that is scribed on the outer diameter of the chopper flange and the vacuum chamber. When reinstalling, realign the flange to this alignment. Note that removing the chopper flange will alter your current velocity calibration.
- 2) Place the entire flange assembly with the cable attached on a nearby surface such that the chopper wheel and slide assembly are free to move.
- 3) Disconnect the servo 3-pin electrical connector and plug in the new servo, make sure to match up the black/red/yellow (or white) colors on the connector between the mating connectors.
- 4) Run the AMS program in the MS toggle mode so that the command for servo movement is issued (toggling between block and open position) and observe that the new servo is actually moving. If it is not one needs to follow another course of action...
- 5) Having confirmed that the new servo operates, next go into the menu and set the chopper "Chop" position to 35. This is the electronic center position for the servo. Close the menu and run the program in the TOF mode. This will set the servo to the new center position. At this point, disconnect the 10-pin circular connector on the chopper flange. When disconnecting this cable carefully observe the servo output shaft and verify that the servo position did not "jump" when power was removed. If it did, repeat this step.
- 6) The next step is to remove the failed servo unit. Pay close attention to how this mechanical linkage is attached, ie. which side the mechanical linkage is on. First

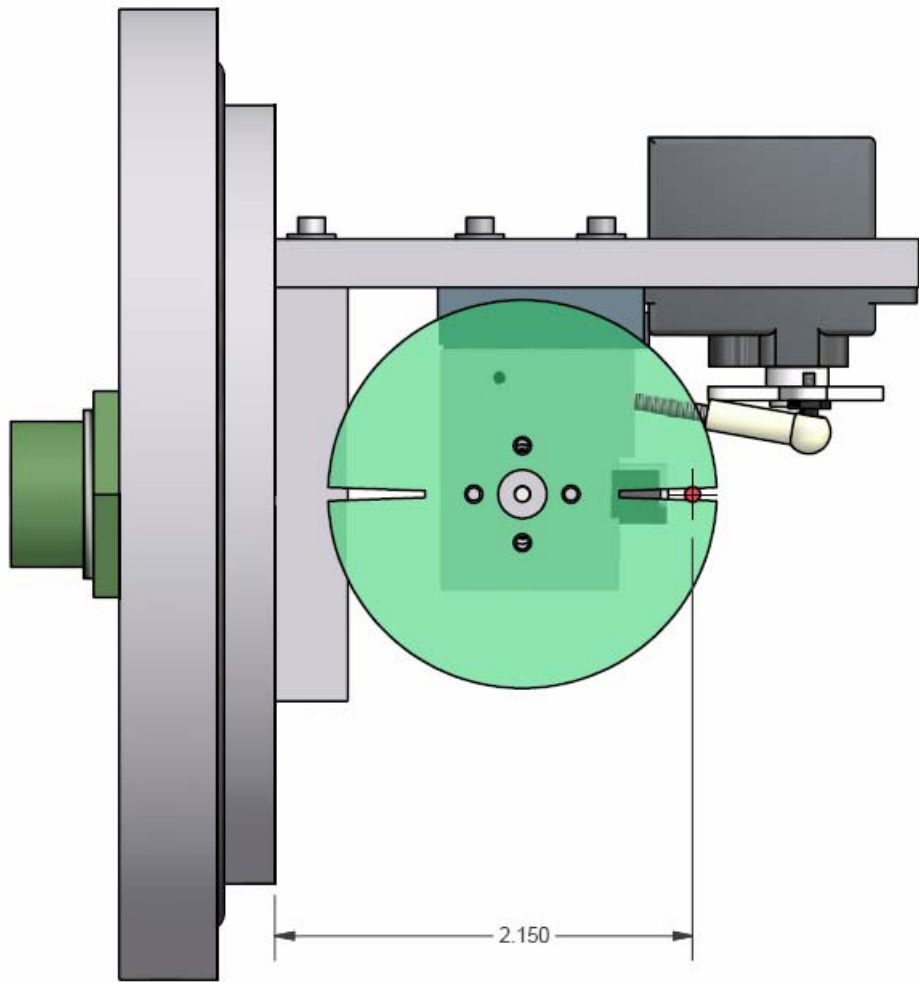
remove the servo output arm that couples the rotary motion of the servo to linear travel on the slide assembly, this is the small white 4-arm cross attached with a Phillips screw. Now remove the servo arm by gently prying it off of the servo body. Note that the output shaft has splines to align the output arm.

Also, at this stage check the movement of the ball joints couplings. The plastic fitting over the ball joints should move freely. Too much friction here can cause premature failure as the servo has to work harder than it needs to. If the joints appear tight use a sharp razor to slice the plastic coupling that fits over the ball to allow it to expand. It appears that over time these plastic couplings shrink while under vacuum and lead to this “high friction” condition.

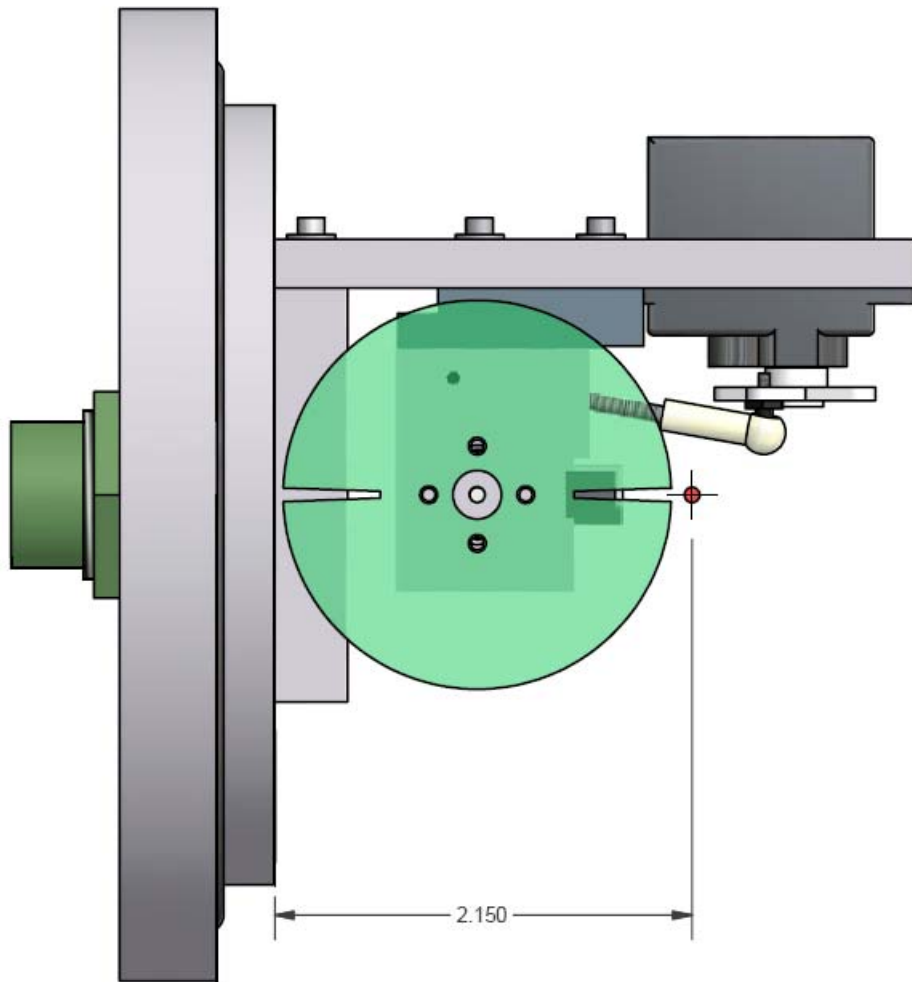
- 7) Mount the new servo unit and secure with the two #2-56 machine screws and tie the servo cable to the side of the assembly.
- 8) Next replace the servo output arm onto the output shaft. The important issue here is getting the correct rotational position. Since the servo was set to the electronic center (step 5), the output arm should be placed on the shaft such that the slide assembly is at its half-way point (note that the slide has ½” of total travel). Do not replace the Phillips screw which holds the output arm in place quite yet...
- 9) Reconnect the cable to the flange and operate the program in the TOF mode. Using the “g” and “G” key strokes to position the chopper in the block/chop and open positions observe the assembly for smooth and un-hindered movement. Make sure that the slide has not “bottomed” out in either the block or open positions and that in the open position the wheel is not touching the flange. If there are problems here of this nature than either the output arm was replaced in the wrong position or the mechanical linkage (the #2 threaded rod with the ball joint ends) needs adjustment. Make any necessary adjustments. If the assembly operates properly replace the Phillips screw to secure the output arm. Fine adjustment is made when the system is operating using the “Calibrate Servo Travel” routine.
- 10) Several measurements should be verified before reinstalling in the vacuum. Refer to the drawings below. These drawing show the beam location (red dot) with reference to the vacuum side flange surface.



View showing "Beam Block" position



View showing "Beam Chop" position



View showing "Beam Open" position