Magnus VLF

Replacing a TH2 Carriage with a Universal Carriage with Z-stage

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Revision History

Revision	Date	Author	Comments
A-A	09 Feb 2005	R.Bouchal/A.Blignaut	First official release
-B	12 April 2005	R Bouchal	Production release (no changes)
-C	July 8, 2005	M.Herbert	Note changed in section 5.4-2.
-D	Dec 22, 2005	A.Blignaut	Note added to section 6 to set the base thickness parameter to 0.
B-A	15 June 2006	A.Blignaut / M.Zgrych / A.Edge	Updated for universal carriage installation with Z-stage. Removed calibration section and referred to Head replacement doc instead.

Replacing a TH2 Carriage with a Universal Carriage with Z-stage

CONTENTS

Revision History i

1. Overview 1

2. Upgrade prerequisites 1

3. Additional Documents Required 1

4. Parts / tools Required 1

5. Theory of Z-stage Operation 2

6. Upgrade Procedure 2
   - 6.1 Recording the current device status 2
   - 6.2 Removing the TH2 3
   - 6.3 Installing the Z-stage support components 4
   - 6.4 Removing the TH2 carriage 6
   - 6.5 Installing the universal carriage 9

7. Installing the TH2 12
   - 7.1 Upgrading the TH2 12

8. Calibration and Setup 13
   - 8.1 Burning in the Z-stage 13
   - 8.2 Adjusting the head tilt 14

9. Updating the workstation software 14

10. Final Testing 14

11. Disabling the Z-stage option 15

1. OVERVIEW

This procedure describes how to upgrade a Magnus VLF with a TH2 carriage to a universal carriage with Z-stage. Because the exact configuration of the Magnus VLF will differ from device to device, the steps that are needed to upgrade the device will also differ. This document will cover all configuration possibilities, but you may not need to execute some of them.

2. UPGRADE PREREQUISITES

The Magnus VLF must have the Thermal 2 head chiller tube upgrade already installed. If not, the large junction block at the entry of the flex track interferes with the push cylinder on the new Z-stage.

3. ADDITIONAL DOCUMENTS REQUIRED

- *Replacing a TH2 on a Universal Carriage with Z-stage* (719-00705A)
  This document is needed for performing Z-stage calibration and head calibration after the carriage has been replaced.
- *Series 2 X-Speed Upgrade*
  This document is needed for the installation of the laser shields if customers are using 83 in. plates. See section 11 for installing laser shields for customers using 83 in. plates.

4. PARTS / TOOLS REQUIRED

- Z-stage kit for semi-automatic devices (518-01821A)
- Z-stage kit for automatic devices (518-01822A)
- 100x microscope **or** the tilt viewing tool and procedure 719-00424A
  - 690-00225A: Tilt viewing tool (lenticular), 2400 dpi and 1200 dpi
  - 690-00226A: Tilt viewing tool (lenticular), 2540 dpi and 1270 dpi
- Calipers (digital preferred)

Additional parts for customers using 83 in. plates:

- Laser shield kit for 5183 drum (518-01466A)
- Laser shield kit for 6383 drum (518-01465A)
- Home side tab (252-09870A)
- Away side tab (252-09927A)

5. THEORY OF Z-STAGE OPERATION

The new Z-stage moves the head in the axis of the imaging beam to allow for repositioning of the head for different plate thicknesses.

The basic operation involves the positioning of an angled wedge (2 degrees) by means of a stepper motor and lead screw device. Once the wedge is positioned, an air cylinder, which is attached to the thermal head guide rod, clamps the wedge up against a hard stop. Consequently the head is clamped into a predetermined position based on the position of the wedge. The 2-degree angle on the wedge allows for roughly a 29:1 ratio of movement of the wedge compared to the movement of the head. This advantage affords a fine control of the end position of the head with minimal accuracy necessary on the wedge control.

The head guide rod is located in a matched set of four plastic guides forming the V-groove. The new head guide rod has a very smooth, hard chromed finish to minimize wear of the V-groove.

The 5^{th} point support uses the head's regular button, which is supported on the carriage by the 5^{th} point pivot assembly. This pivot assembly consists of a set of small cam followers mounted to a pivot frame to allow for slight angular misalignment. The two cam follower bearings roll on the annular surface area of the head's 5^{th} point button.

When a device is initialized, the Z-stage moves to the appropriate location based on the loaded plate thickness and a NVS parameter (**set mh zstagezero**). The Z-stage will stay locked until a different plate thickness is selected. See Table 1 for some of the Z-stage NVS parameters.

Table 1: Z-stage NVS parameters

Name	Active	Default	Unit
ZstageGain	0.4	0.4	-
ZstageSPM	1127.559	1127.559	steps/mm
ZstageMSR	4	4	microsteps/step
ZstageZero	0	0	mm

6. UPGRADE PROCEDURE

6.1 Recording the current device status

1. Using calipers, measure the thickness of a medium size plate used by the customer. Take several measurements in different areas to get an average measurement.
2. Load the plate you have just measured (or another one from the same batch).
3. Type `>>plot edge` to find the plate edge position and call this **x**.
4. Type `>>carriage moveto x+100` to move the carriage 100 mm inboard of the edge of the plate.
5. Type `>>head install on` and record the focus error for later use.

6. Type `>>carriage moveto x+300` to move the carriage further into the plate and record the focus error value again.
7. Type `>>carriage init` to move the carriage to the home position
8. Run a diagnostic plot 28 (2-pixel (20-micron) horizontal lines).
9. Use a 100x microscope (or the tilt checking tools) to measure any saw tooth pattern for tilt at the swath boundaries. If there is, record this now. This will be used later when checking the head tilt.

6.2 Removing the TH2

1. Initialize the carriage:
   `>>carriage init`.
2. Move the carriage to the 1050 mm position for the best head access:
   `>>carriage moveto 1050`
3. On automatic devices, open the front hood, rear hood, and the door in the middle of the device. Also remove the center laser panels, the load table rails, and the unload table panels.
   On a semi-automatic device, open the rear hood and remove the center of the table section.
4. Turn the device power off and turn the air supply off at the pressure regulator shut off valve.
5. If there is an ejector on the right side of the device (engine manifold side), open the ejector lid, slide the ejector unit forward, and raise the ejector table.

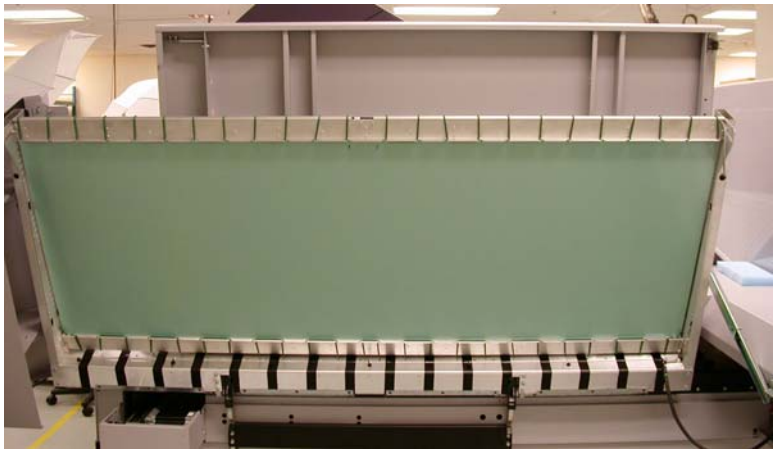


Figure 1: Ejector lid and table up

6. Move the drum vacuum unit to access the engine manifold panel.
7. Remove the engine manifold side panel and open the regulator door to gain access to the engine manifold and the flex track.

Note: Wear an anti-static wrist strap when handling the head and related electronics.

8. Remove the head from the carriage and carefully place it somewhere where you can work on it easily. Use toweling to catch and clean up any coolant that is spilled when disconnecting the tubes.

9. Remove the six screws and remove the adapter plate from the carriage. Wipe the adapter plate clean before making the measurement in the next step.

6.3 Installing the Z-stage support components

If the device you are upgrading already had a Z-stage, then the supporting cables, tubes, GENINE board and cables, and Z-stage solenoid will be installed. You can skip this section and proceed to the next section: Removing the TH2 carriage.

The new Z-stage needs a red and black 5/32-inch tube from the head to the engine manifold and an additional solenoid on the manifold. It also needs two cables from the GENINE board in the power box (one for the home/away sensor and the other for the motor driver). Some devices may have the cables and tubes already installed—they will be neatly rolled up and secured with a cable tie to the end of the flex track. A single action solenoid valve (headstage unlock) will also be installed on the engine manifold for this purpose. If they are not installed, follow these steps to install them:

1. Remove the flex track from the carriage where the two brackets connect by removing the two screws connecting the brackets.

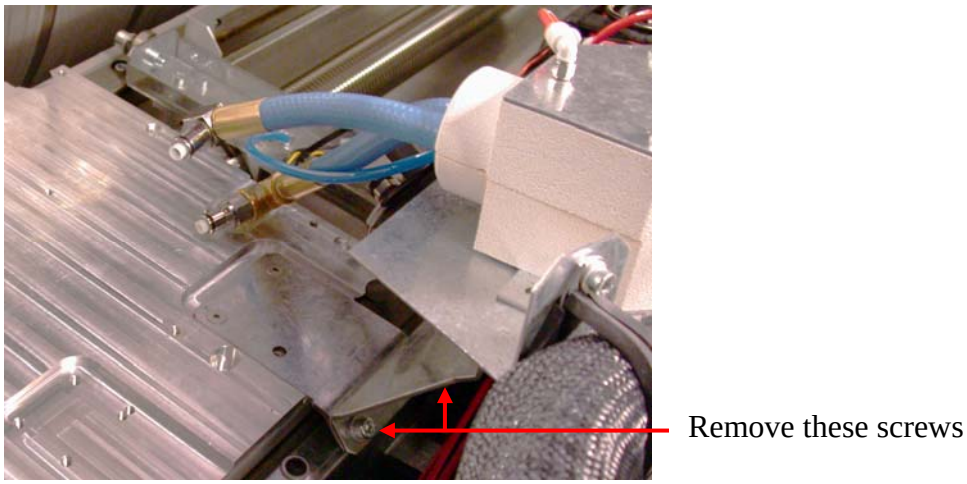


Figure 2: Flex track mounting screws

   a. To make it easier to slide the cables and tubes into the flex track, lay it flat towards the manifold side of the device.

   b. Feed a spare piece of tube through the cable side of the flex track from the carriage to the disconnected end at the side of the device. This will be used to pull the cables into the flex track.

   c. Tape the cable connectors to the end of the spare tube and pull them into the flex track to the carriage.

Note: Make sure that you attach the GENINE connectors. The head connectors must be left at the loose end of the flex track.

2. Make a second pass with the spare piece of tube to pull the new tubes into the tube side of the flex track.

3. Install the Z-stage unlock solenoid valve on the engine manifold in the slot second from the bottom of the manifold assembly. Attach the black and red tubes that you just fed through the flex track.

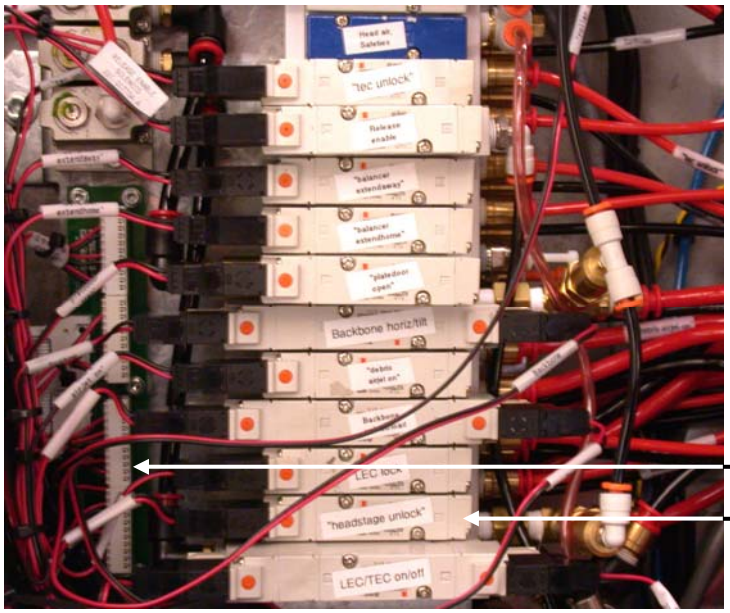


Figure 3: Engine manifold

4. Connect the manifold cable to the solenoid. If no cable is present for the Z-stage solenoid, then remove the existing cable from J3 on the manifold interface board and replace it with the cable from the upgrade kit (10-5142A).

5. Remove the power box panel.

6. Route the GENINE cables along the cable duct underneath the flex track, around the frame at the side of the device, and into the power box.

In the power box:

7. If you are upgrading a Magnus VLF that does not have GENINE 0 installed, you must first install the GENINE board, the terminator, and the canbus cable. See Figure 4 for installation location.

8. Mount the Z-stage motor resistor bracket above the GENINE board (use existing holes).

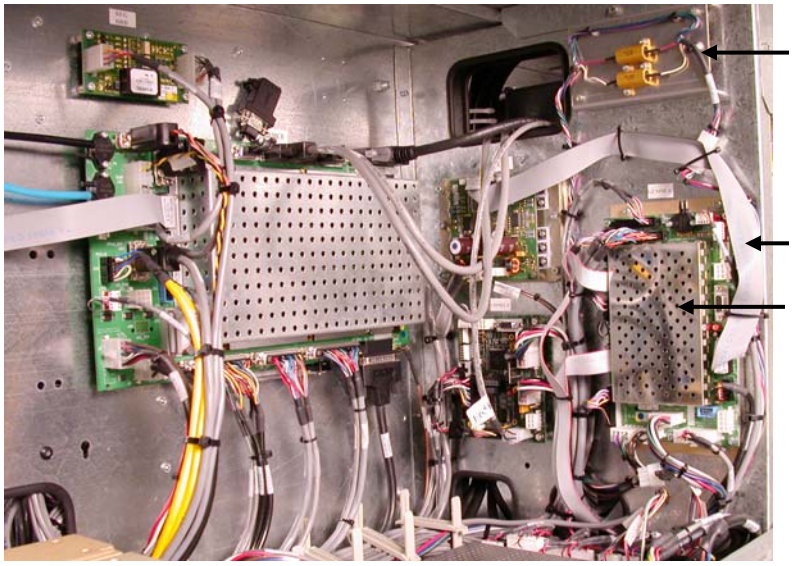


Figure 4: Power box

9. Connect one of the resistor cables to the GENINE 0 board (J25), and connect the other cable to one of the new cables you routed from the carriage (220-00544A).

10. The other routed cable connects to the GENINE 0 board (J20).

11. Secure all cables neatly with cable ties.

12. Install the power box panel.

6.4 Removing the TH2 carriage

1. Remove all three pieces of the cable track support bracket from the carriage. The upper and lower pieces will be reused—the middle part will be replaced with a new part (252-0973A) included in kit 512-00343B.

2. Measure the gap between the TH2 carriage and the ballscrew collar—it will be approximately 3 mm (see Figure 5). This measurement will be used when installing the universal carriage.

3. Using a new 3 mm hex key (preferably a straight key, not a ball end key) that has not been rounded, loosen the three setscrews on the clamp collar that secures the flextube to the ballscrew nut—half a turn is all that is required.

Note: Take care not to strip these setscrews as they may be tight and difficult to remove.

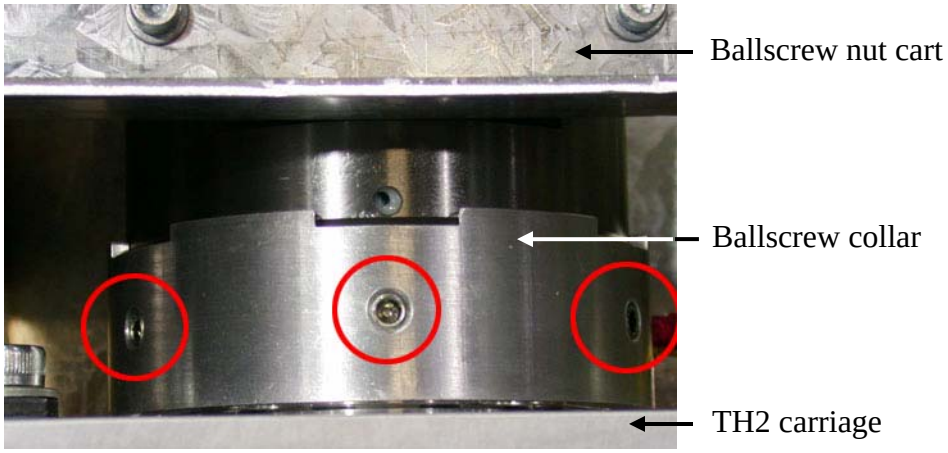


Figure 5: Loosening the ballscrew collar setscrews

4. Separate the carriage from the ballscrew nut and push the carriage along the tracks to the home side of the device.
5. Remove the yellow ballscrew drive motor cover on the away side of the ballscrew.
6. Disconnect the 6-pin connector to the ballscrew drive motor.

Note: When turning the ballscrew using a drill in the next step, a voltage will be generated by the motor that can damage the electronic control board for the motor. The 6-pin connector is disconnected to prevent this from happening.

7. Using the ballscrew drive tool (690-00808A) and a drill, move the ballscrew nut close to the carriage in order to support the ballscrew at the home side.

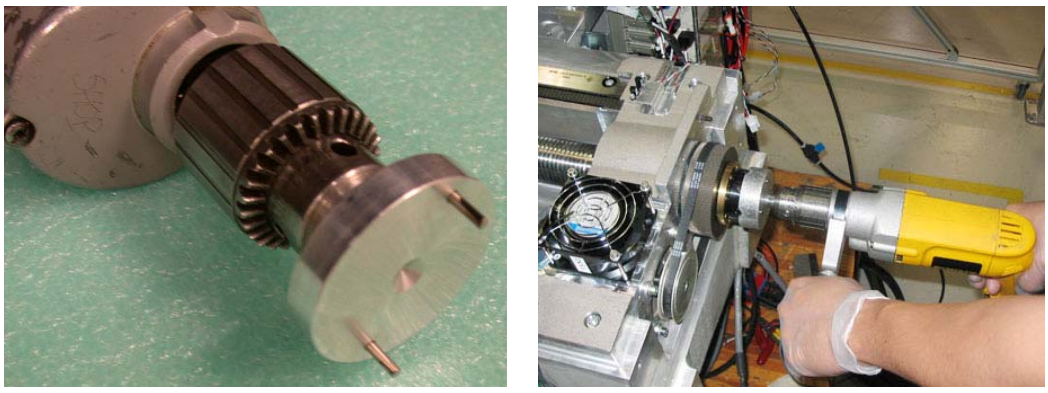


Figure 6: Tool for turning the ballscrew with a drill

8. Remove the home sensor tab from the carriage. The home tab will be reused.

9. Remove the home sensor bracket assembly.

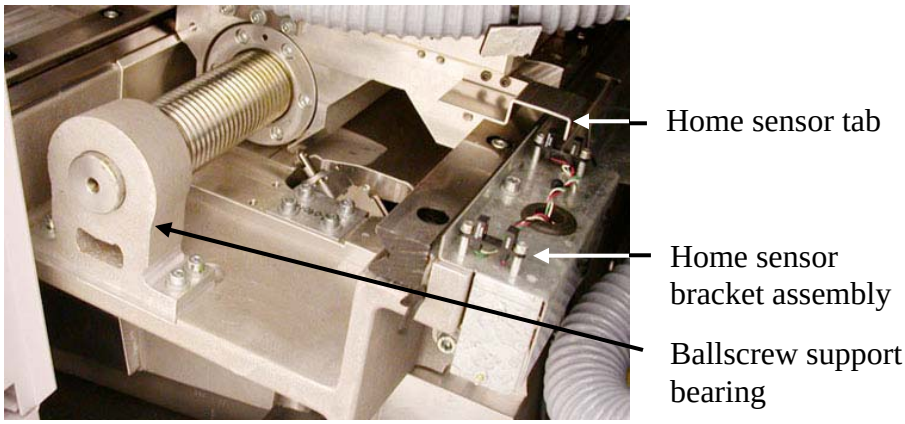


Figure 7: Home side sensor bracket assembly

10. Remove the ballscrew support bearing assembly.
11. Completely remove the carriage from the ballscrew by carefully sliding it off.

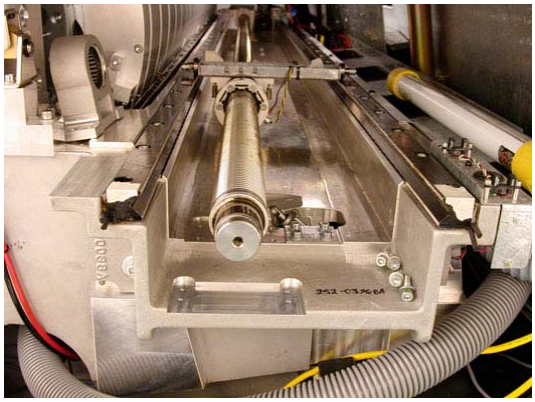


Figure 8: Carriage removed from the ballscrew

12. Remove the six screws to remove the flextube from the old carriage—it will be reused on the new carriage.

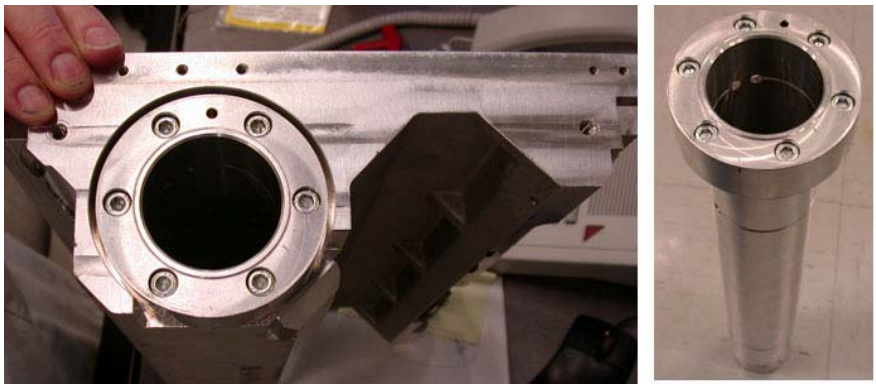


Figure 9: Removing the carriage flextube

6.5 Installing the universal carriage

1. Put some masking tape over the sharp edge formed by the top and ends of the tracks to prevent the sharp edge from creating aluminum filings as the carriage is installed.

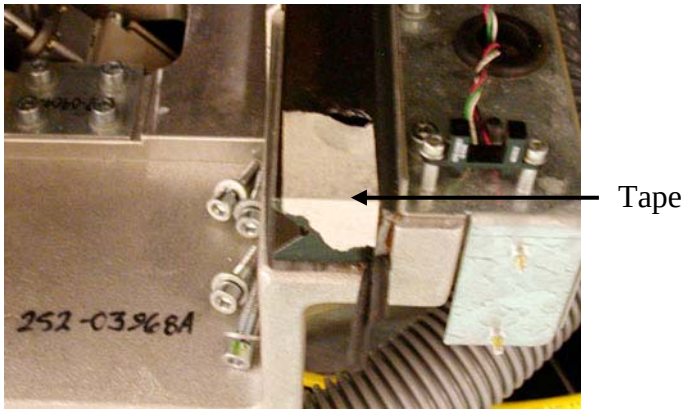


Figure 10: Putting tape on the sharp carriage track edges

2. Install the new carriage without the flextube, wipers, home tab, or cable track support brackets.

3. Install the ballscrew support bearing temporarily with one screw on either side. To ensure that the ballscrew is centered, push the bearing assembly towards the drum and towards the carriage before tightening the screws. The bearing edges must be up against the casting cutout as shown below.

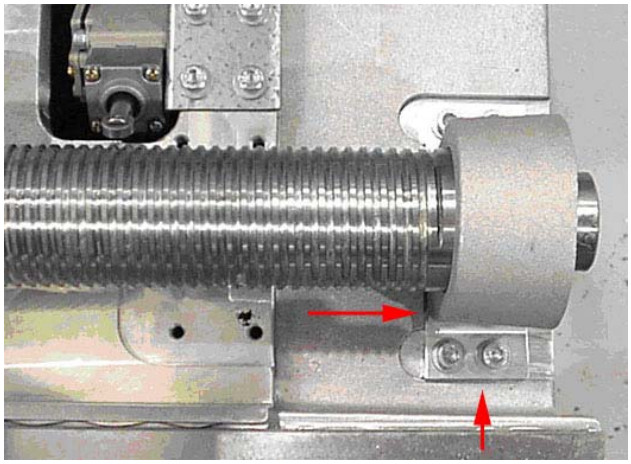


Figure 11: Ballscrew bearing alignment

4. Using the ballscrew drive tool and an electric drill, move the ballscrew nut to the away side of the device—move it as far as possible without hitting anything.

5. Move the carriage by hand so that it is accessible through the head service opening. Slide the carriage back and forth by hand at a speed roughly the same as the retrace speed and ensure that the carriage moves smoothly. If the carriage motion is not smooth, check for debris on the tracks and clean them as necessary. It may be necessary to remove the carriage and clean the bearings if debris gets stuck to one of the bearings.

6. Once smooth carriage motion is achieved, move the carriage to the center of the head service opening.

7. Use the ballscrew drive tool to move the ballscrew nut to the center of the ballscrew close to the carriage.

8. Install the away side wipers onto the carriage. Lightly push each wiper so that it contacts the track while tightening the screw.

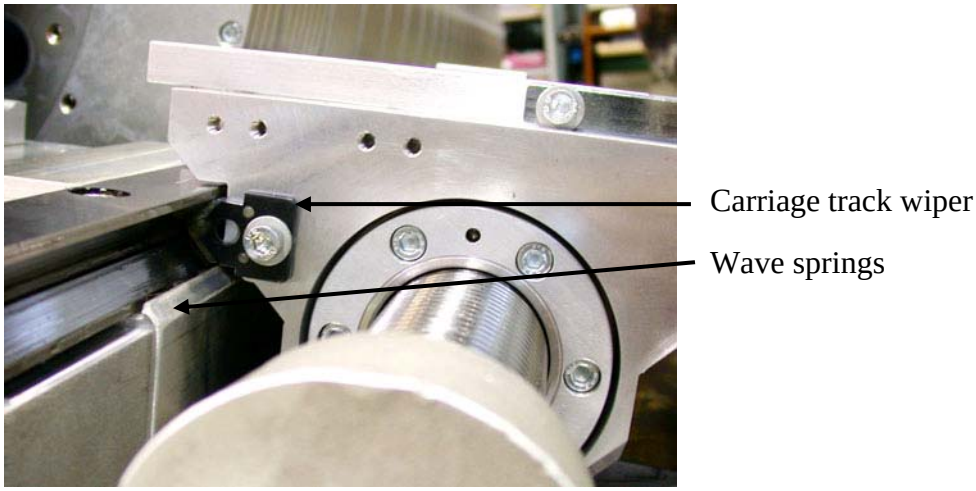


Figure 12: Installing the carriage track wipers

9. Move the ballscrew nut to the away side of the ballscrew again and slide the carriage back and forth over the whole range of travel and ensure that the wipers do not contact the wave springs. Once you are satisfied that the wipers do not contact the wave springs, move the carriage to the home position.

10. Move the ballscrew nut approximately 150 mm (6 in.) from the carriage to support the ballscrew at the home side.

11. Remove the ballscrew support bearing assembly.

12. Without removing the carriage, install the flextube and fasten the six flextube screws.

13. Install the ballscrew support bearing assembly using all four cap screws. To ensure that the ballscrew is centered, push the bearing assembly towards the drum and towards the carriage before tightening the screws. See Figure 11 for alignment.

14. Install the home sensor bracket assembly.

15. Install the home tab removed from the old carriage on the new carriage and align it with the sensor. The home tab mounting holes are smaller and lower on the new carriage than on the original carriage. Using M4 cap screws with large diameter heavy washers, it should be possible to mount the old home tab to the new carriage and align it so that it will not break the sensor.

Note: If the customer is using 83 in. plates, then new home and away sensors must be installed. See Parts / tools Required for part numbers.

16. Install the home side wipers on the carriage. There should be a very small gap between the wipers and the tracks. Move the carriage back and forth to ensure the wipers do not prevent carriage movement.

17. Using the ballscrew drive tool, move the nut cart to the right side of the head service opening.

18. Move the carriage towards the ballscrew nut and slide the flextube into the clamp collar until the shoulder on the flextube hits the collar. The gap between the collar and the carriage should be the same as you measured earlier with the old carriage (approximately 3 mm). Alternatively, there should be a 42 mm gap between the nut cart and the carriage.

19. Apply Loctite 242 to the three setscrews that clamp the collar onto the flextube and tighten the setscrews. Again, take care not to strip the hex socket of the setscrews.

20. Reinstall the lower portion of the cable track support bracket onto the carriage. Note that the feature on the carriage where this bracket is installed is 25 mm further to the right than on the original carriage. This is why the middle section of the cable track support bracket must be replaced. After installing this part, notice that there is very little clearance, if any, with the cable track. Loosen the two screws securing the fixed end of the cable track and move it as far away from the carriage as you can. This should create enough clearance that the bracket will not hit the cable track.

21. If it is not already installed, install the Series 2 Z-stage on the carriage. There should be one 0.012 in. thick shim under the 5th point support assembly as the starting point for tilt adjustment. A tilt adjust shim kit containing two 0.002 in. shims, one 0.003 in. shim, one 0.006 in. shim, and one 0.012 in. shim is also provided. The extra shims are to be attached to upper right hand corner of the carriage using two M4 cap screws and two oversized (9/16 in. OD) washers.

22. With the Series 2 Z-stage, the head hold-down springs are attached using studs. Install the four spring hanger studs in the carriage.

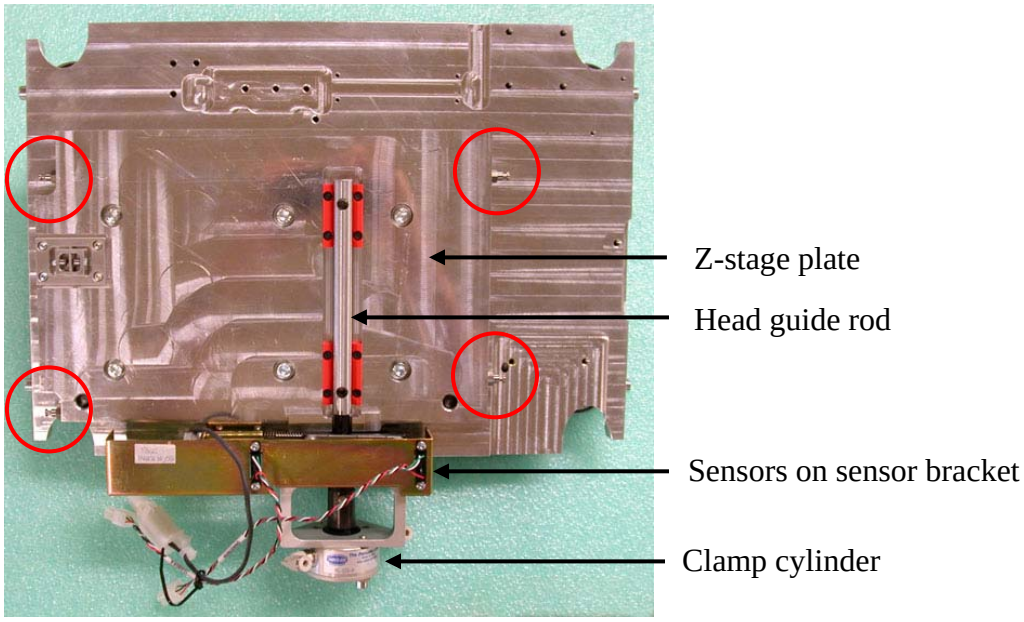


Figure 13: Carriage spring hanger studs (circled)

7. INSTALLING THE TH2

For TH2 installation, see the following document: *Replacing a TH2 on a Universal Carriage with Z-stage* – section 5.

7.1 Upgrading the TH2

Note: Wear an anti-static wrist strap when working with the thermal head.

1. Remove the old flexure plates by removing the M4 screws holding them in place on the sides of the head and slide the plates out of the head.
2. Cut the cable ties on the side handles and slide the handles into the head.

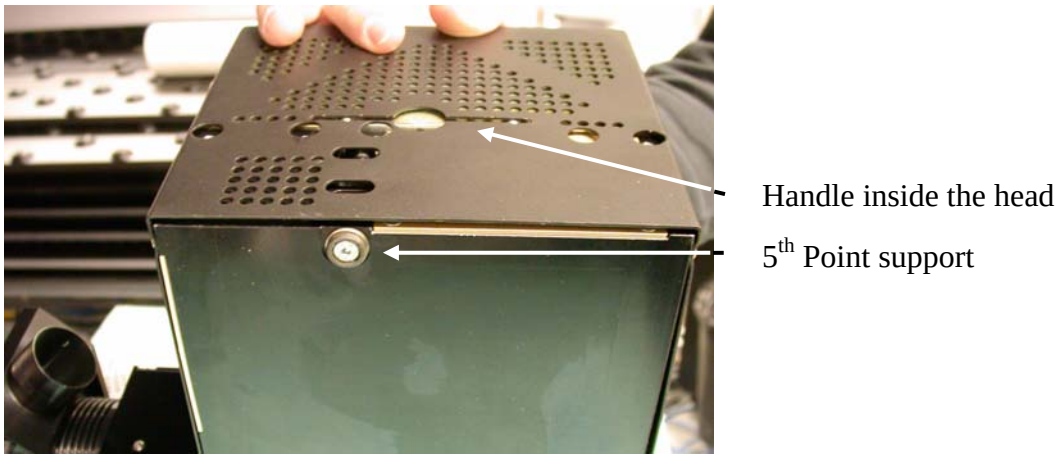


Figure 14: Thermal 2 head 5th point

3. Install the new spring hanger studs where the flexure plates were removed.
    - On the side with the 5th point support, add several M4 washers to each stud when installing the studs—the washers act as shims so that the studs align better with the studs on the carriage (usually 3 or 4 washers are sufficient).
    - On the connector side, you do not need to add washers to the spring hanger studs.



Figure 15: TH2 spring hanger studs

4. Remove the head guide rod from the TH2 and clean the grease from the area with isopropyl alcohol and a lint-free cloth.

5. Check if the rod needs to be replaced and replace it if necessary. Use the same screws to install the new head guide rod in its place—do not put grease on the new rod and do not over-tighten the screws.
   If the device had a TH2 Z-stage previously installed, the rod on the head should be hard-chromed and ground. If there is any doubt about this, replace the rod. DO NOT use a standard 303SS rod. The surface finish on the 303SS rod is not suitable for contact with the Turcite V-blocks and will destroy them in short order if used. You can tell the difference between the rods by looking at the ends. The standard 303SS rod has a tapped hole in both ends; the hard-chromed rod only has a tapped hole in one end.

6. Clean all other contact surfaces with isopropyl alcohol and a lint-free cloth.

7. Install the TH2.

8. CALIBRATION AND SETUP

Calibrate the Z-stage according to the following document: *Replacing a TH2 on a Universal Carriage with Z-stage* – section 6.1.

8.1 Burning in the Z-stage

The Z-stage uses engineered plastic guides forming a V-groove with a hard chromed steel head guide rod that slides approximately 1.5 mm back and forth. Tests have shown that the wear of these components is approximately 14 microns in depth. The wear rate is high in the first few hundred cycles and rapidly decreases after that (we have tested up to 650,000 cycles and wear beyond the first few thousand cycles was almost negligible). Therefore, we recommend running the Z-stage in for as many cycles as time allows. To do this, run a loop script from service shell as described below:

1. Set the current plate thickness to 0.6 mm.
   The plate thickness is set to an unrealistically high value to ensure that the Z-stage moves through its complete range of travel.

2. Go to the service shell scripts page and start a new loop script.

3. Type **zstage init** , check the **wait for** box, and copy and paste the **command complete** line from a previous command in service shell.

4. In the next box, type **zstage position** , check the **wait for** box, and copy and paste the **command complete** line from a previous command in service shell.

5. Save this loop and set the number of cycles between 200 and 1000 (as many cycles as time permits).

6. Run this script until it is complete.

8.2 Adjusting the head tilt

Adjust the TH2 tilt according to the following document: *Replacing a TH2 on a Universal Carriage with Z-stage* – section 6.2.

9. UPDATING THE WORKSTATION SOFTWARE

The plate thickness data is critical for the Z-stage to correctly position the head. Measure the actual thickness of all the customer's plates and enter these numbers in the Media Tool section of the Print Console software.

10. FINAL TESTING

As a last test, ask the customer to send some of their real files through their workflow. Run several different thicknesses of their plates to force the Z-stage to move. Check in service shell that the Z-stage is moving to the correct locations and that no errors are reported.

If possible, ask the customer to run some of the newly imaged plates on press to make sure there are no imaging problems due to the stage upgrade.

11. DISABLING THE Z-STAGE OPTION

If the installation is not successful, you must manually position the head at a nominal focus error value and disable the Z-stage option.

Note: Ensure that you have the laser off or you are wearing laser eye protection when servicing the head.

To disable the Z-stage option:

1. To gain access to the stepper motor and sliding wedge, remove the sensor bracket (see Figure 13) by removing the two home sensor screws. Also remove the home/away sensor tab mounted on top of the sliding wedge by removing the two M3 screws.

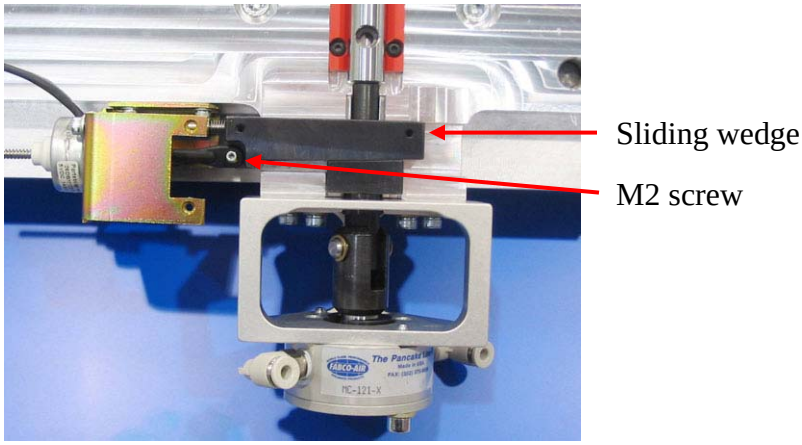


Figure 16: Z-stage mechanism (sensor bracket and sensor tab removed)

2. Disconnect the stepper motor lead screw from the sliding wedge by disconnecting the M2 screw bolting the rod end into the sliding wedge.
3. Install the sensor tab with the two M3 screws.
4. Move the sliding wedge to an approximate focus position and lock the clamp cylinder by typing `>>zstage lock`.
5. Perform a normal **head install on** routine to use the head's auto focus laser as a measuring device and iterate these steps to get it to the desired focus error value.
6. When the focus error value is set, disable the Z-stage option in service shell:
   `>>option zstage disable`
7. Install the sensor cover and any panels that are still open.