MultiMode Adjustment Screw Maintenance Procedure

This Support Note covers maintenance procedures for adjustment screws used on Bruker small sample microscopes. These screws are used to support and position the head relative to the scanner, and must be cleaned periodically to ensure smooth operation. Instructions for the removal, cleaning, lubrication and replacement of adjustment screws are included in this Support Note.

Document Revision History: MultiMode Adjustment Screw Maintenance Procedure

Rev.	Date	Sections	Ref. DCR	Approval
Rev. B	01-18-2011	Re-branded		Ruth Wishengrad
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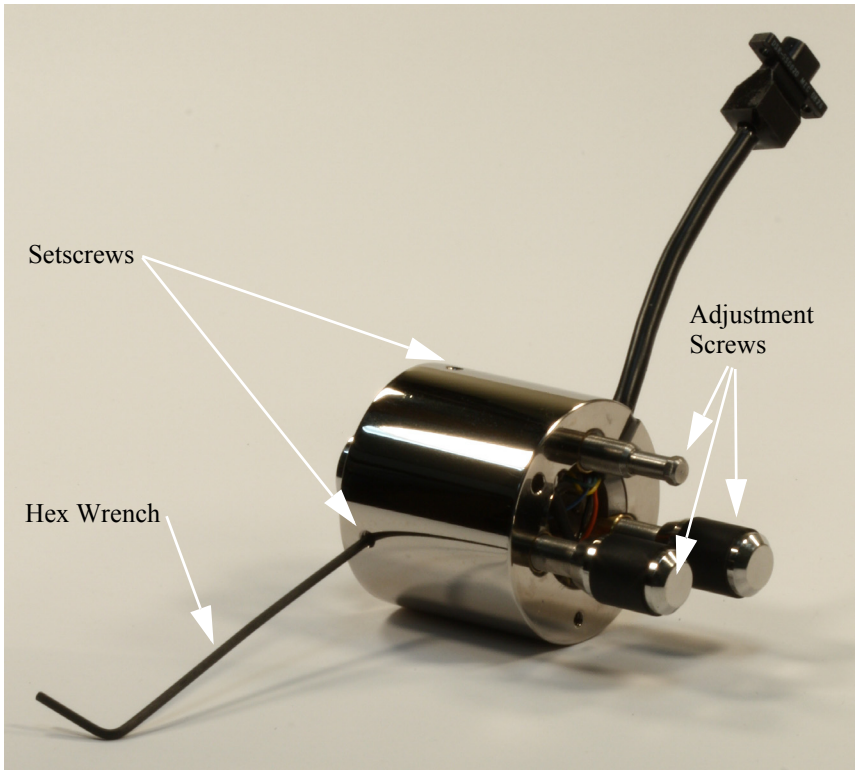
1 Quick Start Information

Your scanner comes with a 1/16 inch hex wrench/key (See Figure 455.1a). This wrench is used to tighten or loosen the setscrews on the side of the scanner which in turn control the tension on the three adjustment screws that run all the way through the scanner. Verify that each adjustment screw turns freely in both directions, but feels snug. (Adjustment screws should turn freely while exhibiting sufficient rigidity to stabilize the head). Adjustment screws that are too loose will allow for drift between the head and the sample which will be evident at small scan sizes. However, if the motor adjustment screw tension is set too tight, the motor may not be able to turn.

Figure 455.1a Setscrew & Adjustment Screw Locations



2 Adjustment Screw Maintenance Procedure

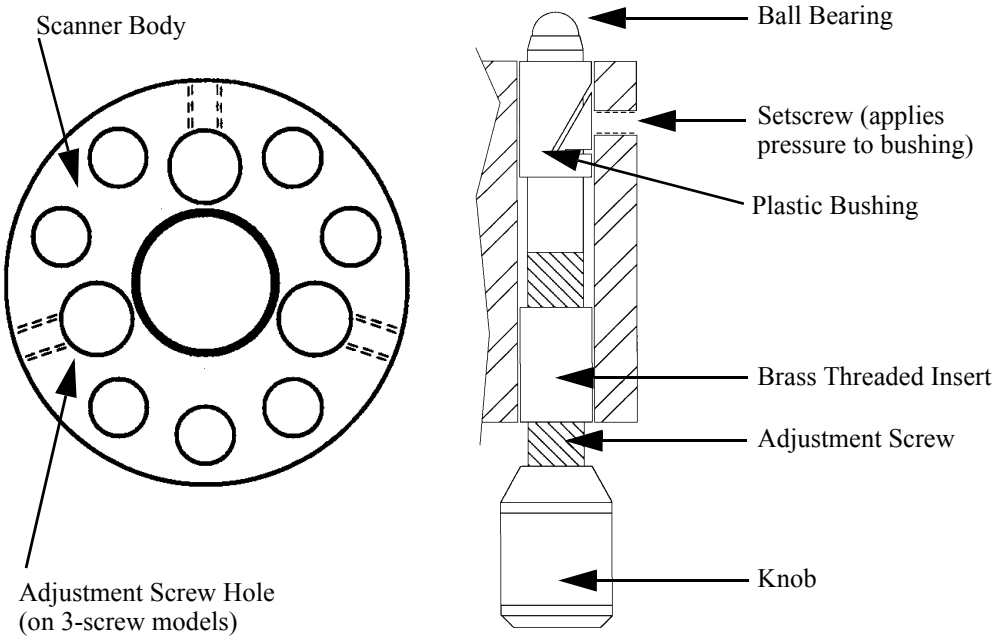
This section covers maintenance procedures for adjustment screws used on Bruker small sample microscopes. These screws are used to support and position the head relative to the scanner, and must be cleaned periodically to ensure smooth operation. Instructions for the removal, cleaning, lubrication and replacement of adjustment screws are included in this section. A schedule of inspection and service is recommended at least **every three months**.

If adjustment screws are inspected and cleaned regularly, they should last the life of the scanner without replacement. Contamination of the screws with grit depends heavily upon the operating environment, types of material(s) being scanned, and operator handling.

2.1 Inspection

Small Sample SPMs utilize fine-pitch (1/4”-80) adjustment screws; in some scanners, two of them are manually turned, and a third (rear) screw is turned by a motor located in the microscope base. The Vertical Engagement “JV” scanner has just one adjustment screw. Figure 455.2a, below, illustrates a screw and adjacent hardware installed on later-model (post-August 1993) microscopes. Earlier models have their brass threaded inserts installed at the top of the scanner body (rather than the bottom) and feature a Teflon bushing. Inspection and service is similar for all types.

Figure 455.2a Adjustment Screw and Adjacent Hardware Depiction



Adjustment screws are threaded into brass inserts, which are affixed to the scanner body with epoxy. Although screws are not heavily lubricated, a light film of oil is applied to them at the factory to prevent galling. This allows sufficient lubrication for fine adjustment, while minimizing drift (i.e., loosening) between the screws and scanner body due to the slow displacement of lubricant from screw threads.

Problems develop whenever screws become fouled with fine grit: screws may be difficult to turn and/or exhibit any of the following symptoms:

- Eccentric, rotational “limp” (i.e., alternatively easy, then difficult to turn).
- Faint, crunching or grinding noises when rotated.
- Microscope cannot engage sample surface, i.e., motor is unable to rotate rear adjustment screw.

If *any* of these conditions are noted, screws should be backed out and cleaned as described below.

Note: If screws are frozen (i.e., cannot be rotated), DO NOT attempt to force them! Return the scanner body and screws to Bruker for repair.

The user should inspect screws *at least* every three months, more often if possible. It is a good practice to check screws whenever the scanner body is removed by turning manually and feeling for resistance. This is especially true of the rear, motor-actuated screw, which may be fouled without the user's notice.

2.2 Remove Adjustment Screws

To remove adjustment screws, do the following:

1. Remove SPM head and disconnect the scanner body from the Small Sample base by pulling its cable connector straight up. Hold the scanner body firmly in your hand.

2. Gently turn each screw to check for resistance. Turn counterclockwise until backed out of its screw hole. If resistance is experienced in turning the screw, stop, rotate briefly in the opposite direction, then retry. If resistance is experienced on later-model scanners, loosen the setscrew which applies pressure to the plastic bushing (see diagram above), then try again.

3. If screws are frozen (i.e., cannot be rotated at all), DO NOT attempt to force them. Return the entire scanner body and screws to Bruker for repair.

2.3 Inspect for Physical Damage

Adjustment screws are made of hardened stainless steel; threaded inserts are made of a much softer brass. If a screw becomes fouled with hard grit it may bind against the threaded insert. If the bound adjustment screw is forcefully rotated, the screw will almost always destroy the brass insert: threaded inserts may become cross-threaded, or stripped entirely of threads. If this occurs, they will have to be pressed out and replaced; return to Bruker for repair.

1. Once screws are removed from the scanner body, they may be washed using methanol. Do not use strong solvents such as methyl chloride, MEK, benzene, etc. Use a fine brush or swab to remove grit from between threads and shoulder. Observe caution around rubberized knob surfaces; certain solvents may dissolve them! Be sure to remove all grit from surfaces; air dry.

CAUTION:	Do NOT splash solvent on the scanner tube or wiring at the center of the scanner body—certain components (e.g., wiring insulation) may be dissolved, causing scanner failure!
ATTENTION:	Ne pas éclabousser le tube en céramique piézo-électrique ou le montage à l'intérieur du tube avec un solvant. Certains composants pourraient être dissous, entraînant une défaillance du tube.
VORSICHT:	Verwenden Sie keine Lösungsmittel auf dem Scanner-Röhrchen oder den Kabelanschlüssen am Piezo - manche Komponenten (z.B. Isolation der Anschlußdrähte) könnten sich auflösen und eine Fehlfunktion des Scanners nach sich ziehen.

2. Use a swab stick (e.g., Q-tip, Puritan swab, etc.) to carefully clean grit from the threaded brass inserts. Be sure to remove all grit from threads; air dry.

3. Carefully inspect surfaces for signs of wear or damage. If small burrs are visible inside of the threaded brass inserts, they may removed by gently sanding with fine emory cloth, then recleaned using a swab and solvent. If threads are cross-threaded or stripped, the unit will have to returned to Bruker for repair.

2.4 Clean Guide Bushings

Plastic guide bushings are installed to stabilize screws and increase rigidity. Tolerances between screws and bushings are very tight, necessitating removal of all grit. Use a swab and methanol as described above to clean bushings thoroughly.

Note: It is not necessary to remove setscrews from the scanner base to clean bushings. (Setscrews are used only to apply pressure to the shoulder of each adjustment screw; see diagram above.) If setscrews are removed, they should be re-torqued to approximately 4 in/oz., or until the adjustment screw can be turned snugly without binding.

2.5 Lubricate

Apply a very fine layer of lubricant to each adjustment screw. Lubricant may consist of high-vacuum grease, optical coupling grease, or equivalent. Screws should exhibit a slight sheen and no more, indicating that they have been finely coated.

Note: Excessive use of oil and grease on screws can cause the head to drift slightly. This is due to a slow displacement of lubricant between the screw and threaded insert. As lubricant is slowly squeezed out between the screw and threaded insert, the screw settles, causing the head to lower itself (and the tip) toward the sample. This is especially apparent during atomic-resolution imaging.

2.6 Reinstall

1. Verify that all screws, threaded inserts and plastic bushings are free of grit.

2. Replace adjustment screws in their threaded inserts. Carefully turn them down clockwise until the shoulder of the screw engages the plastic bushing, and the screw's ball bearing appears at the top of the scanner body.

   Note: If screws bind during reinstallation, *stop immediately.* Back the screw out again, reclean as described above, then redo installation. Recheck that the setscrew is properly torqued at the plastic bushing. If screw still cannot be installed without binding, return to Bruker for repair.

3. Verify that each screw turns freely in both directions, but feels snug. (Adjustment screws should turn freely while exhibiting sufficient rigidity to stabilize the head).