
Small Sample Adjustment Screw Maintenance Procedure

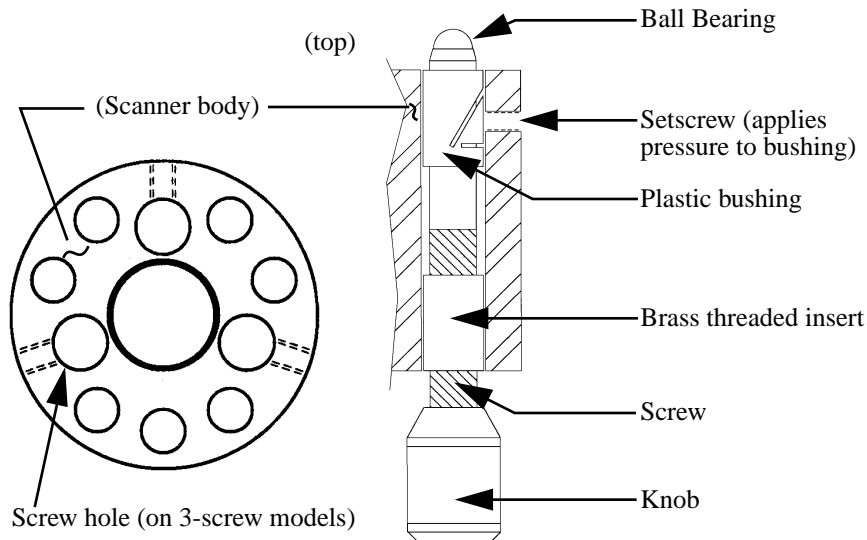
Document Overview

Support Note 216 covers maintenance procedures for adjustment screws used on Digital Instruments 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. This support note provides instructions for the removal, cleaning, lubrication and replacement of adjustment screws. A schedule of inspection and service is recommended at least **every three months**.

216-1 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. The diagram 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.



216-1.1 Manual Inspection

Adjustment screws are threaded into brass inserts, which are epoxied into the scanner body. 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 Digital Instruments 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.

216-1.2 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, rerotate 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 Digital Instruments for repair.

216-1.3 Inspect screws and threaded inserts 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 Digital Instruments 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.
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.

NOTE: 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!

3. Carefully inspect surfaces for signs of wear or damage. If small burrs are visible inside of the threaded brass inserts, they may be 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 be returned to Digital Instruments for repair.

216-1.4 Clean plastic 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 retorqued to approximately 4 in/oz, or until the adjustment screw can be turned snugly without binding.

216-1.5 Lubricate adjustment screws.

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.

216-1.6 Reinstall adjustment screws.

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 reattempt installation. Recheck that the set-

screw is properly torqued at the plastic bushing. If screw still cannot be installed without binding, return to Digital Instruments 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.)

216-2 Summary

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.