Maintenance Service on Nikon CoolScan Slide Scanner

Summary: Major disassembly of scanner mechanism and controller circuit board, lubricate and manually actuate slide rails and stepper motors.
Time to perform: about 2 hours

The X-axis scanning runs on three slide rails and a stepper motor. The Z-axis Autofocus runs on 2 slide posts, 2 forked sliders and a stepper motor. Both of these mechanisms require lube until they move easily and smoothly. Circuit board removal is required as most of the mechanism to be lubed is on the left side. Only one X-axis slide rail is accessible from the right side, making it an incomplete job. Clean sensor lens and two front-sided mirrors, as needed.

Statement of Warranty, Limits of Liability agreement, and other WARNINGS is included in Section IV, near the end of this document.

I. Qualify that the unit is operational, incoming inspection

0) check to see that no data cable is attached and that jacks are not damaged or contact pins are bent or corroded.

1) make sure that unit turns on with just AC plugged in. See that green light turns on, blinks and stays steady. Position unit in vertical position with power switch on top.

2) during the blinking phase, the unit is booting up and goes through mechanism qualification steps, see if you can hear any buzzing where stepper motors are moving the scanner mechanism. Testing of Autofocus is first and X-axis scan is second.

3) look inside the slide module throat and see if you can see any narrow strip of light from the LED light module located in the upper case near where the inner edge of the slide mount would be.

Symptoms:

4) if any of the mechanisms doesn't move during the qualification step, the green light changes to a rapid blink (about every half sec) and then steady green at the end of the boot sequence.

This negative failing rapid blink diagnostic will show up by the NikonScan app not recognizing that a correctly booted scanner is attached...the infamous "Nikon Scan was unable to find any active devices" dialog box message.

If yes to all four, then the unit just needs to be lubricated with Teflon and lens and mirrors cleaned with alcohol and or aqueous lens cleaner.

5) if there is slow blinking (about once per second) during boot for about 15 sec and then a steady green, then the slide scanner has booted normally and this maintenance and cleaning procedure is not required at this time.

If the NikonScan app can't see a SCSI attached scanner, then usually the Windows computer needs the Adaptec ASPI driver installed too (in addition to the SCSI board AHA-2940 driver).

II. Tools needed:

1) Set of jewelers screwdrivers, needs both flat bladed and Phillips tips. As a minimum, a set of 6 from Radio Shack $8-10 (Archer Japan) will do. A quality set from Felo Cat# 280-907-06 kit of six double hex shaft tips plus handle with knurled nut clamping chuck (Germany) $40 is better, especially their Phillips #0 size (UPC 4007157-507235).

A separate Wiha brand Cat#261 Phillips #1 screwdriver ($7 Germany) is also highly recommended for its precision tip that fits screw heads perfectly, even under high-torque stress and has a 3" long round shaft and rigid handle for hard-to-reach mechanism screws. The Wiha tip is machined so precisely that screws seem to stick on the tip without being magnetic.

May need a medical-type hemostat, forcep or tweezer to pick out dropped and re-position tiny screws. Available at an unusually complete Ace hardware store, such as Seven Corners Hardware, St Paul, Minnesota, (651) 224-4859 7corners.com, with an upstairs nationally-rated catalog mail-order operation at (800) 328-0457

2) DuPont Teflon Multi-Use Lubricant, sets up dry, Cat# D002101, UPC 036121-176232, 2 fl oz, mfgr & distrib Finish Line, Inc, 1545 5th Industrial Ct, Bay Shore, Long Island NY 11706, (631) 666-4186; a fine particulate teflon carried in a evaporative petrochemical dispersing vehicle, or equivalent http://www.performancelubricant.dupont.com/dp_products_multi.html . Popular at REI and bike shops, Finish Line Teflon Dry Lube $5 2oz squeeze bottle; http://www.finishlineusa.com/products/lubechoices.htm#dry

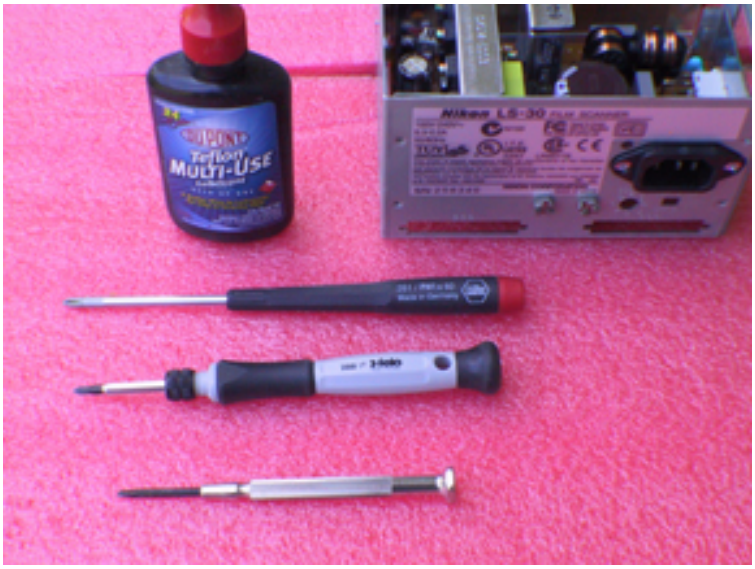

Fig 1. Jewelers screwdrivers, typical Radio Shack in front, Felo Phillips #0 with hex shaft middle, and Wiha Phillips #1 in back, with Teflon lubricant

Picked up this Teflon lube sample gratis at the National Association of Manufacturers show at McCormick Place Convention Expo, Chicago. Medical-type syringe and needle may be helpful. Did use Solder Seal Gunk brand L508 PTFE (generic Teflon) Lubricant in a spray can, available at an unusually complete auto parts store (noticed that Solder Seal Gunk Liquid Wrench L512 dry film PTFE Cerflon (Teflon) Lube is listed in their catalog, unevaluated). The lube is sprayed into the cap and transferred with an end of a screwdriver tip or Q-tip. The DuPont / Finish Line formulation is better by leaving a thin white coating of Teflon that seems to adhere to metal, yet not leaving an oily residue that attracts dust.

Do NOT recommend using an oil (sewing machine, 3-in-1), synthetic grease lube (white), silicone lube or spray, or penetrating solvents like WD-40.

3) Lighted work table with comfortable Herman-Miller Aeron chair, with 50 watt quartz halogen high intensity lamp. Highly recommend a high intensity flashlight to see black hidden parts of mechanism. Use a Makita ML902 flashlight 9.6v Ni-Cd with ratcheting right angle head, or equivalent. Perhaps a Petzl Tikka forehead-strapped LED flashlight will work too.

4) Plastic (pink) antistatic foam pad, 1 ft x 18" x 1/2" thick, preferably grounded with 2 Meg-ohm resistor.

5) Cheseborough-Ponds cotton Q-tips or TexWipe foam swabs and aqueous lens cleaner, isopropyl alcohol or Everclear liquor 190 proof ethanol. Kimberly-Clark Chemwipe tissues.

6) Antistatic bag, 12" x 14" to hold circuit board

7) receptacles to conveniently organize and secure tiny screws, recommend a 6-pack of empty vials (tubs) with intact foil covers. Suggest Kraft Crystal Light diet beverage powder concentrate empty tubs, UPC 043000-950517, or equivalent. Don't drop screws on the floor as the tiny black ones will be extremely hard-to-find (and extremely hard-to-buy to replace them).

8) About 2 hours of quality time, known-good test computer with NikonScan v3.1 application (or equivalent) installed, data interface and data cable, AC power cord for Nikon and grounded power strip.

9) 8 1/2" x 11" notepad and PaperMate Write Bros pen with cap

III. Disassembly and maintenance service procedure

(this example is for Nikon Coolscan III, model LS-30 which has two MD-50 pin SCSI jacks, 1999 vintage)

0) remove all AC power and signal cables.

A) take out any transport screws from bottom of case and throat of slide carrier, where example MA-20 slide mount adapter fits into. Store them by screwing them in the back panel, threaded holes are just above the SCSI connectors.

B) take off 4 screws on back panel, separate halves of metal case, and set aside, put in vial #1. Check to see if there is any corrosion, water damage, or any evidence of liquid spillage inside. Check to see if there are any loose parts inside, screws, plastic bits, packing materials, etc

c) loosen 4 screws on right side of circuit board which have large rectangular 1/4" x 1/2" square grounding solder pads. Do NOT remove 2 screws with 1/4" square solder pads as they hold the SCSI controls subassy; also leave the other 4 screws on the circuit board next to the SCSI connectors.

D) remove 4 screws on back panel next to SCSI connectors, put in vial #2. The circuit board should be loose but still attached.

E) remove 5 cables on bottom side of circuit board and 2 cables on top side of circuit board. May need to use fingernail, thin jewelers screwdriver or forcep to separate the cable jack and connector. Refrain from pulling on the wires with fingers or forcep; just get it to barely separate, then insert and twist a flat bladed screwdriver in the gap. Don't need to label them as they are all different.

Lube connectors, especially the metal wiring inserts in the connector with Teflon. The connectors depend on spring-loaded wiring inserts to make reliable pressure contact with the jack pins. The spring-loaded inserts often micro-corrode due to high humidity, as these are only commercial spec'd connectors (not like high-reliability military spec'd connectors)

F) remove the 4 screws that hold in circuit board, put in vial #3

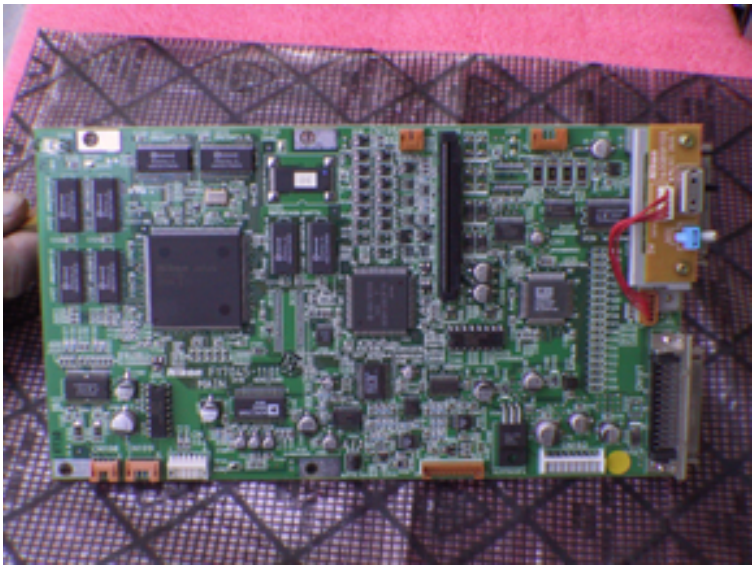

Fig 2. Circuit board, see mid-board the vertical long black connector for orange flexible circuit, note on the right-edge is a vertically sliding latch

G) from the top, locate orange flexible ribbon cable and lift the left-edge locking mechanism delicately with a flat bladed screwdriver. Remove the flex ribbon cable and lube contacts and the jack's locking mechanism with Teflon.

H) separate circuit board from mechanism handling by the edges, inspect for dirt, corrosion, for any scratches or cracked board, and sniff for any burned part(s). Store in anti-static bag and set aside.

I) inspect power supply in left side, especially for any bloated or leaking round cylindrical brown capacitors; 4 larger ones, 3 black striped smaller ones. There is a soldered-in ceramic 3.15A internal fuse F1. Disassemble, unsolder and replace if needed

J) remove front plastic bezel, there are top and bottom plastic snaps

K) lubricate the three X-axis rails with Teflon with several drops of lube. Use a flat bladed screwdriver and surface tension of the liquid lube to place it and tilt mechanism until the entire rails are uniformly covered.

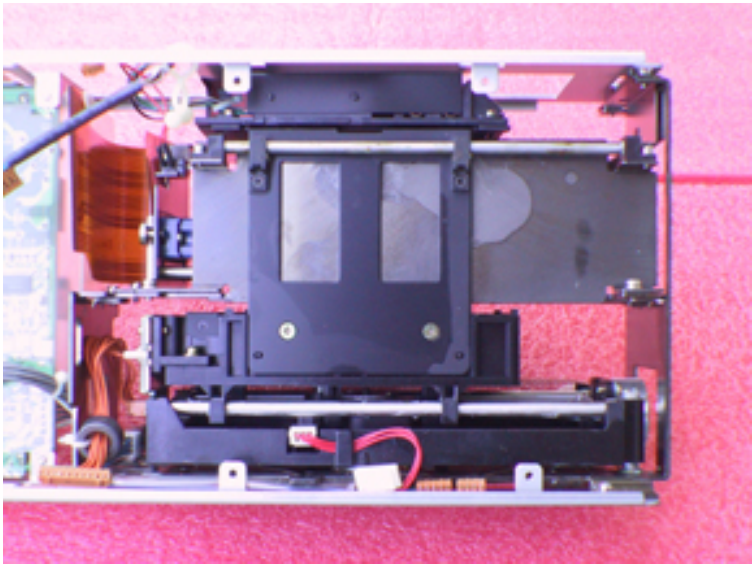

Fig 3. Left side of scanning mechanism, two of three X-axis rails and forked guides of Autofocus Z-axis mechanism is visible, under circuit board

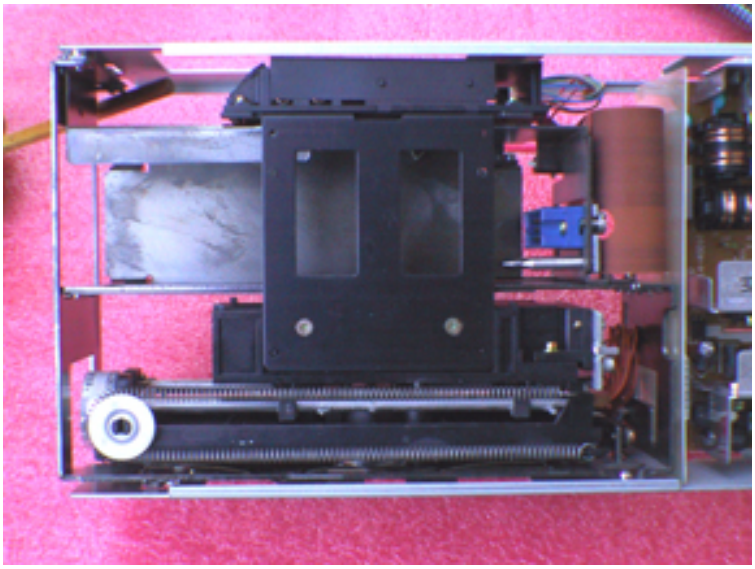

Fig 4. Right side of scanning mechanism, only one of three X-axis rails is visible, just under the upper tension spring. The LED light source assy on top and the CCD sensor assy is within the middle of sliding mechanism. The Z-axis Autofocus mechanism in the bottom between the two springs.

L) on the front of mechanism is a round stepper motor, with a slot in end of the shaft. Manually run it back and forth from end to end, to additionally distribute the Teflon lube and add where necessary.

M) the stepper motor has a threaded shaft and attachment block to mechanism. Using Teflon lube and surface tension of a drop of lube on screwdriver tip, delicately lube and repeat as needed. Use a PaperMate pen cap to hold the return pressure spring out of the way for access to attachment block. Manually run the mechanism back and forth from end to end. When satisfactory, return the carriage to a central position.

If a medical syringe is available, it may be easier, but the Teflon may settle out and the vapor pressure of carrier vehicle may cause it to squirt out on unintended places.

N) On the bottom of the mechanism, there is a spring-loaded brown bronze clip / spring covering the Autofocus Z-axis stepper motor shaft. Using a Felo Phillips #0 screwdriver, remove the tiny screw only, put in vial #4

It may be screwed-in tight, so use a like-new tip and lots of persuasive but delicate hammering, pressure and torque on hex-shaft (like an micro-impact wrench), remove screw but do NOT bung-up the screw-head, may need assistance here as it can be a two-person job

O) using a small flat-bladed screwdriver, carefully pry-lift slightly the clip and slide it off the shaft of motor, exposing the slot on the end of shaft. The shaft is under the front-side of clip between the visible metal screw ends of the motor mount

P) manually run the Autofocus up and down and lube the four bearings. There are two short post-type bearings on the bottom of both sides of the mechanism. And there are two fork type bearings that slide up and down on the upper X-axis shaft. Also lube the four contact points on the two leaf springs on bottom that provide return pressure on the mechanism

It is considered that Teflon lube and manually working it is an especially important step for the Autofocus mechanism. When moving it up and down, observe to make it as smooth as possible, although it will appear to be jerky at the ends of range

Q) the Autofocus stepper motor has a threaded metallic-colored shaft that can barely be seen buried within the mechanism. Use Teflon lube and surface tension of a drop of lube on screwdriver tip, lube it several times. Manually run it up and down some more. When satisfactory, return it to middle of its range, where movement must be smooth

R) replace the circuit board, flexible connector, 7 connectors. Replace 4 screws on back panel and 4 screws on circuit board. Tighten the back panel screws first, then the circuit board screws second

Make sure that the bundle of 10 individual orange wires that pass through the black ferrite core are looped appropriately and are free & not kinked when the scanning assy is moved back and forth

Time to test the bare mechanism under live power; be careful to not touch power supply parts which may have dangerous high voltage. Plug in power cord and turn on power switch

S) watch the shaft of Z-axis Autofocus stepper motor during the beginning part of the boot process, it must rotate back and forth. The carriage can be manually moved out of mid-range in both X-axis and Z-axis so that the smooth operation can be observed.

When satisfactory, move and center the stepper motor bronze clip over the shaft and secure with the tiny screw.

T) with a test slide in the MA-20 module inserted, watch the X-axis movement as the mechanism moves from a central position, back to the inner-most position and to a central position during the boot process. The green light must be blinking slowly on several boot trials. You may have to manually help the carriage to move back and forth to the front-most position until the X-axis stepper motor logic has autocalibrated itself. Repeat under its own power until satisfactory

U) using a Q-tip or Texwipe swab and alcohol or lens cleaner, clean the mirrors and lenses as needed, inspect with a bright light.

V) attach data cable when test computer is off, boot-up Nikon, then computer and test with NikonScan app with Preview scan and final Scan. Inspect scanned image for sharpness; night scenes with pin-point street lighting can be a good test subject.

W) re-attach the front bezel and watch for satisfactory boot operation.

X) Remove cables and re-attach case and four screws.

Y) test again boot process and with NikonScan

Z) test again a week later and / or burn-in for 48 hours

Appendix A:

(to remove the black mechanism assy from the metallic-colored case structural assy)

This additional disassembly may be required to remove the top light source module to clean front surface mirrors, both on top and bottom where the lens and sensor module is.

i) remove the four screws on top module, place in vial #5

ii) remove tiny black screw on front corner of structural assy, place in vial #6. Note the indexing of the top plate with other screw heads

iii) remove three screws on bottom that attach the black mechanism to base of the structural assy, place in vial #6

The whole black mechanism will slide out. This will facilitate cleaning access to especially dirty mirrors and lens

iv) reverse procedure for re-assembly. The light source assembly is in elongated sliding slots. Fasten in the mid-position.

IV. Warranty and Limits of Liability

This procedure is provided on a "best-efforts" basis and there is no warranty whatsoever herein, and is provided "AS-IS." It requires a high-level of technical competence and mechanical dexterity, such as an "A+ Certification" Computer Technician plus 3 years experience, or equivalent, and demonstrated ability to handle and understand complex, delicate optical mechanisms and instruments.

(ie practice of something simpler, like reviving a bad CD-ROM, CD player or VCR that is eating tapes).

A prerequisite is being able to comfortably use Scott Mueller's "Upgrading and Repairing PCs," the 1500-page defacto "Bible" by Que, documentation available from manufacturers on the internet, and having successfully built a custom-made computer from scratch (separate components).

This is the Entire Agreement between the User and the Service Provider

The User assumes all risk in using this document. If this procedure is used, the User specifically agrees to "hold harmless" from any and all liability alleged the responsibility of the Author, which

can include death by electrocution, poisoning by ingestion of lubricants and solvents, blindness by exploding components, laser LEDs, and not wearing safety glasses, and irreversible and expensive damage to any and all equipment, computer, tools and instruments.

V. Reference

Major chips on circuit board, where this information is copyright by Nikon Corp, Tokyo, Japan. CoolScan is a registered trademark. LS-30 S/N are 258340, 233527, 246184

circuit board P/N F178045-1101-1 , components single-sided, mostly surface mount passive components, era 2000 date codes
BIOS chip Firmware = 30, soldered-in
main chips:
Nikon EI-104 vE17 main controller
Hitachi HD6413003F16 H8/3003 microcontroller
Analog Devices AD9220AR 12-bit A/D converter
Analog Devices AD7528JR 8-bit D/A converter
LSI Symbios 53CF92A SCSI controller
WinBond W24257AJ-15ns memory x8
JRC 7809A voltage regulator
high quality capacitors are metal encased

CCD Signal Processing board on sensor assy
P/N F17045-1102-1 small subassy with orange 10 wire connector
Stepper Motors X-axis NN-251

Power Supply:
Zebra C7D14-4001C switching power supply
Fuse 3.15A ceramic in-line soldered-in
Regulator chips 5 each
Mitsubishi M51995AFP on reverse of board
UR1 voltage adjust pot