

HD-2300A Daily Operation Guide

Last modified on August 2009 by Dr. Jinsong Wu

Note: This guide is NOT complete operation manual of HD-2300. It is only for your daily operation quick reference. For detailed operation manual, please refer to <http://www.nuance.northwestern.edu/epic/manuals.htm>

Remember:

1. Please send a copy of your publication (e-format preferred) to Jinsong (jinsong-wu@northwestern.edu) if you use any TEM results taken with this microscope! We highly appreciate if you include NUANCE Center in the Acknowledgement.
2. Adjust the alignment settings **ONLY** when necessary.
3. Refill Liquid Nitrogen if your experiment goes over 2 hours.

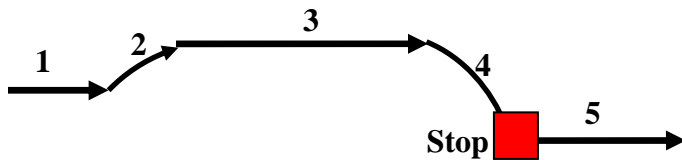
BEFORE YOU START

- Check conditions of HD-2300A before logon the access control.
 - Vacuum statue (Turbo: normal; IP1: <8E-9; IP2: <6E-8; column reading: <6E-5 Pa); (On the main menu, select [Setup] and then [Evac Control])
 - Sample position (X=0, Y=0, tilt=0); (On the main menu, select [Operate] and then [Stage Control])
- Check FOM-online to see notes left by previous user.

START-UP

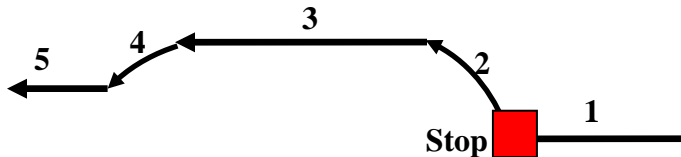
1. Fill LN2, Log in Access Control in FOM, <http://www.fom.northwestern.edu/>.
2. Load Specimen. Remember to check the O-ring!

Take the holder out



- 1: Gently pull it out till it stops
2. Turn it 15° clockwise
3. Gently pull it out till it stops
4. Turn it 30° counterclockwise till it stops.
- Stop:** Set the EVAC-AIR switch to AIR.
5. Gently pull it out straight (so we do not bend the holder).

Put the holder in

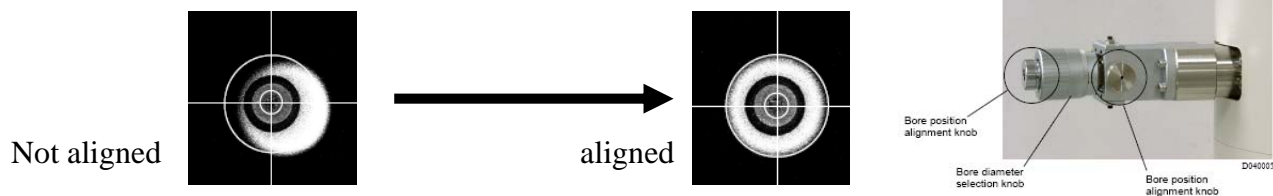


- 1: Gently push in till the holder stops
- Stop:** Set the EVAC-AIR switch to Evac.
2. Once green light on (alarm on), turn it 30° clockwise.
3. Let it slid in (hold it so it can slide in gently).
4. Turn it 15° counterclockwise
5. Let it slide in gently.

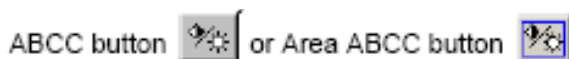
3. Turn on HV: Open “HV control” menu (On the main menu, select [Setup] and then [HV Control]), choose kV (80, 120 or 200 kV) and click “HV on”. If you wish to change to 120 or 80 kV: click “Standby” firstly and then select 120 kV (or 80 kV) and click “HV on”.
4. Open gun valve: turn the “GV Lock” switch from close to AUTO (open).

Column Alignment

5. Alignment of movable aperture position
 - On the main menu, select [Operate] and then [Alignment], select ‘Aperture alignment’ and click “On”.
 - By moving the aperture (turn the two knobs on the aperture) to center it:



6. Auto Alignment (On the main menu, select [Operate] and then [Auto Alignment Mode])
 - current center alignment: select “SE” icon on the toolbar; find a suitable area; ABCC (auto adjustment of brightness and contrast; set magnification to 20K-200K; find Eucentric height; adjust focus (you can use Auto Focus function); select [SE alignment] and click “Start”.




- Auto compensation for image escape in astigmatism correction: this can be done in any of detection mode: SE, ZC and TE; to get a clear and focused image and then select **[Stigma alignment]** and click “Start”.
 - Auto centering of visual field (in TE imaging mode): Click on “**TE**” icon to choose TE mode; select **[Bright area centering]** and click “Start”.
 - Focus: mag>50K, select **[Focus]** and click “Start”
 - Stigma: mag>50K, select **[Stigma]** and click “Start”.
7. Fine Column Alignment (manually)
- Find an interesting sample area and go to desired magnification. Go to low-magnification mode if necessary.
 - On the main menu, select **[Operate]** and then **[Alignment]**, select ‘Column alignment’ and click “**Start**”.
 - Lens ISF reset and sample height adjustment:
 -  **Lens reset**.....Resets the lens current (C1, C2, OBJ and PROJ).
 - Turn Z-control knob to adjust the sample height to focus (Eucentric height).
 - Click “**Next**” and followed the instruction in the menu to do fine “AL” alignment (aperture alignment): by turning the two Stigma knobs to stabilize the image.
 - Click “**Next**”, by turning the two Stigma knobs to stabilize the image when TEM starts stigma coil modulation along X.
 - Click “**Next**”, by turning the two Stigma knobs to stabilize the image when TEM starts stigma coil modulation along Y.
 - Click “**Close**” once you get to the last step.
 - Go to “TE” mode; go to 20-40K mag; select “DEAL Alignment”; center the bright spot by using the two multifunctional knobs (stigma).
8. Auto Alignment wizard: select **[Operate]** and then **[Alignment]**, select ‘Auto alignment’ and click “**Start**”. As guided by the wizard, you can easily carry out the alignment to astigmatism correction.

Image Observation

9. Scan speed settings: fast (TV rate) and slow scan mode: from 0.5s/frame (slow 1) to 20 s/frame (slow 4).
10. Selection of image observation signal: SE (secondary electron image), ZC (Z contrast image) and TE (phase contrast image).
11. Image movement by means of Image Shift: the Image SHIFT knobs.
12. Raster rotation: The direction of images can be adjusted by rotating the raster scan direction of the beam. Click the [Raster rotation button] or select **[Raster rotation]** from **[Operate]** menu.
13. Focus and stigma: can be done manually or automatically (see7).
14. Different lens operation modes: **[Setup]** menu select **[Column setup]**: (when you change the mode, you have to do the alignment again).
 In terms of probe current: Decan>EDX>Normal>Nano-diffraction>High Resolution>Ultra-High Resolution (more probe current, more beam damage).
 In terms of image resolution (from the best to the worst): Ultra-High resolution>High Resolution>Normal>Decon.
 Decon is the de-contamination mode used to reduced contamination;
 Nano-diffraction mode: Probe has a small convergent angle to see clearly the nano-diffraction patterns (by using live-diffraction camera).
15. Select right condenser aperture: Aperture 1 (150 um) > 2 (75 um) > 3 (50 um) > 4 (30 um); the bigger the aperture, the larger the probe current.
16. Select appropriate camera length: **[Setup]** menu select **[Column setup]**: in ZC mode, you can use either ZCM (Z-contrast; 62-330 mrad) or DCM (diffraction contrast; 46-245 mrad); in TE mode, you can use either PCM (phase contrast; 3 mrad) or WAM (wide angle; 30 mrad).

Take Picture

17. Set capture conditions: from **[Setup]** select **[Image setup]**: you can change the capture speed and image resolution.
18. Click the capture icon to record and then save the file to the TEM Server.

EDS Spectra collection and spectral imaging

19. On the Thermo computer, open the software: NSS; select your Project or set up a new one.
20. Insert both of the EDS detectors; Put in EDX aperture (**[Setup]** menu select **[Column setup]**). Without the aperture, all you got is the noise from the grid!
21. In NSS software, select “Both detectors”.
22. Find the interested area and select “Spectrum” icon in the NSS to collect an EDX spectrum; You can use other functions like “Point and shoot” and “Line Scanning”; Select “Spectral Imaging” to do spectral imaging.
23. Save your data. You also can generate a report by clicking the “Export to Word” button. The EDS spectrum can be saved as JPG file by highlighting the spectrum and then choosing “Copy To”.
24. Please retract both detectors and take out the EDX aperture once you are done.

STEM shutdown

25. Zero the stage: from **[Operate]** menu select **[Stage control]**, set “Auto Drive” x to 0 and y to 0, click ‘**Start**’.
26. For holder tilting along X and Y, you need manually tilt them back.
27. **CLOSE GUN Valve!!** (close gun valve whenever you need to change samples too).
28. take specimen holder out of the column; Remove specimen and insert specimen holder back to STEM.
29. If you are the last user of today, go to [HV control] menu and click “Stand By” (put HV in the stand by mode); turn off both monitors.