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A63.7080

Scanning Electron Microscope

Std FEG SEM

Instruction Manual

Content

1. Overview

1.1. Product Features

A63.7080 Scanning Electron Microscope Std FEG SEM, is a digital Field Emission Gun scanning electron microscope (referred to as A63.7080). It is a large-scale precision electronic optical instrument for studying the microstructure of objects. The focused electron beam can scan point by point on the surface of the sample to receive the excited electronic signal to form an image：

1. It adopts field emission electron gun, which has the characteristics of high brightness and large depth of field. It is suitable for the analysis and observation of rough surface and fracture; the image is full of three-dimensional, realistic, easy to identify and explain.
2. The surface structure of large solid samples can be observed. The sample diameter is 0~15mm. The sample preparation method and sample pretreatment process are simple.
3. The max resolution can reach 1.5nm.
4. The observation magnification range is large, from 15x of low magnification to 500,000x of high magnification; for multi-phase and multi-component non-uniform materials, it is convenient for ordinary observation under low magnification and fine observation analysis under high magnification.
5. Easy to operate, after a short period of training, user can operate the instrument.
6. The quality of the image can be appropriately improved by using electronic methods and computer technology. For example, the image processor can adjust the brightness and contrast of the image, etc., so that all light/dark parts of the image can be improved to show clearly.
7. Provide more image viewing methods, such as using a dual magnification device or a split image selector to simultaneously view images of different magnifications or images of different signal detectors on the display.
8. According to the purpose of observation, it is possible to increase the dynamic test using a sample stage such as high temperature, low temperature and stretching, and observe the phase transformation and morphological changes under different conditions.
9. The instrument has good expandability to make different analysis work by adding different signal detection devices. For example, an X-ray energy spectrometer (EDS) can be used to perform micro-regional component analysis while observing the morphology, and to qualitatively and quantitatively analyze the elemental composition of different micro-regions of the sample.
10. The operating system adopts Windows 7 operating system, the software operation interface is user friendly, concise and intuitive; the images can be displayed in same screen display, can be scaled and zoomed, and the image resolution can be selected; it support USB2.0 standard communication interface, support plug/play function.
11. The standard image processing software supports a variety of common image

formats, and conversion between different image formats. The optional image processing software enhanced a series of image processing functions such as particle size analysis, on the basis of standard image processing software.

1.2. Main uses and scope of application

Scanning electron microscope is suitable tool for observation of surface topography of metal, ceramic, semiconductor, mineral, biological, polymer, composite materials and nanoscale one-dimensional, two-dimensional and three-dimensional materials (secondary electron image, backscattered electron image); Analysis of point, line and surface components of the micro-area. It is widely used in petroleum, geology, minerals, electronics, semiconductor, medicine, biology, chemical, polymer materials, public security criminal investigation, agriculture, forestry and other fields.

Scanning electron microscope can perform microscopic morphology analysis. If equipped with other analytical instruments, conventional micro-analysis of components can be performed, including elemental quantification and qualitative component analysis. When performing microscopic morphology analysis, the spatial resolution can reach sub-micron level; it can measure the state of grain boundary, or the phase identification of crystal/grain, and the measurement of crystal and grain orientation; Distribution measurements can be made with fast multi-element surface scanning and line scanning.

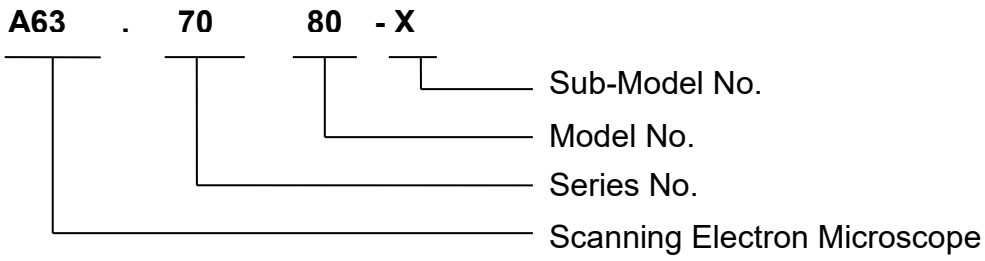
In modern industrial production and scientific research, the development of scanning electron microscopy has become a necessary means for material analysis, monitoring industrial and agricultural production, ensuring product quality, and ensuring the safety and efficiency of large production processes. At the same time, it is related to human survival and development in biology, environmental protection and medicine. The application of the field is also changing with each passing day; the development of military modern high-tech (such as biological weapons, chemical weapons wars, on-site poison detection, life support tasks, etc.) has played a huge role.

1.3. Model & Product Name

Product Name: Field Emission Gun Scanning Electron Microscope

Model No.：A63.7080

1.4. Composition of the model No. and its representative meaning



1.5. Main technical data

Resolution	1.5nm@ 15kV or 30kV
Magnification	15x~500000x
Electron Gun	Schottky Field Emission Gun
Accelerating Voltage	0~30kV
Lens System	Electromagnetic lens
Objective Diaphragm	Include 3 diaphragm, out of vacuum room, position customized
Specimen Room	Include 6 interface, can connect WDS、EDS、BSE and etc.
Standard Specimen Stage	X 50mm/Y 50mm/Z 25mm, T=-5°~90°,R=360°
Large Specimen Stage	X 80mm/Y 50mm/Z 30mm, T=-5°~90°,R=360°
Vacuum System	Fully automatic ultra-high vacuum system

1.6. Dimension and weight

1.6.1. Instrument Dimension

Electron optical tube section：	800×800×1380(mm)
Electrical cabinet control part：	600×800×1600(mm)
Operator table：	800×1350（mm）

1.6.2. Instrument Weight

Total Weight：	550 Kgs

1.7. Environmental conditions for using

In order to obtain the best working condition of the instrument, ensure that the environment's stray magnetic field, vibration, room temperature, humidity and power supply meet the requirements of the installation environment before the instrument is installed.

1.7.1. Equipment requirements for the room

A63.7080 is required to be installed in an independent laboratory with strong load-bearing capacity (floor load ≥ 246 Kg/m2) and good anti-vibration effect. The room where the instrument is installed should be able to be shaded, and some work needs to be done in the darkroom. At the same time, the user should be able to provide a desk lamp for sample and photo inspection without illumination.

1.7.2. Requirements for temperature and humidity environment

In the laboratory where A63.7080 is installed, the room temperature is required to be constant and the humidity is small. The temperature should be kept between 20 °C and 25 °C, the relative humidity should be less than 70%, and equipment that guarantees to meet these requirements, such as air conditioners, dehumidifiers, wet and dry thermometers, etc.

1.7.3. Requirements for power supply

1.7.3.1. Requirement for power

A63.7080’s main body (excluding X-ray analysis equipment), need to supply: AC 220V, 50Hz, 15A, with UPS power supply, at least two power output sockets (220V, 50Hz, 10A and 220V, 50Hz, 16A respectively)). The experimental indoor air equipment switch is: AC 220V, 40A.

In addition, the test equipment for the installation of A63.7080 and accessories needs to be equipped with power: 220V, 50Hz, 10A. The power outlet should have three cores and two cores and a terminal block.

1.7.3.2. Requirement for power supply quality

Like other high-precision electronic equipment, the A63.7080 is sensitive to electrical noise and power drift. Required voltage AC 220V ± 10%, 50Hz ± 1 Hz, standard distortion-free sine wave (waveform distortion less than ± 2%), no noise, transients, oscillations and pulses. When there is a problem with the power supply, the impact on the A63.7080 may be varied, sometimes affecting the resolution of the instrument, and sometimes linear or stripe streaks may appear on the image.

If there is a device with large power and large power consumption, the power supply line cannot be shared with A63.7080. At the same time, it is the responsibility of the user to ask the professional to bury the independent ground wire. Other equipment cannot share the ground wire with the instrument and ensure that the grounding resistance is less than 3Ω.

1.7.4. Requirements for vibration

Although the electron optical tube of A63.7080 has a vibration isolating device, vibration beyond the allowable range (frequency 0 to 200 Hz) will have a bad influence on the normal operation of the instrument. In the mounting position of A63.7080, the vibration in any direction should be less than 3μm. The CNC engineer will perform a comprehensive measurement of the instrument and perform data analysis before installation. If the analysis results indicate that there is a problem with the environmental conditions, the user will be advised to make improvements.

It is important to note that the vibrations caused by excessive sound can also affect the high-resolution image of the A63.7080. It is the responsibility of the user to provide a relatively "quiet" environment for the A63.7080. If it is found that the sound in the installation environment affects the SEM image, it is the user's responsibility to take action to correct it. Depending on the source of the sound that affects the instrument, you can eliminate the sound source or find another suitable place to install the instrument.

1.7.5. Requirements for low frequency stray magnetic fields

Special attention must be paid to transformers, motors, and power supply lines near the A63.7080 installation environment to ensure that the magnetic induction in any direction should be less than 1.5 × 10-7T (1.5 milligauss, P--P). Any magnetic field that exceeds the limit must be corrected. If you can know what

equipment is in your environment (adjacent, upstairs, downstairs, etc.), it is good for measuring or correcting problems.

1.8. Impact on the environment and energy

The X-ray radiation of A63.7080 meets the standards required by the state and does not affect the environment and energy

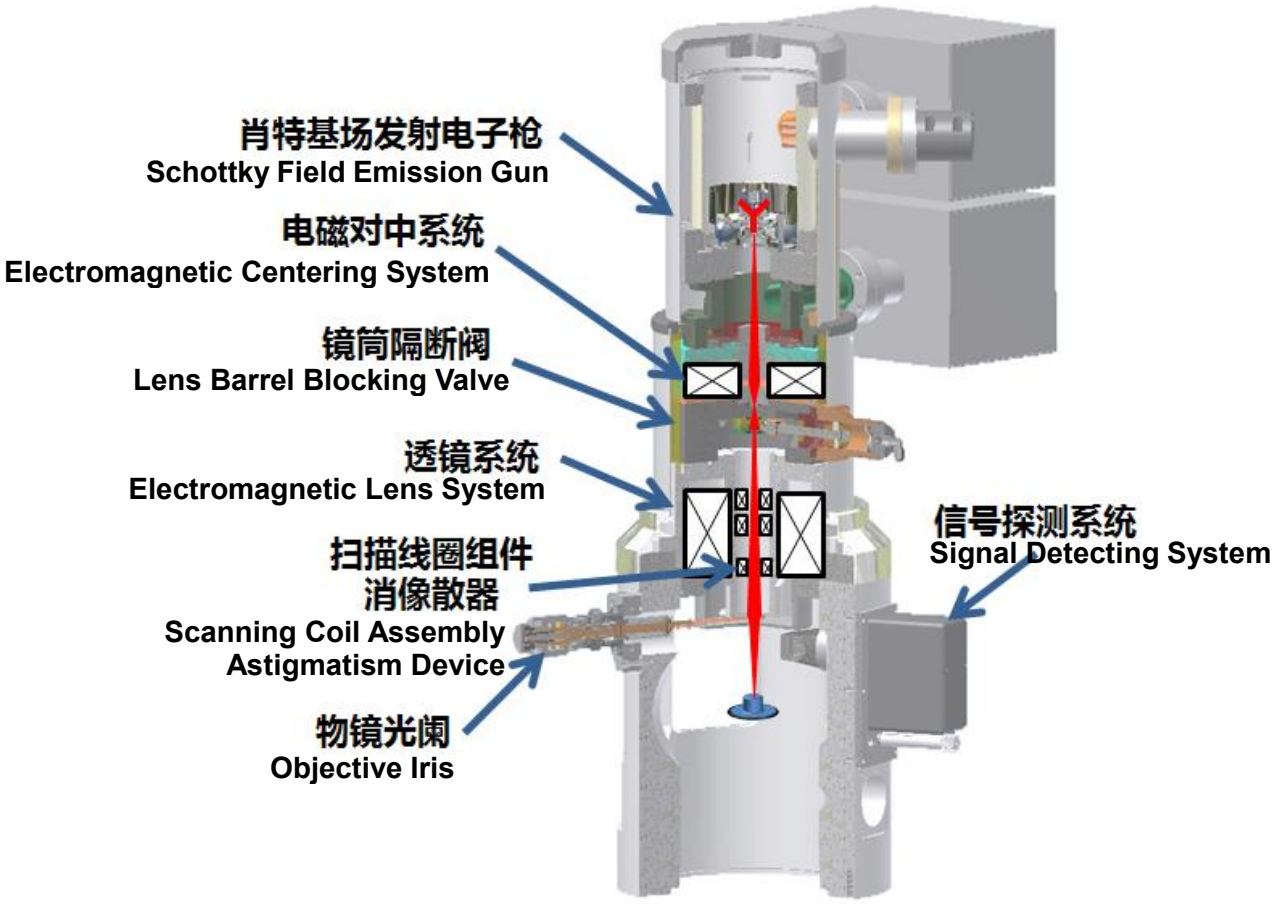
1.9. Security

A63.7080 is safe to use, it complies to Chinese national standards for instrument safety requirements.

2. System composition and working principle

2.1. Overall structure

A63.7080 interacts with an electron beam with a certain energy to excite a physical signal. The imaging signal is collected, digitized, and the like by means of a computer system and an electrical control system to form an image. The overall structure of A63.7080 mainly includes electronic optical tube, sample chamber, vacuum system and electrical cabinet control.



Picture 2-1 Electron Optical Tube

2.2. Electron optical tube

The A63.7080 electro-optical lens barrel is capable of generating and focusing an electron beam, and finally forms a small-diameter beam spot on the sample. The electron optical lens tube is composed of a Schottky field emission electron gun, an electromagnetic centering system, a lens barrel blocking valve, a lens system, a scanning coil assembly, an astigmatism device, and a signal detecting system, as shown in Picture 2-1. There is an electromagnetic shielding tube outside the entire optical path, which can eliminate the interference of the external stray electromagnetic field on the electron beam.。

2.2.1. Schottky field emission electron gun

The Schottky field emission electron gun is a high-brightness electron source consisting of a very fine single crystal tungsten wire tip and four electrodes. The four electrodes are the suppression pole, the absorption pole, the focusing pole and the anode, and the tungsten wire tip acts on the electric field. A high-brightness cross spot is formed, and the cross spot is imaged under the focusing of the lens system.

2.2.2. Electron beam electromagnetic alignment system

Mechanical alignment may not guarantee strict alignment of the electron beam, so the electromagnetic alignment system is used to perform electromagnetic alignment correction to ensure that the electron beam coincides with the central axis of the optical path. A63.7080 uses two sets of electromagnetic centering coils to form an electromagnetic alignment system, which can be easily adjusted by the control software to make the electron beam coincide with the optical path axis.

2.2.3. Lens system

The main part of the lens system consists of an objective lens, which is an asymmetrical lens with a long working distance, a low spherical aberration coefficient and a small magnetic flux leakage. Under the objective lens, the pole piece can be disassembled in the sample chamber, and the removal of the pole piece under the objective lens does not affect the original state of the scanning coil.

An adjustable objective lens is mounted below the objective lens and is placed in the main plane of the objective lens by adjustment. The objective lens mount can be loaded with three diaphragms. The diaphragm diameter is usually 100μm or 200μm (users can also install other diameter diaphragms according to actual needs). The objective lens X, Y direction adjustment device is installed in the right front of the sample chamber. With this adjustment device, the objective lens can be selected according to the user's needs and aligned with the electron beam. The objective pupil can affect the depth of focus, resolution, and beam current.

2.2.4. Scanning coil assembly

The scanning coil assembly is mounted in the pole hole of the objective lens so that the electron beam can be deflected in the X and Y directions on the surface of the sample.

When observing a high magnification image, the fine areas of interest on the image are typically moved, which is accomplished by electrical displacement. The electrical displacement is achieved by the DC level applied to the scanning coils X, Y for the purpose of movement.

2.2.5. Astigmatism Device

The astigmatism device is mounted in the scanning coil assembly to quickly and easily correct astigmatism

2.2.6. Signal Detecting System

The signal detection system collects low energy secondary electrons and high energy backscattered electrons.

When the grid at the front end of the detector is applied with a positive voltage, low-energy secondary electrons are attracted into the detector, and a positive voltage of 10KV is applied to the scintillator to accelerate the secondary electrons. The photon generated by the scintillator enters the window of the low noise photomultiplier tube, and the photomultiplier tube outputs the video signal.

If the grid is negatively charged, the backscattered electrons enter the detector.

2.2.7. A63.7080 Accessories

Standard accessories that can be installed in the A63.7080 include X-ray energy spectrometers, X-ray spectrometers, and cathode fluorescent probes. The X-ray spectrometer is the most commonly used.

The X-ray energy spectrometer consists of an energy spectrometer detector and an energy spectrum analysis system, which enables spectral line acquisition and analysis.

2.3. Sample room and sample stage

The sample chamber is mounted on a shock-proof frame with a vacuum system mounted below and an electron-optic lens barrel mounted on it. The sample stage is loaded from the front door of the sample chamber, and the sample chamber is deflated without affecting the vacuum of other systems. The sample chamber provides a working space for the sample and also facilitates attachment installation. The sample chamber accessories include a high temperature stage, a low temperature stage, a stretching stage, and etc.

2.3.1. Standard sample room

The standard sample has a diameter of Φ156 mm, a sample chamber inlet diameter of Φ 153 mm, and a sample chamber height of 284 mm. It can be equipped with various types of sample stages and detectors, such as X-ray spectrometer, X-ray spectrometer, cathode fluorescent probe, backscattered electron detector, secondary electron detector and other experimental devices.

2.3.2. Large sample room

The large sample chamber has an approximate size of 10 inches by 10 inches by 13.5 inches and allows observation of large samples. The large sample chamber can also be equipped with various types of sample stages and detectors, such as X-ray spectrometers, X-ray spectrometers, cathode fluorescent probes, backscattered electron detectors, secondary electron detectors and other experimental devices. The number of interfaces is also larger than the standard sample chamber.

2.3.3. Standard sample stage

The standard sample stage is used in a standard sample chamber. The

standard sample stage has a similar sample stage operation and the range of motion is as follows:：

- Horizontal X,Y=50mm
- Vertical Z=25mm
- Inclination T=-5°~ +90°
- Rotation R=360°Continous

The sample locking device can be used to lock the sample table and the sample chamber after the sample stage is inserted to reduce the effects of vibration.

2.3.4. Large sample stage

The large sample stage allows observation of large volume samples that can be moved in the X, Y, and Z directions and can be rotated and tilted. The height (Z) of the sample is adjusted externally to meet the working distance requirement (the distance from the sample surface to the pole piece under the objective lens), and the continuous adjustable range is 30 mm.

The large sample stage is tilted from 0° to +90°. At low magnifications, if the observed area is at the center of the display, the observed area is still within the field of view when the sample is tilted (there will be small movements). The positive value of the tilt angle is read directly, and the negative value should be -100° plus the indicated value to get the true value. For example, if the indication is 96°, the true value should be -100°+96°=- 4°.

The large sample stage can also be rotated 360° when tilting. The center of rotation is at the center of the sample holder. The minimum value of the rotation reading is 0.1°.

The large sample stage has a range of movement of 80 mm and 60 mm in both X and Y directions. The movement of the large sample stage before and after is the X direction, which corresponds to the horizontal movement of the picture tube. The large sample stage moves to the left and right in the Y direction, and the corresponding picture tube moves up and down. If the tilt is within the depth of focus, then the magnification is essentially the same and the entire image is clear.

Large sample tables can generally be placed in a 15mm diameter sample, and larger samples can also be placed in the sample stage for observation. But pay special attention to not allowing the sample to touch the pole piece under the objective lens. When observing a large sample, you can loosen the fixed sample holder screw and fix the sample directly at the X, Y, and Z orthogonal points for observation.

The sample locking device can be used to lock the sample table and the sample chamber after the sample stage is inserted to reduce the effects of vibration.

2.3.5. Standard sample room accessories

The standard sample chamber can be equipped with a high temperature stage, a low temperature stage and a stretching stage to observe the state of

the sample under different conditions.

2.4. Vacuum system

The electron optical lens barrel and the sample chamber must be operated under a certain vacuum state, and the realization and control of the entire system vacuum is completed by the vacuum system. The vacuum system is mounted below the sample chamber and is connected directly to the barrel via a vacuum line.

The vacuum system is shown in Figure 2 2. It mainly includes ion pump, molecular pump, mechanical pump, connecting pipe, damping device, various valves, and various measurement regulations. The details are as follows:

1. Ion pump: used for pumping system ultra-high vacuum.
2. Molecular pump: used to pump high vacuum system.
3. Mechanical pump: used for pumping system low vacuum and molecular pump pre-stage vacuum.
4. Connecting the pipe: for the connection between the vacuum parts.
5. Various valves: for vacuum control, for example: V1 can separate the electron gun from the sample chamber. When the sample chamber is deflated, the electron gun can maintain the vacuum state; V2 is used to pump the sample chamber and the electron gun is low vacuum; when the sample chamber When the electron gun reaches the molecular pump start-up requirement, the molecular pump starts to make the system obtain a high vacuum; when the sample chamber and the electron gun reach the ion pump start-up requirement, the ion pump starts, so that the system obtains an ultra-high vacuum.
6. Vacuum measurement regulation: vacuum measurement in real time, vacuum control with valve.
7. Air compressor: The air compressor supplies power to each pneumatic valve.

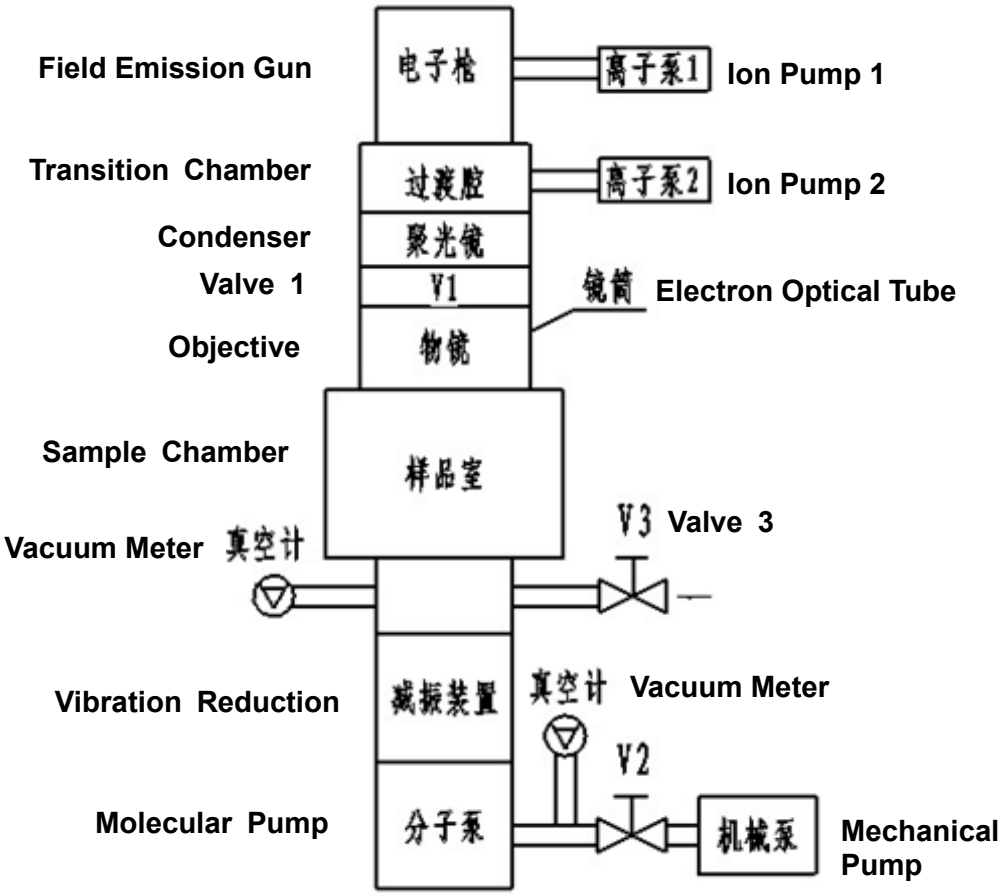


Figure 2-2 Vacuum System

The vacuum control part is installed on the front and rear panels of the main frame, and can be fully controlled from low vacuum to high vacuum. The vacuum system is controlled by a thermocouple tube and logic circuit to achieve real-time measurement of vacuum.

The vacuum system is easy to operate. The operator only needs to press the work button, and the system will automatically reach the high vacuum state required for the work from the initial state; the system can be operated manually during maintenance.

2.5. Electrical cabinet control

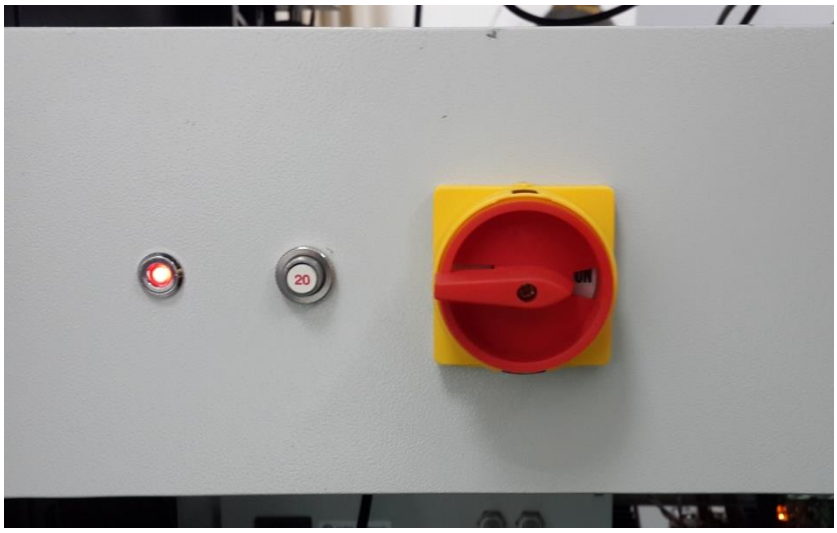
The electrical cabinet control consists of an electrical cabinet and a computer system to control various functions of the A63.7080, as well as to observe sample images, take photographs, etc.

2.5.1. Electrical cabinet

The electrical cabinet includes a circuit board, a power supply, etc. for implementing various functions of the A63.7080, and is controlled by a computer operation interface. The electrical cabinet of A63.7080 includes three

parts: SEM control electric system, vacuum power supply and field emission gun power supply.

The power switch of the SEM control electrical system, the power switch of the vacuum system and the power switch of the field emission gun are relatively independent and are controlled by respective power button switches. However, there is a main switch in the middle of the electrical cabinet. This switch can cut off the three parts of the SEM control electric appliance, the vacuum power supply and the field emission gun power supply at the same time.



Picture 2-3 Power Switch

2.5.2. Computer System

The computer operating system is Windows 7 operating system. At present, the peripherals are unified USB2.0 standard communication interface and support hot swap.

The interface of the electronic mirror operation control software is simple, friendly and intuitive. It is easy for users to master and easy to communicate between users. Optimized software design, super fault tolerance, less system resources, and more stable and reliable operation.

The electronic mirror operation control software is on the same screen display, and the image display and scanning control are combined to facilitate the user's operation; the software window can be zoomed to fully meet the needs of the user's observation; the oscilloscope function can display the waveform map or the gray histogram in real time; Editing function, support multiple languages including traditional Chinese, simplified Chinese, more powerful.

The EM operation control software also provides a variety of automatic control functions: auto focus, automatic astigmatism, and automatic brightness/contrast functions. After adopting the new algorithm, accuracy, adaptability, reliability, etc. are greatly improved. If the noise ratio is very poor, it still works.

The electronic mirror operation control software generates image scale

and image format selectable settings; supports a variety of common image formats, and conversion between different image formats; the software integrates some common image processing functions, which is more convenient to use.

The computer operating system can be installed with electronic mirror image processing software, which is a more powerful independent image processing software; supports a variety of common image formats and conversion between different image formats; on the basis of general image processing functions, added some New features; enhanced a range of image processing features related to particle size analysis.

3. Use and operation of electron microscope software

3.1. Familiar with the basic use of Windows 7

The A63.7080 operating software is installed on the Windows 7 operating system and complies with all applications of the Windows 7 operating system. Therefore, if you are familiar with the use of the Windows 7 operating system, you will be better able to use the A63.7080 operating software.

The Windows 7 operating system has many features and tools that make the use of the computer easier and more efficient. For details, please see the information in the Help section of the Windows 7 operating system.

3.2. Software Control Panel

The EMI control software desktop table is shown in Figure 3 1. Double-click the figure to open the software control interface, as shown in Figure 3 2. The SEM control software includes various functions of operating the electron microscope, obtaining the figure image and the figure image analysis. The control interface mainly includes a menu bar, a toolbar, a figure image display area, and a scan control window.

Figure 3-1 Software Icon

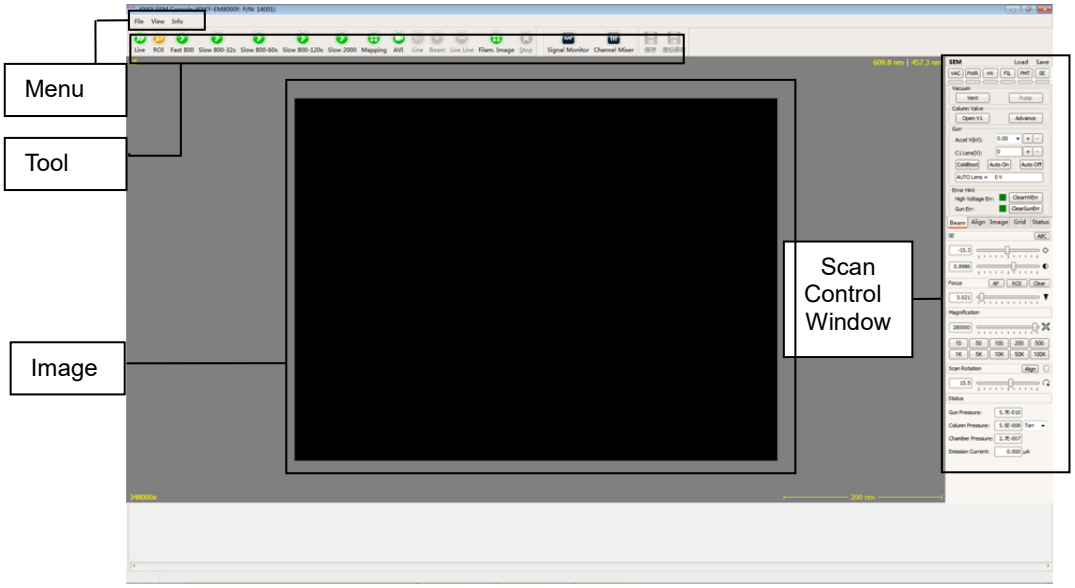


Figure 3-2 Software Control Panel

3.2.1. Software Scan Control Window

Figure 3-3、3-4 show main function & meaning of software

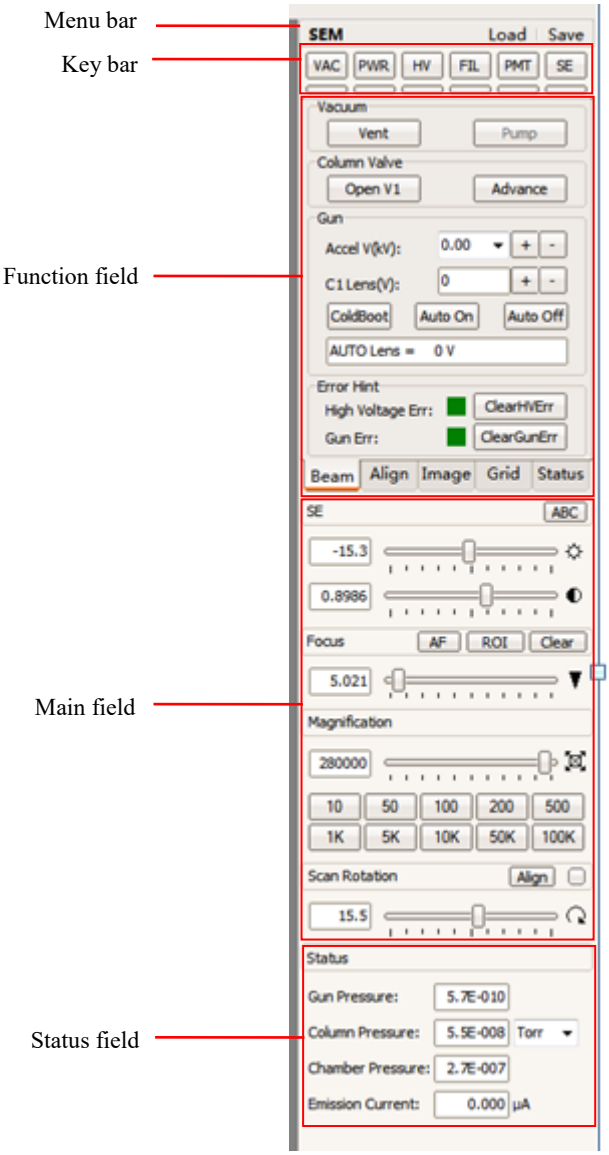


Figure 3-3 Scan Control Window

Main Component	Function
Menu bar (Page 2-9)	- **Load**: Loading of configurations - **Save**: Saving of configurations
Key bar (Page 2-10)	- Switching on and off several several functions - Shows the status of the relevant function
Function Field - **Beam** - **Align** (Page 2-14) - **Image** (Page 2-15) - **Aux** - (Page 2-16) - **Status** (Page 2-17)	Contains functions for controlling the SEM Set-up of the electron beam Set-up of the stigmator Set-up of the scan area Set-up of external image signals (device-dependent) Displays several values like operating voltage, error codes of HV and Gun (device-dependent) and user operating log
Main field (Page 2-18)	Set-up of the following functions: - Brightness/Contrast - Focus - Magnification - Scan Rotation
Status field	Displays several values like e.g. vacuum and emission current

Figure 3-4 Scan Control Function

Note Mouse operation: After clicking the active block on the toolbar, drag the mouse to fine tune the corresponding parameters; After double-clicking the active block on the toolbar, drag the mouse to thicken the corresponding parameters; The right mouse button determines the current parameter value.

3.2.2. Starting and Shut down

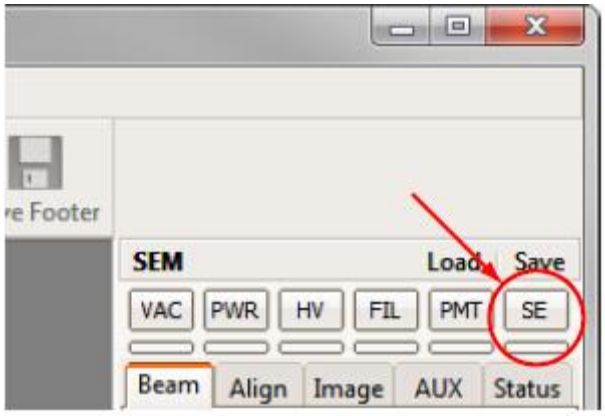


Figure 3-5 Click“SE”

1. Run the SEM operating software.

2. Click “SE” in the upper right corner of the control interface to open the SEM operating software.

(The configuration information when the last use is opened by default)

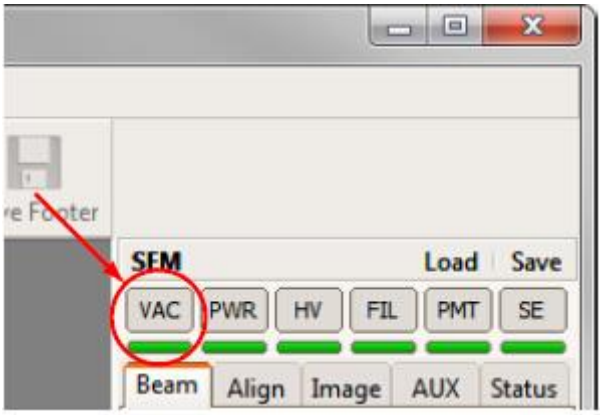


Figure 3-6 Click“VAC”To Closc

1. To close software, click ”VAC”。
2. Wait until all indicator lamp power off
3. Close software (The last used configuration information will be saved automatically.)

3.2.3. Function buttons

The scan control window function button and status display are shown in Figure 3 7. The function buttons indicate the meaning as shown in Table 3 1.。

Figure 3-7 Scan Windows Function Keys & Displays

Table 3-1 Function Keys Meaning

Component	Function
VAC Status display: gray green red	Turning on and off the vacuum (device-dependent) High vacuum not OK High vacuum OK No high vacuum in the column (it is not possible to turn on SEM electronics)
PWR Status display: gray green red	Turning on and off SEM electronics Mains voltage turned off Mains voltage turned on Error in the mains voltage of SEM electronics
HV Status display: gray green green red	Turning on/off the gun high voltage After pressing this button, the gun high voltage will be powered up to the preset value within a configurable amount of time. Gun high voltage turned off Gun high voltage is powered up or down Gun high voltage turned on High voltage was turned off after an error

表 3-1（续）

Component	Function
FIL	Turning on/off the filament After pressing this button, the filament current will be powered up to the preset value within a configurable amount of time.
Status display:	
gray	Filament turned off
green	Filament is powered up or down
green	Filament turned on
yellow	Error message of the gun high voltage (filament underheating or faulty)
PMT	Turning on/off photo multiplier voltage and extraction voltage (device-dependent)
Status display:	
gray	Photo multiplier voltage and extraction voltage turned off
green	Photo multiplier voltage and extraction voltage turned on
red	No high vacuum in sample chamber (it is not possible to turn on PMT and SE)
SE	Turning on/off scintillator high voltage
Status display:	
gray	Scintillator high voltage turned off
green	Scintillator high voltage turned on

3.2.4. Electronic Gun Control

The main function area of the control software has multiple tabs (Beam, Align, Image, AUX, Status), and the Beam tab is the gun control area, as shown in Figure 3-8. Divided into vacuum control zone, gun parameter setting zone, error prompt zone, including all functions of electronic gun parameter setting and monitoring.

Vacuum control zone: “Pump” button is used to automatically vacuum the system; when changing samples, click “Vent” to deflate the sample chamber; “Open V1” button to control the switch of V1 valve; click “Advance” button to pop up advanced Function window, as shown in Figure 3-9。

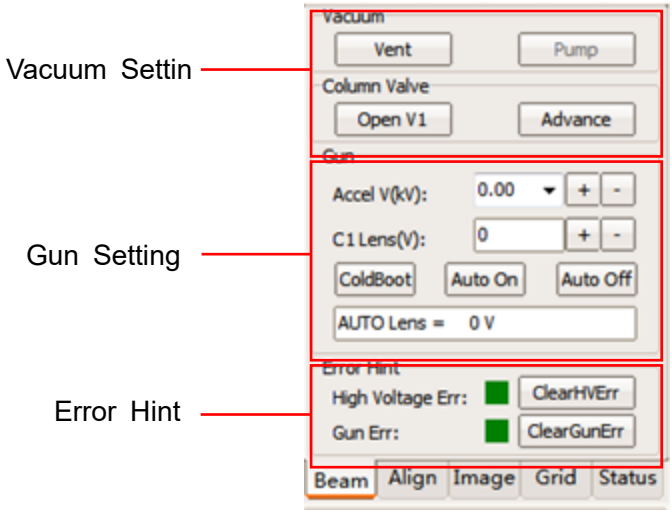


Figure 3-8 Electron Gun Function Window

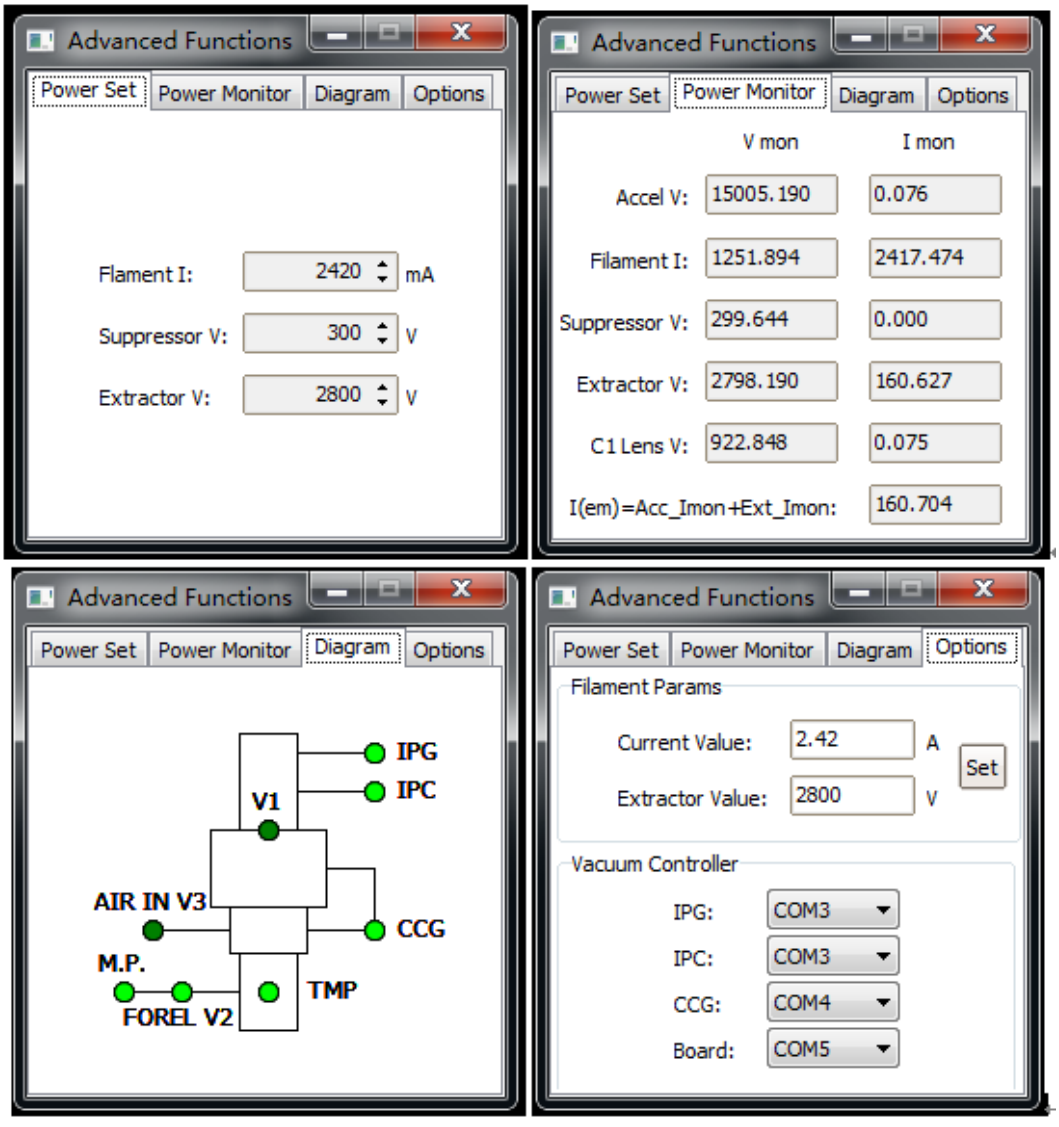


Figure 3-9 Advance Function Window

The advanced function window includes four pages: Power Set, Power Monitor, Diagram, and Options. On the Power Set page, you can fine-tune the gun parameters (recommended for users). The Power Monitor page displays the current filament current value and the voltage values of the electrodes. The Diagram page displays the current vacuum valve status. The Options page allows you to perform the initial parameters of the gun and the serial port. Number setting.

The gun parameter setting area is used to start the electron gun, ie "ColdBoot" or "Auto On"; turn off the gun and click "Auto Off" to set the high voltage value (Acce IV) and the filament current value (C1 Lens).

The error prompt area is used to display high voltage and gun error status. The box is green, indicating no error; the box is yellow, indicating a communication error, the box is red, indicating a serious error, you must click the button to clear it.

3.2.5. Electrical alignment

The Align tab is used to adjust astigmatism, electrical centering, rocking to medium, the "Stigmator" function is used to adjust astigmatism, Beam shift and Beam tilt are used to adjust the translation and tilt of the beam pair, and Wobbler is the adjustment objective. Swing in the middle of the light, Filam. Image is a filament image

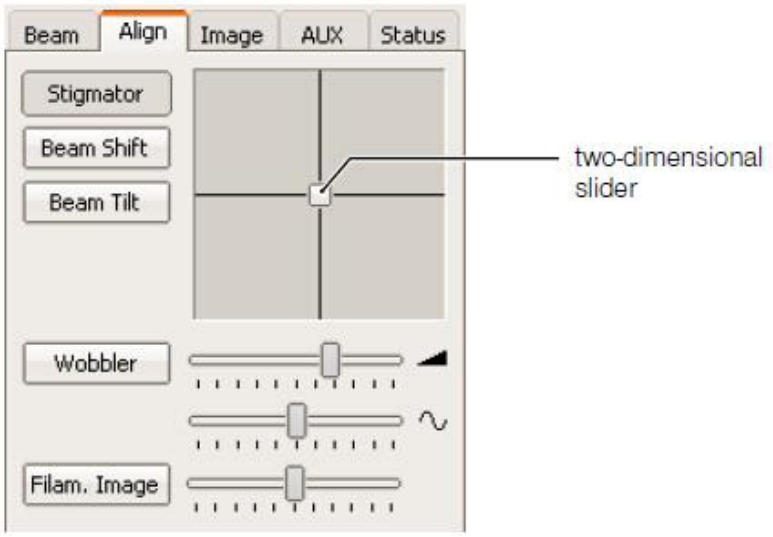


Figure 3-3 Electrical alignment adjustment

表 3-2 电对中功能

Component	Function
| Stigmator |	For setting up the stigmator coils
| Beam Shift |	Moving the slider sets the coil currents for Beam Shift X and Beam Shift Y.
| Beam Tilt |	Moving the slider sets the coil currents for Beam Tilt X and Beam Tilt Y.
| Wobbler |	Activating the focus wobbler For setting up wobble frequency and amplitude For setting up wobble amplitude For setting up wobble frequency
| Filam. Image |	Turning on cathode mapping (device-dependent) For setting the magnification Automatically starts a corresponding scan

3.2.6. Image electrical displacement

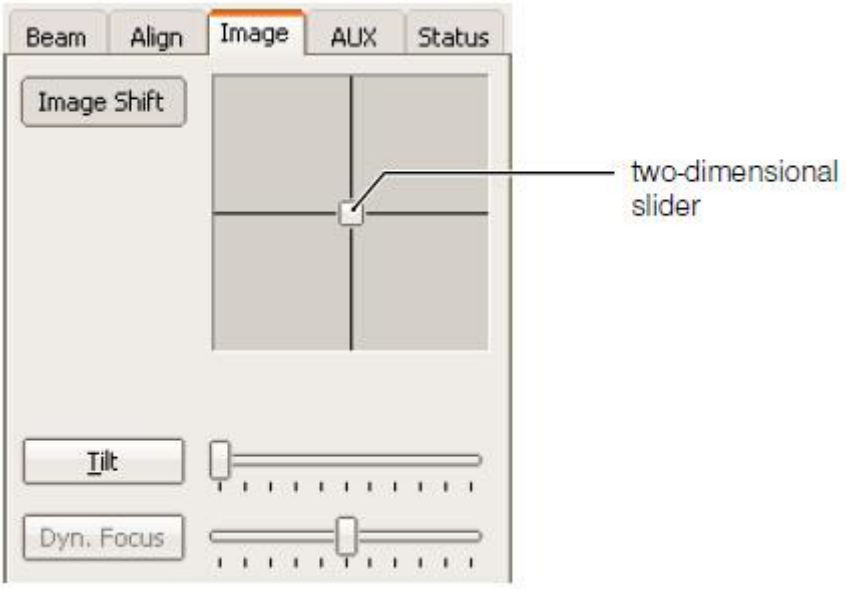


Figure 3-4 电位移调节

3.2.7. Main function area

The main function area of the scan control window is shown in Figure 3 12. In the function area, the function bar for adjusting brightness, contrast, adjusting focus and magnification is included, which can easily adjust various parameters.

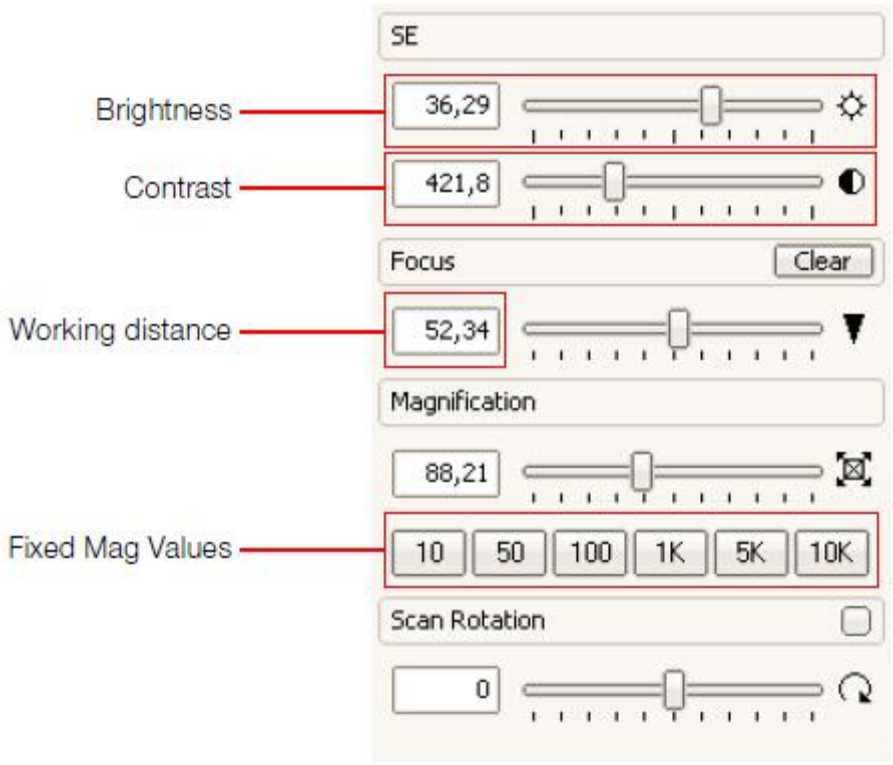


Figure 3-5 Scan Control Window

Table 3-3 Scan Control Function

Component	Function
SE	
– **Brightness**	– Changes the brightness of the image within a range of 0 up to 100% by setting the zero position of the SE preamplifier – Can be set with the slider or by direct input of values
– **Contrast**	– Sets the SE detector high voltage within a range of 0 up to 1.5kV (device-dependent). This leads to a change in contrast of the picture. – Can be set with the slider or by direct input of values

Component	Function
Focus	– Modifies the objective lens current. Thus, the image is focused, and the working distance in millimeter can be preselected. – Can be set with the slider or by direct input of values
– **| Clear |**	Activates lens clearing (i.e. sets the focus to maximum value for a short amount of time)
– **Working distance**	Shows the current working distance
Magnification	Sets up the magnification with the slider or by direct value input
– **Fixed Mag Values**	Direct selection of fixed mag values which can be entered in "semcontrol.xml"
Scan Rotation	– Rotating the scan area on the sample within a range of -180° up to +180° – Can be set with the slider or by direct input of values – **Checkbox**: Activates or deactivates scan rotation

3.3. Image acquisition

3.3.1. Overview of the Software Interface

The software control interface is shown in Figure 3 13, including the menu bar, toolbar, Figure image display area, and scan control area. After opening the control software, follow the corresponding function adjustment to get the Figure image in the figure image display area.

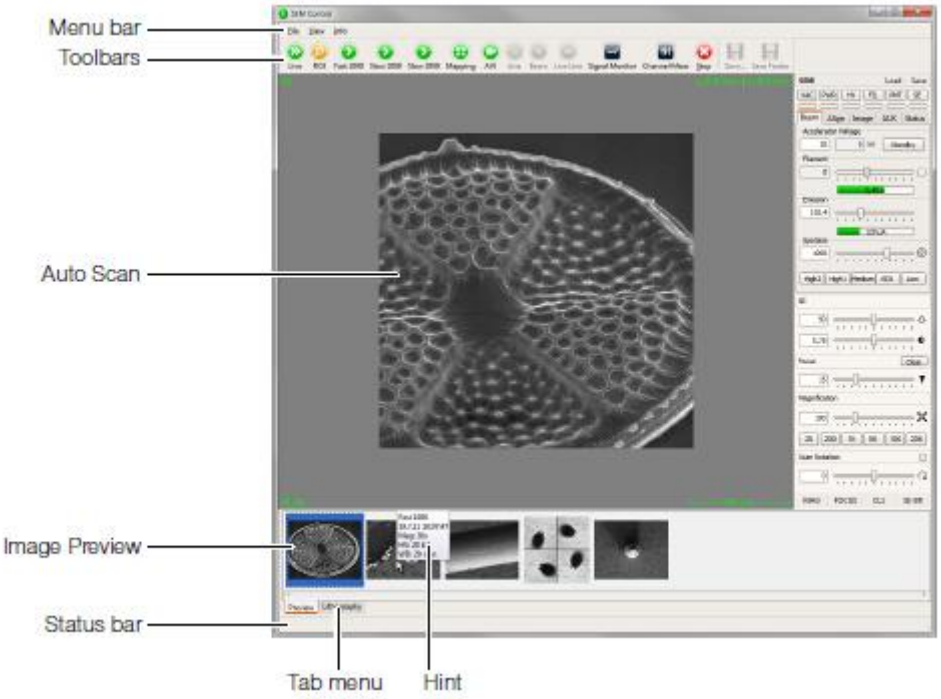


Figure 3-6 Software Control Window

3.3.2. Scan Settings

During the adjustment of the Figure image, right-click on the Figure image area to see the interface shown in Figure 3 14. Click on the corresponding option to make the relevant settings. Click on "settings" to set the detector type, scan speed, sync mode, etc., as shown in Figure 3 15.

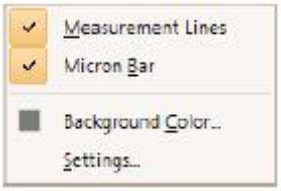


Figure 3-7 Scan Setting

Figure 3-8 Scan Speed Setting

3.3.3. File Management Menu

Click on the menu bar "file" to save or print the Figure image as shown in Figure 3 16. There is a shortcut to save the Figure image in the toolbar. As shown in Figure 3 17, you can select the storage location and name the Figure image file.

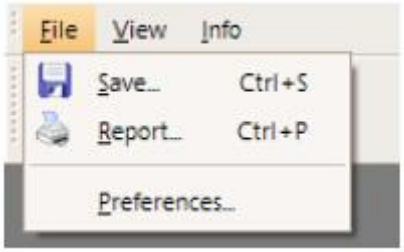


Figure 3-9 Save Image

Look	Function
	Opens the **Save Image** window for saving the current image or layout
	Transfers the current image or layout to the image processing software DIPS

Figure 3-10 Save File Shortcut

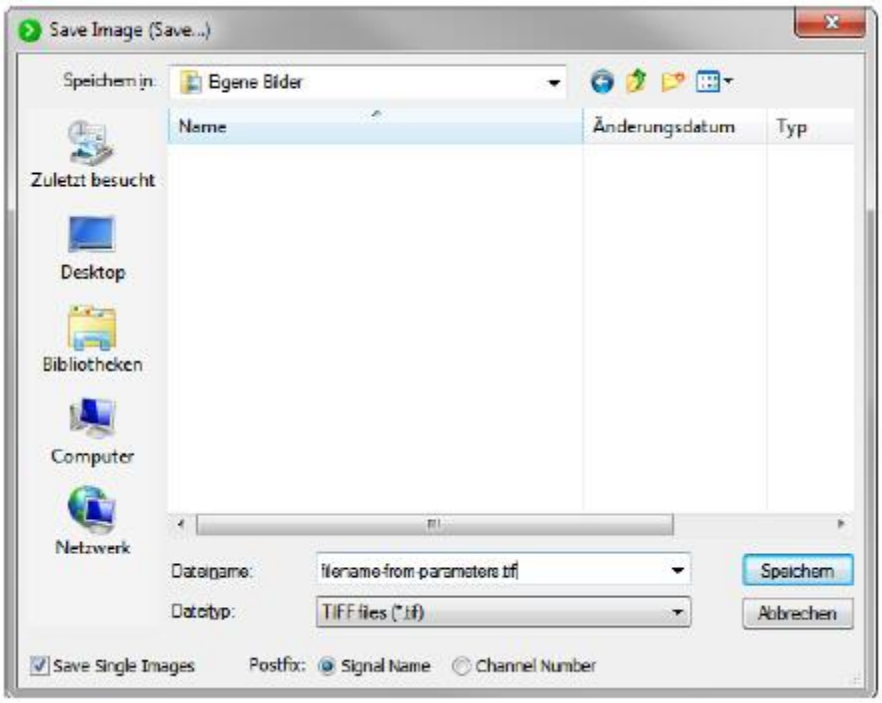


Figure 3-11 Name The File

3.3.4. Getting images

The toolbar of the software interface has a shortcut to scan the Figure image, as shown in Figure 3 19, and the functions are shown in the table.

Figure 3-12 Scan Button

Table 3-4 Scan Image Button Meaning

Button	Function	Description
	Live Scan (Page 3-44)	Starts a continuous live preview
	Region Scan (Page 3-47)	Starts a Region Scan
	Slow Scan (Page 3-50)	Starts a Slow Scan
	Mapping (Page 3-53)	Starts a mapping
	Line Scan/ Point Measure-ment (Page 3-57)	Opens a dialog window for set-up and operation of line and point mea-surements
	Beam Posi-tioning (Page 3-75)	For positioning the electron beam on the sample
	Center Scan (Page 3-76)	Activates an adjustable scan area in an acquired Live Scan or Slow Scan image
	AVI (Page 3-79)	Opens a dialog window for recor-ding video sequences
	Live Line (Page 3-88)	Initializes a continuous line scan in an acquired Slow Scan image
	Signal Monitor (Page 3-91)	Opens the Signal Monitor
	Channel Mixer (Page 3-96)	Opens a dialog window for live mixing of image signals

4. SEM Microscope Operation Procedure

4.1. Preparation and inspection before use

4.1.1. Power Supply Check

Check whether the power supply (AC 220V) is normal, the cable connection is correct, and the ground wire is connected properly before A63.7080 is turned on.

If the above situation is not working properly, please consult or notify the manufacturer to repair.

4.1.2. Key position of the main rack panel

Check that the knob is in the correct position before starting A63.7080:

1. Is the mechanical pump power switch in the "OFF" position?
2. Is the electrical cabinet power switch in the "OFF" position?。

4.1.3. Installed the panel correctly

Before using A63.7080, check whether the panel and platen of the A63.7080 mainframe and electrical cabinet are installed securely to avoid falling off during work or the operator's body touching the components of the electrical cabinet.

4.1.4. No people behind main unit & cabinet during work

When working in A63.7080, there should be no people walking behind the main unit and the electrical cabinet to avoid breaking the cable and the air pipe, causing personal danger or damage to the instrument. When taking high-resolution photos, it is also required that there should be no people walking behind the main unit and the electrical cabinet, and the generated vibration will affect the figure image.。

4.2. Operating procedures, methods and precautions for starting the electron microscope

Description of "**Standby** Status" and "**Shutdown** Status": The field emission gun SEM does not need to be turned off every day during daily use, but is in the "standby state"; in the "standby state", the block valve is closed, the electron gun, Both the electrical system and the vacuum system are in operation. When the electron microscope is not used for a long time, you need to click the “auto-return” button to turn off the electron gun for about 30 minutes, so that the electron microscope is “off state”; in the off state, the electron gun is in the off state, the vacuum system still needs to work, so that the lens barrel Under high vacuum. During the transportation of the instrument, the electron microscope needs to be powered off, all the systems of the electron microscope stop working, and the electron microscope is in the "stop state".

4.2.1. Starting the Electron Microscope from Standby

A63.7080 is easy to use, starting from the standby state to start the

electron microscope. Just open the V1 block valve, the electron microscope control software will automatically adjust the brightness, contrast, auto focus and other operations. You can immediately see the figure image in the figure window, which is easy to operate. Fast. To start the electron microscope from the off state, you need to click the "hot start" button to start the electron gun, the startup time is about 40 minutes; after the startup is completed, open the V1 block valve to see the image。

4.2.2. Starting the electron microscope from the off state

4.2.2.1. Acquisition of ultra-high vacuum

1. Turn on the mechanical pump power switch; turn on the air compressor power switch and observe the pressure gauge above 4kg/cm.
2. Turn on the appliance main switch.
3. Turn on the field gun power switch, electrical system power switch, and vacuum power switch in the vacuum pump and electrical cabinet.
4. Click “Pumping” on the software interface, the system automatically completes the pumping process, and the operation is simple and convenient.
5. Bake the vacuum system to obtain an ultra-high vacuum.

4.2.2.2. Manual

The manual mode is mainly used for instrument maintenance. Includes vacuum leaks and electrical repairs. In this way, pay special attention to whether the switches of the respective valves are correct.

1. Turn on the mechanical pump power switch; turn on the air compressor power switch and observe the pressure gauge above 4kg/cm.
2. Turn on the appliance main switch.
3. Disconnect all high voltage and filament heating power supplies; close the shutoff valve V1.
4. In the vacuum control panel behind the main frame, turn the “AUTO/MAN” switch to the manual “MAN” position and turn all valve manual switches to the off position.
5. Turn on the mechanical pump.
6. Open the front stage valve V2; when the sample chamber vacuum reaches 50Pa or more, press the molecular pump to start the switch, the system enters the pumping high vacuum state, and after the molecular pump is fully started, turn on the ion pump.
7. If switching from manual to automatic mode, first turn off all manual switches and turn the “AUTO/MAN” switch on the vacuum control panel behind the main frame to the automatic “AUTO” position.

4.2.2.3. Handling precautions

In order to prevent the instrument from malfunctioning, the instrument is equipped with a chain protection device. However, some incorrect operation will still cause the instrument to malfunction. To this end, in addition to strict adherence to the operating procedures, you should also pay attention to the following items:

1. The lens barrel isolation valve V1 must NEVER be opened until the vacuum level has not met the requirements.

2. When the vacuum control mode is changed from manual to automatic, pay special attention to whether each manual valve is closed.

3. Do not vent the power to the sample room and the electron gun immediately after turning off the power of the electrical cabinet, so as to avoid residual high voltage discharge on the electron gun detector and damage the filament and the scintillator.

4. Do not plug in the printed board and wire plugs while the power is on.

5. If the lens barrel is not deflated, do not remove the objective light mast.

6. Always turn off the V1 valve before turning off the electrical cabinet (CONSOLE POWER).

7. Do not manually activate the molecular pump and open the V1 valve while the sample chamber is deflated.

8.The electron optical lens of the electron microscope has been pre-adjusted to the optimum state before delivery, that is, there are small combined mechanical tolerances and better alignment. When there is a problem with the lens barrel, it can be repaired by the service personnel of the manufacturer.

4.2.2.4 Start computer and electrical cabinet

Press the computer power switch and the computer will automatically run the program (if the user name and password are set, you need to enter the user name and password) to enter the Windows 7 desktop.

Turn on the electrical main switch.

4.2.3. Placing or replacing samples

If you do not need to place or replace samples, you can go directly to the next section.。

4.2.3.1. Sample chamber deflation

1. Deflate the sample chamber before placing or replacing samples. Before deflation, turn off the high voltage, contrast and filament and close the

shutoff valve V1.

2. Click “Deflating” on the software interface and the vacuum system will automatically deflate the sample chamber.

3. After the deflation is completed, the sample chamber door is loose and the sample chamber is in an atmospheric state.

4.2.3.2. Place or replace samples

After the sample chamber is deflated, loosen the sample stage lock and rotate the Z direction counterclockwise several times so that after the sample is changed, the sample does not hit the objective pole lower boot. Pull the sample stage out of the sample chamber and pull it out for the convenience of the operator. Do not use excessive force during the pull-out process to avoid damage to the sample stage guide.

Use the replacement sample special screwdriver to loosen the fixed top wire under the sample cup, remove the sample cup, and replace it with a new sample cup. (The sample cup should be coated with a conductive paste or double-sided conductive tape to bond the new sample. If the sample is not conductive, It should be sputtered), the position is preferably 10mm from the sample holder, the fixed top wire is tightened with a special screwdriver, and then the sample stage is pushed back to the sample chamber.

4.2.3.3. Vacuuming the sample chamber

Click on the “pumping” of the software interface and the vacuum system will automatically vacuum the sample chamber. When the system begins to enter a high vacuum state, open the V1 valve and the instrument can begin operation.

4.2.4. Turning on the gun power supply

The software control interface starts the electronic gun power supply into "cold start" and "hot start". After the filament is replaced, the gun is added for the first time. It is necessary to use the cold start. After the electronic gun is turned off daily, the "hot start" is used to start the automatic gun adding program.

Note:

◆ “Cold Start” and “Hot Start”: The cold start has a waiting time of 20 minutes during the gunning process. Since the field emission electron source is deflated more when it is used for the first time, it may cause the vacuum to drop, and it is necessary to wait for 20 minutes during the filling process.

◆ High voltage HV and filament cannot be added until the vacuum level has not met the requirements.

◆ The vacuum and high pressure interlock of the system will automatically cut off when the vacuum is low.

4.2.5. How to get images

After starting the electron microscope, open the V1 block valve and you can see the figure image in the figure window of the software control interface. In actual use, in order to obtain the desired Figure image, relevant adjustments, such as axis, astigmatism, brightness contrast, etc., are required.

4.2.5.1. Automatically get image

Set the HV value on the A63.7080 operating software to match the HV value in the gun software. Click "AF" (auto focus) to complete "one click view"

4.2.5.2. Adjusting contrast and brightness

Adjust the brightness slider to change the brightness of the Figure image, darkening to the left and brightening to the right.

Adjust the contrast slider to change the contrast (contrast) of the Figure image, weakening to the left and enhancing to the right.

Note: The electron beam is scanned on the sample, the secondary electrons emitted from the surface of the sample are collected, accelerated and bombarded with the phosphor, the electronic signal is converted into a photon signal, and the photon signal is converted into an electronic signal by a photomultiplier and amplified. . The change in brightness is to adjust the DC level of the video signal; the contrast change is to adjust the voltage of the photomultiplier, that is, to change the amplification gain, which is equivalent to changing the contrast of the Figure image.。

4.2.5.3. Adjusting the electrical alignment

The electrical alignment can correct the deflection of the electron beam. The electron gun mainly adjusts the tilt of the electron beam by the mechanical position to coincide with the axis of the electron optical lens barrel. When the filament is working for a while, the electron beam will have some offset. Two pairs of electromagnetic deflection coils X and Y are installed under the electron gun. By adjusting the current value of the coil, the magnetic field of the deflection electron beam can be changed, so that the electron beam and the axis of the electron optical lens tend to coincide, thereby correcting the deflection of the electron beam.。

4.2.5.4. Adjusting or changing the objective diaphragm

Click the wobbler button on the software control interface (you can use the selection function). If the image moves on the screen, it means that the objective lens is not good, and you need to adjust the objective lens. If the image is almost motionless on the screen, it means the objective light. The coupling axis is very good and there is no need to adjust the objective lens.

When adjusting the objective lens to close the axis, follow the steps below：

1. Use the active selection and fast scan mode to create a “feature point” on the Figure image.
2. Select a range of about 5000 times the low magnification; click the wobbler button to observe the movement of the image.
3. Adjust the knob of the objective lens in both directions so that the image does not shift or move to a minimum.
4. Select a high magnification to 50,000 times and click the wobbler button to observe the movement of the image.
5. Adjust the knob of the objective lens in both directions so that the image does not shift or move to the minimum.。

When replacing the objective lens, rotate the knob of the objective lens to rotate in the radial direction (clockwise rotation inward, counterclockwise rotation outward), let the indicator line correspond to the corresponding position, and then follow the steps of adjusting the objective lens to close the axis. , adjust the newly replaced objective lens to close the shaft.

Adjusting the objective lens to match the axis requires multiple exercises and accumulation of experience, especially in the process of obtaining high-resolution images.

If the objective lens does not have a hinge, the image is difficult to focus clearly, and the astigmatism is large. When observing the high-magnification Figure image, the effect is more obvious.。

4.2.5.5. Image Focusing

Adjusting the current of the objective lens can change the excitation of the objective lens package to focus the electron beam on the surface of the sample. If the focusing current of the objective lens is different, the focal length of the objective lens is different, so that the magnification is different, and the operating software can automatically correct the magnification according to the objective current value.

In the process of image focusing, the functions of the following parts are usually used interchangeably, which makes it easier for the operator to obtain images.。

4.2.5.5.1. Changing the scanning method

Scanning methods include regular scanning, active selection scanning, line scanning, point scanning, double magnification scanning, and figure image segmentation scanning. Common scans and active selection scans are common.。

1. General scan
2. Activity area selection
3. Line scan
4. Point scan

5. Double magnification scan
6. Image split scan

4.2.5.5.2. Changing the scanning speed

Refer to picture 3-2 software control panel

4.2.5.5.3. Adjusting the magnification

Refer to picture 3-2 software control panel

4.2.5.5.4. Astigmatism

Refer to picture 3-2 software control panel

4.2.5.5.5. Electric Displacement Adjustment

Refer to picture 3-2 software control panel

4.2.6. Adjusting sample position

When viewing a sample, it is often necessary to adjust the position of the sample. The sample stage contains a total of X, Y, Z, rotation R and tilt T five-dimensional motion。

4.2.6.1. Sample X, Y direction movement

Rotate the knob on the gate of the sample chamber marked with an “X” and the sample moves in the X direction. When the knob is turned clockwise, the sample moves from left to right in the X direction of the screen; when the knob is turned counterclockwise, the sample moves from right to left in the X direction of the screen. The amount of movement of the sample in the X direction is 0-50 mm (25 mm is the center position) and is indicated by a scale.

Rotate the knob on the gate of the sample chamber marked with “Y” and the sample moves in the Y direction. When the knob is turned clockwise, the sample moves up and down in the Y direction of the screen; when the knob is turned counterclockwise, the sample moves from bottom to top in the Y direction of the screen. The amount of movement of the sample in the Y direction is 0-50 mm (25 mm is the center position) and is indicated by a scale.

Users with automatic sample stations can use the software to control the X and Y movement of the sample stage.

4.2.6.2. Sample Z-direction movement

Rotate the sample chamber with the “Z” knob on the gate of the sample chamber.

4.2.6.3. Sample rotation R

Rotate the knob on the door of the sample chamber marked with “R”. The sample rotates and the rotation angle ranges from 0 to 360 degrees with a scale indication.

4.2.6.4. Sample tilt T

Rotate the knob on the door of the sample chamber marked with “T”, the sample is tilted, the angle of inclination is 0-90°, and there is a scale indication.

4.2.6.5. ample Grounding

The sample forms a loop through the sounder and ground. When the sample is directly grounded, the alarm will alarm, so when observing the Figure image, the sample should not touch the objective pole under the objective or be grounded directly.

Note: The position of the fixed sample should not be too high, so as not to exceed the rear support plate of the tilting seat, otherwise the pole shoe under the objective lens may be damaged. If the sample itself is very high, adjust the “Z” direction knob before fixing the sample to lower the position of the sample holder. Do not use too large a sample to avoid touching the electron detector. Larger samples can be observed at a low working distance of 20-24 mm.

4.2.7. Sample Preparation

Sample preparation by SEM is very simple. Take a sample and stick it on the sample cup with conductive or conductive tape.

If the sample is not conductive, stick the sample to the sample cup with conductive paste or conductive tape, and then sputter a conductive film (usually gold or carbon) with a sputter. For details, see the Sputterer Instruction Manual.

4.2.8. Image Processing Operations

Double click to start the software as below picture shown:

4-1 Softater Icon

4.3. Monitoring and Recording in Operation

4.3.1. Working of the vacuum system

A63.7080 vacuum system is fully automatic control, the operator should start according to the operation steps, pre-vacuum, if the automatic process is terminated, or the high vacuum state can not be reached for a long time, or the vacuum is too low during the work of A63.7080 For interlock protection, the operation process and phenomena should be recorded in detail, and the

machine should be stopped according to the operation steps, and the manufacturer should be notified in time for maintenance.

4.3.2. Software Working Status

For details, see the software log.

4.4. Operating procedures, methods & precautions for shutdown

4.4.1. Daily standby status

Click “Close V1 Valve” in the software interface, the electron microscope can be in standby state.

4.4.2. Shutdown Status

Close the V1 valve, click the software interface "automatic retreat" button, wait for the software to automatically complete the gun withdrawal step, close the software control interface, close the electrical cabinet。

4.4.3. Closing the electrical cabinet

Shut down power supply of cabinet.

5. Maintenance

- A63.7080 requires very limited user maintenance and is very demanding. Under normal circumstances, the user cannot open the panel to prevent the high voltage and the circuit board from being exposed to the outside, causing damage to the operator. At the same time, if there is no guidance from the manufacturer's engineers, the user cannot move the overall position of A63.7080 to avoid damage to the instrument and make A63.7080 not working properly.
- The user's maintenance work on A63.7080 mainly includes the following parts:
- Replace the scintillator of the secondary electron detector
- Cleaning objective lens and light beam
- Of course, if the user needs these jobs, they can also be completed by the manufacturer or under the guidance of the engineer.
- In order to avoid damage to the instrument, other maintenance work should be notified to the manufacturer's engineer or under the guidance of the engineer, for example:
- Cleaning the scanning coil
- Cleaning the entire electron optical tube
- A63.7080 machine movement, etc.

5.1. Maintenance during operation

5.1.1. Replacing Scintillator of the Secondary Electron Detector

When the scintillator is bombarded by the electron beam for a long time, surface contamination is caused, and a charge is accumulated on the surface of the scintillator to cause a discharge phenomenon. At the same time, the luminous efficiency of the scintillator will also decrease, so that the signal-to-noise ratio of the Figure image will decrease, and the scintillator should be replaced. In general, it needs to be replaced once a year.

To replace the scintillator, follow these steps:

1. Click on “Deflated” and pull the sample stage completely out.
2. Remove the grid of the detector.
3. Remove the pressure ring and scintillator.
4. Place the new scintillator into the pressure ring and install it on the light pipe.

   Note: Keep the side without the phosphor facing the light pipe. Do not touch or touch the side with the phosphor.

5. Clean the grid, blow it dry and attach it to the detector.
6. Use a multimeter to measure the connection between the grid and the mount to ensure good contact.

7. Install the sample stage on the sample chamber, push in gently, and click “Pump”.
8. 8. Wait until the vacuum system has completed the ultra-high vacuum and other work can be performed.

5.1.2. Cleaning the objective diaphragm and rod

After working for a period of time A63.7080, the objective diaphragm is easy to produce pollution, the image quality is degraded, and it needs to be cleaned frequently. The cleaning interval depends on the use and pollution.

The objective pupil and the light mast should be removed as follows:

1. Click on “Deflation” until the sample door is loose.

Figure 5-1 Objective Diaphragm

2. Turn the knurled knob on the light lever counterclockwise until the thread is completely disengaged.
3. Pull the light lever out by hand and place it on a clean, lint-free cloth. The reverse side (ie, the matte side of the diaphragm) is up, as shown in Figure 51.
4. Use a pair of tweezers against the top post of the fixed diaphragm and pour the three objective lenses onto the lint-free cloth one by one, as shown in Figure 52.
5. Remove the top column and small spring of the fixed diaphragm and place it in alcohol for 20 minutes with ultrasonic cleaning.
6. Dry the top column and small spring of the fixed diaphragm with a hot air

blower and place it on a clean, lint-free cloth.

7. Use a bamboo stick to remove the rubber “O” ring from the light rod.
8. Apply a small amount of polishing paste on a lint-free cloth, polish the polished rod, especially in the groove where the light is placed, and carefully polish it with a thin bamboo stick against the lint-free cloth; carefully cut the three small holes in the groove with a fine cotton swab. polishing.
9. Clean the polished light rod with warm water with detergent, then rinse it in warm water (preferably hot water); check the light rod under the light, especially the light Whether the rod is polished or not, there are still black spots, stains and residual polishing paste; if there is residue, it needs to be re-polished or brushed until it is completely clean.。

Figure 5-2 Remove Diaphram from Bar

10. Dehydrate the optical mast with absolute ethanol and blow dry with a hot air blower.
11. Install the rubber “O” ring that you just removed on the sealing groove of the light rod.
12. Place the three objective lenses on the molybdenum boat of the vacuum coater, pump to a high vacuum, and heat the diaphragm to orange for half an minute。

Note: The temperature should not be too high to avoid burning out the diaphragm; if there is a platinum pot, you can also put the diaphragm into the platinum pot or the white gold boat (or use the tweezers to clamp the edge of the diaphragm, as shown in Figure 5 3), the front side of the pupil (glossy side) is heated upwards with an alcohol lamp to a slight

redness, and the dirt on the visible light ray changes from yellow to black, and then gradually disappears. Repeat the burning for 1-2 times, each time for a few seconds, until the surface of the enamel is smooth, be careful not to burn for a long time, so as not to damage the glare. Cool the burnt light in alcohol and place it on a clean, lint-free cloth.

Note: Platinum enamel is soft and thin. When using stainless steel tweezers, it is easy to scratch the surface of the enamel. Especially when scratching the pupil, it will affect the image quality, so you need to be very careful. Place the diaphragm on a clean, lint-free cloth and gently clip the edges with tweezers.

13. The three objective lenses are mounted in the optical mast. The back side is mounted upwards and is fixed with a top post and a small spring.
14. Apply a thin layer of vacuum grease to the rubber “O” ring of the light rod.
15. Insert the light rod into the iris holder, adjust the position so that the limit pin is in the limit groove, and push the light rod flat to make the thread contact.
16. Turn the knurled knob on the light lever clockwise until the first score line on the light rod is flush with the end face.
17. Click “Pumping” and wait for the ultra-high vacuum to perform other work.。

Picture 5-3 Burning Diaphragm on Fair

5.1.3. Other maintenance work

Maintenance of A63.7080 also includes cleaning the liner, cleaning the scanning coil, the objective lens lower boots and the entire electron optical tube, or moving the A63.7080 to other places. These maintenance work must be performed by a professional engineer appointed by the manufacturer. Authorized by the manufacturer and engineered by an engineer who has been specially trained and qualified by the manufacturer.

5.2. Maintenance cycle

Each year, the unit need to be inspected and repaired by engineer， and be checked under normal working conditions to eliminate potential hazards.

5.3. Normal maintenance procedures

请参见服务程序中所述。

5.4. Maintenance during long-term parking

If A63.7080 is not used for a long time, the gun should be turned off and turned off.。

6. Transportation and Storage

6.1. Lifting and transportation precautions

A63.7080 should prevent inversion, rain and strong earthquakes during hoisting, handling and transportation to prevent severe cold and exposure.

6.2. Storage conditions, storage period and precautions

A63.7080 should be stored in a dry, ventilated, non-corrosive gas house before opening the box to prevent inversion, rain, cold and exposure. The storage room temperature is -10 ° C ~ +40 ° C, the relative humidity is not more than 80%.

Since the inside of the electro-optical lens barrel of A63.7080 is vacuumed at the factory, it is best to complete the installation within one month after arrival, to ensure the vacuum inside the lens barrel, to avoid the accumulation of moisture and the like, and to internal sensitive parts. Causes pollution, even corrosion, which affects the optimal working condition of the instrument.

7. Unpacking and Inspection

7.1. Unpacking Precautions

1. Before opening the A63.7080, carefully check the laboratory conditions to ensure that the installation and commissioning requirements are met.
2. The A63.7080 unpacking environment is guaranteed to be dry, ventilated and free of corrosive gases.
3. Take care to prevent inversion, rain and strong earthquakes during the unpacking process to prevent severe cold and exposure.
4. Care should be taken during the unpacking process to avoid contamination, damage or damage to the components.
5. In the process of unpacking, check the “A63.7080 Product Packing List” and check it in time to avoid missing parts.。

7.2. Inspection contents

The user needs to confirm the completeness of the A63.7080 product and the appearance of the instrument during the unpacking process.

7.2.1. A63.7080 Packing List (For Reference Only)

No.	Name	数量	单位
1	A63.7080 Scanning Electron Microscope	1	Set
2	Carbon conductive tape	1	Disc
3	Bamboo stick (for cleaning)	1	Bag
4	Cleaning Cloth	20	Sheet
5	Sample Cup	10	pc
6	Hexagonal Screw Driver	1	Set
7	Tweezers	1	Pc
8	Screw Driver	2	pc
9	Power Supply Earth Cable	10	Meter
10	Instruction Manual (PDF Version)	1	Pc
11	exhaust pipe	5	Meter
12	Clean nitrogen tube	8	Meter

Note: The above content is for reference only. If it is inconsistent with the supply contract (attached packing list), the supply contract shall prevail.

7.2.2. Instrument appearance inspection

Under the condition of sufficient light, visual observation, the appearance of the instrument should be free of large scratches and stains.

8. Other

8.1. Guarantee, after-sales service, contact information.

8.1.1. Manufacturer's guarantee commitment

All kinds of SEM products and related ancillary products produced by our company, we promise to provide users with on-site installation, relocation and various system maintenance, repair, system upgrade, system expansion, etc. in a timely and fast after-sales service. service

8.1.2. After-sales service

All types of SEM products and related ancillary products produced by our company are responsible for after-sales service by OPTO-EDU technicians.

Warning: In order to ensure the safety of the instrument, it is forbidden to install any other software in the computer; before copying files from the computer with a floppy disk, USB disk or removable hard disk, make sure it is not infected! Therefore, the instrument damage

8.1.2.1. Scanning electron microscope installation procedure

After the instrument arrives, the user will be notified to arrive in time for installation. The main contents of the installation work are：

1. The installer will unpack and inspect the goods together with the user according to the Packing List.
2. After the installation and commissioning of the installer is completed, the user will check the instrument item by item according to the requirements of the “Installation Acceptance Report”. After the acceptance is passed, the user signs and seals the report and submits it to the company for filing and the user to reserve the bottom。
3. After the instrument is accepted by the installer, the user will be retrained for three days according to the requirements of the User Training Report, so that the user can master the basic operation of the sample and the simple maintenance of the instrument. After the training, the user signs the report and handed it over to the OPTO-EDU installer to bring it back to the company for filing.

8.1.2.2. Warranty period

Free consultation, free on-site repair, free replacement of parts (except for damage caused by abnormal use).

8.1.2.3. Out of warranty period

Lifetime paid service, spare parts and consumables are guaranteed.

8.1.3. Contact information

- Tel：0086 10 88696020，88696030
- Fax: 0086 10 88696085
- Email: sale@cnoec.com
- Web: www.cnoec.com.cn
- Address：F-1501 Wanda Plaza, No. 18 Shijingshan Road, Beijing 100043, China

8.2. User feedback

In order to improve product quality, OPTO-EDU conscientiously implements the ISO9000 quality system improvement requirements. After the installation, acceptance and training of the instrument, please fill out the “Customer Satisfaction Information Questionnaire” and sign it.。

8.3. Other matters that need to be explained to the user

- Other things that need to be explained to the user include:
- To ensure the normal operation of the instrument, please do not install any applications and software that are not related to this in the instrument system computer to avoid damage to the system control.
- Because there are high voltage power supplies and related equipment in the system, if you have any related problems, please contact our maintenance engineers first, and carry out relevant tests under their guidance to avoid unnecessary damage.
- If the power supply and grounding wire used by the instrument have changed, please consult our maintenance engineers before the change to avoid system interference caused by changes in the electrical environment and affect the operating status of the system.。

9. Appendix: Abbreviations, Glossary of Terminology

Abbreviations & Glossary of Terminology		
Chinese	**English**	**解释 Refers To**
扫描电镜	SEM	Scanning Electron Microscope
场发射	FEG	Field Emission Gun
A63.7080	A63.7080	A63.7080 Scanning Electron Microscope
镜筒	COLUMN	Electron optical tube column
分辨率	RESOLUTION	Max resolution
工作距离	Working Distance (WD)	Distance between sample surface to objective lens.
束流	PROBE CURRENT	Electron Beam Probe Current
束斑尺寸	SPOT SIZE	Size of electron beam spot on sample surface
高压	High Voltage (HV)	Electron Beam Accelerating Voltage
单击	Click	Single Click on left button of mouse
双击	Double click	Double Click on left button of mouse
右击	Right click	Single Click on right button of mouse