Starter Guide for The SU8220 / SU8230 / SU8240

This Starter Guide shows a part of the instruction manual. Please refer to the [SAFETY SUMMARY] of the instruction manual before use. Please refer to the instruction manual for more detailed information about the instrument.

STARTER GUIDE CONTENTS

Main unit Display unit

Specimen Setting

Refer to section 3.2 of the instruction manual.

(1) To fix a specimen on the specimen stub, use conductive paste or conductive double-sticky tape.
(2) Attach the specimen stub to the specimen holder.
(3) Adjust the height of specimen so that the highest point matches the lower surface of the height gauge.

Specimen holder

Adjustment of specimen height

1. Starting Instrument

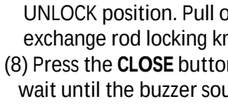
Refer to section 3.1.3 of the instruction manual.

(1) To start the SU8200, turn on the display power switch (▬ side).
(2) Log on Windows with the user account “PC-SEM”.
(3) The SEM control program will start up. Enter login name and its password, and click the **OK** button.
(The default login name at shipment is “PC-SEM” [no password is set])

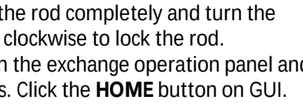
Display power switch

2. Loading the Specimen

Refer to section 3.2.4-5 of the instruction manual.



HV indication area

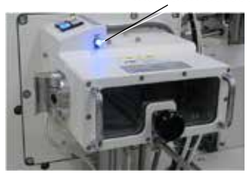


SU8230/8240 SU8220
(Specimen exchange position)

Exchange operation panel

Insertion detection lamp

(1) Accelerating voltage should be off in the HV indication area.
If accelerating voltage is **on**, click the **OFF** button..
(2) Click the **EXC** (SU8230/8240) or **HOME** (SU8220) button on GUI.
The stage will move to the specimen exchange position (SU8230/8240) or the home position (SU8220) and the indicator is lit in green.
(3) Press the **AIR** button on the exchange operation panel.
Buzzer will sound when air introduction into the specimen exchange chamber is completed.
(4) Open the exchange chamber door.
Turn the exchange rod locking knob counterclockwise to release the lock, and push the rod out of the open airlock door.
Turn the specimen holder lock / unlock knob clockwise and insert the rod tips into the holes of the specimen holder. Turn the specimen holder lock / unlock knob counterclockwise and confirm that the holder is locked to the rod.
(5) Pull the specimen exchange rod back into the airlock door and turn the locking knob clockwise to lock the rod.
Close the specimen exchange chamber door and press the **OPEN** button on the exchange operation panel. The chamber is evacuated and then, the gate valve will open.
Wait until the buzzer sounds.
(6) Turn the exchange rod locking knob counterclockwise to release the lock,
Insert the specimen carefully looking inside the specimen chamber through the viewing window, until the insertion detection lamp at the side of the exchange operation panel is lit in blue.
(7) Turn the specimen holder lock / unlock knob clockwise to UNLOCK position. Pull out the rod completely and turn the exchange rod locking knob clockwise to lock the rod.
(8) Press the **CLOSE** button on the exchange operation panel and wait until the buzzer sounds. Click the **HOME** button on GUI.

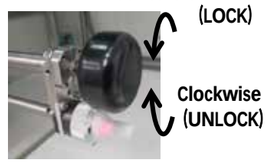


(When exchange rod is inserted)

(When door is open)

Specimen exchange chamber

Exchange rod locking knob



Specimen holder lock / unlock Knob

Attachment of specimen holder

Insert the rod tips into the holes of the specimen holder

3. Image Observation

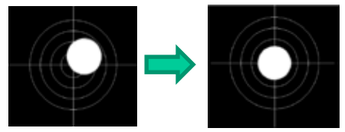
Refer to sections 3.3 - 3.8 of the instruction manual.

(1) Set the specimen **Size** and **Height** in the **STAGE** tab. ⑧
(2) Confirm and set operating conditions.
① Accelerating voltage, Emission current ② Magnification ⑦ Scan Mode
⑨ Signal select (Optics tab) ⑩ Operating condition (Optics tab)

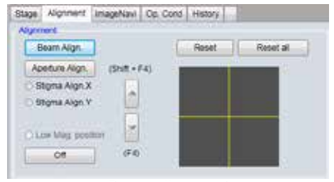
(3) Click the **ON** button to turn on HV. Adjust the brightness / contrast with the **AUTO Contrast** button④ or the **AUTO** button(P-1) on the manual operation panel.

Refer to section 3.4.3 of the instruction manual.

(4) If the image does not appear, adjust the electron beam axis.
Click the **Beam** button⑤ or the **MODE** button(P-2) on the manual operation panel to adjust the beam alignment. Bring the circular image to the center of the image area. Click the **Off** button on the **Alignment** tab.



Beam alignment image



Beam alignment

(5) Adjust magnification with the **MAGNIFICATION** knob.(P-3)
Adjust focus using **FOCUS** knobs. (P-4) Move the stage to look for the field of interest. (To use the Low-Mag mode for field search, click the **H/L** button③, or press the **LOW MAG** button(P-3) on the manual operation panel.)

(6) Carry out image adjustment shown below at near the field of interest.

Image adjustment method

Refer to section 3.4.3 of the instruction manual.

Image drift (swaying or shifting) → Axis adjustment
Turning focus knob
Image distortion (stretching) → Correct astigmatism

(Axis adjustment)

Refer to section 3.6.3 of the instruction manual.

Click the **Aperture** button. ⑥
Minimize the wobbling motion of the image by adjusting the **STIGMA/ALIGNMENT X** and **Y** knobs (P-2).

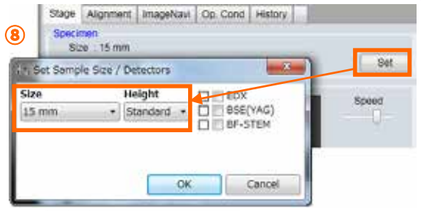
(Astigmatism Correction)

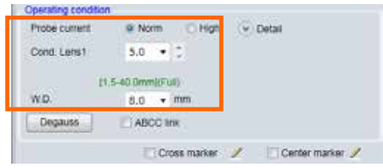
Refer to section 3.6.5 of the instruction manual.

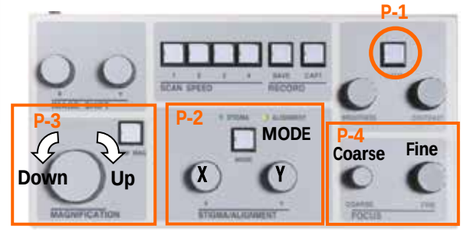
After adjusting focus, correct astigmatism to reduce distortion (“smearing”) of the image. Use the **STIGMA/ALIGNMENT X** and **Y** knobs (P-2) alternately to obtain the sharpest image.

※Repeat above adjustments two or three times increasing magnification.

(7) Select the field of view, confirm image with slow scan and then, click the **Capture** button ⑪.







Manual operation panel

4. Retrieving the Specimen

Refer to sections 3.9.1-3 .9.3 of the instruction manual.

(1) Click the **OFF** button to turn off HV.
(2) Move the specimen stage to the exchange position.
(3) Take out the specimen from the specimen chamber.
Refer to [2. Insert a specimen in SEM].)
(4) Close the specimen exchange chamber.
Press the EVAC button on the exchange operation panel.

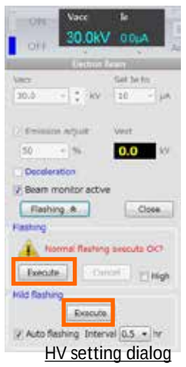
5. Shutdown Procedure

Refer to section 3.9.4 of the instruction manual.

(1) Confirm that the [EVAC] button on the exchange operation panel is lit.
(2) Close the SU8200 SEM control program.
(3) Shut down Windows. Wait until PC is shut down.
(4) Turn off the display power switch (◯ side).

About flashing

Refer to section 3.3.2 of the instruction manual.



HV setting dialog

(1) Normal Flashing
To clean up the electron emitter tip, execute a normal flashing every 12 hours. If 12 or more hours have elapsed since the previous normal flashing, a warning message will appear. Turn off HV and click the **Execute** button in the **HV Setting** dialog window.
(2) Mild flashing
To maintain stable emission over the short run, use mild flashing.
Usually select the **Auto flashing** check box and set “1” for **Interval**.

Part No. 534-8003

Signal detection

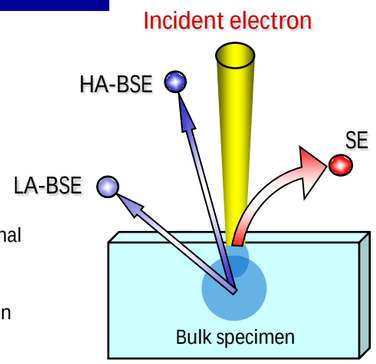
Refer to section 3.6.1 of the instruction manual.

SE (Secondary Electron)

- Emitted from near the specimen surface, about within 10nm depth.
- Shows topographical surface information.
- Shows good voltage contrast.
- Has ~10eV average energy.

BSE (Backscattered Electron)

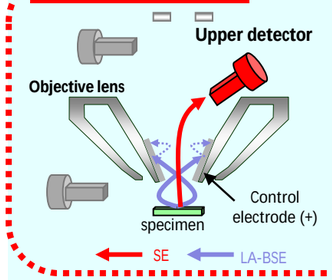
- Has high energy comparable to that of the incident electrons.
- Includes compositional surface information, as the BSE yield is proportional to the mean atomic number of the specimen.
- Information varies according to the scattering angle from the specimen.
  - ① HA-BSE (High Angle BSE) ･･･Compositional/Crystalline information
  - ② LA-BSE (Low Angle BSE) ･･･ Mixture of compositional and topographical information
- Energy range is about 50eV to that of incident electron beam.



Electron signals emitted from the specimen.

Signal selection for normal observation modes (accelerating voltage: 0.5～30 kV)

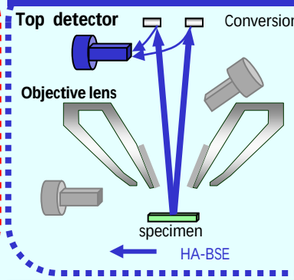
SE image : SE(U)



① SE is detected with the Upper detector through the objective lens.
② backscattered electron is not detected.

u Rich Topographical information
u High-resolution
u Good voltage contrast

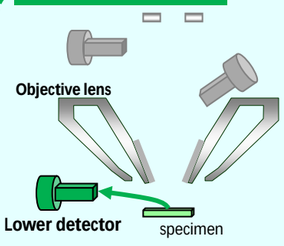
HA-BSE image : HA-BSE(T)



① HA-BSE is converted to secondary electron at the conversion electrode and detected with the Top detector.

u Rich Compositional information
u Less topographic information

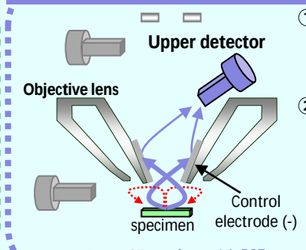
SE image : SE(L)



①Low angle BSE and SE are detected with the Lower detector.

u Rich Topographic information
u Less sensitive to specimen charging-up

LA-BSE image : LA-BSE(U)



① LA-BSE is converted to secondary electron at the control electrode and detected with the Upper detector.
② Amount of SE is controlled by variable negative electrode voltage.

u Compositional + Topographic information (LA100(U))
u Mixture of SE and LA-BSE image (LA0(U)～)
u Less sensitive to specimen charging-up

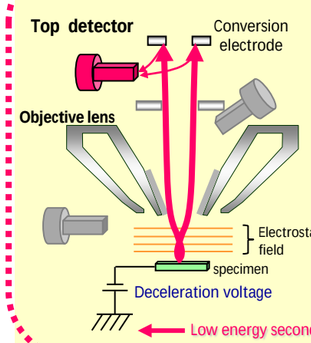
Deceleration Mode * (Landing voltage 10V** ～ 2 kV)

Refer to section 3.3.6 of the instruction manual.

* In the Deceleration mode, a negative voltage (deceleration voltage, Vd) is applied to the specimen. If the specimen has an uneven surface, or is tilted, or observation points are near the edge of the specimen, a good image may not be obtained in Deceleration mode.

** To use a landing voltage of 90 V or lower, select the **Use 10 to 90V Vland** check box on the **General** tab of the Settings dialog window.

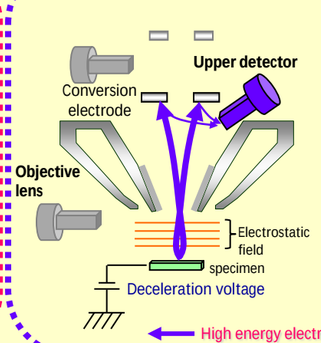
Low energy SE image : SE(T)



① Low energy secondary electron emitted from the specimen is accelerated by the deceleration voltage and detected with the Top detector.
② Low energy component of SE excluding higher energy component is detected.

u Topmost surface information
u Sensitive to surface potential
u High resolution at low incident electron energy

High energy electron image : SE＋BSE(U)

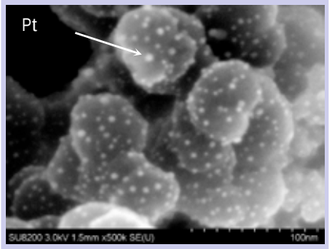
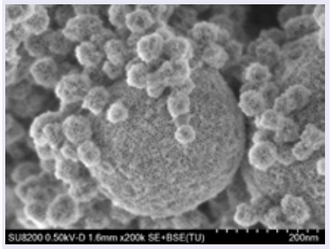
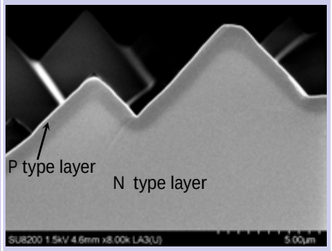
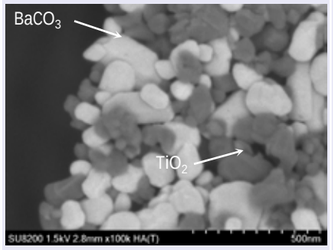
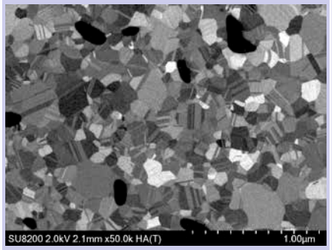
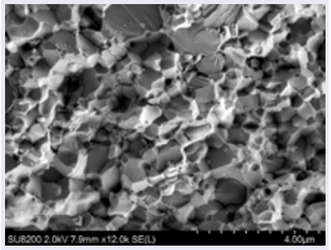


① Higher energy component of SE and BSE are detected with the Upper detector.
②Low angle and higher energy electron excluding low energy component are detected.

u Topographic information of very small structures (nanometer order)
u Less sensitive to specimen charging-up
u High resolution at low incident electron energy

Recommended Operating Conditions

Refer to section 3.11 of the instruction manual.

Purpose	Example ※1	Point	Recommended condition	
High resolution		Specimen : Carbon catalyst with platinum nano particles Accelerating voltage : 3 kV Signal : SE Choose appropriate acceleration voltage and WD for high resolution image.	Signal	SE
			Signal name ※2	SE(U)
			Accelerating voltage	2～15 kV
			WD	1.5～4 mm
			Probe current mode	Normal
Topmost surface information		Specimen : Silica particle Landing voltage : 0.5 kV Signal : SE Observe in low acceleration voltage to detect SE signal from the specimen's topmost surface. Deceleration mode is also effective.	Signal	SE
			Signal name ※2	SE(U) SE(T) SE+BSE(U) ※3
			Accelerating voltage	0.8～3 kV 0.1～1 kV※3
			WD	1.5～3 mm
			Probe current mode	Normal/High
Voltage contrast		Specimen : Solar cell cross section Accelerating voltage : 1.5 kV Signal : SE When an internal potential difference exists, varied secondary electron detection efficiency shows voltage contrast. Large probe current and fast scan speed are effective for observation.	Signal	SE
			Signal name ※2	SE(U) LA0～5(U)
			Accelerating voltage	0.5～2 kV
			WD	1.5～8 mm
			Probe current mode	High
Composition		Specimen : Mixed particles of $BaCO_3/TiO_2$ Accelerating voltage : 1.5 kV Signal : HA-BSE Large probe current and slow scan speed are necessary to observe BSE image, as amount of BSE signal is very small compared to the SE signal. BSE is less sensitive to charging artifacts.	Signal	LA-BSE HA-BSE
			Signal name ※2	LA100(U) HA(T)
			Accelerating voltage	1～3 kV
			WD	1.5～3 mm
			Probe current mode	High
Crystal		Specimen : Gold thin film Accelerating voltage : 2 kV Signal : HA-BSE Large probe current and slow scan speed are necessary to observe BSE image, as amount of BSE signal is very small compared to the SE signal.	Signal	LA-BSE HA-BSE
			Signal name ※2	LA100(U) HA(T)
			Accelerating voltage	1～3 kV
			WD	1.5～3 mm
			Probe current mode	High
Topography		Specimen : Ceramic cross section Accelerating voltage : 2 kV Signal : SE(L) Topographical structure can be emphasized using shadow effect of the Lower detector. Use relatively long WD. Signal of the Lower detector is less sensitive to charging artifacts.	Signal	SE(L)
			Signal name ※2	SE(L)
			Accelerating voltage	1～5 kV
			WD	8～15 mm
			Probe current mode	Normal/High

※1 Images are shown as examples. Additional specimen information could be obtained using other signals.
※2 The parenthetic character describes the detector. T : Top detector, U : Upper detector, L : Lower detector
※3 Use deceleration mode.