Note

This instrument has been tested and found to comply with the limits for CISPR 11 Class A. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment .

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the inter – ference at his own expense.

JSM-6380, JSM-6380LV

Scanning Electron Microscope

Instruction manual

No.ISM6380/6380LV-1

Printed in Japan

Notice

- This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the environment, especially radio communications.
- This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the environment, especially radio communications.
- The information in this manual, which is based on specifications believed correct at the time of publications, is subject to change without notice due to improvements made in the instrument.
- In order to assist us in preparing future documentation, please advise your nearest JEOL service office if you find any errors in this manual.
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TRADEMARK

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SELLING

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MANIFUCTURE

JEOL technics Ltd.

6-38 Musashino 2-chome, Akishima-Shi, Tokyo, 196-0021 Japan

For servicing or inquires, please contact your JEOL service office.

Safety precautions

To ensure that you use this instrument correctly, read carefully following safety precautions prior to starting operation or maintenance. The descriptions below contain important information related to safety.

Contact your local service center whenever you are unclear about an operation or maintenance.

Please keep the operation manual on hand so that you can consult it whenever necessary.

The safety definitions used in our company's operation manuals and their meanings are as follows:

! WARNING: A potentially hazardous situation which, it not avoided, may result in death or serious injury.

! CAUTION: A potentially hazardous situation which, if not avoided, may result in minor injury or material damage.

The following marks represent potential hazards. Please follow the instructions and never touch the parts marked with these sings.

We request that you use the instrument in a proper manner and within the scope of the purposes and usages described in the brochures and operation manuals. Never make modifications such as removing protective parts, replacing component parts and unlocking safety measures.

Safety precautions for optional attachments that are built into or attached to the instrument are described in the individual operation manuals.

! WARNING

■ General warning

- Do not unlock or remove any covered parts, modify or remove component parts, or dismantle these parts in any way other than their intended use, due to the risk of a thermal, electrical or radiation hazard occurring.
- Never remove the grounding wire or connect it to any other location than that specified, due to the risk of electric shock.
- If it is necessary to move the instrument, various hazards are expected. Confirm the specifications and installation requirements for the instrument, check the state of the new installation site and consult your local service center.
- When performing maintenance, checks, or routine operations, never stand on the operation console table on instrument frame.

■Warning for replacing the oil diffusion pump

- Be sure not to touch the boiler or cover of the oil diffusion pump immediately after its heater has broken, because these parts are very hot and you may receive a burn. To cool the heated parts to room temperature, maintain the follow of cooling water for at least 30 minutes.
(flow?)

■Warning for replacing the filament

- The wehnelt is very hot immediately after the filament burnt out. Do not touch the wehnelt. Allow it to cool down sufficiently (about one hour), then replace the filament with the removal tool.

! CAUTION

■ General cautions

- If an abnormality occurs in the instrument, stop it immediately. To stop the instrument follow the instructions, then contact your local service center.
- If a power failure occurs, the instrument will automatically stop. When the power resumes, restart the instrument.
- If a water failure occurs, the main power is shut down automatically. When the water supply is restored, restart the instrument.
- Since the electron optical column is placed on the frame via an anti-vibration mount, the electron optical column will sway a little when you operate the knobs. Take care not to get your fingers caught in any clearance resulting from this sway.
- An instrument that has been installed properly will usually not vibrate or emit any unusual noise. Should this occur, stop the instrument immediately and contact your local service center.

■ Cautions concerning the cooling water

The water leak sensor is not attached to this device.
The passage system might cause corrosion and damage and the water leak by the water quality and a pressure increase etc. in cooling water.
Please install the water leak sensor (option) in preparation for an emergency water leak. When the water leak is generated by installing this water leak sensor, a large amount of water leak can be prevented.
Please use the cooling water circulation device (option) when the water quality and the pressure of tap water are improper. (In the device that has Turbo Molecular Pump of the option, cooling water is not used.)

■ Cautiuons concerning the vacuum pump oil

When vacuum pump oil is replaced or vacuum pump is repaired, process the oil in the proper way.

■ Cautions concerning the oil rotary pump

- Be sure not to disconnect the rubber hose from the oil rotary pump during operation. If you do so, the oil in the oil diffusion pump will flow back to the electron optical column, causing serious damage to the instrument.
- Do not let the oil level of the oil rotary pump fall below the lower limit. If the pump operates with only a small quantity of oil, trouble may occur.

■ Cautions when disassembling and cleaning the electron optical column

- When it becomes necessary to perform maintenance that requires disassembling and cleaning of the electron optical column or replacement of parts other than those specified in maintenance, contact your local service office.
- When you clean electron optical column components, use a cleaning agent a nonflammable highly volatile, highly efficient solvent that is free from impurities and is not harmful to the human body. Be sure to use the solvent in a location free from combustible material and sources of ignition and with open windows or proper ventilation, regardless of the quantity used.
- When you use a cleaning agent, be sure to wear protective gloves that are resistant to the solvent.

■ Notes and Cautions concerning Personal Computer (PC)

PC: A personal computer (PC), whose operating system (OS) is Windows XP, must have FlashPoint 3Dx on the VideoCapture Board.

Hardware

- Never modify the hardware settings and also never install additional boards. If you do, the PC or the SEM may not work normally.
- Never connect devices other than the recommended ones. If you do, the PC or the SEM may not work normally.
- Make sure not to locate a motor in the vicinity of the electron optical column. If you do, the fluctuation of stray magnetic fields may disturb SEM images.

Software

- Never install application software other than the recommended software. If you do, the PC or the SEM may not work normally.
- Never delete application software or files which have been installed. If you do, the SEM control software may not work normally.
- When an error message appears while operating the SEM control software, close Windows, switch off the PC and reset the SEM, and then switch on the PC again. If the SEM control software has not finished normally, the present SEM data vanishes.

OS

- Never upgrade the OS or driver software. If you do, the PC or the SEM may not work normally.
- Never change the settings of the [Screen Resolution] while the SEM control software is being executed. If you do, SEM images may not be displayed or the PC may hang up.
- Never change the settings of the [Dual monitor] while the SEM control software is being executed. If you do, SEM images may not be displayed.
- Never change the settings of [Color quality] and [Font Size] in the window that appears when you click the set button of the property display screen. If you do, the SEM control software may not work normally.
- If the setting of [Screen Resolution] is changed, the settings of the color and refresh frequency (rate) may vary automatically.
- If the setting of the [Refresh frequency] in the property display screen is changed, the SEM images may be disturbed.
- Do not activate the screen saver. If the screen saver becomes active when the SEM control software is being executed, SEM images may not be displayed and the PC may hang up.
- If you effectively set [Enable pointer shadow] and [Show shadows under menus], the shadow of pointer and menus becomes magenta color when there is a mouse pointer or a menu on the SEM image.
- If you effectively set [Use the following transition effect for menus and tooltips], the shadow of menu becomes magenta color for a moment when the GUI menu is selected.
- Do not set [System Standby] effectively. The personal computer may be hung-up when this setting operates while executing the SEM control software.
- Do not set [Enable hibernation] effectively as mush as possible. The Windows screen may be fall into disorder when this function operates while executing the SEM control software. Moreover, it enters the state that the SEM image is not displayed when the personal computer is restored from hibernate, and the reactivation of the personal computer is needed.
- A under portion of "Active data display (SEM information)" on the GUI slightly hides when the setting of the

[Window and buttons] is [Windows XP style].

- Never change the settings of the user while the SEM control software is being executed. If you do, the Windows screen may be fail into disorder. When changing the settings of user, change it after the SEM control software is exited.
- Never execute the "log off" of the user while the SEM control software is being executed. If you do, the Windows screen may be fail into disorder. When executing the "log off" of user, execute it after the SEM control software is exited.
- Windows／display／Mouse is normally set as follows;
  (※ When the new user account is created, confirm the settings as follows;)

Screen resolution:	1024×768 pixels
Color quality :	Highest (32-bit)
Font size:	Normal
Refresh frequency:	75 Hz
Enable pointer shadow:	Invalidity
Show shadows under menus:	Invalidity
System Standby :	Invalidity
Enable hidemation :	Invalidity
Window and buttons :	Windows classic style
keep a computer in the condition which is always the latest:	Invalidity

Display of SEM Images

- A wave-like noise sometimes appears in displayed SEM images, and the margin of a SEM image looks like a mosaic. If this happens, close Windows, switch off the PC and then switch on the PC again.
- If an application software (such as Paint software) using the magenta color is overlapped on the SEM image, the part of the image in magenta color may disappear. It will return when application software is moved to the position which does not overlap to a SEM images.
- When the SEM GUI window is moved, SEM image right side may be disturbed. It will return when the SEM GUI window is slightly moved to left or right.

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Contents

Chapter 3 Explanation of GUI

Chapter 4 Operation

Chapter 5 Maintenance

1

General, specifications and composition

Specifications and composition guaranteed when no modification or addition is made, and subject to change without notice.

1.1 General

The main characteristics of this device···

- A resolution guarantee the 3.0nm (Accv; 30kV, WD8mm, Secondary electron image) of this class maximum.
- A minimum magnification ×8 (Accv; 11 to 30kV, WD48mm) or ×5 (Accv; 0.5 to 10kV, WD48mm) was realized.
- New Graphical User interface (GUI) which enriched various observation support functions and easy operation, and the meaty automatic-functions, recipe function and simplified DTP function are provided. A series of work to report preparation from image observation can perform efficient. Moreover, each user can make it to GUI to which my own way is easy-to-use according to the usage because each user can freely customize the icon on GUI.
- Easy operation···Only because the Sample Groups with "Smile Shot" is selected, the image can be easily obtained.
- An EDS and WDS (option) becomes an analysis position WD10mm and X-ray extraction angle 35° , and it can perform the good analysis of the efficiency in the X-ray analysis. And, mapping in the low magnification can perform under the condition which is the same as high resolution observation.
- This device can be installed flexibility to the floor because all units are provided to the electron optical column console.
- This instrument can be observed the non-conductive sample in the LV-mode.

1.2 Specifications

1.2.1 Performance

<JSM-6380>

Resolution (SEI)	3.0 nm guaranteed (Acc V 30kV, WD 8mm)
Magnification	8× (WD 46mm) to 300,000× (146 steps, digital indication) 5× to 7× settable (It is effective only when the condition is set to WD48mm and Acc.V 10kV or less) Automatically corrected for Acc V and/or WD changes Instantaneously changeable to an optionally preset magnification from any current magnification
Image mode	SEI, BEI (detected by the SE detector)
Probe current	Approximately 1 pA to 1 μA

<JSM-6380LV>

High-vacuum mode (HV mode)

Resolution (SEI)	3.0 nm guaranteed (Acc V 30kV, WD 8mm)
Magnification	8× (WD 46mm) to 300,000× (146 steps, digital indication) 5× to 7× settable (It is effective only when the condition is set to WD48mm and Acc.V 10kV or less) Automatically corrected for Acc V and/or WD changes Instantaneously changeable to an optionally preset magnification from any current magnification
Image mode	SEI, BEI (composition image, topographic image and stereoscopic image)
Probe current	Approximately 1 pA to 1 μA

Low vacuum mode (LV mode)

Resolution (BEI)	4.0 nm guaranteed (Acc V 30kV, WD 5mm)
Vacuum pressure in the specimen chamber	
Adjustable pressure	10 to 270 Pa
Lowest pressure	1 Pa
Image mode	BEI (composition image, topographic image and stereoscopic image)

Notes:

SEI:	Secondary-electron image
BEI:	Backscattered-electron image
Acc V:	Accelerating voltage
WD:	Working distance

1.2.2 Electron detector

<JSM-6380>

Secondary-electron detector	Collector, scintillator, light guide and photomultiplier tube

<JSM-6380LV>

HV mode

Secondary-electron detector	Collector, scintillator, light guide and photomultiplier tube
Backscattered-electron detector	Semiconductor (P-N junction) detector

LV mode

Backscattered-electron detector:	Semiconductor (P-N junction)

1.2.3 Vacuum system

<JSM-6380>

System control	Fully automatic	
Ultimate pressure	0.1mPa order	
Evacuation time	Approx. 2 minutes 30 seconds	
Oil rotary pump	100 L/min,	one
Oil diffusion pump	4-inch 420 L/s with water cooling baffle,	one

<JSM-6380LV>

System control	Fully automatic	
Ultimate pressure in gun chamber		
HV mode	0.1mPa order	
LV mode	1mPa order (when the vacuum pressure in the specimen chamber is 27Pa)	
Evacuation time		
HV mode	Approx. 1 minutes 40 seconds	
LV mode	Approx. 1 minutes 30 seconds	
Oil rotary pump	100 L/min,	two
Oil diffusion pump	4-inch 420 L/s with water cooling baffle,	one
Foreline trap	Cartridge type	
Orifice holder	Removable type (always mounted)	
Orifice	400μm diameter	
Control valve	Fine metering valve type	
Specimen chamber pressure gauge	Pirani gauge	

1.2.4 Electron optical system (EOS)

1.2.4.a Electron gun

Accelerating voltage	0.5 to 30kV (53 steps) (0.5 to 3kV; 100V steps, 3 to 30kV; 1 kV steps)
Filament	Precentered tungsten hairpin filament
Bias voltage	Automatic bias (linked to Acc.V)
Alignment	Electromagnetic 2-stage deflection type
Automatic gun alignment	Automatic filament-heating, current setting and automatic gun alignment, automatic system
Beam blanking	Automatically works in the freeze mode. (damage to the sample is reduced)

1.2.4.b Lens system

Condenser lens (CL)	Zoom condenser lens
Objective lens (OL)	Supper conical objective lens
Lens reset	Provided for CL and OL (for hysteresis elimination)
Focusing	AFD (automatic focusing) provided, manual focusing possible
Focus link	Linked to Acc V change
Auto focus tracer	Linked to WD change (when the motor drive stage is attached)
Dynamic focus	Linked to AccV and magnification
Wobbler	Provided for movable aperture (MAP) alignment, linked to magnification
Movable aperture (MAP)	3-step variable with click-stop mechanism, fine adjustment in X and Y direction possible

1.2.4.c Stigmator (Astigmatism correction)

Astigmatism correction	Electromagnetic 8-pole (Precentered X-Y adjustment type)
Automatic stigmator	Provided (manual correction possible)
Stigmator reset	Linked to AccV and/or WD

1.2.4.d Scan coil

Scan coil	Electromagnetic 2-stage deflection type
Image fine shifter	Approx. ±50 μ m in X and Y directions (Acc V 30 kV, WD 10mm)
Automatic magnification correction	Provided for AccV and/or WD changes
Preset magnification	The 5-types magnification settable

1.2.4.e Specimen stage

Type	Eucentric (T-and R-axes with eucentric function : [MSR/MS5] is necessary)
Specimen movements	X movement : 80mm Y movement : 40mm Z movement : Eucentric movement range WD5～48mm Focusing range WD5～48mm Tilt (T) : −10 to +90° (Tilt movement differs with specimen holder size) Rotation (R) : 360° (endless)
Specimen holder	10mm diameter × 10mmH 32mm diameter × 10mmH (with an adapter for mounting four 10mm-diameter specimens)
Maximum specimen size	6-inch (152.4mm) diameter loadable 125mm diameter full coverage with rotation movement
Specimen exchange	Stage draw-out type (specimen holder slide in/out type)

1.2.4.f Attachments port

【Specimen chamber】

Energy Dispersive X-ray Analyzer(EDS) port	One
Wavelength dispersive spectrometer (WDS) port	One
Backscattered Electron image Detector(BEIW) port	One
Specimen Cooling Unit (SCU)／Specimen Holder image for IC (SHIC) port	One

【Electron optical column】

Probe Current Detector(PCD) port	One

【Specimen stage】

Airlock Chamber (ALC)／Specimen Chamber Scope (SCS) port	One
Absorbed Current Terminal(ACT) port	One

1.2.5 Display system

Display tube　　LCD color monitor　　one set

1.2.5.a Scan system

Scanning mode　　Full-frame scan (640× 480 pixels), Half-size reduced scan (320× 240 pixels)

Scan speed

	Horizontal (ms)	Vertical (s)	Pixels
SCAN1	0.284	0.075	320× 240
SCAN2	0.284	0.150	640× 480
SCAN3 Selectable	20 (16.67)	10 (8.33)	640× 480
	20 (16.67)	20 (16.67)	1280× 960
SCAN4 Selectable	80 (66.67)	80 (66.67)	1280× 960
	160 (133.3)	160 (133.3)	1280× 960
	80 (66.67)	160 (133.3)	2560× 1920
Photo (Auto-saving) Selectable	20 (16.67)	20 (16.67)	1280× 960
	80 (66.67)	80 (66.67)	1280× 960
	160 (133.3)	160 (133.3)	1280× 960
	80 (66.67)	160 (133.3)	2560× 1920

Line frequency: 50Hz [Values in brackets: 60Hz]

Frame memory　　2560× 1920× 8 bits

Number of pixels　　640× 480, 1280× 960, 2560 × 1920

1.2.5.b Image processing

Averaging	1 to 255 frames
Look-up table	Linear、contrast enhancement/attenuation, γ -correction, multi-level cording, partial enhancement, inverse contrast
Pseudo color	16 colors
Multiple display	Display of 2 or 4 image in one frame
Digital zoom	Display of arbitrary area 2×or 4×
Dual magnification	Display the original image in the left frame, display the zoom image in the right frame
Scaler	Line-width measurement、Multi point measurement

Text display

Display position	36 columns×24 lines in an image
Text	Alphanumeric characters, symbols
Background	Black or image can be selected
Text entry device	Keyboard

Data display

Display position	Horizontal at the bottom of the screen
Contents	**<HV mode>** Accelerating voltage, Magnification, Micron marker with micron value, Film number (4 digits), Alphanumeric comment (10 characters) Notes: Display of each item can be turned on or off. Ten alphanumeric characters can be changed to date, WD, spot size or image mode. **<LV mode>** Same as that for the HV mode except that the vacuum pressure (Pa) in the specimen chamber is indicated instead of the image mode JSM-6380LV
Background	Black or image can be selected

File saving

Format	BMP, TIFF or JPEG
Media	Floppy disk and hard disk

1.2.6 Operation system

1.2.6.a Basic system

Computer	IBM PC／AT compatible computer
Operation system (OS)	Windows®XP*
	* Windows®XP is a trademark of Microsoft Corp.

1.2.6.b Operation

Operation method	Graphical user interface, mouse and keyboard (Operation keyboard is optionally available.)
Recipe function	Saving and loading of images and observation condition (various condition of EOS, a stage position, vacuum mode) for each specimen. "Custom" and "Standard" are prepared to recipe function. "Custom" for individual user can be saved. "Standard" for all users can be used. Number of custom recipes can be freely registered according to the hard disk capacity.
Automatic function	
Automatic gun alignment	Simultaneous, and the automatic filament heating and the automatic alignment adjustment are single and executable
Automatic focusing (AFD)	Combination with ACB possible, linked to accelerating voltage possible
Automatic astigmatism correction (ASD)	Combination with ACB and AFD possible
Automatic contrast/brightness (ACB)	Linked to accelerating voltage change

Support functions for image observation

Click center	An arbitrary position on the image display area can be moved to the center of the image by double-clicking. (Snap shot image display area available)
Click center zoom	An automatically 15-steps zooms in the magnification of the image moved by the click center function. (Snap shot image display area possible)
Drag	The image can be moved by dragging an arbitrary position on the image.
Drag and zoom	An automatically 15-steps zooms in the magnification of the image moved by the drag function.
Frame feed	The image can be moved a specified fraction of the field of view.
Snap shot	The two frozen images can be pasted on the snap shot area and enables stage control.
Scan rotation (option)	Always corrects the X/Y movement direction by the SRT ON.

Easy operation function

Smile shot	Only because the "Sample Groups" is selected, the image can be easily obtained

User setting

Mouse control	The mouse control operation can be changed to up/down or left/right.
Movement of stage	The direction of the movement of the stage can be changed on the Live or stored image display area. (The motor drive stage is necessary)
Icon setup	An icon button on the GUI can be selected and set.
Eco mode	The power saving mode can be set

1.2.7 Operation table

TBL1	750 (W) ×900 (D) ×750 (H) mm、 (option)
TBL2	1100 (W) ×900 (D) ×750 (H) mm、 (option)
	Personal computer／JED is build into the operation table (TBL1 and TBL2)

1.2.8 Safety devices

Devices to protect against vacuum, water, power failures, and leakage current are provided.
The flow-rate correction mechanism of cooling water and the Water Leak Sensor (WLS) can be installed by the option.

1.2.9 Eco mode

When you do not do the operation such as personal computers during the fixed time (It is possible to set at the time to Eco Mode ON.)
ON/OFF is possible on Graphical User Interface (GUI)

1.2.10 Others

BNC outputs	BNC-R connector (for VIDEO printer connector) one
Service receptacles	AC100V、8A one
	AC100V、5A one

1.3 Installation requirements

■ JSM-6380 and JSM-6380LV commonness

Power	100 V ±10%, 50/60 Hz, 3.0kVA (Voltage drop should be within 3 %.at 3.0kVA)
Grounding terminal	100Ω or less, one
Cooling Water	
Faucet	14 mm outer diameter or ISO 7/1 Rc1/4, one
Drain	At least 25 mm inner diameter or ISO 7/1 Rc1/4, one
Flow rate	2 L/min
Pressure	0.05 to 0.2 MPa (gauge pressure)
Temperature	15 to 25℃ (59°F to 77°F)
Environment	
Temperature	15 to 25℃
Humidity	60% or less
Stray AC magnetic field	0.3μT(p-p) or less, AC (50/60Hz sine wave, WD15 mm; Acc V, 30kV)
Floor vibration	2μm(p-p) or less at sine wave of over 5Hz frequency
Floor space	2,500 (W) × 2,500 (D) × 1,800 (H) mm or more
Door width	850 mm or more

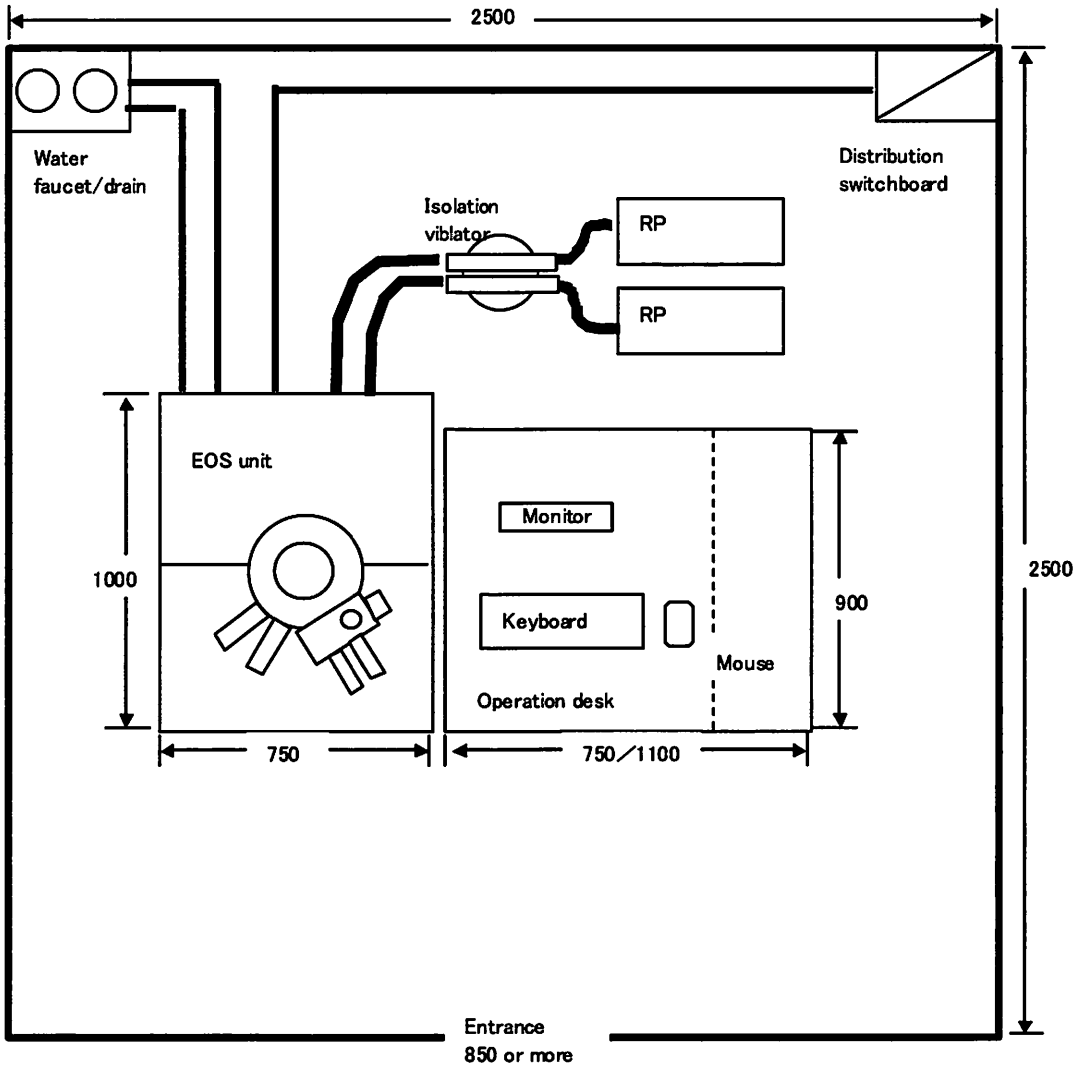
Dimensions and weight

	Width (mm)	Depth (mm)	Height (mm)	Weight (kg)
EO column unit	750	1000	1445	Approx. 320
Operation desk※1	750／1100	900	750	Approx. 40／60
Oil rotary pump	460	175	255	Approx. 23 ※2
Vibration isolator	270	200	200	Approx. 10

※1 : An operation desk can be selected from TBL1 or TBL2. TBL1; MP-08010 (Width: 750mm), TBL2; MP-08020 (Width: 750mm)

※2 : For JSM-6380LV; weight of one set

1.3.1 Installation layout example



- This above figure shows a typical installation layout for a LV-SEM. An oil rotary pump (one) is removed in the case of the standard SEM.
- An operation desk can be selected from [MP-08010: W750mm] or [MP-08020: W1100mm]. Moreover, it is possible to set it up even with OA desk etc. on the market by removing the operation table from the "Composition".
- Be sure to maintain service areas at the left sides and the rear side of the microscope even if a small installation area is available.
- Install the microscope well apart from facilities producing vibrations or electromagnetic waves such as rods, busy passages, railroads, elevators, air conditioners and their air outlets, and power transmission lines.

1.4 Composition

■ JSM-6380

【 Standard】

- Electron optical column unit ····· 1 set
- Movable aperture ····· 1 set
- Personal computer (including personal computer, keyboard, etc.) ····· 1 set
- LCD color monitor ····· 1 set
- Software ····· 1 set
- Oil rotary pump ····· 1 set
- Vibration isolator ····· 1 set
- Tool box (including standard accessories and tools) ····· 1 set
- Parts for installation and transportation (including power cable, water hose, etc) ····· 1 set

【 Option】

- Operation desk ····· 1 set

■ JSM-6380LV

【 Standard】

- Electron optical column unit ····· 1 set
- Movable aperture ····· 1 set
- Personal computer (including personal computer, keyboard, etc.) ····· 1 set
- LCD color monitor ····· 1 set
- Software ····· 1 set
- Backscattered electron detector ····· 1 set
- Oil rotary pump (two) ····· 1 set
- Vibration isolator ····· 1 set
- Tool box (including standard accessories and tools) ····· 1 set
- Parts for installation and transportation (including power cable, water hose, etc) ····· 1 set

【 Option】

- Operation desk ····· 1 set

1.5 Instrument warranty

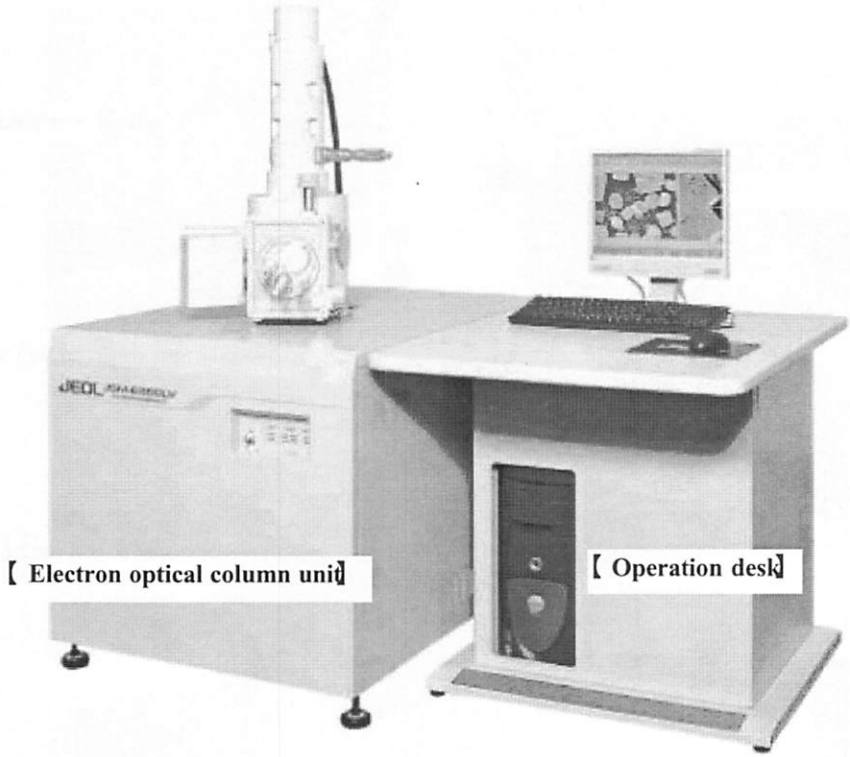
This instrument is guaranteed for one year from the date of installation. We undertake to repair it free of change in the event that it breaks down within this period, except in cases where the breakdown is the result of a force majeure or careless handling.

2

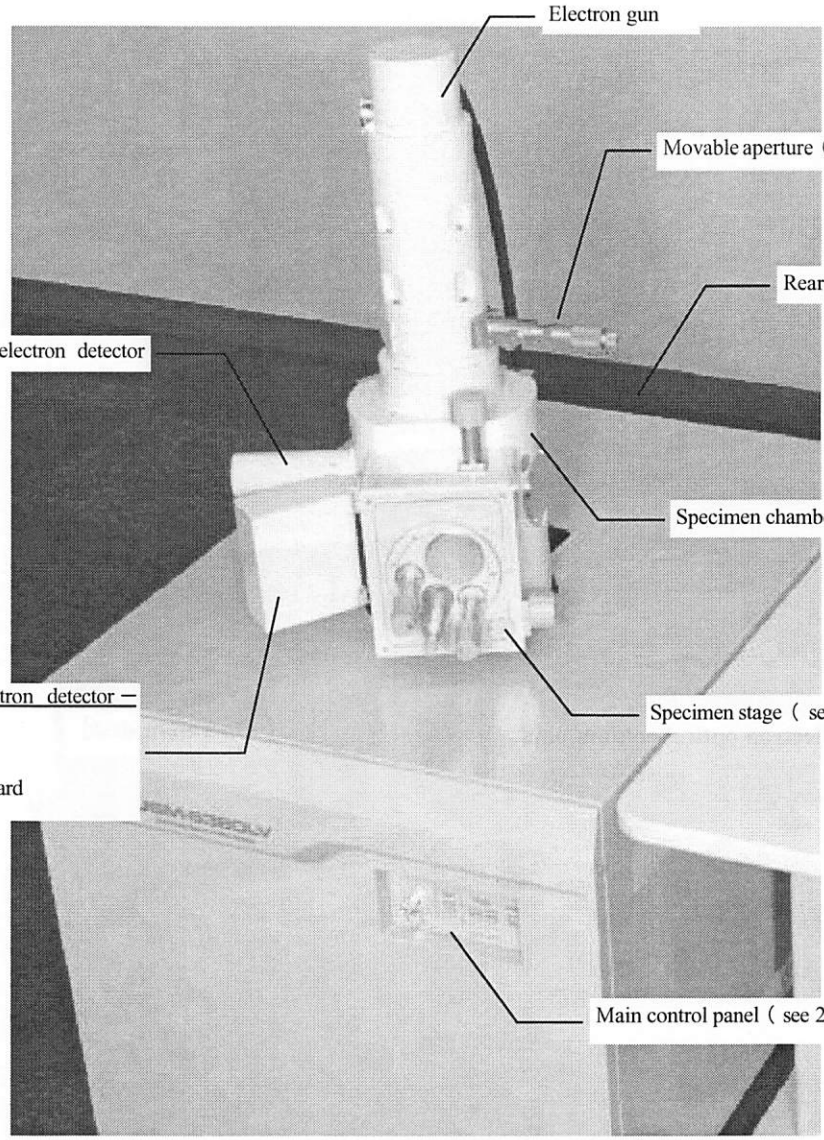
Name and explanation of each part

2.1 Exterior of instrument

"JSM-6380／LV Scanning Electron Microscope" is composed of [Electron optical column unit] and [Operation desk].



2.2 Electron optical column unit

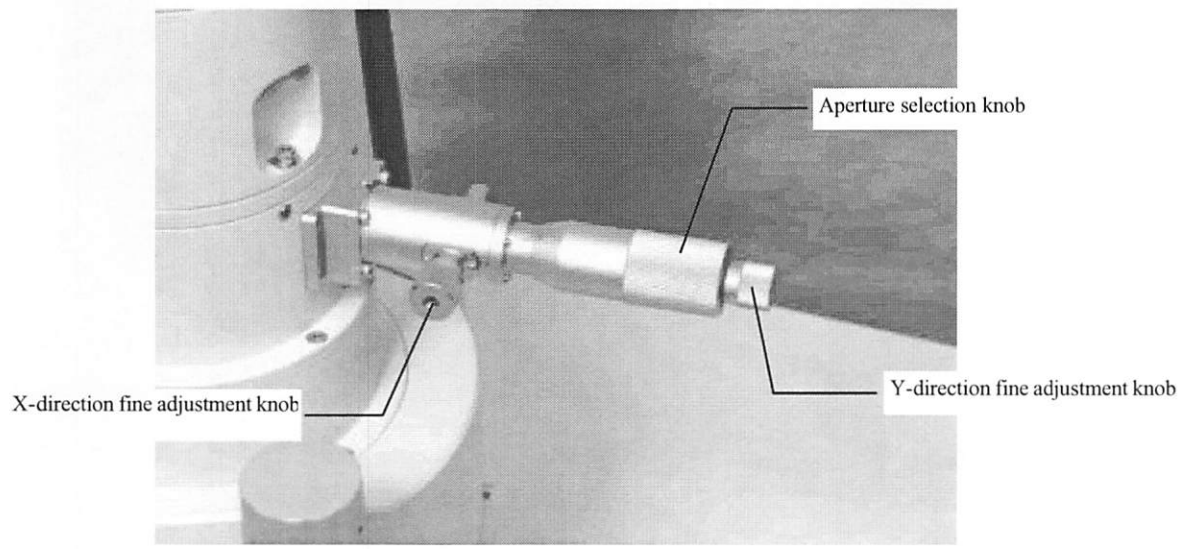


2.2.1 Movable aperture

! CAUTION

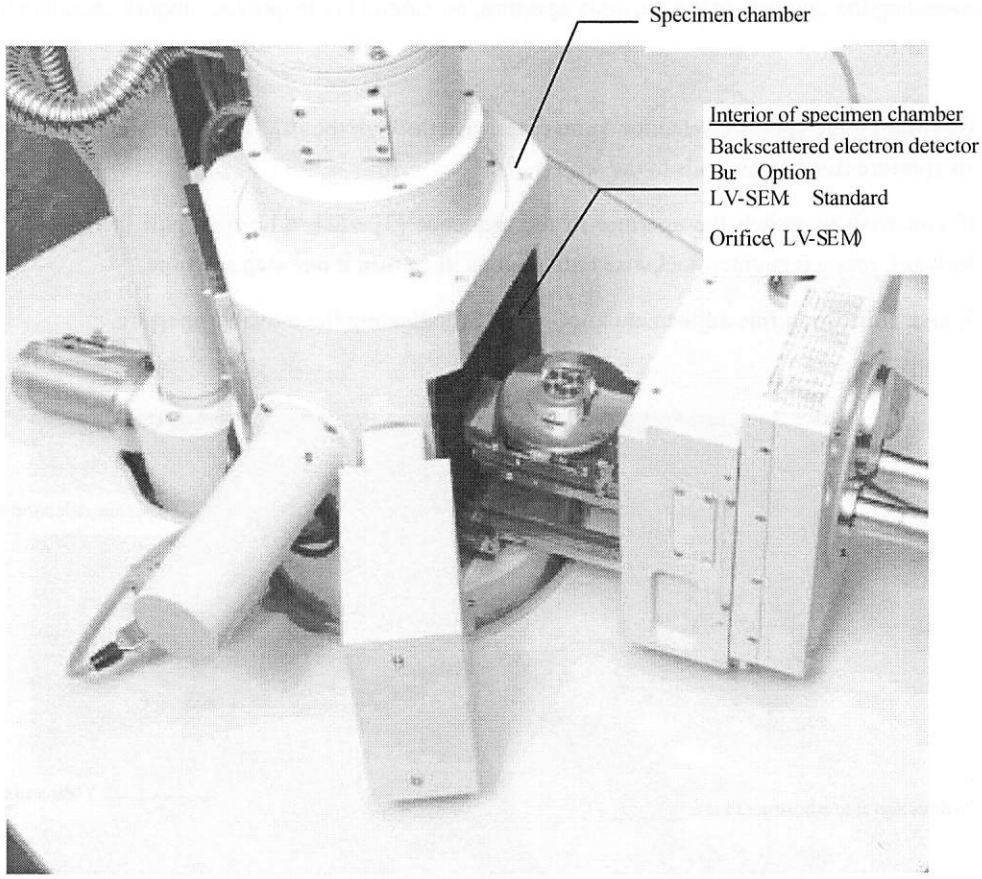
When selecting the aperture of the movable aperture, be careful not to get your fingers caught in the grip.

- By rotating the aperture selection knob clockwise through the [0]→[1]→[2]→[3] positions, you can select an aperture that corresponds to the scale.
- If you wish to switch the aperture in the sequence [3]→[2]→[1]→[0], pull the aperture selection knob forward, rotate it counterclockwise until it stops, then turn it one step at a time.
- X and Y direction fine adjustment knobs used for adjusting the movable aperture.

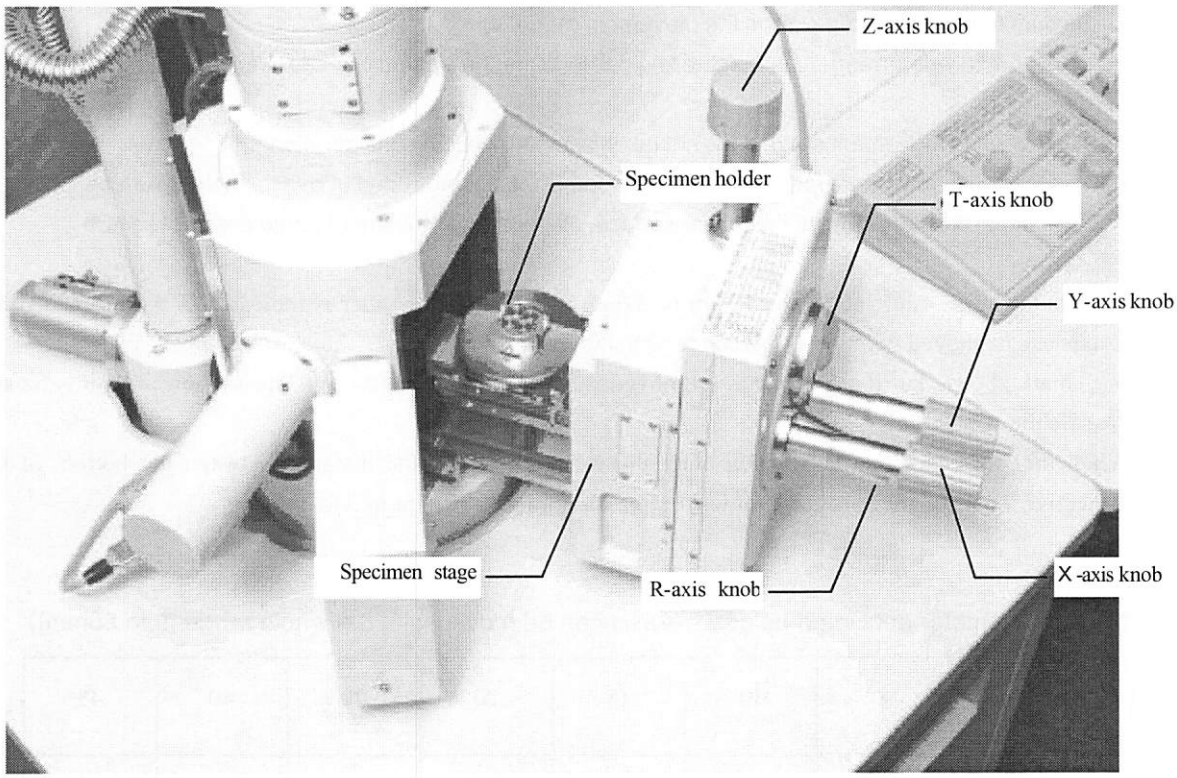


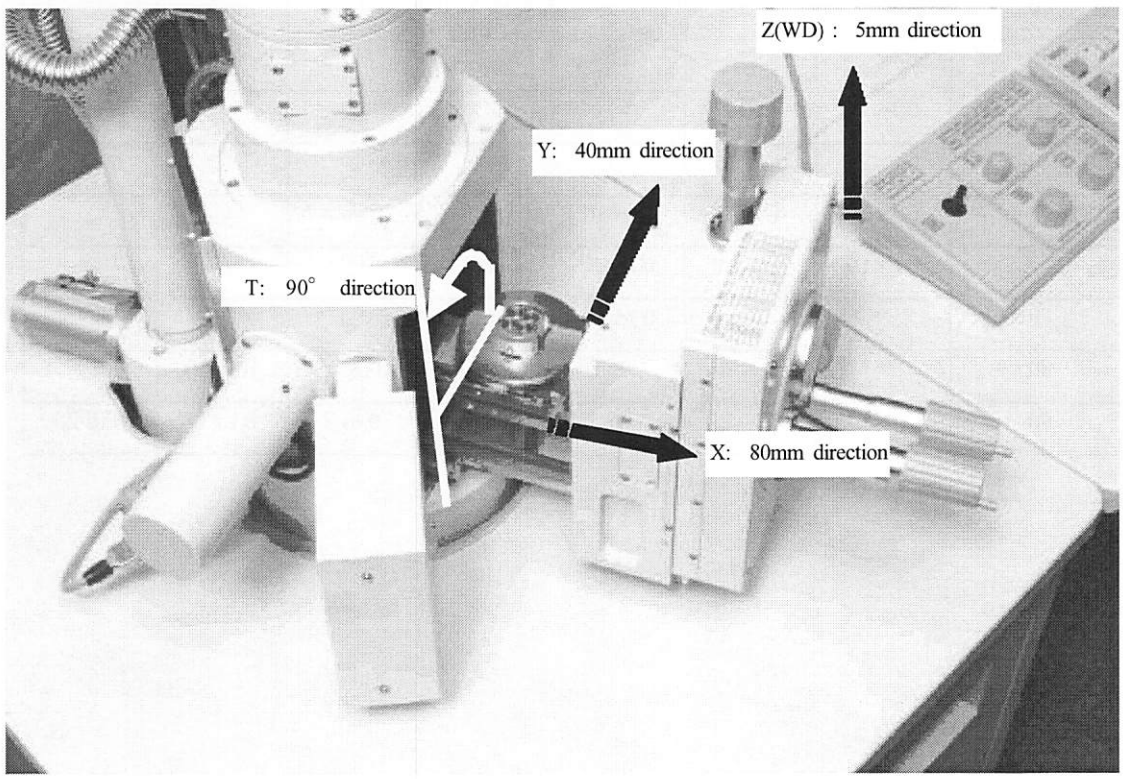
Scale	Aperture （μmdia.）	Purpose of use
3	100	Use when a large current is necessary such as using WDS.
2	30	Used for normal observation, EDS analysis, and etc.
1	20	Used for high resolution observation
0	None	Use for maintenance work

2.2.2 Specimen chamber



2.2.3 Specimen stage





【 **Moving of the stage**】 R=360° endless

2.2.3.a Range of movement of the stage

! CAUTION

- Be sure to move the stage within the movement range.
  When it exceeds a range, the stage or holder touches the bottom of objective lens, and it is likely to be damaged.
- The following movement range does not taken sample size into consideration.
- The following movement range is based on a sample is not protruded above the holder surface.
  If a sample protrudes above the holder surface, the following movement range does not secure.

Y-axis movement range about the 10mm or 32mm dia. specimen hokder is indicated as the following table. X-axis can be moved with the whole range [0 to 80mm].
"○" mark shows that the Y-axis can be moved with the whole range. "×" mark shows that it is outside the safe movement range.
When the stage is set in accordance with the following table, the distance between the bottom of OL (objective lens) and the specimen holder surface is coming to be kept to 3 to 5mm.

■ 10mm diameter specimen holder (X-axis can be moved with the whole range [0 to 80mm])

Z (mm) / T (°)	8	10	15	20	30	40	48
0	○	○	○	○	○	○	○
10	○	○	○	○	○	○	○
20	○	○	○	○	○	○	○
30	0 to 23	○	○	○	○	○	○
40	0 to 21	0 to 25	○	○	○	○	○
50	0 to 20	0 to 23	0 to 30	○	○	○	○
60	0 to 19	0 to 21	0 to 27	0 to 35	○	○	○
70	×	×	0 to 10	0 to 25	○	○	○
80	×	×	×	0 to 3	0 to 15	0 to 30	○
90	×	×	×	×	0 to 7	0 to 17	0 to 25

■32mm diameter specimen holder (X-axis can be moved with the whole range [0 to 80mm].)

Z (mm) / T (°)	8	10	15	20	30	40	48
0	○	○	○	○	○	○	○
10	○	○	○	○	○	○	○
20	○	○	○	○	○	○	○
30	0 to 9	○	○	○	○	○	○
40	0 to 7	0 to 10	○	○	○	○	○
50	0 to 6	0 to 9	0 to 16	○	○	○	○
60	0 to 6	0 to 8	0 to 14	0 to 20	○	○	○
70	×	×	0 to 10	0 to 18	0 to 29	○	○
80	×	×	×	0 to 3	0 to 15	0 to 30	○
90	×	×	×	×	0 to 7	0 to 17	0 to 25

Moving an image on the screen

If you change the WD using the Z-axis knob, the visual field on the image rotates, and the shift direction differs slightly. (working Distance?)

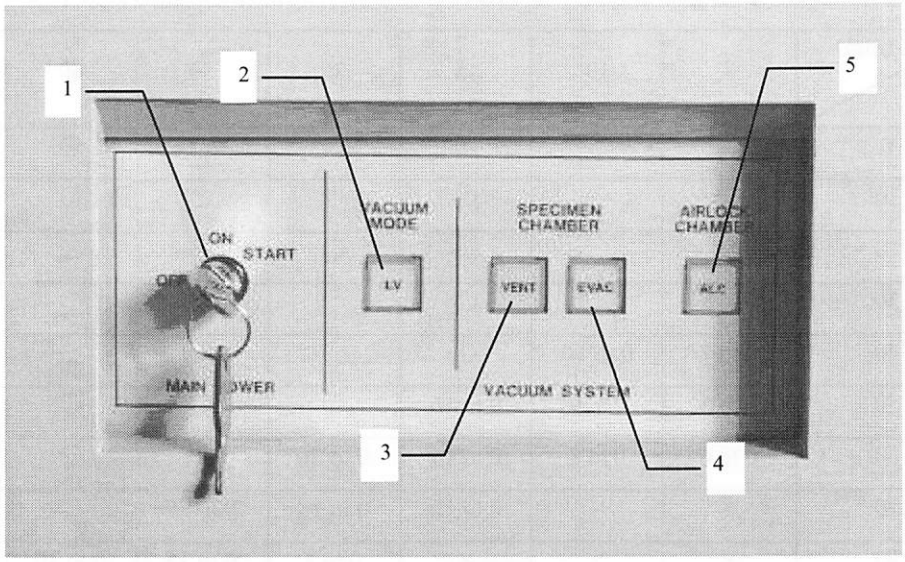
A Y-direction is moved in the WD 10mm neighborhood through the X direction to top and bottom right and left.

It is taken in becoming shorter WD (8mm direction) than WD10mm, and view turns...to the counterclockwise direction a little.

It is taken in becoming longer WD (48mm direction) than WD10mm, and view turns...to the clockwise direction a little.

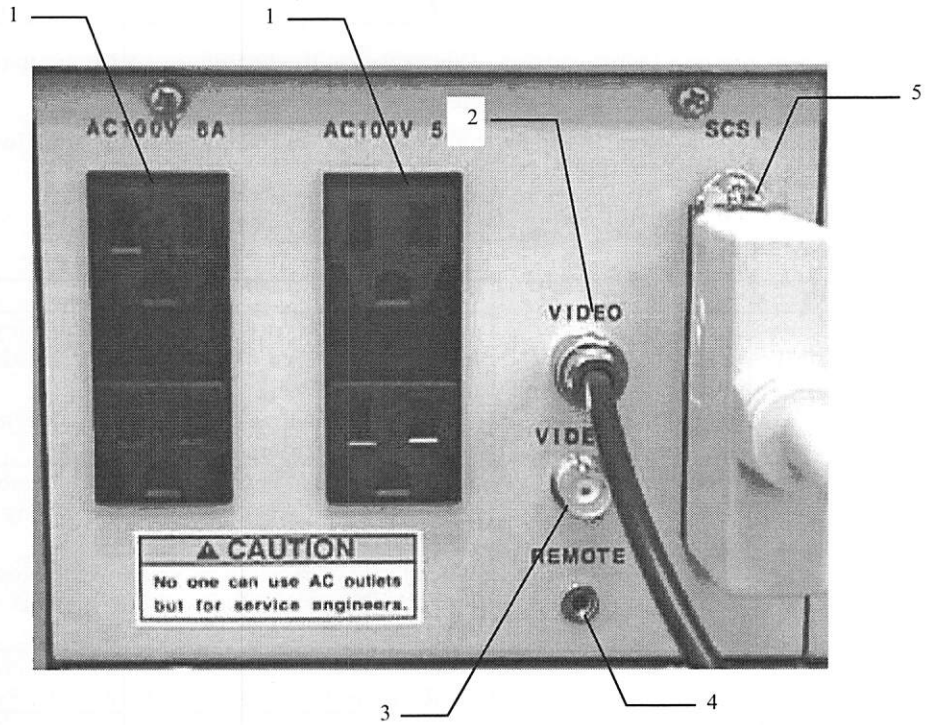
When the specimen holder except the above followings is used, see to the instruction manual of an optional specimen holder to move the stage.

2.2.4 Main control panel



	Name	Explanation	Remarks
1	MAIN POWER key switch	Key switch used to set the status of the main power supply to OFF or ON	
2	VACUUM MODE LV switch	Switch used for changing over the active data display [HV] or [LV]. When this switch is ON (switch lamp is lit), the Vac. mode is set to [LV]. When this switch is OFF, the Vac. mode is set to [HV].	It is effective with LV-SEM
3	SPECIMEN CHAMBER VENT switch	Switch used for the specimen chamber and the electron optical column to atmosphere. When this switch is pressed for vent, the switch lamp flashes. When the specimen chamber and electron optical column becomes atmosphere pressure, the VENT switch lamp lights.	
4	SPECIMEN CHAMBER EVAC switch	Switch used for evacuating the specimen chamber and the electron optical column. When this switch is pressed for evac, the switch lamp flashes. When the evacuation is completed, the switch lamp lights.	
5	AIRLOCK CHAMBER ALC switch	Switch used for evacuating the airlock chamber It is effective when opening the GUI	It is effective with airlock chamber is attached

2.2.5 Rear panel



	Name	Explanation	Remarks
1	AC100V 8A／AC100V 5A	Service outlet	
2	VIDEO	Connect to personal computer	
3	VIDEO2	Connect to printer	The printer is necessary
4	REMOTE	Connect to video printer	The video printer is necessary
5	SCSI	Connect to personal computer	

2.3 Option

2.3.1 Operation keyboard (OKB)

The SEM is operated basically using a mouse. This operation Keyboard is provided for an operator, who is not familiar to mouse operation, to operate the microscope with switches and knobs.
Critical operations, such as focusing in a high magnification range and astigmatism correction, can be performed easily by conventional manner.

Purpose of use	Name	Explanation
Stage control The motor drive stage (option) is necessary	X／Y switch	When this switch is ON, if you move the joystick left or right, the X-axis is driven. If you move the joystick to front or rear, the Y-axis is driven. When this switch is ON, if you tilt the joystick, the X-and Y-axes are driven simultaneously.
	T／Z switch	When this switch is ON, if you move the joystick to the front or rear, the Z-axis is driven. (Front: Z long WD side, Rear: Z short WD side) When this switch is ON, if you move the joystick to the left or right, the T-axis is driven. (Left: T minus side, Right: T plus side)
	R switch	When this switch is ON, if you move the joystick left or right, the R-axis is driven. (Left: R minus side, Right: R plus side)
	Joystick	When the joystick is moved through a small angle, the drive speed falls and when the joystick is moved through a large angle, the drive speed rises. (The drive speed changes linked to the magnification.)
Fine shift	FINE SHIFT switch	Uses it by fine shift of the observation field When this switch is ON, if you move the joystick left or right, fine shift X is driven. If you move the joystick to the front or rear, fine shift Y is driven. If you tilt the joystick, fine shift X and Y are driven simultaneously. When this switch is ON, if you press it once again, the fine shift is reset, and the image returns to the center. (Shift distance is approx. $\pm 50\,\mu$ m at an Acc.volt of 30kV and WD of 10mm)
Select scanning mode	VIEW switch	Uses when you want to look the whole sample. When this switch is ON, the magnification is set to the minimum value for the WD used, and the scanning speed becomes SCAN2. When you press the VIEW switch once again, the screen reverts to the original magnification and scanning speed. If you add magnification or scanning speed while keeping this switch ON, the switch goes OFF, and the original magnification and scanning speed are canceled. The VIEW switch enables you to set an averaging coefficient.

Purpose of use	Name	Explanation
Select scanning mode	SCAN1 to 4 switch	SCAN1 switch uses when adjusting the image quality. SCAN2 switch uses when selecting the field of view. SCAN3 switch uses when confirming the fine-structure of the sample after selecting the field of view. SCAN 4 switch uses when checking the photograph condition. If you press the SCAN 1 switch, a small screen and exposure marker appears. A live image appears in the small screen, and a frozen image appears outside it. The SCAN 1 to 3 switches enables you to set an averaging coefficient. The SCAN 3 or 4 switches enables you to set the scanning speed and number of pixels.
	FREEZE switch	Uses when you want to look the frozen image. In the VIEW or SCAN 1/2/4 mode, if you set the FREEZE switch to ON, a frozen image appears instantaneously. In the SCAN 3 mode, if you set the FREEZE switch to ON, a frozen image appears after that one frame has been acquired. In the SCAN 4 mode, if you set the FREEZE switch to ON, a frozen image surely appears after that one frame has been acquired. When this switch is ON, if you press it once again or press one of the VIEW and SCAN 1 to 4 switches, the switch goes OFF, and changes to a live image (image acquisition starts).
	PHOTO switch	It is possible to save automatically when [Auto Save] has been checked with "Standard Setup window-Scan". (See 3.2.1.a) If you press one of VIEW and SCAN 1 to 4 during the image save, it is canceled.

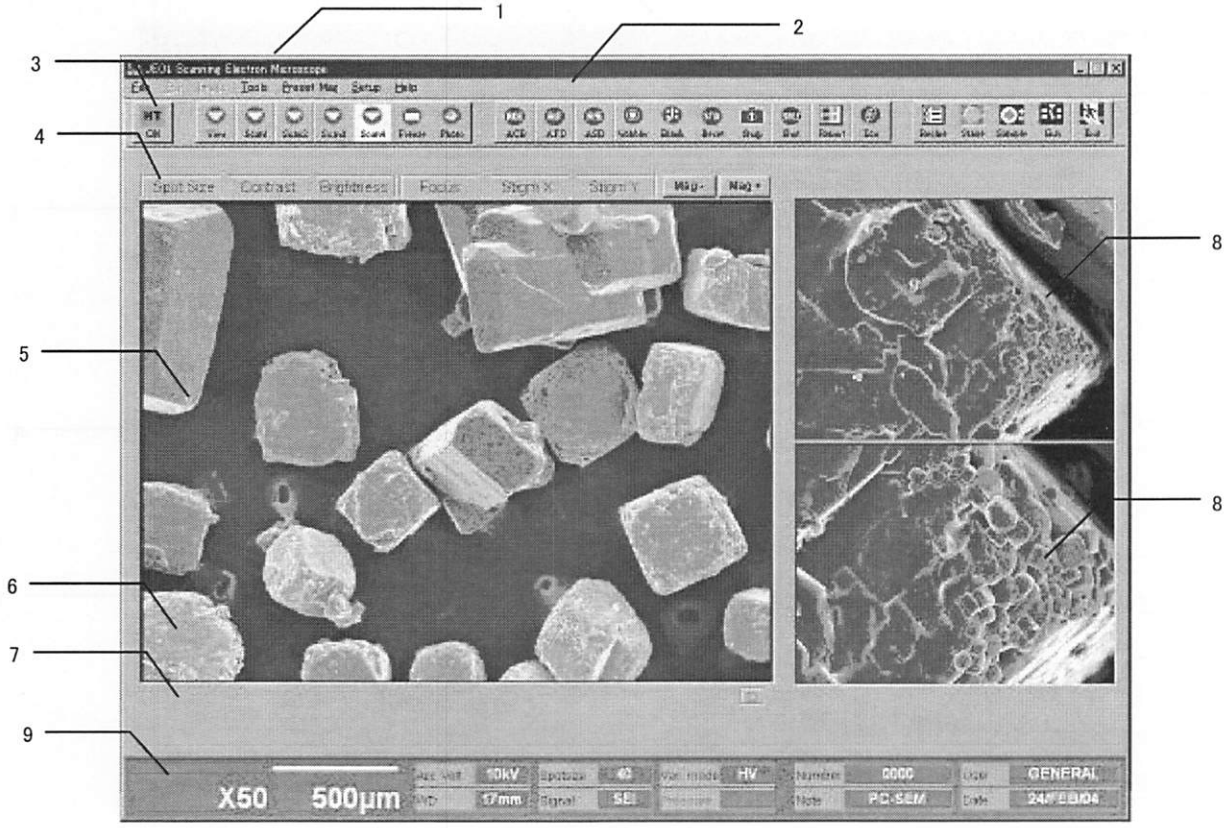
Purpose of use	Name	Explanation
Focusing	COARSE switch、FOCUS knob	When the COARSE switch is ON, you can carry out rough focusing using the FOCUS knob. When the COARSE switch is OFF, you can carry out fine focusing using the FOCUS knob. Tuning the FOCUS knob counterclockwise results in under-focusing, and turning it clockwise results in over-focusing.
Contrast and brightness adjustments	STIG switch (OFF)、control knob	When the STIG switch is OFF (the CONT and BRT lamps are lit.), adjust the contrast and brightness of the image using the left and right control knobs. Turning the left control knob counterclockwise reduces the contrast, and turning it clockwise increases the contrast. Turning the right control knob counterclockwise makes the image dark, and turning it clockwise makes the image bright.
Astigmatism correction	STIG switch (ON)、control knob	When the STIG switch is ON (the X and Y lamps are lit), correct the astigmatism of the image using the left and right control knobs. The left control knob corrects astigmatism X, and the right control knob corrects astigmatism Y.
Changing magnification	MAGNIFICATION knob	Turning this knob counterclockwise lowers the magnification, while turning it clockwise raises the magnification.
	INST MAG switch	When this switch is ON, the magnification changes using [Preset Mag] on the menu bar (the magnification displayed in the bottom list box) is selected. When this switch to OFF, the original magnification is restored. When this switch is ON, if you change magnification using the MAGNIFICATION knob or press the VIEW switch, the switch goes OFF.
Automatic button	ACB switch	When this switch is ON, ACB (auto contrast and brightness) starts and optimum image of contrast and brightness appears for a several second later.
	AUTO STIG switch	When this switch is ON, Auto stigma starts and stigmator corrected of astigmatism image appears for a several second later.
	AUTO FOCUS swiitch	When this switch is ON, Auto focus starts and focused image appears for a several second later.

3

Explanation of GUI

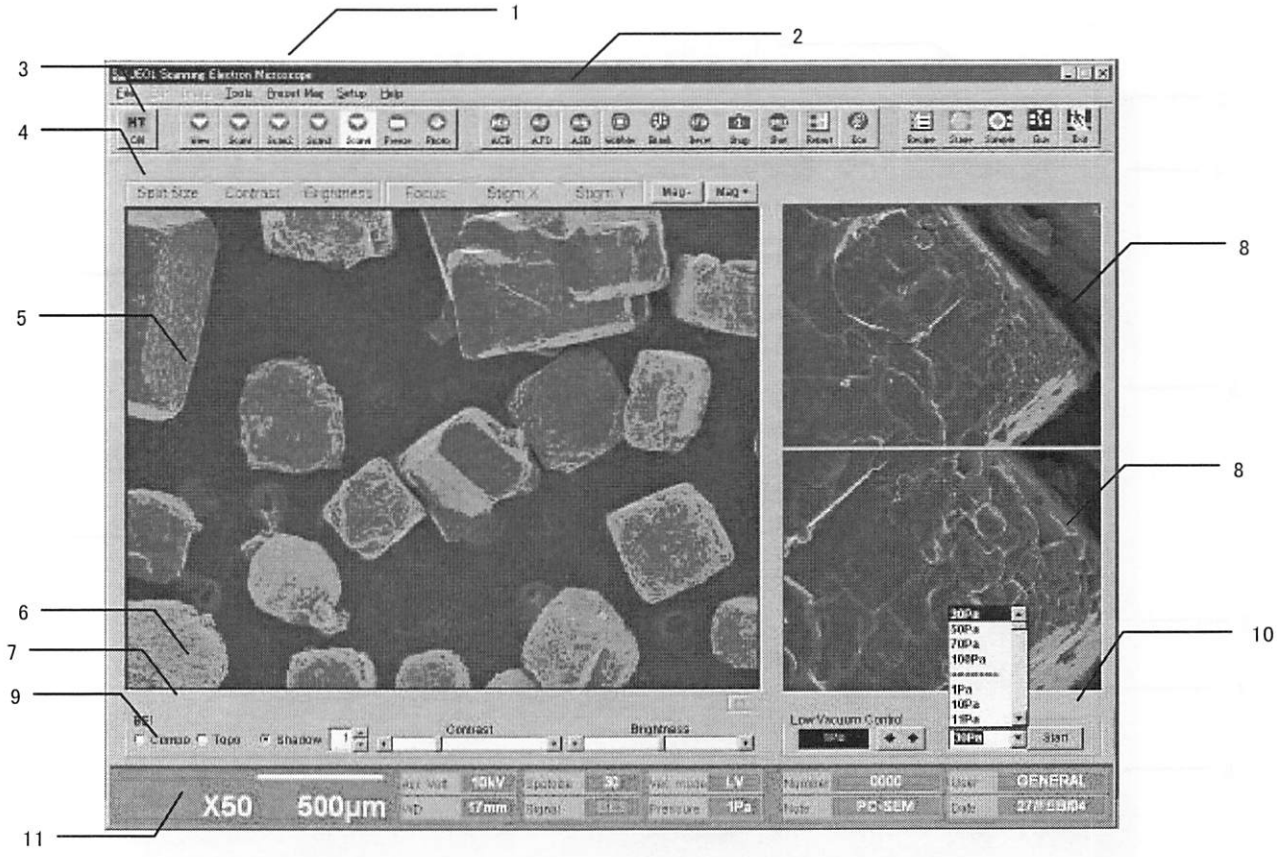
3.1 GUI layout

■JSM-6380



	Items	Explanation	Remarks
1	Title bar	[JEOL Scanning Electron Microscope][(GUI minimum)][(GUIclosing)] are indicated. When [ ] button is clicked, "Exit Microscope Program window" is appeared.	
2	Menu bar	When each menu is clicked, a pull-down menu is indicated.	See 3.1.1
3	Text icons	HT ON／OFF, scanning mode changing buttons and etc. are arranged.	See 3.1.2
4	Manual control buttons	Manual adjusting buttons and magnification changing buttons are arranged.	See 3.1.3
5	Image display area	A SEM image of 640×480 pixels can be displayed, and the image shift and stage movement can be controlled.	See 3.1.4
6	Image data display	The image data (accelerating voltage, magnification) display is displayed when the frozen image is displayed.	
7	Coordinates display・Image size switching button	Coordinates display : The current stage position is displayed. (the motordrive stage is necessary) Image size switching button : Image size can be changed.	See 3.1.5
8	Snap shot image area	Pastes image file or the current image on the image display area, and the stage can be moved. (the motor drive stage is necessary)	See 3.1.6
9	Active data display	This shows the present situation of SEM.	See 3.1.7

■JSM-6380LV

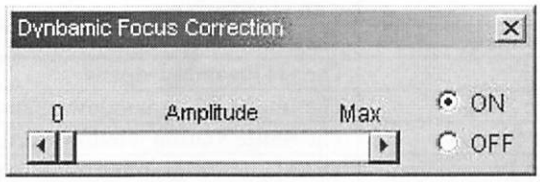


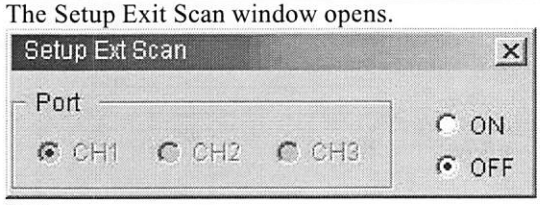
	Items	Explanation	Remarks
1	Title bar	[JEOL Scanning Electron Microscope][_ (GUI minimum)][✕ (GUIclosing)] are indicated. When [✕] button is clicked, "Exit Microscope Program window" is appeared.	
2	Menu bar	When each menu is clicked, a pull-down menu is indicated.	See 3.1.1
3	Text icons	HT ON／OFF, scanning mode changing buttons and etc. are arranged.	See 3.1.2
4	Manual control buttons	Manual adjusting buttons and magnification buttons are arranged.	See 3.1.3
5	Image display area	A SEM image of 640×480 pixels can be displayed, and the image shift and stage movement can be controlled.	See 3.1.4
6	Image data display	The image data (accelerating voltage, magnification) display is displayed when the frozen image is displayed.	
7	Coordinates display・Image size switching button	Coordinates display : The current stage position is displayed. (the motordrive stage is necessary) Image size switching button : Image size can be changed.	See 3.1.5
8	Snap shot image area	Pastes image file or the current image on the image display area, and the stage can be moved. (the motor drive stage is necessary)	See 3.1.6
9	BEIW menu	HV mode : It is displayed when [BEIW] is selected from Signal LV mode : It is displayed when the vacuum mode is changed to [LV].	See Page.3-20
10	Low Vacuum control tool	HV mode : — LV mode : Display	See Page.3-21
11	Active data display	This shows the present situation of SEM.	See 3.1.7

3.1.1 Menu bar

	Pull-down mennu	Explanation	Remarks
■File	Open Image File	Image opening window opens	
	Save Image File	Image saving window opens	
	Video Print	A live image／frozen image can be remote printed with video printer	[Video Printer] is necessary
	Smile View	The Smile View window opens	[SMV] is necessary
	Report	The DTP window opens	See Page.3-34
	Image Album	The Image Filing window opens	[IFS] is necessary
	Smile Station	The Smile Station window opens	[SS] is necessary
	Macro Programing	The Macro Programing Software window opens	[MPS] is necessary
	Backup Users File	Users File Backup window opens	
	Install Users File	Users File Install window opens	
	Exit Scanning Electron Microscope	The SEM control program finishes	
■Edit	Text Editor	The Text Editor menu appears.	
	Image Clip	The frozen image is copied on the clipboard, and itcan be pasted to other application software.	
	Image copy	The frozen image is copied. Uses for pasting the copied image on the snap shot image area or DTP.	
	Image past	Uses for pasting the copied image by using the IFS or DTP on the image display area.	
■Image	Look-up Table ／ Color	The Look-up Table window opens.	
	Dual Split Screen	The Dual Images menu appears.	
	Quad Split Screen	The Quad Images menu appears.	
	Digital Zoom	The Digital Zoom menu appears.	
	Dual Magnification	The Dual Magnification menu appears.	
	Scaler	The Scaler menu appears.	
	Multi Point Measurement	The Multi Point Measurement menu appears.	
	Beam controller	The Beam Controller menu appears.	[BCX] is necessary

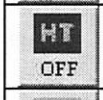
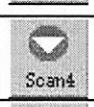
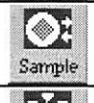
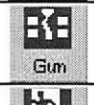
■Edit, ■Image; only selectable a freeze mode

	Pull-down menu	Explanation	Remarks
■Tools	Smile Shot	It can indicate an image easily to be inexperienced in the SEM-operation. The Smile Shot window opens.	See Page.3-41
	Scan Rotation	The Scan Rotation window opens	[SRT] is necessary
	Dynamic Focus	The Dynamic Focus Correction window opens.  ON/OFF button When it is switched to [ON], the focus correction by the scroll bar is possible. Scroll bar button 0 to Max, Continuous variability Tthe amount of correction remains stored in the memory until the instrument is switched off, even if you set the OFF／ON button to [OFF].	
	Beam Blanking	The beam blanking works. When the beam blanking is made to work, a specimen does not irradiate an unnecessary electron beam, and specimen damage is prevented. Beam blanking automatically works when the frozen imageis displayed, and specimen damage is reduced.	
	OL Wobller	Uses for adjusting the movable aperture (MAP), and it is the function to change periodically an OL current. An image moves in every direction greatly when an electron beam deviates from the optical axis.	
	Lens Reset	Lens reset takes place. It can be used SEM with the best condition for cleaning the hysteresis of the lens. It is not necessary by the usual observation.	
	Stigma Reset	The memorized astigmatism condition (the most suitable condition in shipping) is reproduced. Use it when an image shifts in the oblique direction even if you adjust the focus of the image. It is effective when an original image cannot be reproduced again after the astigmatism correction。	
	Auto Focus Tracer	Automatically focusing the image when the Z-axis of the stage is moved	[MSZ ／ MS5] is necessary
	Probe Current Detector	It is effective to measure the electron beam current to irradiate the sample. The device is necessary when the sample current is regulated and a condition is unified for executing the X-ray analysis (EDS／WDS).	PCD is necessary
	Neutralizer	It is effective in reducing halation (the image be veiled in haze of white) of the image.	[SEI] only
	Chamber Scope	Monitor the specimen chamber interior The stage can be moved with confirming the position of sample.	[SCSS ／ SCST] is necessary

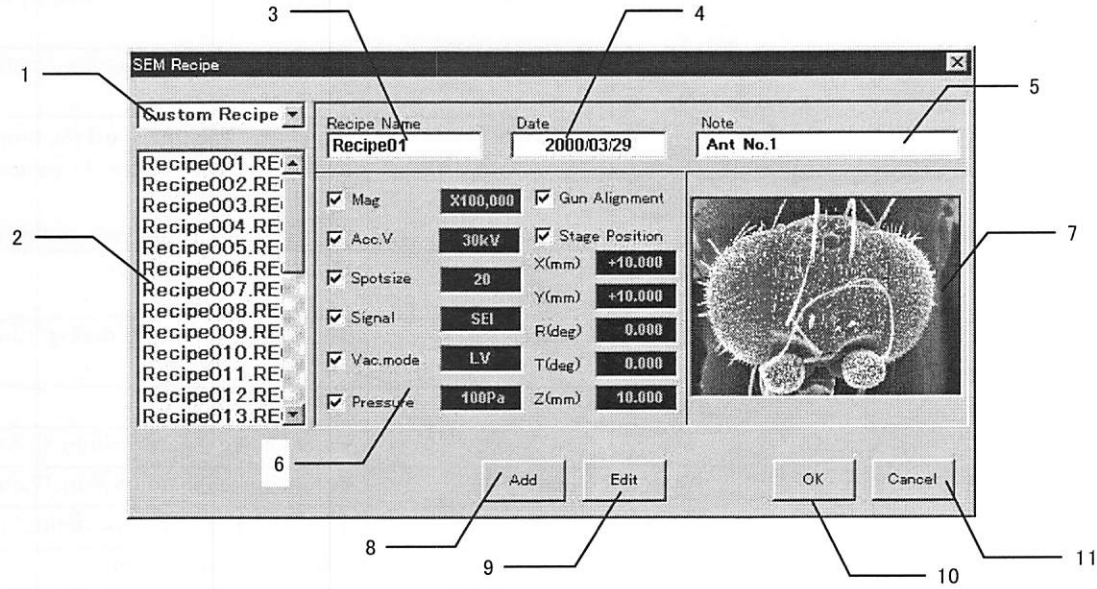
■Preset Mag	×100,000	Set the magnification to [×100,000]	It can be setup in an arbitrary magnification. (See 3.2.1.d)
	×10,000	Set the magnification to [×10,000]	
	×1,000	Set the magnification to [×1,000]	
	×100	Set the magnification to [×100]	
	×35	Set the magnification to [×35] The [×35] corresponds to INST MAG switch on the OKB. When it clicks, magnification changes, and the part of the indication changes to the magnification just before clicking. When it clicks again, the magnification is returned to original.	
	Preset	The Standard Setup-Preset Mag Window opens.	
■Setup	Standard Setup	The standard setup window opens. Scan, Auto Function, Image Data, Preset Mag, Stage Setup, Eco mode and Action functions can be setup	See 3.2.1
	Icon User Setup	Icon User Setup window opens Every user can be set the ion buttn on the GUI	See 3.2.2.a
	Setup Exit Scan	The Setup Exit Scan window opens.  Port When the external control signal is inputted to the SEM, the port can be selected. ON/OFF When the TTL signal_Low level is inputted to the SEM, external scan is set to [ON]. When the TTL signal_High level is inputted to the SEM, external scan is set to [OFF].	[ESITF] is necessary
■Help	Contents	The PC-SEM Help window opens.	
	About	The SEM program version information window opens.	

3.1.2 Text icons

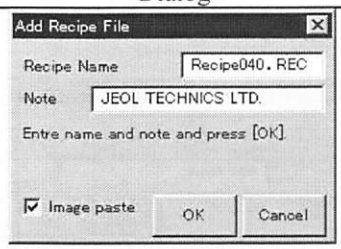
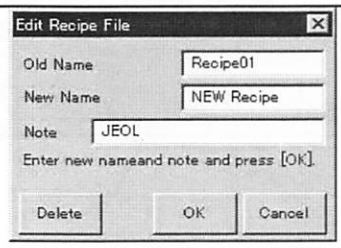
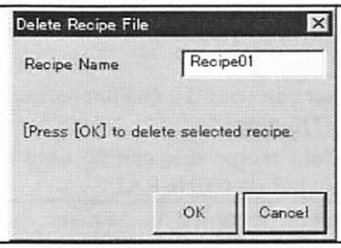
The text icon can add according to the SEM operation..

	Icon	Purpose of use	Explanation	Remarks
HV			Observation is being prepareted	Vacuum state : Wait, Pre Evac, Evac
		Image display	Image observation is possible	Vacuum state : Ready
			Image is being observed	
View		Observation of whole sample (the field of view searching)	Minumum magnification with Scan2 (it differs with WD)	
Scan 1		Image quality adjustment		
Scan 2		General observation (the field of view searching)		
Scan 3		Observation of the fine structure of sample Confirming of auto-save		
Scan 4		Confirming of auto-save		
Photo		Auto-saving the image		[Auto Save] is checked ⇒3.2.1.a
Freeze		Frozen image observation	View, Scan1/2/4; A frozen image appears instaneously Scan3; A frozen image appears after that one frame has been acquired. Scan4; A frozen image surely appears after that one frame has been acquired even if you click [Freeze] button. To cancel, click other Scanning button (View, Scan1, etc.)	Menu bar [Image] and [Edit] can be selected in the freeze mode The running message appears. (Zoom, Save is possible)
Custamize icons		Icon setup according to the SEM operation		See 3.2.2.a or 3.2.2.b
Recipe		Observation condition save/reproduce	The SEM Recipe window open	See 3.1.2.a
Stage		Holder selection, stage position save/reproduce	The Stage Control window open	The motor drive stage is necessary
Sample		Sample exchange	The Specimen Exchange window open	See 3.1.2.b
Gun		Gun alignment	The Gun Alignment window open	See 3.1.2.c
Exit		Exit SEM	The Exit Microscope Program Window open	See 3.2.1.d

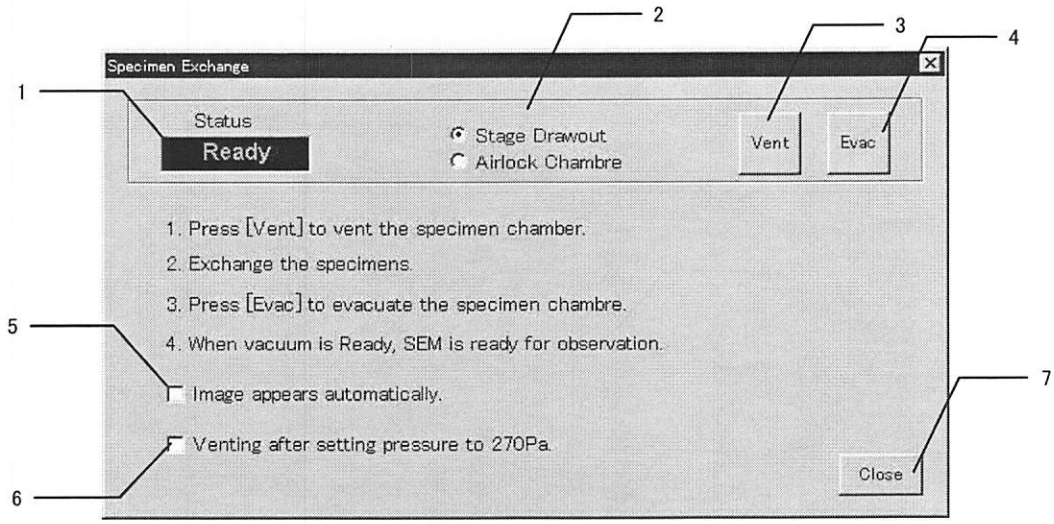
3.1.2.a Recipe



	Item	Initial	Explanation
1	Selection of list	CustomRecipe (when the SEM is started)	Selects with [▼] button Custom Recipe Each user can record a custom recipe (Freely) Standard Recipe A standard recipe that can be used in common by all users (including GENERAL)
2	List		Indicates the recorded recipe name Recipe name can be entered within 8 characters
3	Recipe Name	Recipe001	Indicates the selected recipe name
4	Data		Indicates the recorded time and day
5	Note		Note can be entered within 77 characters
6	Recipe (observation condition)	Check on Mag, AccV, Spotsize, Signal, Vac mode Check off Except above	Displays the contents of the selected recipe It is possible that the contents being checked is reproduced [Vac mode] and [Pressure] are effective with LV-SEM. [Stage Position] is effective when the motor drive stage is attached. [Vac mode], [Pressure] and [Stage Position] are not actually
7	Recipe image		Displays the image of selected recipe It is displayed only when the [Image paste] box is checked with "Add Recipe file dialog"
8	Add		The Add Recipe File dialog opens (See next page)
9	Edit		The Edit Recipe File dialog opens (See next page)
10	OK		Uses when the recorded recipe conditions are desired to be alive again.
11	Cancel		The SEM Recipe window closes

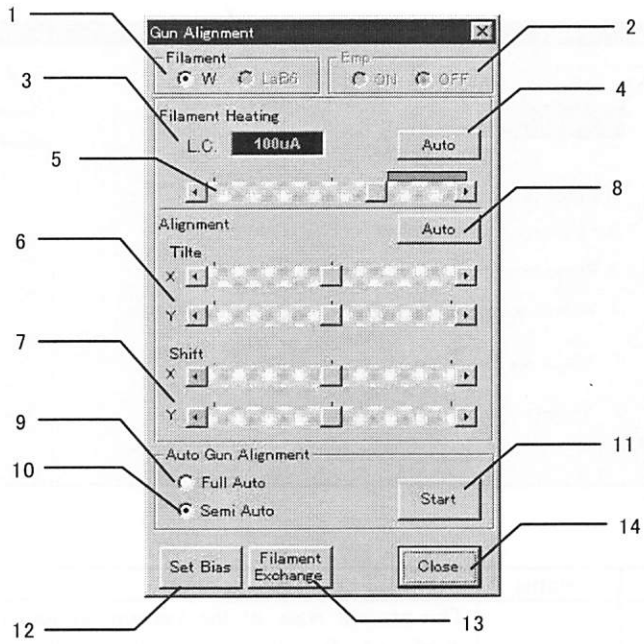
Item	Dialog	Explanation	
Add		Recipe Name	Enters by keyboard （within 8 characters）
		Note	Enters by keyboard (within 77 characters)
		Image paste	Check on; The image oft the moment when it clicked [OK] button is pasted. (Except Scan1 mode) Check off ; The image is not pasted
		OK	Register the new recipe
		Cancel	The "Add Recipe File dialog" closes
Edit		Old Name	The selected recipe
		New Name	Enters by keyboard (within 8 characters)
		Note	Enters by keyboard (within 77 characters)
		Delete	The "Delete Recipe File dialog" opens
		OK	Change the recipe name
		Cancel	The Edit Recipe File dialog closes
Delete		Name	The selected recipe
		OK	Delete the recipe
		キャンセル	Returns to the "Edit Recipe File dialog"

3.1.2.b Sample



	Item	Status	Explanation	Remarks
1	Status		The present state of the vaccum system is displayed. It takes about 20 minutes to change from [**Wait**] to [**Ready**]	
		Wait	The oil diffusion pump (DP) oil is being pre-heated. (Warm-up time period)	
		Vent	The specimen chamber and column are under atmospheric pressure.	
		Pre Evac	The specimen chamber and column are being pre-evacuated.	
		Evac	The specimen chamber and column are being evacuated.	
		Ready	High voltage can be applied to the electron gun. (SEM image can be observed.)	
2	Stage Drawout / Airlock Chamber		Display the operation guide	
3	Vent		It can be vent the specimen chamber to atmospheric pressure	
4	Evac		It can be evacuated the specimen chamber It can be started the "Smile Shot function"	See page.3-41
5	Image appears automatically		When it is checked after a high vacuum has been activated, the HT ON automatically and image is displayed. It is effective when the "Open this window when exchanging the sample" is removed the check mark	See page.3-41
6	Venting after setting pressure to 270Pa		It is effective with LV-SEM When it is checked, evacuation status after the pressure set has been changed to 270Pa. Use this function for powder specimens or pressure-sensitive specimens. The pressure inside the specimen chamber rises to atmospheric pressure in about 1 minutes 30 seconds.	
7	Close		Closes "Specimen Exchange window"	

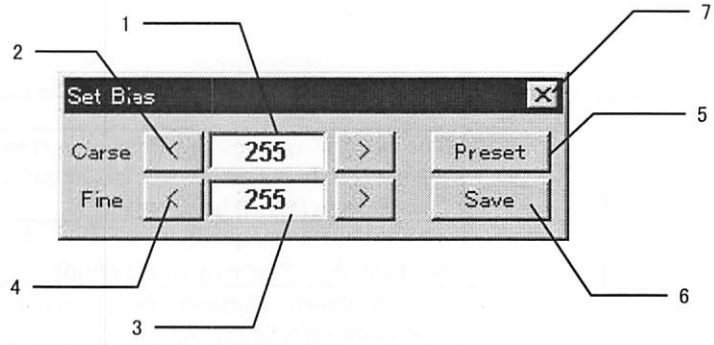
3.1.2.c Gun



	Item	Explanation	Remarks
1	Filament	W : Tungsten filament、LaB6 : LaB6 filament	[LBG] is necessary
2	Emp	ON : emission pattern on、OFF : emission pattern off	
3	L.C	Displays the load current (unit; μA)	
4	Auto	Filament heating is automatically adjusted Automatic adjustment is carried out principally at the precent accelerating voltage. However, when the precent accelerating voltage is below 5kV, automatic adjustment is carried out at 5kV, and then the original accelerating voltage is restored.	HV mode only
5	Scroll bar	Adjusts the filament heating current. A button is usually arranged in front of the orange area. It causes filament wrong point when it is arranged in the area. If you place the button within the orange-colored area, sometimes it may cause filament abnormality.	
6	Tilt X, Y	Tilt of electron beam is adjusted by the tilt [X, Y] current in the Tilt[X, Y]alignment.	
7	Shift X, Y	Parallel shift of electron beam is adjusted by the shift [X, Y] current in the Shift[X, Y]alignment.	
8	Auto	Tilt and shift alignment of electron beam is automatically adjusted. Automatic adjustment is carried out principally at the precent accelerating voltage. However, when the precent accelerating voltage is below 5kV, automatic adjustment is carried out at 5kV, and then the original accelerating voltage is restored.	HV mode only
8	Auto Gun Alignment	The filament heating and alignment are automatically adjusted	[SEI] only

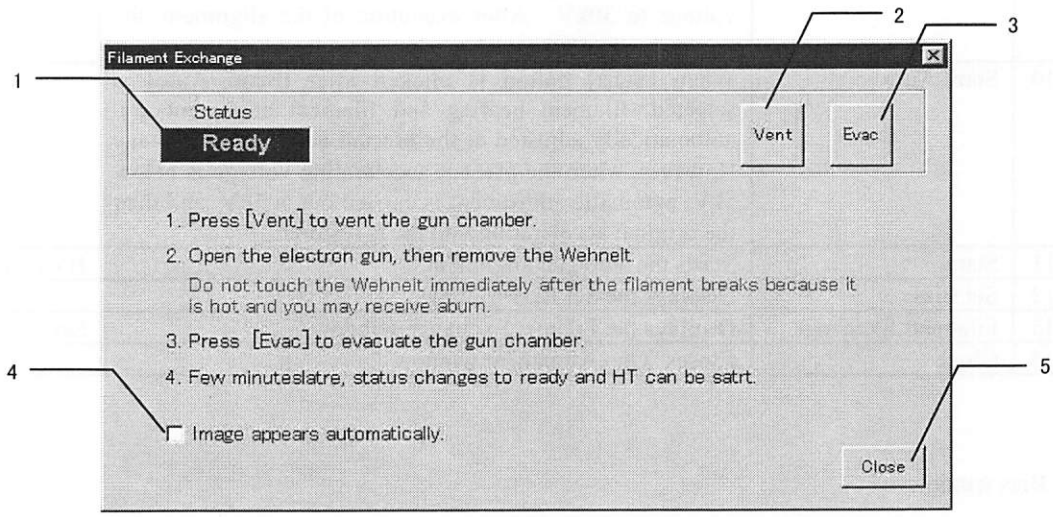
9	Full Auto	When [Start] button is clicked after [Full Auto] is selected, filament heating and filament alignment are automatically adjusted after setting the accerelating voltage to 30kV. After execution of the alignment, the original accerelating voltage is restored.	
10	Semi Auto	When [Start] button is clicked after [Semi Auto] is selected, filament heating and filament alignment are automatically adjusted at the precent accelerating voltage. However, when the precent accelerating voltage is below 5kV, automatic adjustment is carried out at 5kV, and then the original accelerating voltage is restored.	
11	Start	Starts the auto gun alignment	HV mode only
12	Set Bias	Displays the Set Bias window.	
13	Filament Exchange	Displays the Filamet Exchange window	See next page
14	Close	Closes "Gun Alignment window"	

Set Bias window



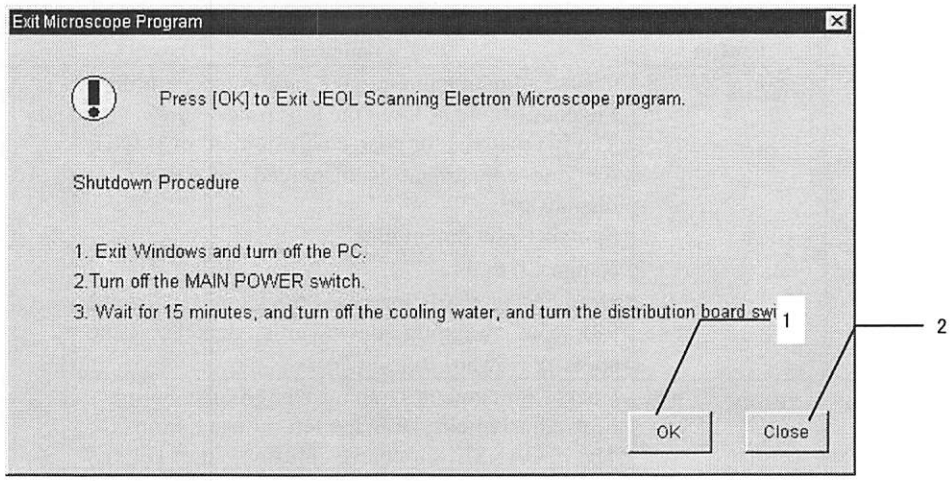
	Item	Explanation
1	Digital display of coarse adjustment value	The coarse adjustment value of the filament heating current is displayed in decimal digits. (0 to 255)
2	Coarse adjustment button	When the < button is clicked, the digital value is decremented by 1 step. When you keep pressing the button, the digital value goes down sequentially. When the > button is clicked, the digital value is incremented by 1 step. When you keep pressing the button, the digital value goes up sequentially.
3	Digital display of fine adjustment value	The fine adjustment value of the filament heating current is displayed in decimal digits. (0 to 255)
4	Fine adjustent button	When the < button is clicked, the digital value is decremented by 1 step. When you keep pressing the button, the digital value goes down sequentially. When the > button is clicked, the digital value is incremented by 1 step. When you keep pressing the button, the digital value goes up sequentially.
5	Preset	The value preset before the set bias window is opened become alive.
6	Save	The values after adjustment are saved and then the windows are closed.
7	×	Closes "Set Bias window".

Filament Exchange window



	Item	Status	Explanation	Remarks
1	Status		The present state of the vaccum system is displayed. It takes about 20 minutes to change from [**Wait**] to [**Ready**]	
		Wait	The oil diffusion pump (DP) oil is being pre-heated. (Warm-up time period)	
		Vent	The specimen chamber and column are under atmospheric pressure.	
		Pre Evac	The specimen chamber and column are being pre-evacuated.	
		Evac	The specimen chamber and column are being evacuated.	
		Ready	High voltage can be applied to the electron gun. (SEM image can be observed.)	
2	Vent		It can be vent the specimen chamber to atmospheric pressure	
3	Evac		It can be evacuated the specimen chamber It can be started the "Smile Shot function"	 See page.3-41
4	Image appears automatically		When it is checked after a high vacuum has been activated, HT ON automatically and starts auto gun alignment. It is effective when the "Open this window when exchanging the sample" is removed the check mark	 See page.3-41
5	Close		Closes "Filement Exchange window"	

3.1.2.d Exit



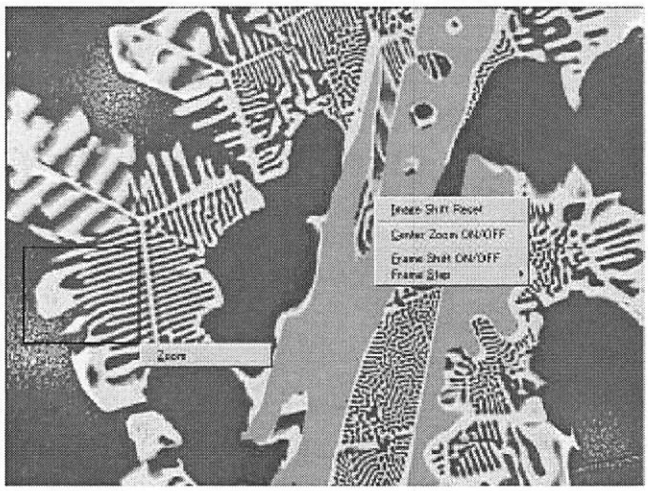
	Item	Explanation
1	OK	THe SEM control program finishes.
2	Clsose	Closes "Exit Microscope Program window"

3.1.3 Manual control buttons

Item	Button	Explanation	Remarks
Spot Size	Spot Size	Coarse adjustment; Drag the right mouse button Fine adjustement; Drag the left mouse button The [COARSE] for coarse adjustement or [FINE] for fine adjustment is displayed on the image display area. Spotsize adjustment tool Range : 0 to 99 Dragging upwards increases the spotsize (toward 99), and dragging downwards decreases the spotsize (toward 0).	The mouse control can be changed. (See 3.2.1. g)
Contrast	Contrast	Coarse adjustment; Drag the right mouse button Fine adjustement; Drag the left mouse button The [COARSE] for coarse adjustement or [FINE] for fine adjustment is displayed on the image display area. Dragging upwards makes contrast be stronger, and dragging downwards contrast be weaker	
Brightness	Brightness	Coarse adjustment; Drag the right mouse button Fine adjustement; Drag the left mouse button The [COARSE] for coarse adjustement or [FINE] for fine adjustment is displayed on the image display area. Dragging upwards makes brightness be brighter, and dragging downwards brightness be darker.	
Focus	Focus	Coarse adjustment; Drag the right mouse button Fine adjustement; Drag the left mouse button The [COARSE] for coarse adjustement or [FINE] for fine adjustment is displayed on the image display area. Dragging upwards makes over-focus, and dragging downwards under-focus.	
Stigm X, Y	Stigm X Stigm Y	Coarse adjustment; Drag the right mouse button Fine adjustement; Drag the left mouse button The [COARSE] for coarse adjustement or [FINE] for fine adjustment is dsplayed on the image display area.	
Magnfication Up	Mag +	When it clicks using the left mouse button, the magnification increases by one step . When it keeps pressing it, the magnification increases until the highest magnification.	
Magnification Down	Mag -	When it clicks using the left mouse button, the magnification decreases by one step . When it keeps pressing it, the magnification decreases until the lowest magnification.	

3.1.4 Image display area

- A live image, frozen image or file image is displayed.
- The image shift and stage movement can be controlled. (Except image file)
- The motor drive stage is necessary to move the stage.



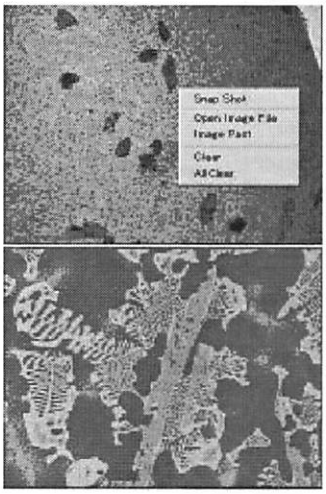
Operation	Item	Explanation	Remarks
Right mouse button ckicks	Image Shift Reset	The image can be returned to the original position after being moved.	
	Center Zoom ON／OFF	Changes function to [click center] or [Click center zoom].	
	Frame Shift ON／OFF	Changes function to [frame shift] or [image shift].	
	Frame Step	Selects the step (10 to 100％) of frame shift function.	
Right mouse button drags	Zoom	The image in the rectangle area is moved to the center of the image display area, and it can be displayed with full size	The motor drive stage is necessary

3.1.5 Stage position Image size switching button

Item	Display	Explanation	Remarks
Stage position	X=6.821mm	Displays current position of X-axis	The motor drive stage is necessary
	Y=2.549mm	Displays current position of Y-axis	
	T=-0.148deg	Displays current position of T-axis	
	Z=15.004mm	Displays current position of Z-axis	
	R=327.387deg	Displays current position of R-axis	
Image size switching button		Changes image size Scan 1  (320×240 pixels) /  (160×120 pixels) Scan 2, 3, 4 and Freeze  (640×480 pixels) /  (320×240 pixels)	

3.1.6 Snap shot image area

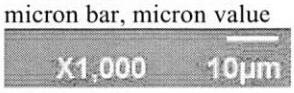
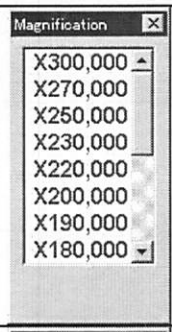
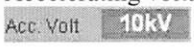
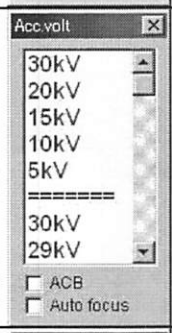
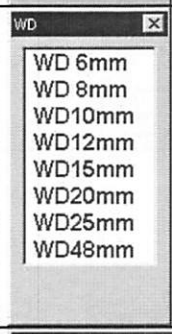
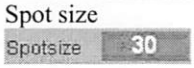
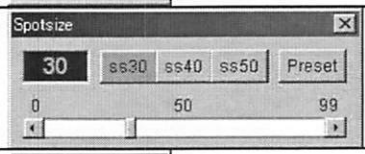
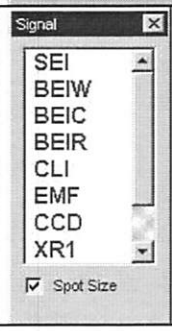
- The snap shot image or file image is displayed. (Up to 2-image can be displayed)
- The [Step1] (upper-side) and [Snap 2] (lower-side) icons can be added to the text icon. (See 3.2.2.a)
- The image shift and stage movement can be controlled.(except image file)
- The motor drive stage is necessary to move the stage.

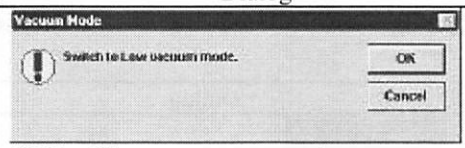
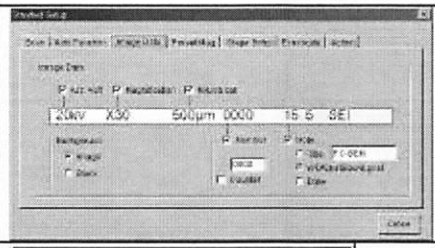


Operation	Item	Explanation	Remarks
Click right mouse button	Snap Shot	The frozen image pastes and enables stage contol.	The motor drive stage is necessary
	Open Image File	Displays the "File Open window" Selects th image file and pastes it	The stage can not be controlled
	Image Paste	The copied image pastes	
	Marker Clear	Clears the marker	
	All Clear	Clears the pasted image and marker.	

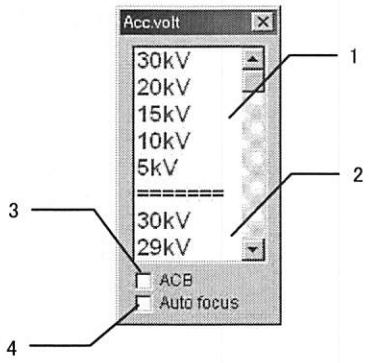
3.1.7 Active data display

When each item (except "Pressure") is left-clicked mouse button, the dialog linked with the item opens.

	Item	Dialog	Remarks
1	Magnification value, micron bar, micron value 		
2	Accelerating voltage 		See page.3-19
3	Working distance 		
4	Spot size 		See page.3-19
5	Signal 		See page.3-20

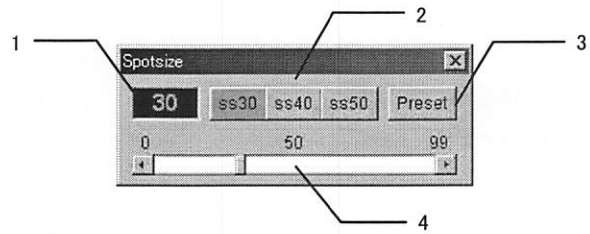
	Item	Dialog	Remarks
6	Vacuum mode Vac. mode HV	 [OK] : Changes vacuum mode [Cancel] : Closes "Vacuum Mode dialog"	It is effective with LV-SEM When the vacuum mode is changed to [LV], the "Low Vacuum Control tool" appears. (See page.3-21)
7	Pressure Pressure	—	When the vacuum mode is changed to [LV], the specimen chamber pressure (Unit : Pa) is displayed
8	Number Number 0000		See 3.2.1.c
9	Note Note PC-SEM		
10	Date Date 27/FEB/04		
11	User User GENERAL		See page.3-22

■ AccV dialog



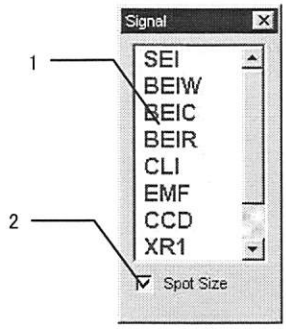
	Item	Explanation
1	Dialog・upper-side	Initial: 20, 15, 10, 5, 1.0kV When changing the accelerating voltage, the initial value is changed. Ex.) Selects [30kV]. →30, 20, 15, 10, 5.0kV
2	Dialog・lower-side	30 to 3.0 ; 1kV step、3.0 to 0.5; 100V step
3	ACB	Checks [ACB], ACB (automatic contrast and brightness) operatess when the accelerating voltage is changed.
4	Auto Focus	Checks [Auto Focus], AFD (automatic focusing) operates when the accelerating voltage is changed.

■ Spotsize dialog



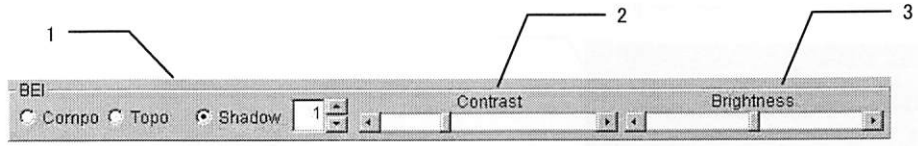
	Item	Explanation
1	Spotsize value	Displays the current spotsize value (ss)
2	ss30, ss40 and ss50 buttons	Iinitial : ss30(on), ss40, ss50 When the [ss＊＊] button is clicked, the spotsize is changed to clicked value. Adjust the spotsize value and click the [Preset] button. The [ss＊＊] is switched to the adjustment value (precent value).
3	Preset	The precent value is memoried to the clicked [ss＊＊] button.
4	Scroll bar	Adjusts the spotsize value. Range: 0～99

■ Signal dialog



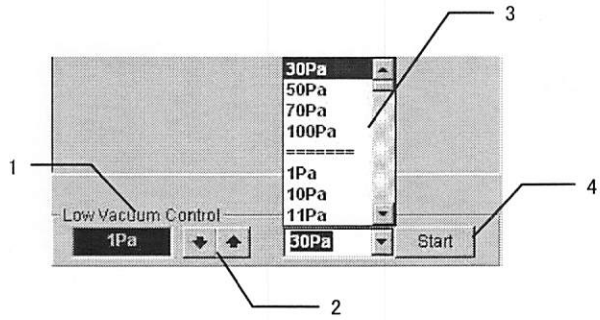
	Item	Explanation
1	List	SEI, BEIW, XR1, XR2, BEIC, BEIR, EMF, CLD, CLDIR, AUX, REF, LSEI When [BEIW] is selected, the BEIW menu is opened (BEIW is necessary)
2	Spot Link	When it is checked, , the spotsize of the signal selected last time is maintained even when the signal is switched over. When it is not checked, the spotsize for the respective detector is set.

BEIW menu



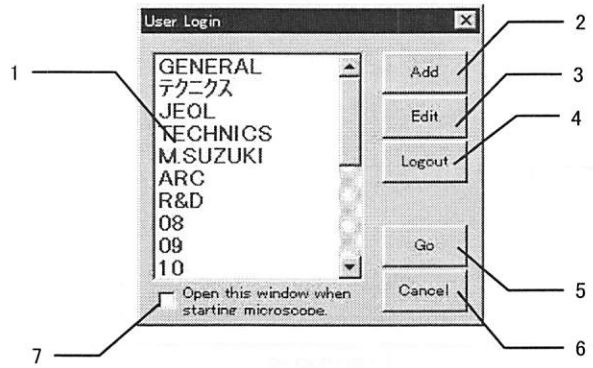
	Item	Explanation
1	Switching signal	Topo : The topgraphy image can be observed. The signal name of the image data and active data display switches to [BEC]. Compo : The composition image can be observed. The signal name of the image data and active data display switches to [BET]. Shadow : The stereoscopic image can be observed. The signal name of the image data and active data display switches to [BES]. The level of the stereoscopic image (stereoscopic vison) can be emphasized. (1 to 10)
2	Contrast	The contrast of the backscattered electron image can be coarsely adjusted. Fine-adjustment can be performed by the manual control button [Contrast].
3	Brightness	The brightness of the backscattered electron image can be coarsely adjusted. Fine-adjustment can be performed by the manual control button [Brightness].

■ Low Vacuum Control tool

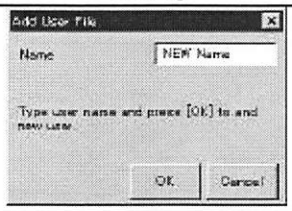
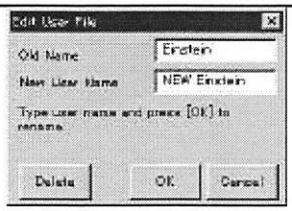
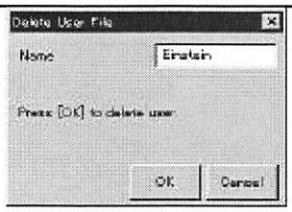
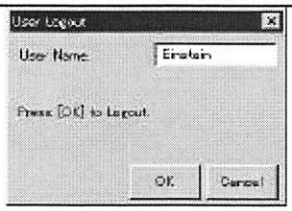


	Item	Explanation
1	Pressure value	The pressure selected from the list is displayed When the [Start] button is clicked, the pressure value is flicking during operation. When the pressure setting is finished, flicking stops
2	↑、↓	[↑] : The pressure value decreases (specimen chamber pressure goes low) [↓] : The pressure value increases (specimen chamber pressure goes high)
3	Pressure list	1Pa, 10Pa to 130Pa (1Pa step), 130Pa to 270Pa (10Pa step) Upper-side : 30, 50, 70, 100Pa (initial) When adjusting the pressure, the preset value is switched Selection method : left-click on the value
4	Start	Start: The pressure setting starts Stop: The pressure setting interrupts

■ User Login window



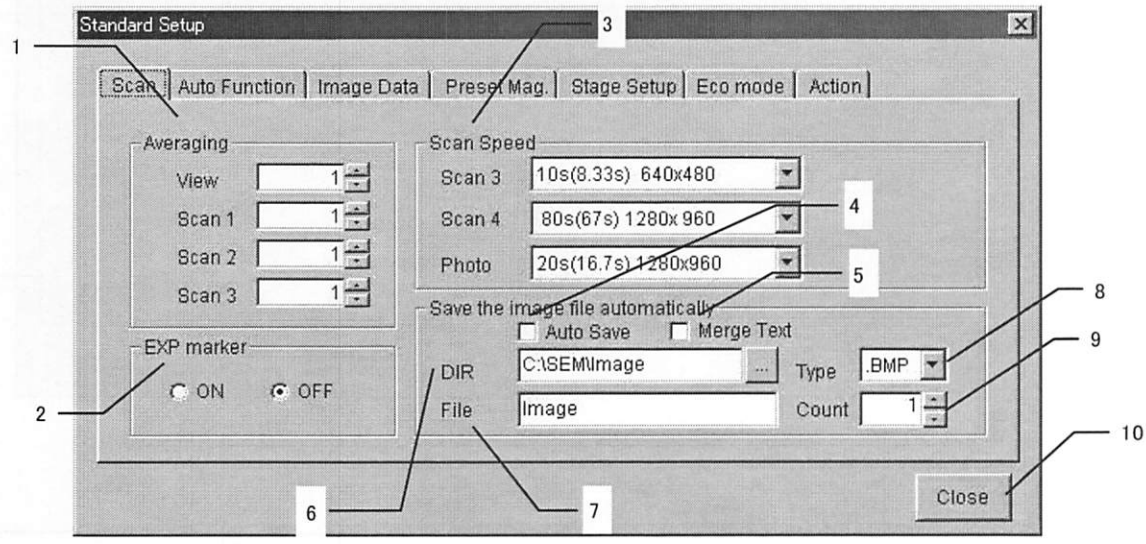
	Item	Explanation
1	Users list	The registered user name is displayed
2	Add	The "Add User File dialog" opens
3	Edit	The "Edit User File dialog" opens
4	Logout	The "User Logout dialog" opens
5	OK	The system logs into the selected user from the list
6	Cancel	The "User Login window" closes
7	Open this window when starting microscope	When you check it, the "User Login window" appears when the SEM-GUI is opened.

	Dialog	Item／explanation	
Add		User Name	Enters by keyboard (within 8 characters)
		OK	Register the new user
		Cancel	The "Add User File dialog" closes
Edit		Old Name	The selected user
		New Name	Enters by keyboard (within 8 characters)
		Delete	The "Delete User File dialog" opens
		OK	Change the user name
		Cancel	The "Edit User File dialog" closes
Delete		Name	The selected user
		OK	Delete the user name.
		Cancel	Returns to the "Edit User File dialog"
Logout		User Name	The current user name from the list
		OK	The present user logged out, and it is returned to [GENERAL]. (it is returned when it was finished with GENERAL last time)
		Cancel	The "User Logout dialog" closes

3.2 Details

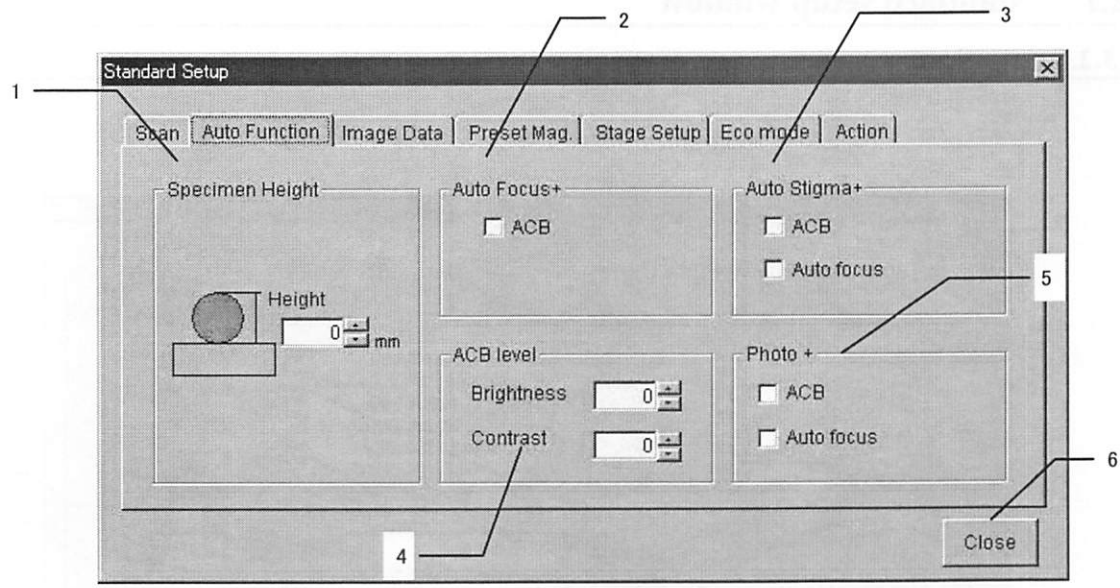
3.2.1 Standard setup window

3.2.1.a Scan



	Item	Explanation
1	Averasing	Averasing range : 1 to 255
2	EXP marker	ON: The exposure marker is displayed on the Scan1 mode. OFF: The exposure marker is not displayed on the Scan1 mode.
3	Scan Speed	Select the scan speed／resolution
4	Auto Save	When [Auto Save] is checked, an image file automatically saved after storering the image by [Photo] button. (Or, click the [Save] button when the frozen image is displayed.)
5	Merge Text	When [Marge text] is checked, the text and image data are merged to the image file. (The text and image data are saved to the image file and another file) When the check mark is not placed in this box, the text and image data are not merged to the image file. (The text and image data are saved to another file.)
6	DIR	When ... button is clicked, the window for designating directory opens, so you can designate the file to save images Initial: SEM Image
7	File	File name can be changed by clicking the file name box Initial: SEM Image Initial file name : Image
8	Type	Image file format to save automatically can be selected Format; BMP／TIFF／JPEG
9	Count	A count number is displayed in an image file, and it is increamented by one each time a file is saved. Count range: 0001 to 9999
10	Close	The "Standard Setup window" closes

3.2.1.b Auto Function

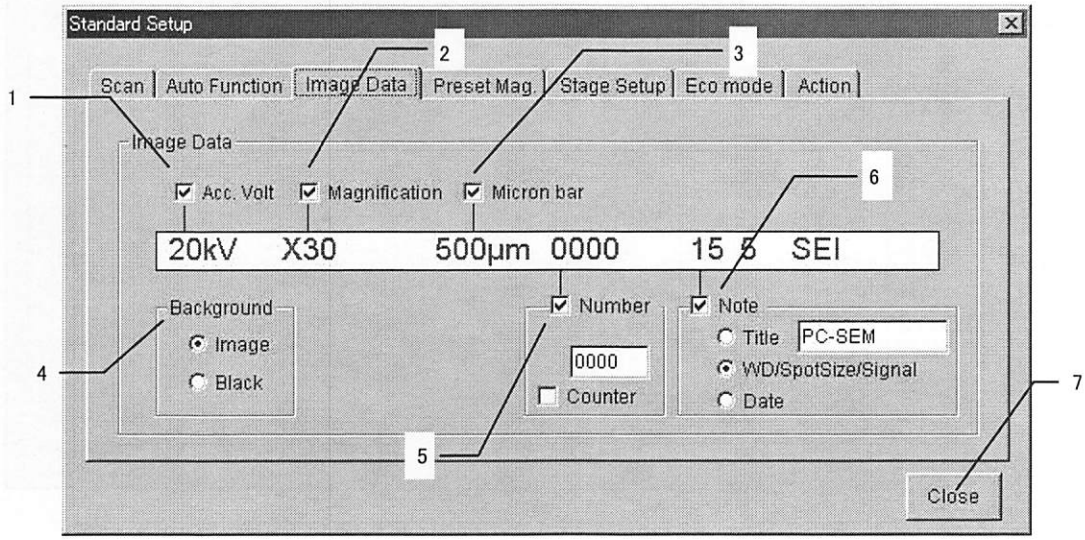


	Item	Explanation
1	Specimen Height	When the specimen observation surface is protruded abovethes pecimen holder surface, input the amount of correction (H=0 to 43mm) beforehand. The operation time required for automatic focusing can be shortened. Input the amount of correction in advance when the surface of the sample protrudes from the surface of specimen holder. When a sample is moved in the Z direction, amovement limitation works, and a collision to the bottom of abject lens and the BE-detector is prevented. (When the motor drive stage is being used) When you input value of [1mm or more] for correcting, [Stage Initialize] cannot be performed.
2	Auto Focus・ACB	When the [ACB] is checked, ACB is also activated when the [AFD] button is clicked
3	Auto Stigma・ACB, Auto focus	When the [ACB] and/or [Auto focus] is checked, ACB and/or AFD is also activated when the [ASD] button is clicked.
4	ACB・Brightness／Contrast	When [ACB] button is clicked, the respective levels of brightness can be set in 4-stage in the increasing and decreasing directions. When you increase the number, the brightness becomes higher, and vice versa.
		When [ACB] button is clicked, the respective levels of contrast can be set in 4-stage in the increasing and decreasing directions. When you increase the number, the contrast becomes stronger, and vice versa.
5	Photo・ACB, Auto focus	When the [ACB] and/or [Auto focus] is checked, ACB and/or AFD is also activated when the [Photo] button is clicked.
6	Close	The "Standard Setup window" closes

The icon setup is necessary to use the [ACB], [AFD] and [ASD] buttons. (See 3.2.2.a)

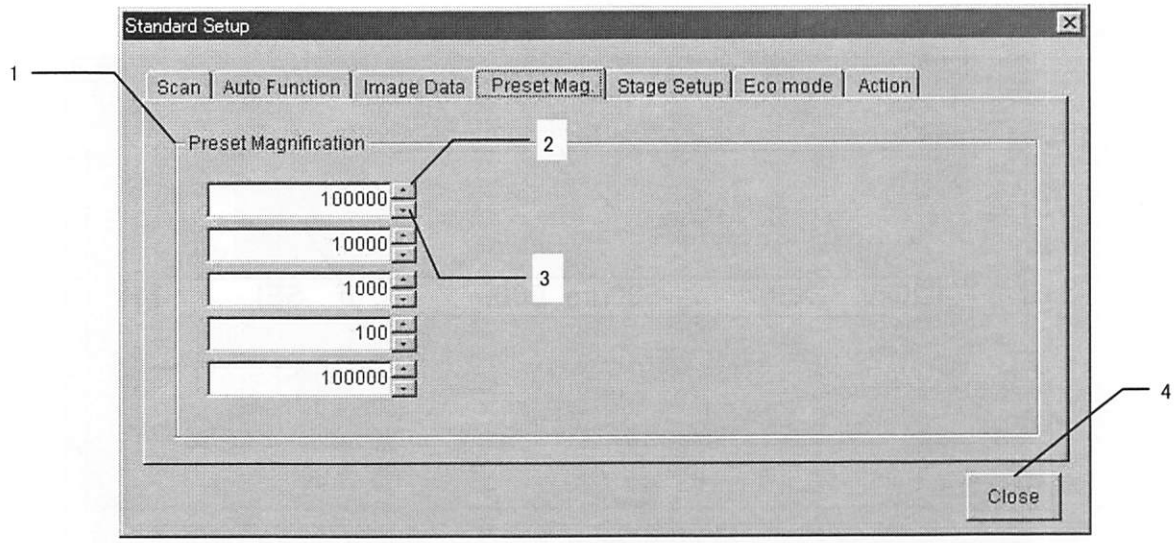
3.2.1.c Image Data

All have been checked as default. Checked／not checked status is linked with active data display and image data.



	Item	Explanation
1	Acc. Volt	The accelerating voltage is displayed in the image data.
2	Magnification	The magnification is displayed in the image data.
3	Micron bar	The micron value and micron-marker are displayed in the image data.
4	Background	Image: Image data is displayed in white superimposed on the image. Black: Image data is displayed in white on a black background.
5	Number	The number is displayed in the image data. (Range: 0000 to 9999) When [Counter] is checked, the number counts up each time a stored using the [Photo] button.
6	Note	A note is displayed in the image data [Title], [WD／SpotSize／Signal] and [Date] can be selected. When the "Title box" is clicked, a title can be enter. (20 characters) When the LV-SEM, [WD／SpotSize／Signal] is displayed as [WD／Spotsize／Pressure]
7	Close	The "Standard Setup window" closes

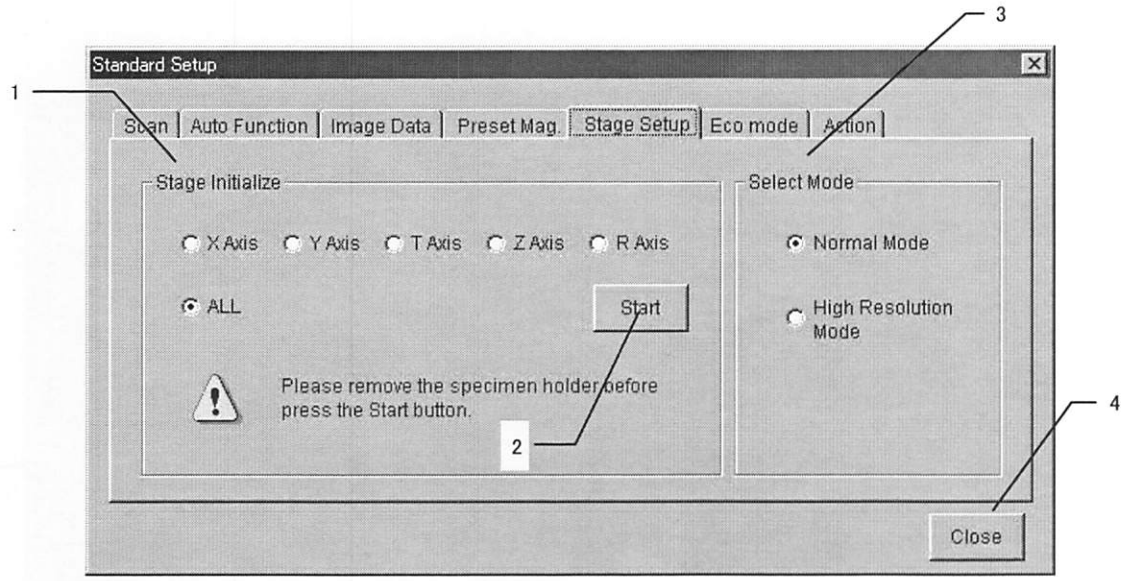
3.2.1.d Preset Mag



	Item	Explanation
1	List	The bottom magnification in the list is linked with the INST MAG switch on the OKB.
2	[▲]	When the [▲] is clicked, the magnification value increases by one-step.
3	[▼]	When the [▼] is clicked, the magnification value decreases by one-step.
4	Close	The "Standard Setup window" closes

3.2.1.e Stage Setup

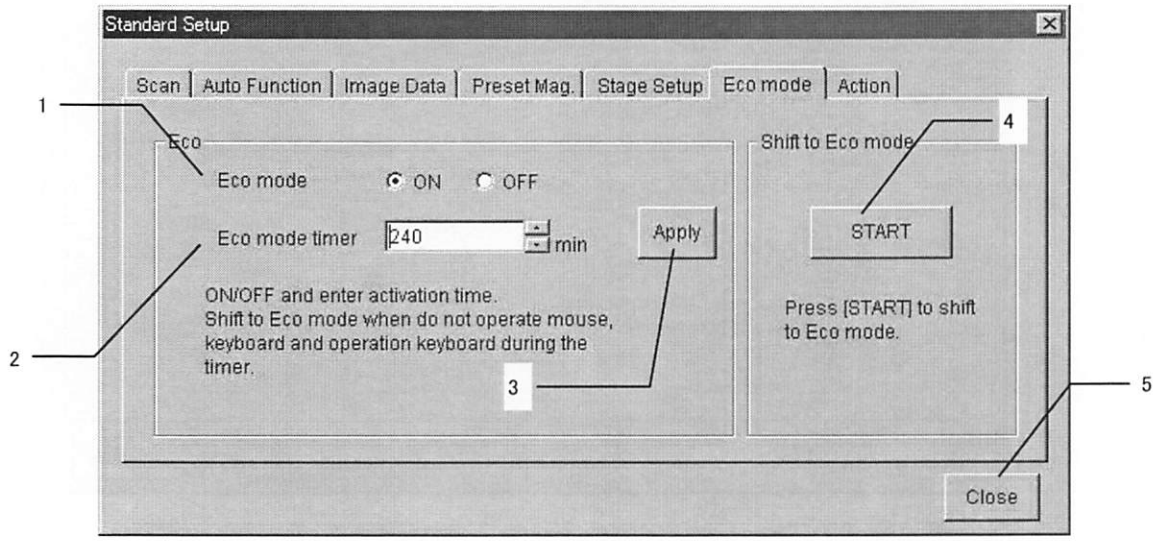
It is effective when the motor drive stage is attached. However, the possible axis of initialization varies in the stage type.



	Item	Explanation
1	Stage Initialize	X Axis: When [X Axis] is selected, the initialize of X-axis can be performed. Y Axis: When [Y Axis] is selected, the initialize of Y-axis can be performed. T Axis: When [T Axis] is selected, the initialize of T-axis can be performed. Z Axis: When [Z Axis] is selected, the initialize of Z-axis can be performed. R Axis: When [R Axis] is selected, the initialize of R-axis can be performed. ALL: When [ALL] is selected, the initialize of all-axes can be performed.
2	Start	Performs the stage initialize Note) When the stage initializing is performed, vent the specimen chambver to atmospheric pressure and remove the specimen holder in advance When you want to interup the stage initializing, move the stage with GUI or OKB.
3	Select Mode	Initial : Normal Mode Normal Mode: Z (WD)-axis of the motor stage can be moved until the 8mm. High Resolution Mode: Z (WD)-axis of the motor stage can be moved until the 5mm.
4	Close	The "Standard Setup window" closes

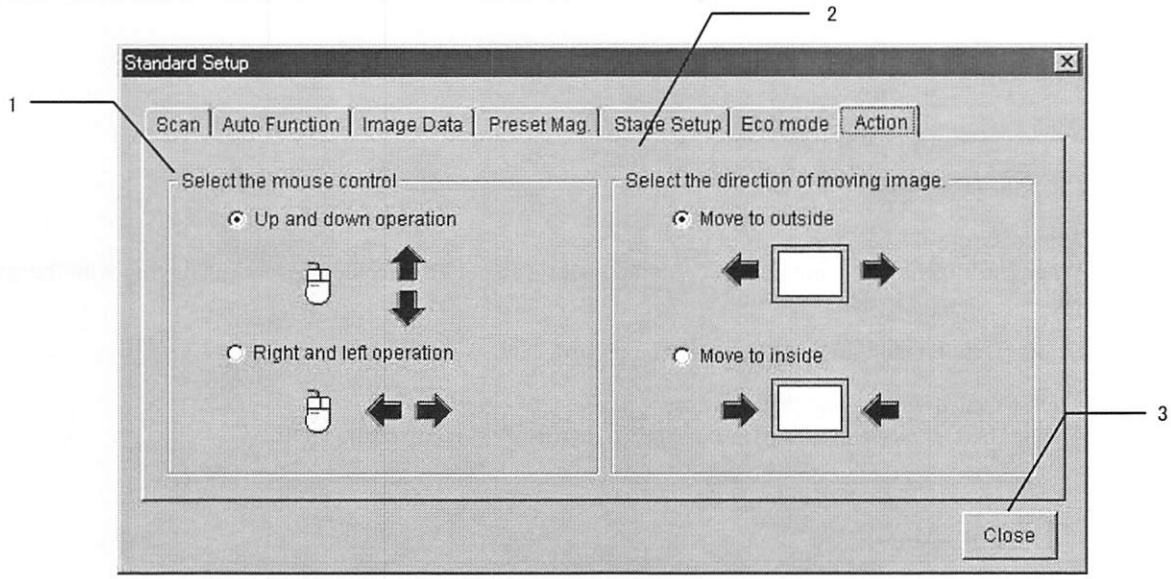
3.2.1.f Eco mode

When you do not do the operation (such as personal computers operation, OKB operation and EDS control) during the fixed time, it shift to the suspend mode and restrain the consumption power of this device.
The Eco mode can add the icon (Eco) on the GUI. (See 3.2.2.a)



	Item	Explanation
1	Eco mode	Initial : OFF Eco mode set ON／OFF
2	Eco mode timer	Initial : 240 minutes Time until starting the Eco mode is set. Range : 10 minutes／1-step
3	Apply	Apply the "Eco mode ON/OFF", and "Eco mode timer"
4	START	Shifts the "Eco mode"
5	Close	The "Standard Setup window" closes

3.2.1.g Action



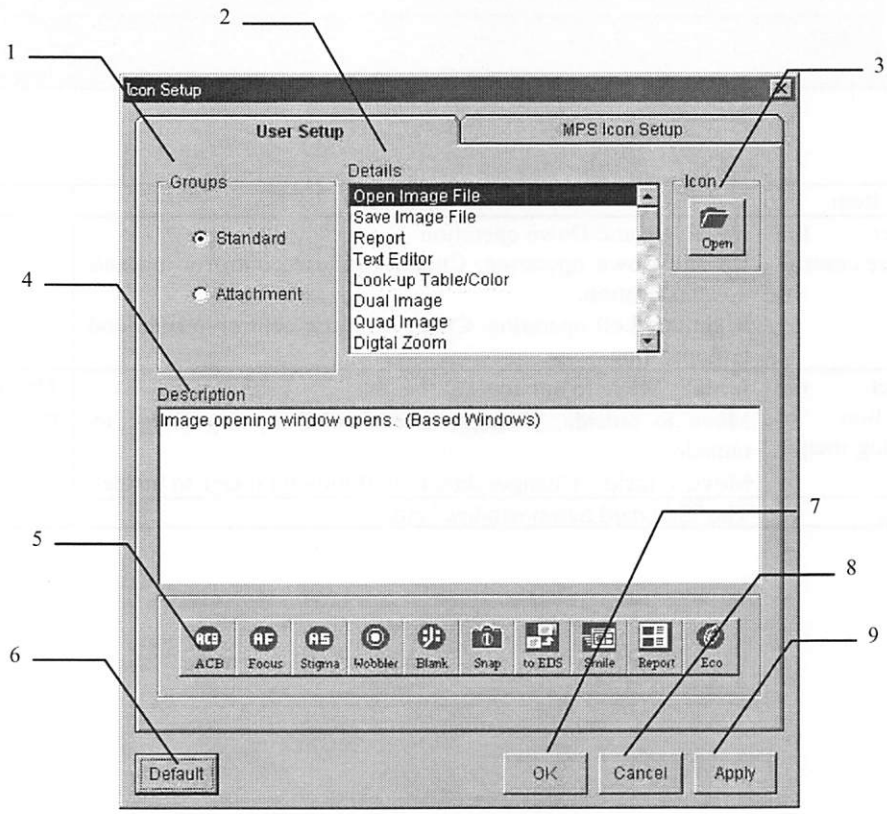
	Item	Explanation	Remarks
1	Select the mouse control	Initial: Up and Down operation Up and Down operation: Changes mouse control to up and down operation. Right and Left operation: Changes mouse control to right and left operation.	
2	Select the direction of moving image	Initial : Move to outside Move to outside: Changes direction of moving image to outside. Move to inside: Changes direction of moving image to inside.	The motor drive stage is necessary
3	Close	The "Standard Setup window" closes	

3.2.2 Text icon

3.2.2.a Icon setup

■ **User Setup**

1. Select Menu bar [Setup／Icon Setup].
2. Click the [User Setup]
3. Select "Groups".
   When the attachment is not attached, [Attachment] can not be selected because displaying with the gray out .
4. Select [Details], and drag it onto the "Icon group"
5. Click [Apply] button, and [OK] button.
   The applied icons (icon group) are displayed on the "Text icon" of the GUI.



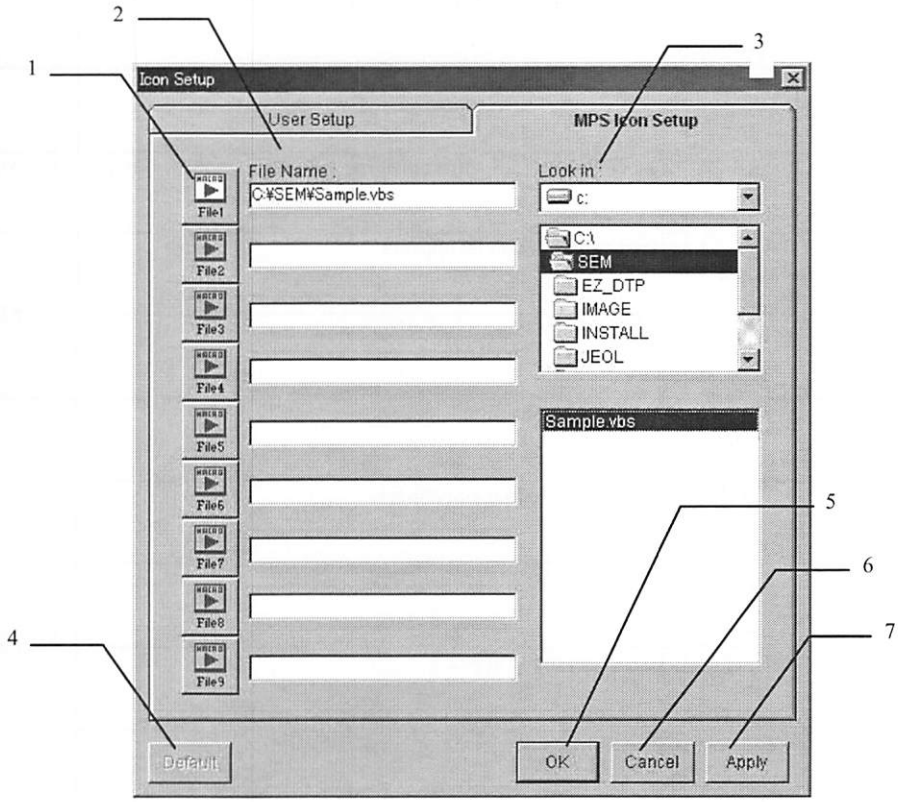
	Item	Explanation
1	Groups	See "Customize icon list" (page.3-32)
2	Details	Details list of the selected "Group"
3	Icon	Indicate the icon
4	Description	The operation explanation of the selected icon
5	Icon group	The icon which want to castomize is arranged (Maximun : ten icons)
6	Default	Return the icon group to the initial.
7	OK	The icon group is displayed on the "text icon"
8	Cancel	The "Icon Setup window" closes.
9	Apply	Icon group and MPS files are applied.

■ **MPS Icon Setup**

1. Select Menu bar [Setup／Icon Setup].
2. Click the [MPS Icon Setup].
3. Specify the MPS file (Drive, Folder, File), and click the icon.

   It is the same operation even if drag the MPS file to the "File Name box".MPS
4. Click the [Apply] button, and [OK] button

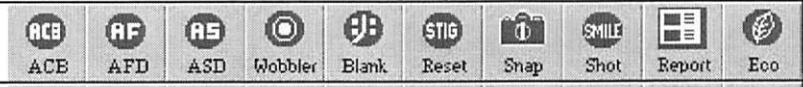
   The MPS file setting is applied, and it ia added to the "Details (User Setup)"



	Item	Explanation
1	Icon button	Afer a file is selected, a file is set up by clicking on the icon.
2	File Name	Indicate the file name
3	Look in	Drive, Folder, File
4	Default	Gray color
5	OK	The icon group isdisplayed on the "text icon"
6	Cancel	The "Icon Setup window" closes.
7	Apply	Icon group and MPS files are applied.

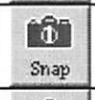
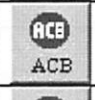
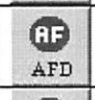
■ **Custamize icon lit**

Initial (GUI startup, default)

	Icon groups
Bu & LV-SEM	
IXRF is attached with Standard	

【 Standard】

Details	Icon	Description	Remarks
Open Image File		Image opening window opens. (Based Windows)	
Save Image File		Image saving window opens. (Based Windows)	
Report		The DTP program software start. The DTP window opens	See page. 3-35
Text Editor		The Text Editor menu appears	See page. 3-38, 3-39
Look-up Table / Color		The Look-up Table window opens	
Dual Image		The Dual Screen menu appears	See page. 3-40
Quad Image		The Quad Screen menu appears	
Digital Zoom		The Digital Zoom menu appears	
Scaler		The Scaler menu appears	
Multi Point Measurement		The Multi Point Measurement menu appears	
Dual Magnification		The Dual Magnification menu appears	
OL Wobbler		Uses for adjusting the movable aperture (MAP), and it is the function to change periodically an OL current. An image moves in every direction greatly when an electron beam deviates from the optical axis.	
Beam Blanking		The beam blanking works. When the beam blanking is made to work, a specimen does not irradiate an unnecessary electron beam, and specimen damage is prevented. Beam blanking automatically works when the frozen imageis displayed, and specimen damage is reduced.	
Dynamic Focus Correction		The Dynamic Focus window opens	
Eco Mode		The Standard Setup window opens	See 3.2.1.f

Details	Icon	Description	Remarks
Stigma Reset		The memorized astigmatism condition (the most suitable condition in shipping) is reproduced. Use it when an image shifts in the oblique direction even if you adjust the focus of the image. It is effective when an original image cannot be reproduced again after the astigmatism correction.	
Lens Reset		The image is switched to freeze mode, and the lens reset takes place. It can be used SEM with the best condition for cleaning the hysteresis of the lens. It is not necessary by the usual observation.	
Imnage Shift Reset		The image can be returned to the original position after being moved (except center zoom)	
Preset Mag		You can change the magnification to arbitrary magnification set in standard setup window. If you click once again, the magnification reverts to the original value	See 3.2.1.d
Naturalizer		It is effective in reducing halation (the image be veiled in haze of white) of the image. It cannot be used with signal [REF] or vacuum mode [LV].	[SEI] only
Snap Shot1 (2)		A live image (exc ept Scan1) or frozen image pasted on the Snap Shot image area (upside)	
		A live image (except Scan1) or frozen image pasted on the Snap Shot image area (downside)	
Smile Shot		Sample groups is selected, and the image is indicated on the most suitable condition when it clicks on OK	See page. 3-41
ACB		Uses when you want to adjust the image contrast and brightness automatically.	
AFD		Uses when you want to focus an image automatically.	
ASD		Uses when you want to correct an astigmatism the image automatically.	

[Attachment]

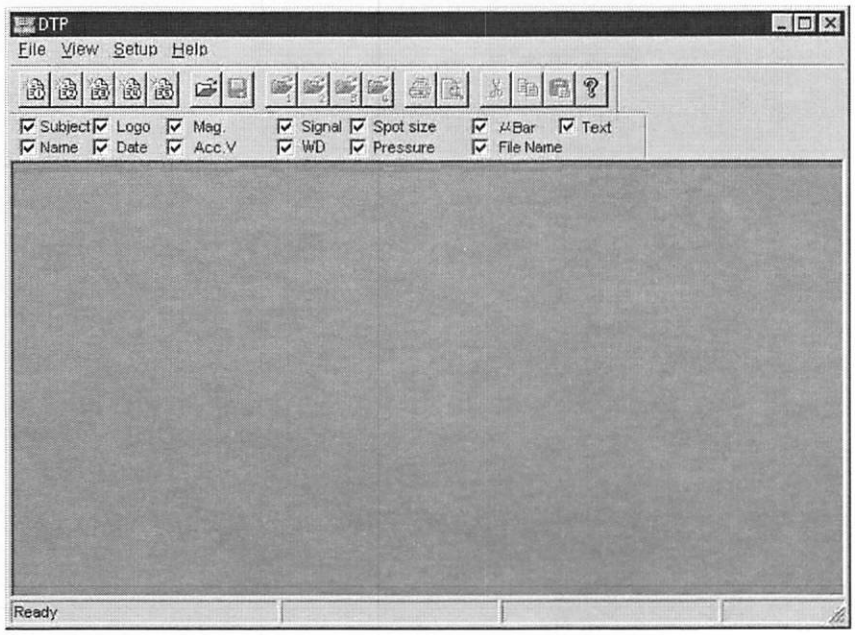
Details	Icon	Description	Remarks
Scan Rotation		The Scan Rotation window opens.	
Image Album		The Image Filing Program Software starts. The IFS window opens.	
Probe Current Detector		It is effective to measure the electron beam current to irradiate the sample. The device is necessary when the sample current is regulated and a condition is unified for executing the X-ray analysis (EDS／WDS).	
Beam Controller		The Beam Controller menu appears.	Freeze mode only
Video Print		A live image or frozen image can be remote printed with Video Printer	
Chamber Scope		The Chamber Scope works	
MPS File 1～9		The Macro Programing Software file start. You can set up practice file of MPS at right mouse button.	See page. 3-31
Frame Shift		The image can be moved a specified fraction of the field of view. (10 to 100 percent)	When the motor drive stage is installed in this instrument, the "Groups" becomes "Standard"
EDS Integration		The EDS icons window opens	
Smile View		The Smile View program software starts The Smile View window opens	
Smile Station		The Smile Station program software starts The Smile Station window opens	
Emission Pattern		The Emission Pattern works	

When the attachment is not installed into the instrument, "Attachment" cannot be selected with "Icon Setup window

3.2.2.b Details of custamize icons

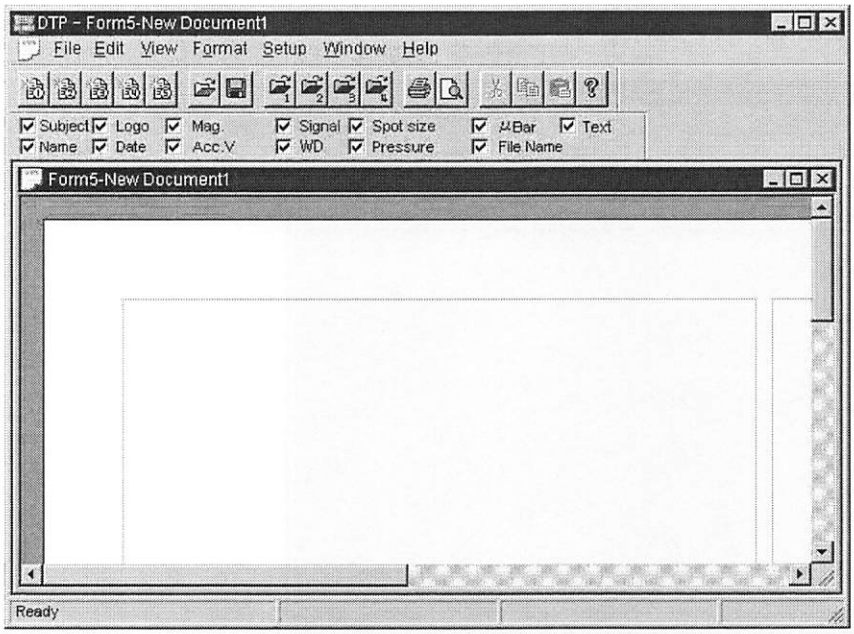
■ **Report**

■ **Immediatery after the DTP startup**



	Pull-down menu	Icon	Explanation
■File	New		Selects a document.
	Open		Open the dialog to open a file.
	Print Margin		Displays the print margin setting dialog.
	Recent File		Clicking the file name opens the file. (Stores up to 8-file)
	Exit		Closes the DTP window.
■View	Tool bar		Displays or hides tool bar.
	Status bar	Ready	Displays or hides status bar.
	Check bar	Subject Logo Name Date	Displays or hides SEM information. Not displayed／printed if not checked. Can display or hide check bar.
■Setup	Standard style		Displays a standard style window.
	Text memory		Displays a text memory window.
■Help	About		Displays the version information dialog.

■ **DTP being actuate d**



	Pull-down menu	Icon	Explanation
■File	New		Let you select a format.
	Open		Displays a dialog that opens an existing DTP file.
	Close		Closes the DTP file on which you are working.
	Save		Saves the DTP file on which you are working.
	Save as		Displays the save dialog to let you assign a name to the file.
	Image File Open		Displays the file opening dialog. (file is in bmp. type)
	Logo File open		Displays the file opening dialog
	Print		Displays standard printer dialog.
	Print Preview		Changes to print-preview screen.
	Margin		Displays the print margin setting dialog.
	Recent File		Clicking the file name opens the file. (Stores up to 8-file)
	Exit		Closes the DTP window.
■Edit	Undo		Restores the preceding action. This selection is grayed out when image is pasted.
	Cut		Cuts text.
	Copy		Copies text.
	Paste		Paste a text. (This selection is in effect when Cut, Copy or Select All is selected.)
	Select All		Selects the entire text.
	Image Paste		Pastes an image.

	Pull-down menu	Icon	Explanation
■View	Tool bar		Displays or hides tool bar.
	Status bar		Displays the status of the format on which you are working and information such as image number and image size. Displays or hides status bar.
	Check bar		Displays or hides SEM information. Not displayed/printed if not checked. Can display or hide check bar.
■Format	Title Font		Displays the font dialog for designating.
	Text Font		Displays the font dialog for designating.
■Setup	Standard Style		Displays a standard style window.
	Text Memory		Displays the text memory window.
■Window	Cascade		Overlays multiple formats on the display.
	Tile		Displays multiple formats side by side.
	Arrange Icons		Arranges minimized formats.
	Active Document		Displays file name. The file name that is checked is the active document.
■Help	About		Displays the version information dialog.

■ **Documents**

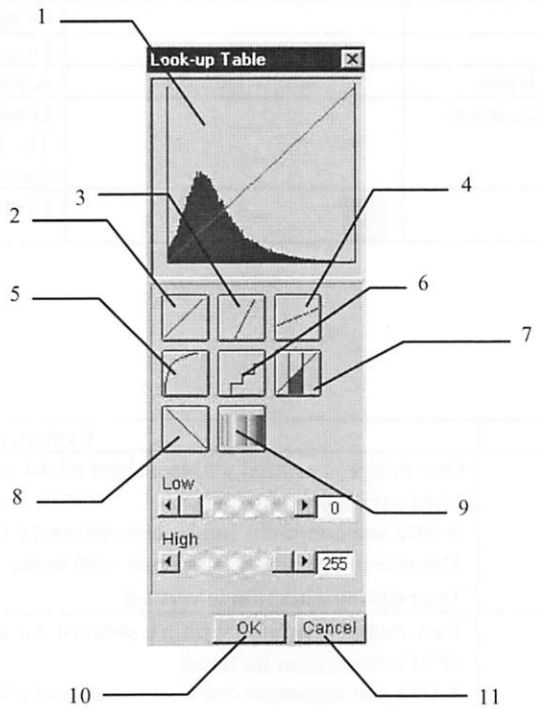
Type	Explanation
Document 1	One-image is printed within a sheet of A4 size/letter paper. SEM information included. A title and comment can be entered, and a logo (.bmp image) can be pasted. The one-image size is 128.0mm×96.0mm The printing direction is vertical.
Document 2	Two-image is printed within a sheet of A4 size/letter paper. SEM information included. A title and comment can be entered, and a logo (.bmp image) can be pasted. The one-image size is 128.0mm×96.0mm The printing direction is vertical.
Document 3	One-image is printed within a sheet of A4 size/letter paper. SEM information included A title can be entered, and a logo (.bmp image) can be pasted. The one-image size is 163.2mm×217.6mm The printing direction is horizontal
Document 4	One-image is printed within a sheet of A4 size/letter paper. The one-image size is 208.0mm×156.0mm The printing direction is horizontal
Document 5	4-image is printed within a sheet of A4 size/letter paper. The one-image size is 120.0mm×90.0mm The printing direction is horizontal

■ Text editor

	Menu／Item／Explanation	
Text Editor	Text Editor Background ⊙ Image ○ Black Symbol Clear Exit	
	Background Image/Black	The background becomes on the image/black color
	Symbol	The "Symbol list window" opens
	Clear	All text clears
	Exit	The "Text Editor menu" closes

Freeze mode only

■ Look-up table window

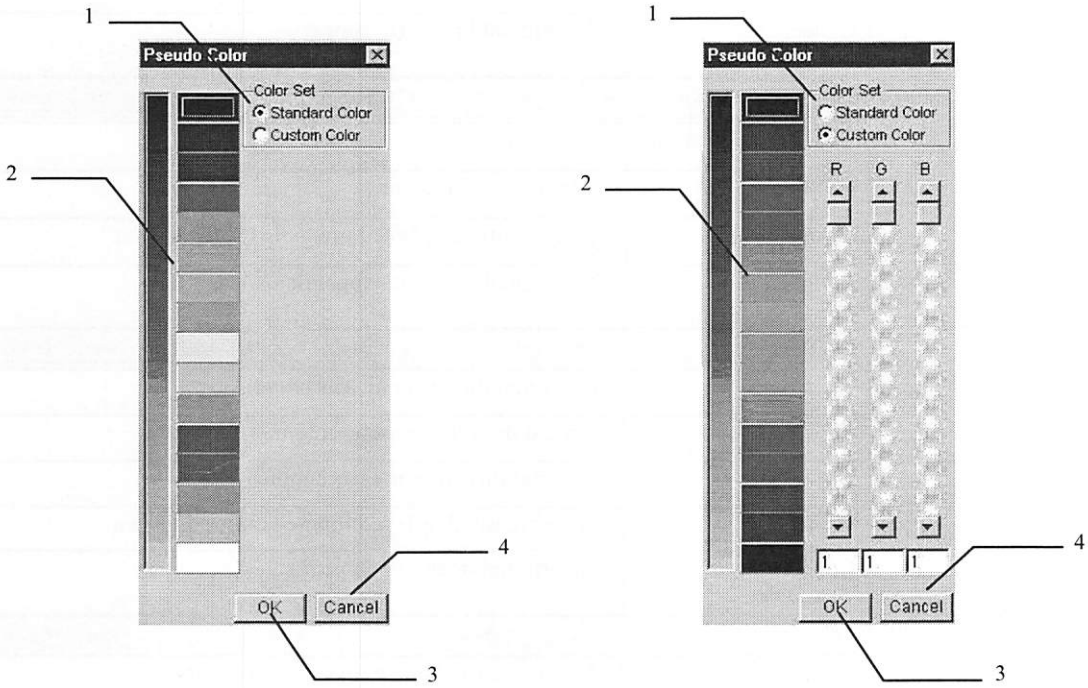


	Item	Brightness correction button	Explanation
1	Graph display		The vertical axis represents the output value and the horizontal axis the input value. Displays the function graph when correction is made and the histogram when the correction function of the brightness correction button is appried.
2	Linear		Makes it possible to display the image without correction.
3	Contrast highlight		Highlights contrast of levels L-H on display. Range: Low-level (0 to 254), High-level (1 to 255)
4	Contrast reduce		Lowers contrast of levels L-H on display. Range: Low-level (0 to 254), High-level (1 to 255)
5	Gamma correction		Corrects brightness with gamma curve on display. Range: 1 to 1.0, 1.1, 1.25, 1.5, 1.7, 2.0, 2.5, 3.0, 5.0, 10.0
6	Multivalued processing		Displays after multivalued processing. Range: 4,8, 16, 32, 64, 128

7	Partial highlight		Highlights a part in green color on display. Levels L-H are displayed in green color and others in monochrome. Range: Low-level (0 to 254), High-level (1 to 255)
8	Brightness reverse		Reverses brightness on display.
9	Pseudo color		The "Pseudo color window" opens
10	OK		The original image is overwritten by the image that has undergone brightness correction.
11	Cancel		The original image re-appears

Freeze mode only

■ **Pseudo color window**



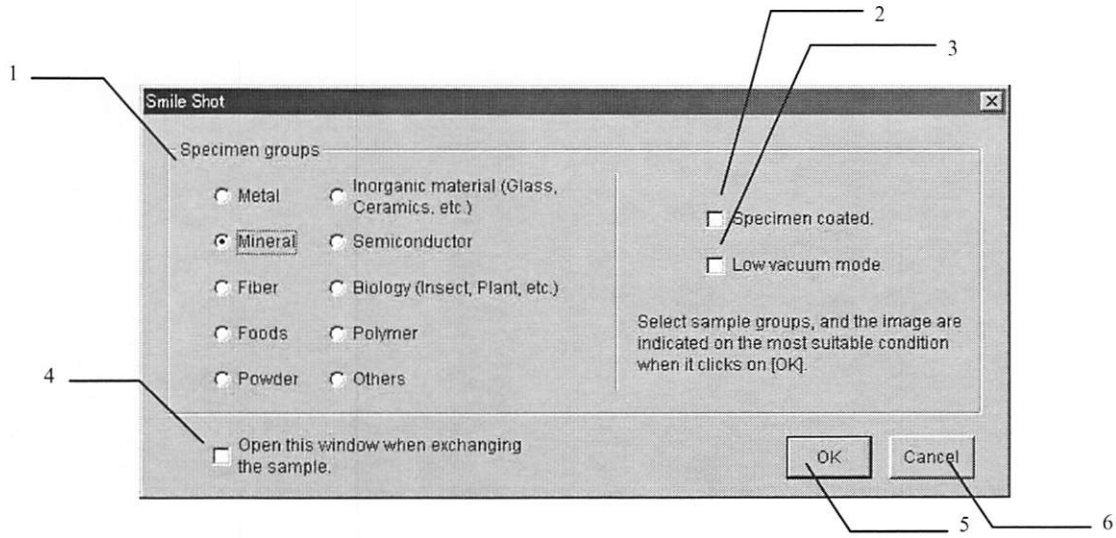
	Item	Explanation
1	Color set	Standard color: Color level (16-color) changing impossible Custom color: Color level changing is possible
2	Color level	Color level changing is possible only when the [Cutom Color] is selected Range: RGB (1 to 255)
3	OK	The original image is overwritten by the image that has undergone brightness correction.
4	Cancel	Retuns to the "Look-up Table window".

■ **Image operation tool**

	Menu／item／Explanation	
Dual screen	Dual Images Write Cancel	
	Write	The currently displayed image is turned frozen
	Cancel	The original image re-appears
Quad screen	Quad Images Write Cancel	
	Write	The currently displayed image is turned frozen
	Cancel	The original image re-appears
Digital zoom	Digital Zoom ○×2 ○×4 Zoom In Write Cancel	
	Zoom magnification	×2、×4
	Zoom in/Zoom out	Zoom in the frame image/Returns to original the enlarged image
	Write	The currently displayed image is turned frozen
	Cancel	The original image re-appears
Dual magnification	Dual Magnification ○×2 ○×4 Position Write Cancel	
	Dual magnification	×2、×4
	Position	Field of view changes
	Write	The currently displayed image is turned frozen
	Cancel	The original image re-appears
Scaler	Scaler ○X ○Y ○D Write Cancel	
	X	Horizontal direction measurement
	Y	Vertical direction measurement
	D	Diagonal direction measurement
	Write	The currently displayed image is turned frozen
	Cancel	The original image re-appears
Multi point measurement	Measurement ○Line ○Circle Write Cancel	
	Line	Measures a distance between two points
	Circle	Measures the diameter of the circule
	Write	The currently displayed image is turned frozen
	Cancel	The original image re-appears

Freeze mode only

■ **Smile Shot (Easy operation function)**



	Item	Expranation	Remarks
1	Specimen Groups	The sample which it wants to observe can be selected	
2	Specimen coated	When the check mark is placed, it is set up the high Acc.V condition. When the check mark is removed, it is set up the low Acc.V condition	
3	Low vacuum mode	When the check mark is placed, it is set up the low vacuum condition.	
4	Open this window when exchanging the sample	When the check mark is placed, the Smile Shot window is displayed by pressing the SPECIMEN CHAMBER EVAC switch (or clicking the [EVAC] button on the "Specimen Exchange window).	The Smile Shot window is displayed even with the ALC switch and ALC] button at the time of ALC installation
5	OK	After finishing the evacuation of the specimen chamber, the image is indicated on the most suitable condition.	
6	Close	The "Smile Shot window" closes	

4

Operation

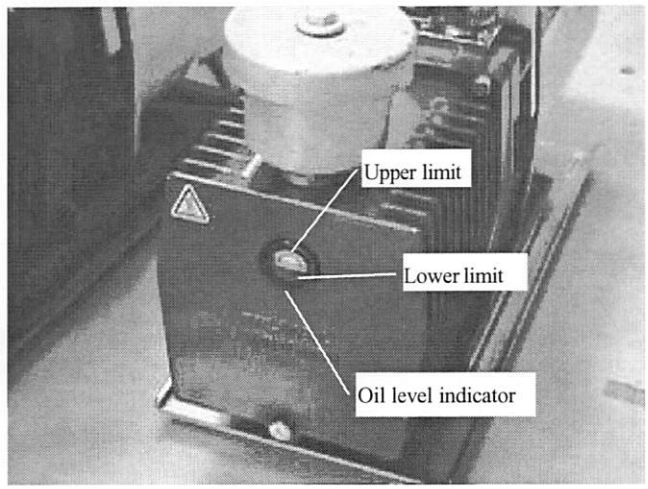
4.1 Pre-starting check

! CAUTION

Take care that the oil level does not fall below the lower limit.
If you continue to operate the pump with insufficient oil, the pump may break down.

Using the oil level indicator of the RP, check the reduction of the oil level and also whether or not the oil is contaminated.
Perform this check about once every three months, or at shorter intervals if the pump is used more frequency.

If it is necessary to replenish or replace the oil, contact your local JEOL service office.



4.2 Starting the instrument

1. Pass cooling water through the system. (Flow rate; 2.0L/min)
2. Turn ON the power board switch.
3. Turn ON the MAIN POWER switch on the main control panel.

   Insert the key in to the MAIN POWER switch, turn it to START, then take your hand away. The key returnsto ON, and power is supplied to the evacuation system.
4. Wai for about 10 second, switch on the personal computer and run Windows.
5. Click [Start/Program] on the desktop.
6. Click [JEOL SEM/SEM Main Menu]

   The starting screen appears, and when the software starts running, the screen changes over to SEM-GUI.

   The system log into [GENERAL] as the user.
7. When the [HT] button of the text icon becomes to [HT OFF], the image observation is possible.

4.3 Shutting down the instrument

1. Click [Exit] button of the text icon.
2. Click [OK] button of the Exit Microscope Program.
3. The SEM program finishes, and the screen returns desktop of Windows.
4. Click [Start] button on the desktop.
5. Exit Windows, then switch off the personal computer.
6. Turn OFF the MAIN POWER switch on the main control panel.
7. After waiting for about 15 minutes, turn OFF the distribution switchboard and turn off the cooling water.

4.4 Restart the instrument

1. Click [Exit] button of the text icon.
2. Click [OK] button of the Exit Microscope Program.
3. The SEM program finishes, and the screen returns desktop of Windows.
4. Click [Start] button on the desktop.
5. Exit Windows.
6. Turn the MAIN POWER key switch to START and wait several seconds, then switch on the personal computer.
7. Select [Start／Program], and [JEOL SEM／SEM Main Menu] on the desktop.
8. When the text icon [HT] button becomes [HT OFF], SEM can be used.

4.5 User management

4.5.1 User login

1. Click the active data display [User].

   The "User Login window" is appeared.

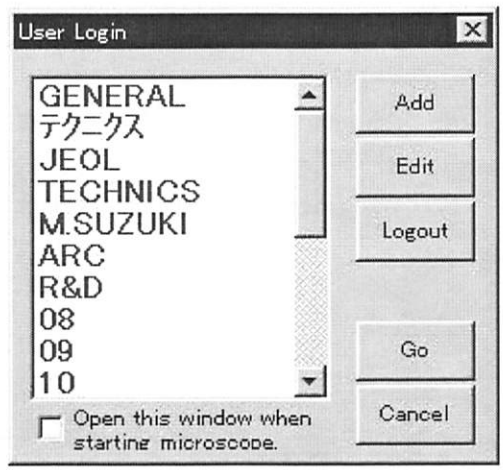
2. Select user name from the list and click the [OK] button.

3. The SEM working parameters (accelerating voltage, magnification and others) which the most recently user set reappear as the present parameters.

   When the user is registered, the SEM can be used with [GENERAL].

   If you check [Open this window when starting microscope], the user login window appears when the SEM-GUI is opened.

   When the [Cancel] button is clicked, the user login window closes.



4.5.2 Add

1. Click the active data display [User].

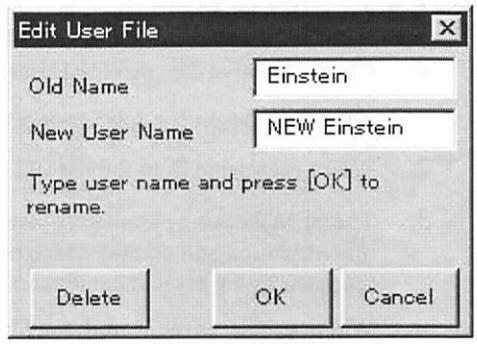
2. Click the [Add] button, and input the user's name (within 8 characters).

3. Click the [OK] button. That completes registration of a new user's.

4. When the [Cancel] button is clicked, the Add dialog closes.

4.5.3 Edit

1. Click the active data display [User].
2. Select User to edit from the list.
3. Click the [Edit] button, and input the user's name (within 8 characters).
4. Click the [OK] button. That completes changing of a user name.
5. When the [Cancel] button is clicked, the Edit dialog closes.

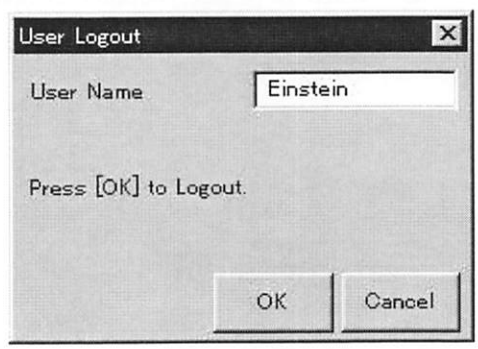


4.5.4 Delete

1. Click the active data display [User].
2. Select user to delete from the list.
3. Click the [Edit] button, and click [Delete] button.
4. Click the [OK] button. The selected user is deleted.
5. When the [Cancel] button is clic ked, the Delete dialog closes.

4.5.5 User logout

1. Click the active data display [User] when the [User login] is executed.
2. Click the [Logout] button, and click the [OK] button.
3. The SEM working parameters at the times are saved and the SEM returns to the normal operating conditions. (User name becomes [GENERAL])
4. When the [Cancel] button, the "User login window" is appeared.



4.6 Exchange of sample

! CAUTION

When returning the specimen stage to the specimen chamber, take care not to get your fingers crushed between the stage and the specimen chamber.

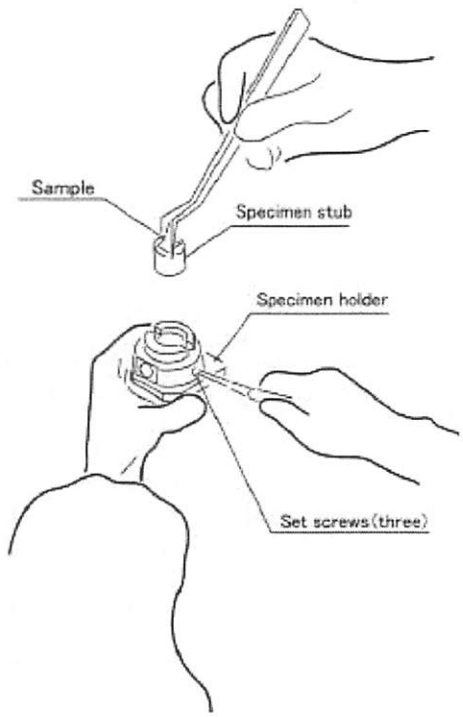
1. Click the text icon [HT] button to get [HT OFF].
2. Click the text icon [Sample] button.
3. Select [Stage Drawout] in the specimen exchange window, and click the [Vent] button.
   When the sample like a powder that splatter easily is installed, check the [Venting after setting pressure to 270Pa], and click the [Vent] button. (It is effective with LV-SEM)
4. After about 50 seconds, the pressure inside the specimen chamber rises to atmospheric pressure. Then, slowly withdraw the stage and remve the specimen holder.
5. To make a sample.

   Set a sample on the specimen stub and attach it on the specimen holder so that the position of the specimen surface to be observed coincides with that of the top face of the specimen holder.

   If the specimen observation surface is protruded above the specimen holder surface, [Specimen Height]. (See 3.2.1.b)

   Use a conductive paint in order to prevent electric charging for some specimens.

   Avoid specimen containing much moisture or oil. Such specimen would contaminate the inside of the electron optical column.

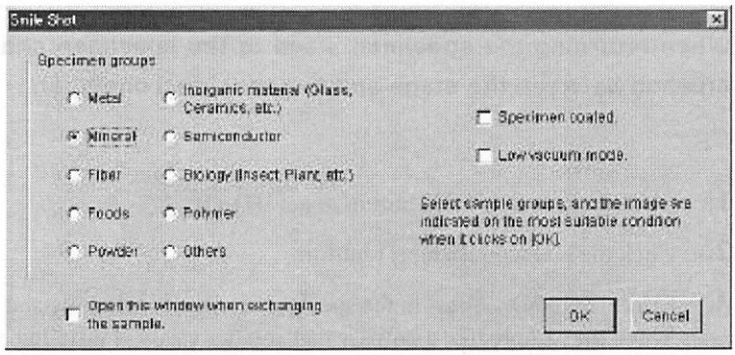


6. Attach the specimen holder to the stage.
7. After pushing the stage until it is in intimate contact with the specimen chamber, click the [Evac] button to evacuate the specimen chamber.
8. When the status in the specimen exchange window becomes [Ready] (Text icon [HT OFF]), you can observe specimen image.

An inexperienced user will recommend the use of the "Smile Shot" to the SEM operation. Refer to 4.6.1 for details.

4.6.1 Smile shot (Easy operation function)

1. Attach the sample for referring the [4.6 Exchange of sample], push the stage until it is in intimate contact with the specimen chamber
2. Select "Menu bar" [Tools／Smile Shot], or click the [Shot] button.
   It is necessary to add the icon to use the [Shot] button. (See 3.2.2.a)
3. Select attached sample from the "Sample Group".
4. Click [OK] button.
5. After evacuating the specimen chamber is completed, the image is displayed automatically with the most suitable condition.



6. Only when you want to exhaust it, remove the check mark of [This window opened at the time of sample exchange], and then click [Cancel] button.

When the "Smile Shot" is used, set the filament to the position of the image observation in advance.

	Item	Expranation	Remarks
1	Specimen Groups	The sample which it wants to observe can be selected	
2	Specimen coated	When the check mark is placed, it is set up the high Acc.V condition. When the check mark is removed, it is set up the low Acc.V condition	
3	Low vacuum mode	When the check mark is placed, it is set up the low vacuum condition.	
4	Open this window when exchanging the sample	When the check mark is placed, the Smile Shot window is displayed by pressing the SPECIMEN CHAMBER EVAC switch (or clicking the [EVAC] button on the "Specimen Exchange window).	The Smile Shot window is displayed even with the ALC switch and ALC] button at the time of ALC installation
5	OK	After finishing the evacuation of the specimen chamber, the image is indicated on the most suitable condition.	
6	Close	The "Smile Shot window" closes	

4.7 Observation of secondary electron image

1. Initial setting

Accelerating voltage	About 20kV
Magnification	View
Working distance (WD)	20mm
Spotsize	20 to 30
Signal	SEI
Movable aperture	2

2. Click the text icon [HT] button to get [HT ON].

3. Observe the image by using the automatic function ([ACB], [AFD], [ASD] buttons).
It is necessary to add the icon to use the automatic function ([ACB], [AFD] and [ASD] buttons). (See 3.2.2.a)

4. Move the point of rough target to the center of image display area with [Click center] function.

5. Change the scanning mode (recommend Scan1), and find the point of target.

6. Get the target point with increasing magnification gradually.

7. Move the target point to the center of the image display area, and set it in necessary magnification.

8. Adjust the image quality to obtain the optimum by using the manual control button.

Makes proper condition with the recipe function

When observing a sample through the SEM, it is generally necessary to set observing conditions suited to the sample. This SEM let you set appropriate observing conditions simply by selecting a recipe suited to the specimen from representative observing conditions that are recorded on the standard recipe.

The vaccum mode, pressure and stage coordinate position (The motor drive stage is necessary) are only displayedand are not actually alive. The vaccum mode and pressure are effective only with LV-SEM.

It also lets each user create and save containing observing conditions for all types of specimens. Refer to [4.11.3.a] to register a recipe file.

1. Click the text icon [Recipe] button.

2. Select [Custom recipe] or [Standard Recipe].

3. Select recipe file from the list and click the [OK] button.

4. The recorded recipe conditions are desired to be alive again.

For observing at high magnification it is recommended to focus at low magnification first and then increase magnification gradually. Or, when you want to observe more high resolutions;
[Set to short working distance (WD)], [Set to high accelerating voltage] and [Set to small spotsize]. See [Observation condition] (4.7.1) for details.

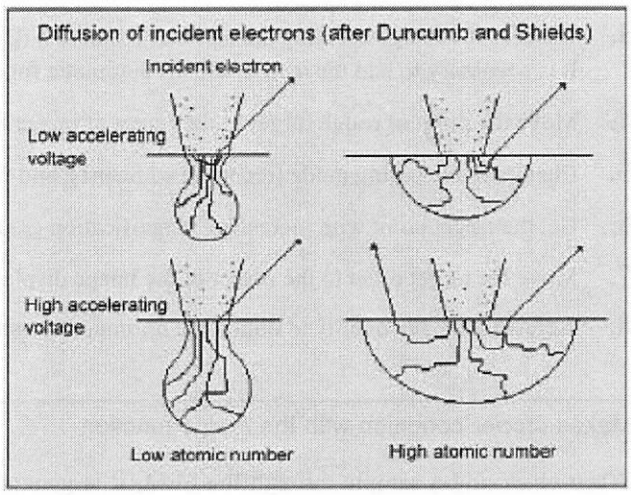
4.7.1 Observation condition

Conditions for observing a specimen, such as accelerating voltage, illumination current, movable aperture, and working distance (WD), must be selected most suitably. Also, sampling (specimen preparation) and tilting of specimen must be taken into consideration. Furthermore, brightness adjustment, astigmatism correction, focus adjustment and other adjustments are also important for achieving optimum image quality.

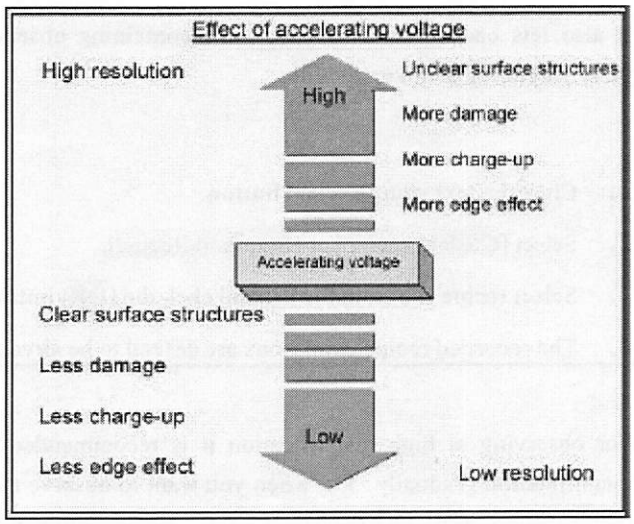
4.7.1.a Image quality depending on accelerating voltage

The electron probe diameter certainly becomes smaller, theoretically, as the accelerating voltage increases. However, some disadvantages as presented below appear as the accelerating voltage increases.

a. The microscopic structure of the specimen surface tends to be broken
b. Edge effect becomes remarkable
c. Charge buildup tends to occur
d. Specimen damage tends to occur

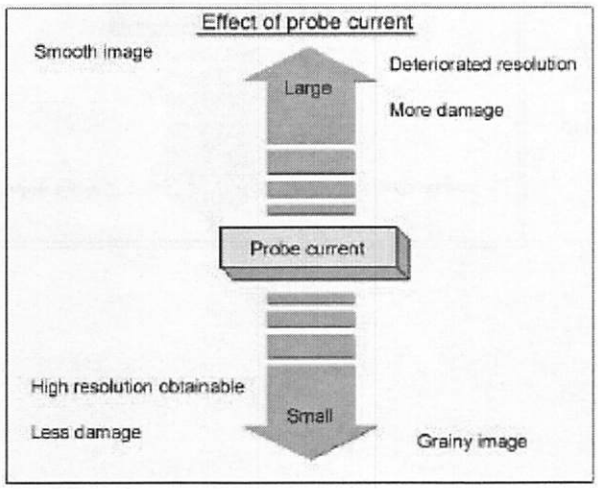


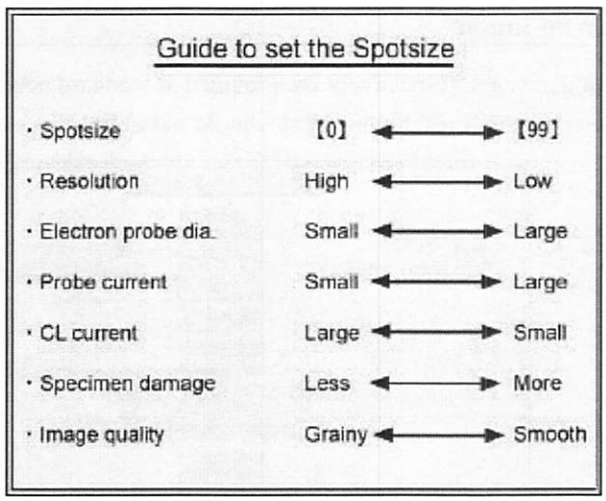
When you use a lower accelerating voltage, the details of microscopic structure of the specimen surface appear more clearly. When using a high accelerating voltage, the illuminating electrons can reach deeper inside the specimen and as a result, unnecessary signals generated from the inside of the specimen (backscattered electrons, for example) lower the contrast, thus hiding the details of microscopic structure of the specimen surface. For this reason, especially for observing a specimen of low-density material, a low accelerating voltage is desirable.



4.7.1.b Effect of illumination current

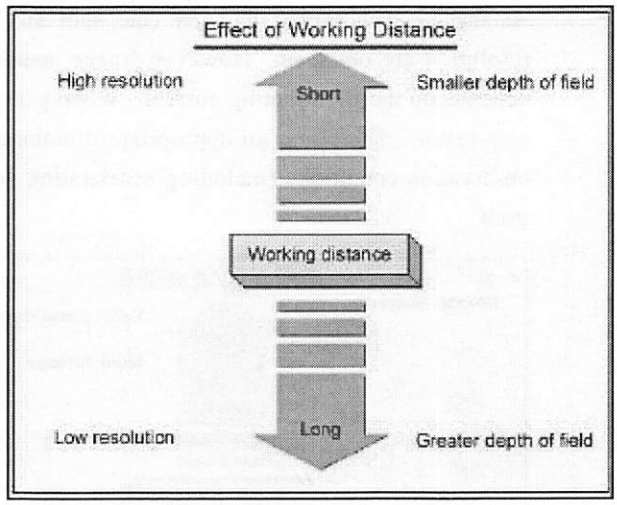
As the electron probe diameter (the spot size) becomes smaller, higher magnification and so higher resolution are obtained. However, image smoothness, that is, the S/N (signal/noise) ratio of the image, depends on the illuminating current. When you try to reduce the probe diameter, the probe current reduces as a result. Therefore, an appropriate illuminating current must be selected according to magnification, observation conditions (including accelerating voltage , tilting of specimen and others) and the specimen itself.





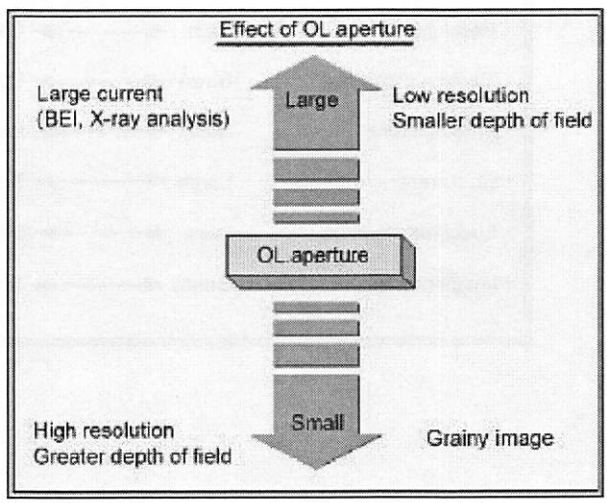
4.7.1.c Effect of working distance (WD) on image

With a short WD, high-resolution images can be obtained though the depth of field becomes shallow. On the other hand, with a long WD, the depth of field becomes deep though image resolution deteriorates. And, sampling and tilting of specimen must be taken into consideration along with WD in selecting the optimum observation conditions. Furthermore, brightness adjustment, astigmatism correction, focus adjustment and other adjustments are also important for optimum image quality.



4.7.1.d Effect of aperture diameter on image

The Movable apertures with 20, 30, and 100μm diameters, respectively are provided as standard accessories. You must select the optimum aperture diameter for high resolution. You should not select too small an aperture because sufficient signals, as well as appropriate probe size, become necessary.



Typical suitable diameters for example are as follows.

For high resolution	20 μm diameter
For routine observation or EDS analysis	30 μm diameter
For WDS analysis or work with large probe currents	100 μm diameter

4.7.2 Selection of scanning speed

There are kinds of a "Live image" (image to be updated at contrast frequency) as following. Click each button according to purpose.

The aveaging, and scanning speed/resolution can be set. (See 3.2.1.a)

	Icon	Purpose of use	Remarks
View		Uses when you wish to look the whole sample.	Averaging (1 to 255)
Scan1		Uses when adjusting the image quality	
Scan2		Uses when selecting the field of view.	
Scan3		Uses when confirming the fine structure of the sample	Averaging (1 to 255) Scanning speed/Resolution
Scan4		Uses when checking the saving condition	Scanning speed/Resolution
Photo		Uses when saving the image automatically	

■ View

When the [View] button is clicked, the magnification switches to the lowest possible magnification at the present WD and the scanning speed changes to [Scan2]. When the [View] button is again clicked, the original magnification and original scanning speed are restored.

When the magnification and scanning speed are changed in view mode, the original magnification and scanning speed are canceled.

WD and minimum magnification

Minimum magnification	WD (mm)	Minimum magnification	WD (mm)
×40	4.4 to 5.4	×19	20.5 to 21.4
×37	5.5 to 6.4	×18	21.5 to 24.4
×35	6.5 to 7.4	×17	24.5 to 26.4
×33	7.5 to 8.4	×16	26.5 to 28.4
×30	8.5 to 11.4	×15	28.5 to 31.4
×27	11.5 to 13.4	×14	31.5 to 34.4
×25	13.5 to 15.4	×13	34.5 to 37.4
×23	15.5 to 16.4	×12	37.5 to 40.4
×22	16.5 to 18.4	×10	40.5 to 45.4
×20	18.5 to 20.4	×8 (×5)	45.5 to

(×5) ; When the Acc.V is set to 10kV or less.

■ Scan1

When the [Scan1] button is clicked, displays the exposure marker. (However, "Exposure Marker" is set "ON". Refer to 3.2.1.a for details)

The cursor of the exposure marker moves in accordance with the adjustment of image contrast (CNT) and brightness (BRT).

When the cursor is almost at the center of the screen, the image contrast and brightness become optimum. The relation differs a little depending on the specimen.

4.7.3 Adjustment of focus, contrast, brightness and astigmatism

4.7.3.a Focus

1. Automatic

   Click the text icon [AFD] and/or [ASD] buttons. A sharply focused image appears in a few seconds. It is necessary to add the icon to use the [AFD] and [ASD] buttons. (See 3.2.2.a)

2. Manual

   Point to manual control button [Focus].

   Drag it up and down using the right mouse button (for coarse adjustment) or the left button (for fine adjustment).

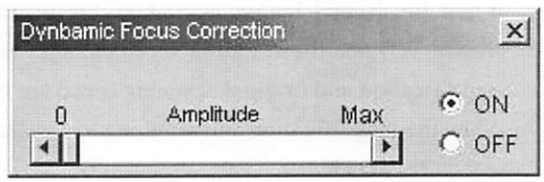
   [COARSE] for coarse adjustment or [FINE] for fine adjustment is displayed on the left part of the image display area.

   Dragging upwards makes over-focus, and dragging downwards under focus.

4.7.3.b Dynamic focus

Use dynamic focus correction when the sample is placed obliquely at a high angle, but the upper and lower edges of the image are not in focus.

1. Adjust the focusing the live image at the center.
2. Select "Menu bar" [Tools／Dynamic Focus Correction], or click the text icon [DFC] button. It is necessary to add the icon to use the [DFC] buttons. (See 3.2.2.a)



3. Select the OFF／ON button to [ON].
4. Click the text icon [Scan3] or [Scan4] button.
5. Correct the focusing with scroll bar button.

   Once correction has taken place, the amount of correction remains stored in the memory until the instrument is switched off, even if you set the OFF／ON button to [OFF].

When you focus the image in the high magnification, the image shows to flow in a certain direction before and after the focal point.

Observe it well before and after the focal point of the high magnification (× 10, 000 over). If it shows that an image flows, the astigmatism correction is necessary. Proceed to [Daily maintenance].

4.7.3.c Contrast and brightness

1. Automatic

   Click the text icon [ACB] button. An image with optimal contrast and brightness appears in a few seconds.
   It is necessary to add the icon to use the [ACB] button. (See 3.2.2.a)

2. Mannual

   Point to manual control button [Contrast] or [Brightness].

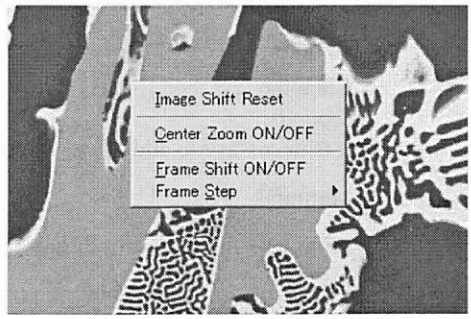
   Drag it up and down using the right mouse button (for coarse adjustment) or the left button (for fine adjustment).

   [COARSE] for coarse adjustment or [FINE] for fine adjustment is displayed on the left part of the image display area.

   Dragging upwards makes contrast be stronger (brightness be brighter), and dragging downwards contrast be weaker (brightness be darker).

4.7.4 Selection of the field of view

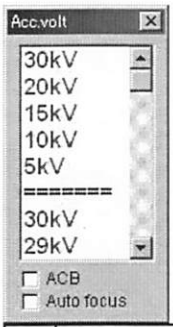
Click the right mouse button on the image display area. The popup menu appears, stage and image can be moved.



Function	Purpose of use	Operation	Remarks
Drag and drop	Move to the arbitrary position	Remove the check mark from [Center Zoom ON／OFF]. Drag the image	When the motor drivestage is installed, the motor stage is moved with the magnification of × 4,500 or less
Image shift reset	The image can be returned to previous position after being moved with except "Center Zomm" function.	Click [Image Shift Reset].	[SHIFT Reset] button can add. (See 3.2.2.a)
Click center	An arbitrary position can be moved to the center of the screen.	Remove the check mark from [Center Zoom ON／OFF]. Double-click the left mouse button with arbitrary position.	
Center Zoom	Moves an arbitrary position to the center of the screen and automatically zoom up the observation magnification by 15-step.	Check [Center Zoom ON／OFF]. Double-click the left mouse button with arvitrary position.	
Frame Shift	The image can be moved a specified fraction of the field of view. (10 to100%) Ex.) If [50%] is specified as the frame-feed amount, the field of view will move half way, and if [100 %] is specified, it will move all the way to the adjacent field.	Check [Frame Shift ON／OFF]. Specify [Frame Step] in percent. Move the mouse pointer to the edge of the image display area. Click the frame shift icon ⏮, ⏭. The image moves in the designated percentage of the field of view in the icon direction.	The motor drive stage is necessary [SHIFT] button can add. (See 3.2.2.a)

4.7.5 Setting the accelerating voltage

1. Click the active data display [Acc.V].
2. Double-click the desired value from the Acc.V dialog.
   The selected accelerating voltage is displayed at the top of dialog.



	Item	Explanation
1	Dialog・upper-side	Initial: 20, 15, 10, 5, 1.0kV When changing the accelerating voltage, the initial value is changed. Ex.) Selects [30kV]. →30, 20, 15, 10, 5.0kV
2	Dialog・lower-side	30 to 3.0 ; 1kV step、3.0 to 0.5; 100V step
3	ACB	Checks [ACB], ACB (automatic contrast and brightness) operatess when the accelerating voltage is changed.
4	Auto Focus	Checks [Auto Focus], AFD (automatic focusing) operates when the accelerating voltage is changed.

4.7.6 Adjustment of spotsize

Set the spotsize value corresponding to the purpose.

For routine observation, set the spotsize value to about 30.

For high resolution, set the spotsize to a value smaller than 30.

For analysis or work with a large probe current, set the spotsize to a value larger than 30.

■Manual control button

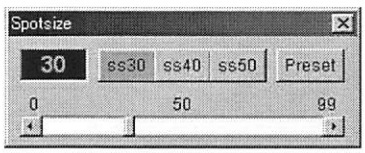
3. Point to manual control button [Spot Size].
4. Drag it up and down using the right mouse button (for coarse adjustment) or the left mouse button (for fine adjustment)

   [COARSE] for coarse adjustment or [FINE] for fine adjustment is displayed on the left part of the image display area.

   Dragging upwards increases the spotsize (toward 99), and dragging downwards decreases the spotsize (toward 0).

■Active data display

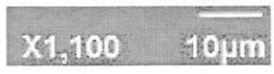
1. Click the active data display [Spotsize].
2. Adjust the spotsize value with "Spot Size dialog".



	Item	Explanation
1	Spotsize value	Displays the current spotsize value (ss)
2	ss30, ss40 and ss50 buttons	Initial : ss30(on), ss40, ss50 When the [ss＊＊] button is clicked, the spotsize is changed to clicked value. Adjust the spotsize value and click the [Preset] button. The [ss＊＊] is switched to the adjustment value (precent value).
3	Preset	The precent value is memoried to the clicked [ss＊＊] button.
4	Scroll bar	Adjusts the spotsize value. Range: 0～99

4.7.7 Setting the magnification

4.7.7.a Setting the magnification

1. Clcik near 

of active data display.
2. Double-click desired magnification from the magnification dialog.

   The magnification indication range of the dialog changes at the SEM condition.

   WD45.5mm or less and accelerating voltage 10kV or less.

   ×5 to ×300,000

   Except above condition

   ×8 to ×300,000

3. When you wish to fine-adjust the current magnification, uses the manual control [Mag-][Mag+] button.

4.7.7.b The magnification switches instantaneously

When using Menu bar [Preset Mag], it can switch the magnification instantaneously. It is recommend present the magnification you use frequently in image observation beforehand using [Standard Setup].

1. Click the Menu bar [Preset Mag], and click the desired magnification.
   Or, click the [MAG Preset] button. It can be changed to the registred magnification value (bottom of list) with the following operation.

   However, it is necessary to add the icon the to use the [MAG Preset] button. (See 3.2.2.a)

■ **Registering the preset magnification**

1. Click Menu bar [Pseset Mag／Preset].
2. Set the magnification using the [▲] or [▼] button in the list, or input numerical value directly in the magnification display box.

   If the magnification you have input is not based on the magnification provided, the set value is replaced to the nearest value provided.

   The bottom magnification in the list is linked with the INST MAG switch on the OKB and [MAG Preset] button.
3. Click [Close] buton.

4.7.7.c Others

■ Expansion/reduction of image size

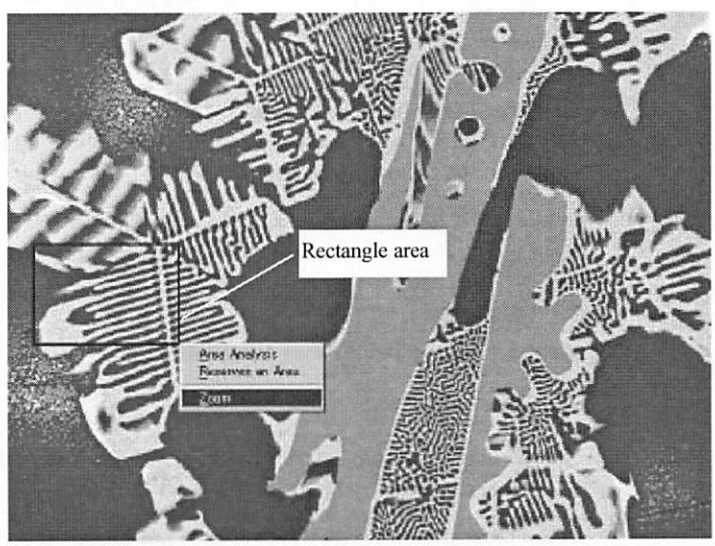
Each time you click the button, the image size switches over as follows.

	Button display;	Button display;
Scan1	320×240	160×120
Scan2	640×480	320×240
Scan3	640×480	320×240
Scan4	640×480	320×240
Freeze	640×480	320×240

■ Area zoom

A part of the image zoom in and it can be displayed with full size. (The motor drive stage is necessary.)

1. Drag the right mouse button to draw the rectangle area which you wish to zoom in the image display area
2. Click [Zoom].
3. The image in the rectangle area is moved to the center of the image display area, and it is displayed with full size.



4.7.8 Setting a focusing current that corresponds to the WD

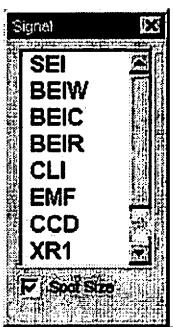
When the WD is known, you can roughly focus rapidly using this function. And, when the same WD (Ex.10mm) is desirable in X-ray analysis, you can keep the same WD by performing image focusing using the Z-axis of the stage after clicking [10mm].

1. Click active data display [WD].
2. Double-clicking the desired WD from the WD dialog.

   The focus current corresponding to the double-clicked WD is set.

4.7.9 Selection of signal

3. Click active data display [Signal].
4. Double-click the desired signal from the signal dialog.



	Item	Explanation
1	Spot Link	When it is checked, , the spotsize of the signal selected last time is maintained even when the signal is switched over. When it is not checked, the spotsize for the respective detector is set.

■Signal list

	SEI	BEIW	BEIC	BEIR	EMF	CLD	CLDIR	AUX	REF
Image data display	SEI	BEC BET BES	BEI	BEI	EMF	CLI	CLI	AUX	REF
Activedata display	SEI	BEIW	BEIC	BEIR	EMF	CLI	CLI	AUX	REF
LV mode	–	○	○	○	○	○	○	○	–

4.7.10 Displaying the frozen image

1. Click text icon [Freeze] button.

Scan	Operation	Display	Remark
View	Click [Freeze] button	A frozen image appears instaneously	
Scan1			
Scan2			
Scan3		A frozen image appears after that one frame has been acquired.	
Scan4		A frozen image appears instaneously	A frozen image surely appears after that one frame has been acquired even if you click [Freeze] button.
Freeze	Click [Freeze] button again	Changes to a live image before the [Freeze] button was clicked	
	Click one of [View], [Scan1][Scan2][Scan3]and [Scan4]	Changes to a live image of clicked button	
	Click [Cancel] buttonon the "Message	Changes to a live image before the [Freeze] button was clicked	

■Message

	Message／Button／Explanation
Frozen	
	Zoom : A frozen image is displayed in the entire screen, the following buttons are displayed Image Size : An image is displayed corresponding to the size (a number of pixels) of the frozen imag. Image is moved to the dragged direction. Display Size : An image is displayed corresponding to the CRT size. When the image size is smaller than the screen, the blank space around it is displayed in black. Close : The image returns to the original freeze state it had before the [Zoom] button was clicked. Save : The precent frozen image can be saved. "Image Savung Window" displays When checking the [Auto Save] with "Standard Setup window", the precent frozen image is saved automatically. Cancel : Changes to a live image

4.7.11 Acquiring the image (Photo)

1. Click the text icon [Photo] button.

The diaplayed image is saved automatically. ([Auto Save] is to be checked in advance. Refer to 3.2.1.a for details)
The automatic saving can be selected the photospeed and number of pixels. (See 3.2.1.a)

	Photo speed	Number of pixels	Remarks
Photo	20 (16.67) s	1280×960	
	80 (66.67) s	1280×960	
	160 (133.3) s	1280×960	
		2560×1920	High quality

Line frequency: 50Hz [Values in brackets: 60Hz]

4.8 Daily maintenance

Check the following items regularly for using the SEM under a stable condition, and perform the adjustment work if necessary. Refer to [Trouble shooting], when an image is not improved even if you adjusted the following items.

Gun alignment (align the axis of electron beam)

When a sharp image cannot be obtained to not align the axis of electron beam.

Bias adjustment

Set to proper value the filament current (L.C value), or perform it with the gun alignment.

Generally speaking, when the L.C value is high, the service life of the filament becomes shorten though brightness and performance rise. On the contrary, when the L.C value is low, brightness and performance deteriorate though the service life of the filament becomes longer.

Adjusting the movable aperture

When a sharp image cannot be obtained even when you have adjusted the focus by the greatly changing of observation condition (accelerating voltage, WD, spotsize)

Astigmatism correction

When the image appears to flow in a certain direction before and after the focal point for observing with the high magnification (×10,000 over)

4.8.1 Gun alignment

If filament heating is insufficient or if the electron beam is not aligned with the axis, a sharp image cannot be obtained even when you have adjusted the focus. In such a case, perform the gun alignment.

4.8.1.a Auto gun alignment

The filament heating and alignment (Tilt／Shift) will be adjusted automatically.

1. Click text icon [Gun] button.
2. Select [Full Auto] or [Semi Auto]of the Auto Gun Alignment
3. Click [Start] button.

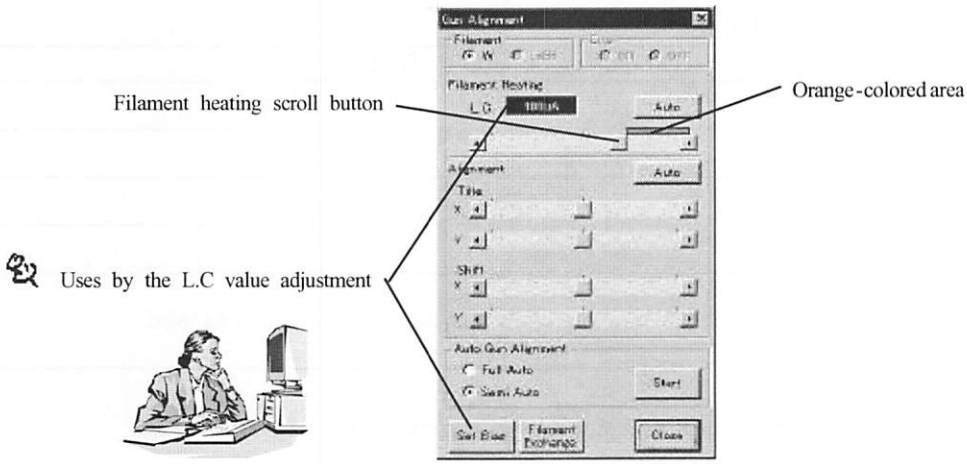
4.8.1.b Manual gun alignment

When you want to change the Spotsize (S.S) as followings, perform the manual gun alignment.
The S.S. is raised for X-ray analyzing.
The S.S. is raised for observing the image in LV mode.
The S.S. is lowerd for obtaining the sharp image.

1. Mount the sample and displays the secondary electron image (SEI).

   Select one of sample as followings, and perfom the gun alignment.
   The conductive sample which there is no problem even if it is damaged by the electron beam.
   Specimen holder
   Specimen stub

2. Click text icon [Gun] button.
3. Set the filament heating scroll bar button is fron t of the orange-colored area.
4. Set the S.S. to [30], and adjust the Alignment-Tilt [X／Y] scroll buttons so that the image becomes as bright as possible.
5. Move the filament heating scroll bar button to the left edge.

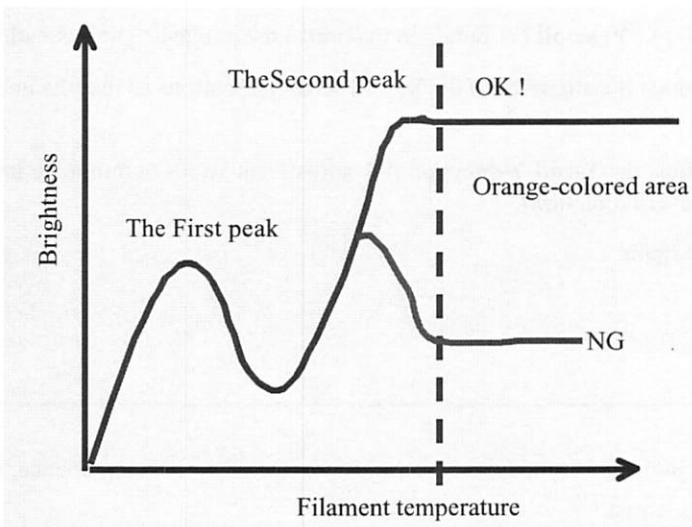


6. When you slowly drag the scroll bar button to the right, the image becomes bright a moment in the vicinity of the scroll bar center. (The first peak)

7. Further drag this button to the right to display an image, stabilize the load current (L.C) and the image brightness will not change from a certain position onward. (The second peak: saturation point)

8. Set the filament scroll bar button to just the left of the saturation pint.

   If you set this button to the right of the saturation point (into orange-colored area), an over-current will occur, causing the life of the filament to be reduced.



Adjustment of [L.C] is carried out with [Set Bias].

Acc.V (kV)	L.C. (μ A)	Remarks
30, 25, 20, 15	Approx. 85	
10	Approx. 75	
5	Approx. 60	
3.0, 2.5	Approx. 50	
2.0, 1.5	Approx. 45	The [Coarse] button in Bias Set window cannot be used.
1.0	Approx. 40	

9. Set the target on the image, and focus the image with the magnification ×10,000

10. Select Menu bar [Tools／OLWobller], or click the [Wobb] button.
It is necessary to add the icon to use the [Wobb] button. (See 3.2.2.a)

11. Adjust the X-and Y-direction fine adjustment knobs minimize image shift (make not to move the in every direction).

When you want to change greatly the S.S. and display the image, perform adjustment after the Step 12.

12. Raise gradually the S.S from [30], and set it to [90].

When an image disappears on the way to be reising S.S. (for example near S.S. [60]), adjust the alignment-Shift [X／Y] scroll bar buttons so that the image becomes as bright as possible. And if the image does not appear, adjust to obtain the image with the manual control button [Contrast] or [Brightness].

13. Adjust the alignment-Shift [X, Y] scroll bar button to maximize the image brightness with S.S. [90].

14. Set the S.S. to [30], and adjust the alignment-Tilt [X／Y] scroll bar buttons so that the image becomes as bright as possible.

15. Start OL Wobbler, and adjust the X-and Y-direction fine adjustment knobs to minimize image shift (make not to move the in every direction).

16. Repeat step 12 to 15 once again.

About set bias
When the accelerating voltage is changed while the Bias Adjustment window is being opened, the window is closed and the value adjusted is stored.

4.8.2 Adjustment of the MAP

If the MAP (movable aperture) deviates from the optical axis, it may be impossible to obtain a sharp image even if the lens is focused, or a limitation may be imposed on the visual field. After peforming the following work, confirm the MAP, and adjust it if necessary.

- If the OL aperture was changed over, or the aperture foil replaced.
- If the accelerating voltage was greatly changed.
- If the WD was greatly changed.
- If the spotsize was greatly changed.

1. Set the magnification to about ×10,000, then focus the image.
2. Select Menu bar [Tools／OLWobller], or click the [Wobb] button.
   It is necessary to add the icon to use the [Wobb] button. (See 3.2.2.a)

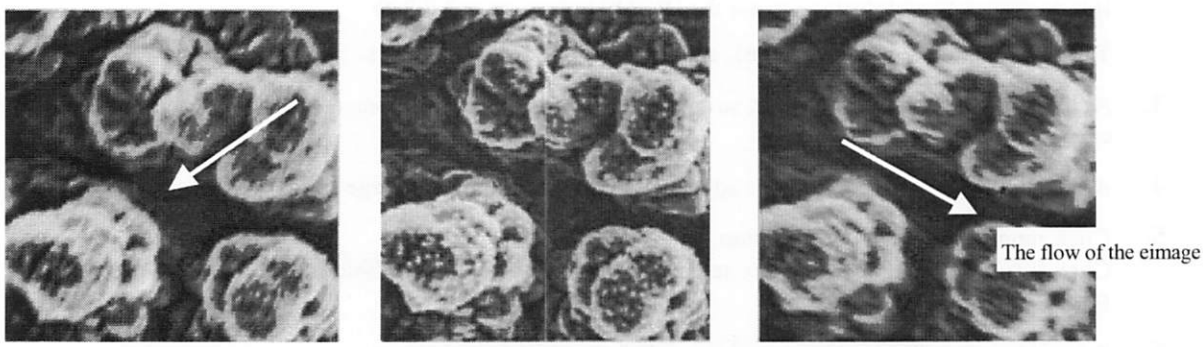
   The scanning mode becomes Scan1, and the running message appears.
3. At this time, an image is not shift, so omit the following step. An image shifts in every direction greatly, carry out the following step.
4. Adjust the X- and Y-direction fine adjustment knobs to minimize image shift.
5. Click running message [OFF] button.
   Click [Wobb] button once again or select Menu bar [Tools／OL Wobbler] to stop the OL Wobller function..
6. Select Menu bar [Tools／Lens Reset], or click the [LENS Reset] button
   It is necessary to add the icon to use the [LENS Reset] button. (See 3.2.2.a)
7. Repeat step 2 to 6 once again.

4.8.3 Astigmatism correction

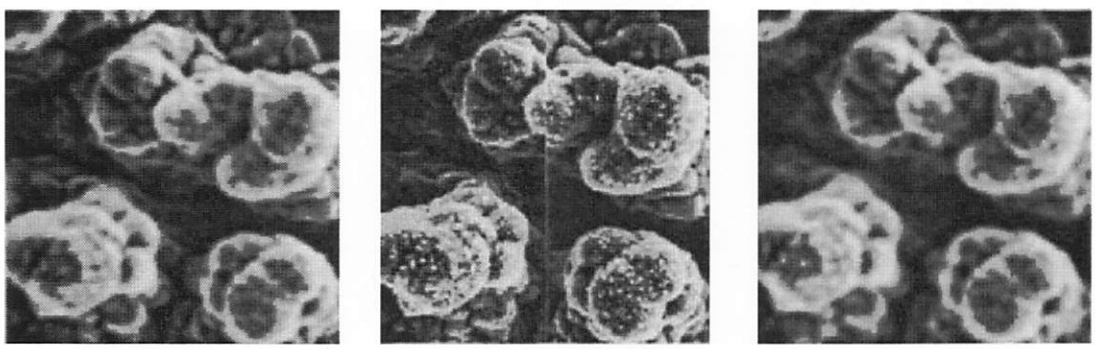
Astigmatism is not noticeable at low magnification (about ×1,000), however if you raise the magnification to a high value, the image appears to flow in a certain direction before and after the focal point, making it difficult to perform accurate focusing (image with astigmatism). If there is no astigmatism, blurring occurs uniformly in all directions before and after the focal point due to mis-focusing, hence the image can be accurately focused. (image without astigmatism) Astigmatism can also occur when the work shown at right is carried out, so correct it if necessary.

- If the OL aperture was changed over, or the aperture foil replaced.
- If the accelerating voltage was greatly changed.
- If the WD was greatly changed.
- If a magnetic sample is being observed.

【 Image before astigmatism correction】



【 Image after astigmatism correction】



1. Set the magnification to a value slightly higher than the magnification used for the current observation.
2. Focus the image using the manual control button [Focus].
3. If the image appears as shown in the lower photographs before and after the focal point (blurring occurs due to mis-focusing), there is no astigmatism, so omit the following steps.
4. Adjust manual control button [StigmX] and [StigmY] so as to obtain the sharpest image.
5. Select Menu bar [Tools／Lens Reset], or click the [LENS Reset] button
   It is necessary to add to the icon use the [LENS Reset] button. (See 3.2.2.a)
6. Repeat steps 2 to 5 once again.

4.9 Observation of backscattered electron image

4.9.1 Operation principle

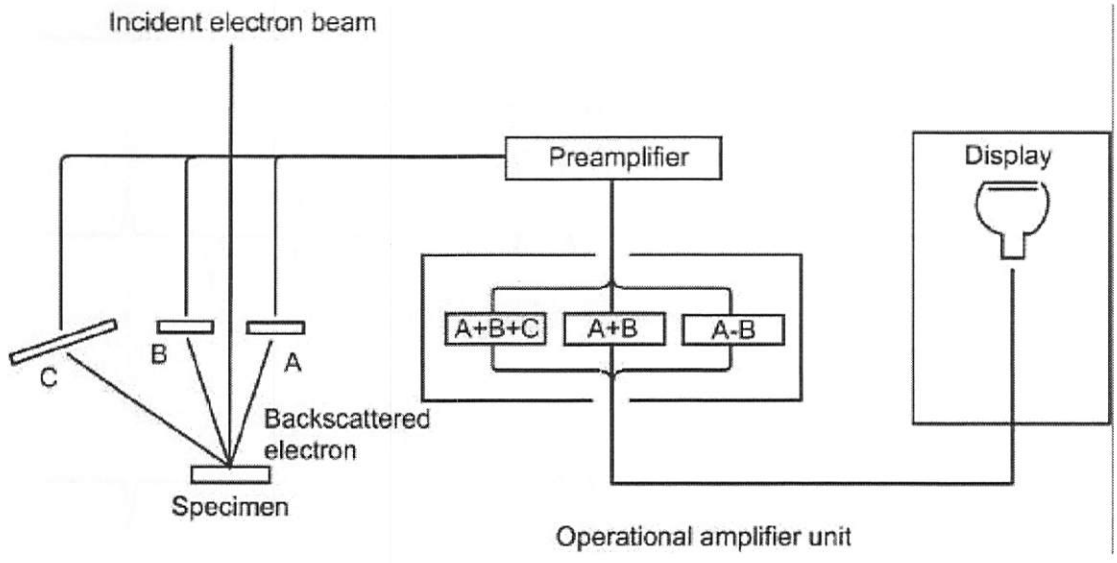
■ Formation of composition image and topography image

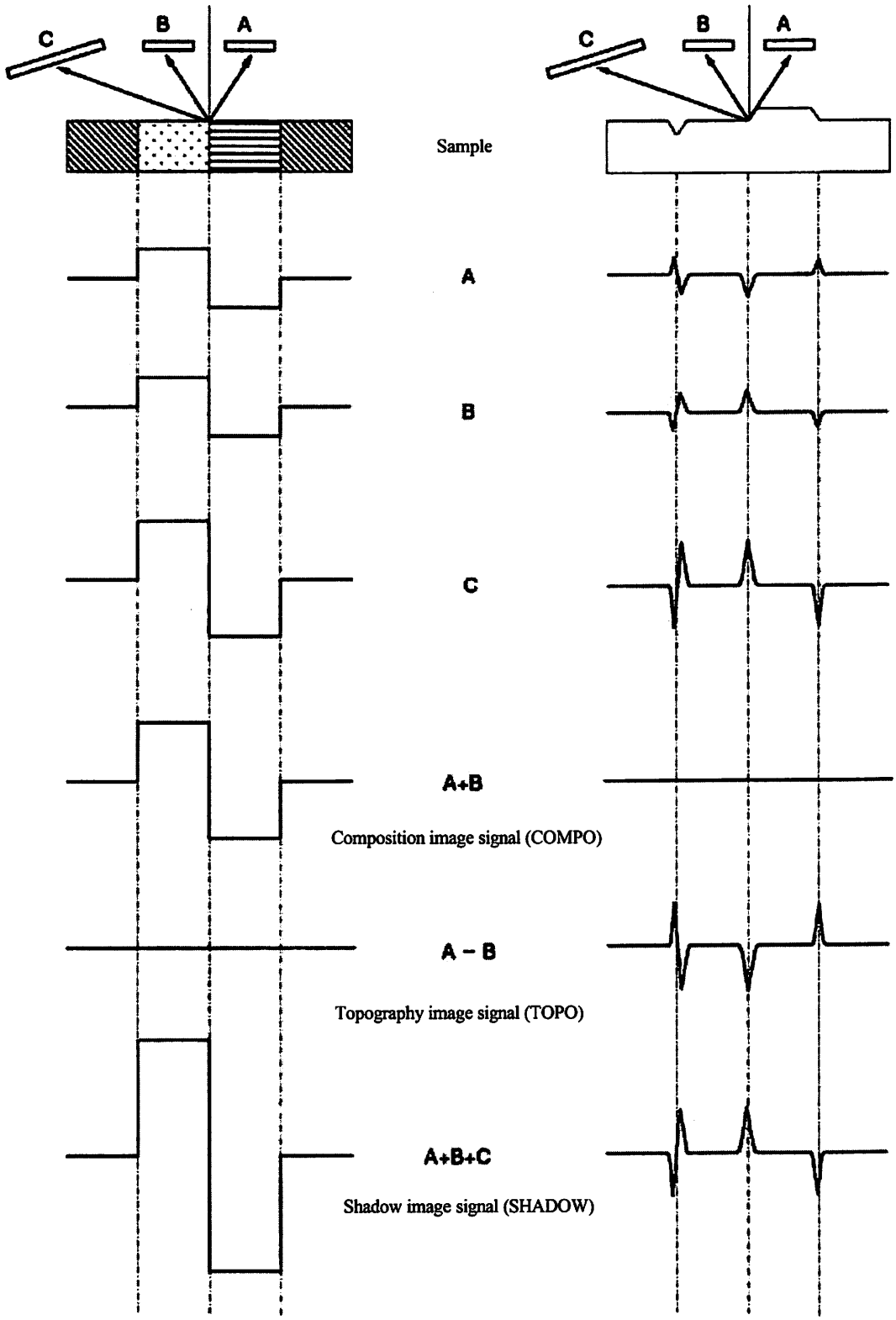
A lower figure is a block diagram showing the basic signal flow for image formation. The specimen surface is scanned by an incident electron beam to generate backscattered electron which have information of the surface topography, physical and chemical properties of the specimen. These backscattered electrons with said information are deleted from different directions by semiconductor detecting elements A and B are arranged symmetrically at an optical axis, and the detected electrons with quantitative changes are converted into electrical signals. The two signals thus obtained are amplified by the preamplifier, and fed into the operational amplifier. The operational amplifier further amplifies the two signals, and at the same time, adds or subtracts these signals from detecting elements A and B.

The adds signal is used as a video signal for displaying COMPO BEI, and the subtracted signal saves as a video signal for displaying TOPO BEI. The desired video signal is fed to CRT for display.

■ Formation of shadow image

The electrical signals of detecting elements A and B make are composition signal, and add this signal to obtained electrical signal by the detecting element C for SHADOW. The consequence is that these signals are used as a video signal for displaying SHADOW BEI.




C
B
A
Sample
A
B
C
A+B
Composition image signal (COMPO)
A – B
Topography image signal (TOPO)
A+B+C
Shadow image signal (SHADOW)

4.9.2 Observation of backscattered electron image

The backscattered electron, which is information from the surface of the sample is detected, and The unevenness of the specimen surface and the distribution of compositional elements can be observed by detecting the backscattered electrons having the information of specimen surface. Display the secondary electron image first, then you can display the backscattered electron image smoothly.

7. Vent the specimen chamber to atmospheric pressure, and install the sample.
8. Display the secondary electron image.
9. Click active data display [Signal], and double-click [BEIW] of the signal dialog.
10. Select the kind of signal from the BEIW menu.
    When the image brightness is inappropriate click text icon [ACB] button. It is necessary to add the icon to use the [ACB] button. (See 3.2.2.a)
11. Focus the image, and adjust the image quality.

    Changing the signal type may change the image brightness. In that case, adjust the image brightness by means of text icon [ACB] button and manual control button [Contrast][Brightness].

■A guide for observation condition

	Criterion	Tendency	Caution
WD	10 to 20mm	Image is brighter at shorter WD	Take care lest detector hits sample
Accelerating voltage	15 to 25kV	Image is brighter at higher accelerating voltage	Some sample are damaged by electron beam
Spotsize	30 to 60	Image is brighter at larger spotsize	Same as above
MAP	1/2	Image is brighter at [2]	

A feature of backscattered electron image

The lighter the element in a composition image, the darker is the image. The heavier element, the brighter is the image.

The Shadow image shows as if light was illuminated from the right side of the sample.
In case of convex portion, the right side appears bright and the left side dark. In case a concave portion, the above is reversed.

4.10 Image observation in LV mode

4.10.1 The dried sample

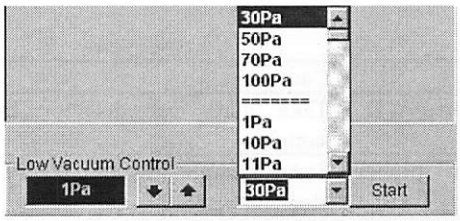
1. Vent the specimen chamber to atmospheric pressure, and install the sample (the dried sample such as paper, cloth and resign).
2. Switch [Vac. mode] to [LV], then eacuate the specimen chamber.
3. Click text icon [HT] button get to [HT ON].
4. Set the accelerating voltage to [15kV].
5. Set the pressure in specimen chamber to [30Pa].

   Select the numerical value from the list of Low Vacuum Control tool, and click [START] button.

   The [Pressure] display starts blinking. When the pressure setting isfinished, the flickering stops. (It takes several minutes for completion of the pressure setting.)

   When the pressure setting is not finished after the elapse of five minutes or the valve is locked during the pressure setting period (the pressure setting is not finished), the pressure setting is interrupted and a message describing the interruption is displayed. Close the message and adjust the pressure once again.

【Low Vacuum Control tool】



	Item	Explanation
1	Pressure value	The pressure selected from the list is displayed When the [Start] button is clicked, the pressure value is flicking during operation. When the pressure setting is finished, flicking stops
2	↑、↓	[↑] : The pressure value decreases (specimen chamber pressure goes low) [↓] : The pressure value increases (specimen chamber pressure goes high)
3	Pressure list	1Pa, 10Pa to 130Pa (1Pa step), 130Pa to 270Pa (10Pa step) Upper-side : 30, 50, 70, 100Pa (initial) When adjusting the pressure, the preset value is switched Selection method : left-click on the value
4	Start	Start: The pressure setting starts Stop: The pressure setting interrupts

6. Set the [Spotsize] of active data display to [30 to 60] and select [1] for the shadow level of the BEIW menu.
7. Click text icon [View] button.
8. Set the stage position to sample center. (X=23mm, Y= 25mm)
9. Observe the image using the automatic function ([ACB], [AFD], [ASD] button).
   It is necessary to add the icon to use the automatic function ([ACB], [AFD] and [ASD] buttons). (See 3.2.2.a)
10. Switch over the scanning speed to [Scan1].
11. Adjust the manual control button so as to obtain the optimum image quality.
12. For assuming charging-up, increase the magnification by about four steps and observe the image.
13. When you observe the charged image, increase the pressure in the specimen chamber and/or adjust spotsize value so that charging vanishes.

■ Reration between pressure-charging up-brightness

Low ←	Pressure	→ High
Large ←	Charging up	→ Small
Bright ←	Brightness	→ Dark

Charging up?
A phenomenon where by part of the image becomes particularly bright as a result of the sample acquiring an electrical charge

4.10.2 The sample containing moisture

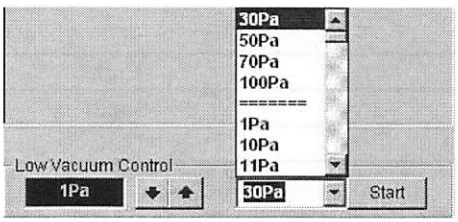
1. Vent the specimen chamber to atmospheric pressure.
2. Install the sample not containing moisture (metals or others, a specimen holder itself) first to execute [Auto Gun Alignment].
3. Switch the active data display [Vac. mode] to [LV], then eacuate the specimen chamber.
4. Set the pressure in specimen chamber to [50 to 70Pa].

   Select the numerical value from the list of Low Vacuum Control tool, and click [START] button.

   The [Pressure] display starts blinking. When the pressure setting isfinished, the flickering stops. (It takes several minutes for completion of the pressure setting.)

   When the pressure setting is not finished after the elapse of five minutes or the valve is locked during the pressure setting period (the pressure setting is not finished), the pressure setting is interrupted and a message describing the interruption is displayed. Close the message and adjust the pressure once again.

【 Low Vacuum Control tool】



	Item	Explanation
1	Pressure value	The pressure selected from the list is displayed When the [Start] button is clicked, the pressure value is flicking during operation. When the pressure setting is finished, flicking stops
2	↑、↓	[↑] : The pressure value decreases (specimen chamber pressure goes low) [↓] : The pressure value increases (specimen chamber pressure goes high)
3	Pressure list	1Pa, 10Pa to 130Pa (1Pa step), 130Pa to 270Pa (10Pa step) Upper-side : 30, 50, 70, 100Pa (initial) When adjusting the pressure, the preset value is switched Selection method : left-click on the value
4	Start	Start: The pressure setting starts Stop: The pressure setting interrupts

5. Vent the specimen chamber to atmospheric pressure, and install the sample (containing moisture, like a biological sample and botanical sample).
6. Evacuate the specimen chamber.
7. Click text icon [HT] to get [HT ON].
8. Adjust manual control butons so as to obtain the optimum image quality.
9. For assuming charging-up, increase the magnification by about four steps and observe the image.
10. When you observe the charged image, increase the pressure in the specimen chamber and/or adjust spotsize value so that charging vanishes.

■ Reration between pressure-charging up-brightness

Low ←	Pressure	→ High
Large ←	Charging up	→ Small
Bright ←	Brightness	→ Dark

Charging up?
A phenomenon where by part of the image becomes particularly bright as a result of the sample acquiring an electrical charge

4.11 Management of user file

This instrument is compatible with multi-users. The SEM operating conditions for each user are managed using user files and are usually saved on the hard disk in the computer.

The saved file contains the SEM conditions when the user logged out by, custom recipe files created by the user and stage files (the motor drive stage is necessary).

These files can be backed up on a disk (floppy disk, magneto optical disk, etc.), in a batch, so that if the file on the hard disk is damaged or erased, the back-up disk can be used to install the file.

4.11.1 Backing up users file

1. Select the Menu bar [File／Backup Users File].
2. Insert the media (floppy disk, magneto optical disk) in the personal computer.

   If you wish to use the floppy disk, purchase a commercially available MS-DOS formatted disk.
3. Select of the media of the place of the backup and a directory, and click [OK] button.
4. Custom recipes (including a recipe image) and other files (SEM status) made by the currently logged-in user are backed up, and dialog closes.

   If it is lack of capacity, a message dialog is opened and use file data cannot be backed up.

4.11.2 Installing users file

5. Select [File／Install Users File] on the menu bar.
6. Insert the back-up disk in the personal computer, select directory and click [OK] button.
7. The user files are installed to the hard disk of the personal computer, and dialog closes.

   If it is lack of capacity, a message dialog is opened and use file data cannot be installed.

4.11.3 Recipe

When observing a specimen through the SEM, it is generally necessary to set observing conditions suited to the specimen. This SEM let you set appropriate observing conditions simply by selecting a recipe suited to the specimen from representative observing conditions that are recorded on the standard recipe. It also lets each user create and save containing observing conditions for all types of specimens. Also the created recipe can be copied to another recipe file at any time.

4.11.3.a Registering

1. Acquire the image that you want to register the observation condition. (Recommend; Freeze mode)
2. Click text icon [Recipe] button.
3. Select [Custom Recipe], and click [Add] button.
4. Input recipe name (within 8 characters) and note, and click [OK] button.
5. The currently displayed recipe is registered to custom recipe and dialog closes.

Image paste

When the [Image paste] is checked, the live image (except Scan1 mode) or frozen image is recorded and saved in the recipe.

This [Image paste] reflects the image at the point when [OK] button was clicked. This means that the image whose entire area is not displayed may be saved and recorded. It is recommended not to use Scan3 and Scan4 in which the scanning speed is slow, but instead freeze image.

4.11.3.b Editing

1. Click text icon [Recipe] button, and select [Custom Recipe].
2. Select recipe file from the list and click [Edit] button.
3. Input recipe name (within 8 characters) and note, and click [OK] button.
4. The recipe file name is changed and dialog closes.

4.11.3.c Deleting

1. Click text icon [Recipe] button, and select [Custom Recipe].
2. Select recipe file from the list and click [Edit] button, then click [Delete] button.
3. Click [OK] button.
4. The selected recipe file is deleted and dialog closes.

4.12 Image operation

4.12.1 Brightness correction

8. Display the frozen image.
9. Select the Menu bar [Image／Look-up Table/Color], or click the [LUT] button.
   It is necessary to add the icon to use the [LUT] button. (See 3.2.2.a)
10. Click the brightness correction buttonand adjust the correction level.
11. Click [OK] button.

    The original image replaced with the brightness corrected image.

4.12.2 Color display

Using color dislay of the image allows a structure of interest to be emphasized.

1. Display the frozen image.
2. Select the Menu bar [Image／Look-up Table/Color], or click the [LUT] button.
   It is necessary to add the icon to use the [LUT] button. (See 3.2.2.a)
3. Click  button and select [Standard Color] or [Custom Color].
   The standard color cannot be changed.
   To select [Custom Color], select the color level and set a numerical value (1 to 255) with RGB scroll bar.
4. Click [OK] button.
5. The original image replaced with the color-processed image.

■ About color level

When 16-color levels are set

The colors set at [Level 1 to 16] are replaced in a range in which brightness is divided into 16 equal points.

When 5-color levels are set

An image whose brightness level is set is displayed in the set color and others in black.

Level	Brightness	Color
Level 1	1 to 15	Black
Level 2	16 to 31	Blue
Level 3	32 to 47	Green
Level 4	48 to 63	Cyan
Level 5	64 to 79	Red
Level 6	80 to 95	Magenta
Level 7	96 to 111	Yellow
Level 8	112 to 127	White
Level 9	128 to 143	Gray
Level 10	144 to 159	Light blue
Level 11	160 to 175	Light green
Level 12	176 to 191	Light cyan
Level 13	192 to 207	Light red
Level 14	208 to 223	Light magenta
Level 15	224 to 239	Light yellow
Level 16	240 to 255	Light white

4.12.3 Dual split screen display

This function is compatible only with the image file. It can be used conveniently for comparison and observation of two different images because it can synthesize two image files on display.

1. Display the frozen image.
2. Select the Menu bar [Image／Dual Split Screen], or click the [Dual] button.
   It is necessary to add the icon to use the [Dual] button. (See 3.2.2.a)
3. Select image file from the dialog, and click [OK] button.
4. The image displayed at the right and the frame moves to the left. Select another file and click [OK] button. The image is displayed at the right and left and the scroll bar appears. Use the scroll bar to move the image.
5. When it is desired to replace a recalled image with a different image, double-click the left mouse button on the image. Select an image file from the dialog and click [OK] button.
6. When the menu bar [Write] button is clicked, the currently displayed image is turned frozen.

4.12.4 Quad split screen display

This function is compatible only with the image file. It can be used conveniently for comparison and observation of four different images because it can synthesize two image files on display.

1. Display the frozen image.
2. Select the Menu bar [Image／Quad Split Screen], or click the [Quad] button.
   It is necessary to add the icon to use the [Quad] button. (See 3.2.2.a)
3. Select image file from the dialog, and click [OK] button.
4. The image displayed at the upper-right and frame moves to the bottom-right. A file is selected in order of the bottom left, the upper left in the same way, and click [OK] button.
5. When it is desired to replace a recalled image with a different image, double-click the left mouse button on the image. Select an image file from the dialog and click [OK] button.
6. When the menu bar [Write] button is clicked, the currently displayed image is turned frozen.

4.12.5 Digital zoom

This function copes with frozen image and an image file. It is convenient when only a certain point is expanded and if wants to observe it because an image inside the frame is magnified two times or four times and it can be indicated.

1. Freeze the display image, or open the image file
2. Select theMmenu bar [Image／Digital zoom], or click [Zoom] button.
   It is necessary to add the icon to use the [Zoom] button. (See 3.2.2.a)
3. Select [×2] or [×4].
4. Drag the frame and determinate the position to be enlarged, and click [Zoom in] button.
5. The inside of the range frame enlarges to fill the entire screen. To appear the original image, click [Zoom out] button.
6. When the menu bar [Write] button is clicked, the currently displayed image is turned frozen.

4.12.6 Scaler

The scaler is capable of setting markers at any positions on an image, and measuring and display the length between two markers. Line widths (in X-, Y,- and D- directions) can be measured.

1. Display the frozen image or open an※ Image file.
2. Select Menu bar [Image／Scaler], or click the [Scaler] button.
   It is necessary to add the icon to use the [Scaler] button. (See 3.2.2.a)
3. Select a measuring mode

   When you want to measure the horizontal direction･･･Select [X].
   When you want to measure the vertical direction･･･Select [Y].
   When you want to measure the diagonal direction･･･Select [D].
4. Drag the line cursor and specify the measurement point.
   The measured value is displayed in real time on the screen.
5. When clicking the [Write] button, the condition that it is indicated at precent becomes one sheet of frozen image.

The four-line cursors appear when you select the measuring mode [D]. When you set the measuring point, drag each cursor, or drag an intersection of cursor.

When dragging an intersection of cursor, a pair of vertical and horizontal line cursors can be moved together.

※Image file

The saved file of rewriting the image by the following operation cannot be measured.

Dual Screen、 Quad Screen、 Digital Zoom、 Dual Magnification

The saved file except the above operation can be measured. (The text file of the same name exist to the saved folder, and do not overwrite the data.)

4.12.7 Multi point measurement

The scaler is capable of setting markers at any positions on an image, and measuring and display the length between two markers or the diameter of a circle. Distances between any two positions, and diameters of circles can be measured.

1. Display the frozen image or open an※ Image file.
2. Select Menu bar [Image／Multi Point Measurement], or click the [Scaler] button.
   It is necessary to add the icon to use the [Scaler] button. (See 3.2.2.a)
3. Select a measuring mode.

   When you want to measure the distance between the two points ···Select [Line].
   When you want to measure the diameter of the circle···Select [Circle].
4. Specify the measurement point by dragging the mouse.

   When the "Line" is selected··· The position where the left mouse button is pushed becomes the start point, the position where the mouse button is released the end point. A line having the distance between the two points you drag the mouse is displayed. When the mouse button is released, the measured value is displayed on the monitor.

   When the "Circle" is selected··· The position where the left mouse button is pushed becomes the center of the circle. A circle having the diameter corresponding to the distance you drag the mouse is displayed.

   When the mouse button is released, the measured value is displayed on the monitor.
5. When clicking the [Write] button, the condition that it is indicated at precent becomes one sheet of frozen image.

Up to 10 measurements in total can be carried out in the Line and Circle modes.
The measured value, line and／or circle can be erased. Put the mouse pointer on it and click the right button.
The measured value indication can be moved. Drag it with left mouse button.

※Image file

The saved file of rewriting the image by the following operation cannot be measured.

Dual Screen、Quad Screen、Digital Zoom、Dual Magnification

The saved file except the above operation can be measured. (The text file of the same name exist to the saved folder, and do not overwrite the data.)

4.12.8 Dual Magnification

This is the function to simultaneously display the original image (at the left) and an enlargement of the partial image specified with the magnification frame (at the right) dividing the screen into two. Twofold or fourfold magnification can be selected.

1. Display the frozen image or open an image file.
2. Select Menu bar [Image／Dual Magnification], or click the [D-Mag] button.
   It is necessary to add the icon to use the [D-MAG] button. (See 3.2.2.a)
3. Select [×2] or [×4].
   The original image is displayed with a magnification frame on it in the left half of the screen and an enlargement of the partial image in the magnification frame in the right half of the screen.
4. Specify the range to be enlarged by dragging the magnification frame.
   If the range can be specified in the currently selected field of view, you can omit the operation in the next step. If you want to change the field of view, operate as follows.
5. Click [Position] and change the field of view.
   The original image is displayed together with the range frame across the whole screen. Drag the range frame over the field of view you want to get and click [OK]. The image in the range frame is displayed in the left half of the screen and an enlargement of the partial image specified with the magnification frame in the right half of the screen. Repeat the operation in Steps 3 and 4, if necessary.
6. When clicking the [Write] button, the condition that it is indicated at precent becomes one sheet of frozen image.

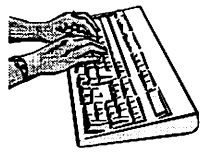
4.12.9 Text Editor

When you wish to enter the text icon on the image display after showing the image, operate as followings. The entered text with the image can be saved.

1. Display the frozen image
2. Select the Menu bar [Edit／Text Editor], or click the [Text] button.
   It is necessary to add the icon button to use the [Text] button. (See 3.2.2.a)
3. The cursor is displayed on the upper left corner of the image display area.
4. Enter the text from the keyboard.

   Some of SEM function cannot be used during the text editing.

   "LineFeed" is not possible using the [Enter] key when the "Symbol list window" is selected.
   Press [Enter] key after clicking on the SEM



5. Exit text editor.

   Click the Text Editor menu [Exit] button.

■Operation list

Function	Key	Remarks
Start		Select Menu bar [Edit／Text Editor]
Cursor shift	↑ ↓ ← →	The cursor moves up, down, left or right. The cursor stops at the top, bottom, left or right end without a carriage return taking place.
	End	The cursor moves to the right end of the line in which it is located.
	Home	The cursor moves to the left end of the line in which it is located.
Backspace	Back space	The cursor moves back to the left. Text over which the cursor passes is deleted.
Line feed	Enter	The cursor moves to the left end of the next line.
Insertion	Insert	Text is inserted at the location of the cursor. The text to the right of the cursor shifts to the right. If the text shifts to the right end, it disappears off the right end of the screen without a carriage return taking place. If you press the [Insert] key again, text insertion ends.
Deletion	Delete	The text at the location of the cursor is deleted, and the text at the right of the cursor side shifts to the left.
Clear screen		Click [Clear] button, and click the Clear window [OK] button.
Character control	Caps Lock	Each time you press the [Caps Lock] key, the status of the key changes over to ON (upper case letters) or OFF (lower case letters).
Background		[Image] : The background becomes on the image [Black] : The background becomes on the black color
Symbols		Click [Symbol], select from the list window. Note) "LineFeed" is not possible using the [Enter] key when the "Symbol list window" is selected. Press [Enter] key after clicking on the SEM
Exit		Click [Exit] button

4.13 Management of the image

4.13.1 Saving an image

! CAUTION

Change and don't save the extension of the file name which has already been in the saving location.
If the extension (file type) is changed with the same existing filename and saved in the saving location, the SEM information (*.TXT) will be overwritten and the previous contents will be cleared. (no message inquiring if the information is to be overwritten will appear) Designate another location for saving or change the file name before saving.

1. Display the frozen image or image that was rewritten by "Image operation".
2. Select the Menu bar [File／Save Image], or click the [Save] button.
   It is necessary to add the icon to use the [Save] button. (See 3.2.2.a)
3. Designate the location for saving (drive, folder) and enter the file name.
4. When the [Paste Text] is checked, the text and photo data are saved as an image. Otherwise, the text and photo data will be saved in separate files.
5. Click [OK] button.
   The image is saved and closes the dialog.

4.13.2 Opening the image file

1. Select the Menu bar [File／Open Image File], or click the [Open] button.
   It is necessary to add the icon to use the [Save] button. (See 3.2.2.a)
2. Select a file and click [Open] button.
3. The selected image is located and displayed, then closes the dialog.

4.14 Creating the report

DTP (destop publishing) for printing images, SEM data and text on a general-purpose printer can be used for convenience in preparing reports.

Before using DTP, be sure to install the printer driver. Otherwise, an error will occur when DTP is used. Therefore, install the printer driver for Windows even if the printer will not be used. If the user's general-purpose printer is used, install its printer driver according to the instruction manual for the printer.

Flow of repor creating···Ex.)

Startup DTP

Select documnt （Open DTP file）

Paste image

Input comment and other information

Print

Save document

Exit DTP

4.14.1 Startup DTP

1. Display the frozen image.
2. Select Menu bar [File／Report], or click the [Report] button.
   It is necessary to add the icon to use the [Report] button. (See 3.2.2.a)
3. The DTP program starts and the DTP window opens.

4.14.2 Exit DTP

1. Select Menu bar [File／Exit] on the DTP window.
2. The DTP program ends and the DTP window closes.
3. If there is any DTP that is not saved, the message dialog will appear.

   When clicking [Yes] button, the file saving dialog will appear.

   When clicking [No] button, the DTP program ends and the DTP window closes.

   When clicking [Cancel] button, closes the message dialog.

4.14.3 Select document

1. Click one of  buttons in the DTP window.

4.14.4 Pasting the image

! CAUTION

If the image has been copied, the DTP program may not work.
When pasting the image, copy the image by the GUI or IFS (option) in advance.

■Pasting the precent displayed image

1. Copies the frozen image on the image display area using [File／Image copy] on the menu bar of SEM-GUI.
2. Startup DTP, and select the document.
3. Select Menu bar [Edit／Image Paste] of the DTP window.

   The image is pasted to the image-display area of the selected document, and SEM information (magnification, accelerating voltage, etc.) of the image is displayed.

■Pasting the image file

1. Startup DTP, and select the document.
2. Click one of  buttons on the DTP window.
3. Select an image file and click [Open] button.

   The image is pasted to the image-display area of the selected document, and SEM information (magnification, accelerating voltage, etc.) of the image is displayed.

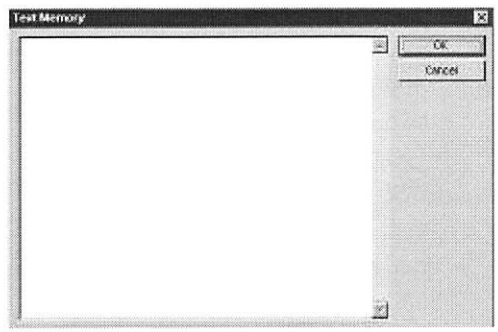
   Repeat the above operation according to the selected document.

4.14.5 Input subject, comment, etc.

Ordinally, enter the subject, comment, etc. directly into the document.
To paste a logo (bmp. file), click the right mouse button the logo area of the document and use the pop-up menu.
If the same subject, comment, name and logo are used each time a new document is created, proceed as follows because they can be recorded. They are displayed in these areas and can be printed each time a new document is created.

4.14.5.a Registration of comment

1. Select Menu bar [Setup／Text memory] of the DTP window.
2. Click an area and click [OK] button after entering a comment.
3. The comment is recorded.

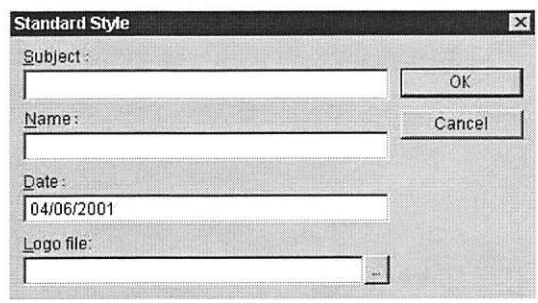


4.14.5.b Registration of subject, date, name and logo

1. Registration of title, date and name.

   Select [Setup／Standard Style] on the menu bar of the DTP window.

   Click an area of [Subject], [Date] or [Name], and click [OK] button after entering them.



2. Registration of logo

   Create the logo.
   Refer to the relevant menuals for instructions on logo creation and other.

   Enter the file name directly into [Logo File], and click the [OK] button.

   Or, click the [...] button and select file. Otherwise, Select the logo filefrom [File／Logo File Open]of the DTP window and click the [OK] button.

The recorded subject and other information may not be displayed depending on the document.

The font and font size of the subject and comment (text) can be altered.
Select Menu bar[Format] of the DTP window.

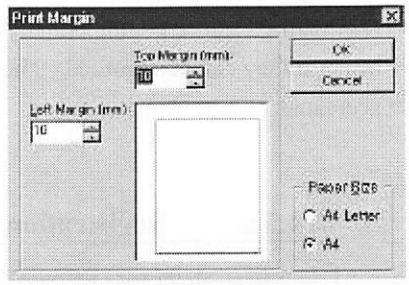
4.14.6 Printing

4. Setup the printer to print. (Refer to the printer manual for more information)

5. Set the print margin.

   Select Menu bar [File／Margin] of the DTP window.

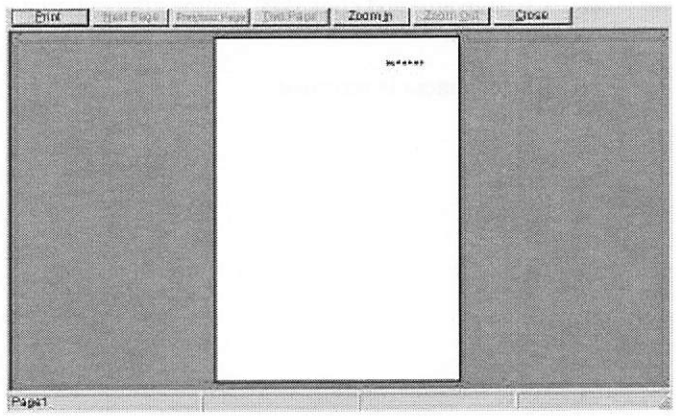
   Select paper size and input a margin value (0 to 60), then click [OK] button.



6. Confirm the document layout by using the print preview.

   Click  button on the DTP window.

   Check the printing range, etc. using the [Zoom in] button and other. The [Print] button permits you to preview the document before printing it.



7. Select Menu bar [File／Print] of the DTP window, and click [OK] button.

   To print the form you are now using, click  button.

! CAUTION

- When a Mitsubishi digital color printer (CP770D or other) is used, set the print margin at both left and top to 0mm and the paper expantion factor in the property of the print window to 50% or less. Otherwise, the document will be printed off the paper.
- The printing range varies with the type of printer.
  If the printer is changed, set it so that the print margin fits the printer.
- Printout may differ from that checked on the screen and the actual one may not fit within the paper size.

4.14.7 Saving and opening the document

■Saving the document

1. Click  button on the DTP window.
2. Select the driver and folders, enter a filename.
3. Click [Save] button.
4. The document is saved as a DTP file.

■Opening the document

1. Startup DTP and click  button on the DTP window.
2. Select the DTP file and click [OK] button.
3. The DTP file is displayed as a document on the DTP window.

4.15 Trouble shooting

4.15.1 Vacuum system

Symtoms	Cause	Countermeasures
Power is not supplied	The power board switch is OFF	Turn ON the power board switch
	100V AC is not being supplied	Verify the [100V AC]
	The safety device operated because of a water failure	Click [OK] button to close the message dialog Exit SEM program and turn off the power to the personal computer Turn off the MAIN POWER switch and wait until water supply is restored Feed water and wait for about five minutes Turn on the MAIN POWER switch to start the instrument.
	The safety device operated because of a power failue	Turn off the MAIN POWER switch and wait until power is restored Make sure that water is being fed Turn on the MAIN POWER switch to start the instrument
	The Water Leak Sensor (WLS) operated because of a water leak	 Shut down the instrument and turn off the cooling water, then call service center
• The RP (oil rotary pump) does not start when the instrument is started • The VENT and EVAC switch lamp blink	The RP thermal protector operated because of the over-current	Turn off the MAIN POWER switch Make sure that the room temperature is between 15 and 25℃ Press the RP manual reset button to start the instrument
	The RP fuse blown out because of the over-current	 Shut down the instrument and call service center
• When the RP has stopped while the instrument is running • The VENT and EVAC switch lamp blink • No-image is displayed • Warning message is displayed	The RP fuse blown out or the thermal protector operated because of the over-current	Shut down the instrument and call service center

Symtoms	Cause	Countermeasures
Evacuation does not take place, or takes a long time to complete	Loose parts	Tighten up loose parts
	A sample containing a lot of gas or moisture is installed	Remove moisture from a sample, or replace it
	Inferiority of O-ring or packing (Twist, wrong position, contaminated with dust, being torn)	Check the twist and wrong positions. Check whether a O-ring and packing are contaminated with dust. Adjust a twist. Return it in the right position. Remove dust. When the O-ring or packing is torn, call serivice center
	The wehnelt has just been cleaned	Wait for a while
	RP (oil rotary pump) or DP (oil diffusion pump) oil has deteriorated	Call service center

! WARNING

Do not touch the RP motor when the RP has stopped while instrument is running.

You may get burn in the hand because the RP motor is very hot.

4.15.2 Image observation

Symtoms	Cause	Countermeasures
L.C value (load current) is unstable	The electron gun mis-aligned	Re-align the electron gun
	The filament has a whisker	Replace the filament
	The filament is mis-centered	Re-center the filament
	The wehnelt is contaminated	Clean the wehnelt
	The wehnelt has just been cleaned	Wait for a while
L.C value is abnormal, or too small/too large	Bias adjustment is not perform	Perform bias adjustment
An image does not appear	The text icon [HT] button is [OFF] or [Wait]	Click text icon [HT] button to change [HT ON]
	An auto function does not operate	Turn [HT ON], Confirm whether the filament is heated. And, automatic functions (ACB, AFD, etc.) try again.,
	The signal is not [SEI]	Set the signal to [SEI]
	The image has excess or insufficient contrast and/or brightness	Adjust it with manual control button [Contrast] and [Brightness]
	The electron gun mis-aligned	Re-align the electron gun
	The filament heating insufficient	Align the electron gun, or adjust bias
	The movable aperture mis-aligned	Align the movable aperture
	The filament is burnt out	Replace the filament
An image does not appear in LV mode		Set the appropriate sample (specimen holder), and evacuate in HV mode Set the Z-axis (WD) to [10mm] Click text icon [HT] button to change [HT ON] Select [Semi Auto] from the Gun Alignment window and click [Start] button Click [HT] button to change the [Ready] Try again with LV mode
An image has no sharpness	The image has astigmatism	Correct it with manual control button [StigmX] and [StigmY]
	The image has insufficient contrast and/or brightness	Adjust it with manual control button [Contrast] and [Brightness]
	The spotsize is too large	Reduce the spotsize
	The electron gun mis-aligned	Re-align the electron gun
	The accelerating voltage is too low	Raise the accelerating voltage
	The movable-aperture foil has deteriorated	Replace the movable aperture foil
	The inside of electron optical column is contaminated	Call service center

Symtoms	Cause	Countermeasures
The image does not focus in the vertical direction	The sample is set to high tilt angle	Eliminate the tilt of sample Correct with "Dynamic Focusing function"
Threre is noise, roughness, and distortion on the image	The sample has acquired electric charge	Re-evaporate a sample Reduce the accelerating voltage Reduce the spotsize Fine-adjust the pressure in the specimen chamber (LA -SEM)
	The spotsize is too small	Increase the spotsize
	The accelerating voltage is unsuitable	Change the accelerating voltage
	The image has astigmatism	Correct it with manual control button [StigmX] and [StigmY]
	The image has excess or insufficient contrast and/or brightness	Adjust it with manual control button [Contrast] and [Brightness]
	The sample is not properly fixed	Properly fix the sample
	Loose parts	Tighten up loose parts
	External magnetic field	Keep it away from the instrument
	The movable aperture foil has deteriorated	Replace the movable aperture foil
	The inside of electron optical column is contaminated	Call service center
• The image appears with poor brightness compared with the former time • The image brightness changes in a cycle	The scintillator tip has deteriorated	Call service center

4.15.3 DTP

Symtoms	Cause	Countermeasures
DTP program stops	The printer driver is not installed	Install the Windows printer driver even when the printer is not to be used
	Pasting the image: The image to paste does not exist	Exit DTP program, and restart DTP program
Document is only partially printed	Print margin/paper size is not correctly set	Print margin/paper size is correctly set The print margin varies with the type of printer. Set it to fit to the printer
Text/Subject/Name/Date cannot be entered or pasted	The document is selected which cannot be entered or pasted	Select the document which can be entered or pasted, and create the new document
Logo cannot be pasted	The document is selected which cannot be pasted Logo is not created in the bmp. format	Select the document which can be pasted, and create the new document Create the logo in the bmp. format
Image cannot be pasted	The image to paste is not displayed in the freeze mode The image is saved except the BMP／TIFF／JPEG format	The image to paste is displayed in the freeze mode, and try again The image is saved with BMP／TIFF／JPEG format
SEM information is not displayed or printed	The check box is not make a check mark on the check bar The [Document4] or [Document5] is selected	The check box is checked on the check bar Create the new document with a [Document1], [Document2] or [Document3]

4.16 Running message list

Operation	Running message	Explanation
Click [Photo] button	Photographing	
Click [Freeze] button	Frozen	
Click* [AFD] button	Auto Focus running	
	Auto Focus + ACB running	When the [Auto Focus + ACB] on Auto Function of the Standard Setup window is checked
Click* [ASD] button	Auto Stigma running	
	Auto Stigma + Auto Focus running	When the [Auto Stigma + Auto Focus] on Auto Function of the Standard Setup window is checked
	Auto Stigma + ACB running	When the [Auto Stigma + ACB] on Auto Function of the Standard Setup window is checked
	Auto Stigma + Auto Focus + ACB running	When the [Auto Stigma + ACB and Auto Focus] on Auto Function of the Standard Setup window is checked
Click* [ACB] button	ACB running	
Click [Start] button on the Auto Gun Control of theGun Alignment window	Auto Gun Alignment running	Filament heating and filament alignment (tilt and shift) are automatically adjusting
Click [Auto] button on the Filament Heating of the Gun Alignment window	Auto Filament Saturation running	Filament heating is automatically adjusting
Click [Auto] button on the Alignment of the Gun Alignment window	Auto Gun Alignment runnning	Tilt and shift alignment of electron beam is automatically adjusting
Click* [Blank] button, or select Menu bar [Tools / Beam Blanking] (There is a check mark)	Beam Blanking ON	
Click* [Wobb] button, or select Menu bar [Tools / OL Wobbler] (There is a check mark)	OL Wobbler ON	

It is necessary to add the icon to use the [* button]. (See 3.2.2.a)

4.17 Error message list

If the trouble occurs as follows, an error messages appears and beeps buzzer sound.

Cause	Message	Buzzer sound	Countermeasures
Water being stop 断水	COOLING WATER FAILURE	Interrupts an evacuation system power supply, and beeps buzzer sound contiguously	Shut down the instrument and wait until water supply is restored Pass cooling water, and wait for about five minutes Re-start the instrument
DP temperature is low	DP TEMPERATURE LOW	Beeps buzzer sound…three times	Wait for a while When the DP temperature does not rise even if it waits for about 15 minutes, [DP HEATER FAULT] message appears.
Water being laek	LEAK of COOLING WATER (WLS is attached)	Interrupts an evacuation system power supply, and beeps buzzer sound contiguously	 Shut down the instrument and turn off the cooling water, then call service center
DP heater being burnt out	DP HEATER FAULT	Beeps buzzer sound contiguously	Shut down the instrument and call service center
Vacuum error occur	EVACUATION FAILURE	Beeps buzzer sound…three times	Vent the specimen chamber to atmospheric pressure, and check the O-ring and/or packing (twist, wrong position, etc) Remove twist, correct position and re-evacuate the specimen chamber When the O-ring or packing is torn, call service center
RP stopped	RP STOPPED	Interrupts an evacuation system power supply, and beeps buzzer sound contiguously	Shut down the instrument and call service center

Cause	Message	Buzzer sound	Countermeasures
Filament being burnt out (The filament electric current (L.C value) not flowed even if the filament heating becomes 80H or more	FILAMENT BURNT OUT	Beeps buzzer sound...three times	Replace the filament
When the automatic function is operated with HT off or the filament heating scroll bar is set to 80H or less.	HT OFF	Beeps buzzer sound...three times	Turn [HT ON] and please try again
When L.C value flowed more than 150 μ A	FILAMENT ABNORMAL	Beeps buzzer sound...three times	Remove the filament from the wehnelt of the gun chamber. Check whether "Whisker" on the filament does not occur. If the whisker occurs, replace the filament because the instability of gun emission is caused.
Vacuum system stops	VACUUM SYSTEM TROUBLE	Interrupts an evacuation system power supply, and beeps buzzer sound contiguously	Shut down the instrument and call service center
Prohibition of exhaust control in the "VENT Lock signal" input	VENT ENABLE (VSITF is being used)	Beeps buzzer sound...three times	Cancel the [Vent-Lock signal], and try again
Valve control error occurs in the LV mode	VALVE CONTROL FAILURE	Beeps buzzer sound...three times	Please set or adjust pressure again
When the connection was cut during the external control	EXT SCAN ENABLE (ESITF is being used)	Beeps buzzer sound...three times	Connect the cable securely Input the external control signal
Touch sensor operates in the stage moving	Touch Sensor detected Stage collision (The motor drive stage is being used)	Beeps buzzer sound...three times	Wait for a while until the stage is moved to safety position. Vent the specimen chamber to atmospheric pressure, confirm the damage of the sample, OL and BEIW. There is damage ··· call service center There is no damage···Take care to move of the sample, and try again. ※When the specimen observation surface is protruded above the specimen holder surface, input the amount of correction. (See 3.2.1.b)

5

Maintenance

5.1 Parts the must be maintained

A JEOL engineer performs the maintenance work of [DP oil], [RP oil] and [Foreline trap] in the table. Please, call service center.

	Parts	Cleaning interval
1	Filament・Wehnelt	L.C value (load current) is unstable L.C value not rise with filament heating Error message appears
2	Anode・liner tube	Once every 1 to 2 years Cleaning is it toward the aperture (cap shaped) in the tip of the liner tube. Stop cleaning if trash and dirt don't seem to be conspicuous except for the liner tube.
3	Movable aperture	When the astigmatism increases, preventing a bright image from being obtained
4	Orifice（LV-SEM）	When the astigmatism increases, preventing a bright image from being obtained
5	O-ring・packing	When evacuation cannot take place or requires a long period.
6	DP oil	Once every 3 to 5 years（Recommended）
7	RP oil	Once every 1 year（Recommended）
8	Foreline trap-Cartridge type (LV-SEM)	Once every 2 to 3 years（Recommended）

5.2 Cleaning materials

Cleaning liquid	Use cleaning liquid that has high cleaning performance, is of high purity, nearly harmless to humans, non flammable, and volatile. Follow the precautions indicated on the container of the cleaning liquid. Ensure that the room is adequately ventilated, and do not place your fingers in the liquid. (be sure to ware working gloves) Use cleaning liquid to remove common dust and abrasive. Normally, cleaning liquid is used by moistening a piece of gauze or a cotton stick with it. Small parts that have been cleaned can be effectively finished off by immersing them in a beaker filled with cleaning liquid. (you can obtain even better results by using ultrasound cleaner)
Work gloves	Use polyethylene film gloves. This prevents parts from becoming soiled, and also protects the skin on your hands and fingers.
Gauze	Use gauze that is clean and does not generate impurities when immersed in cleaning liquid. Use gauze for rubbing parts with an abrasive and also for wiping away dust and stains using cleaning liquid.
Cotton stick	Use cotton sticks that are clean and do not generate impurities when immersed in cleaning liquid. Use cotton sticks for rubbing parts with an abrasive and also for wiping away dust and stains using cleaning liquid. (fine parts, holes, etc.)
Cotton wool, toothpick	Use clean cotton wool after wrapping it around a toothpick. Use it for rubbing parts with an abrasive, and also for wiping away dust and stains using cleaning liquid. (fine parts, holes, etc.)
Metal abrasive	Use a paste type abrasive that can be easily removed by cleaning liquid. Use it when dust and stains cannot be removed with cleaning liquid. Never use an abrasive on threaded parts or intricate parts. Also, take care that abrasive does not get onto parts that are not normally cleaned.
Beaker	Use a stainless steel beaker. Do not use a glass beaker because it is liable to break. Pour cleaning liquid into the beaker and use it for finishing off fine parts that have been cleaned.
Hand blower	You can also use a safe, clean container that enables inert grass to be blown out.
Tools	Use the tool included among the accessories or commercially available tools. Replace screwdrivers and other tools that are visibly damaged.

! Precautions in maintenance work

- **Do not adopt an unreasonable posture when working for maintenance.**
  An unreasonable posture becomes the cause which a waist and so on hurts.

- **Do not use an organic liquid when wiping off the dust of exterior of the instrument.**
  Wipe off it with dried cloth after removing the dust. If it is very dirty, wipe it with wet cloth and then dry cloth.

- **Do not dismount, disassemble with bare hands. Be sure to use polyethylene film gloves or the like.**
  The internal parts are precision-machined. Use special care so as to prevent them fro m contamination.

- **Use tools in the proper way, and avoid using undue force to tighten screws.**

- **When you handle tools, use special care not to drop them on the parts and damage them.**

- **When parts is to be secured with two or more screws, screw all of them lightly in until they are blocked and them tighten one after another a little at a time.**

- **Carefully remove and remount parts without exerting undue force.**
  Forcing parts in or out could cause eccentricity which might make it impossible to remove and remount the parts.

- **Store removed and disassembled parts is readily identifiable groups.**
  Put small parts such as screws in laboratory dishes. For long-term storage, use a desiccator to prevent oxidation.

- **Place disassembled parts on a rugged workbench covered with aluminum foil.**

- **For heavy parts, place additional material under the mat and make sure that no screws, etc. are left behind.**

- **Place a cover or an exposed portion that does not require disassembly. Cover such a portion with an aluminum foil to keep out dust.**

5.3 Cleaning method

! WARNING

When handling cleaning liquid, be sure to use polyethylene film gloves.
There is a risk of acquiring a skin disorder depending upon the particular kind of cleaning liquid used of the sensitivity of your skin, so be sure to read the precautions concerning liquid before using it.

■Wiping off dust and stains with cleaning A cleaning liquid

Use cleaning A cleaning liquid to clean parts that are not very dusty stainsy, or parts that cannot be rubbed.

- Wipe flat surfaces and outside surface of parts, and also threaded parts, with a piece of gauze, or the like, moistened with cleaning liquid. Wipe dust and stains off the vicinity of holes and the inside surfaces of parts using a cotton stick (of a size that matches the area to be cleaned), or the like, moistened with cleaning liquid. Never clean parts made of plastic or other material that is likely to be dissolved by the cleaning liquid.
- Clean oil and grease off small parts and also clean intricate parts by pouring the cleaning liquid into a beaker then immersing the parts. You can obtain even better results by using an ultrasound cleaner. Replace the cleaning liquid from time to time according to the extent to which it becomes contaminated. After cleaning the parts, remove them fro m the beaker and quickly remove any cleaning liquid adhering to them by using blower brush.

■ Rubbing with cleaning B metal abrasive

Use cleaning B metal abrasive on very dusty parts and also parts that can be rubbed.

- Coat flat surfaces and outside surface of parts with a small quantity of abrasive using gauze, or the like. Rub the vicinity of holes and the inside surfaces of parts using a cotton stick (of a size that matches the area to be cleaned) or the like, coated with a small amount of metal abrasive. Do not use a lot of force when rubbing a parts in the vicinity of a hole. Also, do not rub parts excessively. Never rub threaded parts with metal abrasive.
- If you have done [Cleaning B], repeat [Cleaning A] a couple of times to completely wipe all metal abrasive off.

5.4 Filament replacement and cleaning

! WARNING

Do not touch the wehnelt immediately after the filament breaks because it is not you may receive a burn. Before removing the wehnelt for about one hour, then remove it using a dedicated tool.

! CAUTION

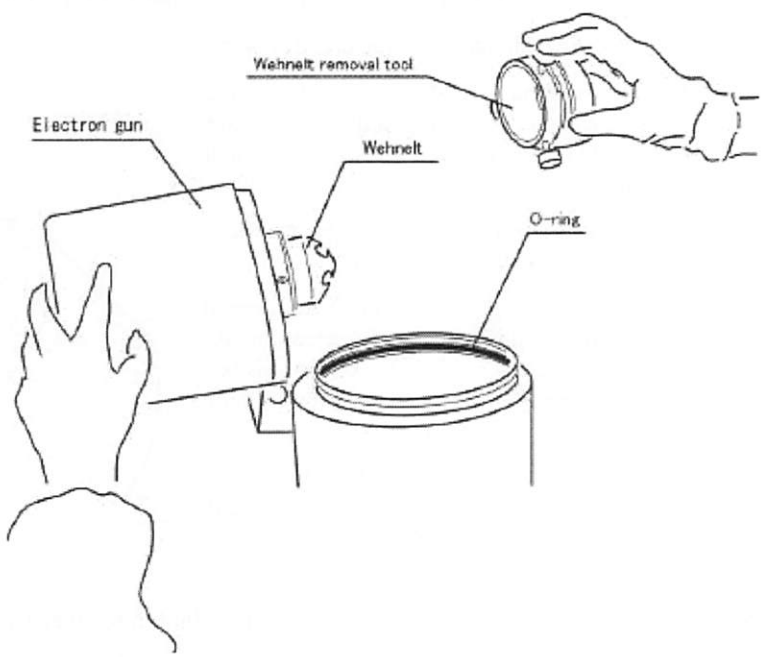
- Do not open the electron gun except the maintenance work (filament replacement, etc.)
  It has possibility that dust and so on goes into the electron optical column when the electron gun is opened unreasonably and that a trouble is caused.
- When installing the filament, take care not to touch the tip of the filament.
- When closing the electron gun, take care not to slip the O-ring out of position.
- When closing the electron gun, take care not to get your fingers crushed between the electron gun and electron optical column.

1. Click [OK] button for closing the message dialog.
2. Click [Vent] button of the filament exchange window for venting the electron optical column to atmospheric pressure.
3. Open the electron gun, and remove the wehnelt.

   Set the wehnelt removal tool in such a way that the three screws of the wehnelt removal tool will align with the smooth faces on the sides of the wehnelt and tighten the screws.

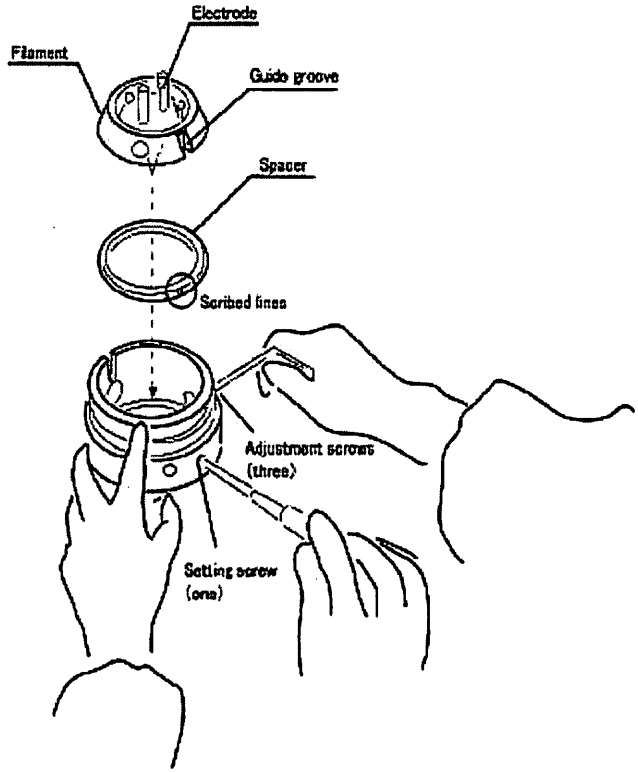
   Pull the wehnelt removal tool straight to remove the wehnelt from the electron gun and then loosen the screws to remove the wehnelt removal tool.

   Closes the electron gun after removing the wehnelt.



4. Disassemble the wehnelt, and remove the filament.

   Grasp the electrode of the filament when removing the filament.



5. Clean the cap, and other parts, then install a new filament.

   Re-install the filament in the opposite sequence to removal.

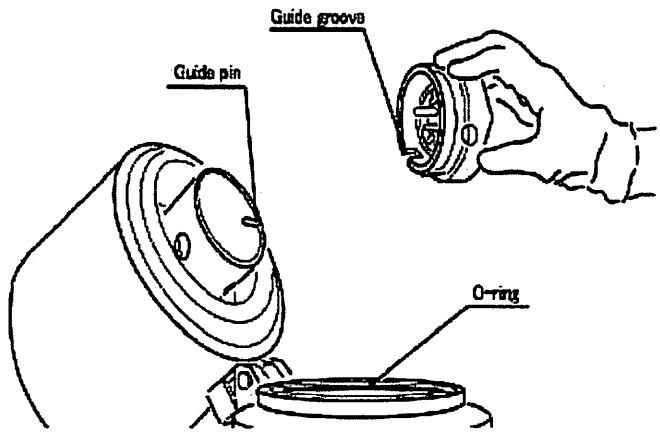
6. Check the filament position (centering).

   Show the wehnelt from the side, if the tip of the filament is protruding, replace the spacer.

7. Install the wehnelt and close the electron gun.

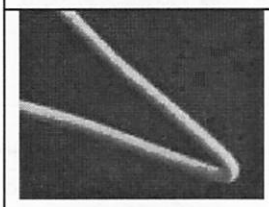
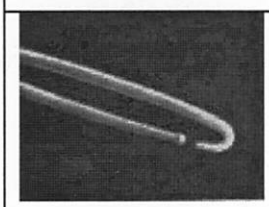
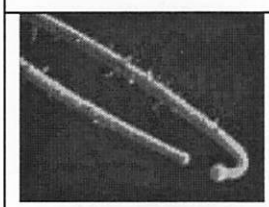
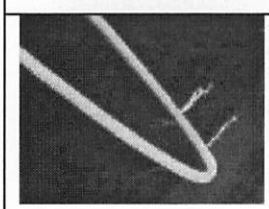
   Open the electron gun, align the guide groove on the wehnelt with the guide pin on the electron gun, then push in the wehnelt unit it clicks into position.

   - If there is dust and so on the wehnelt, remove it with hand blower.
   - If the O-ring of the electron optical column is dusty, carry out cleaning A, then adequately dry the O-ring. Next, coat the O-ring with the minimum necessary amount of grease.
   - If the O-ring is damaged or torn, you must replace it, so contact your local JEOL service office.



8. Click [Evac] of the filament exchange window button for evacuating the electron optical column.
9. When the status in the filament exchange window becomes [Ready], click the text icon [HT] to get [HT ON].
10. Perform the auto gun alignment. (see Chapter4-4.8.1.a)

■Tip of the filament condition

Tip of the filament condition	State
	Un-use
	Ordinary broken When the filament is used well at a long time.
	Abnormal broken When the over load current is flowed to the filament.
	Whisker Since the load current becomes to instability, it is necessary to change the filament with a new one.

■Relation between the spacer and filament

Number of scribed lines	Thickness (mm)	Brightness	The life of filament
3	2.1	Medium	Normal
4	2.2	Low	Long

5.5 Cleaning the anode and liner tube

! WARNING

Do not touch the wehnelt immediately after the filament breaks because it is not you may receive a burn.
Before removing the wehnelt for about one hour, then remove it using a dedicated tool.

! CAUTION

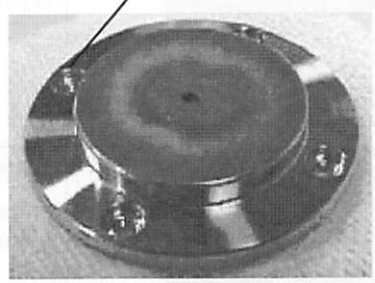
- Turn OFF the MAIN POWER switch after venting the electron optical column to atmospheric pressure.
- When cleaning the electron gun, take care not to slip the O-ring out of position, or get your fingers crushed between the electron gun and electron optical column.

1. Open the electron gun and remove the wehnelt.

Stores the removed wehnelt in such a way that it is not exposed to dust.

2. Turn OFF the MAIN POWER switch, and remove the anode.

Remove the setting screws. **Screw the suitable screw into the screw hole for removing the anode, and pull it out vertically.**

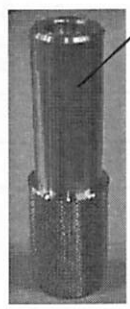


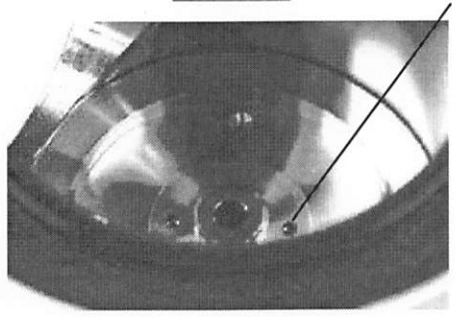
3. Remove the liner tube.

Remove the setting screws (two). Screw the "liner tube extraction tool" and pull the tool vertically.

As for important by operation step3, it is [pull the liner tube out slowly and vertically, and return it again]. A "slow" reason is to prevent two O-ring being torn to keep the vacuum of the liner tube.

And, cleaning is it toward the aperture (cap-shaped) at the tip of the liner tube. Stop cleaning if you look through the liner tube and trash and dirt don't seem to be conspicuous.





4. Clean the anode and liner tube.

   Select the cleaning method according to the extent to which these parts are soiled.

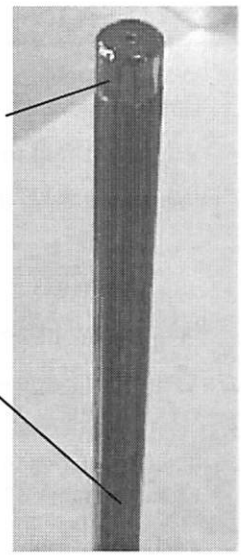
5. Re-assemble the anode and liner tube.

   Perform re-assembly work in the opposite sequence to that in which you disassembled or pulled out the anode and liner tube.

6. Install the wehnelt, then evacuate the electron optical column.

Aperture
Turn it counter clockwise to remove the aperture.

Liner tube

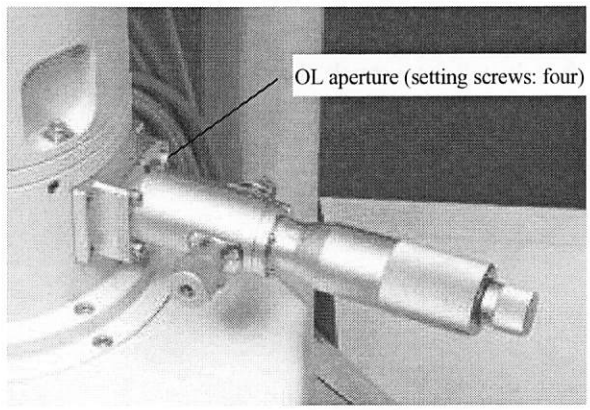


5.6 Cleaning the MAP

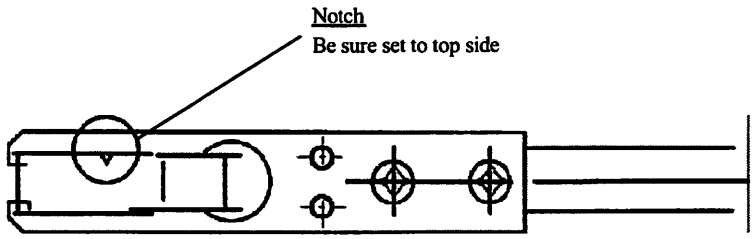
! CAUTION

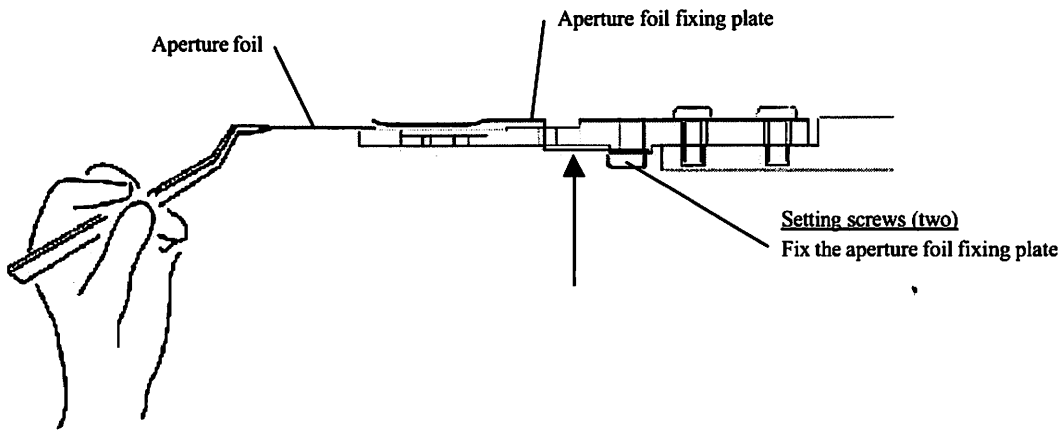
- When removing or installing the MAP, take care that the tip of the MAP does not touch the electron optical column.
- When pushing the aperture foil fixing plate, take care not to touch with bare hands.
- When installing the aperture foil, take care not to deform or damage it.

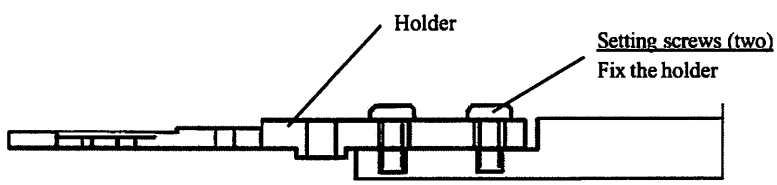
1. Set the aperture position to [0].
2. Vent the electron optical column to atmospheric pressure, and remove the MAP.
3. Cover the mounting port of the movable aperture to prevent ingress of dust.
4. Push the aperture foil fixing plate, and take out the aperture foil.
5. Carry out cleaning A.
6. When the tip of the MAP is very dusty, disassemble it and carry out cleaning B. Re-assemble the aperture in the opposite sequence to disassembly. (see next page.)

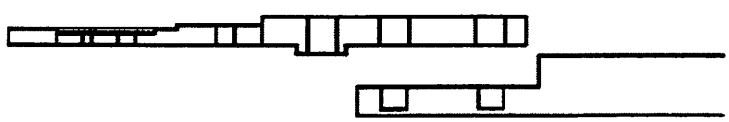


7. Push the aperture foil fixing plate, and install a new aperture foil (standard accessory).
8. If there is dust and so on the tip of the aperture, remove it with hand blower.
9. Install the MAP, and evacuate the electron optical column.


Notch
Be sure set to top side


Aperture foil
Aperture foil fixing plate
Setting screws (two)
Fix the aperture foil fixing plate


Holder
Setting screws (two)
Fix the holder



5.7 Cleaning the orifice (LV-SEM)

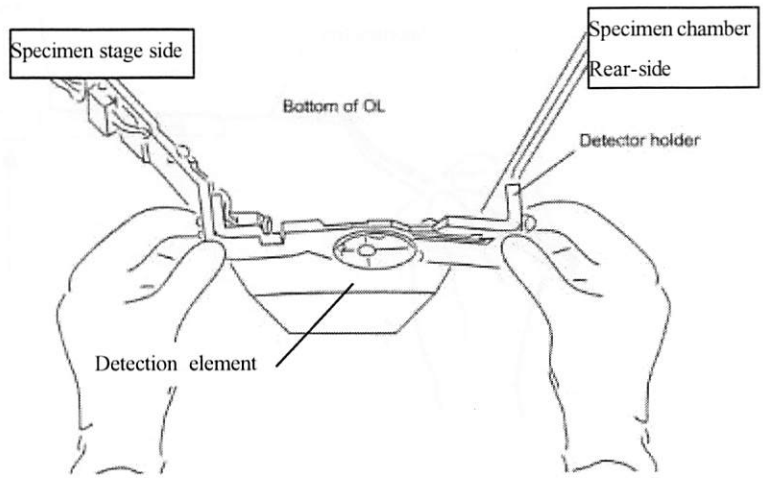
! CAUTION

- When the moving the detector holder, take care not to touch the detection element.
- When removing or installing the orifice, take care not to touch any parts inside the specimen chamber.
- When installing the aperture foil, take care not to deform or damage it.

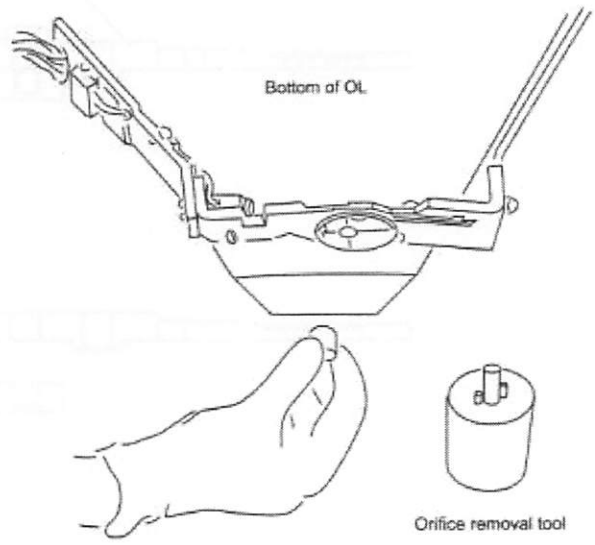
1. Vent the specimen chamber to atmospheric pressure and slowly withdraw the specimen stage.

   When an optional backscattered electron detector (BEIC or BEIR) is attached, pull the backscattered electron detector until it stops to the front.

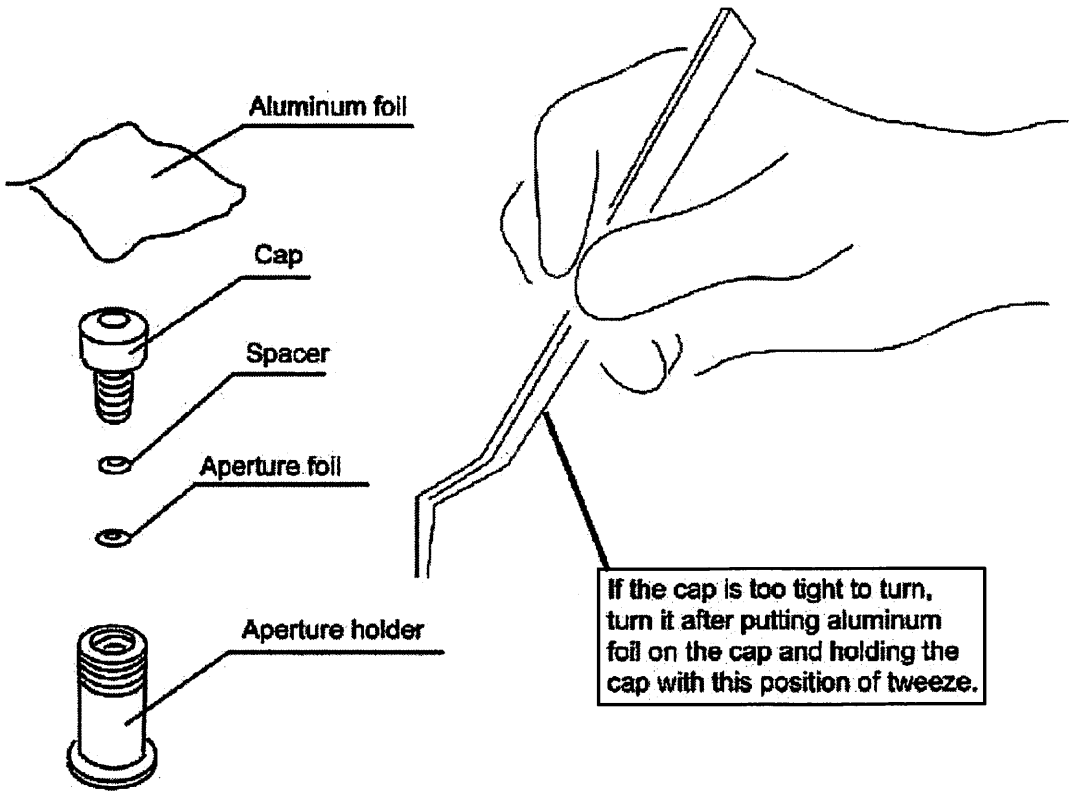
2. Slightly push down the detector holder.
3. Move the detector holder to the right-side not to touch the bottom of OL as much as possible.
4. Slowly let go hands from the detector holder.



5. Attach the orifice removal tool to the orifice.
6. Viewing the tool from the underside, turn it counterclockwise and remove the orifice.



7. Disassemble the orifice, then clean these parts as shown in the figure.
8. Reassemble the orifice. Perform re-assembly work in opposite sequence to that in which you disassembled.
9. Reinstall the orifice, and set the detector holder to the original position.
10. **You must be set the detector holder so that a space may not be open between the detector holder and underside of OL. (The detector holder has a guide groove to set to the hole of OL.)**
11. Evacuate the specimen chamber.



TP 5 FS Board

TP4 Volt Tp5 - 0.1V w/VR2 PS 125

1.819
.24
2.059

1.822
240
2.062

TP Smith
2.640
2.540

726-3836