

JSM-7100F

FIELD EMISSION SCANNING ELECTRON MICROSCOPE OPERATION GUIDE

For the proper use of the instrument, be sure to read this instruction manual. Even after you read it, please keep the manual on hand so that you can consult it whenever necessary.

JSM-7100F

FIELD EMISSION
SCANNING
ELECTRON
MICROSCOPE
OPERATION
GUIDE

**Please be sure to read this instruction manual carefully,
and fully understand its contents prior to the operation
or maintenance for the proper use of the instrument.**

JEOL

NOTICE

- This instrument generates, uses, and can radiate the energy of radio frequency and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the environment, especially radio communications.
- The following actions must be avoided without prior written permission from JEOL Ltd. or its subsidiary company responsible for the subject (hereinafter referred to as "JEOL"): modifying the instrument; attaching products other than those supplied by JEOL; repairing the instrument, components and parts that have failed, such as replacing pipes in the cooling water system, without consulting your JEOL service office; and adjusting the specified parts that only field service technicians employed or authorized by JEOL are allowed to adjust, such as bolts or regulators which need to be tightened with appropriate torque. Doing any of the above might result in instrument failure and/or a serious accident. If any such modification, attachment, replacement or adjustment is made, all the stipulated warranties and preventative maintenances and/or services contracted by JEOL or its affiliated company or authorized representative will be void.
- Replacement parts for maintenance of the instrument functionality and performance are retained and available for seven years from the date of installation. Thereafter, some of those parts may be available for a certain period of time, and in this case, an extra service charge may be applied for servicing with those parts. Please contact your JEOL service office for details before the period of retention has passed.
- In order to ensure safety in the use of this instrument, the customer is advised to attend to daily maintenance and inspection. In addition, JEOL strongly recommends that the customer have the instrument thoroughly checked up by field service technicians employed or authorized by JEOL, on the occasion of replacement of expendable parts, or at the proper time and interval for preventative maintenance of the instrument. Please note that JEOL will not be held responsible for any instrument failure and/or serious accident occurred with the instrument inappropriately controlled or managed for the maintenance.
- After installation or delivery of the instrument, if the instrument is required for the relocation whether it is within the facility, transportation, resale whether it is involved with the relocation, or disposition, please be sure to contact your JEOL service office. If the instrument is disassembled, moved or transported without the supervision of the personnel authorized by JEOL, JEOL will not be held responsible for any loss, damage, accident or problem with the instrument. Operating the improperly installed instrument might cause accidents such as water leakage, fire, and electric shock.
- The information described in this manual, and the specifications and contents of the software described in this manual are subject to change without prior notice due to the ongoing improvements made in the instrument.
- Every effort has been made to ensure that the contents of this instruction manual provide all necessary information on the basic operation of the instrument and are correct. However, if you find any missing information or errors on the information described in this manual, please advise it to your JEOL service office.
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Note: For servicing and inquiries, please contact your JEOL service office.



Please be sure to read carefully the following Software License Agreement before using the software supplied by JEOL Ltd. If you do not agree to the terms and conditions of the Agreement, please do not use the software and contact JEOL Ltd.

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This Software License Agreement is made and entered into by and between you, the end-user customer, and JEOL Ltd. (hereinafter referred to as JEOL) in witness of agreement between both parties upon licensing of the right to use the software (which is hereinafter referred to as the Licensed Software) owned by JEOL.

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1. JEOL does not guarantee proper performance of the Licensed Software if it is modified or translated.
2. JEOL does not warrant that the Licensed Software is free from defects or fit and useful for your particular purpose.

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JEOL shall not be liable for any damages or losses incurred by you or any third party or for any claim of a third party against you arising out of or in relation to the use of the Licensed Software.

Article 8. (Confidentiality)

You shall keep confidential the content of the Licensed Software supplied hereunder by JEOL and the terms and conditions of this Agreement, and shall not divulge or disclose them to any third party without the prior written consent of JEOL.

Article 9. (Term of Validity)

1. This Agreement shall become effective as of the day you accept the terms hereof and so remain unless it is terminated pursuant to the next Article.
2. Notwithstanding the item above, the provisions set forth in the Article 8 (Confidentiality) shall remain effective even after the termination hereof.

Article 10. (Termination)

In any of the following event, JEOL may forthwith terminate this Agreement by so notifying you without any prior notification and may claim the damages incurred:

- (1) Any breach on your part of any of the provisions hereof,
- (2) Occurrence of seizure or provisional seizure or provisional injunction on your property; auctioning of your property; bankruptcy, corporate liquidation, and filing for corporate reorganization on your part; or proceedings taken against you for collection of tax delinquency.

Article 11. (Steps to Be Taken after Termination)

Upon the termination of this Agreement pursuant to the Item 1 of Article 9 and Article 10, you shall destroy the Licensed Software and notify JEOL of such destruction.

Article 12. (Discussion in Good Faith)

Matters not stipulated herein shall be discussed in good faith and settled between you and JEOL.



WARRANTY INFORMATION

1 Limited Warranty

Products manufactured by JEOL Ltd. (hereafter “JEOL products”) that fail under normal use by the customer during the warranty period will be repaired or replaced, at JEOL’s discretion, without charge.

The components, modules and devices that are provided as replacements will be new parts or refurbished parts that provide the same performance as new parts. All components, modules and devices removed under this warranty become the property of JEOL.

1.1 Applicable Products

- This warranty applies only to hardware and software products manufactured by JEOL Ltd.
- For components that are not JEOL products, such as the computer, HDD, memory device, and the like, the warranty provisions of the respective manufacturers shall apply.

1.2 Warranty Period

- In the case of products for which the warranty period is recorded in the contract documentation, the recorded warranty period shall take precedence.
- If not specifically stated elsewhere, the warranty period is 12 months or a separately specified period from the date on which the acceptance test is completed after delivery to the customer.
- For components that are not JEOL products, like the computer, HDD, memory device, and the like, the warranty start date shall be the date on which the acceptance test is completed after delivery to the customer and the warranty periods established by the respective makers shall apply.
- In the event that parts are replaced or repaired free of charge during the warranty period, there is no change to the warranty start date or the warranty period for the product.

1.3 Scope of the Warranty

■ Failure diagnosis

If a problem occurs, contact your JEOL service office and describe the conditions and content of the problem. JEOL will assess the problem based on the situation and content of the problem.

■ Repair method

If it is determined that the problem is caused by a fault or defect of a JEOL product, repair or replacement will be performed free of charge. The choice of whether to repair or replace a component is entirely at the discretion of JEOL.

■ Warranty exclusions

This limited warranty does not extend to products for which any of the following situations apply. Even within the warranty period, in the situations listed below, a fee will be charged to repair the product.

- Product is operated or stored in an environment or under conditions that do not satisfy the specified installation requirements.
- The installation environment has changed (temperature, humidity, magnetic fields, etc.) since the time of installation.
- There is significantly accelerated deterioration of components and/or corrosion of electrical circuitry as a result of exposure to extreme temperature, humidity, or an environment containing highly-corrosive gases or excessive dust.
- The quality of the utilities (including electricity, water, gas, air quality) has worsened.
- The customer has relocated an installed instrument.

- Even in the case of a portable or movable instrument designed to be transported to a remote location or moved around for use by the user, damage or failures caused during the instrument relocation by the customer.
- Product has not been properly maintained.
- Consumable items or parts with the specified replacement period have not been replaced as specified.
- Corrupted operating system or application software, or damaged computer used with the instrument, caused by shutting down the main power to the computer without performing the proper shutdown sequence.
- Products that have been disassembled, modified or repaired by the customer in ways other than those specified in the instruction manuals provided with the instrument.
- Products with damage or failure caused by using them in combination with hardware, software, peripheral devices, and accessories that have not been provided or approved by JEOL.
- Damage or failure resulting from a situation caused by the customer, such as failing to properly manage the instrument, for which JEOL cannot be held responsible.
- Corruption of the operating system or application software, or damage to a computer used with the instrument, caused by fluctuations in the electricity or power failure.
- Product damaged as a result of fire, earthquake, flooding, lightning or other natural disaster, or due to local conflict or war.
- Damage or malfunction of operating system, application software, or the instrument itself as a result of infection by a computer virus.
- Instruments that have been restored after being disposed of or re-sold without prior written notice to and agreement from JEOL.

1.4 Items Not Covered by Warranty

- Regardless of whether a product is still within the warranty period, this warranty does not cover losses or damage to devices made by any other manufacturer at the customer site even if they are damaged by a malfunction of the JEOL product.
- JEOL is not responsible for any loss or damage to data recorded onto storage media, or to storage units. The customer is responsible for making back-up copies of their own data.
- Replacement parts for maintenance of the instrument functionality and performance are retained and available for seven years from the date of installation. Thereafter, some of those parts may be available for a certain period of time. Please contact your JEOL service office for details before the period of retention has passed.
- For items that are frequently updated, remodeled, or disappear from the market, like the computers used with the JEOL products, it may not be possible to obtain an exact replacement.

2 Repairs for a Fee

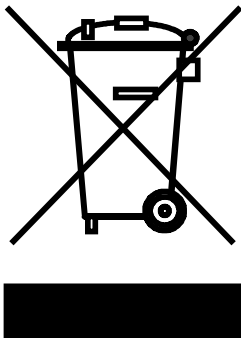
Repairs of JEOL products are available with charges after the end of the warranty period, or at anytime a customer requests. The components, modules and devices that are provided as replacements during the paid repair work will be new parts or refurbished parts that provide the same performance as new parts. All components, modules and devices removed during such repairs will become the property of JEOL.

- The warranty period for parts replaced and the service during paid repair work is a period of 3 months after the completion of the repairs; or, in the case of parts that must be periodically replaced, the warranty period is the length of the specified replacement period.
- In the event that repairs are performed again during the warranty period, there is no change to the warranty start date or the warranty period.

Notes on Disposal for Business Users

Attention:

Your product is marked with this symbol. It means that used electrical and electronic products should not be mixed with general household waste. There is a separate collection system for these products.



■ In the European Union

This symbol means that electrical and electronic equipment, at the end of its life, should be disposed of correctly.

In the European Union there is a separate collection system for used electrical and electronic products. Please help us to conserve the environment we live in!

Electrical and electronic appliances and machines often contain materials which, if handled or disposed of incorrectly, are potentially hazardous to human health and to the environment. They are, however, essential for the correct functioning of your appliance or machine. Therefore, please do not dispose of your old machine or appliance together with your household waste.






Your JEOL product is designed and manufactured with high-quality materials and components which can be recycled and reused. If the product is used for business purposes and you want to discard it, please contact your JEOL dealer, who will advise you about the end-of-life disposal arrangements.

■ Outside the European Union

If you wish to discard this product, please contact your local authorities and ask for the correct method of disposal.

NOTATIONAL CONVENTIONS AND GLOSSARY

■ Examples for general notations

 CAUTION :	Important precautions for use, which, if not followed, may result in damage to or problems with the device itself.
IMPORTANT NOTICES :	Important notices for operating the instrument.
 :	Additional points to remember regarding the operation.
 :	A reference to another section, chapter or manual.
1, 2, 3 :	Numbers indicate a series of operations that achieve a task.
 :	A diamond indicates a single operation that achieves a task.
File :	The names of menus, commands, or parameters displayed on the screen are denoted with bold letters.
File-Exit :	Selecting a menu item from a pulldown menu is denoted by linking the menu and the item with a dash (-). For example, File-Exit means selecting Exit from the File menu.
 :	Keys on the keyboard are denoted by enclosing their names in a box.

■ Examples for mouse terminology

Mouse pointer:	A mark, displayed on the screen, which moves following the movement of the mouse. It is used to specify a menu item, command, parameter value, and other items. Its shape changes according to the situation.
Click:	To press and release the left mouse button.
Right-click:	To press and release the right mouse button.
Double-click:	To press and release the left mouse button twice quickly.
Drag:	To hold down the left mouse button while moving the mouse.

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+ + + SAFETY PRECAUTIONS + + +

Although this instrument is protected with safety device which prevents the occurrence of accident that could result in an injury, harm, and damage to the users or instrument itself, the safety feature may not work properly if you use the instrument for the purpose of use not intended or in an improper usage. For the proper use of the instrument, please be sure to read all of the instructions, descriptions, notices, and precautions contained in this manual carefully to understand them fully prior to the operation or maintenance. This section, "Safety Precautions," contains important information related to safety for using of the instrument.

The safety indications and their meanings are as follows:

⚠ **DANGER:** An imminently hazardous situation which, if not avoided, will result in death or serious injury.











⚠ **WARNING:** A potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION:** A potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or a situation that could result in serious damage to facilities or acquired data.

Labels bearing the following symbols are attached to dangerous locations on the instrument. Do not touch any of these locations with your hands or anything else.



Examples of symbols

-  • Use the instrument properly within the scope of the purpose and usage described in its brochures and manuals.
-  • Never open/remove protective parts (exterior panels) and parts that can't be opened/removed without use of tool (including key), or disconnect/ connect the cables/connectors that are not described in this manual.
-  • Never attempt to do any works of disassembling/assembling the instrument other than those described in this manual.
-  • Never make modifications that include installing substitute parts and disabling safety devices or other safety features.
-  • Never disconnect the grounding wire or move it from the prescribed position. Failure to follow this instruction could result in electric shock.
-  • The AC power cord provided with this system is supplied for the particular device so that never use it for any other equipment.
-  • To avoid falling, do not climb onto the operation table and console during daily operation or during maintenance or inspection.
-  • When you dispose of the instrument or liquid or other waste, follow all applicable laws and regulations, and dispose of it in a proper manner without polluting the environment.
-  • Be sure to read the "Safety Precautions" section of the manuals for the accessories attached to or built into the instrument.
-  • If anything is unclear, please contact your JEOL service office.



WARNING for Installation



- **Do not attempt to install the instruments by yourself.**

Installation work requires professional expertise and JEOL is responsible for the installation of the instruments and related attachments purchased from JEOL. Consult your JEOL service office.

WARNING

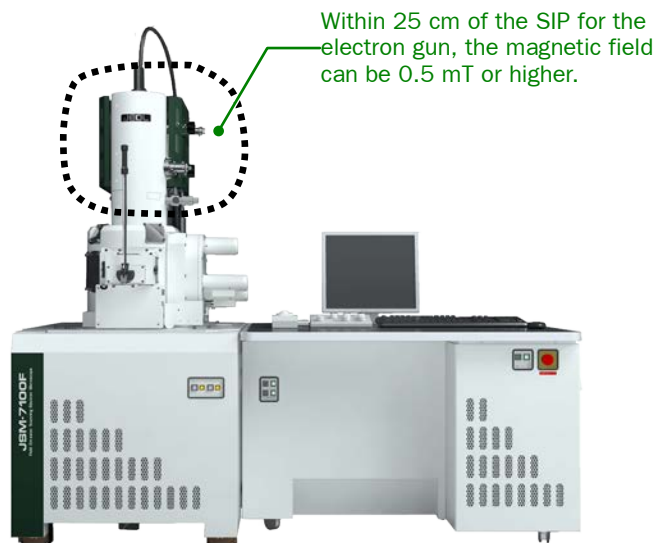
■ About strong magnetic field



- **This instrument generates a strong magnetic field of more than 0.5 mT. Exercise care not to bring ferromagnetic substances or devices, which may be affected by the magnetic field, into the room where the instrument is installed or the area where the magnetic field exists.**



Especially, magnetic fields can affect the operation of some medical electronic implants, for example, cardiac pacemakers. Note that cardiac pacemakers may not operate properly when exposed to magnetic fields larger than 0.5 mT. Other medical implants, especially those that contain ferromagnetic materials, may also be strongly affected when brought near magnets. Such implants include aneurysm clips, surgical clips, and prostheses. Exercise great care because magnetic fields can result in injury or death. Moreover, a memory device that uses a magnet such as a credit card might have its data destroyed. Problems might also occur with on a wristwatch or other devices.



■ General warnings



- When moving the instrument is required, 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.



- Never remove the rear panel for maintenance such as replacement of fuses or any other electric parts; otherwise you may get an electric shock. Be sure to ask JEOL service personnel for such work.



- There are potential hazards, concerning the high voltage and magnetic field, which may take place while a service engineer is disassembling or repairing the instrument for maintenance. Keep well away from the instrument on such occasions.

■ Warnings when using a nitrogen gas cylinder



- Dry nitrogen gas is supplied at high pressure in a compressed gas cylinder and must be handled with care.

Prior to use, ensure that:

- There is no furnace or heating appliance near the gas cylinder
- There is no electric wiring near the gas cylinder
- The gas cylinder is installed on a special stand or secured to a wall with chains
- The temperature in the area where the gas cylinder is installed does not exceed 40 °C
- Never apply any mechanical shock to the gas cylinder during operation.



- A cylinder valve open/close handle used for opening and closing the gas cylinder should be provided on the top of the gas cylinder to minimize hazards in an emergency.



- Normally, an expiration date is indicated on compressed gas cylinders. Check this and use a gas cylinder that has passed pressure-withstanding tests.



- When you operate the gas valve, you do not stand directly in front of the gauges but operate it from the side, an angle (45 degrees for example). This prevents injury from shattered glass if the pressure gauge explodes. We recommend that you wear a face guard for protection.



- Nitrogen is inert and harmless to the human body; however, when a room is filled with a large quantity of leaked gas, the room becomes dangerous. You run the risk of suffocation due to a decreased oxygen concentration.

■ Beware of water leak



- Cooling water is used in the instrument. Turn on the cooling water system and make sure that there is no water leak. Be careful not to exceed the specified pressure and flow-rate of cooling water; otherwise, the cooling water tube might burst with pressure.



- Hoses and/or tubing for cooling water line require a periodical replacement that is once in five years for general usage and once in three years for use in the clean room. If those hoses and/or tubing are used longer than our recommended replacement time by disregarding our caution, they may begin to crack and leak the water and/or oil and damage the surroundings. As a JEOL service engineer carries out the replacement, please request the work whenever the periodic inspection and maintenance is done.

**CAUTION****■ General cautions**

- If anything abnormal occurs with the instrument, according to Section 3.3 “STOPPING THE INSTRUMENT IN AN EMERGENCY AND RESTARTING IT” of the manual, immediately stop operation, and then contact your local service center.



- When installing the specimen holder or inserting the objective lens aperture, take care not to get your fingers caught in the space between the specimen exchange chamber and the specimen exchange rod, and the space between the selecting knobs.



- An instrument that has been installed properly will usually not vibrate or give off annoying noises. Should this occur, stop the instrument immediately and contact your local service center.




- Use the breaker (ground-fault circuit interrupter) only in cases of emergency. Do not touch the breaker unless you need to.

When the breaker trips, contact the service center because the instrument might be damaged.



- **Never open the manual valves MV1 or MV2.**

The vacuum in the electron gun chamber and the intermediate chamber is lost rapidly, and takes a long time to recover.

 These manual valves are used when the emitter is replaced. If you need to replace the emitter contact your JEOL service office.

■ Cautions concerning optional attachments

- **Liquid Nitrogen Trap:**

When you feed liquid nitrogen to the tank, you must wear the proper protective attire, including safety glasses and insulated gloves for handling cooling media. Do not allow the liquid to touch any part of your body or to be splashed around. There is a danger of injury from frostbite.



- **Large sample exchange chamber:**

When you open or close the exchange chamber using the valve, be careful so that you do not hurt your fingers by having them caught between the knob and the instrument.



- **Be careful when inserting and removing the specimen-exchange rod.**

Be careful that your fingers are not pinched by the exchange mechanism section.



- **Cryo system:**

Since in use, the tip of the specimen-cooling holder is kept in the cryogenic state with the liquid nitrogen, take care not to touch it with bare hands.



- **Backup power supply for ion sputter pump:**

There is a risk of electric shock when the UPS-402 etc, backup power supplies are used. Take care not to touch this power supply. Only JEOL service personnel maintain it.

**• Energy Dispersive Spectrometer:**

- Do not install or remove the energy dispersive spectrometer on or from your instrument by yourself. If such a necessity arises, contact your local service center.
- Use a stable and safe stool when replenishing the liquid nitrogen tank with liquid nitrogen. Take particular care not to be splashed with liquid nitrogen during replenishment.
- Take care not to touch the analyzer drive motor shaft during measurement.
- The Be thin membrane is used for the window material of the X-ray sensing station. The Be thin membrane is harmful. Because of this, you must wear gloves when you remove and store the sensing station. Do not touch the sensing station with bare hands. Also, be extremely careful when store the sensing station.



- **The gas cylinder should always be equipped with an handle to open / close the cylinder valve, so that the valve can be operated quickly in case of an emergency.**

PRECAUTIONS FOR USE

The following precautions are important which, if not followed, may result in damage to the instrument itself.

■ Microscope column

- **Do not touch the axis alignment screws of the microscope column.**
They are adjusted and tightened prior to shipping the instrument. To avoid trouble, never try to manipulate them.

■ Specimen stage

- **Be sure to observe with the specimen (including powders and easily scattered material) fixed to the stage.**
If a specimen is scattered in the specimen chamber, it might inhibit performance significantly.
- **Be sure to enter the specimen height offset correctly when the stage is moved in the Z direction during setting of the WD (working distance).**
Otherwise, the specimen might collide with an objective lens and might break the objective lens.
- **When the SM-71031SE2A (specimen exchange chamber Type 2A) has been configured, the maximum height of the specimen that can protrude above the cylinder top face of the specimen holder is 30 mm.**
If you insert a specimen that exceeds the 30 mm limit and protrudes above the cylinder top face, damage occurs to the specimen or specimen-exchange chamber.
- **If you insert a specimen that protrudes above the cylinder top face of the specimen holder into the specimen chamber, be sure to enter a value in the [Specimen Offset] column.**
If you do not enter the offset for the height of the specimen, there may be a collision between the specimen and the objective lens or an optional device.
- **Do not insert the specimen holder into the specimen chamber if the specimen chamber is tilted.**
The specimen holder may fall into the specimen chamber.
- **Before closing the door of the specimen-exchange chamber, confirm that the O-ring of the door is free of dust and dirt and correctly positioned in the groove.**
If the O-ring is contaminated with dust or gets caught, a vacuum leak might occur.
- **When using a specimen-exchange rod for specimen exchange, carefully read the cautions on the label that is attached above the specimen-exchange chamber.**
If you apply a load of 50 N or more to the specimen-exchange rod and fail to comply with these exchange procedures, the specimen-exchange rod may be bent or become damaged. Exercise extreme care.
- **Be sure to fully withdraw the specimen-exchange rod until the stopper is engaged.**
If the specimen-exchange rod is raised upward when the rod is not completely pulled out, the specimen-exchange rod may be bent and damaged.
If you do not use the specimen-exchange rod in accordance with these procedures, the rod might be bent and be damaged.

- **When the specimen holder is inserted into the specimen chamber, be sure to properly select the inserted specimen holder from the Specimen Holder Selection dialog box.**

If the inserted specimen holder is not properly selected, the specimen might collide with the objective lens or other component, possibly causing damage.

- **Do not loosen any alignment screws. Loosening the screws may cause damage to the instrument.**
- **Perform the initialization of the specimen stage position upon the re-starting of the control software if the PC was accidentally shut-off during its operation.**

The specimen stage position is corrected to a normal status. If the specimen stage is used without performing initialization while the origin point is shifted, there is a danger of damage to the stage.

■ EVACUATION SYSTEM

- **If power is interrupted for more than 4 hours, contact your JEOL service office.**

If a power failure occurs, the instrument will automatically shut down in safe mode; restart the system as soon as the power is restored. However, if the system was shut down for 4 hours or longer, contact your JEOL service office for assistance.

- **If a cooling water failure occurs during the operation, the high voltage and lens power supplies are shut down automatically. Restart the power supplies after the cooling water is restored.**
- **Regularly inspect the rubber hoses of the rotary pump (RP) to ensure that the connections are secure during operation.**

If the rubber hose comes off when you are using the instrument, it might cause serious problems.

- **Do not disconnect the rubber hoses of the rotary pump while it is operating.**

If a rubber hose becomes disconnected during operation, air may enter into the turbo molecular pump, creating serious problems.

- **Replace the rotary pump oil with new oil once a year.**
 - **Replace the oil mist trap of the rotary pump once a year.**
 - **In order to guarantee the performance of the turbo-molecular pump used for this instrument, oil cartridge replacement every two years (for a fee) and bearing replacement every four years (for a fee) are required.**
- Maintenance by a JEOL service engineer is needed within the service life.**

If you use the turbo-molecular pump exceeding the service life, vibrations can occur inside the pump and this might have an adverse influence on the observed image.

- **Although you can operate the oil-rotary pump until the oil level reaches the lower limit of the oil indicator, be careful that the oil level does not fall lower than that.**

Continuing to operate the pump with insufficient oil can cause damage to the pump.

- **Be careful to avoid damage to the nozzle section when removing an old rubber hose. If the nozzle is scratched or damaged, this may compromise the vacuum.**

■ DISASSEMBLY and CLEANING

- **If disassembly or assembly work of the microscope column or other section is required, be sure to contact a JEOL service office.**

If maintenance work, such as column disassembly, cleaning or parts replacements, other than as indicated in the maintenance instructions, is required, the customer should not attempt to perform the disassembly or assembly work.

- **When performing the cleaning tasks for the components indicated in the maintenance lists, be sure to comply with the following.**
 - Wear thin work gloves when handling the parts from inside the microscope column. Fingerprints and skin oils on these parts causes oxidation, and becomes a source of electric charge.
 - Complete tasks, such as cleaning and replacement of column parts, as quickly as possible. Parts exposed to atmospheric conditions for a long period of time will oxidize.
 - The cleaning solutions used for the microscope column should be highly-effective cleansers, contain little or no impurities, be non-flammable yet evaporate well, and can be safely tolerated by humans at high concentrations. When handling the cleaning solutions, be sure to wear protective gloves that will not be damaged by any of the solvents. Also ensure adequate ventilation in the room, such as leaving windows and doors open.
 - Be sure that there is no damage or debris (dust, fiber) adhered to the O-rings or surfaces in contact with the O-rings. Even slight damage or debris can cause problems with the vacuum. Furthermore, use only the specified vacuum grease.

■ Software

- **Do not install any application software or programs on the system computer without our permission.**

The performance of the system control or operating software might be affected, depending on the type of application software installed. If you install software without our permission, we might consider it as a modification of the system.

- **Do not delete any of the application software or files that are installed on the computer used to operate the instrument.**

The operation and control software for the instrument may not operate correctly.

■ OS

- **Do not change the setting for monitor resolution.**

If the resolution of the screen is changed, the operation and control software for the instrument may not operate correctly.

- **Do not change the display settings for the screen colors or font size.**

The operation and control software for the instrument may not operate correctly.

- **Do not change any of the settings for [Personalization] or [Display] under [Control Panel] – [Appearance and Personalization].**

The operation and control software for the instrument may not operate correctly.

- **Do not enable the screen saver.**

If the screen saver starts while the operation and control software for the instrument is running, the software may stop working properly.

- **Do not enable the system stand-by function.**

If this function operates while the operation and control software for the instrument is running, the computer may hang up.

- **Do not enable the System sleep status to be set while the operation and control software for the instrument is running.**

The Windows display may be corrupted. In addition, when the computer is restored from the sleep status, the images will not be displayed, and it will be necessary to re-boot the computer.

- **Do not enable the Windows firewall.**

The operation and control software for the instrument may not operate correctly.

- **Do not switch the Windows user while the operation and control software for the instrument is running.**

If the user is switched while the operation and control software for the instrument is running, the Windows display may be corrupted. If you must switch the user, be sure to terminate the operation and control software for the instrument beforehand.

- **Do not connect any USB devices while the operation and control software for the instrument is running.**

The updating of the SEM images may be interrupted.

■ Other

- **Be careful about using USB (Universal Serial Bus) devices.**

This instrument utilizes the USB during operation. Therefore, if an external device (memory stick, hard disk drive, etc.) is connected to the USB port while the instrument is being used, this may cause problems with the SEM operations.

- **The service life of the tubing used for the cooling water is 5 years at an ordinary installation site, and 3 years when installed in a clean room. Ask service personnel to replace the tubing before the end of the service life.**

If the tubing is used past the end of the recommended service life, there is a danger of water leakage from cracks that occur in the tubing, creating serious problems in the installation environment.

- **If there is a possibility that a fixed specimen may fall, attach a specimen-falling protection plate beforehand.**

A JEOL service engineer will perform the attachment of the specimen-falling protection plate. When the specimen-falling protection plate has been attached, the time from when the specimen chamber is at atmospheric pressure until the specimen chamber reaches a state in which specimen observation can be performed, and the time from when specimen exchange is performed until the specimen can be observed, will be delayed by several tens of minutes depending on the environment where the instrument is used.

1 GENERAL

The JSM-7100F is a field-emission scanning-electron microscope that enables not only a high-resolution observation of the fine structure of the specimen surface but also various analyses such as EDS, WDS, EBSD, and CLD, thanks to its Schottky field-emission (T-FE) electron gun, cutting-edge imaging technology, and computer technology.

This microscope adopts a T-FE electron gun to accommodate various analytical instruments, and can obtain a stable probe current of the order of picoamperes (pA) to a hundred nanoamperes (nA). Also, the first condenser lens positioned immediately below the electron-gun emitter provides high resolution even at a high probe current greater than a nanoampere (nA).

The operation screen enables you to switch between observation modes according to your purpose. Even a beginner can display the intended image easily by switching the screen directly according to the intended use such as image observation, analysis, or image comparison.

Recently, there is a growing need to simultaneously observe a specimen from multiple separated locations and share information about the specimen. By incorporating the remote control mechanism of the SEM, you can not only observe the image from a distant location but also control the instrument by, for example, giving instructions about the position you want to observe.

Furthermore, in consideration of the environment, an energy-saving mode is provided to reduce power consumption when the SEM is not in use.

In addition, a wide range of options is available for this microscope to detect and analyze the secondary electron, backscattered electron, transmitted electron, characteristic X-ray, and other signals generated by irradiating the specimen with the electron probe. By a combined use of various options, you can derive information for multiple uses, thereby broadening the application of the microscope. Especially when combined with an energy dispersive X-ray spectrometer (EDS), the microscope enables you to analyze the elements in a microscopic region on the specimen surface and observe the distribution of elements with high accuracy and efficiency without damaging the specimen.

As a conclusion, this microscope can contribute to research fields including metals, minerals, semiconductors, biology, and new materials and various industrial technologies.

2 CONFIGURATION DESCRIPTION OF THE MICROSCOPE

2.1 Configuration of the instrument

The SEM consists of an electron column and cabinet, a console (including the main power supply and operations) and an oil rotary pump. To observe the specimen, the electron column contains the electron-optics system and the specimen chamber. The operation console holds the lens-control system, image-processing system and SEM-control devices that include the operation panel, stage-control panel, mouse, keyboard and observation display.

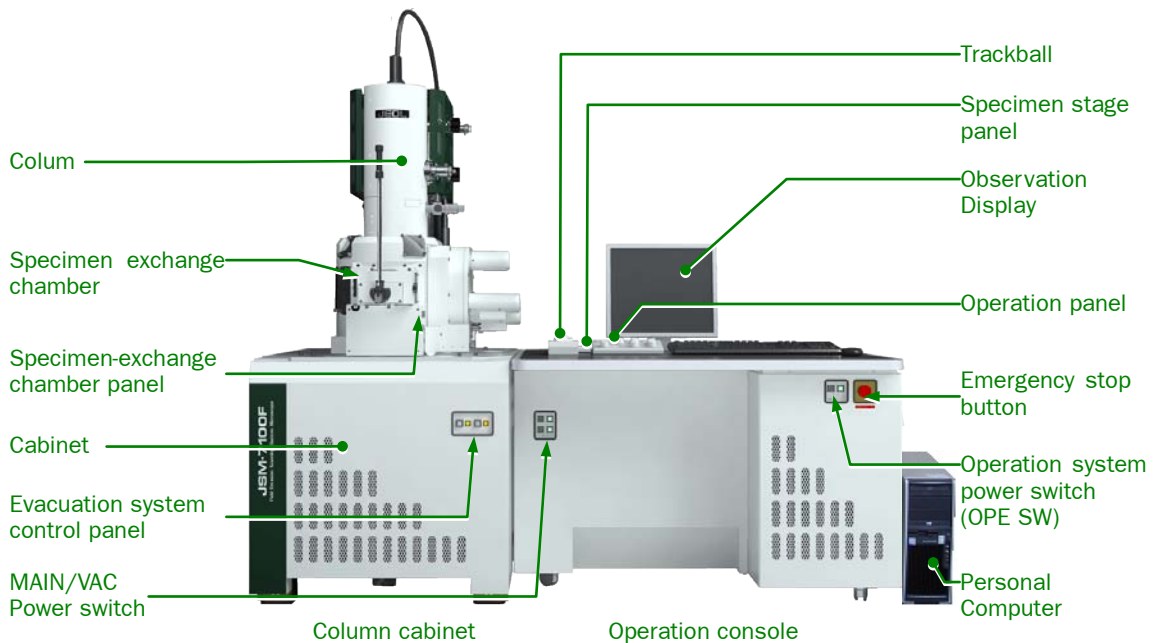


Fig. 1 Configuration of the instrument

—CAUTION—

- **Beware of using USB (Universal Serial Bus) devices.**

This instrument uses USB for its operation. Therefore, when you are using this instrument, connecting any device (such as memory or a hard disk drive) to the USB port adversely affects the SEM operation.

- **The column is completely adjustment-free. The screws and adjustment knobs are for the use of service personnel, and already adjusted. Never touch them.**

2.2 Column cabinet

This figure shows the main parts of the column.

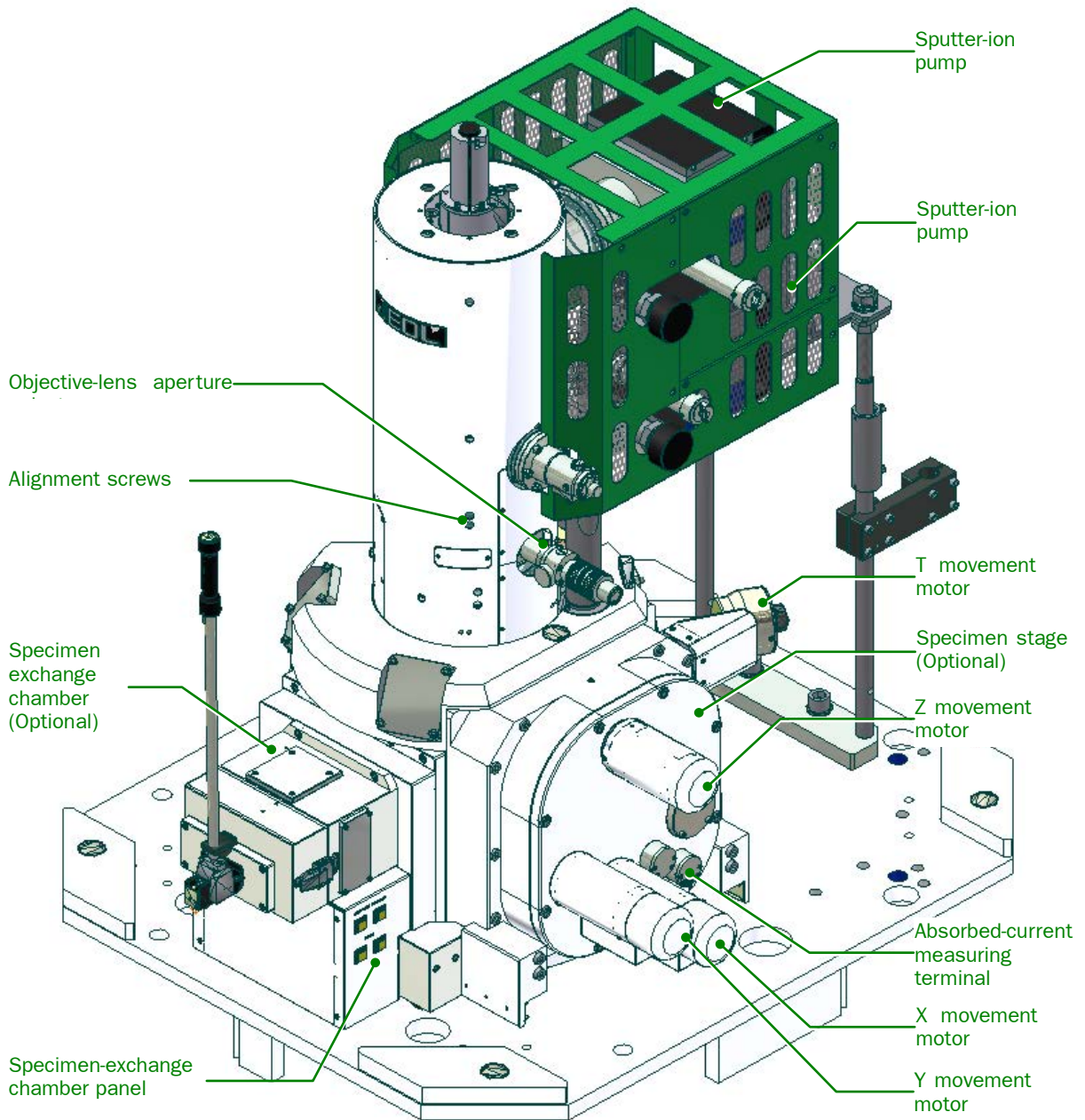


Fig. 2 External view of the column

2.2.1 Alignment screws

The alignment screws were completely adjusted at the factory, and are tightened accordingly.

—CAUTION—

Do not loosen any alignment screws.

Loosening the screws may cause damage to the instrument.

2.2.2 Objective-lens aperture selector

The selector has been set to scale 4 as default.

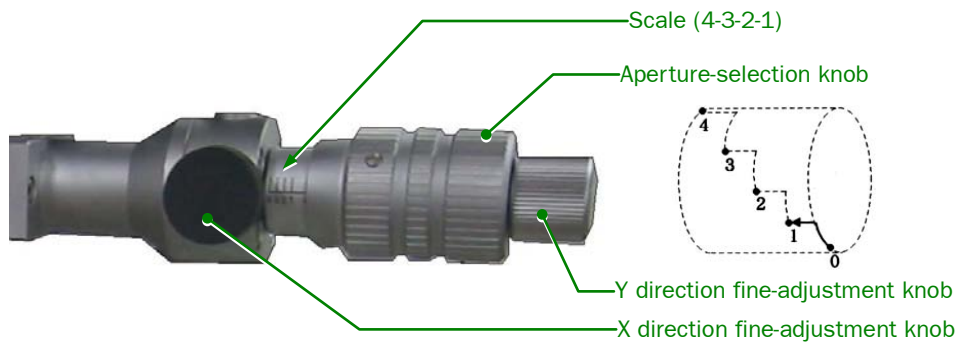


Fig. 3 Objective-lens aperture selector

Table 1 Selection of objective-lens apertures

Scale	Aperture diameter ($\mu\phi$)	Probe current indication coefficient	Purpose of use
4	30	Approximately 1	High-resolution observation/EDS
3	50	Approximately 2	EDS/EBSD
2	70	Approximately 5	EBSD/CLD/WDS
1	110	Approximately 10	CLD/WDS
0	1,000	-	Axis alignment

2.2.3 Specimen-exchange chamber and specimen-exchange chamber panel

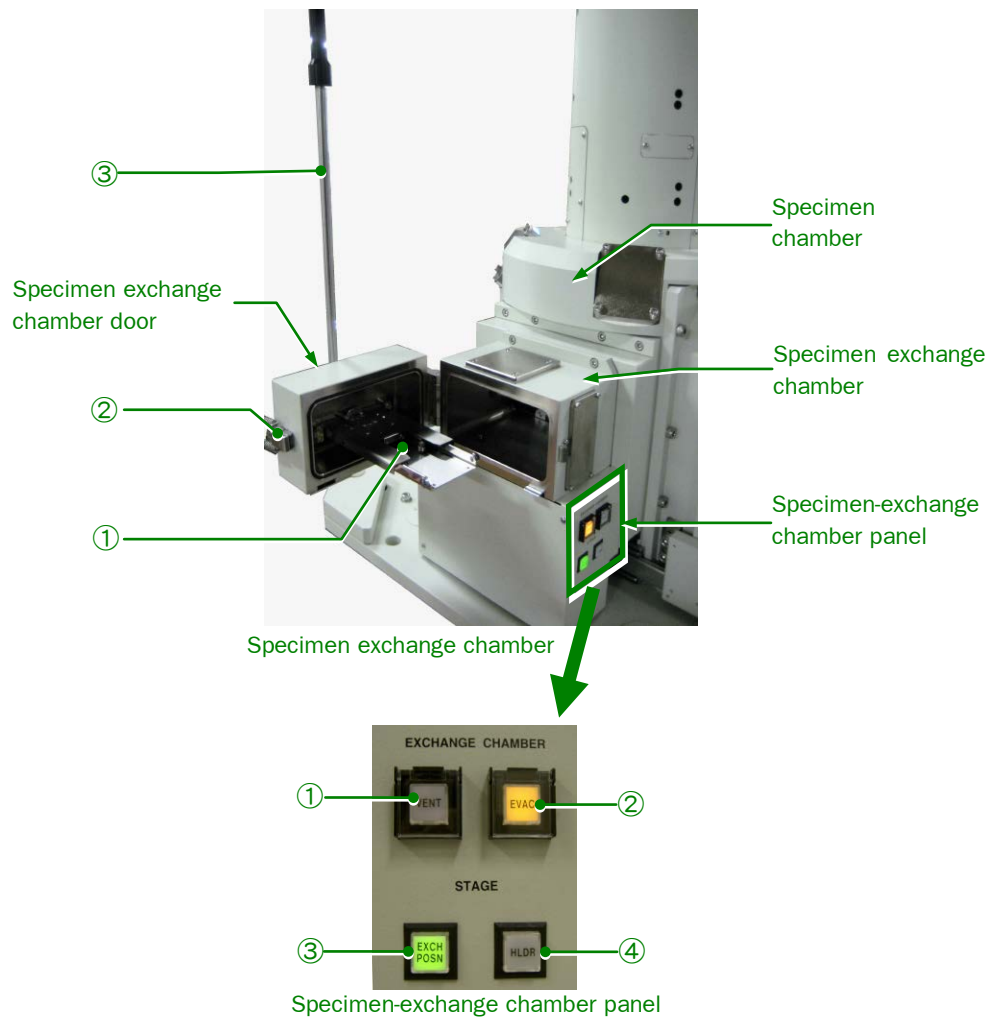


Fig. 4 Specimen-exchange chamber and specimen-exchange chamber panel

● Specimen exchange chamber

- ① Specimen-holder chuck
This chuck holds the specimen holder in the specimen-exchange chamber and places it on the specimen stage, and returns it vice versa.
- ② Locking hook
Use this hook to close and secure the door of the specimen-exchange chamber.
- ③ Specimen-exchange rod
Use this rod to load and unload the specimen holder.

2.2.6 Evacuation system control panel (front of the column cabinet)

The switches for evacuating the column are located at the front of the cabinet.

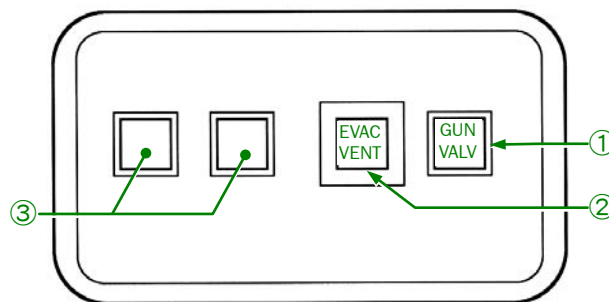


Fig. 5 Evacuation system control panel

① **GUN VALV button**

Use this button to open or close the electron gun chamber isolation valve (V1).

Pushing the GUN button forces the valve (V1) between the electron gun and specimen chamber to close.

Ordinarily, keep the button un-pressed. The valve will then open and close linked with the Observation ON/OFF buttons on the screen.

② **EVAC VENT button**

Press the EVAC VENT button when you want to vent the specimen chamber (including the objective lens) temporarily or re-evacuate it.

If you push this button, the button lamp lights and nitrogen gas enters the chamber.

If you push it again, the button pops out and the lamp goes out; then the specimen chamber is re-evacuated. Wait till the image observation is enabled.

③ **Spare buttons**

Usually, these buttons do not function.

2.3 Names and functions of the operation console

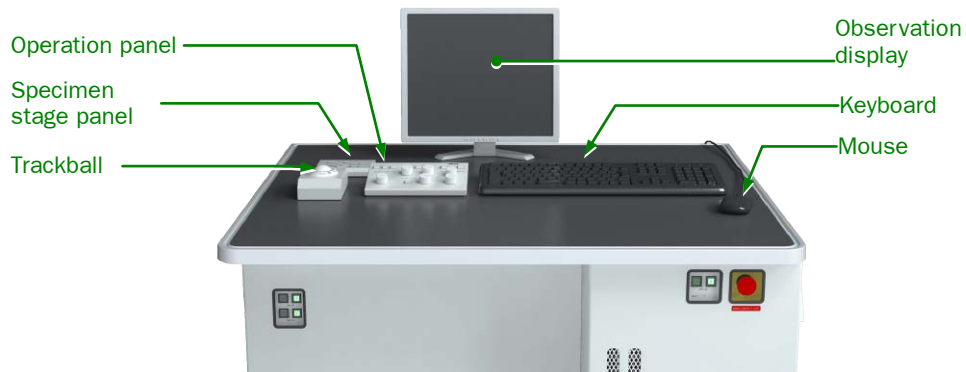


Fig. 6 Operation console

2.3.1 Observation display

The display shows the SEM images and menus for operating the SEM.

2.3.2 Mouse

The mouse has a wheel. Use the mouse when you observe SEM images or move images. The buttons and the wheel of the mouse have the following functions.

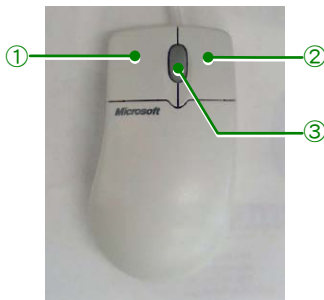


Fig. 7 Mouse

- ① **Left button**
Click: Select one of the various functions on the observation window.
Drag: Move the image or the specimen stage, measure, or draw an image.
- ② **Right button**
Click: Operate a function or move the specimen stage.
- ③ **Wheel**
Rotation: Change the SEM magnification.

2.3.3 Trackball

Use the trackball when you want to rotate or move the stage in the X or Y direction.

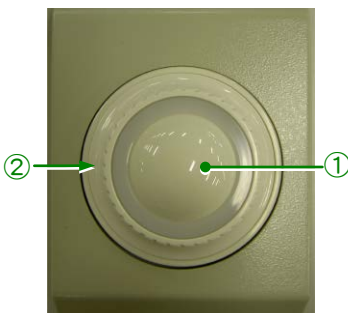


Fig. 8 Trackball

- ① **Trackball**
Roll the trackball to move the stage in the X or Y direction in the observation window.
- ② **Rotating ring**
Use the ring to rotate the stage.
When you rotate the ring a lot, the rotation speed accelerates.

2.3.4 Specimen stage panel

Use the specimen stage panel (SPECIMEN STAGE CONT) when you want to move the stage manually.

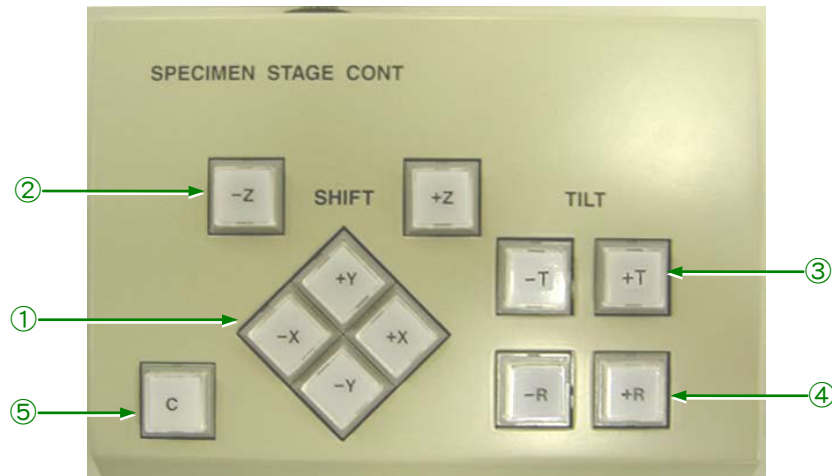


Fig. 9 Specimen stage panel

① **SHIFT buttons X, Y (horizontal movement)**

Pushing X and Y buttons move the stage in the horizontal directions (X, Y). Use the X buttons for left and right movements and the Y buttons for forward and backward movements.

It is necessary to set the basic setting again to switch the direction where the observation image moves when the +/- button is pressed.

The initial settings are as follows:

- +X: The image moves to the right. -X: The image moves to the left.
- +Y: The image moves upward. -Y: The image moves downward.

② **SHIFT buttons Z (WD movement)**

The Z buttons adjust the specimen height (working distance).

- +Z: The +Z button increases the working distance.
- Z: The -Z button decreases the working distance.

③ **TILT buttons (tilt)**

Pushing the Tilt button inclines the specimen.

- +T: Pushing the +T button increases the tilt angle.
- T: Pushing the -T button decreases the tilt angle.

④ **R buttons (rotation)**

Pushing the Rotation button rotates the specimen.

It is necessary to set the basic setting again to switch the direction where the observation image moves when the +/- button is pressed.

The initial settings are as follows:

- +R: Pressing the +R button rotates the image clockwise.
- R: Pressing the -R button rotates the image counterclockwise.

⑤ **C button (movement speed selection)**

By pushing the C (coarse) button, you can switch the stage movement speed between coarse and fine.

2.3.5 Operation panel

The operation panel contains knobs and buttons that you use when you observe an image or make a measurement.

You can change the settings according to the observation or measurement.

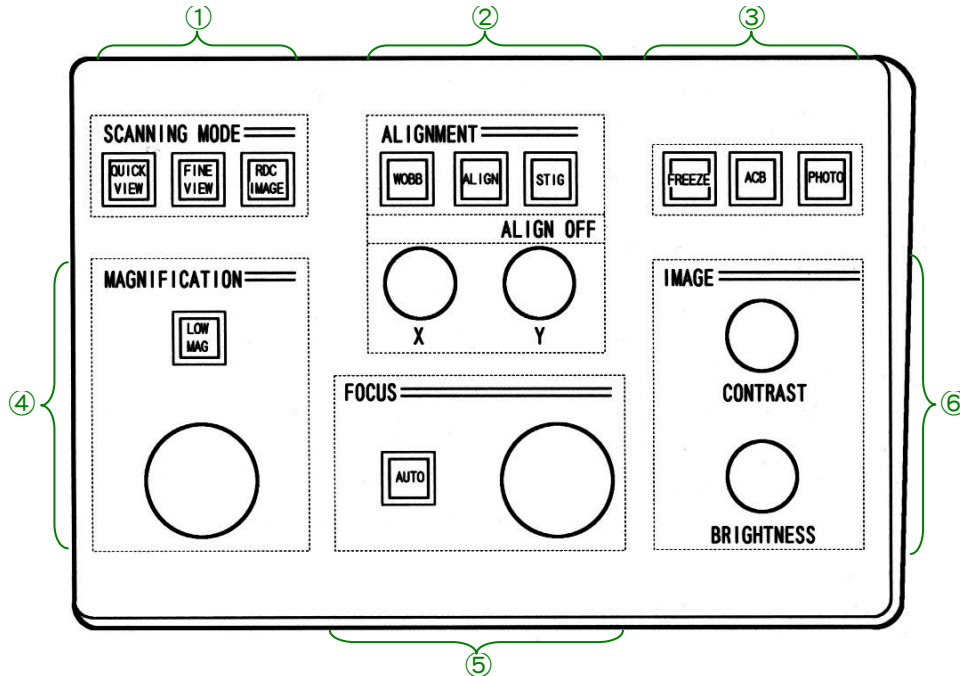


Fig. 10 Operation panel

- ① **SCANNING MODE (scanning speed)**
 - QUICK VIEW button: This button sets the scanning to high speed. You can select either of two speeds (quick 1 or 2) by pushing the button.
 - FINE VIEW button: This button sets the scanning to low speed. You can select either of two speeds (fine 1 or 2) by pushing the button.
 - RDC IMAG button: Pushing the button lights the button lamp and the scanning area is limited to 1/4.
- ② **ALIGNMENT (electron-beam alignment)**
 - WOBB button: This button is for alignment of the electron column (source alignment, beam alignment, stigma-center X, stigma-center Y). When you push the WOBB button, the lamp of the button blinks and the image changes periodically. Pushing the button again turn off the light of the button and the wobble mode.
 - ALIGN button: When you push this button, the button lamp turns on and the alignment window opens. The item changes whenever you push the ALIGN button, and you can select the necessary item. For each item, turn the X or Y knob for alignment.

Table3 Functions of the ALIGN button and the X and Y knobs

ALIGN button	Function of the X and Y knobs	Operation
Source Align.	Gun alignment	Turn the knobs so that the image does not move at PC18 (when using middle or large probe-current).
Beam Align.	Beam alignment	Turn the knobs so that the image does not move.
Stigma-center X	Stigmator X centering	Turn the knobs so that the image does not move.
Stigma-center Y	Stigmator Y centering	Turn the knobs so that the image does not move.

STIG button: When you push this button, the button lamp turns on and the instrument switches to the stigmator-adjustment mode.

X and Y knobs: The X and Y knobs adjust the X or Y value of the item you selected using the ALIGN or STIG button.

③ FREEZE/ACB/PHOTO (image acquisition/photography)

FREEZE button: When you push this button, the button lamp turns on and freezes the image based on the setting to freeze the image.

☞ For detailed information regarding the settings to freeze images, refer to “Operation Settings” in the JSM-7100F instruction manual.

ACB (automatic contrast and brightness) button:

When you push this button, the button lamp turns on and the software changes the image to the previously set contrast and brightness.

☞ For detailed information regarding the settings for the ACB, refer to “Operation Settings” in the JSM-7100F instruction manual.

PHOTO button:

When you push this button, the button lamp turns on and the software begins to store images. After the instrument finishes photographing images, the lamp darkens.

☞ For detailed information regarding the settings for the PHOTO, refer to “Operation Settings” in the JSM-7100F instruction manual.

④ MAGNIFICATION

MAGNIFICATION knob:

Use this knob to change the magnification. The observation window shows you the current magnification. When you select D-Mag, the observation window shows the direct magnification of the image.

LOW MAG button

When you push this button, the button lamp turns on and the software lowers the magnification. If you push it again, the lamp goes out, and the magnification goes back to the previous value.

- ⑤ **FOCUS**
 FOCUS knob: Use this knob to focus images.
 AUTO button: Use this button to start the automatic function. When you push this button, the button lamp blinks and the preset automatic function starts. You can select auto focus, automatic stigma, or WD as the automatic function (the initial setting is auto focus).
 ☞ For detailed information regarding the settings for the AUTO, refer to “Operation Settings” in the JSM-7100F instruction manual.
- ⑥ **IMAGE (brightness control)**
 CONTRAST knob: Use this knob to adjust the contrast of the image.
 BRIGHTNESS knob: Use this knob to adjust the brightness of the image.

2.3.6 Power Buttons

The following figure shows the power buttons of the operation system for SEM.



Fig. 11 Front of the operation console

■ Front of the operation console

● MAIN/VAC power switches

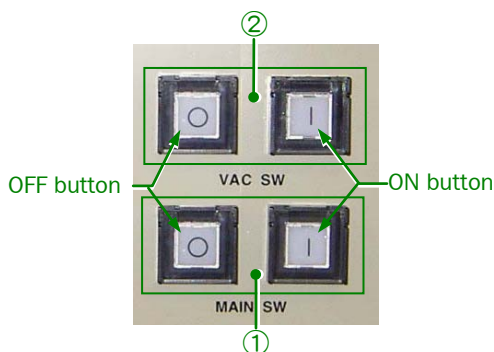


Fig. 12 MAIN VAC power switches

- ① **MAIN SW buttons**
 These buttons are the main power switches of the SEM system.
- ② **RESET button**
 These buttons are switches for the evacuation system. They are for driving the evacuation system except for the ultra-high vacuum ion pump

● Operation system power switches

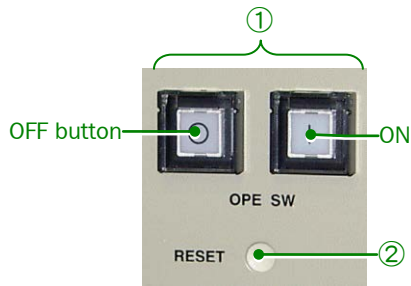


Fig. 13 Operation system power switches

- ① OPE SW buttons
These buttons turn on and off the operation system (not including the evacuation system).
- ② RESET button
This button resets the power of the operation system.

● Emergency stop button



Fig. 14 Emergency stop button

Press the switch when the system has a problem or it is necessary to stop immediately due to a natural disaster.

■ Rear of the operation console

● Circuit breakers (over current and ground fault interrupters)

—CAUTION—

Do not touch the breaker except in an emergency.

If the breaker trips, immediately contact your service office. It indicates an unusual situation in the system.

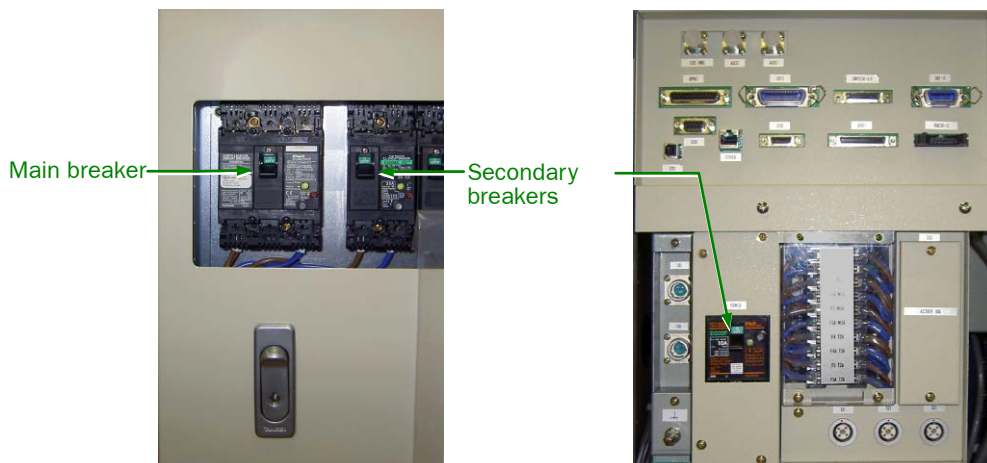


Fig. 15 Power supply circuit breakers

Circuit breakers, for all of the SEM system power supply. The breakers shut down the power when any over current happens. They are not used in normal operation.

3 SYSTEM SHUTDOWN AND STARTUP

The procedures for stopping and starting the instrument are different in these cases: ① normal use; ② long-term shutdown (for a long-term vacation); ③ emergency stop. This chapter explains how to stop and start the instrument in each case.

This instrument enables a high-resolution observation of the specimen. To ensure this, it is necessary to reduce gas molecules, which contaminate the specimen during observation, by maintaining a high vacuum. Normally, it is recommended that you run the evacuation system continuously.

3.1 Shutting down and starting the instrument in ordinary use

In ordinary use, while the evacuation system is continuously running, shut down and start the instrument based on the following steps.

3.1.1 Shutting down the instrument

1. Select **File — Exit** from the menu bar in the observation window.

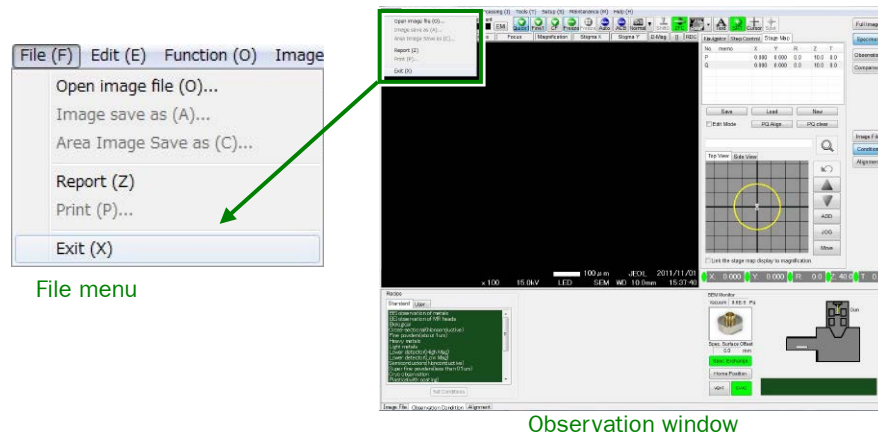


Fig. 16 File menu

The user login dialog box appears.

2. Click the **Exit** button.
The Windows desktop appears.



Fig. 17 User login dialog box

3. Click the Windows Start button  and then click the **Shut Down** button.

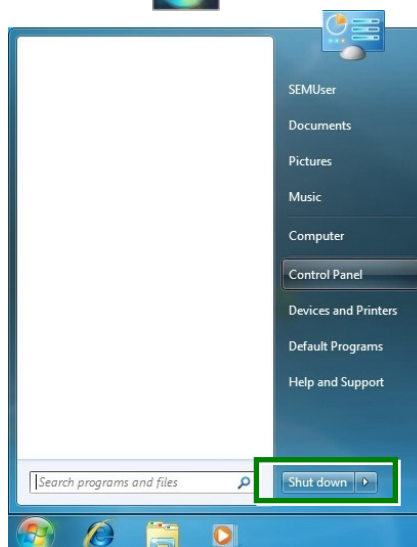



Fig. 18 Windows start menu

4. Press the OFF button in the OPE SW panel located at the bottom right of the operation table.

The SEM operation system turns off.

 Although this step shuts down the instrument, the evacuation system continues to run.

MAIN SW: ON

VAC SW: ON

5. Shut off the cooling water tap.

 If you are using a water chiller, turn it off as well.

3.1.2 Starting the Instrument

1. Confirm that the instrument has been shut down with ordinary operations.

Prerequisite: MAIN SW: ON button is lit

VAC SW: ON button is lit

2. Open the cooling water tap.

 If you are using a water chiller, turn it on as well.

3. Press the ON button of the operation system power switch.

The SEM operation system turns on.

4. Turn on the power supply of the computer.

Windows starts and the Startup screen appears.


5. Select the user account set by JEOL and then input the password.

The default settings of user account and password are "SEMUser".

Default settings: User account: SEMUser

Password: SEMUser

Change the user account and the password when you need to.

 Refer to chapter 7 "Operations by Administrator" in the JSM-7100F instruction manual.

6. Double-click the **PC_SEM** icon on the desktop.



Fig. 19 SEM icon

The SEM control system starts and the user login dialog box appears.

- ✎ After you press the ON button of the operation system power switches (OPE SW), wait for about 1 min before starting the SEM control system. Because the earlier clicking might induce not to start the SEM control system.

7. Select a user name and enter a password.

- ✎ The follow is an example when a guest is selected.

User name: **guest**
 Password: **(None)**



Fig. 20 User login dialog box

The user name you choose here determines the recipe list that appears in the SEM control software and the file path that saves images.

8. Click the **Start** button.

The SEM observation window appears and you can use the operation panel and trackball.

- ✎ For detailed information regarding procedures for SEM observation, refer to Chapter 4, “Basic Operations”.

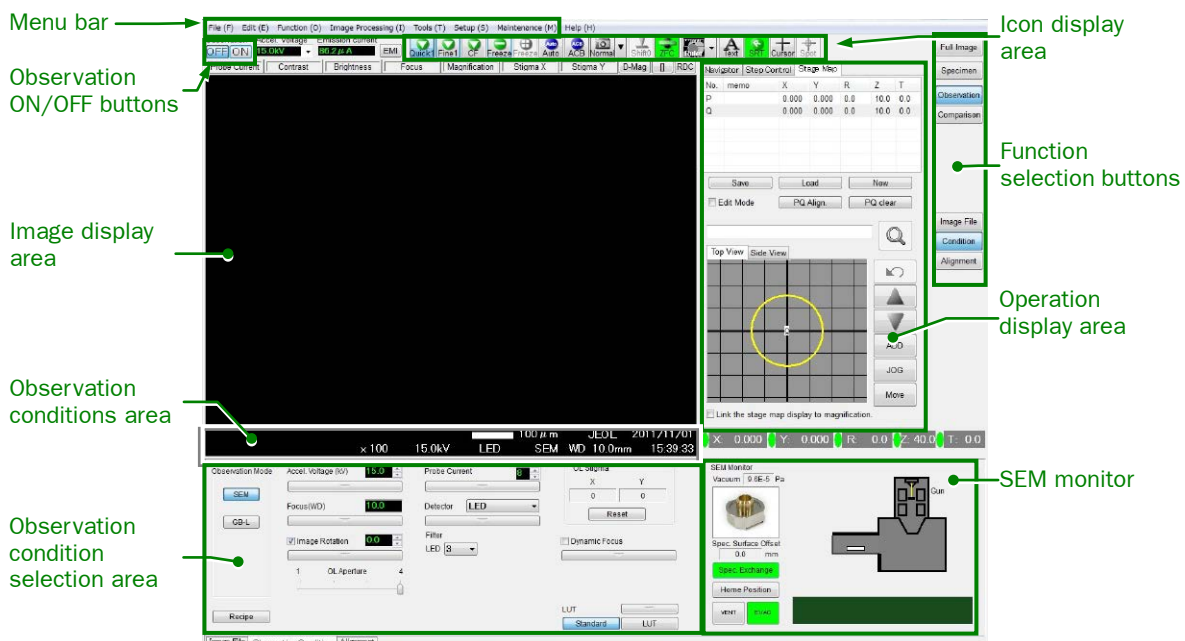


Fig. 21 Observation window

3.2 Shutting down the instrument to prepare for a long term stop and then starting it

This section explains the procedures that are needed when the instrument is off for a long term due to long holidays or other reasons.


3.2.1 Shutting Down the Instrument to Prepare for a Long Term Stop

1. According to the procedure in Section 3.1.1, "Shutting down the instrument".
2. Press the OFF button of the VAC SW button in the front of the operation system. (Fig.12)


The vacuum system stops.

3. Keep the ON button of the MAIN SW buttons pressed.

This keeps the ion pump on to maintain the ultra-high vacuum in the microscope.

 If you want to turn off the MAIN SW, you need to install a separate, optional backup battery for high vacuum.

The backup battery is automatically turned on when the battery of the ultra-high vacuum system (ion pump) loses its charge, such as MAIN SW OFF or power failure.

 In the case of using the backup battery, the system can keep the ultra-high vacuum for about 14 days.


3.2.2 Starting the Instrument after Long Term Stop

1. Confirm that the MAIN SW is on.
2. Turn on the VAC SW.
This starts the evacuation system.
After you press VAC SW ON button and the evacuation system starts, image observation is possible in about two hours.
3. Start the system according to the procedure in Section 3.1.2, "Starting the Instrument".

3.3 Shutting down the instrument in case of an emergency and then starting it


If an emergency occurs or you need to stop immediately for a natural disaster or a similar reason, press the emergency stop button.

3.3.1 Emergency stop

- ◆ Press the emergency stop button. (Fig. 14)
The emergency stop button is located at the bottom right of the operation table.
Pressing this button turns off all the power supplies to stop the instrument.
 If you press the emergency stop button due to a problem with the instrument, contact your JEOL service office.

3.3.2 Restarting the instrument

Take the following steps to start the instrument after you press the emergency stop button.

1. Be sure that the instrument does not have any mechanical failures.
Check the connection, the flow, and the pressure of the cooling water and nitrogen gas.
2. Turn the emergency stop button to the RESET direction.
Turn the button until the button head pops up.
3. Press MAIN SW ON button.
4. Turn on the VAC SW.
This starts the evacuation system.
 After you press VAC SW ON button and the evacuation system starts, image observation is possible in about two hours.
5. Press the operation system power switch RESET button and then press the OPE SW ON button.
6. Turn on the power supply of the computer to start it.
7. Select the user account of Windows and enter the password.
8. Double-click the **PC_SEM** icon on the desktop.
This starts SEM control system.
9. Select the user login name “Administrator” and enter the password “jeoladmin”.
10. Click the **Start** button.
SEM observation window appears.
11. Confirm that any error messages are not displayed in the observation window.
If any error message appears, contact your local JEOL service office.
12. Select **Maintenance — GUN/VAC** from the menu bar in the observation window.
The Maintenance window appears.

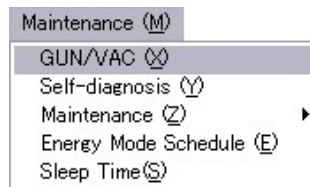


Fig. 22 Maintenance menu

13. Select the **Gun fine adjustment** tab and click the **Protection Release** button.

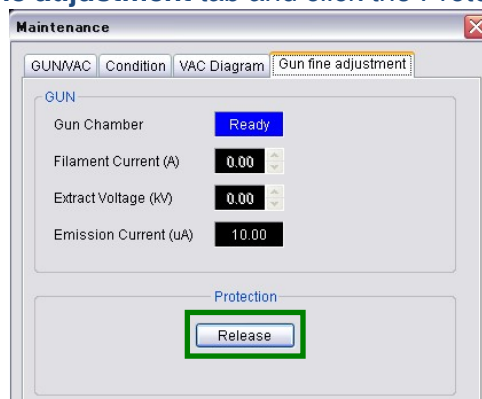


Fig. 23 Maintenance window

This cancels the protection of the electron gun, enabling the electron gun to start up.

14. Confirm that the Gun Chamber status is “Ready” (blue), select the GUN/VAC tab, and click the **Startup** button.

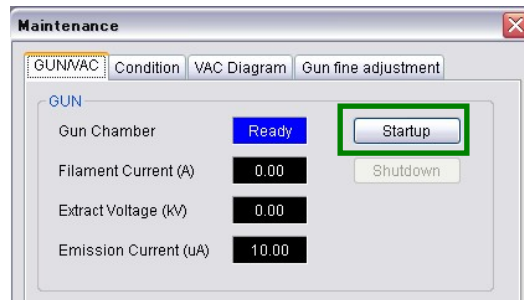



Fig. 24 Maintenance window



This starts the Gun-Startup sequence. This sequence completes in about 20 minutes.

 If the Gun Chamber status is not “Ready” (blue), contact your local JEOL service center.

15. Confirm that the instrument is completely evacuated and is ready for image observation.
After you press VAC SW ON button and the evacuation system starts, image observation is possible in about two hours.
16. On the SEM observation window, switch the Observation ON/OFF buttons to **ON**, and perform SEM observation. (Fig. 33)

3.3.3 Measures at a power failure

If a power failure occurs, the instrument shuts down automatically and safely.


-  However, if the power failure lasts four hours or more, it becomes difficult to restore the pressure of the ultra-high vacuum system (ion pump). We recommend that you use the optional battery backup power supply for the ultra-high vacuum system.
-  Restoration of the pressure of the ultra-high vacuum system requires baking of the electron gun. In this regard, contact your local JEOL service office.

3.3.4 Restarting the instrument after a power failure

- ◆ Start the system according to the procedure in Section 3.3.2, “Restarting the instrument”.
If an error message appears in the observation window, contact your local JEOL service office.


4 BASIC OPERATIONS


This chapter describes the basic operations of the scanning electron microscope (SEM).

 For more details, refer to the main instruction manual.

4.1 Preparing a specimen

This chapter describes how you mount standard specimens. The 12.5 mm diameter holder is used as an example.

 The type of specimen and its shape determines how you mount specimens. For detailed information, refer to the appropriate documents.

 The specimen holder is another factor that determines how you mount specimens. For detailed information, refer to the appropriate manual for the specimen holder.

● Required items

Specimen:	Rectangular specimen as an example. Here, a slice of square specimen with a diagonal of 12.5 mm or less is used as an example.
Specimen holder:	12.5 mm diameter specimen holder
Specimen stub:	12.5 mm diameter, 10 mm thick
Conductive paste:	Conductive paste for securing the specimen

4.2 Mounting a specimen

The following are the procedures for mounting a specimen to the specimen stub.

1. Apply a thin layer of conductive paste to the specimen stub to secure a specimen onto the stub.

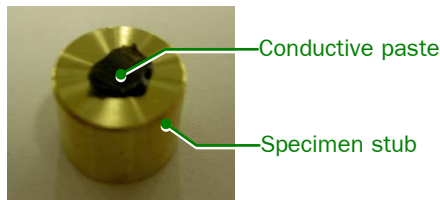


Fig. 25. Specimen stub

2. Put the specimen on the paste to fix it onto the stub.

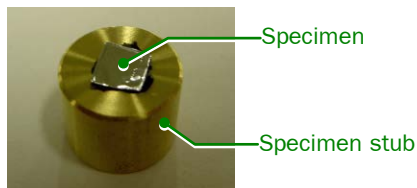


Fig. 26 Securing the specimen

3. Wait a few minutes for the paste to dry.
4. Secure the specimen stub (specimen) to the specimen holder, as follows.
 - a. Insert the specimen stub (specimen) into the specimen holder.
 - b. Align the specimen surface with the top face of the cylinder.
Use a flat-blade screwdriver to turn the adjusting screw at the bottom of the specimen holder to adjust the height of the specimen.
 - c. Lock the specimen stub (specimen) in place using two setscrews.

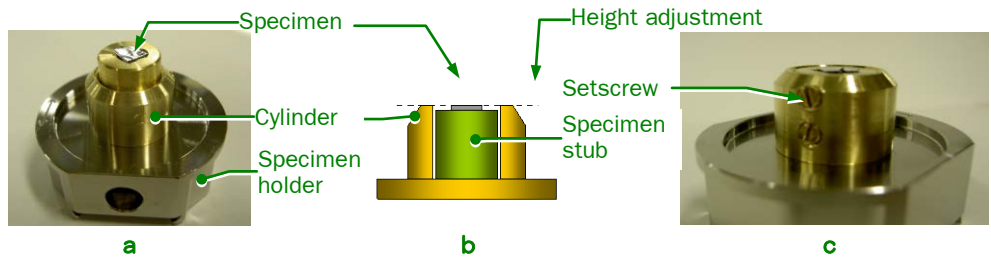


Fig. 27 Mounting a specimen

—CAUTION—

Be sure to observe with the specimen (including powders and easy-to-scattering material) fixed to the stage.

If a specimen is scattered in the specimen chamber, it might inhibit performance remarkably.

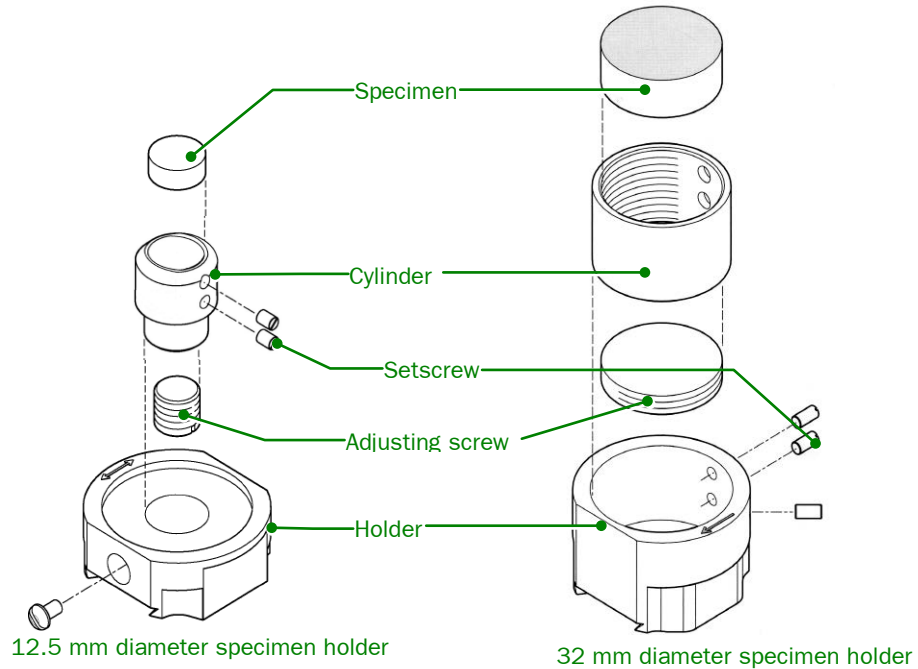


Fig. 28 Standard specimen holder

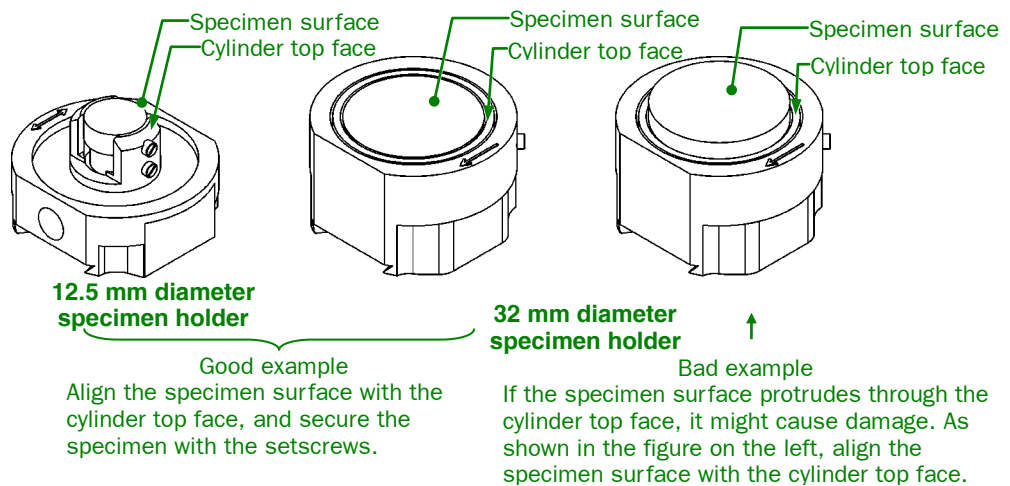


Fig. 29 Positioning the specimen

- ✂ If you lost the setscrew, please contact your local JEOL service office.
- ✂ When the SM-71031SE2A (specimen exchange chamber Type 2A) has been configured, you can insert a specimen at a maximum height of 30 mm protruding above the cylinder top face from the specimen-exchange chamber

—CAUTION—

- **When the SM-71031SE2A (specimen exchange chamber Type 2A) has been configured, the maximum height of the specimen is 30 mm that can protrude above the cylinder top face.**

If you insert a specimen that exceeds the 30 mm limit and protrudes above the cylinder top face, damage occurs to the specimen or specimen-exchange chamber.

- **If you insert a specimen into the specimen chamber that protrudes above the cylinder top face, make sure that you enter a value in the specimen surface offset column.**

If you do not enter the error for the height of the specimen, there may be a collision between the specimen and the objective lens or an attachment.

■ The direction of mounting and observing a specimen

Align the arrow mark on the specimen holder to the insertion direction of the holder during installation.

The direction that the arrow below shows is the same as the orientation when you observe the specimen on the screen.

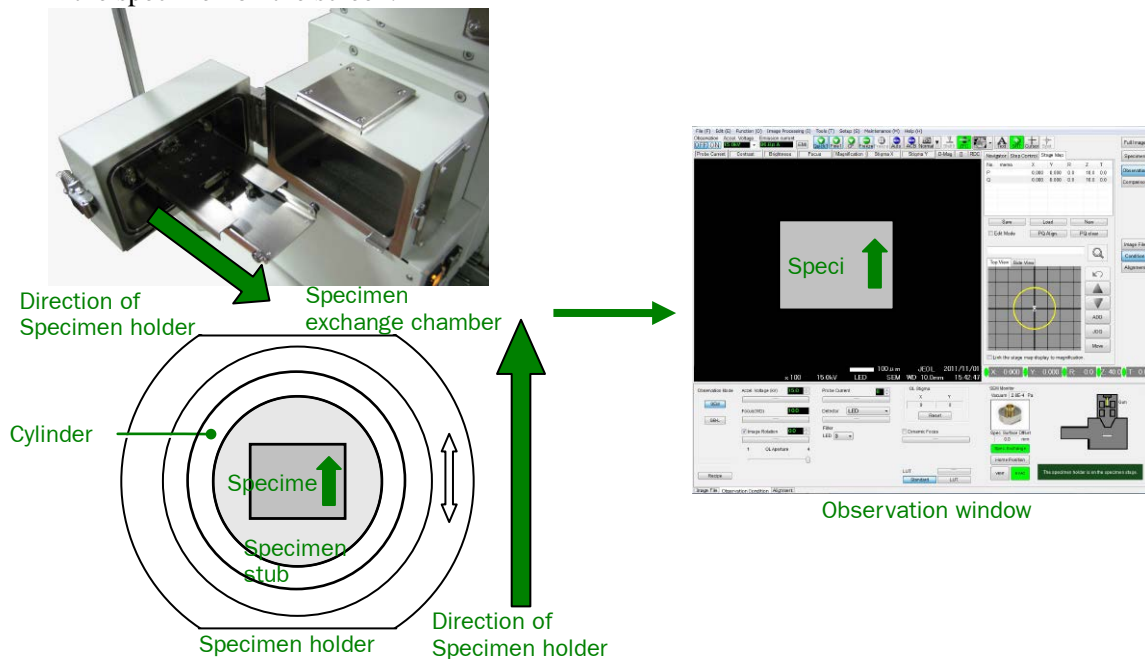


Fig. 30 Directions of specimen installation and observation

4.3 Replacing a specimen

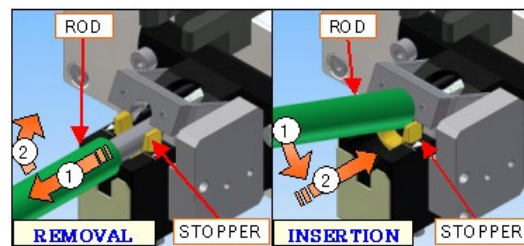
To observe the specimen that you prepared in Section 4.1 “Preparing a specimen” and Section 4.2 “Mounting a specimen”, load the specimen holder into the specimen chamber. The procedure for the replacement of the specimen depends on the type of specimen-exchange chamber.

The procedures for the manual specimen exchange chamber, SM-71031SE2A “TYPE2A specimen exchange chamber” or the SM 71010 “TYPE1 specimen exchange chamber”, are described.

—CAUTION—

When using a specimen-exchange rod for specimen exchange, carefully read the cautions on the label that is attached above the specimen-exchange chamber.

If you apply a load of 50 N or more to the specimen-exchange rod when used not in accordance with these exchange procedures, the specimen-exchange rod may bend or become damaged. Exercise extreme care.



▲ CAUTION

【 REMOVAL 】

1. Pull the rod out until the stopper goes up with a click.
2. Afterwards, lift the rod up gently.

【 INSERTION 】

1. Gently push the rod down until the rod is level.
2. Insert the rod.

※ Failure to comply this instruction could result mechanical faults.

Fig. 31 “Specimen Exchange Cautions” Label

☞ When the automatic specimen-exchange chamber is installed, refer to the separate manual for the automatic specimen-exchange chamber.

■ Observation window

Since the operation is done by observing the screen below, please reference the subsequent operations.

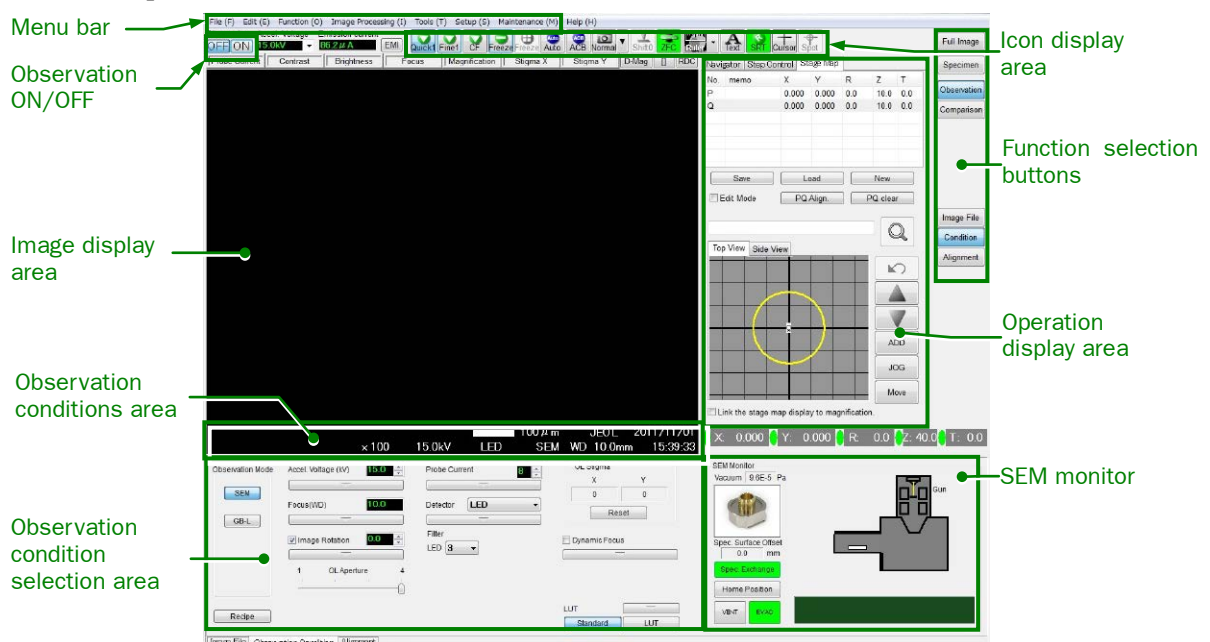


Fig. 32 Observation window

■ Loading a specimen

1. Confirm the Observation OFF button is selected in the observation window.
 ✎ Click the **OFF** button if it is ON

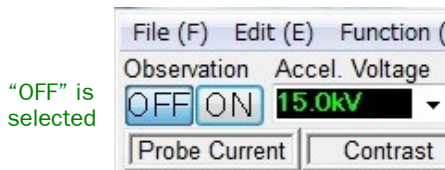


Fig. 33 ON and OFF buttons under Observation

2. Click the **Specimen** button in the observation window.

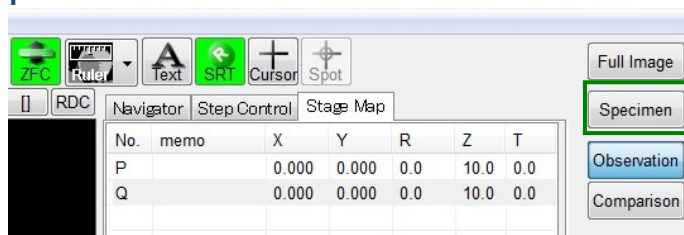


Fig. 34 Function selection buttons

3. Click the **Spec. Exchange** button in the SEM Monitor to the lower right of the observation window.

The specimen stage moves to the specimen-exchange position and the EXCH POSN lamp of the specimen-exchange chamber panel turns on.

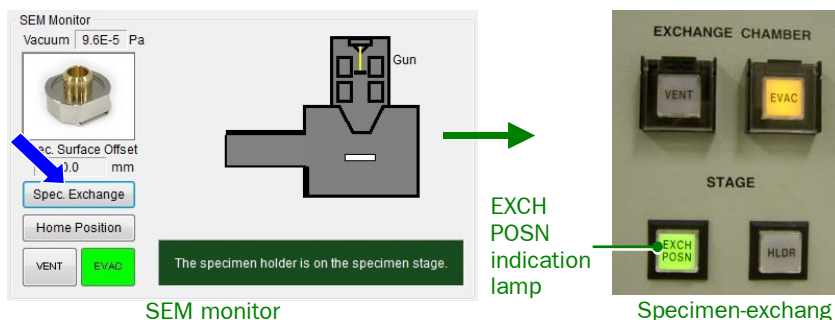




Fig. 35 SEM Monitor

4. Click the **VENT** button in the SEM Monitor or press the VENT button on the specimen-exchange chamber panel.
 Clicking the **VENT** button in the SEM Monitor displays a confirmation dialog box.
 Clicking the **OK** button introduces nitrogen gas into the specimen-exchange chamber.
 When the specimen-exchange chamber reaches atmospheric pressure, the “VENT” button lights.



Fig. 36 Confirmation dialog box

Pressing the VENT button on the specimen-exchange chamber panel causes the button lamp to blink, introducing nitrogen gas into the specimen-exchange chamber. The button lamp lights when the specimen exchange chamber becomes the atmospheric pressure.

5. Unlock the specimen-exchange chamber door releasing the latch; open the door.
6. Install the specimen holder into the specimen-exchange rod.
Slide the specimen holder into the specimen chuck following the direction of the arrow, insert it into the middle of the specimen holder chuck, and then install the specimen-exchange rod.
 -  If you are using a standard specimen holder, you can insert the holder from either direction since it is marked with a two-headed arrow.
 -  When you insert the specimen holder into the chuck, insert it in such a way that the specimen holder is placed in a horizontal position.

—CAUTION—

Do not insert the specimen holder into the specimen chamber if the specimen chamber is slanted.

The specimen holder may fall into the specimen chamber.

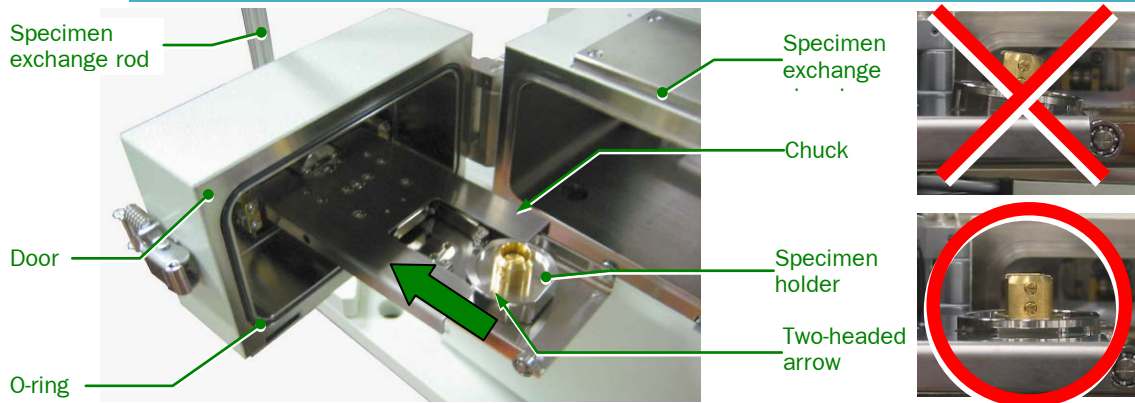


Fig. 37 Setting the specimen holder in place

7. Close the door of the specimen-exchange chamber and lock it using the latch.

—CAUTION—

Before closing the door of the specimen-exchange chamber, confirm that the O-ring of the door is free of dust and dirt and correctly positioned in the groove.

If the O-ring is contaminated with dust or gets caught, a vacuum leak might occur.

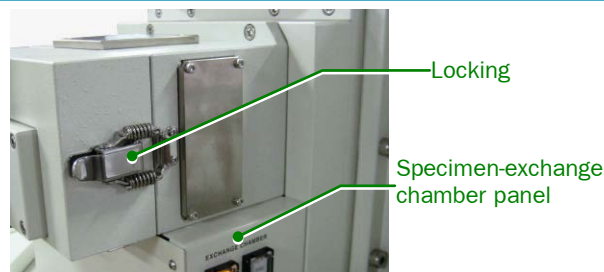


Fig. 38 Specimen exchange chamber

8. Press the EVAC button on the specimen-exchange chamber panel or click the **EVAC** button in the SEM Monitor.
Pressing the EVAC button on the specimen-exchange chamber panel causes the button lamp to blink and evacuates the specimen-exchange chamber.
When the specimen-exchange chamber reaches high vacuum, the button lamp changes from blinking to lighting.

Clicking the **EVAC** button in the SEM Monitor displays a confirmation dialog box. Clicking the **OK** button evacuates the specimen-exchange chamber. When the specimen-exchange chamber reaches high vacuum, the EVAC button lights.

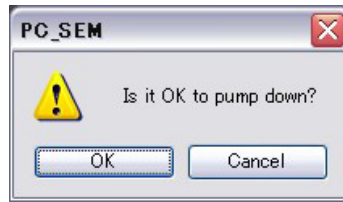


Fig. 39 Confirmation dialog box

9. Confirm that the status of the lamps on the specimen-exchange chamber panel is as follows.
 - EVAC button: Lit (the specimen-exchange chamber is under high vacuum)
 - EXCH POSN indicator lamp: Lit (the specimen stage is at the specimen-exchange position)
 - HLDR indicator lamp: Unlit (the specimen holder is not on the specimen stage)
10. Lower the specimen-exchange rod pipe horizontally with the hook attached to it.

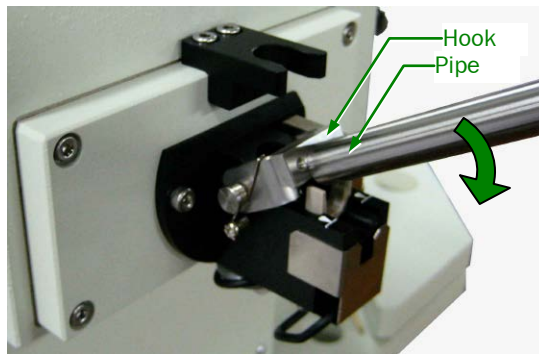


Fig. 40 Specimen exchange rod

11. Depress a stopper by the pipe until the specimen-exchange rod comes to horizontal.

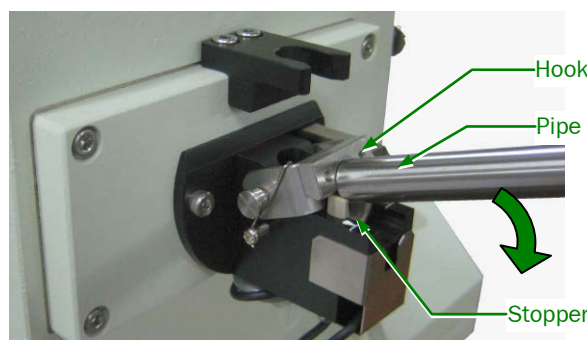




Fig. 41 Specimen exchange rod

12. Insert the specimen-exchange rod fully.
13. Ensure that the HLDR indication lamp on the specimen-exchange chamber panel is turned on and then, pull out the specimen-exchange rod completely.
 -  The lamp lights when the specimen holder is on the specimen stage.
 -  When the specimen holder is set on the specimen stage, the “Select specimen holder” window appears on the observation window.

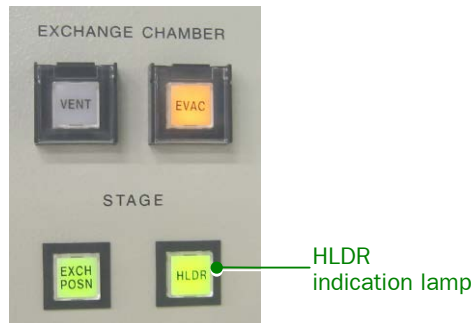



Fig. 42 specimen-exchange chamber panel

14. After the stopper snaps and comes up, bend the end of the specimen-exchange rod up.

 Be sure not to rub the end of the pipe against the stopper.

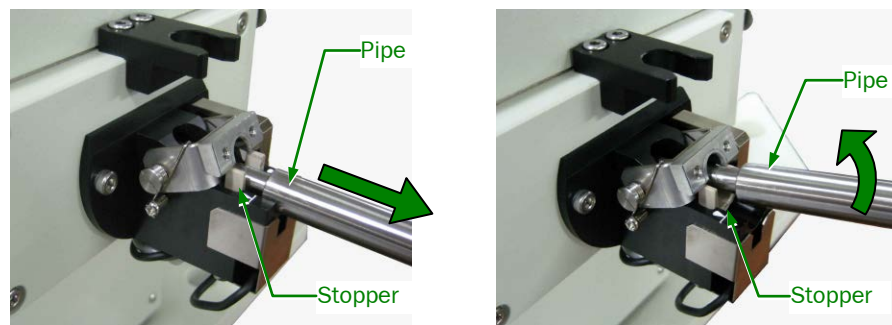


Fig. 43 Specimen exchange rod

—CAUTION—

Be sure to fully withdraw the specimen-exchange rod until the stopper snapped.

If the specimen-exchange rod is raised upward when the rod is not completely pulled out, the specimen-exchange rod may be bent and damaged.

If you do not use the specimen-exchange rod in accordance with these procedures, the rod might be bent and be damaged.

15. Bend the specimen-exchange rod, and then set the pipe on the hook. The specimen exchange is completed. You will be able to open the Electron gun chamber isolation valve (V1).

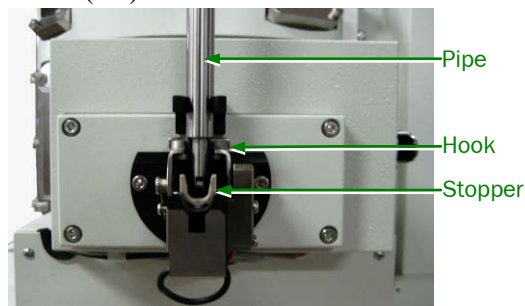


Fig. 44 Securing the specimen-exchange rod

16. Select the specimen holder from the display list in the Select Specimen Holder dialog box. If the specimen surface is protruding from the cylinder top face when you insert it, ensure that you enter the error for the specimen surface offset (mm), and then click the **OK** button.

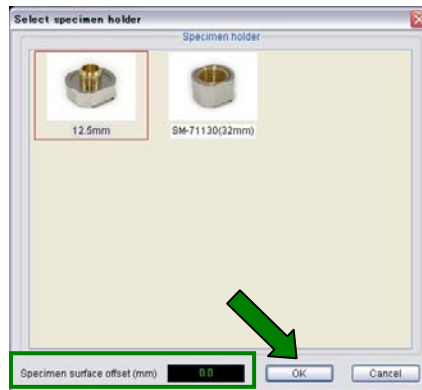


Fig. 45 Select Specimen Holder

17. On the observation window, switch the Observation button to **ON**, and start image observation.

■ Unloading a specimen

1. Confirm the Observation OFF button is selected in the observation window.
 - ✎ Click the **OFF** button if it is ON
2. Click the **Spec. Exchange** button in the SEM Monitor.
 - ✎ This moves the specimen stage to the position to replace the specimen.
 - ✎ The specimen stage moves to the specimen-exchange position, and the EXCH POSN lamp of the specimen-exchange chamber panel turns on.
 - ✎ EXCH POSN lamp is effective only when the observation OFF button has been selected. Be sure to check whether the OFF button has been selected when you exchange a specimen.
3. Lower the specimen-exchange rod pipe horizontally with the hook attached to it.

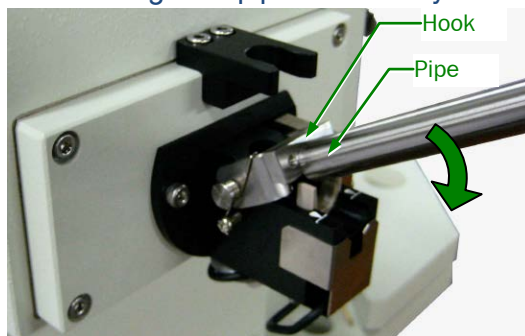


Fig. 46 Specimen exchange rod

4. Depress a stopper by the pipe until the specimen-exchange rod comes to horizontal.

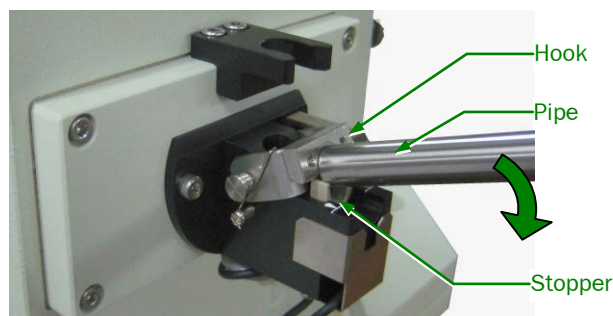



Fig. 47 Specimen exchange rod

5. Insert the specimen-exchange rod fully.

6. Extract the specimen-exchange rod fully.
HLDR indication lamp on the specimen-exchange chamber panel will turn off when the specimen holder is unloaded from the specimen stage.
7. After the stopper snaps and comes up, bend the end of the specimen-exchange rod up.
 -  Be sure not to rub the end of the pipe against the stopper.

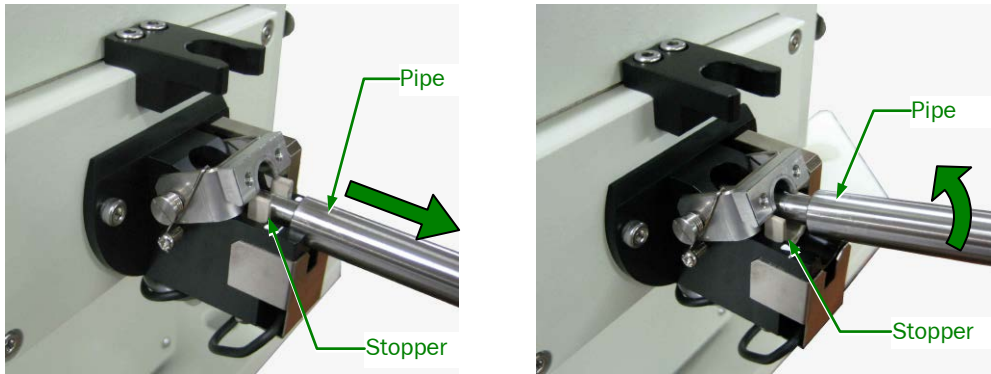


Fig. 48 Specimen exchange rod

—CAUTION—

Be sure to fully withdraw the specimen-exchange rod until the stopper snaps.

If the specimen-exchange rod is raised upward when the rod is not completely pulled out, the specimen-exchange rod may be bent and damaged.
If you do not use the specimen-exchange rod in accordance with these procedures, the rod might be bent and be damaged.

8. Bend the specimen-exchange rod, and then set the pipe on the hook.

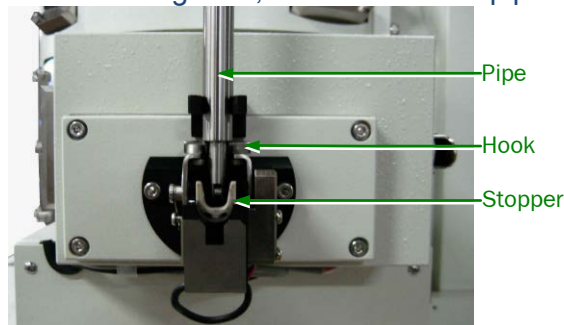




Fig. 49 Securing the specimen-exchange rod

9. Press the VENT button on the specimen-exchange chamber panel or click the VENT button in the SEM Monitor.
 -  Pressing the VENT button on the specimen-exchange chamber panel causes the button lamp to flash, introducing nitrogen gas into the specimen-exchange chamber. When the specimen-exchange chamber reaches atmospheric pressure, the button lamp changes from blinking to lighting.
 -  Cricking the VENT button in the SEM Monitor displays a confirmation dialog box. Clicking the OK button introduces nitrogen gas into the specimen-exchange chamber. When the specimen-exchange chamber reaches atmospheric pressure, the VENT button lights.
10. Unlock the specimen-exchange chamber door, open the door, and take the specimen out.

4.4 Observing a specimen

The following procedure describes how to observe a specimen.

1. Click the **Specimen** button in the observation window.
2. From the Recipe window, select the recipe that matches the specimen and then click the **Set Conditions** button.

This automatically sets the observation condition based on the recipe you selected.

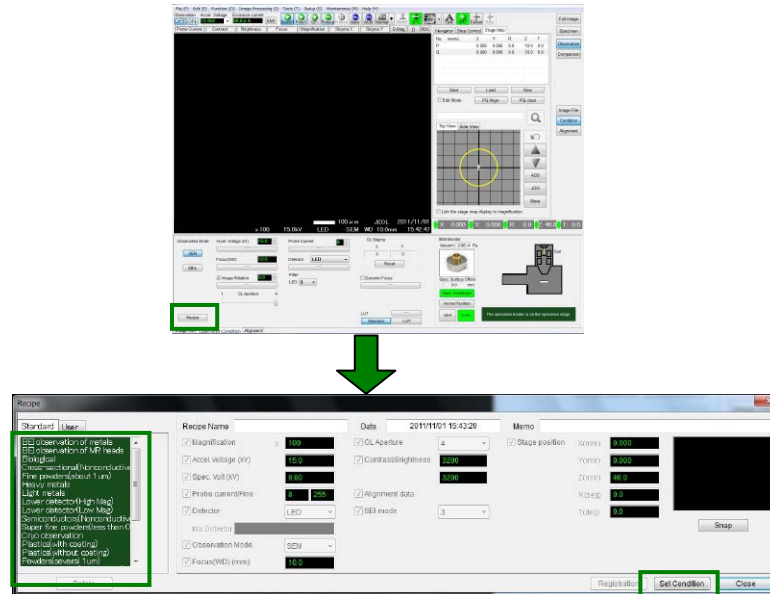


Fig. 50 Recipe

In Recipe, you can save an observation condition that is suitable for the specimen that you chose.

3. Click the **ON** button under Observation.

The gun chamber isolation valve opens automatically and the image is displayed on the image display area.

If the GUN button on the evacuation system control panel on the front of the cabinet is depressed, the gun chamber isolation valve does not open. In this case, press the GUN button to release it.

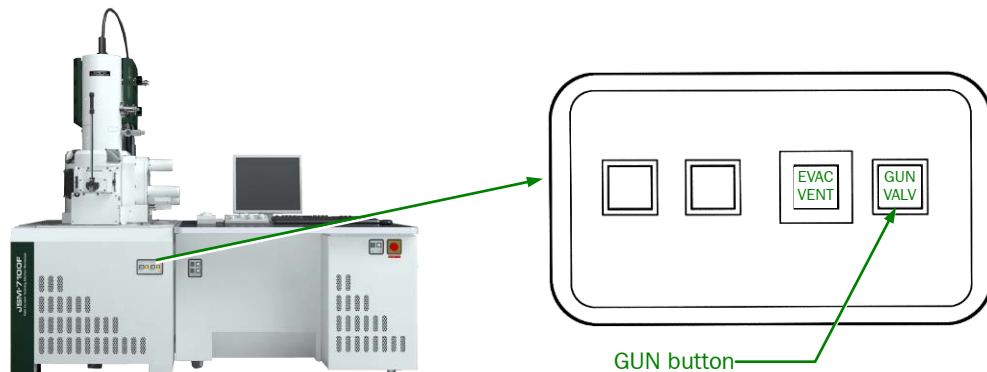


Fig. 51 Evacuation system control panel

4. Adjust the image and observe the specimen.

4.5 Focusing

The instrument is automatically controlled in order to achieve focus by using each condition (such as the accelerating voltage and WD) if the specimen surface and cylinder height matches.

- ✎ In this section, operations are shown for a situation when the specimen surface and the cylinder top face are at almost identical heights. If the specimen surface and the cylinder top face do not match, it means that the WD (working distance) and stage Z shift position are not equal. In this situation, shift the Z stage movement and roughly focus or lower the magnification and roughly focus.

4.5.1 Focusing using the FOCUS knob

1. Match the WD (working distance) with the stage Z movement position.
2. Rotate the FOCUS knob on the operation panel.

If the focus is out of range, reduce the magnification and focus again.

- ✎ When you turn the FOCUS knob, the change in focus is linked to the magnification.

4.5.2 Focusing using MOUSE on the observation window

Click the manual operation (Focus) button and adjust the focus using MOUSE on the observation window.

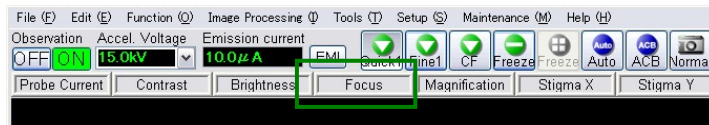



Fig. 52 Buttons for manual operations

- ✎ In regard to focusing if using the manual operation button, refer to the operation manual.

4.5.3 Automatic focus

- ◆ Press the AUTO button on the operation panel (Fig.10) or click the  icon in the observation window (Fig. 32).
 - ✎ Set the function of the AUTO button to automatic focus as a basic setting in advance.
 - ✎ Automatic focus might not operate effectively for a mirror-surface specimen. Attempt to focus on a rough part of the surface.

4.6 Checking and adjusting optical axis shift (Beam alignment)

Perform the optical axis alignment. Normally, it does not matter in regard to thoroughness of the check; however, perform adjustment if you can observe the image at a high magnification.


1. Move a distinctive shape to near the center of the observation window.
2. Press the ALIGN button  on the operation panel.

Image display switches to RDC mode (field of view is limited), and the focus of the image changes periodically.

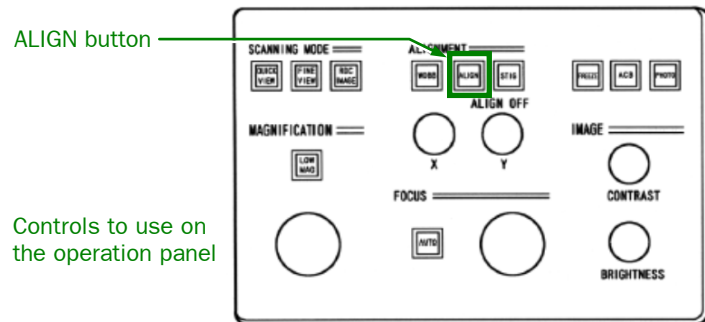


Fig. 53 ALIGN button

3. Adjust the axes by using Alignment knob X/Y so that the focus changes in the same place even if the focus changes periodically.

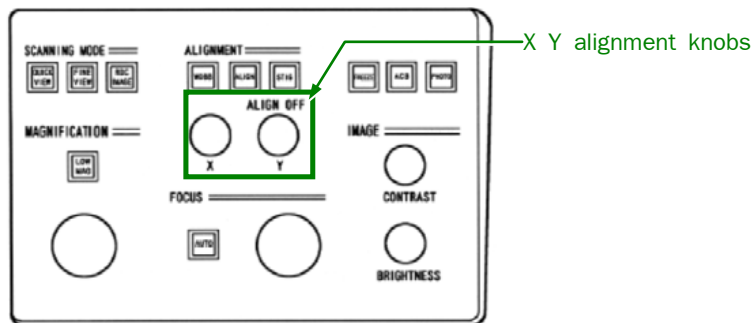


Fig. 54 Alignment knobs

- If the image is stationary
If the image remains stationary even when the focus changes periodically, no adjustment is required.
- If the image moves
If the image moves periodically as the focus changes periodically, adjustment is necessary. Using the X, Y alignment knobs, move to the position where the image is stationary. If the image remains stationary even when the focus changes periodically, adjustment is completed.

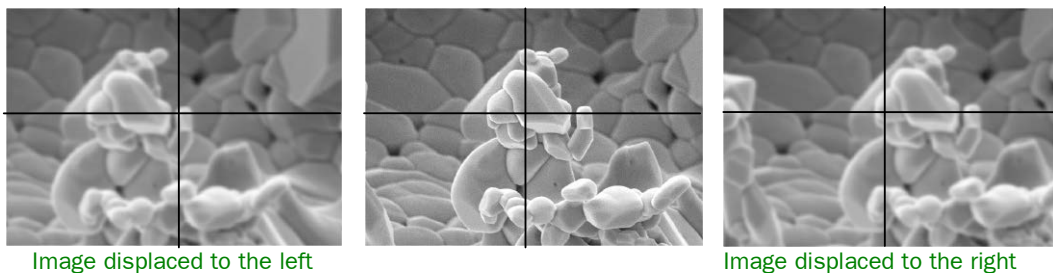



Fig. 55 Images with Optical Axis Shifts

4. Press the STIG button  on the operation panel.
This completes the optical-axis alignment procedure.

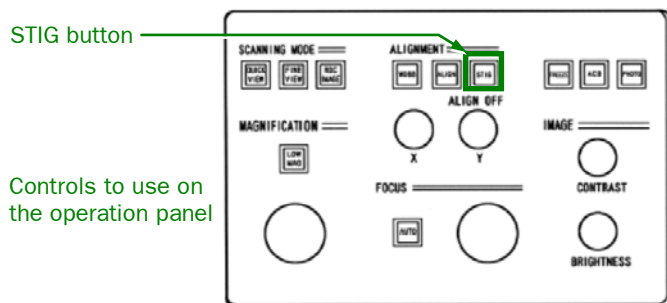


Fig. 56 STIG button

4.7 Astigmatism correction

You may need to carry out astigmatism correction when you are observing a high-magnification image.

If the image has astigmatism, the image expands diagonally when you try to focus it (as shown on the left and right in Fig. 57). Carry out astigmatism correction if this happens.

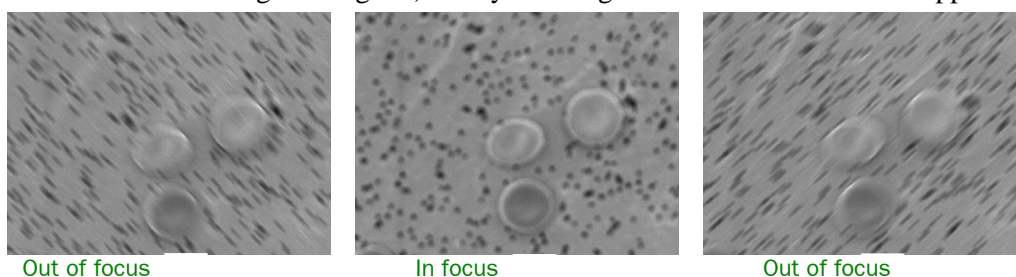


Fig. 57 Images with astigmatism

4.7.1 Astigmatism correction from the operation panel

The following steps describe how to perform the astigmatism correction. It is useful when you want to manually correct astigmatism or when the automatic astigmatism correction does not work.

1. Turn the FOCUS knob to adjust the focus to the position where the distortion does not appear. (as shown in the center of Fig. 57).
Around the focus position, the direction of the distortion changes.
2. Press the STIG button on the operation panel.
The STIG button-lamp turns on.
3. Adjust the X and Y knobs to obtain shaper images.
Correct the astigmatism by rotating the XY knob so that the distortion of the image disappears.

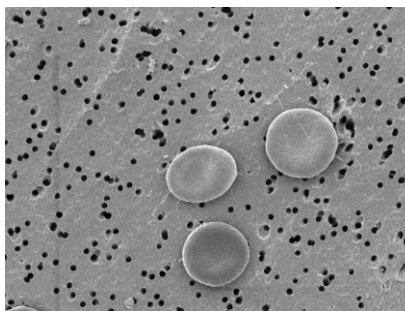



Fig. 58 Sharp image


4. Repeat Steps 1 to 3 to match the focus till the distortion of the image that is due to the astigmatism disappears.

 Even if you change the focus after you complete the above steps correctly, the image does not diagonally elongate, but defocus only occurs.


4.7.2 Astigmatism correction using MOUSE on the observation window


Click the manual operation (Stigma X, Y) buttons and adjust the focus using MOUSE on the observation window.

4.7.3 Automatic astigmatism correction

- ◆ Press the AUTO button on the operation panel (Fig.10) or click the  icon in the observation window.

Performs automatic astigmatism correction. If astigmatism has been automatically corrected and the image is focused, there is no image distortion.

 In Operation Settings, select Auto focus + Auto Stigma under Auto Button in advance.


 Depending on the form of the specimen, the correct operation may not be performed. In this situation, refer to the manual to perform astigmatism correction.

4.8 Adjusting the brightness

This section explains how to adjust the brightness of the image.

4.8.1 Automatically adjusting the brightness

Take the following steps to perform the automatic adjustment of the contrast and brightness.

- ◆ Press the ACB button on the operation panel or click the  icon in the observation window.

This starts the automatic contrast and brightness adjustment.

4.8.2 Manually adjusting the brightness

- ◆ Adjust with the CONTRAST and BRIGHTNESS knobs on the operation panel.

CONTRAST knob: For adjusting contrast.

BRIGHTNESS knob: For adjusting the brightness.

4.8.3 Adjusting brightness using MOUSE on the observation window

Click the manual operation (Contrast, Brightness) buttons and adjust the focus using MOUSE on the observation window.

4.9 Direct magnification display

The image size in the SEM has three magnification modes: standard, enlarged, and direct magnification.

Changing the image size in the observation window or changing the size of the observation display also changes the image magnification. This is why this SEM has a direct magnification mode.

4.9.1 Method to display the direct magnification

The D-Mag button is located in the manual operation section of the observation window.

 The standard and the enlarged displays have the D-Mag button.

◆ Click the **D-Mag** button.

The image size switches to the direct magnification size and the D-Mag button lights.



 $\times 1$ display size is 120 mm \times 90 mm.



Fig. 59 D-Mag button

4.10 Image enlargement display

You can enlarge the image to full screen size. In standard display (normal observation), since the screen contains the display controls for adjusting and filing images, an image that is 1,280 \times 960 pixels is reduced to fit the image space. However, in the enlarged display, the image can be displayed in full size according to the pixels of the display.

 The regular-observation display and the enlarged display are different in image size but they share the same image data.

■ Standard display

The standard display is used for image observation, image adjustment or other operations. To switch to the enlarged display, click the Full Image button at the upper right corner of the observation window.

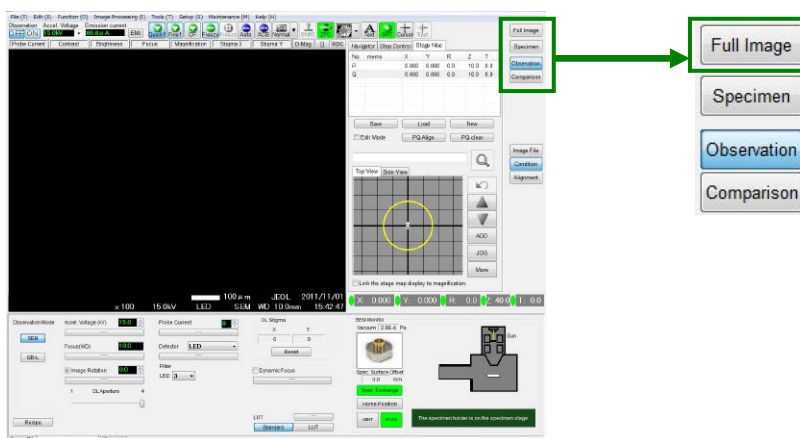



Fig. 60 Observation window

■ Enlarged display


The enlarged display is used for full-size observation and for various checking purposes for acquired images.

 The image information (data size) does not change even if you enlarge the image.

To return to the standard display, click the Standard button at the upper right corner of the observation window.

4.11 Moving the field of view

This section describes how to move the field of view while you observe images of specimen.

 You can use a variety of methods to move the field of view depending on the purpose.

4.11.1 Moving the field of view in the observation window

The following method is the most common way to shift the field of view using the observation window. This method controls the field of view to bring the image you seek to the center of the observation window.

1. In the observation window, right-click the mouse on the position that you want to move to the center of the field of view and then select Move to image center from the menu.

The desired position moves to the center of the observation image.

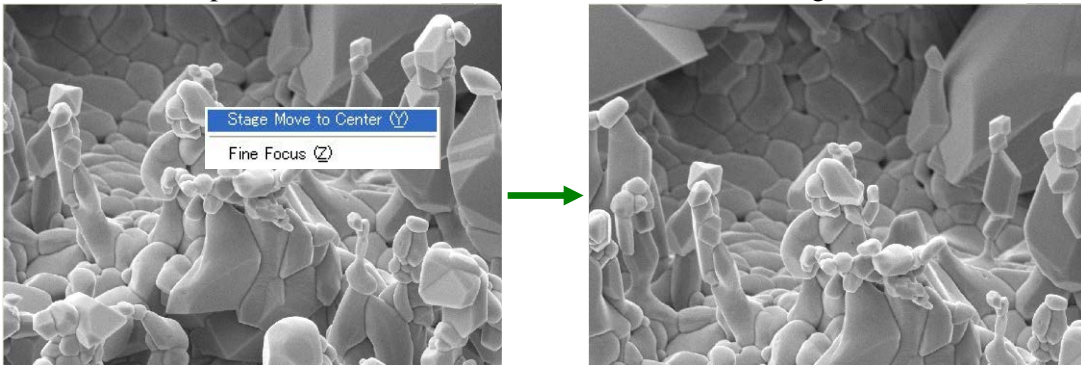


Fig. 61 Move to image center

2. Change the magnification and observe the image.
By centering the field of view in the observation window, you can keep observing the desired position even when you increase the magnification.

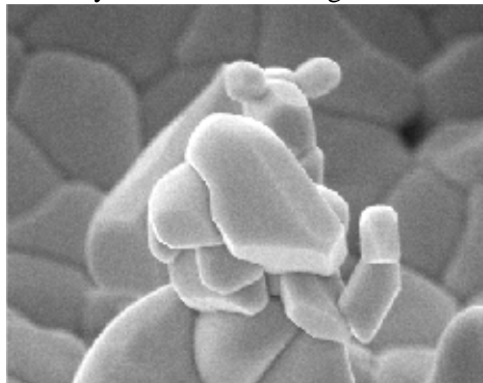



Fig. 62 Increasing the magnification after moving the field of view

4.11.2 Moving the field of view using the trackball

You can easily move the field of view by using the trackball.

- ◆ Move the trackball up or down or left or right.

You can control the field of view by rolling the trackball up or down or left or right.

 The amount of image motion resulting from the trackball movement is linked to the magnification.

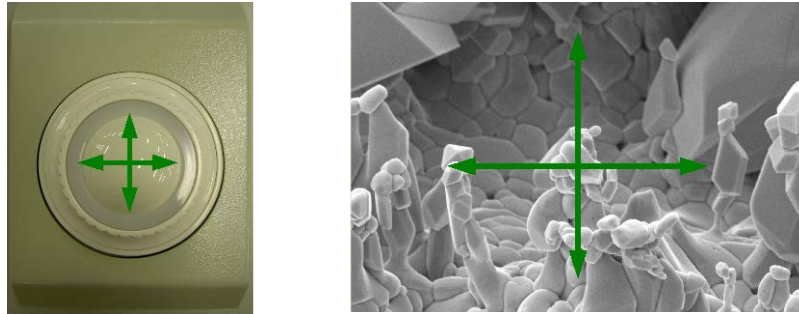



Fig. 63 Moving the field of view using the trackball

4.11.3 Moving the field of view using the specimen stage panel

You can move the field of view using SHIFT X and Y of the specimen stage panel. (Fig. 9)

4.11.4 Moving the field of view at high magnification (Image shift)

Here is how to move the field of view when you are observing the image at high magnification (Default setting: $\times 50,000$ or greater). This method uses the mouse in the observation window.

 This method limits the motion of the field of view at lower magnification. While the movement is being performed, a monitor showing the permitted range of movement for the image shift is displayed on the observation window area.

- ◆ Drag the mouse in the observation window.

Dragging the mouse (or moving the mouse while pressing the left button) moves the field of view as the mouse moves.

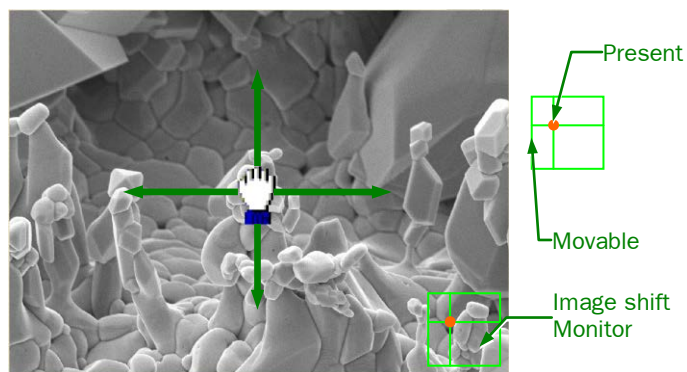





Fig. 64 Moving the field of view by dragging mouse


 The magnification to move the image shift can be set in Operation Settings.

 If you want to reset the image shift, click the image shift reset button  in the icon display area.

4.12 Aligning the specimen orientation (Scan rotation)

When observing the cross section of a specimen or a linear specimen, align the specimen horizontally or vertically on the screen axes. This section describes the procedure for aligning the direction of the image display and the direction of the specimen. Use this method when rotating the field of view without tilting the specimen (0 degree tilt).

 When you want to observe the specimen with tilting, turn off the scan rotation and align the specimen using the method in Section 4.13, “Tilt-observing a specimen”.

1. In the observation window, select Observation – Condition.
2. Click the  button in the Image Rotation section of the observation condition selection area.

The image rotation window appears.

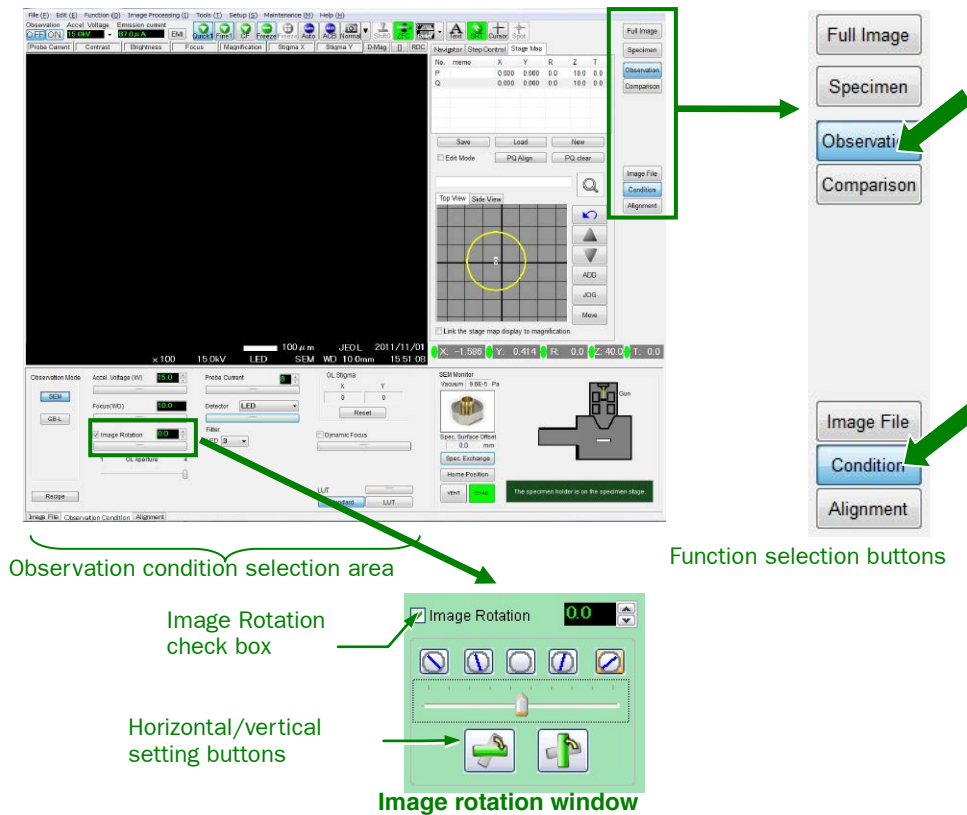



Fig. 65 Image rotation window

3. Select the Image Rotation check box.
4. Click the **horizontal setting button** .

A message that states “Draw a line where you want the image to be horizontal” appears.
5. To draw a line on the place where you want to turn the image horizontal, drag the mouse while pressing the left button.

Drag the mouse while pressing the left button in the direction that you want the image to be horizontal and then release the left button.

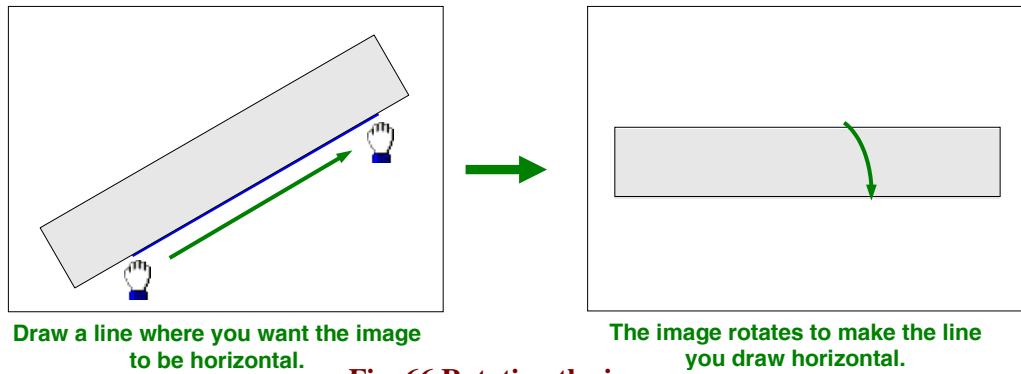


Fig. 66 Rotating the image

6. Confirm that the image automatically rotated and became horizontal.
7. Adjust the observation position by using X and Y movements.
 - If you want to vertically align the line, click the vertical setting button and then carry out the same process as the horizontal rotation process.
 - If the scan rotation is turned OFF, select OFF for the Image Rotation checkbox of the image rotation display or turn OFF the button located in the SRT icon display area.

4.13 Tilt-observing a specimen

This section describes the procedure for observing a specimen while tilting it after aligning the cross section of the specimen horizontally.

If you tilt the specimen to make an observation, you will need to horizontally adjust the specimen tilt surface with the center of the window. In this case, adjust the horizontal position by using the rotating movement of the stage.

When you rotate the specimen, be sure to check the eucentric rotation is turned on.

1. Select the Step Control tab in the operation display section of the observation window.
2. Click the **horizontal** button .

When you click the button, a message that states “Draw the line on the part you want to make horizontal” appears.

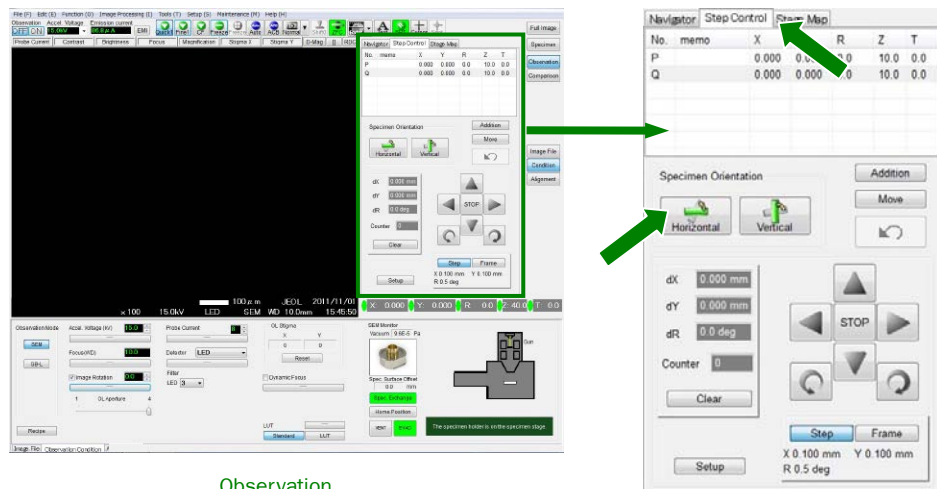


Fig. 67 Operation display area

3. To draw a line on the place where you want to turn the image horizontal, drag the mouse while pressing the left button.
 Drag the mouse while pressing the left button in the direction that you want the image to be horizontal and then release the left button.

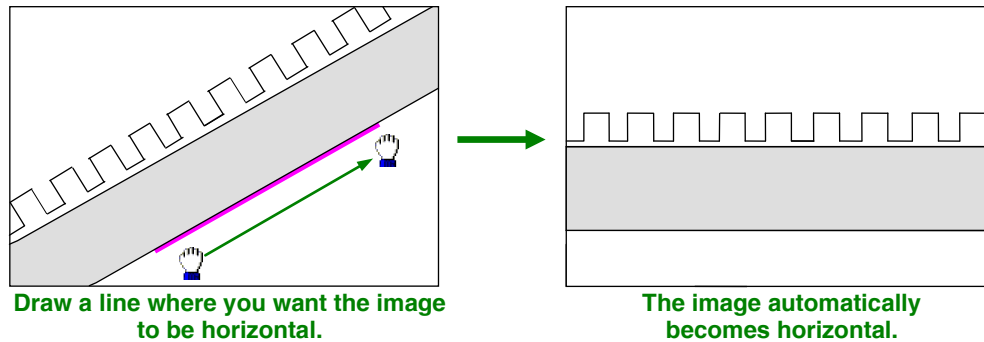


Fig. 68 Aligning the image with the horizontal

4. Confirm that the image automatically rotated and became horizontal.
5. Using the trackball or the specimen-stage panel, align the observation position with the center of the screen.
6. Tilt the specimen.

There are three methods to tilt the specimen.

- In the observation window, enter a value in the T box in the stage display section, and click the Move button.

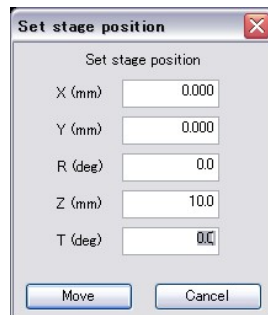


Fig. 69 Setting the stage position

- Drag the mouse on the specimen holder section on the "Holder Map Display" of the stage map in the observation window.

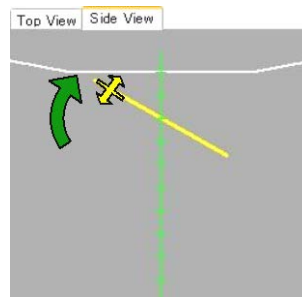


Fig. 70 Stage Map

- Use the TILT button on the specimen-stage panel.

7. Tilt the specimen to the required angle and observe it.
By tilting the stage, you can observe the surface and the cross section of the specimen.
By tilting the cross section, you can observe the surface structure of the cross section.

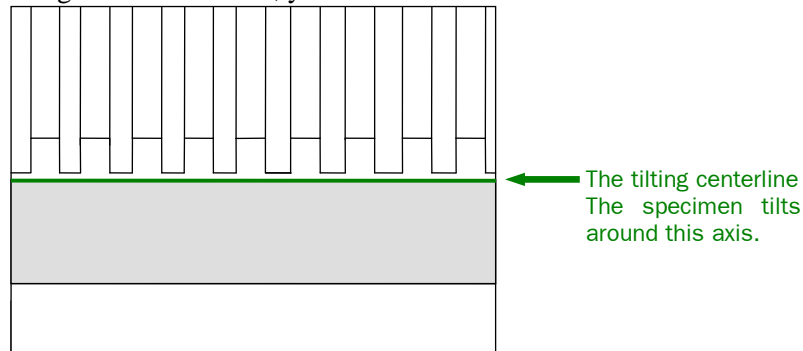


Fig. 71 Tilting the image

8. Adjust the focus if necessary.


4.14 Comparing images

You can display multiple signals as images simultaneously, compare them and save them all at the same time. Also you can load the saved images and compare them.

■ Image comparison on a split display

There are three split-display modes: the horizontal split mode, the vertical split mode, and the four-way split mode.

The following shows the horizontal split mode. The process is the same for all modes.

1. In the observation window, click the Comparison button and then click the H-Dual button.
The display changes to the horizontal split mode.
2. A blue frame appears in the image display area.
The top image is enabled. If there is an image on left and right, the left is enabled.
3. In the signal selection section of the observation condition selection area, select the signal you want to observe.
4. Click the mouse at the lower image of the window.
The blue frame moves to the lower image.
 The image is frozen; turn off using the FREEZE button on the operation panel or in the observation window to switch to live image.
5. In the signal selection section of the observation condition selection area, select the signal you want to observe.
Two kinds of live images are displayed on the upper and the lower parts of the screen.

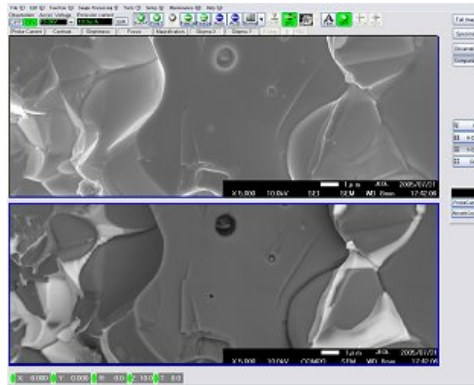


Fig. 72 Horizontal split

✎ If you split the screen and save the image, the pixel dimensions of the images are as follows:

Horizontal split mode: 1,280 × 480 pixels

Vertical split mode: 1,280 × 960 pixels

Four-way split mode: 1,280 × 960 pixels

4.15 Adding images with multiple signals

This instrument can simultaneously display multiple live images. Adding each signal (such as secondary-electron image and compositional image in BE mode) while observing the live images facilitates the image-feature recognition.

1. Click the detector bar of the observation condition selection area to display the subpanel.

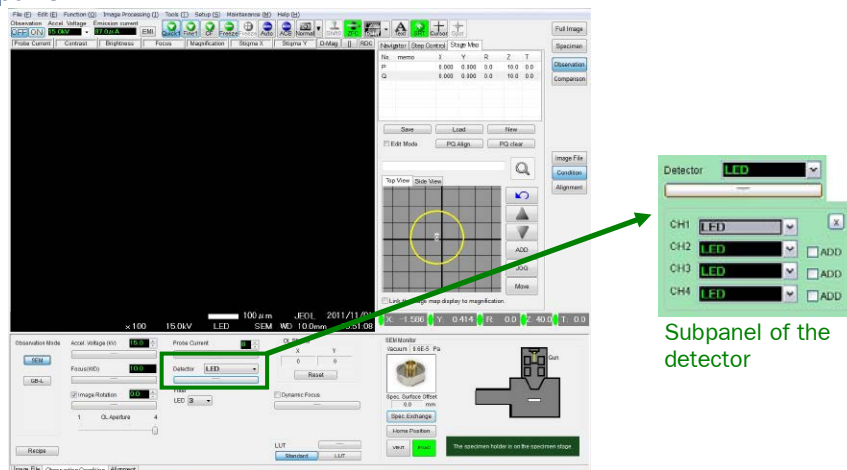


Fig. 73 Observation window

2. Select the detector to be added from the detector selection area (pull-down menu).
 - ✎ You can add up to 4 signals (CH1 to CH4).
3. Select the Add check box that is next to the detector selection area. The images that you checked are added to the topmost CH1 image. The sum appears as a live image at the top of the window.

4.16 Measuring the size

You can measure the size of the specimen in the observation window. The method for measuring the size using the cursor is shown here. There are three kinds of length measurement using the cursor: the X direction, the Y direction, and the D (diagonal) direction. The following is an example of the D (diagonal) direction that can measure in three directions.

1. Click the  button and then click the  button.



Fig. 74 Ruler icon

Or, click **Tools — Measurement — Measure R.**

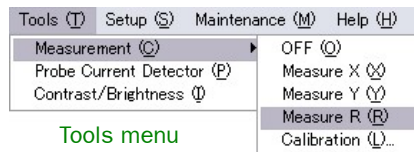


Fig. 75 Diagonal measurement

Two pairs of cursors (vertical and horizontal), and the X (horizontal), the Y (vertical) and the D (diagonal) sizes appear in the observation window.

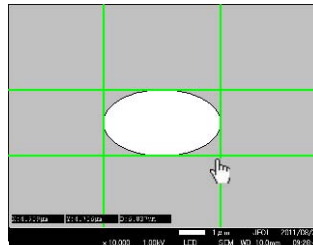



Fig. 76 Cursor measurement

2. Hold down the left mouse button, and move the cursor to measure the width.
 -  When you move the pointer close to a cursor, the shape of the pointer changes to a hand mark.
3. Measure by moving the cursor to the measurement point.

The results of measurements are displayed on the lower left of the image.

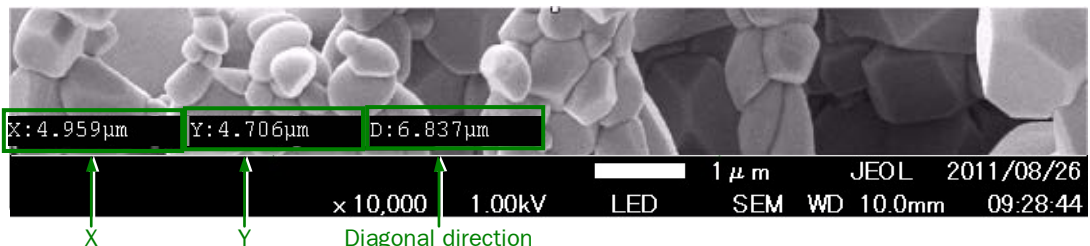


Fig. 77 Results of measurements

4.17 Switching between live image and freeze image


The SEM image in the image display area has two modes: Live and Freeze. You can choose either one of them.


- Live image:

Use this when you want to observe a live image for field-of-view search or other purposes.

- Freeze image:

Stops the updating process of the image. When you start the freeze function, the image freezes.

 The image freezes when you complete the electron beam scan.

 When you check the Integration check box in the Display System/Scan tab in the Operation Settings, the instrument performs the integration and freezes the image.

- ◆ Press the **FREEZE** button on the Operation Panel or click the **FREEZE** button in the Observation window.

This changes the image to the freeze mode. Both buttons are lit during the freeze mode. Both buttons are lit during the freeze mode.

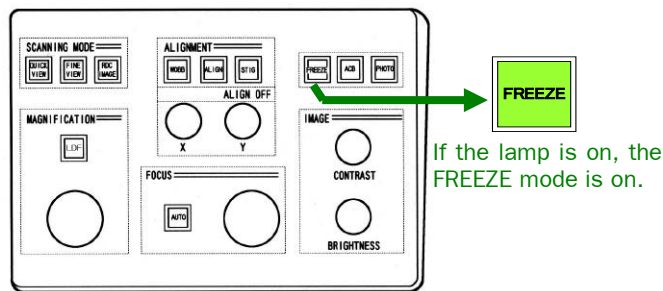


Fig. 78 FREEZE button on the operation panel




Fig. 79 Freeze button in the observation window

4.18 Photographing and saving images

You can photograph and save the image you are observing. Photographing is carried out based on pixel numbers, scanning speed, and other related conditions that you set in the operation setting.


1. Select the field of view in the observation window.


First adjust the focus and brightness.

2. Press the **PHOTO** button on the operation panel or click the  icon in the observation window.

The button blinks when photographs are taken.

When you are taking live images, the images are taken by the scanning speed that you set in the basic setting, and the images are frozen. The **FREEZE** button turns on.

 To photograph images, set the scanning speed in advance in the Operation Settings.

- After the image freezes, the Save As dialog box appears.
 If the image is already frozen, the Save As dialog box appears directly.

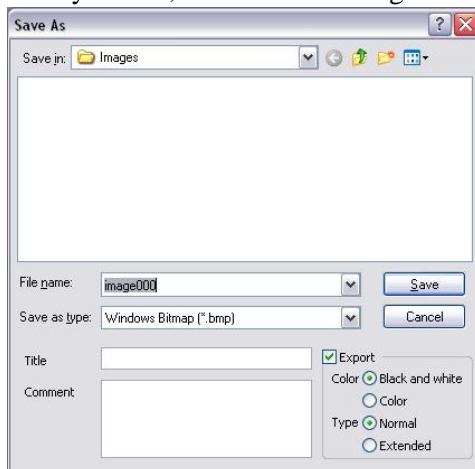



Fig. 80 Save As dialog box

- Set the following items in the Save as dialog box.

Save in:	Select a folder to save the image.
File name:	Enter the file name of the image to be saved.
Save as type:	Select the image format to save the image (BMP, JPEG, or TIFF).
Title:	Enter a title if you want to add one to the image.
Comment:	Enter comments about the image.
Export:	Saves the image with the observation conditions (such as the accelerating voltage).
Color	
Black and white:	Saves the image and text in black and white.
Color:	Saves the image and text in color.
Type	
Normal:	Observation conditions, which are chosen on the Operation Settings — Photo and Print Data tab are recorded when you save the image.
Extended:	Observation conditions, which are chosen on the Operation Settings — Extended Photo Data tab are recorded when you save the image.
- Click the **Save** button to save the image.
 The conditions for the photography are based on the conditions that you selected for the basic operation.

 Default settings:	
Scanning speed:	Value set in Fine 1
Integration:	Off
Image size:	1,280 × 960 pixels
Exposure time:	Exposure time set by the above scanning speed.

4.19 Organizing images

You can display the stored images as thumbnails. You can then load and delete them.

1. In the observation window, click the **Observation** button and then click the **Image File** button.

The image filing area appears in the operation control area at the bottom of the window.

2. Organize the images in the image filing area.

- a. Displaying the images as thumbnails

Thumbnail images saved in advance appear for the individual user. Seven images appear here.

If you want to display other images, drag the scroll bar under the thumbnails.

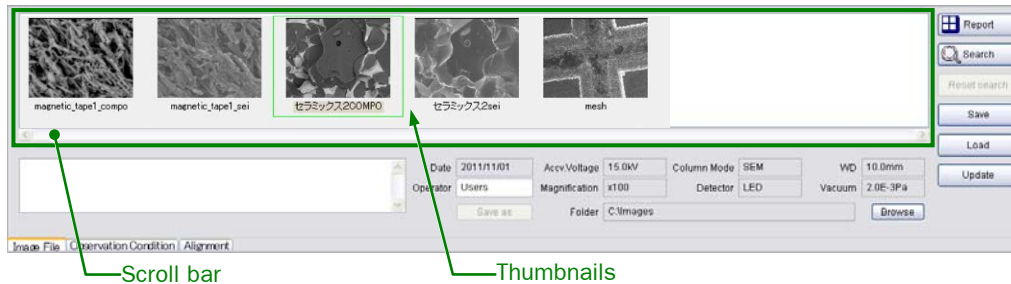


Fig. 81 Image filing area

- b. Loading a saved image


You can observe saved images in the observation window.

- 1) Left-click the thumbnail image that you want to display in the observation window.

A green outline appears.

- 2) Click the Load button.

The image you select appears in the observation window.

 To load a thumbnail image, drag the image to the observation screen with the mouse or double-click the image.

- c. Searching for an image

You can search for the image that you want to load. Narrow the image down by entering a name to find the image.

4.20 Report (pasting images to the standard format)

You can output saved images in a report with a specific format.

You can paste images by simply dragging them from the image filing area onto a report in a prepared standard format. Also, you can display the observation conditions (you can select functions such as magnification) of the image that you pasted.

1. Select **File** — **Report** from the menu bar or click the Observation button and then click the **Image File** button in the observation window.

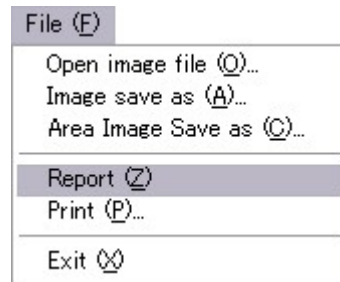


Fig. 82 Menu Bar and Observation Window

2. Click the **Report** button in the image filing area of the observation window. The Layout sheet (standard format) for the report opens.
3. Display the user layout (standard format) that you previously created in the new. lay window.

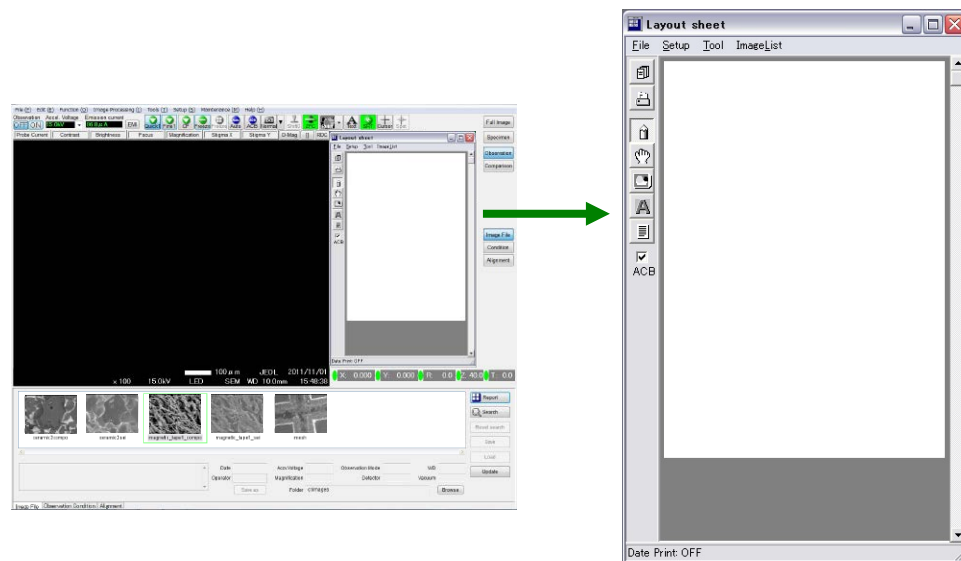


Fig. 83 Displaying Layout sheet

- a. Select **Layout Settings** — **User Layout** of the layout sheet.
- b. Since the list of User's Layout appear, select the one you need. Click the layout (standard format) of the report that you need so that it appears in the new. lay window.

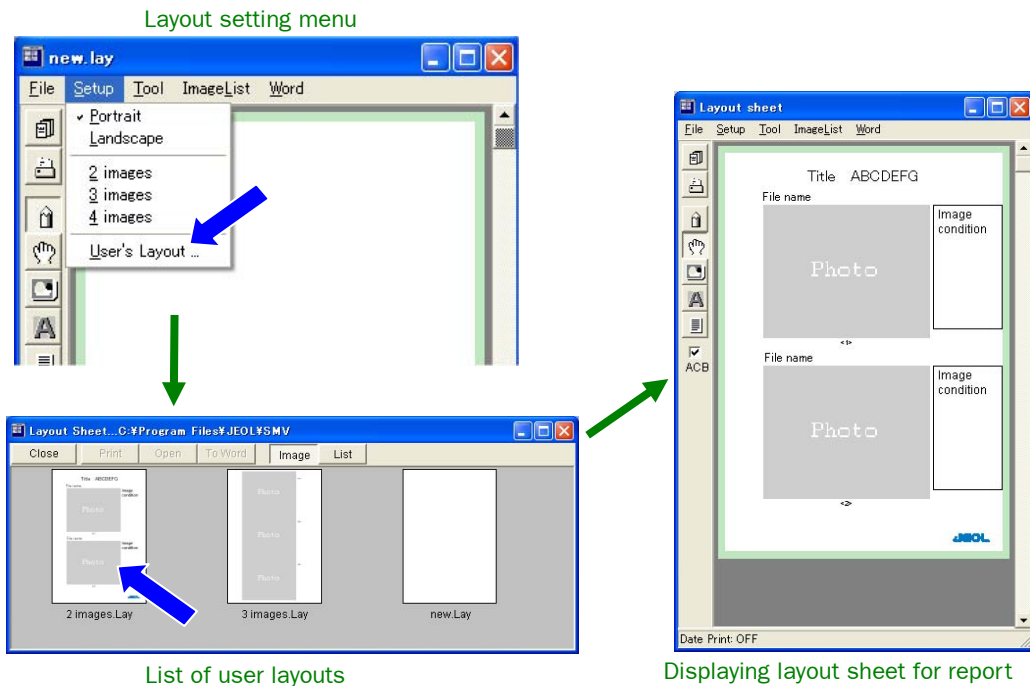


Fig. 84 Displaying Layout sheet

4. Use the mouse to drag the image to the report photo from the image filing display area.
The image is pasted on the Photo area and the observation conditions appear on the right of the image.

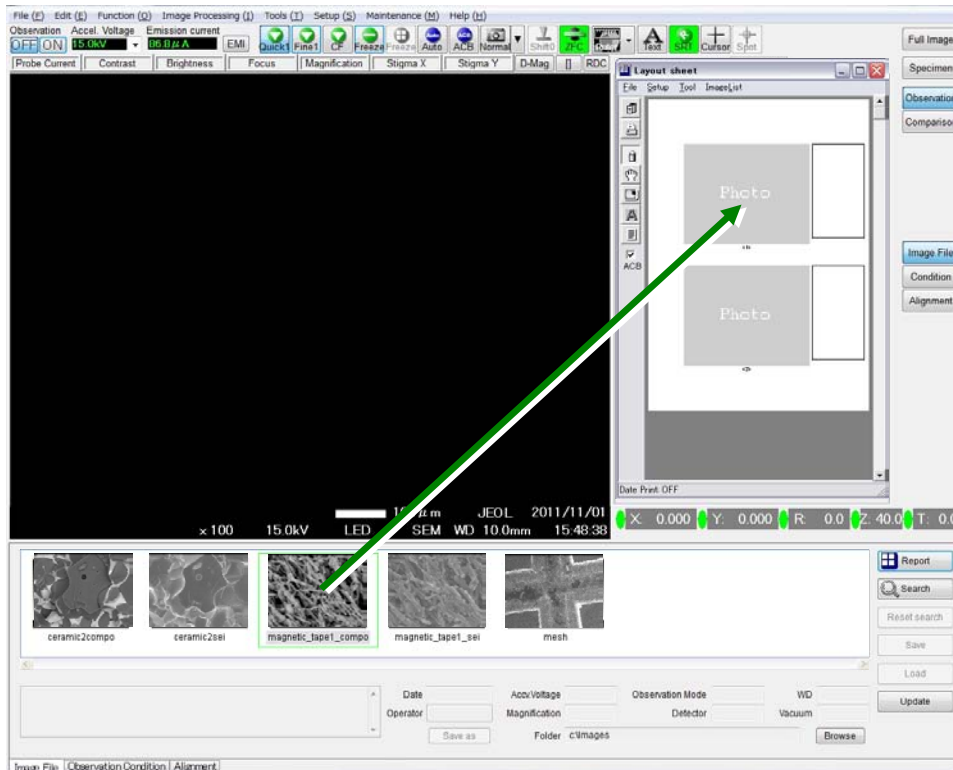


Fig. 85 Pasting image into report

5. In standard format, save or print the report of images that you pasted.
 - a. To print, select **File — Print** from menu bar in the 2 images. Lay window. When you select Print, the Print dialog box appears. Click the Print button, and the printer stated in the dialog box starts to print.

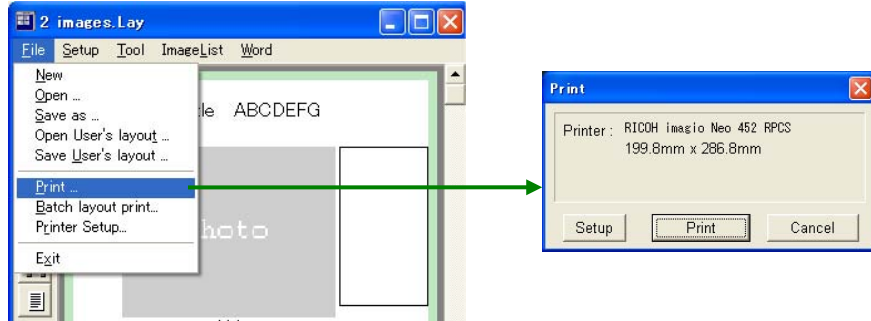


Fig. 86 Print dialog box

- b. To save, select **File — Save as** from the menu bar of the “2 images. Lay” window and then follow the instructions in the “Save as” dialog box. You can select one of the following formats to save the report:

- Layout File (*.lay):

You can rewrite the report.

- JPEG (90 dpi for Web) File (*.jpg):

The entire report is saved in JPEG format with an image quality equivalent to 90 dpi.

- BMP (90dpi) (*.bmp):

The entire report is saved in bitmap format with an image quality equivalent to 90 dpi.

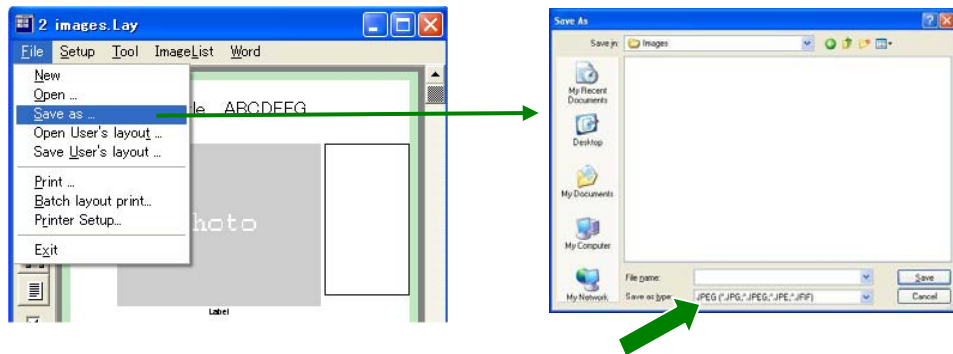


Fig. 87 Selecting format for saving report