

SCANNING ELECTRON MICROSCOPE
SU8700

INSTRUCTION MANUAL

(User's Operation/Maintenance Edition)

Please read through this manual carefully and store it in a safe place.



- Please thoroughly understand safety instructions and warnings in this manual before using the instrument.
- Instructions in this manual and in warning labels must be strictly obeyed.
- Keep this manual close at hand to ensure that it is accessible whenever needed.

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PREFACE

Thank you very much for purchasing the SU8700 scanning electron microscope.

The SU8700 scanning electron microscope (hereafter abbreviated as SU8700) is designed for observing/evaluating specimens prepared for the system by means of an electron beam accelerated at 100 V to 30 kV.

In this manual, the functions and maintenance of this product are explained for the person who has received training of electron microscope operations. Supervision is required when a person who has not received such technical training.

Before attempting operation, be sure to read this manual carefully together with the instruction manuals accompanying the accessories you purchased. Please acquaint yourself with the SU8700 and its accessories of proper use.

After reading this instruction manual, keep it in a safe place near the instruction so that it can be referred to whenever needed.

ABOUT THIS MANUAL

- The SU8700 comprises of a main unit and optional accessories.
This instruction manual includes descriptions of the outline, functions, operations and maintenance procedures of the SU8700 main unit.
For each optional accessory of the SU8700, refer to the relevant accompanying instruction manual.
- This instruction manual consists of the following six chapters.
 - Chapter 1 SPECIFICATION AND INSTALLATION REQUIREMENTS (installation requirements, items to be prepared by user, etc.)
 - Chapter 2 FUNCTION (including descriptions of control knobs and switches)
 - Chapter 3 OPERATION (including operational procedures for image observation, and image data saving/output)
 - Chapter 4 MAINTENANCE (including maintenance procedures for each part, troubleshooting, and action to take on occurrence of power failure, etc.)
 - Chapter 5 REPLACEMENT PARTS
 - Chapter 6 TROUBLESHOOTING
- This manual contains the operating and maintenance instructions and cautionary matters for the SU8700.
- First of all, be sure to read the "IMPORTANT" and "GENERAL SAFETY GUIDELINE" chapters at the beginning of this manual for ensuring safety in operation of the SU8700.

IMPORTANT

Leakage X-Ray Radiation from This Instrument

The effective dose equivalent of leakage X-ray radiation under its actual operating conditions satisfies the requirement specified in the IEC 61010-1:2010(Third Edition)+AMD1:2016. In the ICRP recommendations, it is stated that electron microscopes, along with home television sets (cathode ray tube type), fall into a category of potential radiation sources that could produce undesired byproduct X-rays. It is therefore required to ensure safety with sufficient care in operation of the instrument.

To be on the safe side, please observe the following cautionary instructions.

- (1) Use the instrument properly according to the application purposes and procedures specified in the manual, catalog, and other accompanying technical documents.
- (2) Do not remove any protective external parts from the instrument or mount any unspecified parts.
- (3) Do not modify the instrument to disable its safety mechanisms.
- (4) Since laws and regulations regarding prevention of radiation damage may be revised in time, the user is required to meet the revisions of the regulations properly to use the instrument.

Warranty on Product

Hitachi High-Tech Corporation warrants the SU8700 to be free from defects in material and manufacturing workmanship under normal use within the product specifications indicated in this manual and under conditions given below. This warranty is void if the instrument is not used in accordance with the instruction manual.

IMPORTANT

(1) Scope of Warranty

Any parts that were proved by Hitachi High-Tech Corporation to be defective in design or workmanship during the warranty period will be repaired without charge. A substitute part may be used for repair, or replacement with an equivalent product may be made instead of repair. System components that are upgraded frequently for improvement may not be available in original versions at the time of replacement. Repair or replacement after the warranty period is available at charge.

(2) Warranty Area

Within the country where this instrument has been delivered.

(3) Warranty Period

One year from the date of installation.

(4) Exclusions from Warranty

Note that the following cases are excluded from the scope of warranty even if they occur within the warranty period.

- (a) Failure due to operation at a place not meeting the installation requirements specified by Hitachi High-Tech Corporation.
- (b) Failure due to power supply voltage/frequency other than specified by Hitachi High-Tech Corporation or due to power failure.
- (c) Corrosion or deterioration of the piping/tubing due to impurities contained in gas, air or cooling water supplied by the user.
- (d) Corrosion of the electric circuits or deterioration of the optical elements due to highly corrosive gas atmosphere such as chlorine gas.
- (e) Failure due to use of hardware, software, or spare parts other than supplied by the Hitachi High-Tech Corporation.
- (f) Failure due to improper handling or maintenance by the user.
- (g) Failure due to maintenance or repair performed by any person other than a service representative authorized by Hitachi High-Tech Corporation, or detachment or modification of parts performed by the user.
- (h) Failure due to relocation or transport not approved by the Hitachi High-Tech Corporation after initial installation.
- (i) Failure due to acts of God, including fire, earthquake, storm, flood, lightning, social disturbance, riot, crime, insurrection, terrorism, war (declared or undeclared), radioactive pollution, contamination with harmful substances, etc.
- (j) Failure of consumables or parts that have reached the end of specified useful life.
- (k) Failure due to continued use of any part that has reached the end of its specified service life.

- (l) Failure due to disassembly, modification, or relocation not approved by Hitachi High-Tech Corporation.
 - (m) After disposal of this instrument, or after its resale without prior approval from Hitachi High-Tech Corporation.
 - (n) Failure due to use not described in the manual or improper repair not approved by Hitachi High-Tech Corporation.
 - (o) Failure of parts excluded from the warranty in the instruction manual or other documents.
 - (p) Failure of the personal computer used in the system, or damage to the OS, application software, or data due to power interruption or momentary voltage drop caused by lightning or the like.
 - (q) Failure of the personal computer in the system, or damage to the OS, application software, or data due to disconnection of the main power to the personal computer without performing the specified normal shutdown procedure.
 - (r) Failure of the hardware, or damage to the OS, application software or data due to computer virus infection.
- (5) Limitations on Warranty
- (a) Any express or implied warranties other than the explicit conditions indicated in (1) above are excluded from this warranty.
 - (b) Any other express or implied warranties of merchantability or fitness for a particular purpose are not included in this warranty.
 - (c) No liability is assumed for direct or indirect damages arising out of explicit or implied warranties.
 - (d) Oral or written information or advice given by our dealers, distributors, agents or employees without our express permission shall not create a warranty or in any way increase the scope of this warranty.

Installation, Relocation, and After-sales Technical Service

(1) Installation and Relocation

- (a) The customer must not install the instrument.
To ensure the safety and high accuracy operation of instrument, Hitachi High-Tech Corporation service engineer who is trained and qualified by Hitachi High-Tech will carry out the installation.
- (b) Before installation of this instrument, the user is requested to make preparations and to notify the sales or service engineer of Hitachi High-Tech Corporation for satisfying the installation requirements according to this manual.
- (c) When relocation of this instrument becomes necessary after initial installation (delivery), please notify the sales or service engineer of Hitachi High-Tech Corporation to avoid possible troubles due to relocation. (Relocation service will be provided on a chargeable basis.)

(2) After-sales Service

- (a) For after-sales technical service, contact the sales or service representative of Hitachi High-Tech Corporation.
- (b) After the warranty period, maintenance, inspection, etc. are available through a contract.
- (c) For 10 years after the delivery, its maintenance can be provided to ensure operation of the instrument.
Even when more than 10 years have elapsed after delivery, maintenance will basically be provided as long as the relevant units and parts are available. Note, however, that this statement does not represent any extension of the above-mentioned useful life of the instrument.

Disposal of Instrument

In the present design, this instrument does not use materials that would directly cause environmental disruption. Note, however, that the environmental protection laws and directives may be revised or amended. Therefore, be sure to consult with the sales or service engineer of Hitachi High-Tech Corporation when planning disposal of this instrument or its parts.

Lithium batteries are used in the Turbo molecular pump and the personal computer of this instrument. Therefore, please contact our service engineers of Hitachi High-Tech Corporation whether lithium batteries are used in your dry pump.. When disposing of the lithium batteries, strictly follow the relevant laws and regulations regarding industrial waste disposal and environmental protection.

Insulating oil is used in the HV tank of this instrument. When disposing of the insulating oil, strictly follow the laws and regulations regarding industrial waste disposal and environmental protection.

Disposal of Cooling Water Circulator (Option)

In an arrangement where a cooling water circulator is provided for this instrument, check whether the cooling water circulator is categorized as a class-1 specific product that uses a chlorofluorocarbon coolant (CFC, flon) indicated in “the law regarding implementation of recovery and destruction of CFCs for particular products” (CFC recovery-destruction law). Regarding disposal of the class-1 specific product, it is required to refer disposal servicing to a “class-1 CFC recovery agent” registered with the authorities concerned.
For disposal, contact our sales or service represent

Disposal of Ion Pump (IP) Backup Power Supply (Option)

The Ion pump (IP) backup power supply uses lead-acid batteries. For disposal, contact our sales or service representative

Service Life of Instrument

This instrument has a service life of 10 years after the date of its initial use (installation), which is estimated under the condition that periodic maintenance/checkup, replacement of life-limited parts, and repair of worn parts are carried out as specified in this instruction manual. When more than the service life have elapses after delivery, perform the safety check-up by our sales or service representative of Hitachi High-Tech Corporation (with charge). In case of operating the instrument after elapses of service life, it can cause of malfunction of instrument and risk of safety. Please note that safety check-up is unable to perform due to operating condition or instrument installation condition.
In addition, purchasing a new instrument may need to consider due to the result of the safety check-up.

Technical Seminars and Training for Customers

To ensure safety and high accuracy in operation of the instrument, technical seminars and training courses are available at Hitachi High-Tech Corporation's facilities or your site. For further information, contact the sales representative of Hitachi High-Tech Corporation. (The technical seminars and customer training courses are available on a chargeable basis.)

Other Precautions

Disclaimer of Liability for Industrial Properties of Third Party

Hitachi High-Tech Corporation does not assume any liability for a third party's complaint regarding infringement of any patent rights or industrial properties with respect to products manufactured through use of the equipment supplied by Hitachi High-Tech Corporation or its related companies or application of said instrument.

Handling of Chemicals

- (1) The user is responsible for following relevant legal standards and regulations in the handling, storage and discarding of chemicals to be used for cleaning this instrument.
- (2) Chemicals shall be handled, stored, and disposed of, as instructed by respective suppliers.

Substances of Very High Concern

Hitachi High-Tech Corporation investigates the substances of very high concern (SVHCs) (REACH regulation (EC) No.1907/2006) content in the products based on the information which is provided in that supply chain.

The SVHC which is found to contain in the products is as follows;

The substance name: Lead
CAS registry No.: 7439-92-1

The substance name: Bisphenol A; 4,4-Isopropylidenediphenol
CAS registry No.: 80-05-7

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The operation screens in this instruction manual are mainly Windows 10 screens.

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```
printf("%s",png_get_copyright(NULL));
```

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Glenn Randers-Pehrson
glennrp at users.sourceforge.net
March 26, 2015

◆ zlib (1.2.3)

```
/* zlib.h -- interface of the 'zlib' general purpose compression library version 1.2.3, July 18th, 2005
```

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Jean-loup Gailly Mark Adler
jloup@gzip.org madler@alumni.caltech.edu

*/

◆ libtiff(4.0.3) /<Optical Drive> : ¥OSS¥Source code¥libtiff-4.0.3

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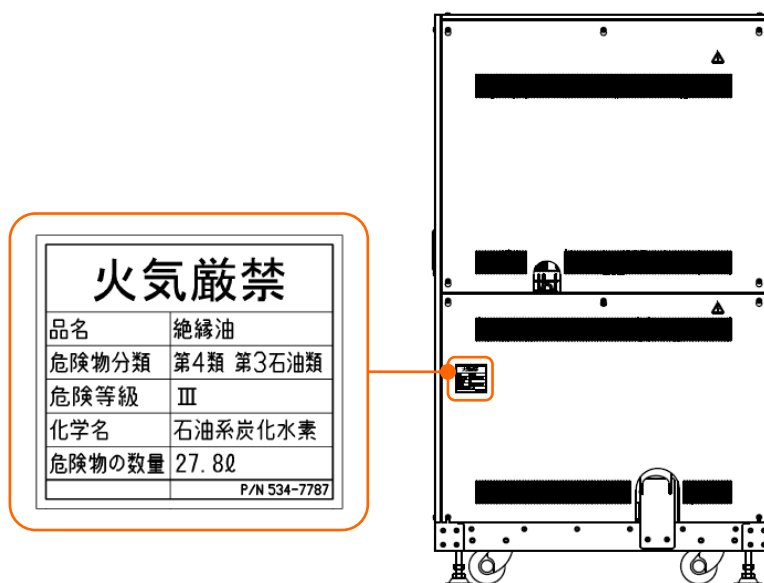
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- CMU・・・「CMU License」
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Handling of the Insulation Oil Used for HV Power Supply

Insulation oil used for the HV power supply of this instrument is classified as a Class 4 Petroleum No.3. Its land transportation in Japan is subject to the domestic fire services act. For this reason, the label shown below is affixed to the instrument to meet requirements of the above. This label is valid only in Japan.



Layout of the label

User Manual Addendum for WEEE

Information for Users on WEEE (Only for EU countries)



This symbol is in compliance with the Waste Electrical and Electronic equipment directive 2002/96/EC (WEEE). This symbol on the product indicates the requirement NOT to dispose the equipment as unsorted municipal waste, but use the return and collection systems available.

Information on Disposal for Users.

1. In the European Union

If you need to discard this product or discard user serviceable parts:
Please contact your Hitachi High-Tech office in the European Union or distributor who will inform you of the recycle of the product.
You might be charged for the costs arising from take-back and recycling.

2. In other Countries outside the EU

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

If you want to find our Hitachi High-Tech office in the European Union, you can find at <http://www.hitachi-hightech.com/eu/about/corporate/location/index.html/>

California Perchlorate Material Notice


Perchlorate Material – special handling may apply.




See: <http://www.dtsc.ca.gov/hazardouswaste/perchlorate/>

This product's real-time clock battery or coin cell battery may contain perchlorate and may require special handling when recycled or disposed of in California.

GENERAL SAFETY GUIDE

Safety Alert Symbols and Signal Words

The warnings for human safety is indicated and described in the following alert headings that is consisted by the safety alert symbol [, [WARNING] and [CAUTION].

	<p>: This is a safety alert symbol. Safety alert symbol used for calling attention to a potential hazard that could cause personal injury. To prevent possible hazards or injury, be sure to follow the safety precautions preceded by this symbol.</p>
	<p>WARNING : Indicates a potentially hazardous situation which, if not avoided, will or can result in death or serious injury.</p>
	<p>CAUTION : Indicates a hazardous situation which, if not avoided, will or can result in minor or moderate injury.</p>

Other safety precautions or useful reminders are indicated by the following signal words.

<p>NOTICE</p>	<p>: Indicates a potentially hazardous situation which, if not avoided, will or can result in damage to the product or property, serious failures in the instrument, damage to data, or environmental pollution, though personal injury may not be incurred.</p>
<p>NOTE</p>	<p>: Indicates explanations about the proper use of the product to avoid minor damage and obtain the maximum performance and functionality.</p>



Common Safety Precautions

Precautions Prior to Use

- Follow the precautions and instructions stated on the warning labels attached on the instrument and those contained in all the accompanying instruction manuals. Failure to do so could result in fatal/serious injury or damage to the instrument due to an electric shock or fire.
- Absolutely avoid modifying the product, using non-specified parts, or using the instrument with safety devices detached, as it could be hazardous.
- When using a chemical such as reagent for the instrument, it shall be handled properly, referring to the information about material characteristics and handling (SDS).
- When using a chemical such as a reagent, you are responsible for proper ventilation of the room. Inadequate ventilation could endanger human health.
- Keep in mind that the hazard warnings in the manuals or on the product cannot cover every possible case, as it is impossible to predict and evaluate all circumstances beforehand. Always be alert and use your common sense.
- If an abnormality such as unusual noise, odor or smoke occurs during operation of the instrument, immediately shut down the power supply and take proper safety measures as required. Then, contact our sales or service representative.
- Follow the precautions and instructions stated on the instruction manual of each manufacturer for the option devices.
- When emergency stop, turn OFF the main breaker.

Be sure to observe the cautionary instructions mentioned above. Failure to do so may result not only in improper specimen observation and evaluation, but also in personal injuries.



Common Safety Precautions (Continued)

Installation, Maintenance, and Relocation

- Keep the attachment and the check list close at hand to ensure that it is accessible whenever needed..

If the instrument is operated with any one of the standard parts missing, a failure may occur, resulting in a hazardous condition.



If any item is missing or damaged or if you have any question, consult a service engineer or our sales representative.
- The maintenance and checkup procedures to be performed by the user are only those described in this manual. Before performing the maintenance and checkup procedures described in the manual, attain a clear understanding of them.

Any installation, maintenance, relocation other than those described in this manual must be performed by a service engineer of Hitachi High-Tech Corporation.

A failure to observe the above can result in instrument malfunctions or personal injuries.
- Replace the life-limited parts with new ones at intervals specified in this manual. If the instrument is operated without replacing a life-limited part, a failure can occur, resulting in a hazardous condition. For maintenance that is intended to be performed by service engineers, contact a service engineer or our sales representative of Hitachi High-Tech Corporation.

Warnings and Cautions While Operating This Instrument

Shown below are the cautionary instructions not contained elsewhere in this manual.

 WARNING	
	<p>● Accident due to Continuous Use under Abnormal Condition</p> <p>If the instrument is used continuously under abnormal condition of instrument, electric shock or fire be occurred. Shut down the power supply immediately as soon as an abnormality condition is found such as unusual noise, odor, or fuming occurs during operation of the instrument. Then, take proper safety measures as required and notify a service engineer of Hitachi High-Tech Corporation.</p>



Common Safety Precautions (Continued)

Shown below are the cautionary instructions not contained elsewhere in this manual.

CAUTION

● Fatigue due to Long Hours of Operation



Looking at the monitor over an extended period may lead to eyestrain or body fatigue. Recommended to take a break of 10 to 15 minutes per hour during operation.

In addition, please prepare a proper table and chairs by referring to the SEMI standard or other standard for the operation.

● Radiation Hazard due to Laser Beam



The Super Multi drive incorporated in the personal computer (PC) of this instrument is equipped with a laser light source. The PC is designed to meet the safety standards specified in industrial standards such as the International Electrotechnical Commission (IEC 60825-1:2014 Edition 3.0). The laser device arrangement conforms to the Class-1 Laser Device Standards stipulated in the Federal Regulations of the U.S.A. Under the normal operating conditions, laser radiation harmful to human health will not leak out of this instrument. However, to be on the safe side, please observe the following cautionary instructions.

- Do not open the panel of the laser device. There are no user-serviceable components in the laser device.
- For any laser light source, the user is not allowed to make control adjustment.
- Be sure to leave repair of the instrument to our service engineers.
- Never remove any cover from the instrument while power is connected to it.

● Fuming and Ignition due to Inappropriate Operation



This instrument is equipped with protective devices such as fuses, overcurrent detectors, electric leakage detectors, and alarm indicators. If a protective device is activated, contact a service engineer of Hitachi High-Tech Corporation.

Power on the instrument again without proper elimination can cause of unexpected dangers such as fuming or ignition.

Warning Indications in This Manual

Shown below are the cautionary instructions contained in this manual and the section numbers corresponding to them.

WARNING

- Tipping or Falling of Heavy Unit



The Main unit (about 670 kg) and the EO control unit (about 270 kg) are heavy objects. It can cause of injury by tumbling the heavy object due to earthquake or other. Recommend to use fixing tools after installation of the instrument. Relocation of the instrument is carried out by service engineer only and the customer are not allowed to perform the relocation of instrument.

(Chapter 1 Specification and installation requirements)

- Injury upon Lifting Heavy Unit



The weight weighs about 25 kg.

Careless lifting of this unit could result in injury. Lifting should be carried out by using a forklift or the like.

The weight must be moved by a service engineer trained and certified by Hitachi High-Tech Corporation only. The customer should not attempt relocation.

(Chapter 1 Specification and installation requirements)



Warning Indications in This Manual (Continued)

WARNING

- Burns due to Contacting with Hot Surface
(Baking of the Electron gun and Ion pump)



When the electron gun and the ion pump are baked for maintaining high-vacuum performance, they are heated up to approximately 250°C. To prevent burns, never touch the electron gun or ion pump until they cool down sufficiently.

If the electron gun is heated up due to an erroneous operation or malfunction, the electron gun may reach a very high temperature and it can cause burns. Make sure to turn OFF the OUTER BAKE breaker after electron gun baking is completed.

After the completion of baking, it will take approximately six hours for the electron gun and ion pump to cool down to nearly room temperature. Remember that the electron gun and the ion pump remain extremely hot for this period of time after baking. To prevent burns, never touch the electron gun or ion pump until they cool down sufficiently.

After an abnormal termination of baking (due to power interruption etc.), it will take approximately six hours for the electron gun and ion pump to cool down to nearly room temperature.

To prevent burns, never touch the electron gun or ion pump until they cool down sufficiently.

(Chapter 4 Maintenance)

- Explosion and inhaling hazardous substances



Ethanol is an organic solvent.

- There is a danger of explosion if vaporized ethanol is ignited.
- Excessive inhalation of vaporized ethanol could cause breathing difficulty or other severe ill effects.
- If ethanol is gulped, touches the skin or splashes into eyes by mistake, there is a risk of polyneuritis such as sensory paralysis or walking difficulty due to irritant actions.
- Handle ethanol in a well-ventilated and flame-free place and be careful not to inhale its vapor substantially. In addition, utilize breathing apparatus, protective goggles/gloves/boots, etc. as required.



(Chapter 4 Maintenance)



Warning Indications in This Manual (Continued)

WARNING

- Pacemaker Failure



The magnetic field produced from the permanent magnet of the ion pump (about 30 mT at the circumference, about 3 mT outside the ion pump cover) can cause a cardiac pacemaker to malfunction. A person using a pacemaker should not come within 0.6 m of the ion pump.

(Chapter 4 Maintenance)

- Electric Shock due to High Voltage.



Make sure the FIL lamp and the HV lamp are off when performing electron gun baking. Avoid electron gun baking while the FIL lamp and the HV lamp are lit. High voltage is supplied under this condition and there is a danger of electric shock.

(Chapter 4 Maintenance)

Voltage up to AC 100 V, DC 30 kV are used inside this instrument. When touching the inside parts or circuit of the main unit area, the control area and the power supply area, it can cause death or severe injury by receiving an electric shock. Do not remove the cover.

(Chapter 6 Trouble shooting)

- Electric Shock due to Improper Grounding



Insufficient grounding of the instrument can cause not only incorrect operation but also lead to electric shock. Do not touch the grounding wire. The grounding wire to the instrument shall be carried out by a service engineer of Hitachi High-Tech Corporation.

(Chapter 1 Specification and installation requirements)

Caution Indications in This Manual

CAUTION

- Injury due to Falling



If you sit on the main unit, the cover may break and it may cause you to fall and to be injured.

Do not sit or lean to the cover.

(Chapter 1 Specification and installation requirements)

Since it requires the work at a high place, please use a stepladder.

Otherwise, you may fall and be injured. Please make sure to use a step ladder which satisfies the customer's safety standard.

(Chapter 4 Maintenance)

- Roller Parts Inside



It can cause injury by getting caught your hands or hair by the roller parts of the stage. Beware of roller parts of the stage when the stage is drawn out.

(Chapter 3 Operation)



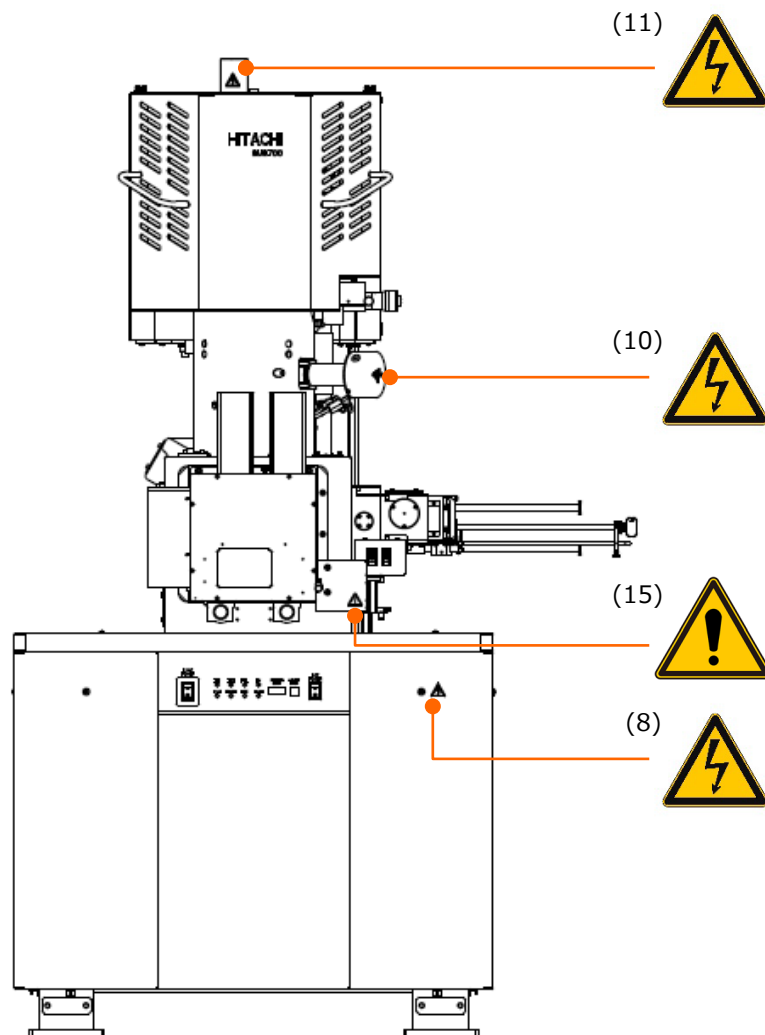
Warning and Caution Labels on Instrument

Pages SAFETY - 9 to 27 show warning and caution labels that are affixed to the SU8700. Confirm the actual WARNING and CAUTION labels attached on the instrument.

The labels should be checked periodically and cleaned so that they can be viewed clearly from a safe distance.

If warning labels fade and become difficult to read due to deterioration with age, contact our service representative of Hitachi High-Tech Corporation for replacement.

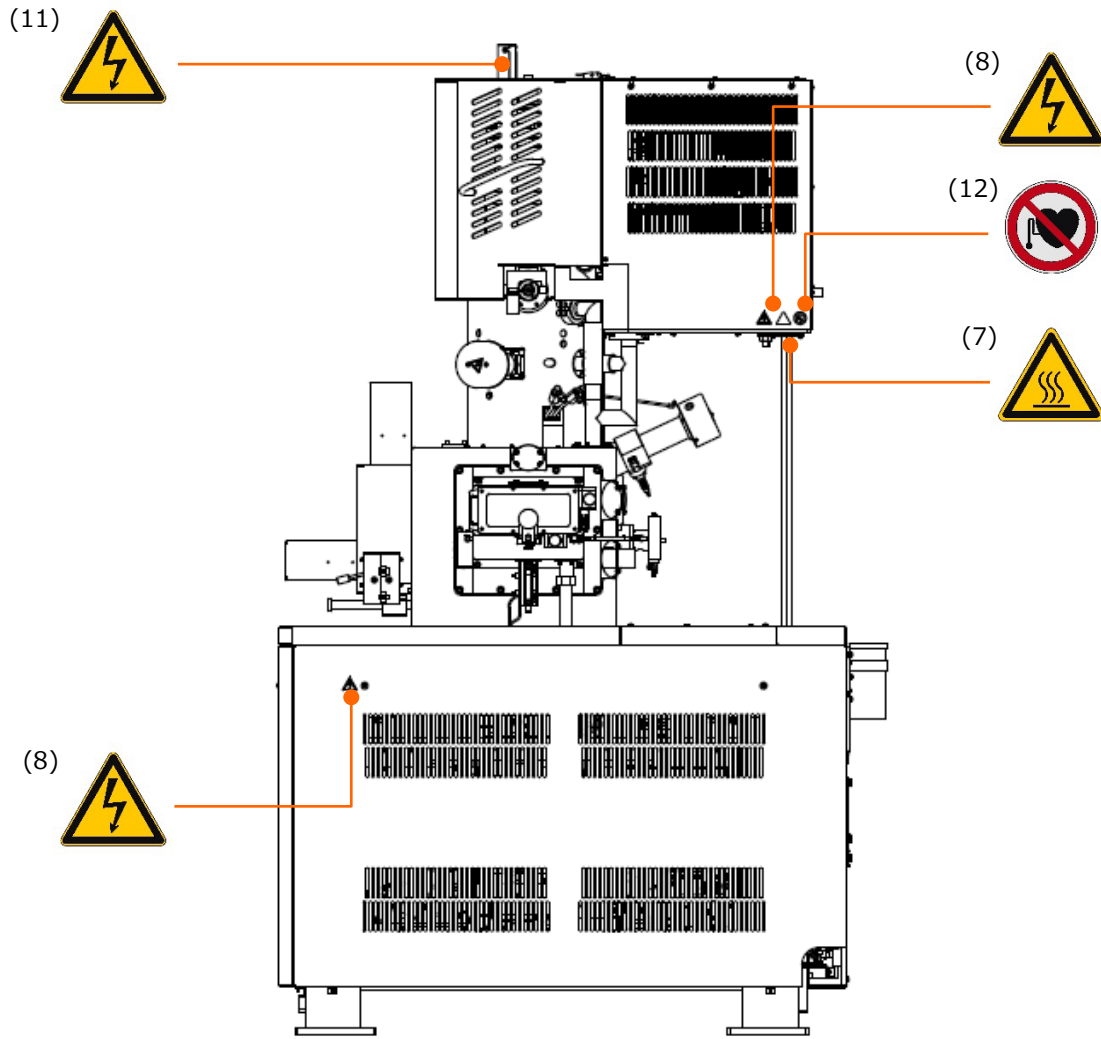
Standard version



(Front view)

Locations of WARNING and CAUTION labels on main unit

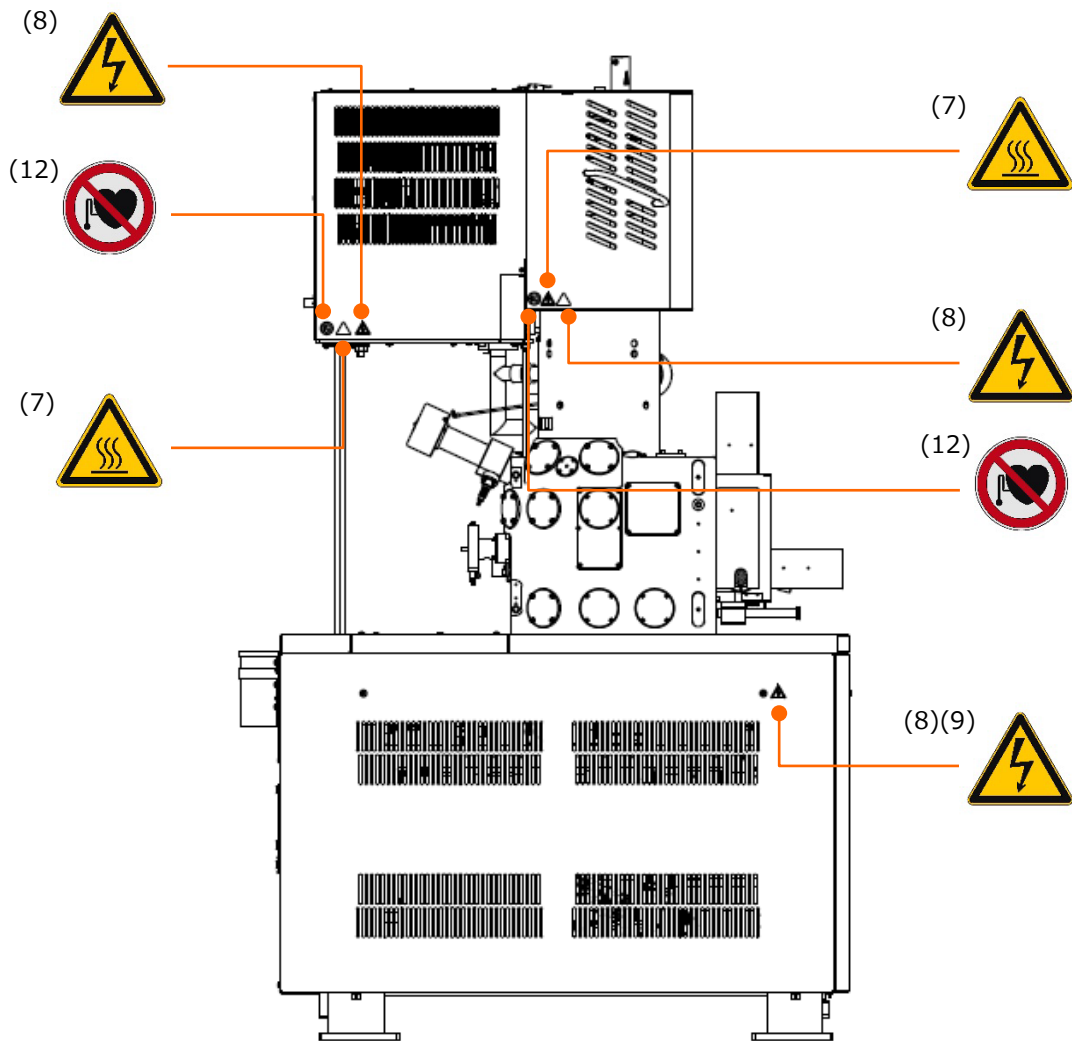
Warning and Caution Labels on Instrument (Continued)



(Right side view)

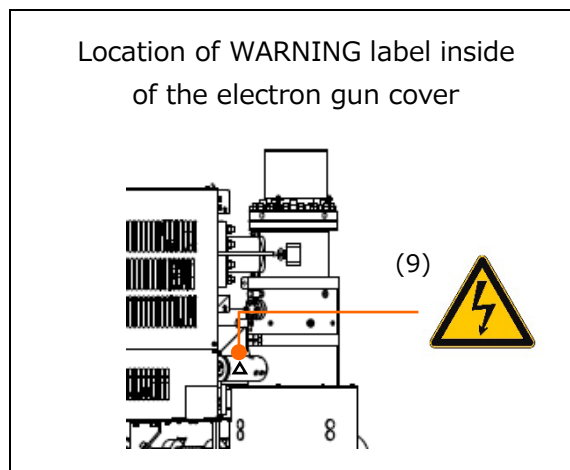
Locations of WARNING and CAUTION labels on main unit

Warning and Caution Labels on Instrument (Continued)

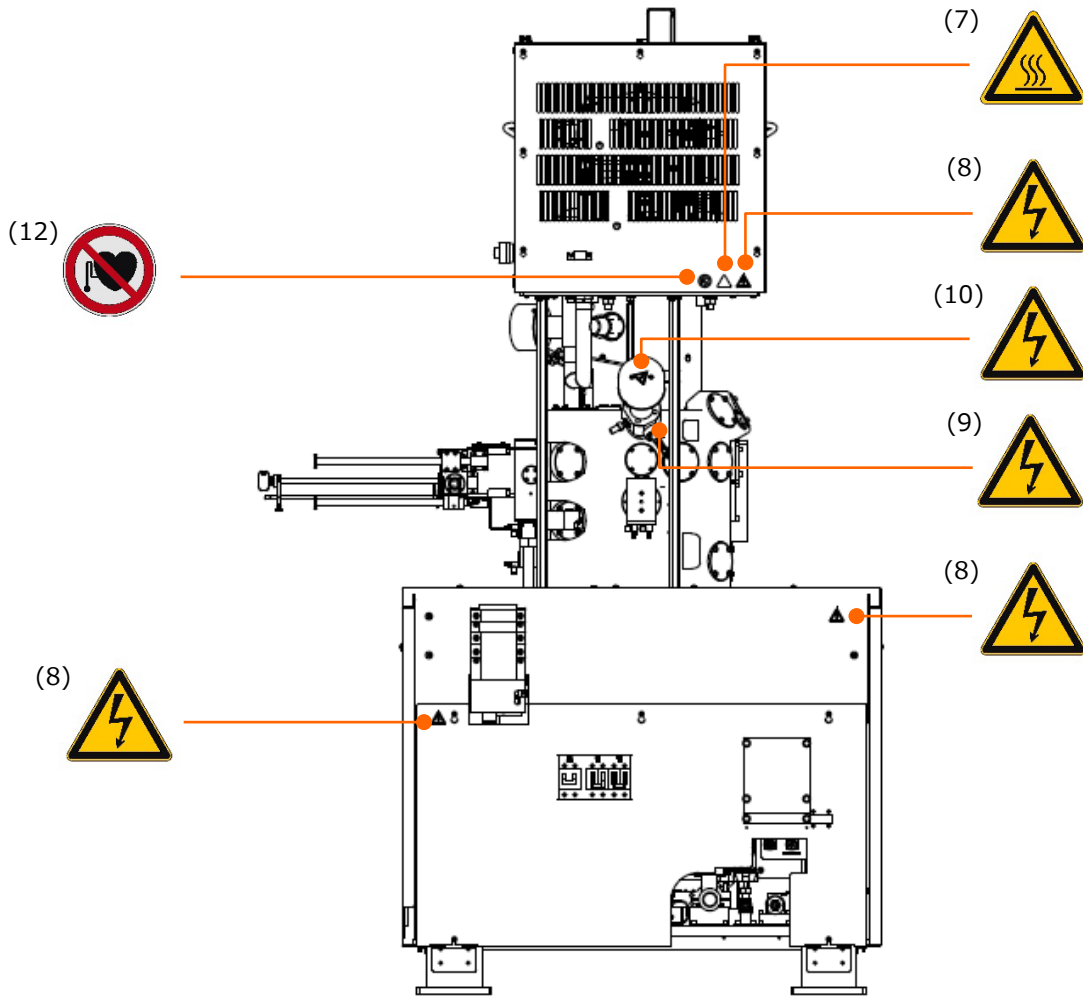


(Left side view)

Locations of WARNING and CAUTION labels on main unit



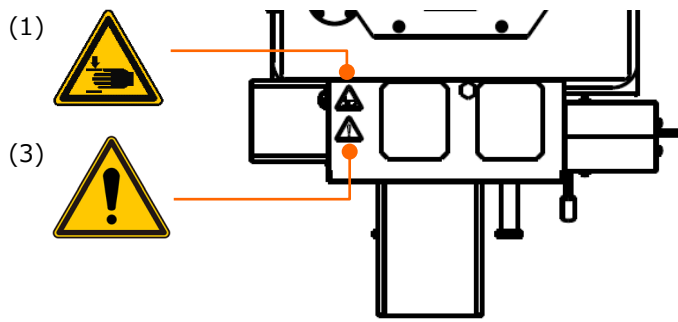
Warning and Caution Labels on Instrument (Continued)



(Rear view)

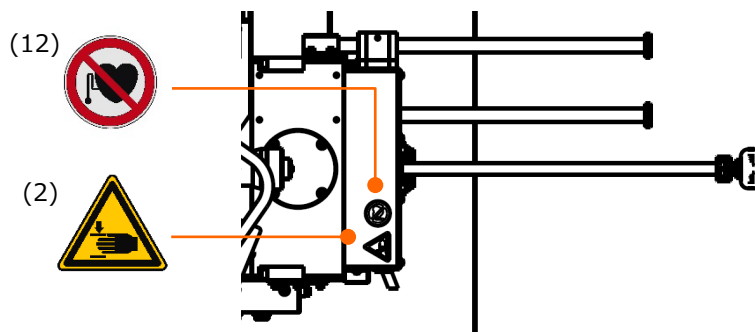
Locations of WARNING and CAUTION labels on main unit

Warning and Caution Labels on Instrument (Continued)



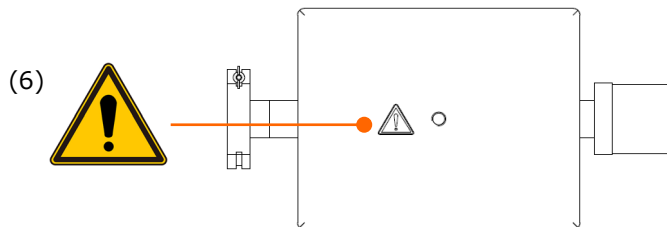
(Top view)

Locations of WARNING and CAUTION labels on the stage



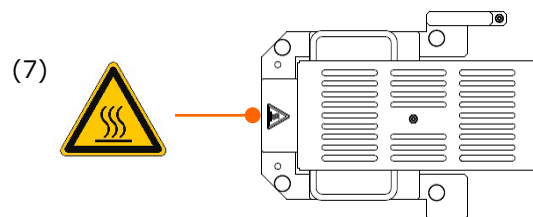
(Top view)

Locations of WARNING and CAUTION labels on the specimen exchange chamber



(Top view)

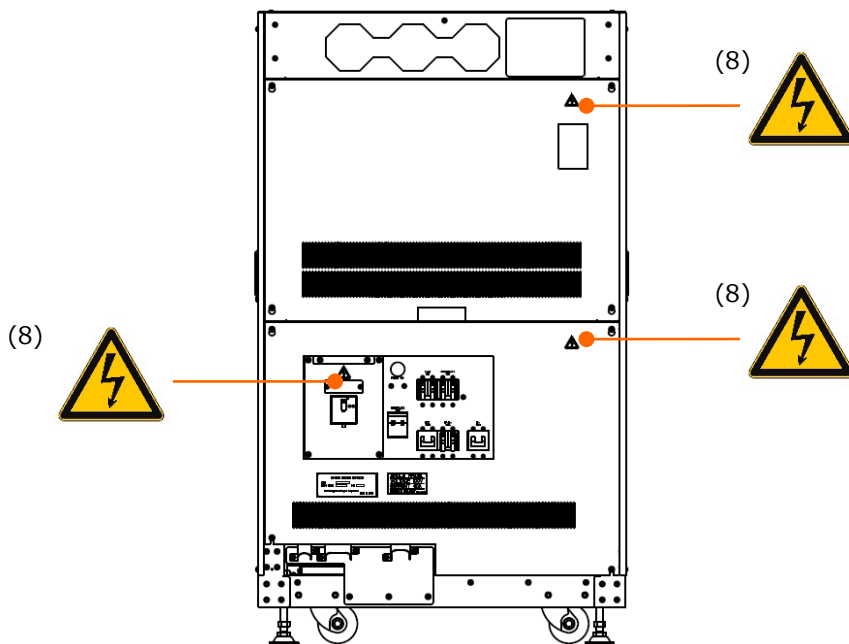
Locations of WARNING and CAUTION labels on weight



Cover for baking

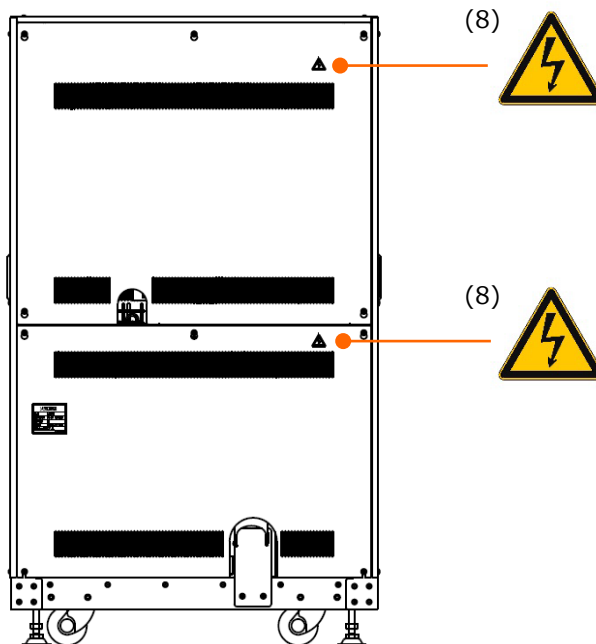


Warning and Caution Labels on Instrument (Continued)



(Front view)

Locations of WARNING and CAUTION labels on EO control unit

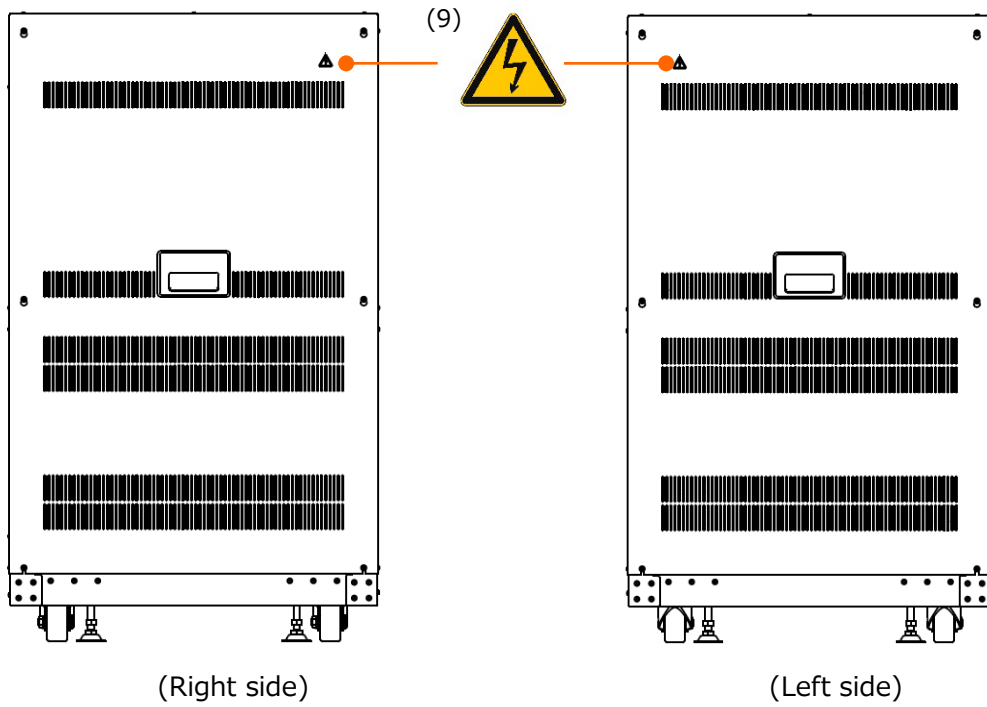


(Rear view)

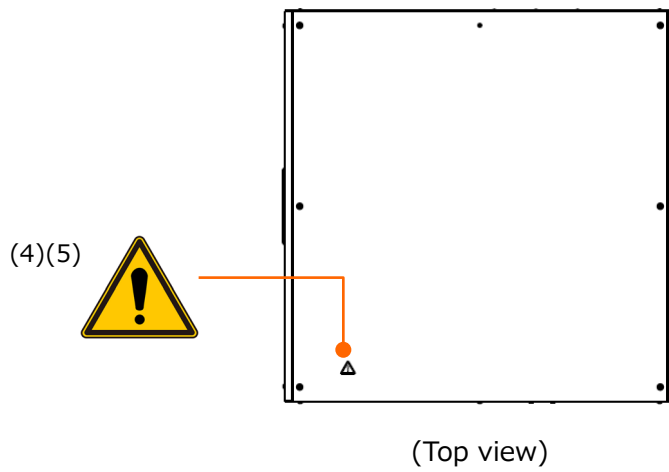
Locations of WARNING and CAUTION labels on EO control unit



Warning and Caution Labels on Instrument (Continued)



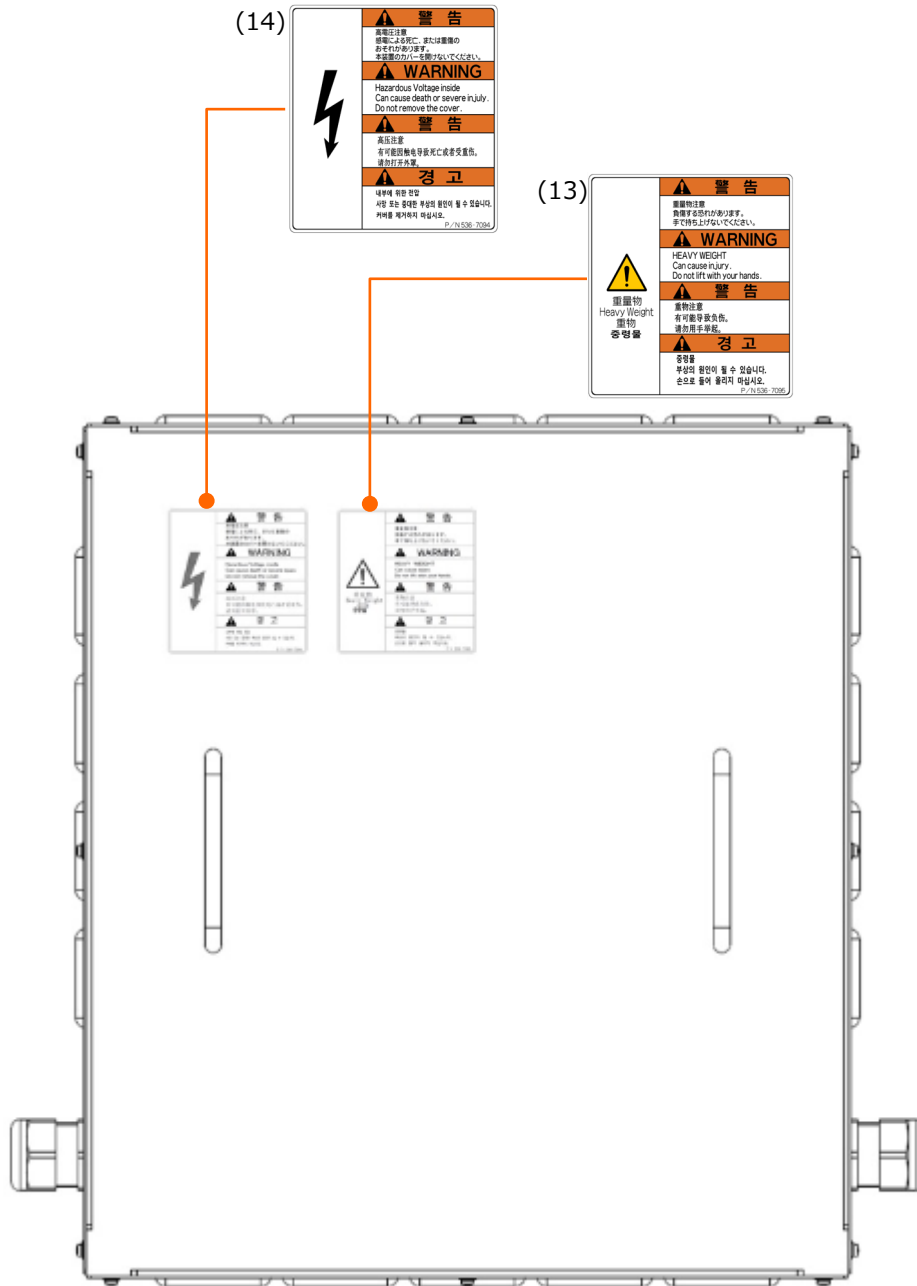
Locations of WARNING and CAUTION labels on EO control unit



Locations of WARNING and CAUTION labels on EO control unit



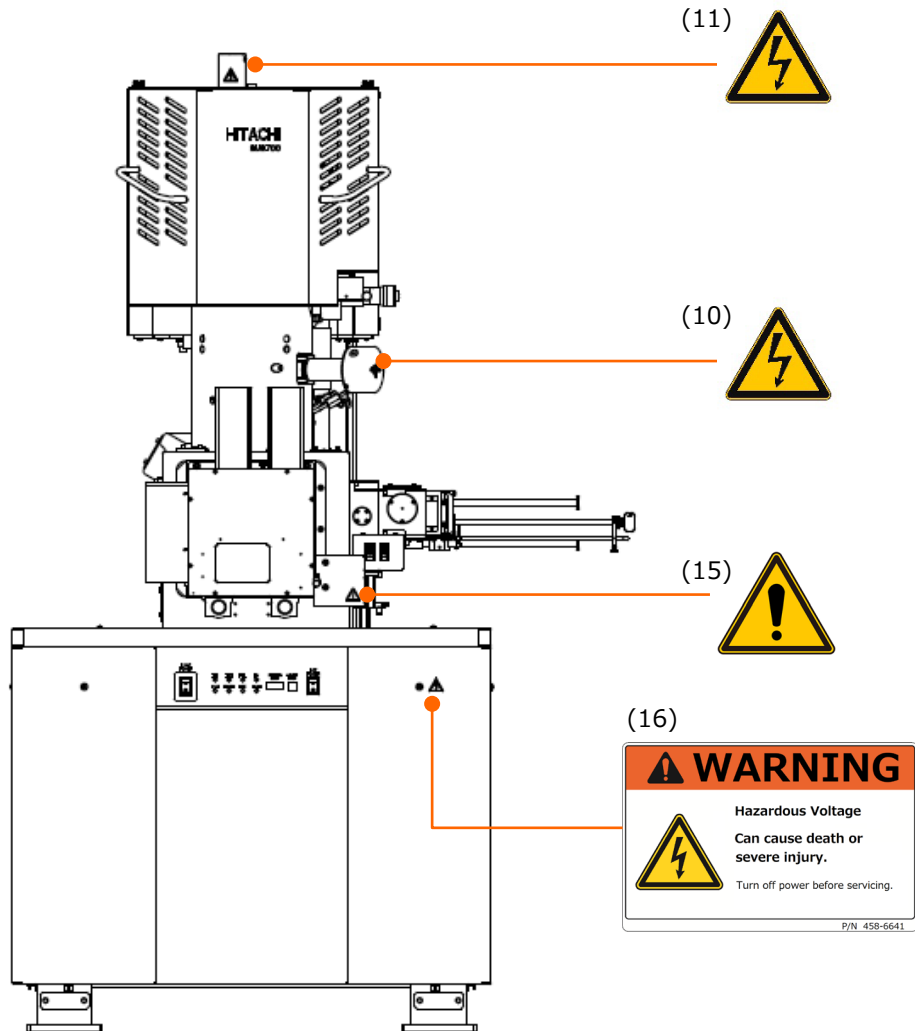
Warning and Caution Labels on Instrument (Continued)



Locations of WARNING and CAUTION labels on stepdown transformer (option)

Warning and Caution Labels on Instrument (Continued)

SEMI-S2 guideline conforming version

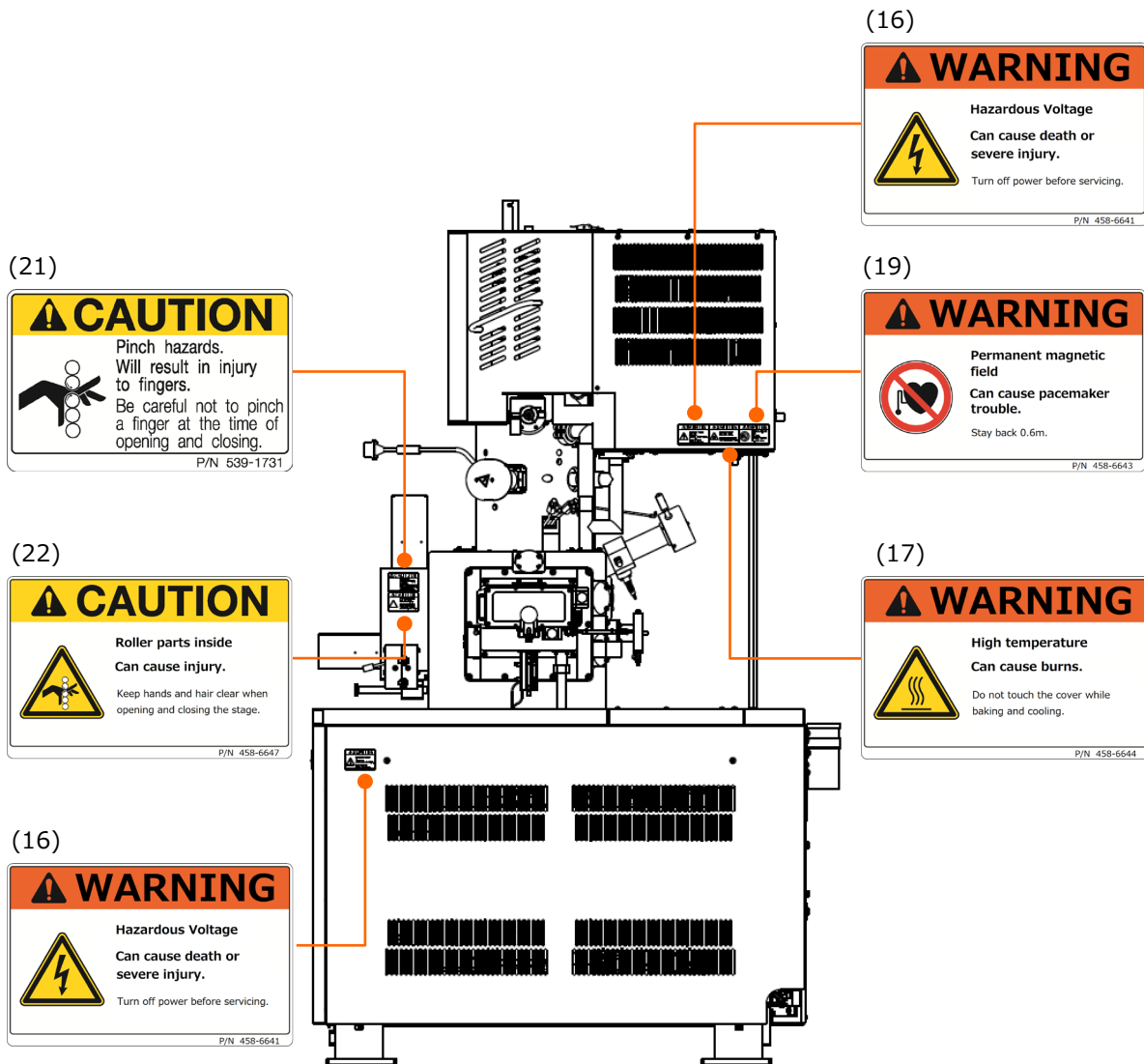


(Front view)

Locations of WARNING and CAUTION labels on main unit



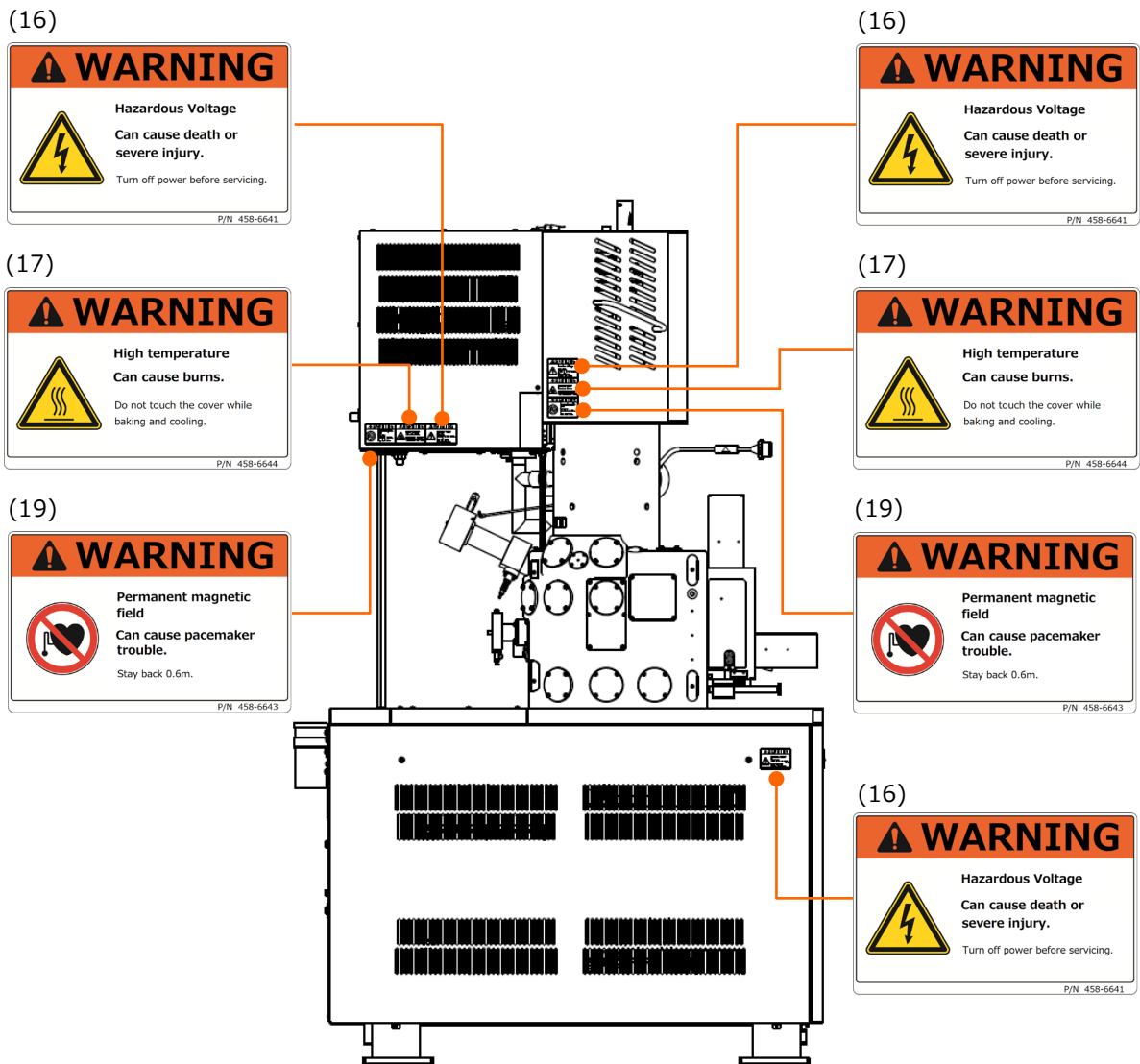
Warning and Caution Labels on Instrument (Continued)



(Right side view)

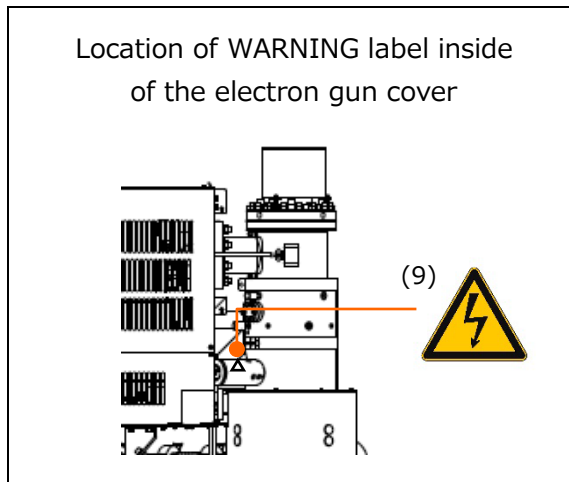
Locations of WARNING and CAUTION labels on main unit

Warning and Caution Labels on Instrument (Continued)

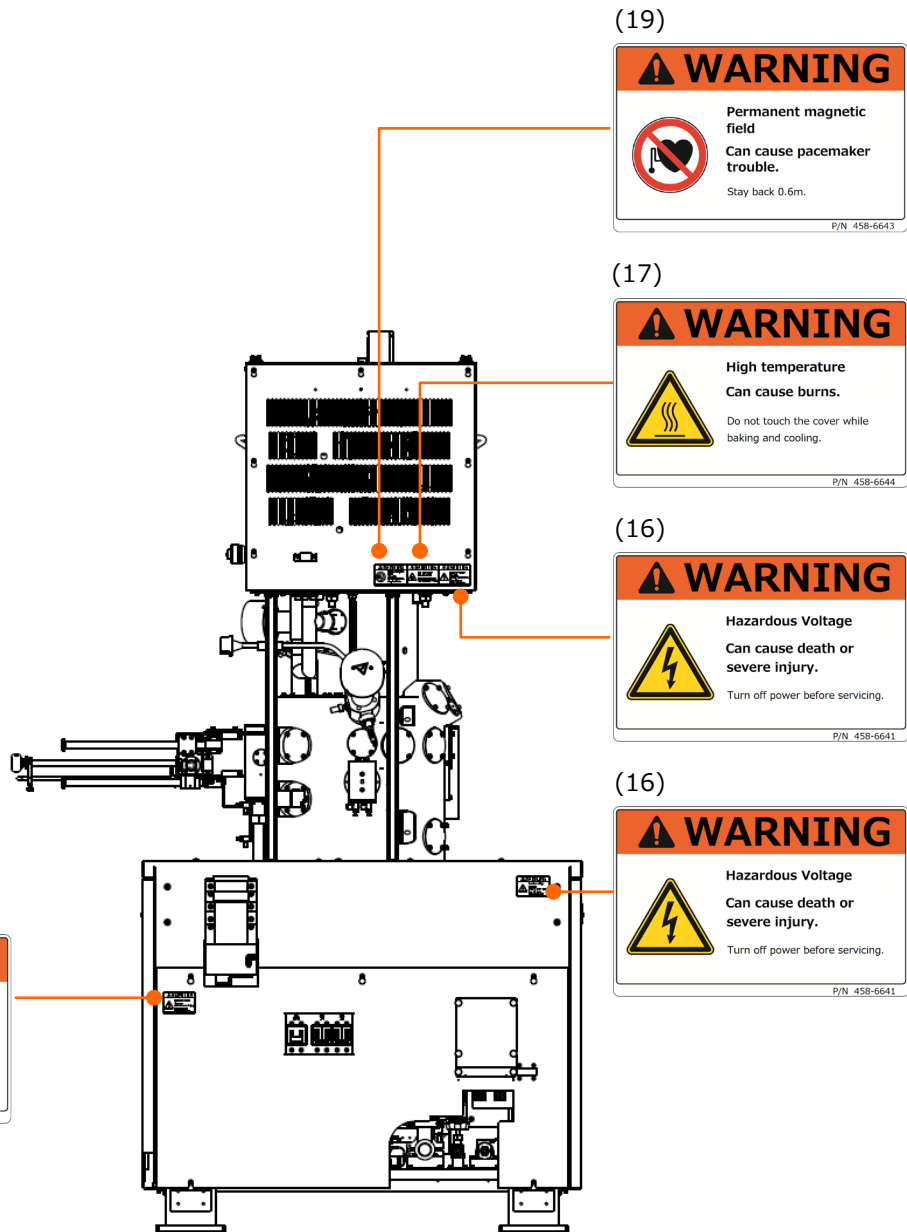


(Left side view)

Locations of WARNING and CAUTION labels on main unit



Warning and Caution Labels on Instrument (Continued)



(16)

WARNING

Hazardous Voltage
Can cause death or severe injury.
Turn off power before servicing.

P/N 458-6641

(19)

WARNING

Permanent magnetic field
Can cause pacemaker trouble.
Stay back 0.6m.

P/N 458-6643

(17)

WARNING

High temperature
Can cause burns.
Do not touch the cover while baking and cooling.

P/N 458-6641

(16)

WARNING

Hazardous Voltage
Can cause death or severe injury.
Turn off power before servicing.

P/N 458-6641

(16)

WARNING

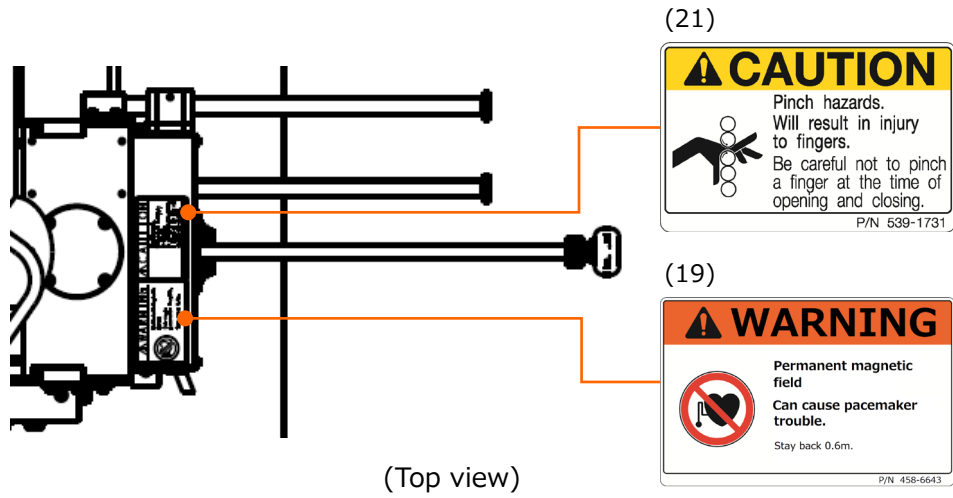
Hazardous Voltage
Can cause death or severe injury.
Turn off power before servicing.

P/N 458-6641

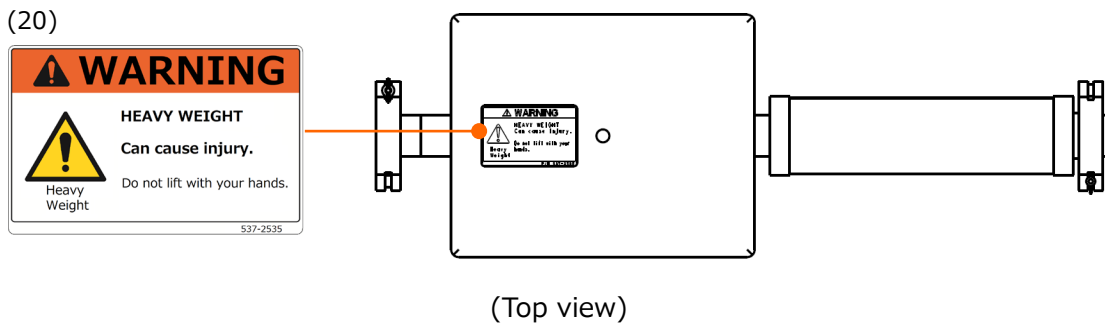
(Rear view)

Locations of WARNING and CAUTION labels on main unit

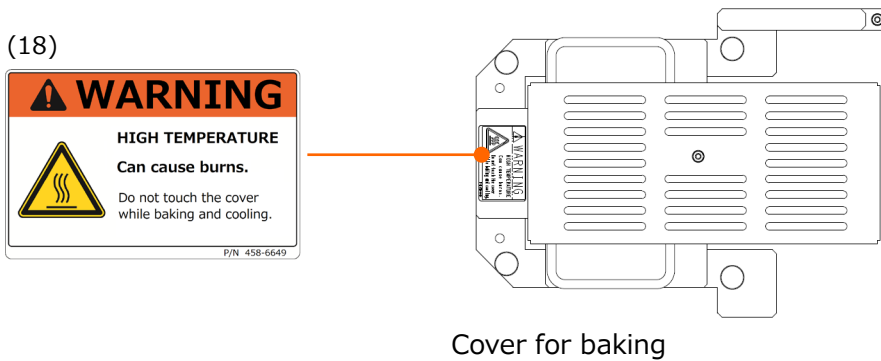
Warning and Caution Labels on Instrument (Continued)



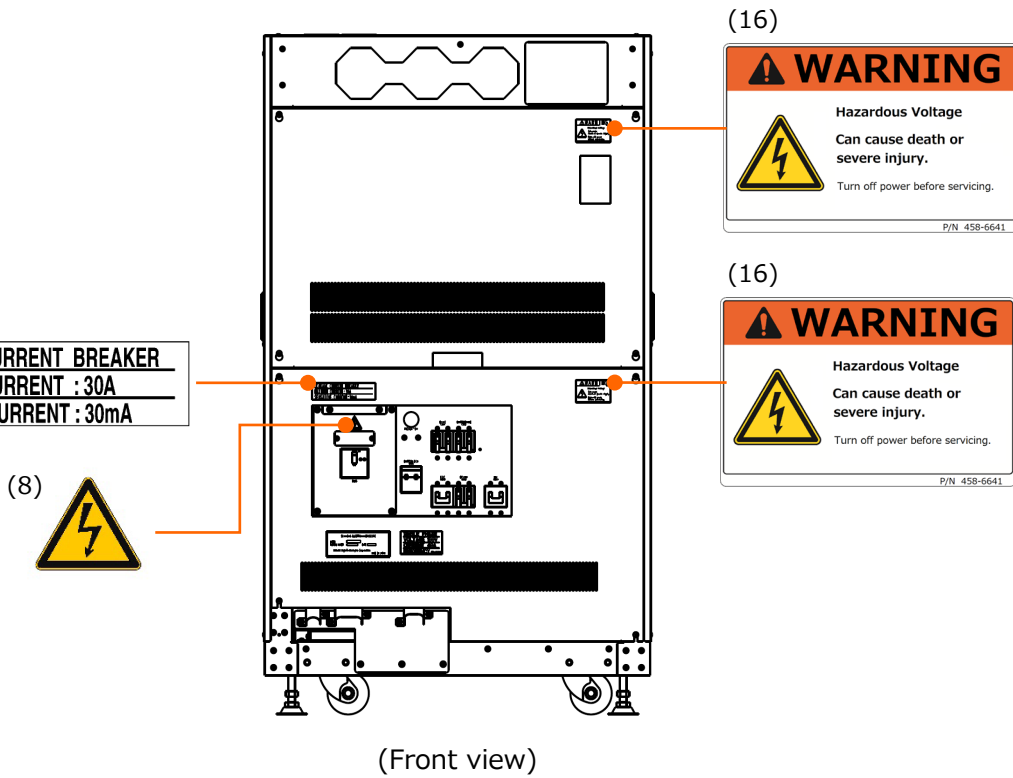
Locations of WARNING and CAUTION labels on the specimen exchange chamber



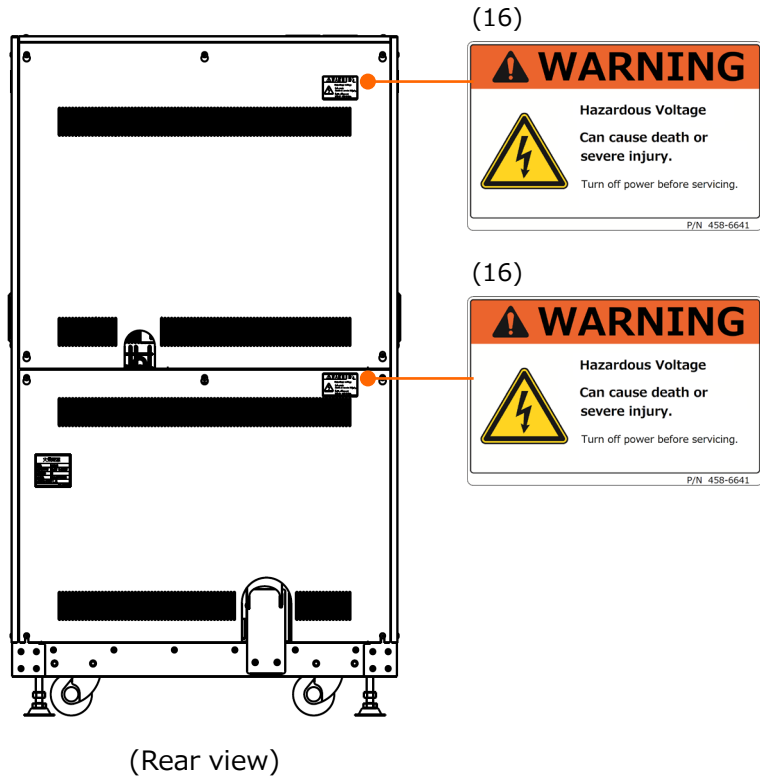
Locations of WARNING and CAUTION labels on weight



Warning and Caution Labels on Instrument (Continued)

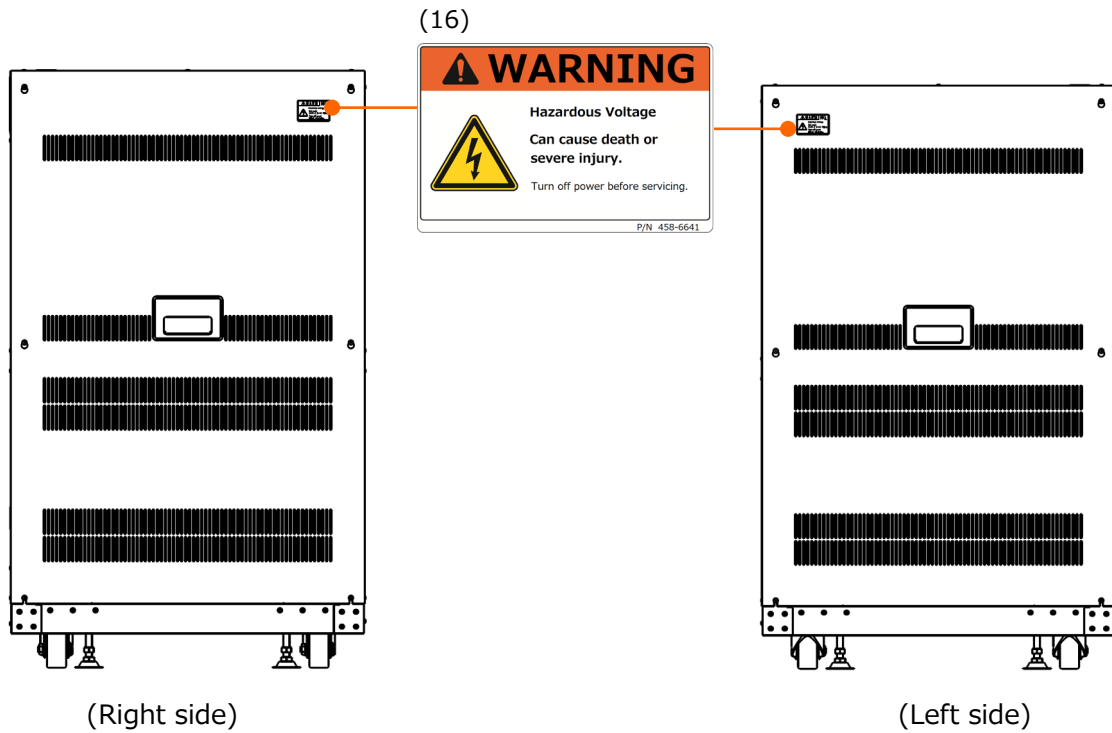


Locations of WARNING and CAUTION labels on EO control unit

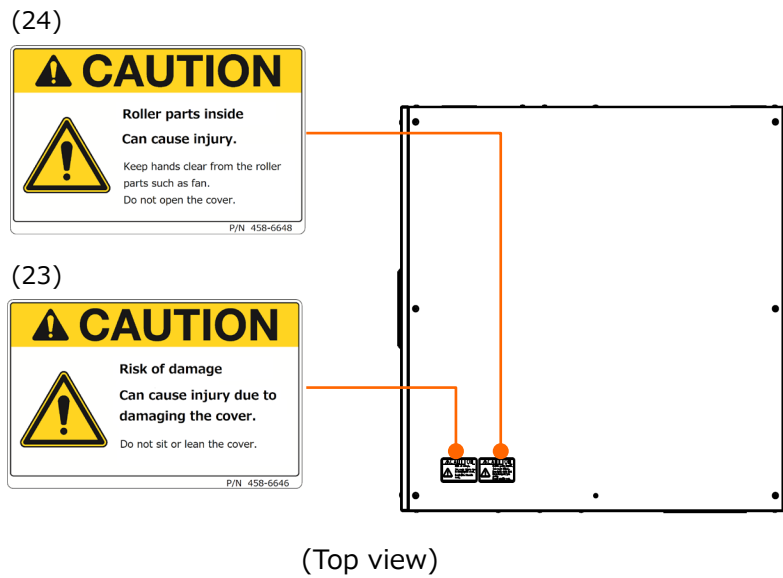


Locations of WARNING and CAUTION labels on EO control unit

Warning and Caution Labels on Instrument (Continued)



Locations of WARNING and CAUTION labels on EO control unit









Locations of WARNING and CAUTION labels on EO control unit









Warning and Caution Labels on Instrument (Continued)

Contents of each labels are described as below.

(1)		CAUTION
		Pinch point hazards. Can cause injury. Keep hands clear when opening or closing the stage. P/N 458-6624
(2)		CAUTION
		Pinch point hazards. Will result in injury to fingers. Be careful not to pinch a finger at the time of opening and closing. P/N 458-6624
(3)		CAUTION
		Roller parts inside. Can cause injury. Keep hands and hair clear when opening or closing the stage. P/N 458-6625
(4)		CAUTION
		Roller parts inside. Can cause injury. Keep hands clear from the roller parts such as fans. Do not open the cover. P/N 458-6625
(5)		CAUTION
		Caution Can cause injury due to damaging the cover. Do not sit or lean to the cover. P/N 458-6625
(6)		CAUTION
		Caution Heavy Object (25 kg) Muscle strain or back injury. Lifting should be carried out by using a forklift or the like. In addition, only the service engineers are allowed to perform this work. P/N 458-6625

Warning and Caution Labels on Instrument (Continued)






(7)		<p>CAUTION</p> <p>High Temperature Burns due to contact with High-temperature parts Beware of burn due to high temperature of the inner part during Ion pump baking and cooling. Do not remove the cover.</p> <p style="text-align: right;">P/N 458-6622</p>
(8)		<p>WARNING</p> <p>Hazardous Voltage Can cause death or severe injury. Only a service engineer is allowed to perform this work. Do not remove the cover.</p> <p style="text-align: right;">P/N 458-6621</p>
(9)		<p>CAUTION</p> <p>Hazardous Voltage (10 kV) Can cause death or severe injury. Only a service engineer is allowed to perform this work. Do not remove the cover.</p> <p style="text-align: right;">P/N 458-6621</p>
(10)		<p>WARNING</p> <p>Hazardous Voltage (1000 V) Can cause death or severe injury. Only a service engineer is allowed to perform this work. Do not remove the cover.</p> <p style="text-align: right;">P/N 458-6621</p>
(11)		<p>WARNING</p> <p>Hazardous voltage inside Can cause death or severe injury. Turn HV off before removing this cover. HV will be shut off if this cover is removed during HV is ON.</p> <p style="text-align: right;">P/N 458-6621</p>
(12)		<p>CAUTION</p> <p>Persons with pacemaker implants stay out. Can cause interference with pacemaker operation. Stay back more than 0.6 m.</p> <p style="text-align: right;">P/N 458-6623</p>

Warning and Caution Labels on Instrument (Continued)



<p>(13)</p>		<p>WARNING</p> <p>Can cause injury. Do not lift with your hands.</p> <p>P/N 536-7095</p>
<p>(14)</p>		<p>WARNING</p> <p>Hazardous Voltage inside Can cause death or severe injury. Do not remove the cover.</p> <p>P/N 536-7094</p>
<p>(15)</p>		<p>CAUTION</p> <p>Interlock function Make sure to equip a protection unit. HV will forcibly OFF due to the interlock when the protection unit is removed.</p> <p>P/N 458-6625</p>
<p>(16)</p>		<p>WARNING</p> <p>Hazardous Voltage Can cause death or severe injury. Turn off power before servicing.</p> <p>P/N 458-6641</p>
<p>(17)</p>		<p>WARNING</p> <p>High temperature Can cause burns. Do not touch the cover while baking and cooling.</p> <p>P/N 458-6644</p>
<p>(18)</p>		<p>WARNING</p> <p>High temperature Can cause burns. Do not touch the cover while baking and cooling.</p> <p>P/N 458-6649</p>
<p>(19)</p>		<p>WARNING</p> <p>Permanent magnetic field Can cause pacemaker trouble. Stay back 0.6 m.</p> <p>P/N 458-6643</p>

Warning and Caution Labels on Instrument (Continued)

(20)	 <p>WARNING HEAVY WEIGHT Can cause injury. Do not lift with your hands. P/N 537-2535</p>	<p>WARNING</p> <p>Heavy Weight Can cause injury. Do not lift with your hands.</p> <p>P/N 537-2535</p>
(21)	 <p>CAUTION Pinch hazards. Will result in injury to fingers. Be careful not to pinch a finger at the time of opening and closing. P/N 539-1731</p>	<p>CAUTION</p> <p>Pinch hazards. Will result in injury to fingers. Be careful not to pinch a finger at the time of opening and closing.</p> <p>P/N 539-1731</p>
(22)	 <p>CAUTION Roller parts inside Can cause injury. Keep hands and hair clear when opening and closing the stage. P/N 458-6647</p>	<p>CAUTION</p> <p>Roller parts inside Can cause injury. Keep hands and hair clear when opening or closing the stage.</p> <p>P/N 458-6647</p>
(23)	 <p>CAUTION Risk of damage Can cause injury due to damaging the cover. Do not sit or lean the cover. P/N 458-6646</p>	<p>CAUTION</p> <p>Risk of damage Can cause injury due to damaging the cover. Do not sit or lean the cover.</p> <p>P/N 458-6646</p>
(24)	 <p>CAUTION Roller parts inside Can cause injury. Keep hands clear from the roller parts such as fan. Do not open the cover. P/N 458-6648</p>	<p>CAUTION</p> <p>Roller parts inside Can cause injury. Keep hands clear from the roller parts such as fan. Do not open the cover.</p> <p>P/N 458-6648</p>

EMO Switch (Option)

Outline

The EMO Switch can power OFF the instrument forcibly by pressing the button switch when it is in the emergency condition.

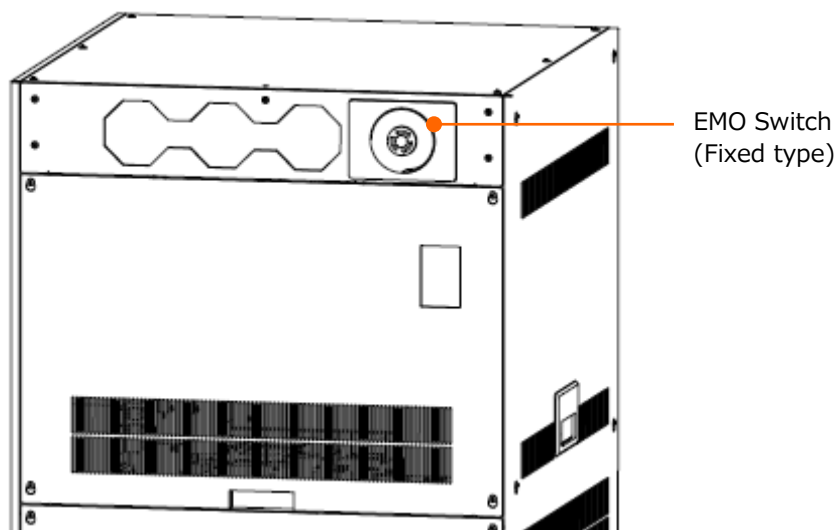
NOTE: Please press the button only when it is in an emergency. When shutting down all power of the instrument forcibly, it can cause of failure of observation because the observing image will not be saved and it take time to restart.

External view

The EMO Switches will be arranged at the two places on the upper front of the EO control unit (Fixed type) and on the operation table (Mobile type).

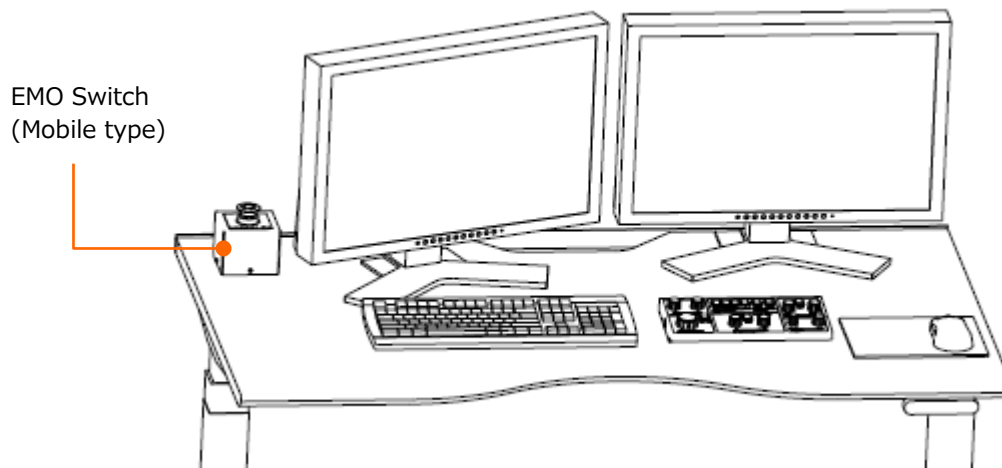
The EMO Switch on the operation table can be moved freely within the range of the cable length (Approximately 2 m from the bottom right at the rear side of the main unit.)

NOTE: Unintentional operation or damage can be occurred by tumbling or dropping the EMO Switch (Mobile type). Make sure to place the EMO Switch at the stable place such as on the operation table (horizontal place).



Location of the EMO Switch (Fixed type)

EMO Switch (Option) (Continued)



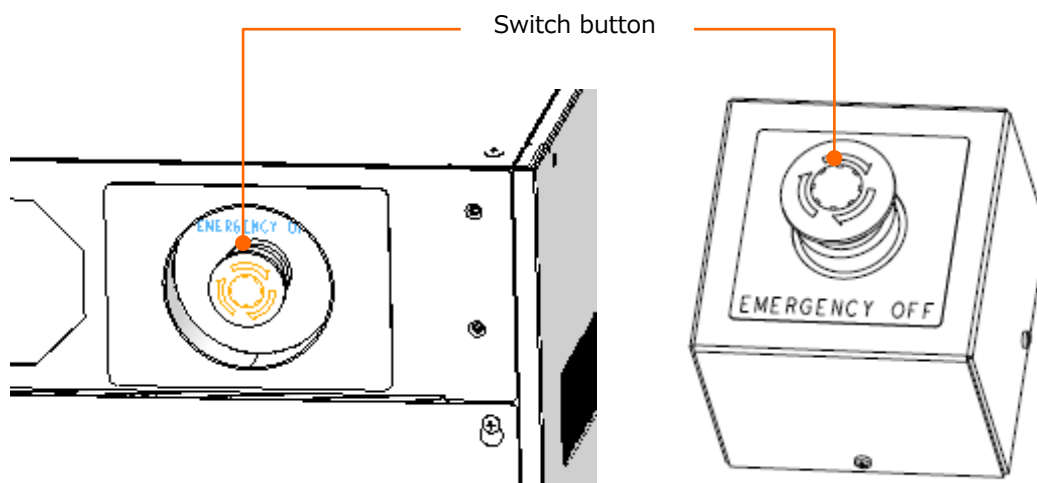
Location of the EMO Switch (Mobile type)

Operation method of the EMO Switch

All powers of the instrument will be OFF by pressing either EMO Switch button on the upper front of the EO control unit (Fixed type) or on the operation table (Mobile type).

The instrument will kept the shutdown condition unless unlock the button switch by rotating the button switch clockwise.

NOTE: Please press the button only when it is in an emergency. When shutting down all power of the instrument forcibly, it can cause of failure of observation because the observing image will not be saved and it take time to restart.



Recovery procedures after pressing the EMO Switch

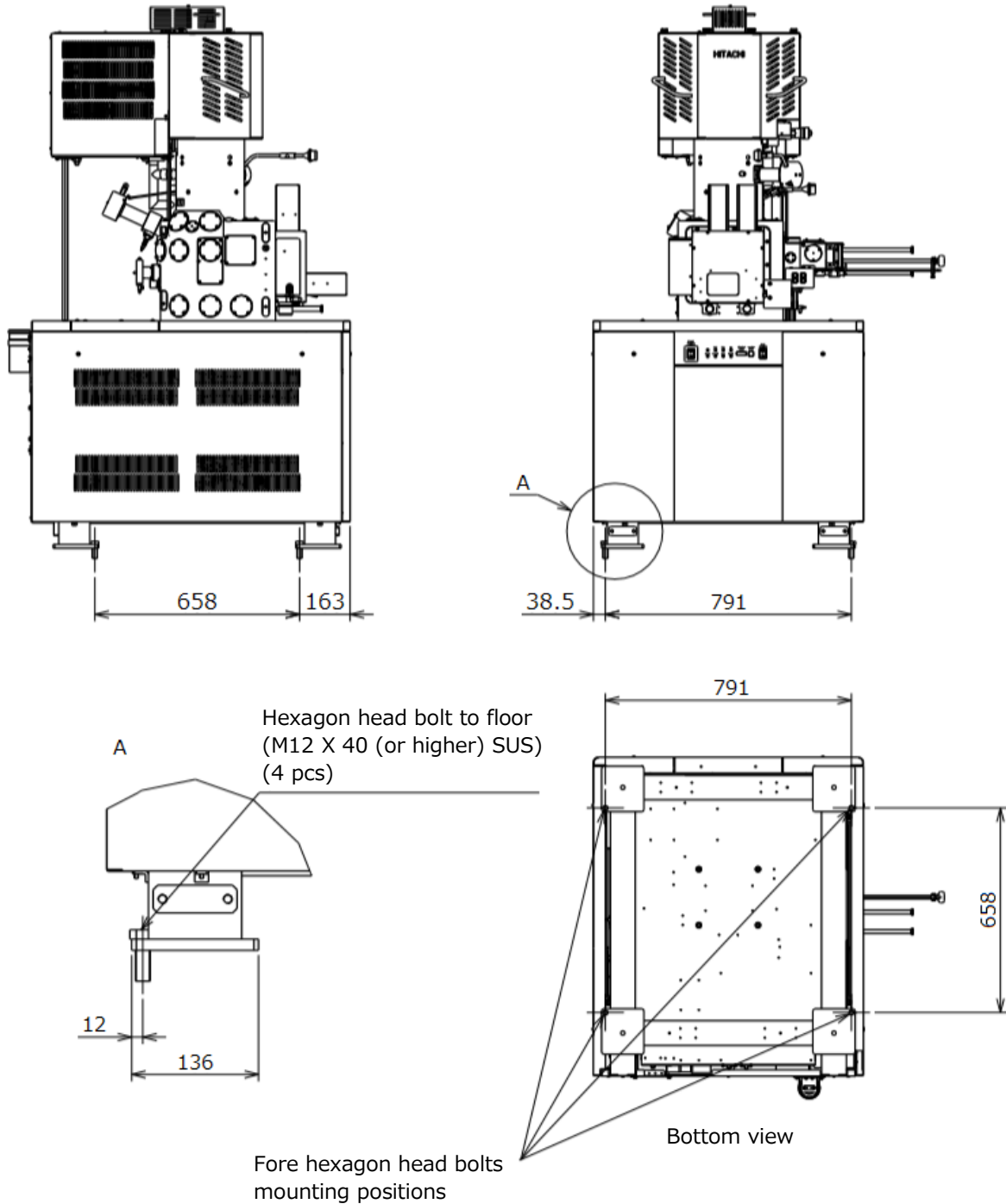
- (1) Make sure to set OFF the following switches and breakers before unlock the EMO Switch.
 - Main unit: [EOC POWER] switch, [EVAC POWER] switch, IP1 breaker, IP2 breaker, STAGE breaker
 - EO control unit: HV breaker, IP/HV breaker, EVAC breaker, EOC breaker, OUTER BAKE breaker, MAIN breaker
- (2) Unlock the switch by rotating the EMO Switch button clockwise.
- (3) Startup the instrument.

Reference: SU8700 instruction manual
4.5 Operation after recovery from power failure and for star-up of instrument



Protection against movement caused by earthquake (Option)

Main unit



* The values on this specification is based on the calculation.

Protection against movement caused by earthquake (Main unit) (Recommend)



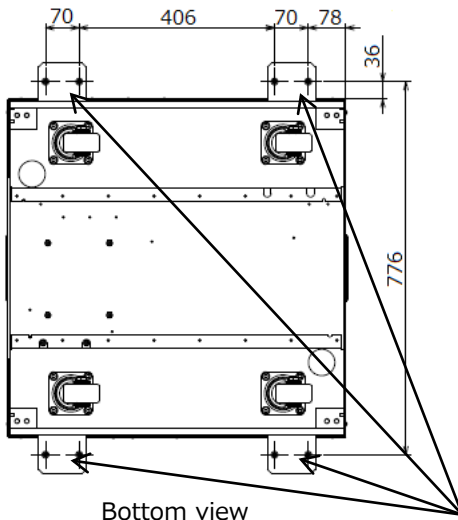
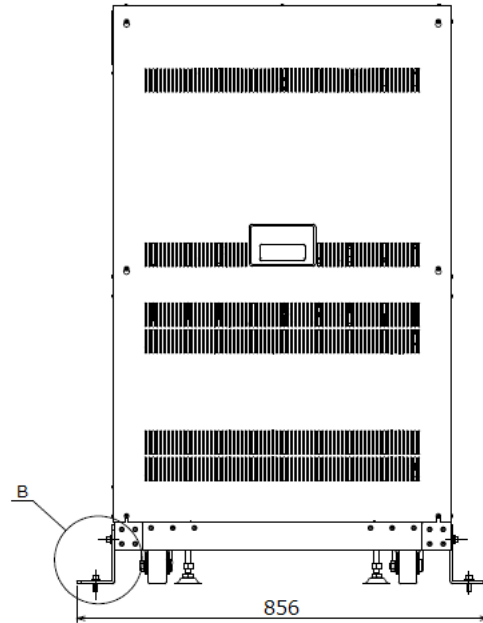
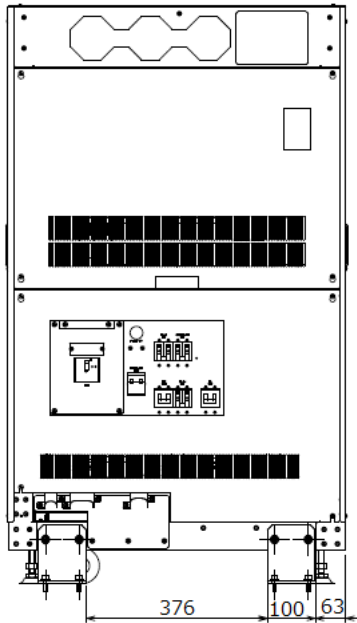
SAFETY SUMMARY



Protection against movement caused by earthquake (Option) (Continued)

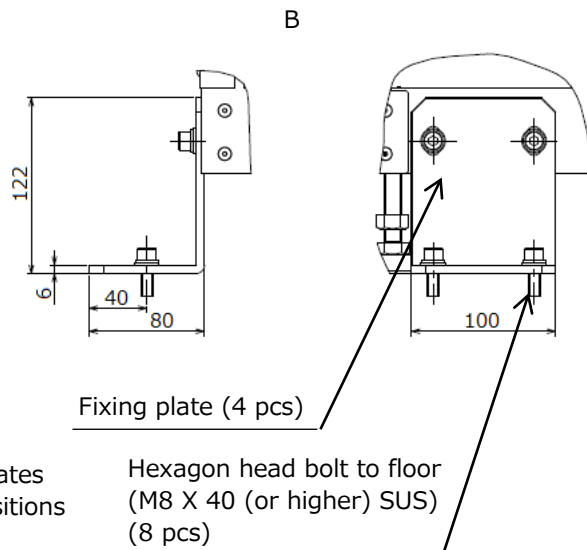
EO control unit

SAFETY SUMMARY



Bottom view

Four fixing plates
mounting positions



* The values on this specification is based on the calculation.

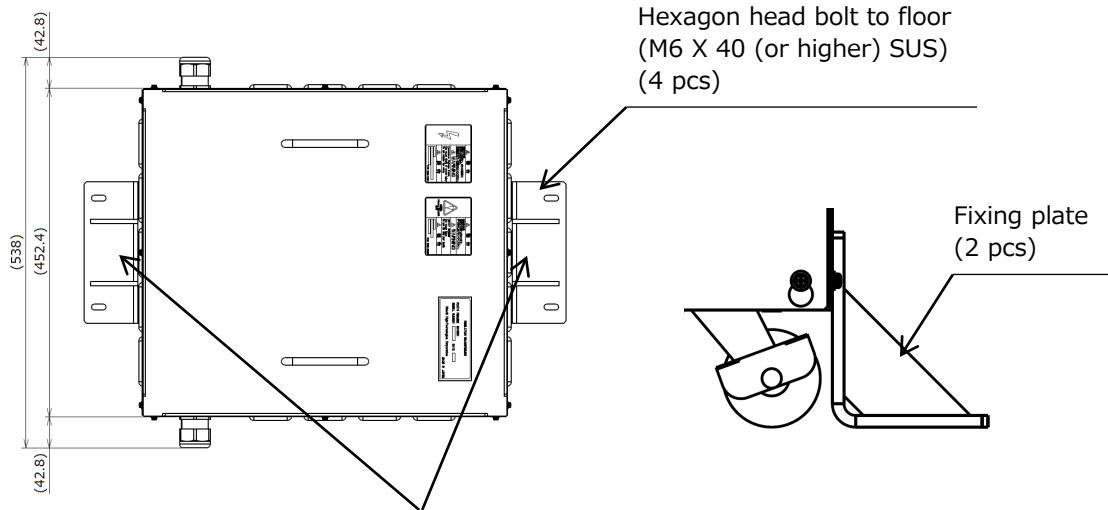
* The bolts to fix on the floor are customer's supplied items.

Please prepare the hexagon head bolts to floor (M8 X 40 (or higher) SUS) (8 pcs) before installing the fixing plates.

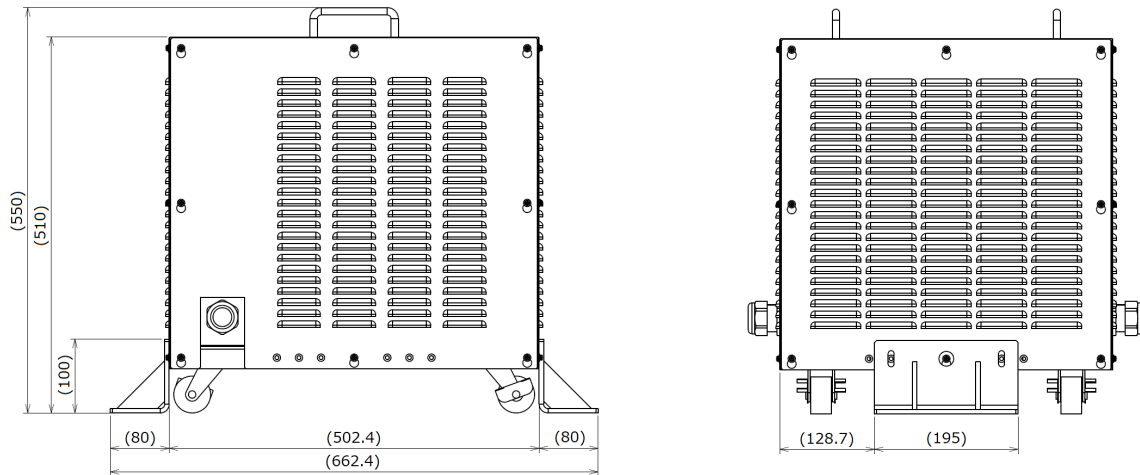
Protection against movement caused by earthquake (EO control unit) (Recommend)

Protection against movement caused by earthquake (Option) (Continued)

Step down Transformer unit (Option)



Two fixing plates mounting positions.



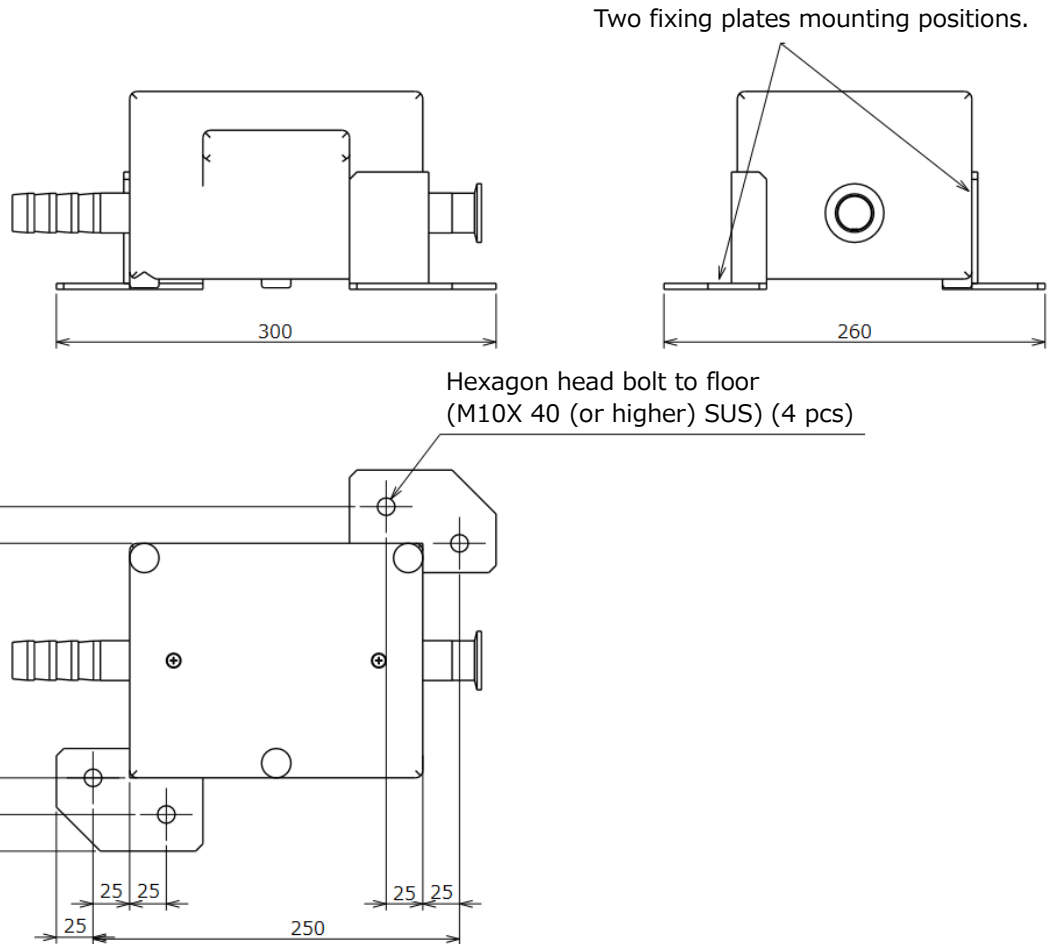
- * The values on this specification is based on the calculation.
- * The bolts to fix on the floor are customer's supplied items.
Please prepare the hexagon head bolts to floor (M6 X 40 (or higher) SUS) (4 pcs) before installing the fixing plates.

Protection against movement caused by earthquake
(Step down Transformer unit) (Recommend)

Protection against movement caused by earthquake (Option) (Continued)

Weight unit

SAFETY SUMMARY

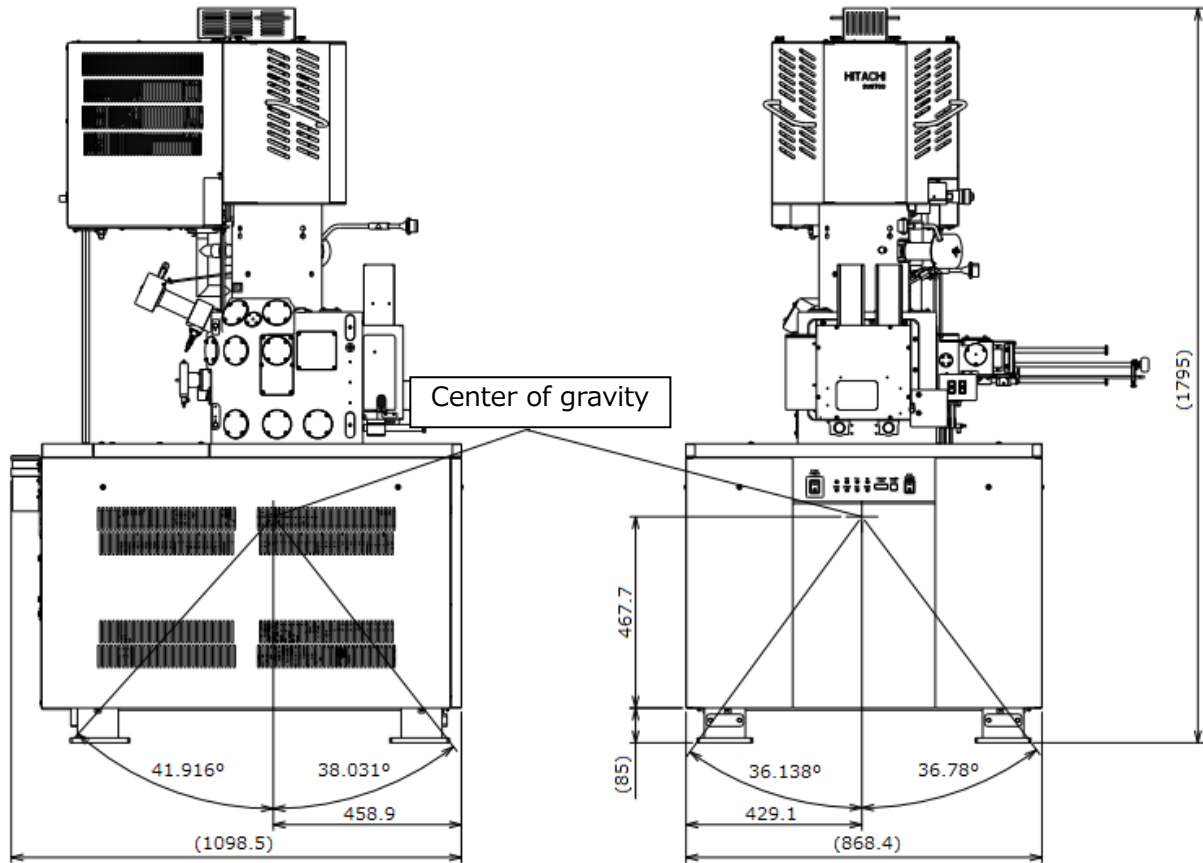


- * The values on this specification is based on the calculation.
- * The bolts to fix on the floor are customer's supplied items.
Please prepare the hexagon head bolts to floor (M10 X 40 (or higher) SUS) (4 pcs) before installing the fixing plates.

Protection against movement caused by earthquake
(Weight unit) (Recommend)

Center of gravity on each unit

Main unit

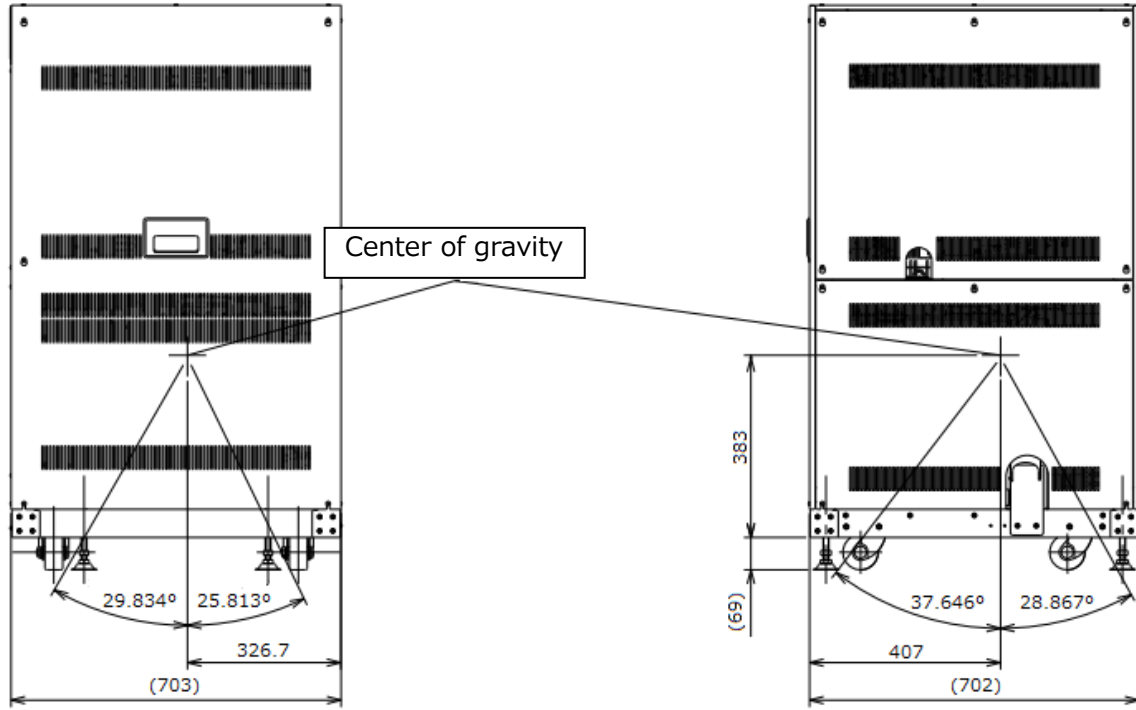


* The center of gravity is based on the calculation.



Center of gravity on each unit (Continued)

EO control unit

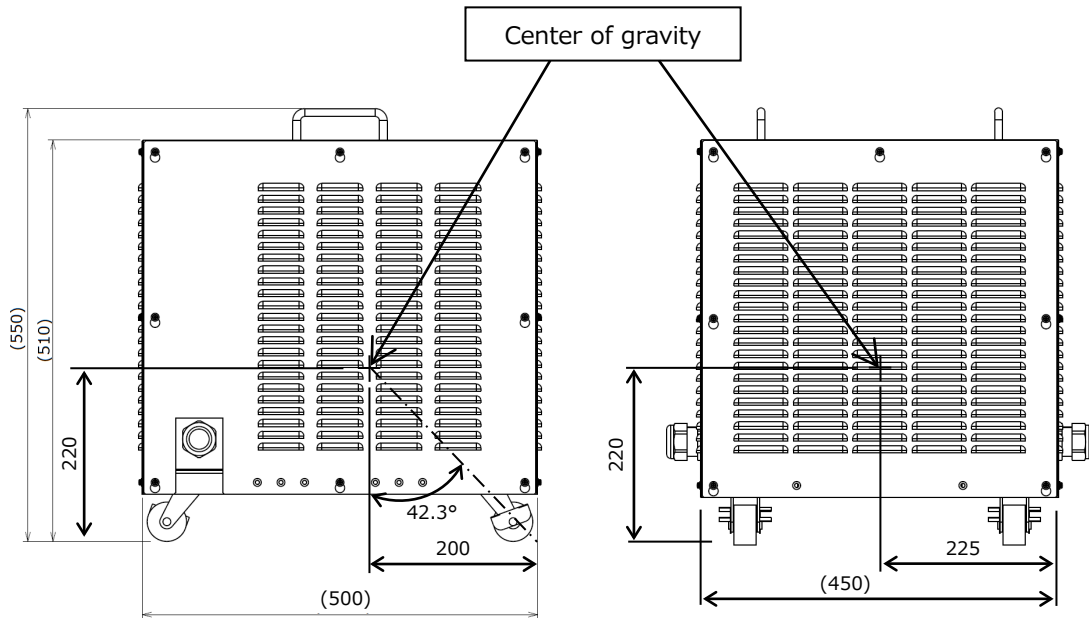


* The center of gravity is based on the calculation.



Center of gravity on each unit (Continued)

Step down Transformer unit (Option)



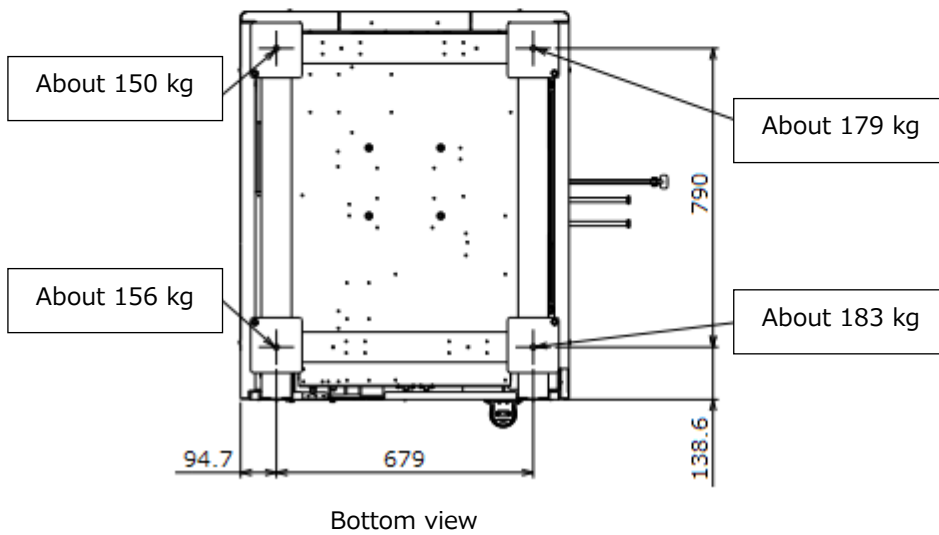
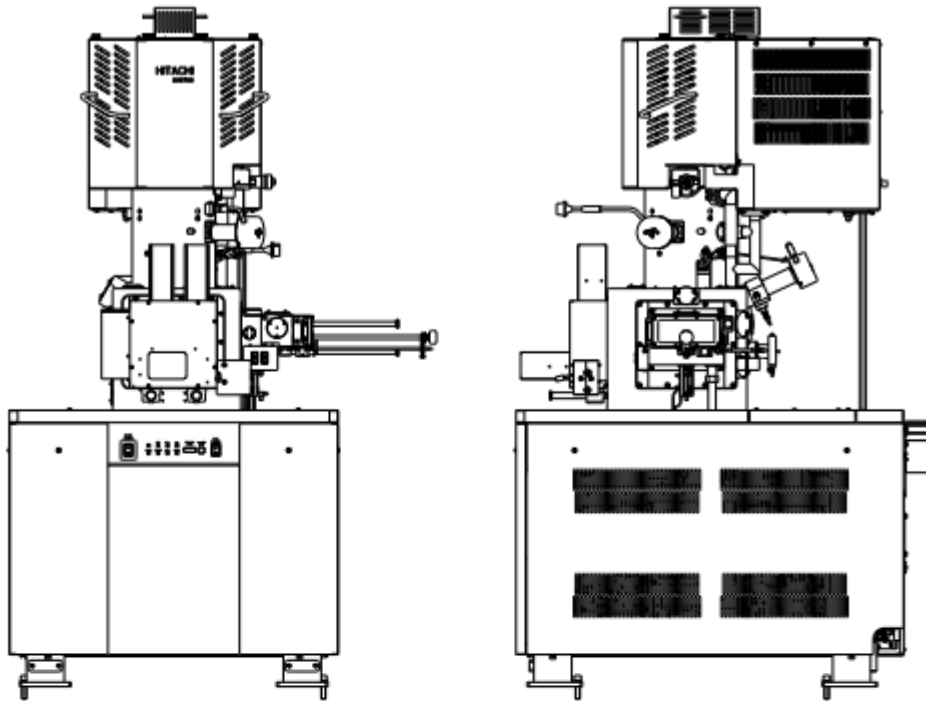
* The center of gravity is based on the calculation.



SAFETY SUMMARY

Weight allocation

Main unit

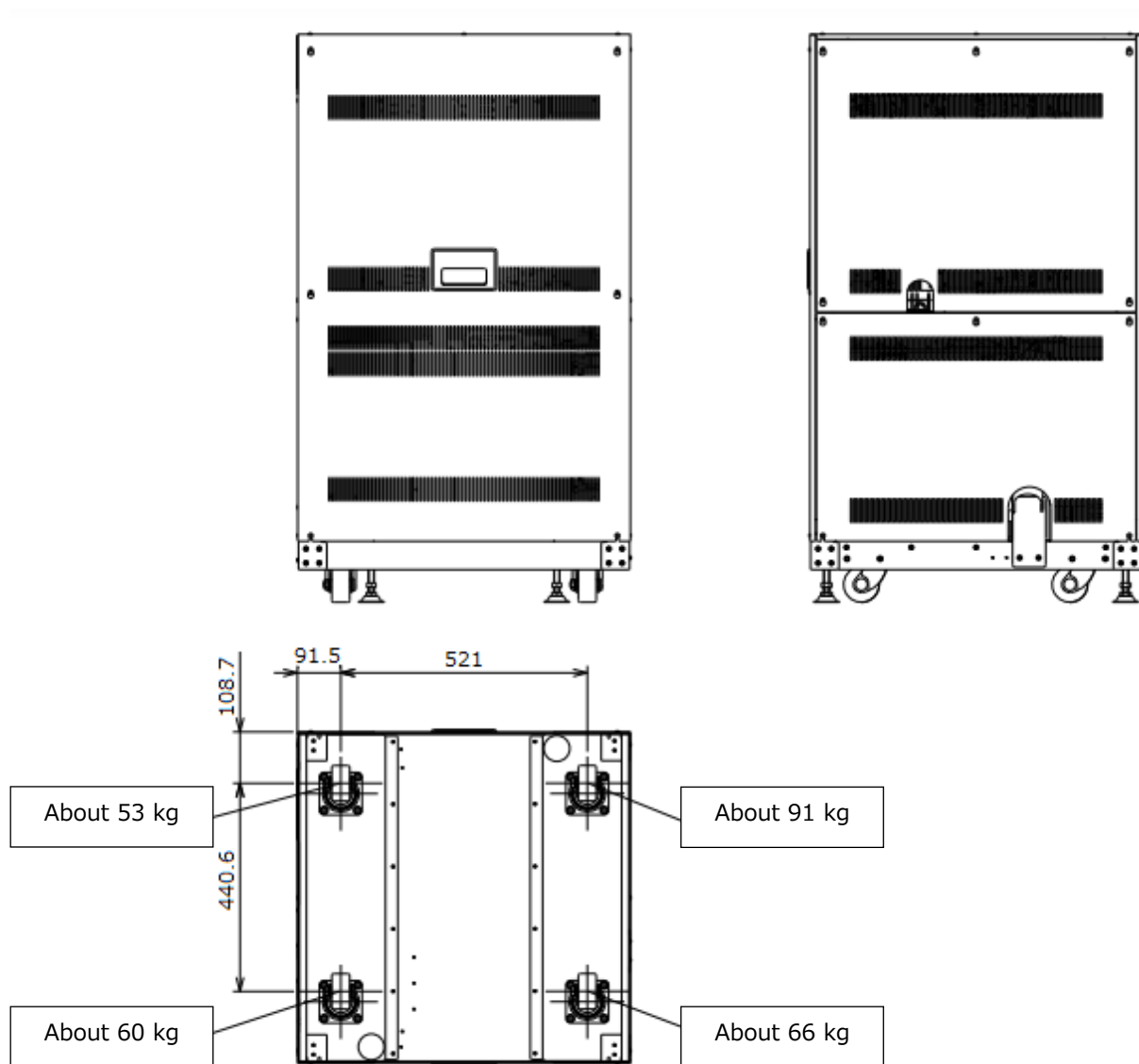


* The weight allocation is based on the calculation.

Weight allocation on the legs of the main unit

Weight allocation (Continued)

EO control unit



Bottom view

* The weight allocation is based on the calculation.

Weight allocation on the legs of the EO control unit



SAFETY SUMMARY



Other Safety Guidelines

CAUTION

- **Power Interruption**

On occurrence of a power interruption or a momentary power voltage drop due to lightning, etc., the PC of this instrument may become faulty or the system software, application software, or data may be damaged.

It is recommended to employ an uninterruptible AC power supply unit in consideration of voltage drops.

- **Power Supply**

Make sure that the power supply for the SU8700 is single-phase AC 100 V, 4 kVA, 50/60 Hz (without installation of the step down transformer) or AC 115/120/200/208/220/230/240 V, 4 kVA, 50/60 Hz (with installation of the step down transformer). The instrument must be continuously energized.

Use a ground terminal having a grounding resistance of 100 Ω or less.

Additionally, the grounding terminal must not be shared with any other electrical devices. Be sure to ground the instrument independently.

- **Water Leakage**

A water leak detector is not configured into the standard instrument. If the quality or pressure of cooling water is improper, the piping may corrode or crack and cause water leakage. In cases where a cooling water circulator cannot be used, be sure to install a water sensor available from us. The water leakage sensor for preventing a notable leakage of water. However, water leak detector is configured into the instrument with SEMI-S2 option. Beware of handling when the following water leak detection error is occurred on the instrument with SEM-S2 option.

Cooling water has stopped to introduce to the system because water leakage is detected. Can cause of injury due to electric shock. Stay away from the system and contact a service engineer. If it is possible, shut down or stop the water supply including the cooling watery circulation system.

Other Safety Guidelines (Continued)

CAUTION

● Cooling Water

- Use cooling water having a low residual chlorine concentration of 0.5 ppm or lower. If the residual chlorine concentration is higher than this level, the cooling water lines will corrode and result in water leakage. It is recommended to employ a temperature-controlled cooling water circulator.
- The supply pressure of cooling water should be within the range of 50 to 100 kPa.
- The flow rate of cooling water should be approximately 2 L/minute on each water line.
- For connection between the water inlet port and the water inlet hose, use a pipe joint of tapered female thread type (Rc 3/8).
- The drain hose from the drain port should be led to a drainage line. Fasten the drain hose securely so it will not come out of the drainage line. If the drain hose becomes loose, water leakage will occur.
- After operation, be sure to close the main valve at the cooling water inlet port.
- The water inlet and drain hoses are made of soft vinyl chloride. The longer the hoses are used, the more they will harden and lose their elasticity. The hoses therefore need to be replaced periodically and checked for water leakage prior to use.
- If there is a probability of the cooling water freezing in a cold climate, it is advisable to supply an antifreeze solution through a temperature-controlled cooling water circulator.
- The temperature of cooling water must be maintained so that it is not more than 7°C below the room temperature. Condensation will form in the cooling water paths when the difference between the temperatures is 7°C or more. If the instrument is used for a long time under the condition where condensation forms, important parts including the objective lens magnetic path may be rusted and eventually damaged, in which case the objective lens unit must be replaced with a new one.

● Other Applications on Computer

Never install any application software, other than those that have undergone an operational check by us, into the personal computer of this instrument. Otherwise, an unpredictable screen may be displayed, the instrument may be adversely affected, or the instrument system may function abnormally.

Malfunction of the system due to installation of any other application software is out of the scope of the warranty.

Other Safety Guidelines (Continued)

CAUTION

- Power Supply to Personal Computer (PC)

In case of shutting down the PC or application software forcibly an unsaved data will be deleted. Exit all operatable application software before shutting down the PC.

- Ethernet Connection (Main Unit and PC)

The main unit and control PC are connected with Ethernet cable. A port (RJ-45-J interface), which is at the network controller on the board in PC, is used only for the Ethernet. The main unit and control PC are communicating entire time during use. When the network does not connect properly, reduction of communication speed, interruption of communication or interfere with the system operation is occurred. When the main unit and control PC are connected, be sure the followings.

- The connection of Ethernet cable is only use for the main unit and control PC. (Directly connect the main unit and the PC) Do not use a hub or any network device between the connections.
- Use the network cable which is based on category 5 (Cat 5) standards.
- For a company internal network or any local network (LAN) connection, additional network controller is needed. Be sure to separate the main unit port and LAN port.
- Use the port at the network controller on board in PC which is used for the connection between the main unit and the control PC. In case of using additional network controller, reduction of communication speed or interruption of communication is possibly occurred, especially, using the adapter to convert from USB port to network port.

Other Safety Guidelines (Continued)

CAUTION

● Network Connection

The PC is equipped with an Ethernet port for network connection. Sufficient knowledge on the network environment is required for network connection via Ethernet. Proceed with connection upon consulting the network supervisor.

- Cable connection to the Ethernet port will be performed by an authorized installer or our service representative. Contact our sales or service representative.
- When connecting the PC to a network, be sure to run a computer virus program. For further information, refer to “Protection against Computer Viruses” in this chapter.
- The Ethernet cable is not supplied, so the customer must prepare a suitable one.
- Utmost care should be taken when changing the PC pre-settings for network connection. If the settings required for system operation are changed, the system may fail to operate normally.
- Do not install an unspecified software program for network connection. Otherwise, it may adversely affect the system preventing it from operating normally.
- To connect to a particular network or if you request a connection service, contact our sales or service representative.
- Since the Ethernet port is used in a case where an external device such as an EDX is connected through the optional external communication interface, a hub for branching will have to be prepared for connection to other than the external unit. Consult our sales representative since certain external units are standard-equipped with such a hub.
- Establishing a network connection using the Microsoft-TCP/IP protocol requires an IP address. Secure such an address by consulting the network administrator. Connecting to an external device, such as an EDX, requires another IP address for the device.

● About PC Freezing

If the PC freeze (the mouse and the keyboard won't work) for some reason, on the keyboard press the [Ctrl], [Alt] and [Delete] keys simultaneously, and shut down the system by following the instructions that appears in the dialog box (software resetting). After that, close Windows normally, turn off the main unit, and restart it. If this condition occurs, any data up to that point will be lost. If the PC fails to restart after a software reset operation, verify that the hard disk access indicator light is off, and press the Power button for a long time to turn it off forcibly. Since turning off power when the hard disk is still running can damage the hard disk and disable to PC from starting, this technique should be used only as a last resort.

Other Safety Guidelines (Continued)

CAUTION

- **Protection against Computer Viruses**

If any program/data is damaged suddenly or an unexpected operation/screen is encountered, it may cause lie in the condition that the PC is infected with a computer virus. Computer viruses are malicious programs that sneak into computers to cause misbehavior or damage to data. A software program designed to offer protection against computer viruses is called an anti-virus or vaccine program.

Computer virus infection may spread via network communication, program downloading, exchangeable storage media such as USB memory, or communication with infected PC. Never use a program or storage media that is suspected to contain a virus.

In case of using a program or storage media that is suspected to contain a virus, be sure to carry out virus-scanning inspection. However, some kinds of anti-virus programs cannot eradicated particular viruses. It is therefore advisable to periodically save a backup data of hard disk. The use is requested to prepare an anti-virus program and carry out virus removal on the user's own responsibility.

- **Data Backup**

On occurrence of a system failure or wrong operation, data stored in the PC or hard disk or others may be damaged or destroyed. It is therefore advisable to periodically save important data such as image data from the PC or the hard disk to storage media such as an external hard disk.


- **Update program of Windows**




Microsoft periodically distributes a new update program of Windows for increasing the security level or improving the liability. Updating a new program by connecting a PC to network and maintaining the PC at the latest condition are recommended.

However, functions of PC can be unstable due to the update program or applying the update program. In such a case, uninstall the updated program. It is therefore advisable to periodically save important data such as image data as a backup.

安全使用注意事项

安全警告标签及标语的定义

关于人身安全的注意事项，将安全警示符号  和标识词“警告”、“注意”相组合，用以下方式表示。

	: 这是一个安全警示符号。 它用于提醒可能导致人身事故的潜在危险。 请遵循此符号后面的所有安全信息，以避免可能发生的伤害或死亡。
 警告	: 表示如不规避，将可能导致死亡或重伤的潜在危险情况。
 注意	: 表示如不规避，将可能导致轻度或中度人身伤害的潜在危险情况。

以下标识词表示非人身安全方面的注意事项，或者是实用信息。

通知	: 表示如不规避，将可能导致财产损失、设备严重损坏、数据丢失、环境污染的危险情况，但是不会发生人身安全方面的事故。
注	: 用于正确使用设备、防止轻度故障、充分发挥设备性能。



有关安全的共同注意事项

使用前的注意事项

- 请遵守贴在设备上的警告标签以及所有所提供使用说明书中的注意事项和规定，以免发生触电或火灾导致的死亡、重伤或者设备损坏等事故。
- 严禁擅自改装设备，或者使用非指定的部件。另外，严禁在拆除安全装置的状态下使用设备，以防发生危险。
- 试剂等化学品应确认其性状及安全说明（SDS），以保证正确使用。
- 使用试剂等化学物质时，由用户责任对房间充分换气。如果通风不足，可能会造成健康损害。
- 虽然设备或使用说明书中的注意事项是经过充分研究后制定的，但是仍有可能发生意外。操作时不仅遵守规定事项，而且用户自身也要时刻保持警惕。
- 使用过程中出现异声、异臭或冒烟等异常现象时，应立即切断电源，并根据情况采取安全措施后联系销售责任人或本公司指定的服务公司。
- 请根据各制造商的使用说明书正确使用设备上的可选配件。
- 在紧急停止时，请关闭 MAIN 断路器。

请务必遵守上述规定。不遵守规定可能导致样品观察不准确，评估结果错误，甚至造成人身伤害。





有关安全的共同注意事项（续）

安装、维护和搬迁上的注意事项

- 请标准附属品与检查单近旁一起保管，以免丢失。如果标准附属品不够的状态运行设备，可能会发生故障，导致安全上的障碍。
万一有缺乏、损坏或有您介意的地方，请联系安装工员、销售人员或本公司指定的服务公司。
- 用户的维护工作仅限于本使用说明书上规定的项目。维护前，请仔细阅读使用说明书并掌握其中的内容。请不要执行使用说明书中未描述的维护工作，请将其交给本公司指定的服务公司。不遵守这些可能导致设备故障或人身伤害。
- 请在指定的周期内更换本使用说明书中规定的消耗品。在不及时更换消耗品的情况下运行设备时，可能会导致设备故障，或导致安全问题。另外，请与本公司指定的就近服务公司联系，以进行除用户责任范围以外的更换工作。

使用中的警告及注意事项

在使用说明书的正文中未描述的警告项目如下所示。

 警告	
	<ul style="list-style-type: none">● 由于在异常状态下继续使用而导致的事故 <p>使用处于异常状态的产品可能会导致触电或火灾。当使用中出現异声、异味、冒烟等异常现象时，请立即关闭电源。之后，请根据情况采取安全措施，并与本公司指定的服务公司联系。</p>



有关安全的共同注意事项（续）

在使用说明书的正文中未描述的注意事项如下所示。

注意

● 长时间使用导致的疲劳



长时间保持同一姿势看监视器时，眼部或躯体上会积累疲劳。长时间使用时，要每小时休息 10 至 15 分钟，以保持眼睛或躯体的健康。另外，请参照 SEMI 标准等配备操作所需的桌椅，并遵守这些标准要求。

● 激光束辐射引起的紊乱



电脑内置的 Super Multi Drive 中装有激光光源。配备激光设备的电脑符合国际电工委员会的标准（IEC 60825-1: 2014 Edition 3.0）。特别是激光器，它符合美国政府机构设定的 1 类激光设备标准，通常情况下不会向设备外部辐射有害人体的激光束。请务必遵守以下注意事项。

- 请勿打开激光设备的面板，其中没有用户可维修的组件。
- 请勿调整此处未描述的激光设备控制器等。
- 设备维修工作务必交给本公司指定的服务公司。
- 请勿卸下设备盖板。

● 由于使用不当而冒烟和着火







本设备中安装了保护装置，这些装置在保险丝、过电流检测器、泄漏检测器、异常状态显示功能等发生异常时启动。保护装置一旦启动，请联系本公司指定的服务公司。

在没有消除故障的状态下打开电源，有可能发生冒烟、起火等意外事故。

操作手册中的警告

本使用说明书中描述的警告及其所在位置汇总如下。

 警告	
<ul style="list-style-type: none"> ● 因掉落而受伤 	<p> 主体（670kg）、E0 控制单元（270kg）是重物。由于地震而可能造成人身伤害，建议安装后使用支架等进行固定。设备移动由本公司指定的服务公司负责进行，用户不应搬移设备。</p> <p style="text-align: right;">（第 1 章 设备规格和安装条件）</p>
<ul style="list-style-type: none"> ● 由于抬起重物导致的伤害 	<p> 压铁是质量约为 25kg 的重物。如不注意，抬起时可能导致人身伤害。抬起时，使用搬运工具等。</p> <p>压铁移动工作由本公司指定的服务公司负责进行。用户不应该进行搬移工作。</p> <p style="text-align: right;">（第 1 章 设备规格和安装条件）</p>
<ul style="list-style-type: none"> ● 因触摸高温单元而灼伤（电子枪 / 离子泵烘烤） 	<p> 电子枪和离子泵将加热到约 250℃，以实现电子枪高真空化。严禁触摸电子枪、离子泵和周围区域，以免灼伤。</p> <p>如果电子枪由于错误动作而被加热，可能会处于高温状态而导致灼伤。烘烤电子枪后，务必关闭 OUTER BAKE 断路器。</p> <p>烘烤完成后，冷却至接近室温需要约 6 小时。在此之前，加热单元和周边部位处于高温状态。严禁触碰它，以免被灼伤。</p> <p>当烘烤非正常终止（停电等）时，需要大约 6 个小时才能冷却到接近室温。在此之前，由于加热部位处于高温状态，所以严禁触碰它，以免被灼伤。</p> <p style="text-align: right;">（第 4 章 维护）</p>



操作手册中的警告（续）

警告

● 爆炸与吸入有害物质引起的损坏



乙醇是有机溶剂。

- 如果挥发的乙醇着火，有发生爆炸的可能性。
- 挥发的乙醇吸太多时，身负重伤或困难呼吸障碍的可能性。
- 如果误饮乙醇，还要触摸皮肤或进入眼睛，作用刺激性的影响被发麻及步行困难等神经炎障碍的可能性。
- 请在通风良好没有烟火的地方作业，还要注意过多吸入。
- 此外，需要时使用空气呼吸器，保护眼镜，保护手套和保护安全靴。

（第4章 维护）



● 起搏器故障



来自离子泵永磁体的磁场（周边 10mT，离子泵盖外侧约 1mT）可能会损坏起搏器。起搏器用户应保持离离子泵至少 0.6m 的距离。

（第4章 维护）

● 高压触电



进行电子枪烘烤工作时，请确保 FIL 灯和 HV 灯熄灭。FIL 灯和 HV 灯点亮时，请勿烘烤电子枪。由于施加高电压，可能会发生电击。

（第4章 维护）

本设备内部具有最大 AC 100V、DC 30kV 的电压，触碰时可能会触电。如果在本设备正在通电中，拆下主体、控制单元和电源的盖板并触摸内部部件或电路，可能会因触电而导致死亡或严重伤害等事故。请勿卸下设备盖板。

（第6章 故障检修）

● 接地错误引起的电击



地线连接错误的设备将无法正常工作，而且存在触电危险。请勿触摸地线。




本设备的地线连接工作由本公司指定的服务公司进行。

（第1章 设备规格和安装条件）



操作手册中的注意

本使用说明书中列出的注意事项及其所在位置汇总如下。

 注意	
<ul style="list-style-type: none">● 翻倒造成的伤害 	<p>由于主体盖板损坏而设备被翻倒时，可能会造成人身伤害。请勿爬上盖板上面或抵靠盖板。</p> <p style="text-align: right;">（第 1 章 设备规格和安装条件）</p> <p>请使用活梯进行高空作业。在这种情况下，当心摔倒而受伤。请使用符合用户公司梯子安全标准的活梯。</p> <p style="text-align: right;">（第 4 章 维护）</p>
<ul style="list-style-type: none">● 因卷入而受伤 	<p>在工作台转动部分卷入手或头发时会有受伤的危险。在工作台拉出状态下，当心手或头发被卷入转动部分。</p> <p style="text-align: right;">（第 3 章 操作）</p>



本设备的警告标签

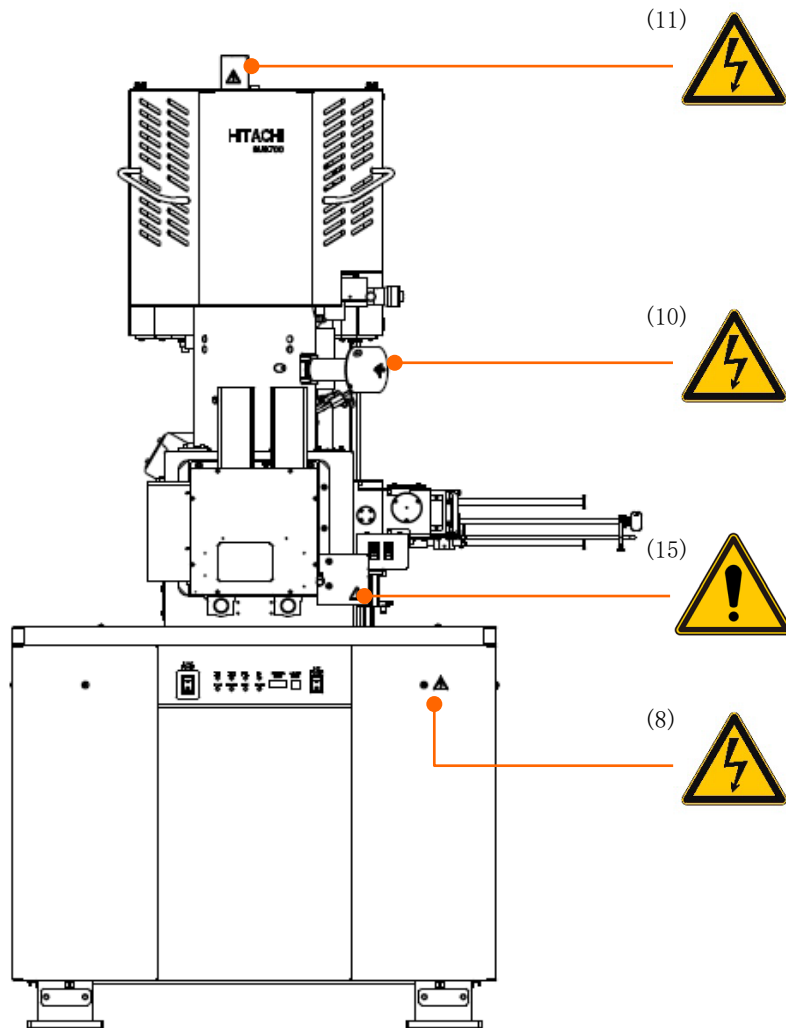
贴在 SU8700 扫描电子显微镜上的警告标签见安全-8~安全-26 的页面内容。

请确认实物警告标签的内容。

请定期清洁并保养警告标签，以便在安全距离内看清。

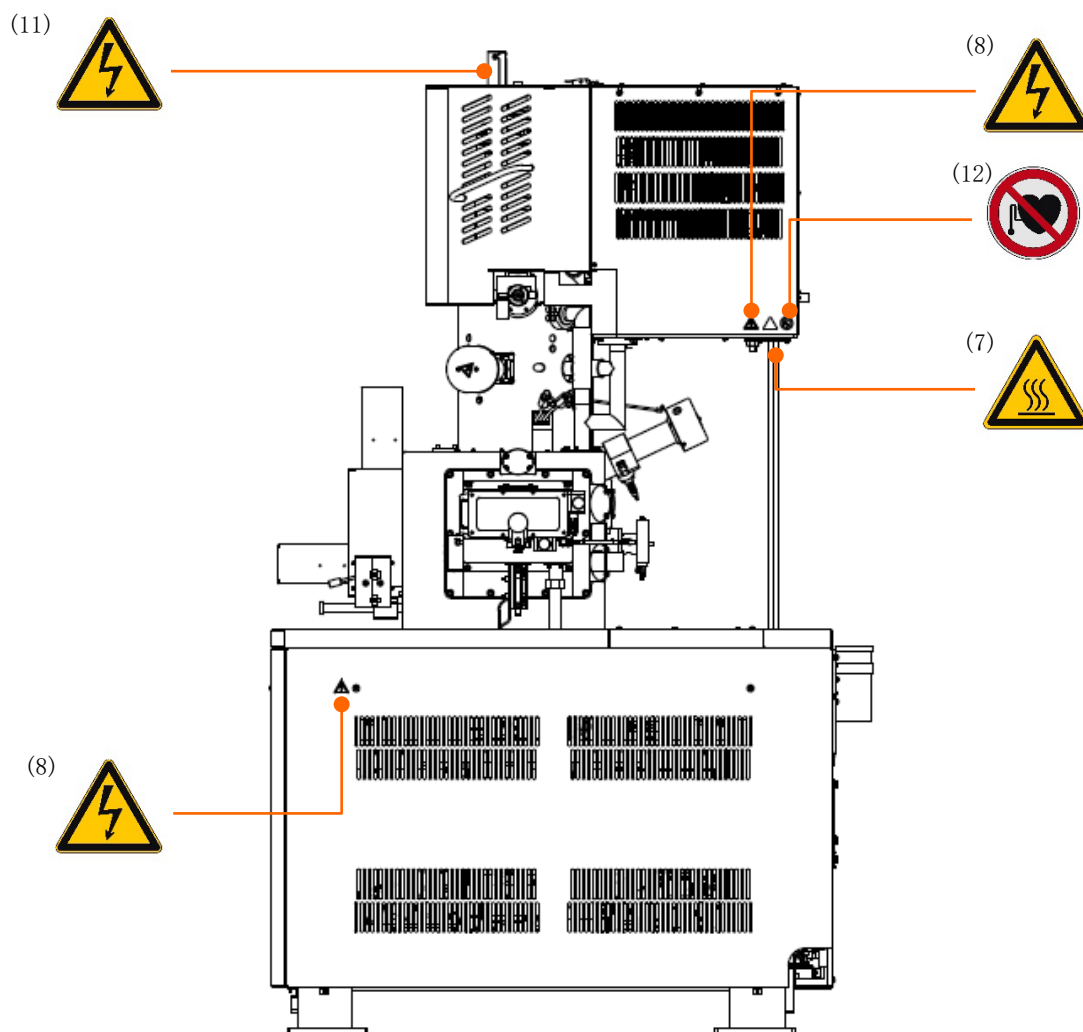
如果警告标签因老化而模糊不清，请联系本公司指定的服务公司换取新标签。

标准类型



主体部分（正面）上的警告标签粘贴位置

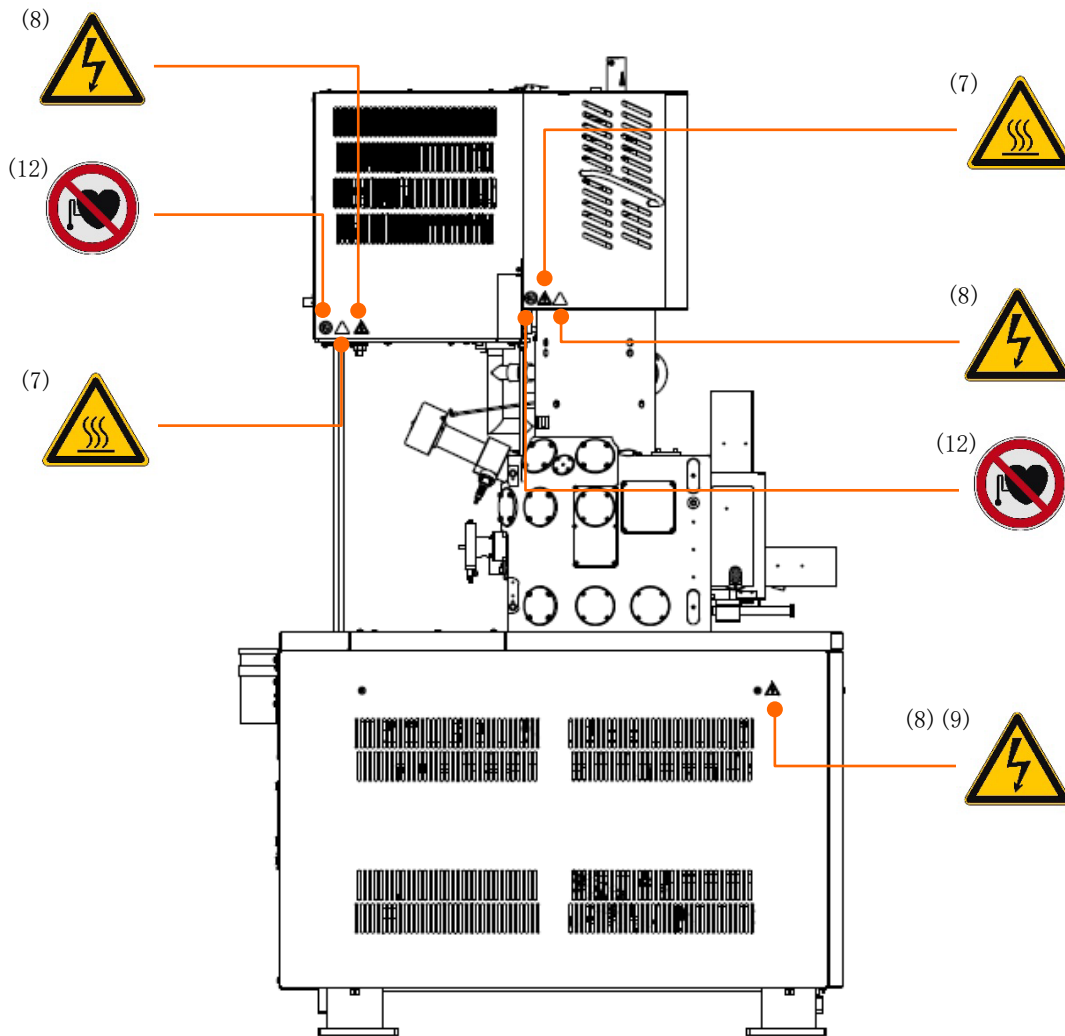
本设备的警告标签（续）



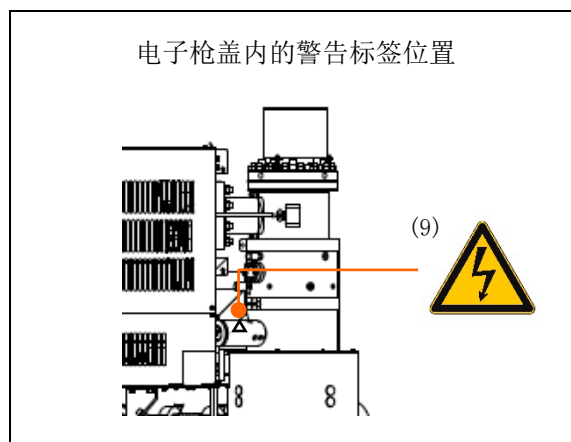
主体部分（右侧）上的警告标签粘贴位置



本设备的警告标签（续）

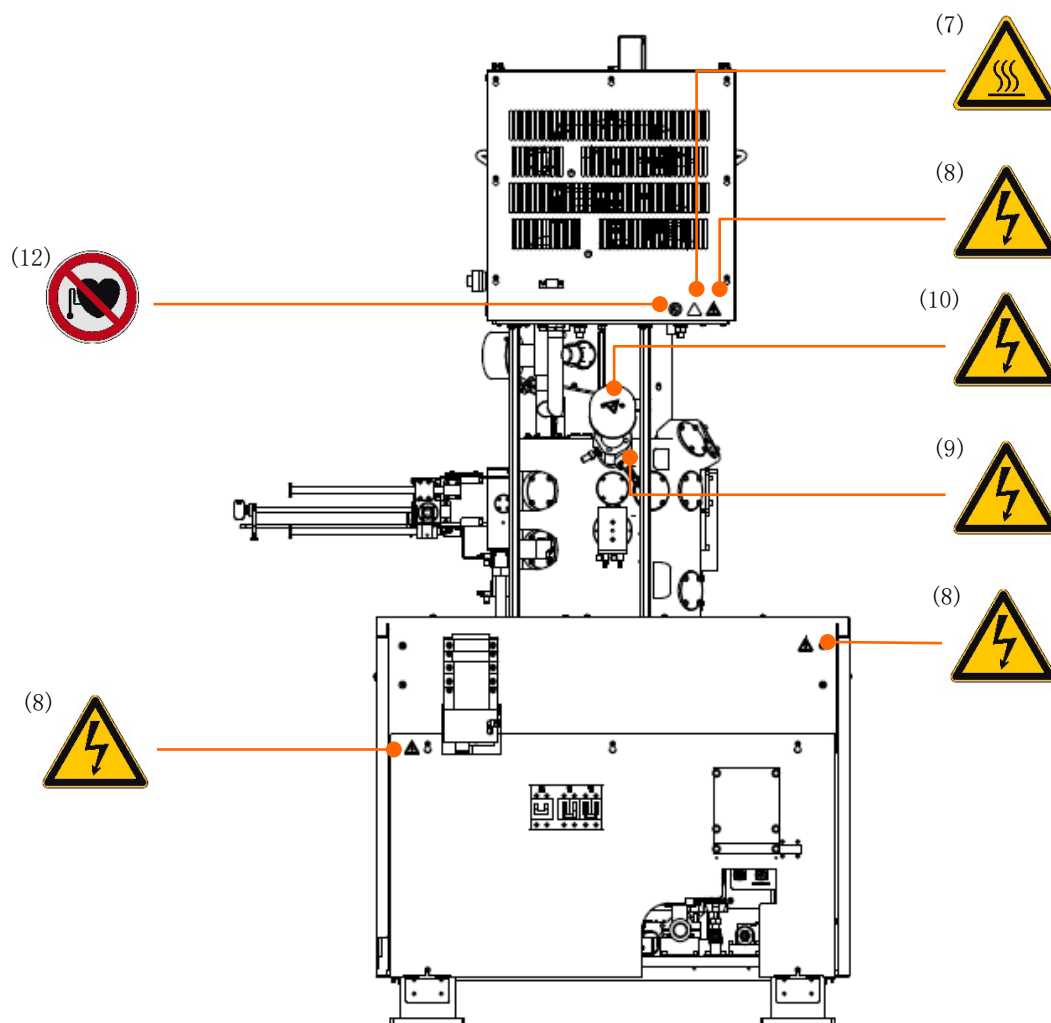


主体部分（左侧）上的警告标签粘贴位置



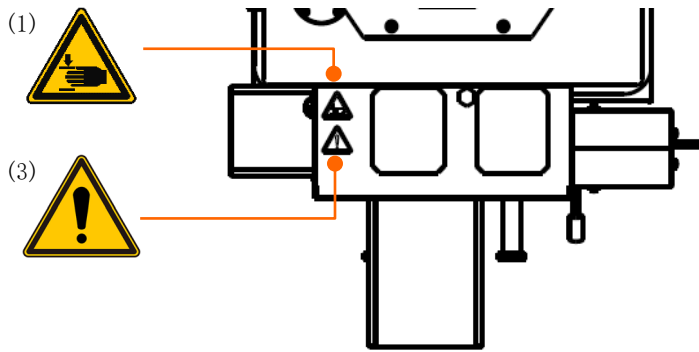
电子枪盖内的警告标签位置

本设备的警告标签（续）

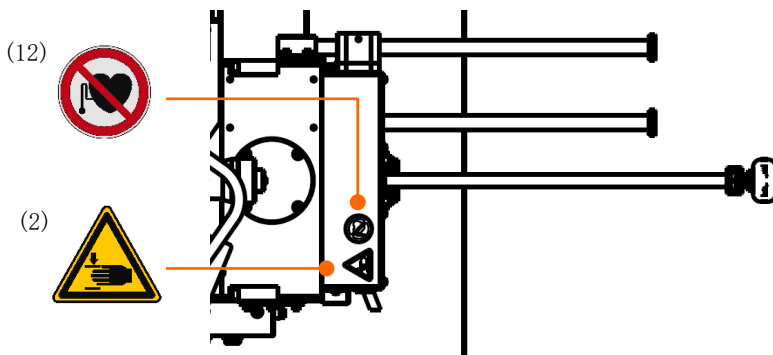


主体部分（背面）上的警告标签粘贴位置

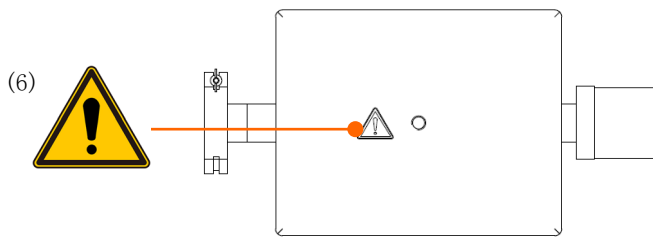
本设备的警告标签（续）



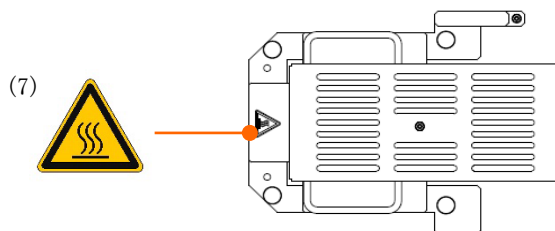
工作台上表面的警告标签粘贴位置



样品交换器上的警告标签粘贴位置

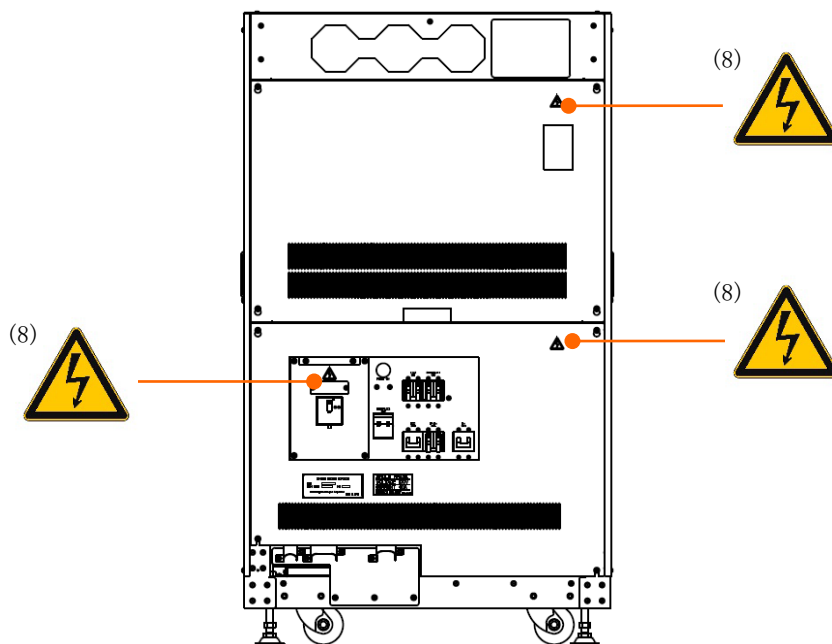


压铁（俯视图）上的警告标签粘贴位置

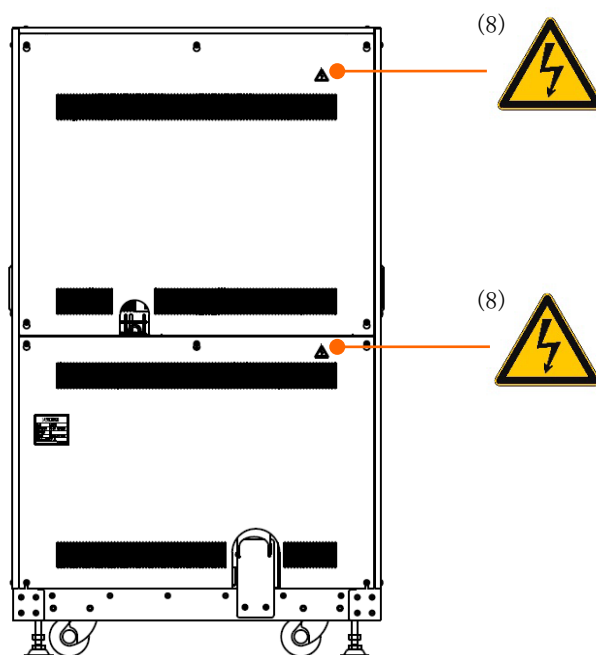


烘烤用盖子

本设备的警告标签（续）

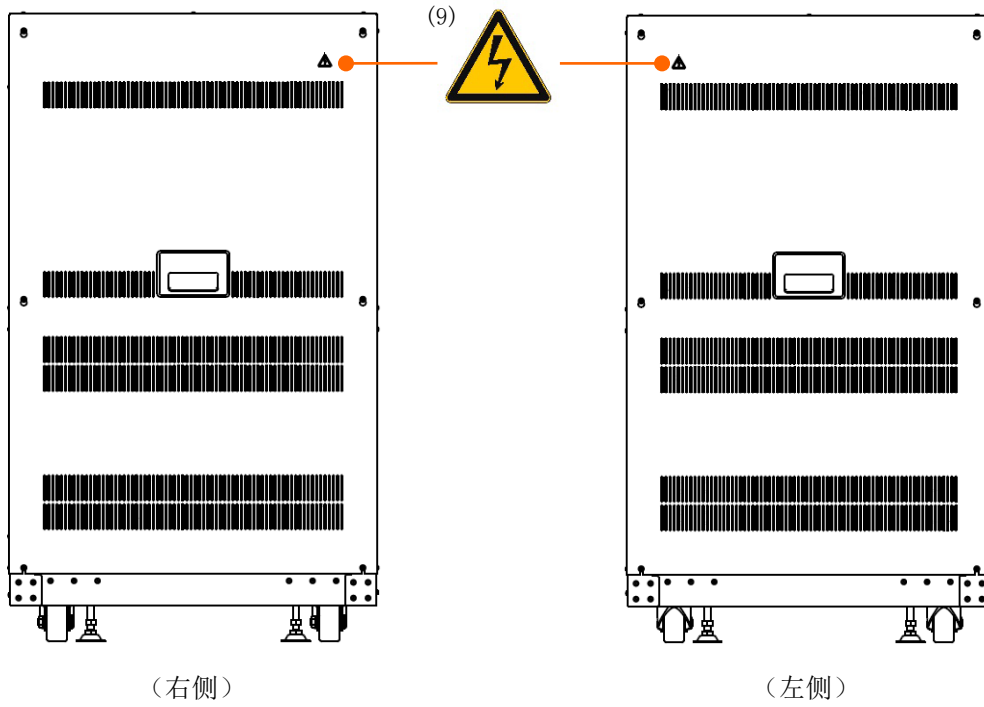


E0 控制单元（正面）警告标签粘贴位置

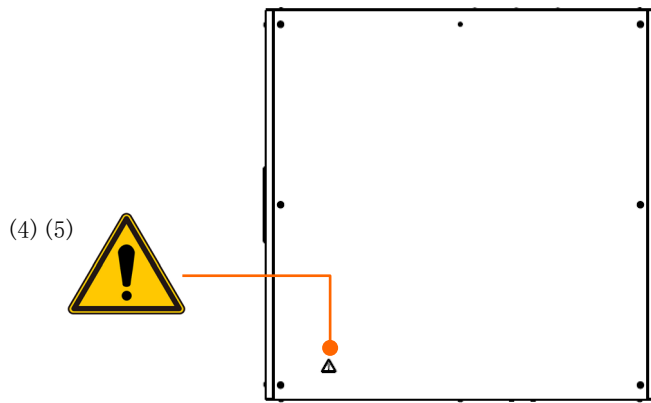


E0 控制单元（背面）警告标签粘贴位置

本设备的警告标签（续）

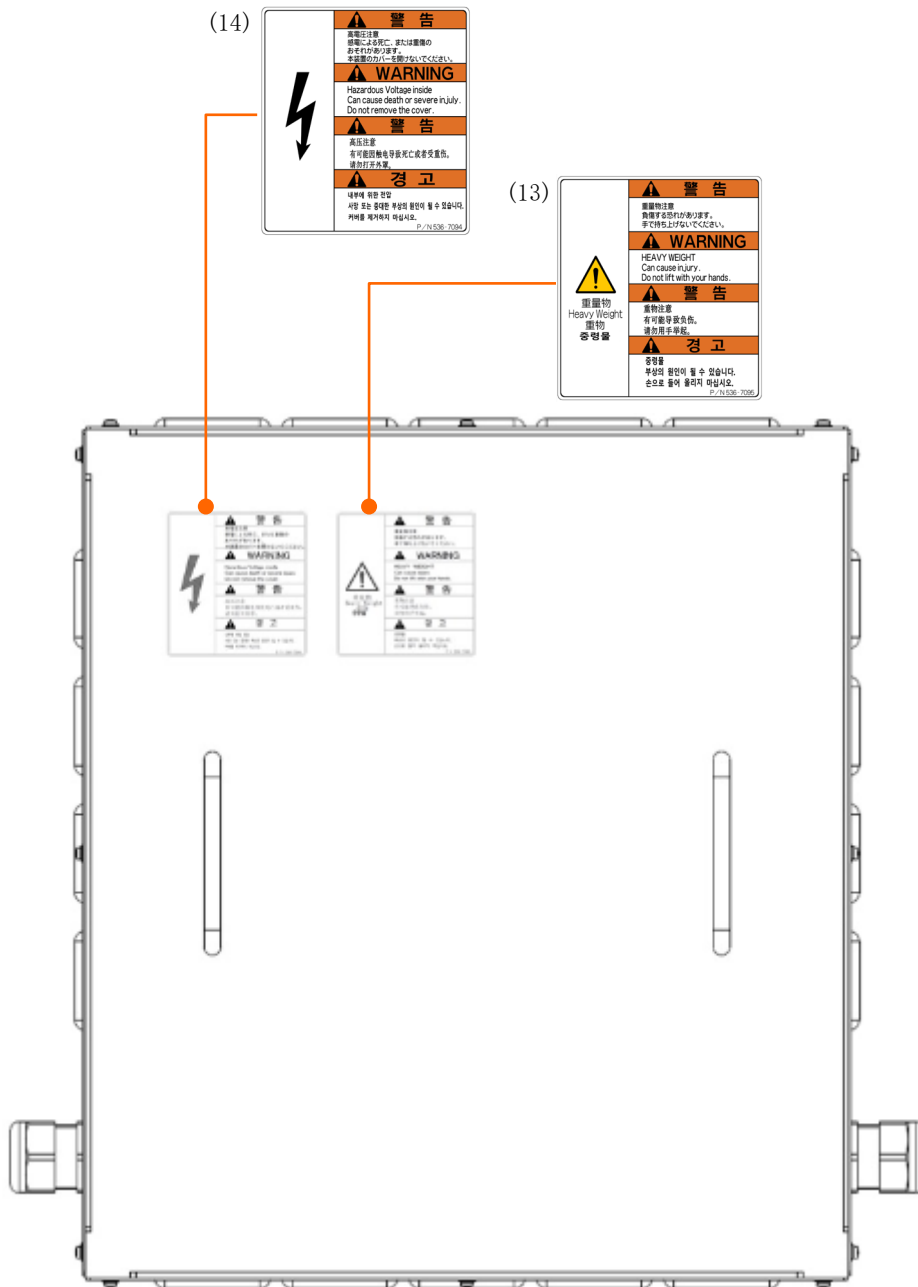


E0 控制单元上的警告标签粘贴位置



E0 控制单元（俯视）上的警告标签粘贴位置

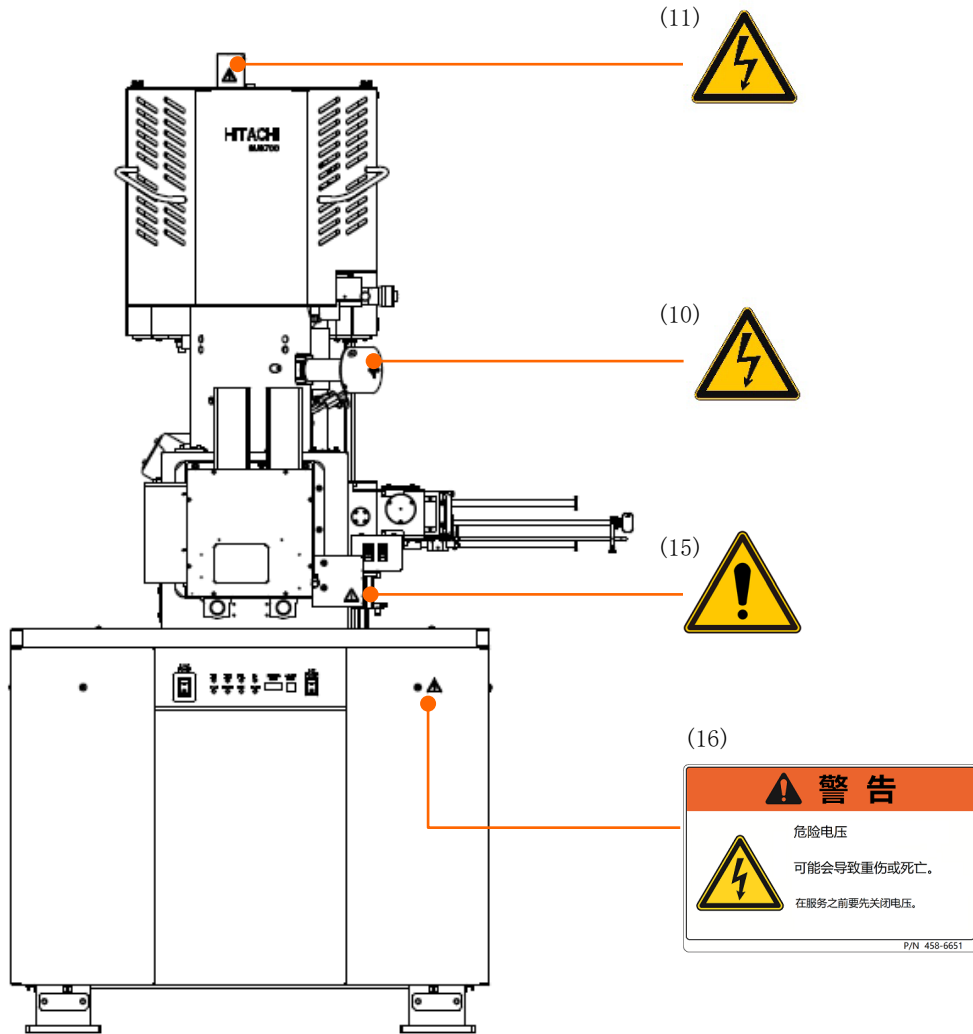
本设备的警告标签（续）



降压变压器（可选）上的警告标签粘贴位置

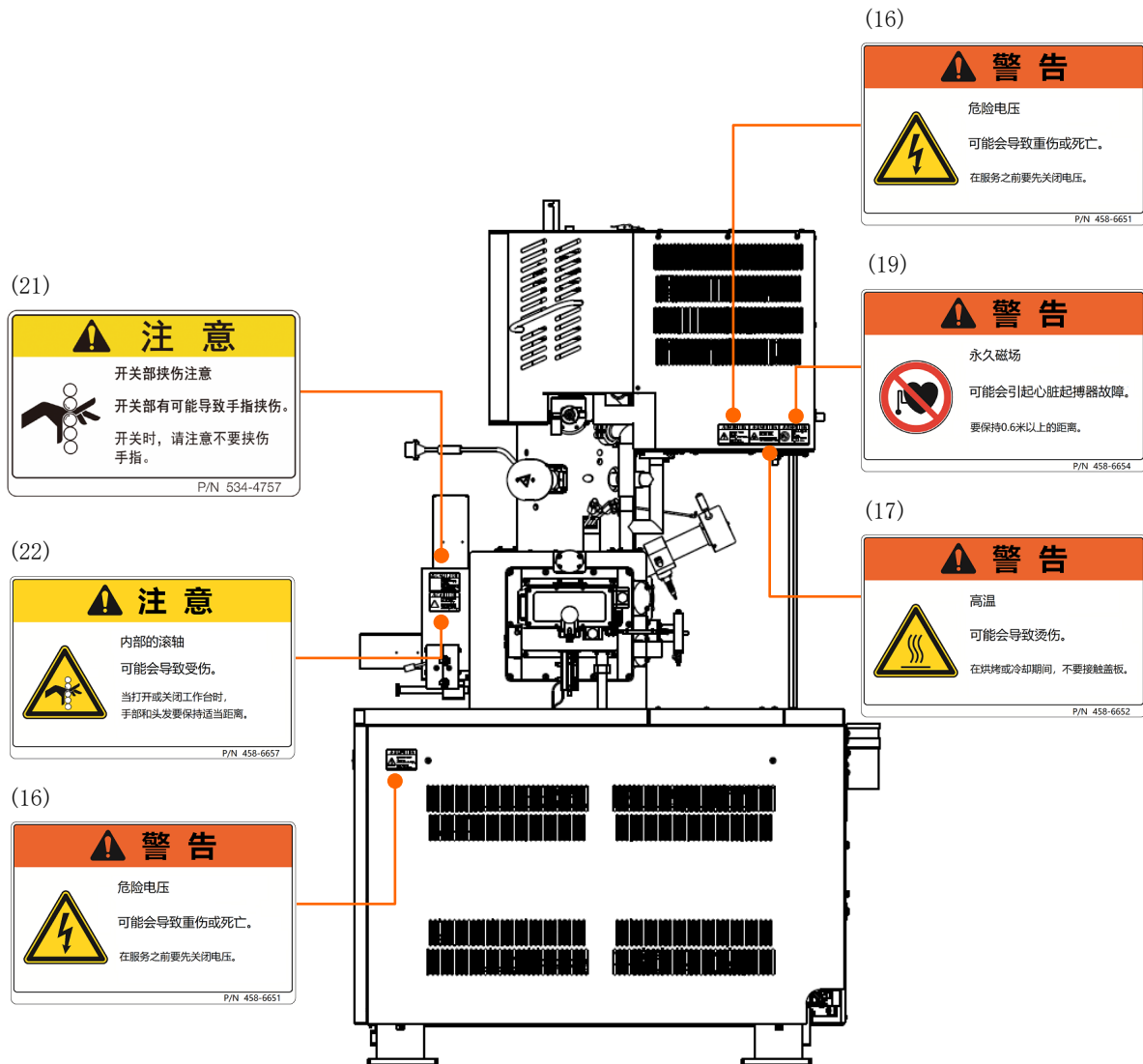
本设备的警告标签（续）

SEMI-S2 适用类型



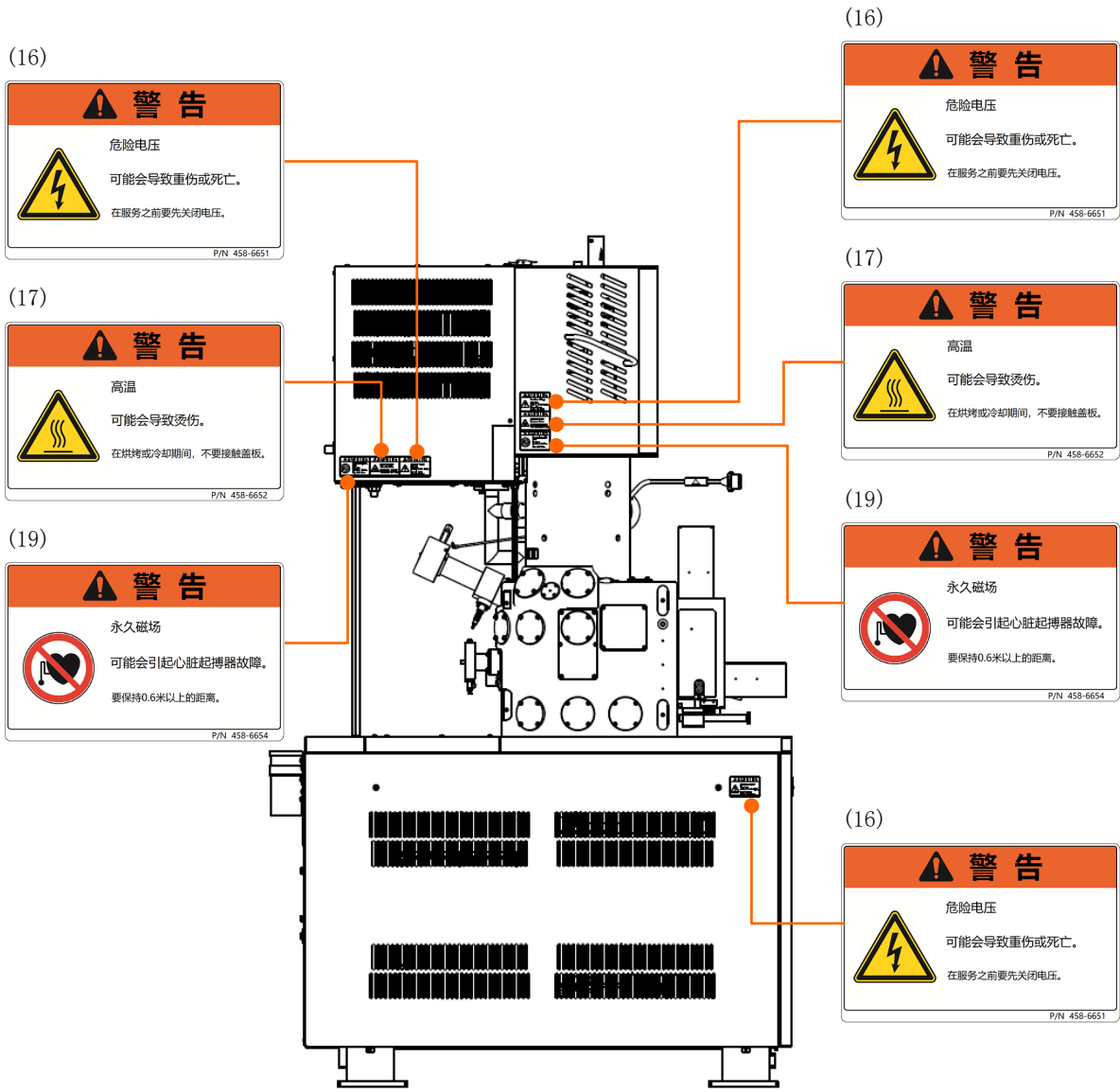
主体部分（正面）上的警告标签粘贴位置

本设备的警告标签（续）

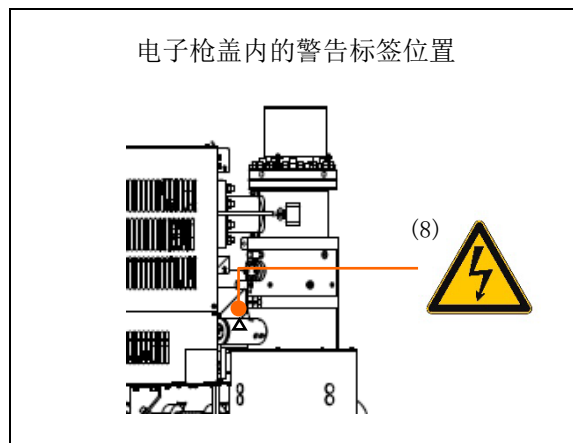


主体部分（右侧）上的警告标签粘贴位置

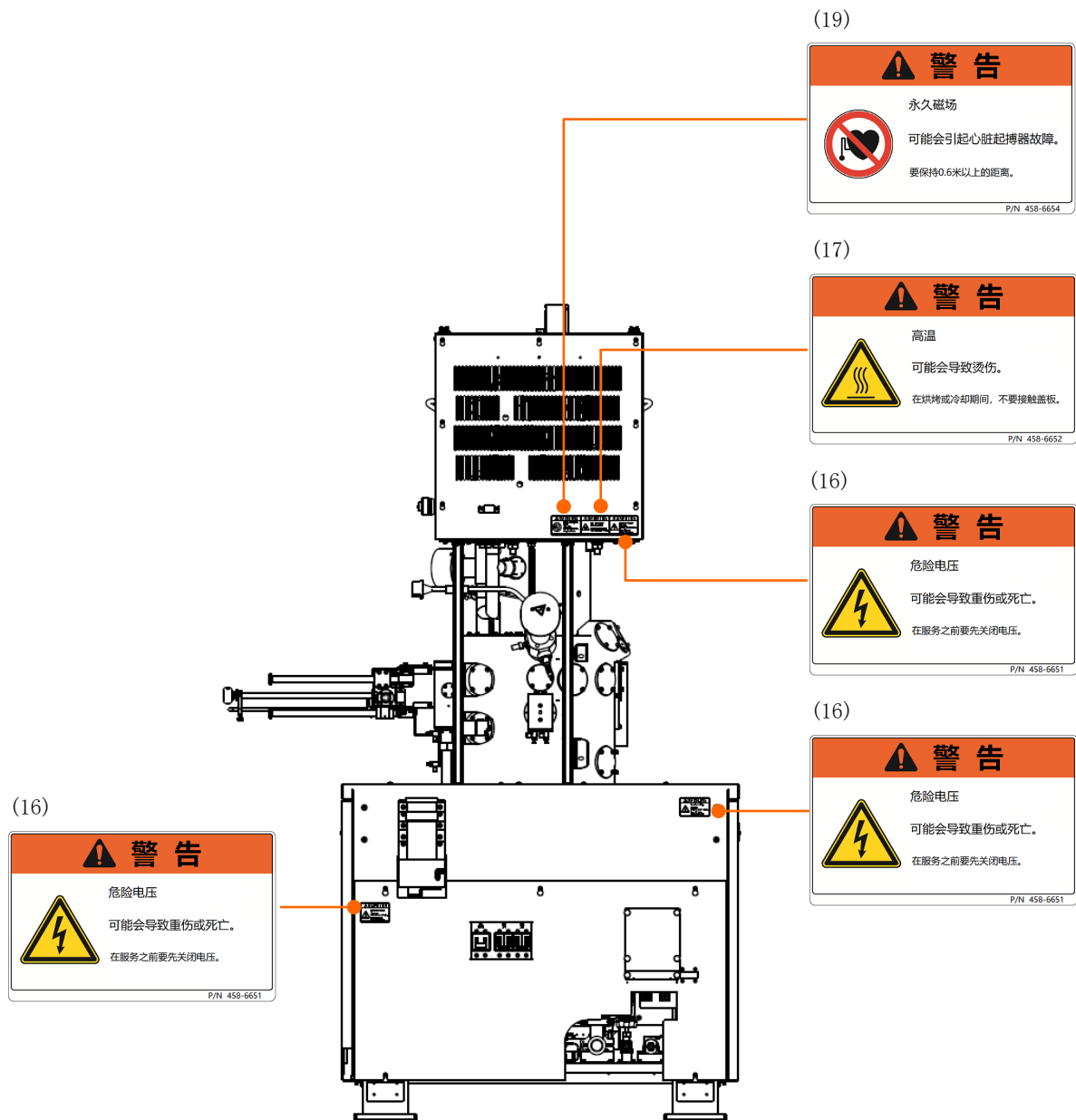
本设备的警告标签（续）



主体部分（左侧）上的警告标签粘贴位置

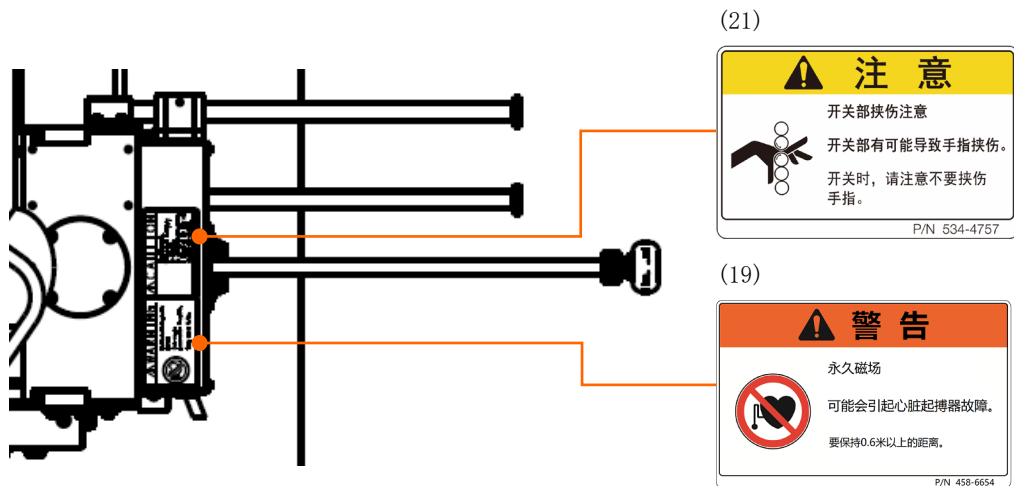


本设备的警告标签（续）

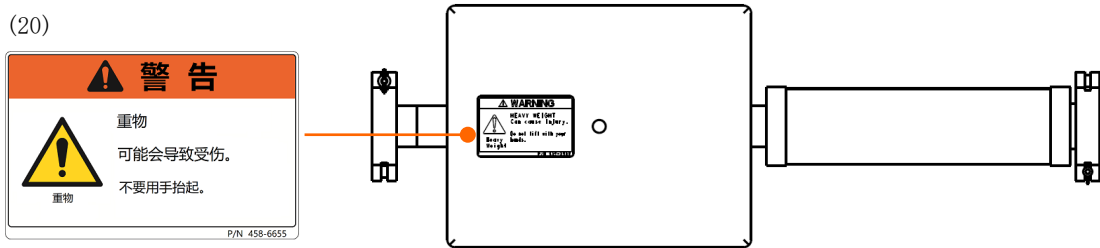


主体部分（背面）上的警告标签粘贴位置

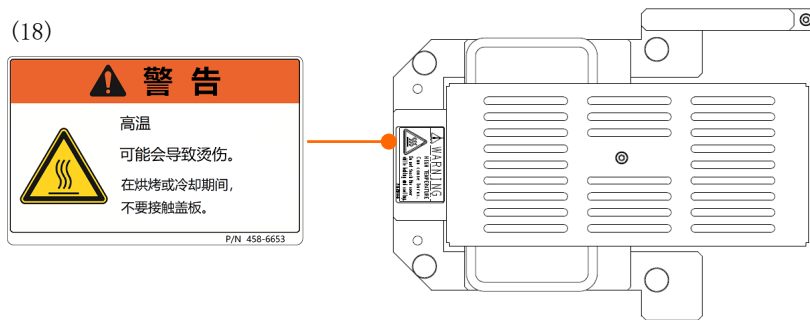
本设备的警告标签（续）



样品交换器上的警告标签粘贴位置

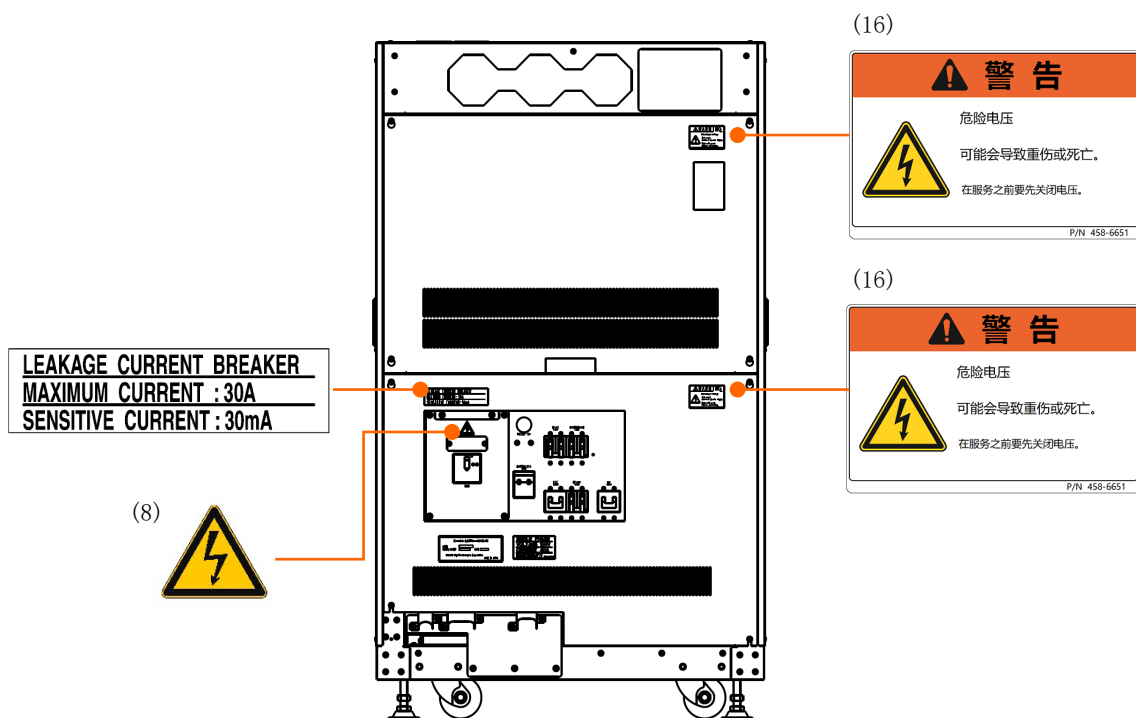


压铁（俯视图）上的警告标签粘贴位置

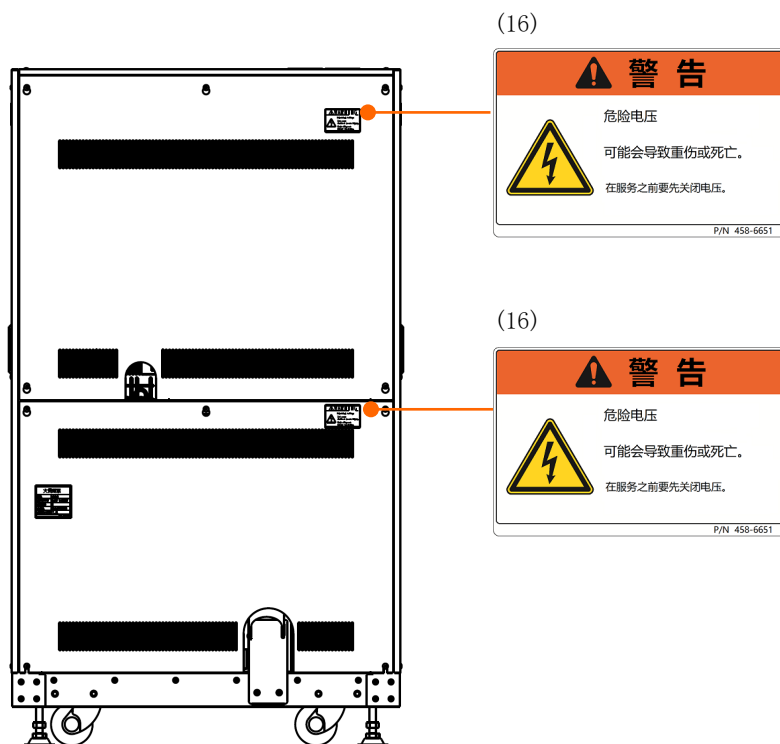


烘烤用盖子

本设备的警告标签（续）

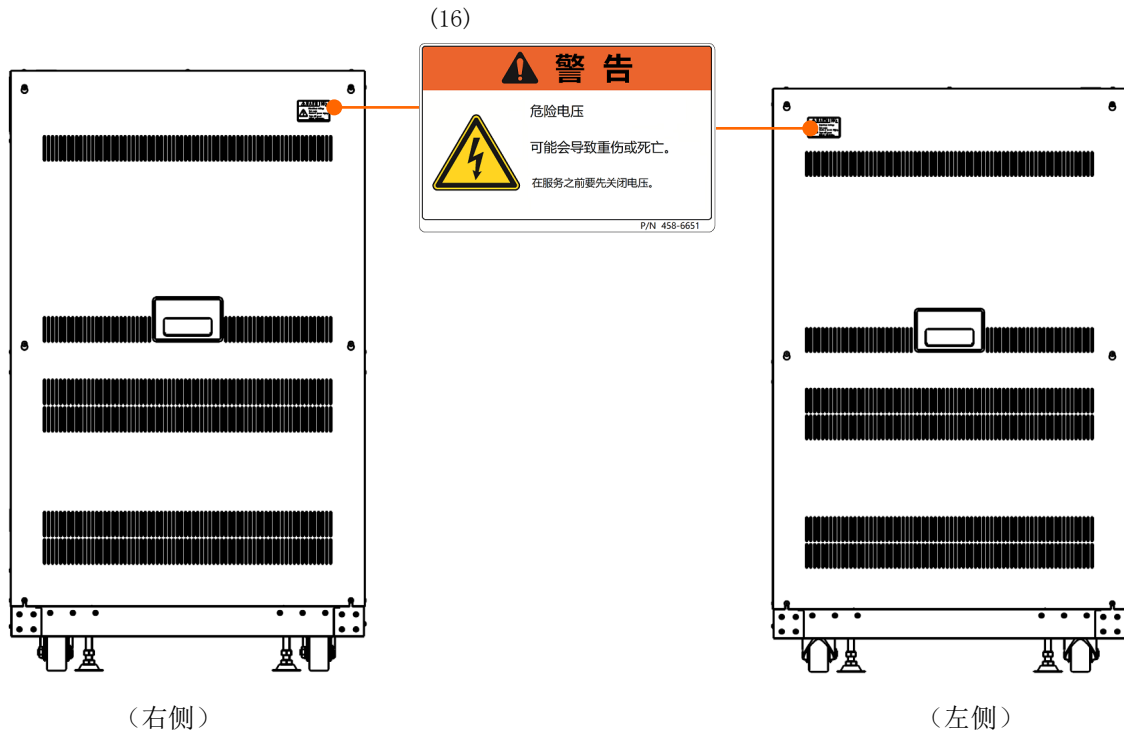


E0 控制单元（正面）上的警告标签粘贴位置

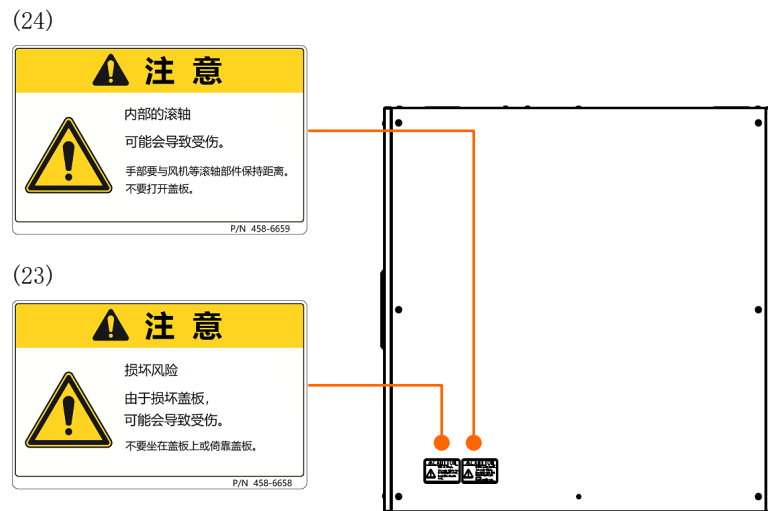


E0 控制单元（背面）上的警告标签粘贴位置

本设备的警告标签（续）



E0 控制单元上的警告标签粘贴位置



E0 控制单元（俯视）上的警告标签粘贴位置

本设备的警告标签（续）

各标签的内容如下所示。

(1)		注 意
		<p>当心夹伤 具有受伤的危险。 打开或关闭工作台时，小心不要夹到手指。</p> <p style="text-align: right;">P/N 458-6624</p>
(2)		注 意
		<p>当心夹伤 具有受伤的危险。 打开或关闭样品交换室时，小心不要夹到手指。</p> <p style="text-align: right;">P/N 458-6624</p>
(3)		注 意
		<p>当心卷入 手指、头发等可能会卷入工作台移动部件而受伤。 抽出工作台时当心手指等被卷入。</p> <p style="text-align: right;">P/N 458-6625</p>
(4)		注 意
		<p>当心卷入 手指可能卷入至风扇等的转动部件而受伤。 请勿打开盖板。</p> <p style="text-align: right;">P/N 458-6625</p>
(5)		注 意
		<p>当心损坏 盖板损坏后设备翻倒时，可能会受伤。 请勿爬上盖板上面或抵靠盖板。</p> <p style="text-align: right;">P/N 458-6625</p>
(6)		注 意
		<p>当心重物（25kg） 具有受伤的危险。 抬起时，使用搬运工具等。 另外，由本公司指定的服务公司负责操作。</p> <p style="text-align: right;">P/N 458-6625</p>
(7)		注 意
		<p>当心高温 具有灼伤的危险。 在烘烤和冷却期间内，盖子内部处于高温状态。 请勿拆卸盖子。</p> <p style="text-align: right;">P/N 458-6622</p>



安全使用注意事项

本设备的警告标签（续）

<p>(8)</p>		<p>警告</p> <p>当心高压 具有触电而导致死亡或重伤的危险。 由本公司指定的服务公司负责操作。 用户不应打开这个盖子。</p> <p style="text-align: right;">P/N 458-6621</p>
<p>(9)</p>		<p>注意</p> <p>当心高压（10kV） 具有触电而导致死亡或重伤的危险。 由本公司指定的服务公司负责操作。 用户不应打开这个盖子。</p> <p style="text-align: right;">P/N 458-6621</p>
<p>(10)</p>		<p>警告</p> <p>当心高压（1000V） 具有触电而导致死亡或重伤的危险。 由本公司指定的服务公司负责操作。 用户不应打开这个盖子。</p> <p style="text-align: right;">P/N 458-6621</p>
<p>(11)</p>		<p>警告</p> <p>当心高压 具有触电而导致死亡或重伤的危险。 拆下这个盖子时请关闭 HV。 如果在打开 HV 的状态下拆下这个盖子，HV 将被强制关闭。</p> <p style="text-align: right;">P/N 458-6621</p>
<p>(12)</p>		<p>注意</p> <p>永磁磁场（1mT） 起搏器可能会出现故障。 起搏器用户请保持 0.6m 以上的距离。</p> <p style="text-align: right;">P/N 458-6623</p>
<p>(13)</p>		<p>警告</p> <p>重物注意 有可能导致负伤。 请勿用手抬起。</p> <p style="text-align: right;">P/N 536-7095</p>

本设备的警告标签（续）

<p>(14)</p>		<p>警告</p> <p>高压注意 有可能因触电导致死亡或者受重伤。 请勿打开外罩。</p> <p>P/N 536-7094</p>
<p>(15)</p>		<p>注意</p> <p>注意连锁操作 一取掉保护单元连锁启动，HV 强制关闭。 保护单元必须在安装在装置上时使用。</p> <p>P/N 458-6625</p>
<p>(16)</p>		<p>警告</p> <p>危险电压 可能会导致重伤或死亡。 在服务之前要先关闭电压。</p> <p>P/N 458-6651</p>
<p>(17)</p>		<p>警告</p> <p>高温 可能会导致烫伤。 在烘烤或冷却期间， 不要接触盖板。</p> <p>P/N 458-6652</p>
<p>(18)</p>		<p>警告</p> <p>高温 可能会导致烫伤。 在烘烤或冷却期间， 不要接触盖板。</p> <p>P/N 458-6653</p>
<p>(19)</p>		<p>警告</p> <p>永久磁场 可能会引起心脏起搏器故障。 要保持 0.6 米以上的距离。</p> <p>P/N 458-6654</p>
<p>(20)</p>		<p>警告</p> <p>重物 可能会导致受伤。 不要用手抬起。</p> <p>P/N 458-6655</p>



安全使用注意事项



本设备的警告标签（续）

<p>(21)</p>		<p>注意</p> <p>夹点危险 可能会导致手指受伤。 打开或关闭时，小心不要夹到手指。</p> <p>P/N 539-4757</p>
<p>(22)</p>		<p>注意</p> <p>内部的滚轴 可能会导致受伤。 当打开或关闭工作台时， 手部和头发要保持适当距离。</p> <p>P/N 458-6657</p>
<p>(23)</p>		<p>注意</p> <p>损坏风险 由于损坏盖板， 可能会导致受伤。 不要坐在盖板上或倚靠盖板。</p> <p>P/N 458-6658</p>
<p>(24)</p>		<p>注意</p> <p>内部的滚轴 可能会导致受伤。 手部要与风机等滚轴部件保持距离。 不要打开盖板。</p> <p>P/N 458-6659</p>

紧急停止开关（选件）

概 要

紧急停止开关是一个用于紧急时切断仪器所有电源的按压式开关。

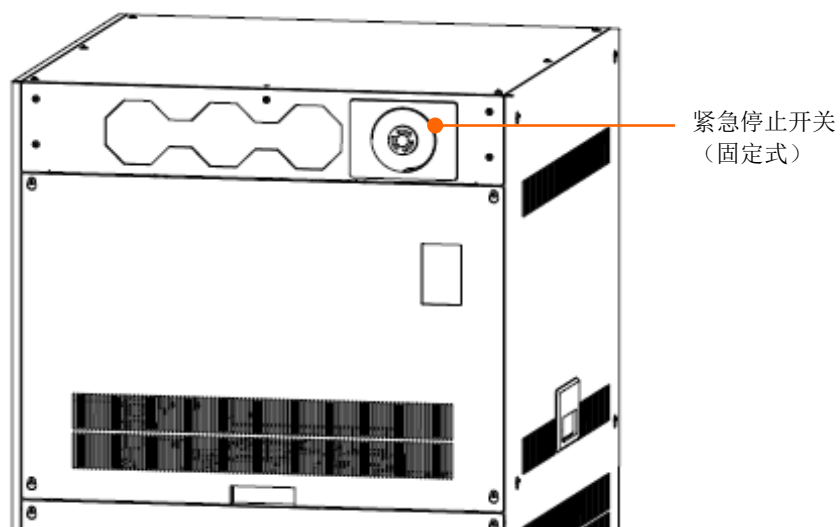
注：非紧急情况，不要按下。仪器的所有电源都被切断，因此启动仪器需要时间，并且还会出现观察中的图像没有保存下来等对观察产生影响的情况。

外 观

紧急停止开关设置在 E0 控制单元正面上部（固定式）和操作台（移动式）这两处。

操作台上的紧急停止开关为移动式开关。在电缆够得着的范围内（离本体右后方下部约 2 米处）可自由配置。

注：紧急停止开关（移动式）由于倾倒或掉落，有可能损坏开关部位或导致错误操作（无意中切断电源）。要设置在操作台等稳定场所（平坦之处）。

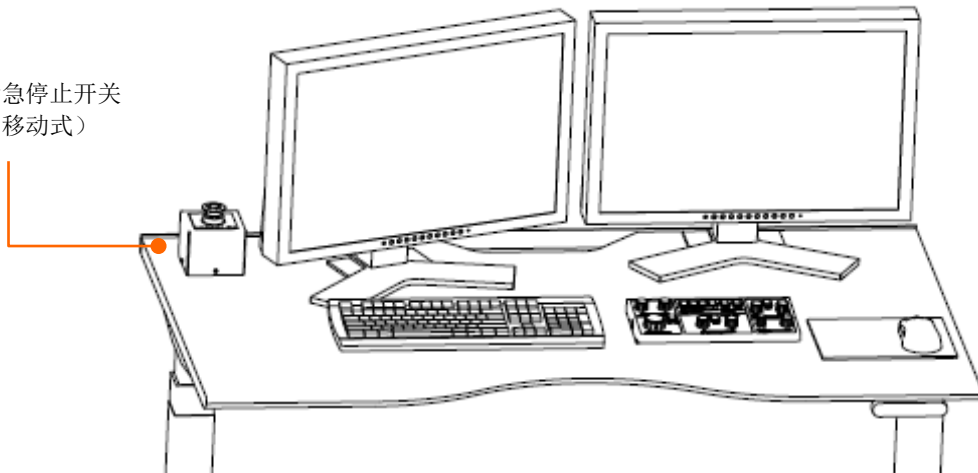


紧急停止开关（固定式）的设置处



紧急停止开关（选件）（续）

紧急停止开关
（移动式）



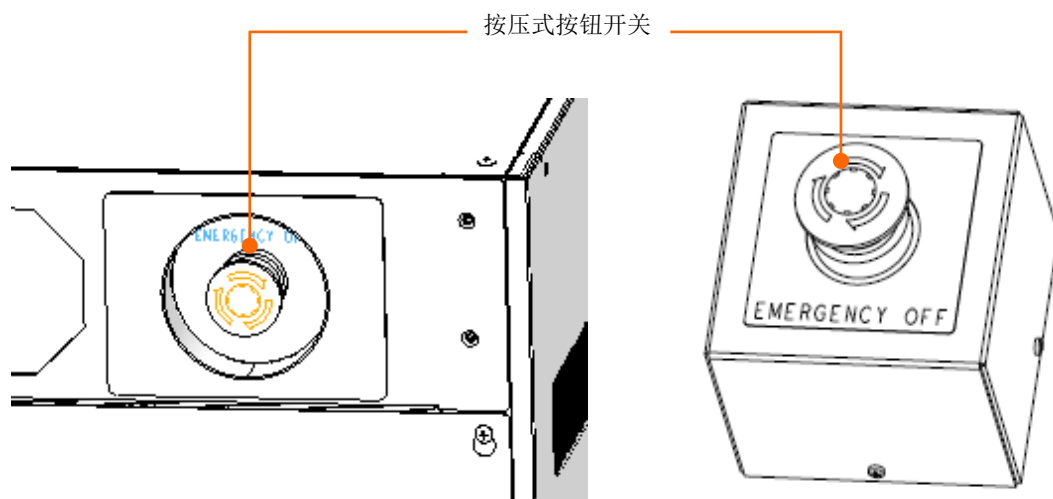
紧急停止开关（移动式）的设置处

紧急停止开关的动作方法

如按下 E0 控制单元正面上部的紧急停止开关（固定式）或操作台上的紧急停止开关（移动式）的任意一个按钮开关，仪器的所有电源就会被切断。

只要不顺时针转动按压式按钮开关并解除锁定状态，仪器就会保持所有电源切断的状态。

注：非紧急情况，不要按下。仪器的所有电源都被切断，因此启动仪器需要时间，并且还会出现观察中的图像没有保存下来等对观察产生影响的情况。



紧急停止开关（选件）（续）

紧急停止开关动作后的复原方法

- (1) 在解除紧急停止开关的锁定状态之前，要关闭下列的所有开关以及电流断路器。
 - 本体单元侧 : “EOC POWER” 开关、“EVAC POWER” 开关、IP1 电流断路器、IP2 电流断路器、STAGE 电流断路器
 - EO 控制单元 : HV 电流断路器、IP / HV 电流断路器、EVAC 电流断路器、EOC 电流断路器、OUTER BAKE 电流断路器、MAIN 电流断路器
- (2) 顺时针转动按下的紧急停止开关按压按钮开关，并解除开关的锁定状态。
- (3) 启动仪器。

参照：SU8700 操作说明书

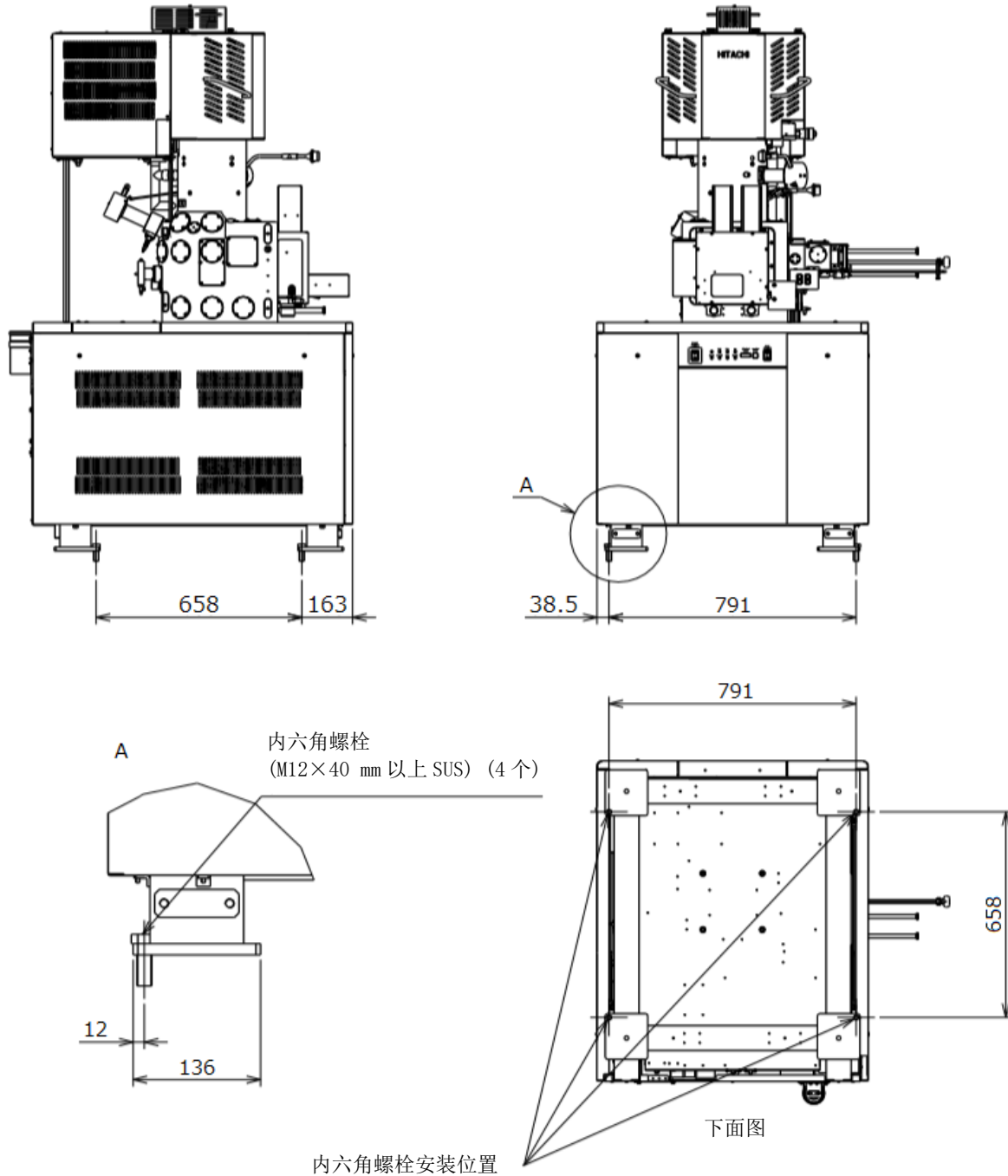
4.5 Operation after recovery from power failure and for star-up of instrument



地震防范措施（选项）

仪器本体

安全使用注意事项

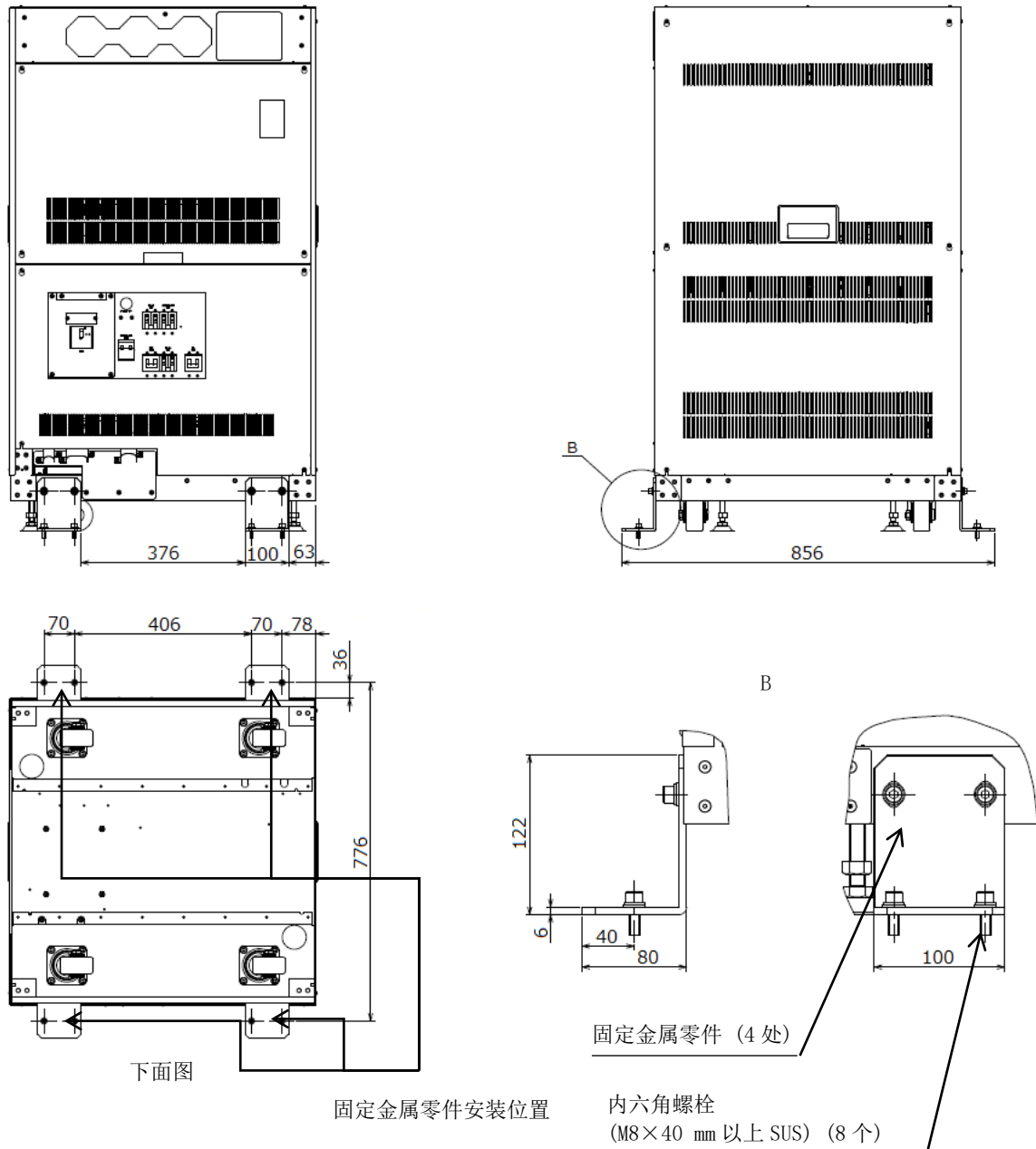


※ 本规格为依照计算得出的数值。

地震防范措施（仪器本体）（推荐例）

地震防范措施（选件）（续）

E0 控制单元



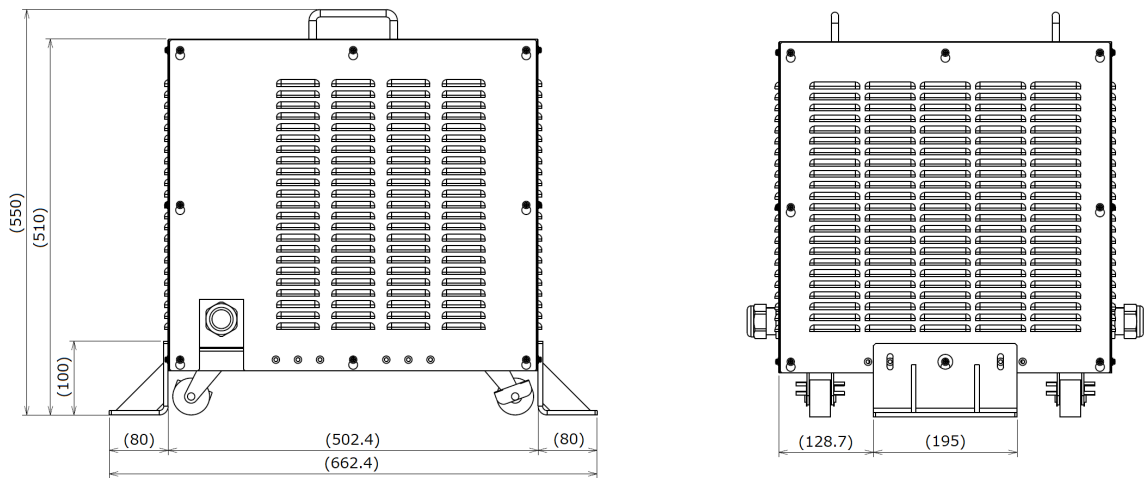
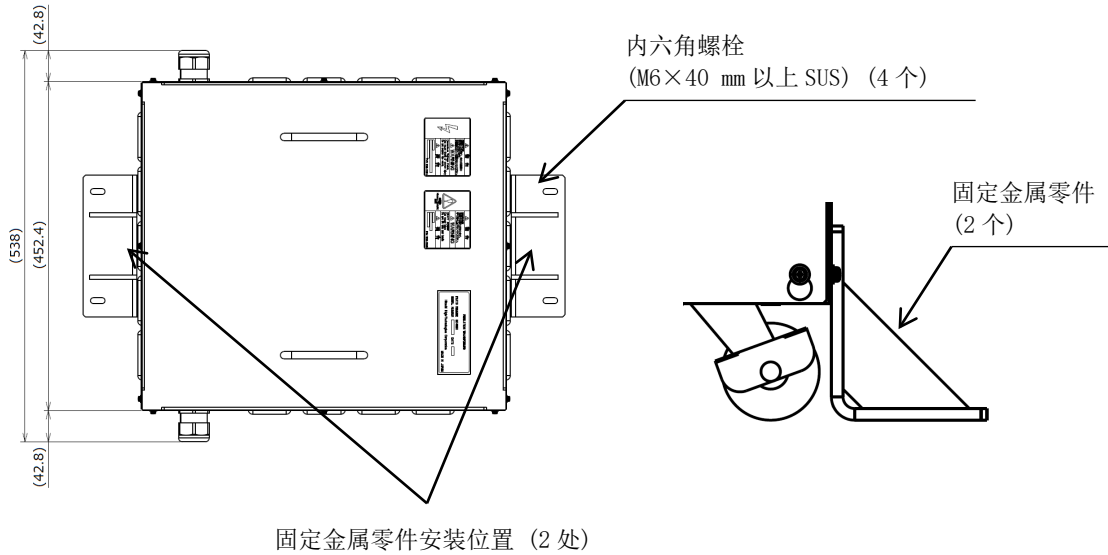
- ※ 本规格为依照计算得出的数值。
- ※ 固定金属零件安装到地面的螺栓由用户自行准备。
应提前准备内六角螺栓（M8×40 mm 以上 SUS）（8 个）。

地震防范措施（E0 控制单元）（推荐例）

地震防范措施（选件）（续）

降压变压器（选件）

安全使用注意事项

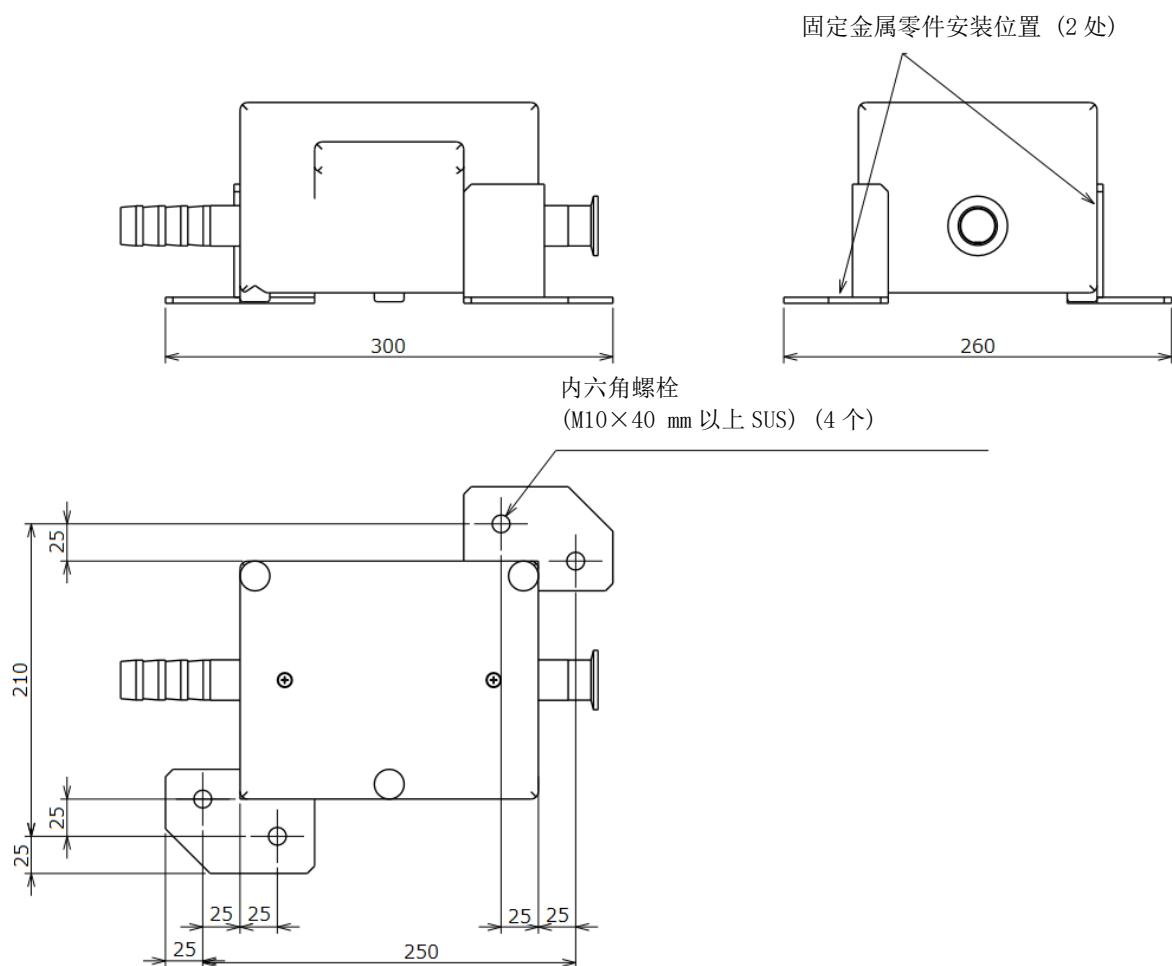


- ※ 本规格为依照计算得出的数值。
- ※ 固定金属零件安装到地面的螺栓由用户自行准备。
应提前准备内六角螺栓（M6×40 mm 以上 SUS）（4 个）。

地震防范措施（降压变压器）（推荐例）

地震防范措施（选件）（续）

压铁



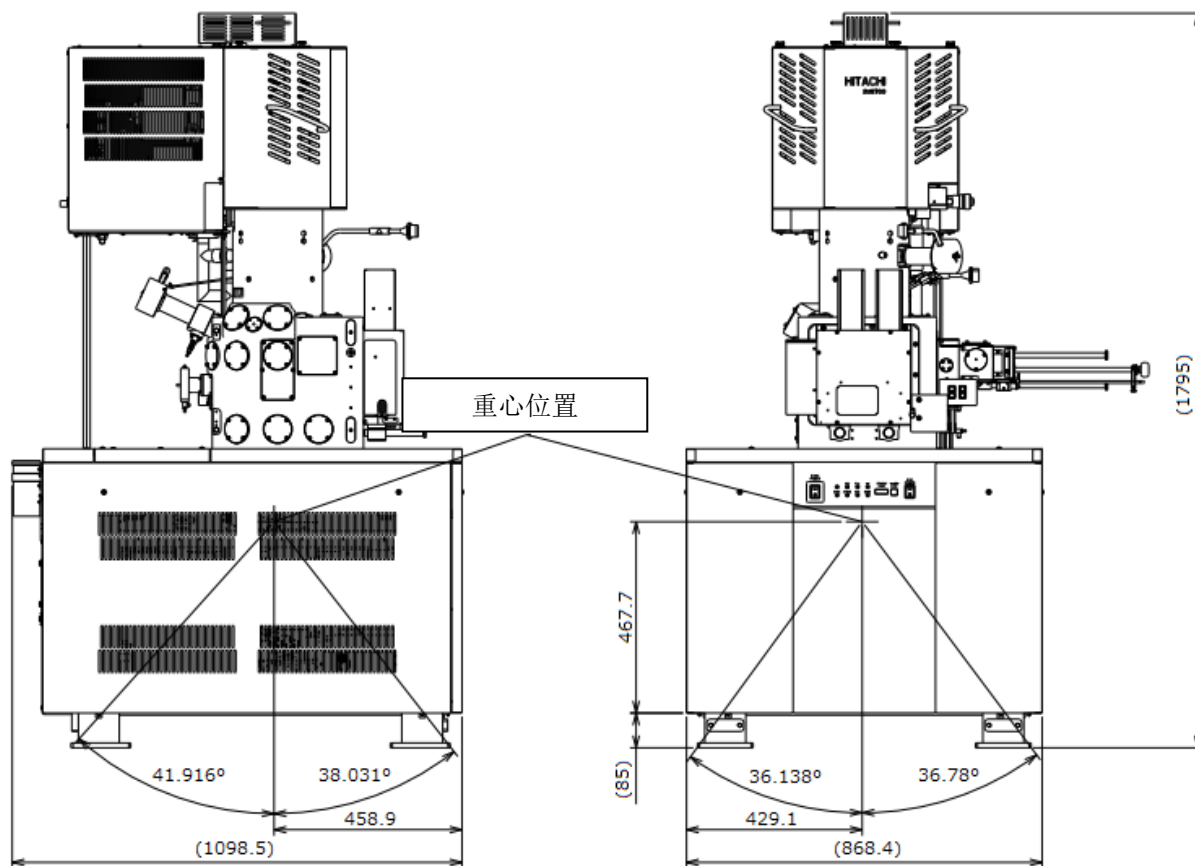
- ※ 本规格为依照计算得出的数值。
- ※ 固定金属零件安装到地面的螺栓由用户自行准备。
应提前准备内六角螺栓（M10×40 mm 以上 SUS）（4 个）。

地震防范措施（压铁）（推荐例）

各单元的重心位置

仪器本体

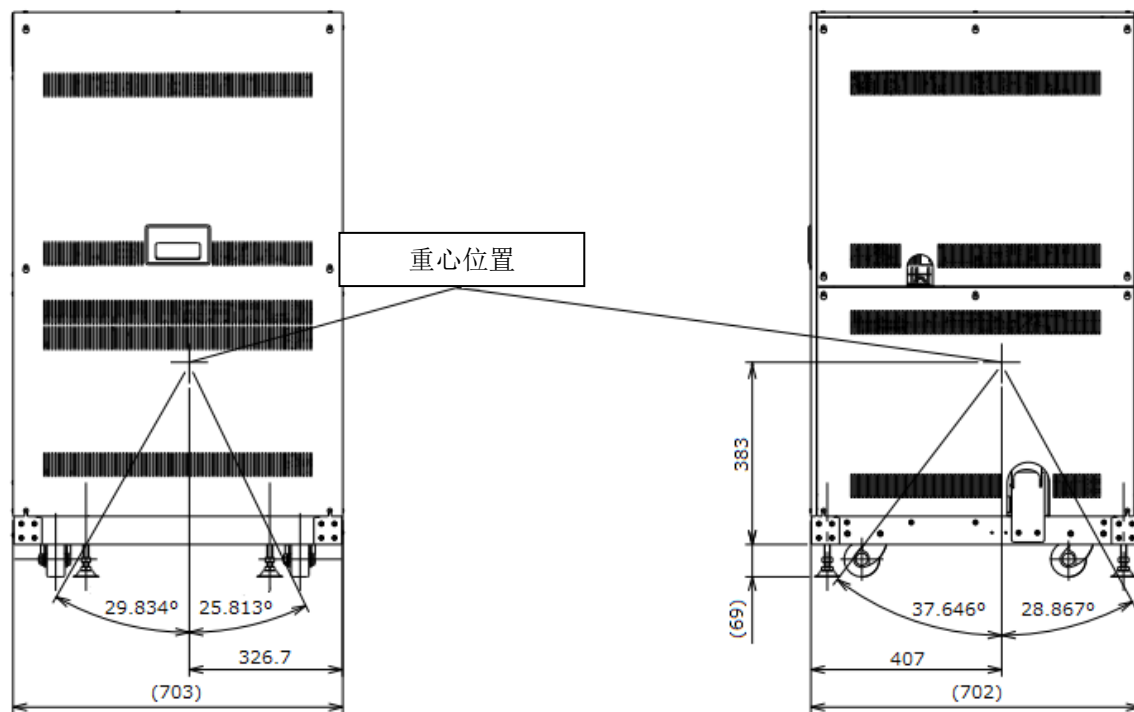
安全使用注意事项



※ 本规格为依照计算得出的数值。

各单元的重心位置（续）

E0 控制单元

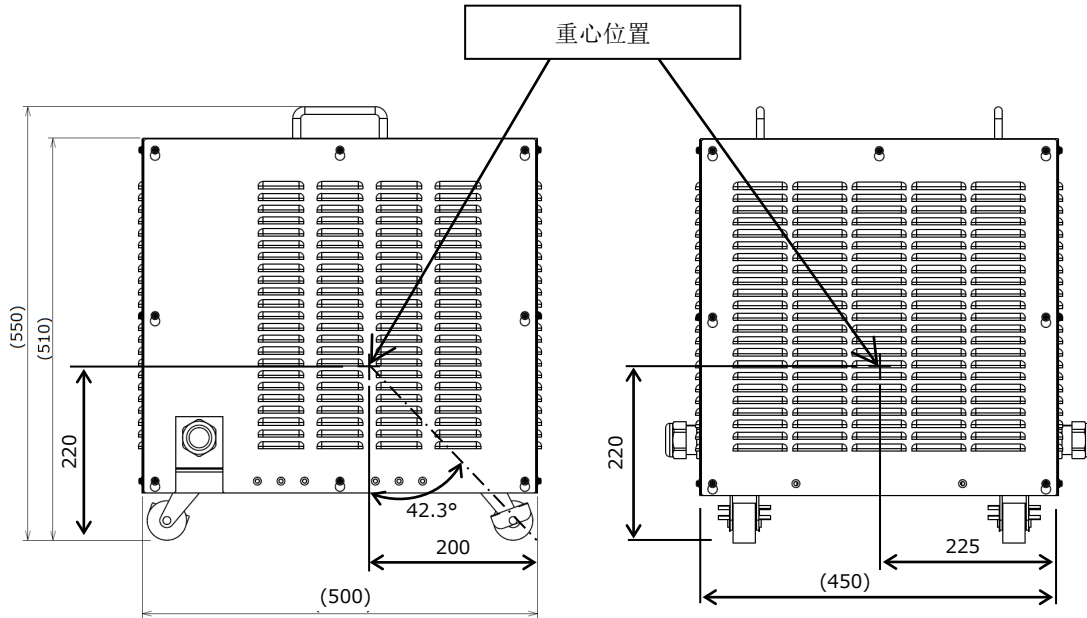


※ 本规格为依照计算得出的数值。

安全使用注意事项

各单元的重心位置（续）

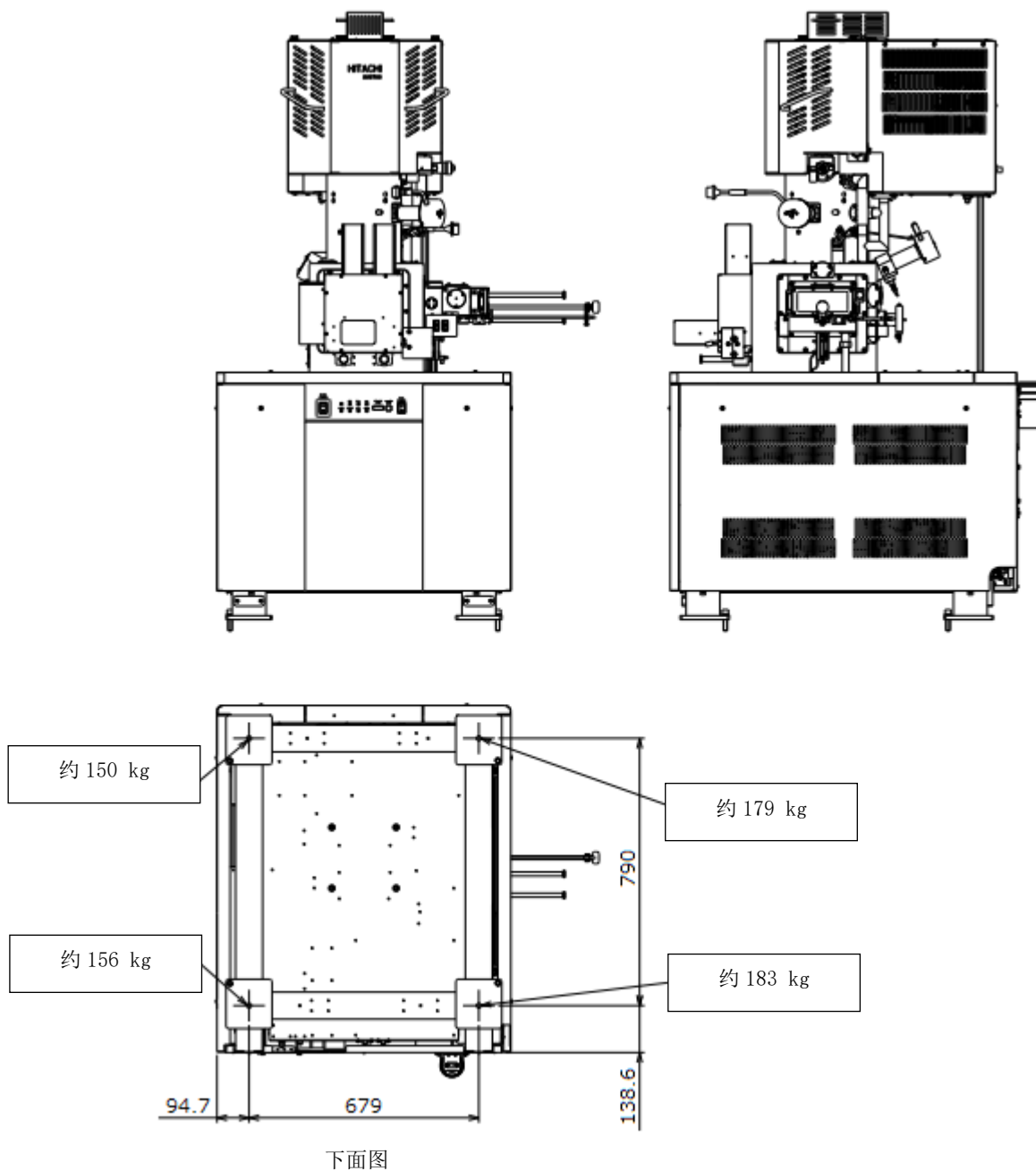
降压变压器（选件）



※ 本规格为依照计算得出的数值。

重量分配

仪器本体



※ 本规格为依照计算得出的数值。

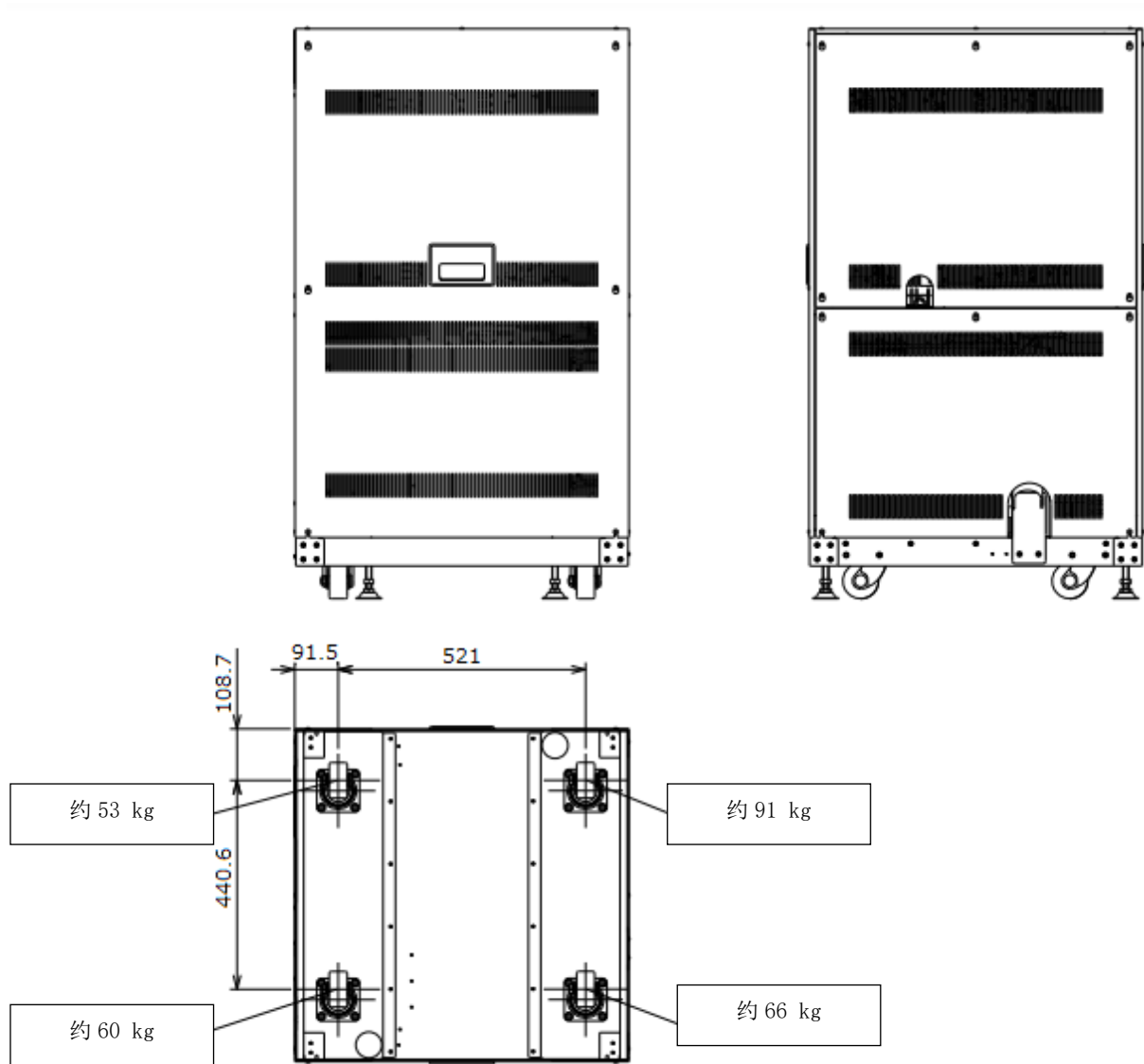
仪器本体脚部的重量分配

! 安全使用注意事项

重量分配 (续)

E0 控制单元

安全使用注意事项



下面图

※ 本规格为依照计算得出的数值。

E0 控制单元脚部的重量分配

其他注意事项

注意

● 关于停电

由于停电、雷击等所致的电源瞬间电压下降，设备中的电脑可能会发生故障，或者 OS、应用软件、数据会损坏。作为电源瞬间电压下降的对策，建议使用交流式不间断电源等。

● 关于电源

请确保 SU8700 的供电电源为单相 AC 100 V, 4 kVA, 50/60 Hz (除了安装降压变压器时) 或 AC 115/120/200/208/220/230/240 V, 4 kVA, 50/60 Hz (安装降压变压器时)。

另外，电源应保持连续通电。

接地时，请使用接地电阻为 100 Ω 或更小的接地端子。

请勿与其他电源设备共用接地端子。请在地面单独接地。

● 关于漏水检测

标准设备中没有附带漏水检测器。由于冷却水的水质和压力引起的流路系统腐蚀或裂缝，有时会发生漏水现象。如果无法使用冷水循环装置等，请务必购买并安装供水套件。

除了减压恒流阀外，在紧急情况下利用供水套件的漏水传感器还可以防止大量漏水。

SEMI-S2 选件的设备附带漏水检测器。SEMI-S2 选件设备的漏水检测器如发生错误时，应注意下列事项。

如检测到漏水时，冷却水将停止供应。

此时有可能发生触电，因此不要靠近设备，而要联系本公司指定的服务工程师。

如有可能，关闭冷却水供应口的总阀。

● 关于冷却水

- 请使用低余氯浓度 (0.5ppm 以下) 的水作为冷却水。如果余氯浓度高，则在流路系统中引起腐蚀并导致漏水。另外，建议使用可控制温度的冷水循环系统。

- 至于冷却水量，一个系统需要约 2L/min。

- 冷却水的额定供应压力为 50k~100kPa。

- 请拧紧管件用锥形螺钉 (Rc 3/8)，以防止冷却水供应口和软管接口脱落。

- 排水口软管应连接在排水沟，并且必须固定牢固，以防止软管从排水沟跳出。如果脱落，可能会浸水。

- 使用后必须关闭冷却水供应口的主阀。

- 供水和排水软管的材质是软质氯乙烯。软管长期使用会硬化且弹性减弱，所以应定期更换，同时使用前要检查漏水情况。

- 在冬季冷却水有可能冻结时，请使用含有防冻液的冷水循环装置等。

- 通过设置和管理，使冷却水温度不低于室温 7℃ 以上。当冷却水温度和室温之间产生 7℃ 或更高的温差时，在冷却水通道系统会发生结露。如果在这种状态下长时间使用，冷却的物镜磁路等关键部件会生锈，有时会导致故障，需要更换整套物镜。

其他注意事项（续）

注意

● 关于电脑软件的安装

如果在本设备的电脑中安装了非本公司提供的软件，导致本设备动作错误时，它不在产品保修范围内。在这种情况下，即使是本公司产品的保修期内，修复本设备系统时会收费。安装软件时，请使用 OS 的“系统恢复”、“备份和恢复”等功能，采取恢复到安装前的状态等措施。

● 关于电脑

如果强制终止应用软件或电脑，会丢失所有未保存的数据。当有可操作的应用软件时，请务必正常终止应用软件，然后强行终止电脑。

● 关于设备主体和电脑的以太网连接

用以太网连接设备主体和控制用电脑时，专门使用电脑板载网络控制器（RJ-45-J 接口）的一个端口。在设备使用过程中，设备和电脑之间始终进行通信。如果未正确连接网络，可能会降低通信速度或通信中断，并且本设备将无法正常运行。在设备主体与电脑的以太网连接方面请注意以下事项。

- 设备主体和控制用电脑的以太网务必一对一连接（直接用网络电缆连接设备和电脑）。请不要连接其他网络设备，如集线器。
- 请使用符合 5 类（Cat 5）或更高标准的电缆。
- 公司内部网络等本地连接（LAN 连接）时，电脑上要追加网络控制器，本设备连接用端口和 LAN 连接用端口应分开。

关于本设备和控制用电脑的连接用网络控制器，请使用电脑板载端口。

当使用添加到电脑的网络控制器时，可能会发生通信速度下降或通信中断的现象。尤其是使用将 USB 端口转换为网络端口的适配器时，会发生通信速度下降或通信中断的现象。

其他注意事项（续）

注意

● 关于网络连接

电脑持有用于网络连接的以太网端口。用以太网进行网络连接时，对网络环境方面必须有足够的知识。请咨询网络管理员后进行连接工作。

- 以太网端口上的电缆连接由安装技师或本公司指定的服务公司进行。请联系销售责任人或本公司指定的服务公司。
- 将电脑连接到网络时，请务必采取措施防范电脑病毒。有关详细信息，请参阅本章的“关于电脑病毒”。
- 附属品中未包含以太网电缆，请用户备好合适的电缆。
- 请慎重更改旨在网络连接的电脑配置。如果更改了本设备操作所需的配置，本设备的系统可能无法正常运行。
- 不要安装用于网络连接的特殊软件。这可能对设备产生不利影响，或者本设备的系统可能无法正常运行。
- 如果要连接到特殊网络或请求连接到网络，请联系销售责任人或本公司指定的服务公司。
- 以可选的外部通信接口连接到 EDS 等外部设备时需要使用以太网端口，因此连接至非外部设备时，为了分支而应备好集线器。一些外部设备标准配备集线器，因此请咨询销售责任人。
- 使用 Microsoft-TCP/IP 协议进行网络连接时需要 IP 地址，因此请事先咨询网络管理员。连接外部设备（如 EDS）时，外部设备需要另一个 IP 地址。

● 关于电脑死机

如果由于某种原因而电脑处于死机状态（无法执行鼠标和键盘输入操作），请同时按下[Ctrl]、[Alt]和[Delete]键，按照对话框内容强制终止（软件重置）。之后，请正常终止 Windows，关闭电脑后重新启动。如果出现这种情况，相应时期的数据将会丢失。如果即使执行软件重置也无法重启电脑，请确保硬盘的存取指示灯熄灭，然后按住电源按钮强行关闭电源。请注意，如果硬盘运行时关闭电源，可能会损坏硬盘并且无法启动电脑。



其他注意事项（续）

注意

● 关于电脑病毒

如果程序突然出故障，或数据突然发生缺陷或损坏，或电脑出现意外动作或画面，电脑可能受到病毒感染了。电脑病毒是一种恶意程序，它悄悄地侵入电脑，随意运行电脑并破坏数据。另外，检测和删除电脑病毒的程序称为防病毒软件。

下载含电脑病毒的程序或使用含电脑病毒的可交换存储介质（如 USB 存储器），都会感染电脑病毒。另外，受病毒感染的电脑通过通信或存储介质可能会感染其他电脑。请勿使用可能包含电脑病毒的程序或存储介质。

如果电脑受病毒感染，请使用防病毒软件进行检查。但是，根据防病毒软件的类型，有时无法删除电脑病毒。在这种情况下，建议事先备份硬盘。另外，请备好防病毒软件并自行删除电脑病毒。

● 关于数据备份

设备故障或错误操作时可能会损坏电脑或硬盘（HD）中的数据。请定期将重要数据（如图像数据）备份到 CD 或 DVD、外部硬盘等。

● 关于 Windows 更新

Windows 有一个提高安全性和可靠性的更新程序，该程序定期由 Microsoft 发布。将电脑连接到网络时，建议应用更新程序并使其保持最新状态。但是，在极少数情况下，由于更新程序本身或更新程序应用失败，操作可能会变得不稳定。在这种情况下，请卸载已应用的更新程序。另外，为了以防万一，重要数据（如图像数据）应定期备份。

根据《电子信息产品污染控制管理办法》有关要求

电子信息产品污染控制标志



：本标志为电子信息产品污染控制标志，适用于在中华人民共和国境内销售的所有电子信息产品。扫描电子显微镜也属于电子信息产品。标志中央的数字是指产品的环保使用期限的年数。所谓环保使用期限是在该产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外泄或突变，用户使用该产品不会对环境造成严重污染或对其人身，财产造成严重损害的期限。

有毒有害物质或元素的名称及含量表示

该产品中有毒有害物质或元素的名称以及含量见表 1。

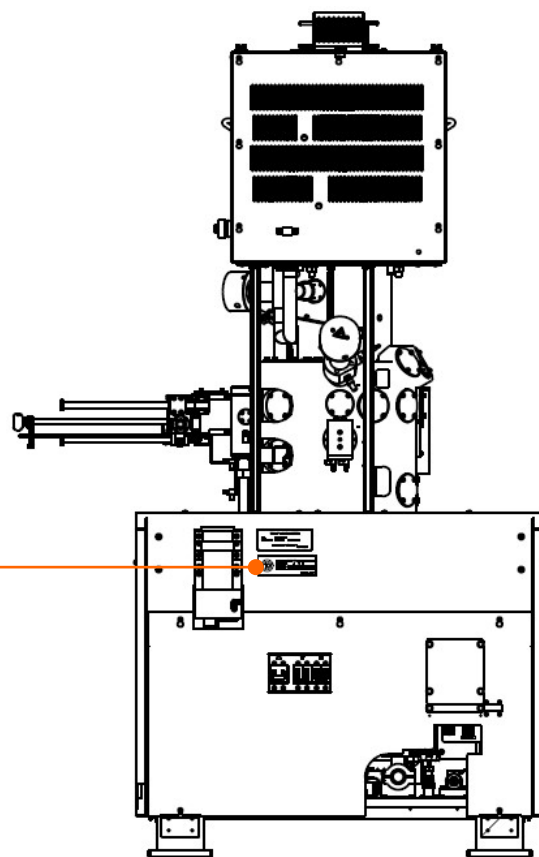
表 1 产品中有毒有害物质或元素的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
主机装置	×	○	○	○	○	○
E0 控制单元	×	○	○	○	○	○
干式真空泵	×	○	○	○	○	○
附属品	×	○	○	○	○	○

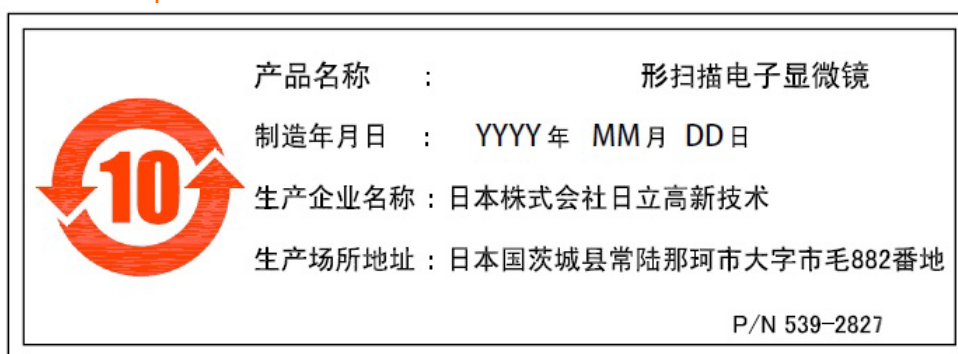
本表格依据 SJ/T 11364 的规定编制。
 ○：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
 ×：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

本产品的电子信息产品污染控制标志表示方法

电子信息产品污染控制标志会张贴在本产品的下图表示部分。



主机装置背面




电子信息产品污染控制标志

图1 电子信息产品污染控制标志标签粘贴位置

⚠️ 안전한 사용을 위해

⚠️ 안전 경고 기호와 표제어의 정의

사람의 안전과 관련된 주의 사항은 안전 경고 기호 ⚠️ 와 ‘경고’나 ‘주의’와 같은 단어를 조합한, 다음과 같은 표제어로 표시합니다.

	: 이것은 안전 경고 기호입니다. 잠재적으로 사람에게에 위해를 가하는 위험에 주의를 환기시키기 위해 사용하고 있습니다. 일어날 수 있는 위해 또는 사망을 회피하기 위해 이 기호 뒤에 나오는 모든 안전 메시지를 준수해 주십시오.
⚠️ 경 고	: 이것은 회피하지 않으면 사망 또는 중상을 초래할 가능성이 있는 잠재적 위험 상황을 나타내기 위해 사용하고 있습니다.
⚠️ 주 의	: 이것은 회피하지 않으면 경상 또는 중간 정도의 상해를 초래할 수 있는 잠재적 위험 상황을 나타내기 위해 사용하고 있습니다.

사람 이외의 안전에 관한 주의 사항이나 알아 두면 도움이 되는 사항은 다음 표제어로 표시하고 있습니다.

통지	: 이것은 회피하지 않으면 사람에게에 위해를 가하지는 않지만 재물 손상, 장치의 중대한 손상, 데이터 손상, 환경 오염을 일으킬 우려가 있는 위험 상태를 나타내기 위해 사용하고 있습니다.
☐ 주	: 장치를 올바르게 사용하여 장치의 경미한 손상을 회피하고, 기능과 성능을 충분히 발휘시키기 위한 설명을 나타내기 위해 사용하고 있습니다.

안전에 관한 공통적 주의 사항

사용 전 주의

- 장치에 붙어 있는 경고 라벨이나 납품된 모든 취급설명서에 표시되어 있는 주의 사항 및 지시 사항을 준수해 주십시오. 잘 지키지 않으면 감전이나 화재로 인한 사망, 중상 또는 장치의 파손을 일으킬 우려가 있습니다.
- 장치의 개조, 지정되지 않은 부품의 사용, 안전장치를 제거한 상태의 사용은 위험하므로 절대로 하지 마십시오.
- 시약 등과 같은 화학물질을 사용할 경우에는 물질의 성상 및 취급에 관한 정보(SDS)를 확인하여 적절하게 취급해 주십시오.
- 시약 등과 같은 화학물질을 사용할 경우에는 고객의 책임하에 방을 충분히 환기해 주십시오. 환기가 충분하지 않을 경우에는 건강 피해가 발생할 우려가 있습니다.
- 장치나 취급설명서에 표시되어 있는 주의 사항은 충분히 검토한 내용이지만, 그럼에도 불구하고 예측을 초월한 사태가 발생할 수 있습니다. 조작하실 때는 지시에 따른 뿐만 아니라 항상 고객님의 자신도 주의해 주십시오.
- 사용 중에 이상한 소리, 이상한 냄새, 이상한 연기 등이 발생하면 즉시 전원을 차단하고, 상황에 따른 안전대책을 실시한 후 담당 영업사원 또는 당사가 정한 서비스 회사에 연락해 주십시오.
- 장치에 사용하는 옵션 제품은 각 제조사의 취급설명서에 따라 올바르게 사용해 주십시오.
- 비상정지 시 MAIN 브레이커를 OFF로 해 주십시오.

이상의 지시를 반드시 엄수해 주십시오. 지시에 따르지 않으면 정확한 시료 관찰이나 평가 결과를 얻지 못할 뿐만 아니라 사람의 신체에 상해를 일으킬 우려가 있습니다.



안전에 관한 공통적 주의 사항(계속)

설치, 보수, 장소 변경에 관한 주의

- 부속품은 분실하지 않도록 체크리스트와 함께 주변의 가까운 곳에 보관해 주십시오. 표준 부속품이 부족한 상태로 장치를 가동시키면, 장치에 고장이 발생해 안전상 문제가 발생할 수 있습니다. 만일에 결품, 파손 또는 이상한 점이 있으면 설치 작업자 또는 담당 영업사원, 혹은 당사가 정한 서비스 회사에 상담해 주십시오.
- 고객님의 실시하도록 되어 있는 보수 내용은 본 취급설명서에 기재되어 있는 항목에 한정되어 있습니다. 취급설명서에 기재되어 있는 내용을 잘 이해하신 후에 실시해 주십시오. 취급설명서에 기재되어 있지 않은 보수는 실시하지 마시고, 당사가 정한 서비스 회사에 맡겨 주십시오.
이 사항들을 지키지 않을 경우에는 장치의 고장, 인신상의 상해를 일으킬 우려가 있습니다.
- 본 취급설명서에 정해져 있는 한정 수명 제품은 정해진 주기에 교환해 주십시오. 한정 수명 제품의 교환을 제대로 하지 않은 채 장치를 가동시키면, 장치에 고장이 발생해 안전상 문제가 발생하는 경우도 있습니다. 또한 고객님의 실시하도록 되어 있는 것 이외의 교환 작업은 가까운 당사 지정 서비스 회사에 연락해 주십시오.

사용 시의 경고 및 주의 사항

취급설명서의 본문 중에 기재되지 않은 경고 사항을 아래에 나타냅니다.

 경 고	
	<ul style="list-style-type: none"> ● 이상 상태에서 계속 사용함에 따른 사고 <p>이상 상태인 채로 사용하면 감전이나 화재의 원인이 됩니다. 사용 중에 이상한 소리, 이상한 냄새, 이상한 연기 등이 발생하면 즉시 전원을 차단해 주십시오. 그 후 상황에 따른 안전대책을 실시한 다음에 당사가 정한 서비스 회사에 연락해 주십시오.</p>

안전에 관한 공통적 주의 사항(계속)

취급설명서의 본문 중에 기재되어 있지 않은 주의 사항을 아래에 나타냅니다.

주의

● 장시간 사용에 따른 피로



모니터를 보면서 조작할 경우, 같은 자세로 장시간 모니터를 계속 들여다보면 눈과 몸에 피로가 축적됩니다. 장시간 사용할 경우는 건강을 위해 매 1 시간마다 10 분-15 분 정도 휴식을 취하여 눈과 몸이 쉬도록 해 주십시오. 또한 조작할 때 필요한 책상 및 의자는 SEMI 규격 등을 참고하여 적합한 것을 준비해 주십시오.

● 레이저 광선 방사에 의한 장애



컴퓨터에 내장된 슈퍼 멀티 드라이브에는 레이저 광원이 들어 있습니다. 레이저 장치를 갖춘 퍼스널 컴퓨터는 국제전자공학위원회 규격 등의 안전기준을 충족시키고 있습니다 (IEC 60825-1: 2014 Edition 3.0). 레이저에 관해서는 특별히 미국 정부기관이 정한 Class 1 의 레이저 장치 기준에 적합한 것으로, 통상적인 사용의 경우 인체에 유해한 레이저 광선을 장치 외부로 방사하는 경우는 없습니다. 따라서 아래 주의 사항을 반드시 지켜 주십시오.

- 레이저 장치의 패널을 열지 마십시오. 고객님의 수리할 수 있는 구성 부품은 없습니다.
- 여기에 기술되어 있지 않은 레이저 장치에 대해서도 컨트롤 조작 등과 같은 조절은 하지 마십시오.
- 장치 수리는 반드시 당사가 정한 서비스 회사에 의뢰해 주십시오.
- 장치의 커버를 떼내지 마십시오.





● 부적절한 사용에 따른 발연과 발화



본 장치 내에는 퓨즈, 과전류 검출기, 누전 검출기, 이상 상태 표시의 표시 기능 등 이상이 발생한 경우에 작동하는 보호 기기가 설치되어 있습니다. 보호 기기가 작동할 경우에는 당사가 정한 서비스 회사에 연락해 주십시오. 이상 원인을 제거하지 않은 상태에서 전원을 다시 투입하면, 발연이나 발화 등 불의의 사태가 발생할 수 있습니다.

취급설명서 중의 경고 표시

이 취급설명서 안에 기재되어 있는 경고와 그 경고가 기재된 부분은 아래와 같습니다.

 경 고	
<ul style="list-style-type: none"> ● 낙하에 의한 부상 	<div style="display: flex; align-items: center;">  <p>본체(670kg)와 EO 제어 유닛(270kg)은 중량물입니다. 지진으로 인해 부상을 입을 우려가 있으므로, 설치 후 고정 금구 등으로 고정하시길 권해드립니다. 이동 작업은 당사가 정한 서비스 회사가 실시합니다. 고객님은 이동 작업을 하지 마십시오.</p> <p style="text-align: right;">(제 1 장. 장치 사양 및 설치 조건)</p> </div>
<ul style="list-style-type: none"> ● 중량물을 들어 올릴 때의 부상 	<div style="display: flex; align-items: center;">  <p>웨이트는 질량이 약 25kg 정도인 중량물입니다. 부주의하게 들어 올리면 신체에 장애가 발생할 우려가 있습니다. 들어 올릴 때는 두 명이 실시하거나, 운반 기기 등을 사용해 주십시오. 웨이트 이동 작업은 당사가 정한 서비스 회사가 실시합니다. 고객님은 이동 작업을 하지 마십시오.</p> <p style="text-align: right;">(제 1 장. 장치 사양 및 설치 조건)</p> </div>
<ul style="list-style-type: none"> ● 고온 부위 접촉에 의한 화상(전자총 / 이온 펌프의 베이킹) 	<div style="display: flex; align-items: center;">  <p>전자총 고진공화를 위해 전자총 및 이온 펌프를 약 250°C 로 가열합니다. 손대면 화상을 입으므로 전자총이나 이온 펌프 및 그 주변부는 절대로 손대지 마십시오.</p> <p>잘못된 동작으로 전자총부가 가열되었을 경우, 고온이 되어 화상을 입을 우려가 있습니다. 전자총 베이킹 종료 후에는 반드시 OUTER BAKE 브레이커를 OFF 로 해 주십시오.</p> <p>베이킹 종료 후 실온 가까이까지 내려가려면 약 6 시간이 걸립니다. 그때까지 가열 부위 및 그 주변부는 고온 상태입니다. 손대면 화상을 입으므로 절대로 손대지 마십시오.</p> <p>베이킹 이상 종료(정전 등) 시 실온 가까이까지 내려가려면 약 6 시간이 걸립니다. 그때까지 가열 부위는 고온 상태입니다. 손대면 화상을 입으므로 절대로 손대지 마십시오.</p> <p style="text-align: right;">(제 4 장. 보수)</p> </div>

취급설명서 중의 경고 표시(계속)

경고

● 폭발, 유해물질 흡입에 의한 장애



에탄올은 유기용제입니다.

- 증기가 된 에탄올에 인화하면 폭발할 우려가 있습니다.
- 증기가 된 에탄올을 너무 많이 흡입하면 증상을 입거나 호흡곤란이 발생할 우려가 있습니다.
- 실수로 에탄올을 삼키거나, 에탄올이 피부에 닿거나 눈에 들어가면 자극 작용으로 감각마비나 보행곤란 등의 다발성 신경염이 발생할 우려가 있습니다.
- 환기가 잘 되고 화기가 없는 장소에서 작업을 하고, 과다 흡입이 생기지 않도록 주의하면서 사용해 주십시오. 또한 필요에 따라 공기 호흡기, 보호 안경, 보호 장갑, 보호 장화 등을 사용해 주십시오.

(제 4 장. 보수)



● 심박조율기의 고장



이온 펌프의 영구자석이 만드는 자기장(주변에서 10mT, 이온 펌프 커버 바깥에서 약 1mT)으로 인해 심박조율기가 고장날 우려가 있습니다. 심박조율기를 사용하시는 분은 이온 펌프에서 0.6m 이상 떨어져 주십시오.

(제 4 장. 보수)

● 고전압에 의한 감전



전자총 베이킹 작업을 실시할 때는 반드시 FIL 램프와 HV 램프가 꺼져 있는 것을 확인해 주십시오. FIL 램프와 HV 램프가 켜져 있는 동안은 전자총 베이킹 작업을 실시하지 마십시오. 고전압이 걸린 상태가 되어 감전될 우려가 있습니다.

(제 4 장. 보수)

본 장치의 내부에는 최대 AC100V, DC30kV 를 사용하고 있기 때문에 손대면 감전될 우려가 있습니다. 본 장치의 통전 중에 본체부, 제어부 및 전원부의 커버를 떼내고 내부의 부품이나 회로에 손대면 감전되어 사망하거나 중상을 입을 우려가 있습니다. 장치의 커버를 떼내지 마십시오.

(제 6 장. 문제 해결)

● 부적절한 접지에 의한 감전






접지선이 올바르게 연결되어 있지 않은 장치는 정상적으로 동작하지 않을 뿐 아니라 감전의 우려가 있습니다. 접지선에는 손대지 마십시오. 본 장치의 접지선 연결 작업은 당사가 정한 서비스 회사가 실시합니다.

(제 1 장. 장치 사양 및 설치 조건)

취급설명서 중의 주의 표시

이 취급설명서 안에 기재되어 있는 주의와 그 주의가 기재된 부분은 아래와 같습니다.

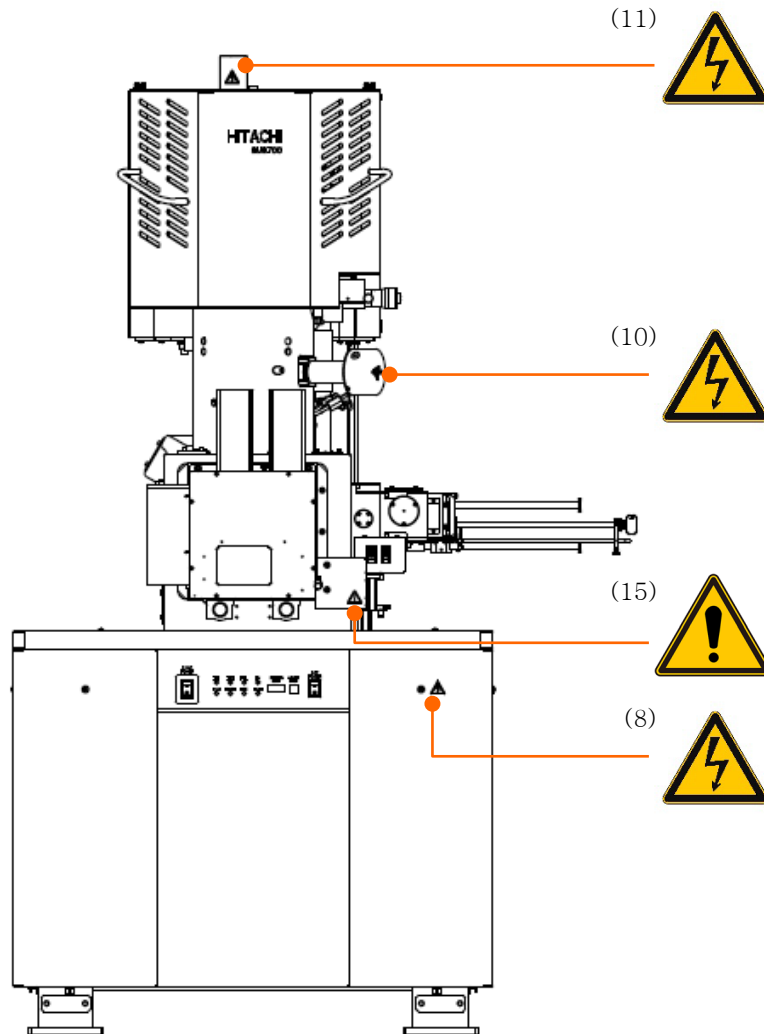
 주의	
<ul style="list-style-type: none"> ● 넘어짐에 의한 부상 	<p> 본체의 커버가 파손된 결과 넘어져 부상을 입을 우려가 있습니다. 커버 위에 올라타거나 기대지 마십시오.</p> <p style="text-align: right;">(제 1 장. 장치 사양 및 설치 조건)</p> <p>높은 장소에서 작업할 때는 사다리를 사용해 주십시오. 그때는 넘어져 부상을 입을 우려가 있으므로 주의해 주십시오. 사다리는 고객님의 안전기준에 적합한 사다리를 사용해 주십시오.</p> <p style="text-align: right;">(제 4 장. 보수)</p>
<ul style="list-style-type: none"> ● 말려 들어감에 의한 부상 	<p> 스테이지 회전부에 손이나 머리카락이 말려 들어가 부상을 입을 우려가 있습니다. 스테이지를 꺼낼 때는 회전부에 손이나 머리카락이 말려 들어가지 않도록 주의해 주십시오.</p> <p style="text-align: right;">(제 3 장. 조작)</p>

본 장치의 경고 라벨

SU8700 주사전자현미경에 부착되어 있는 경고 라벨을 안전-8~안전-26 페이지에 표시합니다.
경고 라벨의 내용을 현물로 확인해 주십시오.

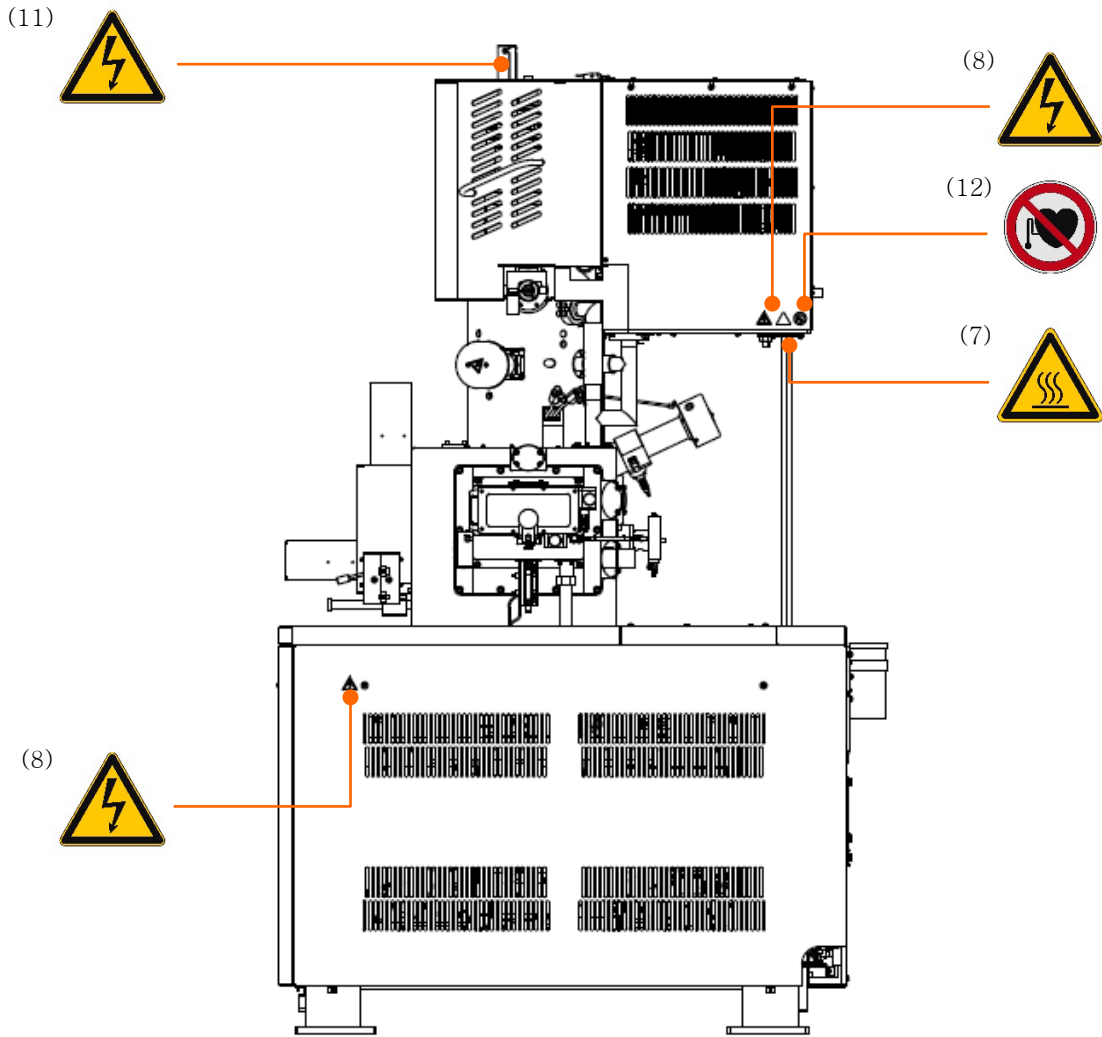
경고 라벨은 정기적으로 점검하여 안전한 거리에서 잘 보이도록 청소하고 유지하시기 바랍니다.
시간 경과에 따른 열화로 경고 라벨이 희미해져 보이지 않게 되었을 때는, 당사가 정한 서비스 회사에 연락해 새로운 라벨로 교환해 주십시오.

표준 타입



메인 유닛부(정면)의 경고 라벨 부착 위치

본 장치의 경고 라벨(계속)

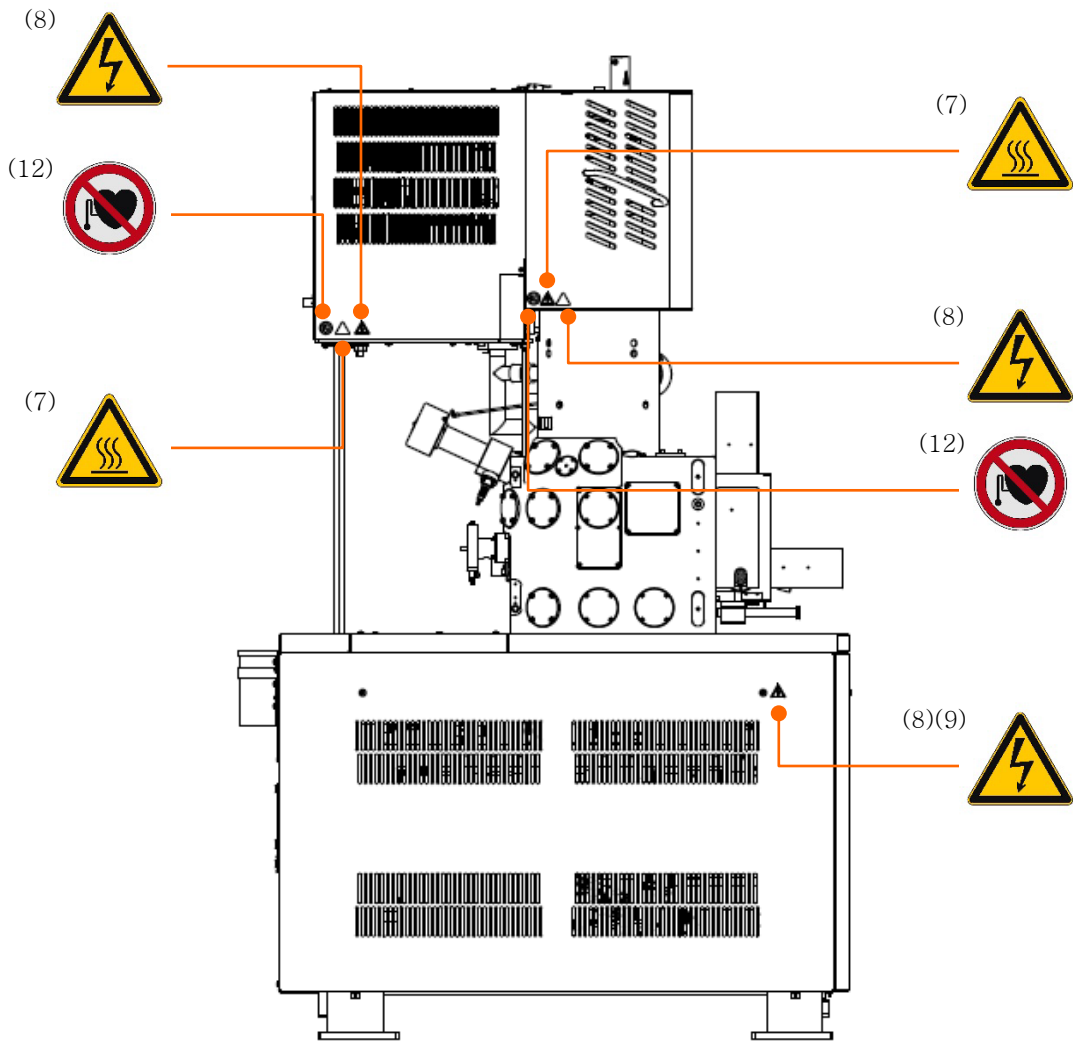


메인 유닛부(오른쪽)의 경고 라벨 부착 위치

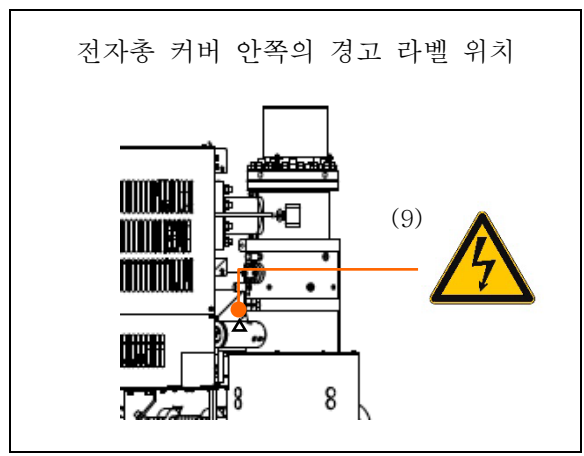
안전한 사용을 위해

본 장치의 경고 라벨(계속)

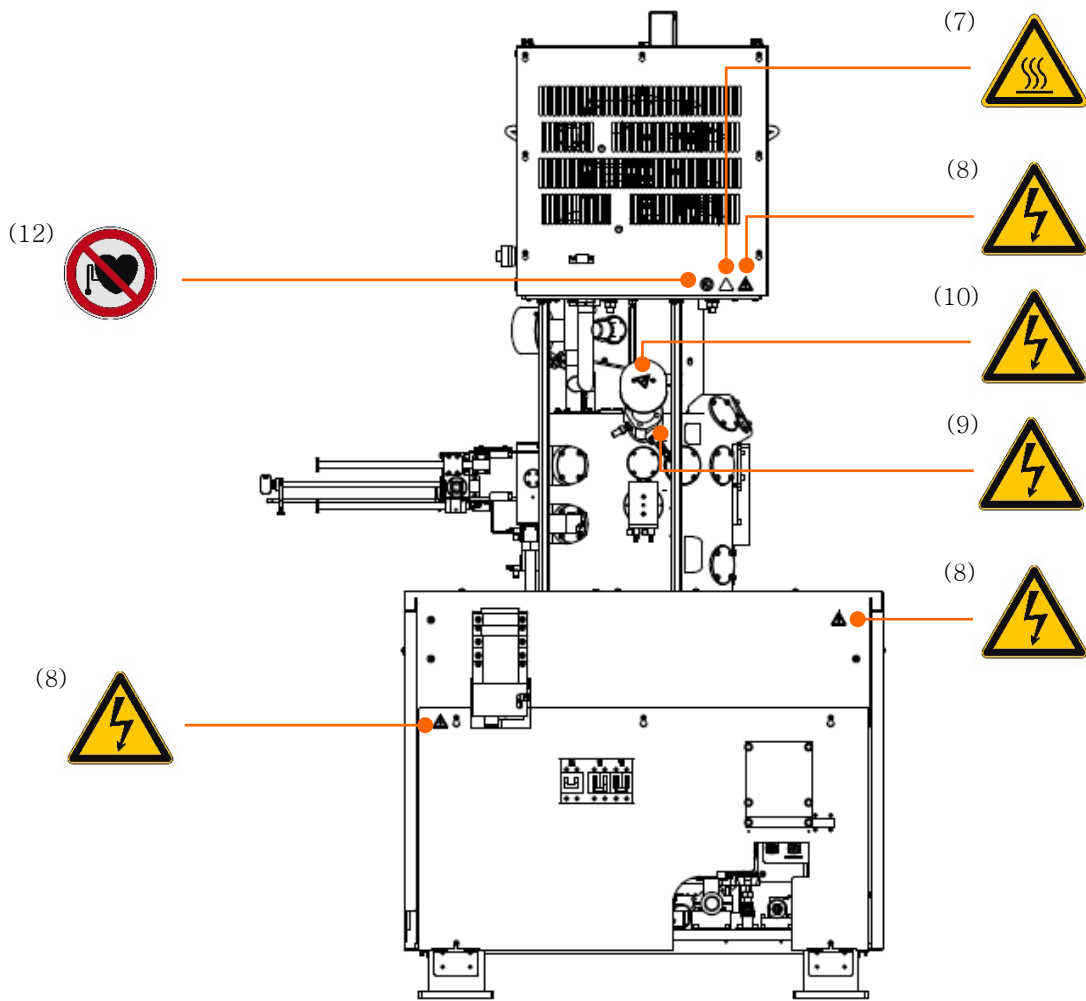
▲ 안전한 사용을 위해



메인 유닛부(왼쪽)의 경고 라벨 부착 위치

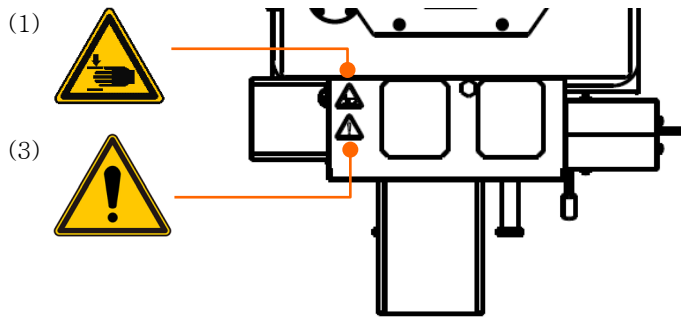


본 장치의 경고 라벨(계속)

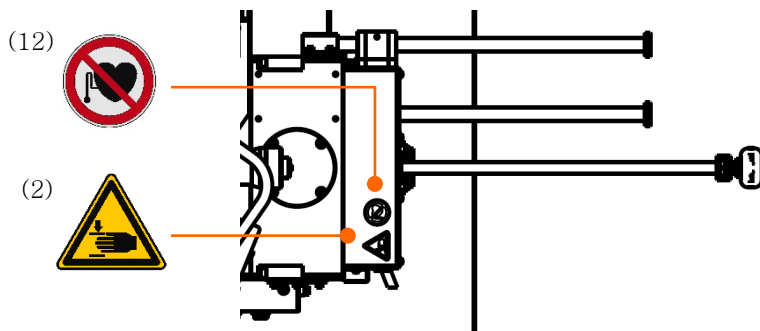


메인 유닛부(뒷면)의 경고 라벨 부착 위치

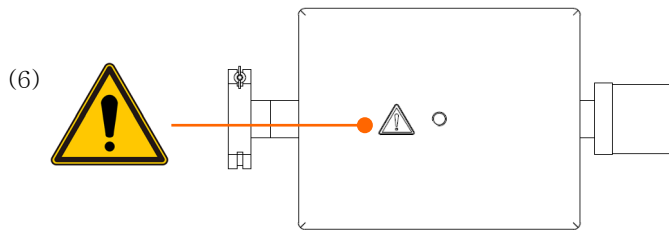
본 장치의 경고 라벨(계속)



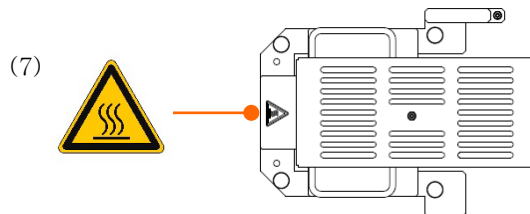
스테이지 상면부의 경고 라벨 부착 위치



시료 교환기 상면부의 경고 라벨 부착 위치

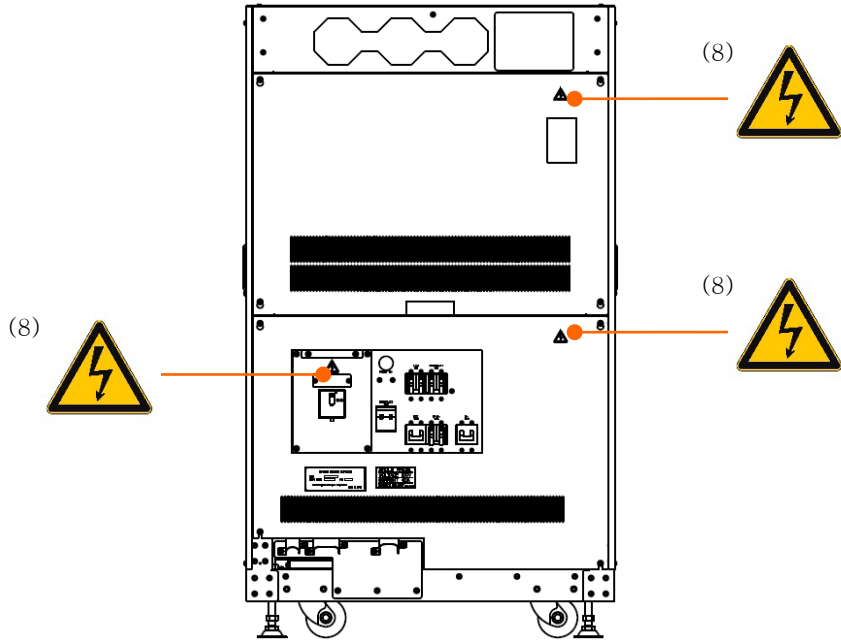


웨이트(상면도) 경고 라벨 부착 위치

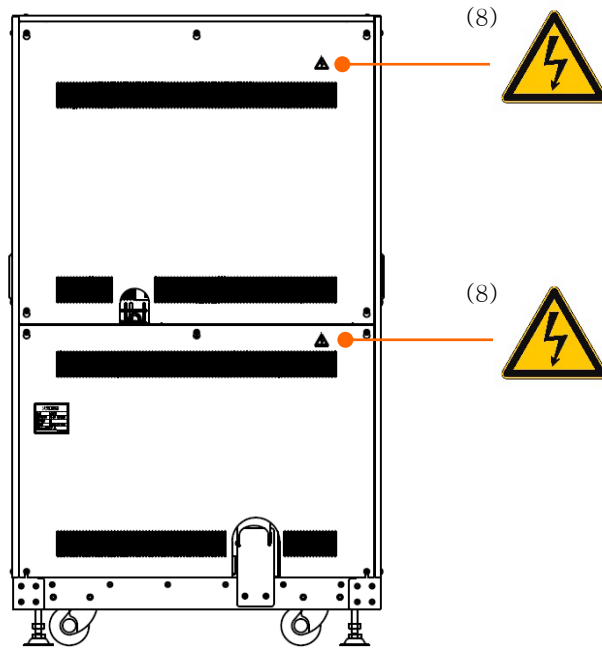


베이킹용 커버

본 장치의 경고 라벨(계속)



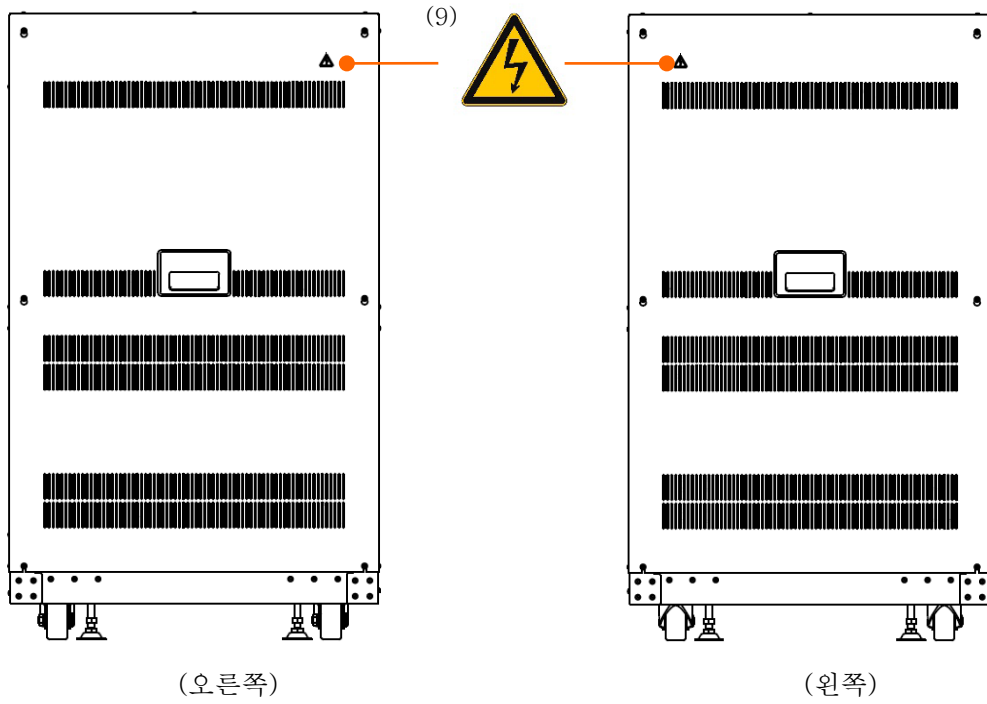
EO 제어 유닛(정면)의 경고 라벨 부착 위치



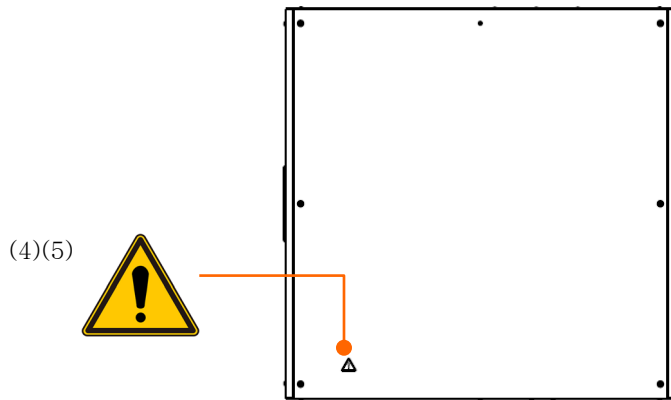
EO 제어 유닛(뒷면)의 경고 라벨 부착 위치

본 장치의 경고 라벨(계속)

안전한 사용을 위해

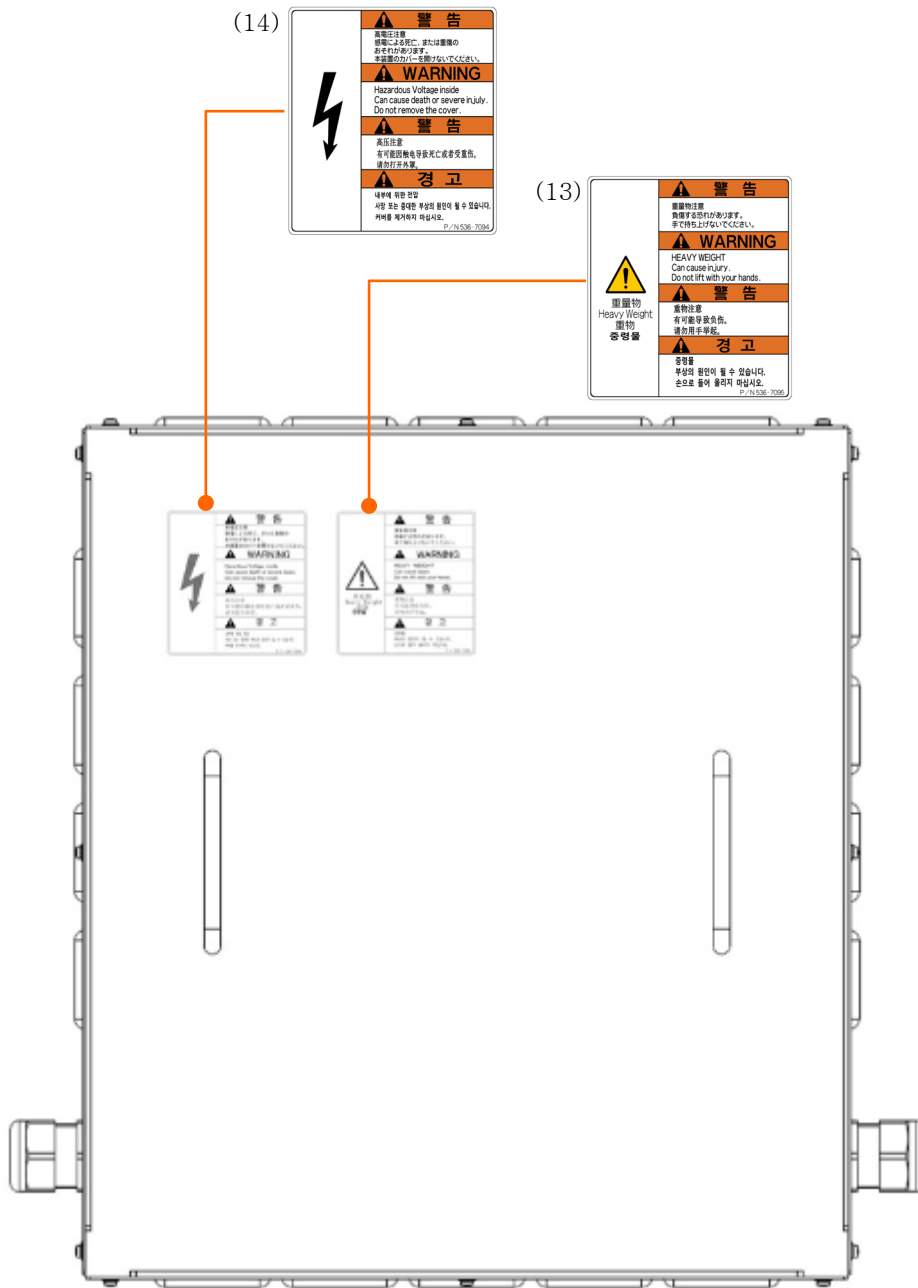


EO 제어 유닛의 경고 라벨 부착 위치



EO 제어 유닛(상면)의 경고 라벨 부착 위치

본 장치의 경고 라벨(계속)

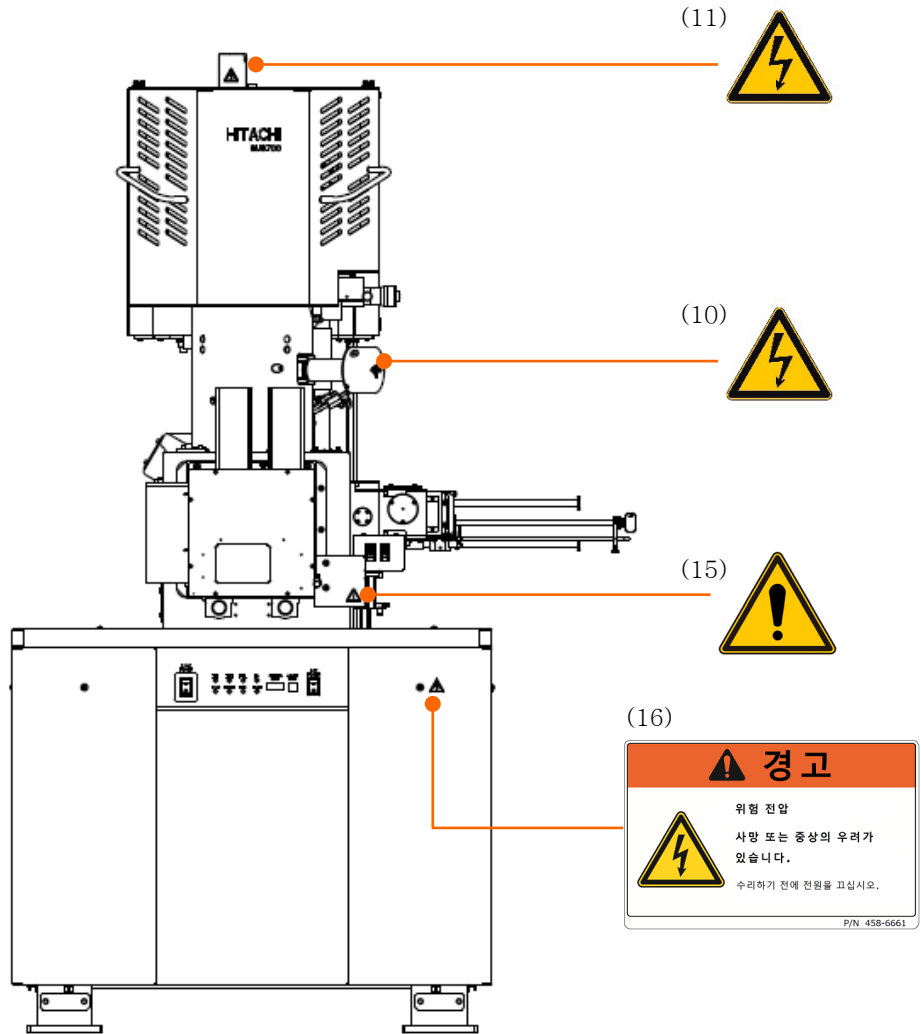


스텝 다운 트랜스(옵션)의 경고 라벨 부착 위치



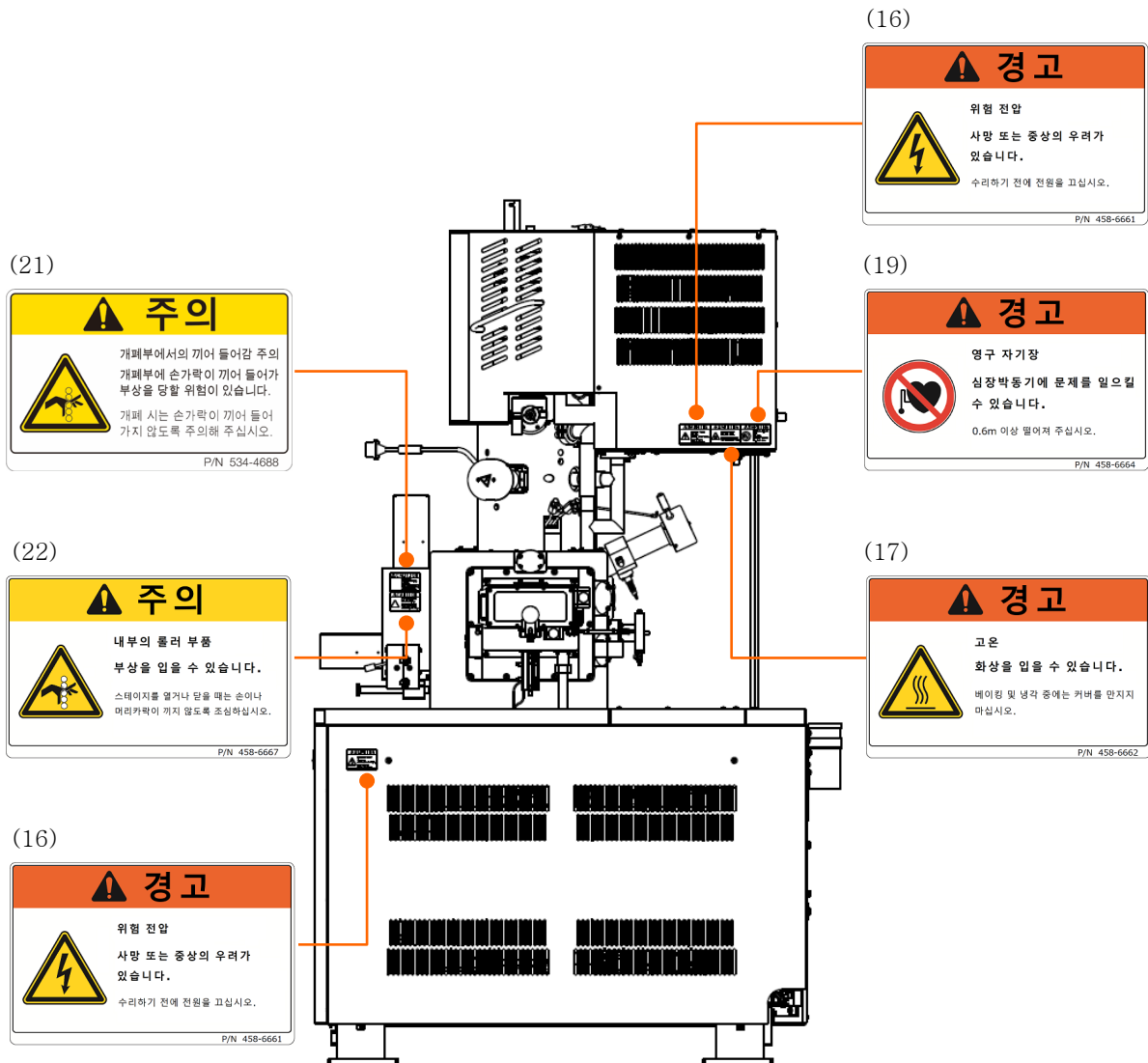
본 장치의 경고 라벨(계속)

SEMI-S2 대응 타입



메인 유닛부(정면)의 경고 라벨 부착 위치

본 장치의 경고 라벨(계속)

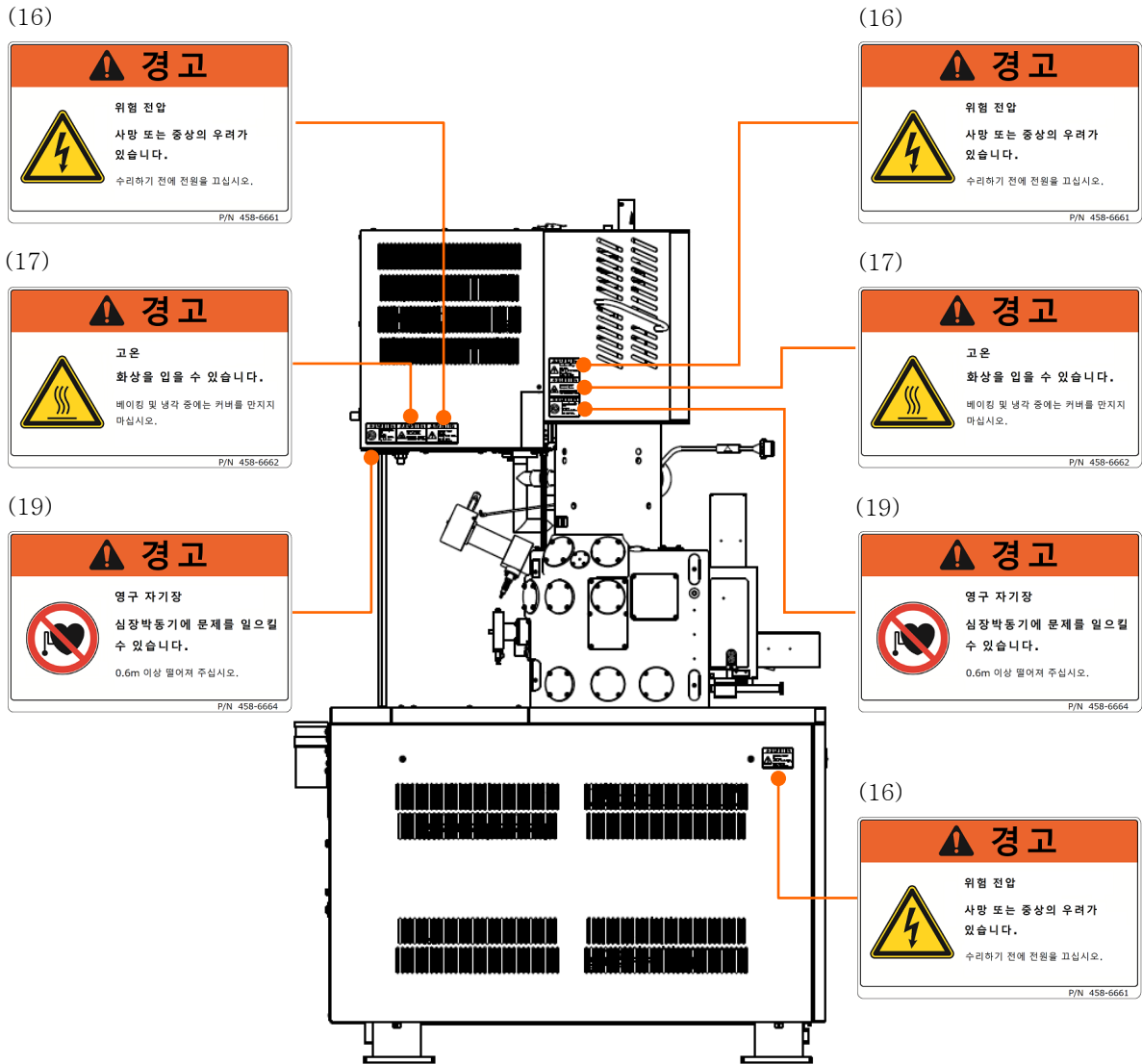


메인 유닛부(오른쪽)의 경고 라벨 부착 위치

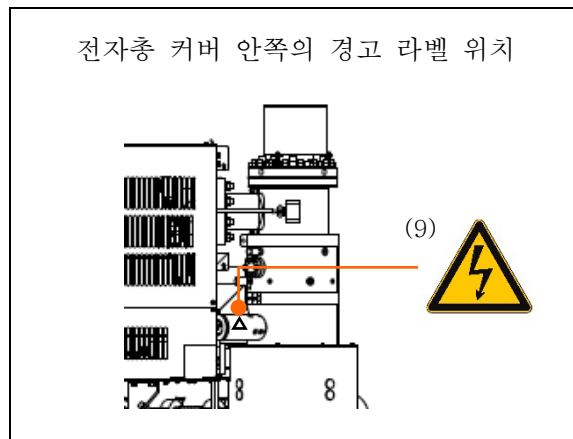


본 장치의 경고 라벨(계속)

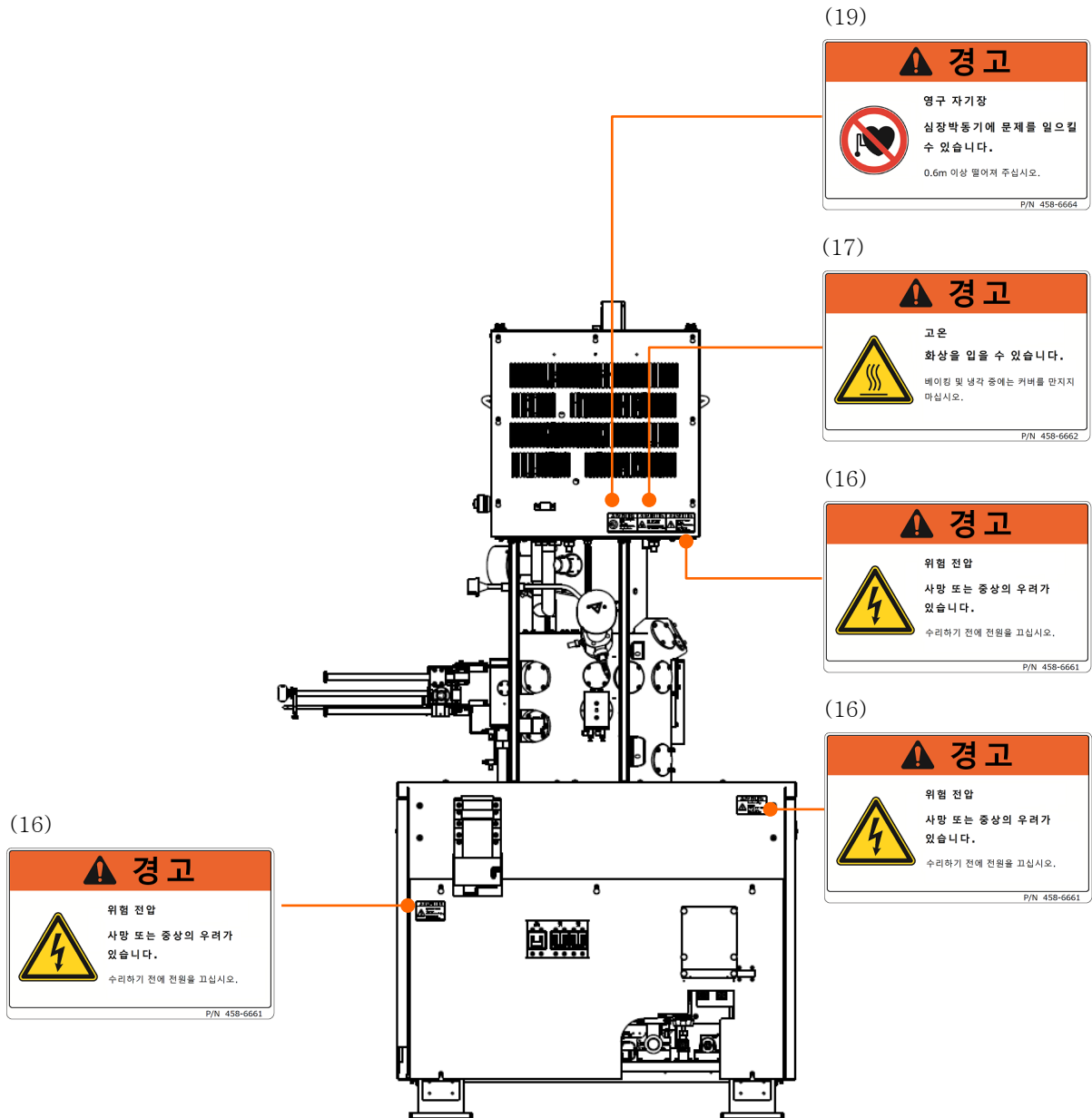
▲ 안전한 사용을 위해



메인 유닛부(왼쪽)의 경고 라벨 부착 위치



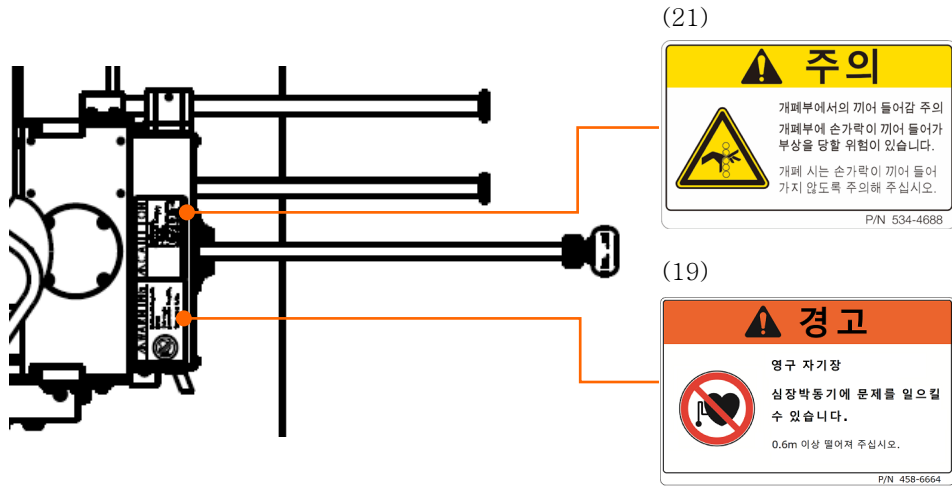
본 장치의 경고 라벨(계속)



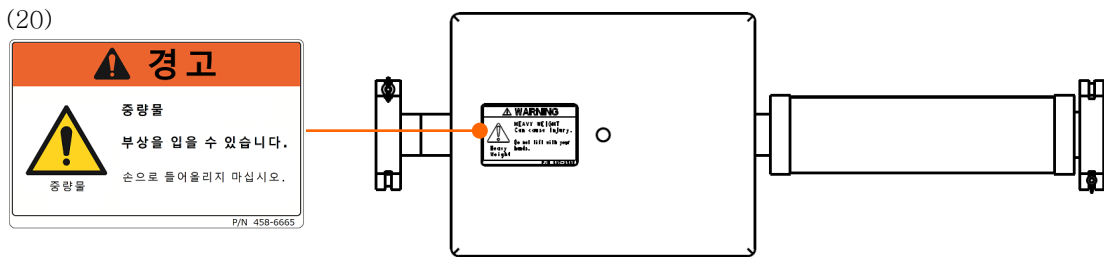
메인 유닛부(뒷면)의 경고 라벨 부착 위치



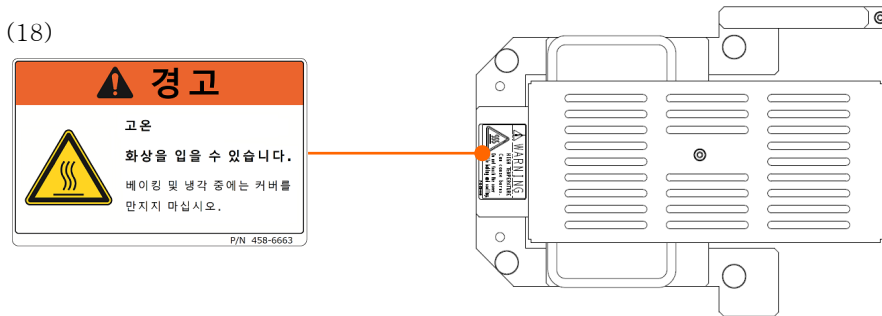
본 장치의 경고 라벨(계속)



스테이지 상면부의 경고 라벨 부착 위치

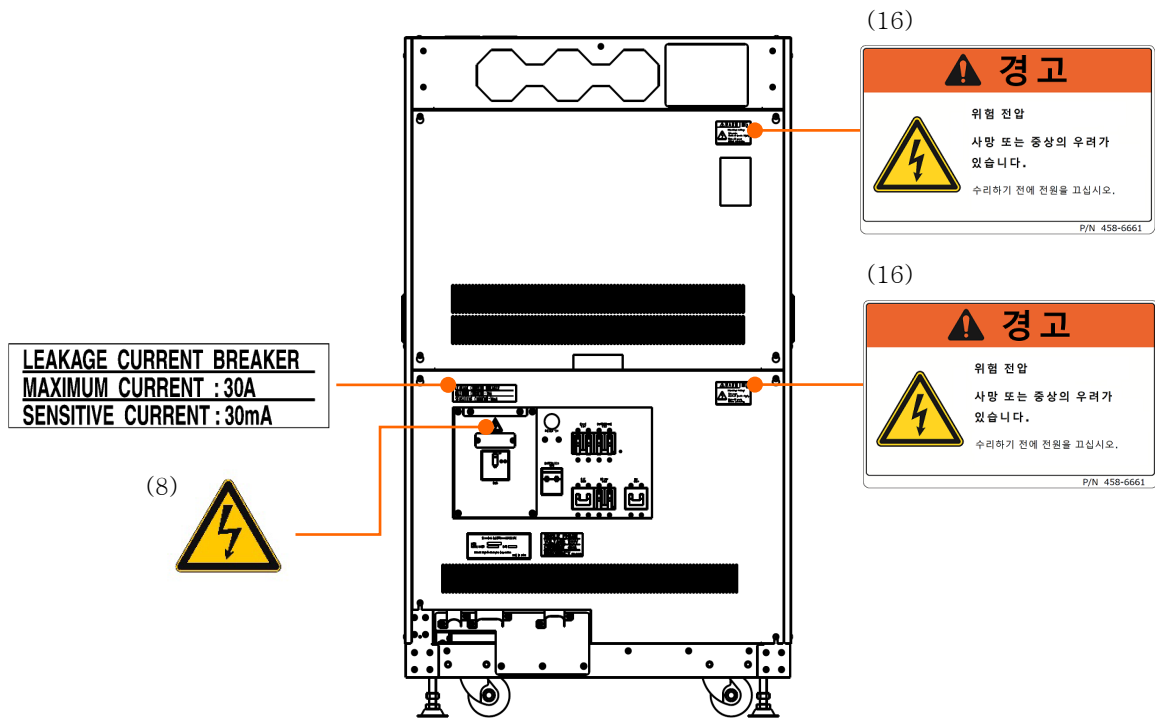


웨이트(상면도) 경고 라벨 부착 위치

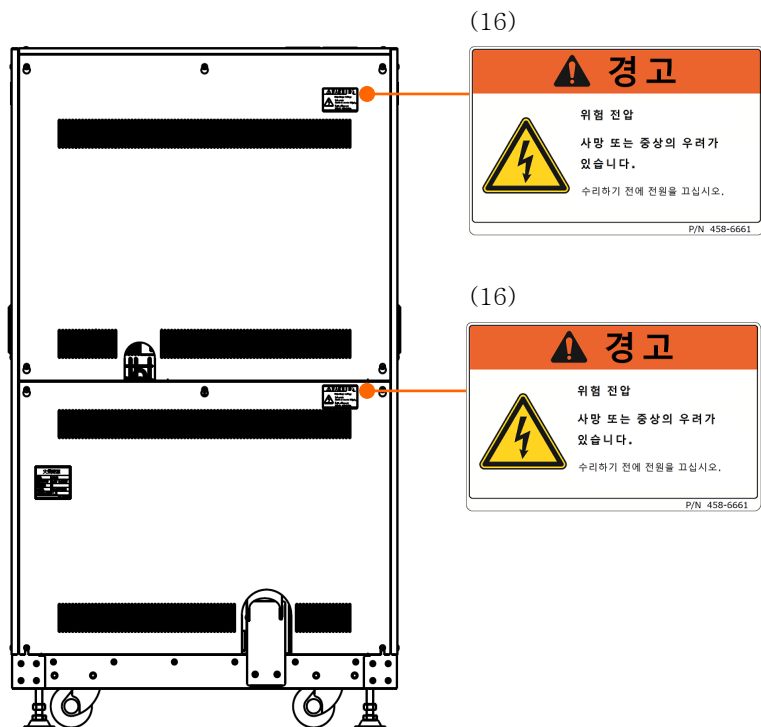


베이킹용 커버

본 장치의 경고 라벨(계속)



EO 제어 유닛(정면)의 경고 라벨 부착 위치

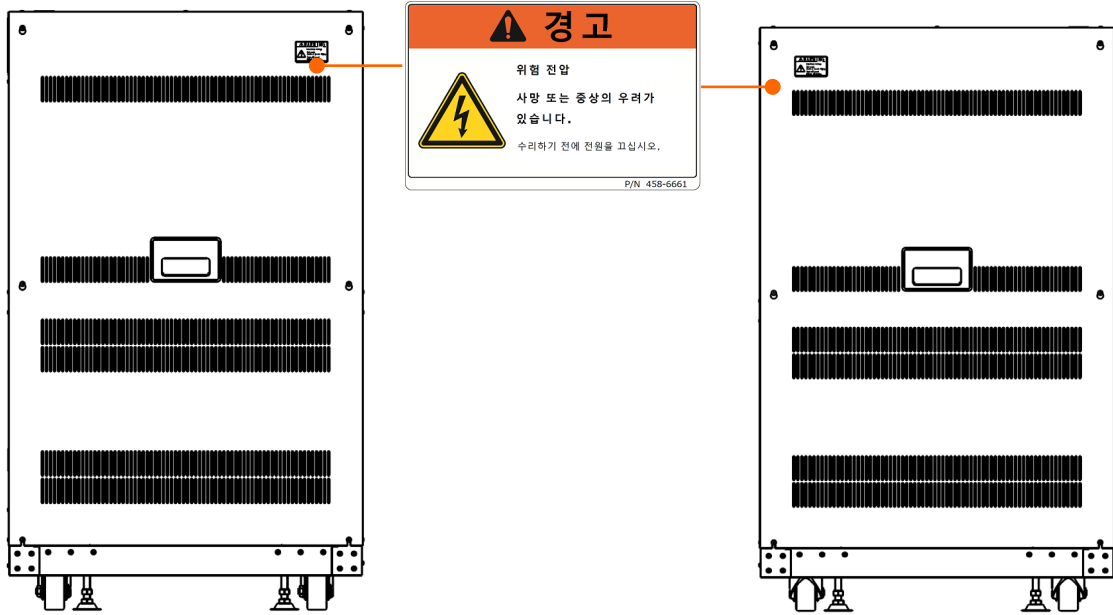


EO 제어 유닛(뒷면)의 경고 라벨 부착 위치

본 장치의 경고 라벨(계속)



(16)



(오른쪽)

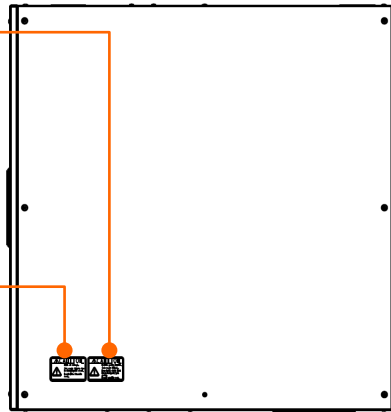
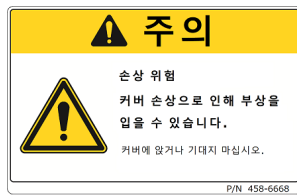
(왼쪽)

EO 제어 유닛의 경고 라벨 부착 위치

(24)







(23)



EO 제어 유닛(상면)의 경고 라벨 부착 위치

본 장치의 경고 라벨(계속)

각 라벨의 내용은 다음과 같습니다.


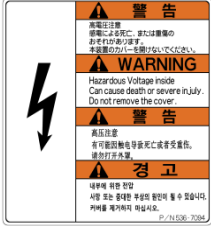





(1)		주 의
		끼임 주의 부상을 입을 우려가 있습니다. 스테이지 개폐 시 손가락이 끼지 않도록 주의해 주십시오. P/N 458-6624
(2)		주 의
		끼임 주의 부상을 입을 우려가 있습니다. 시료 교환실 개폐 시 손가락이 끼지 않도록 주의해 주십시오. P/N 458-6624
(3)		주 의
		말려 들어감 주의 스테이지 가동부에서 손가락이나 머리카락 등이 말려 들어가 부상을 입을 우려가 있습니다. 스테이지를 꺼낼 때는 손가락 등이 말려 들어가지 않도록 주의해 주십시오. P/N 458-6625
(4)		주 의
		말려 들어감 주의 팬 등의 회전부로 손가락이 말려 들어가 부상을 입을 우려가 있습니다. 커버를 열지 마십시오. P/N 458-6625
(5)		주 의
		파손 주의 커버가 파손된 결과 넘어져 부상을 입을 우려가 있습니다. 커버 위에 올라타거나 기대지 마십시오. P/N 458-6625
(6)		주 의
		중량물 주의(25kg) 부상을 입을 우려가 있습니다. 들어 올릴 때는 두 명 이상이 하거나 전용 기구를 사용하십시오. 또한 작업은 당사가 정한 서비스 회사가 실시합니다. P/N 458-6625

본 장치의 경고 라벨(계속)

▲ 안전한 사용을 위해

(7)		주 의
		<p>고온 주의 화상을 입을 수 있습니다. 베이킹 중 및 냉각 시간 중에는 커버 내부가 고온이 됩니다. 커버를 떼내지 마십시오.</p> <p style="text-align: right;">P/N 458-6622</p>
(8)		경 고
		<p>고전압 주의 감전에 의한 사망 또는 중상의 우려가 있습니다. 작업은 당사가 정한 서비스 회사가 실시합니다. 고객님은 이 커버를 열지 마십시오.</p> <p style="text-align: right;">P/N 458-6621</p>
(9)		주 의
		<p>고전압 주의(10kV) 감전에 의한 사망 또는 중상의 우려가 있습니다. 작업은 당사가 정한 서비스 회사가 실시합니다. 고객님은 이 커버를 열지 마십시오.</p> <p style="text-align: right;">P/N 458-6621</p>
(10)		경 고
		<p>고전압 주의(1000V) 감전에 의한 사망 또는 중상의 우려가 있습니다. 작업은 당사가 정한 서비스 회사가 실시합니다. 고객님은 이 커버를 열지 마십시오.</p> <p style="text-align: right;">P/N 458-6621</p>
(11)		경 고
		<p>고전압 주의 감전에 의한 사망 또는 중상의 우려가 있습니다. 이 커버를 떼낼 때는 HV 를 OFF 로 해 주십시오. HV 가 ON 인 채 이 커버를 떼내면, HV 는 강제 차단됩니다. 또한 작업은 당사가 정한 서비스 회사가 실시합니다. 고객님은 이 커버를 열지 마십시오.</p> <p style="text-align: right;">P/N 458-6621</p>
(12)		주 의
		<p>영구자석 자기장(1mT) 심박조율기가 고장날 우려가 있습니다. 심박조율기 사용자는 0.6m 이상 떨어져 주십시오.</p> <p style="text-align: right;">P/N 458-6623</p>

본 장치의 경고 라벨(계속)


<p>(13)</p>		<p>경 고</p> <p>중량물 부상의 원인이 될 수 있습니다. 손으로 들어 올리지 마십시오.</p> <p>P/N 536-7095</p>
<p>(14)</p>		<p>경 고</p> <p>내부에 위험 전압 사망 또는 중대한 부상의 원인이 될 수 있습니다. 커버를 제거하지 마십시오.</p> <p>P/N 536-7094</p>
<p>(15)</p>		<p>주 의</p> <p>인터락 작동 주의 보호유닛을 떼어내면 인터락이 작동하여 HV 가 강제 차단됩니다. 보호유닛은 반드시 장치에 장착한 상태로 사용해 주세요.</p> <p>P/N 458-6625</p>
<p>(16)</p>		<p>경 고</p> <p>위험 전압 사망 또는 중상의 우려가 있습니다. 수리하기 전에 전원을 끄십시오.</p> <p>P/N 458-6661</p>
<p>(17)</p>		<p>경 고</p> <p>고온 화상을 입을 수 있습니다. 베이킹 및 냉각 중에는 커버를 만지지 마십시오.</p> <p>P/N 458-6662</p>
<p>(18)</p>		<p>경 고</p> <p>고온 화상을 입을 수 있습니다. 베이킹 및 냉각 중에는 커버를 만지지 마십시오.</p> <p>P/N 458-6663</p>
<p>(19)</p>		<p>경 고</p> <p>영구 자기장 심장박동기에 문제를 일으킬 수 있습니다. 0.6m 이상 떨어져 주십시오.</p> <p>P/N 458-6664</p>

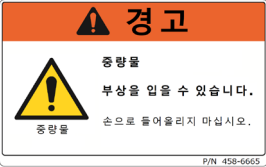






안전한 사용을 위해



본 장치의 경고 라벨(계속)


 안전한 사용을 위해

(20)	 <p>경고 중량물 부상을 입을 수 있습니다. 손으로 들어올리지 마십시오. 중량물 손으로 들어올리지 마십시오. P/N 458-6665</p>	<p>경고</p> <p>중량물 부상을 입을 수 있습니다. 손으로 들어올리지 마십시오.</p> <p style="text-align: right;">P/N 458-6665</p>
(21)	 <p>주의 개폐부에서의 끼어 들어감 주의 개폐부에 손가락이 끼어 들어가 부상을 당할 위험이 있습니다. 개폐 시는 손가락이 끼어 들어가지 않도록 주의해 주십시오. P/N 534-4688</p>	<p>주의</p> <p>개폐부에서의 끼어 들어감 주의 개폐부에 손가락이 끼어 들어가 부상을 당할 위험이 있습니다. 개폐 시는 손가락이 끼어 들어가지 않도록 주의해 주십시오.</p> <p style="text-align: right;">P/N 534-4688</p>
(22)	 <p>주의 내부의 롤러 부품 부상을 입을 수 있습니다. 스테이지를 열거나 닫을 때는 손이나 머리카락이 끼지 않도록 조심하십시오. P/N 458-6667</p>	<p>주의</p> <p>내부의 롤러 부품 부상을 입을 수 있습니다. 스테이지를 열거나 닫을 때는 손이나 머리카락이 끼지 않도록 조심하십시오.</p> <p style="text-align: right;">P/N 458-6667</p>
(23)	 <p>주의 손상 위험 커버 손상으로 인해 부상을 입을 수 있습니다. 커버에 얹거나 기대지 마십시오. P/N 458-6668</p>	<p>주의</p> <p>손상 위험 커버 손상으로 인해 부상을 입을 수 있습니다. 커버에 얹거나 기대지 마십시오.</p> <p style="text-align: right;">P/N 458-6668</p>
(24)	 <p>주의 내부의 롤러 부품 부상을 입을 수 있습니다. 팬과 같은 롤러 부품에 손이 닿지 않도록 하십시오. 커버를 열지 마십시오. P/N 458-6669</p>	<p>주의</p> <p>내부의 롤러 부품 부상을 입을 수 있습니다. 팬과 같은 롤러 부품에 손이 닿지 않도록 하십시오. 커버를 열지 마십시오.</p> <p style="text-align: right;">P/N 458-6669</p>

비상정지 스위치(옵션)

개요

비상정지 스위치는 비상 시 장치의 모든 전원을 차단하기 위한 누름 버튼 스위치입니다.

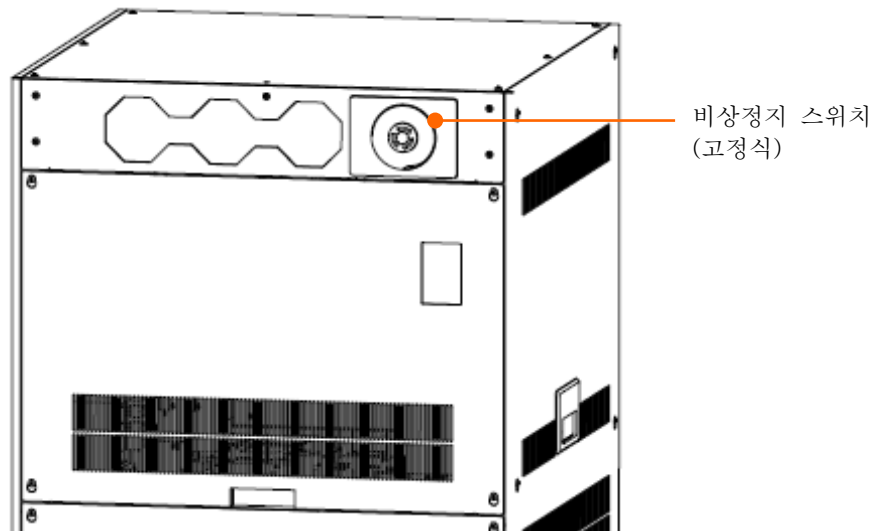
☞ : 비상 시 외에는 누르지 마십시오. 장치의 모든 전원이 차단되기 때문에, 장치 가동 시작에 시간이 걸릴 뿐만 아니라 관찰 중인 이미지가 저장되지 않는 등 관찰에 지장을 초래하는 경우가 있습니다.

외관

비상정지 스위치는 2 개소, 즉 EO 제어 유닛 정면 상부(고정식)와 조작 테이블(이동식)에 설치되어 있습니다.

조작 테이블에 있는 비상정지 스위치는 이동식입니다. 케이블이 닿는 범위(본체 오른쪽 후방 하부에서 약 2 m)에서 자유롭게 배치할 수 있습니다.

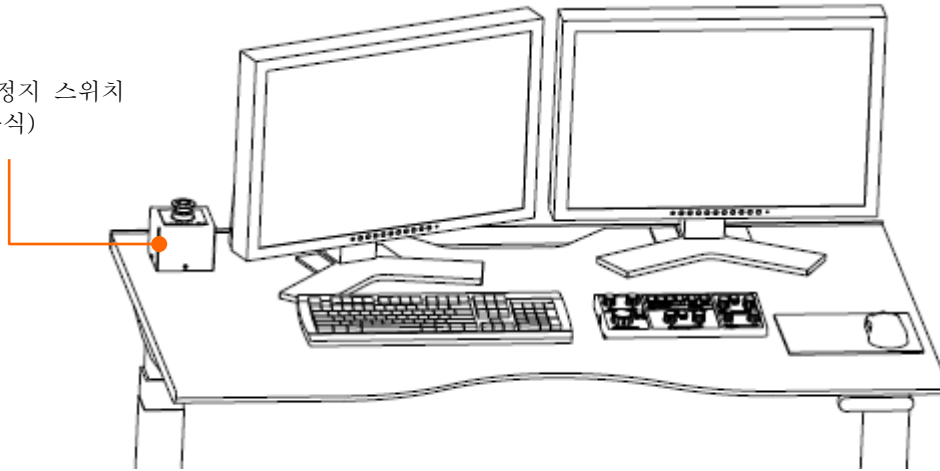
☞ : 비상정지 스위치(이동식)는 넘어지거나 떨어지면 스위치부가 파손되어 조작 오류(의도하지 않은 전원 차단)가 발생할 우려가 있습니다. 조작 테이블 등과 같은 안정된 장소(평탄한 장소)에 배치해 주십시오.



비상정지 스위치(고정식) 설치 위치

비상정지 스위치(옵션)(계속)

비상정지 스위치
(이동식)

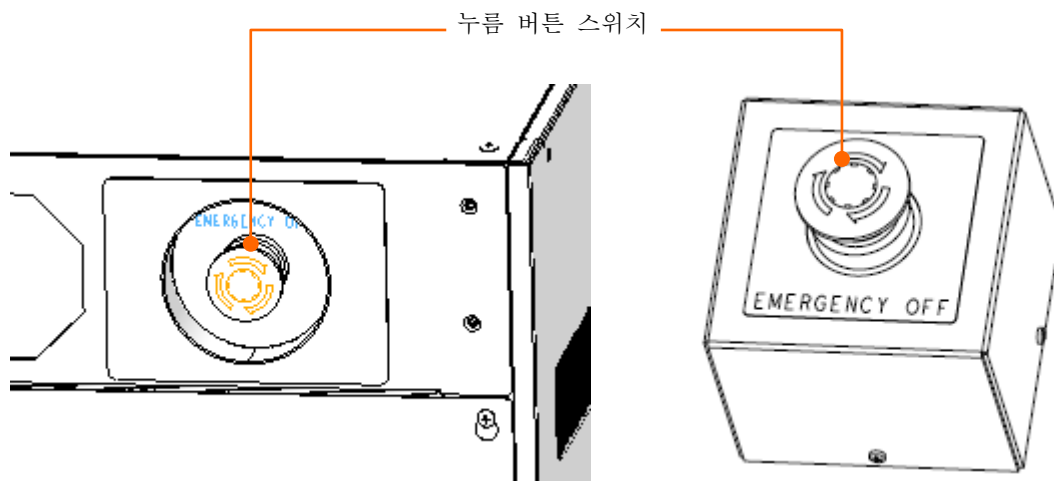


비상정지 스위치(이동식) 설치 위치

비상정지 스위치 동작 방법

EO 제어 유닛 정면 상부의 비상정지 스위치(고정식) 또는 조작 테이블 위의 비상정지 스위치(이동식) 중 어느 한쪽의 누름 버튼 스위치를 누르면, 장치의 모든 전원이 차단됩니다. 누름 버튼 스위치를 시계 방향으로 돌려 스위치 잠금을 해제하지 않는 한 장치의 모든 전원 차단 상태는 계속됩니다.

주 : 비상 시 외에는 누르지 마십시오. 장치의 모든 전원이 차단되기 때문에, 장치 가동 시작에 시간이 걸릴 뿐만 아니라 관찰 중인 이미지가 저장되지 않는 등 관찰에 지장을 초래하는 경우가 있습니다.



안전한 사용을 위해

비상정지 스위치(옵션)(계속)

비상정지 스위치 동작 후의 복구 방법

- (1) 비상정지 스위치의 스위치 잠금을 해제하기 전에 아래의 스위치 및 브레이커를 모두 OFF 로 해 주십시오.
 - 본체 유닛 측 : [EOC POWER] 스위치, [EVAC POWER] 스위치, IP1 브레이커, IP2 브레이커, STAGE 브레이커
 - EO 제어 유닛 측 : HV 브레이커, IP/HV 브레이커, EVAC 브레이커, EOC 브레이커, OUTER BAKE 브레이커, MAIN 브레이커
- (2) 눌러져 있는 비상정지 누름 버튼 스위치를 시계 방향으로 돌려서 스위치 잠금을 해제해 주십시오.
- (3) 장치 가동을 시작해 주십시오.

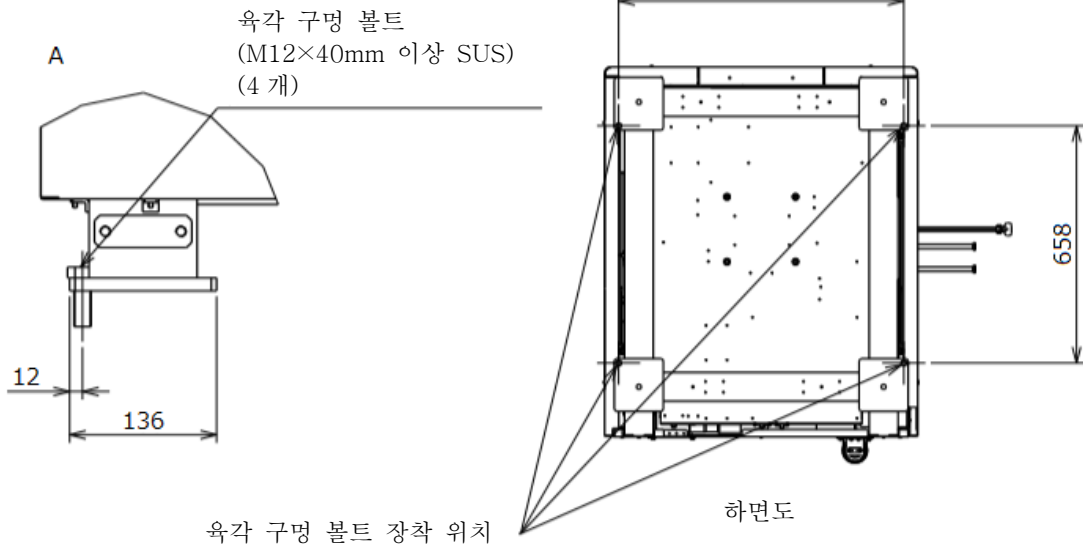
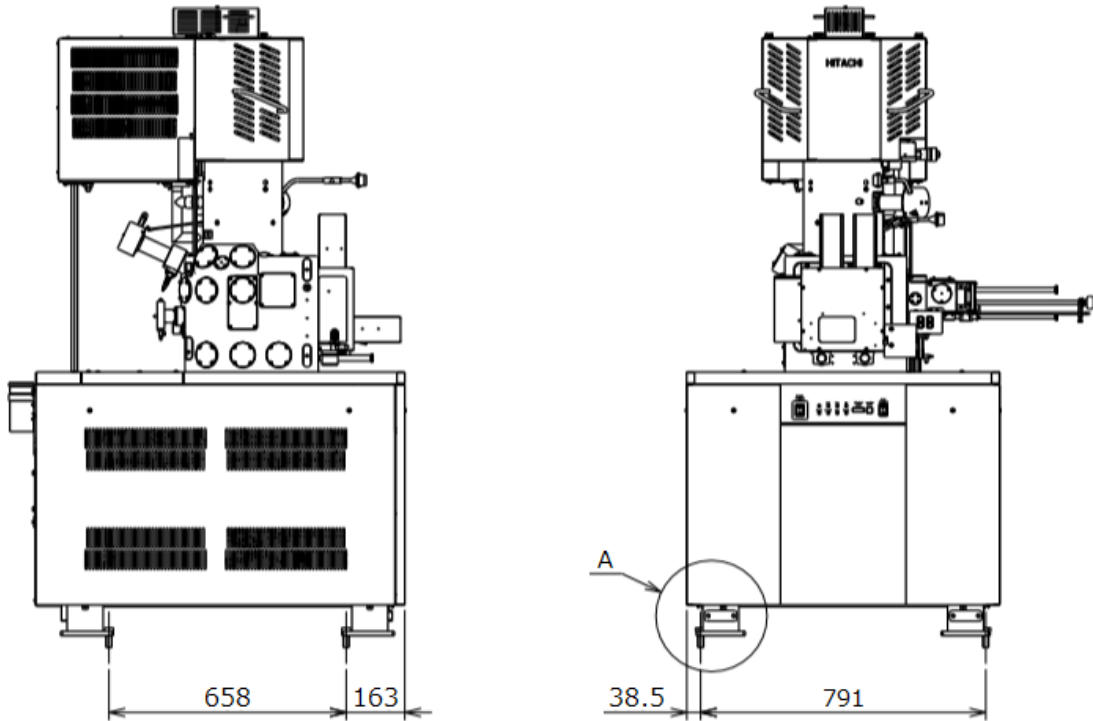
참조: SU8700 사용설명서

4.5 Operation after recovery from power failure and for star-up of instrument

지진 대책(옵션)

장치 본체

▲ 안전을 위한 사용을 위해



육각 구멍 볼트 장착 위치

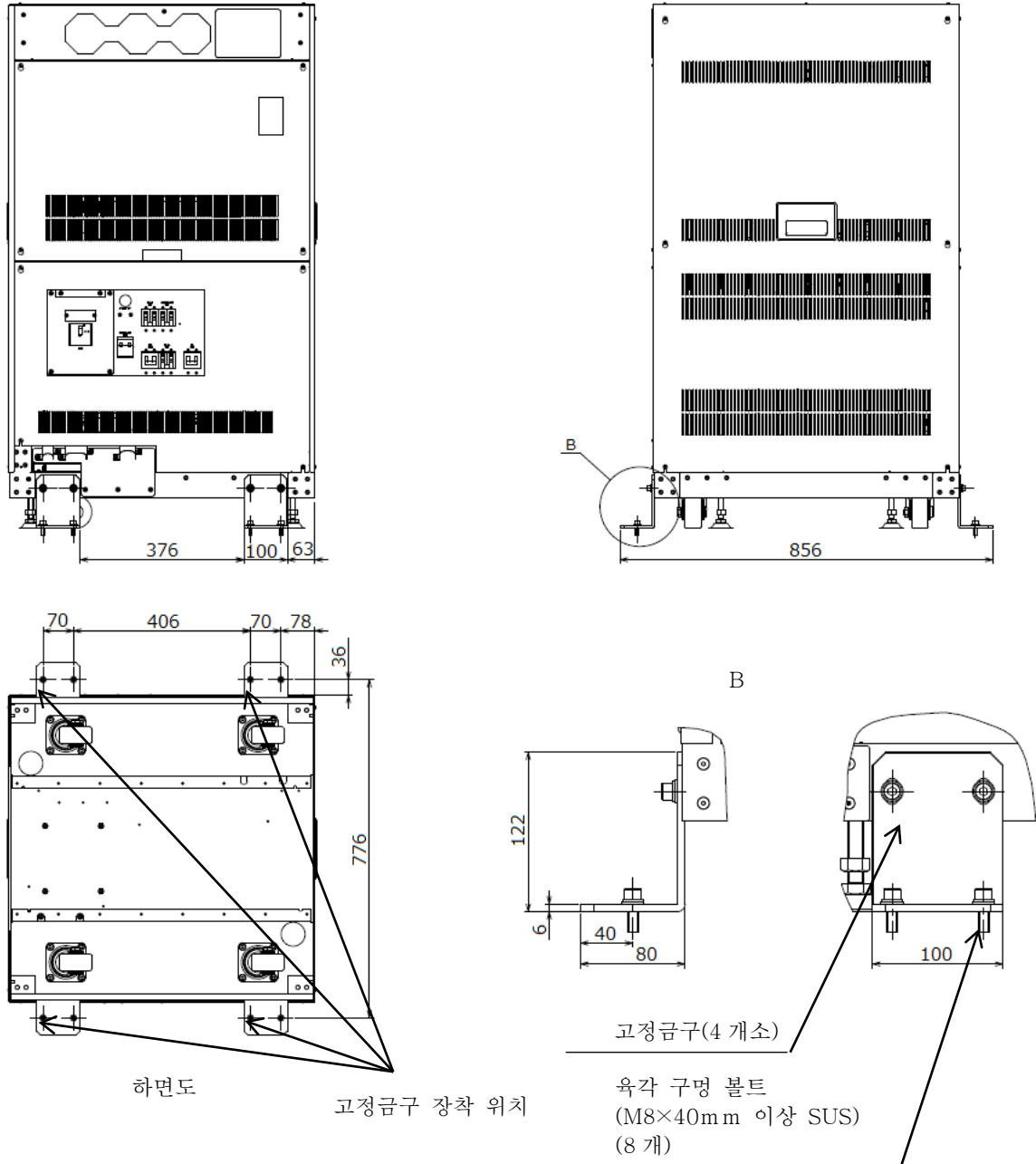
하면도

※ 본 사양은 계산에 따른 수치입니다.

지진 대책(장치 본체)(권장 사례)

지진 대책(옵션)(계속)

EO 제어 유닛



하면도

고정금구 장착 위치

고정금구(4 개소)

육각 구멍 볼트
(M8×40mm 이상 SUS)
(8 개)

※ 본 사양은 계산에 따른 수치입니다.

※ 바닥면에 고정금구를 장착하는 볼트는 고객님의 준비하셔야 합니다.

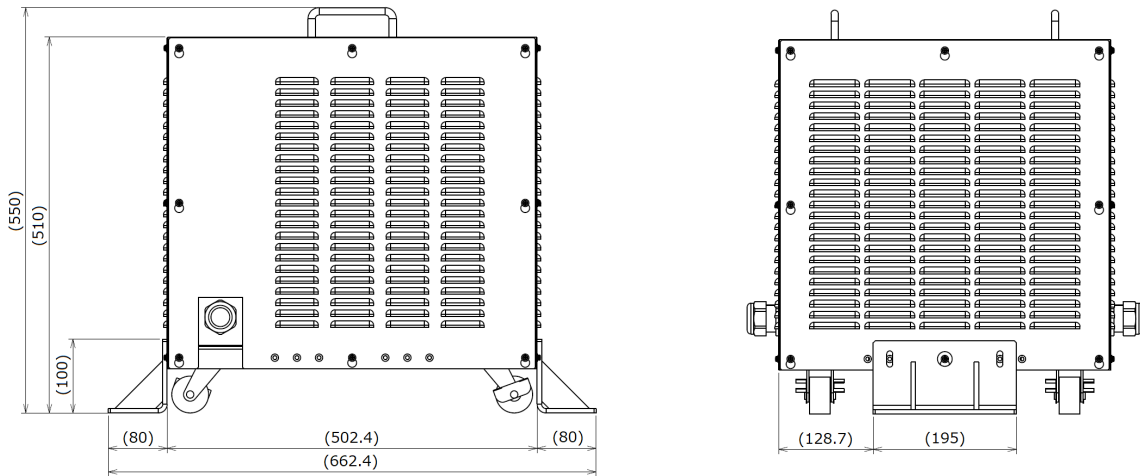
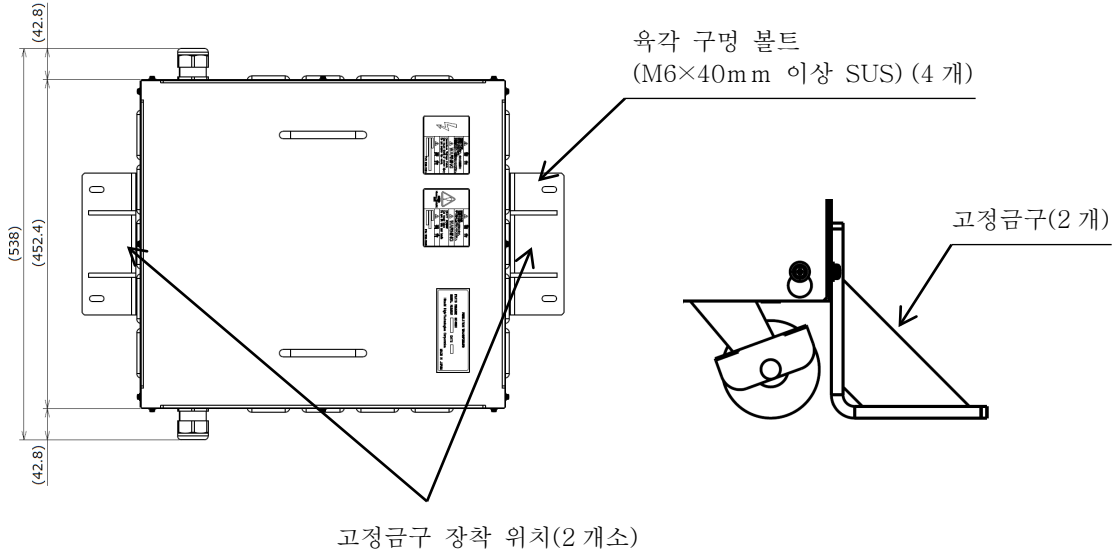
사전에 육각 구멍 볼트(M8×40mm 이상 SUS)(8 개)를 준비해 주십시오.

지진 대책(EO 제어 유닛)(권장 사례)

지진 대책(옵션)(계속)

스텝 다운 트랜스(옵션)

⚠️ 안전을 위한 사용을 위해

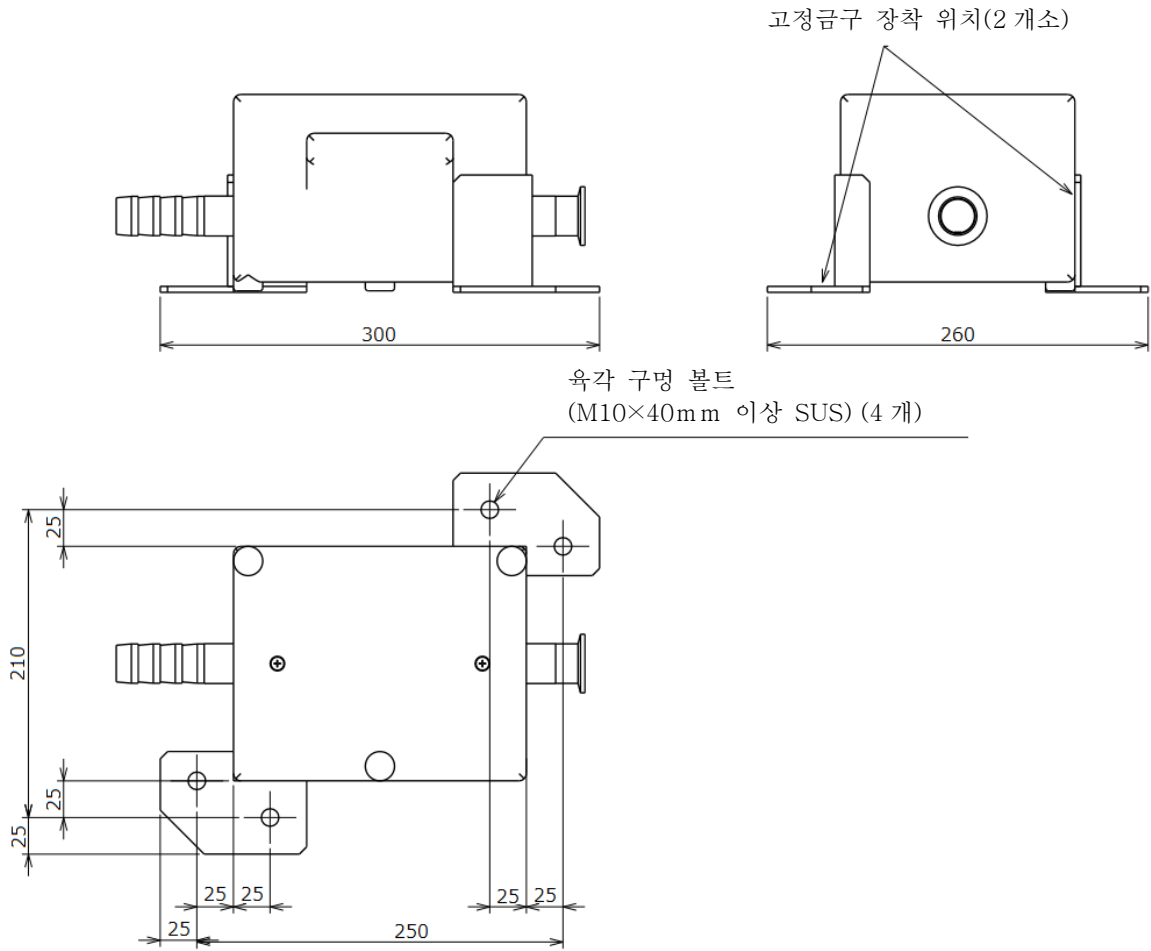


- ※ 본 사양은 계산에 따른 수치입니다.
- ※ 바닥면에 고정금구를 장착하는 볼트는 고객님의 준비하셔야 합니다.
사전에 육각 구멍 볼트(M6×40mm 이상 SUS)(4 개)를 준비해 주십시오.

지진 대책(스텝 다운 트랜스)(권장 사례)

지진 대책(옵션)(계속)

웨이트



- ※ 본 사양은 계산에 따른 수치입니다.
- ※ 바닥면에 고정금구를 장착하는 볼트는 고객님의 준비하셔야 합니다.
사전에 육각 구멍 볼트(M10×40mm 이상 SUS)(4 개)를 준비해 주십시오.

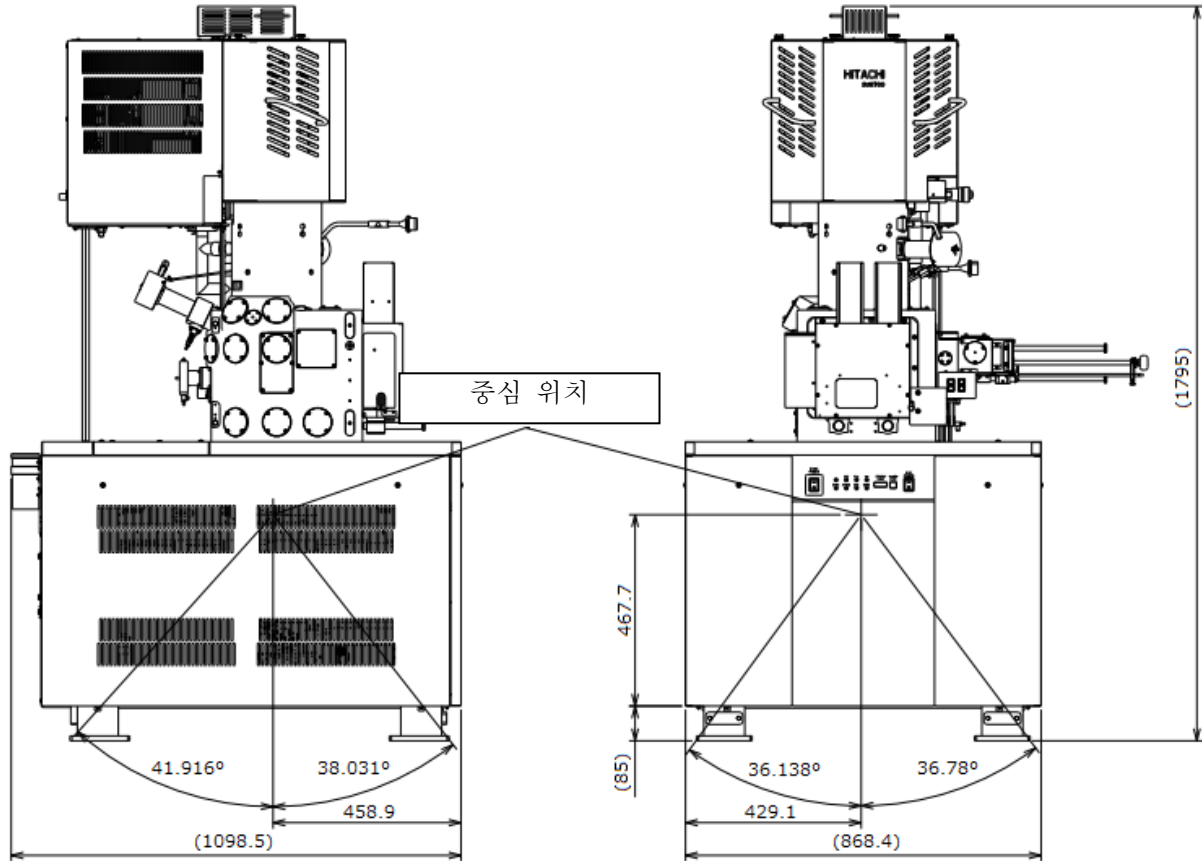
지진 대책(웨이트)(권장 사례)

▲ 안전한 사용을 위해

각 유닛의 중심 위치

장치 본체

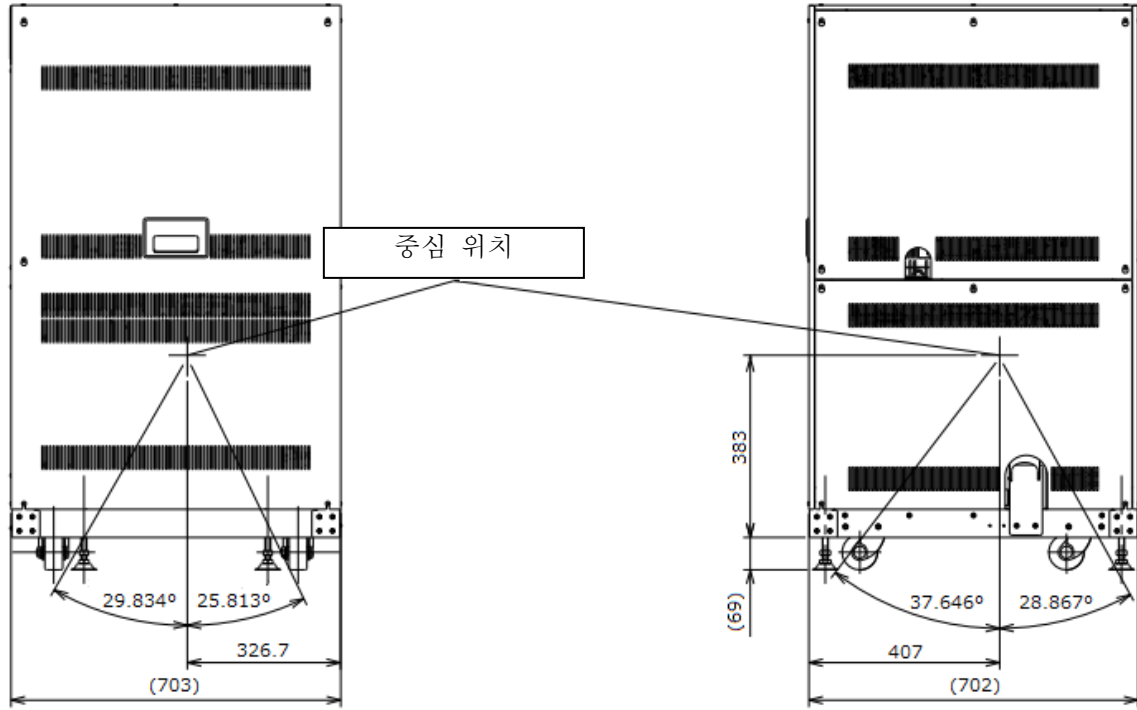
▲ 안전한 사용을 위해



※ 본 사양은 계산에 따른 수치입니다.

각 유닛의 중심 위치(계속)

EO 제어 유닛



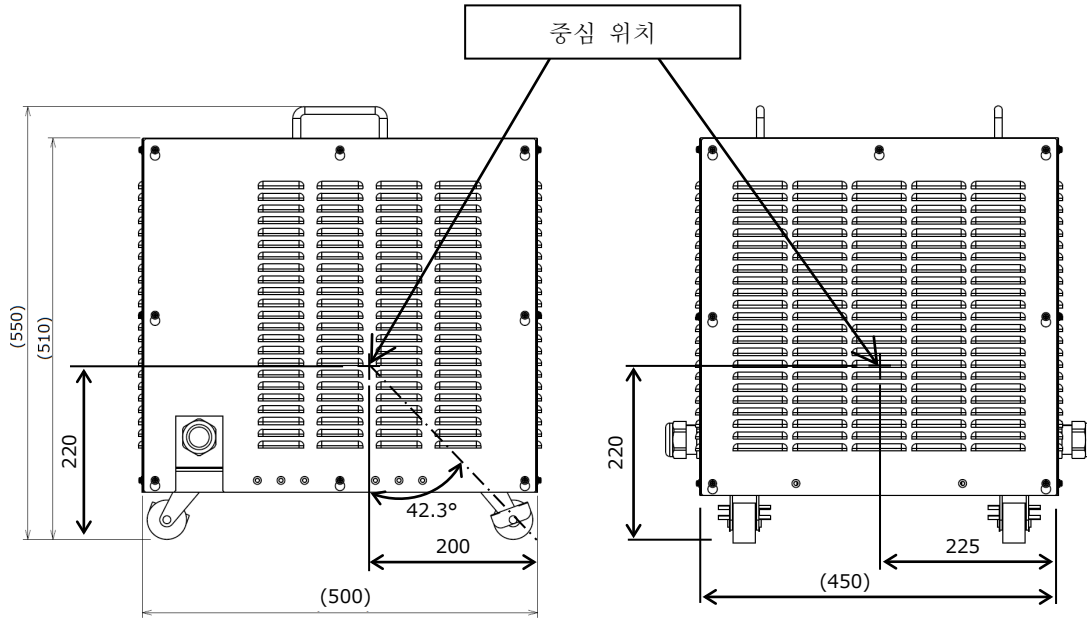
※ 본 사양은 계산에 따른 수치입니다.

▲ 안전한 사용을 위해

각 유닛의 중심 위치(계속)

스텝 다운 트랜스(옵션)

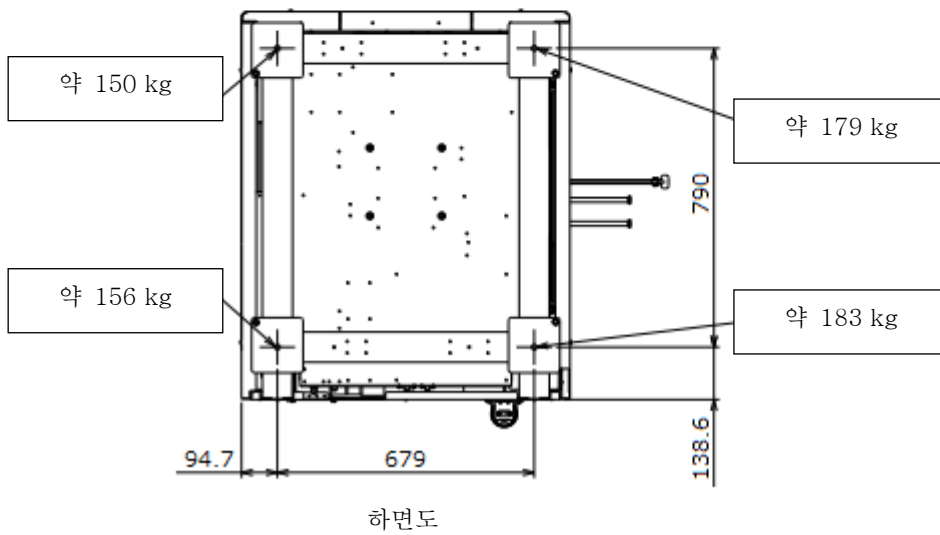
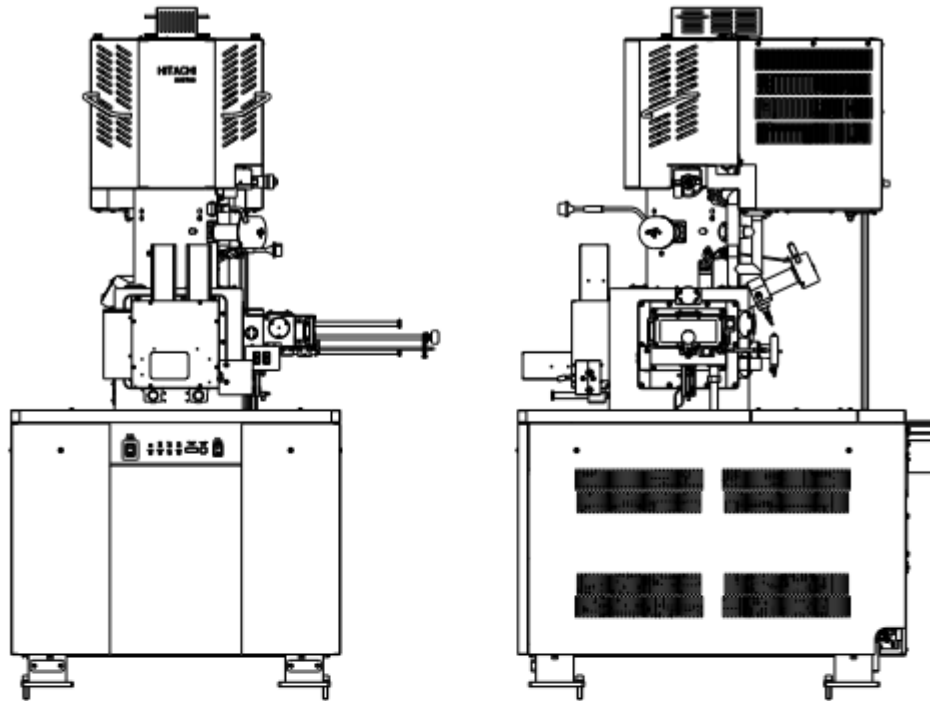
▲ 안전을 위한 사용을 위해



※ 본 사양은 계산에 따른 수치입니다.

중량 배분

장치 본체



※ 본 사양은 계산에 따른 수치입니다.

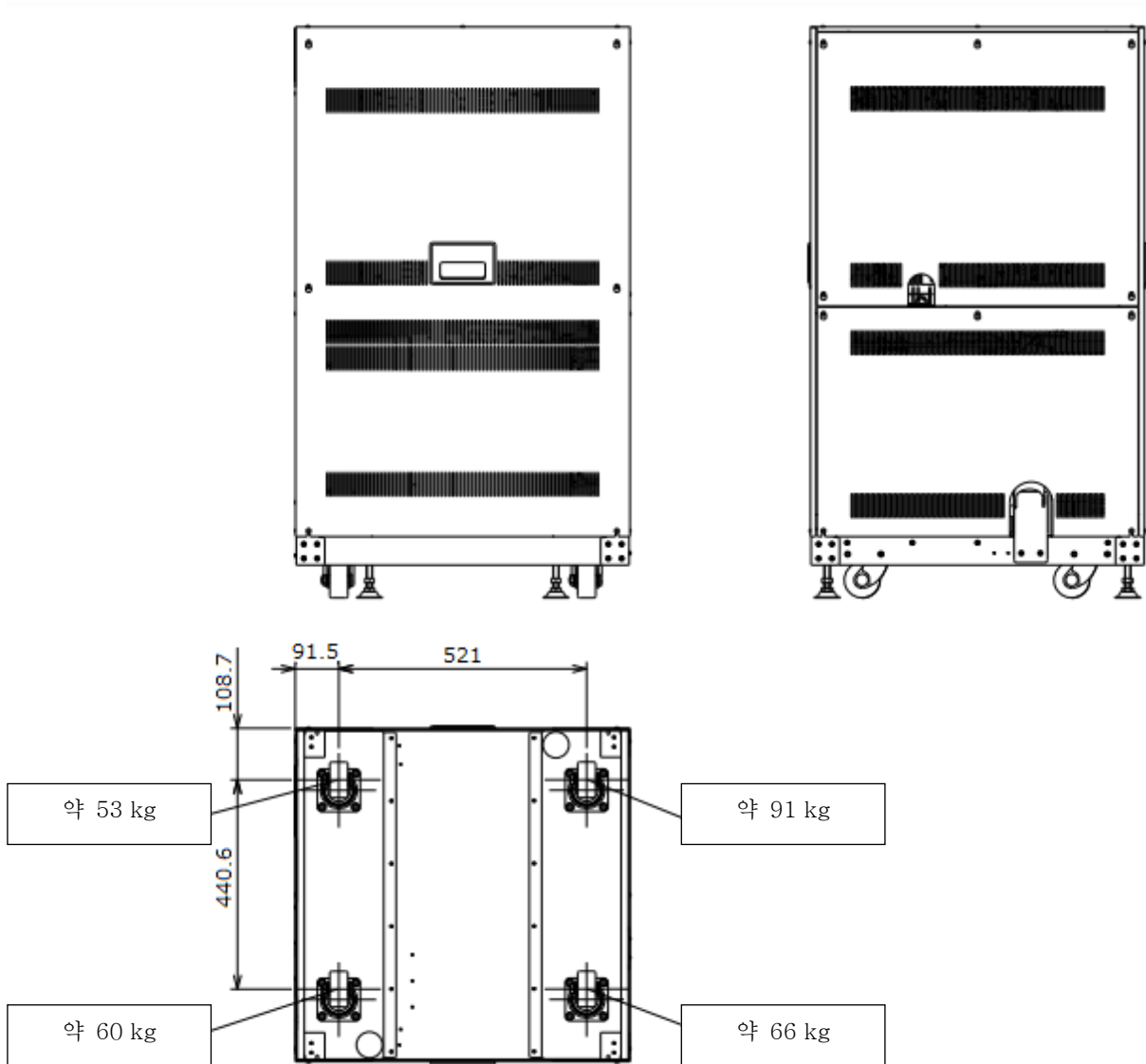
장치 본체 다리 부분의 중량 배분

▲ 안전한 사용을 위해

중량 배분(계속)

EO 제어 유닛

⚠ 안전환 사용을 위해



하면도

※본 사양은 계산에 따른 수치입니다.

EO 제어 유닛 다리 부분의 중량 배분

그 외의 주의 사항

주의

● 정전에 대하여

정전이나 낙뢰 등에 따른 전원의 순간 전압 저하로 장치에 사용되고 있는 PC 가 고장나거나 OS, 애플리케이션 소프트웨어, 데이터가 파손될 가능성이 있습니다. 전원의 순간 전압 저하 대책으로서는 교류 무정전 전원장치 등의 사용을 권장합니다.

● 전원에 대하여

SU8700 에 공급하는 전원이 단상 AC100V, 4kVA, 50/60Hz(강압 변압기가 설치되지 않았을 경우) 또는 AC115/120/200/208/220/230/240V, 4kVA, 50/60Hz(강압 변압기가 설치된 경우)인 것을 확인해 주십시오. 아울러 전원은 연속 통전으로 해 주십시오.

접지는 접지 저항이 100Ω 이하의 접지 단자를 사용해 주십시오.

또한 접지 단자는 다른 전력기기와 공동으로 사용하지 마십시오. 대지에 대해 단독 접지로 해 주십시오.

● 누수 검출에 대하여

표준 장치에는 누수 검출기가 부착되어 있지 않습니다. 냉각수 수질이나 압력 변화 등에 의한 유로계의 부식이나 균열 등으로 누수가 발생하는 경우가 있습니다. 냉수 순환 장치 등의 사용이 불가능한 경우에는 반드시 급수 키트를 구입하신 후에 설치해 주십시오.

급수 키트에는 감압 정류량 밸브 외에 만일의 경우에 대비한 누수 센서가 있어 대량의 누수를 막을 수 있게 됩니다.

SEMI-S2 옵션 장치에는 누수 검출기가 부착되어 있습니다. SEMI-S2 옵션 장치의 누수 검출기에 에러가 발생했을 경우는 아래 사항에 주의해 주십시오.

누수가 검출된 경우는 냉각수 공급이 정지됩니다.

감전 위험이 있으므로 장치에는 접근하지 말고 당사가 정한 서비스 엔지니어에게 연락해 주십시오.

가능하다면 냉각수 급수구의 메인 밸브를 잠가 주십시오.

그 외의 주의 사항(계속)

주의

● 냉각수에 대하여

- 냉각수는 잔류 염소 농도가 낮은(0.5ppm 이하) 물을 사용해 주십시오.
잔류 염소 농도가 높으면 유로 계통에 부식을 유발해 누수의 원인이 됩니다. 또한 온도 관리가 가능한 냉수 순환 장치의 사용을 권장합니다.
- 냉각수의 수량은 약 2L/min 가 1 계통 필요합니다.
- 냉각수의 정격 공급 압력은 50k~100kPa 입니다.
- 냉각수 공급구와 호스 연결부는 빠지지 않도록 관용 테이퍼 나사(Rc3/8)로 조이십시오.
- 배수구에서의 호스는 배수구에 연결함과 동시에 호스가 배수구에서 빠져 날아가지 않도록 확실하게 고정시켜 주십시오. 고정된 부분이 빠지면 침수될 우려가 있습니다.
- 사용 후에는 냉각수 공급구의 메인 밸브를 반드시 닫아 주십시오.
- 급배수 호스의 재질은 연질 염화비닐입니다. 장기간 사용하면 호스가 경화되어 탄력이 약해지므로, 정기적으로 교환함과 동시에 사용 전에 누수 체크를 해 주십시오.
- 겨울철에 냉각수 동결 우려가 있을 경우에는 부동액으로 냉수 순환 장치 등을 사용해 주십시오.
- 냉각수의 온도는 실온에 비해 7°C 이상 낮아지지 않도록 설정하여 관리해 주십시오.
냉각수의 온도가 실온에 비해 7°C 이상의 온도차가 되면 냉각수로 계통이 결로합니다. 이러한 상태로 장시간 사용하면 냉각되어 있는 대물렌즈 자로 등의 중요 부품이 녹슬고, 경우에 따라서는 대물렌즈부 전체의 교환이 필요한 고장이 발생할 수 있습니다.

● 컴퓨터 소프트웨어의 설치에 대하여

본 장치에 사용되는 PC 에 당사가 공급하지 않은 소프트웨어를 설치하여 본 장치가 정상적으로 동작하지 않게 된 경우는 제품 보증의 대상이 되지 않습니다. 그 경우 당사 제품의 보증 기간 내라 하더라도 본 장치의 시스템 복구 작업은 유상으로 해 드립니다. 소프트웨어를 설치할 경우는 OS 의 “시스템 복원”이나 “백업과 복원” 등의 기능을 이용하여 설치 전의 상태로 되돌릴 수 있는 조치를 취해 주시기 바랍니다.

● 퍼스널 컴퓨터(PC)에 대하여

애플리케이션 소프트웨어나 PC 를 강제 종료하면 저장되어 있지 않은 데이터는 모두 없어집니다. 조작 가능한 애플리케이션 소프트웨어가 있을 때에는 반드시 애플리케이션 소프트웨어를 통상적으로 종료한 후에 PC 를 강제 종료해 주십시오.

그 외의 주의 사항(계속)

주의

● 장치 본체와 PC의 이더넷 연결에 대하여

장치 본체와 제어용 PC는 이더넷으로 연결되어 있으며, PC 온보드의 네트워크 컨트롤러(RJ-45-J 인터페이스) 1 포트를 전용으로 사용합니다. 장치 사용 중에는 항상 장치와 PC 간에 통신을 실시하고 있습니다. 올바르게 네트워크 연결을 하지 않았을 경우, 통신 속도가 저하되거나 통신이 중단되어 본 장치가 정상적으로 동작하지 않게 됩니다. 장치 본체와 PC의 이더넷 연결에 대해서는 아래 사항을 주의해 주십시오.

- 장치 본체와 제어용 PC의 이더넷은 반드시 1 대 1 연결(장치와 PC를 직접 네트워크 케이블로 연결)해 주십시오. 허브 등과 같은 다른 네트워크 기기를 중계하여 연결하지 마십시오.
- 네트워크 케이블은 카테고리 5(Cat 5) 이상 규격에 준거한 케이블을 사용해 주십시오.
- 사내 네트워크 등과 같은 로컬 영역 연결(LAN 연결)을 하는 경우는 PC에 네트워크 컨트롤러를 추가하여 본 장치 연결용 포트와 LAN 연결용 포트는 따로 되도록 해 주십시오.

본 장치와 제어용 PC의 연결에 사용하는 네트워크 컨트롤러는 PC 온보드의 포트를 사용해 주십시오.

PC에 추가한 네트워크 컨트롤러를 사용했을 경우, 통신 속도가 저하되거나 통신이 중단되는 증상이 발생할 수 있습니다. 특히 USB 포트에서 네트워크 포트로 변환하는 어댑터를 사용했을 경우에는 통신 속도가 저하되거나 통신이 중단되는 증상이 발생합니다.

그 외의 주의 사항(계속)

주의

● 네트워크 연결에 대하여

PC 에는 네트워크 연결을 위한 이더넷 포트가 갖추어져 있습니다. 이더넷을 이용한 네트워크 연결을 실시할 경우에는, 네트워크 환경에 대해 충분한 지식이 필요합니다. 네트워크 관리자와 상담한 후에 연결 작업을 실시해 주십시오.

- 이더넷 포트와의 케이블 연결은 설치자 또는 당사가 정한 서비스 회사가 실시합니다. 담당 영업사원 또는 당사가 정한 서비스 회사에 상담해 주십시오.
- PC 를 네트워크에 연결할 때는 컴퓨터 바이러스 대책을 반드시 실시해 주십시오. 자세한 내용은 본 장의 ‘컴퓨터 바이러스에 대하여’를 참조해 주십시오.
- 이더넷 케이블은 부속되어 있지 않으므로 적절한 케이블을 준비해 주십시오.
- 네트워크 연결을 위한 PC 설정 변경은 주의 깊게 실시해 주십시오. 본 장치의 동작에 필요한 설정을 변경해 버리면 본 장치의 시스템이 정상적으로 동작하지 않게 되는 경우가 있습니다.
- 네트워크 연결을 위해 특별한 소프트웨어를 설치하지 마십시오. 장치에 악영향을 미치거나 본 장치의 시스템이 정상적으로 동작하지 않게 되는 경우가 있습니다.
- 특수한 네트워크에 연결할 경우나 네트워크로의 연결 작업을 의뢰하실 경우에는 담당 영업사원 또는 당사가 정한 서비스 회사에 상담해 주십시오.
- 옵션으로 제공되는 외부 통신 인터페이스를 사용하여 EDS 등의 외부 장치와 연결하는 경우에는 이더넷 포트를 사용하므로 외부 장치 이외에 연결하는 경우에는 분기를 위한 허브를 준비해 주십시오. 외부 장치에 따라서는 허브를 표준적으로 갖추고 있는 것도 있으므로 담당 영업사원에게 확인해 주십시오.
- Microsoft-TCP/IP 프로토콜을 사용한 네트워크 연결을 실시할 경우에는 IP 주소가 필요하게 되므로 네트워크 관리자에게 상담한 후 준비해 주십시오. EDS 등과 같은 외부 장치를 연결할 경우에는 외부 장치용으로 또 하나의 IP 주소가 필요합니다.

● PC 의 프리징 현상에 대하여

어떠한 이유로 PC 가 프리징 상태(마우스, 키보드에 의한 입력 조작이 불가능해진 상태)가 되었을 경우는 키보드의 [Ctrl], [Alt] 및 [Delete] 키를 동시에 누르고 대화창에 따라 강제 종료시켜 주십시오(소프트웨어 리셋).

그 후 Windows 를 정상적으로 종료시키고 PC 의 전원을 끈 후에 다시 기동시켜 주십시오. 아울러 이 상태가 발생했을 경우는 그 시점의 데이터는 없어집니다. 소프트웨어 리셋 조작을 해도 PC 를 다시 기동할 수 없는 경우는, 하드디스크의 액세스 램프가 꺼져 있는 것을 확인하고, 전원 버튼을 길게 눌러 강제로 전원을 꺼 주십시오. 하드디스크가 움직이고 있는 동안에 전원이 차단되었을 경우, 하드디스크가 파손되어 PC 기동이 불가능해질 우려가 있으므로 충분히 주의하시기 바랍니다.

그 외의 주의 사항(계속)

주의

● 컴퓨터 바이러스에 대하여

프로그램이나 데이터가 갑자기 고장나거나 손상을 입는 등 예상치 않은 동작이나 화면이 표시될 경우에는 PC 가 컴퓨터 바이러스에 감염되었을 가능성이 있습니다. 컴퓨터 바이러스란 PC 에 몰래 숨어들어 PC 를 자의적으로 조작하거나 데이터를 손상시키는 악성 프로그램을 말합니다. 그리고 컴퓨터 바이러스를 검출/제거하는 프로그램을 바이러스 대책 소프트웨어라 합니다.

컴퓨터 바이러스가 들어 있는 프로그램을 통신으로 다운로드하거나 컴퓨터 바이러스가 들어 있는 USB 메모리 등과 같은 교환 가능한 기억 매체를 사용하면 컴퓨터 바이러스에 감염될 수 있습니다. 또한 컴퓨터 바이러스에 감염된 PC 로부터 통신이나 기억 매체를 경유하여 다른 PC 에도 컴퓨터 바이러스가 감염되는 경우가 있습니다. 컴퓨터 바이러스가 들어 있을 우려가 있는 프로그램이나 기억 매체는 사용하지 마십시오.

컴퓨터 바이러스 감염 우려가 있을 경우는 바이러스 대책 소프트웨어로 체크해 주십시오. 단, 바이러스 대책 소프트웨어의 종류에 따라서는 컴퓨터 바이러스를 제거할 수 없는 경우가 있습니다. 이러한 경우에 대비해 사전에 하드디스크의 백업을 해 두실 것을 권장합니다. 또한 바이러스 대책 소프트웨어의 준비 및 컴퓨터 바이러스의 제거는 고객님의 직접 실시해 주십시오.

● 데이터 백업에 대하여

장치의 고장이나 잘못된 조작 등으로 PC 나 하드디스크(HD) 내의 데이터가 파손될 우려가 있습니다. 이미지 데이터 등과 같은 중요한 데이터는 CD 또는 DVD 이나 외장형 하드디스크 등에 정기적으로 백업을 작성하도록 유의해 주십시오.

● Windows 의 갱신 프로그램에 대하여

Windows 에는 보안이나 신뢰성을 향상시키기 위한 갱신 프로그램이 있으며, Microsoft 사로부터 정기적으로 공개됩니다. PC 를 네트워크에 연결했을 경우 갱신 프로그램을 적용하여 최신 상태로 유지할 것을 권장합니다.

단, 드물기는 하지만 그 갱신 프로그램 자체나 그 갱신 프로그램의 적용 실패가 원인이 되어 동작이 불안정하게 되는 경우가 있습니다. 그러한 경우에는 적용된 갱신 프로그램을 삭제해 주십시오. 또한 만일에 대비하여 이미지 데이터 등과 같은 중요한 데이터는 정기적으로 백업을 작성하도록 유의해 주십시오.

(For Korea only)
(한국대상)

Information about the attached chemical substances 부속화학물질에 관한 정보

The attached chemical substances listed below do not correspond to the standard of classification of the harmful factor under the laws of Korea.

첨부된 아래의 리스트의 화학물질은 산업안전보건법 시행 규칙 별표 11의 2 제1호에 따라 유해인자의 분류기준에 해당하지 않습니다.

Table Chemical substances for SEM/TEM/STEM/FIB, etc.

SEM/TEM/STEM/FIB, etc. 용 화학물질

No.	Part No.	Product Name 품명	Notes 비고	Attached Presence 첨부 유무
1	539-2132	Vacuum Grease (Electron Grease)	시료교환실 (옵션) 장착시출하 시 부속품	Yes / <input checked="" type="radio"/> No 유 / 무
2	585-4267	Fomblin YVAC3 Grease		Yes / <input checked="" type="radio"/> No 유 / 무
3	G465016	Fomblin YVAC3 Grease		Yes / <input checked="" type="radio"/> No 유 / 무
4	876-1897	Barrierta Super IS/V		Yes / <input checked="" type="radio"/> No 유 / 무
5	01E-4385	Demnum S-65		Yes / <input checked="" type="radio"/> No 유 / 무
6	420-1255	Oil Compound KS-64		Yes / <input checked="" type="radio"/> No 유 / 무
7	754-4603	Silicon Oil SH 200		Yes / <input checked="" type="radio"/> No 유 / 무
8	872-0165	Apiezon Grease		Yes / <input checked="" type="radio"/> No 유 / 무
9	G465003	Apiezon Grease		Yes / <input checked="" type="radio"/> No 유 / 무
10	01E-5707	FD-20		Yes / <input checked="" type="radio"/> No 유 / 무
11	G465055	KDL Grease		Yes / <input checked="" type="radio"/> No 유 / 무
12	876-1586	Barrierta Oil		Yes / <input checked="" type="radio"/> No 유 / 무


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1. Specification and installation requirements

1.1 Specifications

1.1.1 Resolution

0.6 nm (15 kV accelerating voltage, $WD^* = 3$ mm, Photo magnification x 220,000)

0.8 nm (1 kV accelerating voltage, $WD^* = 1.5$ mm, Photo magnification x 180,000)

0.9 nm (0.3 kV accelerating voltage, $WD^* = 1.5$ mm, Photo magnification x 180,000)

The resolution shall be measured on a resolution measurement specimen (Gold particle on carbon).

* WD (Working Distance)

1.1.2 Magnification

Magnification: x20 to x2,000,000 (Photo magnification)

NOTE: The magnification range is varied depending on WD and accelerating voltage.
The magnification is stipulated to 127 mm x 95 mm of display size (Photo magnification) .

1.1.3 Electron optics system

- (1) Electron gun: ZrO/W Schottkey emission electron gun
- (2) Extracting voltage (Vext): 1.50 to 3.00 kV (0.01 kV steps)
- (3) Accelerating voltage (Vacc): 0.10 to 30.00 kV (0.01 kV steps) Vb: On
1.00 to 30.00 kV (0.01 kV steps) Vb: Off
- (4) Suppressor (Vs): 400 to 700 V
- (5) Lens system: 3-stage electromagnetic lens and static objective lens reduction method
- (6) Objective movable aperture: Objective movable aperture
(Four opening apertures are available from outer side of vacuum and fine adjustment is possible)
- (7) Astigmatism correction coil: Electromagnetic eight-pole method (X, Y)
- (8) Scanning coil: Two stage electromagnetic deflection method
- (9) Detectors: Scintillator/Photo multiplier detector
Upper detector (In-column SE detector)
Lower detector (Chamber SE/BSE detectors)
- (10) Beam blanking: Electromagnetic type
(While image is in the freeze condition)
- (11) Electrical image shift (Image shift): Maximum $60 \pm 6 \mu\text{m}$ (WD = 6 mm)

NOTE: The amount of image shift is varied depending on WD.

1.1.4 Specimen stage

- (1) Drive method: 5-axis motor drive
 - (2) Movable range: X-axis 0 to 110 mm
Y-axis 0 to 110 mm
Z-axis (WD) 1.5 to 40 mm
R-axis (Rotation) 360° continuous
T-axis (Tilt) -5° to 70°
 - (3) Maximum specimen size: 150 mm diameter
 - (4) Maximum specimen height: 36 mm (Including the specimen holder and specimen stub)
 - (5) Specimen weight: 300 g (Including the specimen holder and specimen stub)
 - (6) Specimen exchange: Air lock method
 - (7) Control: Control via GUI
SEM MAP function
Position memory function
Eucentric rotation function
Eucentric tilt function [Specimen height: 36 mm *Including the specimen holder]
Rotation assist function
-

1.1.5 Image display

- (1) Display method
Display the image on the PC
- (2) Monitor for observing
23 inch or equivalent size of LCD
(Display pixels: 1,920 x 1,080)
- (3) Image display mode
Large display mode: 1,280 x 960 pixels
1 display mode: 800 x 600 pixels
2 display mode: 800 x 600 pixels
4 display mode: 640 x 480 pixels
6 display mode: 640 x 480 pixels (2 monitors)
2 display mode: 1280 x 960 pixels (2 monitors)
Reduced area display mode for adjusting (Size can be changed)
- (4) Scan mode
Two dimensional pixel image display mode
Rapid scan (Rapid 1 to Rapid 2 2 types)
Fast scan (Fast 1 to Fast 2 2 types)
Slow scan (Slow 1 to Slow 7 7 types)
CS scan (charge suppression) (CSS 1 to CSS 7 7 types)
Custom scan (Dwell time: 50 Hz: 100 ms to 2 ms, 60 Hz: 80 ms to 1.6 ms)
Reduce scan (High, Medium, Slow 3 types)
Wide scan (High, Slow 2 types)
Beam marking mode
- (5) Auto adjustment functions
Auto Brightness & Contrast Control (ABCC)
Auto Focus Control (AFC)
Auto Stigmator Correction (ASC)
Auto Beam Alignment (ABA)
Auto Aperture alignment (AAA)
Auto Stigmator Alignment (ASA)
- (6) Signal/image processing functions
S/N ratio improvement through frame averaging
S/N ratio improvement by pixel integration
Display the mixed signal image (Three signals at maximum)
- (7) Image data saving
Size of saving image: 640 × 480, 1,280 × 960, 2,560 × 1,920, 5,120 × 3,840,
10,240×7,680^{*1}, 20,480×15,360^{*1*2}, 40,960×30,720^{*1*2}
*1 High resolution capture function
*2 Option

- (8) Auto data display
Comment, auto increment No., Accelerating voltage, WD value, detector name, magnification, FOV, date, time, micron marker, micron value display, vacuum status (when variable pressure unit option is equipped)
- (9) Data input
Enable to input the text, numbers, and marks to the image by the keyboard.
In addition, diagrams (circle, rectangle, arrow line) can be input to the image.

1.1.6 Vacuum system

- (1) Method
Fully automatic pneumatic-valve system
- (2) Vacuum status (Vacuum status which can apply electron beam)
 - Electron gun chamber 6.8×10^{-7} Pa or less (IP1)
 1.0×10^{-4} Pa or less (IP2)
 - Specimen chamber 3.0×10^{-2} Pa or less
- (3) Vacuum pump
 - Electron optics system Ion pump 2 units
 - Specimen chamber Turbo molecular pump 1 unit
 - Dry pump 1 unit (Option for Japan domestic only)
- (4) Compressor 1 unit (Option for Japan domestic only)

NOTE: Please note that only the compressor which pressure range is 0.6 to 0.8 MPa can be used.

- (5) Vacuum gauge
 - Full range gauge 1 unit
 - Pirani vacuum gauge 2 units

1.1.7 Protections

Protections for power interruption, water outage, electric leakage and decreasing the vacuum condition are equipped.

1.1.8 Size and weight

Size and weight	(Width)	× (Depth)	× (Height)	(Mass)
Main unit	1130 (W)	×1100 (D)	× 1800 (H)	: About 670 kg
EO control unit	710 (W)	×710 (D)	× 1210 (H)	: About 270 kg
Weight	200 (W)	×160 (D)	× 140 (H)	: About 25 kg
Recommended operating table	1200 (W)	×750 (D)	× 720 (H)	: 32 kg
Recommended dry pump	210 (W)	× 385 (D)	× 250 (H)	: 23 kg
Recommended air compressor	415 (W)	× 210 (D)	× 514 (H)	: 17 kg
Cooling water circulator	377 (W)	× 500 (D)	× 620 (H)	: 45 kg (When the water tank is empty)

(Unit: mm)

* The product tolerance shall be $\pm 10\%$ on the above.

1.2 Installation requirement

1.2.1 General

The sites and conditions mentioned below must be avoided.

- (1) Room located in the vicinity of transformer substation
- (2) Room located in the vicinity of elevator
- (3) Location near electric equipment consuming high power (e.g., electric furnace) or its power supply
- (4) Location near spark discharge or high-frequency apparatus
- (5) Room filled with gas which corrodes metals
- (6) Place exposed to direct sunlight or strong draft
- (7) Dusty place
- (8) Location subjected to severe vibrations
- (9) Using ground wire in common with other electric equipment
- (10) Location adjacent to radio or sound wave source
- (11) Location near railway
- (12) Windy place

1.2.2 Room temperature, humidity, altitude, contamination level and overvoltage category

- (1) Room temperature 15 °C to 25 °C (Temperature fluctuation 0.5 °C/10 min)
Temperature fluctuation should be 2.0 °C or less during operation of the instrument.
- (2) Humidity 60 % or less
The instrument should be operated in an air-conditioned room (Without condensation).
- (3) Altitude 2000 m or less
- (4) Contamination level 2
- (5) Overvoltage category II

NOTE: ● Only gradual temperature changes are allowed. Sudden fluctuations are not tolerated. Especially for the high-magnification observation, choose an environment that is not subject to extensive temperature change.

- In case wind such as the air conditioning directly hits an instrument, image disturbance due to temperature change can be occurred. Avoid the airflow when capturing a high resolution SEM image.
- When installing the instrument at the high altitude location, contact to our service representative of Hitachi High-Tech Corporation.

1.2.3 Power supply

- (1) Single phase AC 100 V, 4 kVA, 50/60 Hz (For the main unit)

The power supply shall be continuously on. The fluctuation of voltage up to $\pm 10\%$ is acceptable.

Separate power supply for cooling water circulator are required.

NOTE: Only power supply voltage change that is time-wise gradual is tolerated; sudden fluctuations must be avoided.

- (2) The maximum distance from the EO Control unit to the switchboard on the wall is 10 m (The length of the input AC cable is 10 m).
- (3) The tip of connector for the AC cable is M6 crimp terminal.
- (4) Make sure to provide an exclusive open and close device (The device shall be installed into the switchboard by customer).
- (5) In case of using the power supply voltage other than AC 100 V, a step down transformer is required.


NOTE:

- Installation of the step down transformer shall be carried out by service engineers trained and certified by Hitachi High-Tech Corporation only. It is not permitted for the customer to carry out the installation.
- Use of UPS: It is not recommended to use of UPS to the instrument and device which is connected to the instrument.
Melting damage due to increased inrush current or image noise caused of inverter circuit can be occurred depends on a UPS. In addition, Hitachi High-Tech Corporation does not warrant the malfunctions or failure on the instrument caused of connecting a UPS.

1.2.4 Ground terminal

Make sure to connect the grounding wire. The grounding wire must be connected to the ground in a condition with a maximum grounding resistance of $100\ \Omega$. Any grounding terminal used should not be shared with other pieces of electrical equipment and should be grounded on an exclusive basis.

NOTE: To share the ground terminal can potentially cause image distortion and system malfunction.

 **WARNING:** Insufficient grounding of the instrument can cause not only incorrect operation but also lead to electric shock. Do not touch the grounding wire. The grounding wire to the instrument shall be carried out by a service engineer of Hitachi High-Tech Corporation.

1.2.5 Compressed air

When using compressed air supplied within the facility instead of using an air compressor, set the pressure range within 0.6 to 0.8 MPa (Gauge). Any entrained water or oil may lead to erosion of an electromagnetic solenoid valve or an air valve. Please equip an appropriate filter.

1.2.6 Water supply and drain

The following water supply conditions should be satisfied.

Water flow rate: 0.45 to 1.05 L/min

Water pressure: 50 to 100 kPa

Water temperature: 10 to 20 °C (temperature variation: 0.5 °C or less/10 min)

It is recommended to use the water which is low residual chlorine level (0.5 ppm or less) for the circulating thermostatic chamber. When using city water, use the water which is low residual chlorine level (0.5 ppm or less) and natural drainage. If an appreciable amount of deposit is found, attach a proper water filter. The drain port should be located at the floor level, and water pressure must be free from pulsation in a short cycle.

The temperature of cooling water must be maintained so that it is not more than 7°C below the room temperature. Condensation will form in the cooling water paths when the difference between the temperatures is 7°C or more. If the instrument is used for a long time under the condition where condensation forms, important parts including the objective lens magnetic path may be rusted and eventually damaged, in which case the objective lens unit must be replaced with a new one.

Water supply port: One, with tapered female thread for tube (Rc 3/8)

Consult with us if water contains considerable dust or impurities.

Water drain port: One, with tapered female thread for tube (Rc 3/8)

1.2.7 Stray magnetic field

Measure the stray magnetic field at the place for installing the instrument in advance. When the requirements given in Table 1-2-1 are satisfied, no image trouble will occur.

Avoid locations at which abrupt electric current change or magnetic field change might occur due to the presence of a large-sized magnetic clutch or power cable for other equipment.

Table 1-2-1 Allowable stray magnetic field

	Warrantied resolution condition	Frequency component synchronous with power supply AC Magnetic field (Effective value)	Frequency component asynchronous with power supply DC magnetic field fluctuation	Temporal change (Drift)
Allowable value	Accelerating voltage: 15 kV Vb: Auto WD: 3.0 mm Magnification [Photo magnification mode]: 220,000x Probe current mode: Normal Spot intensity: 15 Objective aperture: No.4	150 nT (horizontal) 240 nT (vertical)	170 nT (horizontal) 270 nT (vertical)	200 nT/min (horizontal) 490 nT/min (vertical)
	Accelerating voltage: 1 kV Vb: Auto WD: 1.5 mm Magnification [Photo magnification mode]: 180,000x Probe current mode: Normal Spot intensity: 1 Objective aperture: No.4	80 nT (horizontal) 120 nT (vertical)	90 nT (horizontal) 135 nT (vertical)	300 nT/min (horizontal) 500 nT/min (vertical)
	Accelerating voltage: 0.3 kV Vb: Auto WD: 1.5 mm Magnification [Photo magnification mode]: 180,000x Probe current mode: Normal Spot intensity: 30 Objective aperture: No.4	80 nT (horizontal) 120 nT (vertical)	90 nT (horizontal) 135 nT (vertical)	300 nT/min (horizontal) 500 nT/min (vertical)

nT [Nanotesla]

- NOTE:
- The frequency component synchronous with power supply (AC magnetic field) is an effective value. Therefore, its allowable value should be multiplied by 2.8 for evaluation in terms of p-p (peak-to-peak) value.
 - The DC magnetic field fluctuation stands for a rapid change in stray magnetic field with time lapse. A gradual and moderate change with time lapse is handled as a temporal change (draft). Allowable DC magnetic field is the value when the wave of image due to stray magnetic field is 0.5 mm under the specified condition (Capture time: 40 seconds).
 - The allowable AC magnetic field is the value at the prescribed image disturbance (expansion/contraction or bending of image) of 0.5 mm and at the specified magnification.
 - The allowable DC magnetic field variation is the value at the prescribed image disturbance (Image shift or whisker noise) of 0.2 mm and at the specified magnification.
 - The DC component of stray magnetic field without fluctuation does not cause swaying of the electron beam, and will not affect the image if the amount is around several ten μT (several hundred mG).
 - The allowable values in Table 1-2-1 are the ones under the resolution guaranteeing conditions. The lens condition and operation mode which is different from the selected condition are susceptible to stray magnetic field effect. In general, the longer the WD or the lower the accelerating voltage, the more the electron beam is susceptible to stray magnetic field effect.
 - If the allowable values in Table 1-2-1 are exceeded, the stray magnetic field must be reduced by one of the countermeasures below:
 - Try a different installation location
 - Provide a magnetic shielding box
 - Provide an active magnetic field canceler

1.2.8 Vibration

The floor vibration of the installation site should be measured prior to installing the SU8700. When the measured values are satisfied Table 1-2-2, no image trouble will occur.

When the instrument is installed on the location in a reinforced concrete or steel frame building and satisfies the table value, generally effect of vibration will be minimized.

- No vibration source such as large mechanical tools in vicinity
- No vibration source such as public transportation (such as train)
- Installation location is not the first floor

Table 1-2-2 Allowable vibration

Allowable value (X, Y)		Allowable value (Z)	
Frequency	Amplitude	Frequency	Amplitude
1.0 Hz	8.0 μ mp-p or less	1.0 Hz	20 μ mp-p or less
1.5 Hz	3.0 μ mp-p or less	2.0 Hz	10 μ mp-p or less
2.0 Hz	1.4 μ mp-p or less	3.0 Hz	5.0 μ mp-p or less
2.4 Hz	1.4 μ mp-p or less	4.0 Hz	2.7 μ mp-p or less
3.0 Hz	3.0 μ mp-p or less	5.0 Hz	1.8 μ mp-p or less
5.0 Hz	4.0 μ mp-p or less	6.0 Hz	1.0 μ mp-p or less
6.0 Hz	3.5 μ mp-p or less	7.0 Hz	1.0 μ mp-p or less
10.0 Hz	3.5 μ mp-p or less	10.0 Hz	1.0 μ mp-p or less

The allowable amplitude is determined so that image deviation will not exceed 0.2 mm on a micrograph taken at a magnification of x220,000 of photo data (127 x 95 mm).

Figure 1-2-1 shows the relation between the frequency of floor vibration and the vibration transmittance of the instrument. The vibration transmittance is maximum at the resonance point (approximately 1.6 Hz) of the anti-vibration mount incorporated in the instrument. Therefore, the allowable amplitude is minimum at this point.

- NOTE:
- The waveform of the vibration is a sine waveform. If it is other than a sine waveform the frequency components will become concentrated in the dominant frequency.
 - For the ultra-low frequency vibration of less than 1 Hz sufficient vibration dampening cannot be attained with the technology available today.
 - The 1 Hz to 10 Hz area is interpolated with the direct lines that tie the tolerance values.
 - If floor vibration exceeds the allowable value, please consult Hitachi individually (In case of assuming the vibration problems, measure the vibration in advance).
 - The above-mentioned allowable vibration is measured with a 15 mm of specimen size. The larger specimen, the more susceptible to the effect of vibration and the lower the allowable amplitude.

- Please contact Hitachi High-Tech Corporation when assuming the vibration that exceeds the allowable vibration (In case of assuming the vibration problems, measure the vibration prior to installing the instrument).

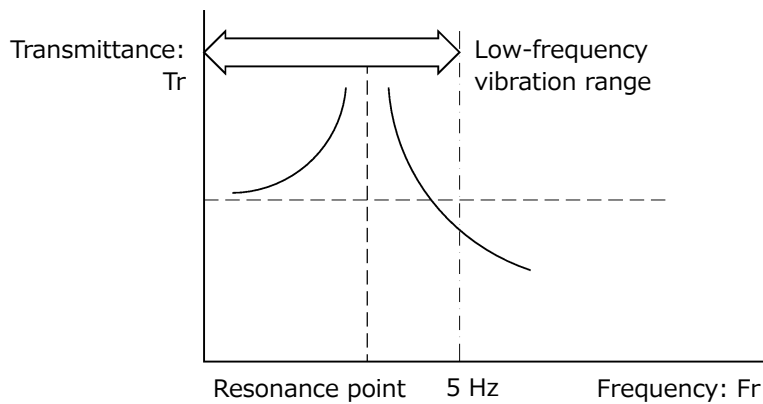


Figure 1-2-1 Frequency of floor vibration and vibration transmittance

1.2.9 Power line noise and electric field noise

Image trouble will occur when such equipment as given in Table 1-2-3 or its power line is installed nearby or, even if distant from the instrument, it is a heavy-duty type. To determine where to install the system, therefore, check for any source of interference noise to prevent such image troubles.

In case equipment energized by power of a frequency different from the commercial frequency employed on the SU8700 or the power line for it is located nearby, scan synchronization with power frequency will become ineffective. Such a location should be avoided.

Table 1-2-3 External Noise Sources

Classification		Noise Source	Source Equipment
Small-sized electric equipment (general/home electrical appliance)	Electric equipment having contacts	Electric discharge (spark, arc)	Flasher (neon sign, ornamental electric bulb), relay, electromagnetic conductor, thermostat (warmer, heater, refrigerator, iron), cash register
	Equipment utilizing commutator motor	Electric discharge (spark, arc) sliding contact	Electric drill, dental engine, motor for sewing machine, vacuum cleaner, electric food mixer, electric shaver, electric massager
	Electric discharge tube	Glow discharge	Neon discharge tube, high-pressure mercury arc lamp
	Controller using semiconductor	Phase controller (transient noise)	Thyristor dimmer, inverter
Equipment using high frequency	High-frequency industrial equipment	Unnecessary radiation*	High-frequency industrial heater, high-frequency electric welder, microwave oven
	High-frequency medical equipment	Unnecessary radiation*	VHF/UHF fulgurators, electric scalpel
	Equipment utilizing ultrasonic wave	Unnecessary radiation*	Flaw detector, depth sounder, fish-finder, ultrasonic cleaner
Power equipment	Power cable (transmission/distribution line)	High voltage, large current	Induction of commercial frequency (electrostatic induction, electromagnetic induction, current leaking in ground)
		Electric discharge (corona, arc)	Corona, poor insulator, poor contact due to corroded metal (arc discharge)
	Electric railroad/train	Electric discharge (spark, arc)	Trolley wire, internal equipment, rectifier
		Reflection	Reflection from car body
Internal combustion engine	Automobile	Electric discharge	Ignition system
		Others	Dynamo, voltage regulator, wiper, horn, indicator
Wireless communication equipment	Large-power transmission equipment	Signal emission*	Broadcasting equipment, radar
		Unnecessary emission	High-frequency transmitter

* Signal that is required in the relevant system but can become a disturbance for other systems.

1.2.10 Disturbance by sound waves

Sound waves (vibrations of air) will adversely affect the instrument regardless of whether their frequency is high or low, causing image trouble. To prevent this, confirm before installation that no sonic disturbance source is located nearby.

If there is any sonic disturbance source in the vicinity of the instrument, then check for noise level. The influence of noise on SEM images differs depending on its frequency. Table 1-2-4 shows the relation between the frequency and allowable sound pressure level (C-characteristic) at the installation site for the instrument.

In general, the sound pressure level decreases as the noise frequency increases, and the noise frequency varies depending on the sonic disturbance source. It is therefore necessary to carry out noise frequency analysis at the installation site to determine the effect of noise (at practical magnification) in each case. In case the noise frequency coincides with the resonance frequency of the instrument, image trouble may occur even when the frequency is the value shown in the Table 1-2-4 or less.

There is a possibility of image disturbance due to sound waves (similar to floor vibration). Noise level should be kept within the values indicated below.

These values were obtained at a magnification of x220,000 and where swaying of image due to sound waves was around 0.2 mm on photo image data (127 x 95 mm).

Table 1-2-4 Allowable sound pressure level (C-characteristic)

Frequency: f (Hz)	Allowable noise level
$f < 140$	72 dB or less
$140 \leq f \leq 800$	60 dB or less
$800 < f \leq 2000$	52 dB or less

1.2.11 Caution on disturbance by electromagnetic wave

Although this instrument does not intentionally produce electromagnetic waves, such waves are slightly emitted from electronic circuitry in the instrument. Equipment that may be adversely affected by electromagnetic noise therefore must not be installed near the instrument. Besides, this instrument may incur image disturbance and malfunction upon receiving external electromagnetic noise. The room in which this instrument has been installed must be controlled so that the following electric apparatus* will not be brought into the room.

* Apparatus that emits radio waves such as specific low-power equipment including cellular phones, transceivers and cordless phones.

The following is a statement of notice about EMC for EU area.

This instrument has suited class A of EN standard EN61326-1 (2013). Do not set up this instrument near the equipment that is influenced data by the electromagnetic radiation noise in this standard allowance value.

The following is a statement of notice about EMC for Korea.

A 급 기기 (산업, 과학용기재)

이 기기는 업무용(A 급)으로 전자파적합등록을 한 기기오니 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

1.2.12 Calorific value

The calorific value of equipment may be required for air-conditioning design of the SEM installation room.

This value can be calculated from the power consumption P [kW] of equipment by the following equation.

$$\text{Calorific value [kcal/h]} = 0.24 \times P \times 3600$$

The SU8700 has the following power consumption and calorific value.

Power consumption: 1.6 [kW]

Calorific value: 1,390 [kcal/h]

- NOTE:
- The above calorific value ignores the calorie (quantity of heat) released out of the room through cooling water and corresponds to the maximum power consumption (at the time of baking). Therefore, the actual calorific value is smaller.
 - When installing a device such as EDS, calculate the calorific value with the above formula and add the value.

1.2.13 Site requirement

(1) Space required

A room of about 3.9 × 3.5 m is required.

(2) Dimensions of entrance

1.2 (W) × 1.8 (H) m or more

(3) Durability of floor

$$\frac{\text{Floor strength (N/m}^2\text{)}}{3} \geq \frac{\text{Quantity of all facilities (kg)} \times 9.8}{\text{floor area (m}^2\text{)}}$$

(4) Others

See Figure 1-2-2 for the system layout.

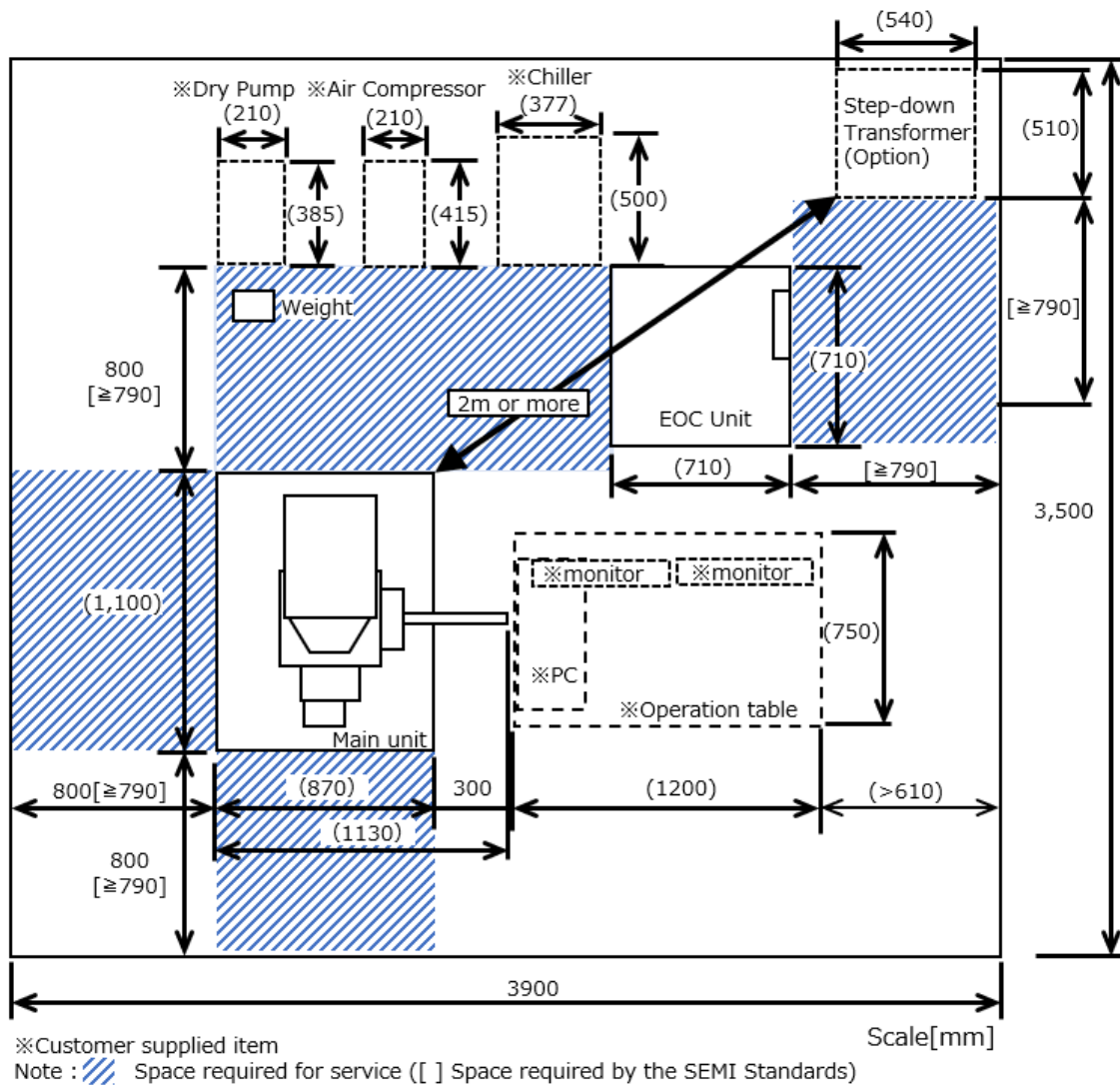




Figure 1-2-2 Layout diagram

-
- NOTE:
- Dotted line indicates the space (ref. value) for installing an operation table, cooling water circulator, a dry pump and Air compressor. The actual installation space depends on the manufacturer or model of circulator.
 - About 800 mm of space is required for maintenance.

-  **WARNING:**
- The Main unit (670 kg) and the EO Control unit (270 kg) are heavy objects. It can cause of injury by tumbling the heavy object due to earthquake or other. Recommend to use fixing tools after installation of the instrument.
Relocation of the instrument is carried out by our service engineers of Hitachi High-Tech Corporation. Customers are not allowed to perform the relocation of the instrument.
 - The Weight weighs about 25kg.
Careless lifting of this unit could result in injury. Lifting should be carried out by using a forklift or the like.
The weight must be moved by a service engineer trained and certified by Hitachi High-Tech Corporation only. Customers are not allowed to perform the relocation of the instrument.

-  **CAUTION:** Can cause injury due to damaging the cover of the main unit.
Do not sit or lean to the cover.

NOTE: The following specifications must be satisfied for water supply/drain.

Water flow rate: 0.45 to 1.05 (Recommended value 0.75 L/min)

Water pressure: 50 to 100 kPa

Water temperature: 10 to 20 °C (temperature variation: 0.5 °C or less/10 min)

Water temperature must not be more than 7 °C below the room temperature.

1.3 Customer-supplied items

Prepare the items as shown in Table 1-3-1 prior to the installation.

Table 1-3-1 Customer-supplied items

Product Name	Quantity	Note
Desiccator or dry storage box	1 set	To storage the specimens and parts
Ethanol	500 mL	For cleaning the parts
Conductive double-sided adhesive tape	1 roll	For fixing a bulk specimen/temporal fixing (for low magnification)
Conductive bonding agent (paste) ^{*1}	30 g	For fixing a specimen (for high magnification)
Clean gloves	1 set	Specimen holder, handling the parts

*1 Prepare a suitable conductive paste. The following types are recommended.

- Carbon paste (Example: TED PELLA cat No.16053)

* Isopropanol is recommended as a solvent.

1.4 Assemble

The following shows the cautions for assembling the instrument.

1.4.1 Power and ground wire

The electrical system after the MAIN breaker of the instrument is designed to operate with the power voltage AC 100 V.

In case of using the power supply voltage other than AC 100 V, a step down transformer is required.

For using the step down transformer, make sure that the output voltage is AC 100V and connect to the instrument.

1.5 Others

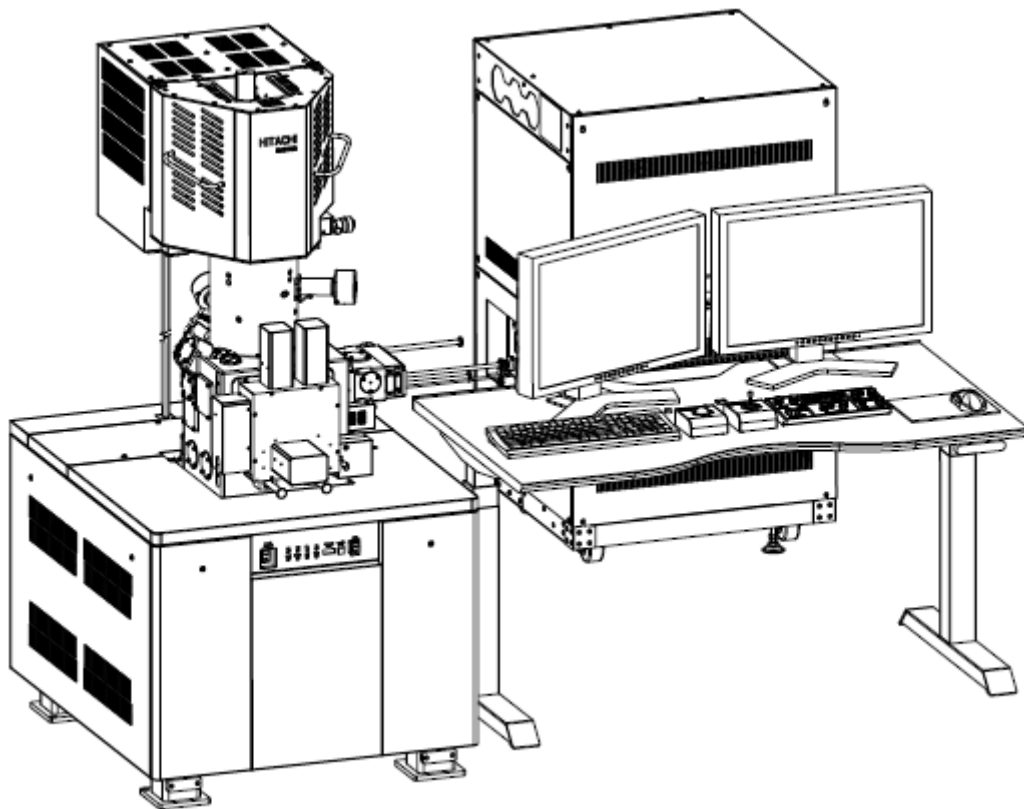
(1) Refer to the standard settings dialog for selecting the language displayed on GUI.

Reference: 2.4.4 Standard settings

(2) Refer to the Version information for the altered functions due to updating the version.

2. Function

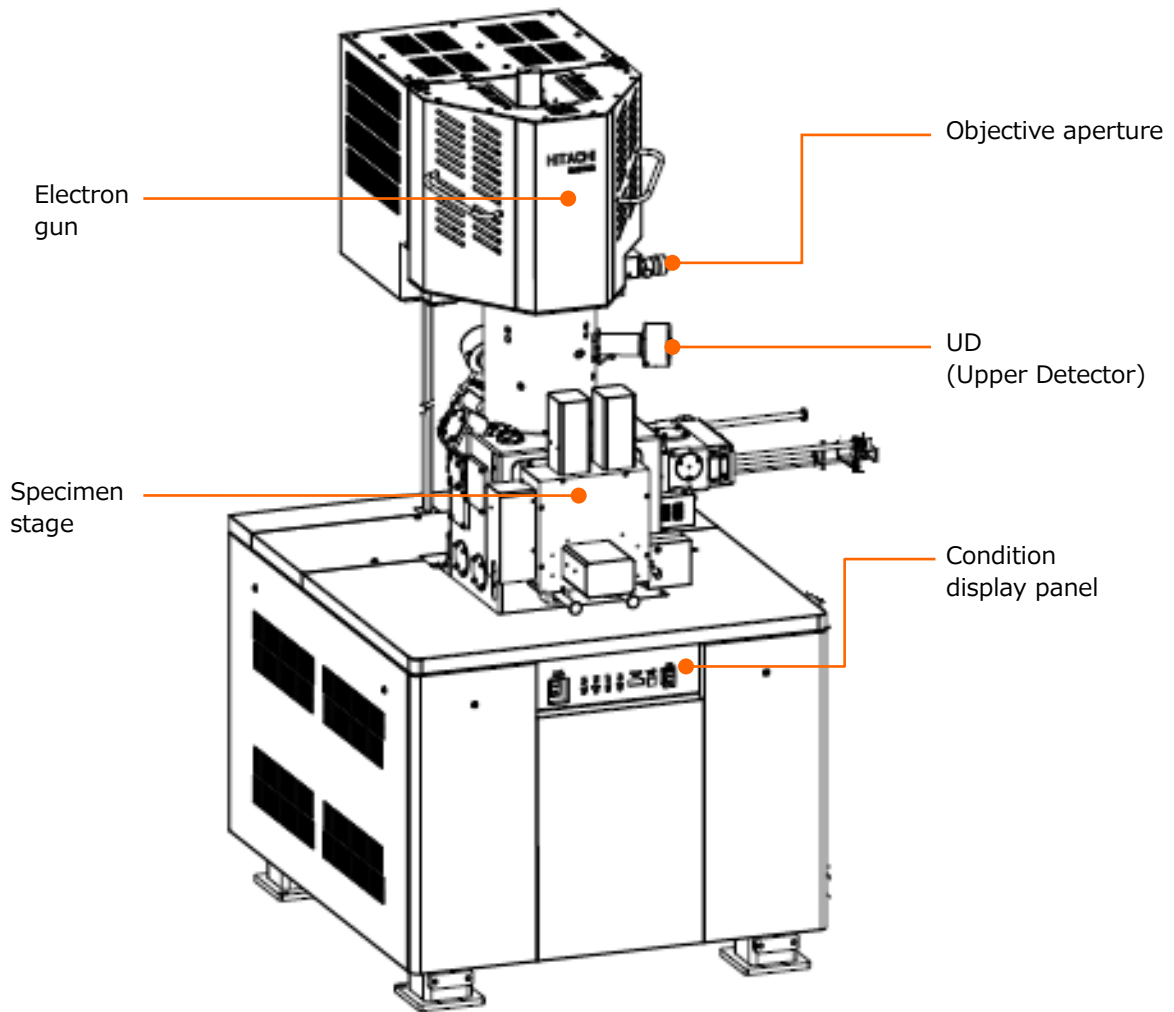
External view of the SU8700 Scanning electron microscope.



2.1 Parts name

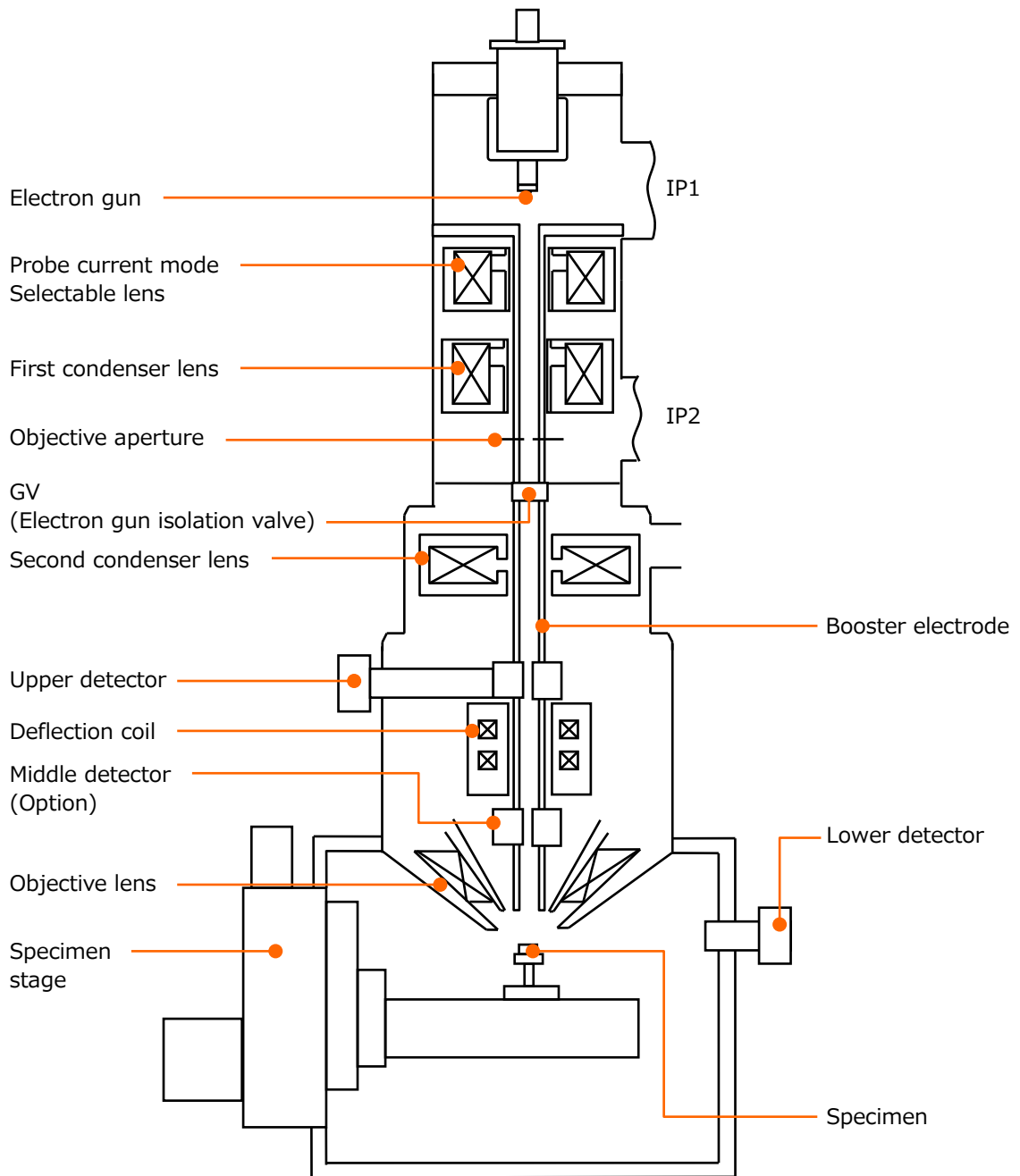
2.1.1 External view of column

The external view of column.

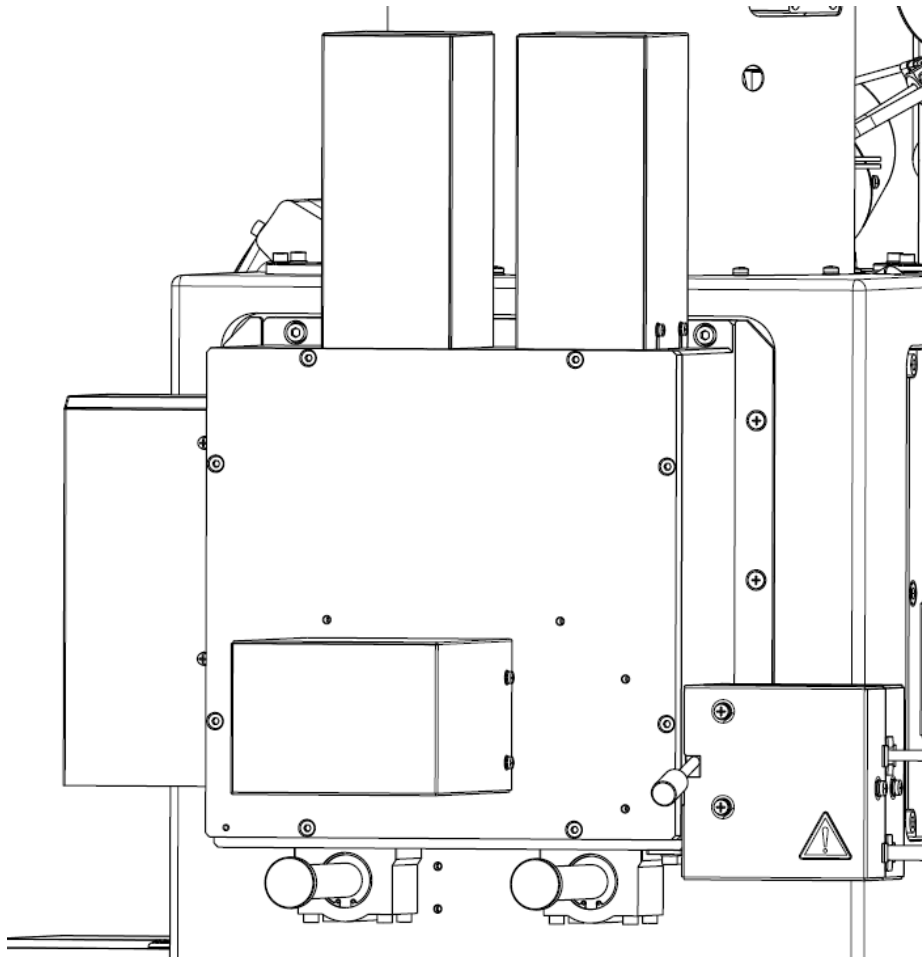


2.1.2 Configuration of column

The schematic sectional view of column.



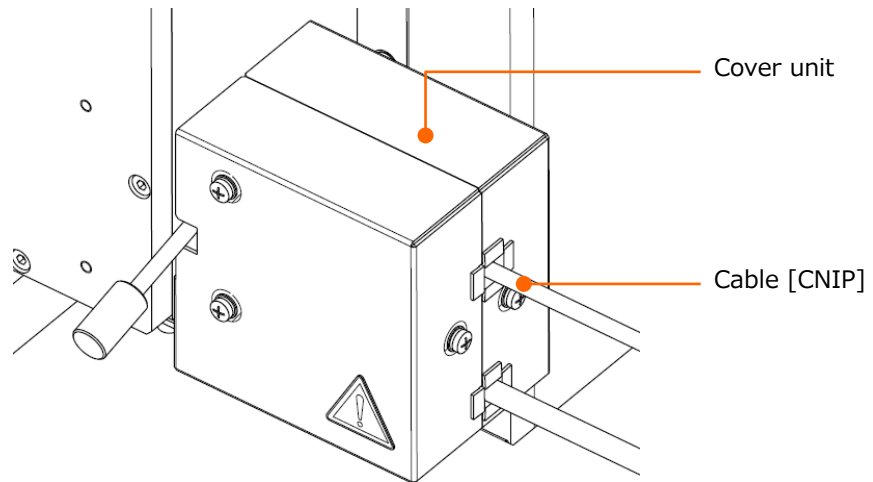
2.1.3 Specimen stage



X direction stage movable range: 0 to 110 mm
Y direction stage movable range: 0 to 110 mm
Z direction stage movable range: WD= 1.5 to 40 mm
Specimen rotation angle R: 360 ° continuous
Tilt angle (T): -5 ° to 70 °

2.1.4 Specimen current measurement

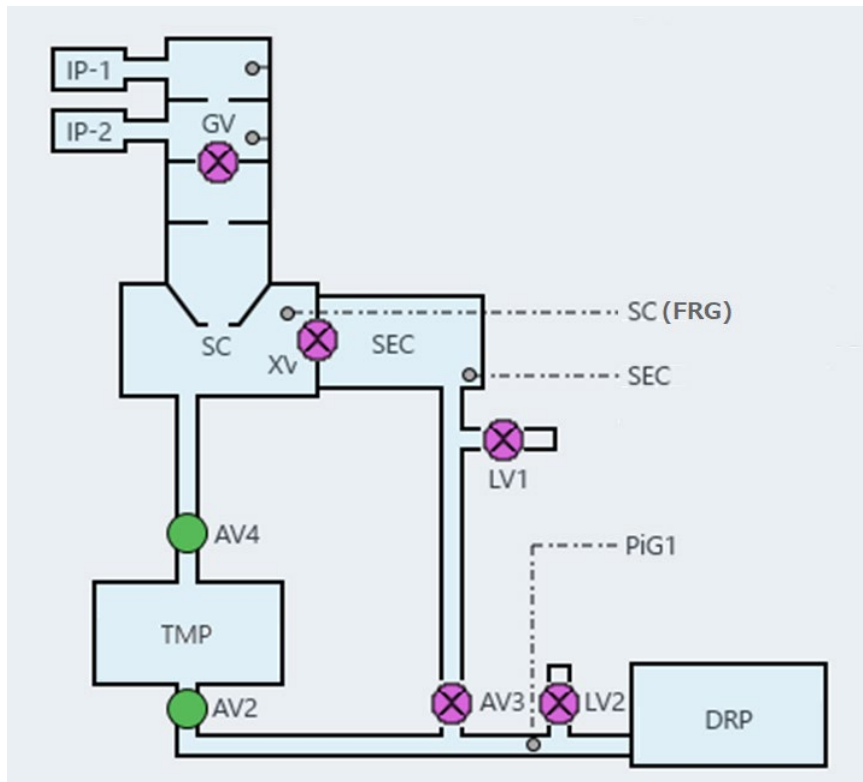
In SU8700, probe current measurement function is equipped in the specimen stage. Do not connect other than the optional specimen bias unit.



Standard connection

2.1.5 Vacuum system

The vacuum system diagram.



- IP1, IP2: Ion pump
- TMP: Turbo Molecular Pump
- DRP: Dry pump (Customer-supplied item)
- GV: Electron gun isolation valve
- SC: Specimen chamber
- SEC: Specimen exchange chamber
- AV2 to 4: Vacuum valve
- LV1, LV2: Leak valve
- PiG1: Pirani vacuum gauge
- FRG: Full range gauge

2.1.6 Condition display panel

Condition display panel is arranged at front of the main unit.



IP1, IP2: Indicate the operating condition of IP1 and IP2. The LEDs are ON during normal operation.

FIL: Indicate the [Start up] condition of electron gun. The LED is ON when electron gun is ready to apply.

HV: Indicate the HV ON or OFF condition. The LED is ON when the HV is applying.

EVAC: Indicate the vacuum system condition. The LED is ON when the EVAC POWER is ON.

STAGE: Indicate the stage condition. The LED is ON when stage power is ON.

EOC: Indicate the EOC (EO Control Unit) condition. The LED is ON when the EOC POWER is ON.

BAKE: Indicate the electron gun baking condition. The LED is ON during the baking.

STATUS CODE: It displays the error code.

ALARM STOP: Stop the error warning buzzer by pressing the button.

2.1.7 Power switch

Power switch is arranged at front of the main unit.



EVAC POWER switch: Power ON/OFF the vacuum system.

EOC POWER switch: Power ON/OFF the EOC (EO Control Unit) POWER switch.

2.1.8 Switch board on the instrument

The switch board is arranged at rear side of the main unit.

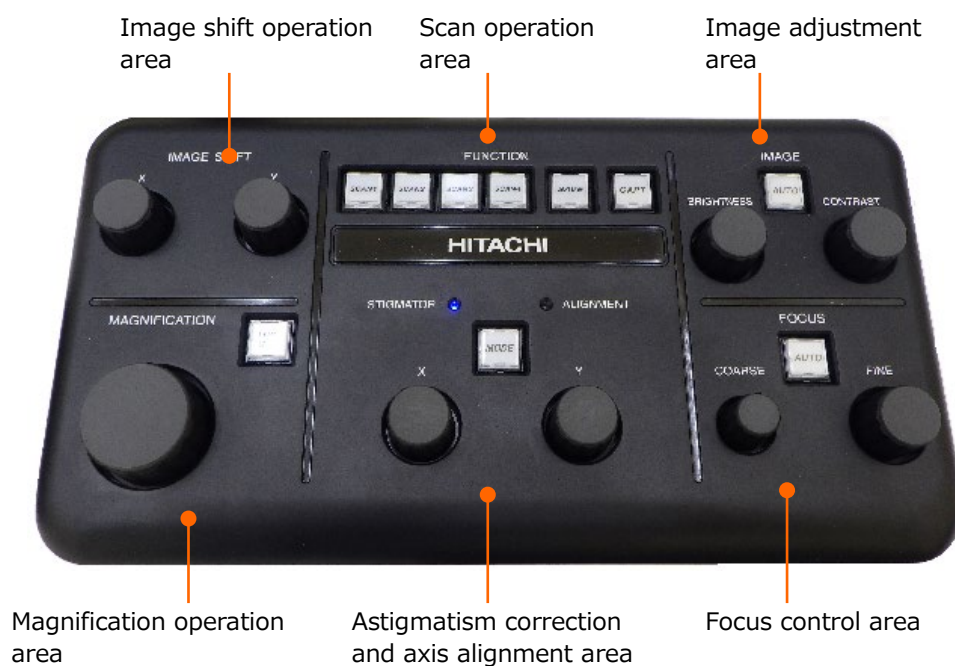


STAGE: The breaker for the stage control unit. Power ON the breaker during the normal use. Power OFF the breaker when the main unit is stopped completely.

IP1, IP2: The IP1 and IP2 power breakers. Power ON the breaker during the normal use. Power OFF the breaker completely.

2.1.9 Manual operation panel

The following shows the manual operation panel.



(1) Magnification operation area

MAGNIFICATION knob: Change the magnification. Rotate the knob to clockwise to increase the magnification.

LOW MAG button: Set to the lowest magnification under the current observation condition.

(2) Image shift operation area

IMAGE SHIFT X and Y knobs: Move the field of view by the image shift (Move the electron beam position).

(3) Astigmatism correction and axis alignment area

STIGMATOR/ALIGNMENT X and Y knobs:

Perform the astigmatism correction or alignment adjustment. The stigmator correction performs when the STIGMATOR LED is ON in blue, and the ALIGNMENT performs when the ALIGNMENT LED is blinking in blue.

MODE button/STIGMATOR/ALIGNMENT LED:

The ALIGNMENT lamp will be ON by pressing the MODE button and the mode will be beam alignment mode. At this time, the alignment panel on the sub panel is displayed. In the alignment status, the present alignment mode changes to the next alignment mode by clicking the MODE button.

(4) Focus control area

FOCUS COARSE/FINE knobs:

Control the focus. The COARSE is for coarse adjustment and the FINE is for fine adjustment. The amount of focusing is linked to the rotating amount of knob. The focus can be controlled even when the magnification is changed.

AUTO button: Control the focus automatically. The setting of pressing and holding the button or pressing the button in short period are available for executing the auto correction function (Auto focus control or Auto astigmatism correction).

(5) Image adjustment area

CONTRAST knob: Control the image contrast.

BRIGHTNESS knob: Control the image brightness.

AUTO button: Control the brightness and contrast automatically. The setting of pressing and holding the button, or pressing the button in short period are available for selecting the performing range (All screens or selected screen only).

(6) Scan operation area

SCAN SPEED (1 to 4) buttons:

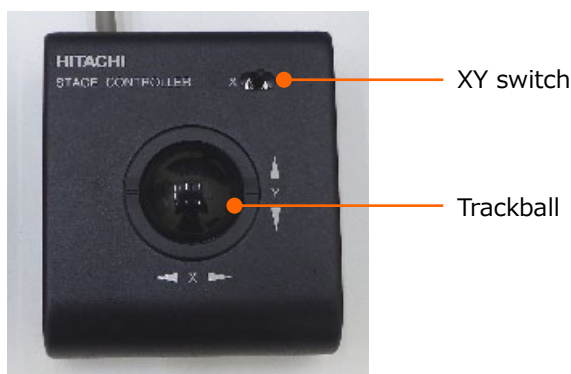
Switch the scan speed. Allocation of scan speeds for each button is the same as the four scan buttons on the control panel.

SAVE button: Save the presently observing image. It is the same function as the control panel item and the Save button in the image display area. The setting of pressing and holding the button, or press the button in short period are available for selecting the range of saving (All screens or selected screen).

CAPT button: It captures and saves an image. It is the same function as the control panel item and the Capture button in the image display area. The setting of pressing and holding the button, or press the button in short period are available for selecting the range of saving (All screens or selected screen only).

2.1.10 Trackball (Option)

The following shows the trackball unit for moving the stage.



Trackball: Move the FOV to the same direction as rotating the ball.
The direction can be reversed.

XY switch (Center): Move the FOV to X and Y directions. The FOV moves to the direction as rotating the ball.

XY switch (X side): When tilting the switch to the X side, the FOV moves to horizontal direction (X) only by rotating the ball.

XY switch (Y side): When tilting the switch to the Y side, the FOV moves to vertical direction (Y) only by rotating the ball.

2.1.11 Joystick (Option)

The following shows the Joystick for moving the stage.



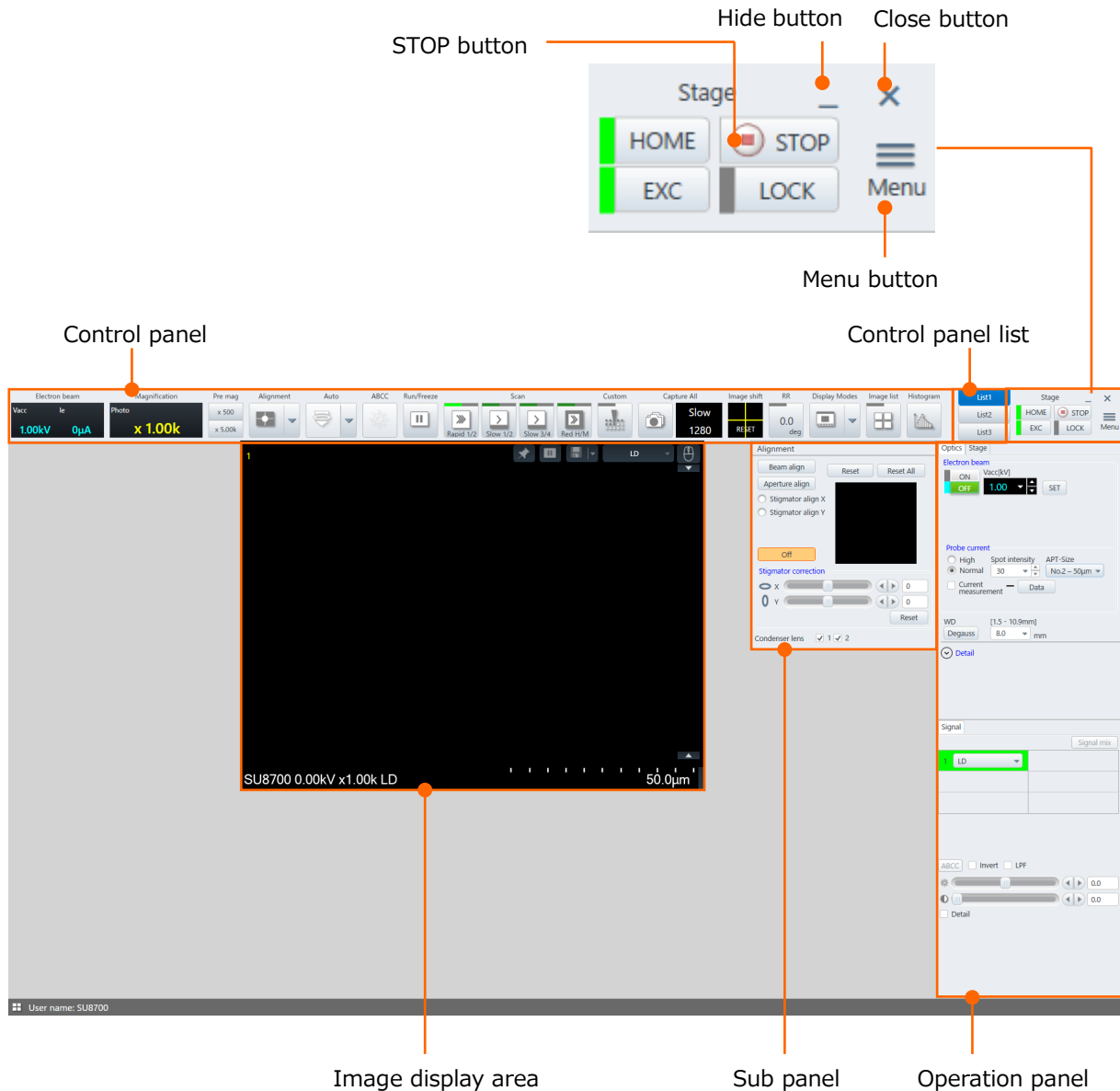
The Joystick is available as an option. The Joystick operates the same as the Trackball except for the X, Y switch.

When equipping both trackball and joystick, the trackball, joystick, or both is selectable.

The trackball and Joystick can be switched by the [Trackball/Joystick] check box on the [Menu]>[Standard settings]>[Stage] tab.

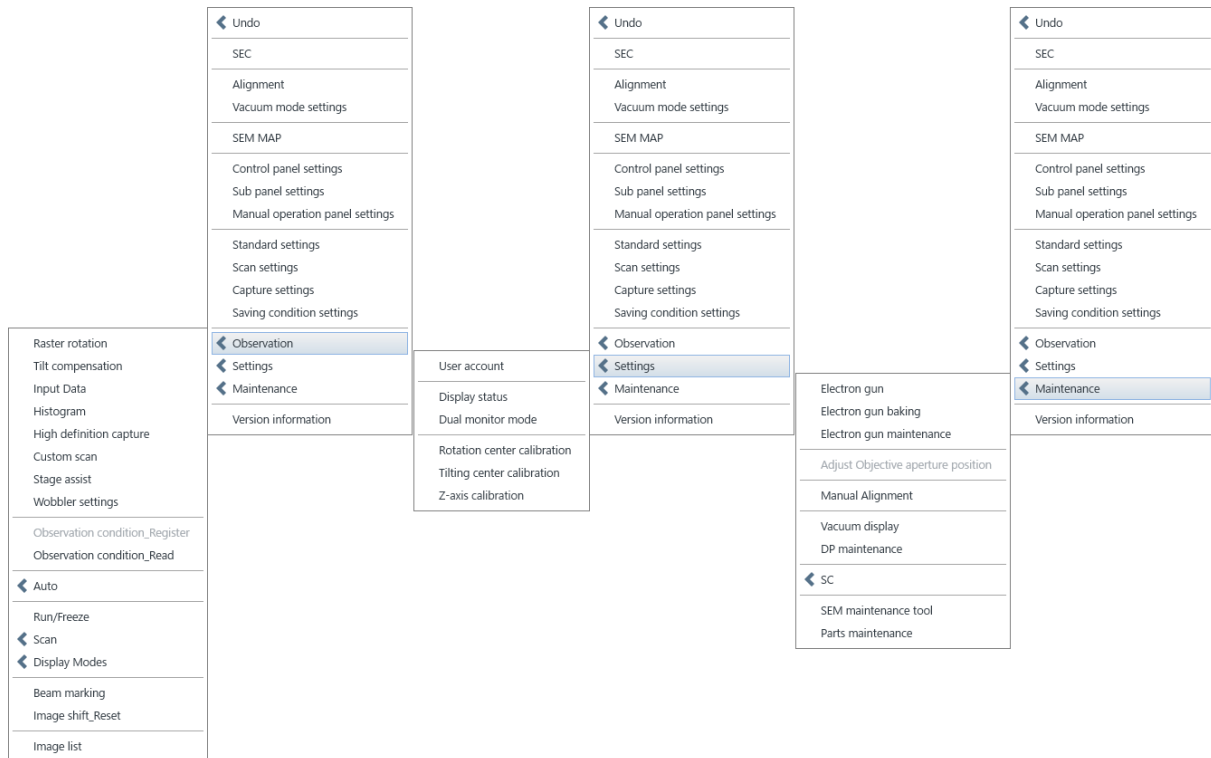
2.2 UI operation display

The UI operation display configures the control panel, operation panel, sub panel, and image display area.



- Hide button
Hide the window and display an icon on the task bar.
- Close button
Close the window and exit the program.
- HOME button
Move the stage to the home position.
- EXC button
Move the stage to the specimen exchange position.

- **STOP button**
Stop the stage.
- **LOCK button**
Lock the stage.
- **Menu button**
Display the menu. Some operations and functions that are not arranged in the operation panel can be performed or selected from the menu.



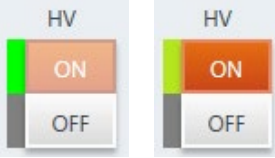

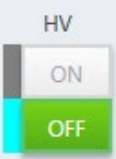
- **Control panel**
Control panel is arranged at upper area of the UI display. The items for the control panel can be edited.
- **Control panel list**
Three types of control panels are available.
- **Operation panel**
The tabs of Signal selections, optics system condition settings, stage operations and detailed settings on the operation panel can be arranged.
- **Sub panel**
The panels of supportive settings or operations such as alignment or others can be arranged.
- **Image display area**
An image for observing, status display, Run-Freeze buttons for scanning, capture button, signal selecting control etc. are arranged in the image display area.

2.3 Control panel function

The following shows the functions categorized in the [Observation] on the control panel.


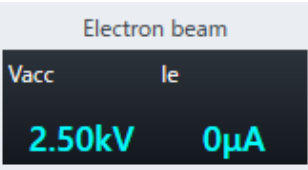
2.3.1 HV

When accelerating voltage is ready to apply status (electron gun operating condition, vacuum status of electron gun and specimen chamber), the [ON] button will be enabled. Apply the accelerating voltage by clicking the [ON] button. Shut OFF the accelerating voltage by pressing the [OFF] button. The below table shows the status of HV buttons. The displays are different in Booster AUTO or OFF while HV is ON as shown in the below.

STATUS	HV
HV ON Left: Booster voltage AUTO Right: Booster voltage OFF	
HV OFF	
Unable to apply accelerating voltage	



2.3.2 Electron beam

The [Vacc] indicates the set accelerating voltage. The [Ie] indicates the present emission current. The following table shows the display according to the HV status. The [Optics] tab on the operation panel will be displayed in front by right clicking the mouse on the display area.

STATUS	Electron beam
HV ON	
HV OFF	

2.3.3 Vacc

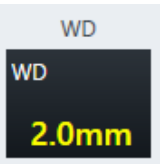
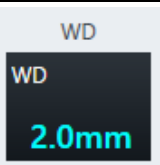
Only the set accelerating voltage will be displayed for the Vacc. The [Optics] tab on the operation panel will be displayed in front by right clicking the mouse on the display area.

STATUS	Vacc
HV ON	
HV OFF	

2.3.4 WD

Display the present WD (Working Distance: The focused position that is calculated by the objective lens current).

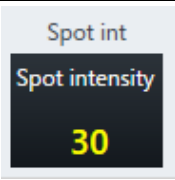
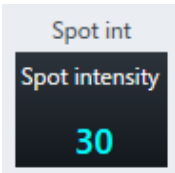
The display will be change according to the HV condition as shown in the below. The [Optics] tab on the operation panel will be displayed in front by right clicking the mouse on the display area.

STATUS	WD
HV ON	
HV OFF	

2.3.5 Spot intensity

Display the set spot intensity. The [Optics] tab on the operation panel will be displayed in front by right clicking the mouse on the display area.

The display will be change according to the HV condition as shown in the below.

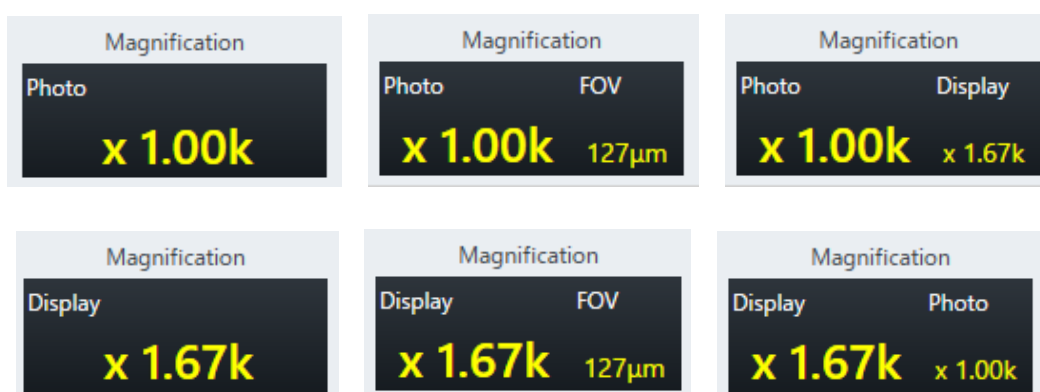
STATUS	Spot intensity
HV ON	
HV OFF	

2.3.6 Magnification

Display the [Magnification]. The magnification can be changed by moving right and left while left clicking the mouse on the display. In addition, the [Mag Secondary display] and [Magnification display exchange] can be switched at [Image display] tab on the [Standard settings] dialog by right clicking the mouse.

The other magnification value or FOV (Field of view, area size) can be displayed simultaneously with the selected magnification value (Sub Mag display).

Moreover, optimized magnification of the image that is output by photo size (4 x 5 inch film, 127 mm x 95 mm), and optimized magnification of the currently displayed image on the monitor (Display magnification) can be selected and displayed.



- NOTE:
- The magnification display of image which is saved by the display magnification is kept at the display magnification.
 - The magnification of data display for the image which is saved by display magnification is S-x display magnification (4 screen, 6 screen mode), M-x display magnification (1 screen, 2 screen mode), L-x display magnification (Large display, large display x 2 mode).
 - The magnification display of image which is saved by display magnification is enabled to the saved monitor size only.

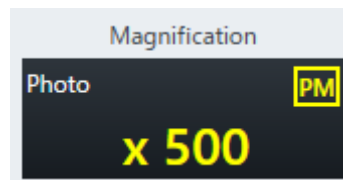
2.3.7 Preset magnification

Set to the magnification which is displayed on the button by clicking the two preset magnification buttons.

The [Image display] tab on the [Standard settings] dialog will be displayed by right clicking the mouse on the button and each magnification parameter can be set.



When the [Pre Mag] value is set, the PM is displayed on the upper area of magnification display.



When selecting a magnification of [Pre Mag], the button will be changed to [Undo]. When clicking [Undo], the display will be returned to the previous magnification.



In addition, when operating the above mouse operation or rotating the MAGNIFICATION knob on the manual operation panel while the magnification is in the pre-set value status, the magnification value will be increased from the preset magnification, the PM will be disappeared, and the magnification status will not be in the [Pre Mag] status.

The [Pre Mag] value can be set by right clicking the mouse on each button and displaying the [Image display] tab on the [Standard settings] dialog.

When the preset magnification is out of the maximum/minimum value under the current setting condition, the magnification will be set at closest magnification value within the limitation.

2.3.8 Round magnification

Present magnification value will be rounded off according to the magnification steps by clicking the [Round] button.

The [Image display] tab on the [Standard settings] dialog will be displayed by right clicking the mouse on the button and each magnification parameter can be set.

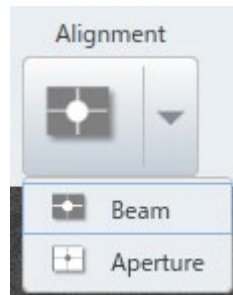


2.3.9 Alignment

(1) Alignment

The alignment button can be selected by clicking the split button (▼) and selecting the [Beam] or [Aperture] button of electron optics axis alignment function. The alignments can be arranged on the control panel separately. The selected function will be allocated to the execute button.

The alignment panel will be displayed in front by right clicking the mouse while releasing the [Alignment] panel on the [Sub panel].



(2) Beam

Display the [Alignment] panel on the [Sub panel] in front and activate the beam alignment mode.

Finish the alignment mode by clicking the button while alignment panel is displaying.

The [Beam] button can be arranged on the control panel independently.



(3) Aperture

Display the [Alignment] panel on the [Sub panel] in front and activate the aperture alignment mode (wobbler mode).

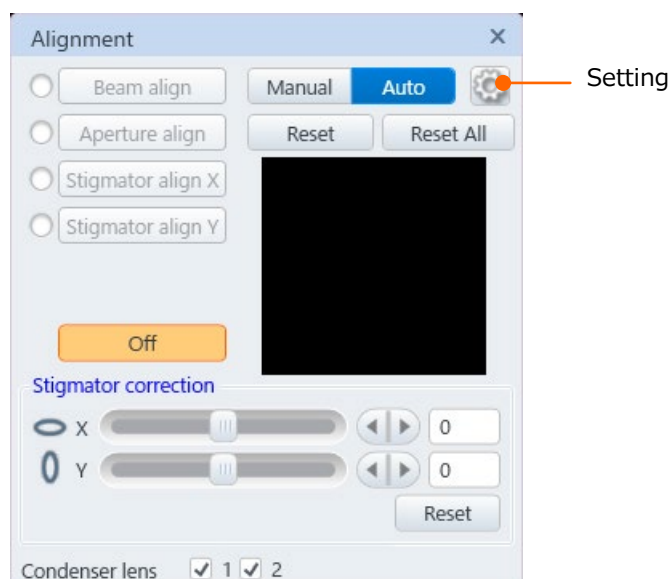
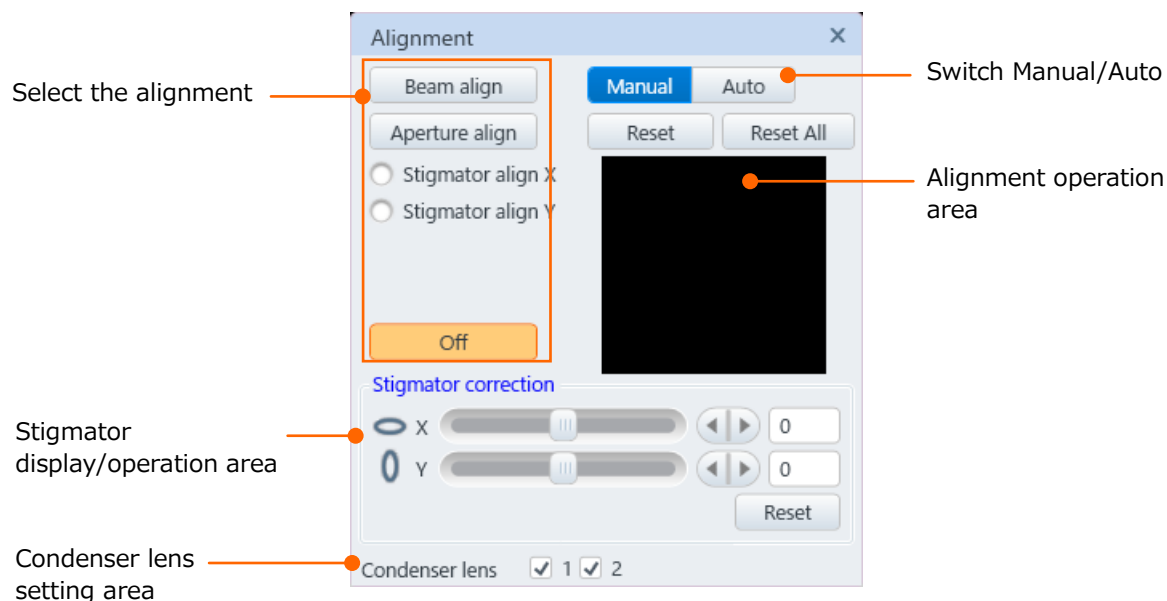
Finish the alignment mode by clicking the button while alignment panel is displaying.

The [Aperture] button can be arranged on the control panel independently.



(4) Alignment panel

The [Alignment] panel can be displayed by selecting from the [Menu]>[Alignment].



- Switching the Manual/Auto
Switch the Manual/Auto for the alignment.
- Selecting the alignment (For manual mode)
Perform each alignment. When selecting the [Off], finish the alignment mode while tab is displaying.

-
- Selecting the alignment (For Auto mode)

Click each alignment button and perform the auto adjustment. When selecting the [Off], finish the alignment mode while tab is displaying. The ULV alignment is not applicable to the auto adjustment.




By clicking the [Mode] button on the manual operation panel, the alignment becomes selectable from the beam alignment in order and the manual adjustment can be performed. The selected alignment mode can be confirmed by the radio button.
 - Reset

Reset the presently executing alignment amount (Set it to the center of alignment range).
 - Reset All

Reset all alignment amount (Set it to the center of alignment range).
 - Alignment operation area

The cross position of cross cursor indicates the presently executing alignment amount. Normally, alignment is performed by using the manual operation panel knob. However, alignment can be performed by left clicking and holding the mouse at the alignment operation area.

By moving the mouse on the alignment operation area, the mouse icon will be changed as bellow.

 - : X/Y direction
 - : X direction (Around the vertical line area of cross cursor)
 - : Y direction (Around the horizontal line area of cross cursor)
 - Stigmator display/operation area

The scroll bars of stigmator X and Y are displayed. Normally, this function is used for checking the present stigmator correction amount, but it could be used for setting the parameter. The mount of stigmator correction can be reset (without correction) by clicking the [Reset].
 - Condenser lens setting area

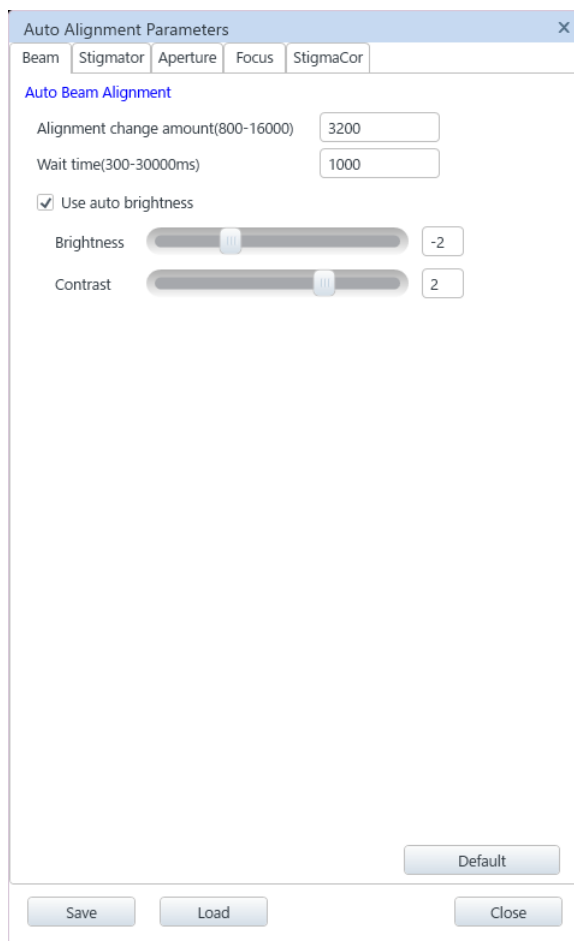
The condenser lens will be non-excitation by setting OFF the check box. This function can be used for mechanical axis alignment only for normal operation. Check ON the check box for the normal operation.

In case of closing the alignment panel while check box is OFF, the check box will be ON forcibly (Include the status when the alignment panel check box is OFF by switching the display mode).
 - Setting (Auto only)

By clicking the settings button displayed in the Auto mode only, the auto alignment parameter dialog will be displayed.

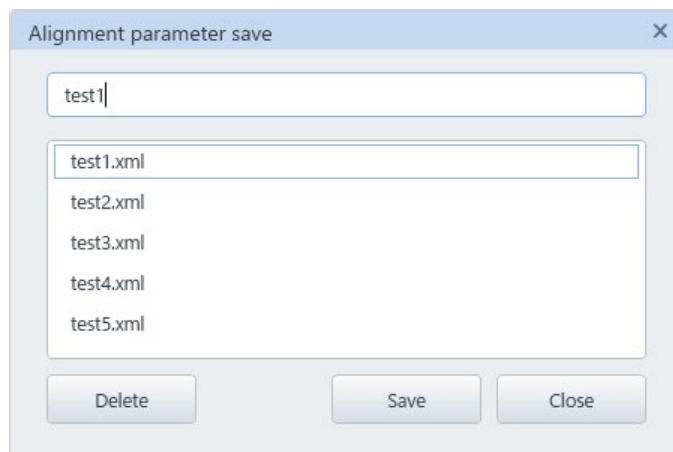
The detail settings, saving or loading of each auto alignment parameter can be performed in this dialog.
-

(5) Auto alignment parameter dialog



- Saving

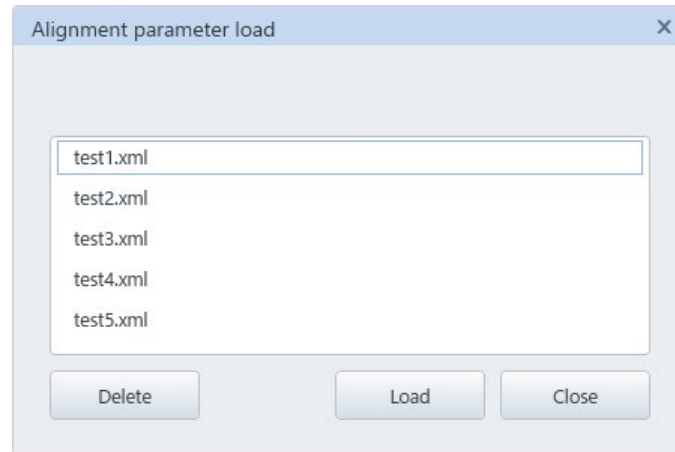
The alignment parameter saving dialog will be displayed by clicking the [Save] button. The set auto alignment parameter condition can be saved. Input the saving name in the text box and save it with the [Save] button. Up to 5 conditions can be saved. To save a new condition when reaching to the saving limit number, delete the unnecessary condition by the delete button. Close the dialog by clicking the close button.



- Loading

The parameter loading dialog will be displayed by clicking the [Load] button.

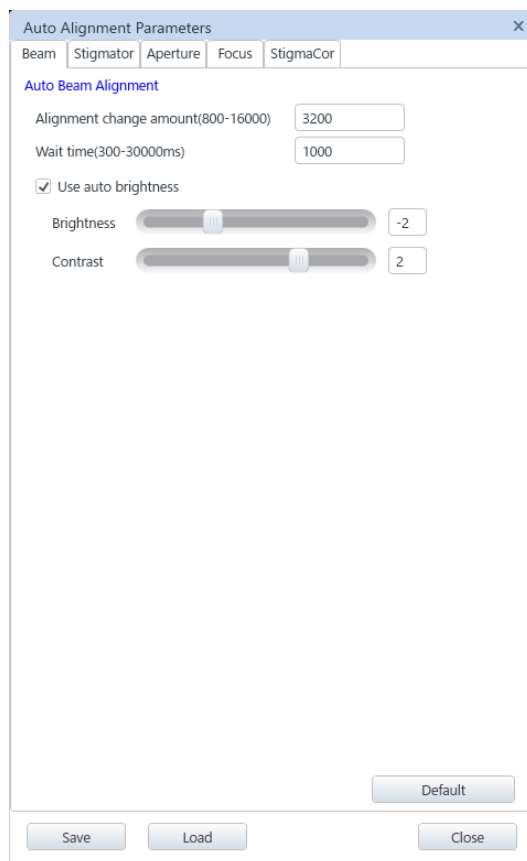
Select the condition name to load and click the Load button. The loaded condition on the auto alignment parameter dialog will be set. Delete the unnecessary conditions by clicking the [Delete] button. Close the dialog by clicking the close button.



- Close

Close the alignment parameter dialog by the close button.

(a) Beam tab



- Alignment change amount
When performing the beam alignment, set the alignment coil change amount for moving to the FOV center direction as a relative value.
- Wait time
Set the wait time until obtaining the image from the alignment coil change.
- Perform the ABCC
Perform the ABCC and beam alignment by enabling the check box.
- Slide of the Brightness and contrast
Set the adjustment level of ABCC (Auto Brightness & Contrast Control) for performing the beam alignment.
- Return to the initial value
Return the beam alignment parameter to the initial value.

(b) Stigmator tab

- Stigmator change amount
Set the change amount of stigmator adjustment coil as a relative value.
- Alignment change amount
Set the change amount of alignment coil on the stigma Alignment as a relative value.
- Wait time
Set the wait time of obtaining the image after changing the alignment coil.
- Matching rate
Set the target value for the auto adjustment as a ratio.
- Present magnification
Select the present magnification radio button when setting the performing magnification to the present magnification.
- Select magnification
Select the select magnification radio button when setting the performing magnification to the select magnification.
In the select magnification 1st and 2nd check boxes, the check ON magnification becomes the magnification for performing stigmator alignment.
- Return to the default value
Return the stigmator alignment parameter to the default value.

(c) Aperture tab

Auto Alignment Parameters

Beam Stigmator Aperture Focus StigmaCor

Auto Aperture Alignment

Defocus coefficient(1.0-1000.0) 10.0

Alignment change amount(800-16000) 3200

Wait time(300-30000ms) 1000

Image matching ratio(10-90%) 10

Magnification to execute

Current magnification

Specified magnification(500-200,000)

1st Magnification 1,000

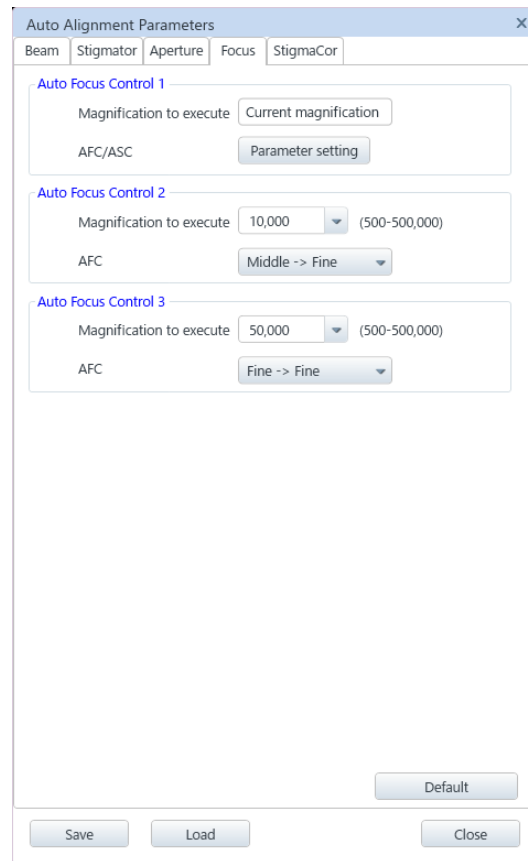
2nd Magnification 2,000

Default

Save Load Close

- Defocus coefficient
The coefficient is for calculating the amount of focus moving amount on the aperture alignment.
- Alignment change amount
Set the alignment coil change amount on the aperture alignment as a relative value.
- Wait time
Set the wait time of obtaining the image after changing the alignment coil.
- Matching rate
Set the target value for the auto adjustment as a ratio.
- Present magnification
Select the present magnification radio button when setting the performing magnification to the present magnification.
- Select magnification
Select the select magnification radio button when setting the performing magnification to the present magnification.
The checked ON magnification on the select magnification 1st and 2nd check boxes becomes the magnification for performing the auto aperture alignment.
- Return to the default value
Return the aperture alignment parameter to the default value.

(d) Focus tab

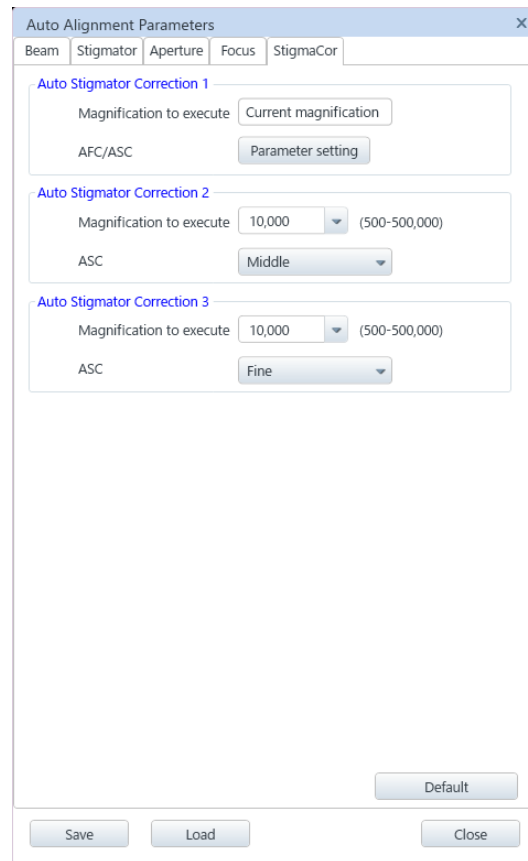


- Auto Focus Control 1
 - Execute magnification:
 - The actual magnification of auto focus and the fixed present magnification
 - AFC/ASC: [Menu]>[Standard settings]>[AUTO] tab>[AFC/ASC] are common settings. Display the parameter dialog of AFC/ASC by clicking the [Parameter settings] button. Refer to the standard settings for the contents of dialog.
- Auto Focus Control 2
 - Execute magnification: Set the execute magnification of Auto focus.
 - AFC: Select the focus search method.

Zlink:	Search the focus by centering the present stage Z position and specimen height setting position.
Coarse -> Middle:	Search the focus in order of Coarse → Middle
Middle -> Fine:	Search the focus in order of Middle → Fine
Fine -> Fine:	Search the focus in order of Fine → Fine
Middle:	Search the focus in the Middle
Fine:	Search the focus in the Fine

- Auto Focus Control 3
 - Execute magnification: Set the execute magnification of Auto focus.
 - AFC: Select the focus search method.
 - Zlink: Search the focus by centering the present stage Z position and specimen height setting position.
 - Coarse -> Middle: Search the focus in order of Coarse → Middle
 - Middle -> Fine: Search the focus in order of Middle → Fine
 - Fine -> Fine: Search the focus in order of Fine → Fine
 - Middle: Search the focus in the Middle
 - Fine: Search the focus in the Fine
- Return to the default value
 - Return the focus parameter to the default value.

(e) Stigmator tab

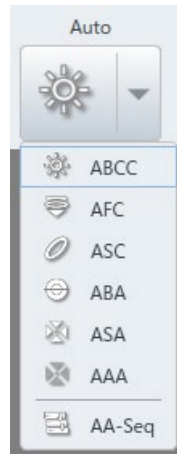


- Auto Stigmator Control 1
 - Execute magnification: The actual magnification of auto focus and the fixed present magnification
 - AFC/ASC: [Menu]>[Standard settings]>[AUTO] tab>[AFC/ASC] are common settings. Display the parameter dialog of AFC/ASC by clicking the [Parameter settings] button. Refer to the standard settings for the contents of dialog.
- Auto Stigmator Control 2
 - Execute magnification: Set the execute magnification of Auto stigmator.
 - ASC: Select the stigmator correction range.
The adjustment range becomes larger in order of Coarse1>Coarse2>Middle>Fine.
- Auto Stigmator Control 3
 - Execute magnification: Set the execute magnification of Auto stigmator.
 - ASC: Select the stigmator correction range.
The adjustment range becomes larger in order of Coarse1>Coarse2>Middle>Fine.
- Return to the default value
Return the stigmator parameter to the default value.

2.3.10 Auto

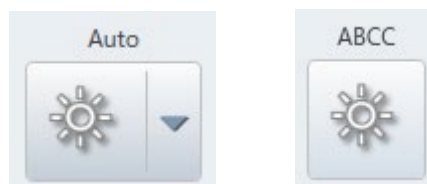
Auto adjustment functions can be selected by the [AUTO] button. Click the split button (▼) and the function list for allocating to the button will be displayed as shown in the below. Select a function from the list and the execute button will be allocated to the selected function. Each auto function can be performed from the [Menu]>[Observation]>[Auto].

Right click on the button, display the [Standard settings]>[Auto] and set the auto function.

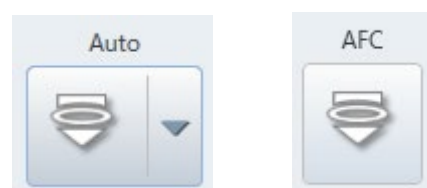


- **ABCC**
Control the contrast and brightness of the presently observing image automatically. In case of multiple screen mode that displays more than two screens, auto adjustment will be performed to all screens (Except for the signal that cannot be applied the auto contrast control and auto brightness control). The [Standard settings]>[Auto] will be displayed by right clicking the mouse on the button and the amount of controlling the brightness and contrast can be changed. The ABCC can be arranged on the control panel independently.

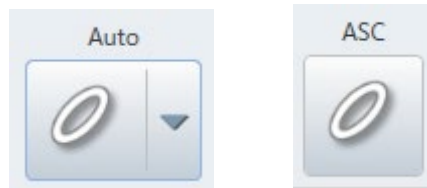
NOTE: The ABCC cannot perform while NONE, Chamber Scope or SEM MAP is selected.



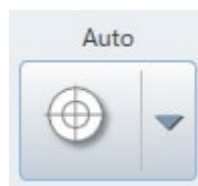
- **AFC**
Perform the focus automatically. AFC can be arranged on the control panel independently.



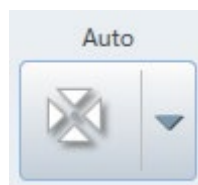
- ASC
Perform the astigmatism correction automatically. ASC can be arranged on the control panel independently.



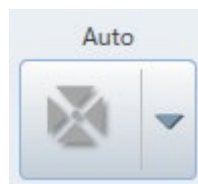
- ABA
Perform the beam alignment automatically. Perform the detection by the Upper detector (UD) or Lower detector (LD).



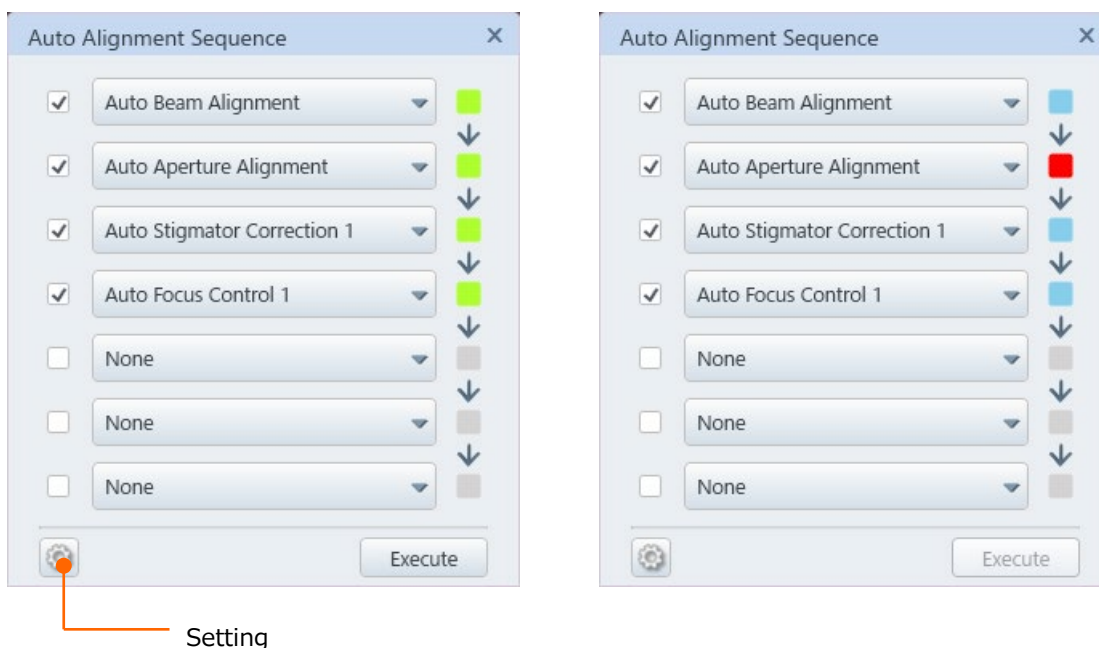
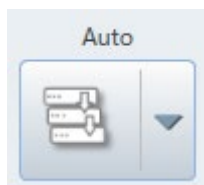
- ASA
Perform the stigmator alignment automatically.



- AAA
Perform the aperture alignment automatically.



- AA-Seq
Perform each auto function continuously.
Auto alignment sequence dialog will be displayed by clicking the AA-Seq button.



Select a performing auto function from each pull down list and perform it with the Execute button.

Activate or deactivate the performing auto function by the check box. The activated auto function is indicated in green, and the deactivated auto function is indicated in in gray. In addition, after performing the function, the auto function will be indicated in light blue and when the auto function is failed, the function is indicated in red.

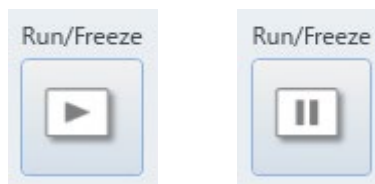
Click the settings button and display the auto alignment parameter dialog then, condition settings of each auto function can be set. Refer to the auto for the contents of dialog.

2.3.11 Run/Freeze

Stop and start the scanning. Stop the scan by clicking the button while scanning. When clicking the button, “Going to Freeze” indicates at the left top on an image until scanning is stopped and “Freeze” indicates when scanning is stopped. In case that scanning speed is slower than Slow3, a message of “Freezing” is appeared during “Going to Freeze” that indicates at the left top on the image and when clicking the stop button on the message, the scan can be stopped while scanning. Run/Freeze can execute from [Menu] > [Observation] > [Run/Freeze].

In case of multiple screen mode which displays more than two screens, [Run/Freeze] is performed to all screens.

For executing [Run/Freeze] on the selected screen, click [Run/Freeze] button that is arranged on each screen.



2.3.12 Scan

Switch the scan speed by clicking scan speed button.

The indicator indicates the followings.

Light green: Present scan

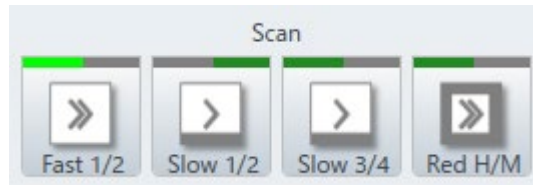
Dark green: The scan that will be selected when clicking the mouse

Right click the mouse on the scan speed button and display the scan button setting dialog. Allocate the scan speed to each button and set the integration (Average) frame number of the Rapid or Fast scan in this dialog.

The Slow Scan and CS Scan can be set other than the button at the left end.

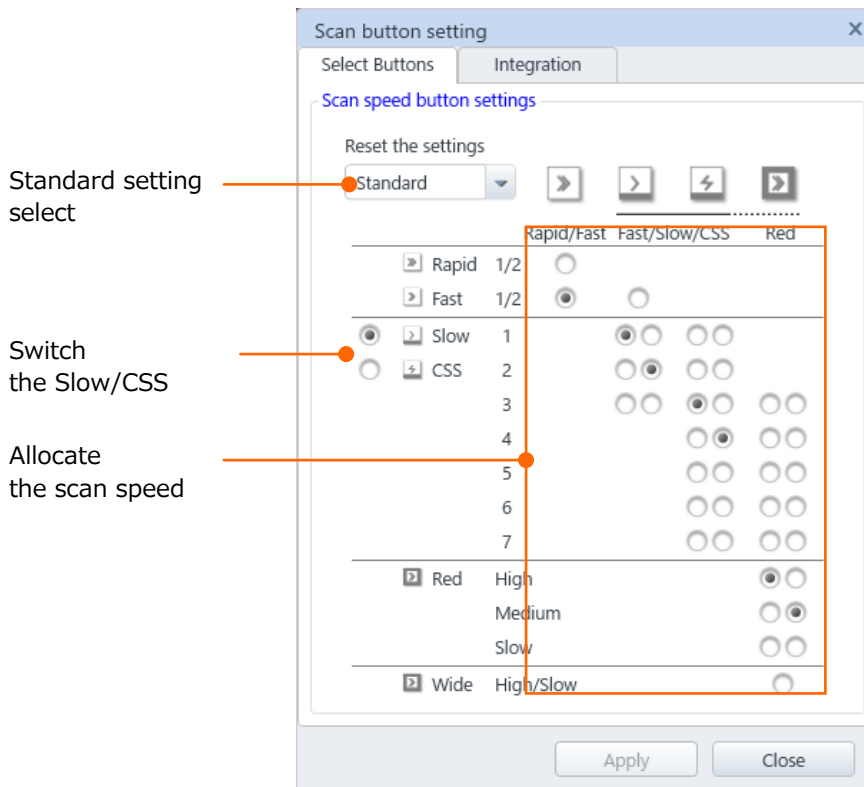
(1) Scan speed button

Switch to the allocated scan speed by clicking the each executing buttons. For an example, switch the Rapid Scan1 to Rapid Scan by clicking the button. Up to eight different scanning speed can be allocated. The same scan speed can set to one button. Allowable speed to allocate to four buttons is different for each button. All scans can be performed by the [Menu]>[Observation]>[Scan].



(2) Scan button setting dialog

Scan button setting dialog can be selected from the [Menu]>[Scan settings].



(a) Select Buttons tab

The [Select Buttons] that can allocate the scan speed to the buttons are arranged at the bottom of the four buttons. The scan speed of each button is limited as above.

- Switch between Slow and CSS
Select either of Slow scan or CSS scan. Cannot use both scans at the same time.
- Allocate the scan speed

Select a scan speed by the selecting buttons which are arranged at the bottom of each button.

The left side button is designed for setting in the fast scan for searching a field of view and right side button is designed for focusing and correcting the astigmatism with reduced area (Red) then, the two middle buttons is designed for setting to Slow scan (or CS scan) for observing and saving an image.

- Standard setting selecting box
Return the buttons to the standard settings. "Standard" and "Less charging" are available in the box.

(b) Integration tab

Improve the image quality by integrating and averaging the frames of images under the Rapid and Fast scans. The number of frames for integrating and averaging can be selected. The left side buttons of R1 to F2 corresponds to the speed of Rapid1, Rapid2, Fast1, and Fast2.

When the selecting the Rapid or Fast scan, the corresponding box is highlighted in orange. The larger number, the better quality can be obtained. However, the time of afterimage will be longer.

In the same setting, the afterimage time is different since the operation time is different depending on the image display mode. Therefore, the settings can be changed for each image display mode.

Click the [Reset] button for setting to the default value.



2.3.13 Custom scan

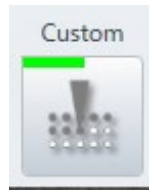
Set the dwell time of scan in the [Custom scan].

(1) [Custom] button

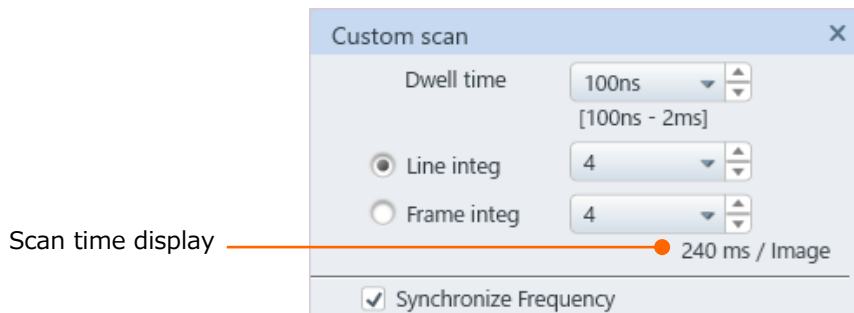
Switch from normal scan to custom scan by clicking the [Custom] button. When clicking the button again, the scan will be switched to normal scan.

Display the [Custom scan] panel on the [Sub panel] in the front by right clicking the mouse on the button. The [Custom Scan] panel can be displayed from the [Menu]>[Observation]>[Custom scan].

Set the parameter of custom scan at the [Custom Scan] window.

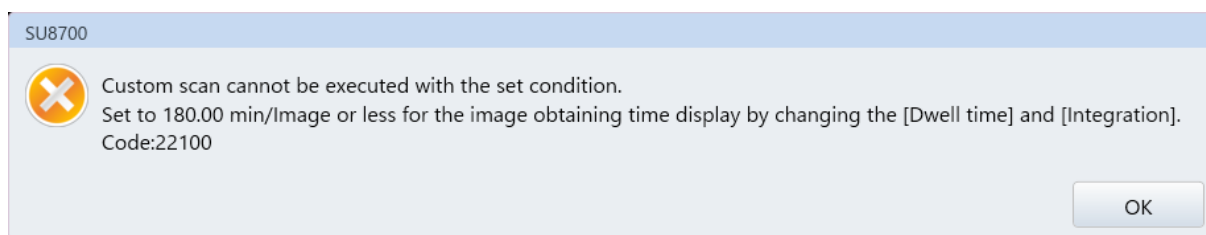


(2) Custom Scan window



- Dwell time
Set the dwell time of scan.
- Line integ
Set the number of scanning frames and integration method.
- Scan time display
Display the scanning time of each scan based on the result of dwell time and integration settings.
- Synchronize Frequency
Synchronize the power frequency by enabling the check box. The power frequency synchronization will be ON by enabling the check box.
When the check box is OFF, the noise due to power supply will be occurred.

- NOTE:
- Up to 180 minutes of scanning time can be set. When the time of 180 minutes is exceeded, the following error message will be displayed. Set the scanning time within 180 minutes according to the message.
 - It may take time to start scanning when switching the dwell time.



2.3.14 Image shift

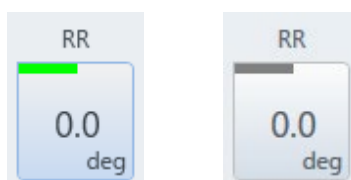
Move the observing field of view by shifting the irradiation point of electron beam. The cross mark position indicates the moving amount of current image shift. Reset the image shift to the center of movable range by clicking the display area of cross mark position. It can be performed from the [Menu]>[Observation]>[Image shift_Reset].



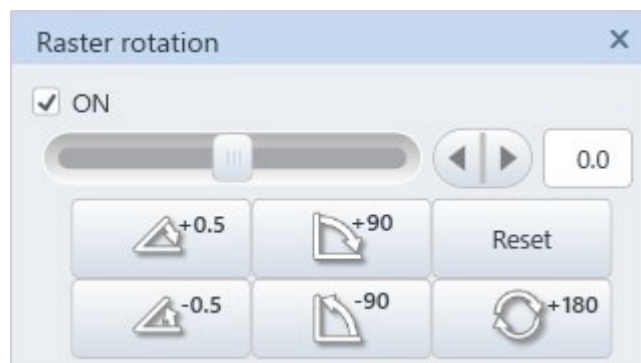
2.3.15 RR (Raster Rotation)

(1) RR (Raster Rotation) button

Enable the raster rotation function and lit the indicator in green by clicking the [RR] button. In addition, Raster rotation panel on the Sub panel will be displayed in front. The [Raster rotation] panel on Sub panel will be displayed in front with the present ON/OFF setting by right clicking the button. Raster rotation setting can be performed on the Raster rotation panel.



(2) Raster rotation panel



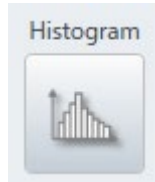
Operate the raster rotation.

Rotate the scanning direction of electron beam and change the direction of image. Raster rotation panel can be displayed from the [Menu]>[Observation]>[Raster rotation].

- Rotation ON/OFF check box
Check the raster rotation check box ON for enabling the raster rotation function.
- Rotation slider
Adjust the angle by sliding the rotation slider knob, clicking the right or left side of the slider knob (1° step), or clicking the fine adjustment button (0.1° step). In addition, the value of angle can be entered at rotation angle display/setting box by the keyboard and defined the value by clicking the [Enter] key.
The angle will be changed continuously while pressing and holding the slider part or fine adjustment button.
- 0.5° rotation button
Rotate the scanning direction +0.5° or -0.5° from present angle.
- 90° rotation button
Rotate the scanning direction +90° or -90° from present angle.
- Reset button
Reset the angle to 0°.
- 180° rotation button
Rotate the scanning direction 180° from present angle.

2.3.16 Histogram

Display the [Histogram]<[Sub panel]. Histogram can be referred for controlling the image contrast and brightness manually. The Histogram panel can be displayed from the [Menu]>[Observation]>[Histogram].

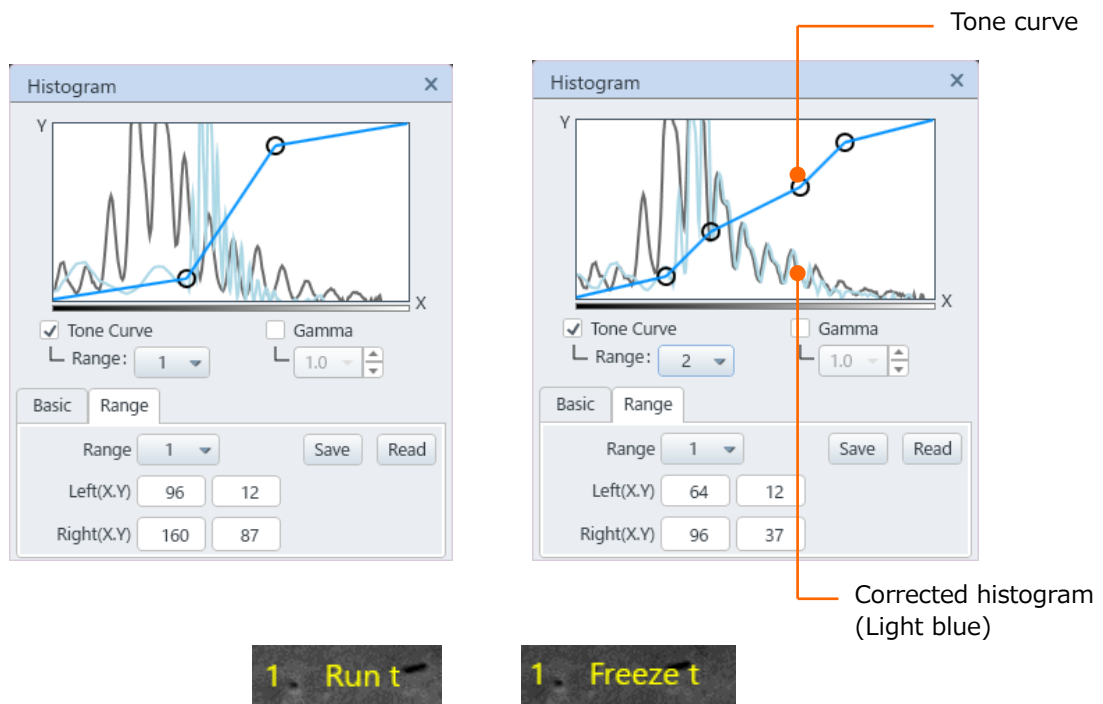


(1) Real time tone curve correction check box

Enable the real time tone curve correction. Calculate the histogram without correcting the tone curve and display the corrected histogram in light blue color. Real time tone curve correction can be set in the different value for each display under the multi-screen mode. Up to 2 tone curve areas can be selected from the pull down list.

The tone curve can be set by dragging and dropping mouse operation or inputting the text in the area tab as desired. Save the set tone curve by clicking the [Save] button and load the tone curve by clicking the [Load] button.

When tone curve correction is enabled, the [Run t] is displayed at the upper right of image while scanning, the [Freeze t] is displayed at the upper right of image while stopping. In addition, when the image signal of data display is ON, the [Detector name_t] is displayed on the image. Detector name of saving file name will be the [Detector name_t] when the [Put signal name] check box is ON in the [Saving settings].

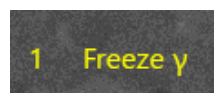
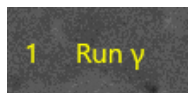
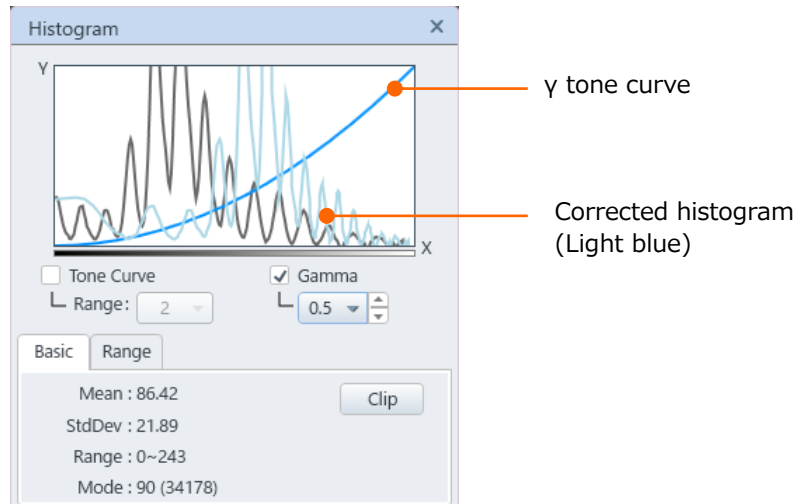


(2) Real time gamma (γ) correction check box

Enable the real time γ correction. Calculate the histogram that is before correcting the gamma and display the corrected histogram in light blue color. Real time gamma correction can be set different value for each display during multi-screen mode.

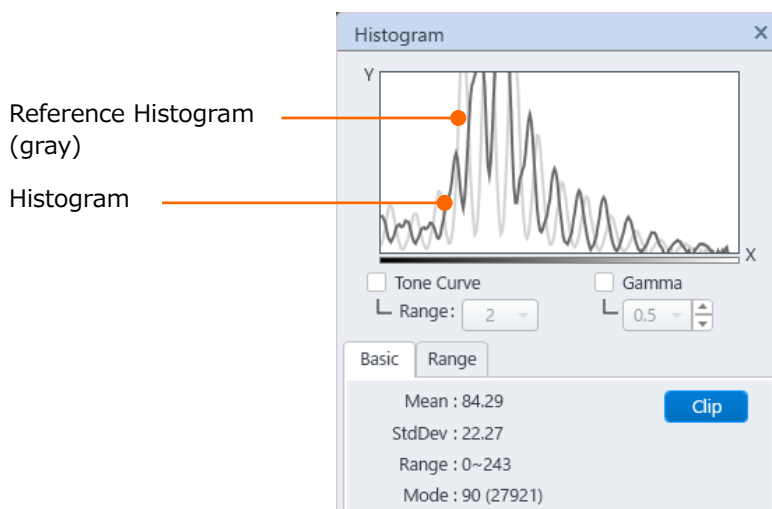
When gamma correction is enabled, the [Run γ] is displayed at the upper right of image while running, the [Freeze γ] is displayed at the upper right of image while freezing.

In addition, when the image signal of data display is ON, the [Detector name_ γ] is displayed on the image. Detector name of saving file name will be the [Detector name_ γ] when the [Put signal name] check box is ON in the [Saving settings].



(3) Clip

Record and display the histogram at the time of clicking the clip button in gray color as a reference. When clicking the button again, the histogram will be hidden.



2.3.17 Saving

Save an image that is presently displaying. In case that the image is scanning, the image will be the freeze condition and the image will be captured after the scanning is stopped. When the image is in the freeze condition, the image will be saved as it is.

The saving condition (Saving destination, image information and file type) can be set in [Saving condition setting] dialog which can be displayed by right-clicking the mouse on [Save] button. The [Saving condition settings] dialog can be selected from [Menu]>[Observation]>[Saving condition settings].

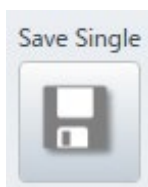
NOTE: The image will not be saved while NONE, Chamber Scope or SEM MAP is selected.

(1) Save button

- Save Single button

Save the presently displaying image.

In case the multiple screens are displayed, only the selected screens will be saved (Images, which frames are highlighted in green).

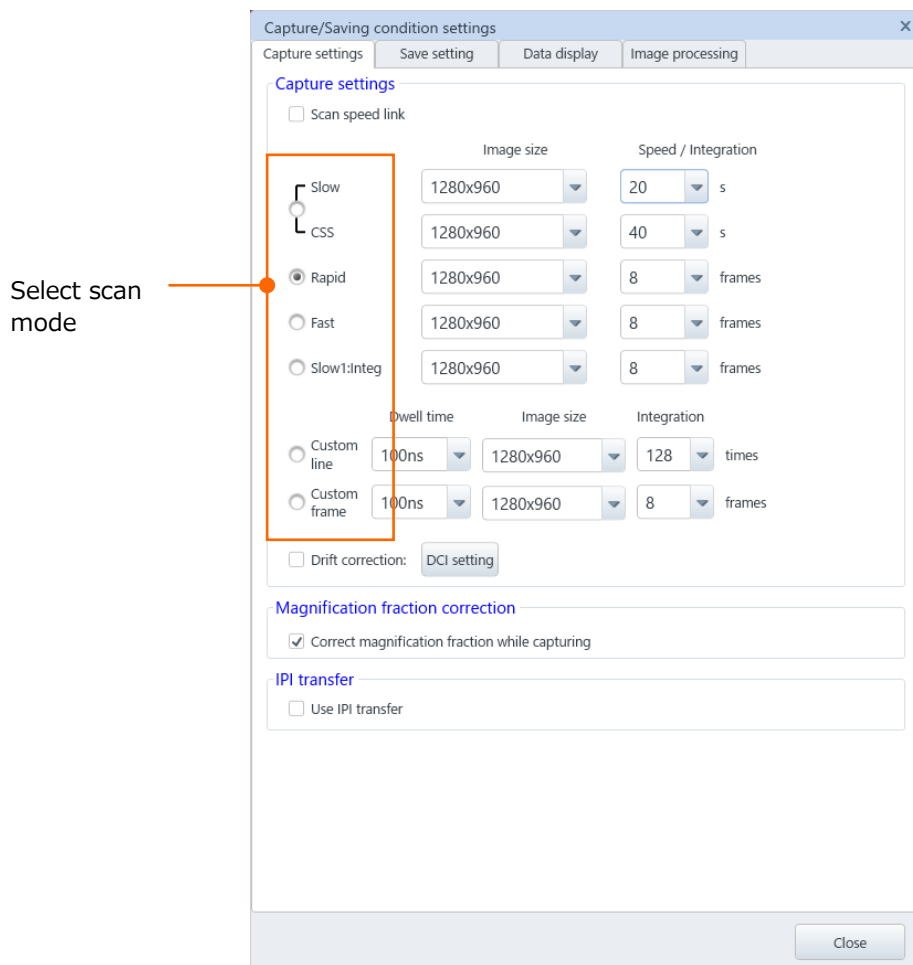


- Save All button

In case multiple screens are displayed, all screens will be saved.



(2) Saving settings window
 (a) Capture settings tab



- Link to scan Check box
 Set the capturing parameter while the check is OFF. Select the scan mode, image size, and speed/Integration number.
 Set the scan mode that is linked to the present scan image setting for capturing while check is ON. The [select scan mode] button in the window is hidden.
 Select the image size and speed/Integration number from the parameters.
- Select scan mode
 Type of scan speed and image size are displayed. The seven types of capture scans are available.
 Slow: Slow scan mode
 CSS: CS scan mode
 Rapid: Rapid scan mode
 Integ: Fast scan frame integration mode
 Slow1: Integration: Slow scan frame integration mode
 Custom-Line: Custom Line scan integration mode
 Custom-Frame: Custom Frame scan integration mode

- Drift correction integration Check box

This function can control the deterioration of resolution that occurs due to image integration processing when the observing target is slowly moved (Drift).

The larger the FOV shift amount, the greater the burr generated on the integration result image by integrating the shifted image. When the FOV is moved by the time goes, the smaller number of integration frames, the shorter the image integration time. Thus, the integration image that smaller effect of FOV shift can be obtained.

This function creates an integrated image (Hereinafter abbreviated as Drift correction) that affection o FOV shift is small by capturing multiple images which are integrated fewer frames (Herein after called as original image) and correcting the position shift between original images with the normalized correlation then, integrating all original images.

NOTE: Image information of surround area will be filled in the drift correction image. The area which is out of FOV or newly appears on the FOV while capturing the multiple original image does not include to the drift correction integration processing.

Check ON the check box to change the display to the drift correction mode.

Drift correction: DCI setting

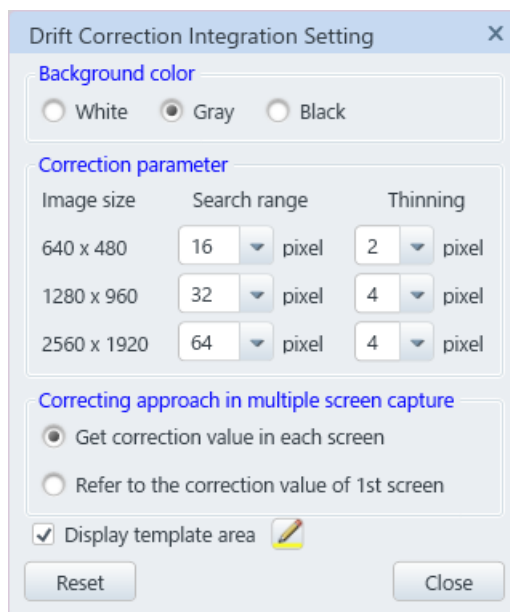
Number of images images

Start image

Total integration frames

- Number of capturing
Select the number of continuous capturing images (2 to 11).
- Integration start image
Select the integration start image.
- Total integration number
Display the integration number. It will be;
Total integration number = Capturing number - Integration start image-1

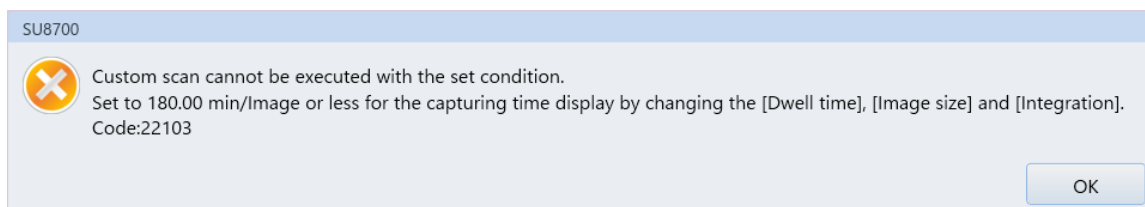
- DCI settings
Click the button and display the drift correction integration settings dialog.



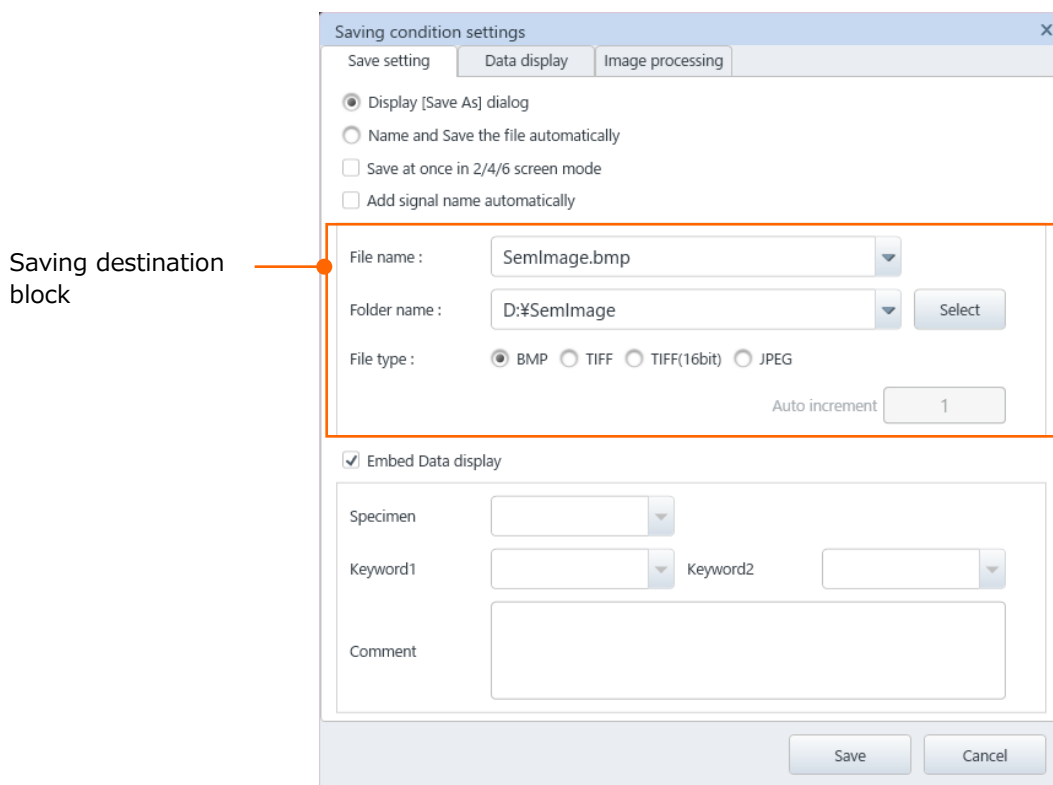
- Background color
Select a color of surround area on the drift correction image.
Change the settings to distinct the color between the data display text or background color and the filled area color.
- Search range
The maximum value (Unit: pixel) of drift amount to correct. The larger the value the larger specimen drift can be corresponded. However, the time of image processing becomes longer.
- Ratio
It is the compressed ratio of original while image processing. The smaller the value, the better obtaining accuracy of specimen drift amount. However, the time of image processing becomes longer.
- Get correction value in each screen
Obtain the drift amount and correct the shift at each display while image processing.
- Refer to the correction value of 1st screen
Use the drift amount obtained on the first display and correct the shift for the second or later display during the image processing. It is effective when obtaining a drift correction image whose structure is difficult to determine due to S/N is insufficient. Select the signal that structure can be determined clearly for the first display.

- Display template area
Check ON the check box and display the frame indicating the template area on the image display area. The frame indicating the template area can be changed by the color button.
- Reset
Set all settings to the default settings.
- Close
Close the drift correction integration settings dialog.
- [Correct magnification fraction while capturing] check box
When this check box is ON, the magnification value will be round off according to the magnification step for capturing an image.
- IPI image transfer settings Check box
Display the IPI image transfer setting by clicking ON the IPI transfer check box on the [Menu]>[Standard settings]>[General] tab. When this check box is ON, perform the IPI transfer of saved image after saving or capturing.

- NOTE:
- The image size or speed/integration number may not be set due to the scan mode.
 - The capturing image size is limited due to the observation condition (Multiple screen mode or others).
 - Up to 180 minutes of capture time can be set. When the time of 180 minutes is exceeded, the following error message will be displayed. Set the capture time within 180 minutes according to the message.
 - It will take time to start capturing when switching the dwell time.



(b) Save setting tab



- Display [Save As] dialog
When [Show image save dialog when saving] in the [Saving settings] window is selected, the [Save As] dialog is displayed whenever the [Capture/Save] is executing. Enter the file name and save the file at each time.
- Name and Save the file automatically
When [Name and Save the file automatically] is selected, the number is added to the defined file name that is selected in the saving destination block of (2) and save the file. In this case, [Saving settings] window will not be displayed.
- Save at once in 2/4/6 screen mode
When [Save at once in 2/4/6 display mode] check box is ON, the image number is added to the files automatically when multiple images are saved simultaneously. The images that are simultaneously captured and saved can be determined by the file names.
- Add signal name automatically
When [Add signal name automatically] check box is ON, the signal name is added to the file name. Signal type of image can be determined by the file name.

- File name, folder name and input text box
Select a folder for saving and the file name.
Click ▼ button at the text input box, the list of folder and file names that are used are displayed. The name can be edited by selecting from the list.
- Select button
Display the window for searching an existing folder or creating a new folder.
- File type
The file format of (BMP), TIFF (TIF), TIFF (16 bit) and JPEG (JPG) are available for saving the file.
- Auto increment setting box
When [Save with automatic numbering] is selected, add the serial number automatically and save a file. The number in this box indicates the starting number for adding. The number from 1 to 9999 can be entered.
The image file name for saving will be [file name that is selected at above_serial number].
A message is appeared when the serial number is reached to the maximum number (9999). In this case, select a new file name. The serial number can be inserted to the top of the data display which is displayed on the observing image.
- Specimen
Enter the specimen's name by text. Inputting the specimen's name is not required at the all the time.
- Keyword 1/2
Enter a desired keyword by text. Inputting the keyword is not required all the time.
- Comment
Enter a comment in the image data information. The comment is not required all the time.

Reference: Image will be saved as below depending on the combination of radio button and check box.

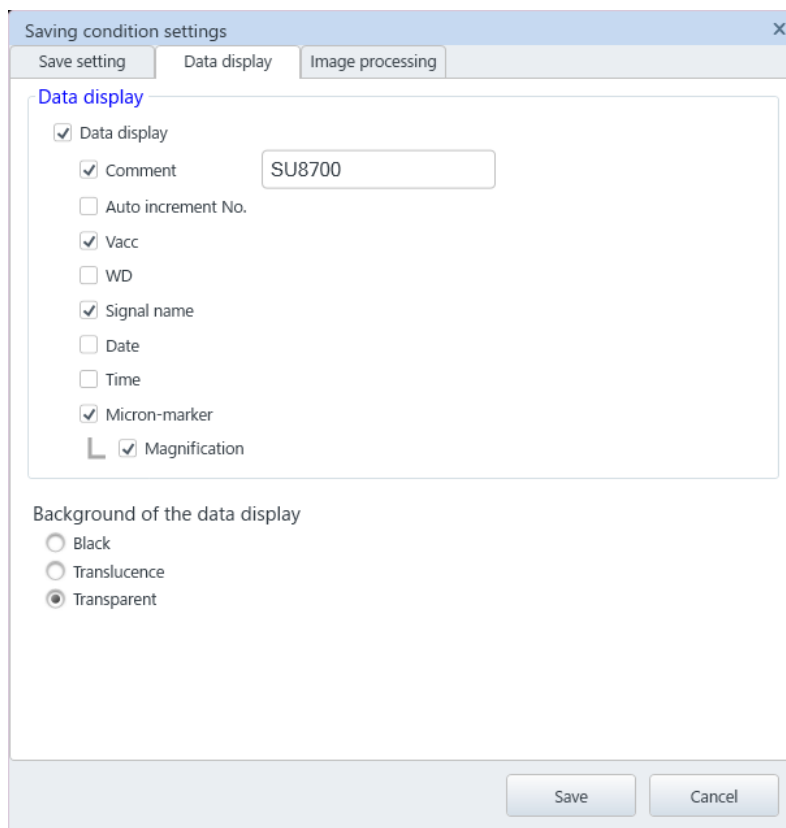
		Radio button: ON	
		Display [Save As] dialog	Name and Save the file automatically
		When saving an image, [Save As] dialog is displayed. However, the dialog is displayed at the first time only and save as the following file name at once.	[Save As] dialog is not displayed and add the serial number automatically. However, the serial numbers are added to images while capturing and saving, and saved at one with the following file name.
Check box : ON	2/4/6 screens Save All	{Input file name}_N.extension	{Input file name}_{Serial number}_N.extension
	Add signal name automatically	{Input file name}_{Signal name}.extension	{Input file name}_{Serial number}_{Signal name}.extension
	2/4/6 screens All Save and Add signal name automatically	{Input file name}_N_{Signal name}.extension	{Input file name}_{Serial number}_N{Signal name}.extension

N: Screen number

- NOTE:
- Display number (N) will not be added under the 1 screen mode.
 - When multiple screens are saved simultaneously, the images that are selecting multiple displays the [NONE] for signal will not be saved.

(c) Data display tab

Set the function for displaying the data such as observation condition in the bottom of the image.



- [Data display] check box
Items that are activating are displayed while the check box is ON.
When the check box is OFF, all of the auto data displays are hidden.
- [Comment] and [Auto increment No.] check boxes
Display or hide the comment or auto increment number by the check box.
Comment can input in the text box at the right side up to 10 characters and numbers. Auto increment No. is a saving method when the [Save with automatic numbering] is selected.
- [Vacc] to [FOV] check boxes
When the check box is ON, the item is displayed.
[Magnification] check box can be activated only when the [Micron-marker] check box is ON. The [FOV] check box can be activated only when the [Micron-marker] check box is ON.

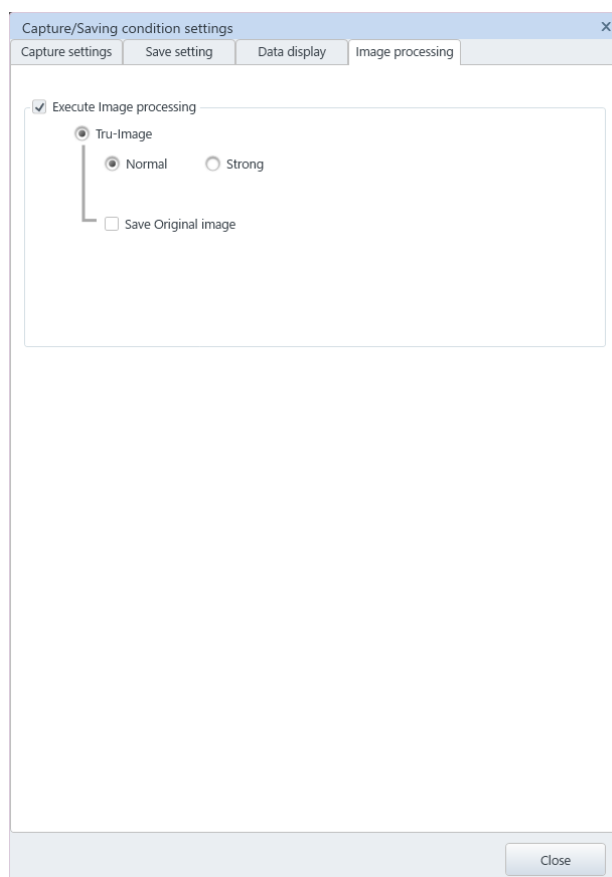
NOTE: When all items in the auto data display area are displayed, the text may be layered due to the limitation of space. In this case, hide the unnecessary items.

- Select the background mode of data display in the [Background of the data display].

(d) Image processing tab

Tru-Image can repair the burr on image which is generated depending on the electron optical condition or contrast deterioration. By enabling this function, perform the Tru-Image and save an image file depending on observation condition (Accelerating voltage, WD, Spot intensity, Specimen height, image size, magnification) while Capturing/saving.

“Freeze TruImage” will be displayed at upper left on the frozen display while executing while performing the Tru-Image.



- Execute Image processing Check box
Image processing that is selected while capturing/saving will be performed.
- Tru-Image
Tru-Image will be performed while capturing/saving will be performed by setting ON the radio button. When select the “Strong,” the image which strongly apply the image processing can be obtained.
 - Save Original image check box
The original image data which is before Tru-Image is performed will be saved as well by setting ON the check box. “_Raw” will be added at the end of the image file name performed the Tru-Image to the original image data file name. The original image will not be saved and only the image file performed the Tru-Image will be saved by setting OFF the check box.

2.3.18 Capture

Capture an image (Import and save the image with the set image size and scan speed).

[Capture settings] window is displayed and image size, scan speed and number of integration can be set by right clicking the mouse on the capture setting display area. The [Capture settings] window can be selected from [Menu]>[Capture settings].

[Saving settings] window is displayed by right clicking the mouse on [Capture] button and saving settings (Saving destination, image information, image type or others) can be performed.

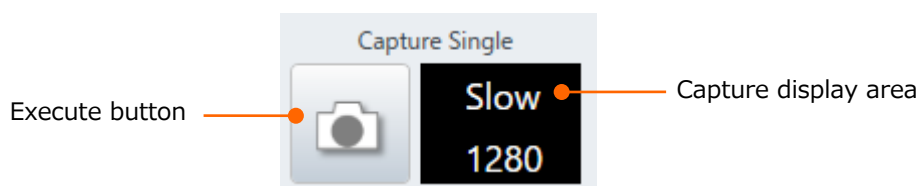
NOTE: Cannot capture the screen that is selecting the [NONE], Chamber Scope and SEM MAP.

(1) Capture button

- Capture Single button

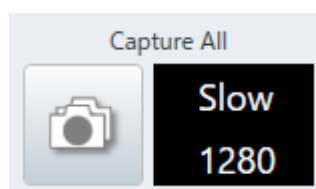
Capture the presently selected image.

If the multiple screen mode is selected, only selected screen for operating (Highlighted with green frame) will be captured.



- Capture All button

Capture all screen when multiple screen mode is selected.



- Execute button

Scan the image from the top. After scanning is completed, the display will be in the Freeze status and the captured image is saved.

When the image is in the Freeze status, Freeze status is released and restart to capture the image. When it is performed under the scan Run status, the Freeze will be released, and capture scan will be performed.

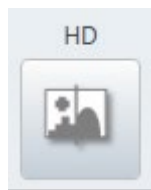
2.3.19 High resolution capture

(1) Execute button

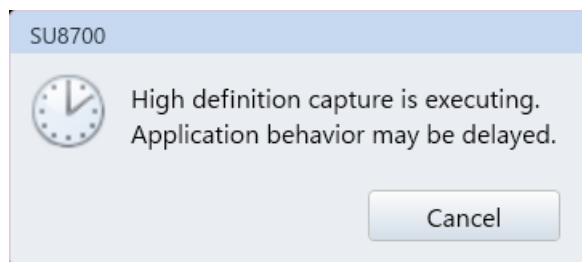
Capture a high resolution image.

Display the [Capture High resolution] dialog in the [Sub panel] by right clicking the mouse on the button. [Capture high resolution] window can be selected from the [Menu]>[Observation]>[Capture High definition].

NOTE: Only the screen that is selected from the [Capture High definition] window in [Sub panel] will be captured. Cannot capture the multiple screens.

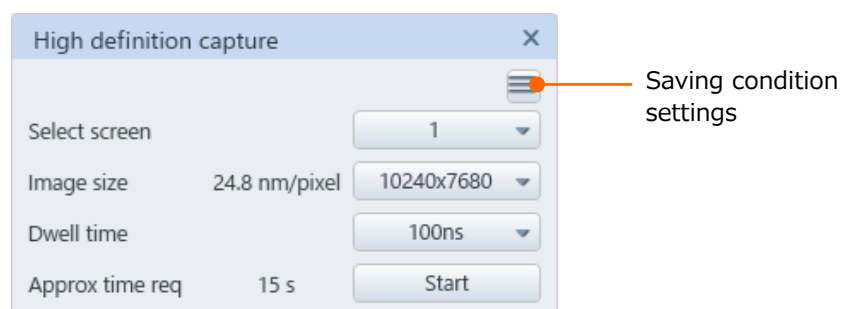


The below message is appeared while capturing High resolution image. Click the [Cancel] to finish capturing.



(2) High resolution capture window

Parameter for capturing a high resolution image can be set.



(a) Saving condition settings

Display the saving condition setting dialog.

(b) Select display

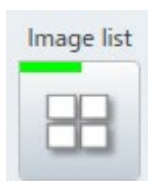
Select the high definition capture execution display from the pull down list.

- (c) Image size
Select an image size for capturing with high definition from the pull down list.
Refer to the [\sim nm/pixel] for the length of each pixel and define the image size.
20480×15360 and 40960×30720 are options.
- (d) Dwell time
Select dwell time for one pixel while capturing high definition image for the pull down list.
- (e) Estimated time
Display the capturing time that is calculated by the (c) image size and (d) Dwell time. The value can be differed from the actual value depending on the condition.
- (f) Start
Execute the high definition capture.

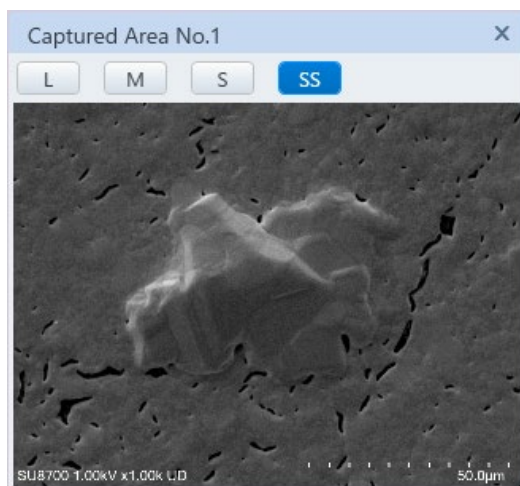
2.3.20 Image list

Display the [Image list] dialog. The [Image list] dialog can be selected from the [Menu]>[Observation]>[Image list].

Images that are captured and saved are minimized and displayed in the list. When capturing and saving are completed and image data is saved, the image list dialog will be displayed.



- (1) Thumbnail display
Minimize and display the captured or saved image.
The thumbnail image can be displayed in the image display area by dragging and dropping the image with the mouse.
When the display image number is increased and width (or height) of display is reached to the limit, a scroll bar is displayed for showing the images.
The maximum number of thumbnail display image is 329. When the number of image reaches to the maximum number, the oldest image will be deleted (Image file will not be deleted).
By clicking the thumbnail image, the selected image is indicated in the orange frame as a target for operating by the tool buttons. Press the [Ctrl] key for selecting multiple thumbnail images or click the edge of the selected image range while pressing the [Shift] key.
By double clicking on the thumbnail image, viewer is activated, and image will be displayed. The display size of viewer can be changed by double clicking on the image display area or select a size at the upper area of viewer.



Multiple viewer can be opened and displayed on front of the desktop. This function can be used for referring and operating the previous capture image while observing the same FOV image in the different conditions. The [Select] button is arranged at the top of dialog for selecting the display size.

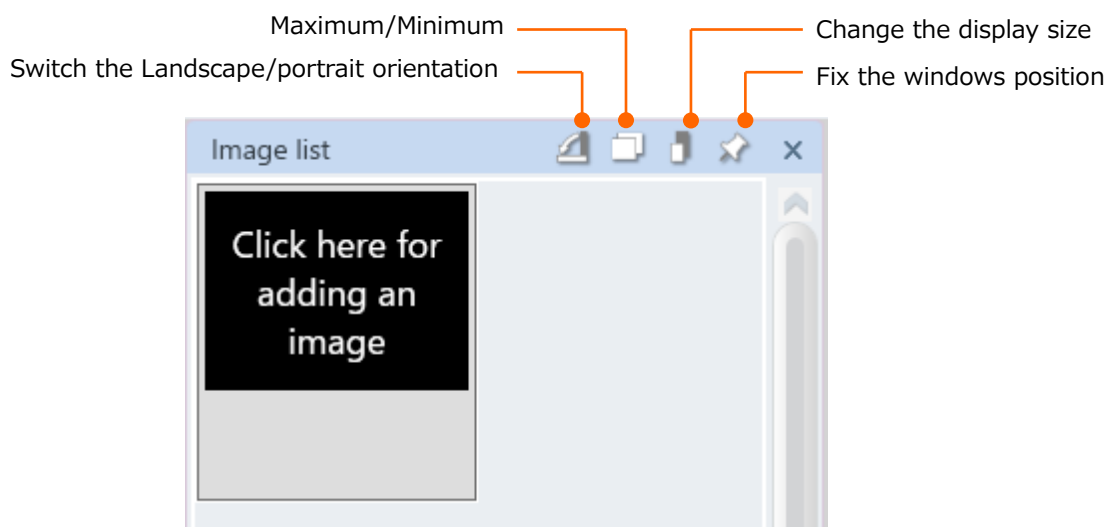
(2) Image information display and detailed information of image dialog

File name of the image data, accelerating voltage while capturing, magnification, detector name will be displayed at the bottom of thumbnail.

Pop-up window of image detail information is displayed by moving the mouse cursor to the thumbnail.

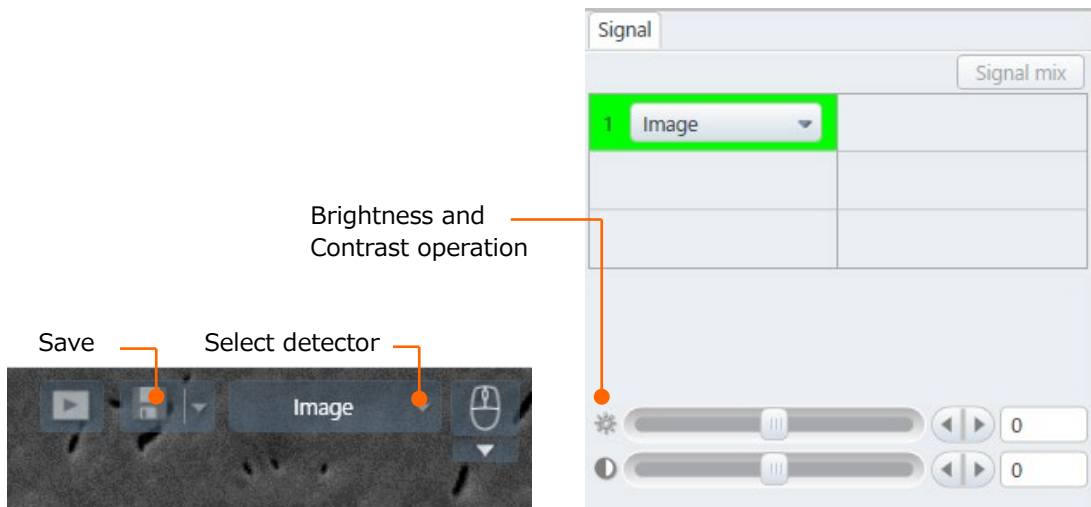
(a) Adding an image list

Display the [File name select] dialog by clicking the [Please click here for adding an image] display area on the image list. Enter file name for displaying in the image list and add the file into the list.



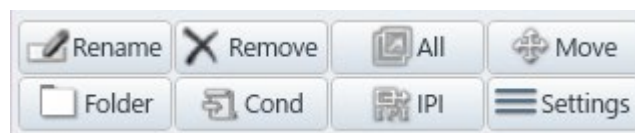
(b) Display from the image list to image display area

An image on the image list can be display to the image display area by dragging & dropping the image to the image display area that NONE is selected on the Select detector. At the time, the selected detector becomes Image from NONE.



In addition, the image that is moved from the image list to the image display area can adjust the brightness from the [Operation panel]>[Signal] tab and the contrast from the contrast operation slider. The adjusted image can newly be saved from the Save button on the image display area.

(3) Tool button



(a) Rename

Change and save the selected image file name. When multiple images are selected, the file name is changed and saved in order to the capture area number.

(b) Remove

Remove the selected thumbnail image from the image list. The saved image file will not be removed.

(c) All

Select all thumbnail images that are displaying in the image list.

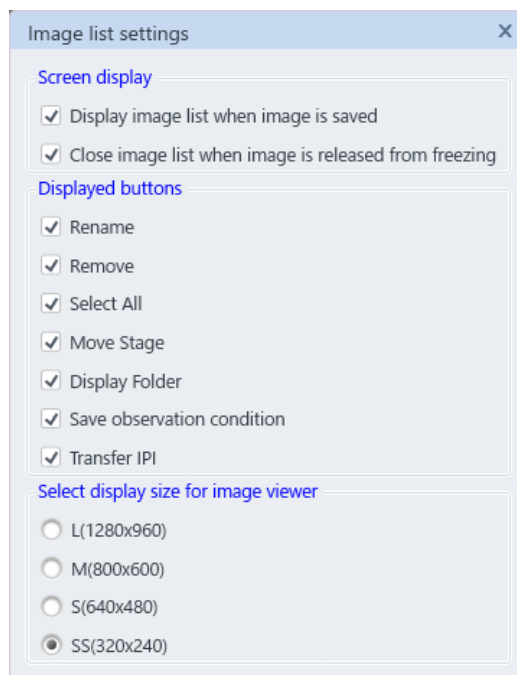
(d) Move

Move the stage to the selected image of stage coordinate. Only X, Y and R axes are moved. It cannot execute while selecting multiple images.

(e) Folder

Display the folder that has saved the selected image. It cannot execute while selecting multiple images.

- (f) Cond
Open [Register] dialog in the [Observation condition] and register the observation conditions of the selected image. It cannot execute while selecting multiple images.
 - (g) IPI
Set the settings by clicking ON the IPI transfer check box from the [Menu]>[Standard settings]>[General] tab. Perform the IPI transfer to the selected image.
 - (h) Switch landscape or portrait orientation
Orientation of image list can be arranged. The image list is arranged at the bottom area (landscape) or left side (portrait) when switching the orientation.
 - (i) Minimize/Maximize
Minimize or maximize the image list. Click the button again to return to the original size.
 - (j) Right clicking the [Menu] function on the [Image list] window
Right click the mouse on the thumbnail image in the image list window and display the functions of tool button.
 - (k) About the Mouse wheel operation on the image list
An image in the image list can be scrolled by the mouse wheel.
- (4) Settings
Display [Image list settings] dialog.



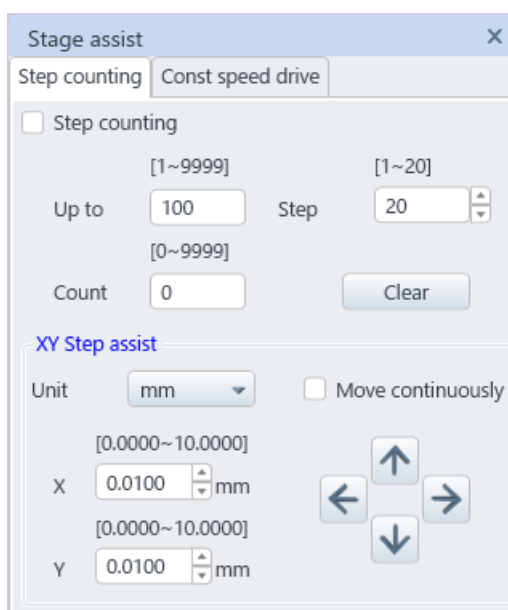
- (a) Screen display
Set the timing for displaying the image list by the check box.
- (b) Displayed buttons
Set the tool button for displaying the image list by the check box.
- (c) Select display size for image viewer
Set the image viewer size to display.

2.3.21 Stage assist

Display [Stage assist] dialog in [Sub panel]. The [Stage assist] panel can be selected from [Menu]>[Observation]>[Stage assist].



(1) Step counting tab



(a) Step counting check box

The mouse pointer while moving the mouse on the image display area will be cross mark by setting ON the step count check box.

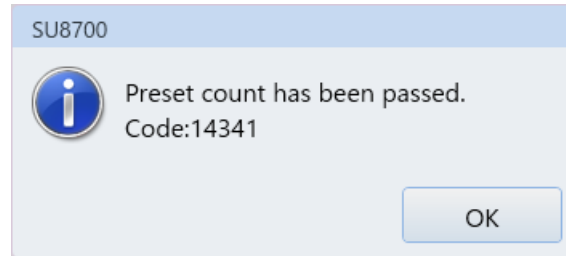
The stage will be moved as moving the clicked position to the center of screen by clicking on the image display area in this condition. The image shift cannot be used simultaneously. Only mechanical movement of stage can be performed.

When clicking it while pressing the Shift key, the stage will be moved to side direction or vertical direction only. The stage will not be moved to diagonal direction even if the clicking position is diagonal direction.

Whether to move to side direction or vertical direction will be defined by clicking the closest axis.

(b) Up to

The following message will be displayed when the count value is same as the value which is input in the counter value or larger. The operation can be continued by clicking the OK button.



(C) Count

The count value will be increased at every time of clicking the mouse on the image by set unit.

(d) Unit

Set the unit for counting.

(e) Clear button

Set the count value to 0 by pressing the [Clear] button.

(f) XY step assist part

- Unit

Unit of step move can be selected from the pull down menu. Only [mm] is available for the normal stage.

- Step button

Click each step button of X, Y to perform the step move by minimum moving unit. The minimum moving value can be changed by inputting the value to the value box directly.

- [Move continuously] check box

Display the [Number of Step move] text box, [Go] button and [Stop] button by setting ON the [Move continuously] check box.

Stage assist

Step counting Const speed drive

Step counting

[1~9999] [1~20]

Up to 100 Step 20

[0~9999]

Count 0 Clear

XY Step assist

Unit mm Move continuously

[-10.0000~10.0000] [1~1000]

X 0.0100 mm 1 times

[-10.0000~10.0000] (0/1)

Y 0.0100 mm Go Stop

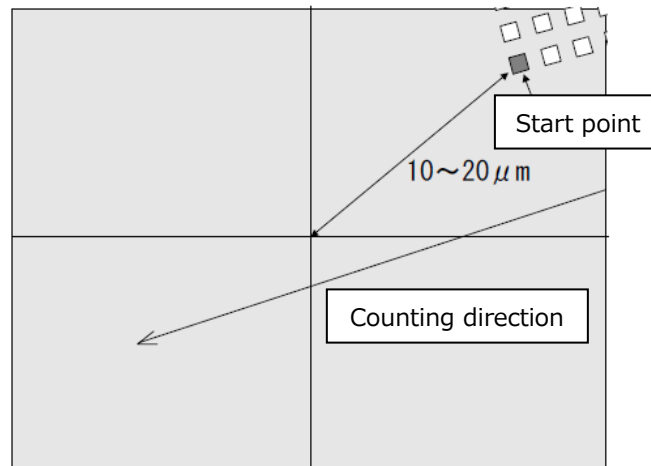
- [Number of Step move] text box
Perform the step move for the input number which is input in the [Number of Step move] text box.
- [Go] button
Perform the step move continuously.
- [Stop] button
Stop the stage move.

NOTE: Note the followings since the stage move with the pitch of several μm or less is smaller value than the mechanical moving accuracy of stage.

- Move to the start point

when the backlash is remained, the point will not be moved to the center of display since the moving amount by the count operation is small. At first, move it about 10 to 20 μm to the opposite direction for moving.

Check ON the step count check box and set the mouse point to cross mark condition then, click and move the start point to the center of display. Move the start point repeatedly until the start point is in the center of display. At this time, reset the count value, set the unit, and start counting.



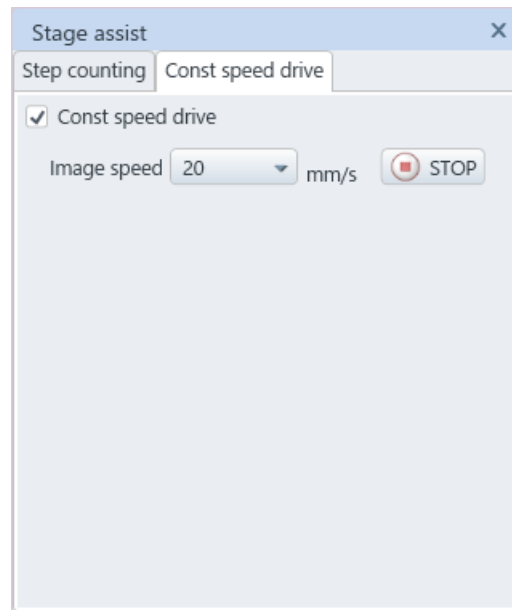
- Adjust the specimen direction to the stage direction as accurate as possible

When the moving direction is changed due to the stage mechanical backlash, the stage will not be moved as the setting. When the stage is moved to diagonal direction, the backlash of XY axes become a problem.

Therefore, set OFF the raster rotation and check the moving direction on display by moving either X or Y then, adjust the stage R axis to match the direction of counting cell line as much as possible. At this time, the image can be moved slightly when moving the stage X axis. In this case, adjust it so that the tracing cell will move along to the diagonal line.

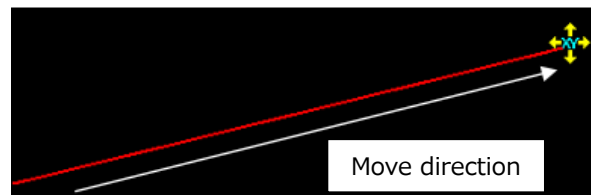
When performing this adjustment, only the X axis of stage will move by setting the XY switch of trackball to X and only Y axis of stage will move by setting the XY switch of trackball to Y.

(2) Constant move tab



(a) Constant move Check box

The mouse pointer while moving the mouse on the image display area will be constant move mark by setting ON the constant move check box. The stage will be moved as the image moving along to the drawing red line by moving the mouse to desired direction while pressing and holding the left button of mouse at the desired position on the image and releasing the button (The direction will be indicated in red line) .



(b) Image speed

Set the image speed from the pull down list.

(c) [Stop] button

Stop the stage.

- NOTE:
- The other stage operation cannot be performed while performing the constant move. In addition, the moving speed on the image will be changed in proportion to the magnification when changing the magnification since the stage moving speed is defined when starting up. By changing the raster rotation, the stage moving direction will not be changed but the visual image moving direction will be changed.
 - Delay of move action is occurred due to backlash when starting up after moving the stage to opposite direction of constant move. The move action will be faster when the stage is moved manually to the constant move direction. In addition, the higher magnification, the slower the speed action when starting up.

2.3.22 Display mode

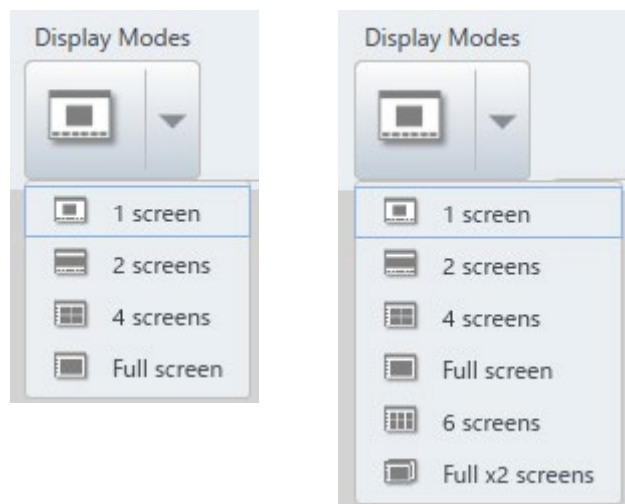
Switch the image display mode.

1, 2, 4 and full screens are available. When the 2 monitor mode is ON, 6 screens and full screen x2 are available.

Signals in the different detectors can be displayed simultaneously under the 2, 4, 6 screens and full screensx2 modes.

The scanning resolution of electron beam can be changed for adjusting to the image size of each display mode (Scan an image according to the capturing image size).

The pull down list as shown in the below is displayed by clicking the split button (▼) . Select a display mode from the pull down list. The display mode can select from [Menu]>[Observation]>[Display mode].



(1) 1 screen mode (800×600 pixels)

The display image size is 800 x 600 pixels in the 1 screen mode.

The repeating speed (frame speed) will be faster because the number of pixels are small. In case the noise is large, and amount of signal is little, or fine adjustment for focusing is required, the image can be clear than the full screen mode.

(2) 2 screens mode (800x600 pixels)

The 800×600 pixel size of images are arranged side by side in the 2 screens mode.

Two different kind of signal images can be observed simultaneously.

[Run/Freeze] and [Capture/Save] buttons are arranged at the upper left side on each image. [Run/Freeze] and [Capture/Save] can be performed for each signal image independently by pressing the buttons.

The target image for operating the BRIGHTNESS, CONTRAST knob, bright adjustment on the [Operation panel]>[Signal] tab or others is highlighted in green by clicking both sides of image display area.

In addition, the signal select boxes are arranged in both screens. The signal for each screen can be selected.

(3) 4 screens mode (640×480 pixels)

The 640×480 pixel size of images are arranged in the 4 screens mode.

The image of four or three different kind of signals and image of mixed signals can be observed simultaneously.

The [Run/Freeze] and [Capture/Save] buttons are arranged at the upper left side on each screen. The [Run/Freeze] and [Capture/Save] can be performed at each screen independently by pressing the buttons.

The target image for operating the BRIGHTNESS, CONTRAST, and bright adjustment on the [Operation panel-Observation]>[Optics] or others is highlighted in green by clicking each image display area.

In addition, the signal select box is arranged in each screen. The signal for each screen can be selected.

(4) 6 screens mode (640x480 pixels)(For 2 monitor mode only)

The 640×480 pixel size of six images are arranged in the 6 screen mode.

Six different kind of signal images, or image of three different kind of signal and image of mixed signals can be observed simultaneously.

The [Run/Freeze] and [Capture/Save] buttons are arranged at the upper left side on each screen. The [Run/Freeze] and [Capture/Save] can be performed at each screen independently by pressing the buttons.

The target image for operating the BRIGHTNESS, CONTRAST, and bright adjustment on the [Operation panel-Observation]>[Optics] or others is highlighted in green by clicking each image display area.

In addition, the signal select box is arranged in each screen. The signal for each screen can be selected.

(5) Full screen mode (1,280×960 pixels)

The 1,280×960 pixel size of image is displayed under the full screen mode. Image is displayed in larger size for observing easily.

Repeating speed for scanning is slower than the 1 screen mode. Thus, select 1 screen mode when the quality of display image does not enough due to the noise.

(6) Full screen x2 mode (1,280x960 pixels)(For 2 monitor mode only)

The 1,280x960 pixels of images are displayed in the full screen x2 mode. Two different kind of signal images can be observed simultaneously. However, the image are displayed by fixed condition (It does not in the floating condition) under the full screen x2 mode. The image will be saved by 1,280×960 pixel size.

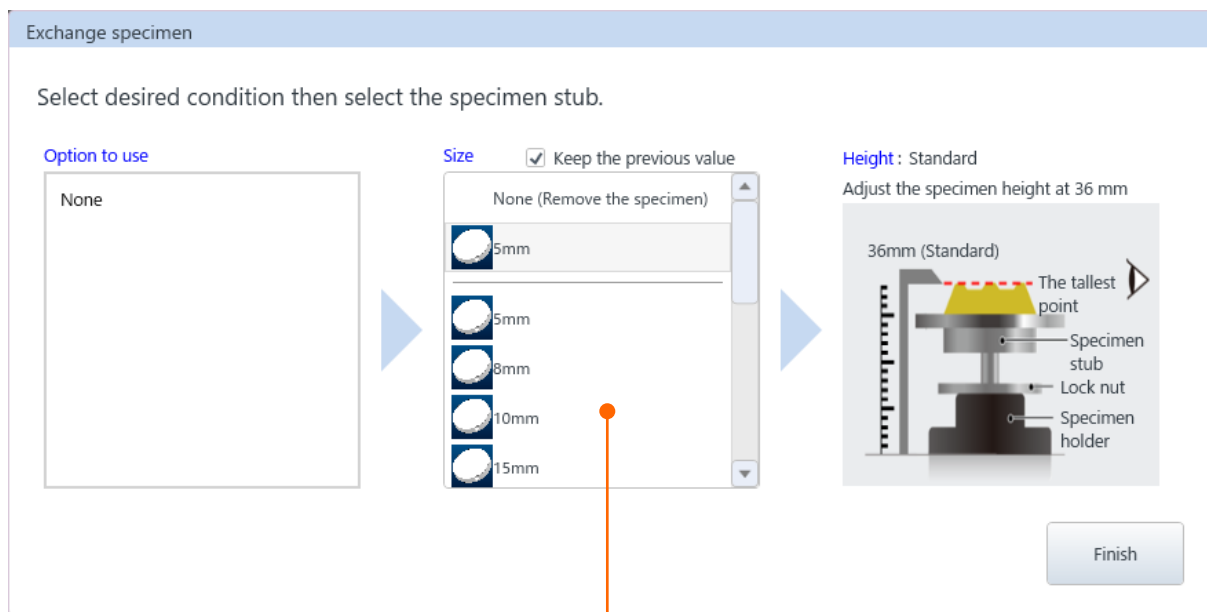
The [Run/Freeze] and [Capture/Save] buttons are arranged at the upper left side on each screen. The [Run/Freeze] and [Capture/Save] can be performed for each screen independently by pressing the button. The target image for operating the BRIGHTNESS, CONTRAST knob, and bright adjustment on the [Operation panel]>[Signal] or others on the manual operation panel is highlighted in green by clicking each screen. In addition, the signal select boxes are arranged in both screens. The signal for each screen can be selected.

The two 1,280×960 pixel size of images are arranged in the full screen x2 mode. Image is displayed in larger size for observing easily. Repeating speed for scanning is slower than the 1 screen mode. Thus, select 1 screen mode when the quality of display image does not enough due to the noise.

2.3.23 Exchange specimen

When clicking the [Exchange specimen] button, the [Exchange specimen] dialog as shown in the below is displayed in the front and the stage will be moved to the specimen exchange position. When the accelerating voltage is ON, the voltage will be turned OFF automatically and specimen exchange sequence is started. The specimen exchange can perform from the [Menu]>[SEC].

(1) Select specimen stab



Specimen stab diameter size list

- Select options to use
Select an optional detector to use from the detector list. Specimen stab list that is selectable for each detector is displayed.
- Size
Select a specimen stab from the specimen stab list.
- Finish (EVAC)
Finish the exchange a specimen sequence and move the stage to the home position.

Note: Make sure to set the parameter properly.

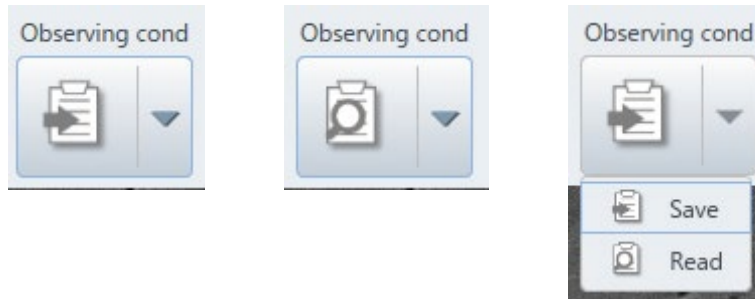
It can cause of damaging the detectors in the specimen chamber, structure, or specimen due to setting improperly.

2.3.24 Observation condition

The observation condition can be loaded by performing the condition setting of electron optics and axis alignment then, registering the settings.

Execute the function that is arranged in the execution button.

Click the split button (▼) and the pull down list is displayed as shown in the below.



(1) Register

Display the [Observation condition_Register] dialog by selecting the [Register] from the pull down list. The dialog can be displayed from the [Menu]>[Observation]>[Observation condition_Register] as well. The present observation condition and image are displayed in the dialog.

Enter a file name into the [Operation condition /File name] text box and enter the comment as required. Click the [Save] button and the observation condition will be registered. Cancel the registering conditions by clicking the cancel button.

As a reference, the image for condition registering will be registered. The image which is still scanning can be registered depending on the condition of clicking the register button (Right after the scan is switched or high definition capture is performed) , the problem can be resolved by registering again under the normal scanning condition.

(2) Read button

Display the [Observation condition_Read] dialog by selecting the [Register] from the pull down list. The dialog can be displayed from the [Menu]>[Observation]>[Observation condition_Read].

The registered observation condition and images are displayed in the dialog. In addition, the recommended condition can be registered in advance.

Select a file name to read from the observation condition list.

The selected observation condition will be set by clicking the [Read] button. Cancel the condition by clicking the [Cancel] button. The observation position, WD, vacuum status, contrast, stigmator/alignment and ULV alignment can be read by enabling the check boxes. Delete the selected observation condition by clicking the [Delete] button.

2.3 Control panel function

- NOTE:
- Recommended condition 01 to 05 is the condition that is initial registration of shipment.
 - If the registered system condition and the system condition of Read condition are unmatched, the Read cannot be performed.
- Example: Display mode setting by the 2 monitor mode, usability of Specimen bias (option) or others.

Observation condition_Read

Operation condition/File name

- Recommend condition 01 Low accelerating voltage (1 kV).pm1
- Recommend condition 02 High accelerating voltage (15 kV).pm1
- Recommend condition 03 High Resolution (1kV).pm1
- Recommend condition 04 High Resolution (15 kV).pm1
- Recommend condition 05 analysis (15 kV).pm1

Selection of conditions

Date: -

Specimen size: -

Vacc: 1.00kV Vb:ON

Spot intensity: 60.0, Normal

Obj aperture: No.2 or No.3

Position: Z(WD):8.0mm, Tilt:0.0deg

WD: 8.0mm

Focus mode: High resolution

Vacuum: High

Signal: 4:UD/MD/LD/NON

Contrast

Stigmator correction/Alignment

User mag correction (0.900~1.100): 1.000

Image

No Image

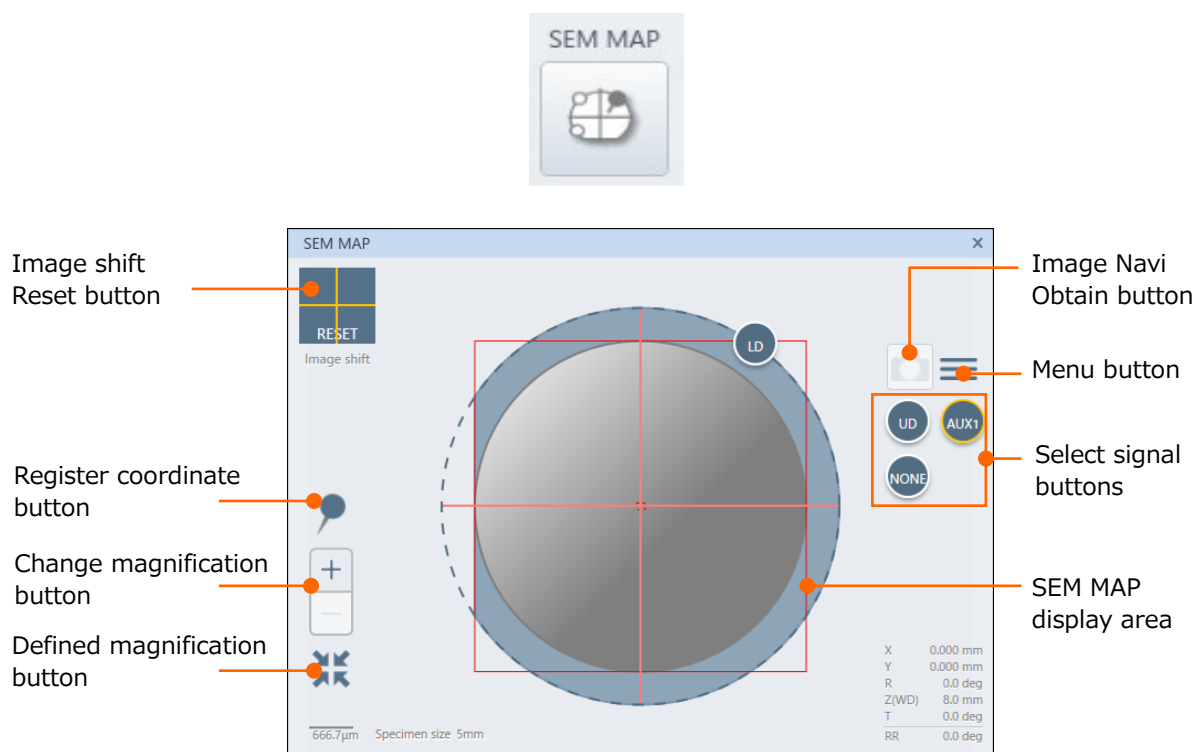
Comment

Default condition

Delete Read Cancel

2.3.25 SEM MAP

Press the [SEM MAP] button and SEM MAP window as shown in the below is displayed in the front. The [SEM MAP] window can be selected from the [Menu]>[SEM MAP].



(1) SEM MAP display area

Specimen stab, which is currently used indicates in gray circle. When double clicking on the specimen stab, the X and Y axes are moved to the center of FOV. In addition, the movable range of stage is indicated in red square frame. The center of specimen stab can be moved within the frame. When the rotation assist function is ON, the movable range indicates in green frame.

(2) Register coordinate button

Register a stage coordinate for observing. Moving to the registered coordinate is possible.

(3) Change magnification button

Magnification in the map display area can be changed.

(4) Defined magnification button

The preset magnification can apply to the map display area. The magnification can be set at the [Menu]>[SEM MAP setting] dialog.

(5) Select signal buttons

Select a detector for displaying in the image display area. The directional detectors are displayed in the arranged direction.

NOTE: When an EDS detector is displayed, EDS icon is appeared. It indicates the positions of EDS detector and specimen.

(6) Image Navi capture button

Obtain the currently observing SEM image and display the image on the SEM Map display area. In addition, obtain the information of the position.

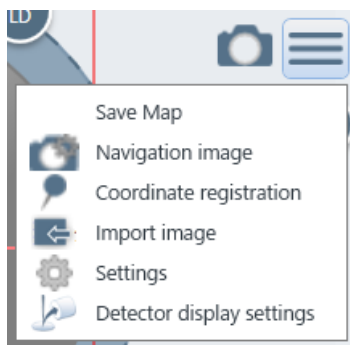
NOTE: In case the magnification is higher than x2000 or number of image for loading is more than 40, the data cannot be loaded.

(7) Image shift reset button

Reset the amount of the image shift.

(8) Menu button

Set the parameter of SEM MAP.



(9) Save MAP

Save the SEM MAP display area.

(10) Navigation display management

Display the [Navigation display management] dialog.



(11) [Move] button

Move the stage to the position where the Navigation image is captured.

(12) [Delete] button

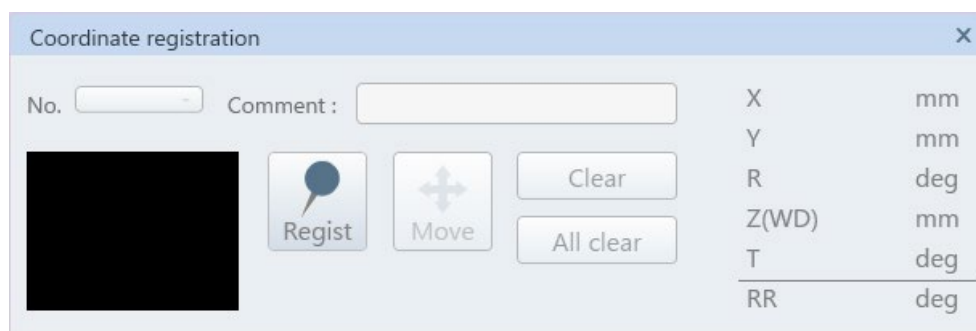
Delete the selected Navigation image.

(13) [Select All] button

Select all navigation images.

(14) Coordinate registration button

Display the [Coordinate registration] dialog.



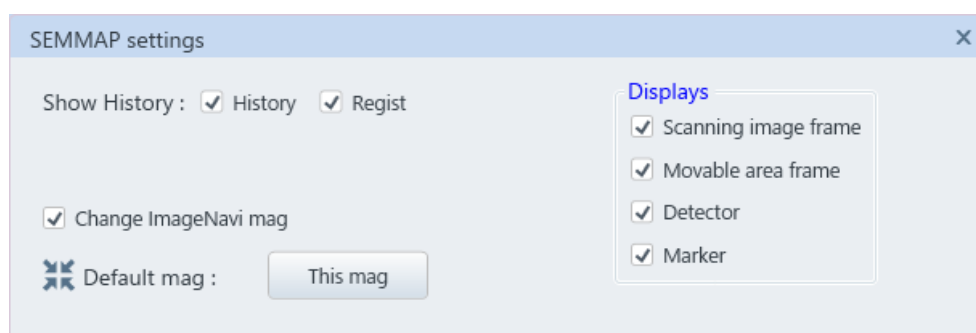
- (a) [No.] pull down list: Select the registered coordinate number.
- (b) [Comment] text box: Enter comment of the selected coordinate number.
- (c) [Register] button: Register the stage coordinate that is observing.
- (d) [Move] button: Move the stage to the position of coordinate number that is selected at (a).
- (e) [All clear] button: Delete the selected coordinate number by pressing the [Clear] button. In addition, all coordinate numbers that are registered will be cleared by pressing the [All clear].

(15) Import image

Obtain the camera image for observing a specimen, image of optical microscope or schematic diagram use the image as a navigation image. Conduct the [3 points alignment] according to the instructions on display.

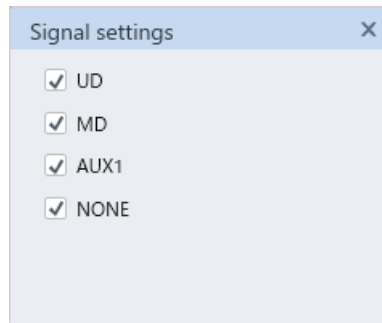
(16) SEM MAP setting

Display the [SEM MAP] dialog. Set the parameter of [SEM MAP].



(17) Detector display settings

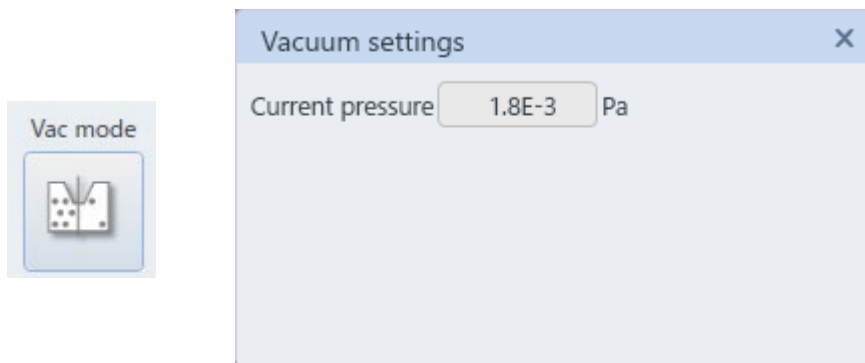
Select detectors (without directivity) for displaying on the SEM MAP window.



2.3.26 Vacuum mode settings

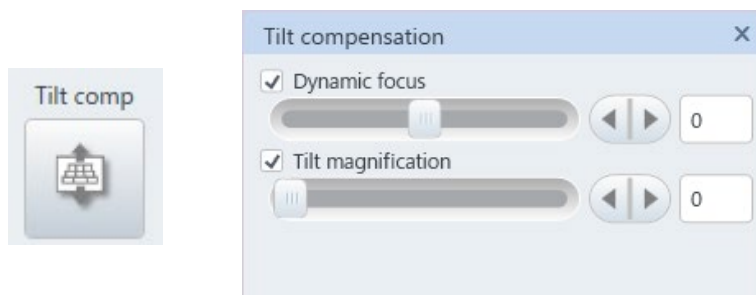
The [Vacuum settings] dialog can be displayed from the [Menu]>[Vacuum mode settings] as well.

The present vacuum status of specimen chamber is displayed.



2.3.27 Tilt compensation

Press the [Tilt comp] button and display the [Tilt compensation] dialog in the [Sub panel]. The [Tilt compensation] dialog can be displayed from the [Menu]>[Observation]>[Tilt comp]. Correct the focus of tilting direction while tilting a specimen and the magnification by this button. This correction is performed by linking to the vertical direction of the display image for scanning. Therefore, when performing this function, the direction of specimen tilt should be vertical direction. This condition is satisfied by setting OFF the raster rotation or rotation angle at 0°.



(1) Dynamic focus

When tilting a specimen, focusing area is decreased. Dynamic focus corrects the focusing area while tilting direction.

Enable the check box and move the slider to the right and left side to the largest area of focusing. In addition, fine adjustment can be performed by entering the number at the right side of the slider.

- NOTE:
- Focus may not be performed properly under the Fast scan.
 - When the dynamic focus is ON, AFC and AST cannot be performed.
 - Dynamic focus will be OFF automatically by closing the [Tilt compensation].

(2) Tilt magnification correction

While tilting a specimen, the tilting direction (Y direction) seems shrink due to observing a specimen from the tilting direction. This function corrects the phenomenon so, the image can be observed as the same condition as the without tilting condition. Enable the check box and move the slider to the right and left sides for adjusting.

In addition, fine adjustment can be performed by entering the number in the right side of the slider.

- NOTE:
- When the Tilt compensation is performed to the specimen which surface of unevenness is large, the unevenness of the specimen surface is emphasized, and the unnatural image may be obtained.
 - The Tilt compensation function will be OFF automatically when the Tilt compensation panel is closed.

2.3.28 Beam marking

Click the [Beam Mark] button and display the [Beam marking] dialog. The dialog can be selected from the [Menu]>[Observation]>[Beam marking] as well.

This function can irradiate the electron beam to the set point and performs the marking.

(1) Beam Mark button

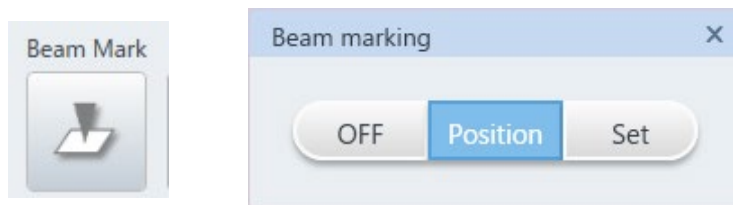
Display the cross marker in light blue color on the image area and the beam marking window by clicking the [Beam Mark] button. Move the cross marker to the desired position for irradiating the electron beam by dragging the mouse.

(2) Mark button

The image is frozen and electron beam is irradiated to the cross marker position by clicking the cross marker button. The irradiation position can be changed while irradiating the electron beam.

(3) [OFF] button or close the window

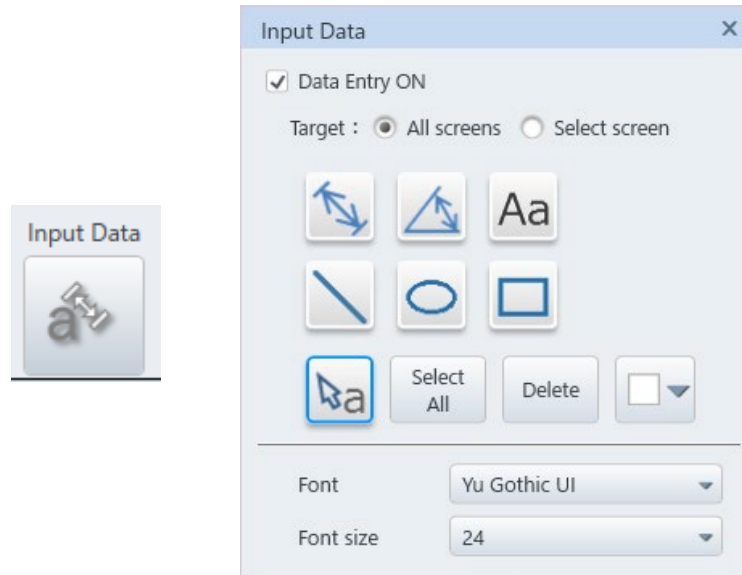
Return to the normal scan mode by clicking the [OFF] button or closing the dialog. To perform the beam marking continuously, click the [Position] button.



2.3.29 Input data

The [Data entry] dialog on the [Sub panel] is displayed. In addition, the [Data entry] dialog can be selected from the [Menu]>[Observation]>[Input data] as well.

Text or graphic can be input on an image by this function.











- [Data entry ON] check box
When the [Data Entry ON] is ON, a text and graphic can be input by selecting the tool buttons. When the check box is OFF, inputting the text and graphic is canceled and the text and graphic that is described area hidden.

NOTE: Operation priority of inputting data is higher than the adjustment operation of the mouse on an image by a mouse. In case of performing the mouse operation on an image, deactivate the [Data entry] and cancel the data input.

- Input target
Select an image for inputting data. Select an image and input the data when the multiple screen mode is selected. Only the selected display can be input the data.
- Tool buttons
Select a tool button and input the text or graphic by operate the mouse on the image.

NOTE: The line can be set 45° step by pressing the [Shift] key when drawing a line. This function is useful when drawing a horizontal or vertical line.

-  **Select, edit:** Click text and the background of the text is black out. Then, the text can edit. When pressing the [Enter] key, the text will be defined, and the text color will be blue.
The position of text can be moved by the mouse operation. In addition, the position of graphics can be moved by clicking the mouse on the graphic.
Color of input data can be changed.
-  **Input text:** Input text on an image Select the [Input text] button and click at the desired position on the image. Text insert part is blackening. Press the [Enter] key for input the text. For inputting the same text data repeatedly, enter text in the text box and click the desired position on the image. Set to the text input condition. The text in the text box will be input by clicking the input position on the image.
-  **Line:** Draw a line. Left click the mouse at the starting point of the line and release the mouse at the end point of the line.
-  **Arrow with measurement line:**
Draw the measurement line. When drawing the line, the value is described automatically. Left click the mouse at the start point of the line and release the mouse at the end point of the line.
-  **Line with angle:** Draw the line with angle. Left click the mouse at the three points.
-  **Circle:** Draw a circle. Left click the mouse at the start point and release it after drawing a circle.
-  **Rectangle:** Draw a rectangle. Left click the mouse at the start point and release it after drawing the rectangle.
-  **Arrow:** Draw an arrow. Left click the mouse at the starting point and release the mouse at the end point.

The above control can be performed repeatedly while the button is ON.

- NOTE:
- The measurement value for displaying is calculated by the magnification of current image. When the magnification is changed, the measurement value is recalculated and updated the value. In case of 2 or 4 screens modes, measurement value will be updated. When a display is frozen and the magnification is changed in the other display under the 2 or 4 screens modes, the correct magnification value will be display in each display.
 - When the screen mode (1 screen, full screen, 2 screens, 4 screens, 6 screens, full screenX2) is changed, the input data will be deleted.
-
- [Color selecting] button
Change the color of text and graphics. The available colors are displayed in the list.

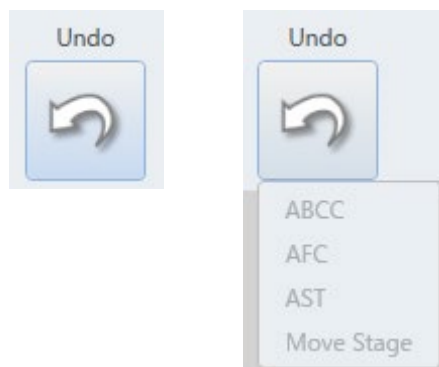
- [Select All] button
Select all input data by clicking the [Select All] button. (The color of selected data is changed to blue). Selected text and graphic can be moved by the mouse operation.
- [Delete] button
Delete the selected text and graphics.
- Font/Font size
Select the type and size of font for the text or measuring display. Click the list and display the font name or size list.

2.3.30 Undo

List of the [ABCC], [AFC], [ASC] and [Move stage] are displayed by clicking the button.

The function can be canceled and return to the one previous condition right after the ABCC, AFC, ASC or stage move on UI is executed by clicking the items.

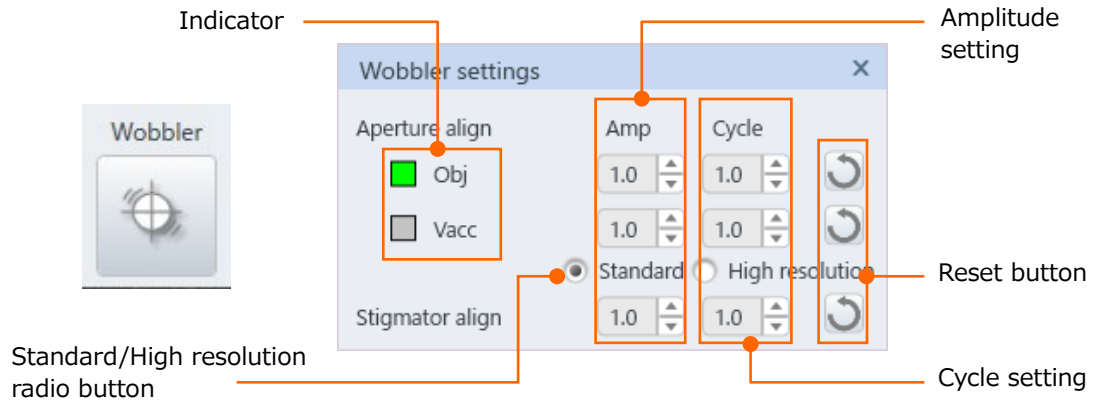
The [Undo] button is activated only when the function is performed. The [Undo] function can be performed from the [Menu]>[Undo] as well.



2.3.31 Wobbler settings

Display the [Wobbler settings] dialog. The dialog can be selected from the [Menu]>[Observation]>[Wobbler settings].

Set the wobbler amplitude and cycle for the aperture alignment, stigmator axis alignment X/Y in this dialog.



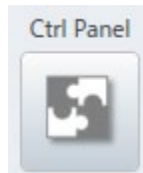
- Indicator
Switch the OBJ wobbler and Vacc wobbler depending on the aperture adjustment condition. The present wobbler status indicate in the indicator.
- Amplitude settings
Set the wobbler amplitude for the aperture alignment, stigmator alignment X/Y.
- Cycle settings
Set the wobbler cycle for aperture alignment, stigmator alignment X/Y.
- Reset button
Click the button and each item will be the default value.
- Standard/High resolution radio button
The standard/high resolution can be set under the aperture alignment mode.
Standard: OBJ wobbler
High resolution:
 - When booster voltage is OFF, OBJ wobbler
 - When the booster voltage is Auto, the accelerating voltage ≤ 22 kV is Vacc wobbler, the accelerating voltage > 22 kV is OBJ wobbler

NOTE: In the Vacc wobbler, an image with good image quality can be obtained but the image can be shifted when adjusting the focus.

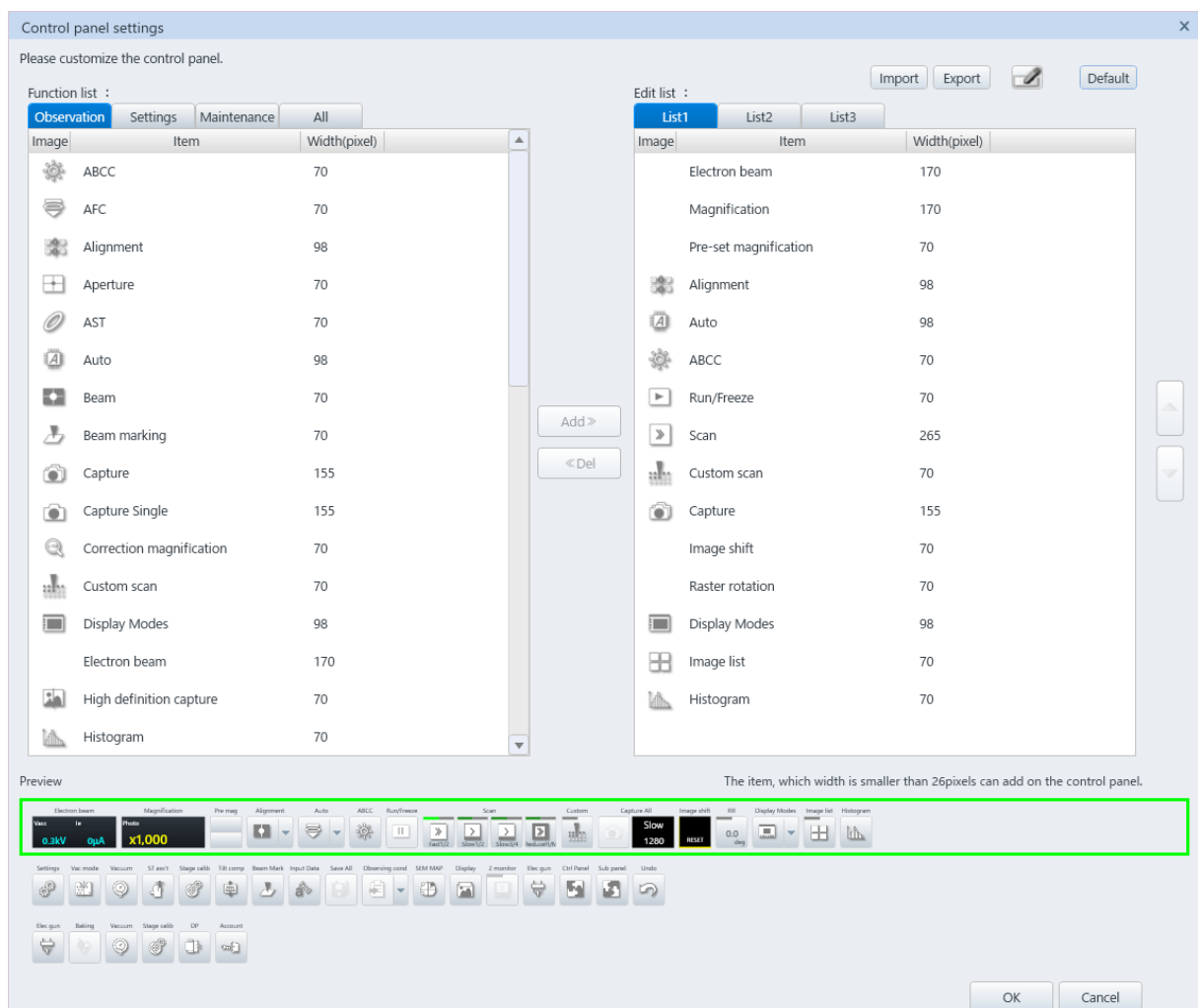
2.4 Control panel settings

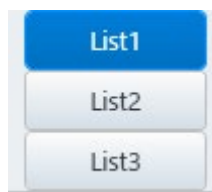
The following shows the items that are categorized in the [Settings] on the control panel.

2.4.1 Control panel settings



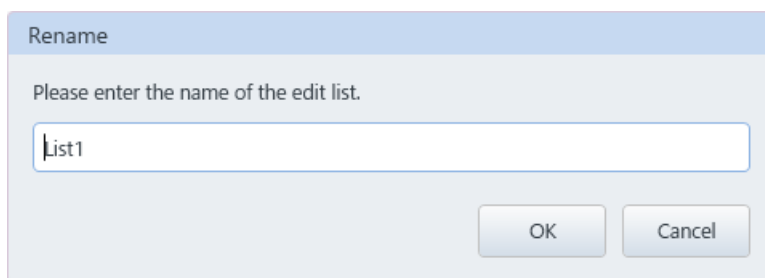
Press the [Ctrl Panel] and display [Control panel settings] dialog. The dialog can be selected from the [Menu]>[Control panel settings] as well.





Edit the control panel at the upper area of UI. The [Control panel settings] dialog can be displayed by right clicking the mouse on the list buttons in the Control panel.

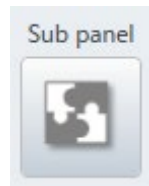
- (1) Function list
The function list that is selected from the [Observation]>[Settings]>[Maintenance] is displayed.
- (2) Edit list
The edit list that is selected from the edit list is displayed.
- (3) Import button
Import the files that is created in the export button.
- (4) Export button
Export all edit lists and names in the edit list to the file.
- (5) Rename
Clicking the [Rename] button and display the [Rename] dialog. The selected edit list name can be changed.



- (6) Default
The edit list will be default settings by pressing the [Default] button.
- (7) Functions list
Display the selected function list.
 - (a) Image
Display images of functions. Some functions display without image.
 - (b) Item
Display the function names. The function names that are displayed on the control panel may be different due to abbreviation.
 - (c) Width (pixel)
Display the width (Pixel) of each function for placing on the control panel.

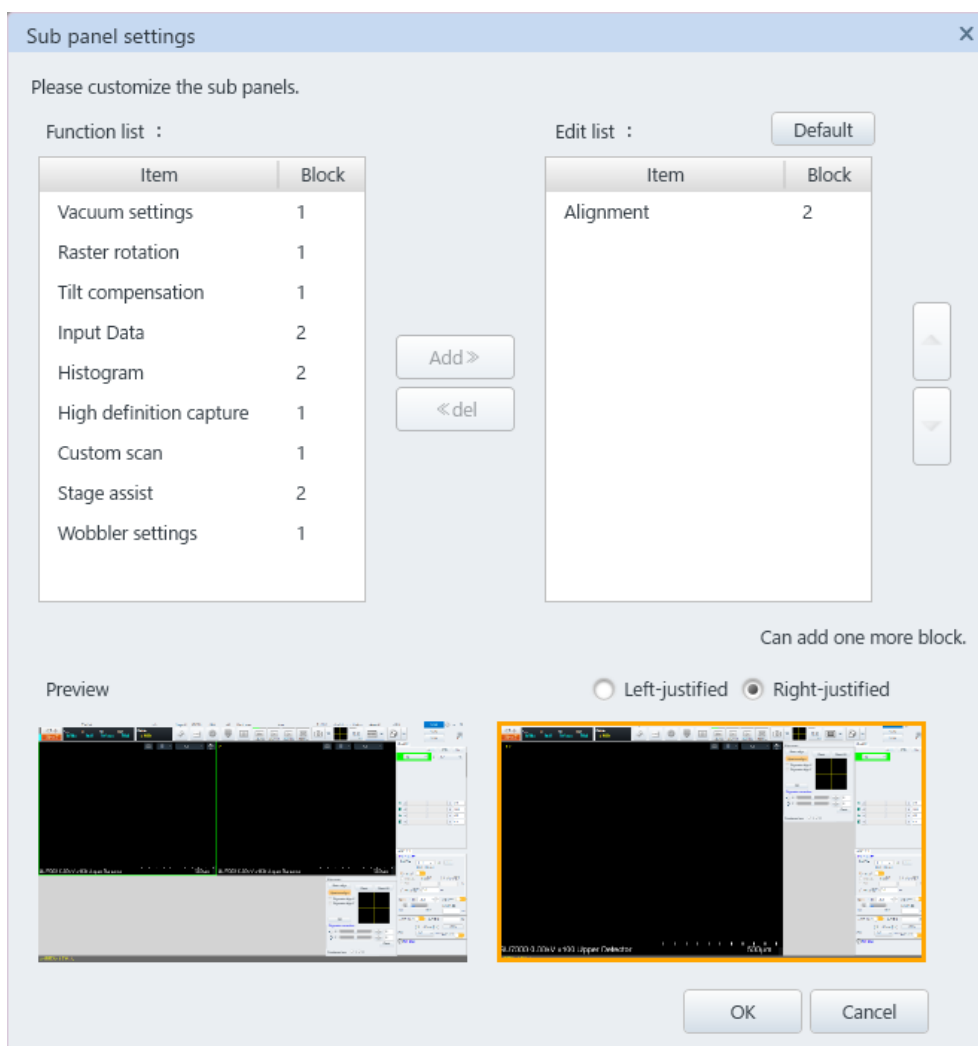
- (8) Add
Add an item in the edit list. Select an item from the function list and click the [Add] button. The selected item is arranged in the edit list (Right side of the control panel).
- (9) Delete
Delete an item from the edit list. Select an item from the edit list and click the [Del] button.
- (10) Arrange the items button
Change the order of the items in the edit list. Select an items from the edit list and press the up and down buttons the to change the order. The item that is on the top of the list displays on the most left side of the control panel.
- (11) Configurable pixel display
The configurable pixels for the control panel are displayed. The control panel can arrange up to 1720 pixels of items at the width. The reference of arranging items are displayed.
- (12) Preview
Items in the control panel is displayed in the preview area. Apply the setting of control panel by pressing the [OK] button. The setting is canceled by pressing the [Cancel] button.
- (13) OK button/Cancel button
Apply the control panel setting by pressing the [OK] button. Press the [Cancel] for canceling the settings.

2.4.2 Sub panel settings



Display the [Sub panel settings] dialog. The dialog can be displayed by the [Menu]>[Sub panel settings] as well.

Display the [Sub panel settings] dialog by pressing the button and edit the [Sub panel settings] dialog which is arranged around the image display area.



(1) Function list

Display the function items in the [Sub panel settings] dialog.

(2) Edit list

Display the function items in the edit list.

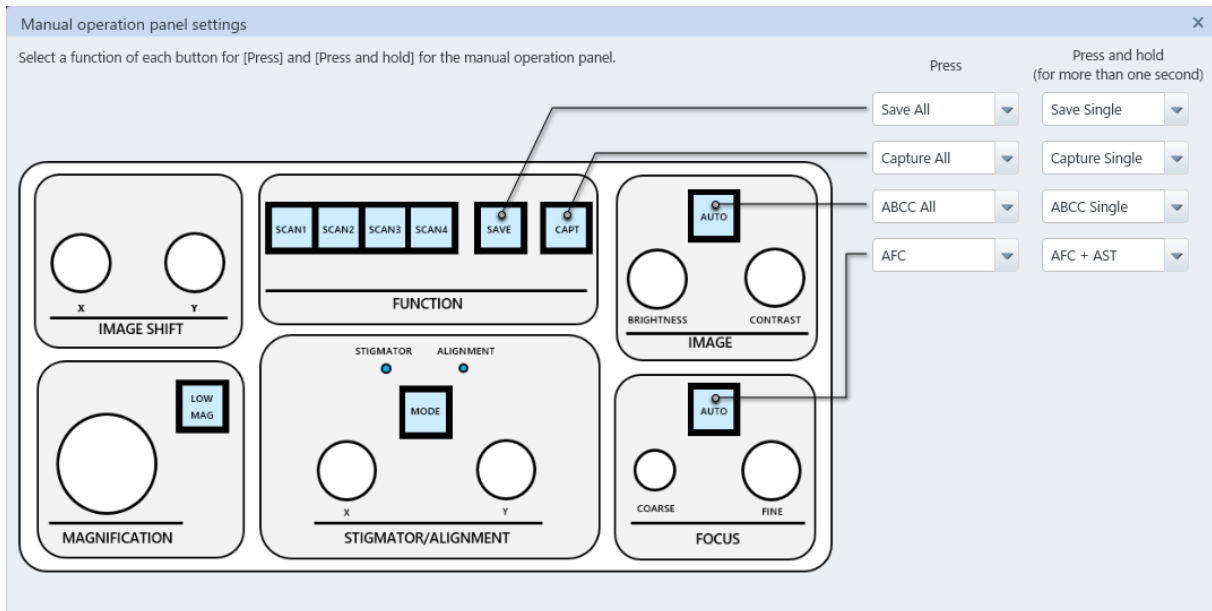
- (3) Default
Press the [Default] button and set the edit list to the default condition.
- (4) Item
Display the function names.
- (5) Block
Indicate the displayed size of function on UI by Block. In the 1 or 2 screens mode, the number of maximum blocks for displaying on UI are 10 blocks. For 4 screens, 6 screens, full screen, and full screen x2 modes, the number of maximum blocks for displaying are 5 blocks.
- (6) Add
Add an item in the edit list. Select an item from the function list and click the [Add] button. The item is placed at bottom of the edit list.
- (7) Delete
Delete an item from the edit list. Select an item from the edit list and click the [Del] button.
- (8) Change the order of items button
Arrange the item positions in the edit list. Select an item from the edit list and press the up and down button to change the order.
- (9) Configurable Block display
Display the number of blocks to set on the UI. The maximum number of displaying on UI is 10 Blocks under the 1 or 2 screens modes and 5 Blocks under the 4 screens, 6 screens, full screens, and full screen x 2 modes.
- (10) Preview
Display the preview for arranging the items. Display the preview when setting the right or left aligns in the displaying. Right or left aligned arrangement cannot be displayed in the preview area.
- (11) OK/Cancel buttons
Apply the [Sub panel settings] settings by pressing [OK]. Press the [Cancel] for canceling the settings.

2.4.3 Manual operation panel



Display the [Manual operation panel settings] dialog by clicking the button. It can select from the [Menu]>[Manual operation panel settings] or the manual operation panel button on the [Menu]>[Standard settings]>[General] tab.

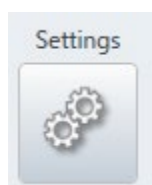
Set the functions that is performed by pressing a button or pressing and holding a button (more than one second) on the manual operation panel. The function of each buttons can be set by selecting from pull down lists.



2.4.4 Standard settings

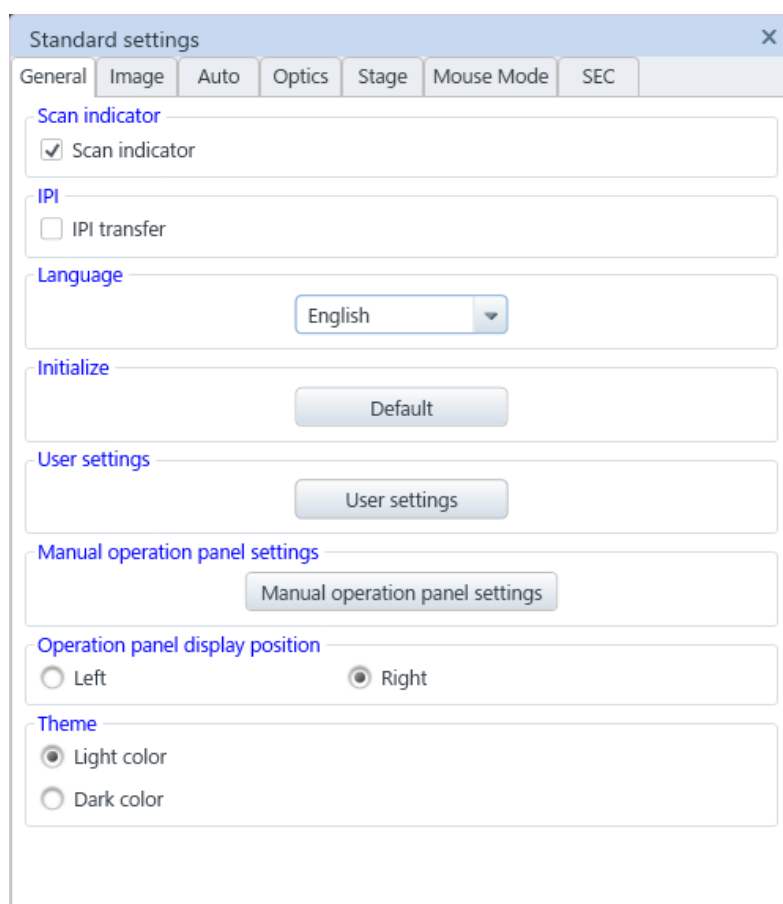
Display the [Standard settings] dialog. The dialog can select from the [Menu]>[Standard settings] as well.

Operation environment settings or others can be performed in this dialog. The dialog separated by each function's tabs. The tab required will be placed in front depending on the place where it is started up.



(1) General

Set the [General] tab settings.



(a) Scan indicator

When the [Scan indicator] check box is ON, an indicator of scanning position while observing an image with slow scan (Slow3 to 7) or CS scan (CSS 3 to 7) is moved from the top to the bottom. The area of image which is upper than the indicator indicates new scanning image and the area which is lower than the indicator indicates the previous scanning image.

(b) IPI

IPI transfer check box

When enabling the IPI transfer check box, transfer to the image processing software Image-Pro. Check ON the IPI transfer as required.

(c) Language

Japanese and English are available.

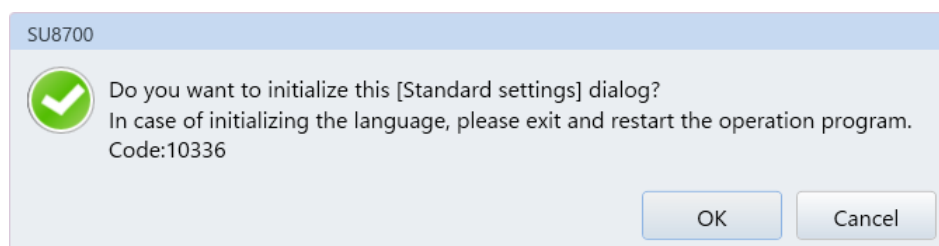
When selecting language from the drop down list, a message for restarting the operation program is appeared. Close the message by clicking the [OK] button and restart the operation program for applying the selected language. When clicking the [Cancel] button, the previous language will be applied.

NOTE: Restart the SEM operation program for applying the selected language.

(d) Initialize setting

Return the settings which are set at each tab for each setting dialog to the initial value when the instrument is installed.

When clicking the [Initialize] button, the following message will be appeared.



Press the [OK] button to initialize the settings.

However, the following setting will not be initialized.

- [General] tab - [User] settings
- [General] tab - [External communication] block (Option)
- [General] tab - [Manual operation panel settings]
- [Image] tab - [Magnification display switching] block

(e) User settings

Display the [User settings] dialog by clicking the button.

The [User settings] button is displayed when logging-in with system administrator name (Default is "SU8700"), and the [Password settings] button is displayed when logging-in with general username.

(f) Manual operation panel settings

Display the [Manual operation panel settings] dialog by clicking the button.

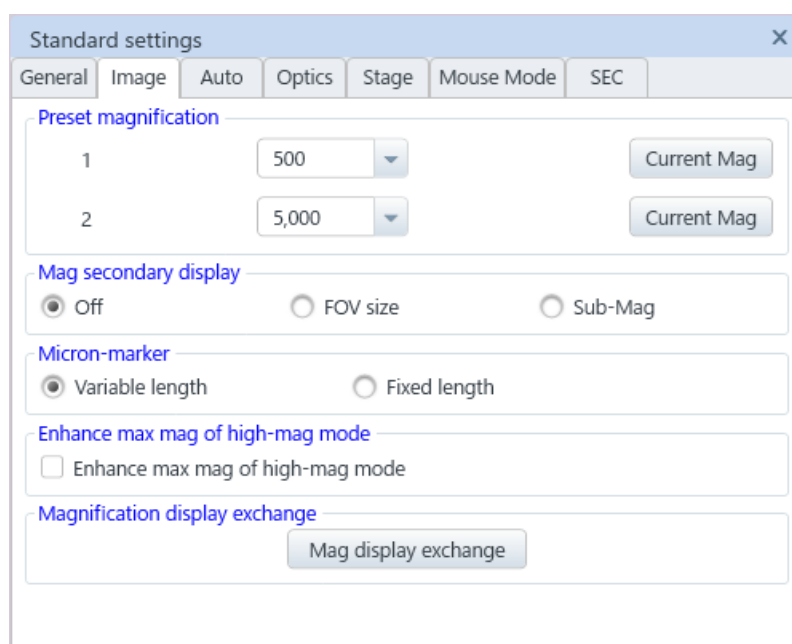
(g) Operation panel display position

Set the operation panel position at the right/left side of display.

(h) Theme

Light or dark colors are available for UI theme.

(2) Image display



(a) Preset magnification

Set the magnification of the [Pre Mag] button.

Select magnification from the list or enter desired value. In addition, the current magnification can be registered by clicking the [Current magnification] button. In case the set value is out of the applicable range under the current condition, the magnification is set to the closest magnification value within the range.

(b) Magnification assist display

Set the magnification assist display settings for the magnification that is displayed on the control panel.

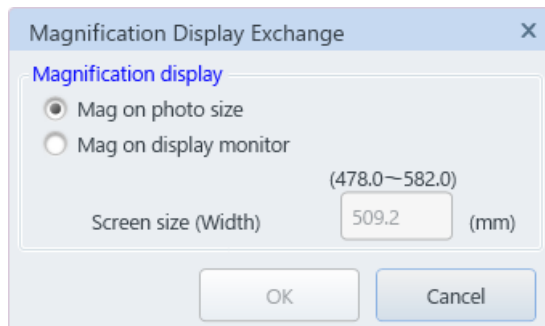
- OFF
The magnification assist display will not be performed.
- FOV size
Display the width of field of view (FOV) which is displayed on the observation display.
- Sub-Mag
When selecting the Sub-Mag, the display magnification while selecting the photo magnification and the photo magnification while selecting the display magnification are subordinately displayed.

(c) Micron-marker

Select a method of Micron-marker (Valuable length or fixed length).

- Valuable length
Adjust the length of marker without fraction.
- Fixed length
Length of marker is fixed. The length of maker can be indicated with fractional number depending on magnification.

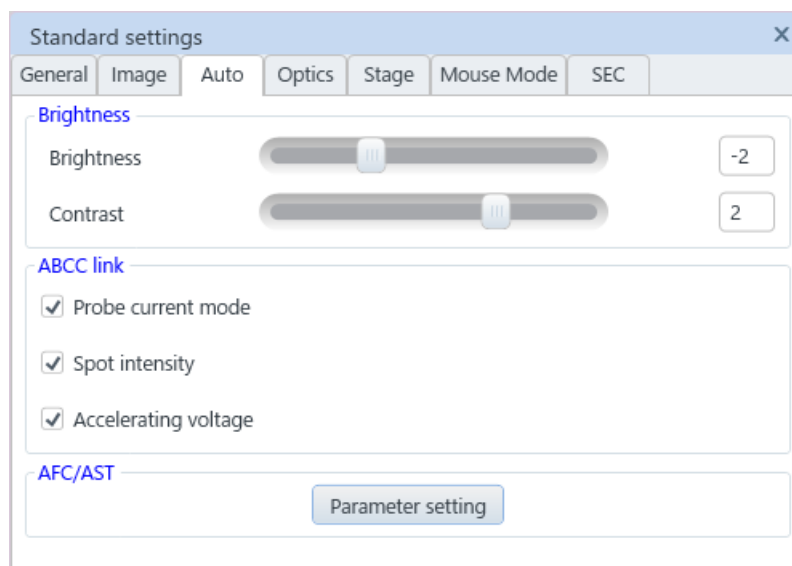
- (d) Enhance Max mag. Of High-mag mode
Expand the magnification from x1000 k to x2000 k by enabling the check box.
- (e) Select Magnification display
Display the [Magnification Display Exchange] dialog by clicking the [Mag display exchange] button.



Switch to the magnifications that is optimized for outputting to 4x5 photo size (127 mm x 95.3 mm) of photo magnification or for displaying on the monitor.

This function is restricted since the standard of observing magnification will be changed. This function can be enabled only when logging-in with system administrator username (The username is SU8700 at default) while starting up the SU8700 operation program.

(3) Auto



- (a) Brightness and contrast
The brightness and contrast of an image that are controlled by pressing the ABCC can set. Set the parameter of the brightness and contrast when the [ABCC] condition is not suitable.
Brightness: Standard value is -2, Contrast : 2 and it can be set by ± 5 steps.
Reference: 3.6.3 Controlling the brightness and contrast of an image

(b) ABCC link

While the check box is ON, ABCC is performed when probe current mode, spot intensity or accelerating voltage is changed.

(c) AFC/ASC

Display the AFC/ASC parameter display by clicking the parameter setting button.

【AFC parameter setting】

It becomes easier to focus by switching magnification of AFC mode and setting the focus search method of Low magnification mode/high magnification mode manually.

For the AFC the Zlink focus which standardizes the Stage Z position and the specimen height setting position and the Coarse, Middle, Fine that are performed from the focus position (WD display) are available. In the normal searching range is wider in order of Zlink>Coarse>Middle >Fine (The order of searching range for Zlink can be different due to the change of accelerating voltage and stage height).

When the searching range is large, it is more effective when the initial shift is large. The smaller the searching range, the closer to the optimal adjustment value.

- Mode switching magnification

Set the magnification for switching the Low magnification mode/High magnification mode for AFC.

 - Low magnification mode

Select the focus search method in the low magnification mode.

Zlink: Search the focus by centering the present stage Z position and specimen height setting position.

Coarse -> Middle: Search the focus in order of Coarse→Middle

Middle -> Fine: Search the focus in order of Middle→Fine

Fine -> Fine: Search the focus in order of Fine→Fine

Middle: Search the focus in the Middle

Fine: Search the focus in the Fine
 - High magnification mode

Select the focus search method in the High magnification mode.

Middle -> Fine: Search the focus in order of Middle→Fine

Fine -> Fine: Search the focus in order of Fine→Fine

Fine: Search the focus in the Fine
 - Return to the initial value

Set the mode switching magnification, the focus search method of low magnification mode/high magnification mode to the initial value.
- Focus parameter check box

The Offset setting will be displayed by setting ON the check box. The focusing becomes easier by setting the offset for the AFC mode of each Coarse, Middle and Fine.

After perform the desired AFC mode with the test button, adjust the shift of focusing with the focus knob on the operation panel or others and click the Correct button.

 - Offset

Coarse: Set the offset for the Coarse

Middle: Set the offset for the Middle

Fine: Set the offset for the Fine
 - Test button

Perform the AFC mode of Coarse, Middle and Fine.
 - Correct button

Calculate and display the offset of Coarse, Middle and Fine.
 - Return to the initial value

Return the offset of Coarse, Middle, Fine to the initial value.

【ASC parameter setting】

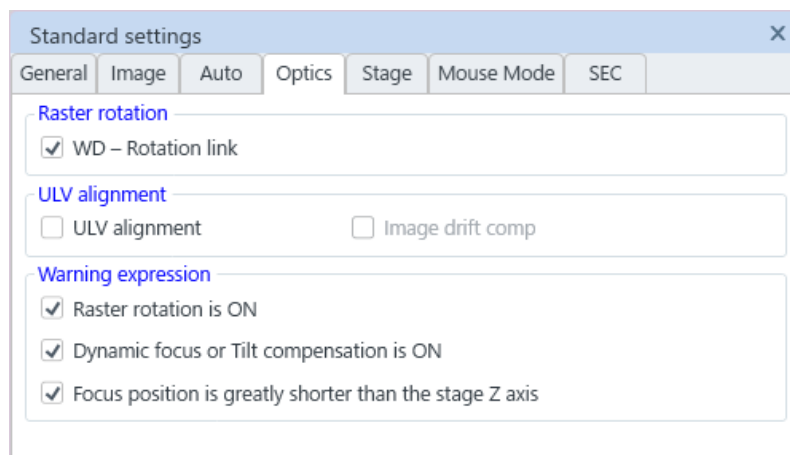
It becomes easier to adjust the astigmatism by setting the ASC mode for each magnification range when performing the AST.

Select the adjustment operation of ASC for each magnification range. Search the optimal adjustment value by changing the value from the present value in ASC. When the adjustment range is large, it is more effective when the initial shift is large. The smaller the adjustment range, the closer to the optimal adjustment value.

The adjustment range becomes larger in order of Coarse1>Coarse2>Middle>Fine.

- Mag < x10,000
 - Coarse1: Perform the ASC in Coarse1
 - Coarse2: Perform the ASC in Coarse2
 - Middle: Perform the ASC in Middle
- $x10,000 \leq \text{Mag} < x40,000$
 - Coarse2: Perform the ASC in Coarse2
 - Middle: Perform the ASC in Middle
 - Fine: Perform the ASC in Fine
- $x40 (000 \leq) \text{Mag}$
 - Middle: Perform the ASC in Middle
 - Fine: Perform the ASC in Fine
- Return to the initial value
 - Set the ASC mode of each magnification range to the initial value.

(4) Electron optics system



(a) Raster rotation

Correct the rotation of image due to the objective lens while changing the focus and match the stage moving direction of X axis and the horizontal direction of image constantly by enabling the [WD-Rotation] check box.

(b) ULV alignment

In the low accelerating voltage status, the condition can be optimized by minimizing the wobbling of image with alignment function and slightly shifting the beam axis. When the [ULV alignment] check box is ON, the [ULV alignment] is added in the [Alignment] dialog. An image is shifted while performing ULV alignment. The image shift will be reset by setting ON the ULV alignment check box.

(c) Warning indication

Error on the operation or interpretation of wrong result can be occurred when the user operates the system without noticing the system condition described in this block item.

Warning message will be displayed when the system is in the condition described in this block item by enabling each check box.

(d) Degauss

Set that the degauss will not be performed while HV-ON operation by setting ON the check box.

(5) Stage

Standard settings

General Image Auto Optics Stage Mouse Mode SEC

Motor drive

On Off

Reverse mode

Mouse operation Track ball/Joy stick

Device selection

Track ball Joy stick

Trackball/Joystick speed

Speed Slow Fast

Magnification Link Normal Fine

Coordinate

	Sample	Stage
XY	<input checked="" type="radio"/>	<input type="radio"/>
Z	<input checked="" type="radio"/>	<input type="radio"/>

Rotation Assist

Activate

Z focus link

Activate

Run degauss at the end of Z motion

Minimum step

Z 0.1mm 0.01mm

Eucentric

Rotate

Tilt

Calib

EDS Z(WD) position

Display Operation panel 15.0 mm

Drift cut

X 1.0 μm Y 1.0 μm Auto

Display Operation panel

Backlash cancel

XY 20 μm

Display Operation panel

(a) Motor drive

Select the [On] for normal use.

Select the [Off] radio button when an optional stage is equipped, and the standard motor drive does not use. The UI is designed by assuming that a standard stage is equipped. Therefore, malfunction can be occurred because the data cannot receive or sent with the removed stage.

(b) Reverse mode

Moving direction of stage can be reversed by the mouse operation on a display, trackball (Option) or joystick (Option).

Enable the check boxes for reversing the moving direction (Example, when enabling the [Trackball/Joystick] check box, image will move to the right direction by rotating the trackball to the left direction).

(c) Trackball/Joystick speed setting (Option)

The Stage moving speed by using the trackball (Option) or joystick (Option) can be optimized by linking to the magnification. Adjust the moving speed with the slider. Select the [Normal] in the [Magnification link] for normal use. When the [Fine] is selected, fine movement of stage in the high magnification (x100k and more) can be performed. However, the traceability is decreased when the moving direction is reversed.

(d) Coordinate system

Select the coordinate system that the center of specimen is set to (0, 0) or not (The coordinate of specimen stub or mechanical coordinate (Stage coordinate)).

The XY coordinate on the observation position is (0,0) (mm) when the coordinate on specimen is selected and the XY coordinate is (35, 55) (mm) when the stage coordinate is selected.

In the Z coordinate on the observing position, the Z axis display is (WD) (mm) in the stage tab on the operation panel that considering the specimen height when the coordinate on specimen is selected. When the stage coordinate is selected, the display is Z (mm) which shows the mechanical stage Z value.

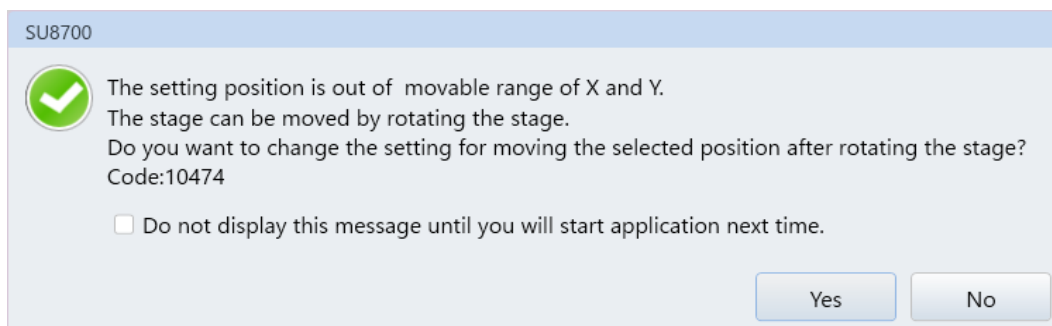
Coordinate on specimen = Stage coordinate - Specimen height

(e) Rotation assist

In case the stage coordinate is close to the limit of movable range, the stage can be moved to the position that has enough space by rotating the stage.

In that case, a confirmation message wither to rotate the stage will be displayed even if the stage is in the movable range.

The message will not be displayed by enabling the [Do not display this message until you will start application next time] check box.



(f) Z focus link

The focus will be changed according to the move on Z axis by setting ON the check box. Focus is changed after moving the Z axis and degauss of lens is performed automatically by enabling [Run degauss at the end of Z motion] check box after Z axis is moved.

However, for avoiding temporarily disappearing of the image due to degaussing, deactivate the check box.

(g) Minimum step

The minimum steps of Z axis is set at 0.1 mm step in the standard. However, the minimum steps of Z axis can be change at 0.01 mm step.

It will be applied for the coordinate value select and step move button operation. This setting applies to the coordinate selecting value and step/continuously moving buttons (Step/continuously move).

In the 0.01 mm step, fine adjustment of Z axis position can be performed. However, the moving speed will be decreased. Select the setting depending on observation purpose.


(h) Eucentric

When the [Eucentric rotation] check box is ON, the X and Y axes are moved to correct position along with the R axis for keeping the present observing position.

The shifting of position is disparate by the amount of shifting from the standard position of specimen height. (If the accuracy of position is required, correction can be performed in the [Correction] dialog, which is activated by [Calibration] button).


(i) Analysis position Z (WD) 

The following button will be displayed in the stage tab on the operation panel by setting the desired Z (WD) in the text box and setting ON the check box for displaying on the operation panel. Move the stage to the set Z (WD) by pressing the button.

(j) Drift cut 

The [Drift cut] is possible to decrease the drift of mechanical position after moving the stage. The amount of drift cut can be set in [X/Y number select] box.

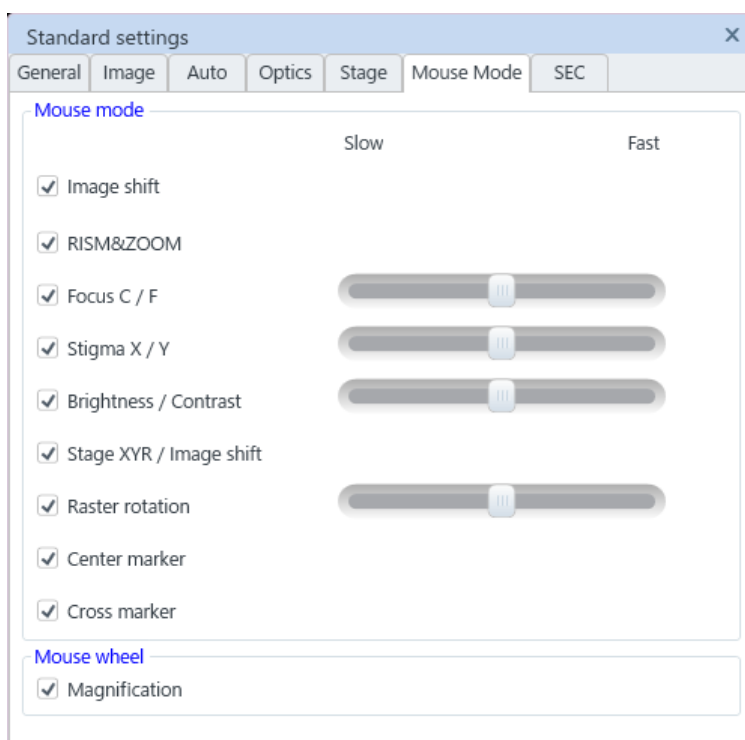
When enabling the [Auto execution] box is ON, drift cut will be performed when moving the X and Y axes by selecting the coordinate. The following button will be displayed in the stage tab on the operation panel by setting ON the check box for displaying on the operation panel. The set drift cut can be performed by pressing the button.

(k) Backlash cancel 

Position of pausing an image is shifted when moving the stage to the same coordinate value. That is called backlash. The backlash can be reduced by moving to the selected position from the same direction. In addition amount of backlash cancel can be selected from the [Number select box].

The following button will be displayed in the stage tab on the operation panel by setting ON the check box for displaying on the operation panel. The set Backlash will be performed by pressing the button.

(6) Mouse Mode



(a) Mouse mode

Set the mouse operation settings on the image display area.

List of functions are displayed by clicking the split button (▼) at upper right of image display area and the mouse is allocated to the selected function.

Enable the check box of mouse operation function for using.

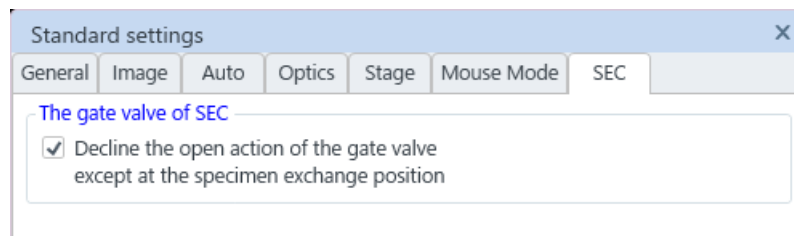
In case of Uncheck the check box, the function will not display in the function list, which is displayed by clicking the split button (▼).

Regarding to the function with a slider bar at the right side, the value for moving amount of dragging the mouse can be adjusted by ± 5 steps as standard value at 0. While dragging operation, the amount of adjustment value can be adjusted by moving the slide bars.

(b) Mouse wheel

Set the Magnification adjustment function which is operated by mouse wheel on the display image area. When the [Magnification] check box is ON, the function is activated.

(7) Specimen exchange



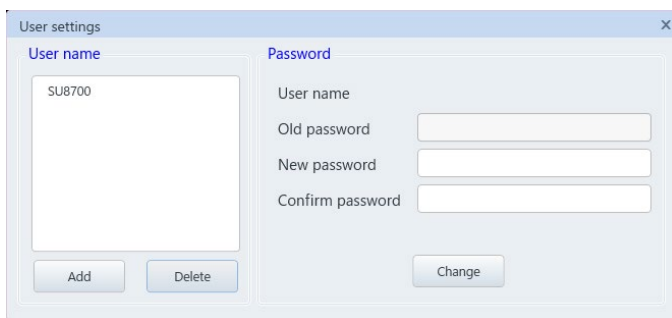
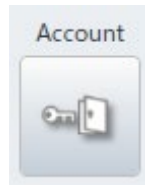
(a) Gate valve for the specimen exchange chamber

Lock the gate valve of specimen exchange chamber other than the exchange position. When the valve is locked, buzzer sounds when pressing the OPEN button on the specimen exchange chamber.

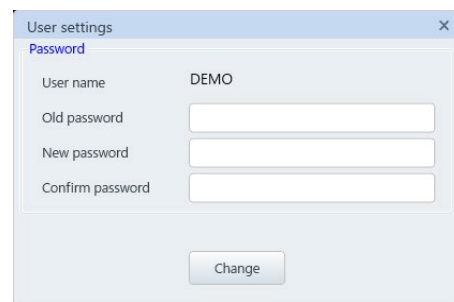
2.4.5 User account

Display the [User settings] dialog. The dialog is displayed by the [Menu]>[Settings]>[User account]. Registering, editing, and setting of password for the new login name can be set in this dialog when logging in the system with system administrator username (“SU8700” when installing).

When log-in with the general username, the password can be changed.



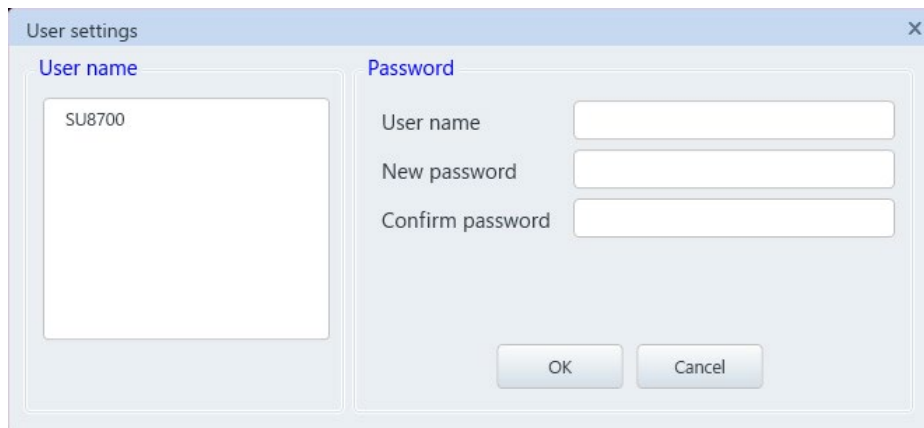
System administrator user “SU8700”



General user

(1) [Add] button

Register a new username or change the password.



(2) [Delete] button

Select a username and delete the user account by clicking this button.

(3) [Change] button

When log-in with the system administrator username, it can change the password of selected username. When log-in with the general username, it can change the password which is logging in.

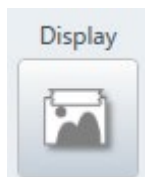
2.4.6 Display type

Type of image display can be changed.

Click the [Display] button and display the image display area with float mode. The image display can be moved by dragging and dropping the mouse. The image display area will return to the previous image display position without the floating mode by clicking the [Display] button.

The function can be performed from the [Menu]>[Settings]>[Display].

NOTE: The display area cannot be moved by dragging and dropping the mouse under the [On image mouse operation] mode.



2.4.7 Monitor mode

Two monitor modes are available.

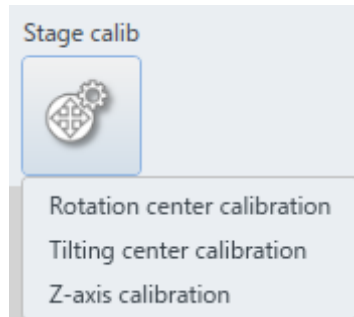
This function is activated when two monitors are connecting to the PC. Click the [2 monitor] button to display the UI on two monitors.

Deactivate the two monitors mode by clicking the button again. This function can be performed from the [Menu]>[Settings]>[2 monitor] as well.

Status	2 monitor mode button
Connection number < 2	
Connection number ≥ 2 & 1 monitor mode	
Connection number ≥ 2 & 2 monitor mode	

2.4.8 Stage calibration

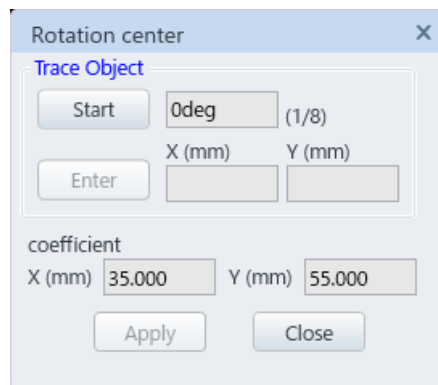
Perform the calibration related to the stage. Perform this function when the accuracy of stage function is deteriorated. This function will be displayed only when logging in by the administrator username [SU8700].



(1) Rotation center calibration (Administrator only)

The calibration is performed for maintaining the accuracy of Eucentric rotation. Measure and correct the shifting amount between the axis of rotation center and the beam.

This function can be performed from the [Menu]>[Settings]>[Rotation center calibration] as well.

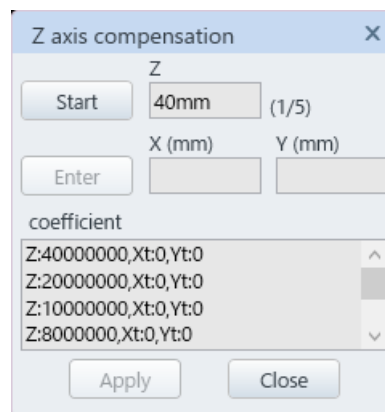


- (a) Set the stage at Z=6 mm, Tilt=0° and R=0°. Display the scan image and search a target structure around the center of specimen stab.
- (b) Click the [Stage Calib] button Message of operation method is displayed.
- (c) Click the [OK] button.
- (d) Move the target structure to the center of scanning image under the magnification at x500 by operating the X and Y axes of stage. Then, click the [Enter] button. The stage will rotate to 45°.
- (e) After the stage is moved, move the target structure to the center of the scanning image by operating the X and Y axes of stage and click the [Enter] button. The stage will rotate to 45° more.

- (f) Repeatedly, move the target structure to the center of scanning image then click the [Enter] button.
The stage will rotate to 45° at each time.
- (g) When the angle of stage rotation is at 315°, click the [Enter] button. The calibration coefficient is calculated and displayed.
This coordinate value is in the stage rotation center, and it should be existed in between $X = 35 \pm 1$ mm, $Y = 25 \pm 1$ mm.
- (h) Apply the calibration coefficient by clicking the [Apply] button. Click the [Close] button to close the dialog.
- (2) Tilt center calibration (Administrator only)
Tilt center calibration is performed for maintain the accuracy of Eucentric tilting. Correct and measure the shifting amount between the center of tilting axis and the irradiation position of beam. This function can be performed from the [Menu]>[Settings]>[Tilt center calibration] as well.

- (a) Set the stage at $Z=15$ mm, Tilt= 0° and $R=0^\circ$. Display the scanning image and search the target structure around the center of specimen stab.
- (b) Click the [Start Calibration] button. Message of operation method is displayed.
- (c) Click the [OK] button.
- (d) Move the target structure to the center of scanning image with the magnification at x500 by operating the X and Y axes of stage. Then, click the [Enter] button of Tilt 0° . The stage will tilt to 20° .
- (e) After the stage is moved, move the target structure to the center of the scanning image by operating the X and Y axes of stage and click the [Enter] button at Tilt 20° . The stage will tilt to 40° .

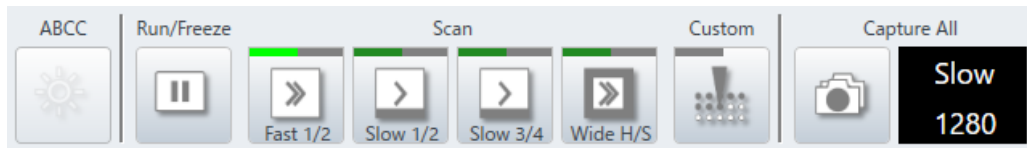
- (f) After the stage is moved, move the target structure to the center of scanning image by operating the X and Y axes of stage then, click the [Enter] button at Tilt 40 °. The calibration coefficient is calculated and displayed. The calculated value indicates the shifting amount of specimen height from the standard position.
- (g) The calibration coefficient is applied by clicking [Apply] button. Close the dialog by clicking the Close button.
- (3) Z axis calibration (Administrator only)
 Perform the Z axis calibration for maintaining the accuracy of Eucentric rotation and Eucentric tilting. Correct and measure the shifting amount from the center axis due to moving Z axis of stage. The function can be performed from [Menu]>[Settings]>[Z axis calibration] as well.



- (a) Insert and set a specimen at Tilt=0°, R=0°. Display the scanning image and search the target structure around the center of specimen stab.
- (b) Click the [Start Calibration] button. In case the optical condition of electron beam is out of the specified value, a message is appeared, and the calibration will be canceled. In this case, set the condition properly and click [Start Calibration] again. the optical condition is correct, a message of operation method is displayed.
- (c) Click the [OK] button. The Z axis of stage moves to 40 mm.
- (d) After stage is moved, perform the focus. Move the target structure to the center of scanning image under the magnification at x500 by operating the X and Y axes of stage. Then, click the [Enter] button.
 The Z axis of stage moves to 20 mm.
- (e) Repeatedly, perform focusing and move the target structure to the center of scanning image then, click the [Enter] button. The axis of stage will move to 10 mm, 6 mm, and 3 mm at each time.
- (f) When the Z axis of stage is 3 mm, click the [Enter] button.
 The calibration coefficient is calculated and displayed.
- (g) The calibration coefficient is applied by clicking the [Apply] button. Click the [Close] button to close the dialog.

2.4.9 Separator

Separate in the group for the control panel items.
Structure the items of UI visually for the usability.



2.5 Control panel maintenance

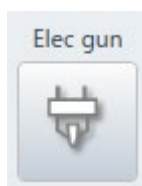
The following shows the items categorized in the [Maintenance] on the control panel.

2.5.1 Electron gun

Display the [Gun control] dialog. The display is different in the administrator user (“SU8700” in the default status) and general user.

The dialog can be displayed by the [Menu]>[Maintenance]>[Electron gun] as well.

Perform each parameter setting, starting up, adjustment and shutting down of the electron gun.



Gun control [X]

Gun status

Actual value

Emission current : Ie μA

Setting value

Extraction voltage : Vext kV kV
(1.50~3.00)

Suppression voltage : Vs V V
(400~700)

Filament current : If A A

Accelerating voltage : Vacc kV kV
(0.50~30.00)

Vb Voltage : Vb AUTO OFF

Vb Error counter

Operating time

Total operation time(H) Increment number of performing [Start-up]

Gun startup

Adjustment

Gun shutdown

System administrator

Gun control [X]

Gun status

Actual value

Emission current : Ie μA

Setting value

Extraction voltage : Vext kV

Suppression voltage : Vs V

Filament current : If A

Accelerating voltage : Vacc kV

Vb Voltage : Vb AUTO OFF

Vb Error counter

Operating time

Total operation time(H) Increment number of performing [Start-up]

Gun startup

Adjustment

General user

(1) Operation status

Indicate the present value and setting value of the emission current, extraction voltage, suppression voltage, filament current and accelerating voltage. The setting value of applying to the electron gun can be changed. The booster voltage can be set to Auto/OFF (The operation can perform by the system administrator only except booster voltage). It indicates the times of Vb errors.

(a) Shutting down status of electron gun

Only the setting value can be changed when the electron gun is shut down under the shutting down status.

When inputting the value to the setting value box or clicking the ▲▼, the text will be in green. The value will be changed by clicking the [Apply] button. All present values stays at "0".

(b) Starting up status of electron gun

When starting up the electron gun is finished in the electron gun starting up status, the parameter is in the present value ≙ setting value status. Change the setting value and click the [Apply] button, or clicking the ▲▼ to apply the value to the present value immediately.'

(2) Operating time

(a) Total operation time

Indicate the accumulating hours of operation for the presently used electron source emitter.

(b) Increment number of performing [Start-up]

Indicate the increment number of starting up the electron gun.

(3) Gun startup

Perform the Startup operation. Refer to the 4 Maintenance for the operation method. In case the [Emission current has decreased. Please check the setting of electron gun.] message is displayed while starting up PC-SEM that is not the normal starting up sequence of the electron gun, click the [Electron aging] button to perform the electron aging. It may recover the emission current condition.

(4) Adjustment (System administrator only)

Perform the [Gun conditioning]. Refer to the 4 Maintenance for the operation method.

(5) Gun shutdown

Shut down the electron gun by clicking the [Shutdown] button. Refer to the 4 Maintenance for the operation method.

2.5.2 Electron gun baking

Display the [Gun baking] dialog. This function will be displayed only when logging in with the administrator username (“SU8700” in the default status).

This dialog can be displayed from the [Menu]>[Maintenance]>[Electron gun baking] as well.



Gun baking dialog box showing the following fields and instructions:

- Total baking time: 24 hours (with up/down arrows)
- Pre-baking procedure checklist:
 - High voltage cable head
 - BAKING COVER
 - Ion pump running
 - Evacuating condition
 - The OUTER BAKE breaker
 - Gun vacuum
 - Confirm safety
- Confirm followings:
 - The high voltage cable plug is removed from the gun head and inserted into the cable head holder.
 - Confirm that the BAKING cover is attached to the electron gun cover.
 - The OUTER BAKE breaker at the Power supply console is turned ON.
 - Make sure that there are enough rooms between the heater cables and units where will be heated (ex. electron gun, ion pumps, etc.), and there is no other unsafe condition. Then, check the "Confirm safety" checkbox.
- Gun baking can be started when the Gun vacuum indicator is green or yellow, and all other indicators are green, and the checkbox is checked.
- If the Gun vacuum indicator is shown "Yellow", The bake out time may be delayed when the Gun vacuum condition becomes worse due to outgas generated by heating.
- Elapsed time after bake out is shown on the display area. For the safety, Please take 6 hours as the cooling time.
- Buttons: Start, Cancel, Close
- Labels: Starting time:, Remaining time:

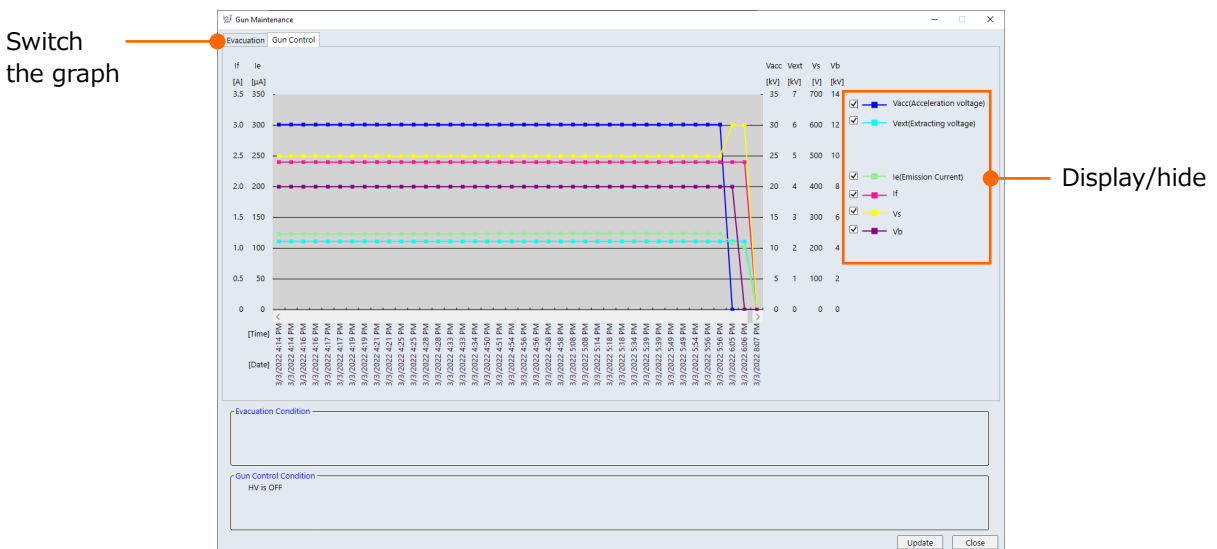
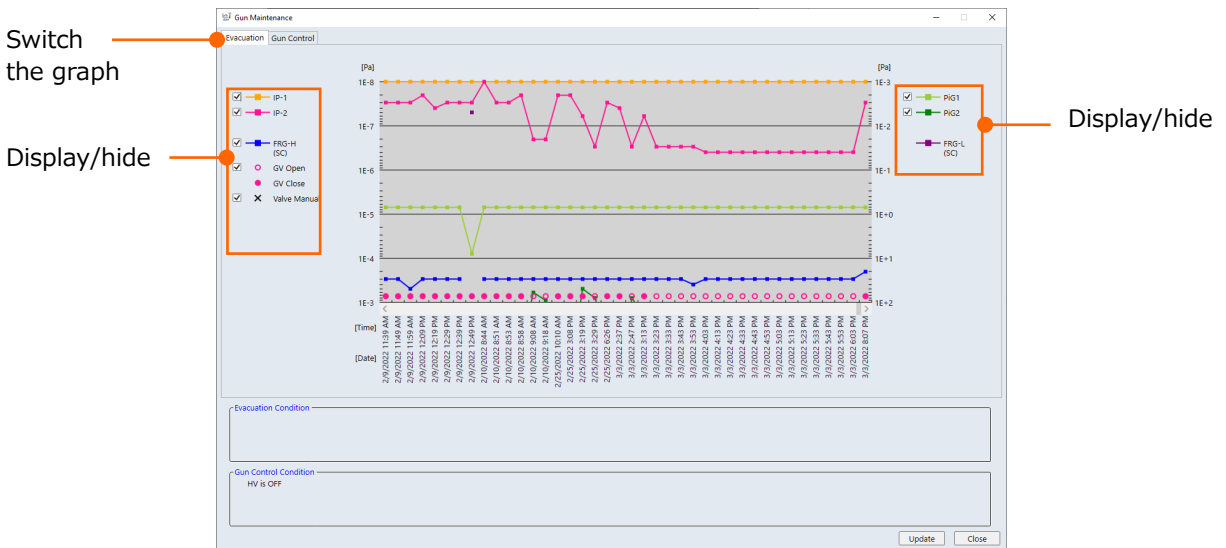
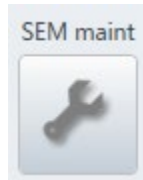
- Baking time
Set the baking time from the pull down list. The time can be set by hour (4 to 99 hours) at the detail setting button.
- Confirming the preparation condition
Display the preparation condition of each items. The baking can start when all condition display boxes are in green.
Confirm the safety and check the [Safety checked] check box.
- Start
Start the baking.
- Cancel
Cancel the baking.
- Start time
Indicate the starting time of baking.

(f) Remaining time

Indicate the remaining time of baking. When the baking is finished, the display changes to the [Elapsed time] and indicate the time up to 10 h at maximum.

2.5.3 Electron gun maintenance

Display the [Electron gun maintenance] dialog. The dialog can be displayed from the [Menu]>[maintenance]>[Electron gun maintenance].



The electron gun status and vacuum status can be confirmed.

- Switching the graph
Switch the graph to display.
- Display/hide
Select the items to display on the graph.
- Vacuum status
Display a warning message when the ion pump power is OFF or the baking recommendation condition due to vacuum level deterioration.
- Electron gun control status
Display a warning message when the HV OFF (Electron gun shut down) or emission current has not flown.
- Updating
Update the message of electron gun or vacuum status.

2.5.4 Adjustment of the Objective aperture position

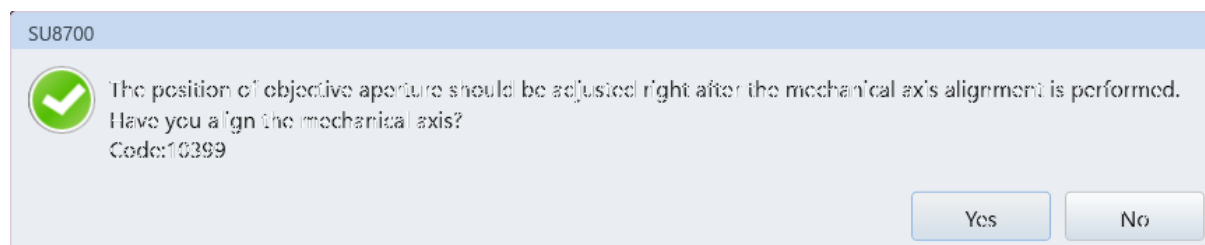
Adjust the objective aperture position. The dialog can be displayed from the [Menu]>[Maintenance]>[Adjust Objective aperture position].

If the objective aperture diameter on the [Operation panel]>[Optics] tab is highlighted in green, the mechanical position of the objective aperture may be shifted. Use this function and adjust the objective aperture position.

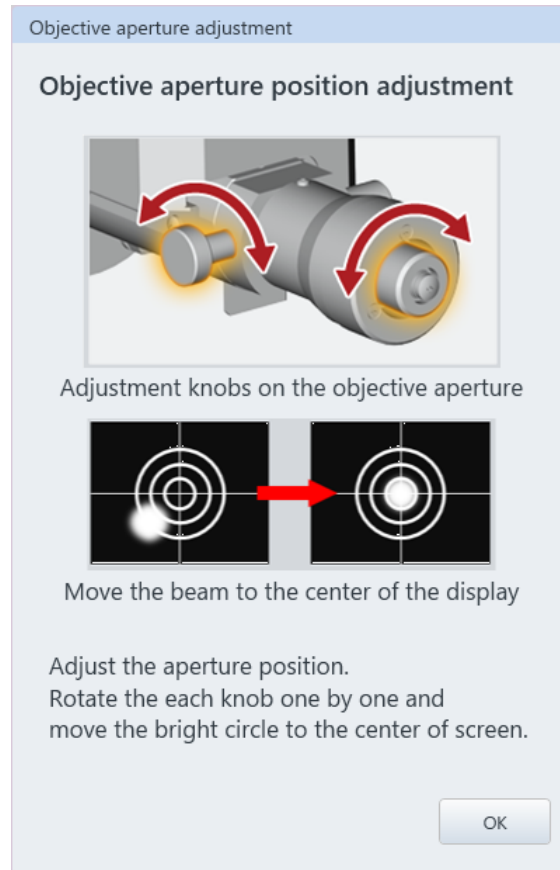
After adjusting the objective aperture position by the objective aperture position adjustment function, the objective aperture diameter on the [Operation panel]>[Optics] tab will be highlighted in black.



The adjustment of objective aperture can be performed when the mechanical adjustment has been complete. Thus, the following confirmation message will be displayed.



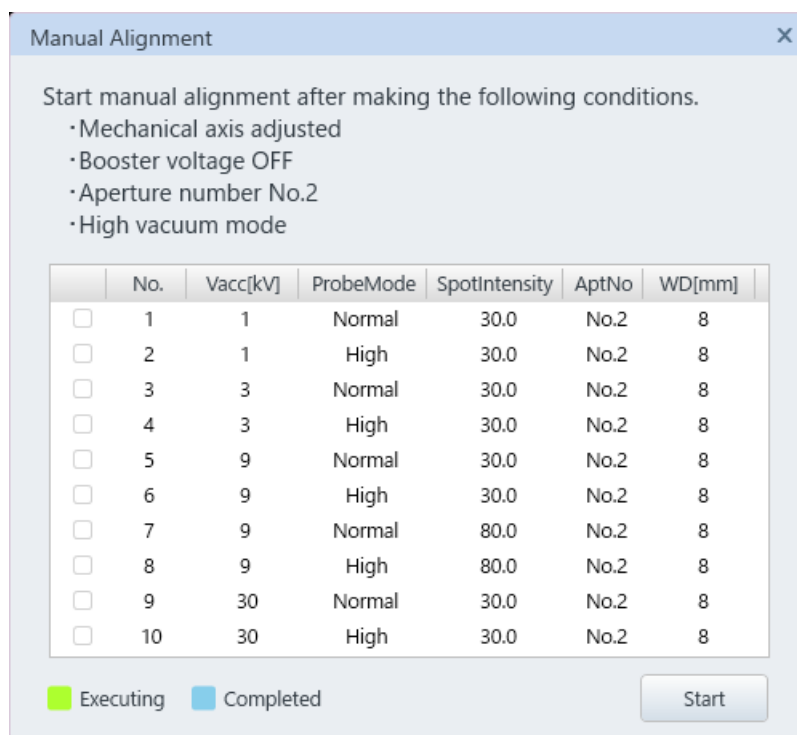
The beam will be ON in the condition of objective aperture adjustment position automatically and following dialog is displayed by selecting the [Yes]. Adjust the position according to the dialog. When pressing the [OK] button after adjusting the position, the conditions will be return to the previous conditions. When clicking the [No] button, the position adjustment sequences will be finished.



2.5.5 Manual Alignment

Perform the manual alignment. Since the adjustment value while changing the optical condition is completed from the registered adjustment condition by performing the manual alignment, the image adjustment becomes easy. This dialog can be selected from the [Menu]>[Maintenance]>[Manual alignment]. This function will be displayed only when logging in with the system administrator username (“SU8700” in the default status).

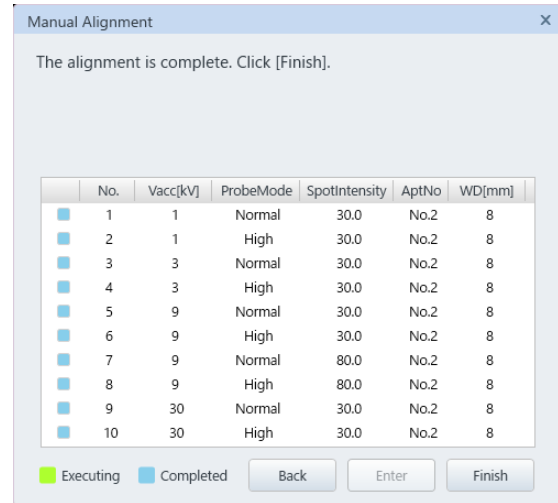
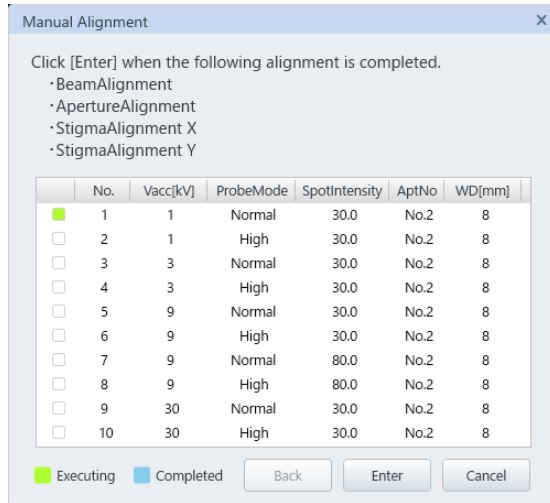
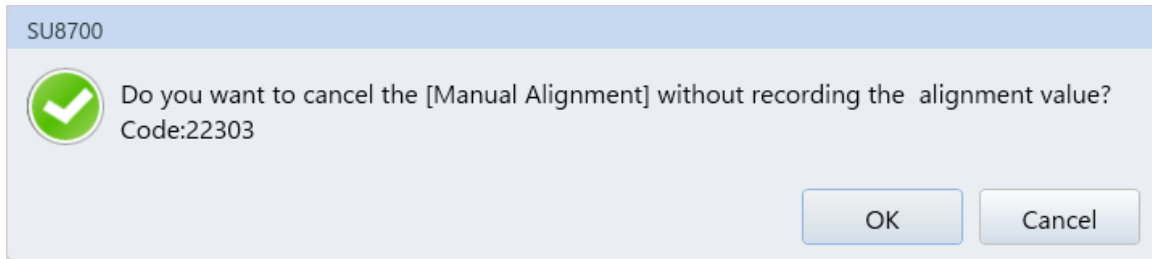
Display the manual alignment dialog by selecting the manual alignment. Perform the mechanical axis alignment, booster voltage OFF setting, aperture number settings and vacuum mode settings according to the dialog condition.



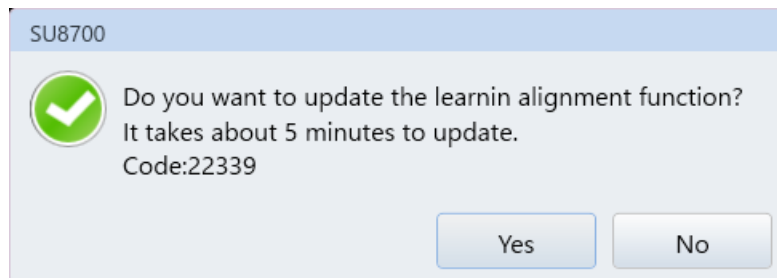
By clicking the [Start] button after HV is ON, the manual alignment condition will be set automatically. Then, perform the [Adjust Objective aperture position] according to the message. When the [Adjust Objective aperture position] is finished, the Manual alignment condition will be set automatically.

When the setting completes, perform the alignment and image adjustment (Beam, aperture, Stigmator axis alignment X/Y, Stigmator correction, focusing). After performing the alignment and image adjustment, the adjustment condition will be registered, and it will be moved to the next condition automatically by clicking the Enter button. To re-do the adjustment, it can be back to the previous condition by clicking the Back button.

Click the [Cancel] button for canceling the manual alignment. In this time, the adjustment value will not be registered.



When all conditions are finished, the indicator will be in light blue and the [Cancel] button will be changed to [Finish] button. Click the [Finish] button to finish it. The Learning alignment function update message will be display. Click the [Yes] button for updating as required.

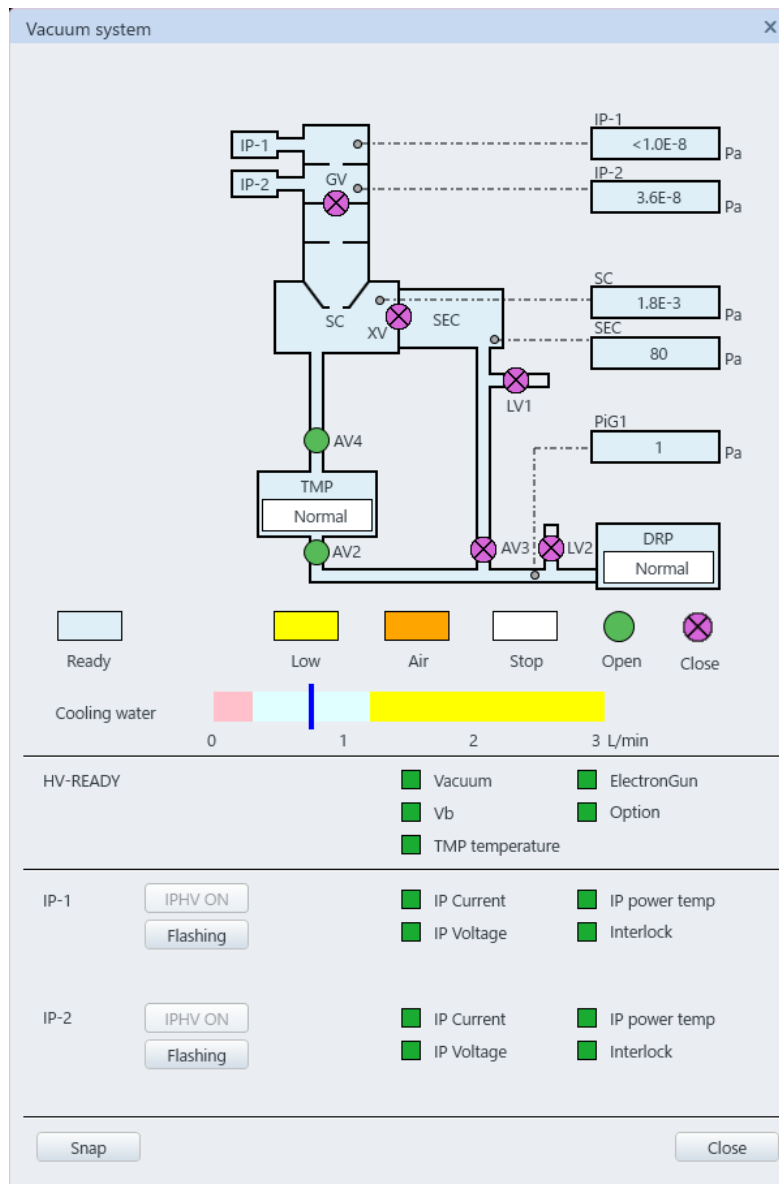


The manual alignment can be adjusted as many time as required.

2.5.6 Vacuum display

Click the [Vacuum] button and display the [Vacuum system] dialog. The dialog can be displayed from the [Menu]>[Maintenance]>[Vacuum display] as well.

This dialog indicates the vacuum system diagram. The vacuum status of each part and amount of cooling water flow can be confirmed.



(1) Vacuum system status

Vacuum status indicates the status of vacuum system. Display the High vacuum mode or VP mode (Option).

(2) Vacuum system diagram

Display each vacuum status in colors (Light blue: vacuum condition, Orange: atmospheric condition) and the open or close condition of valve by symbols.

Ready: Ready to high vacuum mode operation

Low: Pressure has not reach for operating

Air: The atmospheric condition

Stop: Vacuum system has stopped

Open: Valve is opened

Close: Valve is closed



(3) Vacuum status display

Indicate the vacuum status (Pa) of electron gun part (IP1, 2), specimen chamber (SC), specimen exchange chamber (SEC), back pressure of turbo molecular pump (PiG-2). Vacuum status indicates by the box color.

(4) Cooling Water Quantity

Display the amount of cooling water for the objective lens and TMP. The condition is normal when the blue bar is in the light blue area.

(5) HV-READY

Display the condition whether the high voltage is ready to apply or not. All indication will be in green when high voltage is ready to apply.

(6) IP-1, IP-2

Set ON and display the ion pump status and operate the flashing.

(7) Snap

Save the [Vacuum system] dialog.

(8) Close

Close the [Vacuum status] dialog.

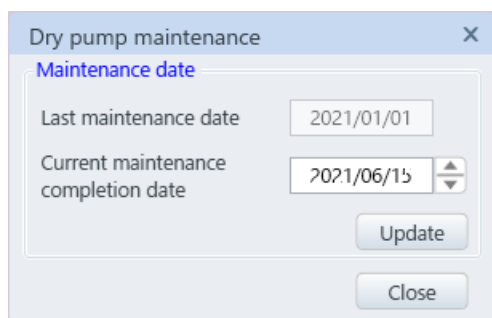
2.5.7 Maintenance of Dry pump

Display the [Dry pump maintenance] dialog. This dialog can be displayed by the [Menu]>[Maintenance]>[DP maintenance].

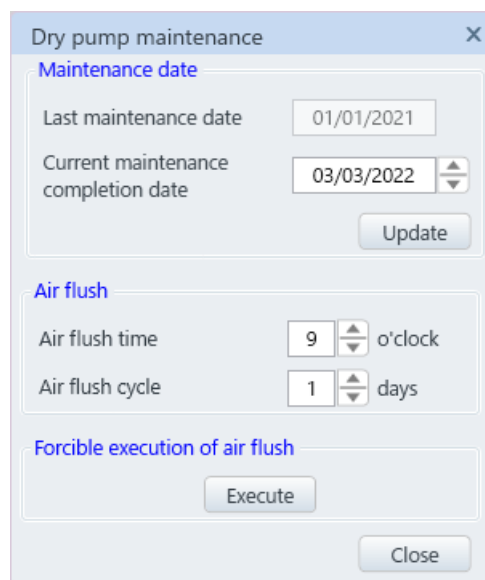


Confirm and update the maintenance date.

In addition, set the cycle and time of Air flash (Cleaning function of inner DP by introducing air) when the dry pump requires the air flashing. When the instrument uses the dry pump which requires the air flash, the Air flash and forcible execution of air flash will be displayed.



Without air flash function



With air flash function

2.5.8 SC (AIR/EVAC)

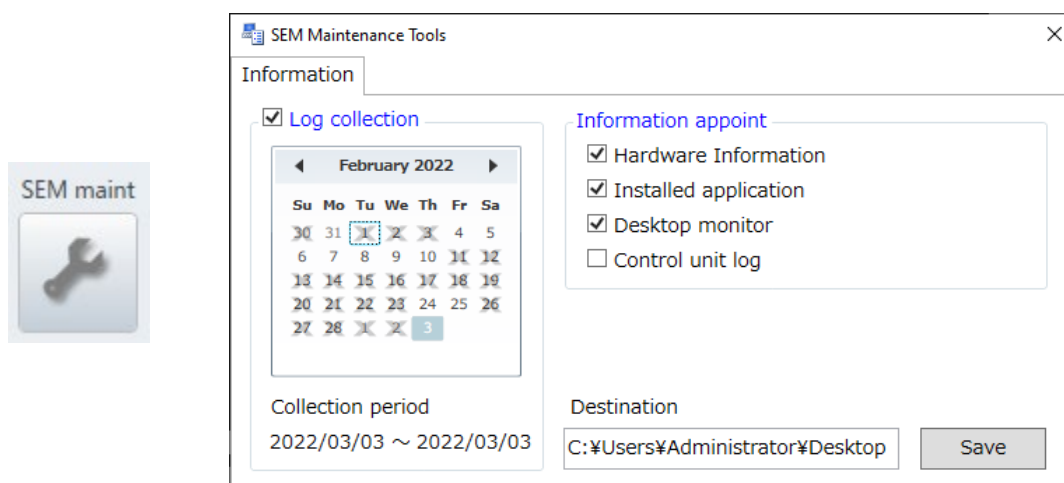
Venting air or pump air to/from the specimen chamber. It can be performed by the [Menu]>[Maintenance]>[SC]>[AIR/EVAC].

NOTE: Please operate the SC (AIR/EVAC) according to the instruction of service engineer of Hitachi High-Tech Corporation.

2.5.9 SEM Maintenance Tools

Display the [SEM Maintenance Tools] dialog.

The dialog can be displayed by the [Menu]>[maintenance]>[SEM maintenance tool].



(1) Obtain log

Select the time period for saving the system information log.

(2) Select information

Select the items for saving the instrument information log.

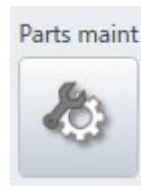
(3) Saving

Save the instrument information log in the saving destination (Desktop). The saving destination cannot be changed.

- NOTE:
- Operate the SEM maintenance tools according to the instruction of service engineer of Hitachi High-Tech Corporation.
 - When switching the language on the Japanese OS, the SEM maintenance tools will be displayed in Japanese.

2.5.10 Maintenance item

Display the [Part maintenance] dialog. The dialog can be displayed by the [Menu]>[maintenance]>[Part maintenance].



Explanation

Alarm settings

State	Parts	Maintenance day	Next Maintenance day	Maintenance cycle
Red	Specimen exchange rod O-Ring	-----	-----	1year
Green	Full range gauge	-----	-----	3years
Green	Holder plate spring	-----	-----	3years

Notice Maintenance period is not a term of a guarantee.Please do maintenance in accord with the situation.

Next exchange due date is -----.
 When the Specimen exchange rod O-Ring deteriorates, produce an omission of vacuum at the time of sample exchange, and a device may break down.
 When movement at the time of the putting in and out of the Specimen exchange rod became heavy, an appropriate amount applies Specified grease to the Specimen exchange rod, and let put several times of the Specimen exchange rod in and out, and grease be familiar.

Display an alarm message at the time of start.
 The Dry-pump regular maintenance message is shown at system startup.

Change Close

Display the maintenance information.

(1) Condition

Indicate the present condition by indicators.

- (a) Green: More than 3 months to the next scheduled date from the present date.
- (b) Yellow: Less than 3 months to the next scheduled date from the present date.
- (c) Red: The present date exceeds the next scheduled date.

(2) Parts

The parts name that is required the maintenance.

(3) Maintenance date

The last maintenance date.

(4) Next maintenance date

The recommended schedule for the next maintenance date.

(5) Maintenance cycle

The recommended cycle of the maintenance.

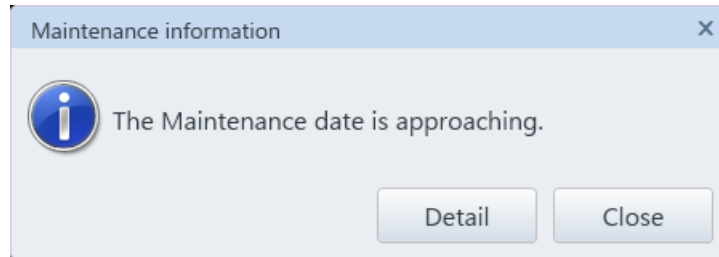
(6) Explanation part

Display the explanation of selected item.

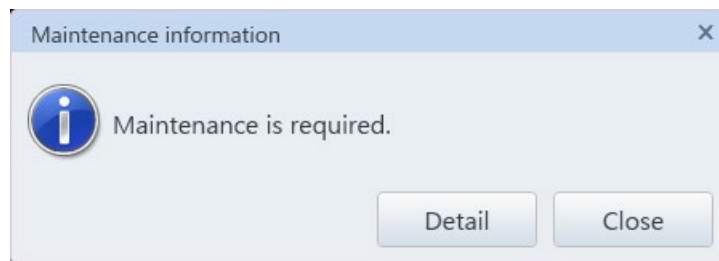
(7) Alarm settings

Display an alarm message when it is in the followings conditions while alarm setting is ON. Display the maintenance information window by clicking the details button. Close the above window by clicking the [Close] button.

(a) The status with yellow



(b) The status with red



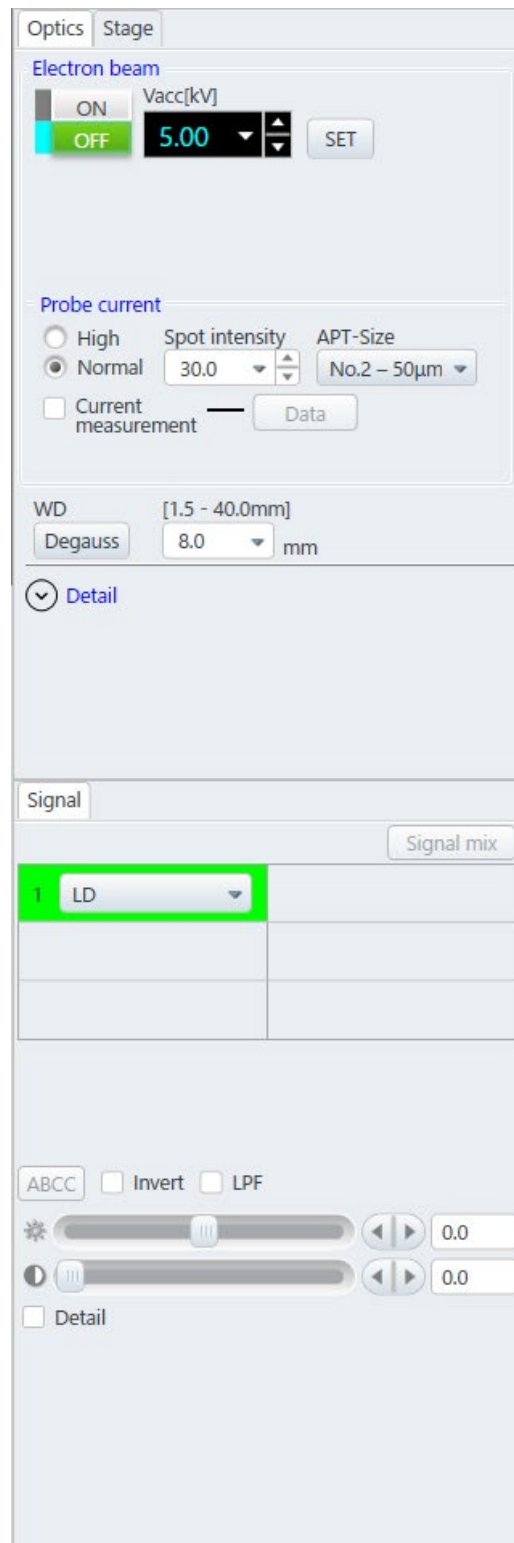
(8) Updating

It will be displayed only when logging in with the system administrator username ("SU8700" in the default status).

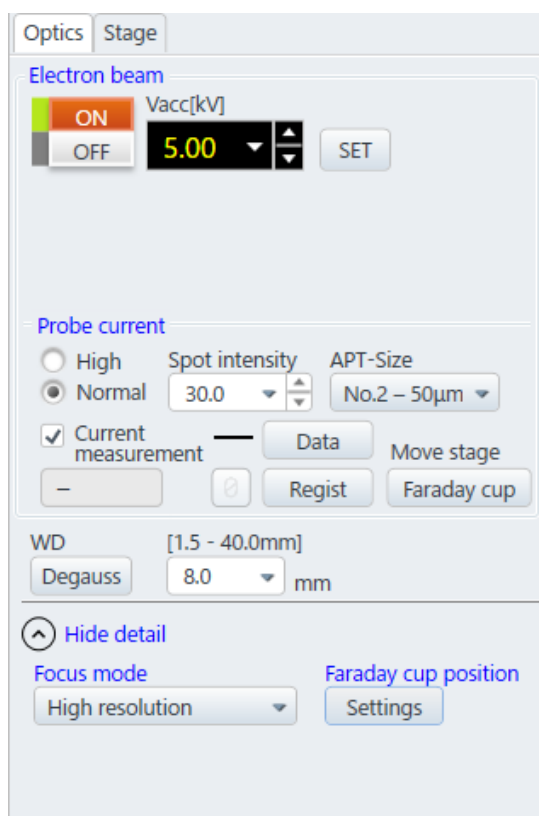
The maintenance date and cycle of selected parts can be changed.

2.6 Operation panel

The electron optics system condition, selecting a signal, Stage operation, other settings or operations are arranged by tabs.



2.6.1 Optics tab



(1) Electron beam

(a) HV

Click the [ON] button and apply the accelerating voltage. Shut off the accelerating voltage by pressing the [OFF] button. The function is the same as the [HV] in the control panel.

(b) Accelerating voltage

Set the accelerating voltage. Click the pull down button and select a desired value from the pull-down list for the accelerating voltage value list.

Recently used voltages are displayed on the top of the list from the 4th (Separated by a line). In addition, the accelerating voltage value can be changed by clicking up and down in the [Detail settings] and clicking the [SET] button.

(2) Probe current

(a) Select the current mode

Select the (Normal) mode, which is the resolution priority, or the (High) mode which is the probe current obtaining priority.

(b) Spot intensity

Select spot intensity from the pull down list. To set more details, it can be set by 1 step in the detail setting button. The smaller value is set, the smaller probe current becomes.

(c) Object aperture size

Display the diameter of presently used object aperture. The smaller No. of aperture is set, the larger the aperture size becomes.

Select an aperture size from the pull down list. Activate the aperture size change sequence and change the aperture size according to the sequence for minimizing the position shift. When the aperture No. indicates in green, the position of objective aperture has not been adjusted. If the aperture No. indicates in green, perform the [Adjust the aperture position].

(d) Current measurement

Check ON the current measurement check box and activate the current measurement function. The measurement of present probe current can be displayed on UI by using a specimen stub with Faraday cup

- Register

Register the measured probe current.

- Data

Display the [Measured current data] dialog.

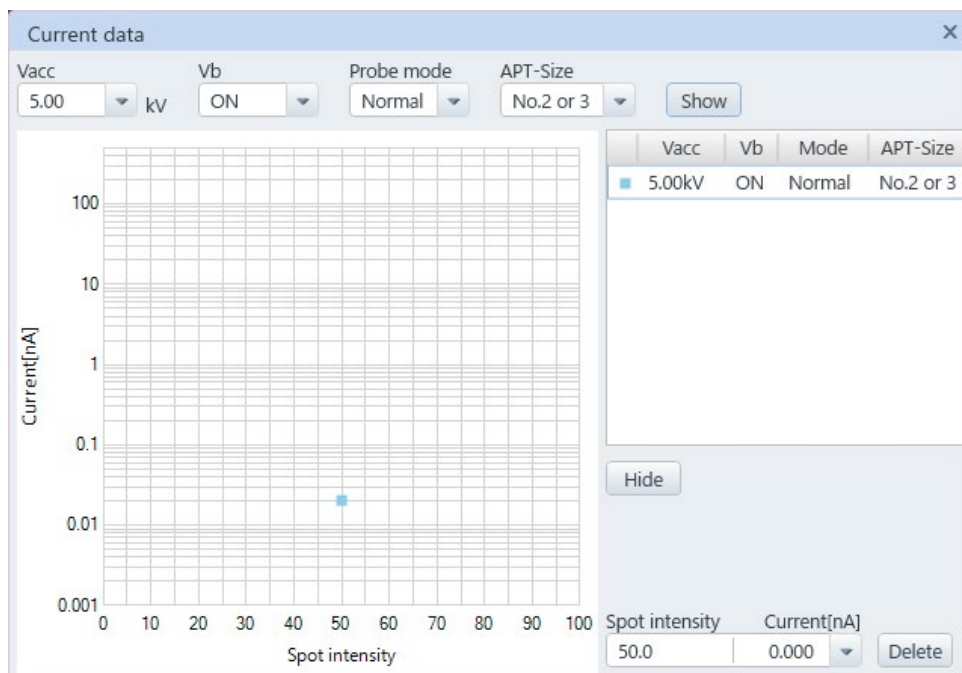
In the measurement current data dialog, the registered probe current can be graphically displayed as the measured current with respect to the spot intensity.

Display the desired probe current condition from the pull down list and click the display button. The measured current value can be shared with all users. For hiding the graph, select a condition for hiding and click the [Hide] button.

Delete the data by selecting the data from the display list and clicking the [Delete] button.

- Zero adjustment button

The button to perform the zero adjustment for the current measurement function. It will be enabled when the HV is OFF.



- Faraday cup
Move the stage to the selected coordinate value and registered at the Faraday cup position. When the stage is moving or has moved, the button change to the [Return]. When pressing the [Return] button, the stage move to the previous position.

(3) WD

(a) WD setting/Display box

Display the present working distance (WD) (The focus position which is calculated by objective lens current).

In addition, when entering the value in the box or selecting a desired value from the WD list, the lens current will be calculated and set for focusing to the WD.

(b) WD range display

Display the WD range that is selectable in the present optical conditions and accelerating voltage at upper area of the WD setting/Display box. The WD range will change depending on the optical conditions and accelerating voltage.

(c) Degauss button

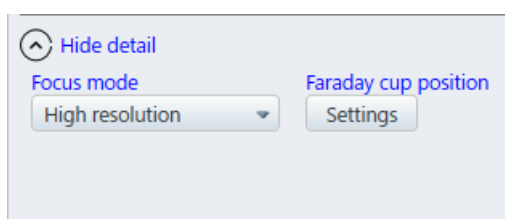
Perform the degauss for the objective lens. When the residual magnetism of the lens is large, the axis of electron optics can be shifted, or the magnification accuracy can be decreased. Press the [Degauss] button for the following cases.

- After greatly change the focus
- Before the axis alignment of electron optics system is performed

Press [F2] key for operating the degauss without opening the [Settings] dialog.

(4) Display/hide the details

Display or hide the following two setting items. The dialog does not need to display for a normal operation.



(a) Observation mode

The [Standard], [High resolution] or [Wide range stigmator] are available. Select the standard for the normal observation. In the [High resolution], the axis alignment condition which is the image resolution priority is set automatically.

The [Wide range stigmator] increases the amount of astigmatism correction. Select this mode when astigmatism cannot be corrected due to observing a magnetic material such as iron.

2.6 Operation panel

(b) Faraday cup position

Register or select the Faraday cup position. Select the stage coordinate No. and input the stage X, Y and R coordinate values then register the position with comments. The present value of stage can import to the stage coordinate. Select the stage coordinate No. and press the [Close] button. When pressing the [Register] button, the data will be overwritten.



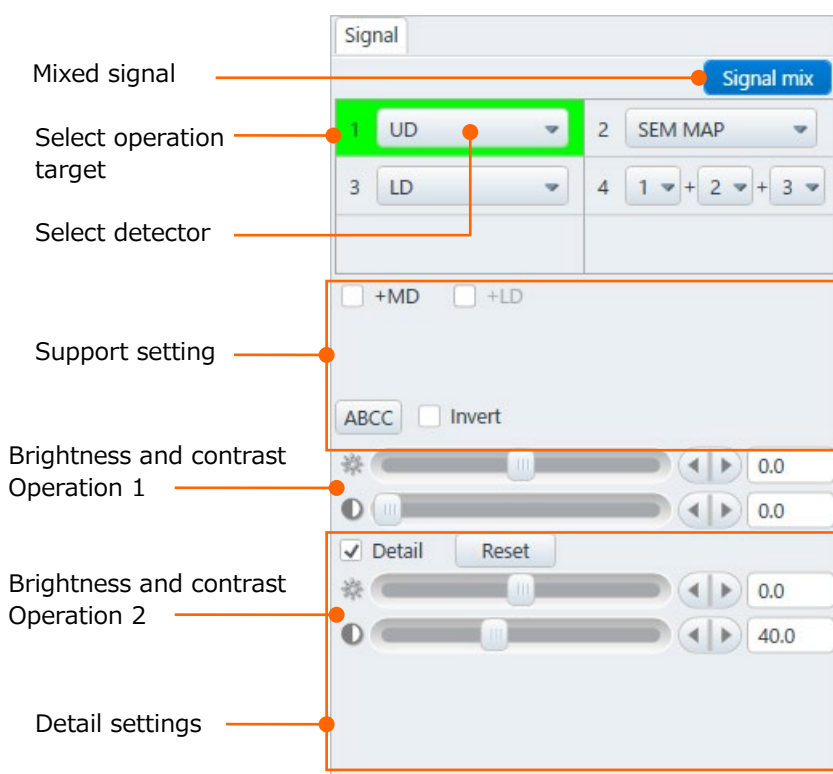
The image shows a software dialog box titled "Register Faraday cup position" with a close button (X) in the top right corner. The dialog is divided into a "Stage position" section and a bottom section with buttons. In the "Stage position" section, there is a "No." dropdown menu set to "1", a "Comment" text input field, and three coordinate input fields: "X" (0.000 mm), "Y" (0.000 mm), and "R" (0.0 deg). Below these inputs are two buttons: "Get Position" and "Register". At the bottom right of the dialog is a "Close" button.

2.6.2 Signal tub

Selecting a detector, setting the detector condition, adjustment of each detector and mixing the signal can be performed in this tub. The following figure shows an example of 4 screens mode. However the same function for selecting a detector is placed at upper right of each screen.

(1) Common settings

Common settings of each detector are described in the followings.



(a) Mixed signal

Mixed image which is integrated the multiple screens can be displayed when selecting more than four screens. The number which is displayed in the detector selecting area indicates the screen. The image of selected detector can be displayed by pressing pulldown button (▼) and selecting from the screen list.

(b) Select operating target

Activate or deactivate the brightness and contrast operation or the brightness and contrast knobs in the manual operation panel. When clicking the button, the button will be highlighted in green color on the selected screen. The target screen for operating can be selected by clicking the desired screen.

(c) Select detector

Detector selecting area display is changed depending on the image display mode and the above the Mix button settings.

Select a detector. Display the detector list by pressing the ▼ button. Select a detector from the list. The name of [detector select box] is be changed to the selected detector and the image is displayed. The detector list is arranged in the image display area.

(d) ABCC

Control the brightness and contrast of the selected image.

(e) Invert polarity

Invert the image of light of dark by enabling [Invert]. The function applies to the selected screen which is framed with green color.

(f) Detail

When enabling [Detail] check box, the detail setting for each detector are displayed. [Brightness and contrast operations 2] is the common item for all detectors.

(g) Brightness and contrast operation 1/2

The function applies to the selected screen which is framed with green color.

The [Brightness and contrast operation 1] corrects the digital brightness and analog contrast.

[Brightness and contrast operation 2] corrects the analog brightness and digital contrast.

The brightness and contrast can be corrected manually at each operation area. Move the slider with the mouse or click the right and left buttons (◀▶) for performing the fine adjustment. Click the right and left area of bar knob for performing the rough adjustment. The value will be displayed on the right box.

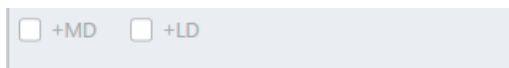
In addition, the value can be entered directly in the value display box (The value is applied by pressing the enter key).

(2) Each detector setting

Two detectors of UD and LD are equipped as a standard for SU8700. MD is an option. The setting items are different in each detector.

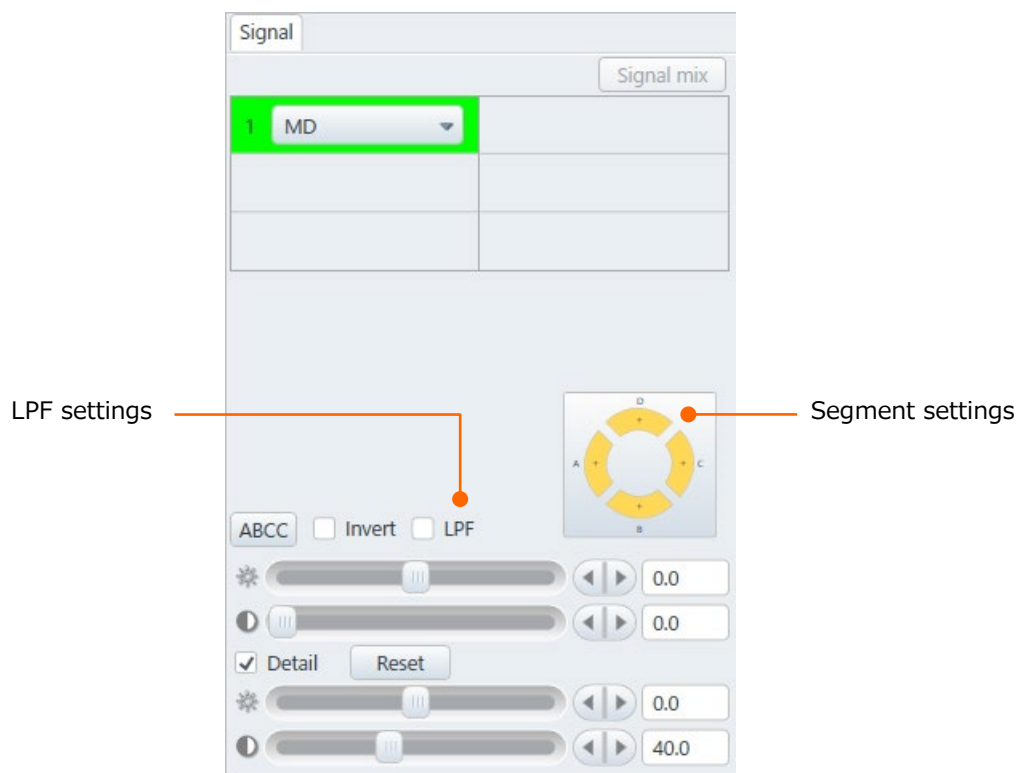
(a) UD

In case the detector (MD (Option), LD) except UD are not selected, the check box of +MD (Option is equipped) for the assist settings and +LD are enabled, and the signal can mix to the UD. In this time, UD (+MD, +LD) is displayed in the image signal area.



(b) MD (Option)

Dedicated settings are existed in the assist settings and detail settings.



- Segment setting
Set the detecting segment of MD. Segment setting is displayed in the dialog. The setting display will be enlarged, and setting can be performed by clicking the segment settings.
Select a segment from the segments of A to D and set a condition from the three condition, [+], [-] or [OFF] at each segment.
- LPF
On or Off the LPF (Low Pass Filter) for MD. When the check box is ON, the contrast will be improved.

(c) LD

Dedicated setting of LD is existed in [Detail].



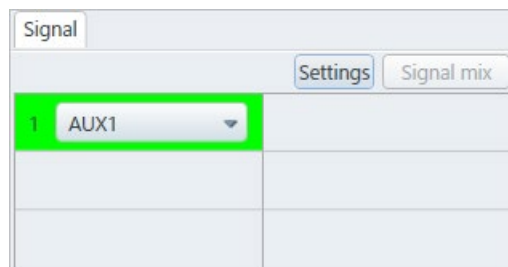
- LD bias
Control the second electron collection efficiency at the LD bias setting area. Move the slider with the mouse or click the right and left button (◀▶) for performing the fine adjustment. Click the right and left area of bar knobs for performing the rough adjustment. The value will be displayed on the right box. In addition, the value can be entered directly in the value display box (The value is applied by pressing the enter key).
Set to [-] side for decreasing and set to [+] side for increasing the second electron collection efficiency.
- Topo image mode (POST-OFF)
Deactivate the extracting voltage of SED when the Topo image mode (POST-OFF) is ON. A topo image can be observed.

NOTE: Obtaining an image may be difficult during low accelerating voltage or lower probe current.

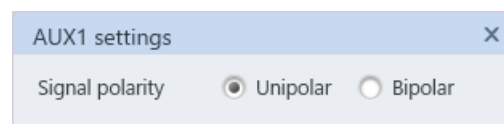
- LPF
ON or OFF the LPF (Low Pass Filter) of PLD. When the check box is ON, the contrast will be improved.

(d) AUX1

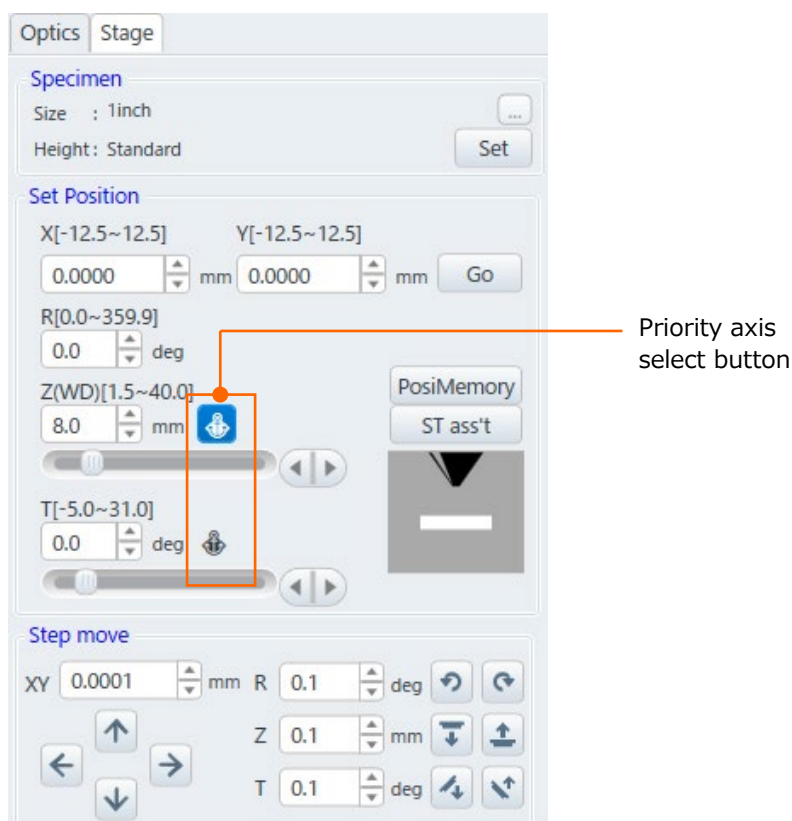
AUX1 displays the image which is imported from the AUX1 connector locating at the rear side of the main unit. Click [Set] button for displaying the AUX1 setting dialog.



- AUX1 setting dialog
Set the signal polarity. Select the Unipolar when the detector signal is 0 V to +10 V. Select Bipolar when the detector signal is -5V to +5V.



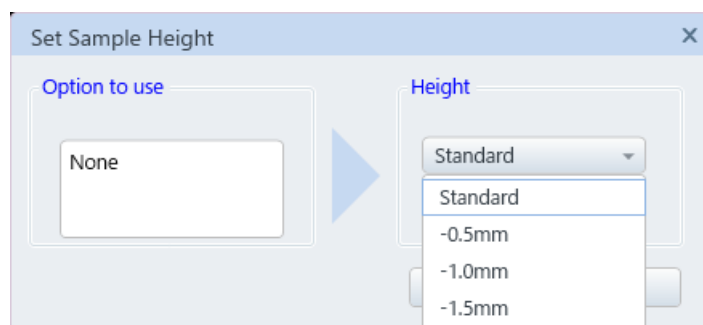
2.6.3 Stage tab



Display the [Stage] tab on [Basic setting] dialog by right clicking the mouse in the stage tab and set each stage parameter.

(1) Settings

The settings button will be activated at the stage home position. Click the [Set] button for displaying the [Set Sample Height] dialog. Select the option to use and deviation of the standard specimen height 36 mm (Standard (0.0 mm) to -1.5 mm).



(2) Size

Display the specimen stub size that is set while exchanging a specimen.

(3) Height

Display the specimen stub height (Deviation from the standard height) that is set for exchanging a specimen.

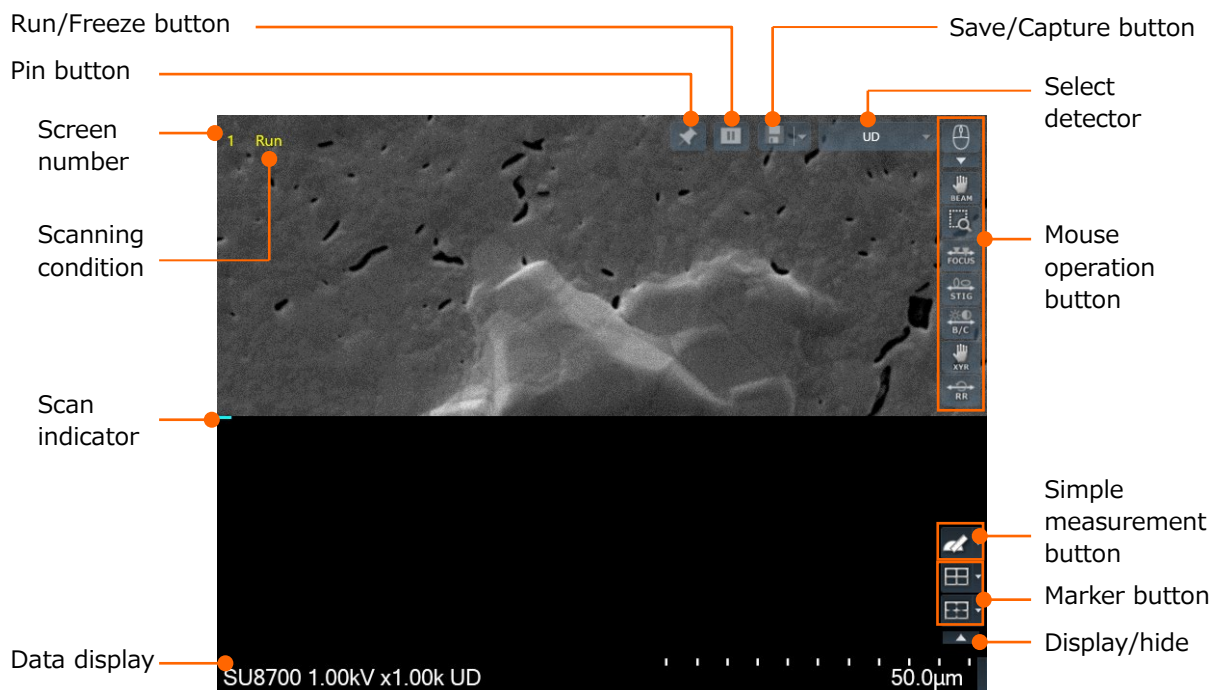
- (4) Position memory
Display the [Position memory] dialog.
- (5) Stage assist
Display the [Stage assist] dialog.
- (6) Coordinate select move
 - (a) X and Y axes operation area
The X and Y boxes indicate the present coordinate value of stage X and Y axes. Input the value and move the stage to the desired position by clicking the [Enter] key or the [Go] button.
 - (b) R axis operation area
The R box indicates the present value of R axis. Input the value and move the stage to the desired angle by clicking the [Enter] key or the [Go] button.
 - (c) Priority axis select button
Movable range of Z and Tilt axes are limited by the other axis. The [Priority axis select] function can prioritize the Z axis (WD) or T axis and set the other value within the movable range.
 - (d) Z axis operation area
The value box at the upper of scroll bar indicates the Z axis position.
Set the value by operating the scroll bar (Click on the bar to set the value by 1 mm steps, click the detail setting button at the right side to set the value by 0.1 mm steps) and click the [Go] button or the [Enter] key to move the stage Z axis. In addition, the value can be set by inputting the value into the value box. The minimum moving step of Z-axis can be set at 0.01 mm in the [Stage] tab on the [Standard settings] dialog.
 - (e) T axis operation area
The value box at upper area of scroll bar indicates the present T axis position.
Set the value by operating the scroll bar (Click on the upper area of bar for setting the value by 1° step, click the ◀ ▶ buttons for setting the value by 0.1 ° step) and click the [Move] button or the [Enter] key to move the T axis. In addition, the value can be set by entering the value into the value box.
- (7) Step move
Perform the step move by the below buttons. Step move can be performed by clicking each step button of 5 axes (X, Y, R, Z and T axes). The step value can be input directly in the value box.
Refer to the following for the positive and negative relation of each step button and coordinate.



- X axis: → - ← +
- Y axis: ↑ + ↓ -
- R axis: + -
- Z axis: + -
- T axis: - +

2.7 Image display area

The observing image, data display, scanning condition, Run/Freeze button, Save/Capture button, select detector, mouse operation button, Simple measurement button and marker button are arranged in the image display area.



- (1) Run/Freeze button

Start and stop the scan. When the screen mode is more than 2 screens, Run/Freeze button is arranged at each screen. The Run/Freeze can be performed by each screen. In addition, the present condition of Run/Freeze indicates in yellow text at the upper left side on the observing image.
- (2) Scan indicator

Scan indicator indicates the updating position on the scanning image. The indicator can be displayed or hidden in the standard settings.
- (3) Save/Capture button

Save or capture the observing image. Click the pull down list at right side of the button and display the function list to select the saving or capturing. When more than 2 screens mode is selected, the [Save/Capture] buttons are arranged at each screen. The [Save/Capture] button can be performed at each screen.
- (4) Detector selection

Select an observing signal. The signals are the same as the [Signal] tab in the operation panel. Signal can be selected in both way. Display the pull down list by clicking the signal selection box and select a signal from the list.

(5) Data display

Display the data display of observation condition and micron marker. Right click the mouse for displaying the [Data display] tab on the [Saving condition settings].

The contents of the data display area can be changed by changing the setting.

(6) Pin button

The image display area position can be fixed by clicking the pin button while setting the image display area to flow by the display type function.

(7) Mouse operation button

(a)  Mouse operation switching button

When clicking the button, the display is changed, and mouse operation is enabled. Click the pull down button and display each mouse operation.

(b)  FOV move (Stage RISM & Image shift RISM)


Move the clicked position clicked to the center of the scanning image. In addition, the position can move by dragging and dropping the mouse.

(c)  Stage RISM & ZOOM

Move the clicked position to the center of the scanning image. In addition, the range that is framed by the mouse is enlarged and displayed.

(d)  Focus C/F

Perform focusing by mouse operation on the image. Fine adjustment can be performed by left clicking the mouse and rough adjustment can be performed by right clicking the mouse.

(e)  Astigmatism correction X/Y

Perform the stigmator correction by the mouse operation on the image. The stigmator of X direction is corrected by left clicking and dragging the mouse and the stigmator of Y direction is corrected by right clicking and dragging the mouse.


(f)  Brightness/Contrast

Control the brightness (left button) and the contrast (right button) of the image by the mouse operation on the image.

(g)  Stage XYR

Display the operation tool of X, Y and R axes on the image and mouse icon is changed to [MOVE].

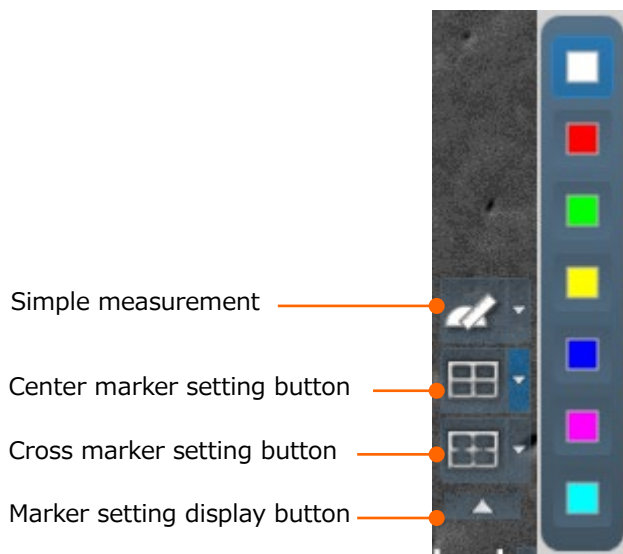
When the clicking the left button, the mouse icon is changed to [STAGE] and each axis of operation by using the mouse is possible. When right clicking the mouse, the mouse icon is changed to [BEAM] and image shift operation can be performed by mouse operation on.

(h)  Raster rotation

Angle of raster rotation can be adjusted by dragging the mouse on the display.

(8) Simple measurement, Marker button

Display the center marker setting and cross-marker setting buttons by clicking the marker setting display button.



(a) Center marker button

Click the button and display the center marker, which indicates the center of display with the crossed line. The color of marker can be selected from the pull down list by clicking the ▼ button.

(b) Cross marker button

Display the cross-marker, which can move to the position of image display area by clicking the button. Move the cross marker position by clicking the image display area. The color of cross maker can be selected from the pull down list by clicking ▼ button.

(c) Simple measurement button

Display the measurement result and measurement cursor which can move to the position of image display area by clicking the button. The measurement cursor color can be changed from the pull down list by clicking the ▼ button.

(9) Display/hide

All displays that are displaying can be displayed or hidden by clicking at upper right side of the screen except for the data display and micron marker.

3. Operation

3.1 Preparation

3.1.1 Confirm the instrument condition

Before starting the operation, confirm that the IP1, IP2, FIL, EVAC, STAGE and EOC lamps at the condition display panel in the main unit are ON. In case that the lamps are OFF, perform the operation of (1) to (4).



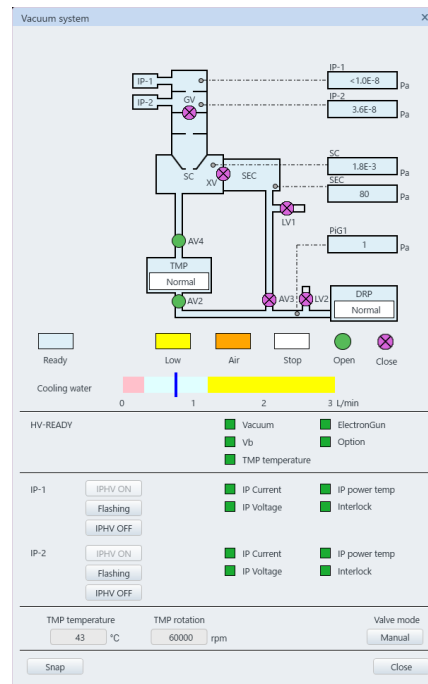
- (1) When the IP1 and IP2 lamps are OFF

Power ON the IP breaker located at rear side of the main unit.

Startup the SU8700 operation program and activate the IP1 and IP2 by pressing the [IPHV ON] button on the [Menu]>[Maintenance]>[Vacuum display]>[Vacuum system dialog].



IP breaker



Vacuum system dialog

- (2) When the FIL lamp is OFF

Startup the SU8700 operation program and press the [Star-tup] button on the [Menu]>[Maintenance]>[Electron gun]>[Gun control dialog]>[Gun startup] for executing the startup sequence of electron gun.

- (3) When the EVAC and EOC lamps are OFF

EVAC: Power ON (-) the EVAC power switch at right side of the main unit.

EOC: Power ON (-) the EO Control Unit at right side of the main unit.



- (4) When the STAGE lamp is OFF

Power ON (-) the STAGE breaker at rear side of the main unit.



3.1.2 Cooling water supply

Water is used for cooling the objective lens and TMP in this instrument. A valve is equipped at the cooling water circulator inlet and the valve is opened and closed by deactivating the EO Control Unit. If the EO Control Unit is activated that water cannot be supplied, a message of [Objective lens cooling water is insufficient or overheat of the objective lens coil is occurred. Please check the amount of the cooling water on the vacuum system and wait until temperature is lowered.] will be displayed.

- (1) Water supply source and control (When a cooling water circulator is used and linked with SEM)

When the cooling water circulator that is linked with SEM is ON, to operate/stop the cooling water circulator will be controlled by linking to the cooling water valve opening and closing operations as mentioned as above.

- (2) Water supply source and control (When a cooling water circulator is used and not linked with SEM)

When exiting the SEM operation, power OFF the EO Control unit and stop the cooling water circulator.

- (3) Water supply and control (When using city water)

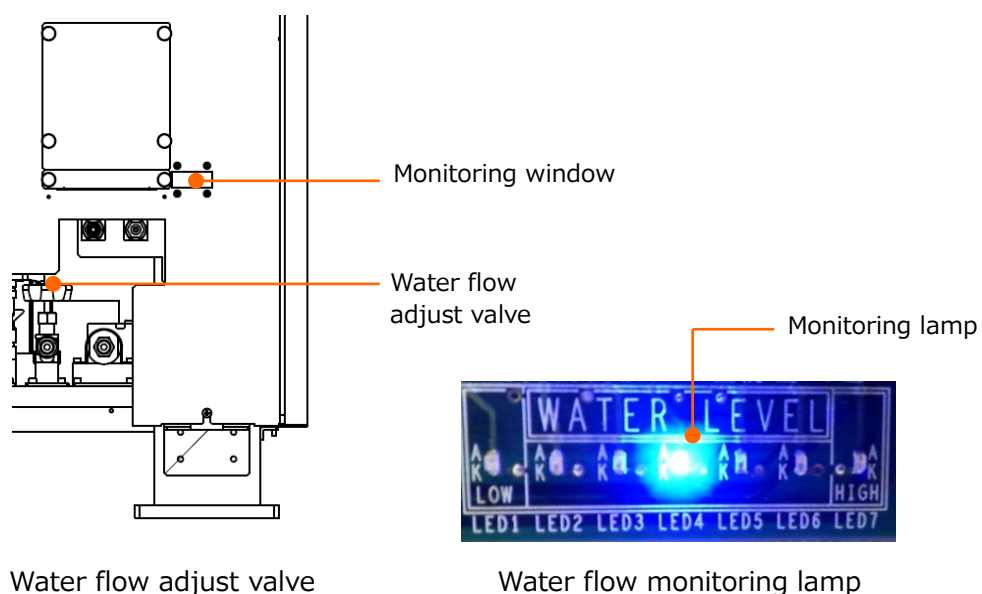
Open the water supply valve before starting the EO Control Unit.

- Adjustment of water flow

Appropriate water flow range is 0.45 to 1.05 L/minute (Recommended value is 0.75 L/minute).

Water flow adjustment performs at back of the vacuum system console. Following figure shows the water flow adjustment valve.

Since the water flow display on the [Vacuum system dialog] cannot be viewed from the back, the LED lamps for the monitor are equipped. Adjust the water flow adjustment valve by checking the LED lamps through the following monitor lamp window.



Seven lamps are arranged and one of the lamp is ON according to the water flow condition.

LED7 (Red): 1.20 L/minutes or more

LED6 (Blue): 1.05 L/minutes ←Maximum

LED5 (Blue): 0.90 L/minutes

LED4 (Blue): 0.75 L/minutes ←Adjust position (Adjust the water flow to ON this lamp)

LED3 (Blue): 0.60 L/minutes

LED2 (Blue): 0.45 L/minutes ←Minimum

LED1 (Red): 0.30 L/minutes or less

(4) Warning when the water flow is excessive or insufficient condition

When water flow is excessive (1.20 L/minute or more), error E601 appears on the vacuum system operation panel. If water flow is insufficient (0.30 L/minute or less), error E602 appears and the buzzer sounds. In addition, when the SEM operation program has started, a message of [Objective lens cooling water is insufficient or overheat] is displayed. This message will be disappeared when the water flow is adjusted properly.

3.1.3 Startup SU8700 operation program

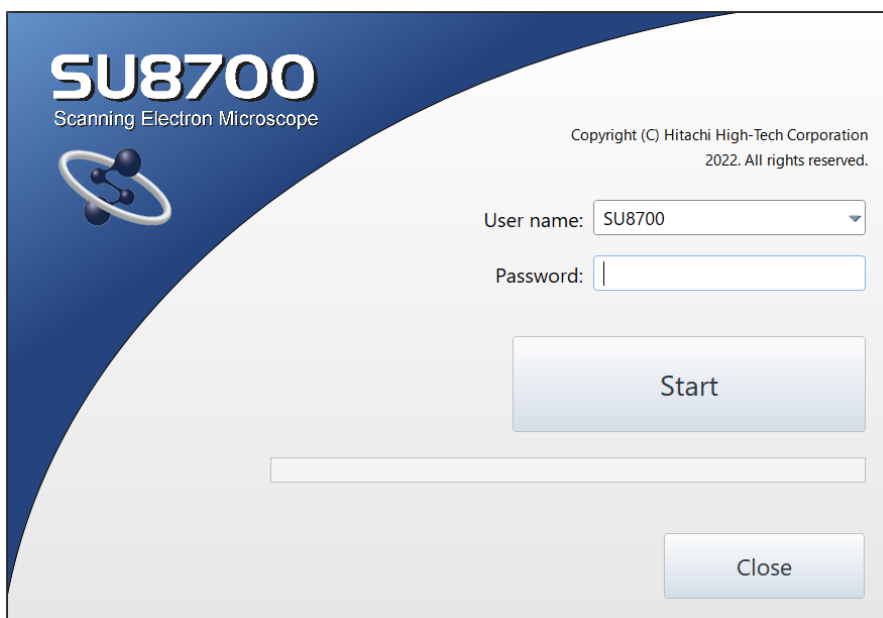
- (1) Activate the OS and start up the SU8700 operation program by clicking the SU8700 operation program icon.



- (2) Click the SU8700 operation program icon and display the log in window.
- (3) Enter the login name and password then, click the [OK] button. The SEM operation window will be displayed. In the delivering status, “SU8700” (without password) for administrator authority has been set in the username.

It is recommended to register a user before operating the instrument.

Reference: 2.4.5 User account

The image shows a login window for the SU8700 Scanning Electron Microscope. The window has a dark blue header on the left with the text "SU8700 Scanning Electron Microscope" and a logo of a scanning electron microscope. On the right, there is a copyright notice: "Copyright (C) Hitachi High-Tech Corporation 2022. All rights reserved." Below this, there are two input fields: "User name:" with a dropdown menu showing "SU8700" and "Password:" with an empty text box. A "Start" button is positioned below the password field. At the bottom right, there is a "Close" button. A horizontal progress bar is visible below the "Start" button.

3.2 Set a specimen

3.2.1 Caution on specimen preparation

Note the followings descriptions while fixing a specimen to a specimen stub.

- NOTE: ● Do not touch the specimen or specimen stub with bare hands. Make sure to wear clean gloves for handling. When sebum is adhered to the specimen or specimen stub, it can cause of contamination.
- Make sure to select appropriate specimen stub size. If the inappropriate specimen stub size is selected, the specimen cannot be protected properly, and it can cause of damaging the specimen or instrument.
 - When double-side conductive tape is used for fixing the specimen, cut the tape to the minimum size. However, the FOV can be drifted during the SEM observation when fixing a specimen with the double-side conductive tape.
 - When conductive paste is used for fixing a specimen, use the minimum amount of paste. Too much paste can release a large quantity of gas into the vacuum, which can cause the contamination. Ensure that the paste has dried enough before setting the specimen to the specimen chamber.
 - Blow excessive powder of specimen with a blower after sprinkling the specimens on the double-sided conductive adhesive tape. The unfixed specimens contaminate the column and can cause of image deterioration.
 - The moisture or oil contained the specimen will contaminate the column. Minimize the amount of water and oil and set the specimen on the specimen chamber.

NOTICE: ● In case of observing an insulating specimen with a project part (Dielectric material) or a field-emitting specimen (such as a carbon nanotube), the specimen may discharge due to the electric field of objective lens.

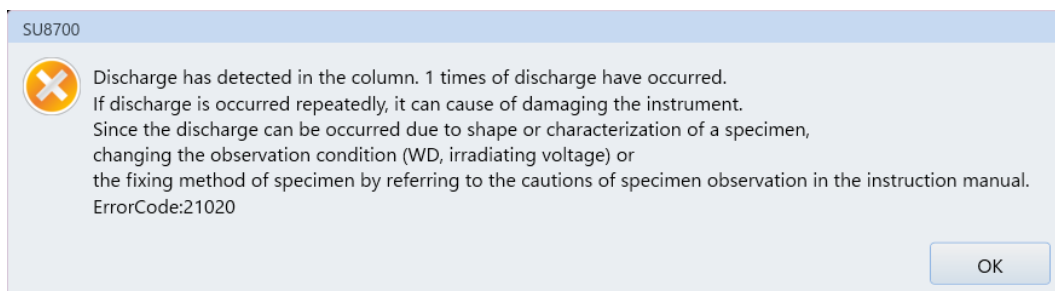
The scintillator of Middle detector can be damaged, and observation will not be performed when the discharge is occurred repeatedly. Thus, to observe with WD=6 mm or more is recommended for observing the specimen which is mentioned as above.

If the specimen is discharging when setting the WD at 6 mm or more, set the probe current at smaller value (set spot intensity at smaller value) or fix the specimen with conductive paste or perform metal coating for the insulating specimen with projection part (Dielectric material). Whereas, for the field-emitting specimen, re-consideration of the fixing method is required.

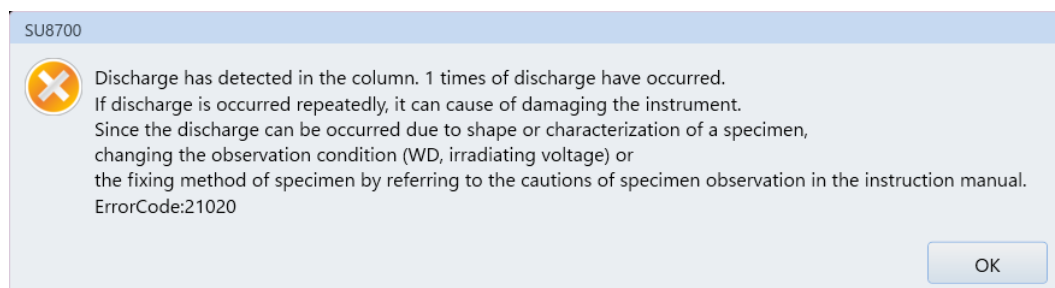
The field emission can be suppressed by fixing the specimen surface evenly when observing a carbon nanotube. In addition, the specimen can be fixed to be flat by fixing it with conductive tape or paste and lightly press from the top, dispersing it into solution and dropping it on the base then, drying it out, or removing the uneven part while observing with an optical microscope.

- Replacement period for the scintillator of Middle detector (Option) is 3 years or 300 times of discharging or less. If more than 300 times of discharging are occurred, replacement of Middle detector is recommended. Please contact a service engineer of Hitachi High-Tech Corporation. The times of discharging can be confirmed at Vb Error counter in [Menu]>[Maintenance]>[Electron gun]>[Gun control dialog].

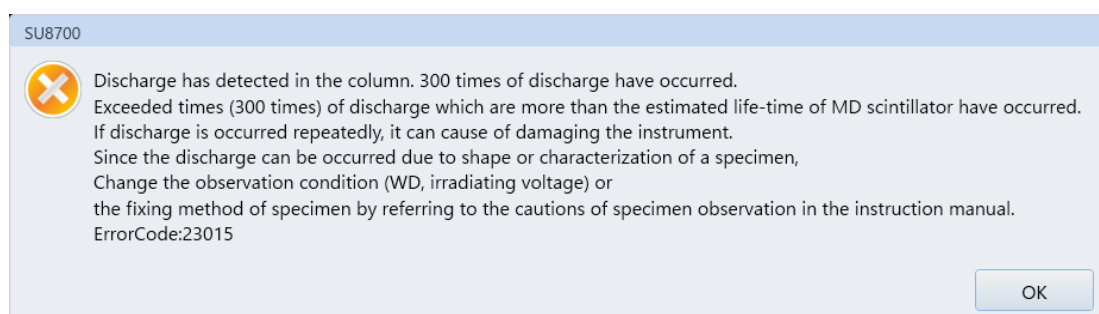
The following error message will be displayed when discharging is occurred. The error message will be different depending on the times of discharging or with/without the Middle detector (Option). Please perform the countermeasure according to the error message



Without Middle detector (Option)



With Middle detector (Option) (Less than 300 times of discharging)



With Middle detector (Option) (More than 300 times of discharging)

3.2.2 Setting specimen to stub

The specimen preparation method is different depending on the different materials. Listed below describes the typical specimen preparation methods.

(1) Prepare a specimen.

Prepare a suitable size of specimen stub that can accommodate the entire specimen. The maximum diameter size of specimen is 6-inch.

NOTE: The attached specimen stub is round. When mounting an angular specimen, select an appropriate specimen stub so that the entire specimen will fit in the specimen stub. Due to selecting an inappropriate specimen stub, it can cause of damaging the specimen and instrument since the proper protection to the specimen cannot be performed.

(2) Fix the specimen to the specimen stub

The setting methods are varied depending on specimen type.

(a) For a solid specimen

Use double-sided conductive adhesive tape for observing a specimen with low magnification (less than x20 k to 30 k).

Use conductive paste for observing a specimen with high magnification (x20 k to 30 k or more) or observing a resin-embedded specimen.

(b) For a powder specimen

Either conductive paste or tape can be used. When using conductive paste, sprinkle the specimens over the conductive paste before the paste is dried out.

After sprinkling the specimens, remove excessive specimen powder by a blower.

(3) Apply metal coating as required.

For observing a non-conductive specimen, the specimen is required the metal coating before starting the observation. Non-conductive and conductive materials are listed below.

(a) Non-conductive specimen

Coating is required.

Example of materials: plastic, glass, paper, resin, fiber, rubber, ceramic, biological specimens (plants, animals, micro-organisms), foods, macromolecules, etc.

(b) Conductive specimen

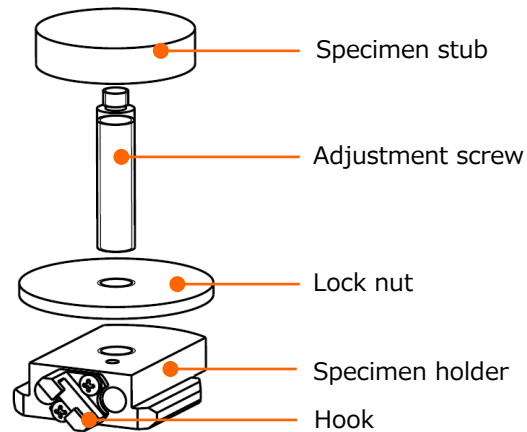
Coating is not required.

Example of materials: metal, carbon, silicon, etc.

3.2.3 Set the specimen stub to the specimen holder

- (1) Set the specimen stub to specimen holder.

Assemble the adjustable screw, lock nut and specimen holder then, fix the specimen stub to the adjustable screw part.

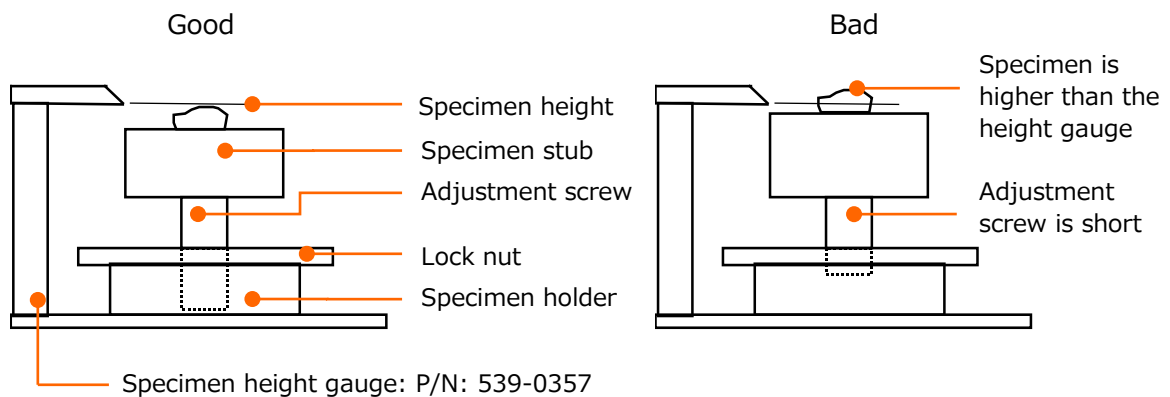


Fixing method of specimen stub

- (2) Adjust the specimen height

Use the attached height gauge or a height gauge which is attached to the specimen exchange chamber and set the specimen height to the 36 mm. Change the specimen stub height by rotating the adjustable screws. After fixing the adjustable screw with the lock nut, measure the height of specimen top surface by the height gauge.

When a large size of specimen stub is used, measure the height of specimen top surface with the height gauge then, adjust the highest position of specimen to 36 mm or less.



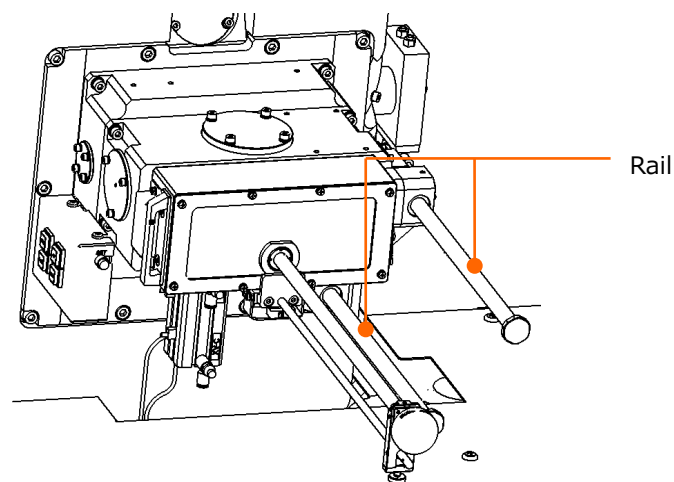
Specimen height setting

(Height gauge which is attached to the specimen exchange chamber)

- NOTE:
- Make sure to set the parameter properly. It can cause of damaging the detectors in the specimen chamber, structure, or specimen due to setting improperly.
 - Make sure to carefully set the specimen height so that it does not higher than the height gauge. When the specimen is tilted or stage Z is small and the specimen size or height is set improperly, it can cause of damaging the objective lens or specimen due to collision.
 - Fix the height adjustment screw to the specimen holder firmly. When the height adjustment screw is short and the condition of fixing to the specimen holder is shallow, it can cause the image disturbance by fixing the specimen firmly. When the height screw is short, use the different length of attached height adjustment screw which has different length.
 - Make sure that the height adjustment screw will not project from the bottom of specimen holder. The specimen holder will not be removed from the stage.

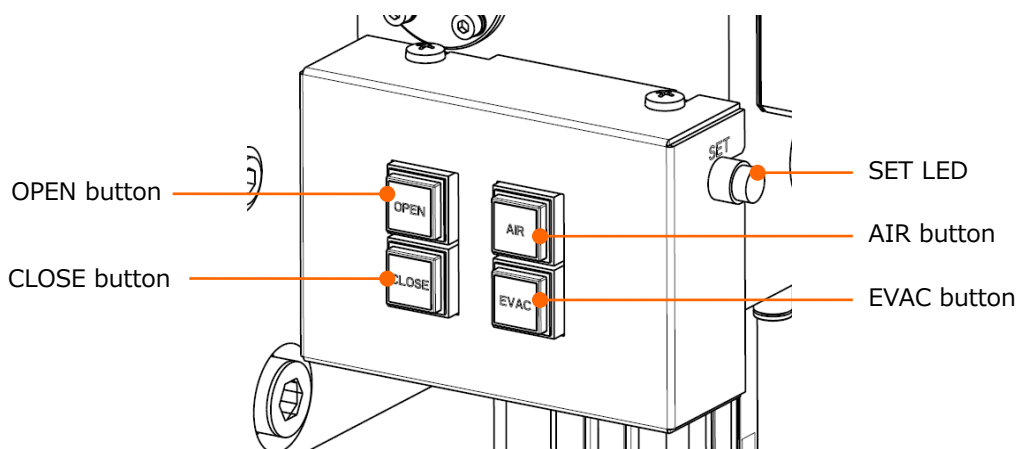
3.2.4 Operation method of specimen exchange chamber

Indicate the specimen exchange chamber.



Specimen exchange chamber

The specimen exchange chamber is moved to front and back along with the rail. Hold the specimen exchange chamber with both hands from right and left sides and move it to front and back while opening and closing. It indicates the specimen exchange chamber.



Operation part of specimen exchange chamber

(1) OPEN button

Open the gate valve equipped between the specimen exchange chamber and specimen chamber.

When the gate valve is opened, the button LED will be ON in orange. When the gate value is closed, the button LED is OFF. The gate valve open will be started by pressing the button when the button LED is OFF. The LED will be blink while opening then, buzzer is ON at once and LED will be ON.

(2) CLOSE button

Close the gate valve equipped between the specimen exchange chamber and specimen chamber.

When the gate valve is closed, the button LED will be ON in green. When the gate value is opened, the button LED is OFF. The gate valve close will be started by pressing the button when the button LED is OFF. The LED will be blink while closing then, buzzer is ON at once and LED will be ON.

(3) AIR button

Vent air to the specimen exchange chamber.

When the specimen exchange chamber is in atmospheric status, the button LED will be ON in orange. When it is in the vacuum condition, the button LED is OFF. By pressing the button when the LED is OFF, air will be vented to the specimen exchange chamber. The LED will be blink while air is venting to the specimen chamber. When the specimen exchange chamber is in the air condition, buzzer is ON at once and LED will be ON.

(4) EVAC button

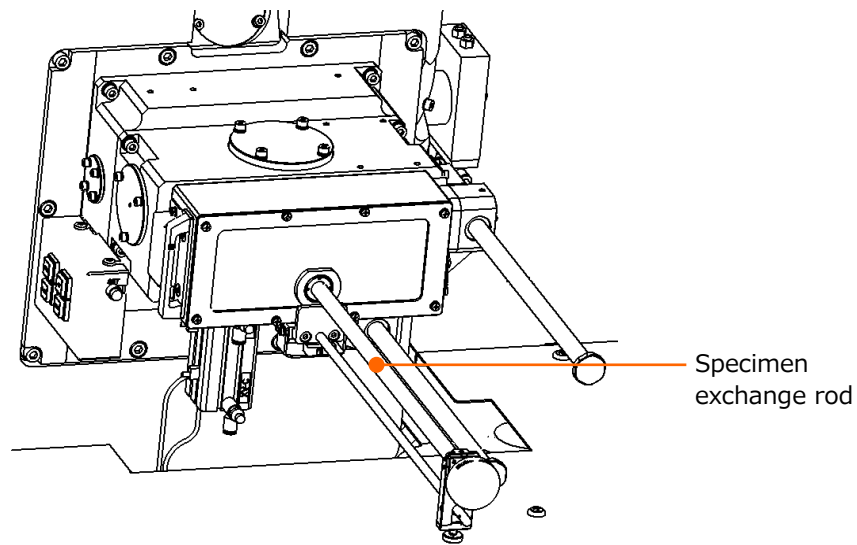
Pump air from the specimen exchange chamber.

When the specimen exchange chamber is in vacuum status, the button LED will be ON in green. When the specimen exchange chamber is in the air condition, the button LED is OFF. By pressing the button when the LED is OFF, air will be pumped from the specimen exchange chamber. The LED will be blink while pumping air then, buzzer is ON at once and LED will be ON.

(5) SET LED

The LED will be ON in blue color when the specimen exchange rod is inserted to the specimen exchange position in the specimen chamber.

The following shows the specimen exchange rod.

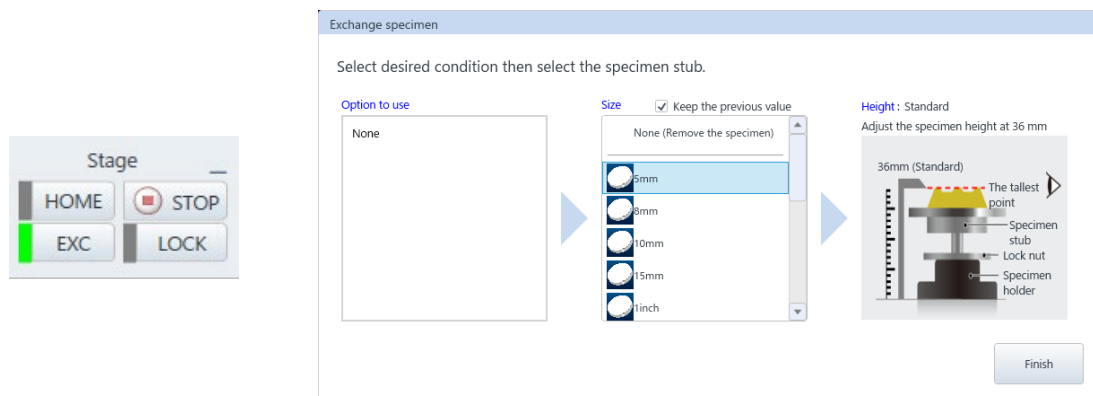


Specimen exchange rod

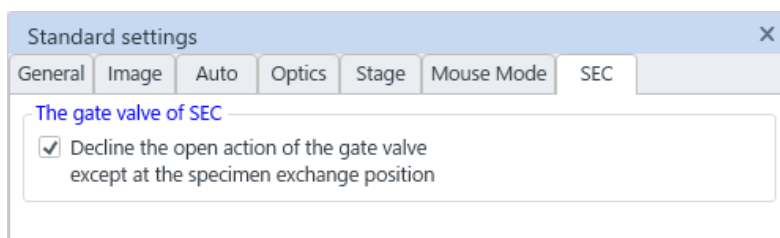
(6) Attach a specimen to the tip of specimen exchange rod in the specimen chamber and exchange the specimen by inserting or extracting the specimen exchange rod.

3.2.5 Operation display of specimen exchange chamber

When clicking the [Exchange specimen] button, the [Exchange specimen] dialog as shown in the below will be displayed in front. When the accelerating voltage is ON, the voltage will be OFF automatically, and specimen exchange sequence will be started. Specimen exchange can be performed from the [Menu]>[SEC].



- (1) Option detector list to use
Set the selectable specimen stub diameter size list depending on the detector.
- (2) Size list
Select a specimen stub from the specimen stub diameter size list.
- (3) Height
Display the specimen height adjustment method of specimen holder.
- (4) Finish the specimen exchange
Finish the specimen exchange and move the specimen stage to the home position.
- (5) Specimen exchange chamber gate valve
When the [Decline the open action of the gate valve except at the specimen exchange position] check box is ON in the standard settings and except the specimen exchange position, protection for disabled the OPEN button of the specimen exchange chamber operation area for not to open the specimen exchange chamber gate valve if the specimen stage is not in the specimen exchange position. If the gate valve will not be opened by pressing the OPEN switch and buzzer is ON (Three times), the operation limitation of specimen exchange switch is enabled.

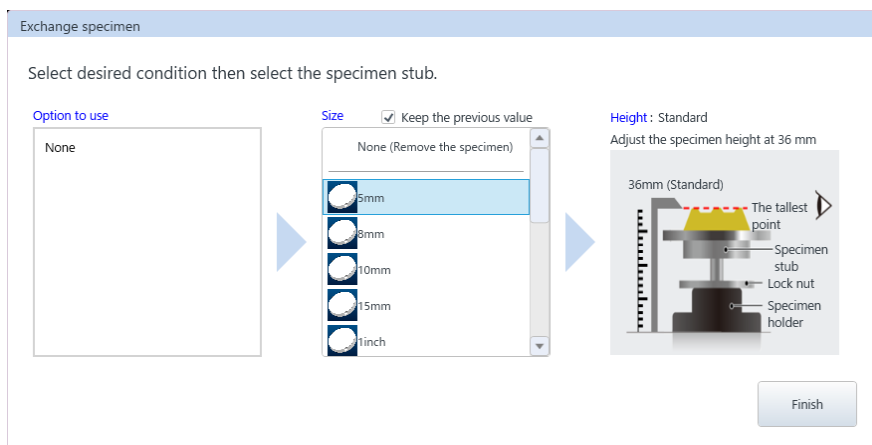


3.2.6 Operation of specimen exchange

- (1) Click the [EXC] button to insert a specimen. The specimen stage will be moved to the specimen exchange position by clicking the button.

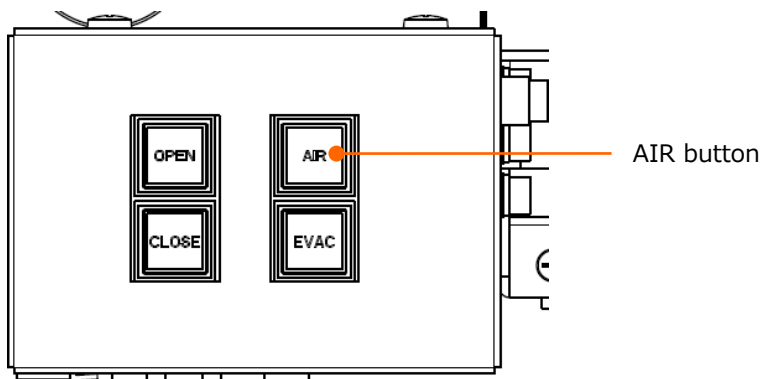


- (2) Display the [Exchange specimen] dialog. Select a specimen size to use.



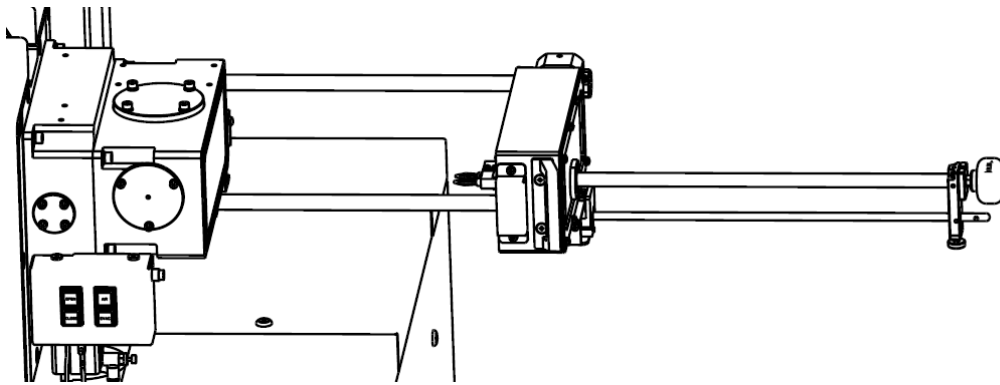
NOTE: Make sure to set the parameter properly.
It can cause of damaging the detectors in the specimen chamber, structure or specimen due to setting improperly.

- (3) Insert a specimen when the specimen is not in the specimen chamber
 - (a) Press the AIR button on the specimen exchange chamber operation area at left side of the specimen exchange chamber.
Air will be vented to the specimen exchange chamber. Buzzer will be ON when the operation is finished.



Operation area of specimen exchange chamber

- (b) Draw out the specimen exchange chamber.



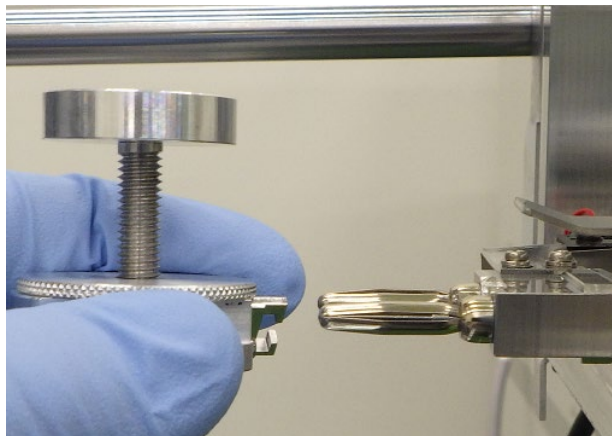
Specimen exchange chamber

NOTE: Do not open or close the specimen exchange chamber by holding the specimen exchange rod. The specimen exchange rod will be bended and the specimen exchange will not be performed.

- (c) Facing up the UNLOCK on the specimen exchange rod and adjust the hole of specimen holder to the tip of specimen exchange rod.



Specimen exchange rod (UNLOCK)

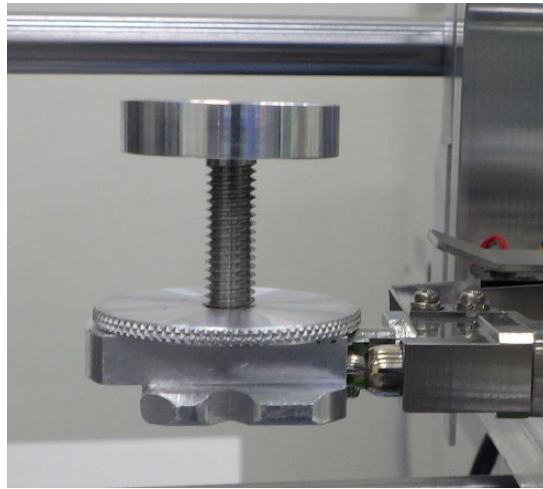


Mount a specimen holder

- (d) Facing up the LOCK on the specimen exchange rod and confirm that the specimen holder will not be come off by pulling out the holder.



Specimen exchange rod (LOCK)



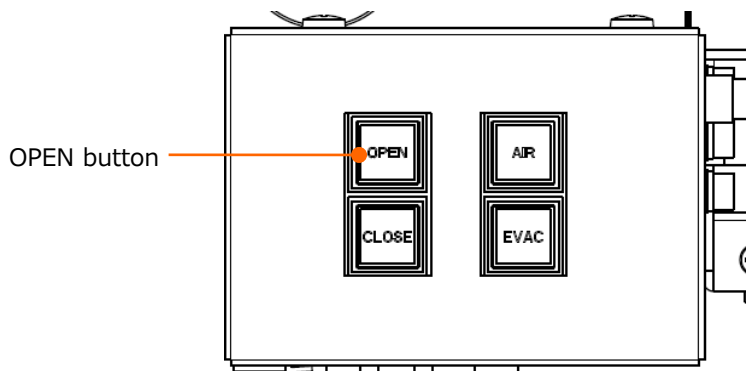
Specimen holder mounting condition

NOTE: Make sure that the LOCK on the specimen exchange rod is facing up after attaching the specimen holder to the tip of specimen exchange rod. Otherwise, the specimen holder will be fallen, and specimen or system will be damaged since it will be inserted to the gate valve when closing the gate valve.

- (e) Draw out the specimen exchange rod and close the specimen exchange chamber.

⚠ CAUTION: Can cause injury. Keep hands clear when opening or closing the stage.

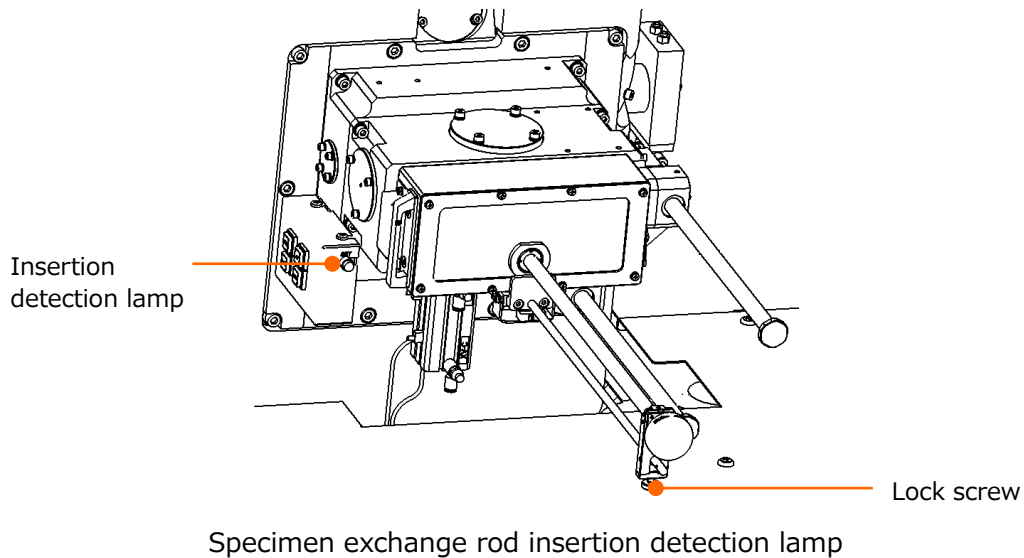
- (f) Press the [OPEN] switch on the specimen chamber operation area.
Pump air from the specimen exchange chamber and open the gate valve then, buzzer is ON.



Operation part of specimen exchange chamber

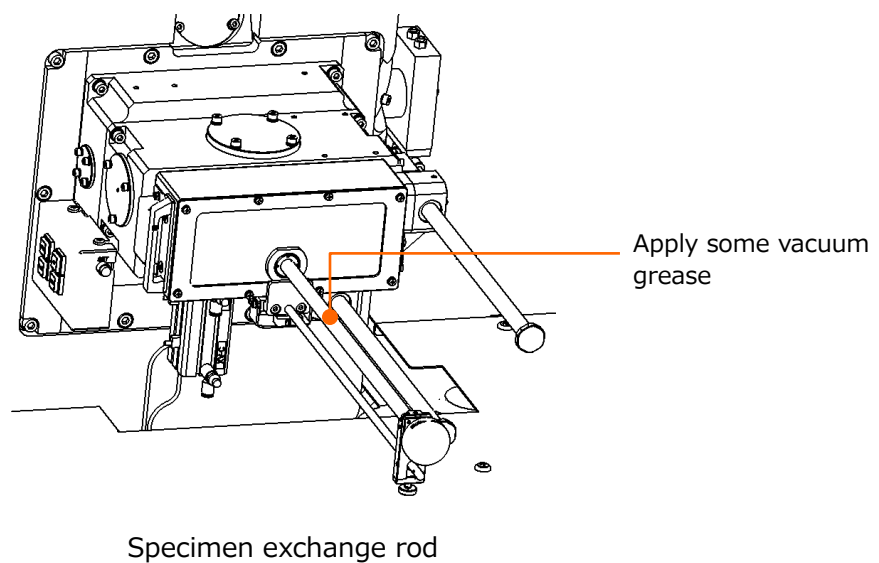
NOTE: If the gate valve will not be opened by pressing the OPEN switch and buzzer is ON (Three times), the operation limitation of specimen exchange switch is ON. After the stage is moved to the specimen exchange position, press the OPEN switch again.

- (g) After loosening the lock screw, insert a specimen exchange rod to the receiving part of specimen holder until the insertion detection lamp on the specimen exchange chamber operation area is ON while viewing inside.



- NOTE:
- The specimen exchange rod can be tilted when mounting a heavy specimen holder (including a specimen). If the specimen exchange rod is inserted while tilting, the specimen holder cannot be set due to interfering to the specimen stage. When inserting a specimen exchange rod, make sure that the specimen holder is firmly set to the receiving part of specimen holder while viewing inside of specimen chamber from the viewing window.
 - When inserting and removing the specimen exchange rod become difficult, apply some vacuum grease (P/N 539-2132) to the specimen exchange rod and insert or removing the specimen exchange rod for few times to apply the grease evenly.

Reference: 5.1.1 Consumables



- (4) Remove a specimen when the specimen is in the specimen chamber
 - (a) Press the OPEN switch on the specimen chamber operation area on the specimen exchange chamber.

The gate valve will be open after the specimen exchange chamber is in the vacuum condition.
 - (b) Loosen the lock screw of specimen exchange rod (Refer to the above (3)(g)).

Facing up the UNLOCK by rotating the knob of the specimen exchange rod to clockwise and insert the specimen exchange rod to the specimen chamber then, insert it to the hole of specimen holder.
 - (c) Facing up the LOCK by rotating the knob of the specimen exchange rod to counterclockwise and remove the specimen exchange rod. At this time, confirm that the specimen holder will be removed with the specimen exchange rod while viewing inside.
 - (d) Pull out the specimen exchange rod until the end and fix the specimen exchange rod with the lock screw (Refer to the above (3)(g)).
 - (e) Press the [AIR] switch on the specimen exchange chamber operation area on the specimen exchange chamber.

The gate valve will be closed, and air will be vented to the specimen exchange chamber.

The Buzzer will be ON after about 15 seconds when the operation is finished.
 - (f) Open the specimen exchange chamber and rotate the knob of specimen exchange rod to clockwise for facing up the UNLOCK. Then, remove the specimen holder from the tip of specimen exchange rod.

3.3 Start the SEM observation

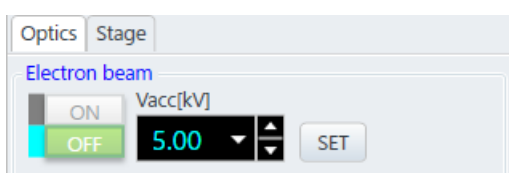
NOTICE: When observing an insulating specimen with a projection part (Dielectric material) or a field-emitting specimen (such as a carbon nanotube), the specimen may discharge due to the electric field of objective lens. The scintillator of Middle detector (Option) can be damaged, and observation cannot be performed when the discharge is occurred repeatedly. Thus, to observe with WD=6 mm or more is recommended for observing a specimen which is mentioned as above.

If the specimen is discharging when setting the WD at 6 mm or more, set the probe current to smaller value (set the spot intensity to smaller value) or fix the specimen with conductive paste or perform metal coating.

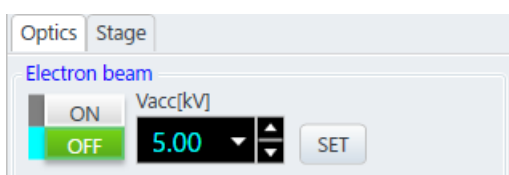
The lifetime of the Middle detector (Option) scintillator is 3 years or 300 times of discharging or less

Accelerating voltage can be applied while the ON/OFF button on the [Operation] panel>[Optics] tab>[Electron beam] is enabled. Apply the electron beam by pressing the [ON] button for starting an observation. In addition, the ON/OFF operation can be performed at the [Control panel]>[HV].

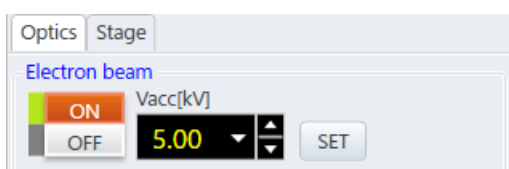
Set the electron beam parameters for an optimized SEM observation and press the [ON] button of Electron beam. After beam is ON, perform the electron beam axis alignment.



Vacc ON/OFF button is deactivated



Accelerating voltage OFF status





Accelerating voltage ON status

NOTE: When pressing the specimen exchange button, the electron beam will be OFF automatically.

3.4 Electron optics system

3.4.1 Accelerating voltage settings

Display the accelerating voltage value list by clicking the button at the right side of the accelerating voltage select box on the [Operation] panel >[Optics] tub >[Electron beam]. Select an accelerating voltage value from the list. Press up /down buttons  and the value can be set by 100 V steps. In addition, the value can be entered in the box by 10 V steps and define the value by pressing the [Enter] key. However, to change the value while applying the accelerating voltage, set the value with the up/down button  and click [SET]. Then, the accelerating voltage will be changed.

NOTE: Make sure to perform the electron magnetic alignment when the accelerating voltage is changed.

3.4.2 Probe current settings

Probe current (specimen irradiation current) can be adjusted at the probe current mode and spot intensity settings. If the probe current cannot be adjusted by setting the probe current mode and spot intensity, change the objective movable aperture.

NOTE: Mechanical adjustment is required after changing the objective movable aperture. It is recommended to perform the normal probe current adjustment by setting the probe spot intensity.

(1) Probe current mode and spot intensity settings

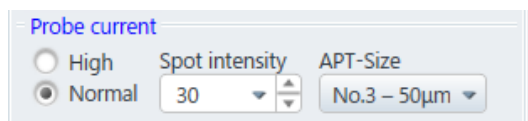
Probe current mode and spot intensity can be set in the [Operation panel]>[Optics] >[Probe current]. For adjusting the probe current accurately, adjust the probe current mode and spot intensity while measuring the current by using a specimen stub with Faraday cup.

(a) Select a probe current mode

- Normal mode is suitable for the observation with small probe current.
- In the High mode, the probe current is 10 times more than the Normal mode. The High mode is suitable for the observation that requires large probe current or X-ray analysis.

(b) Set the spot intensity

The spot intensity can be adjusted 100 times of probe current from the minimum to the maximum. The larger the value, the larger probe current will be. The standard value is 30.



(2) Objective aperture (APT-Size) settings

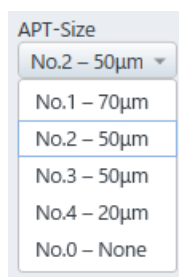
Four different diameters of objective movable aperture are available. The standard size is No.2/No.3 ($\Phi 50\mu\text{m}$). The probe current is about 2 times for the No.1 ($\Phi 70\mu\text{m}$) and about 0.2 times for the No.4 ($\Phi 20\mu\text{m}$) to the standard.

The following description shows the procedures of changing the objective movable aperture.

NOTE: The condition of objective movable aperture (contamination) greatly effect to the image quality especially under the observation in the low accelerating voltage.

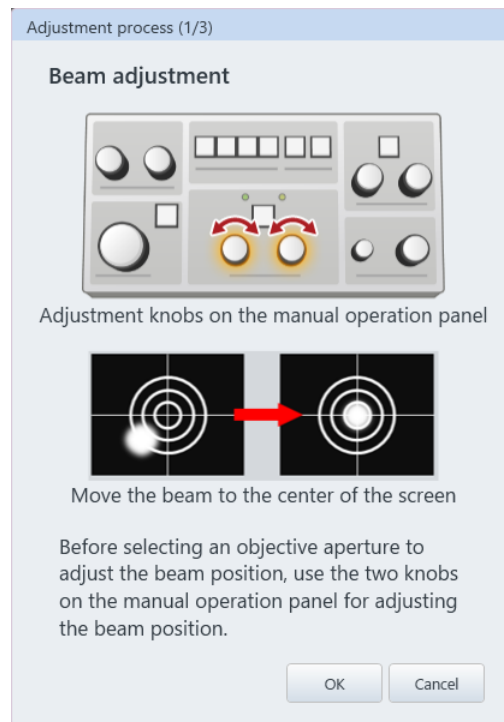
The affection will be noticeable in the low accelerating voltage. Please perform the required periodical maintenance.

(a) Select an aperture from the pull down list of objective aperture in [Operation] panel>[Optics] tub for changing the aperture.

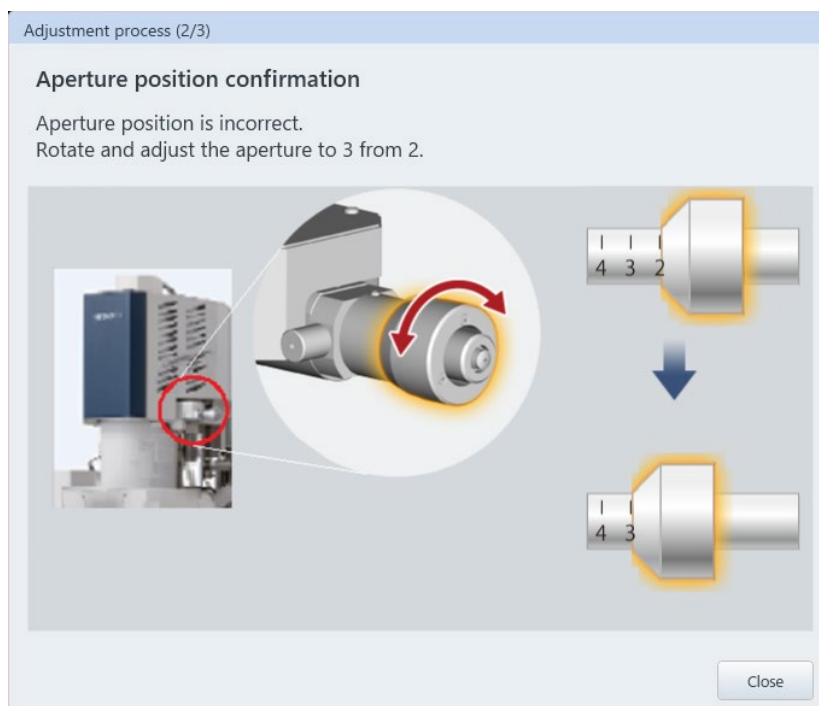


- NOTE:**
- Cannot select the No.0.
 - When selecting aperture size before selecting an aperture size from the pull down list, the objective aperture diameter will be displayed in green color. The aperture position will be shifted so, adjust the position on the [Menu] >[Maintenance]>[Adjust Objective aperture position].

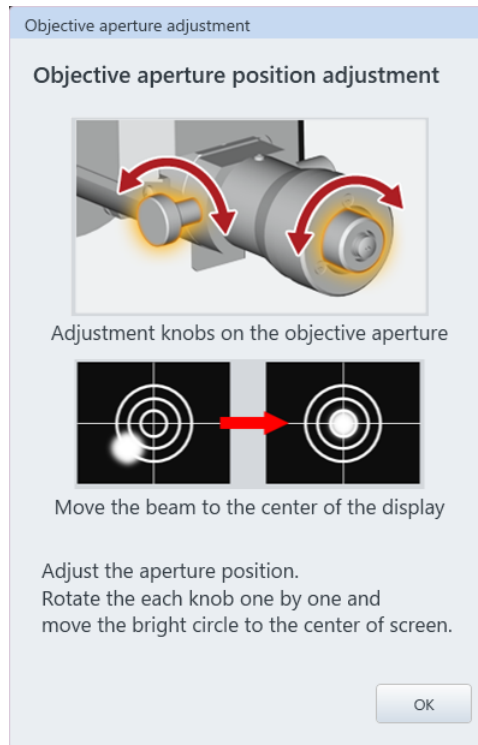
- (b) The following dialog will be displayed by selecting an aperture size from the pull down list. Perform the beam alignment according to the dialog. When the beam alignment is completed, press the [OK] and move to the next operation. Click the [Cancel] for canceling the aperture size changing.



- (c) Switch the aperture size according to the aperture position confirmation dialog. Click the [Close] button for canceling the aperture size change.



- (d) Adjust the aperture position according to the adjustment dialog for the objective aperture position.



3.4.3 Focus settings

Click the triangle button at the WD value in the [Operation panel]>[Optics]>[Probe current] and select the WD value from the list then, the focus is controlled for the WD, and the optimized electron optical condition of objective lens is set. In addition, current focus position of WD is displayed in this area by adjusting the focus knob. The electron optical condition and objective lens current can be set by setting the WD (working distance) value.

(1) WD (Working distance)

The value of WD display box indicates the selectable WD range. The resolution, the depth of focus and limitation of specimen tilting angle can select by changing the WD. The below table shows the relationship between the WD, resolution, depth of focus and the specimen tilting angle.

	Short	← WD →	Long
Resolution	High	← →	Low
Depth of focus	Shallow	← →	Deep
Specimen tilt angle	Small	← →	Large

(2) [Degauss] button

In case of changing the focus greatly, accuracy of magnification or alignment of the electron optical axis can be degraded due to residual magnetization. Therefore, click [Degauss] button under the following conditions. The degauss operation can be performed by pressing the hotkey [F2].

- (a) After greatly change the focus
- (b) Before adjusting the axis of the electron optics (Electromagnet alignment)
if the following operation is carried out, degaussing is performed automatically
- (c) Apply or change the accelerating voltage
- (d) Set the WD
- (e) Change the probe current mode

(3) Adjust the electron beam axis

To obtain the best performance of the instrument, axis alignment for the electron optics is required. Perform the electromagnetic alignment when the accelerating voltage, probe current mode, spot intensity or WD (working distance) is changed.

The axis adjustment describes in the below.

- (a) Align the beam
- (b) Align aperture
- (c) Align stigmator
- (d) Align the ULV (When the accelerating voltage 2 kV or less)

Normally, the alignment of (a) to (c) is performed. However, when the favorable electron beam cannot be obtained after performing the electromagnetic alignment under the accelerating voltage 2 kV or less, carry out the (d).

3.4.4 Align the electron beam axis (Alignment)

(1) Display the electron beam alignment dialog

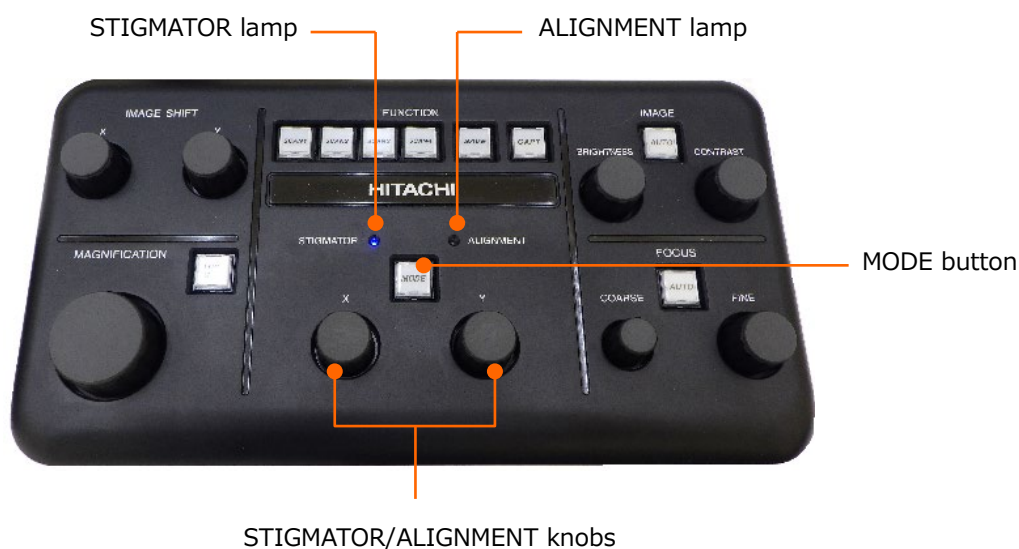
Alignment dialog can be displayed by the following two methods.

(a) Display the dialog from GUI

- [Menu]>[Alignment]
- [Sub panel]>[Alignment]
- [Operation panel]>[Alignment] / [Beam]/[Aperture] button

(b) Startup from manual operation panel

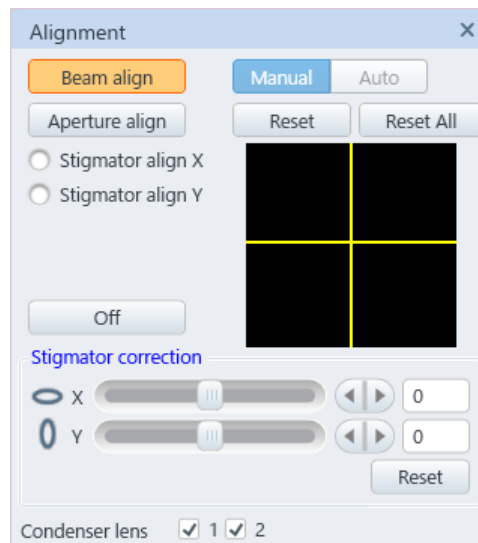
Startup the alignment panel by pressing the STIGMATOR/ALIGNMENT MODE button on the manual operation panel. Press the [MODE] button and the mode will be changed in the order of [Beam alignment]→[Aperture alignment]→[Stigmator alignment]→[···]→[Release]. In addition, the alignment can be released by pressing and holding the [MODE] button.



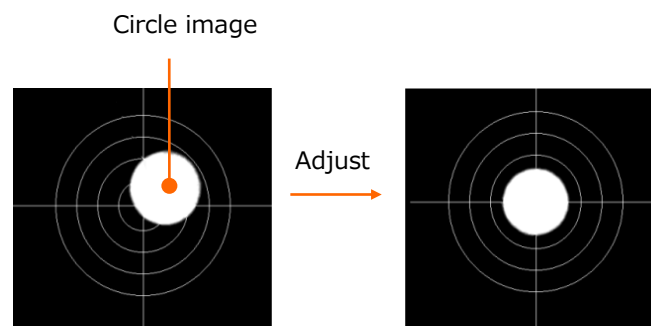
(2) Beam alignment

Align the beam to through the center of the objective lens movable aperture. In case that this alignment is carried out improperly, probe current may be insufficient.

(a) Display the alignment panel.



(b) Click the beam button and the scan image becomes circle. Adjust the contrast for changing the brightness.



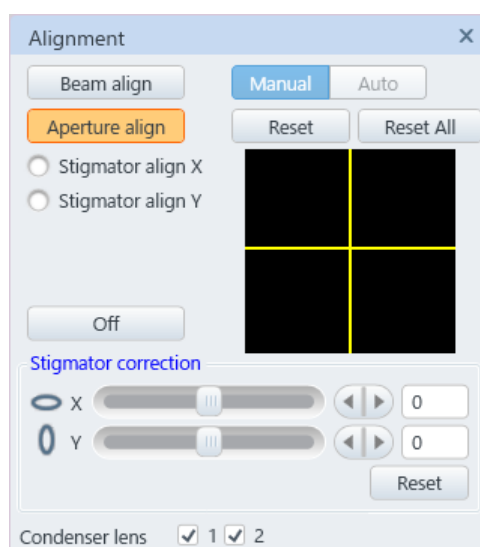
- NOTE:
- In case an image cannot be displayed while maximizing the contrast, click [Reset All] and perform the beam alignment.
 - In case the focus is greatly shifted from the specimen surface, the circle image can be distorted or chipped. In this case, adjust the brightest area to the center of the display, release the beam alignment and focus on the specimen then, carry out the beam alignment again. If the circle image is largely chipped or cannot be displayed when the circle image is adjusted to the center of the display, perform the mechanical alignment according to the procedures of Chapter 4.

- (c) Adjust the circle image to the center of the display by operating the STIGMATOR/ALIGNMENT knobs on the manual operation panel or move the cross marker by dragging the mouse in the alignment dialog.

When adjustment is finished, release the beam alignment by clicking the [Release] button and close the dialog by clicking the [x] button. To perform the other alignment mode, click the [Alignment mode] button.

(3) Aperture alignment

Aperture alignment is performed for adjusting the position of the beam axis through the objective lens. This alignment should be performed for obtaining the favorable resolution and quality image.

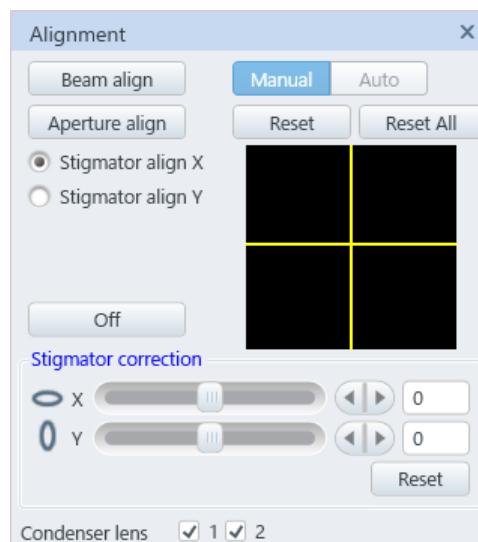


- (a) Set the magnification approximately x5, 000 to x10, 000 and move the target point on the specimen to the center of the display.
- (b) Correct the focus and astigmatism.
- (c) Click [Aperture] button in the [Alignment] dialog. Then, the mode will be the [Aperture alignment] mode and the image position is changed periodically.
- (d) Minimize the image movement by operating the [STIGMATOR/ALIGNMENT] knob on the manual operation panel or left clicking the mouse on the alignment operation area in the [Alignment] dialog.
- (e) Increase the magnification and perform the final adjustment of the aperture.
- (f) After performing the adjustment, click [Release] button on the [Alignment] dialog. Click a desired button directly for performing other alignment.

- NOTE:
- In case greatly changing the focus, click the [Degauss] button in the [Optics] tab in the operation panel then, perform the alignment.
 - Aperture alignment cannot be performed accurately under the low magnification condition (10,000 or less). Carry out the rough alignment in the low magnification then, perform the alignment in the high magnification. In addition, it is important that the focus is carried out properly for performing the aperture alignment accurately.
 - When specimen is observed in the low accelerating voltage (8 kV or less), the image may be shifted while performing the focus even if the image wobbling is minimized because, the aperture alignment is set for obtaining the best resolution.

(4) Stigmator alignment X and Y

Stigmator alignment is carried out for fixing the image position. This alignment is required for performing the ASC accurately.

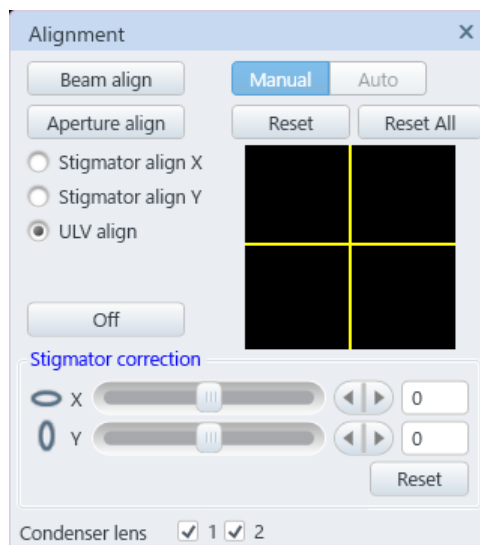


- (a) Set the magnification at approximately x10,000 to x50,000 and move the characteristic position on the specimen surface to the center of the display.
- (b) Correct the focus and astigmatism.
- (c) Click the [Stigmator align X] button on the alignment dialog. Then, the image can be moved periodically.
- (d) Minimize the image movement by operating the [STIGMATOR/ALIGNMENT] on the manual operation panel or left clicking the mouse on the alignment operation area in the [Alignment] dialog.
- (e) Click the [Stigmator align Y] and align the stigmator as well.
- (f) When alignment is finished, click the [Release] button.
Click a desired button directly for performing other alignment.

NOTE: The stigmator alignment may cause degradation of the aperture alignment. Perform the aperture alignment again after completing the stigmator alignment (X/Y). Aperture alignment will not effect to the stigmator alignment.

(5) ULV alignment (Correction function for off-axis chromatic aberration)

The preferable resolution can be obtained while observing a specimen in low accelerating voltage and the slightly shifting the optical axis from the condition that minimizes the wobbling of image by the aperture alignment mode This correction function can be used while the accelerating voltage is 2 kV or less.



(a) Select ULV alignment function

This function is enabled while the [ULV] radio button in the [Alignment] dialog on the [Menu]>[Standard settings]>[Optics] tab is ON.

(b) ULV alignment

After completing the normal electromagnetic alignment, click the ULV button and enter the ULV alignment mode.

Adjust the image for optimizing by operating the [STIGMATOR/ALIGNMENT] knobs on the manual operation panel. After adjustment is completed, finish the [ULV alignment] mode by clicking [Release] button.

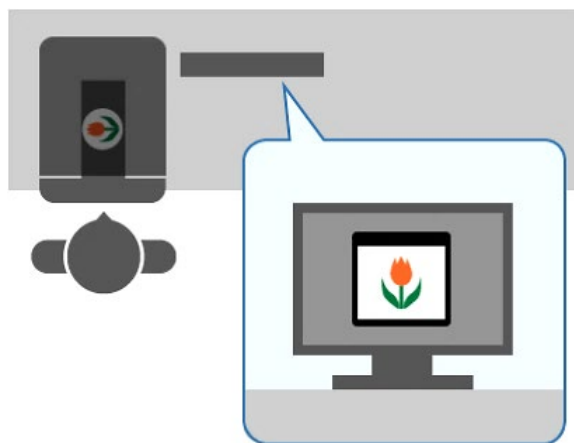
In case of changing the accelerating voltage, align the ULV again. A favorable image may be obtained by performing the ULV alignment because, the specimen condition is changed.

3.5 Operating the specimen stage and moving the observing FOV

Move the field of view (FOV) by changing the stage and electron beam scan positions. The mechanical coordinate (stage coordinate) of stage and the coordinate value on the specimen (Specimen coordinate) methods are available for displaying the coordinate value. The specimen coordinate is $X = 0$, $Y = 0$ mm (Center of the specimen stub), the stage coordinate is $X = 35.0$, $Y = 55.0$ mm. It can be selected from the [Stage] tab on the [coordinate] in the [Menu]>[Standard settings].

3.5.1 Orientation of the specimen and display setting

The below figure shows the relation of the orientation between the specimen holder on the stage and the direction of scanning display area on the monitor.



3.5.2 Outline of the specimen stage operation

The following shows the stage operation methods.

- (1) Operation of the [Stage] on the control panel common part
In the stage operation, the operations of moving the stage by defining the position ($X = 0$ mm, $Y = 0$ mm, $Z = 8$ mm, $R = 0$ deg, $T = 0$ deg), moving to the specimen exchange position, performing the stage lock and stopping the stage are available.
- (2) Operation of the [Stage] tab in the operation panel
In the stage tab, the operations of moving the stage by selecting the coordinate value and the step moving by selecting the movable amount are available.
 - (a) Move the stage by defining the coordinate value
 - X, Y axis: Enter the coordinate value in the coordinate value box and click the [Go] button or press the [Enter] key. In case that the coordinate value that is out of the movable range is entered, a message is appeared without moving the stage.

NOTE: Use the [Backlash cancel] when position reproducibility is required. Use the [Drift cut] when stopping accuracy is required. The buttons for the backlash cancel and drift cut will be displayed in the stage tub on the operation panel by enabling the [Display Operation panel] check box of each item in the [Menu]>[Standard settings]>[Stage] tub.

- R axis: The range of 0° to 359.9° is available. Enter a value in the R coordinate value box and click the [Go] button or press the [Enter] key. During this operation, enable the [Eucentric rotation] check box on the [Menu]>[Basic Settings]>[Stage] for moving the X and Y axes while maintaining the present FOV after rotating the stage (Eucentric rotation function).
- Z/TILT axis: Select the coordinate value by the either method described in the below.
 - Enter the value in the Z or Tilt coordinate value box from the keyboard.
 - Operate the Z or Tilt scroll bar.

After entering the value, move the stage by pressing the [Go] button or the [Enter] key.

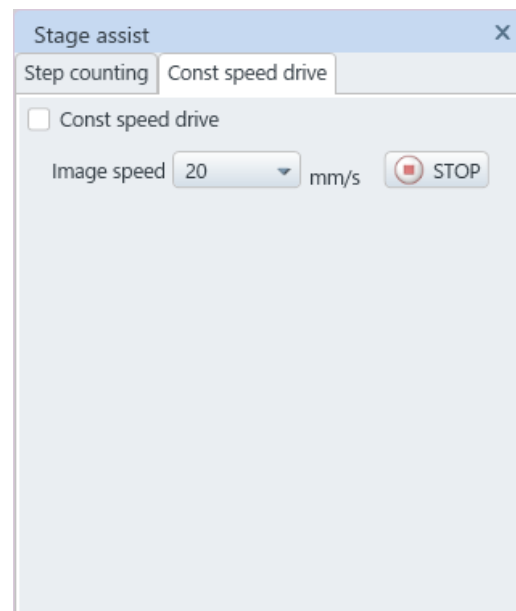
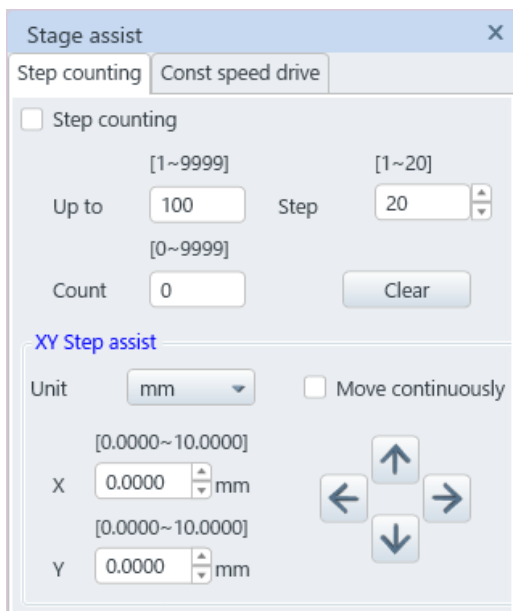
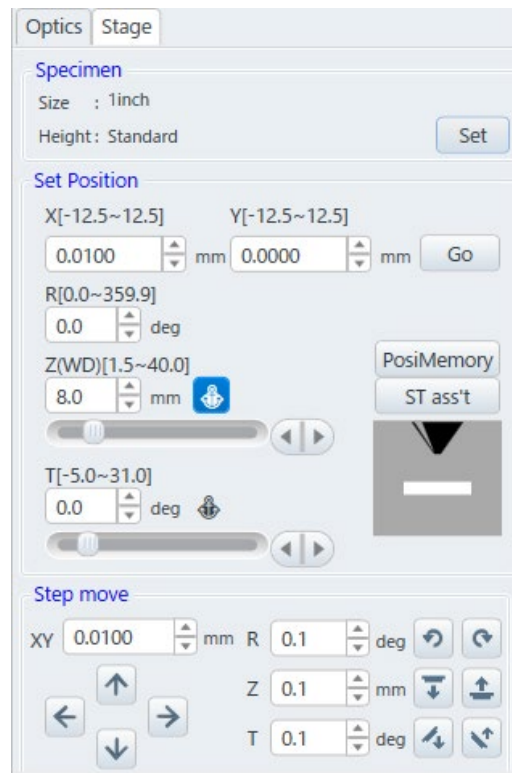
The Y-axis will be moved after the stage is tilted while keeping the present FOV by enabling the [Eucentric tilt] check box on the [Menu]>[Basic settings]>[Stage] tub during this operation (Eucentric tilt function).

- (b) Select a movable amount and perform the step move

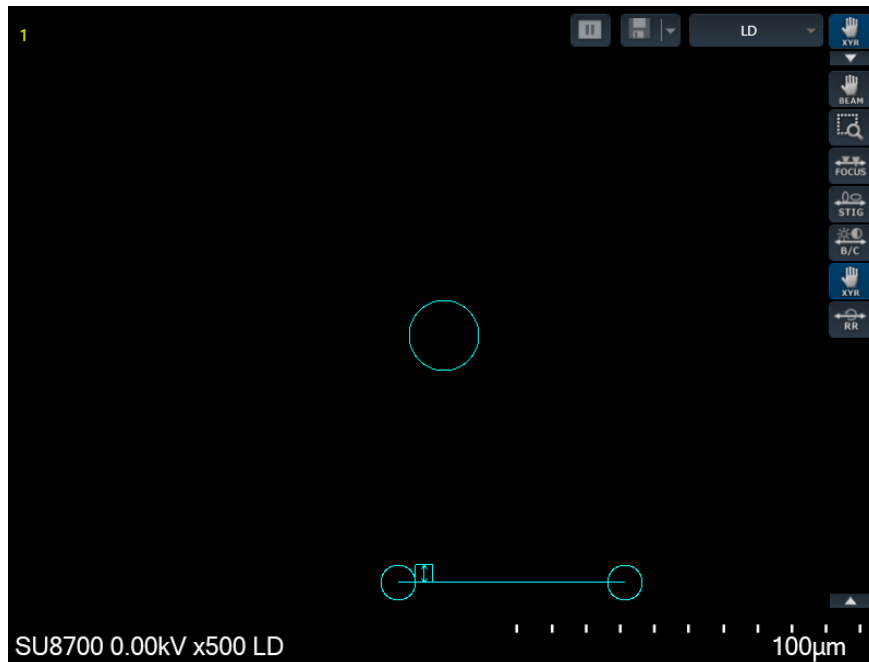
Set the amount of the step move and perform the step move by clicking the [Move] button of each axis.

3.5 Operating the specimen stage and moving the observing FOV

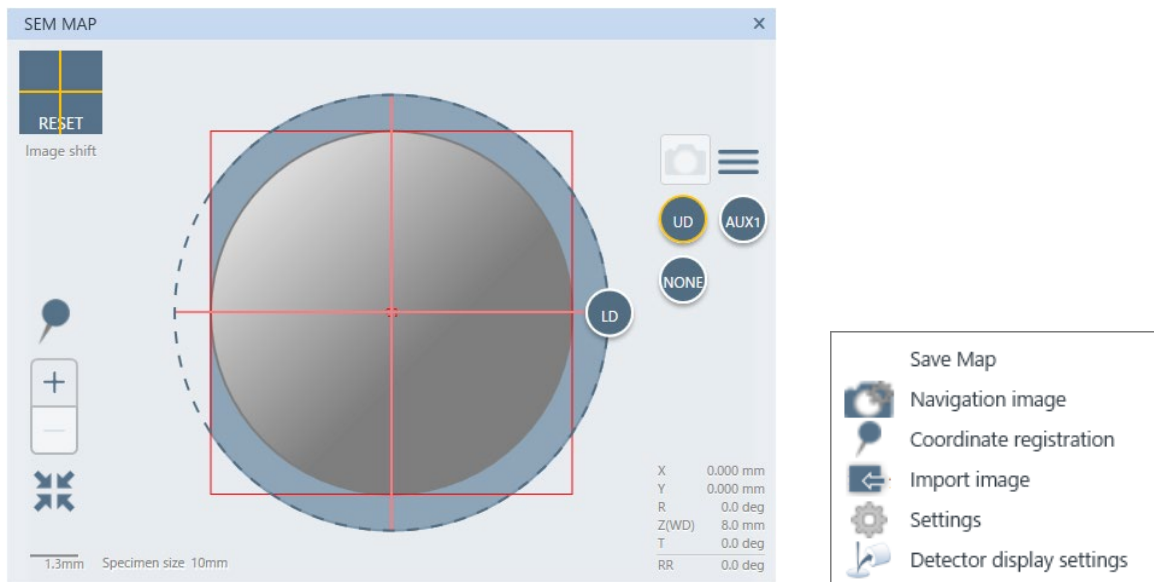
- NOTE:
- Make sure to set the specimen size, height, and detector properly. It can cause of damaging the objective lens or specimen.
 - Release the stage lock while operating the Z and Tilt. When the stage is locked, Z and Tilt cannot be operated.

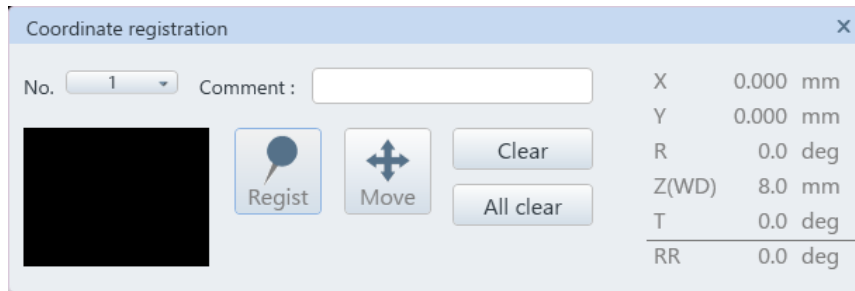


- (3) Mouse operation on an image
Display the control on an image and operate the stage.



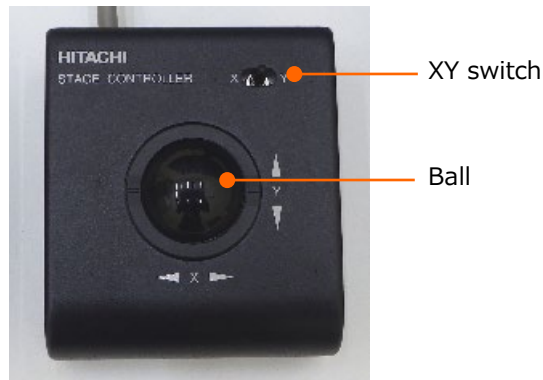
- (4) Operation on the SEM MAP
Move the stage by clicking or dragging the mouse on the SEM MAP. In addition, the stage can move to the registered position that is registered at the [Coordinate registration] in the SEM MAP Menu button.





(5) Trackball (Option)

The image is moved to the rotating direction of the track ball. The stage moving amount by rotating the ball is linked to the image magnification and it is moved greatly in the lower magnification. The track ball movement of X or Y direction can be limited by selecting the XY switch.



(6) Joystick (Option)

The image is moved to the tilting direction of the joystick. The amount of movement of the stage by tilting the joystick is linked to the magnification of the image and it move greatly in the lower magnification.



3.5.3 Movable range of each axis

The following table shows the movable range of each axis and specimen exchange position.

	Movable range	Specimen exchange position*
X	-35 to 75 mm	0 mm
Y	-55 to 55 mm	0 mm
R	0 to 359.9 ° (Continuous rotation)	0 °
T	-5 to 70 °	0 °
Z	1.5 to 40 mm	8 mm

* Set the specimen exchange position when adjusting the specimen exchange chamber.

Movable range of X, Y axes and T, Z axes will be limited within the range shown in the table when the specimen size is large, or an optional detector is inserted. Movable range of X, Y axes for each specimen size are shown in the below table. This limitation of the movable ranges are automatically changed depending on the specimen size, height, or detectors. When these information is set properly, the stage will move within the safety movable range.

Specimen size	X axis movable range	Y axis movable range	Standard attachment
Φ5 mm	-2.5 to 2.5	-2.5 to 2.5	–
Φ8 mm	-4.0 to 4.0	-4.0 to 4.0	–
Φ10 mm	-5.0 to 5.0	-5.0 to 5.0	○
Φ15 mm	-7.5 to 7.5	-7.5 to 7.5	○
Φ 1 inch	-12.5 to 12.5	-12.5 to 12.5	○
Φ2 inches	-25.0 to 25.0	-25.0 to 25.0	–
Φ3 inches	-35.0 to 37.5	-37.5 to 37.5	–
Φ4 inches	-35.0 to 50.0	-50.0 to 50.0	–
Φ5 inches	-35.0 to 62.5	-55.0 to 55.0	–
Φ6 inches	-35.0 to 75.0	-55.0 to 55.0	–
4 inches Mask	-35.0 to 72.0	-55.0 to 55.0	–
5 inches Mask	-33.0 to 62.0	-43.0 to 43.0	–

3.5.4 Stage movable range

(1) Specimen size and stage movable range

The movable area of specimen stage is limited by the specimen size. The movable range is set based on the following descriptions.

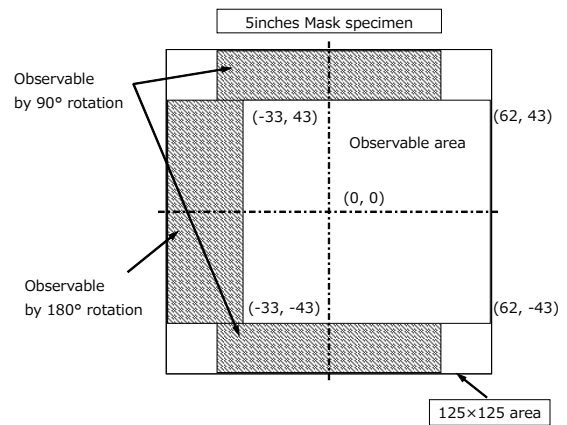
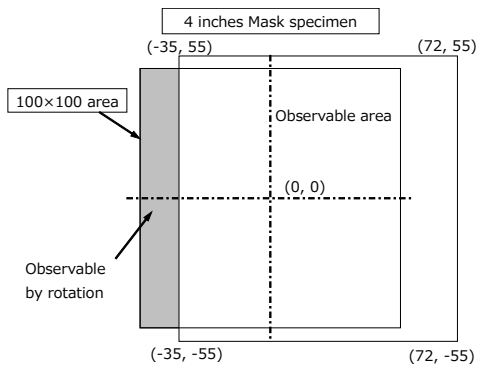
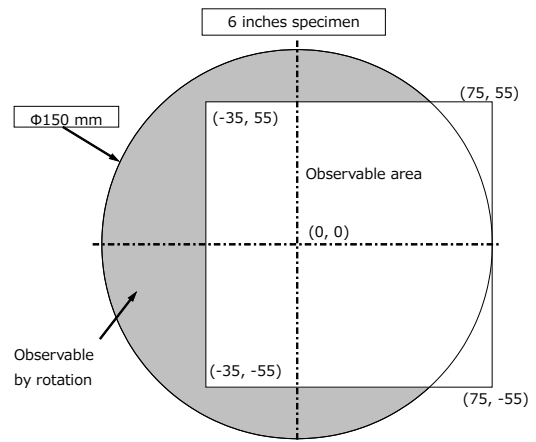
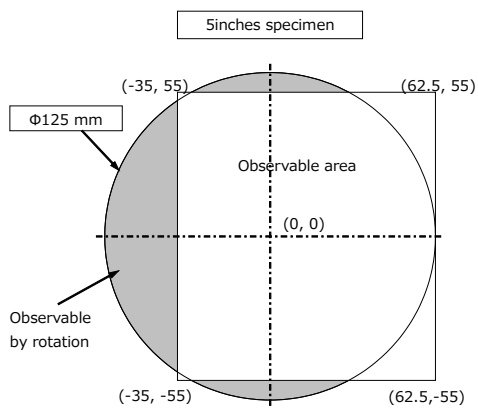
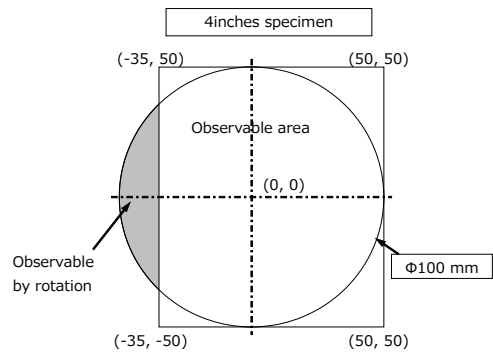
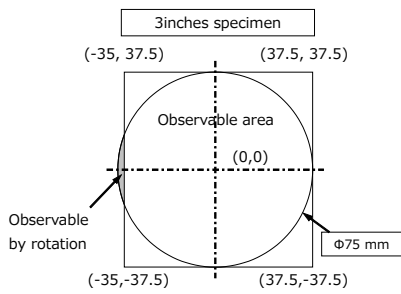
- (a) When the specimen stub size is Φ 3 inches or less, the stage can be moved within the range of each specimen stub size. The stage cannot move more than the necessarily range.
- (b) When the specimen stub size of Φ 4 inch or more is used, the movable range is limited within the range for avoiding that the edge of specimen collides to the objective lens, detector parts located inside of the specimen chamber.

NOTICE: When mounting a specimen, set the specimen size and height properly according to the specimen exchange sequence. When the specimen is tilted or stage Z is small by setting the specimen size and height improperly, it can cause damaging the specimen, objective lens, or detector by contacting the specimen to the objective lens or BSED (Option) that is equipped under the objective lens.

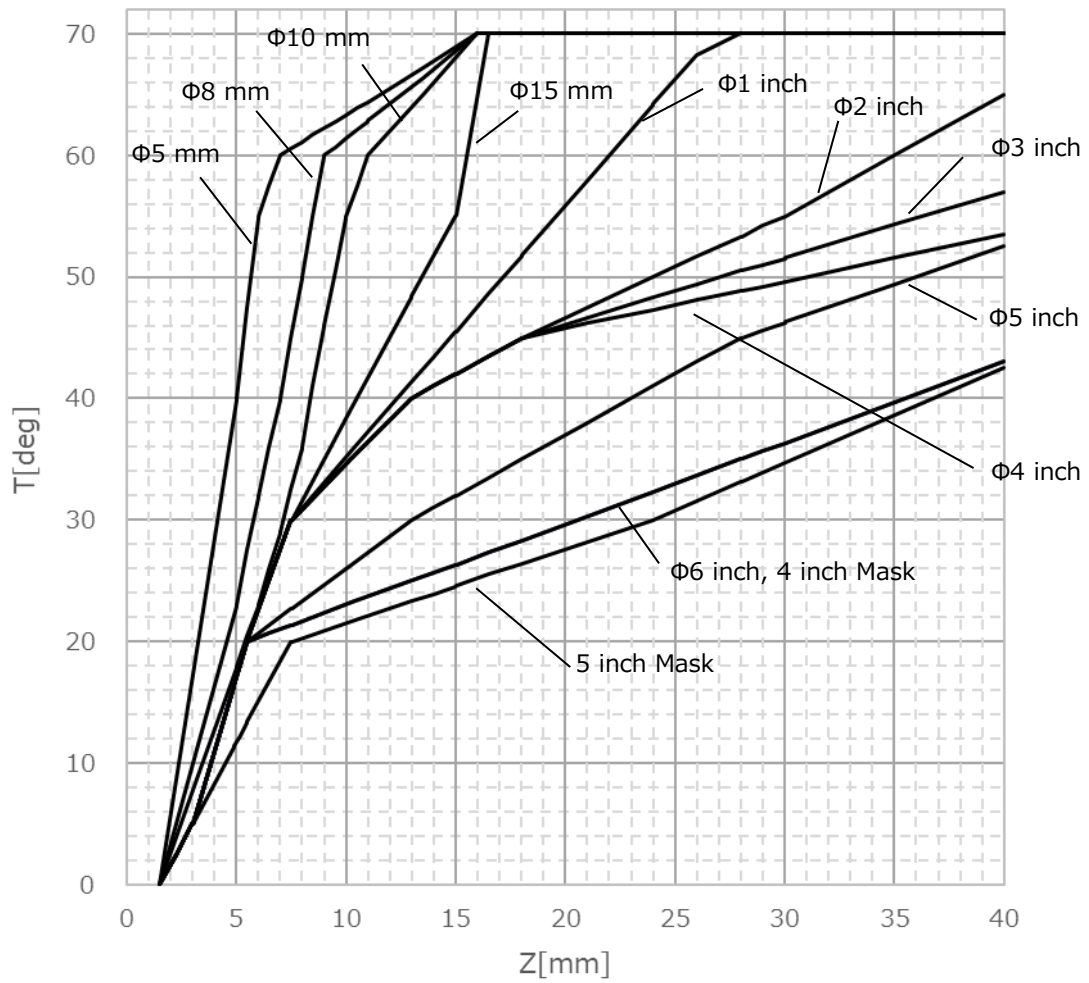
(2) Observation range

The following shows the observation range of each specimen size.

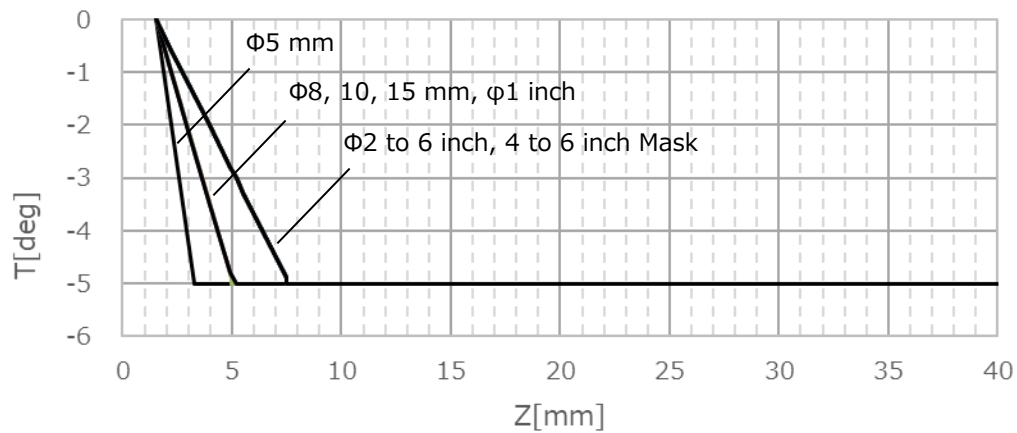
The X, Y observation range of each specimen size (Without optional detector)



In this instrument, when setting the coordinate of X or T axis, the other movable range is calculated as shown in the below. Refer the instruction manual of optional detector regarding the movable range of the optional detector.



Movable range of the T axis to the X axis coordinate
(Plus tilting angle, specimen height at 0 mm)



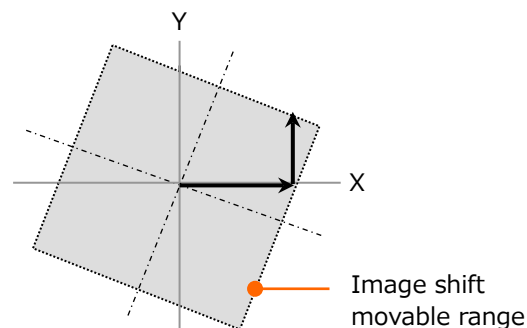
Movable range of T axis to the Z axis coordinate
(Minus tilting angle, specimen height at 0 mm)

3.5.5 Moving the observation FOV by the image shift

This function is possible to shift the irradiation position of electron beam and move the observing FOV. To move to the desired position or the selected position in the display can be performed by operating the [IMAGE SHIFT] knob in the manual operation panel. In addition, the image shift can be reset to the center of the movable range by clicking the image shift area in the control panel.

Carry out this function when the traceability of stage in the high magnification is insufficient or image is drifted after moving the stage. However, the movable range is limited as $\pm 30 \mu\text{m}$ in $\text{WD} = 6.0 \text{ mm}$.

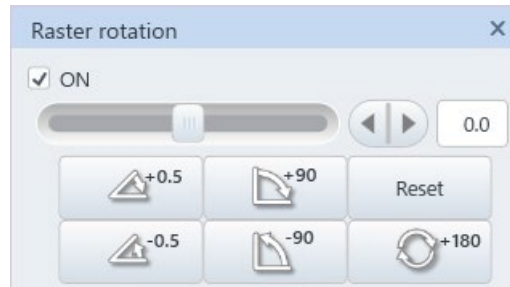
- NOTE:
- Image shift movable range is smaller when the WD is shorter.
 - When observing position is greatly moved by using the [Image shift], the focus or stigmator may be shifted. Correct the focus and align the stigmator again.
 - When moving the FOV by using the [Image shift], the FOV movable range will be as shown in the below (Hatched area) due to the raster rotation angle.



3.5.6 Rotating the FOV

Rotate the FOV by using the raster rotation.

Raster rotation is enabled by clicking the [RR] button on the control panel, or enabling the [ON] check box in [Sub panel settings]>[Raster rotation].



3.5.7 The magnification setting

The following shows the methods of setting the observing magnification.

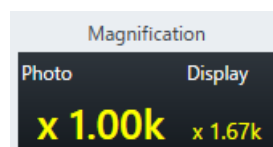
- (1) The [MAGNIFICATION] knob in the manual operation panel

Rotate the [MAGNIFICATION] knob to clockwise for increasing and counterclockwise for decreasing the magnifications.



- (2) Drag the mouse on the magnification display area

Increase the magnification by left clicking and moving the mouse to the right direction on [Control panel]>[Magnification] and decrease the magnification by left clicking the mouse. In addition, when moving to the left, the magnification will be degraded.



(3) Use the Preset magnification

Click the [Control panel]>[Preset] button and the magnification will be set to the Preset value. Click the [Preset magnification] button and the button is changed to [Back].

The magnification can be changed to the previous value by clicking the [Back] button.

NOTE: In case that the preset magnification is out of the maximum or minimum range under the current condition, the magnification will be set to the closest magnification that can be set.

3.5.8 Magnification range

The following shows the minimum photo magnification of each observing condition.

The minimum magnification is limited by focus position (WD) and accelerating voltage.

NOTE: The table shows the reference value. It is different depending on the optical conditions.

(1) Booster voltage: Magnification movable range of AUTO

WD range [mm]	Vacc[kV]								
	≤1	≤2	≤4	≤7	≤12	≤17	≤22	≤27	≤30
WD<1.3	100	110	120	140	165	165	155	150	145
1.3≤WD<1.8	95	100	120	140	165	165	155	150	145
1.8≤WD<2.8	90	95	110	130	155	155	155	150	145
2.8≤WD<3.8	80	85	100	115	135	155	155	150	145
3.8≤WD<4.8	70	75	85	100	120	140	150	150	145
4.8≤WD<5.8	65	70	75	90	110	120	140	150	145
5.8≤WD<6.8	60	65	70	85	100	110	125	135	140
6.8≤WD<8.8	55	55	65	75	90	105	115	125	130
8.8≤WD<10.8	50	50	55	65	75	90	95	105	110
10.8≤WD<12.8	40	45	45	55	70	75	85	95	95
12.8≤WD<15.8	40	40	40	50	60	70	75	80	85
15.8≤WD<20.8	40	35	35	45	50	60	65	70	75
20.8≤WD<25.8	40	30	30	35	40	45	50	55	60
25.8≤WD<30.8	40	30	25	30	35	40	45	45	50
30.8≤WD<35.8	40	30	20	25	30	35	40	40	45
35.8≤WD<40.8	40	30	20	20	25	30	35	35	40
40.8≤WD	40	30	20	20	25	25	30	30	35

(2) Booster voltage: Magnification range of OFF

WD range [mm]	Vacc[kV]				
	≤10	≤15	≤20	≤25	≤30
WD<1.3	180	220	260	290	310
1.3≤WD<1.8	170	210	240	270	290
1.8≤WD<2.8	150	190	220	240	270
2.8≤WD<3.8	130	160	180	200	220
3.8≤WD<4.8	110	130	150	170	190
4.8≤WD<5.8	90	120	140	150	170
5.8≤WD<6.8	80	100	120	130	150
6.8≤WD<8.8	70	90	110	120	130
8.8≤WD<10.8	60	80	90	100	110
10.8≤WD<12.8	50	70	80	90	90
12.8≤WD<15.8	50	60	70	70	80
15.8≤WD<20.8	40	50	55	60	70
20.8≤WD<25.8	30	40	45	50	55
25.8≤WD<30.8	25	30	40	40	45
30.8≤WD<35.8	25	30	30	35	40
35.8≤WD<40.8	20	25	30	30	35
40.8≤WD	20	25	25	30	30

(3) The maximum magnification

The following shows the maximum magnifications of each observation condition.

The maximum magnification is limited by the focus position (WD) and the screen mode.

WD range [mm]	Photo magnification	Actual magnification on screen		
		Screen mode		
		4 screen (640 x 480)	1 display/2 display (800 x 600)	Large display (1,280 x 960)
WD<12.8	1,000k (2,000k)	1,200k (2,500k)	1,500k (3,000k)	2,500k (5,000k)
12.8≤WD	800k (2,000k)	1,000k (2,500k)	1,200k (2,500k)	2,000k (2,500k)

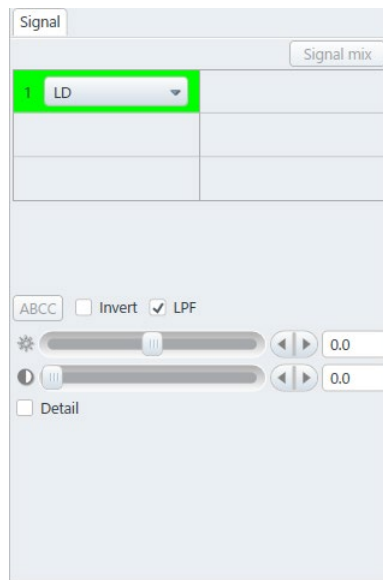
The value with () is enabled when [Enhance max mag of high-mag mode] check box in the Standard settings is ON.

3.6 Observing a specimen

The following shows the required setting and operation for observing a specimen..

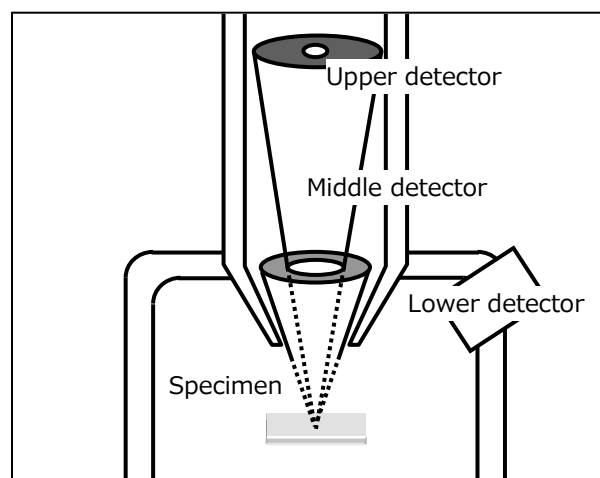
3.6.1 Selecting a detector

Select a detector to use from the [Operation panel]>[Signal] tab or upper area of the image display.



Two detectors (Upper detector/Lower detector) are equipped as a standard. Middle detector (Option) can be equipped. The obtained signal of each detector will be changed depending on the observing condition.

In the typical observing condition, the signals of SE (surface information) is obtained by UD, BSE (composition information) is obtained by MD and BSE (Topographic information) is obtained by LD.



3.6.2 Scan speed setting

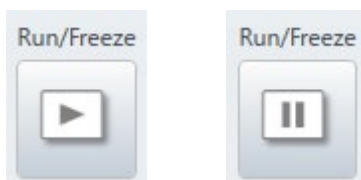
Select a scan speed (scanning speed of electron beam) for observing and obtaining an image.

(1) Scan/stop operation

The Scan/Stop operation can be performed by the [Run/Freeze] button.

The [Run/Freeze] button is located at the upper part of the image display.

The [Run/Freeze] button located at the upper part of image display performs the scan/stop operation.

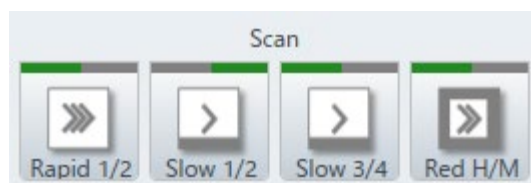


NOTE: The electron beam irradiates to the specimen when a screen with Run status is displayed. scanning. Beware of observing a specimen that is easily affected by the contamination or charging.

(2) Select the scan speed and type

Select the beam scanning method from the Rapid, Fast, CSS, Slow or Reduce for the [Control panel]>[Scan] or the custom scan for the [Control panel]>[Custom].

The setting of [Control panel]>[Scan] can be selected from the four SCAN SPEED buttons on the manual operation panel.



The following shows the scan speed types

(a) Rapid scan mode (Rapid1/2)

Select the rapid scan speed for searching a FOV or performing the coarse adjustment of focusing/astigmatism. In addition, the rapid scan is effective for observing a specimen that is easily charged-up or unable to observe by the slow scan. The number of the integration frames can be set on the [Scan button settings] dialog.

NOTE: In the rapid scan mode, the uniformity of the magnification between the center of image and the left area of image are deteriorated compared with the slow scan. Thus, to use the slow scan mode is recommended for the measurement that requires accuracy.

(b) Fast scan mode (Fast1/2)

Perform the scan with the half speed of the rapid scan. The number of integration frames can be set by the [Scan button settings] dialog. The following table shows the speed of Rapid scan and Fast scan mode.

NOTE: In the Fast scan mode, the uniformity of the magnification between the center of display and the left area is deteriorated compared with the slow scan. Thus, to use the slow scan mode is recommended for the measurement that requires accuracy.

Rapid, Fast scan speed (Unit: ms/frames)

Scan Speed	Screen mode		
	4 screen (640 x 480)	1 screen/2 screen (800 x 600)	Large display (1,280 x 960)
Rapid1	About 40/33	About 60/50	About 80/67
Rapid2	About 40/33	About 60/50	About 80/67
Fast1	About 80/66	About 120/100	About 160/133
Fast2	About 80/66	About 120/100	About 160/133

(Power frequency 50 Hz/60 Hz)

(c) Slow scan mode (Slow1/2)

Create an image with two dimension scan for each time by scanning the electron beam slowly and integrating the signal for each pixel. This mode is effective for the normal observation or the FOV search. Repeat speed is fast in the slow1/2. However, the image can be wobbling under the high magnification and low accelerating voltage condition when the disturbance of power frequency exists.

Slow1/2 scan speed (Unit: Second/Frames)

Scan Speed	Screen mode		
	4 screen (640 x 480)	1 screen/2 screen (800 x 600)	Large screen (1,280 x 960)
Slow1	About 0.5	About 0.7	About 1
Slow2	About 2	About 2.5	About 4

(d) Slow scan mode (Slow3/4/5/6/7)

Create an image with two dimension for each time by scanning the electron beam slowly and integrating the signal for each pixel. This mode is rarely affected by the disturbance of power frequency.

Slow 3/4/5/6/7 Scan speed (Unit: Second/Frame)

Scan Speed	Screen mode		
	4 screen (640 x 480)	1 screen/2 screen (800 x 600)	Large screen (1,280 x 960)
Slow3	About 10/8	About 12/10	About 20/16
Slow4	About 20/16	About 24/20	About 40/32
Slow5	About 40/32	About 48/40	About 80/64
Slow6	About 80/64	About 96/80	About 160/128
Slow7	About 160/128	About 192/160	About 320/256

(Power frequency 50 Hz/60 Hz)

(e) CS scan mode (CSS1 to CSS7)

Create an image by performing the fast scan of electron beam to horizontal direction and integrating the signal by line unit. The abnormal contrast due to charge-up can be decreased comparing to the slow scan in the normal observation. The quality of the image is in the middle of the rapid/fast scan and the slow scan.

While scan is performing, the image will be updated from the upper area as the normal slow scan. Thus, the performance of scanning mode seems same as the slow scan mode but the name on the button in the image screen is different. Identify the status with the button name.

The below table shows the scanning time of each frame. The slower the speed, the more image data integration times, and the image quality (S/N) is improved.

The scanning speed in the horizontal direction is the same in all speeds.

CS scan speed (Unit: second/frame)

Scan Speed	Screen mode		
	4 screen (640 x 480)	1 screen/2 screen (800 x 600)	Large screen (1,280 x 960)
CSS1	About 1	About 1.5	About 2
CSS2	About 2	About 3	About 5
CSS3	About 5.0/4.2	About 7.5/6.2	About 10/8.4
CSS4	About 10/8.4	About 15/13	About 20/17
CSS5	About 20/17	About 30/25	About 40/33
CSS6	About 40/33	About 60/50	About 80/66
CSS7	About 80/66	About 120/100	About 160/133

(Power frequency 50 Hz/60 Hz)

- NOTE:
- Since the CS scan performs to the horizontal direction with high speed, the image may be shifted to horizontal direction on the optional detector whose frequency band is narrow (semiconductor type backscattered electron detector, etc.).
 - Images of CS scan blur more comparing to the image of Slow scan when images are wobbling due to stray alternating magnetic fields.
 - The Slow scan and the CS scan cannot allocate to the buttons simultaneously. The Rapid/Fast scan and the Reduce Area can allocate to the buttons simultaneously.

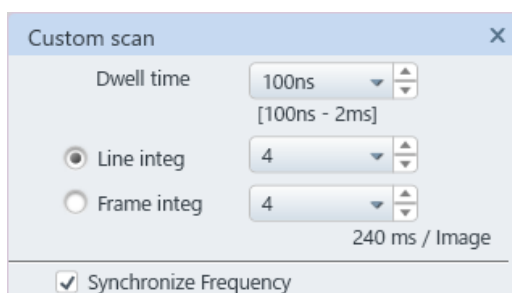
(f) Reduce Area mode (Reduced area) (Red High/Medium/Slow)

The mode is possible to obtain an optimal image and improve the tractability for correcting the focus and astigmatism by improving the quality due to setting slower scan than the Fast scan mode and reducing the observation area. The observation area and size can be moved by dragging the mouse.

The scan speed becomes slower in the order of High>Medium>Slow. Select a suitable scan depending on the observation conditions and detectors.

(g) Custom scan

Select the custom scan for setting the electron beam scanning speed by the dwell time (50Hz: 100ns/pixel to 2ms/pixel, 60Hz: 80ns/pixel to 1.6ms/pixel)



3.6.3 Controlling the brightness and contrast of an image

The brightness and contrast of image can be controlled automatically or manually. Generally, control the brightness and contrast of image automatically then, perform fine control manually.

- (1) Auto brightness & contrast control (ABCC)
 - (a) Perform the brightness & contrast control (AUTO) for all screen displayed for operating by the [Control panel]>[ABCC]. To perform the ABCC to the selected screen, click the ABCC button on the [Operation panel]>[Signal].



[Control panel]>[ABCC]



ABCC on the [Operation panel]>[Signal]

- (b) Manual operation panel



Press and perform the ABCC (AUTO) button at the [BRIGHTNESS] and [CONTRAST] adjustment knobs on the manual operation panel.
- (2) Control the brightness and contrast manually
 - (a) Operations on the display

The brightness and contrast for the selected screen (Detector) can be controlled by the scroll bar that is displaying on the bottom of the [Operation panel]>[Signal] tab. In addition, the analog brightness and digital contrast correction can be performed by setting ON the [Detail] check box.



- (b) Manual operation panel

The brightness and contrast can be controlled by the [BRIGHTNESS] and [CONTRAST] knobs on the manual operation panel.
- (c) Mouse operation on an image display

When the mouse icon is , the brightness of image can be changed and when the icon is , the contrast of image can be change by left clicking and holding the mouse on the image and moving to right and left directions.

3.6.4 Focusing and astigmatism correction

Focus and correct the astigmatism by automatically or manually.

(1) The method of focusing and correcting the astigmatism

Focusing and astigmatism correction are related and repeating of focusing and correcting the astigmatism are required alternatively. The finer adjustment of focusing and astigmatism correction is required in the high magnification and low accelerating voltage. The following shows the procedures.

- (a) Focus the image. The sharpest image can be obtained by optimal focus condition when the astigmatism does not exist. If the astigmatism exists, the image is shifted to the one direction under or over focusing condition and the image is in the uniformed focus condition under the optimal focus condition. In both case, focus to the image optimistically.

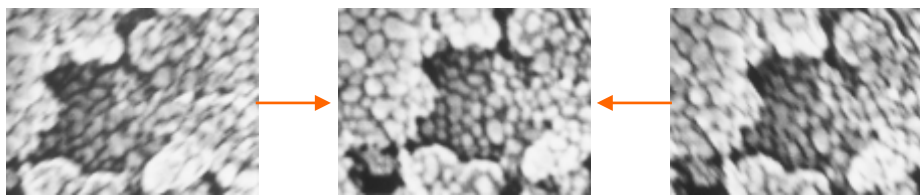
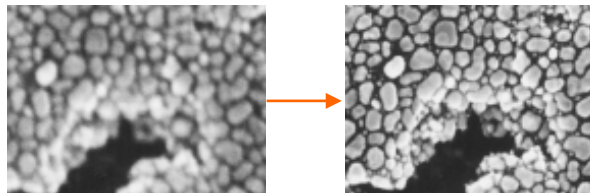


Image without shifting

- (b) Correct the astigmatism. Repeat the X and Y alternately for obtaining the sharpest image.



- (c) Focus to the image again and confirm the image condition of shifting and sharpness image.
 (d) Repeat the procedures of (a) to (c) until the image is adjusted completely.

NOTE: When observing and adjusting the same position on the specimen by high magnification, it will be affected by beam damage and contamination. In case that the specimen is sensitive to beam damage or has a lot of contamination, it is recommended to adjust the image outside of the desired FOV, move to the desired FOV and quickly adjust the focus then, capture the image .

(2) Auto adjustment

(a) Focus (AFC)

Press the [AFC] button on the [Control panel] and execute focusing automatically.



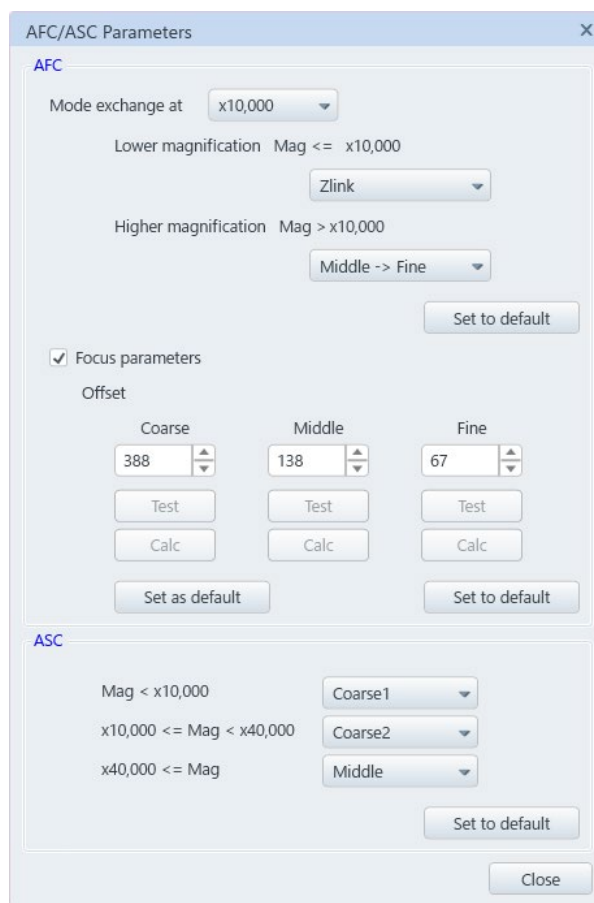
(b) Astigmatism (ASC)

Press the [Control panel]>[ASC] and execute the astigmatism correction.



(c) AFC/ASC parameter settings

Display the AFC/AST parameter setting dialog from the [Menu]>[Standard settings]>[Auto] tab.



Setting for changing the searching range by the magnification is possible in AFC. The searching range is wider in order of Zlink>Coarse>Middle >Fine (The order of searching range for Zlink can be different due to the change of accelerating voltage and stage height).

In addition, the user can adjust the offset amount of auto focus since it is slightly changed depending on the system or conditions. Use the system in the default settings for the normal operation (Click the [Set to default] button to return the value).

The following shows the offset adjustment procedure.

1. Perform the electron optical axis alignment (Electromagnetic alignment) under the observation condition.
2. Perform the focusing and astigmatism correction.
3. AFC/ASC parameter
Set ON the [Auto focus offset] check box in the dialog.
4. Click the [Test] button of operation mode for adjusting.
5. After performing the auto focus, adjust the focusing with the focus knob.
6. Click the [Calc.] button. The offset value will be set.

In the ASC, the setting that changes the searching range by the magnification is available.

The searching range becomes larger in order of Coarse1>Coarse2>Middle>Fine.

(3) Manual adjustment

(a) Focus

Operate the focus knob on the manual operation panel or select the [FOCUS] by the mouse operation on the image for focusing manually.

(b) Astigmatism correction

Rotate the [STIGMATOR/ALIGNMENT] knob on the manual operation panel or select the [STIG] by the mouse on the image for correcting the astigmatism manually.

If the image is move up and down while correcting the astigmatism, perform the stigmator axis alignment.

NOTE: Accuracy of ASC is affected by the specimen surface structures.

In case that the fine structure does not exist on the specimen surface, the contrast is low or the specimen that is easily charged up, this function will not be performed.

3.7 Recoding an image

The observing image can be saved as an image file (bitmap, TIFF, TIFF (16bit), JPEG format). Select the [Save] for saving the presently observing image. Select the [Capture] for saving an image with the condition that is previously set. In addition, the obtained image can be confirmed on [Menu]>[Observe]>[Image list].

3.7.1 Setting the saving condition

Open the [Saving condition] dialog from [Menu]>[Save condition setting] and set the saving destination and conditions.

3.7.2 Saving an image

(1) Save all screens

To save all screens displayed on the image display area, select the [Control panel]>[Save] button.

(2) Save the selected screen (1 screen)

To save the selected screen displayed on the image display area, select the [Control panel]>[Save Single] button or press the [Save] button on the image display area.

3.7.3 Capturing an image

(1) Set the condition of image capture at the [Menu]>[Capture settings].

(2) Capture all screens

To capture all screen displayed on the image display area, select the [Control panel]>[Capture].

(3) Capture the selected screen (One screen)

To capture selected screen displayed on the image display area, click the [Control panel]>[Capture Single] button or select the [Capture] button at upper of the image display area.

3.7.4 Operation of the manual operation panel

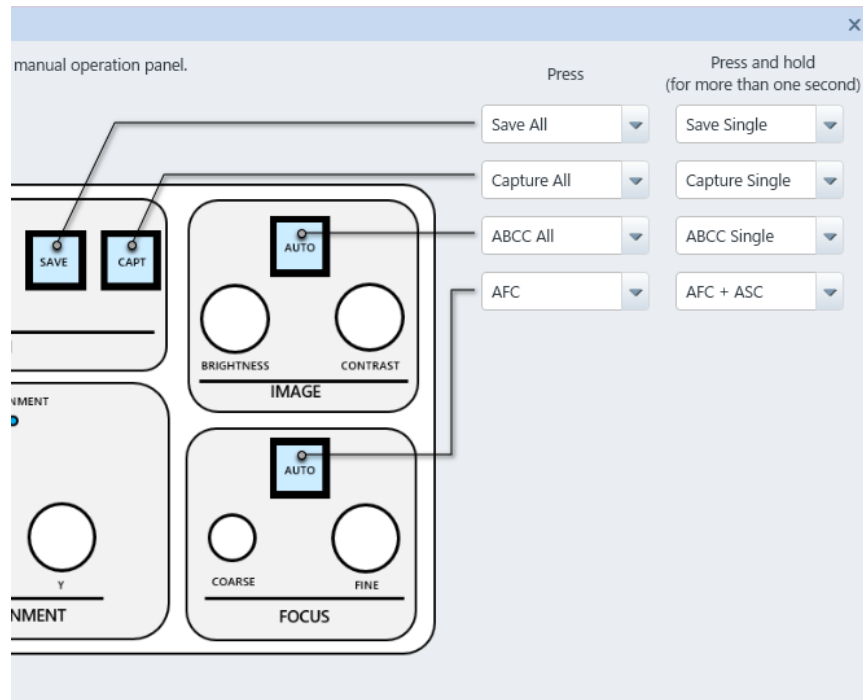
The image saving and image capture operations can be operated from the manual operation panel.

Image saving (3.7.2): SAVE button

Image capture (3.7.3): CAPT button

Press/Press and hold (more than 1 second) the button to set the image saving and capturing method as required.

Reference: 2.4.3 Manual operation panel

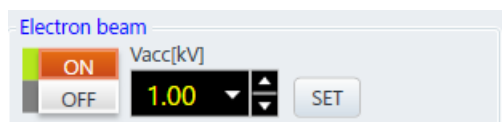


3.8 Stopping operation

Perform the following procedures to stop the system when the observation is finish,

3.8.1 Shutting down the accelerating voltage

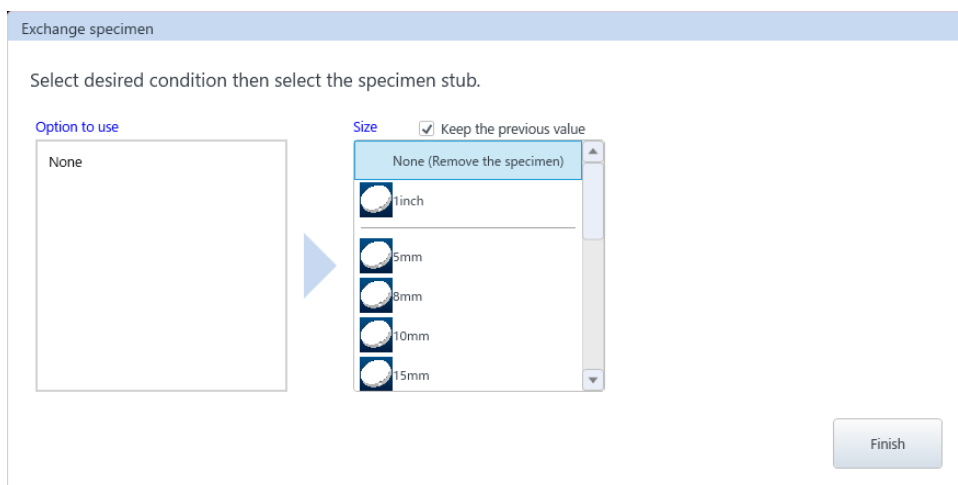
- (1) Close all displaying windows with required processes.
- (2) Click the electron beam OFF in the electron optics system tub on the operation panel and set OFF the accelerating voltage.



Electron optics system tub on the operation panel


3.8.2 Removing a specimen

Release the stage lock and move the stage to the specimen exchange position by clicking the [EXC] button. Wait until Indicator window at left side of the button is ON in green. Select the [None] for the size in the specimen exchange and remove the specimen. Click the [Finish the specimen exchange] button after removing the specimen.

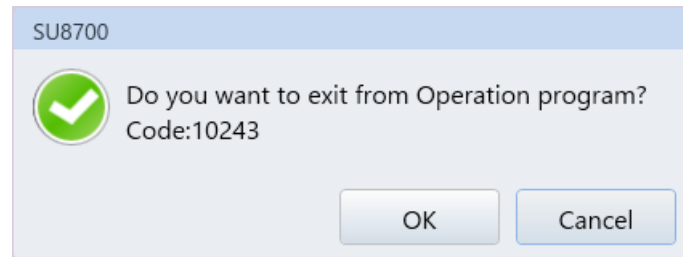


3.8.3 Finishing operation

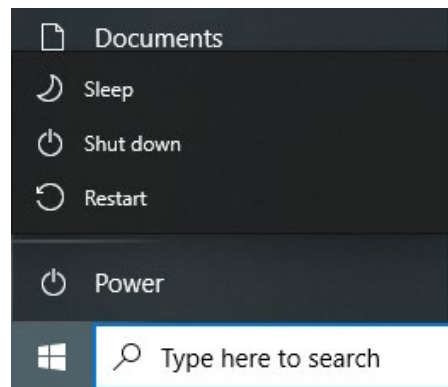
Exit the SU8700 operation program and OS then, power OFF the computer and display.

- (1) The message for confirming of finishing is displayed by clicking the close  button on the SU8700 main window.

The SU8700 operation display will be closed by clicking the OK button.



- (2) Click the Start button on the Windows task bar and select the shutdown.



- (3) Select the shut down the computer on the OS finishing window and click the OK button.
- (4) Wait until the [Please power off the computer] message is displayed (PC power will be OFF automatically depending on the PC settings).
- (5) Turn OFF the [EOC POWER] switch at front of the main unit. Confirm if the EOC lamp on the condition display panel is turned off.

Reference: 2.1.7 Power switch

4. Maintenance

Table 4 shows the maintenance and inspection items that must be carried out periodically to insure the continued proper operation of the instrument.

NOTE: The maintenance or/and inspection items shall be carried out by service engineers only.

Table 4 Periodical maintenance and inspection items

* "U" indicates the USER, "S" indicates the service engineer.

No.	Frequency	Maintenance and inspection items	Responsibility		Remarks
			U	S	
1	Compressor Conformed to the instruction manual	(1) Remove drain from the compressor	○	○	Customer-supplied items
2	Dry pump Conformed to the instruction manual.	(1) Maintenance of dry pump	○	○	Customer-supplied items
3	Chiller Conformed to the instruction manual	(1) Maintenance of Chiller	○	○	Customer-supplied items
4	Every year	(1) Air filter	×	○	
		(2) Cleaning and replacement of specimen exchange rod O-ring	×	○	
		(3) Exchange the SE-TIP	×	○	
		(4) Maintenance of full range gauge	×	○	
5	Every 2 years	(1) Replacement of mini motor R	×	○	
6	Every 3 years	(1) Replacement of scintillator	×	○	
		(2) Replacement of Pirani gauge bulb	×	○	
		(3) Replacement of encoder motor R of motorized stage	×	○	
		(4) Replacement of stage holder plate spring	×	○	
		(5) Replacement of banana tip assemble	×	○	
		(6) Joystick	×	○	Option
		(7) Trackball	×	○	Option
		(8) Replacement of objective aperture plate	×	○	
		(9) Replacement of the operation panel PCB	×	○	
		(10) Replacement of MD scintillator	×	○	Option

4.1 Maintenance of electron optical column

No.	Frequency	Maintenance and inspection items	Responsibility		Remarks
			U	S	
7	Every 4 years	(1) Maintenance of turbo molecule pump (2) Replacement of pulse motor (X, Y, T, Z)	×	○	
8	Every 5 years	(1) Replacement of stage motor driver (X, Y, T, Z)	×	○	
		(2) Replacement of Photomultiplier tube	×	○	
		(3) Replacement of vinyl hose for cooling water	×	○	
		(4) Replacement of cooling fan assembly	×	○	

4.1 Maintenance of electron optical column

4.1.1 Maintaining vacuum in electron gun

Use the electron gun under the continuous energized vacuum status. When the power of ion pump is ON, the electron gun is in the vacuum status. In case the pressure condition of ion pump is deteriorated than the following value, carry out the electron gun baking.

Reference: 4.8 Procedure of electron gun baking

IP1: $>2 \times 10^{-7}$ Pa

IP2: $>2 \times 10^{-5}$ Pa

4.2 Maintenance of parts

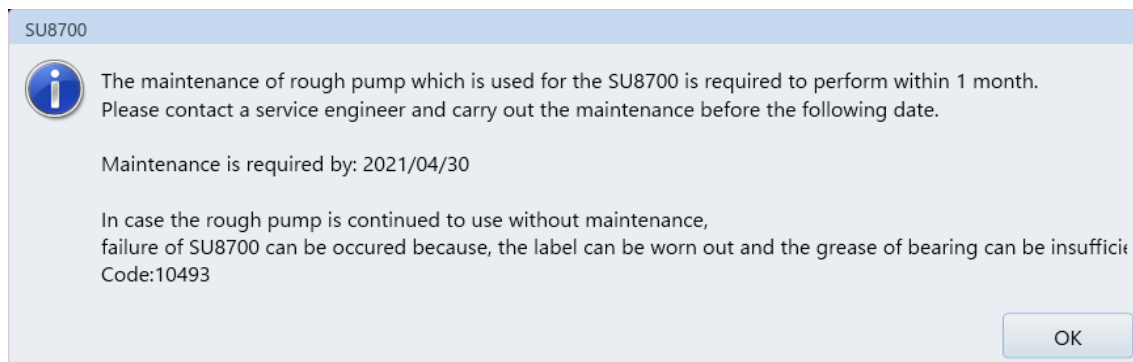
The periodical maintenance of the following parts that are used in this instrument is required. Update the maintenance date after performing the maintenance according to the following procedure. Only administrator user (Login name : SU8700) can update the maintenance date. Please contact a service engineer for performing this maintenance.

Parts	Maintenance cycle
Objective aperture plate	3 years
Scintillator (For LD)	3 years
Turbo molecular pump	4 years
Stage door O-Ring	5 years

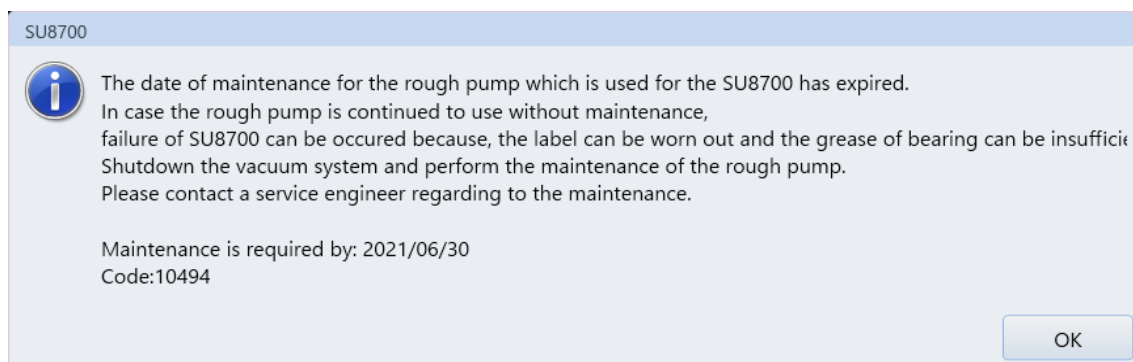
4.3 Maintenance of dry pump (Option)

The periodical maintenance of dry pump is required. Please perform the required periodical maintenance depending to your dry pump. The maintenance of dry pump is available at charge.

The following message will be displayed when the setting maintenance date of dry pump is expired when starting up the SEM. Carry out the maintenance before the date is expired.

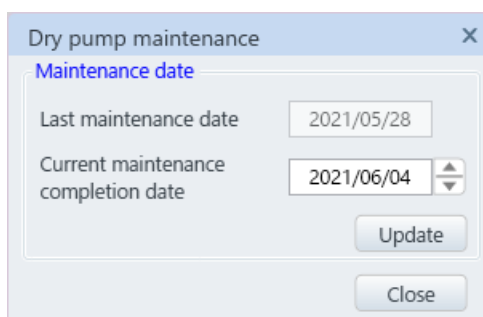


The following message will be displayed when the maintenance date of dry pump is expired while starting up the SEM and every time applying the HV. Carry out the maintenance of the dry pump as soon as possible.



Register the maintenance date after performing the dry pump maintenance as shown in the below.

- (1) Click the [Dry pump maintenance] button on the control panel item and display the following dialog.

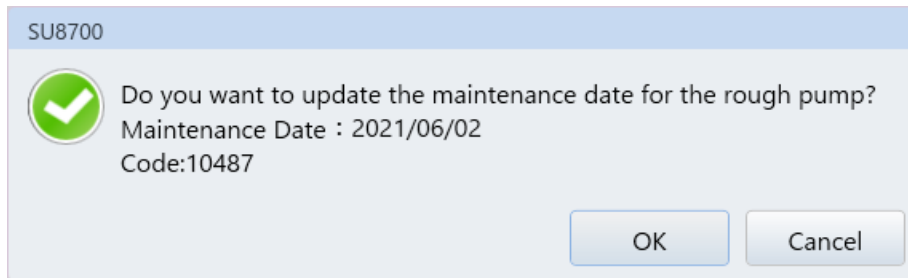


(2) Confirm the maintenance date of dry pump.

Present date is displayed in the maintenance date as the default. In case that the maintenance date is earlier than the default date, the date can be changed up to the seven days before the default date by clicking the arrow button at the side of the maintenance date.

(3) Click the [Update] button.

(4) The below message is displayed. Click the [OK] button for updating the previous maintenance date. In case of changing the date, click the [Cancel] button and carry out the operation from the (2) again.



NOTICE: The periodical maintenance of dry pump is required. Otherwise, performance deterioration of the pump, malfunction or shortening the life-time can be occurred.

4.3.1 Remove the contamination or moisture

The scroll type of dry pump requires to operate for one minute under the atmospheric condition when it is in the condition as shown in the below (It is recommended by pump manufacturer). If the dry pump requires atmospheric pressure operation, our service engineer of Hitachi High-Tech Corporation perform the setting during the installation.

- When it is operated at the first time after installation
- When starting the operation before or after a long period of non-use
- Periodical maintenance (about two times in a week)

NOTICE: If this operation is not performed, an abnormal sound may be generated from the dry pump or parts within the dry pump may be deteriorated earlier than expected.

- (1) Click the [DP maintenance] button on the control panel item and display the following dialog.

Dry pump maintenance

Maintenance date

Last maintenance date 2021/01/01

Current maintenance completion date 2021/06/16

Update

Air flush

Air flush time 9 o'clock

Air flush cycle 1 days

Forcible execution of air flush

Execute

Close

- (2) Click the [Execute] button in the [Air flush].
- (3) The following confirmation message will be displayed. Click the [OK] button to start the air flash procedure.
- (4) The message dialog will be displayed, and air flash will be complete in about five minutes.

Reference: If the dry pump does not require to vent air, the items of air flash will not be displayed.

4.4 Operation at power failure and for complete shutdown of instrument

- (1) Finish the SEM observation, remove the specimen and vent air to the chamber.
- (2) If the detectors of the third party vendor products are installed to the SEM, retract the detectors. Furthermore, if the detector is EDS, turn off the cooling because the element is cooled. Do not turn off power of the third party vendor product before power of SEM is off. If the power of the third party vendor product is off, an interlock is activated, and SEM cannot turn off.
- (3) Shutdown the electron gun.
- (4) When shutting down the electron gun, shut down the Windows.
- (5) Wait until the computer is shut down. The PC power will be turn OFF after few seconds of monitor is OFF. Confirm that the PC power switch lamp is OFF.
- (6) Turn OFF the [EOC POWER] switch at front of the main unit. Confirm if the EOC lamp on the condition display panel is turned OFF.
- (7) Leave the system for one to two hours for cooling down the electron gun source.
- (8) Turn OFF the [EVAC POWER] switch at front of the main unit. It takes approximately 5 minutes to shut down. Confirm if the EVAC lamp is turned OFF.
- (9) Power OFF the IP1 IP2 and STAGE breakers.
Confirm if the IP1, IP2 and STAGE lamps are OFF.
- (10) Power OFF the HV, IP/HV, EVAC, EOC and OUTER BAKE breakers on the EOC Control unit switchboard.
- (11) Power OFF the MAIN breaker.
- (12) Power OFF the power breaker of the facility switchboard and shut OFF the power source to the instrument.
- (13) Stop the cooling water supply. There is no wait time. However, when a cooling water circulator which is link to the instrument is used, the operation of cooling water circulator is stopped by powering OFF the instrument.
- (14) If the detectors of the third party vendor products are installed to the SEM, turn off the power of third party vendor products.

4.4.1 About shutting down the Electron gun

The electron source of SU8700 is a Schottky emitter type. The emission current is extracted by applying an extracting electric field to the emitter point heated to about 1700 K. In normal operation, maintain the instrument as started and use is continuously. Perform the shut down and start-up operation described below only when the instrument will not be used for a long period or a full-off of the power. Flow the Filament current I_f through the emitter to heat and impress a steady electric field by applying the extraction voltage V_{ext} to maintain the emission state of the emission current I_e . When observing with SEM, open the electron gun isolation valve GV installed between the electron gun chamber and the specimen chamber and apply the accelerating voltage V_{acc} . For a stable Schottky emission, the balance between the heating temperature and the extraction electric field is an important matter. Therefore, the start-up and shut down of the electron gun should be performed over a period of time along the predetermined operational sequence. Note that the emission current I_e stabilizes with a gradual increase for a few hours after the completion of the start-up of the electron gun. To maintain a stable performance, it is recommended that the electron gun should be maintained always in a start-up state.

- NOTE: ● The emitter is used in a state heated to high temperature. A sharp temperature variation imposes unnecessary load on the emitter inviting performance deterioration or shortened service life. Do not start nor shut down the electron gun unnecessarily.
- Each of the Schottky emitter has specific values of the Filament current I_f and the Extraction voltage V_{ext} for a stable emission. These values are set by our service engineer at the time of the emitter replacement. If such specific value setting for the filament current (Heating temperature) or for the extraction voltage is altered, the life-time of the emitter may be influenced, or the resolution may be affected due to the emitter shape change. When changing the settings is desired, contact our service engineer of Hitachi High-Tech Corporation.

4.5 Operation after recovery from power failure and for star-up of instrument

- (1) If the detectors of the third party vendor products are installed to the SEM, turn on the power of the third party vendor products.
- (2) Power ON the power breaker on the facility switchboard.
- (3) Power ON the MAIN breaker on the EO Control unit switchboard.
- (4) Press and hold the [RESET] switch for more than one second. A clicking noise of the relay will be heard from inside.
- (5) Power ON the HV, IP/HV, EVAC and EOC breakers on the EOC Control unit switchboard.
- (6) Power ON the IP1, IP2 and STAGE breakers at rear side of the instrument.
- (7) Turn ON the [EVAC POWER] switch at front of the instrument. Confirm that the EVAC lamp on the display panel is ON.
- (8) Turn ON the [EOC POWER] switch at front of the instrument. Confirm that the EOC lamp on the display panel is ON.
- (9) Power ON the PC and start up the SEM application. Log in with the administrator user: SU8700.
- (10) Perform the electron gun baking.
Reference: 4.8 Procedure of electron gun baking
- (11) Start up the electron gun.
Reference: 4.8.3 Startup of electron gun
- (12) Click the [Menu] > [Maintenance] > [Electron gun] or select the [Electron gun] on the control panel items and display the [Gun control] dialog. Click the [Electron gun aging] button to perform the electron gun aging.
- (13) Adjust the mechanical axis.
Reference: 4.9 Mechanical axis alignment
- (14) Align the axis of electron beam.

NOTE: When the emission current I_e is lowered drastically after performing the [Aging], contact our service engineer of Hitachi High-Tech Corporation.

4.6 Operation at water failure

When water supply is stopped while EO Control unit is started up, error message of E602 displays and buzzer sounds. In addition, the condition of E602 is not recovered for a while, objective lens coil is overheated, and image observation will be shut down. In case that water supply condition is not recovered immediately, shut down Windows and power OFF the EO Control unit. The E602 error will be released when powering OFF the EO Control unit.

4.7 Operation for water recovery

While E602 error message is displayed, error will be cleared automatically. When EO unit power is OFF, the operation can be performed by powering ON the EOC unit.

4.8 Procedure of electron gun baking

This operation is permitted to be performed by the instrument administrator only (Login name SU8700).

When baking was performed, it takes about half a day. In addition, gradual change on the emission current may follow continuing for the next several days.

Before conducting baking, it is recommended to consult our service engineer of Hitachi High-Tech Corporation about necessity of baking.

4.8.1 Precaution in electron gun baking

NOTICE: ● Only service engineers of Hitachi High-Tech Corporation who have been qualified through the on-the-job training or a training course provided by Hitachi High-Tech Corporation, or our designated service company are permitted to perform baking of the electron gun.

- Baking operation (by personnel who received training) must be performed according to the procedure in this instruction manual.
- Performing the baking operation without following the procedure in this instruction manual may cause electrical discharge in the HV cable and the electron gun receptacle and an erosion of the SE tip. Be sure to perform baking operation according to the procedure described in the instruction manual.
- If a foreign object enters the HV cable or the HV cable receptacle that is on the electron gun side, it may cause electrical discharge. Be sure to handle them following the procedure described in the instruction manual.
- Please hold the protection tool while removing the high voltage cable from the gun head. The terminal component will be damaged due to holding and removing only the cable.
- Risk of baking operation of the electron gun
Even if a person who has been trained and understands the baking operation performs the baking, the following risks exist.
 - (a) The required high vacuum level cannot be achieved even after performing baking operation, by following procedure described in the instruction manual.
 - (b) Secondary disaster caused by baking operation. (Fire or part burnout)
 - (c) Electrical discharge caused by a high voltage applied after cleaning of the HV cable and electron gun receptacle.
Erosion of the SE tip caused by electrical discharge, or the specified emission current cannot obtain.
 - (d) Disconnection of the baking heater and temperature runaway that are caused by wrong operation. Erosion of the SE tip and the disconnection of the heater caused by wrong connection.

Please note that costs of any trouble (including cost for repair) arising from baking operation that has been performed by the customer as instructed by service engineers of Hitachi High-Tech Corporation or service company are excluded from the warranty even during the warranty period.

- ⚠ WARNING:** It takes approximately 6 hours to cool it down to the room temperature after baking.
Remember that the electron gun and the ion pump remain extremely hot for this period of time after baking. To prevent burns, never touch the electron gun or ion pump until they cool down sufficiently.

4.8.2 Procedure of electron gun baking

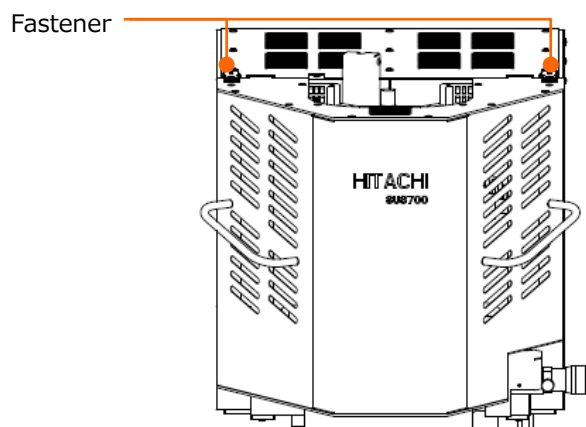
Perform the electron gun baking according to the following procedure.

After the baking, six hours or more is required for cooling.

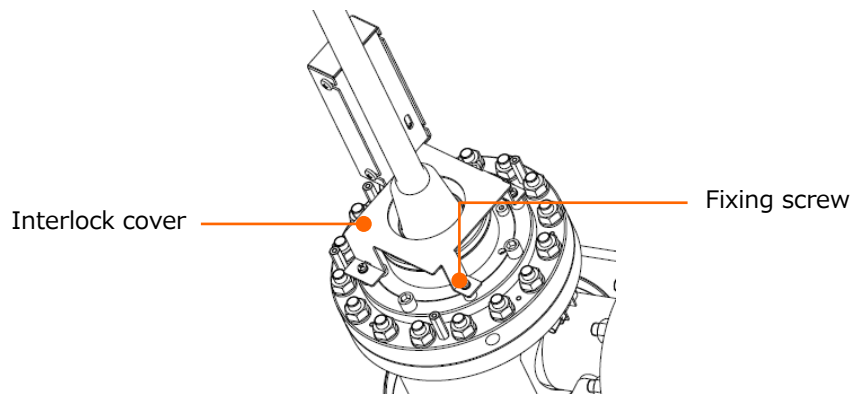
- (1) Turn OFF the HV, if observation is performing and HV is applying.
- (2) Remove the specimen and pump air from the specimen chamber. Please pump air from the chamber in high vacuum mode. The electron gun baking cannot be performed in the variable pressure mode.
- (3) Perform the shutdown operation of the electron gun.
- (4) On completion of the shutdown, confirm that the FIL, HV, BAKE lamps on the condition display panel are OFF.

- ⚠ WARNING:** Make sure that the FIL and HV lamps are OFF when performing electron gun baking. Do not perform the baking while the FIL and the HV lamps are ON. It can cause of receiving the electric shock by the work while the HV is applying.

- (5) Remove the electron cover by loosening the fastener that is fixing the cover.



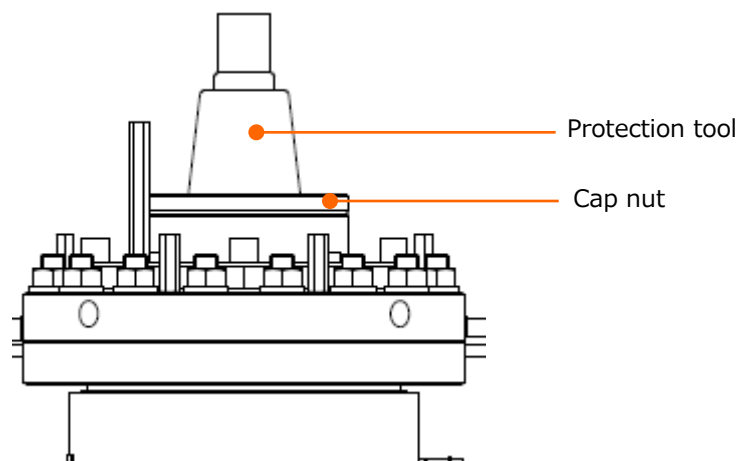
- (6) Loosen the three screws and remove the interlock cover of the electron gun HV cable.
(Interlock operates and turn OFF the high voltage when HV is applying.)



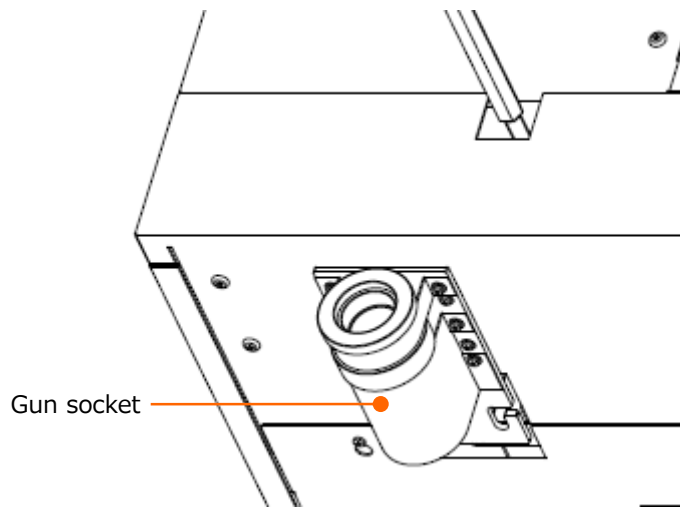
- ⚠ CAUTION:** Since it requires the work at a high place, please use a stepladder. Otherwise, you may fall and be injured. Please make sure to use a step ladder which satisfies the customer's safety standard.

- (7) Loosen the cap nut at the flange part on the high voltage cable head. Please make sure to hold the protection tool while removing the high voltage cable. Remove the high voltage cables to the vertical direction. In case of removing the cable to the diagonal direction, it can cause of damaging the insulation surface of the high voltage cable.

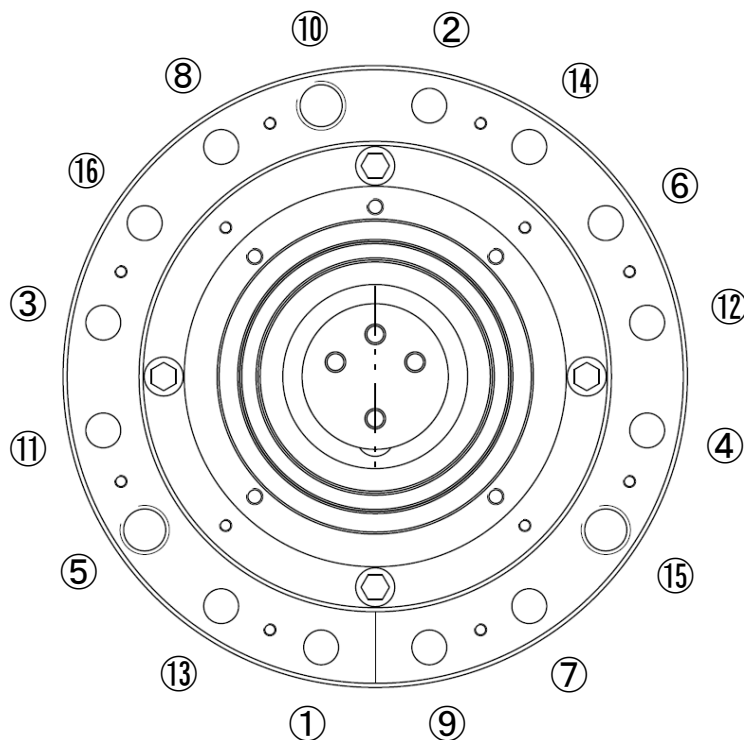
NOTE: Please note that the HV cable and protection cover cable are banded.



- (8) Insert the pulled out HV cable to the gun socket at the rear side of the instrument
(The baking operation cannot be performed without inserting the HV cable to the socket).



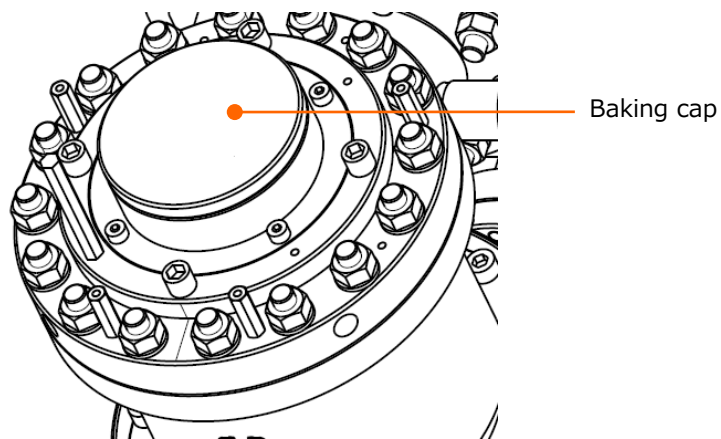
- (9) Re-tighten the screws on top of the electron gun with the sequence shown in the diagram. Use a torque wrench set at 25 N·m when re-tightening the nuts.



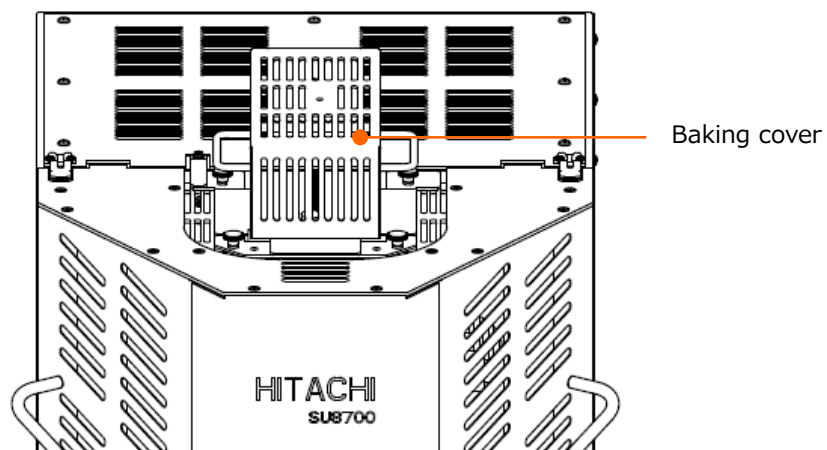
NOTICE: Do not tighten the nuts with exceeding power. It can damage the screws.

NOTE: Use a stepladder to re-tightening the electron gun flange. Perform the work in accordance with the safety standards established at your facility.

(10) Attach the baking cap to the high voltage cable part.



(11) Attach the baking cover to the electron gun cover then attach the electron gun cover on top of the instrument. Fix the baking cover with four knurling screws by hands. The baking cannot be performed without this cover.



NOTE: Before performing the baking, confirm that the wires do not in contact with (or proximity of) the baking heaters attached to the electron gun and the ion pump.

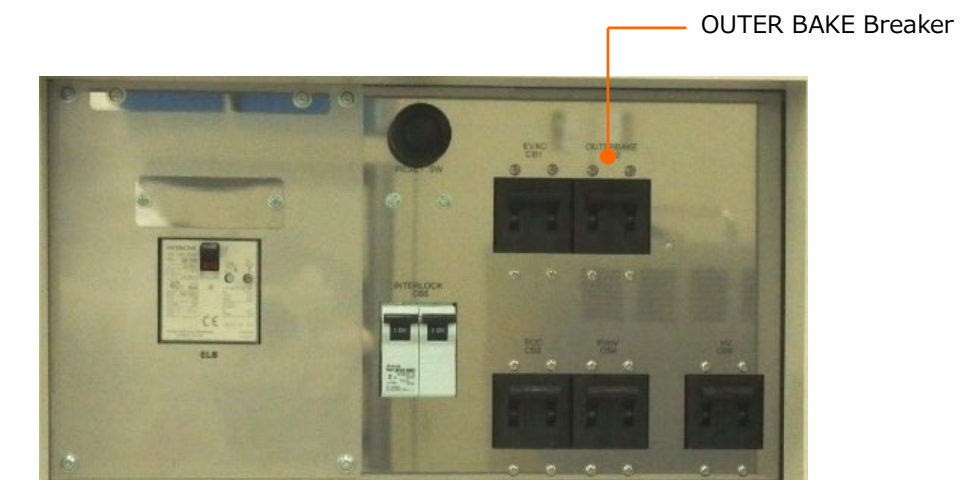
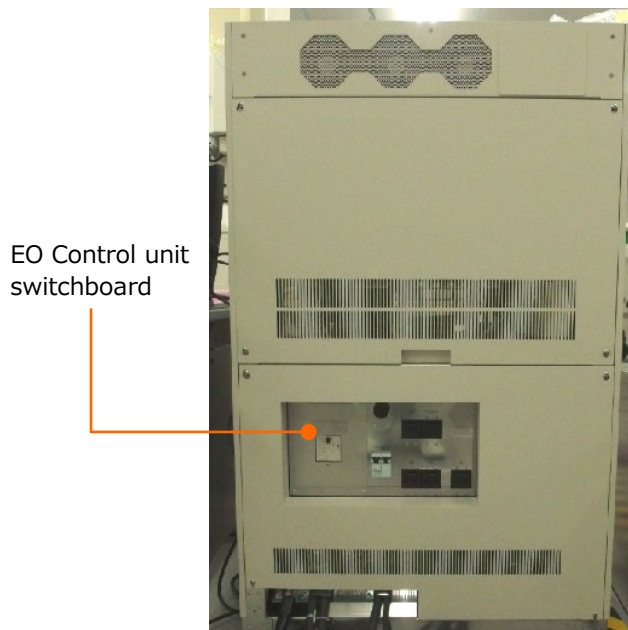
⚠ WARNING: For maintaining high vacuum performance, the electron gun and the ion pump are heated to approximately 250 °C. To prevent burns, do not touch the electron gun or ion pump until cool it down sufficiently.

- (12) Place the accessory high temperature caution plate in front of the column to inform third persons that high temperature baking is performing.

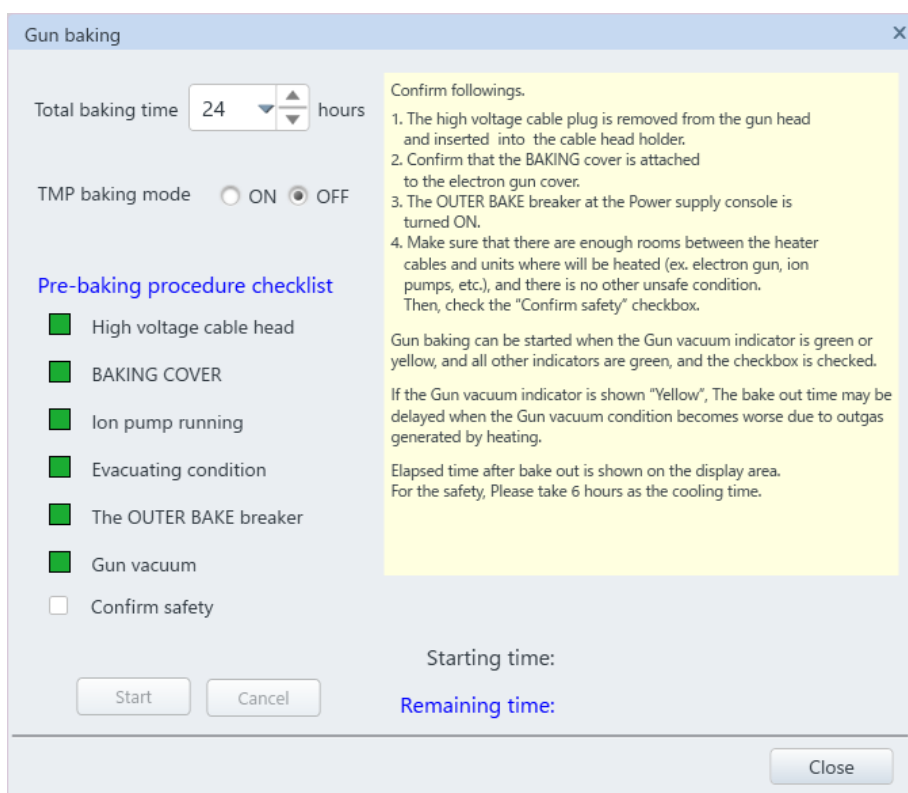
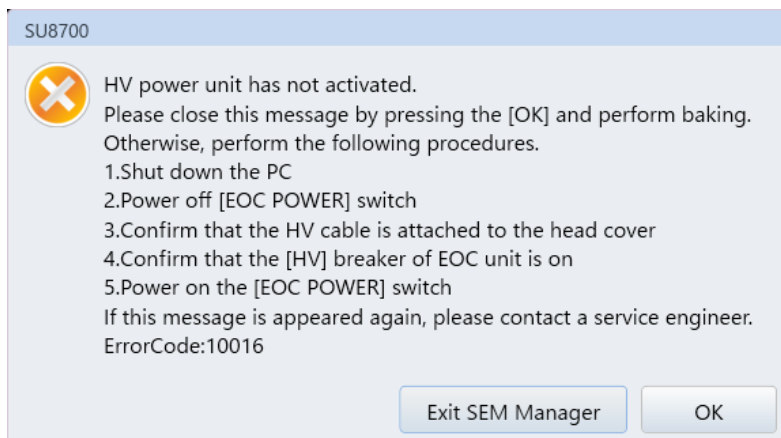


High temperature caution plate

- (13) Power ON the baking power breaker. Power ON the OUTER BAKE breaker on the EO Control unit switchboard.



- (14) Startup the baking. Start up the SEM application with the administrator user (User name: SU8700). When the application is started up, the following message will be displayed. Click the [OK] button on the message. The SU8700 will be started up. Click the [Menu]>[Maintenance] or [Electron gun baking] in the control panel item. The baking dialog will be displayed.



- (15) Set the baking time. About 12 hours of baking is recommended.
- (16) Confirm that all lamps are ON in green. Then, confirm that wires are not contacted to the heating area (Electron gun, Ion pump etc.) and check the condition of heating area. Enable the [Safety checked] check box and click the [Start] button.
- (17) When the baking is started, the [BAKE] is ON in the condition display panel. Estimated time of completing the baking is displayed on the baking dialog.

(18) If a trouble occurs during the baking, an error number will be displayed on the STATUS CODE in the condition display panel.


Error numbers and counter measures are described in the below.

When error occurs, the warning buzzer sounds. Press the [ALARM STOP] switch and error and electron gun baking are released. Perform the countermeasure of the error according to each error number.


Confirm that the error is released and perform the baking again.

Error number	Contents	Countermeasure
801	BAKE breaker is OFF	Check the procedure (13)
803	HV cable head has detached from the retractable socket	Check the procedure (8)
804	Ion pump is OFF	Power ON both IP1 and IP2.
805	Vacuum status of ion pump is deteriorated while performing the baking.	It is displayed while overheat is interrupted until the specified vacuum level is recovered from the lowered state that has been resulted from gas release due to overheat. Leave it as it is.
812	Baking cover is detached	Check the procedure (11).

(19) After baking is complete, confirm that the condition display panel of BAKE lamp is OFF and power OFF the baking power breaker (OUTER BAKE breaker).

 **WARNING:** If the electron gun is heated up due to an erroneous operation or malfunction, the electron gun may reach a very high temperature and it can cause burns. Make sure to turn OFF the OUTER BAKE breaker after electron gun baking is completed.

(20) Confirm that more than six hours has been elapsed after the baking is complete on the display in the baking dialog. When confirming that the electron gun is cooled down, remove the baking cover, electron gun cover and baking cap by the reverse order from (11).

 **WARNING:**

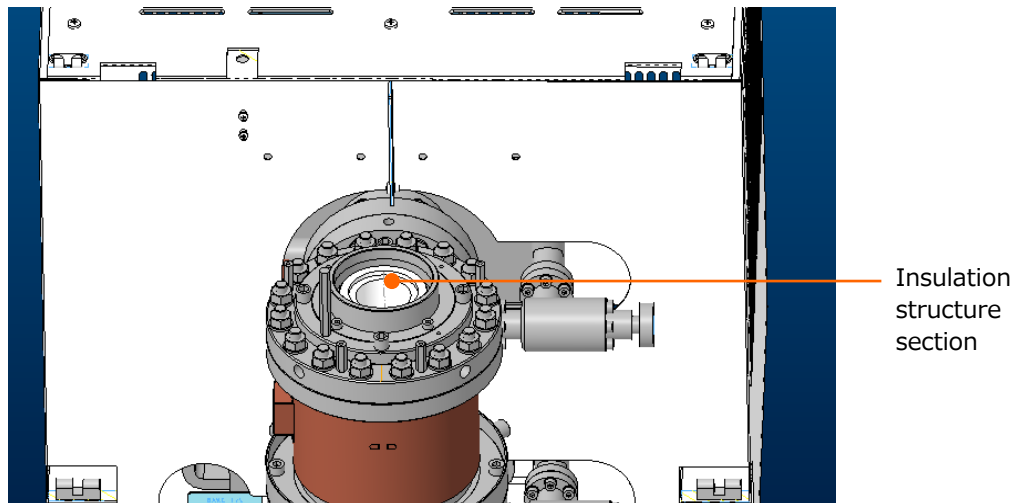
- It takes approximately 6 hours to cool it down to the room temperature after baking. Remember that the electron gun and the ion pump remain extremely hot for this period of time after baking. To prevent burns, do not touch the electron gun or ion pump until cool it down sufficiently.
- After an abnormal termination of baking (due to power interruption etc.), it will take approximately six hours for the electron gun and ion pump to cool down to nearly room temperature. To prevent burns, do not touch the electron gun or ion pump until they cool down sufficiently.

(21) Assembling the HV Cable to the Electron Gun

Reassemble the HV cable to the electron gun with foreign matters attached to the insulated section of the HV cable or the electron gun receptacle during the baking may cause electric discharge. Perform cleaning of the HV cable and the electron gun receptacle according to the following procedures.


(a) Drying Insulation Surface with a Drier

- Dry the insulation structure sections of the HV cable and the electron gun receptacle with a drier. (Use a drier of about 650 W to dry it.)



- If foreign matters or contamination are found in the insulation structure section, remove them, and then clean the area with a wiping cloth moistened with Ethanol. Be sure to dry it up after cleaning.



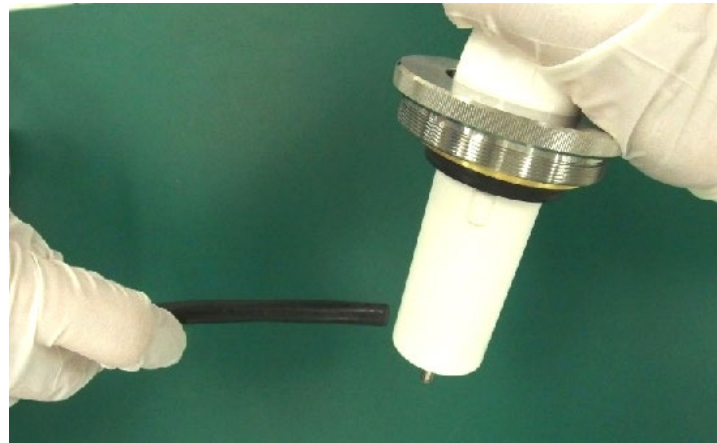
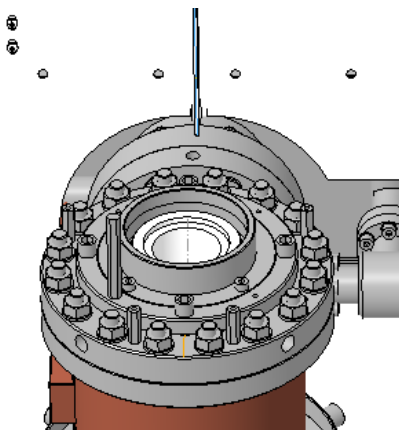
 **WARNING:** Ethanol is an organic solvent.

- There is a danger of explosion if vaporized ethanol is ignited.
- Excessive inhalation of vaporized ethanol could cause breathing difficulty or other severe ill effects.
- If ethanol is gulped, touches the skin or splashes into eyes by mistake, there is a risk of polyneuritis such as sensory paralysis or walking difficulty due to irritant actions.
- Handle ethanol in a well-ventilated and flame-free place and be careful not to inhale its vapor substantially. In addition, utilize breathing apparatus, protective goggles/gloves/boots, etc. as required.

(b) Removing Foreign Matters with Vacuum Cleaner

Remove foreign matters adhered to the electron gun receptacle and the HV cable insulation structure surface by bringing the vacuum cleaner nozzle (with thin nozzle) close to the aspirator area on the gun receptacle and voltage cable surface.

NOTE: If the nozzle touches the aspirator area, the insulation surface may be contaminated. Do not contact the nozzle to the aspirator area.



(c) Assembling the HV cable

Insert the HV cable and fix it with the cap nut. Then, attach the interlock cover and electron gun covers.

Baking operation of electron gun is complete. Perform the [Start up] for the electron gun.

4.8.3 Startup of electron gun

(1) Powering ON the unit

Power ON the HV breaker of EO control unit switchboard and then, turn ON the [EOC POWER] switch at the front of the instrument. Make sure to follow this procedure. Power ON the PC and start up the SEM application. Log in the application with administrator user (SU8700). In case that the HV breaker is OFF, error message will be displayed. When the error message is displayed, close the SEM application, shut down the PC and turn OFF the [EOC POWER] switch. Then, power ON the HV breaker according to the above procedures.

(2) Starting-up operation

When the SEM application is started up, click the [menu]> [maintenance] > [electron gun] or [Electron gun] in the control panel items then, the electron gun dialog will be displayed. Click the [Star-up] button for starting up the electron gun and a message window will be displayed. Click the [OK] button for starting up the electron gun.

In case the button is deactivated, confirm the state of the HV breaker, the lamp condition on the display panel and the interlock condition.

It takes 15 minutes at minimum and 2 hours at the maximum for starting up. The operation on the GUI cannot be performed while starting up.

When starting up operation is completed, a message for finishing the startup operation is displayed.

NOTE: If the FIL lamp of the condition display panel at front of the instrument is OFF when the start-up sequence has been successfully completed, contact our service engineer of Hitachi High-Tech Corporation.

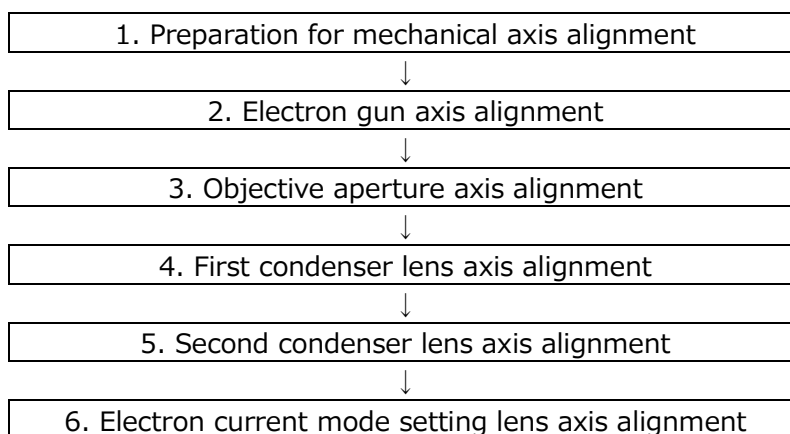
After the electron gun start-up operation completes, the emission current stabilizes after a transition of a gradual increase over a several hours.

It is possible to conduct a SEM observation or an analysis operation switching the electron beam ON while the current is in transit for being stabilized. However, in applications that require long-term stability of the probe current, waiting about half a day after the end of the electron gun start-up is preferable for a good result.

4.9 Mechanical axis alignment

Make sure to perform the alignment of the mechanical axis after the electron gun baking. In a normal operation after the electron gun start-up, the alignment of the mechanical axis of the electron gun and the C1 and C2 lenses are not required. However, if a good electron beam is not obtained even after the alignment of the electromagnetic axis, align the mechanical axis.

⚠ WARNING: The magnetic field produced from the permanent magnet of the ion pump (30 mT at the circumference, about 3 mT outside the ion pump cover) can cause a cardiac pacemaker to malfunction. A person using a pacemaker should not come within 0.6 m of the ion pump.



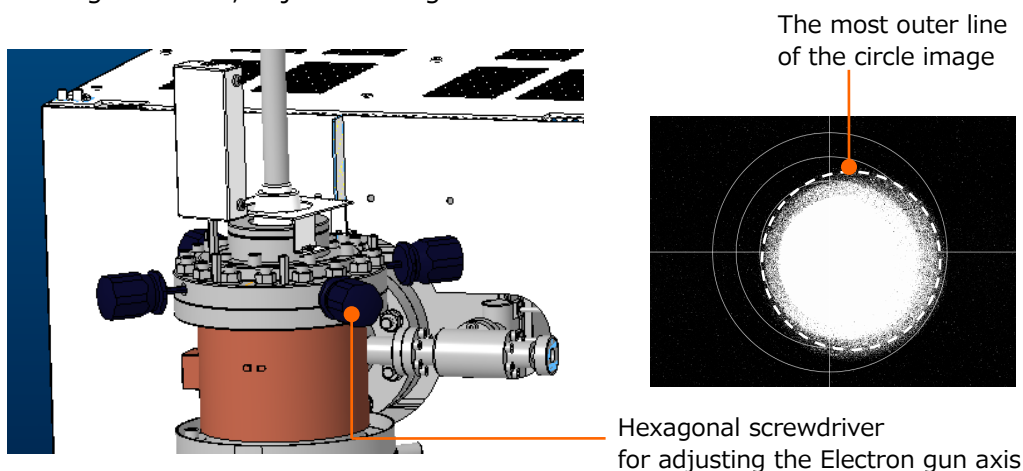
4.9.1 Preparation of the mechanical axis alignment

Before starting the mechanical axis alignment, perform the preparatory operation listed below.

- (1) Set a conductive specimen that is easy to observe such as copper mesh. Then, pump air from specimen chamber in the high vacuum mode.
- (2) Remove the electron gun cover.
- (3) Click the [Menu]>[Maintenance]>[Electron gun] or the [Electron gun] in the control panel items then, display the [Gun control] dialog and set to [OFF] at the Vb Voltage.
- (4) Set the accelerating voltage to 9 kV.
- (5) Display the signal tub on the operation panel and select the LD in the signal select box.
- (6) Set the [probe mode] in the [electron optics system] tub at the [Normal], the [Spot intensity] to 30 and the [Details of observation mode] to the [High resolution].
- (7) Uncheck the [Condenser lens 1] and the [Condenser lens 2] on the alignment panel.
- (8) Set the working distance and the Z axis of specimen stage to 6 mm.
- (9) Select the No.0 for the objective aperture.
- (10) Click the [Reset All] button on the alignment panel.
- (11) Click the [Reset] of [Stigma] on the alignment panel.
- (12) Set the magnification at the minimum.

4.9.2 Electron gun axis alignment

- (1) Set to the beam alignment mode by clicking the beam button on the alignment panel. The circle marker and circle image will be displayed on the screen. In case of the image is too bright or dark, adjust the brightness.

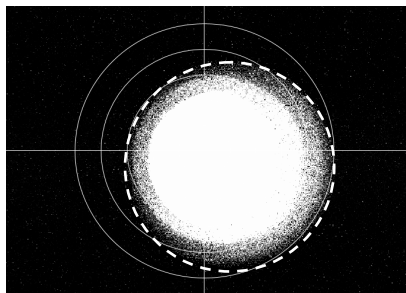


NOTE: Focus on the dark circle of the outer diameter for the circle image. The circle is the adjustment target. Ignore the bright circle image.

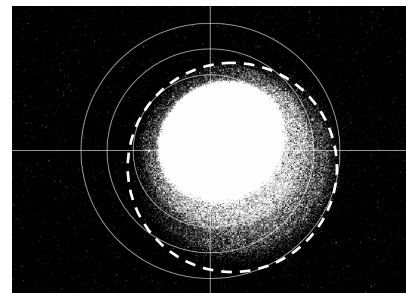
- (2) Remember the circle image position of present beam alignment image (Accelerating voltage 9 kV) and change the accelerating voltage to 1 kV. Click the [Reset All] button on the alignment panel and the [Reset] on the [stigma]. Then, uncheck the condenser lens 1 and 2 check boxes.
- (3) Set to the beam alignment mode by clicking the beam button on the alignment panel. Circle marker and circle image are displayed on the screen. In case of the image is too bright or dark, adjust the brightness. Adjust the center of the circle image to the position of the beam alignment image with accelerating voltage of 9 kV by adjusting the axis adjustment screws (four places) by using hexagonal screwdriver for adjusting the electron gun axis.

NOTE: Focus on the dark circle of the outer diameter for the circle image. The circle is the adjustment target. Ignore the bright circle image.

- (4) Repeat the procedures of (1) to (3). When the position of beam alignment image is the same position by changing the accelerating voltage 1 kV \Leftrightarrow 9 kV, the adjustment of electron gun axis is complete.



9 kV



1kV

- NOTE:
- There is no problem if the circle image is not in the center of beam alignment display.
 - The decreasing the vacuum condition and turning OFF the HV can be occurred during operation. In this case, display the vacuum status dialog by clicking the [Menu] > [Maintenance] or [Vacuum] dialog from the control panel items and wait until the pressure of electron gun chamber is recovered (IP-1 and IP-2) then, perform the alignment again.

4.9.3 Objective aperture axis alignment

- (1) Set the objective aperture to No.2 or No.3 under the beam alignment mode with accelerating voltage 9 kV.

Diameter of the apertures are described as below.

No.1: 70 μm

No.2, No.3: 50 μm

No.4: 20 μm

- (2) The image becomes dark. Adjust the brightness and contrast manually.
- (3) Perform rough alignment of the objective aperture position by using the X, Y knobs for adjusting the circle image to the center of the display.

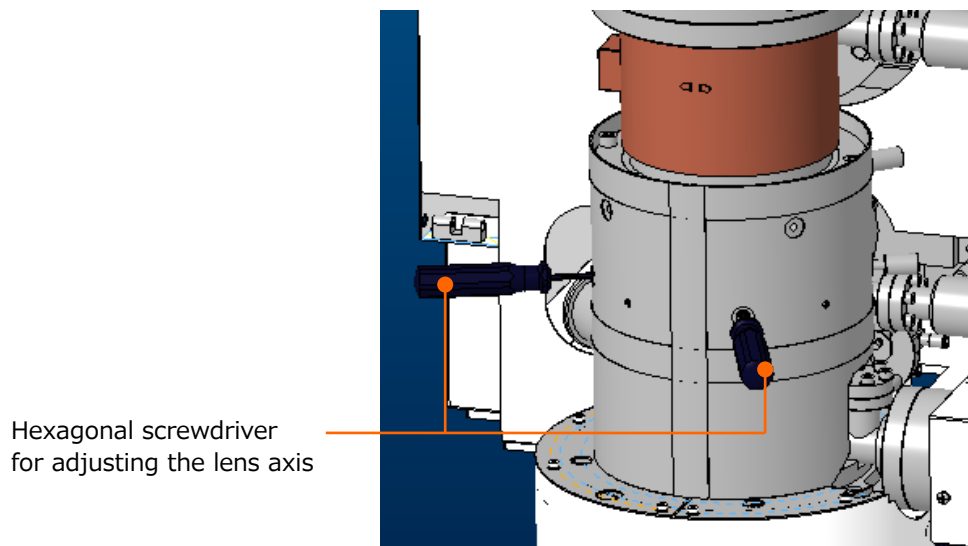
When the adjustment completes, release the beam alignment mode and adjust the brightness and focus of image. Move the stage to the characteristic position on the specimen surface to the center of the display. Move the stage to the characteristic position on the specimen surface to the center of the display.

- (4) Set to the aperture alignment mode by clicking the aperture button on the alignment panel. Adjust the X and Y knobs of the objective aperture for minimizing the image motion. Beware not to move the knobs position after adjusting.



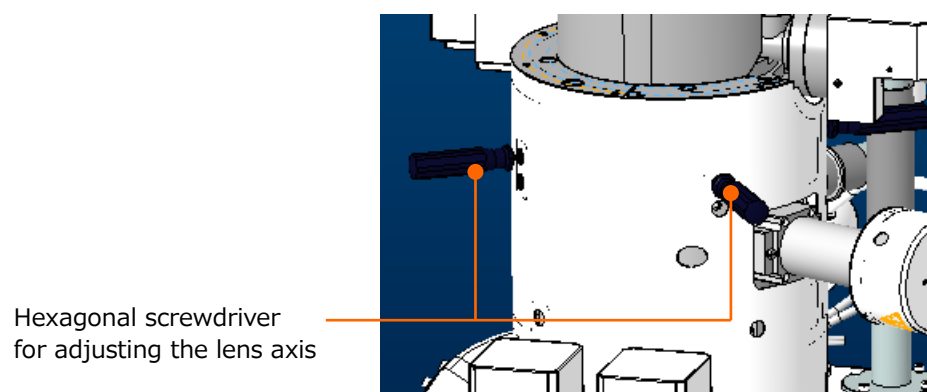
4.9.4 First condenser lens axis alignment

- (1) Click the [Condenser lens 1] check box on the alignment panel while the [beam alignment mode] is ON.
- (2) Confirm that the current mode in operation panel is Normal and spot intensity is 30.
- (3) Adjust the brightness and contrast as required.
- (4) Adjust the center of the circle image to the center of the display with the hexagonal screwdriver for aligning the electron gun axis and the C1 axis adjustment knob.



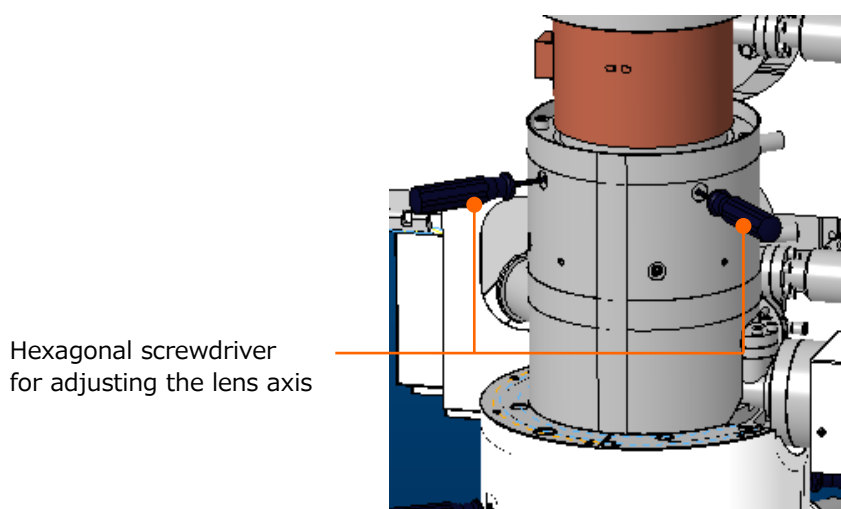
4.9.5 Second condenser lens axis alignment

- (1) Click the [Condenser lens 2] check box and release the alignment panel.
- (2) Adjust the brightness and focus of the image. Move the stage to the characteristic position on the specimen surface to the center of the display.
- (3) Adjust the focus again by clicking the [Degauss] button on the operation panel.
- (4) Set to the aperture alignment mode by clicking the [Aperture] button on the alignment panel. Minimize the image motion by aligning the electron gun axis with the hexagonal screwdriver.



4.9.6 Electron current mode setting lens axis alignment

- (1) Set to the beam alignment mode by clicking [Beam] in the alignment panel.
- (2) Set the electron current mode to High in the operation panel.
- (3) Adjust the center of circle image to the center of the beam alignment display with the hexagonal screwdriver for aligning the electron gun axis and the adjustment knob of beam current mode setting lens axis. Adjust the brightness and contrast as required.
- (4) When the alignment is complete, turn OFF the HV and attach the electron gun cover.



4.10 Precaution on maintenance

Beware of following items before performing the maintenance of instrument.

- (1) Make sure to read the instruction manual and thoroughly understand then, perform the maintenance according to the instruction manual.
- (2) Do not perform the maintenance (disassemble or repair) that is not described in the instruction manual and the maintenance that is only allowed to service engineers.

5. Replacement parts (SU8700)

5.1 Consumables, life-limited parts, and spare parts

5.1.1 Consumables

The consumables parts should always be on hand in sufficient quantities for normal operation. (Refer to Table 5-1-1).

Table 5-1-1 Consumables parts and Customer-supplied items

Part No.	Part Name	Usage	Remarks
-	Ethanol	Cleaning parts	
-	Conductive double-sided adhesive tape	For fixing a bulk specimen/temporal fixing (for low magnification)	
-	Conductive bonding agent (paste)	For fixing a specimen (for high magnification) •Carbon paste (#16053 manufactured by Ted Pella)	
-	Clean gloves	For handling a specimen	
-	Driver set	For daily work	
-	Tweezers	For handling a specimen	
G743002	Bamboo stick	For cleaning vacuum parts	10 pcs
567-4100	Wiping cloth	For cleaning vacuum parts	
S269003	Aluminum foil	For cleaning vacuum parts	
539-4304	Element (Air Filter)	Vacuum system (Leak)	
539-2132	Vacuum grease	For vacuum seal (Sliding part)	

5.1.2 Life-limited parts

Table 5-1-2 lists the life-limited parts. They should be replaced on a predetermined cycle to ensure safety in operation of the instrument and maintain its performance. Replacement work shall be carried out by our service engineer of Hitachi High-Tech Corporation. Please contact service engineers of Hitachi High-Tech Corporation.

Table 5-1-2 Life-limited parts

Part No.	Part Name	Usage	Replacement cycle
J386042	Photomultiplier tube R6249	Detector (UD/LD)	5 years
458-1553	Photomultiplier tube R11265U	Detector (MD)(Option)	5 years
534-3841	Scintillator	Detector (LD)	3 years
458-4600	Scintillator	Detector (UD)	3 years
458-1634	Scintillator	Detector (MD)(Option)	3 years or Electric discharge 300 times
511-0555	SE tip	Electron gun	1 year
458-5841	CA4-193 6500	Electron gun HV cable	5 years
K433004	Pirani gauge bulb	Vacuum system	3 years
K433012	Full range gauge	Vacuum system	1 year
458-4480	Objective aperture plate	Objective aperture (20, 50, 50, 70 μm dia.)	3 years
L536261	Ion pump (30 L/s)	Vacuum system	5 years
L536260	Ion pump (20 L/s)	Vacuum system	5 years
58E-1165	Turbo molecular pump	Vacuum system	4 years
459-2949	Dry pump (NeoDry15E-11)	Vacuum system (Customer-supplied item)	3 year Overhaul
57E-1752	Rubber tube for vacuuming	Vacuum system	5 years
589-0936	Vinyl hose for cooling water	Between Main unit - Chiller	5 years
K591306	Pulse motor XY	Stage	4 years
K591307	Pulse motor TZ	Stage	4 years
459-4026	Mimi motor R	Stage	2 years
458-2818	Encoder R	Stage	3 years
58E-3560	Motor drive (XY)	Stage	5 years
K591337	Motor drive (TZ)	Stage	5 years
459-2762	Holder plate spring	Stage (Specimen exchange)	3 years
536-3787	Banana tip assemble	Specimen exchange chamber system	3 years
534-6065	O-ring P10DG	Specimen exchange rod	1 year

Part No.	Part Name	Usage	Replacement cycle
K111250	Relay	Control system	5 years
K111201	Relay	Control system	5 years
458-5491	Fan for DCPS1 PCB	For DCPS1 PCB	5 years
458-5492	Fan for DCPS2 PCB	For DCPS2 PCB	5 years
458-5493	Fan for EO-DRV PCB	For EO-DRV PCB	5 years
458-5494	Fan for DEF-DRV PCB	For DEF-DRV PCB	5 years
458-5495	Fan for EOC	EO Control unit, fun for exhausting heat	5 years
459-5126	Joystick	Stage controller (Option)	3 years
459-5125	Trackball	Stage controller (Option)	3 years
459-5166	Operation panel PCB	Operation panel	3 years
511-5593	FAN HVC assemble	HV power supply	5 years
510-7058	Condensation sensor	Safety circuit	5 years
511-5595	Photo coupler	HV power supply	5 years
—	Transformer oil	HV power supply	5 years

- NOTE:
- The replacement cycles indicated above do not represent of the warranty period. The replacement cycle is a recommended in interval calculated on the basis of 8 hours operation per day. Predetermine a replacement cycle for each part in accordance with the actual operating schedule.
 - The replacement of transformer oil for HV power and photo-coupler are available with overhaul in the Factory.

5.1.3 Spare parts

The following spare parts shall be prepared to operate the instrument for a long period. Prepare them in sufficient quantities depending on the purpose of use. (See Table 5-1-3).

Table 5-1-3 Spare parts

Part No.	Part Name	Remarks	Q'ty to use
J821152	Fuse LM13	For service engineers	3
J821153	Fuse LM03	For service engineers	8
J821154	Fuse LM05	For service engineers	68
J821155	Fuse LM10	For service engineers	21
J821156	Fuse LM16	For service engineers	56
J821157	Fuse LM20	For service engineers	31
J821158	Fuse LM32	For service engineers	9
J821165	Fuse HM10	For service engineers	1
J821166	Fuse HM16	For service engineers	13
J821168	Fuse HM32	For service engineers	2
J821169	Fuse HM50	For service engineers	2
J821483	Alarm fuse P420L	For service engineers	2
J821484	Alarm fuse P430L	For service engineers	6
J821487	Alarm fuse PL475L	For service engineers	3
J821496	Alarm fuse EP100	For service engineers	1
J821497	Alarm fuse EP125	For service engineers	1
J821498	Alarm fuse EP150	For service engineers	5
J821534	Alarm fuse SP430L	For service engineers	1
J821555	Alarm fuse GP75	For service engineers	2
J821572	Alarm fuse SDP10	For service engineers	1
J821573	Alarm fuse SDP16	For service engineers	2
J821574	Alarm fuse SDP20	For service engineers	8
J821575	Alarm fuse SDP32	For service engineers	14
J821576	Alarm fuse SDP50	For service engineers	4
J821577	Alarm fuse SDP63	For service engineers	2
J821596	Alarm fuse P4100H	For service engineers	1
433-3702	Specimen stub (Φ15)	15 mm diameter	5
536-1190	Specimen stub (Φ10)	10 mm diameter	2
536-1275	Specimen stub (Φ25)	25 mm diameter	5
534-6815	O-ring	Specimen chamber port	19

5.2 Accessories

The table below listed the accessories for the instrument.

Table 5-2-1 Accessories

No.	Part number	Quantity	Part name	Tool Equipment Installation parts	Remarks
1	-----	1	Inspection report	△	
2	-----	1	SU8700 software DVD	△	
3	589-0936	1	Hose (7M x 2)	◎	
4	F229238	1	Tube	△	
5	595-3493	2	Anti-vibration pat	◎	
6	459-3065	1	Protective resistance	△	
7	459-3829	1	IL protection cover	△	
8	539-0357	1	Height gauge	○	
9	539-1354	2	Aluminum plate 2.0	◎	For adjusting the height during the installation
10	539-1355	2	Aluminum plate 1.2	◎	For adjusting the height during the installation
11	580-4769	1	Toolbox	○	
12	J839052	40	Tie wrap TY-25M	◎	
13	N320005	1	Torque wrench N450QLK	○	
14	580-5700	1	Plate	△	For baking
15	520-2772	4	Hexagonal screwdriver 2.5	○	For the electron gun axis alignment
16	520-2771	4	Hexagonal screwdriver 4	○	For the electron gun axis alignment
17	458-3754	4	Hexagonal screwdriver M4	○	For the electron gun axis alignment
18	N315013	1	Hexagonal wrench B12	○	
19	580-5545	3	Guide screw	○	
20	580-5546	3	Guide	○	
21	511-2200	2	OBJ aperture attachment rail	○	
22	S370034	1	Tweezer (TE604467-1)	△	

5.2 Accessories

No.	Part number	Quantity	Part name	Tool Equipment Installation parts	Remarks
23	F276001	1	Teflon tape 0.1X13 (5 M)	△	
24	539-4570	2	Hose nipple 1	◎	
25	546-2305	1	Wrench adapter	○	
26	—	1	Error code plate	△	
27	539-0345	2	Specimen holder	△	
28	535-1257	2	Lock nut	△	
29	535-1258	2	Holder screw (1)	△	M6 Length 19.5
30	535-1259	2	Holder screw (2)	△	M6 Length 13.5
31	539-1358	2	Holder screw	△	M6 Length 26.5
32	433-3702	5	Specimen stub (Φ15)	△	15 mm dia.
33	536-1190	2	Specimen stub (Φ10)	△	10 mm dia.
34	536-1275	5	Specimen stub (Φ25)	△	25 mm dia.
35	535-1255	1	Specimen stub (Φ15)	△	15 mm dia., male screw
36	536-1401	1	Specimen stub (Φ25)	△	25 mm dia., male screw
37	G743002	1	Bamboo stick (TE606014-1)	△	
38	J821152	2	Fuse LM13	△	
39	J821153	2	Fuse LM03	△	
40	J821154	5	Fuse LM05	△	
41	J821155	5	Fuse LM10	△	
42	J821156	5	Fuse LM16	△	
43	J821157	5	Fuse LM20	△	
44	J821158	2	Fuse LM32	△	
45	J821165	2	Fuse HM10	△	
46	J821166	2	Fuse HM16	△	
47	J821168	2	Fuse HM32	△	
48	J821169	2	Fuse HM50	△	
49	J821483	2	Alarm fuse P420L	△	
50	J821484	2	Alarm fuse P430L	△	
51	J821487	2	Alarm fuse PL475L	△	
52	J821496	2	Alarm fuse EP100	△	
53	J821497	2	Alarm fuse EP125	△	
54	J821498	2	Alarm fuse EP150	△	
55	J821534	2	Alarm fuse SP430L	△	
56	J821555	2	Alarm fuse GP75	△	

No.	Part number	Quantity	Part name	Tool Equipment Installation parts	Remarks
57	J821572	2	Alarm fuse SDP10	△	
58	J821573	2	Alarm fuse SDP16	△	
59	J821574	2	Alarm fuse SDP20	△	
60	J821575	2	Alarm fuse SDP32	△	
61	J821576	2	Alarm fuse SDP50	△	
62	J821577	2	Alarm fuse SDP63	△	
63	J821596	2	Alarm fuse P4100H	△	

6. Troubleshooting

6.1 When vacuum system does not work normally

If the vacuum system does not work or the vacuum sequence does not proceed, confirm the following error display.

When an error occurs, an error message displays on the main unit status display panel or buzzer is ON. Confirm the error code on the PC operation display or error display area at front of the main unit. Search the applicable error code from the error code list and take the necessary measures described in the manual.

6.2 When the specimen chamber does not reach to the specified vacuum status

The buzzer sounds and the error code [E105] appears when the vacuum status of specimen chamber has not reached to 3.0×10^{-2} Pa or less even 30 minutes or more is lapsed after starting to vacuum. In this case, perform the following check-ups.

- (1) Vent air into the specimen chamber. Confirm whether any foreign object is inserted between the specimen stage and specimen chamber, and remove the object if any.
In case that the specimen stage and specimen chamber are not closely closed, the specimen chamber is unable to reach to the specified vacuum status. Remove the foreign object and pump air from the chamber again.
- (2) When right after equipping another unit to the specimen chamber, remove the unit. Clean and apply grease to the O-ring and attach the unit again. Then, pump air from the specimen chamber.
- (3) It may take longer to reach to the specified vacuum status if the specimen is dried insufficiently. Turn OFF and ON the [EVAC POWER] switch at side of the main unit.
- (4) If the error is occurred again, please contact a service engineer of Hitachi High-Tech Corporation.


6.3 When the vacuum status of electron gun is less than the specified value

If the vacuum status of electron gun is deteriorated than the following value, carry out the electron gun baking.

IP1: $>2 \times 10^{-7}$ Pa

IP2: $>2 \times 10^{-5}$ Pa


Contact a service engineer of Hitachi High-Tech Corporation if the vacuum status will not improve after carrying out the electron gun baking.

 **WARNING:** Since the voltage up to AC 100 V, DC 30 kV are used inside of this instrument, it can cause of receiving electric shock due to contacting. When contacting to the main unit part, the control area, or inner parts or circuit by removing the power supply area, it can cause death or severe injury by receiving an electric shock. Do not remove the cover.

6.4 When emission current is not set to normal value

If the emission current does not flow normally or the error code [10133] dialog is displayed, confirm, and operate the following procedure.

- (1) Open the electron gun dialog by clicking the [Menu]>[Maintenance]>[Electron gun] and compare the current value of extracting voltage/suppressor voltage/filament current and set value. If the value is greatly different, shut down the electron gun and perform the [Start-up] of the electron gun.
- (2) Perform the aging by clicking the [Electron gun aging].
- (3) Display the vacuum system dialog by clicking the [Menu] > [Maintenance] > [Vacuum display] and confirm the vacuum status of IP-1 and IP-2. If the vacuum status is out of the specified value, carry out the electron gun baking. Then, start up the electron gun.

 **WARNING:** Since the voltage up to AC 100 V, DC 30 kV are used inside of this instrument, it can cause of receiving electric shock due to contacting. When contacting to the main unit part, the control area, or inner parts or circuit by removing the power supply area, it can cause death or severe injury by receiving an electric shock. Do not remove the cover.

6.5 When SEM image does not display on the screen

Check the followings if the SEM image is not displayed or difficult for focusing.

- (1) Check if a specimen is set, the position of specimen is properly set for observing, the accelerating voltage and emission current are normal, signal (Detector) is properly selected for observing or spot intensity is not too small.
- (2) Set the contrast at the maximum.
- (3) Select the beam alignment from the [Menu] > [Alignment]. If the circular image is shifted from the center of the display, align the beam again.
- (4) If not circular image appears in (3) above, open the beam monitor aperture and objective aperture (Set to the "0" position).

If a circular image is appeared, carry out mechanical axis alignment. If the condition will not be recovered, please contact a service engineer of Hitachi High-Tech Corporation.

6.6 When noise on image is large

Three possible causes of noise on image can be considered.

- (1) Snow nose that appears uniformly on image

This type of noise is mainly due to statistical fluctuation in density of primary, secondary, or backscattered electrons. If appears when the probe current is too small, the secondary or backscattered electron emission efficiency of the specimen is too low, or the signal detection efficiency of the detector is too low. If this type of noise is conspicuous on image, check the followings.

- (a) The value of spot intensity is too small.

Set the spot intensity at larger value.

- (b) The number of integration frame is too small

If noise appears especially while the scan speed is set at Rapid or Fast, open the [Scan button settings] dialog from the [Menu]>[Scan settings] and check the setting value of the [Integration] tab. If 1 or 2 is selected, select a larger number. To set at 4 for Rapid1, 8 for Rapid2, 2 for Fast1 and 4 for Fast2 are recommended.

- (c) Contrast is set too high

Noise on image is notable when the contrast is too high. Set the contrast to low and adjust the brightness of the dark spot.

- (d) Beam does not align properly

Select the beam alignment from the [Menu]>[Alignment]. If the circular image is shifted from the center of the display, align the beam again.

- (2) When the probe current or scintillator of secondary electron detector are unstable
Noise that takes the shapes of lateral stripes or trailing bright points may appear on images. If this type of noise is conspicuous, set the WD at about 6 mm and check the differences between the detectors (UD, LD). If the noise appears in particular detector, the detector or scintillator may be deteriorated. In this case, contact a service representative of Hitachi High-Tech Corporation.
- (3) Random noise appears due to partial charge-up of a specimen
Observe another area of specimen or the surface of the specimen stub. If this eliminates the noise, it appears that the charge-up was the problem. Perform appropriate specimen pre-treatment or set the conditions that minimize the charging-up (using a low accelerating voltage or reducing the probe current).

6.7 When astigmatism cannot be corrected

Check the followings if the astigmatism still remains at the maximum correction level.

- (1) If the position of image is shifted while focusing, adjust the aperture alignment from the [Menu]>[Alignment].
- (2) Use another opening of the objective aperture. If the astigmatism is decreased in another opening, the aperture may be contaminated. Since the aperture replacement is required for improving the condition, please contact our service engineer of Hitachi High-Tech Corporation.
- (3) If the image is shifted while correcting the astigmatism, adjust the stigmator align X, Y from the [Menu]>[Alignment].

If the condition will not be improved, please contact a service engineer of Hitachi High-Tech Corporation.

6.8 When the discharge is occurred

In case of observing an insulating specimen with a project part (Dielectric material) or a field-emitting specimen (such as a carbon Nanotube), the specimen may discharge due to the electric field of objective lens.

The scintillator of Middle detector can be damaged, and observation cannot perform when the discharge is occurred repeatedly. Thus, to observe with WD=6 mm or more is recommended for observing the specimen which is mentioned as above.

If the specimen is discharged when setting the WD at 6 mm or more, set the probe current to smaller value (set spot intensity to smaller value) or fix the specimen with conductive paste or perform metal coating for the insulating specimen with project part (Dielectric material). Whereas, for the field-emitting specimen, re-consideration of the fixing method is required.

The field emission can be suppressed by fixing the specimen surface evenly when observing a carbon Nanotube. In addition, the specimen can be fixed to be flat by fixing it with conductive tape or paste and lightly press it from the top, dispersing it into solution and dropping it on the base then, drying it out, or removing the uneven part while observing with an optical microscope.

If an error message for detecting the discharging is displayed during the observation, change the observation condition or specimen fixing method according to the message.

Replacement period for the scintillator of Middle detector (Option) is 3 years or 300 times of discharging or less. It is recommended to replace the scintillator of Middle detector (Option) when the times of discharging exceeds 300 times. Please contact a service engineer of Hitachi High-Tech Corporation.

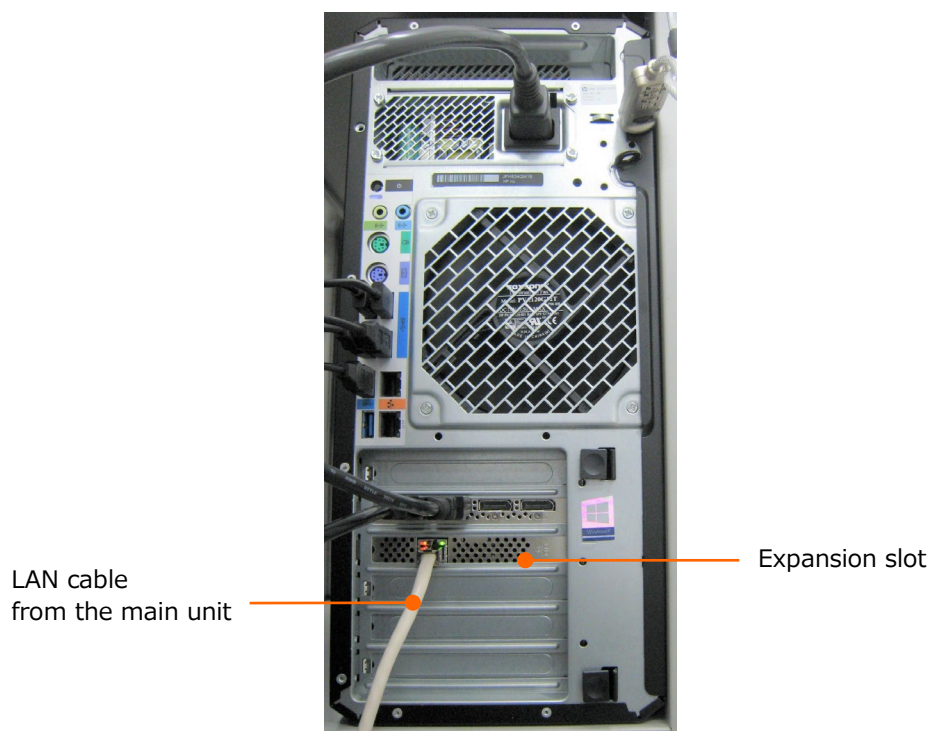
6.9 When auto focus/auto stigma function does not work properly

- (1) Execute the aperture alignment and stigmator align X, Y from the [Menu] > [Alignment] and check if the image is not wobbling. If the image is wobbling, carry out the adjustment for each settings.
- (2) If the observed specimen has no distinct surface structure, automatic adjustment may be difficult. In such a case, the preferable result may be obtained by lowering the magnification.
- (3) Optimized result may not be obtained under the abnormal contrast due to charge-up.

6.10 When SEM operation program does not start up

Check the followings if the SEM operation program does not start up (the progress bar does not extend to the end after log in) after activating and logging in the program.

- (1) Confirm if the [EVAC POWER] switch is ON.
- (2) Confirm if the STAGE breaker at rear side of the main unit is ON.
- (3) Confirm that the LAN cable is properly connected to the PC (whether the LAN cable is connected to the port at the expansion slot side) as shown in the figure below.



6.11 When the PC has frozen

If the PC has frozen during operation, shut down Windows, then restart the PC. When applications other than the SEM operation program are activated, save the important data if it is possible and then perform the shutdown procedure.

- (1) Click the Shut down for the Windows.
- (2) Wait until the computer is shut down. If the PC will not shut down for a long period, press and hold the PC power button to turn OFF the PC power.
- (3) Turn OFF the [EOC POWER] switch at front of main unit.
- (4) Wait about one minute or so and turn ON the [EOC POWER] switch (Power ON the PC unless the PC is started up automatically upon powering on the EOC unit).

If Windows could not be normally shut down at last time, the Windows Error Recovery screen will be displayed. Select the [start windows normally] to start windows.

- (5) Log in to the Windows and start up the SEM operation program.
- (6) When the SEM operation program cannot shut down normally due to PC lockup, the status of PC before shutting down may not be reproduced.

6.12 When error message is displayed

Message displayed on the operation window includes the warning messages on operation and error.

Since the messages are numbered, refer to the error message list in this manual for its countermeasure.

6.13 When condensation is occurred

When condensation occurs, the error code [E651] is displayed at front panel of the main unit and buzzer sounds.

The buzzer can be stopped by pressing the [ALARM STOP] button at front panel of the main unit. However, the error code [E651] cannot be released unless the dew forming on the condensation sensor evaporates.

When the condensation error (Error code [E651] and buzzer are ON in the front panel of the main unit, or Error code [10469] is appeared on the operation display) is displayed, adjust the room temperature or cooling water temperature so that the difference between them is 7°C or less.

The warning buzzer can be stopped by the [ALARM STOP] button at front panel but the error display cannot be released unless the dew forming on the condensation sensor evaporates.

The error should be released within the 2 to 3 hours by changing the room temperature, cooling water temperature, or turning OFF the [EOC POWER] switch immediately after condensation detection.

If the instrument is operated while error is displaying, it can cause corrosion or vacuum deterioration. Please stop the operation immediately.

6.14 Measures to take in emergency

- (1) Power OFF the MAIN breaker of the EOC unit switchboard or power OFF the switchboard breaker directly.
- (2) In case of water leakage, close the cooling water valve.
- (3) Please contact a service engineer of Hitachi High-Tech Corporation.

Appendix Error message list

The list shows the error messages that can be displayed while operating the SU8700.

Code	Category	Error Message
10002	Error	Exceeding the input range. Please check the input range.
10003	Error	Invalid characters are included. Please enter only numeric character.
10005	Error	Exceeding the input range. Please check the input range.
10006	Error	Remaining capacity of memory in the drive is insufficient. At least 550 MB is needed for starting-up the operation program. Please delete unnecessary data files and try again.
10007	Error	PC and SEM cannot communicate. Please restart the devices according to the following procedures. 1. Shut down the PC 2. Power off the [EOC POWER] switch 3. Power on the [EOC POWER] switch
10011	Error	Cannot access to the file. Please check the file.
10013	Error	Communication with image transfer is disconnected. Please check the connection of the image transfer.
10014	Error	Cannot open the file or the data is invalid. Please check the file or data.
10016	Error	High voltage power supply unit is not activated. Please close this message by pressing the [OK] and perform baking. Otherwise, perform the following procedures. 1. Shut down the PC 2. Power off the [EOC POWER] switch 3. Confirm that the HV cable is attached to the head cover 4. Confirm that the [HV] breaker of EOC unit is ON 5. Power on the [EOC POWER] switch If this message is appeared again, please contact a service engineer.

Code	Category	Error Message
10017	Error	<p>Vacuum system has not activated.</p> <p>Please restart the instrument according to the following procedures.</p> <ol style="list-style-type: none"> 1. Shut down the PC 2. Power off the [EOC POWER] switch 3. Confirm that the [EVAC POWER] switch is on 4. Power on the [EOC POWER] switch <p>If this message is appeared again, please contact a service engineer.</p>
10030	Error	<p>Specimen chamber has opened. Please close the specimen chamber.</p>
10049	CriticalError	<p>Vacuum system control power error</p> <p>Vacuum operation has stopped.</p> <p>Please turn OFF the [EVAC POWER] switch and contact a service engineer.</p> <p>{0})</p> <p>{0}:Error code</p>
10050	CriticalError	<p>Vacuum system control power error</p> <p>Vacuum operation has stopped.</p> <p>Please turn OFF the [EVAC POWER] switch and contact a service engineer.</p> <p>{0})</p> <p>{0}:EVAC error code</p>
10051	Error	<p>TMP vacuum pump error</p> <p>Vacuum operation has stopped.</p> <p>Turn off the [EVAC power] switch and wait about 30 minutes then, turn on the [EVAC power] switch.</p> <p>If this message is appeared again, please contact a service engineer.</p> <p>{0})</p> <p>{0}:EVAC error code</p>
10052	Error	<p>Pirani vacuum gauge error</p> <p>Vacuum operation has stopped.</p> <p>Turn off and on the [EVAC power] switch.</p> <p>If this message is appeared again, please contact a service engineer.</p> <p>{0})</p> <p>{0}:EVAC error code</p>

Code	Category	Error Message
10053	Error	<p>Full-range vacuum gauge error Vacuum operation has stopped. Turn off and on the [EVAC power] switch. If this message is appeared again, please contact a service engineer. ({0}) {0}:Error code</p>
10056	Error	<p>The specimen exchange chamber cannot be in the atmospheric condition. Please perform the following operations. 1.Power off the [EVAC POWER] switch 2.Check if the remaining gas amount and current are optimized 3.Power on the [EVAC POWER] switch If this message is appeared again, please contact a service engineer. ({0})</p>
10057	Error	<p>Vacuum valve error Vacuum operation has stopped. Turn off and on the [EVAC power] switch. If this error message is appeared again, please contact a service engineer. ({0}) {0}:EVAC error code</p>
10058	Error	<p>Vacuum valve error Vacuum operation has stopped. Turn off and on the [EVAC power] switch. If this error message is appeared again, please contact a service engineer. ({0}) {0}:EVAC error code</p>

Code	Category	Error Message
10059	Error	<p>Vacuum system error</p> <p>Please perform the following operations.</p> <ol style="list-style-type: none"> 1. Click [Specimen exchange] button 2. Check if the specimen stage and specimen chamber are firmly closed 3. Click [EVAC] button <p>In case the air cannot be vented to the specimen chamber, turn off and on the [EVAC POWER] switch</p> <p>If this message is appeared again, please contact a service engineer.</p> <p>{0}) {0}:EVAC error code</p>
10060	Error	<p>The specimen exchange rod is not pulled out completely.</p> <p>Please pull out the specimen exchange rod until stopped.</p> <p>{0}) {0}:EVAC error code</p>
10061	Error	<p>Specimen exchange chamber is opened.</p> <p>Please close the specimen exchange chamber.</p> <p>{0}) {0}:EVAC error code</p>
10062	Error	<p>The pressure of the compressed air is decreased.</p> <p>Please perform the following operations.</p> <ol style="list-style-type: none"> 1. • In case of using an air compressor → Check if the valve at the air outlet. • In case of using utility air → Check the air supply 2. Power off the [EVAC POWER] switch 3. Confirm that the air pressure is recovered 4. Power on the [EVAC POWER] switch <p>If this message is appeared again, please contact a service engineer.</p> <p>{0}) {0}:EVAC error code</p>
10085	Error	<p>High voltage power supply unit is not activated.</p> <p>Please restart the instrument according to the following procedures.</p> <ol style="list-style-type: none"> 1. Shut down the PC 2. Power off the [EOC POWER] switch 3. Confirm that the HV cable is attached to the head cover 4. Confirm that the [HV] breaker of EOC unit is ON 5. Power on the [EOC POWER] switch <p>If this message is appeared again, please contact a service engineer.</p>

Code	Category	Error Message
10086	Confirmation	The setting value will be saved by clicking [Save]. Do you want to save the setting value?
10087	Warning	The increment operation time or accumulated value of [Startup] times will be reset. Please do not reset the accumulated value unless replacing a chip.
10088	Info	The setting value is being changed to the previous value.
10089	Confirmation	The setting value has not saved. Do you want to save the setting value?
10090	Info	[Startup] of electron gun will start.
10091	Info	Electron gun voltage is increasing. Please do not operate the vacuum system before [Startup] of electron gun is completed. {0} {0}: Sequence condition
10097	Info	[Startup] of electron gun has completed.
10098	Info	[Startup] of electron gun has completed. (Emission current is lower than the optimal range)
10099	Error	[Startup] of electron gun error. (Emission current has not reached to the setting value.)
10100	Error	[Startup] of electron gun error. [Startup] of electron gun has stopped.
10101	Error	Electron gun will be shutdown because vacuum status does not reach to the setting value. (If 0 to 1.6A) Please perform [Baking] again.
10102	Error	Electron gun will be shutdown because vacuum status does not reach to the setting value. (If 1.6 to 2.0A) Please perform [Baking] again.
10103	Error	Electron gun will be shutdown because vacuum status does not reach to the setting value. (If 2.0 to 2.5A) Please perform [Baking] again.
10104	Error	Electron gun will be shutdown because vacuum status does not reach to the setting value. (Vext) Please perform [Baking] again.
10105	Error	Electron gun will be shutdown because emission current is not reached to the setting value. Please perform [Baking] again.
10106	Info	[Aging] of electron gun will start.

Code	Category	Error Message
10107	Info	[Aging] of electron gun is performing. {0} Please do not operate vacuum system until [Aging] is completed. {0}: Sequence condition
10108	Info	[Aging] of electron gun has completed.
10109	Error	[Aging] of electron gun error [Aging] of electron gun has stopped.
10110	Info	[Aging] of electron gun has canceled.
10111	Info	[Aging] of electron gun is performing. Accelerating voltage is decreasing. Please do not operate vacuum system until [Aging] is completed.
10112	Error	[Aging] of electron gun has canceled because the vacuum condition is decreased. (Vacc 2kV)
10113	Error	[Aging] of electron gun has canceled because the vacuum condition is decreased. (Vacc 5kV)
10118	Info	[Aging] of electron gun has canceled.
10119	Info	The [Aging] of electron gun is canceling.
10120	Info	Booster voltage has turned OFF.
10121	Info	[Aging] of electron gun has canceled because the vacuum condition is decreased. (Vacc 1kV)
10122	Info	Electron gun is shutting down.
10123	Info	HV will be turned OFF.
10124	Info	Electron gun will be shutdown.
10126	Info	Electron gun has shut down.
10128	Error	PC and SEM cannot communicate. Please restart the devices according to the following procedures. 1. Shut down the PC 2. Power off the [EOC POWER] switch 3. Power on the [EOC POWER] switch
10129	CriticalError	Electron gun has shutdown because control circuit for the HV power error has occurred. Please contact a service engineer of Hitachi High-Tech Corporation.

Code	Category	Error Message
10130	Error	<p>Electron gun is shutdown because the communication error of HV power is occurred.</p> <p>Please perform the following operations.</p> <ol style="list-style-type: none"> 1. Power OFF the [HV] breaker of EOC unit 2. Shut down the PC and power OFF the [EOC POWER] switch 3. Power on the [HV] breaker 4. Power on the [EOC POWER] switch 5. Execute the [Startup] of electron gun <p>If this error message is appeared again, please contact a service engineer.</p>
10131	CriticalError	<p>Observation has stopped because the HV power of cooling fan error is occurred.</p> <p>Please contact a service engineer.</p>
10132	Error	<p>Electron gun has shutdown due to over current.</p> <p>Please perform [Startup] of the electron gun.</p> <p>If this message is appeared again, please contact a service engineer.</p>
10133	Error	<p>Ion pump error</p> <p>Electron gun has shut down.</p> <p>Please perform [Startup] of electron gun after the vacuum condition is improved.</p> <p>If this message is appeared again, please contact a service engineer.</p> <p>This message is displayed in the following conditions.</p> <ul style="list-style-type: none"> • The pressure condition of electron gun has decreased. • The ion pump cover is dislocated or removed. • The breaker of ion pump power is OFF.
10134	Error	<p>Emission current has decreased.</p> <p>Please check the setting of electron gun.</p>
10135	CriticalError	<p>The setting range of filament current is invalid.</p> <p>Please contact a service engineer of Hitachi High-Tech Corporation.</p>
10136	CriticalError	<p>Electron gun has shutdown because of the filament drive voltage error.</p> <p>The filament may be disconnected.</p> <p>Please contact a service engineer of Hitachi High-Tech Corporation.</p>
10137	CriticalError	<p>Electron gun has shutdown because of the electron gun drive voltage error.</p> <p>Please contact a service engineer.</p>
10138	CriticalError	<p>Electron gun is shutdown due to overheat of HV power supply.</p> <p>Please contact a service engineer.</p>

Code	Category	Error Message
10139	Error	Electron gun is shut down because, safety interlock of high voltage is activated.
10140	Error	Cannot communicate with HV power unit. Please perform the following operations. 1. Shut down the PC 2. Power off the [EOC POWER] switch 3. Confirm that the HV cable is attached to the head cover 4. Confirm that the [HV] breaker of EOC unit is ON 5. Power on the [EOC POWER] switch 6. Execute [Startup] of electron gun If this message is appeared again, please contact a service engineer.
10141	Error	Vacuum system error/Interlock error. Please execute it again when the vacuum condition is recovered or the interlock unit error is released. If the error message is displayed again, please contact a service engineer of Hitachi High-Tech Corporation.
10142	Error	Cannot close the gun valve (GV) . Please check the vacuum system.
10143	Error	Cannot open the gun valve (GV) . Please check the vacuum system.
10145	Info	Extracting voltage value is changing.
10146	Info	Suppressor voltage value is changing.
10147	Info	Filament current value is changing.
10149	Error	Stage error Stage is out of the maximum range (X-axis). If this message is appeared again, please contact a service engineer.
10150	Error	Stage error Stage is out of the minimum range (X-axis). If this message is appeared again, please contact a service engineer.
10151	Error	Stage error Stage is out of the maximum range (Y-axis). If this message is appeared again, please contact a service engineer.
10152	Error	Stage error Stage is out of the minimum range (Y-axis) . If this message is appeared again, please contact a service engineer.

Code	Category	Error Message
10153	Error	Stage error Stage is out of the maximum range (Z-axis). If this message is appeared again, please contact a service engineer.
10154	Error	Stage error Stage is out of the maximum range (Z-axis). If this message is appeared again, please contact a service engineer.
10155	Error	Stage error Stage is out of the maximum range (T-axis). If this message is appeared again, please contact a service engineer.
10156	Error	Stage error Stage is out of the maximum range (T-axis). If this message is appeared again, please contact a service engineer.
10157	Error	Stage error Stage is out of the maximum range (R-axis). If this message is appeared again, please contact a service engineer.
10158	Error	Stage error Stage is out of the maximum range (R-axis). If this message is appeared again, please contact a service engineer.
10162	Error	Stage error Track ball or joy stick is operating. Please stop operating the track ball or joy stick and wait until the stage is stop.
10175	Error	Cannot move the stage. Please perform the following operations. 1. Turn OFF and ON the [STAGE] breaker at rear side of the main unit. 2. Confirm that the stage is stopped 3. Download the stage program again
10196	Error	Cannot move the stage. Please turn off and on the vacuum system and stage powers.
10199	Confirmation	Do you want to apply the calibration value?
10203	Error	Stage has inserted. The specimen can be damaged due to contacting the specimen chamber. Please open the specimen exchange chamber gate for inserting the stage.

Code	Category	Error Message
10206	Error	Cannot move the stage to the specimen exchange position. Please pull out the following detectors. {0} {0}:Detector name
10211	CriticalError	Vacuum system control power error Vacuum operation has stopped. Please turn OFF the [EVAC POWER] switch and contact a service engineer.
10212	Error	The observation condition may be out of the condition for adjusting the auto contrast. Please adjust the contrast manually or retry the auto contrast adjustment under the low magnification.
10213	Error	The observation condition can be out of the effective range of [ABCC]. Please perform the following operations. 1.Select each signals before mixing. 2.Adjust the brightness 3.Select MIX and press [ABCC] again.
10214	Error	The user name is already used for the default. Please enter other user name.
10215	Error	The user name has not registered. Please enter a valid user name.
10216	Error	Password is incorrect. Please enter correct password.
10217	Error	Cannot load the file. Please check the file.
10218	Info	The {0} already exists. {0}:File name or User name
10219	Info	Time out. Restart the scanning.
10220	Error	Time out. If this message is appeared again, please contact a service engineer.
10221	Error	Execute it after [HV] is on.
10222	Error	Time out. If this message is appeared again, please contact a service engineer.
10223	Error	Cannot capture the image.
10224	Error	Remaining capacity of memory in the drive is insufficient. More than {0} MB of remaining capacity is necessary. {0}:Threshold
10226	Error	Remaining capacity of memory in the drive is insufficient.

Code	Category	Error Message
10227	Error	Please input file name.
10228	Error	Please input user name.
10229	Info	Auto increment counter has reached 9999.
10232	Error	Cannot find the folder or cannot save the file because invalid character is included. Please re-select the folder name.
10233	Error	Invalid character is included.
10234	Error	Invalid file name.
10235	Error	Number of entered file name is exceeded the limitation value. Please enter the file name within 255 characters including the folder name.
10236	Error	The user name is invalid.
10237	Error	The specimen name is invalid.
10238	Error	Invalid Keyword.
10239	Error	Number of input data exceeds the limit. Please delete unnecessary data and input the data again.
10240	Error	New password and re-entered password are unmatched. Please check the password and enter again.
10241	Error	Cannot delete the user name.
10242	Error	Cannot save the file.
10243	Confirmation	Do you want to exit from Operation program?
10244	Info	TMP maintenance is needed. Please contact a service engineer.
10245	Confirmation	{0} already exists. Do you want to overwrite? {0}:File name
10246	Confirmation	Do you want to delete {0} ? {0}:File name or User name
10247	Confirmation	Do you want to initialize this [Standard settings] dialog?
10248	Confirmation	Do you want to set the [Stigmator correction/Alignment]?
10249	Confirmation	Do you want to restore the observation position?
10250	Info	Please exit and restart the operation program for applying the language.
10251	Warning	The latest EO Adjust value has not saved. The adjusted value that is set/get at adjustment window may be changed from the saved value. However, these values are not saved to the file. [Notes] Even if the EO Adjust window is closed without file saving, SEM is operated under the current setting value at the adjustment window until operation program is closed.

Code	Category	Error Message
10252	Info	Please exit and restart the operation program for applying the contents.
10254	Confirmation	Do you want to turn off [HV] ?
10255	Error	Serial number is incorrect. Please enter correct serial number.
10256	Confirmation	Do you want to delete this option?
10257	Info	Password has changed.
10258	Info	Please perform the following operations. 1. Move the target structure to the center of display 2. Click [Enter] 3. Stage is rotated by 45 deg. Repeat the 1 and 2 operations up to 315 deg 4. Click [Apply]
10259	Info	Stage Z axis will move {0} mm to {1} mm stepwise. Please perform the following operations. 1. Adjust focus at each position 2. Move the target structure to the center of image 3. Click [Load] 4. After loading the image is completed, click [Apply] {0} to {1}:Minimum value to maximum value
10262	Info	Please move the height of stage Z at {0} mm. {0}:Z axis coordinate
10263	Info	Cannot move the stage due to out of the movable range.
10264	Confirmation	Do you want to delete the all history data?
10265	Confirmation	Do you want to delete the history data?
10266	Info	The starting date for displaying a message of the TMP maintenance will set at {0}. {0}: Date
10268	Error	[ABCC] error
10269	Error	[AFC] error
10270	Error	[ASC] error
10272	Error	[AAA]Error
10277	Info	Cannot find the {0}. {0}:File name
10278	Info	Unauthorized.
10279	Info	Observation condition settings is performing.
10280	Error	The number of observation conditions are exceeded the limit (1000) . Please delete the unnecessary conditions.
10302	Info	[ABCC] is executing.
10303	Info	[AFC] is executing.

Code	Category	Error Message
10304	Info	[ASC] is executing.
10305	Info	[ABA] is executing.
10314	Info	The value of [Accelerating voltage] is changing.
10315	Info	[Auto start] is performing.
10316	Info	[HV ON] is performing. {0}
10317	Info	[HV OFF] is performing.
10318	Error	Number of entered file name is exceeded the limitation value. Please enter the file name within 255 characters including the folder name.
10320	Error	Please input user name.
10331	Error	Cannot change the password because the base folder cannot be found.
10332	Error	Cannot find the base folder. Please check the folder.
10333	Error	Please select user name from the list.
10334	Info	The user name can be registered up to 200.
10335	Info	Cannot find the base folder. PC-SEM will activate at the default value.
10336	Confirmation	Do you want to initialize this [Standard settings] dialog? In case of initializing the language, please exit and restart the operation program.
10339	Error	Cannot perform the Tru-image.
10342	Info	Cannot perform the Tru-image under the Reduce mode. The image which is not performed the Tru-image will be saved.
10358	Error	Cannot operate on the display when executing the [Baking] from the [Operation panel] on the main unit. Please perform [Settings] or [Release] according to the [operation panel] on the main unit.
10374	Info	Move the target structure of specimen to the center of the display and click the position that is corresponded to the navigation image. ({0}/3) {0}: Alignment point (1 to 3)
10375	Info	Alignment is completed. Return to the SEM MAP image display.
10376	Error	Cannot obtain the stage coordinate. Alignment is canceled.
10377	Error	Alignment points are too close. Please set the alignment points again.
10378	Error	Calculation value of alignment is invalid. Please set the alignment points again.

Code	Category	Error Message
10379	Error	Please use this function with the magnification that is lower than x {0}. {0}:Threshold(Mag)
10380	Error	T-axis is tilted. Move the T-axis at 0 deg and set the alignment point again.
10381	Info	Please select an image which size is more than 300 x 225.
10382	Error	Cannot load the image file.
10399	Confirmation	The position of objective aperture should be adjusted right after the mechanical axis alignment is performed. Have you align the mechanical axis?
10400	Warning	Please align the mechanical axis and adjust again.
10401	Warning	Select [High vacuum mode] from [Vacuum settings] then, set the [Objective aperture].
10402	Info	Adjustment condition of [Objective aperture] is applying.
10403	Info	[Adjust Objective aperture] is completing.
10404	Info	[Adjust Objective aperture] has completed.
10405	Warning	[Adjust Objective aperture] has canceled.
10406	Error	Cannot move to the adjustment position of [Objective aperture].
10407	Confirmation	Do you want to remove the image from the image list No.{0}? {0}: Image No.
10408	Confirmation	Do you want to remove the image from the image list No.{0}? {0}: Image No.
10410	Info	Update the image list because the image list or file does not exist.
10411	Error	Cannot display the image. The maximum number of image for displaying is up to 16. Please close the unnecessary images.
10412	Error	Cannot overwrite the data because the information is protected.
10413	Confirmation	Do you want to delete the navigation image file of the image area No. {0}? {0}: Image No.
10414	Confirmation	Do you want to delete the navigation image file of the image area No. {0}? {0}: Image No.
10415	Error	Cannot delete the data because the information is protected.
10416	Error	A protected information is selected. The information is unable to delete.
10417	Clock	Image file is loading. {0} {0}:Progress (File count)

Code	Category	Error Message
10418	Confirmation	{0} image is already existed on the image list. Overwritten image will be listed at the end of the image list. Do you over write it? {0}:File name
10419	Confirmation	{0} image is already existed on the image list. Overwritten image will be listed at the end of the image list. Do you over write it? {0}:File name
10420	Error	{0} has not captured by {1} or the file may be damaged. {0}:File name, {1}: Device name
10421	Error	{0} has not captured by {1} or the file may be damaged. {0}:File name, {1}: Device name
10422	Error	Cannot read more than {0} of image files at once. {0}: Maximum value
10423	Info	Auto increment counter has reached 9999.
10424	Error	Batch process of [Rename] has canceled. The file name of thumbnail image and the name of actual image file may not matched.
10430	Error	This command is invalid.
10435	Info	Processing.
10436	Confirmation	Do you want to apply the settings?
10437	Confirmation	Do you want to set to the default?
10438	Error	Cannot apply the setting of {0} because the setting range is exceeded. {0}:Edit list name
10439	Error	Please enter within 5 letters.
10450	Info	The {0} is already used as a user name. {0}:User name
10451	Confirmation	The setting value has not saved. Do you want to close the window?
10452	Error	Cannot execute [Calibration]. Please change the specimen stub size.
10453	Error	Cannot execute [Calibration] due to detectors are inserted. Please pull out all detectors and perform the [calibration].

Code	Category	Error Message
10454	Info	<p>Please perform [Calibration] according to the following procedure.</p> <ol style="list-style-type: none"> 1. Move the target structure to the center of display 2. Click [enter] of the Tilt 0 deg 3. Stage is tilted at 20 and 40 deg. Move the observation point to the center of display by each tilted angle 4. Click [Apply]1.Move the target structure to the center of display 5. Click [[Apply]
10455	Info	<p>Please perform [Calibration] according to the following procedure.</p> <ol style="list-style-type: none"> 1. Move the target structure to the center of display 2. Click [enter] of the Tilt 0 deg 3. Stage is tilted at 20 deg. Move the observation point to the center of display 4. Click [enter] of tilt 20 degree 5. Click [Apply]
10456	Error	<p>Cannot perform [Calibration]. Please set the specimen height at 0 mm.</p>
10457	Error	<p>Cannot perform [Calibration]. Please perform the following operations.</p> <ol style="list-style-type: none"> 1. Set the accelerating voltage within the range of 1 to 5 kV 2. Set the spot intensity less than 30 3. Turn OFF the booster voltage
10458	CriticalError	<p>The vacuum system is set in the maintenance mode. Please turn OFF the [EVAC POWER] switch and contact a service engineer. {0} {0}:EVAC error code</p>
10459	Error	<p>Cannot reached to the setting pressure of specimen exchange chamber. Please perform the following operations.</p> <ol style="list-style-type: none"> 1. Check if the specimen exchange chamber is firmly closed 2. Click [AIR] and check if it is firmly closed to the specimen chamber without any space 3. Press [EVAC] or [OPEN] on the specimen exchange chamber <p>If this message is appeared again, please contact a service engineer. {0} {0}:EVAC error code</p>

Code	Category	Error Message
10460	CriticalError	Gate valve of specimen exchange device error Please turn OFF the [EVAC POWER] switch and contact a service engineer. {0} {0}:EVAC error code
10461	CriticalError	Vacuum system valve error Please turn OFF the [EVAC POWER] switch and contact a service engineer. {0} {0}:EVAC error code
10462	Info	The HV for the IP-{0} will be turned off. {0}:IP-No.
10463	Info	The HV for the IP-{0} is turning on. {0}:IP-No.
10464	Error	Overheat protection of control power is activated. Please shut down the PC and power OFF the [EOC POWER] switch then, wait about half an hour and restart the system. If this message is appeared again, please contact a service engineer.
10465	Error	Overheat protection of control power is activated. Please shut down the PC and power OFF the [DISPLAY POWER] switch then, wait about half an hour and restart the system. If this message is appeared again, please contact a service engineer.
10466	Info	System has recovered.
10467	Error	HV has turned OFF due to the signal system error. [{0}]Error. {0}:Target detector
10469	Error	The condensation is occurred in objective lens and the cooling water system. Please shut down the PC and power OFF the [EOC POWER] switch then, maintain the air temperature.
10470	Info	MD signal that is added to the other display is turned OFF because MD is selected.
10471	Info	LD signal that is added to the other display is turned OFF because LD is selected.
10473	Info	Condenser lens 1 and 2 are set on.
10474	Confirmation	The setting position is out of movable range of X and Y. The stage can be moved by rotating the stage. Do you want to change the setting for moving the selected position after rotating the stage?

Code	Category	Error Message
10475	Error	Decelerating error HV has turned OFF. If this message is appeared again, please contact a service engineer.
10476	Error	Detector error HV has turned OFF. If this message is appeared again, please contact a service engineer. {0}{1} {0}:Target booster unit, {1}:Error contents
10477	Error	Cannot execute while beam marking is performing.
10478	Error	Execute it after [HV] is on.
10480	Error	Cannot used with the selected signal or scan mode.
10481	Confirmation	Turn off Live Image processing. Are you sure?
10483	Info	The Tru-Image is not executed in a present condition. Only the normal image will be captured.
10484	Info	Parameters have not saved.
10485	Error	Cannot add the item because the number of setting items has reached to the limit.
10486	Confirmation	{0} Do you want to set to the standard settings? {0}: Function
10487	Confirmation	Do you want to update the maintenance date for the rough pump? Maintenance Date: {0} {0}: Date
10488	Info	[Air Flushing] for the dry pump will be performed. The [Air Flushing] is performed while the dry pump is in the atmospheric condition. It takes approximately 5 minutes to complete.
10489	Info	[Air Flushing] for the dry pump is performing. It takes approximately 5 minutes to complete.
10490	Info	[Air Flushing] for the dry pump has canceled.
10491	Info	[Air Flushing] for the dry pump will be performed. The [Air Flushing] is performed while the dry pump is in the atmospheric condition. It takes approximately 5 minutes to complete.

Code	Category	Error Message
10492	Info	<p>The maintenance of rough pump which is used for the SU8700 is required to perform within 2 months. Please contact a service engineer and carry out the maintenance before the following date.</p> <p>Maintenance is required by: {0}</p> <p>In case the rough pump is continued to use without maintenance, failure of SU8700 can be occurred because, the label can be worn out and the grease of bearing can be insufficient. {0}: Date</p>
10493	Info	<p>The maintenance of rough pump which is used for the SU8700 is required to perform within 1 months. Please contact a service engineer and carry out the maintenance before the following date.</p> <p>Maintenance is required by: {0}</p> <p>In case the rough pump is continued to use without maintenance, failure of SU8700 can be occurred because, the label can be worn out and the grease of bearing can be insufficient. {0}: Date</p>
10494	Info	<p>The date of maintenance for the rough pump which is used for the SU8700 has expired. In case the rough pump is continued to use without maintenance, failure of SU8700 can be occurred because label can be worn out and the grease of bearing can be insufficient. Shutdown the vacuum system and perform the maintenance of the rough pump. Please contact a service engineer regarding to the maintenance.</p> <p>Maintenance is required by: {0} {0}: Date</p>
10495	Error	<p>Please lower the Z-axis for tilting the stage at {0} deg and more. {0}: Tilting angle</p>
10496	Error	<p>Pull out all detectors to the extract position.</p>

Code	Category	Error Message
10497	Error	Detector has inserted. Buzzer sounds while stage is moving to safety position. Stop to insert the detector and confirm that the buzzer is stopped. Then, insert the detector again. If buzzer does not sound, you can insert detector immediately.
10498	Error	Stage has locked. Unlock the stage for moving the Z-axis .
10499	Error	Stage has locked. Unlock the stage for moving the T-axis of stage.
10500	Error	Stage lock error Cannot lock the stage Z-axis and T-axis of stage are moving or initialization of Z-axis and T-axis of stage have not completed. Please wait until the moving or initialization of stage is completed. If this message is appeared again, contact a service engineer. If this message is appeared again, please contact a service engineer.
10501	Info	Error X-axis of stage is initializing. Please wait until initialization is completed.
10502	Info	Error Y-axis of stage is initializing. Please wait until initialization is completed.
10503	Info	Error Z-axis of stage is initializing. Please wait until initialization is completed.
10504	Info	Error T-axis of stage is initializing. Please wait until initialization is completed.
10505	Info	Error R-axis of stage is initializing. Please wait until initialization is completed.
10506	Error	Time out. Motor of detector is not activated. Please check the motor of detector.
10507	Error	Over run error Z-axis (CCW side) of stage has overrun. In case the stage will not be recovered automatically, please initialize the stage.

Code	Category	Error Message
10508	Error	Over run error Z-axis (CW side) of stage has overrun. In case the stage will not be recovered automatically, please initialize the stage.
10509	Error	Over run error T axis (CCW side) of stage has overrun. In case the stage will not be recovered automatically, please initialize the stage.
10510	Error	Over run error T axis (CW side) of stage has overrun. In case the stage will not be recovered automatically, please initialize the stage.
10511	Error	Error Stage cannot be moved while the specimen exchange rod is inserted. Please extract the specimen exchange rod.
10512	Error	Stage motion (R-axis) error Please check the parameter for R-axis DC motor or hardware.
10513	Error	Stage motion (R-axis) error Please check the parameter for R-axis DC motor or hardware.
10514	Error	Error Stage motion (R-axis) error has occurred while the CW-axis is moving. Please check the parameter for R-axis DC motor or hardware.
10515	Error	Stage error Stage motion (R-axis) error has occurred while the CCW-axis is moving. Please check the parameter for R-axis DC motor or hardware.
10516	Error	Error Detector has inserted. Cannot initialize the stage while this detector is inserted. Please extract the detector.
10517	Error	Error Detector has inserted. Detectors which cannot be used simultaneously are inserted. Please pull out the detectors.
10518	CriticalError	The vacuum system is set in the maintenance mode. Please turn OFF the [EVAC POWER] switch and contact a service engineer. {0} {0}:EVAC error code

Code	Category	Error Message
10519	Info	Detector is inserted while PC-SEM is deactivated or stage error is occurred. Stage will be initialized.
10520	Error	Cannot move the stage to the initializing position. Confirm the detector condition.
10521	Info	Reference image will be obtained. Overwrite it to the obtained reference image.
10522	Info	Obtaining a reference image is canceled.
10523	Info	Obtaining condition and inserting condition of detector are not matched.
10524	Error	Cannot initialize the stage. Power off and on the stage power. If this message is appeared again, please contact a service engineer. Turn off and on the the stage Power supply switch.
10525	Info	Cannot read the stage setting file. Stage setting will be reset.
10526	Confirmation	Focus mode has changed. Do you want to set to the default condition (high resolution) ?
10527	Info	Booster voltage setting is applying.
10528	Info	The detector buttons can be displayed up to 8 buttons at maximum.
10529	Info	The graphic board that the product supports is not installed. Application behavior may be delayed.
10532	Error	Cannot place to the position.
10533	Info	Exit from software. Please wait.
10534	Info	Stage is moving to the observation position.
10535	Info	Use specimen bias under 6mm or shorter working distance. The Specimen bias should be performed at WD 6mm or shorter.
10536	Info	Switch to Manual mode Click [Keep present value] or [Use previous Manual mode value].
10537	Info	Mode is changing.
10538	Confirmation	The combination of irradiation voltage and specimen bias is inappropriate. Do you want to change to available combination?
10539	Error	The specimen height is exceeded 30 mm. Set the specimen height within the 30 mm.
10540	Confirmation	The specimen height has not selected. Do you want to unselect the specimen?
10541	Confirmation	Cannot perform with the current accelerating voltage value. Do you want to change to the value which is capable of setting?

Code	Category	Error Message
10543	Error	Cooling water error The amount of cooling water is out proper amount. Please adjust the flow amount of the cooling water.
10544	Info	Frame list is being created.
10545	Info	Frame is being saved.
10546	Error	The comparison image does not exist. Please select a comparison image.
10547	Confirmation	Do you want to overwrite the created image on the comparing image?
10548	Error	The frames for creating an image has not been selected. Please select two or more frames.
10549	Error	Fail to capture the images. Please check the capturing area and capture the images again.
10550	Error	Cannot perform the Drift correction. Please check the images and perform the Drift correction again.
10551	Error	Cannot create an image. Please check the images and capture the images again.
10552	Info	Auto frame selection is performing.
10553	Error	The frame does not exist in the selected folder. Please select a folder again.
10554	Error	The number of frame in the folder exceeds the allowable number. Please select a new holder or delete the unnecessary data.
10555	Error	Cannot load the frame. Please check the frame.
10556	Error	The configuration information file does not exit. Please check the data.
10557	Info	An image is being created.
10558	Confirmation	Do you want to delete the current setting of user information In case of exit operation program forcibly, restart the PC.
10559	Error	Close the gate valve and execute again.
10561	Error	Cannot recover the observation condition because, interlock unit is not equipped. Please equip a interlock unit and load the observation condition.
10562	Info	Number of objective lens is different. Do you want to perform the processing with the current aperture condition?

Code	Category	Error Message
10563	Error	Cannot restore the observation position because the position is out of the stage movable range. Please confirm the setting of the specimen size or detector position.
10564	Info	A detector/Unit that is unable to equip has set. {0} {0}: Accessory device name (Including the detector names)
10565	Info	Please extract all inserted detectors.
10566	Error	Although insertion or equipping an unknown option device was detected, the detector ports setting of SEM has not completed. Please extract the device and contact a service engineer.
10567	Info	Data with TIFF(16bit) cannot be saved under the 4 Screen and 6 Screen Display Modes. The image file type will be changed to TIFF.
10568	Info	Cannot perform Tru-Image while selecting TIFF(16bit). The TIFF(16bit) image will be captured without performing the Tru-Image.
10574	Error	Cannot perform the [Lock] for stage. Set the Z within the range of [Z + specimen height (setting value) \leq 12mm, T=0 deg] for locking the Z and T axes of stage.
10577	Info	{0} is selected. {1} signal on other image screen will be changed together to {0} as these signals use same image channel. OK? {0} to {1}: Signal name
10578	Info	Cannot execute the High definition capture with the current conditions.
10579	Error	{0} cannot loaded because of image sizes larger than 5120 x 3840. {0}:File name
10580	Error	{0} cannot loaded because of image sizes larger than 5120 x 3840. {0}:File name
10581	Error	{0} cannot loaded because of image format is TIFF(16bit). {0}:File name
10582	Error	{0} cannot loaded because of image format is TIFF(16bit). {0}:File name
10583	Confirmation	Cannot save images captured with high definition capture. Do you want to perform the processing after restarted the scanning?
10584	Info	High definition capture is completed.

Code	Category	Error Message
10585	Info	Gamma correction can not be applied to the mixed signal Image. Turn off gamma correction.
10586	Info	Cannot recover the observation condition because, booster voltage setting is different. Please check the setting of booster voltage.
10587	Info	Move the target structure of specimen to the center of the display and click the position that is corresponded to the navigation image.
10588	Error	The adjustment range is exceeded range for offsetting. Please set the stage again to positions where the stage and the camera image positions are within the ± 1 mm.
10590	Error	Fail to perform [HV ON].
10591	Confirmation	The measurement result of the current optical condition already exists. Do you want to overwrite?
10592	Info	The measurement result of the selected optical condition does not exist.
10593	Info	The number of graph has reached to the maximum number to display. Please hide the unnecessary graph.
10594	Confirmation	The data will be completely deleted. Do you want to delete the data?
10595	Info	Switch to Manual mode Select Vlanding and Vbias setting.
10596	Confirmation	The combination of irradiation voltage and deceleration voltage are not appropriate. Do you want to change to available combination?
10597	Error	Cooling water has stopped to introduce to the system because, water leakage is detected. Can cause of injury due to electric shock. Stay away from the system and contact a service engineer. If it is possible, shut down or stop the water supply including the cooling watery circulation system. {0} {0}:EVAC error code

Code	Category	Error Message
10598	Error	<p>Cooling water has stopped to introduce to the system because, water leakage is detected.</p> <p>Can cause of injury due to electric shock. Stay away from the system and contact a service engineer.</p> <p>If it is possible, shut down or stop the water supply including the cooling watery circulation system.</p> <p>{0})</p> <p>{0}:EVAC error code</p>
10600	Info	Specimen bias was turned OFF because the booster voltage was turned OFF.
10602	Error	<p>Detector/Booster power error</p> <p>HV has turned OFF.</p> <p>Check the protection unit status.</p> <p>If this message is appeared again, please contact a service engineer.</p>
10608	Info	The HV will be OFF for switching the Vb mode.
10609	Info	The Vb mode is switching.
11018	Error	<p>Control unit versions are not matched.</p> <p>Please contact a service engineer.High voltage Control unit is not activated.</p>
11019	CriticalError	<p>Combination of the control unit and application versions are incorrect.</p> <p>Please contact a service engineer.</p>
11020	Info	<p>Control unit version is not matched. Start Update.</p> <p>Target unit : {0}</p> <p>Note: It takes a few minutes to update.</p> <p>{0}:Unit name</p>
11021	Info	<p>Control unit version is not matched. Start Update.</p> <p>Target unit : {0}</p> <p>Note: It takes a few minutes to update.</p> <p>{0}:Unit name</p>
11022	Info	<p>Control unit is updating.</p> <p>Processing unit : {0}</p> <p>Note: It takes a few minutes to update.</p> <p>{0}:Unit name</p>
11023	Info	<p>Updating of control unit is succeeded.</p> <p>Please restart the applications.</p>

Code	Category	Error Message
11024	Error	Updating of control unit is failed. Turn off the [EOC POWER] switch at the main unit and update the control unit again. If the error is occurred again, please contact a service engineer. Target unit : {0} Error information : {1} {0}:Unit name, {1}: Error information
11400	Info	Constant speed drive finished as stage reached to moving range limit.
14341	Info	Preset count has been passed.
14342	Info	Preset count has been passed.
15012	Confirmation	To change default focus offset value, click [Set as Default] before closing this dialog window.
17024	Warning	The file is not found.
17025	Warning	The File dose not open.
17050	Error	Remaining capacity of memory in the temporary drive is insufficient. More than {0} MB of remaining capacity is required.
17070	Warning	The file name contains characters can not be used for JPEG file. Please change the file name.
17071	Warning	The folder name contains characters can not be used for JPEG file. Please change the folder name.
17716	Error	Cannot create a drift correction image. Please change the optical condition or correction parameters and create it again.
17718	Info	The drift correction image does not apply to the image saving function (16 bit). The image of TIFF (8 bit) will be saved even if the TIFF (16 bit) image saving setting is selected.
17719	Info	Cannot save the drift correction image. The {0} is set to the first screen. Please select the [Get correction value in each screen].
21001	Error	Cannot transfer the image(s), which remain not transferred. Restart the PC. If this message is appeared again, please contact a service engineer.

Code	Category	Error Message
21002	Warning	<p>Cannot read some of the image(s), which remain not transferred.</p> <p>If this message is appeared again, please contact a service engineer.</p>
21003	Warning	<p>Cannot read some of the image(s), which remain not transferred. Some of the image(s) remain not transferred. Please try again to transfer them. (The image(s) without IPI mark in the image list)</p> <p>If this message is appeared again, please contact a service engineer.</p>
21004	Error	<p>Cannot transfer the image(s), which remain not transferred.</p> <ol style="list-style-type: none"> 1. Please carry out the following operations. <ol style="list-style-type: none"> (1) In case any image process is running on Image-Pro, wait until the process is completed. (2) Transfer the image. 2. If this message is appeared again after performing the above operation, please carry out the following operations. <ol style="list-style-type: none"> (1) Restart Image-Pro. (2) Transfer the image. 3. If this message is appeared again after performing the above operation, please carry out the following operations. <ol style="list-style-type: none"> (1) Remove and insert the LAN cable or reconnect the wireless LAN to the PC. (2) Transfer the image. 4. If this message is appeared again after performing the above operation, please carry out the following operations. <ol style="list-style-type: none"> (1) Check the communication settings of Image-Pro. (2) Transfer the image. 5. If this message is appeared again after performing the above operation, please contact a service engineer.

Code	Category	Error Message
21005	Error	<p>Some of the image(s) remain not transferred.</p> <ol style="list-style-type: none"> 1. Please carry out the following operations. <ol style="list-style-type: none"> (1) In case any image process is running on Image-Pro, wait until the process is completed. (2) Transfer the image again. (the image(s) without IPI mark in the image list) 2. If this message is appeared again after performing the above operation, please carry out the following operations. <ol style="list-style-type: none"> (1) Restart Image-Pro. (2) Transfer the image. 3. If this message is appeared again after performing the above operation, please carry out the following operations. <ol style="list-style-type: none"> (1) Remove and insert the LAN cable or reconnect the wireless LAN to the PC. (2) Transfer the image. 4. If this message is appeared again after performing the above operation, please carry out the following operations. <ol style="list-style-type: none"> (1) Check the communication settings of Image-Pro. (2) Transfer the image. 5. If this message is appeared again after performing the above operation, please contact a service engineer.
21006	Error	<p>Cannot transfer the image(s), which remain not transferred. If this message is appeared again, please contact a service engineer.</p>
21007	Error	<p>Cannot transfer the image(s), which remain not transferred. Some of the image(s) remain not transferred. Please try again to transfer them. (The image(s) without IPI mark in the image list)</p> <p>If this message is appeared again, please contact a service engineer.</p>
21008	Error	<p>Cannot transfer the image(s), which remain not transferred.</p> <ol style="list-style-type: none"> 1. Please carry out the following operations. <ol style="list-style-type: none"> (1) In case any error message is appeared on the Image-Pro, carry out the operation according to the message. (2) Transfer the image. 2. If this message is appeared again after performing the above operation, please carry out the following operations. <ol style="list-style-type: none"> (1) Restart Image-Pro. (2) Transfer the image. 3. If this message is appeared again, please contact a service engineer.

Code	Category	Error Message
21009	Error	<p>Some of the image(s) remain not transferred.</p> <ol style="list-style-type: none"> 1. Please carry out the following operations. <ol style="list-style-type: none"> (1) In case any error message is appeared on the Image-Pro, carry out the operation according to the message. (2) Transfer the image again. (the image(s) without IPI mark in the image list) 2. If this message is appeared again after performing the above operation, please carry out the following operations. <ol style="list-style-type: none"> (1) Restart Image-Pro. (2) Transfer the image. 3. If this message is appeared again, please contact a service engineer.
21011	Info	<p>Please use the specimen height gauge for setting the specimen height at less than 1 mm.</p> <p>The specimen height setting by using the gauge can be performed on the [Specimen exchange (Adjusting the specimen height)] window.</p>
21013	Info	<p>Objective aperture position has not adjusted.</p> <p>Please perform [Adjust Objective aperture position].</p>
21014	Info	<p>Please select other than the aperture No.0.</p>
21015	Info	<p>Cannot perform this function. Please reselect the followings.</p> <p>{0}</p> <p>{0}: Reselect items</p>
21016	Info	<p>Other than non available functions is imported.</p>
21017	Info	<p>Only the functions included in Operation program will be imported.</p>
21018	Confirmation	<p>The setting value will be saved by clicking [Save].</p> <p>Do you want to save the setting value?</p> <p>Please exit and restart the operation program for applying the contents.</p>
21020	Error	<p>Discharge has detected in the column. {0} times of discharge have occurred.</p> <p>If discharge is occurred repeatedly, it can cause of damaging the instrument.</p> <p>Since the discharge can be occurred due to shape or characterization of a specimen, Change the observation condition (WD, irradiating voltage) or the fixing method of specimen.</p>
21024	Info	<p>User magnification correction is deactivated because optical condition which is different from the presently applied user magnification correction condition is selected.</p> <p>User magnification correction will be deactivated when.</p>

Code	Category	Error Message
21025	Info	User magnification correction is deactivated because optical condition which is different from the presently applied user magnification correction condition is selected. User magnification correction will be deactivated when.
21026	Info	User magnification correction will be deactivated when HV is OFF.
21027	Error	Setting value is exceeded the movable range of the Eucentric setting. Do you want move the stage without the Eucentric setting?
21033	Error	Interlock unit error. The HV is turned OFF. Confirm the connection of the interlock unit and turn ON the HV. If the HV will not be turned ON or the error message is displayed again, please contact a service engineer of Hitachi High-Tech Corporation.
22000	Error	Because a setting file is damaged, it is reset to a previous value. When this message is shown again, contact a service engineer.
22100	Error	Custom scan cannot be executed with the set condition. Set to 180.00 min/Image or less for the image obtaining time display by changing the [Dwell time] and [Integration].
22101	Confirmation	Custom scan cannot be executed with the set condition. Do you want to initialize the [Dwell time] and [Integration] settings?
22102	Confirmation	Custom scan cannot be executed with the set condition. Do you want to initialize the [Dwell time] and [Integration] settings?
22103	Error	Custom scan cannot be executed with the set condition. Set to 180.00 min/Image or less for the capturing time display by changing the [Dwell time], [Image size] and [Integration].
22200	Error	Ion pump{0} voltage error The HV for the IP-{0} has turned OFF because the HV for the IP-{0} has not output properly. Please contact a service engineer.
22201	Error	Ion pump{0} voltage error Electron gun has shutdown and The HV for the IP-{0} has turned OFF because the HV for the IP-{0} has not output properly. Please contact a service engineer.
22202	Info	The HV for the IP-{0} is turning on.

Code	Category	Error Message
22302	Confirmation	The adjustment has not finished. Do you want to finish without recording the alignment values?
22303	Confirmation	Do you want to cancel the [Manual Alignment] without recording the alignment value?
22305	Info	The Manual Alignment conditions are applying.
22308	Info	The alignment value has been registered.
22309	Info	Manual Alignment is finishing.
22320	Info	[AAA] is executing.
22321	Info	[ASA] is executing.
22322	Info	[ASA_X] is executing.
22323	Info	[ASA_Y] is executing.
22324	Info	[Sequence(ABA)] is executing.
22325	Info	[Sequence(ASA_X)] is executing.
22326	Info	[Sequence(ASA_Y)] is executing.
22327	Info	[Sequence(ASA)] is executing.
22328	Info	[Sequence(AAA)] is executing.
22329	Info	[Sequence(AFC{0})] is executing.
22332	Info	[Sequence(ASC{0})] is executing.
22333	Info	[Sequence(ABCC)] is executing.
22334	Error	[ABA] error
22335	Error	[ASA] error
22336	Info	[Auto Alignment Sequence] is canceling.
22337	Info	The learning alignment function is being updated.
22339	Confirmation	Do you want to update the learnin alignment function? It takes about 5 minutes to update.
22340	Info	Please perform [Adjust Objective aperture position].
22341	Info	Adjustment condition settings is performing.
22342	Error	[ASA_X] error
22343	Error	[ASA_Y] error
23007	Confirmation	Delete registered stage coordinate No.{0}.
23008	Confirmation	The stage coordinate has not saved. Do you want to close the window?
23009	Info	Tone curve can not be applied to the mixed signal Image. Turn off tone curve.
23011	Confirmation	Focus mode has changed. Do you want to set to the default condition (Standard) ?
23012		Since the safety interlock for high voltage system was activated, the electron gun has been shut down.
23013	Error	Stage motion (R-axis) error Please check the parameter for R-axis DC motor or hardware.

Code	Category	Error Message
23014	Error	Vacuum system error Vacuum operation has stopped. Power off and on the [EVAC POWER] switch. If this message is appeared again, please contact a service engineer. {0}
23015	Error	Discharge has detected in the column. {0} times of discharge have occurred. Exceeded times ({1} times) of discharge which are more than the estimated life-time of MD scintillator have occurred. If discharge is occurred repeatedly, it can cause of damaging the instrument. Since the discharge can be occurred due to shape or characterization of a specimen, Change the observation condition (WD, irradiating voltage) or the fixing method of specimen by referring to the cautions of specimen observation in the instruction manual. Please change the fixing method of specimen.
23016	Confirmation	The zero adjustment of current measurement will be performed. Make sure that the BNC cable to measure the current has been connected correctly. This process takes about 6 seconds.
23017	Info	Cannot register the name as {0}.
23018	Error	Cannot add the item because the number of setting items has reached to the limit.
23019	Error	X-axis motion error Please turn off and on the [STAGE] breaker. If this message is appeared again, please contact a service engineer.
23020	Error	Y-axis motion error Please turn off and on the [STAGE] breaker. If this message is appeared again, please contact a service engineer.
23021	Error	Z-axis motion error Please turn off and on the [STAGE] breaker. If this message is appeared again, please contact a service engineer.
23022	Error	T-axis motion error Please turn off and on the [STAGE] breaker. If this message is appeared again, please contact a service engineer.

Code	Category	Error Message
23023	Error	R-axis motion error Please turn off and on the [STAGE] breaker. If this message is appeared again, please contact a service engineer.
23029	Info	{0} and UD(+{1}) are selected. Do you want to set OFF the UD(+{1})?
23030	Info	Do you want to overwrite it to the No.{0}?
23040	Info	Control unit version is not matched. ¥nTarget unit : {0}

EVACSEQ Error code list

If an alarm sound is emitted from the main unit, check the error code on the condition display panel.

Refer to the table below for the code and corrective action when a warning or an error occurs. (*) indicates that the error concerned is due to instrument malfunction. Contact a service representative of Hitachi High-Tech Corporation.

Type	Code	Contents	Countermeasure
Error or Warning other than instrument malfunction	E505	Start to vent air from specimen chamber while specimen chamber is not closed.	Push the specimen stage until it completely touches the specimen chamber, and start evacuating.
	E511	Air pressure for driving valves is lower than its limit value. Vent air from the system while pressure is in the normal status.	Check the operation of the compressor, and verify that the stop valve is open.
	E561	Gate valve open error.	Check the gate valve open setting at the specimen exchange position.
	E601	Cooling water flow is over the specified limit value.	Adjust the cooling water flow so that it is 0.45~1.05 l/min.
	E602	Cooling water flow is less than the specified limit value.	
	E651	The condensation is occurred.	Turn OFF the [EOC POWER] switch, and do not turn it ON until the error disappears. Check if the room temperature is high. The proper room temperature is 15°C to 25°C. The cooling hose may detect and react even with a minute water leak. Also, check for condensation and leakage from the cooling water hose.
Error during electron gun baking	E801	The OUTER BAKE breaker is OFF.	Refer to the user's manual [4.8 Procedure of electron gun baking].
	E802	The HV cable head is inserted to the electron gun.	
	E803	The HV cable head is not properly placed on the cable holder.	
	E804	The ion pump high voltage is not applied.	
	E805	The ion pump vacuum degraded while baking.	

Type	Code	Contents	Countermeasure
	E812	The baking protection cover is not installed.	
Error due to instrument malfunction	E001*	The control power supply error. (DC24V)	-
	E002*	The control power supply error. (DC15V)	-
	E016	The dry pump is not working.	Check if the DRP breaker in the EV-POW unit is turned OFF.
	E021	Rotational speed of TMP1 cannot reach to the normal value.	Turn off the [EVAC POWER] switch and turn it ON again. If the error occurs after restarting, contact a service representative.
	E022	Rotational speed of TMP1 has decreased than the normal value.	
	E031	The TMP1 error. (TMP disconnection)	
	E032	The TMP1 error. (TMP temperature error)	
	E033	The TMP1 error. (Controller temperature error)	
	E034	The TMP1 error. (Power supply error)	
	E035	The TMP1 error. (Excess power voltage)	
	E036	The TMP1 error. (Other error)	
	E037	The TMP1 error. (Communication error)	
	E512	Air pressure for driving valves is lower than its limit value.	Check the operation of the compressor.
	E071*	The Pirani vacuum gauge (Pi1) is broken.	-
	E072*	The Pirani vacuum gauge (Pi2) is broken.	-
	E081*	The vacuum gauge (FRG1) is broken.	-
E101*	Pressure of the intermediate chamber has severely deteriorated.	-	

Type	Code	Contents	Countermeasure
	E102	The pressure of specimen chamber cannot be lowered than the atmospheric pressure.	This error occurs when the specimen chamber vacuum is not lower than atmospheric pressure 20 seconds after the evacuation starts. Check if a foreign object is jammed in the O ring of the specimen stage.
	E104	Each vacuum gauge does not indicate the desired pressure.	Check if a foreign object is jammed in the O ring of the specimen stage or there is a leak from the external device.
	E105	It elapsed 30 minutes or more after venting air from the specimen chamber.	
	E106	Pressure of the intermediate chamber has deteriorated for more than 10 minutes.	
	E142*	Back-pressure cannot be lowered than the atmospheric pressure.	-
	E143*	Back-pressure has severely deteriorated.	-
	E302*	The vacuum valve (AV2) doesn't open.	-
	E303*	The vacuum valve (AV3) doesn't open.	-
	E304*	The vacuum valve (AV4) doesn't open.	-
	E314*	The vacuum valve (GV) doesn't open.	-
	E352*	The vacuum valve (AV2) doesn't open.	-
	E353*	The vacuum valve (AV3) doesn't open.	-
	E354*	The vacuum valve (AV4) doesn't open.	-
	E364*	The vacuum valve (GV) doesn't open.	-
	E367*	The vacuum valve (GV) doesn't open.	-
	E401*	The specimen chamber cannot be in the atmospheric condition.	-

Type	Code	Contents	Countermeasure
PD-BSED (Option) error	E508	The BSE detector is inserted while the stage power is OFF.	Return the BSE detector to the OUT state, turn ON the STAGE breaker on the back of the main unit, confirm that the stage operation is normal, and then insert the BSE detector.
Variable pressure unit (Option) error	E103	The specimen chamber cannot reach to the desired pressure.	Check if a foreign object is jammed in the O ring of the specimen stage or there is a leak from the external device.
	E305*	The vacuum valve (AV5) doesn't open.	-
	E306*	The vacuum valve (AV6) doesn't open.	-
	E307*	The vacuum valve (AV7) doesn't open.	-
	E308*	The vacuum valve (AV8) doesn't open.	-
	E309*	The vacuum valve (AV9) doesn't open.	-
	E355*	The vacuum valve (AV5) doesn't open.	-
	E356*	The vacuum valve (AV6) doesn't open.	-
	E357*	The vacuum valve (AV7) doesn't open.	-
	E358*	The vacuum valve (AV8) doesn't open.	-
	E359*	The vacuum valve (AV9) doesn't open.	-
	E073*	The Pirani vacuum gauge (Pi3) is broken.	-
Specimen exchange chamber related error	E073*	The Pirani vacuum gauge (Pi3) is broken.	-
	E151	The specimen exchange chamber cannot reach to the desired pressure.	Check if a foreign object is jammed in the vacuum seal part of the specimen exchange chamber.
	E152	The specimen exchange chamber cannot reach to the desired pressure.	

Type	Code	Contents	Countermeasure
	E153	The specimen exchange chamber cannot reach to the desired pressure.	
	E154	The specimen exchange chamber cannot reach to the desired pressure.	
	E155	It elapsed 12 minutes after venting air from the specimen exchange chamber.	
	E315*	The vacuum valve (XV) doesn't open.	-
	E365*	The vacuum valve (XV) doesn't open.	-
	E404*	The specimen exchange chamber cannot be in the atmospheric condition.	-
	E502*	The vacuum valve (XV) is not properly connected.	-
	E503	The specimen exchange rod is not at proper position.	Pull out the specimen exchange rod to the specified position.
	E506	Start to vent air from specimen chamber while specimen exchange chamber is not closed.	Close the specimen exchanger and then start evacuation.
	E507	Start to vent air from specimen exchange chamber while specimen exchange chamber is not closed.	Close the specimen exchanger and then start evacuation.
	E561	The conditions are not satisfied to open the vacuum valve (XV).	Open the XV during the specimen exchange sequence.
N ₂ gas leak port (Option) error	E091	The specimen chamber cannot be in the atmospheric condition.	Verify that the N ₂ gas is not empty.
	E092	The specimen exchange chamber cannot be in the atmospheric condition.	
	E131	Improper introduction of N ₂ gas.	
	E132	Improper introduction of N ₂ gas.	

Type	Code	Contents	Countermeasure
Water leak detector (Option) error	E611*	The water leakage is detected. (Objective lens)	The leak detector will be installed only when SEMI compatible option is installed and an error will be displayed at water leakage. Power OFF the whole instrument immediately.
	E612*	The water leakage is detected. (Feed port of water)	
	E613*	The water leakage is detected. (Water circulator)	
	E614*	The water leakage is detected. (TMP1)	
Windowless EDS (Option) error	E523	When following operations are about to perform while the Windowless EDS is cooling, or Power is OFF. 1. Perform the XV OPEN 2. Perform the SC AIR sequence 3. Switching to the VP mode (Option)	Perform the operation after powering ON the Windowless EDS and confirming that the cooling of detector element is stopped. Regarding the Air ready condition or specimen exchange ready condition, follow the instruction manual of Windowless EDS manufacturer.
	E527	When powering OFF the [Evac Power] while the Windowless EDS is cooling, or Power is OFF.	Set ON the [Evac Power]. When powering OFF the [Evac Power], Power ON the Windowless EDS and confirm that the cooling of detector element is stopped. When the Air is ready, set OFF the [Evac Power]. Regarding the Air ready condition, follow the instruction manual of Windowless EDS manufacturer.
	E533	When detecting that the Windowless EDS power is OFF, or cooling is performed while the Air, EVAC or VP mode of specimen chamber is performing.	Power ON the windowless EDS and stop the detect element cooling.

Type	Code	Contents	Countermeasure
Sparkle EC (Option) error	E521	The following operations were attempted or occurred during cleaning. 1. Transition to low-vacuum mode (optional function for the SU8700) 2. Execution of the SC AIR sequence 3. Execution of EV OPEN 4. Execution of SEC EVAC 5. Disconnection of the HV cable 6. Execution of GV Open	Finish cleaning before performing the operation. If the alarm sound does not stop, contact our service engineer.
	E525	The EVAC power supply has been turned off during cleaning.	Turn on the EVAC POWER switch at the front of the main unit.
	E531	The instrument has detected cleaning operation when cleaning is prohibited.	Finish cleaning and contact our service engineer.