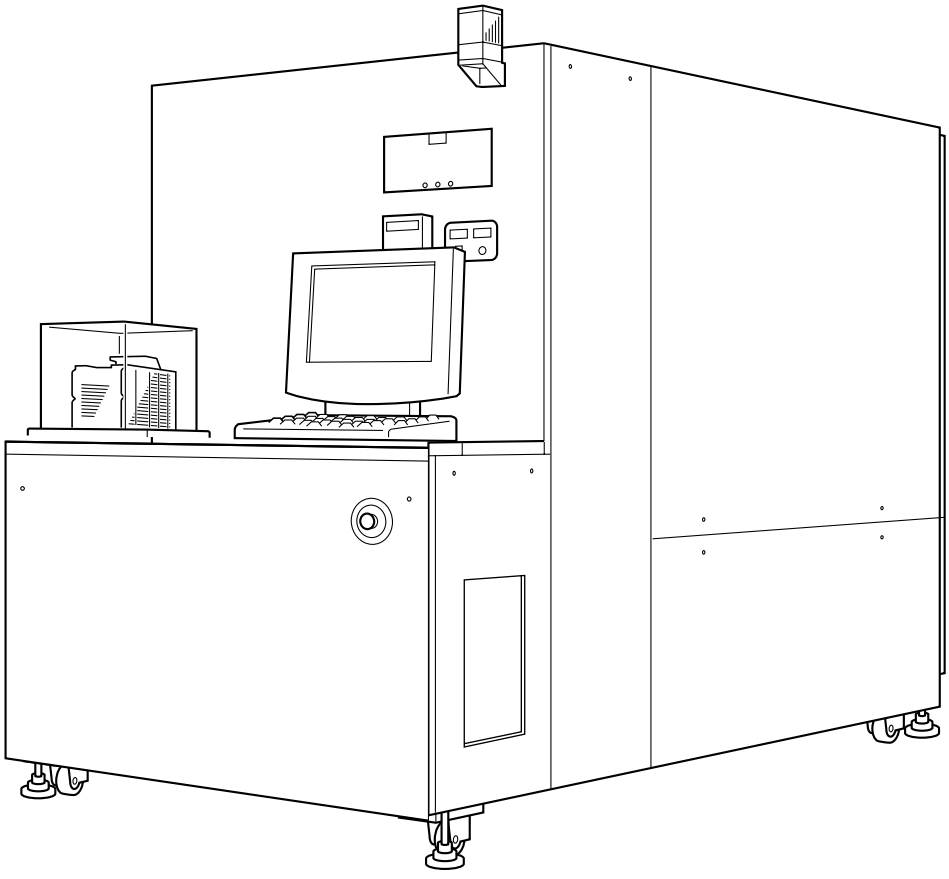
TECHNOS

Total Reflection X-ray Fluorescence Spectrometer

TREX620

OPERATION MANUAL



TECHNOS Co.,Ltd

CONTENTS

PREFACE

Thank you for purchasing this SMIF-Compatible Total Reflection Fluorescent X-ray Wafer Surface Analysis System "Trex620".
"Trex620" uses a special monochromator based on the total reflection fluorescent X-ray analysis method. It provides high sensitivity analysis of 10^9 atoms/cm^2.
For full utilization of this system's capabilities, read this manual thoroughly before using the system, and operate the system properly.

❶ Safety Notices

"Trex620" operation requires accurate prior safety knowledge. Observe the following instructions in order to prevent personal injury to the operator and other persons and prevent property damage.

● The following warning notices indicate the extent of the danger and damage which may occur if incorrect handling is performed.

⚠DANGER : This notice indicates contents which, if ignored, may result in grave danger of death or serious injury.

⚠WARNING : This notice indicates contents which, if ignored, may possibly result in death or serious injury.

⚠CAUTION : This notice indicates contents which, if ignored, may possibly result in personal injury or property damage.

This system has built into it an X-ray generator and a high voltage generator (maximum 60 kV) to drive the X-ray generator. Liquid nitrogen (boiling point –196℃) is used to cool the Solid State Detector (SSD), so handle the SSD carefully.

■ Electric Shock Prevention, X-ray Exposure Prevention and General Instructions

⚠DANGER

● Do not disassemble or modify

- Disassembly or modification can cause breakdown, electric shock or radiation exposure, etc. For internal inspection or repairs, contact the Technos Service Department.

● Stop operation if you detect signs of an abnormal condition such as a strange noise or smell, or abnormal operation.

- Promptly stop operation and contact the Technos Service Department. Continued operation may cause a breakdown, fire or electric shock.

⚠WARNING

● Do not operate the system with safety devices OFF.

- If safety devices are turned OFF, the system will not stop automatically should a malfunction occur. This may cause a breakdown, fire or electric shock.

● Avoid damage to the power cord, etc.

- Do not place heavy objects on top of the power cord or intake and exhaust hoses, do not bend them, and do not place hot appliances near them. This could cause cord damage, fire, electric shock or fluid leakage.

● Do not insert foreign objects into the interior.

- Do not insert foreign objects (metal objects and easily flammable objects in particular) into the cassette elevator or gaps in the bottom of the device, etc.
  This may cause a breakdown, fire or electric shock.

● Do not insert your hand inside the machine, even when the power is OFF.

- Even if the power is cut off due to a malfunction, high voltage may still be operating inside the machine, so do not insert your hand or other objects inside the machine.

⚠CAUTION

● Do not leave unnecessary objects on top of the machine roof or deck.

- Objects falling into the machine could cause a breakdown or fire. Falling objects can also cause an injury or damage the machine.

● Do not clean the machine with alcohol, water or cleansers.

- It could cause an electric shock, breakdown or a fire.

■ Cautions about Liquid Nitrogen

The evaporation of liquid nitrogen generates a large quantity of nitrogen gas. Depending on the quantity of liquid nitrogen, it can create an oxygen deficiency, so do not discharge the liquid nitrogen indoors.
The boiling point of liquid nitrogen is extremely low, –196℃. Direct contact with liquid nitrogen can cause frostbite, so take care to avoid direct contact.

⚠WARNING

● Move out of the room if the oxygen deficiency warning sounds.

- The machine's oxygen alarm indicates an oxygen deficiency has occurred. Promptly move outdoors if the alarm sounds.

⚠CAUTION

● Avoid direct contact with liquid nitrogen.

- Direct contact with liquid nitrogen can cause frostbite. Provide sufficient protection when handling liquid nitrogen.

■ Cautions about Beryllium

Beryllium is used in the X-ray tube and the X-ray window of the Solid State Detector (SSD). Beryllium is toxic to the human body, so be sure to observe the handling instructions in this manual.

⚠WARNING

● Do not touch the X-ray window (beryllium).

- The X-ray window is made of thin beryllium metal; it is easily damaged and toxic. Do not touch it with your hands or any other object.

● Recover pieces of the X-ray window if it breaks.

- If the X-ray window breaks, recover all the pieces. The pieces are toxic, so do not touch them directly with bare hands when you collect them.

⚠CAUTION

● Contact Technos for cleaning of the X-ray window.

- The X-ray window is easily damaged, so contact Technos if you need a dirty window cleaned.

● Beryllium is a toxic waste product.

- The beryllium used in the X-ray window is classified as a toxic waste product. Disposal of parts of the machine, X-ray tube and X-ray window requires special processing. Contact Technos to provide you with correct disposal.

❷ DANGER WARNING Labels

This system has warning labels affixed to it at locations where there are potential dangers. The danger level indicated on the labels (DANGER, WARNING, CAUTION) is applied to situations as shown below.

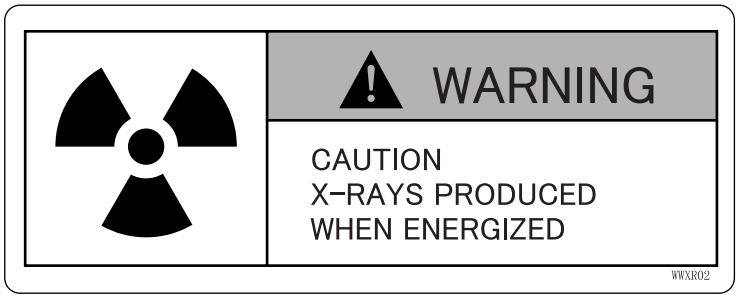
Do not peel labels off or tear them. Take care that objects are not left in front of labels so that the labels are obscured from clear view.

Danger level	Situation applicable to danger level
DANGER	This notice indicates contents which, if ignored, may result in grave danger of death or serious injury.
WARNING	This notice indicates contents which, if ignored, may possibly result in death or serious injury.
CAUTION	This notice indicates contents which, if ignored, may possibly result in personal injury or property damage.

The warning labels show a symbol indicating the type of potential danger, the extent of the danger, and the details of the danger.

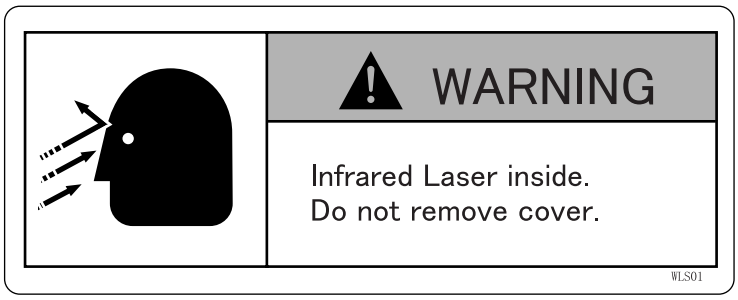
● Labels affixed to the front of Trex620.

① X-ray Warning



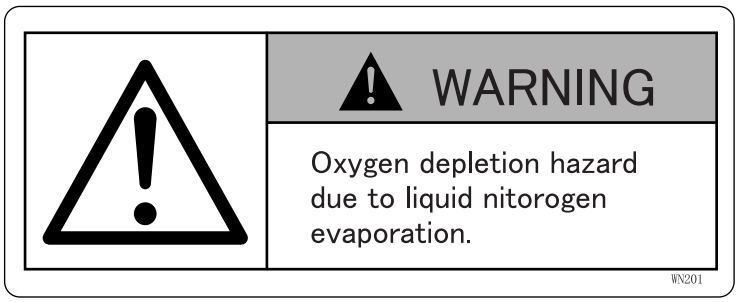
This warning label is attached to the 2 kW XG controller operation panel of the Trex620.
X-rays are generated from the X-ray tube in the X-RAY-ON state.
Although X-rays do not leak outside the machine in normal operation, do not remove the machine outer cover.

② Laser Warning



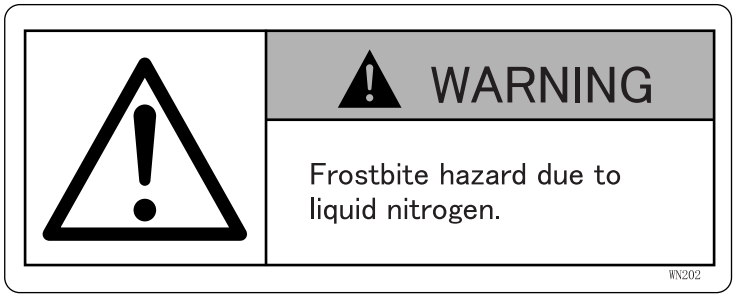
Infrared laser is used for the wafer aligner inside the machine.
Although the cover around the wafer aligner unit is constructed so that laser light does not leak outside the machine, and the operator is not exposed to laser rays during normal operation, do not remove the machine outer cover.

③ Oxygen Deficiency Warning



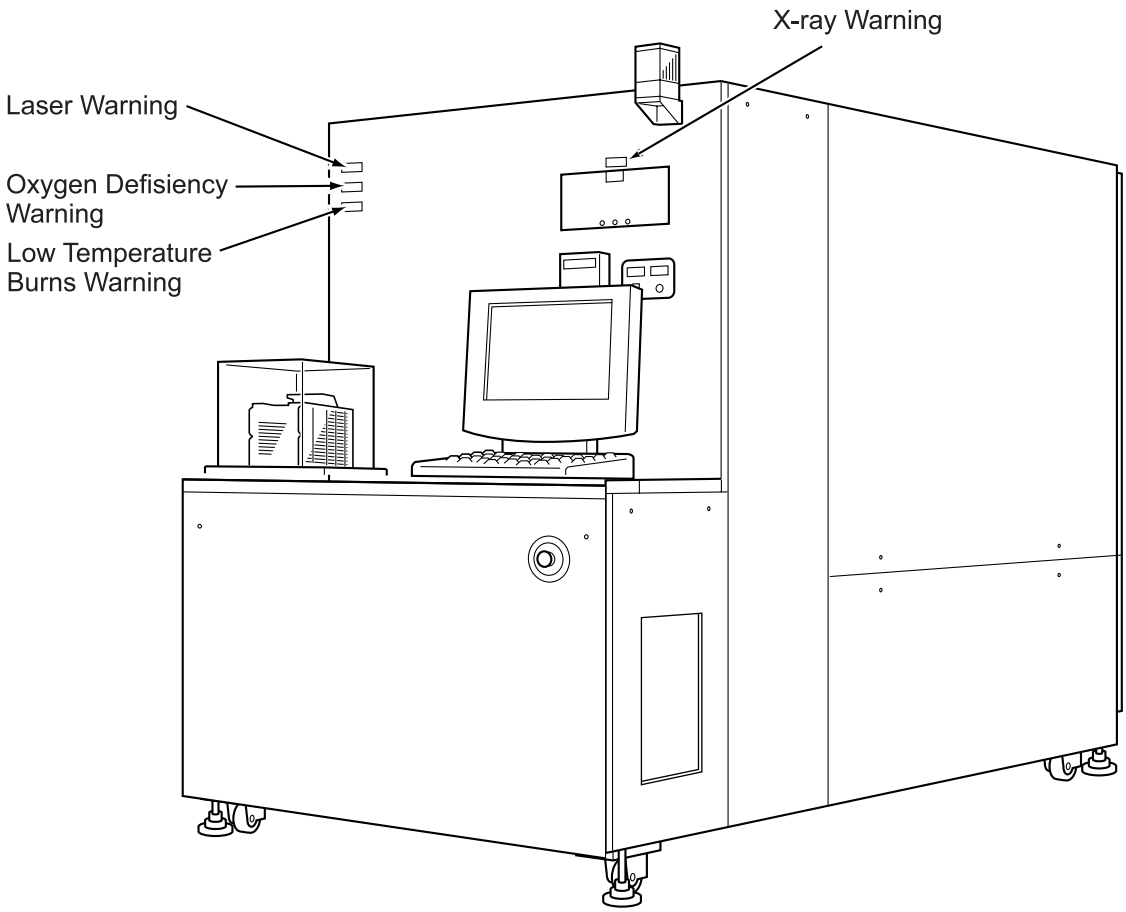
This system uses liquid nitrogen and nitrogen gas.
If leakage of the liquid nitrogen or nitrogen gas occurs, there is danger of the nitrogen causing oxygen deficiency. If a gas leak is discovered, or the oxygen concentration meter activates the alarm, promptly take shelter outside the room.

④ Low Temperature Burns Warning



This system uses liquid nitrogen.
Liquid nitrogen is a liquid with an extremely boiling temperature of –196℃. Direct contact can cause frostbite.
Do not add liquid nitrogen by hand. Using a liquid nitrogen production machine (maker recommended option) is recommended.

■ Display Position of Danger Warning Labels



❸ Fluorescent X-ray and Total Reflection Fluorescent X-ray Analysis

■ Fluorescent X-rays

When X-rays (the same electromagnetic waves as sunlight and light from electric lamps. See Fig.1.) are applied to objects, the X-rays are absorbed by the object. Fluorescent X-rays are one of secondary X-ray which are genarated from the object having unique wavelength of specific elements, the intensity of the X-ray depending on the concentration of the element in the object.

Accordingly, by measuring the fluorescent X-rays generated from the sample, Qualitative analysis of what kind of elements are in the sample and quantitative analysis of the amount of elements present, can be performed.

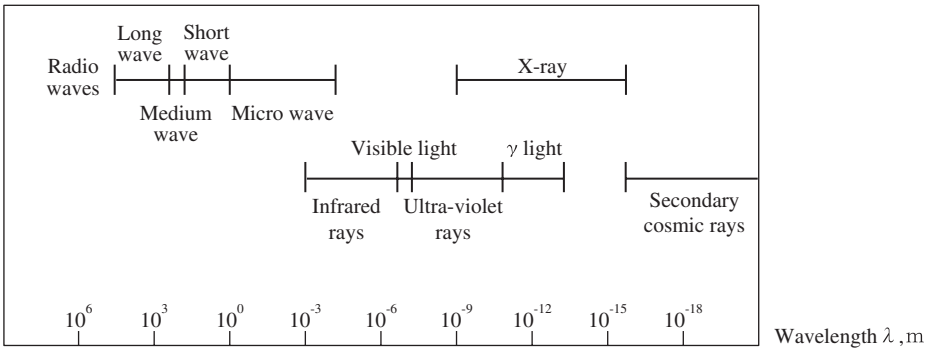


Fig. 1

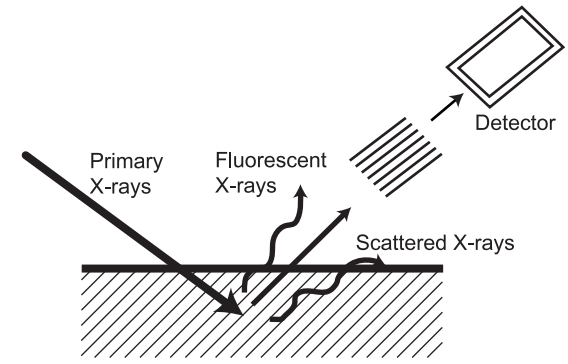
■ Total Reflection Fluorescent X-ray Analysis

When a material is irradiated by X-rays, the X-rays emitted from the material include scattered X-rays in addition to fluorescent X-rays. In order to use fluorescent X-rays to analyze elements, it is necessary to reduce the scattered X-rays among the emitted X-rays and increase the ratio of fluorescent X-rays.

If the incident angle of total reflection conditions, it become possible to be sensitive at very shallow surface and reduce the scattering X-ray. It leads to measure Fluorescent X-ray in high sensitivity. (See Fig. 2, Fig. 3.)

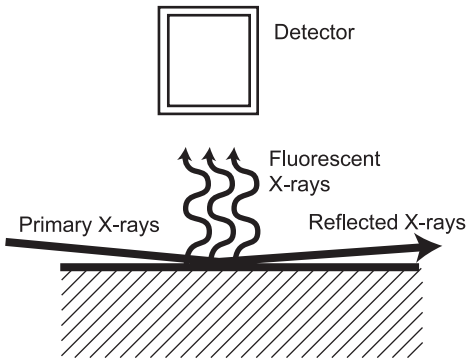
This method of performing qualitative and quantitative analysis of elements at the surface of a material is called "Total Reflection X-ray Fluorescence" (TXRF).

Trex620 performs X-ray irradiation in total reflection conditions using its own particular total reflection position adjustment function, guaranteeing the extent of reproducibility of the analysis values.



Standard Fluorescent X-ray Method

Fig.2

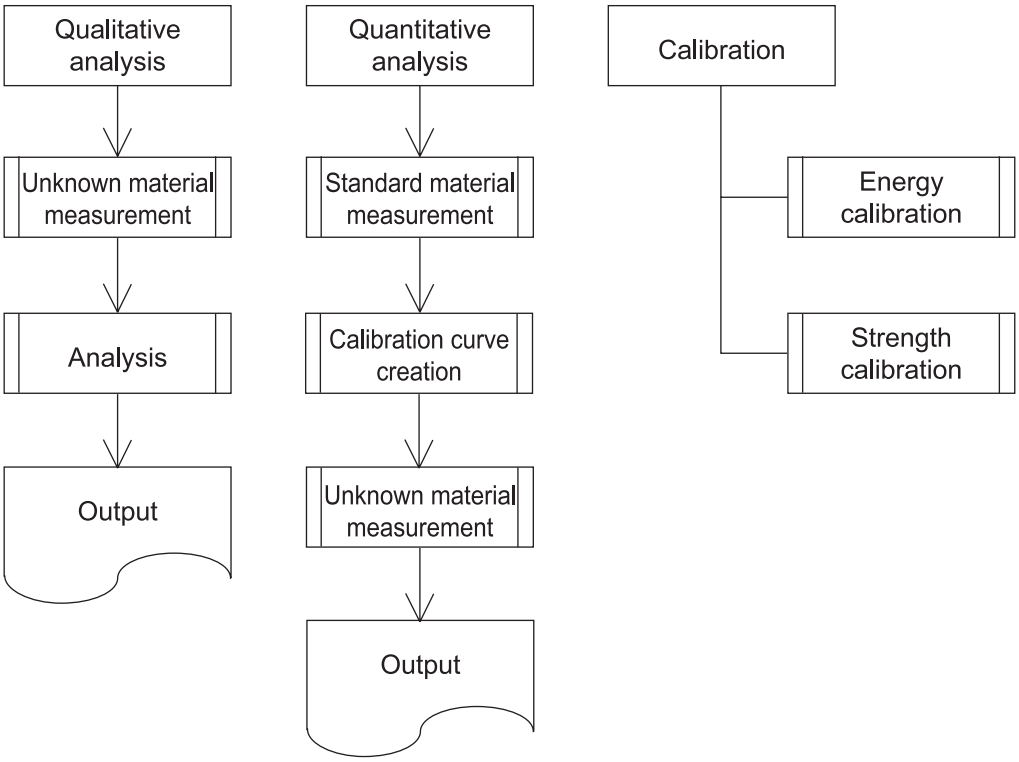


Total Reflection Fluorescent X-ray Method

Fig.3.

■ Outline of Total Reflection Fluorescent X-ray Analysis

Total reflection fluorescent X-ray analysis involves measuring an unknown sample and the analysis can be divided into qualitative analysis of which elements are in the test material, and quantitative analysis of the amount of the elements present. Another function is calibration, which checks the status of the measuring machine itself.



Trex620 is designed so that the above analysis can be performed efficiently and accurately by providing uniformity of the measurement conditions, element conditions and output conditions.

SPECIFICATIONS

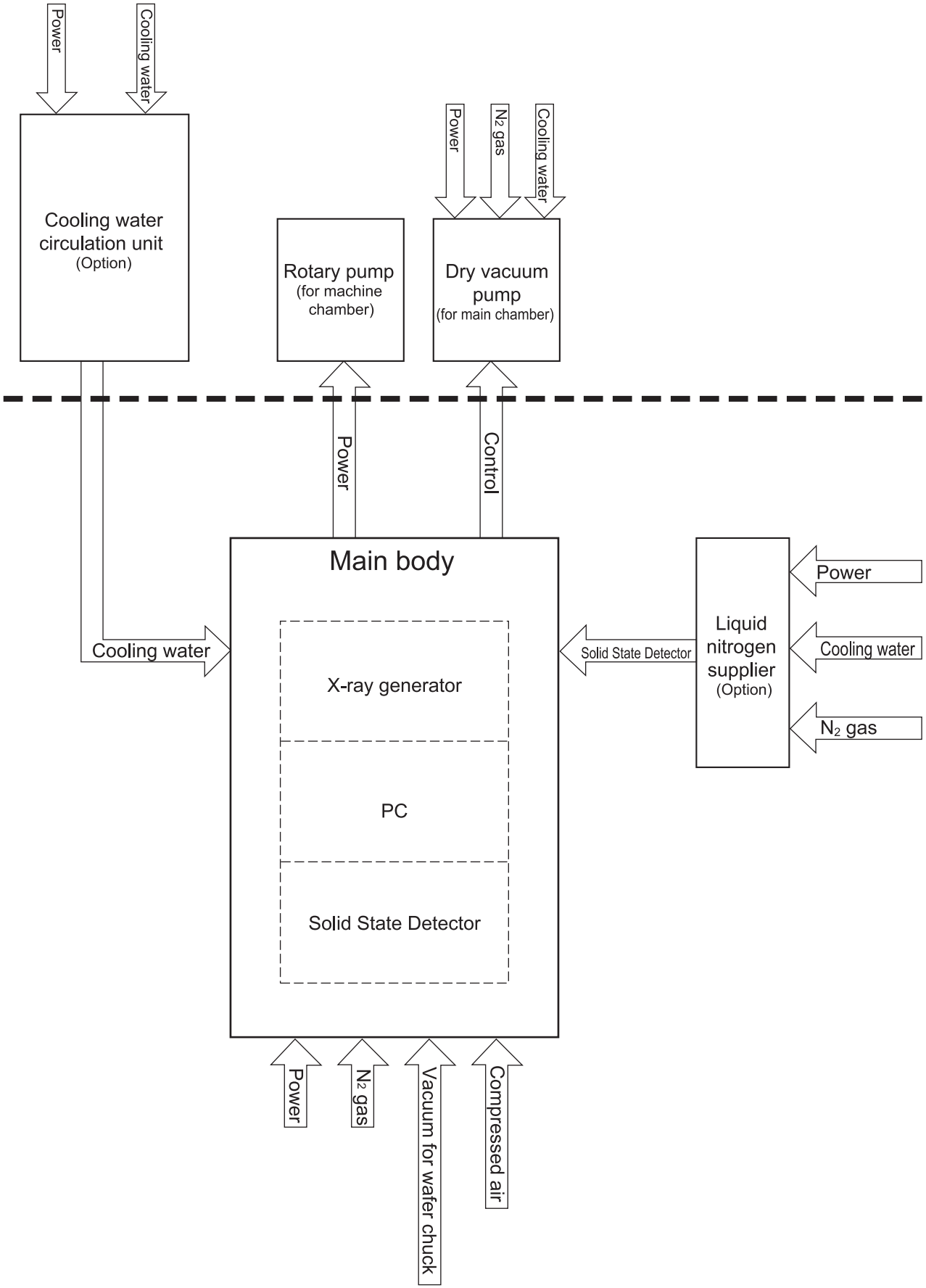
❶ Specifications

< Technos Standard Specifications >

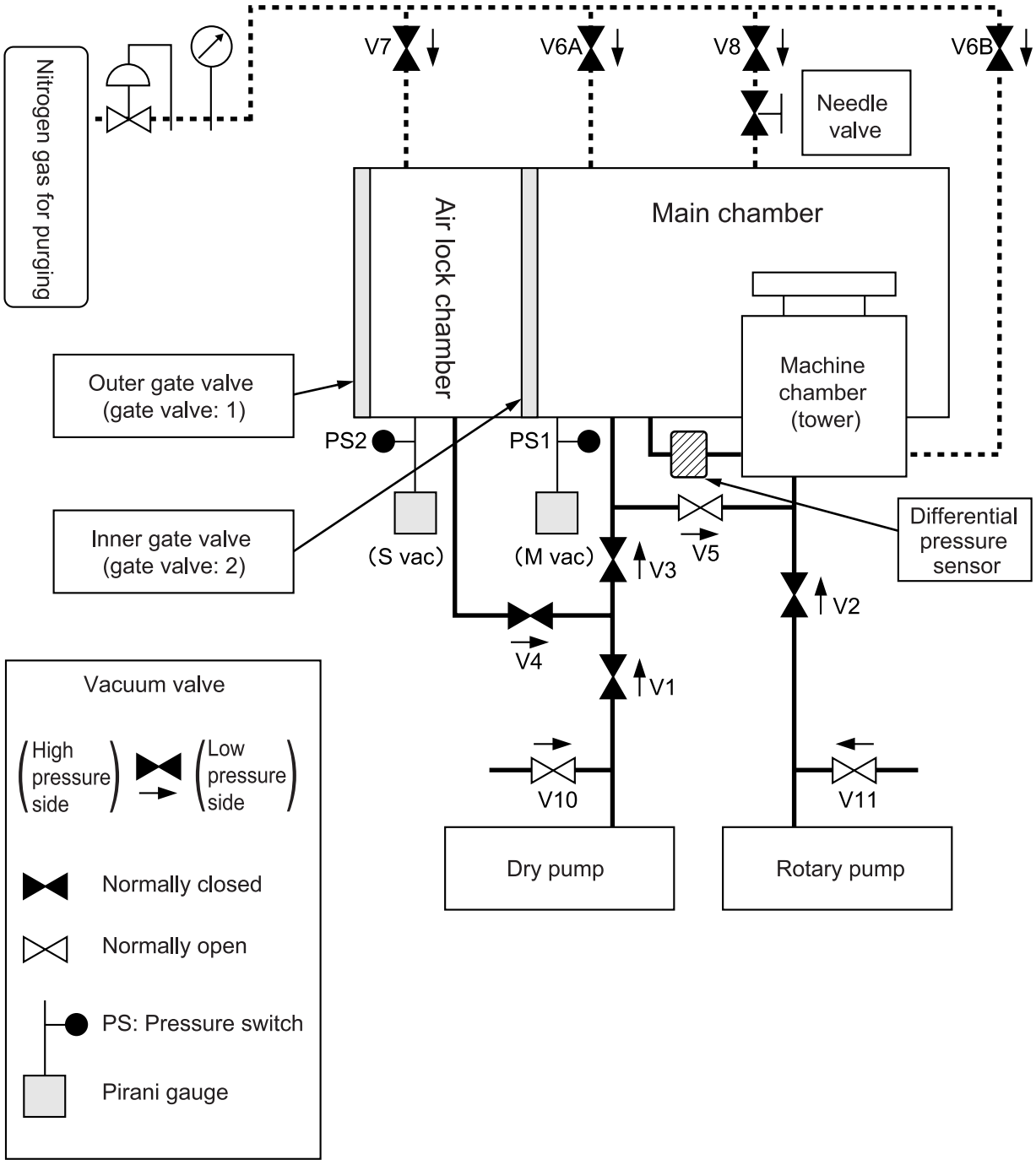
Main body	Power	Voltage: AC 200 V, 3 phase
		Current: 20 A
		Connection method: M5 terminal block
	Ground	Specification: Ground
		Connection method: M5 ground bar
	N_2 gas	Pressure: 0.05 - 0.1 MPa
		Capacity: 3 L/min
		Connection method: 1/4 inch swage lock
	Compressed air (pneumatic)	Pressure: 0.6 - 0.7 MPa
		Capacity: 1 L/min
		Connection method: 1/4 inch swage lock
	Vacuum for wafer chuck	Pressure: -60 KPa or less
		Capacity: 1 L/min
		Connection method: 1/4 inch swage lock
Liquid nitrogen supplier	Power	Voltage: AC 100 V, single phase
		Current: 15 A
		Connection method: M4 terminal block
	Ground	Specification: Ground
		Connection method: M4 terminal block
	Cooling water	Pressure: 0.12 - 0.5 MPa
		Capacity: 2 L/min
		Connection method: PT3/8 inch female screw
	N_2 gas	Pressure: 0.2 - 0.5 MPa
		Capacity: 3 L/min
		Connection method: 1/4 inch swage lock
	Exhaust	Exhaust pressure: -500Pa
		Capacity: 3 m^3/min
		Connection method: 1/4 inch female screw
Coolant circulation unit	Power	Voltage: AC 200 V, 3 phase
		Current: 15 A
		Connection method: M4 terminal block
	Ground	Specification: Ground
		Connection method: M6 ground bar
	Coolant	Pressure: 0.25 - 0.35 MPa
		Capacity: 25 L/min
		Connection method: PT1/2 inch female screw

Dry vacuum pump	Power	Voltage: AC 200 V, 3 phase
		Current: 15 A
		Connection method: Dedicated connector
	Ground	Specification: Ground
		Connection method: Dedicated connector
	Cooling water	Pressure: 0.2 - 0.5 MPa
		Capacity: 3.5 L/min
		Connection method: PT3/8 inch female screw
	N_2 gas	Pressure: 0.2 - 0.5 MPa
		Capacity: 10 L/min
		Connection method: 1/4 inch female screw
	Exhaust	Exhaust pressure: -500Pa
		Capacity: 3 m^3/min
		Connection method: NW40 flange
Rotary pump	Exhaust	Exhaust pressure: -500Pa
		Capacity: 3 m^3/min
		Connection method: PT 1 inch male screw

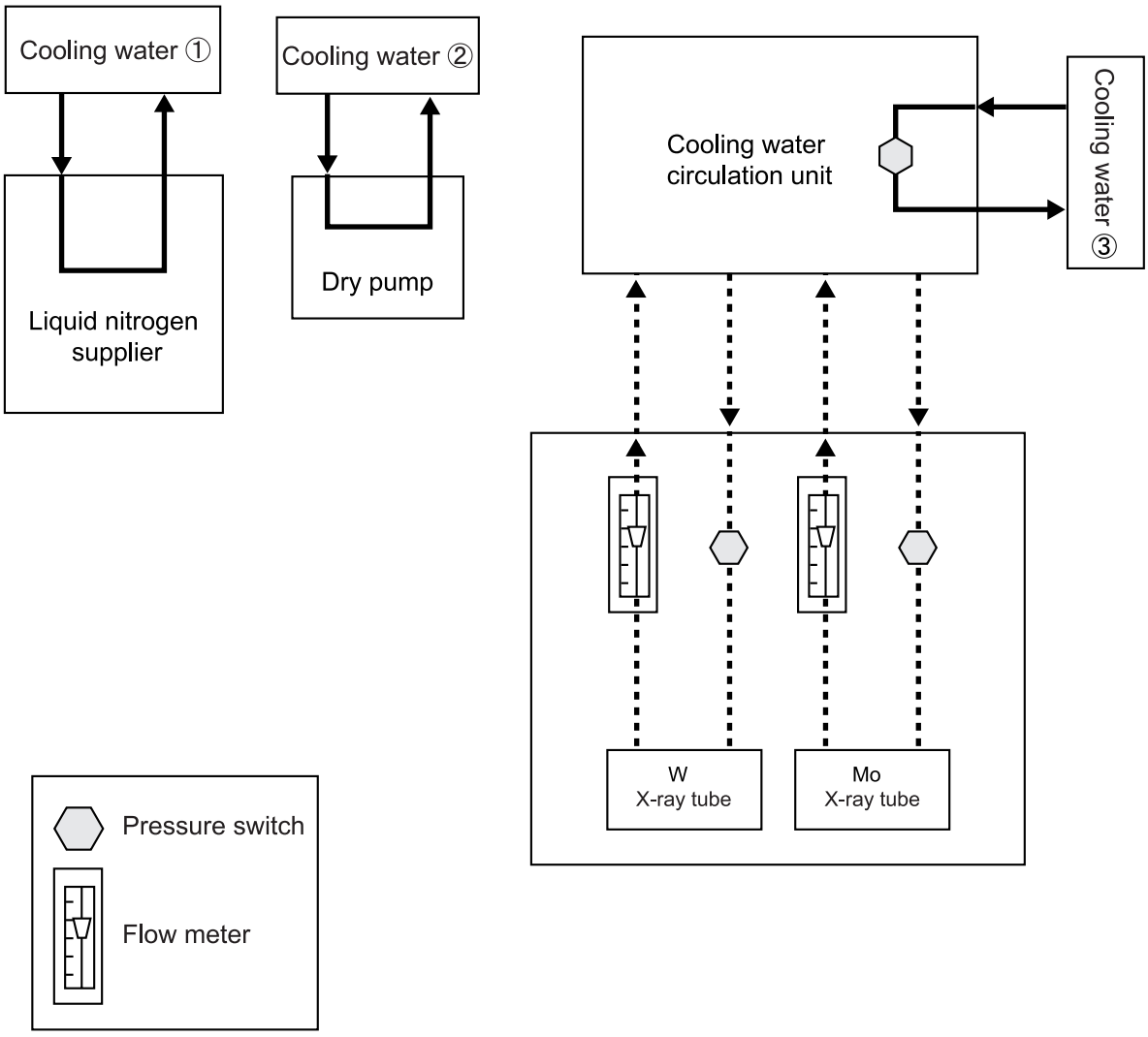
❷ Overall Configuration Diagram



❸ Vacuum System Diagram



❹ Cooling Water System Diagram

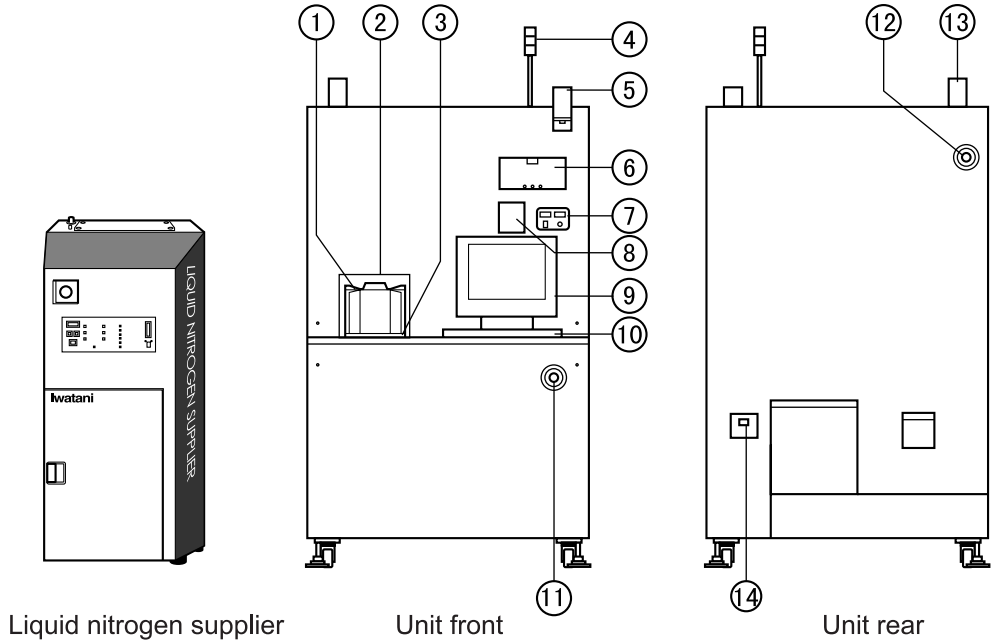


Set values of flow meter and pressure switch

Unit name	Pressure switch set value (MPa)	Flow meter set value (L/min)
W X-ray tube	0.15	3
Mo X-ray tube	0.15	3

PART NAMES

❶ Main Unit



Liquid nitrogen supplier Unit front Unit rear

①Wafer cassette
This is set in the wafer.

②Wafer casset cover
The cassette with the wafer installed is put in the wafer cassette.

③Casset base
This is set in the wafer cassette.

④Operation display lamp
This indicates the operation condition of the unit.

⑤X-ray warning lamp (unit front)
This lights up while X-rays are emitted.

⑥X-ray controller
In manual mode, the X-ray generator of the main unit can be controlled. (Do not use this normally. See page 84.)

⑦Switch panel
This contains switches for turning the power of the main unit ON/OFF, opening and closing the shutter, etc. (See the next page.)

⑧Oxygen densitometer
This indicates the oxygen density surrounding the unit.

⑨Display
This is for setting the measurement condition and checking main unit status.

⑩Keyboard
Use this to set the measurement conditions.

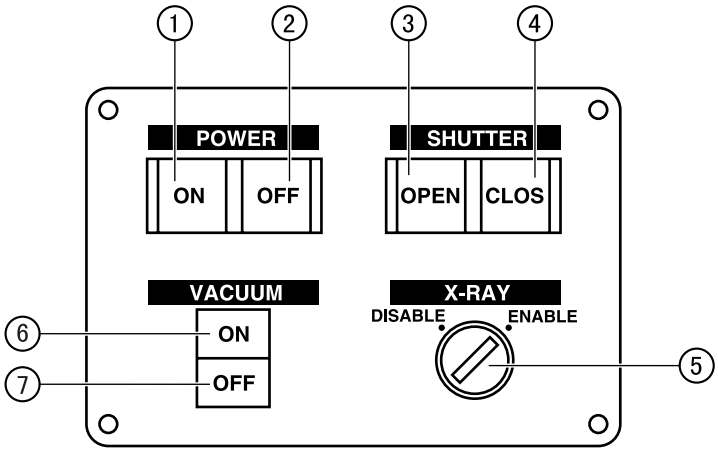
⑪Emergency OFF switch (unit front)
This stops the machine when an abnormality occurs.

⑫Emergency OFF switch (unit rear)
This stops the machine when an abnormality occurs.

⑬X-ray warning lamp (unit rear)
This lights up while X-rays are emitted.

⑭Main power switch
This turns the main power of the main unit ON/OFF.

❷ Switch Panel



①POWER ON switch
This turns the power ON.

②POWER OFF switch
This turns the power OFF.

③SHUTTER OPEN switch
This opens the X-ray shutter.

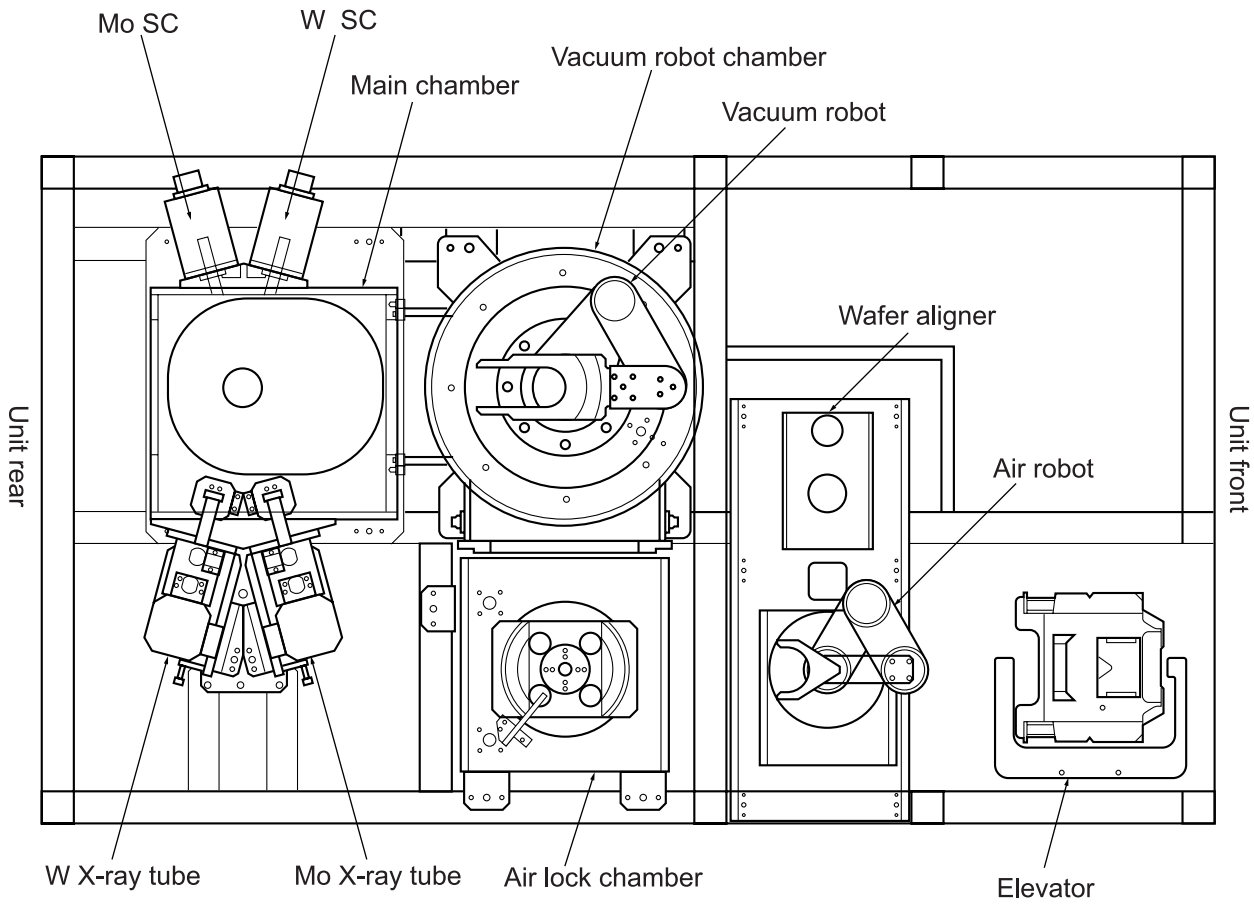
④SHUTTER CLOSE switch
This closes the X-ray shutter.

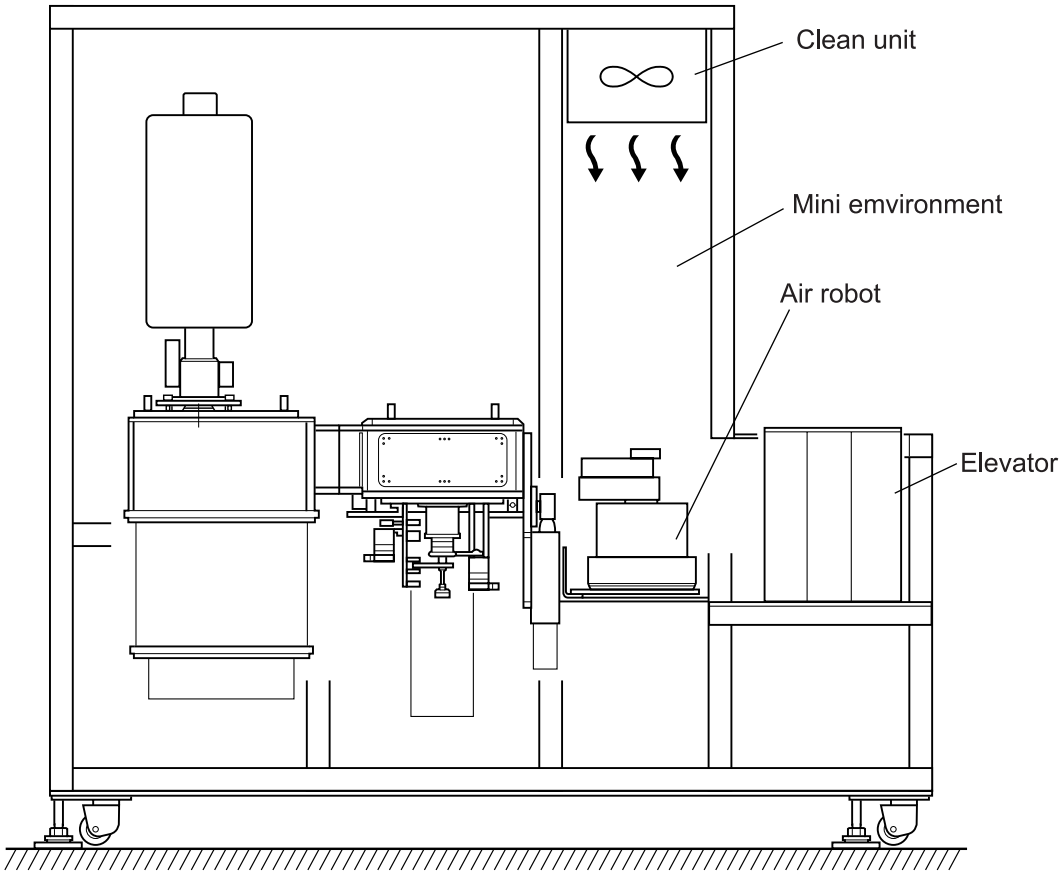
⑤X-RAY DISABLE/ENABLE switch
This switch sets whether or not it is possible to emit X-rays.
ENABLE : Possible
DISABLE : Not possible

⑥VACUUM ON switch
This turns the vacuum ON.

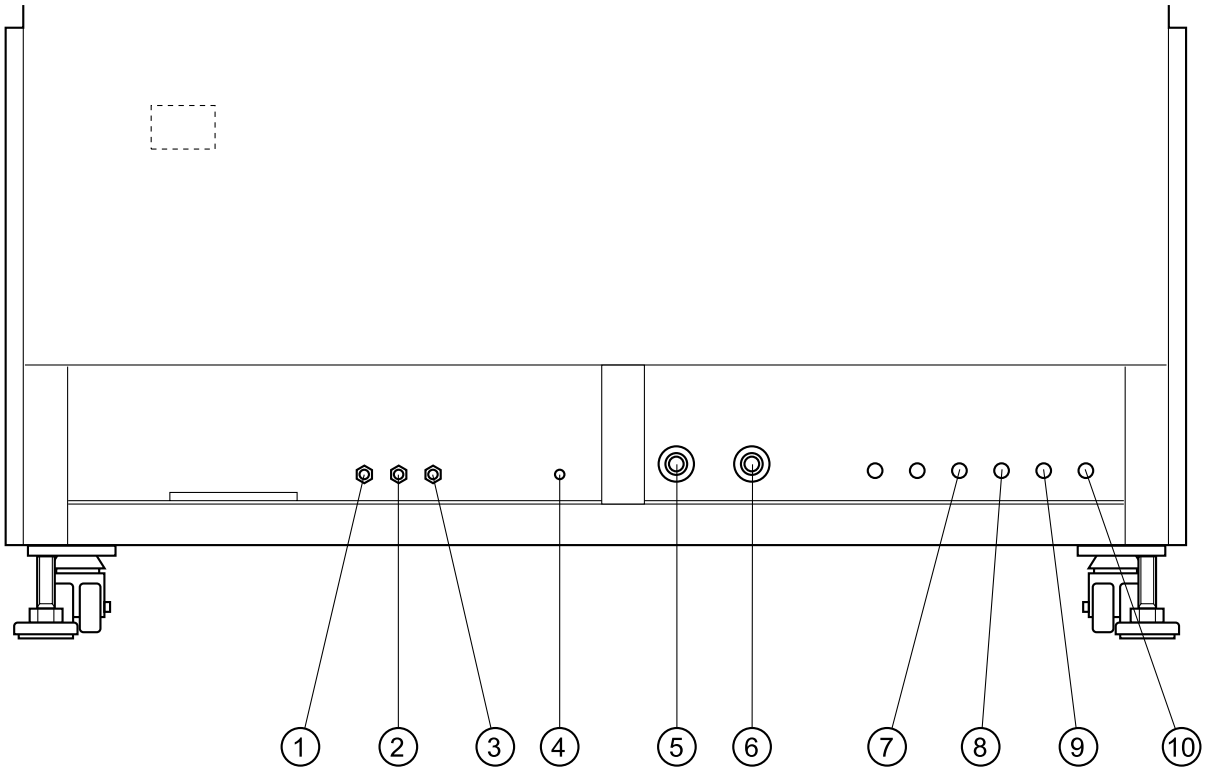
⑦VACUUM OFF switch
This turns the vacuum OFF.

❸ Unit Interior




Clean unit
Mini emvironment
Air robot
Elevator

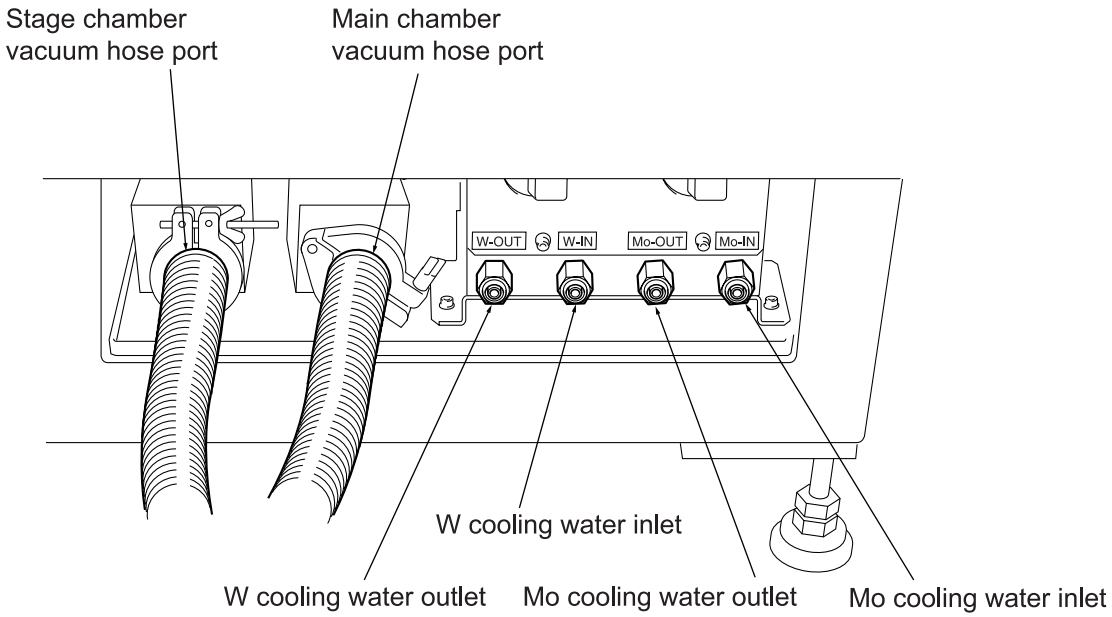
❹ Cooling Water, Air, Nitrogen Gas Hoses



①Nitrogen gas inlet
②Compressed air inlet
③Compressed air outlet
④Wafer chuck vacuum hose port
⑤Stage chamber vacuum hose port
⑥Main chamber vacuum hose port
⑦W cooling water outlet
⑧W cooling water inlet
⑨Mo cooling water outlet
⑩Mo cooling water inlet

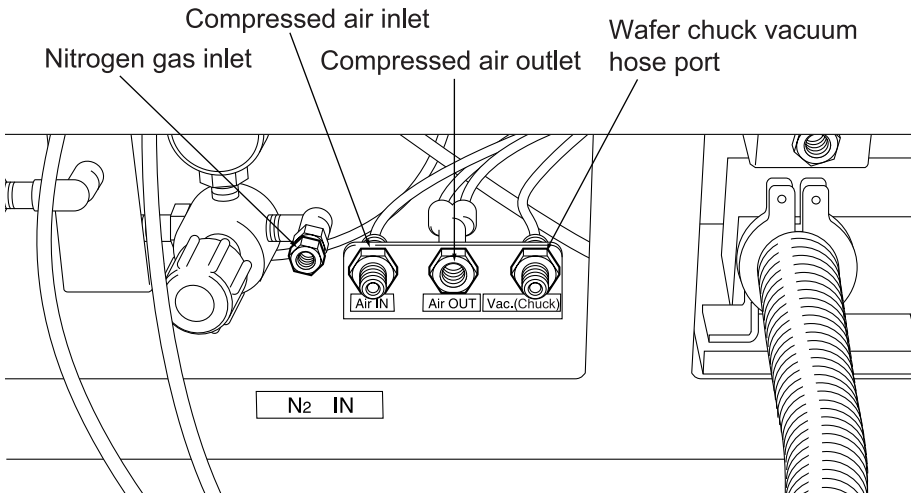
HOSES

❶ Vacuum Hoses and Cooling Water Hoses



Connect the vacuum hoses to the main chamber vacuum hose port and the stage chamber vacuum hose port.
Connect the water hoses to the inlets and outlets for W and Mo.

❷ Nitrogen Gas and Air Hoses



Connect the hoses to the nitrogen gas inlet, compressed air inlet and wafer chuck vacuum hose port.

UNIT STARTING AND STOPPING

The method for starting and stopping the machine are explained below.

❶ Starting the Machine

1. Press the POWER ON switch of the main unit.
2. Press the VACUUM ON switch of the main unit.
3. Turn the PC power ON.
   Start the TREX control program.
4. Supply cooling water to the main unit. (Cooling water will not flow if the main unit power is OFF.)
5. Press the RESET SWITCH on the X-ray controller to release the alarm.

■ When the unit has been off for a long time

Use the following procedure to start the unit if the main unit and the liquid nitrogen supplier have been off for a long time.

1. Start the liquid nitrogen supplier.

⚠CAUTION

- If the unit has been off for a long time, the liquid nitrogen inside the SSD (Solid State Detector) may be insufficient. When the liquid nitrogen supplier is started, liquid nitrogen supply to the SSD starts. Press the POWER ON switch of the main unit at least 4 hours after the nitrogen supply is completed. Pressing the POWER ON switch before 4 hours has passed, may damage the SSD.
- If the supply of liquid nitrogen in the liquid nitrogen supplier is insufficient, supply liquid nitrogen direct to the SSD from another tank or wait until liquid nitrogen accumulates in the liquid nitrogen supplier, then press the POWER ON switch of the main unit. If you supply the SSD from another tank, press the POWER ON switch of the main unit at least 4 hours after the nitrogen supply is completed. Pressing the POWER ON switch before 4 hours has passed may damage the SSD.

2. Press the POWER ON switch of the main unit.
3. Press the VACUUM ON switch of the main unit.
4. Turn the PC power ON.
   Start the TREX control program.
5. Supply cooling water to the main unit. (Cooling water will not flow if the main unit power is OFF.)
6. Press the RESET SWITCH on the X-ray controller to release the alarm.

❷ Stopping the Machine

⚠CAUTION

- The X-ray tube is hot immediately after the X-rays stop, so supply cooling water to the main unit for about 30 minutes after the X-rays stop.

1. Stop cooling water supply to the main unit.
2. Stop the TREX control program, then turn the PC power OFF.
3. Press the VACUUM OFF switch of the main unit, then wait 10 minites before performing the next step.
4. Press the POWER OFF switch of the main unit.

❸ Emergency Procedure

1. Press the EMERGENCY OFF button on the main unit.
2. Stop cooling water supply to the main unit.
3. Stop cooling water supply to the liquid nitrogen supplier.
4. Stop the nitrogen gas compressed air.

❹ Recovery Procedure After Emergency OFF

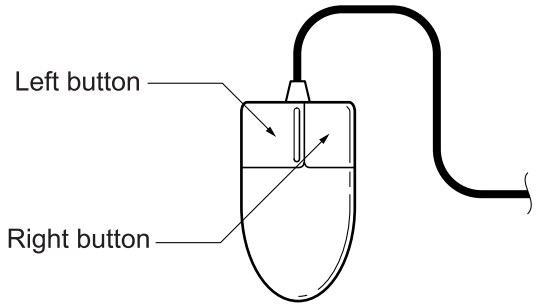
1. Turn the emergency OFF switch on the main unit in the direction of the arrow to release the switch.
2. Press the ON switch of the distribution board.
3. Turn ON the power of the liquid nitrogen supplier.
4. Press the POWER ON switch of the main unit.
5. Press the VACUUM ON switch of the main unit.
6. Turn the PC power ON. Start the TREX control program.
7. Supply cooling water to the main unit. (Cooling water will not flow if the main unit power is OFF.)
8. Press the RESET SWITCH on the X-ray controller to release the alarm.

TREX CONTROL PROGRAM OPERATION

The operation method of the TREX control program is explained below.

❶ Basic Operation

The TREX control program involves selecting items on the computer screen using a mouse, then setting each condition. Basic operation of the mouse is explained below.



Mouse

Click	Quickly press and release the mouse button. In this manual, unless otherwise specified, clicking the left button is standard. Clicking the right button will be indicated by "right click".
Double click	Click the mouse button twice rapidly.
Drag	Move the mouse while pressing the mouse button.

When you want to select an item from a menu or file, move the cursor to above the item you want, then click. The item is then selected.

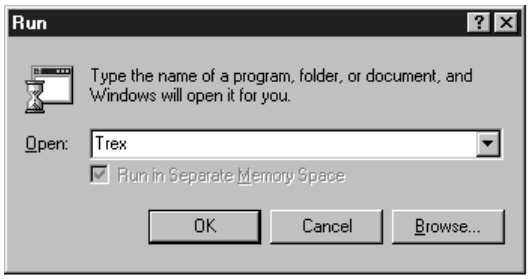
❷ Start and End of Control Program

The start and end method of the TREX control program is explained below.

■ Control Program Start

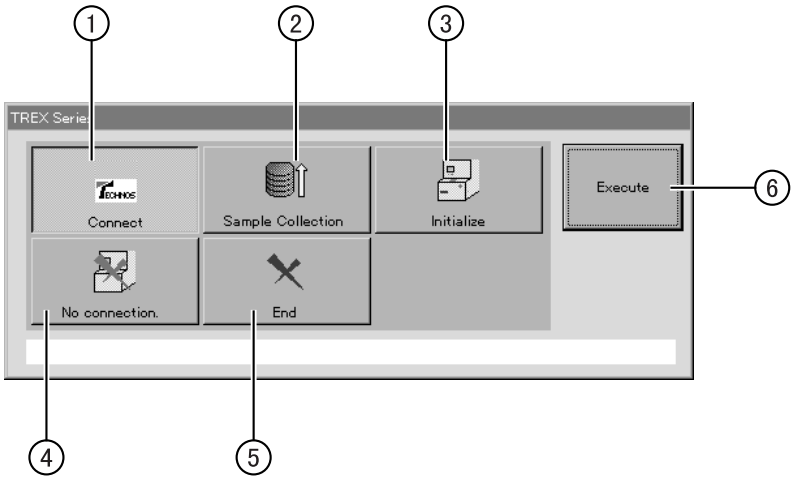
Press the POWER ON switch of the main unit to start the main unit.
Turn the PC power ON and after Windows is invoked, start the TREX control program using the following procedure.

1. Click on START at the bottom of the screen.
2. Select the Run.



3. Type in the input shown above and then click on the OK button.
   After the company logo is displayed on the screen, the start-up screen is displayed next.
   When you select an item and press Execute, the selected item will be executed.

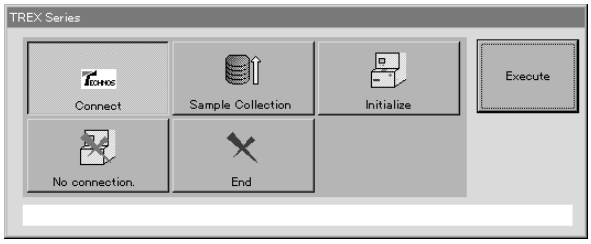
Start-up screen



①Connect	This connects the main unit and the PC. Select it when you want to perform from Measurement to Analysis.
②Sample Collection	This recovers the samples when there are samples remaining inside the main unit.
③Initialize	This initializes the main unit if an error occurs.
④No connection	The main unit and the PC are not connected. Select this when you want to use saved measurement data to perform analysis only.
⑤End	This ends the TREX control program and returns the screen to the Windows screen.
⑥Execute	This executes the selected item.

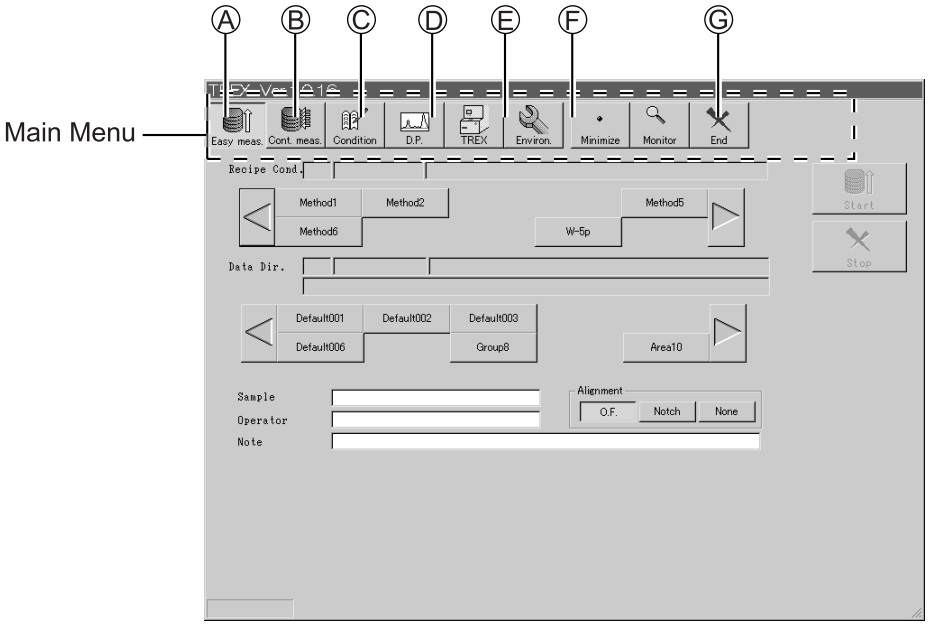
■ Screen Flow Diagram

Start-up screen

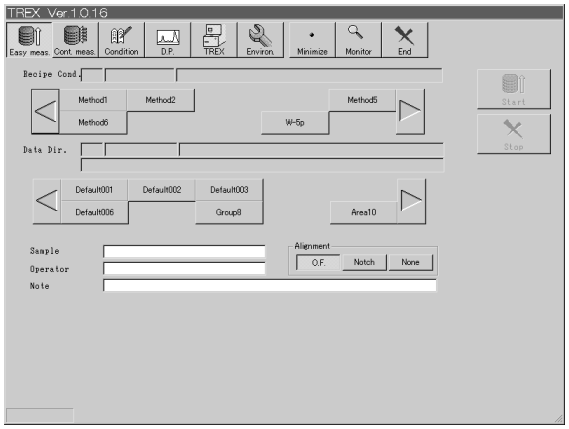


Click on [Connect] ➡ [Execute]

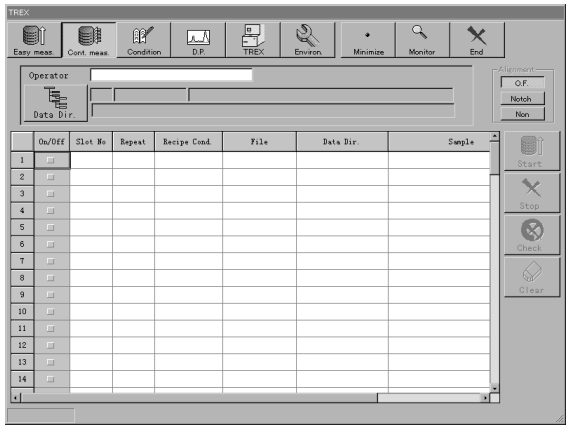
Clicking on the Main Menu buttons switches the screen to the screens shown below.



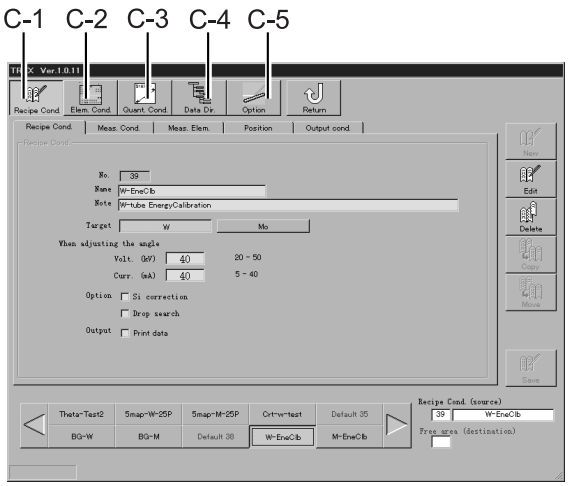
Ⓐ Easy Measurement screen



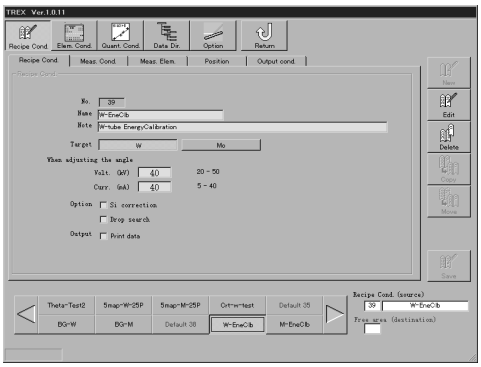
Ⓑ Continuous Measurement screen



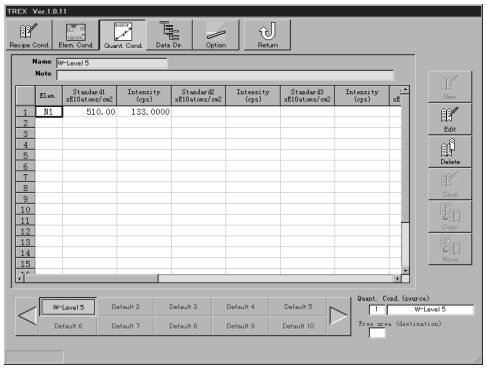
© Recipe Conditions screen



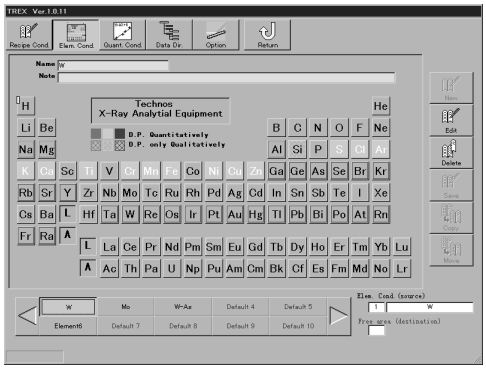
C-1 Recipe Conditions screen



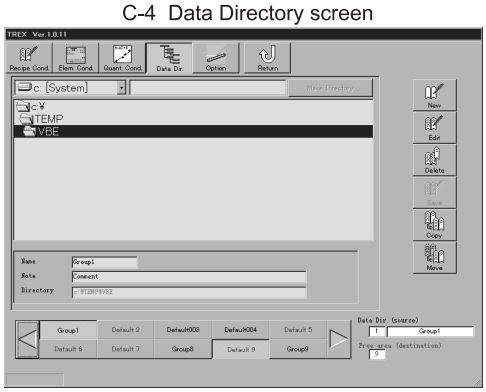
C-3 Quantification Conditions screen



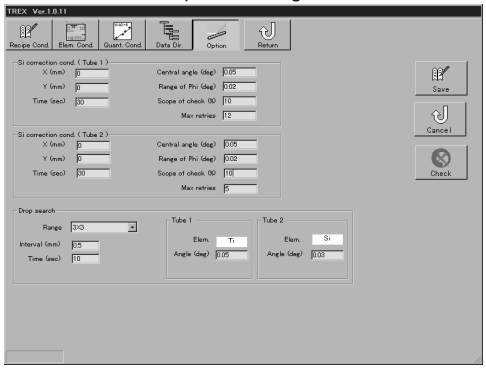
C-2 Element Conditions screen



C-4 Data Directory screen

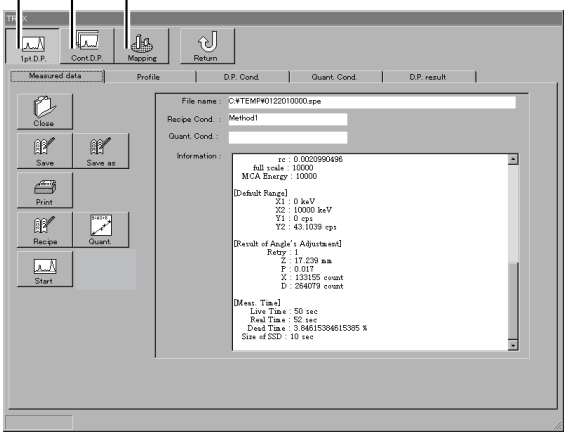


C-5 Option Setting screen

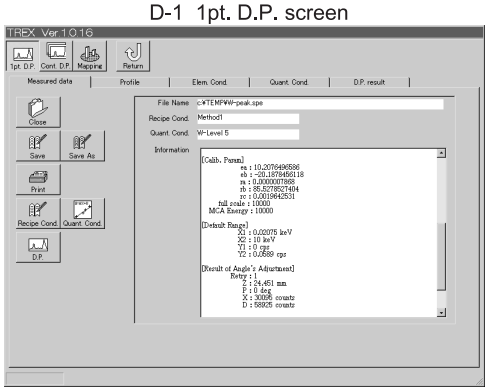


Ⓓ Data Processing screen

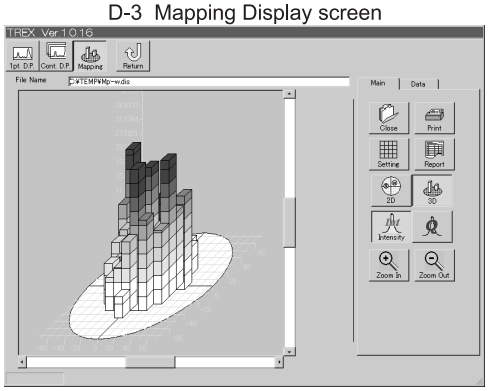
D-1 D-2 D-3



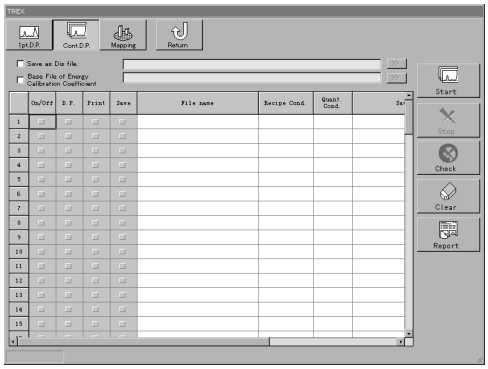
D-1 1pt. D.P. screen



D-3 Mapping Display screen

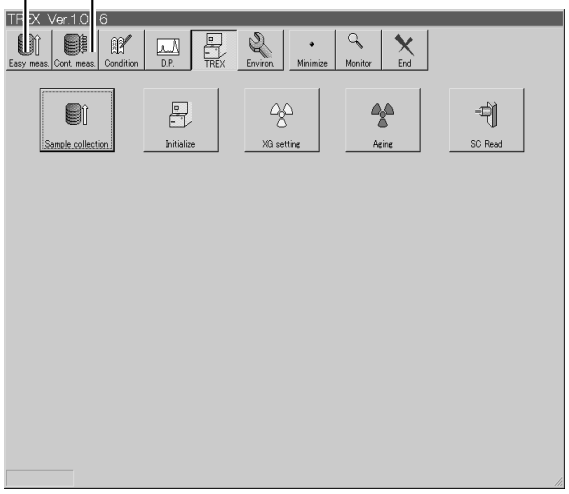


D-2 Continuous D.P. screen

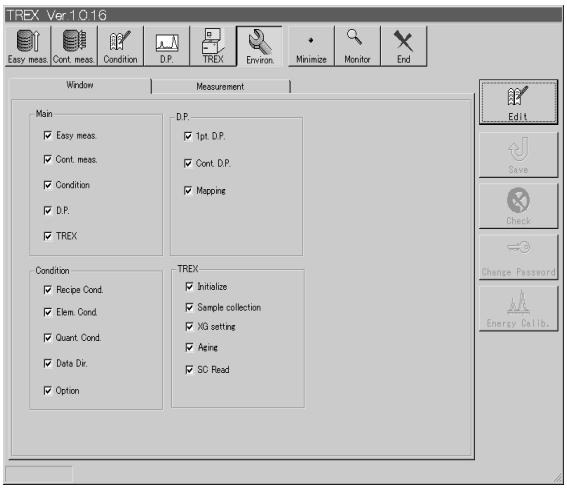


Ⓔ Device Utility screen

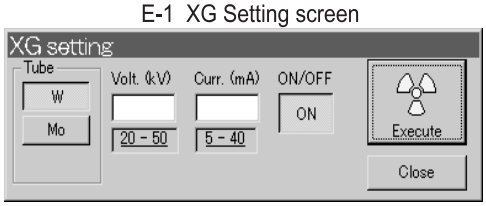
E-1 E-2



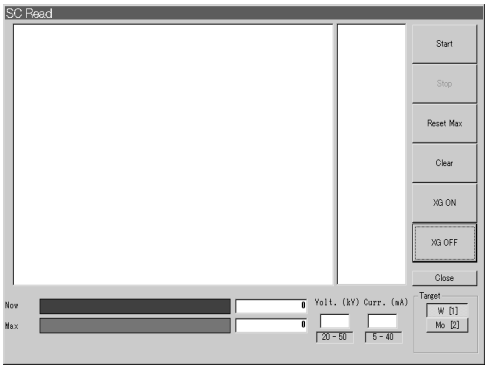
Ⓕ Environment Setting screen



E-1 XG Setting screen

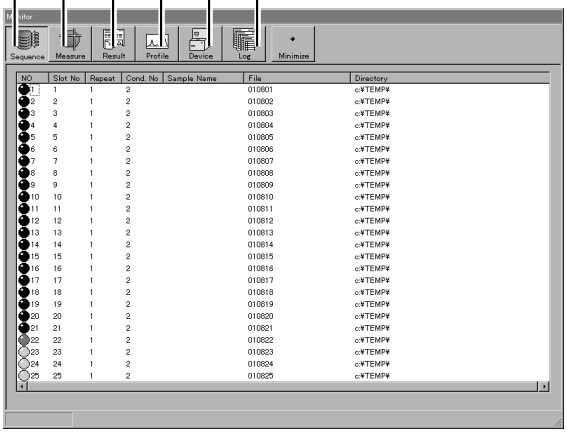


E-2 SC Read screen

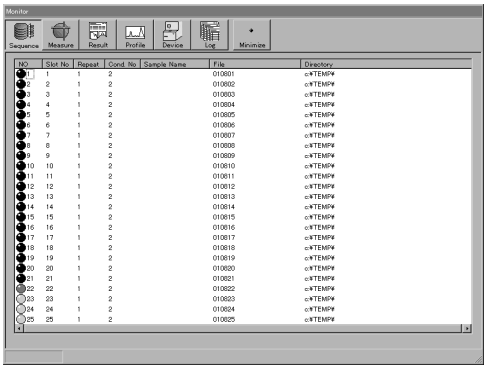


Ⓖ Monitor screen

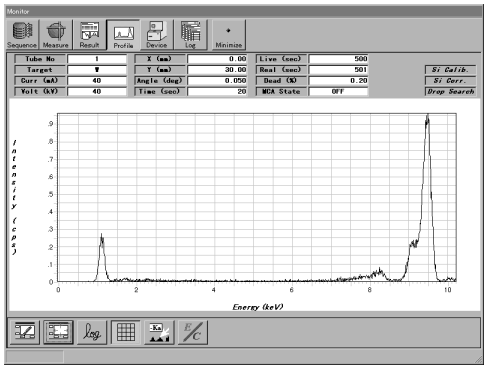
G-1 G-2 G-3 G-4 G-5 G-6



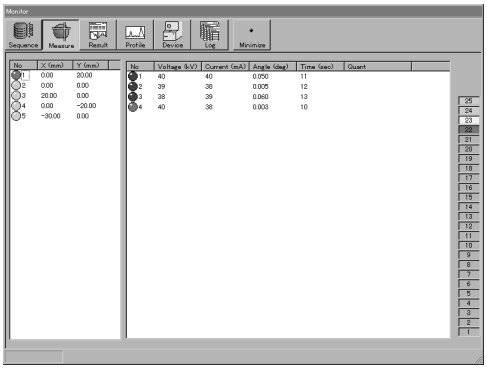
G1 Sequence



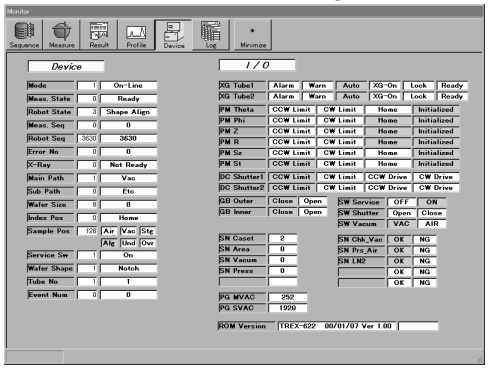
G-4 Profile



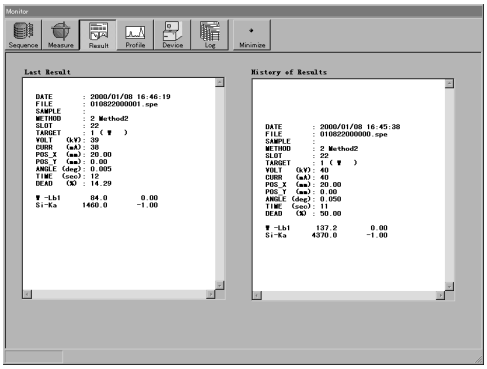
G2 Measure Status



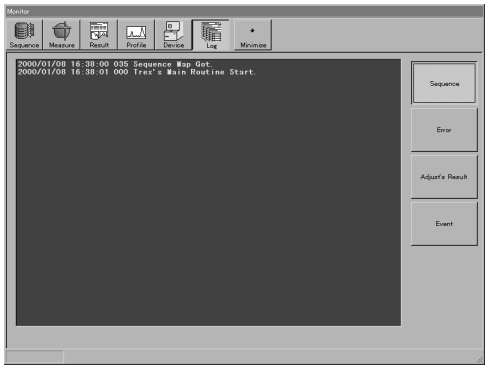
G-5 Device Setting



G-3 Measurement Result

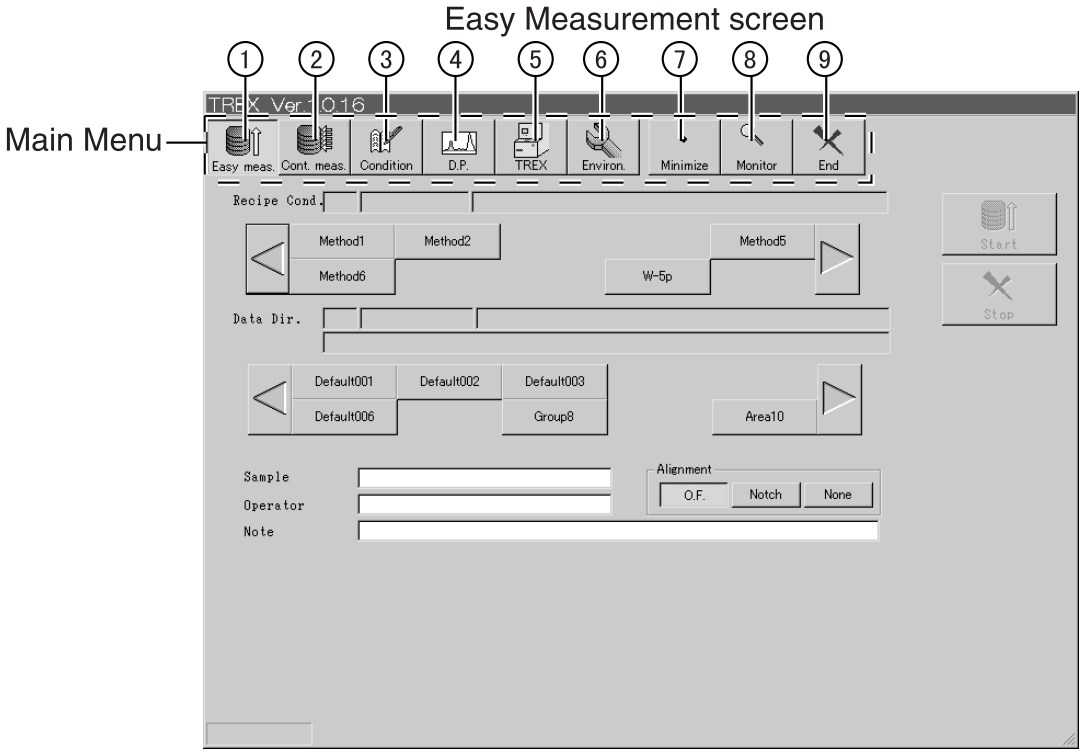


G-6 Log



■ Main Menu

When you select Connect on the Start-up screen, the Easy measurement screen is displayed first. The main menu icons are displayed at the top of the screen. By clicking on the applicable icon, you can select the Easy measurement screen or Continuous measurement screen, or set the Measurement Condition, and so on.



①Easy meas. The Easy measurement screen is displayed. Analysis can easily be performed just by selecting the setting-completed Analytical condition(recipe) and Data Directory. (See page 33.)

②Cont. meas. The Continuous measurement screen is displayed. Different analytical conditions(recipe) can be used for each wafer, or you can change the analytical conditions(recipe) for the same wafer and analyze it any number of times. (See page 35.)

③Condition The Recipe Condition setting screen is displayed. You can set or edit the Recipe Condition and Element condition. (See page 37.)

④Data Processing The D.P.(Analysis) setting screen is displayed. It is possible to evaluate by different D.P. conditions to at the time of measurement done. (See page 53.)

⑤TREX The Device utility screen is displayed. X-ray settings and device initialization can be performed. (See page 65.)

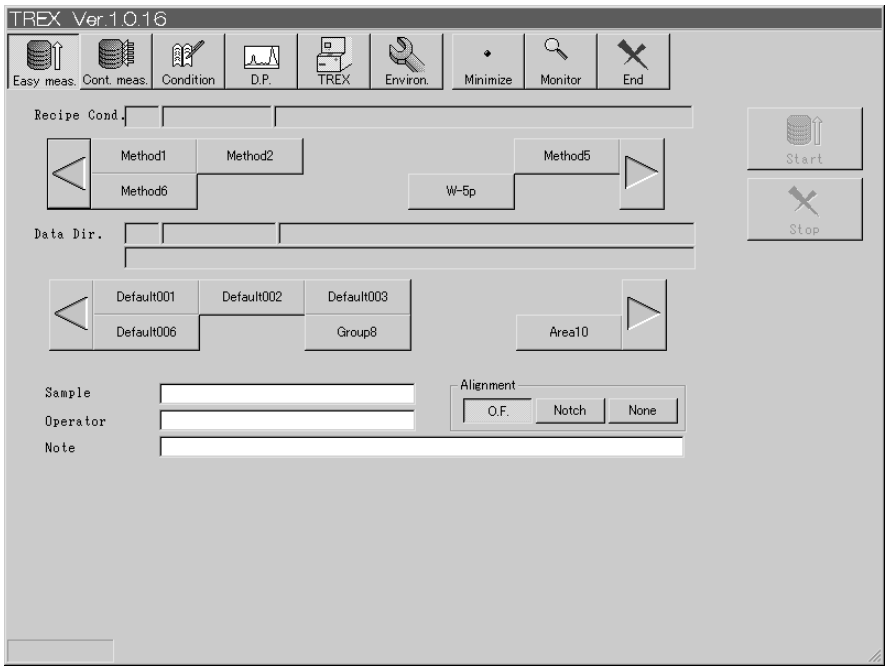
⑥Environment Setting The Environment Setting screen is displayed. Settings for enable/disable display of menu buttons and X-ray status settings after measurement end can be performed. (See page 70.)

⑦Minimize This minimizes the size of the screen display. When the screen is minimized, it is displayed as a button on the Windows task bar.

⑧Monitor The Monitor screen is displayed. The device status during measurement can be monitored. (See page 74.)

⑨End The Trex620 control program ends and the screen returns to the Windows screen. (See page 31.)

■ Control Program End



1. Click on End on the Main Menu.
   The End confirmation screen will be displayed.
   If you select Yes, the control program ends and the screen returns to the Windows screen.
   If you select No, the control program continues.

■ PC End

Before you turn OFF the PC power, always check that measurement is completed.

1. Click on Start displayed at the lower left of the screen.
   Windows Start menu is displayed.
2. Select End Windows from the Start Menu.
   The confirmation screen for turning OFF the PC power will be displayed.
3. Select "Prepare computer for power turn off", then click Yes.
   Soon the screen will display the message "Computer ready for power OFF", and the computer will automatically turn OFF.

⚠CAUTION

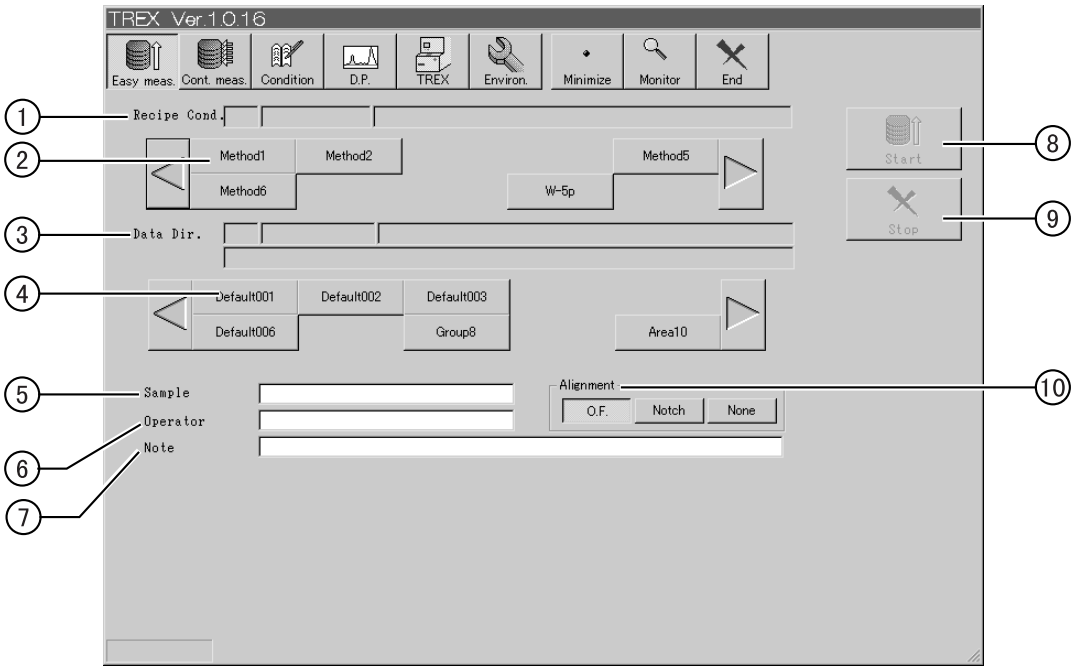
- If you turn off PC power while measurement is performing machine will stop with the sample still inside the machine. If this occurs, restart the control program, then recover the sample using Sample Collection on the start-up screen or the TREX screen.

MEASUREMENT

❶ Easy Measurement

When you click on Easy measurement on the Main menu, the Easy measurement screen is displayed. Analysis can easily be performed just by selecting Recipe and Data Directory for all of wafers in the cassette.

Easy Measurement screen



① Recipe Condition display	When you select the ② Recipe Condition button, the recipe condition number, recipe name and memo contents set for that button are displayed.
② Recipe Condition button	Select the recipe condition to be used from among the buttons. For that button, the recipe name you set for “Recipe Condition setting” (See page 37) is displayed.
③ Data Directory display	When you select the ④ Data Directory button, the Data Directory number, Data Directory name (button name), memo contents and actual Data Directory set for that button are displayed.
④ Data Directory button	Select the data Data Directory from among the buttons. The Data Directory name set for “4 Data Directory Setting” (See page 50.) is displayed among the buttons.
⑤ Sample name	Input the sample name (Common to all the wafers in the same cassette.). Measurement is possible without this input.

⑥ Operator — Input the name of the operator executing the measurement. Measurement is possible without this input.

⑦ Note — Enter a Note about the measurement conditions. You can enter up to 40 one-byte characters.

⑧ Start — Measurement starts.

⑨ Stop — Measurement stops before completion All samples inside the machine are collected. If you click on Start again, measurement starts again from the start.

⑩ Alignment — This sets the wafer shape. This setting is common for all the wafers inside the cassette. This button is only displayed when "Decide Before Start Meas." is selected for Setting of Wafer Alignment on the Setting screen (See page 70).

REFERENCE

● Recipe Condition button, Data Directory button

- For each button, the applicable Recipe name and Data Directory name set for “Recipe Condition setting” (See page 37) and “4 Data Directory setting” (See page 50) are displayed. A maximum of 10 buttons can be displayed on the screen. To display buttons not displayed on the screen, click on the ◀ ▪▶ buttons at the left and right of the screen. The button display changes over in units of 10 buttons each time.
  Buttons for which nothing is set on “Recipe Condition setting” (See page 37) and “4 Data Directory setting” (See page 50) are not displayed.

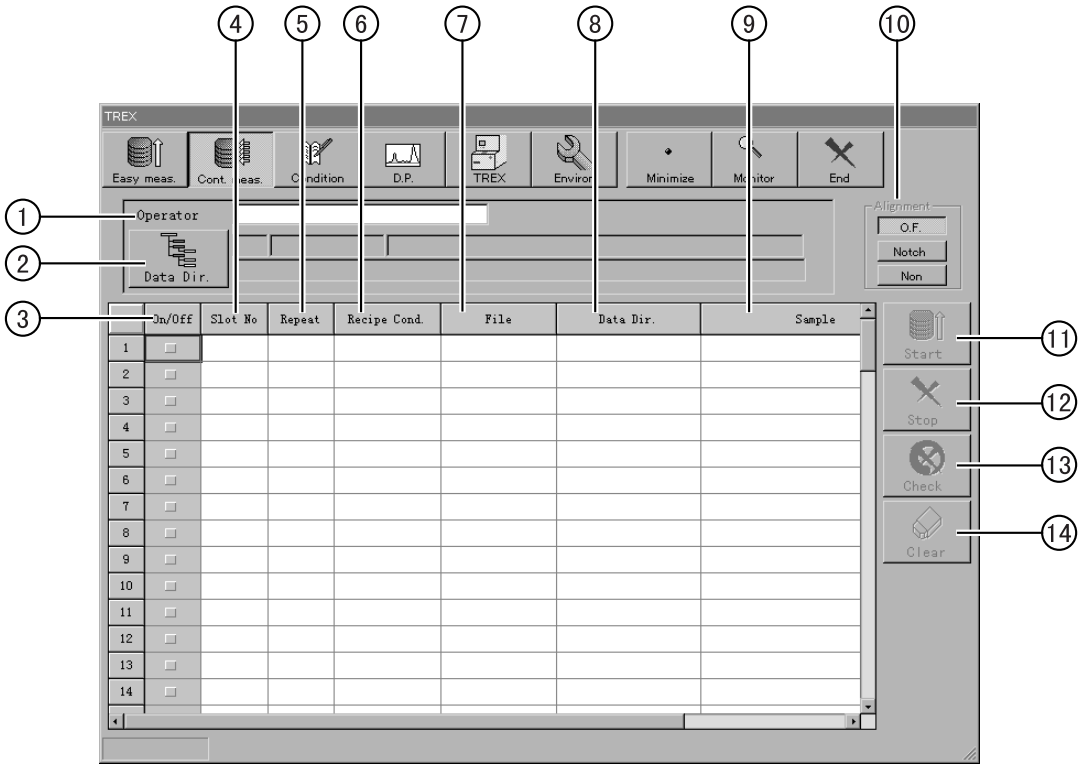
● Saving Measurement Data

- For Easy measurement, the file name is automatically set for the measurement data with the date and number. Changes are not possible.

❷ Continuous Measurement

When you click on Continuous measurement on the Main Menu, the Continuous measurement screen is displayed. Different analytical conditions can be used for each wafer, or you can change the analytical conditions for the same wafer and analyze it any number of times.

Continuous Measurement screen



① Operator	Input the name of the operator executing the measurement. Measurement is possible without this input.
② Data Directory selection button	When your press the button, the Data Directory names set for "4 Data Directory Setting" (See page 50) are listed. Select the Data Directory for measurement data from the list. In the text box next to the button, the Data Directory number and Data Directory name (button name), memo contents and actual Data Directory set for that Data Directory are displayed.
③ On/Off	Used for checking the items you want to measure. Lines not checked are not measured.
④ Slot No	Input the slot number containing the sample to be measured.
⑤ Repeat	When you want to repeat measurement, input the number of measurement times required.
⑥ Recipe Cond.	Select the recipe condition used for analysis. When you click on Recipe Cond., the recipe conditions set for "Recipe Condition Setting" (See page 37) are listed. Select the Recipe Condition from the list.
⑦ File	Enter the file name for the measurement data to be saved.
⑧ Data Directory	Input the Save space when you want to input data at a place other than the place selected at ② Data Directory selection button.

⑨ Sample name — Input the sample name. Measurement is possible without this input.

⑩ Alignment — This sets the wafer shape. This setting is common for all the wafers inside the cassette. This button is only displayed when "Decide Before Start Meas." is selected for Setting of Wafer Alignment on the Setting screen (See page 70).

⑪ Start — The PC perform logical check for all item set, and if all are valid or aceptable, starts measurement.

⑫ Stop — Measurement stops before completion All samples inside the machine are collected. If you click on Start, measurement starts again from the start.

⑬ Check — Check whether the set contents are valid or not. If there is an error in the set contents, a message is displayed, so recheck the set contents if this occurs.

⑭ Clear — Deletes ALL the set contents. It is not possible to delete only selected lines.

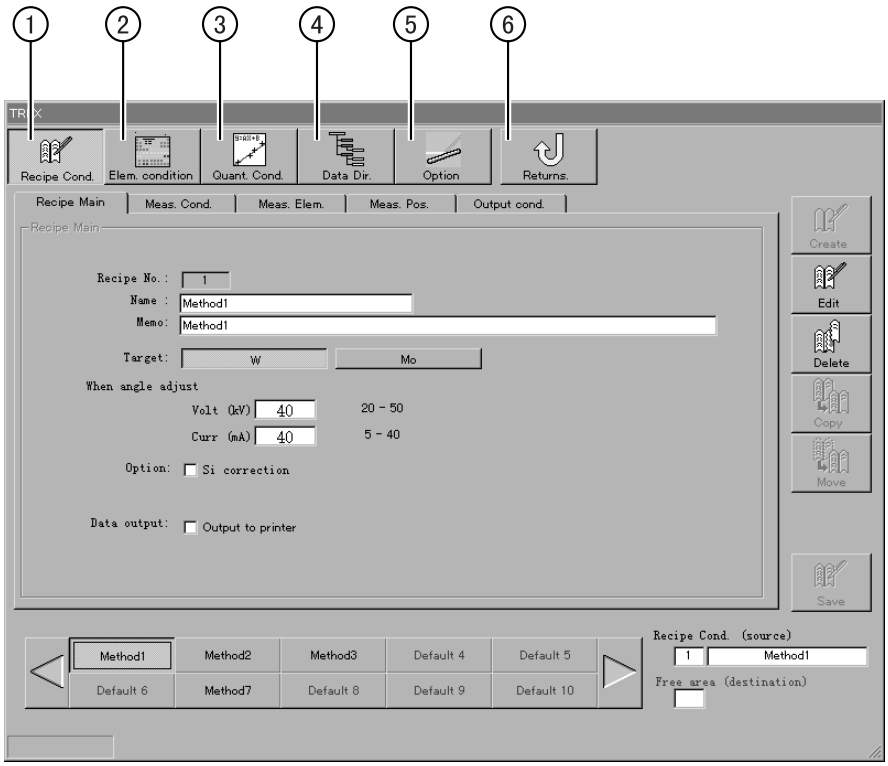
REFERENCE

- You can enter a Note about the measurement conditions in the Remarks box at the left side. You can enter up to 40 one-byte characters.

RECIPE CONDITION SETTING

When you click on Condition on the Main Menu, the Recipe Condition screen is displayed. On the Recipe Condition screen, you can create new recipe conditions or edit existing ones.

Recipe Conditions screen

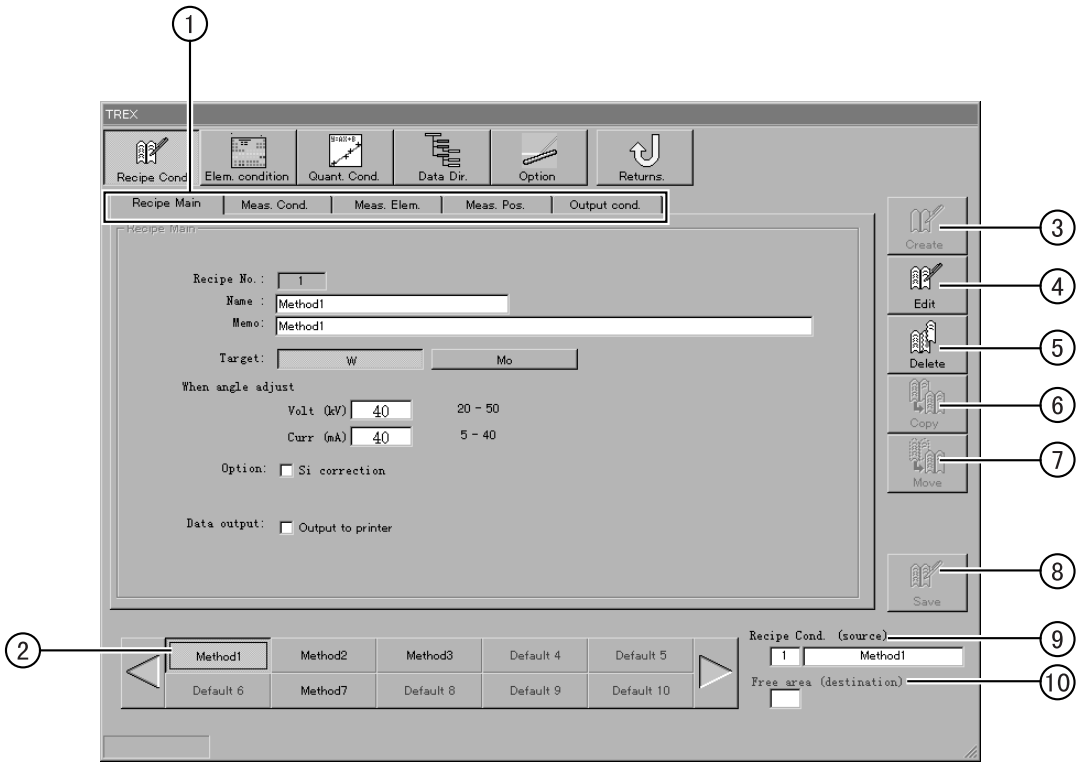


①Recipe Condition	The Recipe Condition screen is displayed. You can input a name for the recipe condition and save it, or set the measurement condition and element condition. (See page 38.)
②Element Condition	The Element Condition screen is displayed. Set the elements for analysis as the element condition. (See page 46.)
③Quant. Condition	The quantification condition screen is displayed. Make calibration coefficient. (See page 48.)
④Data Directory	The Data Directory screen is displayed. Set the Data Directory for the measurement data. (See page 50.)
⑤Option	The Option setting screen is displayed. Set the Option functions. (See page 52.)
⑥Returns	The screen returns to the Main Menu.

❶ Recipe Condition Setting

When you click on Recipe Condition on the Recipe Condition setting screen, the Recipe Condition screen is displayed. You can input a name for the recipe condition and save it, or set the measurement condition and element condition.

Recipe Conditions screen



①Recipe setting tab	Clicking on one of the heading tabs will display the applicable screen for setting each condition.
②Recipe condition button	Select the button for setting each recipe condition. If the recipe is existing, the recipe name is displayed.
③Create	When you select the ② Recipe Condition button for new recipe condition and click the Create button, you can then create a new recipe condition.
④Edit	When you select the ② Recipe Condition button for existing recipe condition and click the Edit button, you can then edit the Recipe condition.
⑤Delete	This deletes the conditions set for the selected ② Recipe Condition button.
⑥Copy	This copies the button set contents displayed at ⑨ Recipe Condition (source) to the button displayed at ⑩ Free area (destination).
⑦Move	This moves the button set contents displayed at ⑨ Recipe Condition (source) to the button displayed at ⑩ Free area (destination). The button contents set at ⑨ Recipe Condition (source) are deleted.

⑧ Save — This saves the edited contents. When the Save button is clicked, the confirmation dialog box is displayed.

⑨ Recipe Condition (source) — When the ② Recipe condition button for recipe condition setting completion is selected when editing, copying or moving the recipe condition, the recipe number and recipe name of that button are displayed.

⑩ Free area (destination) — When the ② Recipe condition button for a non-set recipe condition is selected when creating, copying or moving the recipe condition, the recipe number of that button is displayed.

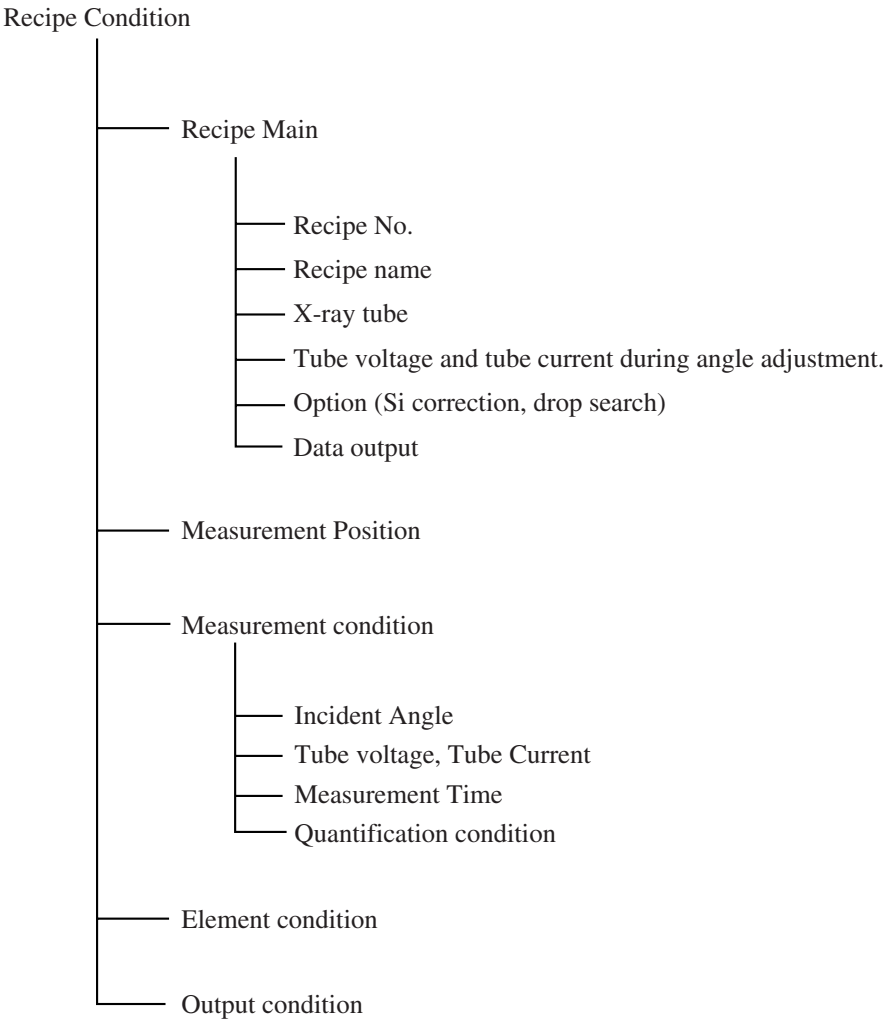
REFERENCE

● Recipe condition button

- The Recipe condition button can register a maximum of 100 items. The screen displays 10 Recipe condition buttons. To display buttons not displayed on the screen, click on the ◀ ▪ ▶ buttons at the left and right of the screen. The button display changes over in units of 10 buttons each time.

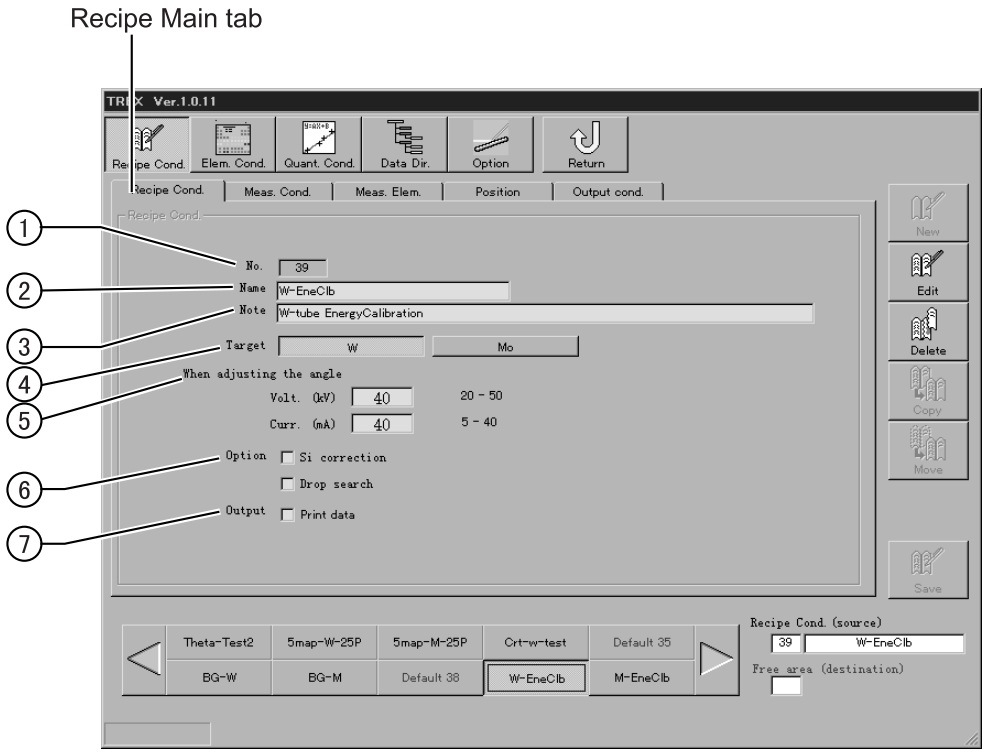
■ Recipe Condition Configuration

Create Quantification condition and Element condition beforehand, then select and set from among the registered conditions.



■ Recipe Setting

When you click on the Recipe Main tab on the Recipe Condition screen, the following screen is displayed. You can set a recipe name, or set the X-ray source when measurement is performed.



①Recipe No. When you select the Recipe Condition button (See page 38), the number applying to that button is displayed.

②Recipe Name Input the recipe name. The name input here is displayed for the Recipe Condition button. When you select a Recipe Condition button for which the recipe condition is already set, the name of that button is displayed.

③Note Input a simple explanation about the recipe condition.

④Target Select the X-ray source used for measurement.

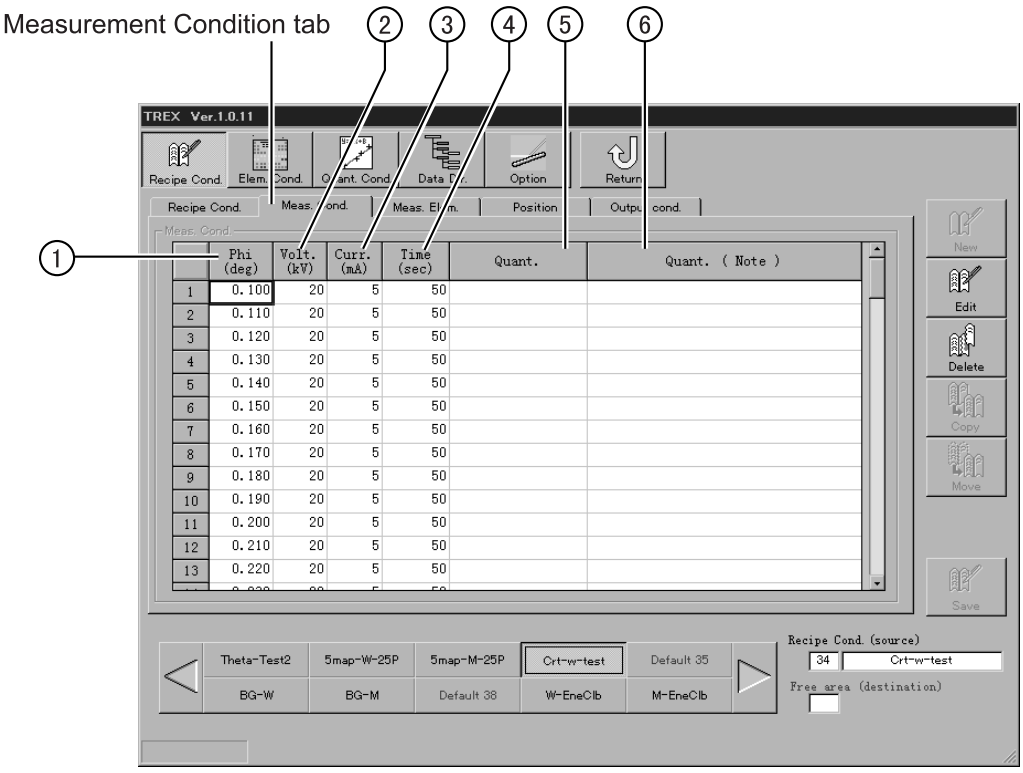
⑤Angle adjust Input the voltage and current of the X-ray source when the angle is adjusted.

⑥Option This sets whether or not to perform Si intensity correction and drop search. If you tick this box, Si intensity correction and drop search are performed using the contents set at “5 Option Setting” (See page 52).

⑦Output If you tick this box, after measurement is completed, the results are automatically printed out.

■ Measurement Condition Setting

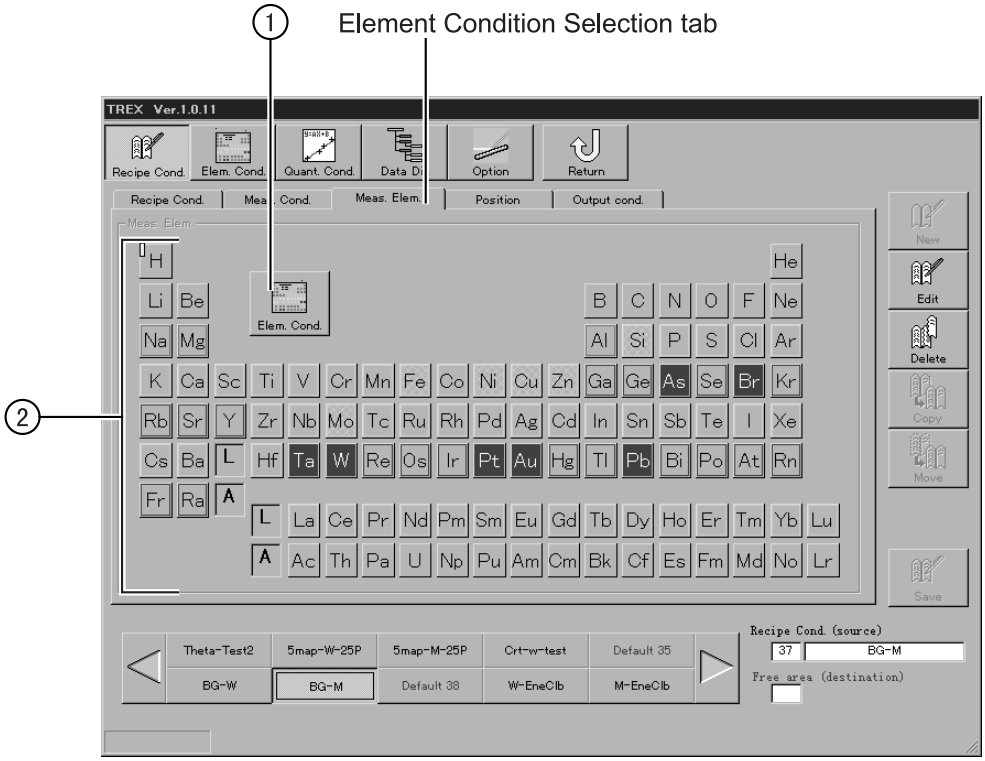
When you click on the Measurement Condition tab on the Recipe Condition screen, the following screen is displayed. You can set the X-rays for measurement use, or set the measurement time. The Measurement Condition can register up to 100 items.



①Phi (deg)	Input the X-ray incident angle .
②Voltage	Set the voltage for the X-ray source selected at Recipe setting (See page 41).
③Current	Set the current for the X-ray source selected at Recipe setting (See page 41).
④Time	Set the measurement time period.
⑤Quantification	Select the Quantification Condition used for Quantitative analysis. When you click on the Quantification display, the list of quantification conditions set for “3 Quantification Condition setting” (See page 48) is displayed. Select the Quantification Condition from the list.
⑥Quantity. Note	This displays the contents of the Note set in the Quantification Condition selected at ⑤ Quantification.

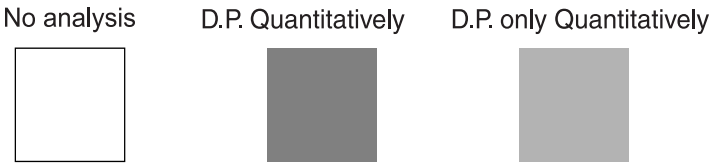
■ Element Condition Selection

When you click on the Element Condition selection tab on the Recipe Condition screen, the following screen is displayed. Select the Element Condition for analysis.



①Element Condition selection button — Select the Element Condition used for analysis. Clicking on the button displays the list of Element Conditions set at "2 Element Condition Setting" (See page 46). Select the Element Condition from the list.

②Element Condition Display — The element symbol displayed is switched in accordance with the selected Element Condition setting.

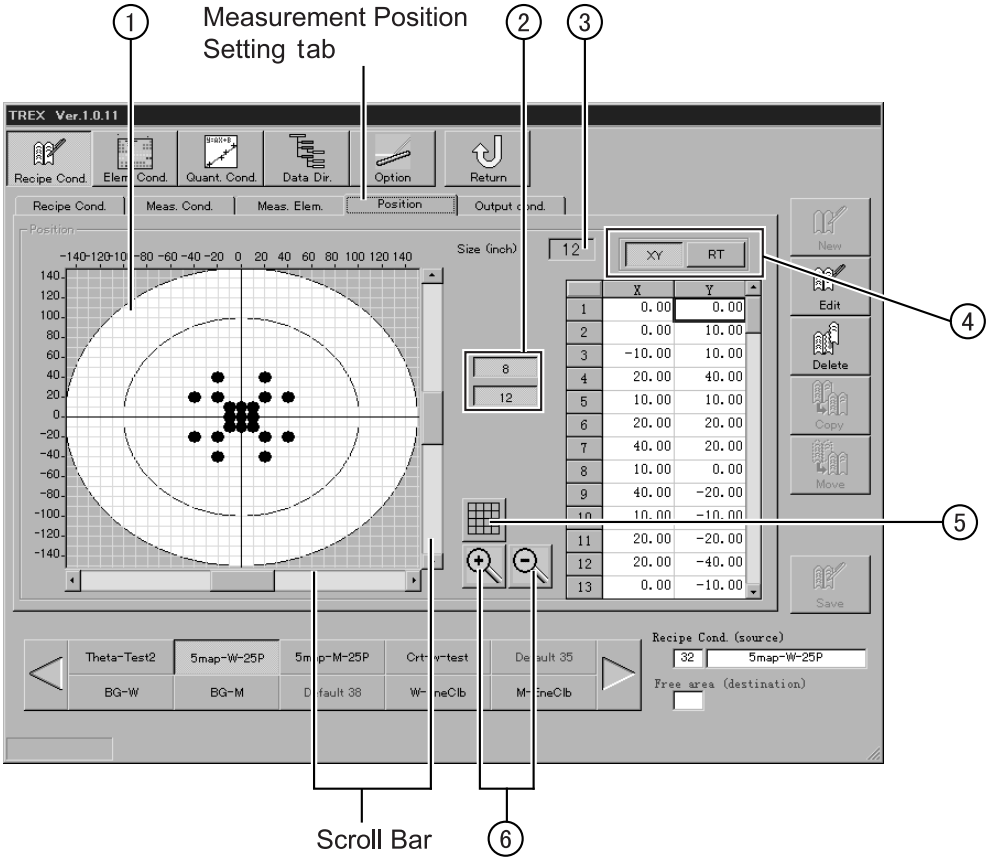


REFERENCE

- Perform editing of the Element Condition at "2 Element Condition Setting" (See page 46).

■ Measurement Position Setting

When you click on the Meas. Pos. setting tab on the Recipe Condition screen, the following screen is displayed. Set the wafer size and measurement position.



①Measurement position display	This indicates the set measurement position. The measurement position is indicated by the black spot. By clicking on the graph with the mouse, you can specify the closest grid intersection as the measurement position.
②Wafer Size	Specify the size of the wafers to be measured.
③Wafer Size display	Display the specified wafer size is displayed.
④Measurement position setting	Set the measurement position. XY Mode : With the wafer center as 0, input the measurement position using X, Y coordinates. RT Mode : Set the measurement position using R (radius) and T (angle).
⑤Grid setting	Clicking here displays the screen for setting the grid display method.
⑥Enlarge/reduce display	Each click on the icon either enlarges or reduces the size of the measurement position display (graph display).

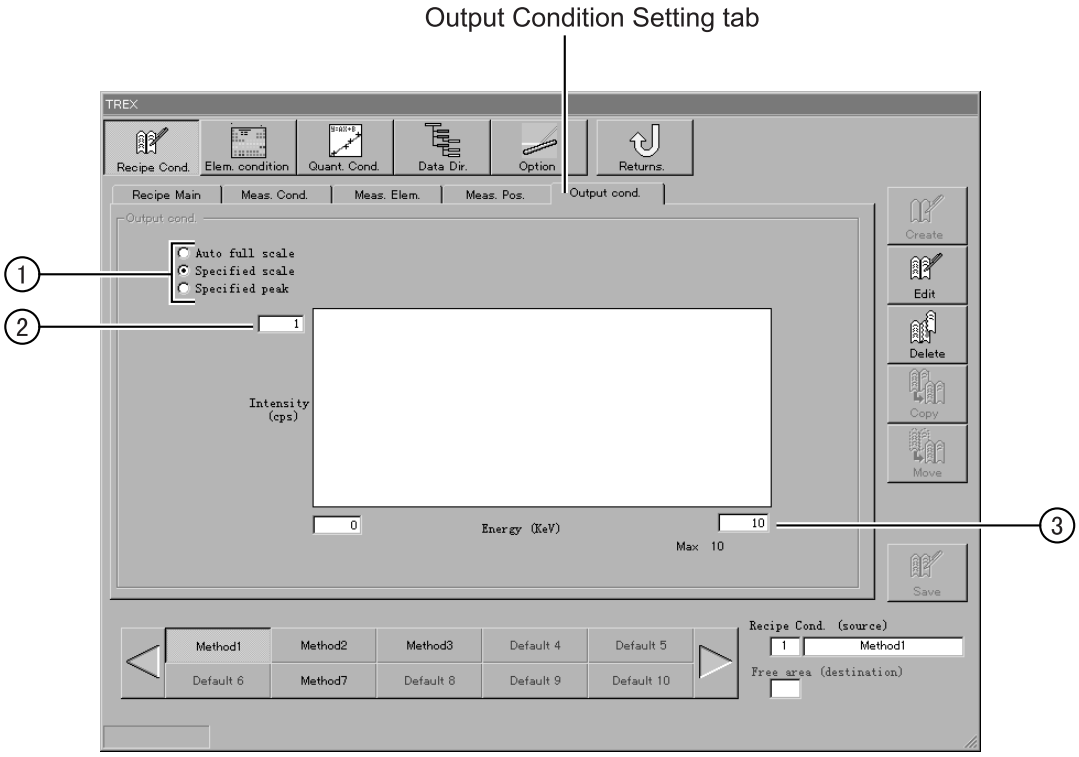
REFERENCE

●Measurement position specification

- When specifying the position using coordinates, input the units in millimeters. Input figures up to the second decimal place.
- Measurement positions can be specified up to 100 locations.
- If some wafers are not displayed on the measurement position display (graph display), use ▼/▲ to drag the scroll bars up or down, or left to right. The screen display will move.

■ Output Condition Setting

When you click on the Output condition setting tab on the Recipe Condition screen, the following screen is displayed. Set the conditions for the output after the measurement is finished.

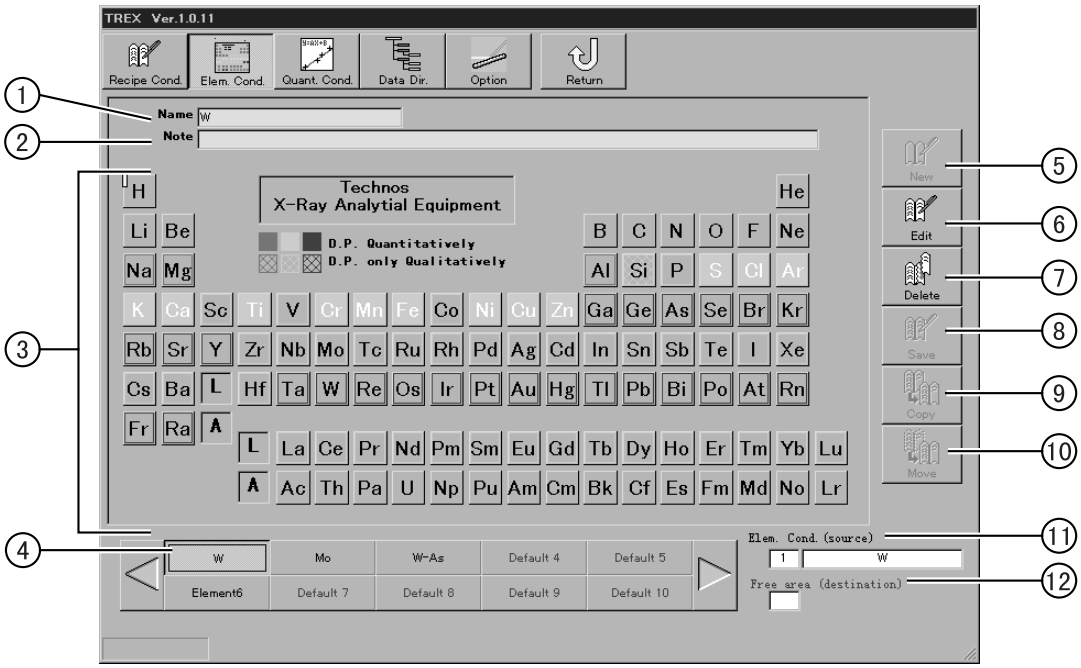


① Output condition selection	Select the setting range for the output.
② Maximum intensity setting	Set the maximum intensity for the output. This is valid when the specified scale is selected.
③ Output Range Setting	Set the range for the output. This is valid when the specified scale or specified peak is selected.

❷ Element Condition Setting

When you click on Element Condition on the Recipe Condition screen, the Element Condition screen is displayed. Set the analysis condition for each element.

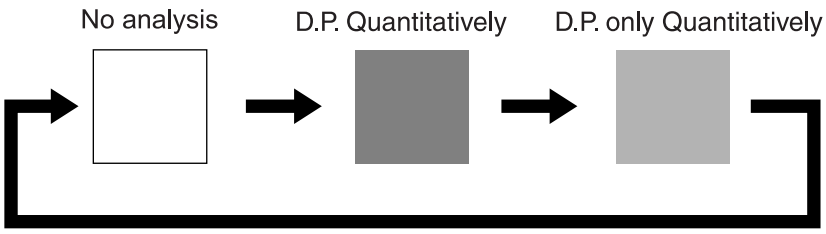
Element Condition screen



①Name Input the Element condition name. The name input here is displayed for the ④ Element Condition button. When you select a ④ Element Condition button for which the Element condition is already set, the name of that button is displayed.

②Note Input a simple explanation about the Element Condition.

③Element symbol display Click on the element symbol display to set the element analysis condition. The display changes as shown below with each click of the mouse.



REFERENCE

- The display color of the element symbol indicates the appropriate X-ray beam for measuring that element.

(1) Green display : Element suitable for measurement by a W beam.
(2) Blue display : Element suitable for measurement by a Mo beam (twin beam machine only).
(3) Red display : Element difficult to measure.
(4) Gray display : Element impossible to measure.

④ Element Condition Button	Select the button to set the element condition. For already set buttons, the element condition name is displayed.
⑤ New	When you select the non-set ④ Element Condition button and click the Create button, you can then create a new Element condition.
⑥ Edit	When you select the ④ Element Condition button for already set Element Condition and click the Edit button, you can edit the Element Condition.
⑦ Delete	This deletes the conditions set for the selected ④ Element Condition button.
⑧ Save	This saves the edited contents. When the Save button is clicked, the confirmation dialog box is displayed.
⑨ Copy	This copies the button set contents displayed at ⑪ Element Condition (source) to the button displayed at ⑫ Free area (destination).
⑩ Move	This moves the button set contents displayed at ⑪ Element Condition (source) to the button displayed at ⑫ Free area (destination). The button contents set at ⑪ Element Condition (source) are deleted.
⑪ Element Condition (source)	When you select the ④ Element condition button for an already set Element condition when editing, copying or moving the Element condition, the condition number and condition name of that button are displayed.
⑫ Free area (destination)	When the ④ Element condition button for a non-set Element condition is selected when creating, copying or moving the recipe condition, the condition number of that button is displayed.

REFERENCE

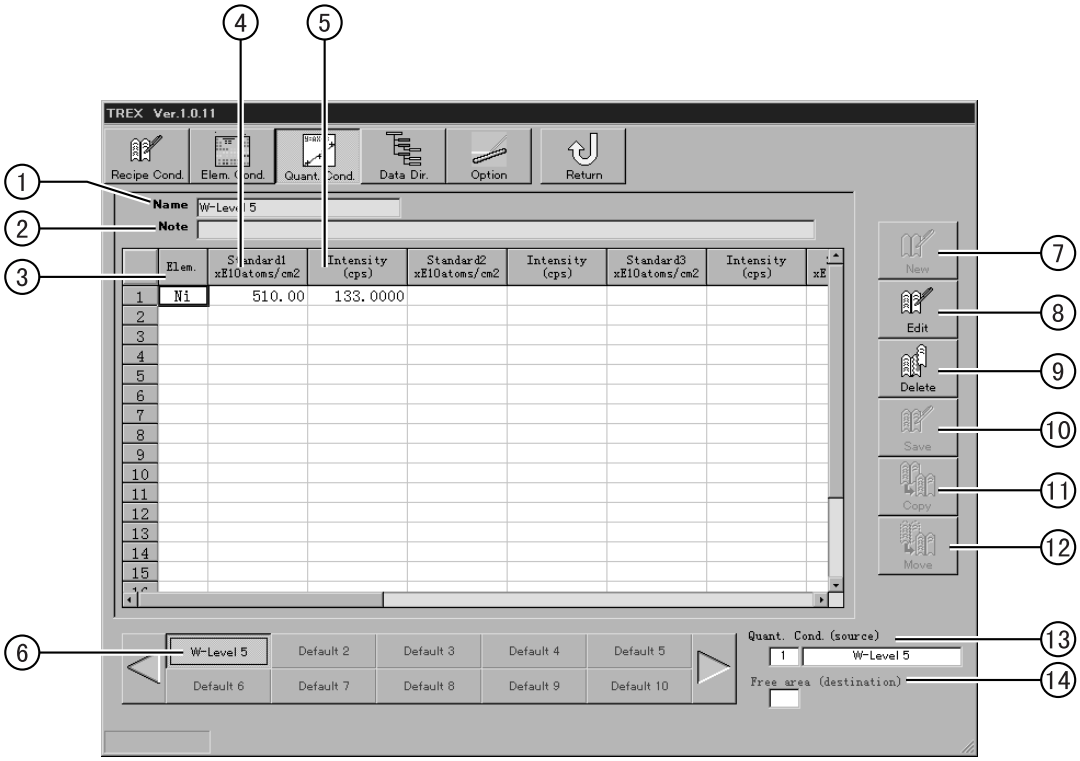
● Element condition button

- The Element condition button can register a maximum of 100 items. The screen displays 10 Element condition buttons. To display buttons not displayed on the screen, click on the ◀ ▪▶ buttons at the left and right of the screen. The button display changes over in units of 10 buttons each time.

❸ Quantification Condition Setting

When you click on Quantity Condition on the Recipe Condition screen, the Quantity Condition screen is displayed.

Quantity Condition screen



①Name	Input the Quantification condition name. The name input here is displayed for the ⑥ Quantification Condition button. When you select a ⑥ Quantification Condition button for which the Quantification condition is already set, the name of that button is displayed.
②Note	Input a simple explanation about the Quantification Condition.
③Element	Select the element to be used for the calibration curve. When you click on Element, the Element Table is displayed. Select the desired symbol from the table.
④Standard sample value	Input the concentration of the standard sample in units of 1xE10 atoms/cm^2.
⑤X-ray Intensity	Input the X-ray intensity (integrated intensity) for the measured by standard sample.
⑥Quantification	Condition Button Select the button to set the Quantification condition. For already set buttons, the Quantification condition name is displayed.
⑦New	When you select the non-set ⑥ Quantification Condition button and click the Create button, you can then create a new Quantification condition.
⑧Edit	When you select the ⑥ Quantification condition button for existing condition and click the Edit button, you can edit the Quantification condition.

⑨ Delete	This deletes the conditions set for the selected ⑥ Quantification condition button.
⑩ Save	This saves the edited contents. When the Save button is clicked, the confirmation dialog box is displayed.
⑪ Copy	This copies the button set contents displayed at ⑬ Quantification Condition (source) to the button displayed at ⑭ Free area (destination).
⑫ Move	This moves the button set contents displayed at ⑬ Quantification Condition (source) to the button displayed at ⑭ Free area (destination). The button contents set at ⑬ Quantification Condition (source) are deleted.
⑬ Quantification Condition (source)	When you select the ⑥ Quantification condition button for an already set Quantification condition when editing, copying or moving the Quantification condition, the condition number and condition name of that button are displayed.
⑭ Free area (destination)	When you select the ⑥ Quantification condition button for a non-set Quantification condition when creating, copying or moving the recipe condition, the condition number of that button is displayed.

REFERENCE

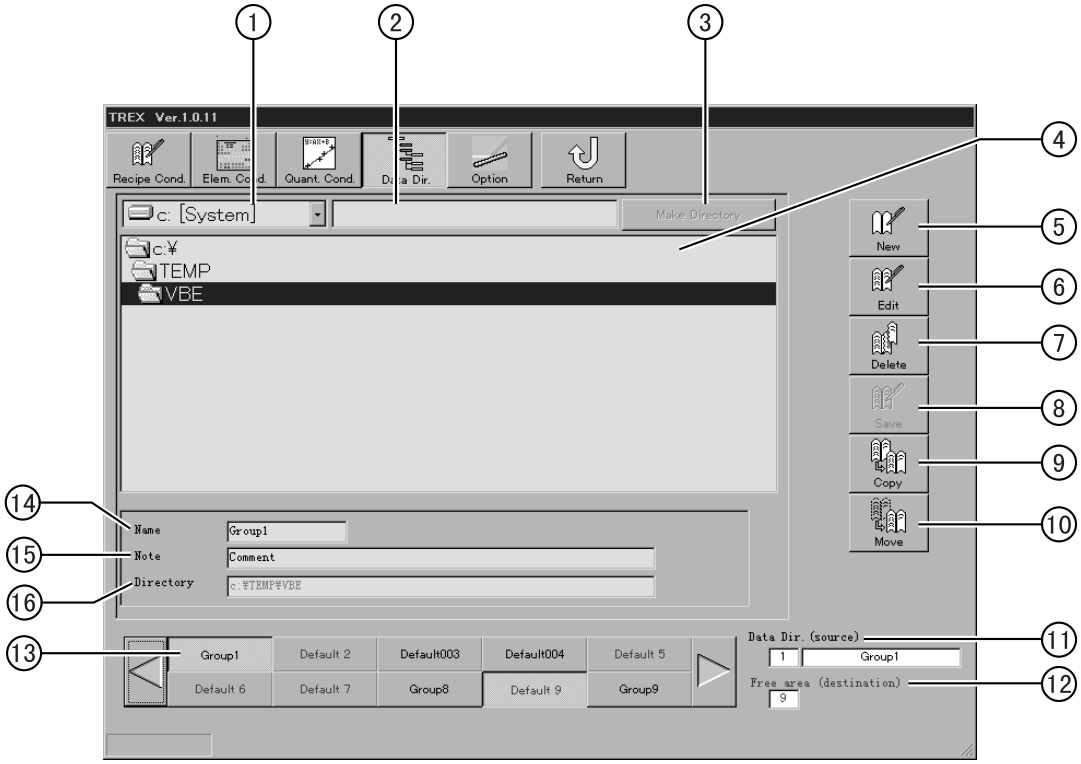
● Quantification condition button

- The Quantification condition button can register a maximum of 100 items. The screen displays 10 Quantity condition buttons. To display buttons not displayed on the screen, click on the ◀ ▪ ▶ buttons at the left and right of the screen. The button display changes over in units of 10 buttons each time.

❹ Data Directory Setting

When you click on Data Directory on the Recipe Condition screen, the Data Directory screen is displayed. This is for setting the Data Directory for the measurement data.

Data Directory screen



①Drive selection	Select the drive where the data is to be saved. Click on ▼ at the right of the box to display the available drives.
②Directory name setting	Input the directory name when creating a new directory.
③Make Directory	Input the directory name in ② Directory name setting, then click on the Make Directory button. The new directory will then be displayed under the currently selected directory.
④Directory selection	Select the directory for saving the data. When the directory is selected, the path is displayed in ⑯ Directory.
⑤New	When you select the non-set ⑬ Data Directory button and click the Create button, you can then create a new entry.
⑥Edit	When you select the ⑬ Data Directory button existing set Data Directory and click the Edit button, you can edit the Data Directory.
⑦Delete	This deletes the conditions set for the selected ⑬ Data Directory button.
⑧Save	This saves the edited contents. When the Save button is clicked, the confirmation dialog box is displayed.

⑨ Copy	This copies the button set contents displayed at ⑪ Data Dir. (source) to the button displayed at ⑫ Free area (destination).
⑩ Move	This moves the button set contents displayed at ⑪ Data Dir. (source) to the button displayed at ⑫ Free area (destination). The button contents set at ⑪ Data Dir. (source) are deleted.
⑪ Data Dir. (source)	When you select the ⑬ Data Directory button for an already set Data Directory when editing, copying or moving the Data Directory, the condition number and Data Directory name of that button are displayed.
⑫ Free area (destination)	When you select the ⑬ Data Directory button for a non-set Data Directory when creating, copying or moving the Data Directory, the condition number of that button is displayed.
⑬ Data Directory button	Select the button for setting the Data Directory. The Data Directory name is displayed for buttons already set.
⑭ Name	Input the Data Directory name. The name input here is displayed at the ⑬ Data Directory button. When you select the ⑬ Data Directory button for a Data Directory already set, the button name is displayed.
⑮ Note	Input a simple explanation about the Data Directory.
⑯ Directory	The directory name where the data is actually saved is displayed.

REFERENCE

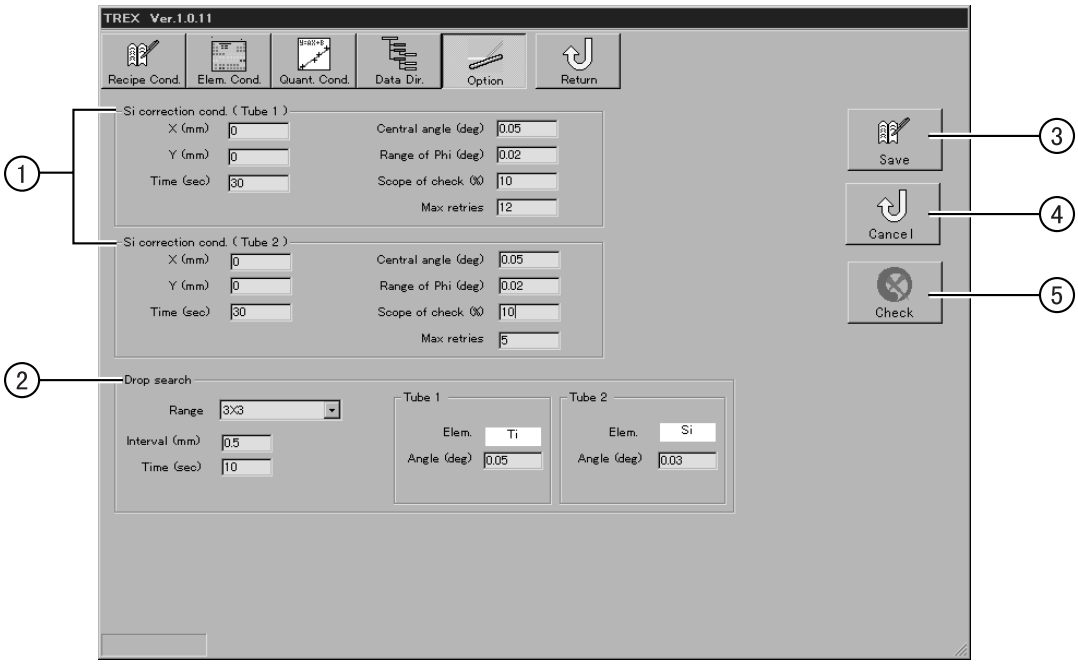
● Data Directory button

- The Data Directory condition button can register a maximum of 100 items. The screen displays 10 Quantity condition buttons. To display buttons not displayed on the screen, click on the ◀ ▪ ▶ buttons at the left and right of the screen. The button display changes over in units of 10 buttons each time.

❺ Option Setting

When you click on Option on the Recipe Condition setting screen, the Option Setting screen is displayed.

Option Setting screen



①Si correction condition	Set the condition for execution of Si intensity correction.
②Drop search	Set the condition for drop search execution.
③Save	Saves the update contents.
④Cancel	Returns the contents of a change back to the condition before the change.
⑤Check	Checks whether the set contents are valid or not. If there is an error in the set contents, a message is displayed. If this occurs, recheck the setting contents.

REFERENCE

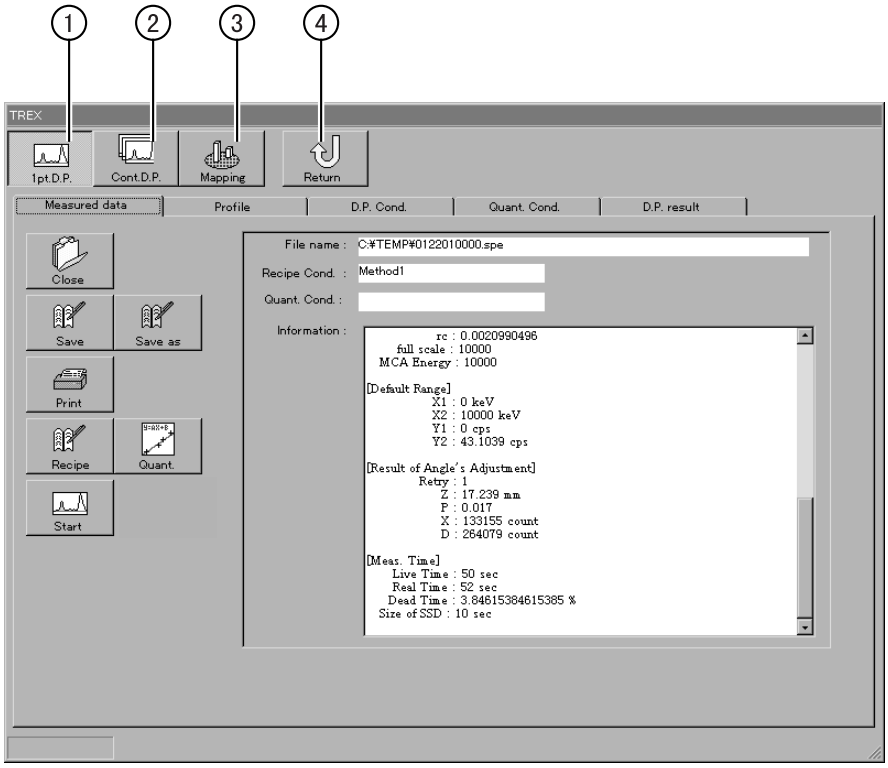
● Drop Search Condition

- Drop Search Condition is only displayed if this function has been requested as an option at the time of purchase.

DATA PROCESSING (ANALYSIS)

When you click on Data Processing the Main Menu, the D.P. screen is displayed. You can set D.P. conditions for the results measured by Easy Measurement or Continuous Measurement, then perform data processing by different D.P. condition at the time of measurement.

Data Processing screen



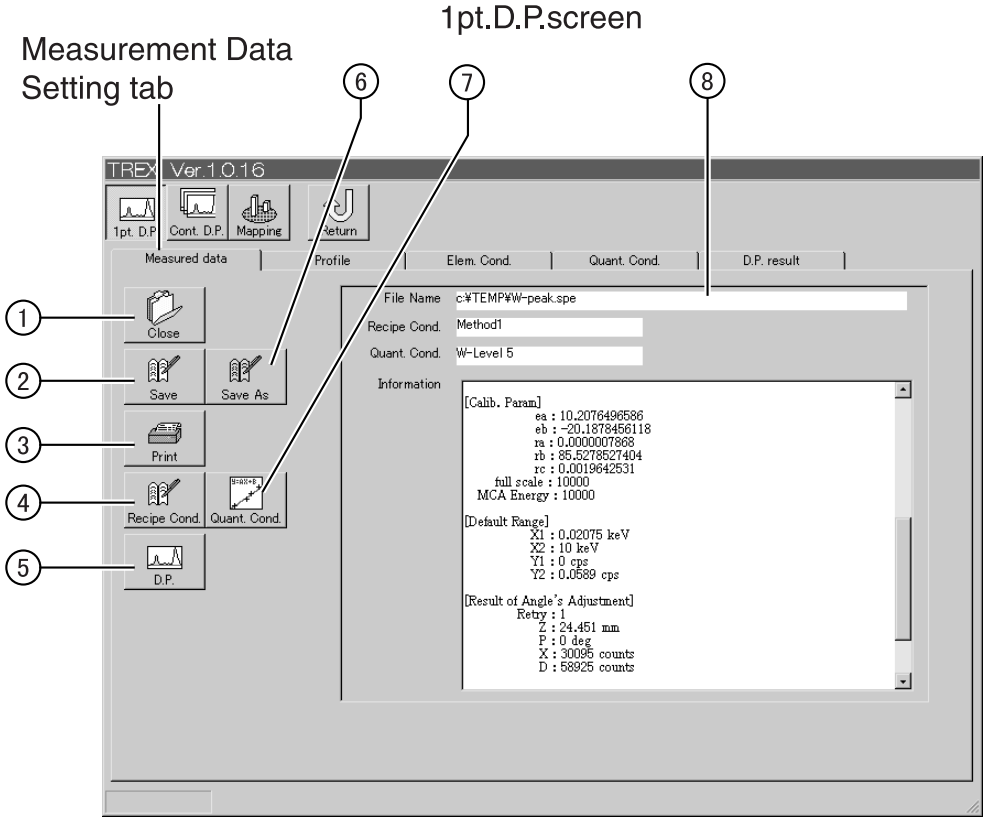
①1 point D.P.	Selects one data item from the saved measurement data and recalculates it. (See page 54)
②Continuous D.P.	Selects multiple data from the saved measurement data and recalculates it continuously. (See page 59)
③Mapping	Displays the measurement results. (See page 62)
④Return	Returns to the Main Menu.

❶ 1pt. D.P.

When you click on 1pt. D.P. on the D.P. main screen, the 1pt. D.P. screen is displayed. You can select one data item from the saved measurement data and recalculate it.

■ Measurement Data

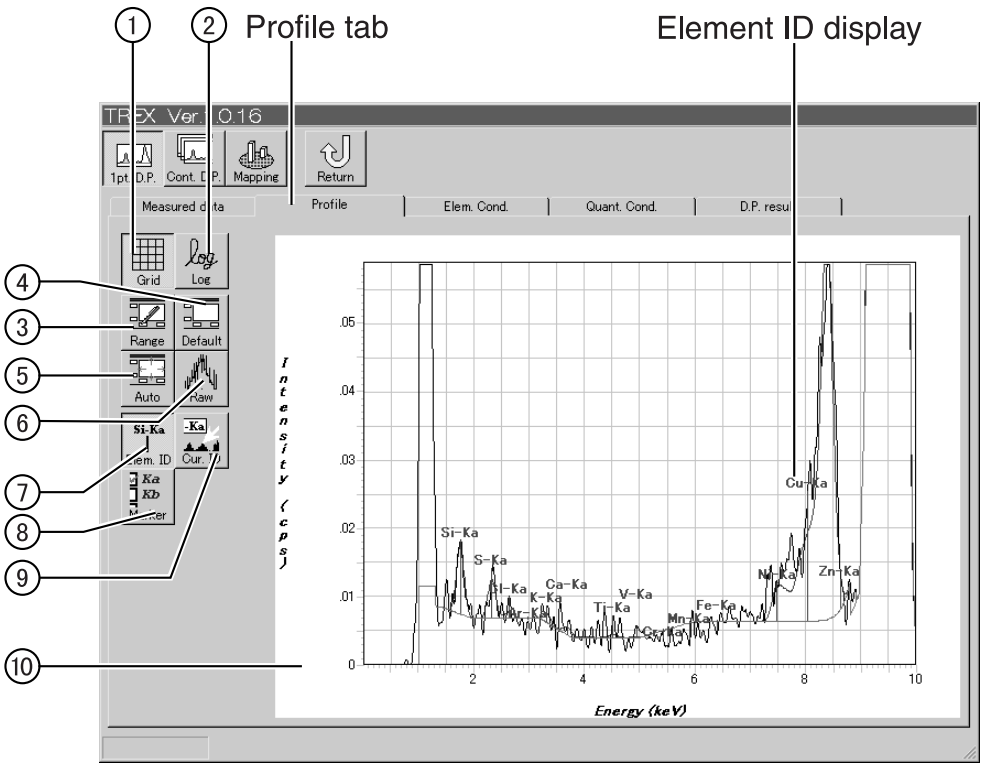
When you click on the Measurement data setting tab on the 1pt. D.P. screen, the following screen is displayed. Select data measured to be performed by 1pt. D.P. .



① Open/Close	Ends the selection of the measurement data you want to display and ends the current display operation.
② Save	The selected measurement data is over written under the same file number. The measured data until then is updated.
③ Print	Prints the analysis results after the 1pt. D.P..
④ Recipe condition	The Recipe conditions are listed. Select the Recipe condition for use in the 1pt. D.P..
⑤ D.P.	1pt. D.P. starts in accordance with the specified Recipe condition and Quantification condition.
⑥ Save as	Saves the recalculated data as a new file name different to the saved measurement data.
⑦ Quantification condition	The Quantification condition list is displayed. Select the Quantification condition for use in 1pt. D.P..
⑧ Data display region	Detailed information on the selected data is displayed.

■ Profile

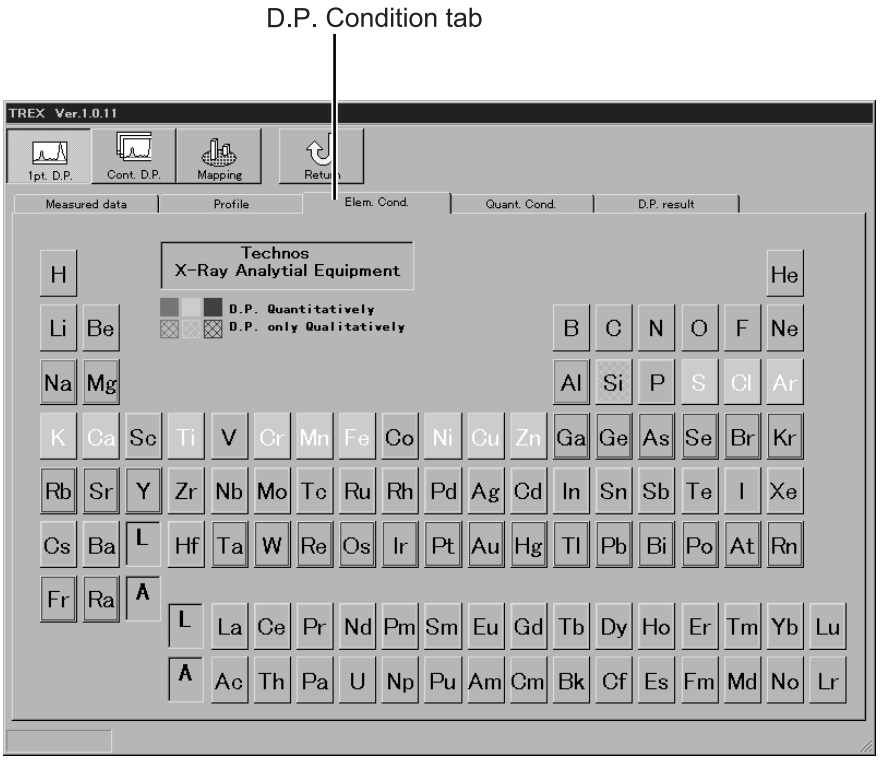
When you click on the Profile tab on the 1pt. D.P. screen, the screen below is displayed. The measurement data selected on the previous page is displayed.



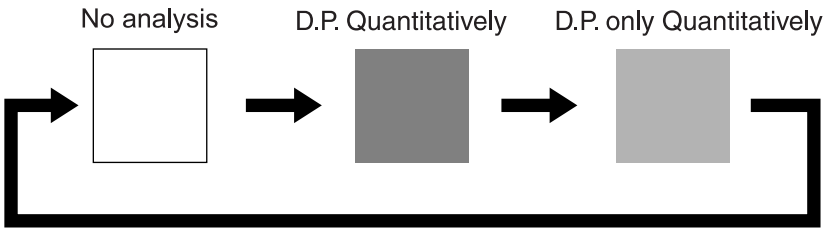
①Grid	This sets whether or not the grid is displayed. It alternates between display/not display each time you click on it.
②Log	This switches the intensity axis between the linear scale and log scale.
③Range	This is for setting the display range of the data display area. Clicking on it will display the screen for setting the display range so that you can set the X-ray intensity range and the energy range.
④Default	Data display occurs in accordance with the settings in Output Condition Setting on 1 Recipe Condition Setting (See page 45).
⑤Auto	The display range is set automatically.
⑥Raw data	This sets whether X-ray intensity is displayed as it is or whether smoothing is performed. The display method changes each time the button is clicked.
⑦Element ID	Clicking on this displays the analysis element at the peak on the analysis waveform of the data display area.
⑧Marker	Select the type of X-ray indicated by the Basic Element ID or cursor ID. (The initial setting is K α only.)
⑨Cursor ID	When you move the cursor to the desired location on the displayed data, the element detected at that energy position is displayed near the cursor.
⑩Data display area	The measurement data selected on the previous page is displayed.

■ Data Processing Condition Setting

When you click on the D.P. Condition tab on the 1pt. D.P. screen, the screen below is displayed. It is for setting the data processing condition used in the 1pt. D.P..



The analysis condition for the element symbol display changes as shown below with each click of the mouse.



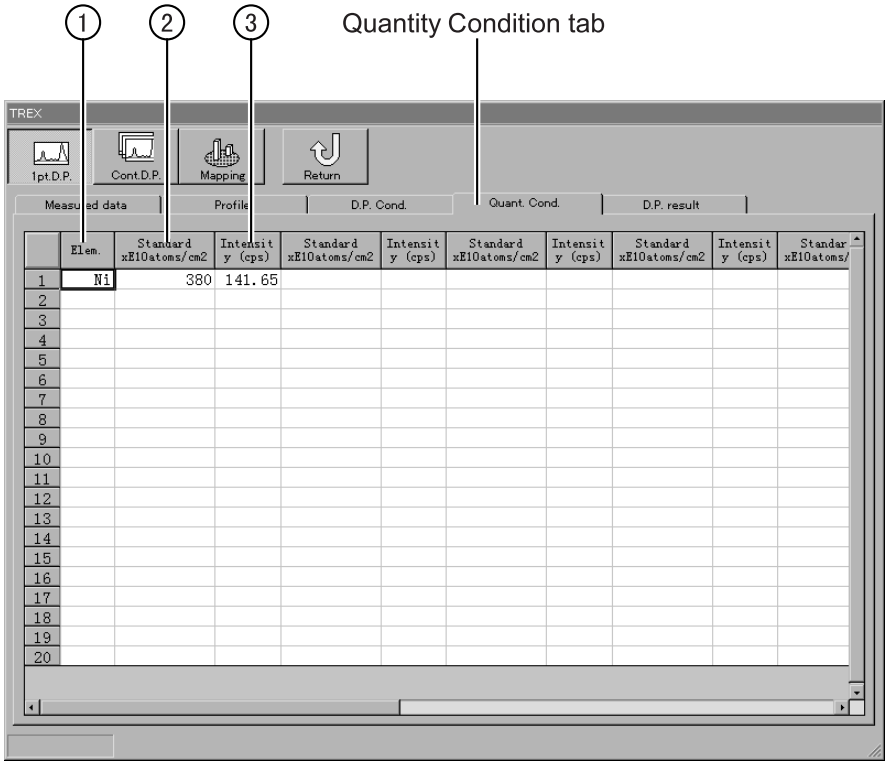
REFERENCE

- The display color of the element symbol indicates the appropriate X-ray beam for measuring that element.

(1) Green display : Element suitable for measurement by a W beam.
(2) Blue display : Element suitable for measurement by a Mo beam (twin beam machine only).
(3) Red display : Element difficult to measure.
(4) Gray display : Element impossible to measure.

■ Quantification Condition Setting

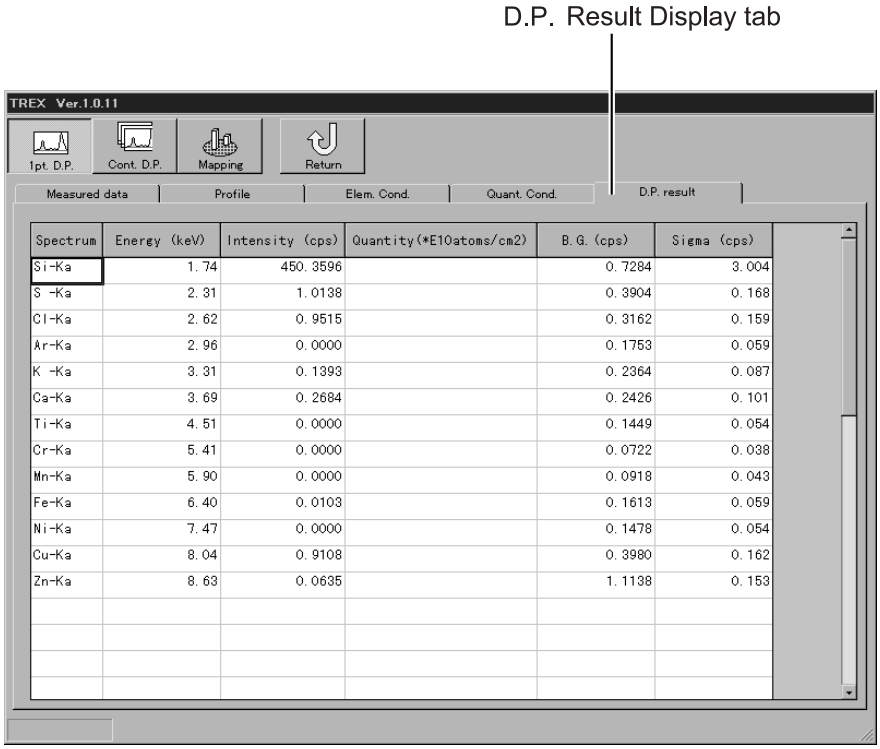
When you click on the Quantification Condition tab on the 1pt. D.P. screen, the screen below is displayed. Use it to set the Quantification Condition for 1pt. D.P..



① Element	Select the element to be used for the calibration curve. When you click on Element, the Element Table is displayed. Select the desired symbol from the table.
② Standard sample value	Input the concentration of the standard sample in units of 1xE10 atoms/cm^2.
③ X-ray Intensity	Input the X-ray intensity (integrated intensity) for the measured by standard sample.

■ D.P. Result Display

When you click on the D.P. result display tab on the 1pt. D.P. screen, the screen below is displayed.

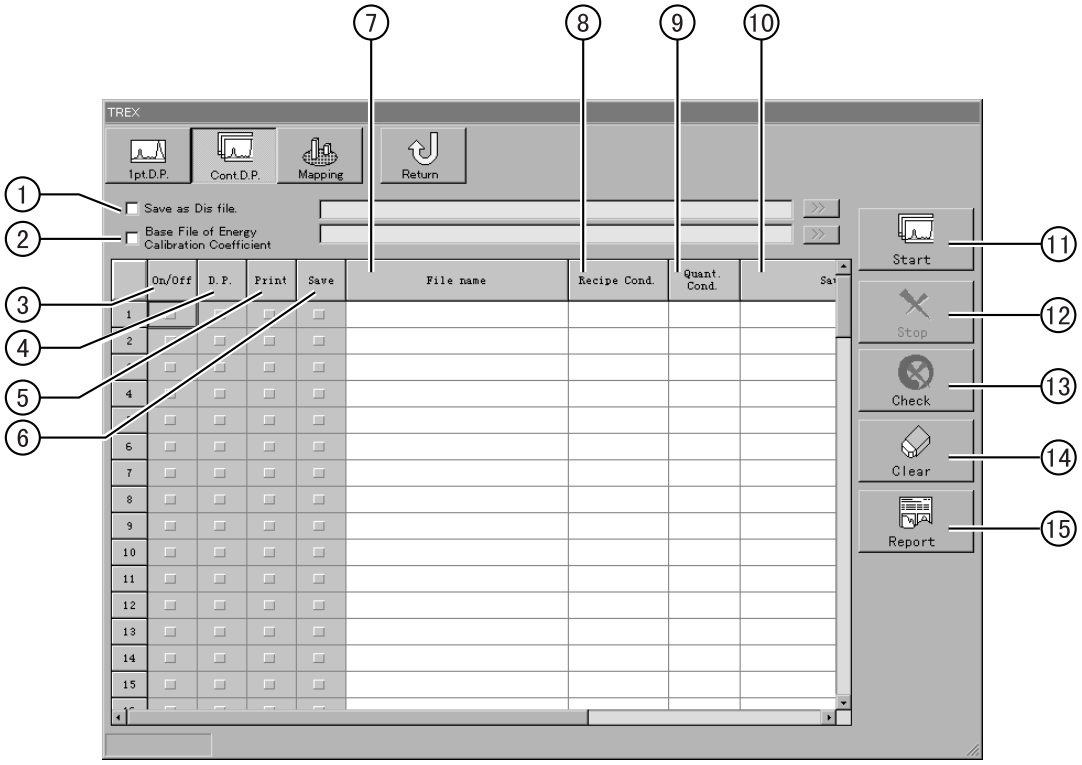


Spectrum	Energy (keV)	Intensity (cps)	Quantity(*E10atoms/cm2)	B.G. (cps)	Sigma (cps)
Si-Ka	1.74	450.3596		0.7284	3.004
S -Ka	2.31	1.0138		0.3904	0.168
Cl-Ka	2.62	0.9515		0.3162	0.159
Ar-Ka	2.96	0.0000		0.1753	0.059
K -Ka	3.31	0.1393		0.2364	0.087
Ca-Ka	3.69	0.2684		0.2426	0.101
Ti-Ka	4.51	0.0000		0.1449	0.054
Cr-Ka	5.41	0.0000		0.0722	0.038
Mn-Ka	5.90	0.0000		0.0918	0.043
Fe-Ka	6.40	0.0103		0.1613	0.059
Ni-Ka	7.47	0.0000		0.1478	0.054
Cu-Ka	8.04	0.9108		0.3980	0.162
Zn-Ka	8.63	0.0635		1.1138	0.153

❷ Continuous Data Processing

When you click on Continuous D.P., the Continuous D.P. screen shown below is displayed. Multiple data can be selected from the saved data and continuous D.P. is performed.

Continuous D.P. screen

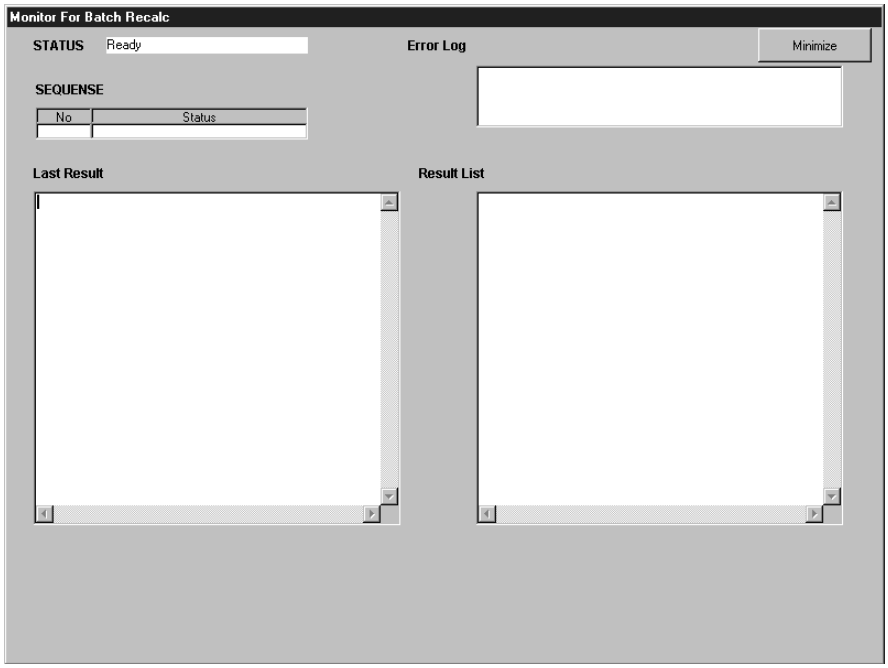


① Save as Dis file	After analysis, check this this box when creating a Dis file. When you click on the arrows at the right of the text box, a dialog box for file selection is displayed for you to select the Dis file.
② Base file of Energy Calibration Coefficient	Check this box when you temporary change the energy calibration value. When you click on the arrows at the right of the text box, a dialog box for file selection is displayed for you to select a file.
③ On/Off	Put a check against each row if you want to check data processing. Lines that do not have a check against them are not processed.
④ D.P.	Put a check in the applicable box in this column when you want to perform recalculation. If there is no check, analysis is not performed.
⑤ Print	Check the Print box when you want to print the analysis result. If there is no check, printing is not performed.
⑥ Save	Check the Print box when you want to save the analysis result. If there is no check, the analysis result is not saved.
⑦ File name	Select the measured data you want for recalculation. When you click on File name, the file names of the measured data are displayed in a list for you to select the desired file from.

⑧ Recipe Condition	Select the Recipe Condition for use in recalculation. When you click on Recipe Condition, the Recipe Condition list is displayed for you to select the analysis condition.
⑨ Quantification Condition	Select the Quantification Condition for use in recalculation. When you click on Quantification condition, the Quantification Condition list is displayed for your selection.
⑩ Save file name	Input the file name when you want to save using a different file name to the time of measurement. If the file name is not input, the data is saved using the name at ⑦ File name.
⑪ Start	Confirm whether the set contents are valid or not. If they are valid, start the analysis operation. If there is an error in the set contents, a message is displayed. If this occurs, check the set contents again.
⑫ Stop	This stops Data Processing.
⑬ Check	This checks whether the set contents are valid or not. If there is an error in the set contents, a message is displayed. If this occurs, check the set contents again.
⑭ Clear	This erases all the set contents. It is not possible to delete only the desired lines.
⑮ Report	The recalculation result is displayed on the screen simply. (See next page.)

● Report Display

Report Display screen

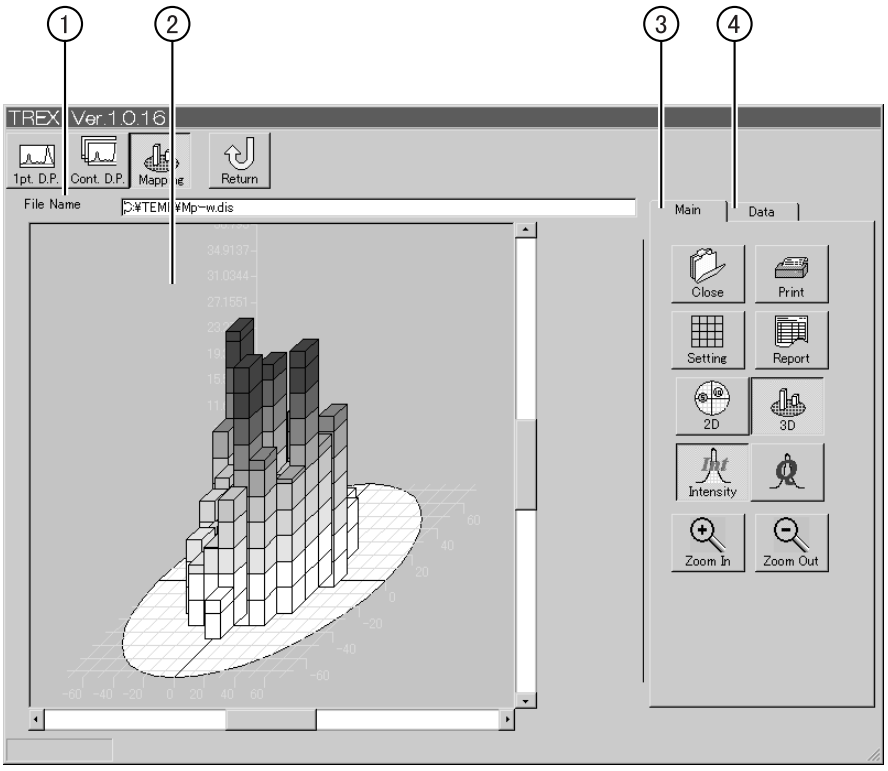


The recalculation result is displayed.
The last result is displayed on the left side of the screen, and the log is displayed on the right side.

❸ Mapping Display

When you click on Mapping Display on the D.P. screen, the Mapping Display screen shown below is displayed. You can choose between a 3-dimensional display or a 2-dimensional display showing a planar view of the wafer.

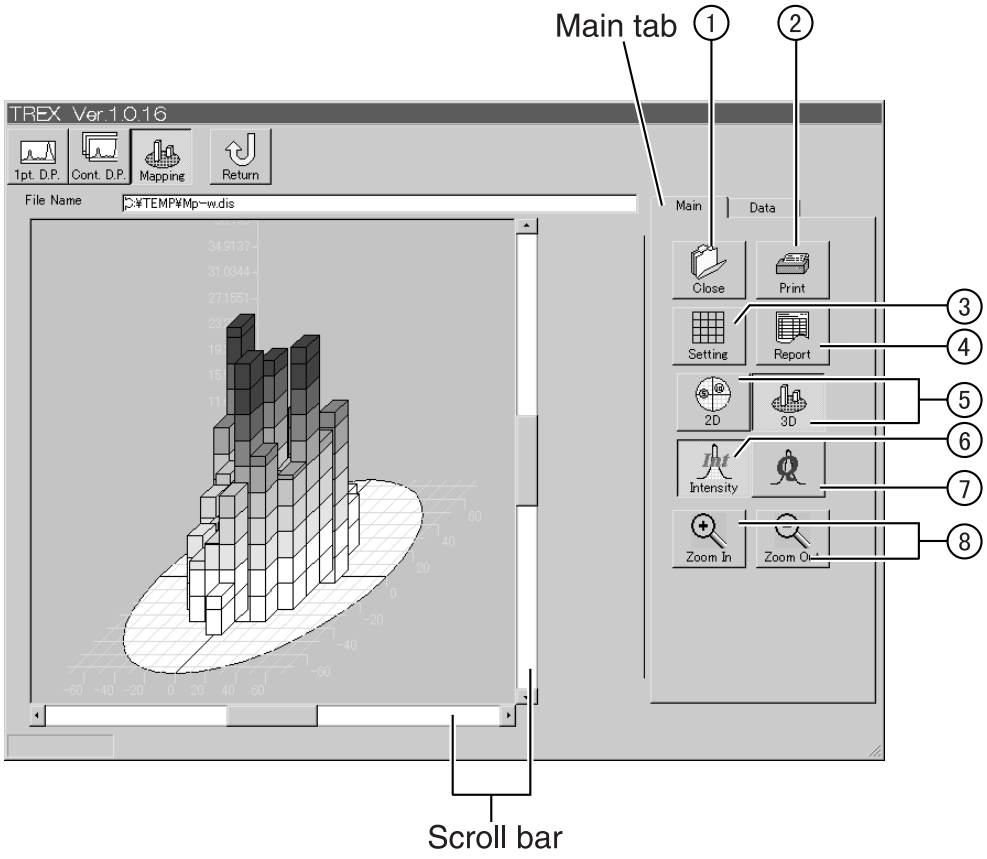
Mapping Display screen



①File	The File name of the displayed data is displayed.
②Data display area	The analysis result is displayed.
③Main tab	The screen for Setting the Display Method is displayed.
④Data tab	The screen for Element selection is displayed.

■ Setting the Display Method

When you click on the Main tab, the buttons for setting the display method are displayed.



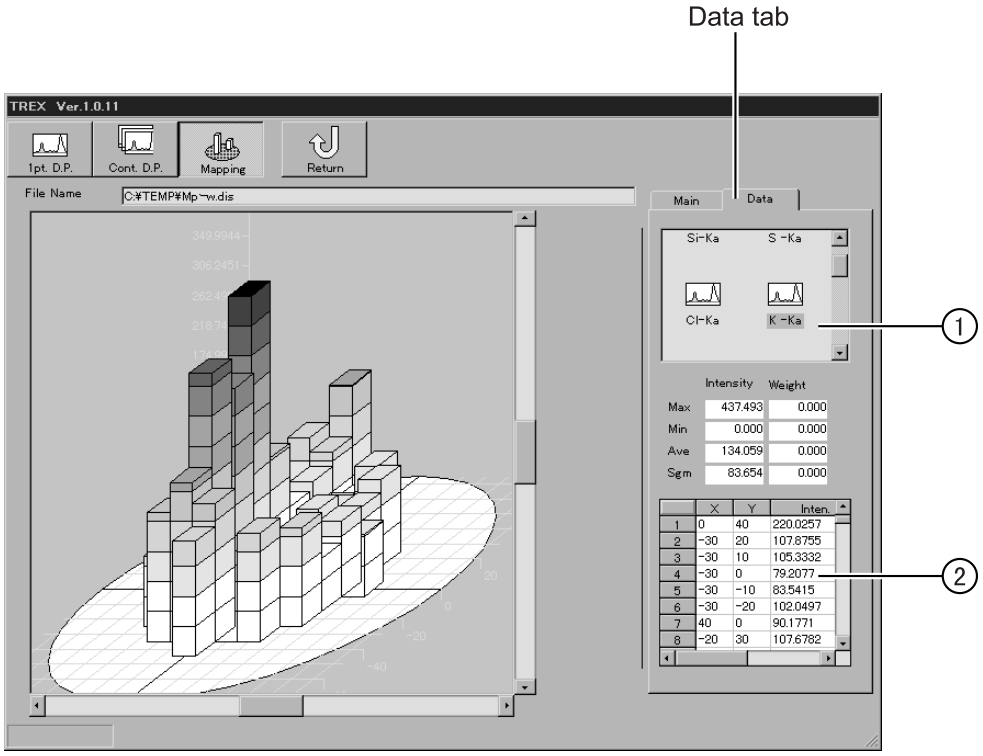
① Open/Close	For selecting the data file you want to display, or ending the currently displayed operation.
② Print	Prints the displayed contents.
③ Setting	Specifies the grid width and the drawing range for the data display area. Clicking on this button displays a dialog box for specifying what you want.
④ Report	A table of detailed data is displayed.
⑤ 2D/3D display	With each click, the data display area changes between 2D and 3D display.
⑥ Intensity	Mapping of the intensity values is displayed.
⑦ Quantitative	Mapping of the quantitative values is displayed.
⑧ Zoom In / Zoom Out	With each click, the data display area expands or reduces.

REFERENCE

- If all the analytical result is not all displayed within the data display area, drag on the scroll bar ▲ / ▼ to shift the screen display.

■ Element Selection

Clicking on the Data tab will display the screen for selection of the element you wish to display. When you select the element, the analytical result is displayed in the data display area.

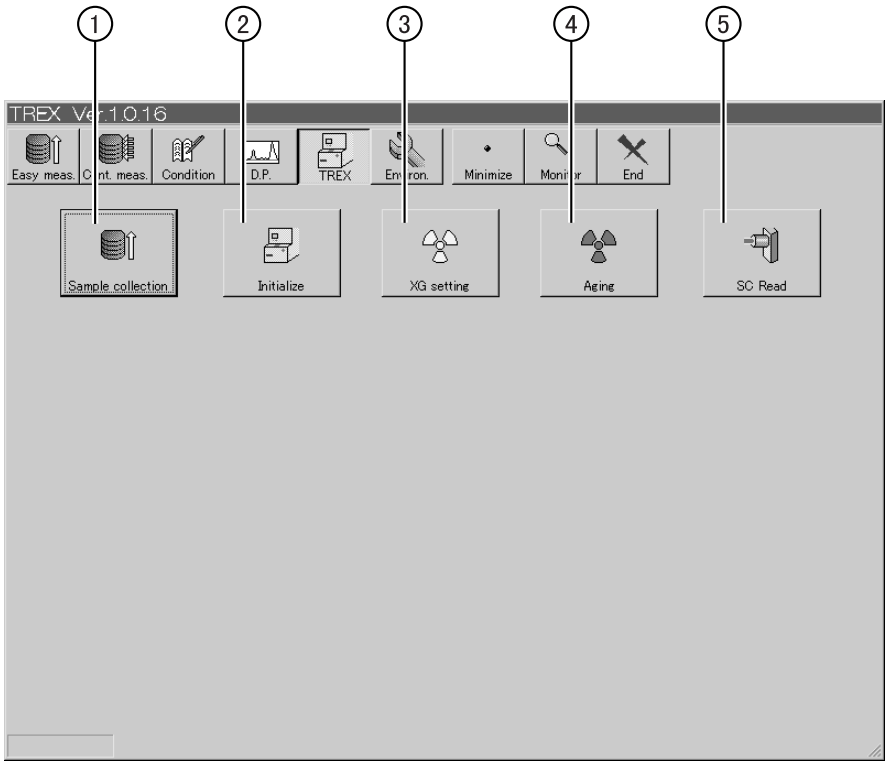


① Element display	The element symbols are listed. Select the symbol you want to display.
② Coordinate position display	The X and Y coordinates of the detected position of the displayed element are displayed.

DEVICE UTILITY

When you click on TREX on the Main Menu, the Device Utility screen is displayed. Device operation such as XG operation and initialization can be performed.

Device Utillity screen

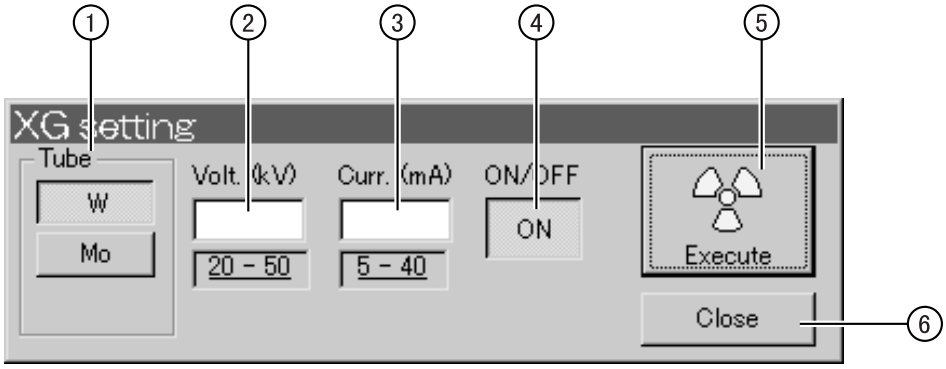


① Sample collection	Any samples remaining inside the device are collected. (See page 69)
② Initialization	The device is initialized. (See page 69)
③ XG setting	The XG setting screen is displayed. XG-related operation can be performed. (See page 66)
④ Aging	The screen for aging of the X-ray tube is displayed.
⑤ SC Read	X-ray intensity display read by SC is displayed. This is used in adjustment, etc. after target replacement.

❶ XG Setting

■ Setting

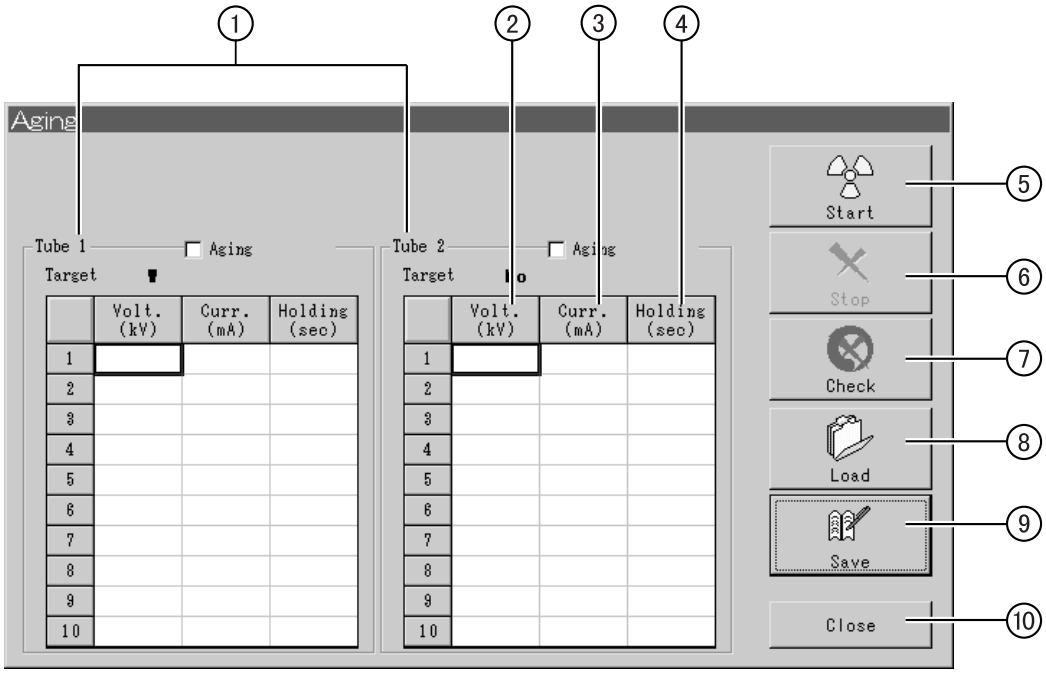
When you click on Setting on the XG setting screen, the following screen is displayed.



①Tube	Select the X-ray source you want to set.
②Voltage	Set the voltage of the X-ray source.
③Current	Set the current of the X-ray source.
④ON/OFF	Switches the X-rays ON/OFF. The button switches between ON/OFF with each click. When it is turned ON, X-rays are started to generate. Turning it OFF stops the X-rays.
⑤Execute	X-rays are discharged under the set condition.
⑥Close	The XG setting ends.

■ Aging

When you click on Aging on the XG setting screen, the following screen is displayed.

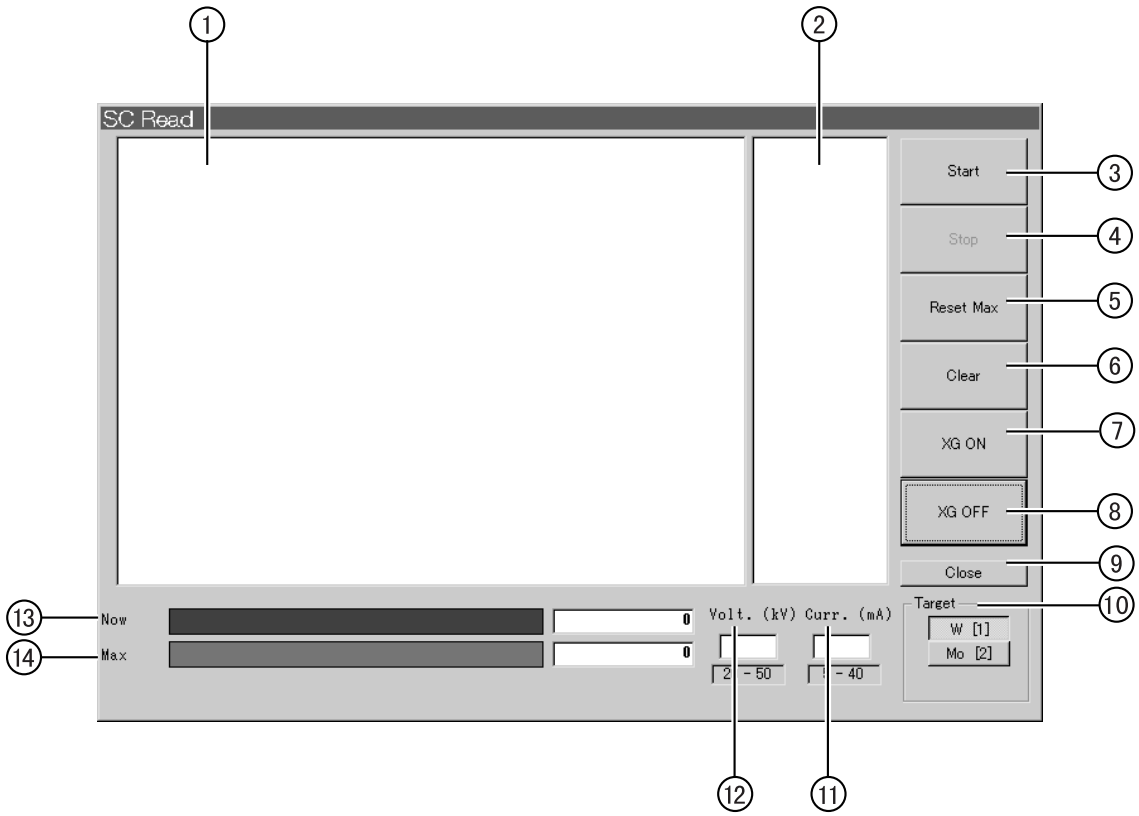


①X-ray Tube Condition	Put a check against Aging for the X-ray Tube you want.
②Voltage	Set the voltage of the aging X-ray tube.
③Current	Set the current of the aging X-ray tube.
④Holding	Set the waiting time from when the X-rays reach the set voltage value and current value until LOCK occurs.
⑤Start	Confirms whether the set contents are valid or not. If they are valid, the engine starts. If there is an error in the set contents, a message is displayed. If this occurs, check the set contents again.
⑥Stop	Aging stops.
⑦Check	Checks whether the set contents are valid or not. If there is an error in the set contents, a message is displayed. If this occurs, check the set contents again.
⑧Load	The set contents of previously set aging is loaded. Clicking on this button displays the file list for you to select from.
⑨Save	The file name is attached to the set contents and saved.
⑩Close	Aging ends.

❷ SC Read Setting

When you click on SC Read on the TREX screen, the SC Read screen is displayed.

SC Read screen



①SC log display (graph)	The X-ray count is displayed using a bar graph.
②SC log display (numerals)	The X-ray count is displayed using a numeral list.
③Start	The SC Read starts.
④Stop	The SC Read stops.
⑤Reset Max	The SC Read maximum value displayed at ⑭ Maximum Value is replaced by the current SC Read value.
⑥Clear	The log displayed at ① SC log display (graph) or ② SC log display (numerals) is deleted.
⑦XG ON	The X-ray is set to the value set at ⑪ Current and ⑫ Voltage.
⑧XG OFF	The X-ray is turned off.
⑨Close	The SC read setting ends.
⑩Target	Sets the X-ray tube that performs SC Read.
⑪Current	Set the current of the X-ray.
⑫Voltage	Set the voltage of the X-ray.
⑬Now	Displays the SC Read value now.
⑭Max	Displays the maximum value since SC Read started.

❸ Initialize

This initializes the main unit. It is used to initialize the machine when it is in a non-initialized condition. When you click on the Initialize button, a confirmation screen is displayed to confirm that you want to initialize.

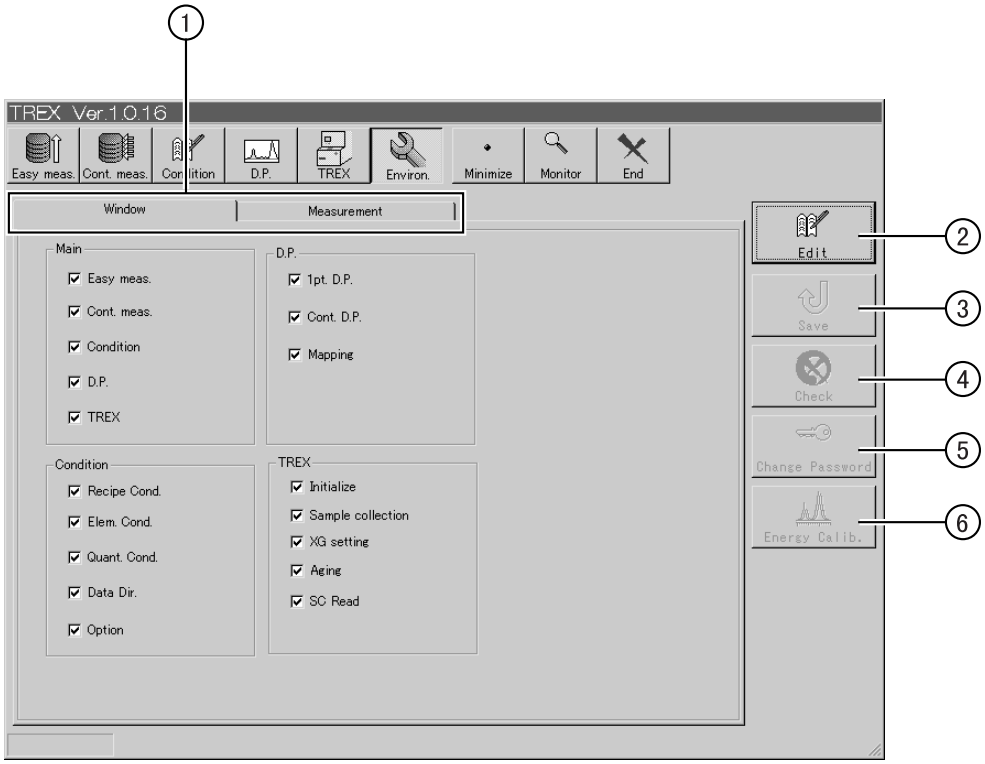
❹ Sample Collection

This is used in situations such as when you reset the PC while there are still samples inside the machine. When you click on the button, a confirmation screen is displayed to confirm that you want to collect the samples.

ENVIRONMENT SETTING

When you click Environment Setting on the Main Menu, the Setting screen is displayed. By this function, some menu items or analytical condition (recipe) can be set to protect miss-operation by unqualitied operator.
The setting contents are protected by a password, so changes cannot be made unless the password matches.

Environment Setting screen



① Setting tab	When you click on the respective tab button, the applicable setting screens appear.
② Edit	Click here to change the setting contents. Input your password when the password input screen is displayed. Once you have input the correct password you can change the setting contents.
③ Save	The setting changes are saved. When you click on this button, a confirmation screen is displayed to confirm that you want to make the changes.
④ Check	This checks that the setting contents are valid. If there is an error in the set contents, a message is displayed. If this occurs, check the set contents again.
⑤ Change Password	Password This changes the password. Clicking here displays the password change screen. Input your password in accordance with the screen instructions.
⑥ Energy Calibration	The screen for energy calibration is displayed (page 74). After you have made a change, restart the application.

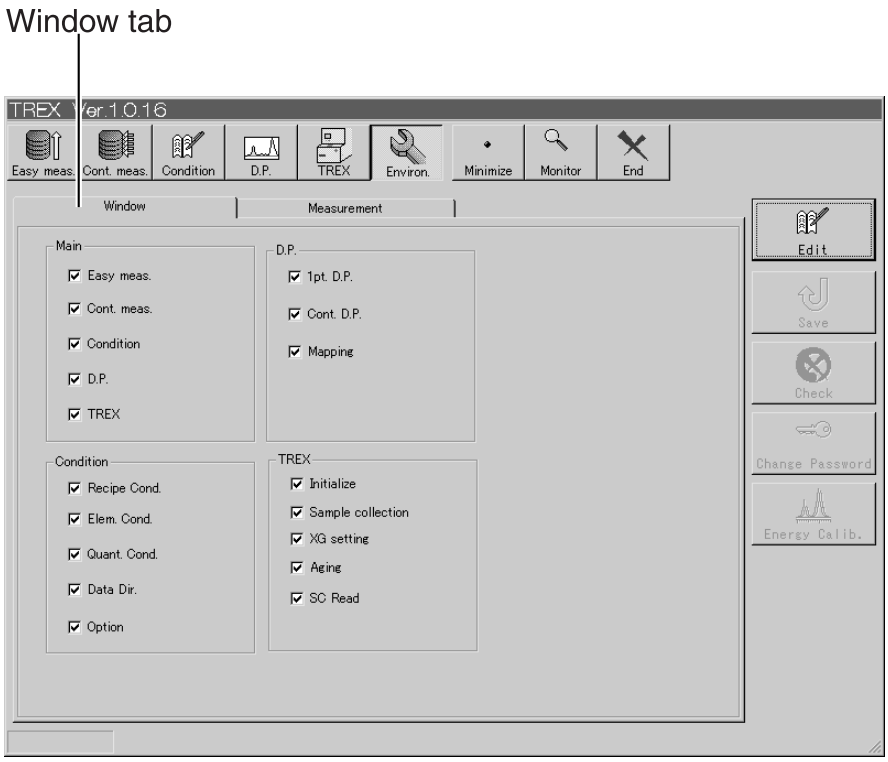
REFERENCE

● PASSWORD

- When the machine is shipped from the factory, the password is set as "Technos".

■ Setting Enable/Disable Display of Menu Buttons

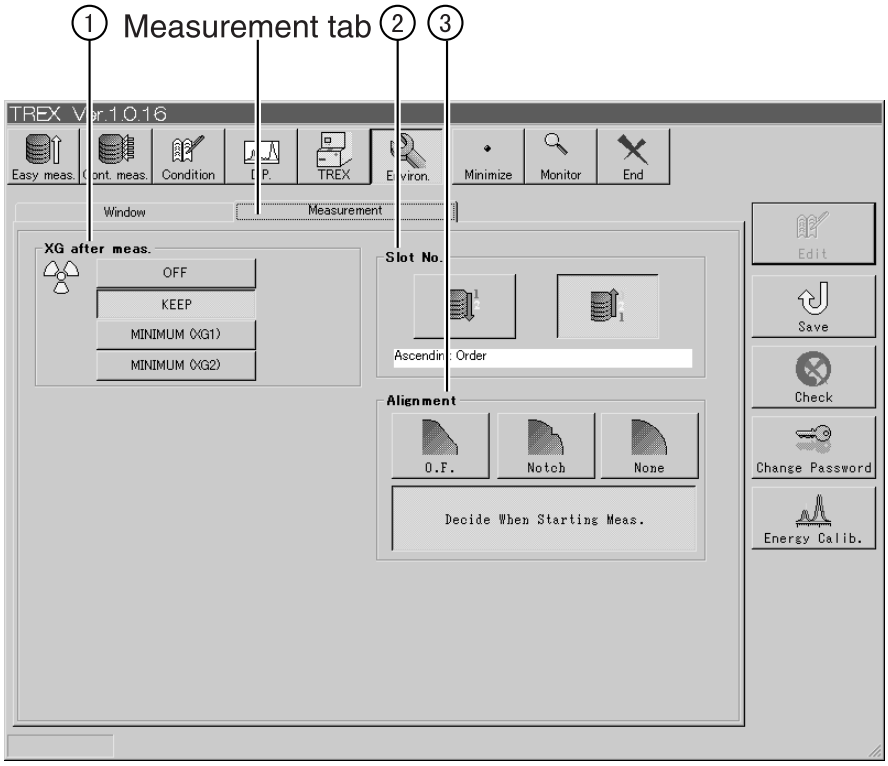
When you click the Window tab on the Setting Menu, the following screen is displayed. This screen is for setting enable/disable display of menu buttons.



Buttons that have a check mark against their name are displayed on each menu. Remove the check mark from the name of any button that you do not want displayed. By not displaying specific buttons, you can set it so that the function of that button can no longer be used and the set contents cannot be changed.

■ Measurement Setting

When you click the TREX tab on the Setting Menu, the following screen is displayed. On this screen you can set the X-ray after the end of measurement and set the wafer alignment to orientation flat.



①XG after meas. This sets the X-ray power condition after measurement is completed. Target1 is for W, target2 is for Mo.

OFF : After measurement, X-ray is OFF.

Keep : After measurement, X-ray maintains the same condition as during measurement.

MINIMUM(XG1) : When measurement is completed, Target 1 is set to minimum load.

MINIMUM(XG2) : When measurement is completed, Target 2 is set to minimum load.

②Slot No. This sets whether the cassette Slot No. has No. 1 at the top or the bottom.

③Alignment This sets wafer aligner function such as O.F. (Orientation Flat), Notch, or None Align. These settings works at the time of measurement. If None is selected, the wafer aligner is not performed before measurement. For some special sample, None should be selected. If you want to make a selection just before measurement, select "Decide Before Start Meas.".

REFERENCE

- When you want to perform high precision, fast measurement, set XG after meas. to "Keep".

● Energy calibration coefficients calculation

This system performs peak fitting of measured data, so calibration of the energy axes and energy resolution is necessary. Accordingly, perform calibration coefficients calculation in the following cases.

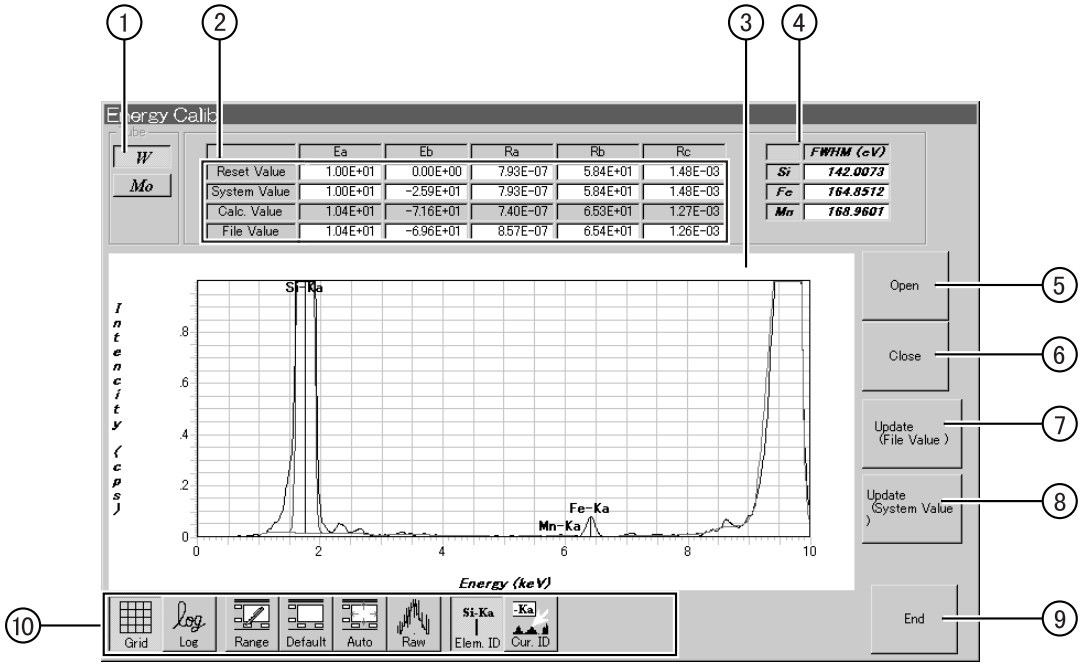
1. When the Solid State Detector (SSD) or linear amp is replaced.
2. When you reinstall the TREX system disk.
3. When the energy axis of the actual peak (black) and analysis peak (blue) do not match.
4. When there is a large difference in the peak width of the actual peak (black) and analysis peak (blue).

● Energy calibration coefficients calculation procedure

1. Load data in which only the Si peak and exciting X-rays (W, or Mo) are clearly indicated. (If there is peak of large inparity, deviation occurs in calculation of coefficients.)
2. Click on ⑥Energy Calibration on page 70. The next page will be displayed.

⚠CAUTION

- Do not perform this operation for the W and Mo beams on the twin beam machine (Trex620).

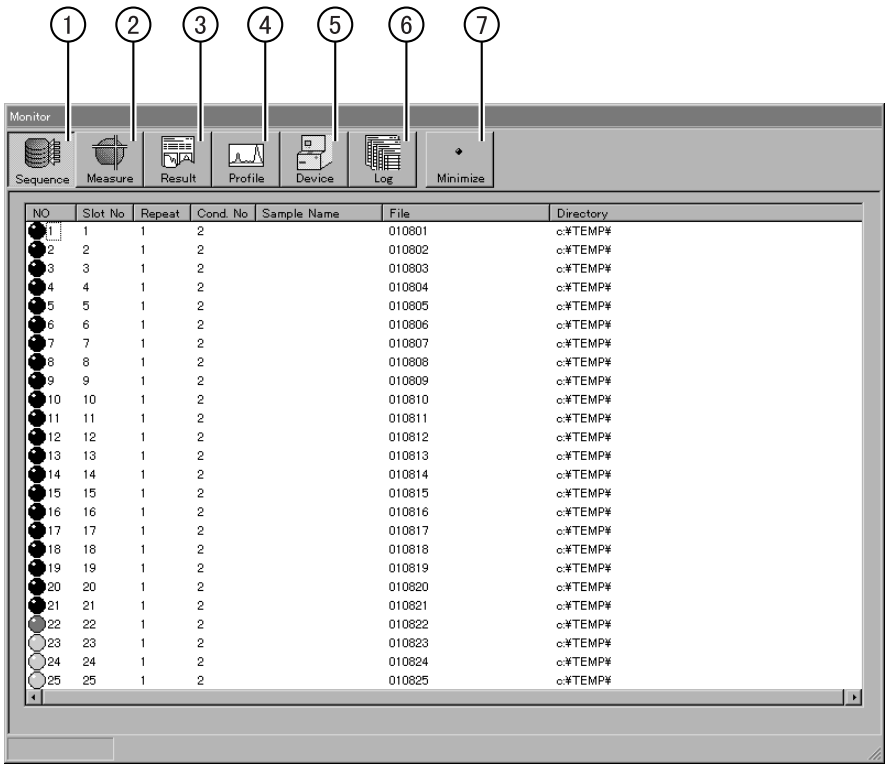


① X-ray Tube	Select the energy calibration display and the X-ray tube for editing. By switching the items here, each reset value and system value changes.
② Calibration Value Set	Each item displays the following contents. Reset Value :Reset value. System Value :Currently used calibration value. Calculated Value :The calibration value calculated based on the read file. The file is read when the Open command is given, and the value is displayed only when the calibration value is calculated successfully. File Value :The calibration value held by the read file is displayed. It is displayed when the file has been read.
③ Data Display Area	The file selected at ⑤ Open is displayed.
④ Half Value Width	Displays the half-value width for the selected calibration value set.
⑤ Open	Opens the measurement file.
⑥ Close	Closes the open file.
⑦ Update (File Value)	Upgrades the calibration value of the open file for the selected calibration value set.
⑧ Update (System)	Upgrades the calibration value of the system for the selected calibration value set.
⑨ End	Finishes energy calibration.
⑩ Data Display Settings	Settings for display of measurement data. See Profile for One Point Analysis (page 55).

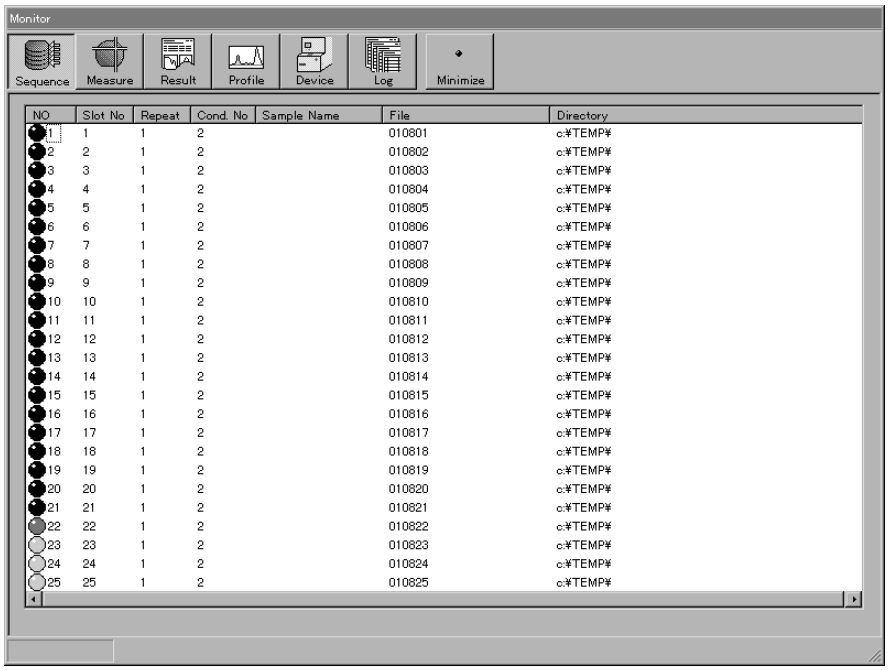
MONITOR

When you click Monitor on the Main Menu, the Monitor screen is activated. If it is already in operation, the Monitor screen is displayed at the front. Clicking on the buttons at the top of the screen will display the applicable screen.

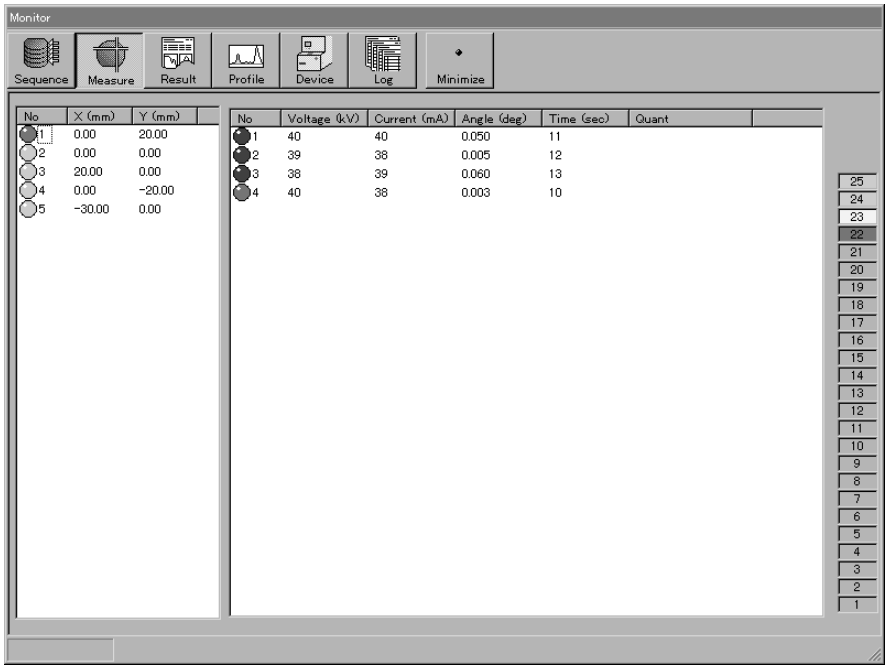
Monitor screen



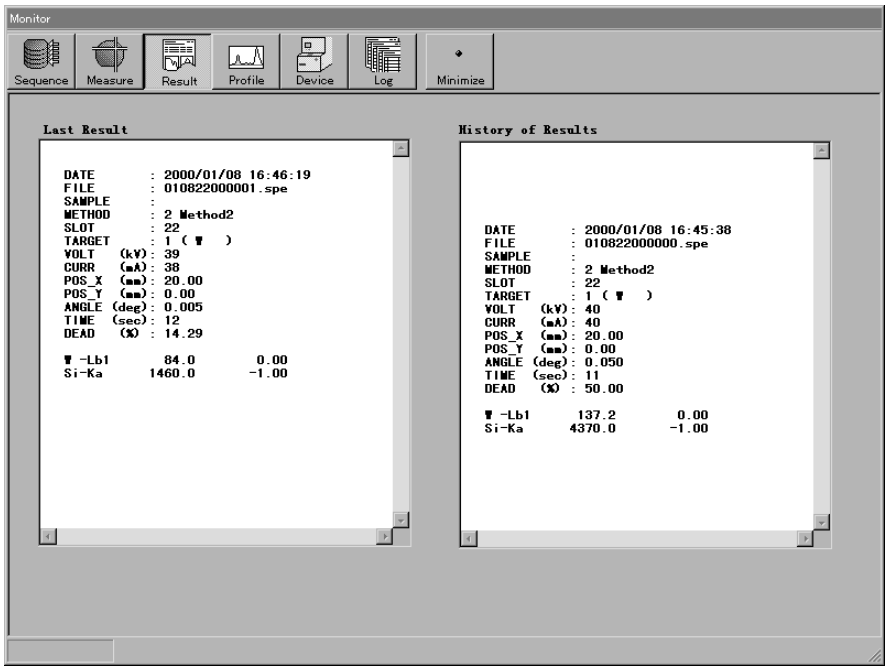
① Sequence The progress of the current measurement sequence is displayed.



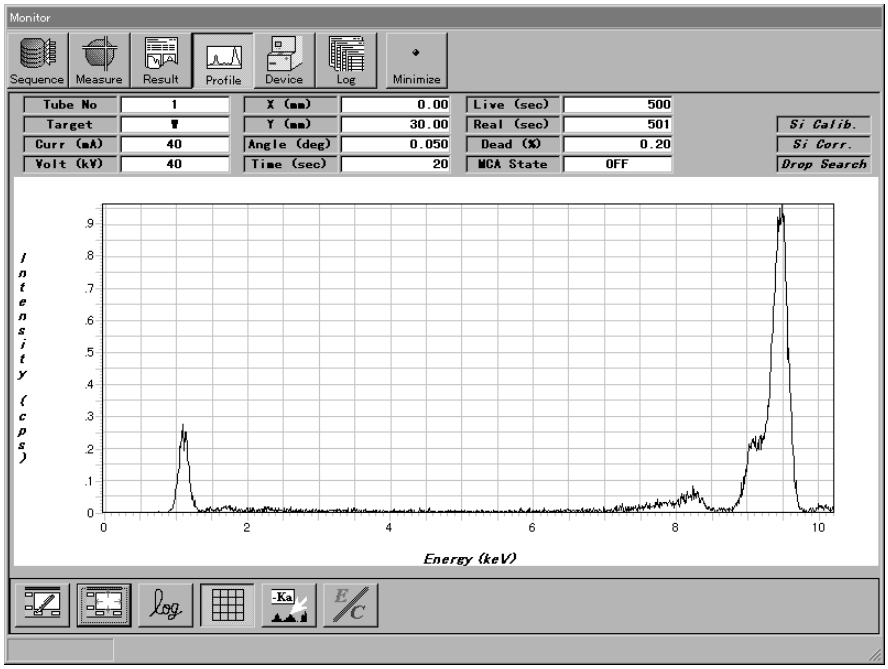
② Measure The progress of the current measurement sequence is displayed in detail.



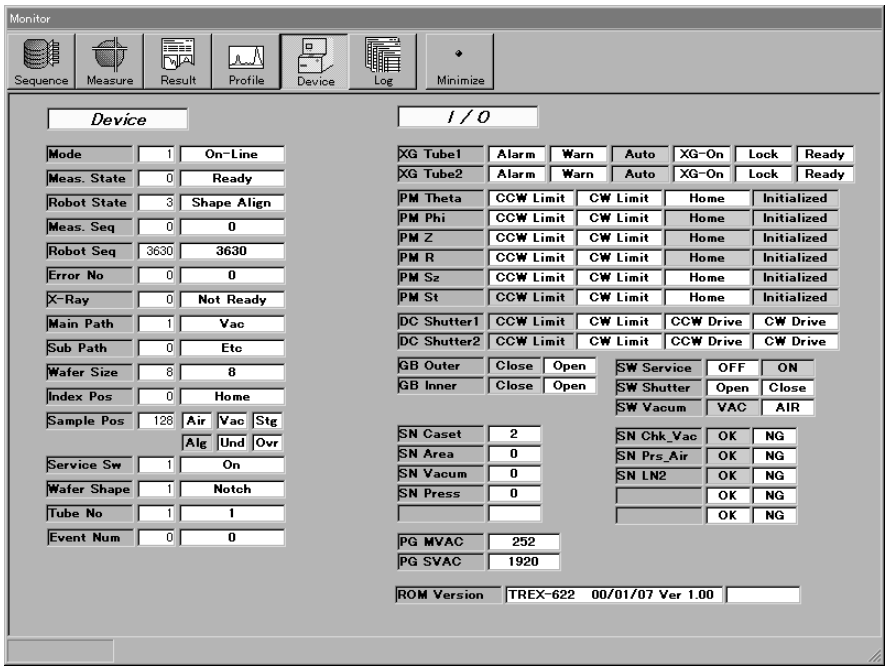
③Result The Last Result and the History of Results are displayed.



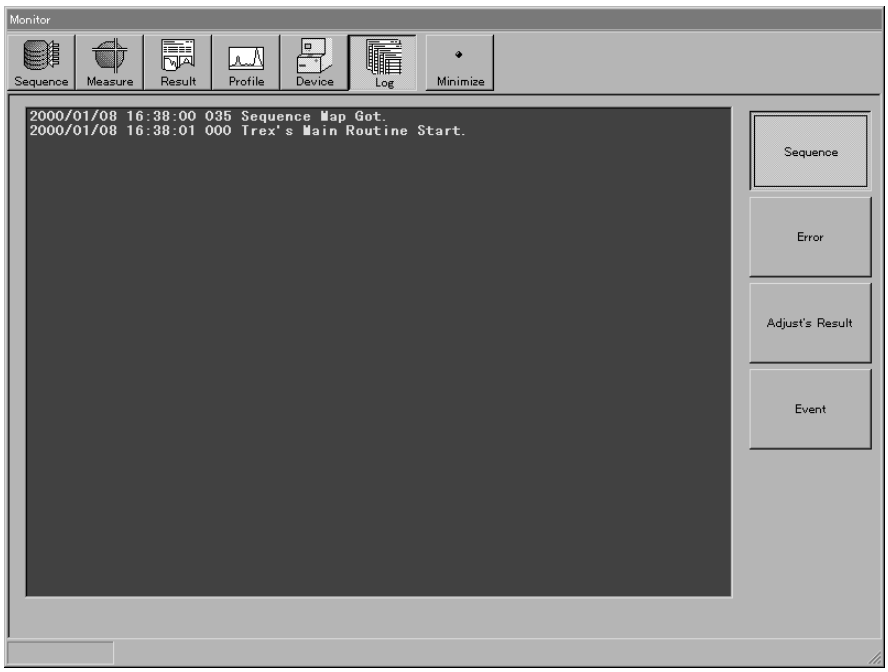
④Profile The observed waveform and its measurement parameters are displayed.



⑤ Device The device status and sensor status indicators are displayed.



⑥ Log Four logs are displayed: Sequence, Error, Adjustment Results, and Event.

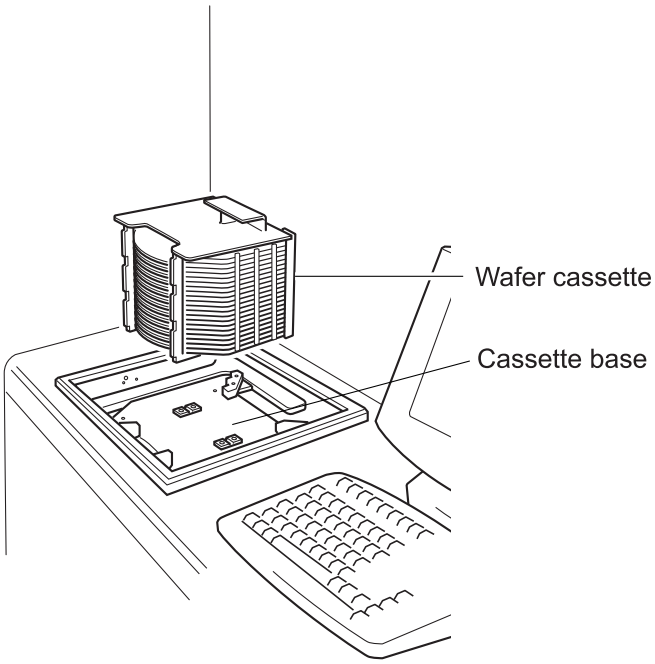


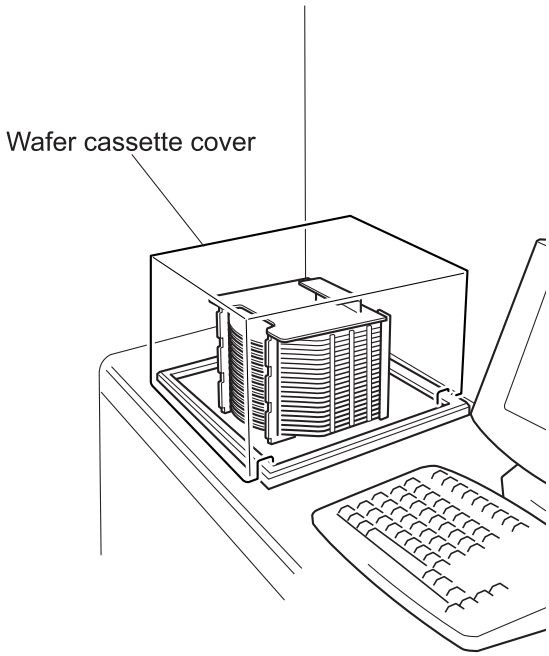
⑦ Minimize This minimizes the size of the Monitor screen.

MEASUREMENT METHOD

❶ Set the Wafer Cassette

1. Set the wafer cassette containing wafers upon the cassette base. Then set the wafer pod cover over the wafer pod.





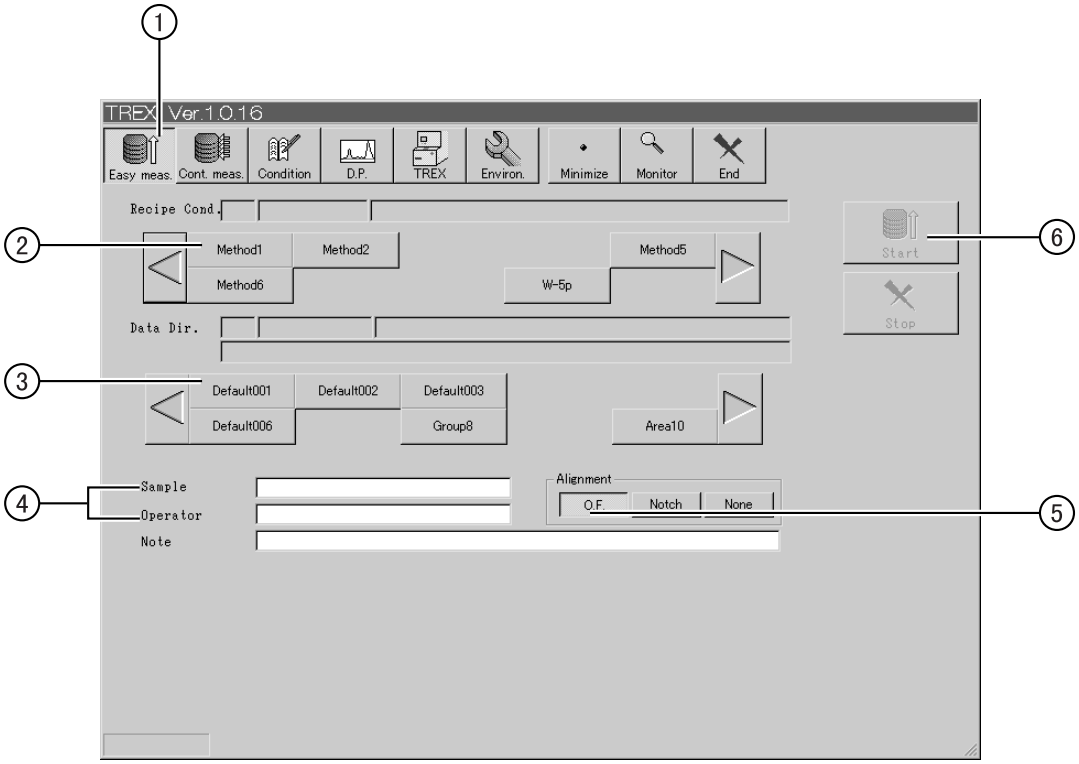
❷ Measurement Execution

■ Easy Measurement

Just by selecting preset measurement conditions and the Data Directory for measurement data, operations from measurement to analysis can be performed.

1. Click Easy meas. on the Main Menu.
   The Easy measurement screen will be displayed.

Easy Measurement screen



2. Using the Recipe condition button to select a preset Recipe condition.
3. Use the Data Directory button to select the Data Directory for saving the measurement data.
4. Input the Sample name and Operator name. (Measurement can be performed without these.)
5. Specify the wafer alignment (Only when “Setting of Wafer Alignment” is set to “Decide Before Start Meas.” on the Setting screen, See page 70.)
6. When you click Start, measurement will start.

REFERENCE

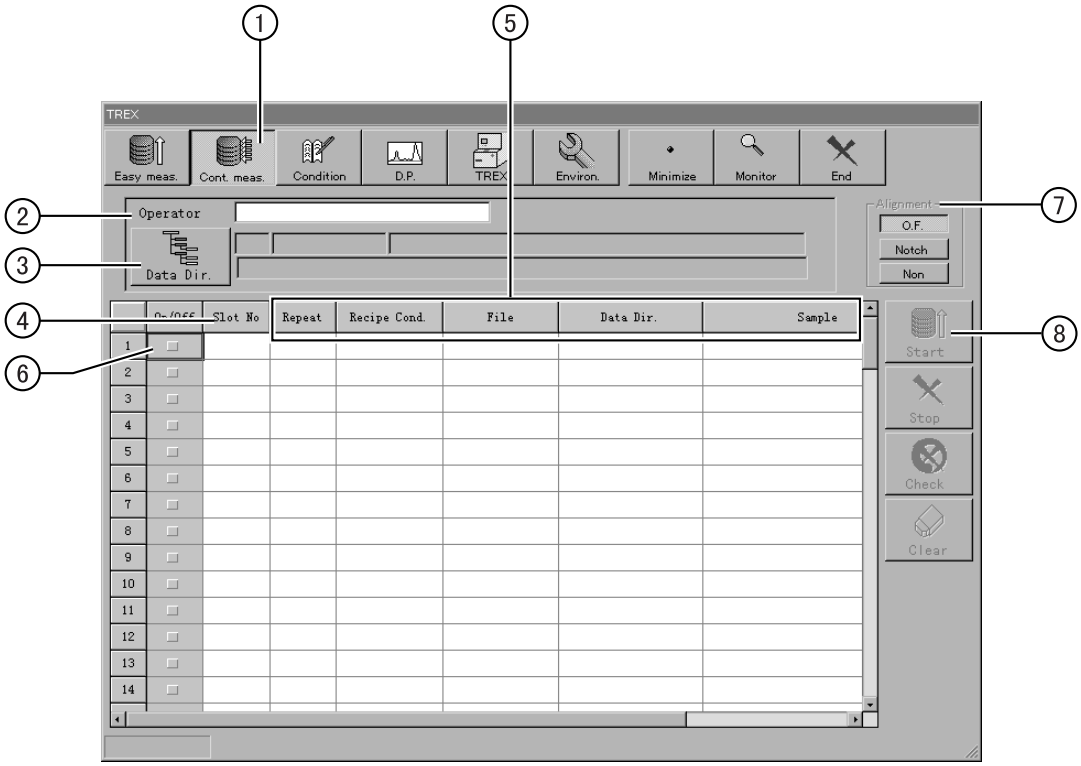
- With the date and number the measurement data is automatically assigned a file name. This cannot be changed.
- When the sample name is input, the same sample name is applied to all the applicable measurement results.
- To cancel measurement, click on Stop. Measurement will then stop and samples inside the machine will automatically be recovered. When you click on Start, measurement will start again from the beginning.

■ Continuous Measurement

A different analytical condition can be applied to each wafer, or the analytical condition can be changed any number of times and applied to the same wafer.

1. Click on Cont. meas. on the Main Menu.
   The Continuous measurement screen will be displayed.

Continuous Measurement screen



2. Input the Operator name. (Measurement can be performed without inputting this.)
3. Click on the Data Directory button and select the Data Directory.
4. Input the Slot No. where the wafer is that you want to measure.
5. Set the number of operation Repeats, Recipe Condition, File name, Data Directory and Sample name.
   ※ Input the Data Directory when you want to save the data at a place other than the directory selected by the Data Directory selection buttons. Measurement can be performed without inputting the sample name.
6. Put a check mark against the rows you want to process.
7. Specify the wafer alignment (Only when “Setting of Wafer Alignment” is set to “Decide Before Start Meas.” on the Setting screen, See page 70.)
8. When you click Start, the parameter check is performed and if the set contents are valid, measurement will start.

REFERENCE

- If the set contents are invalid, a message is displayed at the time for measurement start. If this occurs, check the set contents again.
- To cancel measurement, click on Stop. Measurement will then stop and samples inside the machine will automatically be recovered. When you click on Start, measurement will start again from the beginning.

❸ Interpreting Measurement Data

Basic interpretation of measurement data is explained here. Measurement data can be evaluated using an automatic output printout or a CSV file saved in Text format. Here, automatic output results are used to explain how to interpret the measurement data.

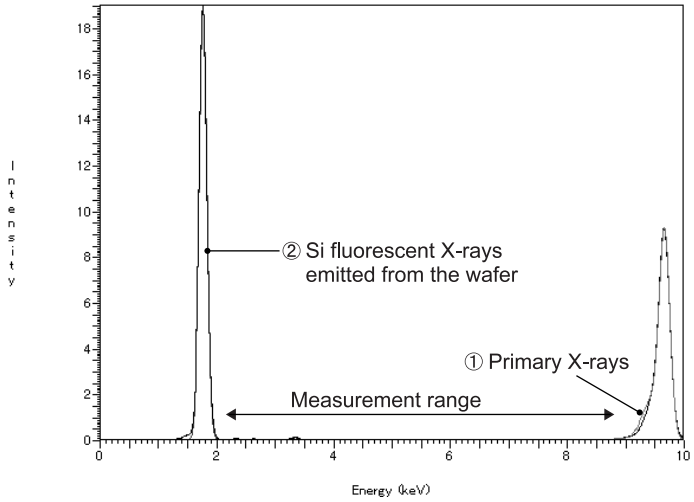


Fig. 1

Enlargement

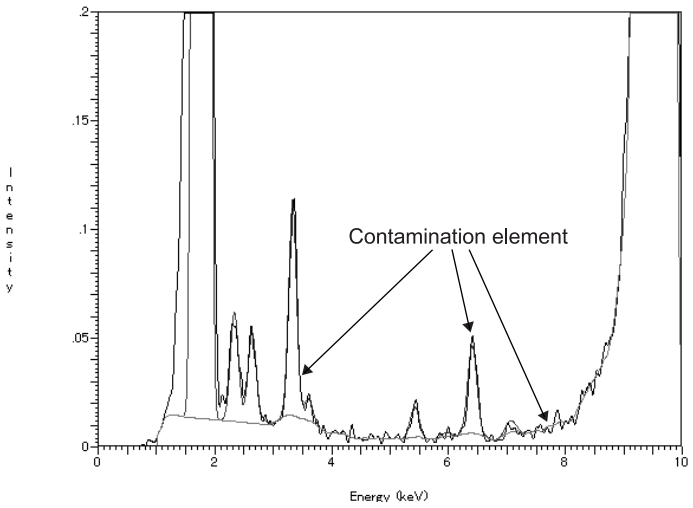


Fig. 2

The measurement data always displays the following 2 types of X-ray.

① Primary X-rays directed at the wafer.

② Si fluorescent X-rays emitted from the wafer

The elements detected between the peaks of these two X-rays are the elements which can be analysed. (Fig. 1, Note 1., 2., 3.)

Normally almost all the measured wafers are clean, so enlarge the diagram near the baseline. (Fig. 2)

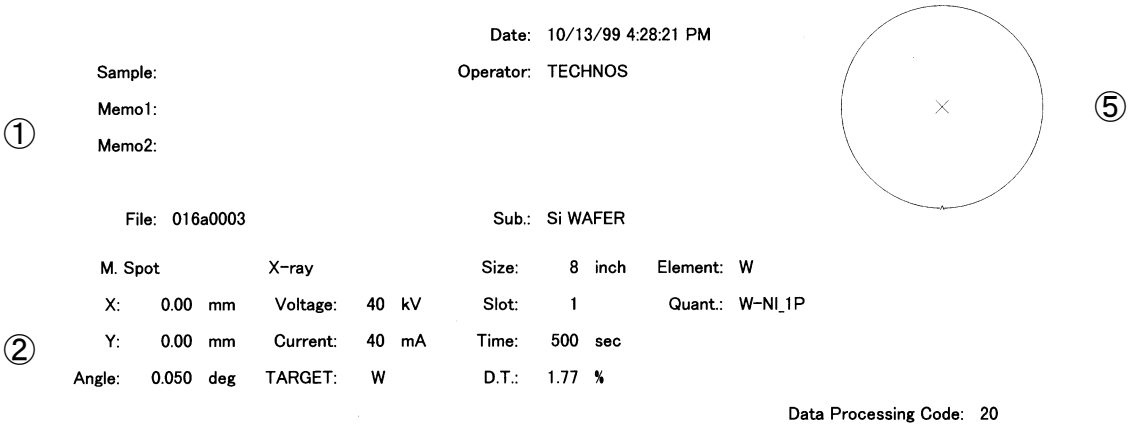
Note 1 When you measure a Si wafer, the Al and P at both ends of the Si overlap the Si peak, so the detection minimum value gets worse.

Note 2 Detection sensitivity becomes lower for elements with energy lower than Si, because of SSD characteristics.

Note 3 When the Mo beam is used, detection up to about 15 KeV is possible.

■ Interpreting Measurement Data

Output results such as the following are obtained for automatic output of measurement results, or output of data using one point analysis.

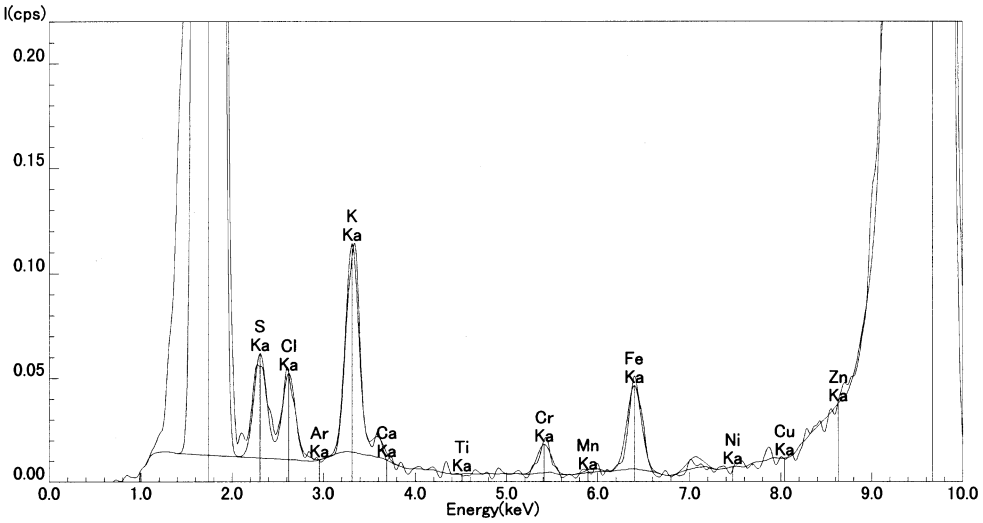


Date: 10/13/99 4:28:21 PM
Sample:
Operator: TECHNOS
Memo1:
Memo2:
File: 016a0003
Sub.: Si WAFER

M. Spot		X-ray			Size:	8 inch	Element:	W
X:	0.00 mm	Voltage:	40	kV	Slot:	1	Quant.:	W-NI_1P
Y:	0.00 mm	Current:	40	mA	Time:	500 sec		
Angle:	0.050 deg	TARGET:	W		D.T.:	1.77 %		

Data Processing Code: 20

Spectrum	Energy keV	Peak Int.cps	Conc. *E10	BG.Int. cps	Stand.Dev.cps
W -Lb1	9.67	249.3141			
Si-Ka	1.74	313.7480		0.2135	0.7924
S -Ka	2.31	0.8405	93.39	0.1927	0.0455
Cl-Ka	2.62	0.7008	48.29	0.1808	0.0420
Ar-Ka	2.96	0.0000	0.00	0.1779	0.0189
K -Ka	3.31	1.7119	56.45	0.2461	0.0626
Ca-Ka	3.69	0.0000	0.00	0.1839	0.0192
Ti-Ka	4.51	0.0000	0.00	0.0661	0.0115
Cr-Ka	5.41	0.2565	1.91	0.0786	0.0259
Mn-Ka	5.90	0.0000	0.00	0.0844	0.0130
Fe-Ka	6.40	0.7784	3.66	0.1196	0.0424
Ni-Ka	7.47	0.0000	0.00	0.1466	0.0171
Cu-Ka	8.04	0.0000	0.00	0.2368	0.0218
Zn-Ka	8.63	0.0000	0.00	0.8063	0.0402



① Sample information

② Measurement condition

③ Result list

※ The concentration value indicates contamination on top of the wafer.

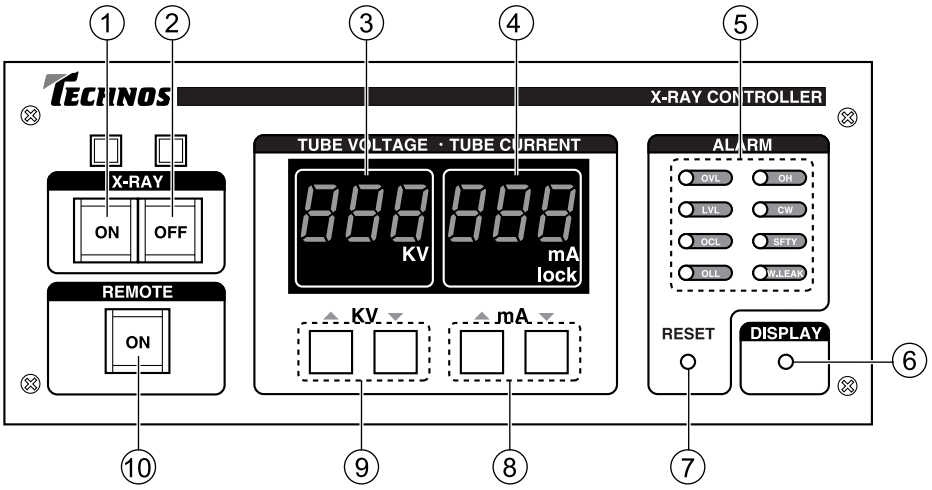
④ Peak profile

⑤ Measurement position

X-RAY CONTROLLER

⚠CAUTION

- Although you can manually control the X-ray tube voltage and tube current by setting the X-ray controller to manual mode, use relay mode normally and do not use manual mode.



①X-RAY ON switch
Turns ON X-ray emission.

②X-RAY OFF switch
Turns OFF X-ray emission.

③TUBE VOLTAGE display
Displays the tube voltage.

④TUBE CURRENT display
Displays the tube current.

⑤ALARM display
The applicable lamp flashes when there is an abnormality in the X-ray generator. (See the next page.)

⑥DISPLAY button
The tube voltage and tube current are displayed while you press this button. The filament voltage is displayed for one second after you release the button.

⑦RESET button
When one of the alarm display lamps flashes, pressing this button after you eliminate the cause of the alarm resets operation to normal.

⑧TUBE CURRENT UP/DOWN keys
These keys raise or lower the tube current setting.

⑨TUBE VOLTAGE UP/DOWN keys
These keys raise or lower the tube voltage setting.

⑩REMOTE SWITCH
This switches between the remote mode and manual mode.
ON (lamp ON) : Remote mode
OFF (lamp OFF) : Manual mode

■ Alarm Display

The alarm display lights up when the following abnormalities occur.

OVL : The tube voltage exceeds the upper limit.
LVL : The tube voltage drops below the lower limit.
OCL : The tube current exceeds the upper limit.
OLL : Abnormal overload has been applied to the X-ray tube.
OH : Overheating of the X-ray generator
CW : Coolant water flow is insufficient or the safety circuit is activated.
SFTY : The X-ray exposure prevention circuit is activated.
W. LEAK : Coolant water leak.

■ Error Display

If an error occurs during the start up of the tube voltage or tube current, the X-ray controller indicates the error on the tube voltage display and tube current display. Pushing the reset button extinguishes the display.

Err10 : X-RAY ON does not occur for the XG body.
If the alarm flashes simultaneously, it is not an error with the X-ray generator.
Cause : Cable fault, connector disconnection, etc. between controller and XG

Err11 : Tube voltage is not applied. (Timeout: 15 seconds)
Cause : Cable fault, connector disconnection, etc. between controller and XG; XG operating fault, etc.

Err12 : Tube current is not applied. (Timeout: 60 seconds)
Cause : Filament break in vessel. High voltage cable faulty, faulty contact, etc.

TROUBLESHOOTING

Error	Error Name	Cause	Countermeasure
1	Vacuum error	The vacuum level inside the chamber has not reached the set value within the specified time. Or vacuum is not applied.	Contact the Technos Service Department.
2	Leak error	Chamber internal pressure does not reach atmospheric pressure within the specified period.	
3	LN2 supplier error	Liquid nitrogen supplier error.	
5	Differential pressure sensor operation	Pressure differential occurred between main chamber and stage.	
10	Sensor value error	The command cannot be executed due to software interlock.	
11	Parameter error	Parameter error when command executed.	
12	Program error	Program error has occurred.	
15	Gate valve (outer) safety sensor operation	Gate valve (outer) safety sensor has operated.	
16	Gate valve (inner) safety sensor operation	Gate valve (inner) safety sensor has operated.	
21	Sample not detected (Aligner)	Sample not detected on aligner.	
22	Sample not detected (Sub Chamber)	Sample not detected in sub chamber.	
23	Sample not detected (Robot Chamber)	Sample not detected in robot chamber.	
24	Sample detected is outside settings	Sample detected is outside settings.	
25	Hand position incorrect	The robot arm position is incorrect.	
26	No cassette	No cassette or pod.	Insert a cassette or pod, then initialize the machine.
28	Sub chamber Z axis timeout	Each axis does not finish operation within the set time.	Contact the Technos Service Department.
29	Sub chamber rotating axis timeout		
30	R axis timeout		
31	θ axis timeout		
32	Z axis timeout		
33	ψ axis timeout		
34	Gate valve (outer) timeout	Outer gate valve operation not completed within specified time.	
35	Gate valve (inner) timeout	Inner gate valve operation not completed within specified time.	
36	Aligner lifter timeout	Aligner lifter operation not completed within specified time.	
37	Shutter 1 timeout	Shutter 1 operation not completed within specified time.	

Error	Error Name	Cause	Countermeasure
38	Shutter 2 timeout	Shutter 2 operation not completed within specified time.	Contact the Technos Service Department.
40	R axis CW limit	The respective axis has exceeded the operation range and activated the limit switch.	
41	R axis CCW limit		
42	θ axis CW limit		
43	θ axis CCW limit		
44	Z axis CW limit		
45	Z axis CCW limit		
46	ψ axis CW limi		
47	ψ axis CCW limit		
48	Sub Chamber Z axis CW limit		
49	Sub Chamber Z axis CCW limit		
50	Sub Chamber rotation axis CW limit		
51	Sub Chamber rotation axis CCW limit		
60	R axis not initialized	R axis was not initialized.	Initialize the machine.
61	θ axis not initialized	θ axis was not initialized.	
62	Z axis not initialized	Z axis was not initialized.	
63	ψ axis not initialized	ψ axis was not initialized.	
64	Sub Chamber Z axis not initialized	Sub Chamber Z axis was not initialized.	
65	Sub Chamber rotation axis not initialized	Sub Chamber rotation axis was not initialized.	
66	Robot not initialized	Robot was not initialized.	
82	EEPROM error	EEPROM memory contents are damaged.	Contact the Technos Service Department.
83	Unable to find return slot, so initialization stopped	A wafer outside the settings was detected, so initialization could not proceed.	Remove the wafer from the atmosphere robot and initialize the machine.
90	Interlock operated	Interlock operated.	Release the interlock and initialize the machine.
91	Compressed air deficiency	Compressed air has insufficient pressure.	Check the compressed air, then initialize the machine.
92	Chuck vacuum pressure deficient	The chuck vacuum pressure is not sufficient.	Check the chuck vacuum pressure, then initialize the machine.
102	Atmospheric robot comm error	Communication error with the atmospheric robot.	After initializing the machine, contact the Technos Service Department.
103	Atmospheric robot BUSY error	During operation, the atmospheric robot received a command requiring operation.	
104	Atmospheric robot sensor error	The atmospheric robot hand has struck something or needs tuning.	Contact the Technos Service Department.
105	Atmospheric robot emergency OFF	The atmospheric robot hand has received an emergency OFF input.	After initializing the machine, contact the Technos Service Department.

Error	Error Name	Cause	Countermeasure
106	Atmospheric robot command error	The atmospheric robot has received an improper command.	After initializing the machine, contact the Technos Service Department.
107	Atmospheric robot operation timeout	Operation of the atmospheric robot was not completed within the specified time.	
108	Atmospheric robot comm timeout	The atmospheric robot does not reply to communication.	
109	Vacuum robot BUSY error	During operation, the vacuum robot received a command requiring operation.	
114	Vacuum robot sensor error	The vacuum robot hand has struck something.	Contact the Technos Service Department.
115	Vacuum robot emergency OFF	The vacuum robot hand has received an emergency OFF input.	After initializing the machine, contact the Technos Service Department.
116	Vacuum robot command error	The vacuum robot has received an improper command.	
117	Vacuum robot operation timeout	Operation of the vacuum robot was not completed within the specified time.	
118	Vacuum robot comm timeout	The vacuum robot does not reply to communication.	
121	Robot parameter error (robot type not fixed)	The robot parameter is outside the range.	
122	Robot sensor error (robot type not fixed)	The robot hand has struck something or needs tuning.	
123	Robot emergency OFF (robot type not fixed)	The robot has received an emergency OFF input.	
124	Robot command error (robot type not fixed)	The robot has received an improper command.	
125	Robot comm timeout (robot type not fixed)	The robot does not reply to communication.	
201	Aligner home return error	Aligner does not initialize.	
202	Aligner home return incomplete	Aligner initialization is not completed.	Initialize the machine.
203	Aligner emergency OFF	The aligner has received an emergency OFF input.	After initializing the machine, contact the Technos Service Department.
204	Aligner motor driver alarm	The aligner motor driver has malfunctioned.	
205	Aligner system parameter malfunction	There is a malfunction in the aligner parameter.	
206	Aligner software limit over	The aligner software limit has been exceeded.	
207	Aligner diagnostic malfunction	There is a malfunction in the aligner diagnostics.	
208	Aligner command duplication	The aligner has received duplicated commands.	
209	Aligner Wafer not attached	The wafer is not attached.	

Error	Error Name	Cause	Countermeasure
210	Aligner controller malfunction	The aligner controller has malfunctioned.	After initializing the machine, contact the Technos Service Department.
211	Aligner centering malfunction	The wafer shape setting is wrong.	Check the wafer shape setting.
212	Aligner O.F. alignment malfunction		
213	Aligner lifter up/down malfunction	The aligner lifter is not operating.	Check the pressure of the compressed air.
216	Aligner not ready	The aligner controller is not responding.	After initializing the machine, contact the Technos Service Department.
217	Aligner time over	The aligner operation is not completed within the specified time.	
218	Aligner sequence error	There is a malfunction in the aligner sequence.	
219	Aligner answer error	The parameter cannot be set for the aligner.	
300	Port comm error	The port has cancelled communication.	
301	Port command error	The command to the port was not appropriate.	
302	Port BUSY error	During operation, a command requiring operation was received.	
303	Port Load error	There was a failure loading the cassette.	
304	Port Unload error	There was a failure unloading the cassette.	
305	Port Lock error	There was a failure locking the pod.	
306	Port Unlock error	There was a failure unlocking the pod.	
307	Port Slot movement error	There was a failure moving to the specified slot.	
308	Port inching error	There was a failure in inching the cassette.	
309	Port map acquisition error	There was a failure in acquiring the wafer map.	
310	Port initialization error	There was a failure in port initialization.	
311	Port operation timeout	Port operation is not completed within the specified time.	
312	Port comm timeout	The port does not reply to communication.	
313	Port parameter error	The port parameter is outside the range.	
314	Port not initialized	The port is not initialized.	Initialize the machine.
315	Port event time out	The event report has not been received from the port.	After initializing the machine, contact the Technos Service Department.
316	Port ACK time out 1	No acknowledgment has come from the port.	
317	Port ACK time out 2		
318	Port secondary message time out	No secondary message has come from the port.	

Error	Error Name	Cause	Countermeasure
450	XG error	X-ray interlock has operated and stopped the X-ray.	Check the X-ray interlock, cooling water, water leakage.
451	Insufficient X-ray quantity	The X-ray quantity required for angle adjustment is not detected.	Contact the Technos Service Department.
452	XG retries exceeded	X-rays not output due to malfunction of the X-ray tube, etc.	
454	No cassette or pod	Start occurred even though there was no cassette.	Install the cassette or pod, then measure again.

Explanation of Terms

Aligner : Orientation flat alignment machine

Port : SMIF. etc, cassette inlet/outlet, elevator.

■ Warnings

After a warning occurs, measurement and transfer is still possible, but after measurement is completed, an error message is displayed on the computer screen. The machine operation after the error occurs is described in brackets in the Cause column below.

Error	Error Name	Cause	Countermeasure
530	XG error	X-ray interlock has operated and stopped the X-ray (All measurement is stopped).	Check the X-ray interlock, cooling water, water leakage.
540	Insufficient X-ray quantity	The X-ray quantity required for angle adjustment is not detected (All measurement is stopped).	Contact the Technos Service Department.
541	XG retries exceeded	X-rays not output due to malfunction of the X-ray tube, etc (All measurement is stopped).	
542	MCA coefficient, no start	X-rays are too strong (Move to next measurement point).	Change the X-ray condition.
550	Z axis adjustment number exceeded	Optimum value for angle adjustment could not be found (Angle adjustment retry).	Retry occurs automatically.
551	ψ axis adjustment number exceeded		
552	ψ axis adjustment non-functional CW		
553	ψ axis adjustment non-functional CCW		
555	No wafer in specified slot of cassette	No wafer was detected in the specified slot of the cassette (Measure next specified slot).	Check the chuck vacuum source.
556	Calculation error	Unable to calculate the optimum value for angle adjustment (Angle adjustment retry).	Retry occurs automatically.

DAILY INSPECTION AND PERIODIC INSPECTION

❶ Daily Inspection

Check the following items in your daily inspection.

● Trex620 Main Body

- The cooling water flow rate must be 3 L/min.
- The nitrogen gas, compressed air, cooling water and wafer chuck vacuum, etc. must be flowing at the specified value or above.
- The remaining capacity of the liquid nitrogen on the SSD side must be 20% or more.
- Check that there is no alarm display illuminated on the XG operation panel.

● Liquid Nitrogen Supplier

- Check that there is no alarm display illuminated on the operation panel.
- The nitrogen gas flow rate must be 3 L/min.

❷ Periodic Inspection

● Monthly Inspection

Check the following items monthly.

● Trex620 Main Body

X-ray Intensity Check

Measure the supplied standard sample and check the integrated intensity value of contamination elements (particularly Ni-ka). (Use the intensity at the time of purchase as a reference value for the integrated intensity value, and if the integrated intensity value changes more than ± 15% of the integrated intensity value at the time of purchase, contact the Technos Service Department.)

Special Direct X-ray Intensity Check

Periodically check the direct X-ray intensity value (SC Read value).
(Use the intensity at the time of purchase as a reference value for the SC Read value, and if the value changes more than ± 10% of the value at the time of purchase, contact the Technos Service Department.)

● Periodic Inspection on a Chargeable Basis

Technos provides a periodic inspection twice a year for a fee. The X-ray intensity check and transport system check is performed beforehand. Contact Technos to request a periodic inspection.

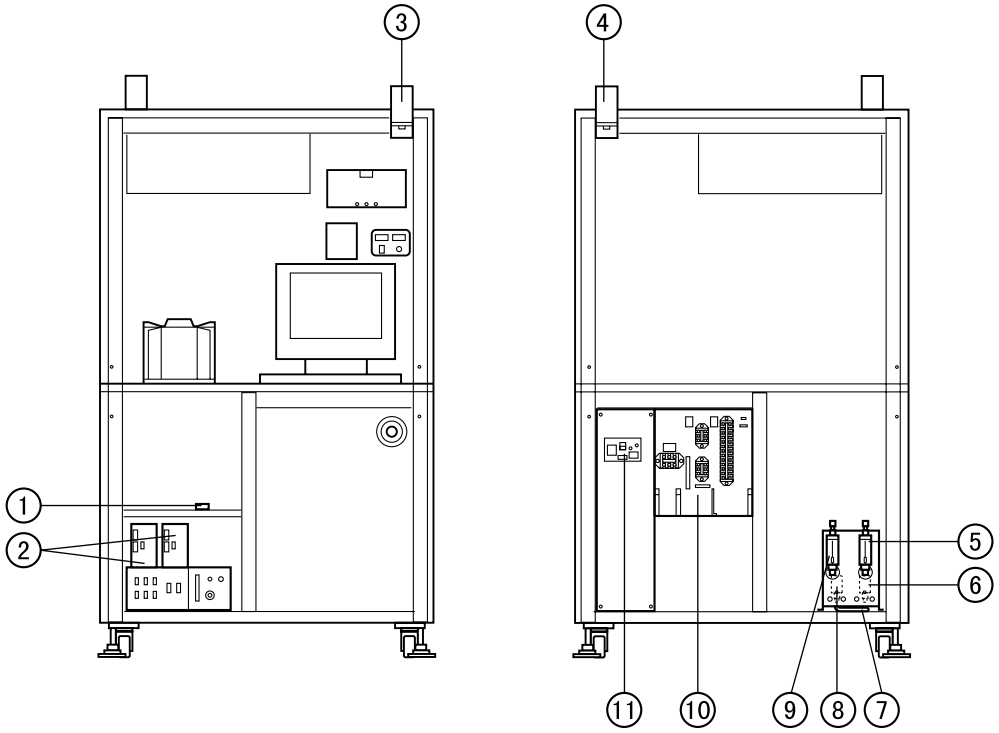
❸ Periodic Replacement Parts

Part Name	Specification	Replacement Timing and Comments
X-ray tube (W)		Every year (Approx. 3 months after purchase) ※
X-ray tube (Mo)		Every year (Approx. 3 months after purchase) ※
SSD Vacuum pump		Every 2 years approx.
Cold head	S030	Every 3 years approx. (only when LSN-3 is used.)
Compressor unit	CW301	Every 3 years approx. (only when LSN-3 is used.)
Water supply pump		Every 3 years approx. (only when a water supply device is used.)

※ This value is for almost continuous operation of the X-ray tube.
When use is intermittent, or there are long periods of standby use at low output, the period is longer.

MAINTENANCE

❶ Position of Unit and Sensors



Unit front

Unit rear

①Wafer size detection sensor (AP7, AP8) adjustment amp

②Robot driver

③X-ray alarm lamp globe failure sensor (system front)

④X-ray alarm lamp globe failure sensor (system rear)

⑤Mo coolant flow sensor

⑥Mo coolant pressure valve

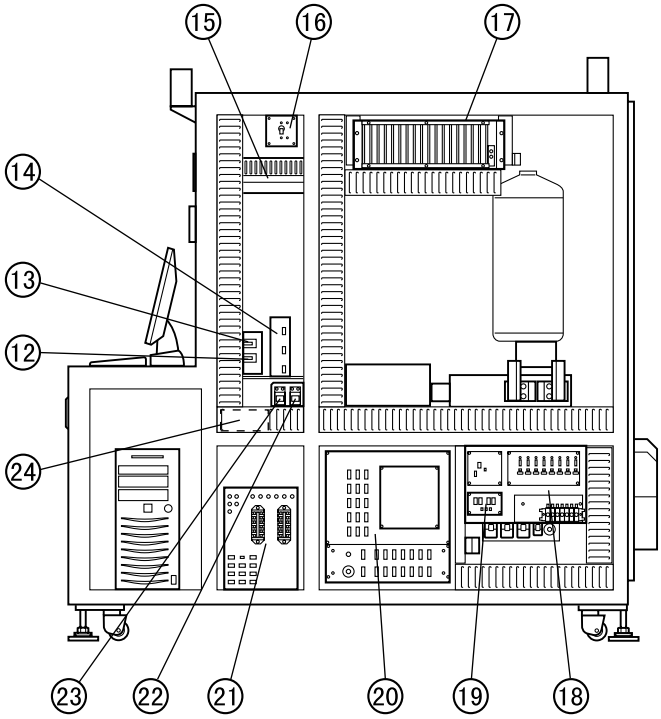
⑦Coolant leak sensor

⑧W coolant flow sensor

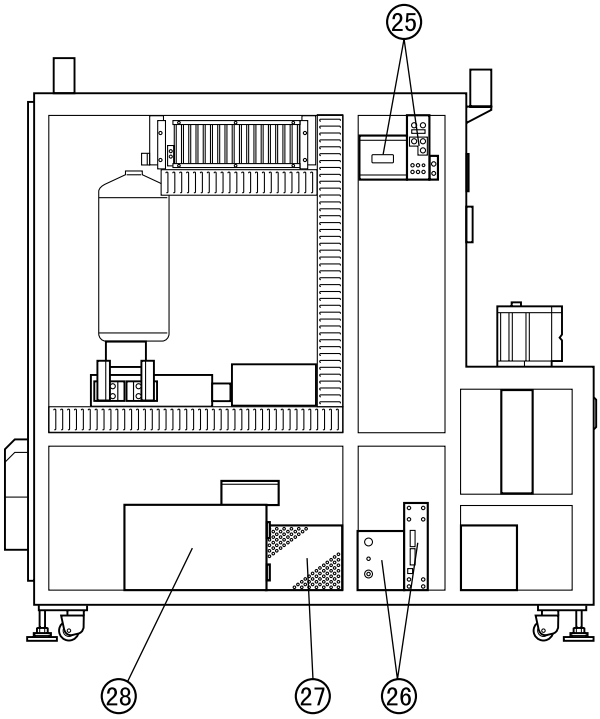
⑨W coolant pressure valve

⑩Rear power board

⑪Main breaker



Unit right side



Unit left side

⑫ M hour meter

⑬ W hour meter

⑭ Signal lamp driver

⑮ XG controller

⑯ Circuit breaker (for clean unit fan)

⑰ CPU rack

⑱ Valve driver

⑲ Safety circuit

⑳ Driver rack (for SSR, pulse drive)

㉑ Power unit

㉒ Wafer chuck vacuum switch

㉓ Compressed air pressure switch

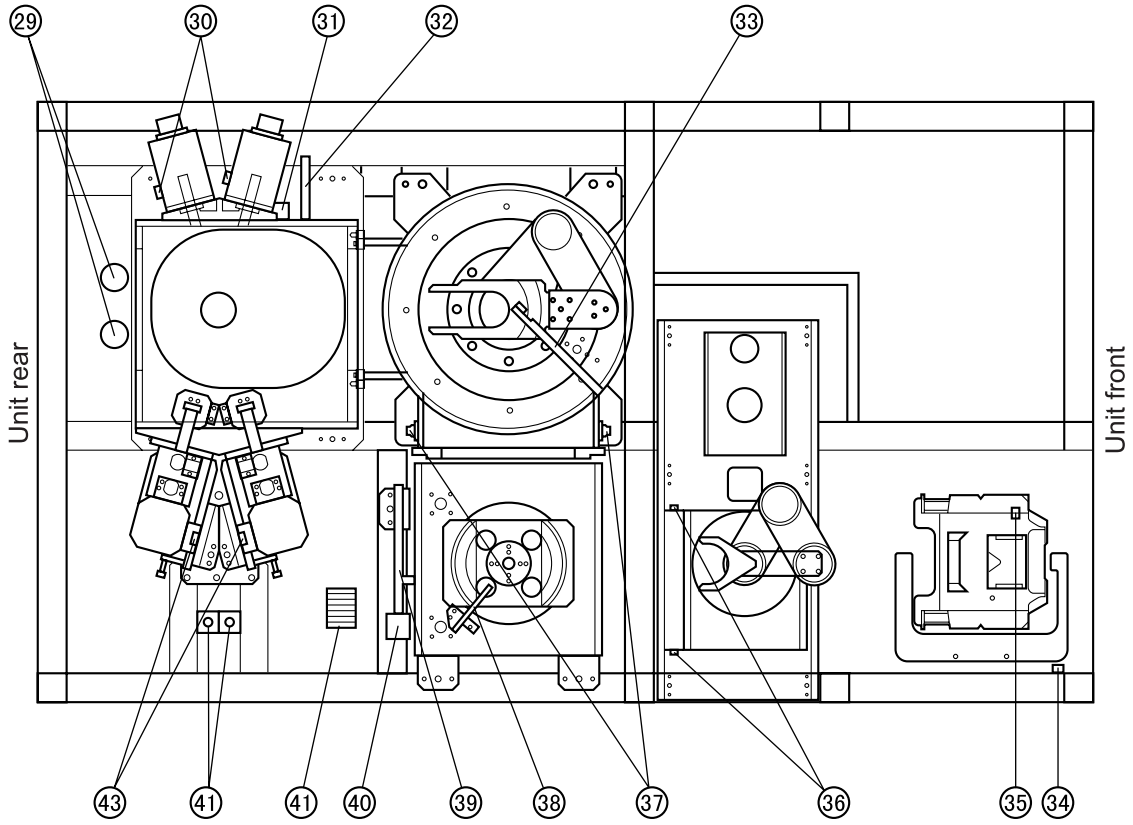
㉔ Power for oxygen concentration meter

㉕ Measurement rack

㉖ Aligner driver

㉗ XG controller

㉘ XG high pressure tank



㉗Vacuum sensor

㉚X-ray counter cover removal sensor

㉛Main chamber vacuum switch

㉜Main chamber vacuum sensor

㉝Wafer detection sensor for vacuum robot (AP5)

㉞Wafer cassette cover detection sensor

㉟Wafer size detection sensor (AP7, 8)

㊱Outer gate valve position sensor (AP1, 2)

㊲Inner gate valve position sensor (AP3, 4)

㊳Wafer detection sensor for airlock chamber (AP6)

㊴Airlock chamber vacuum sensor

㊵Airlock chamber vacuum switch

㊶Sensor adjustment amp (for AP1 - 6)

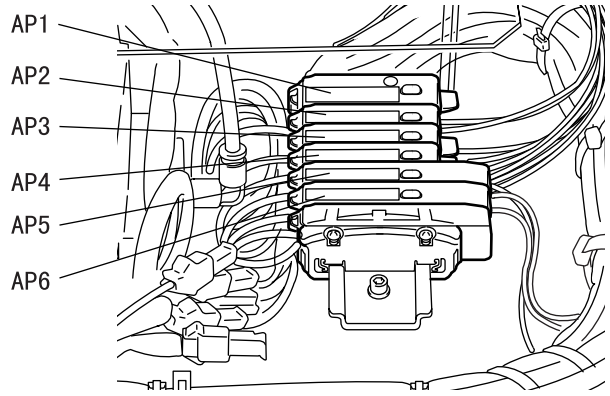
㊷High voltage cable disconnection sensor

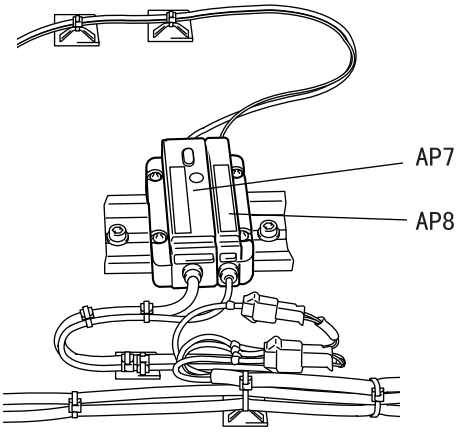
㊸X-ray tube cover removal sensor

❷ Adjustment Method of Sensors, Vacuum Switches and Pressure Switches

■ Optical Sensors

Sym.	Application	Sticker	Adjustment Method	Type	Sensitivity	Logic	Red LED ON condition
AP1	Outer gate valve pinch prevention	Sefety sensor (outer,upper)	2 point tuning	Transmission type	Fine	D-ON	Obstacle present
AP2	Outer gate valve pinch prevention	Sefety sensor (outer,lower)	2 point tuning	Transmission type	Fine	D-ON	Obstacle present
AP3	Inner gate valve pinch prevention	Sefety sensor (inner,upper)	2 point tuning	Transmission type	Fine	D-ON	Obstacle present
AP4	Inner gate valve pinch prevention	Sefety sensor (inner,lower)	2 point tuning	Transmission type	Fine	D-ON	Obstacle present
AP5	Wafer detection	Robot Chamber Wafer Det3	Maximum sensitivity adjustment	Reflection type	Turbo	D-ON	No wafer
AP6	Wafer detection	Sub Chamber Wafer Det	Maximum sensitivity adjustment	Transmission type	Fine	L-ON	No wafer
AP7	6 inch cassette detection	6`Wafer size Dat	2 point tuning	Reflection type	Fine	L-ON	Cassette present
AP8	8 inch cassette detection	8`Wafer size Dat	2 point tuning	Reflection type	Fine	L-ON	Cassette present





● Optical Sensor Adjustment Method

Open the transparent cover of the optical sensor, then perform adjustment.

AP1 - AP4

1. Set work (applicable item such as a cassette or wafer) in position. Press the SET button. The yellow LED comes ON.
2. Press the ON switch of the distribution board.

AP5

1. Do not put anything under the sensor. Press the SET button for at least 3 seconds.
2. Release your finger after the yellow LED flashes.

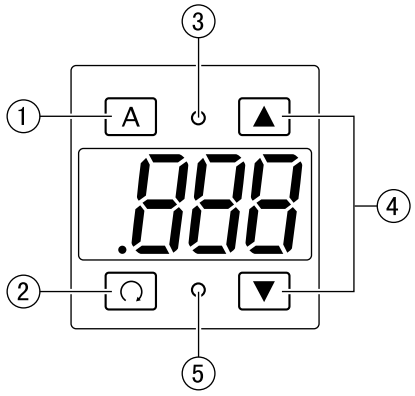
AP6

1. Set work in position. Press the SET button for at least 3 seconds.
2. Release your finger after the yellow LED flashes.

AP7-AP8

1. Set work in position. Press the SET button. The yellow LED comes ON.
2. Remove the work. Press the SET button. The yellow LED turns OFF.

■ Vacuum Switches, Pressure Switches



①Auto key
When in auto tuning mode, operate this key for pressure detection. When in measurement mode, pressing this key for 2 seconds or longer will activate zero adjustment.

②Setting key
Use this key to check or change the setting value.

③Output 1 display lamp (Red LED)

④UP/DOWN key
Use this key to set the output mode, or to change the setting value or unit.

⑤Output 2 display lamp (Green LED)

● Setting Method for Vacuum Switches, Pressure Switches

Use the setting key to select the following setting items for vacuum switches and pressure switches. Use the UP/DOWN key to change the setting value.

Setting Items

Operation mode setting

Switching between N.O. (normal open) and N. C. (normal close)

Response time setting

Value display color setting

When the setting key is pressed for at least 3 seconds in the measurement mode, the mode switches to the operation mode. When each item is set, the display automatically changes to the next setting item.

	Factory default value
Operation mode	F-3
N.O./N. C. switching	N.O.
Response time	2.5(msec)
Value display color setting	2-C

Setting Method

● Operation Mode Setting

1. Press the setting key for at least 3 seconds in measurement mode.
2. Select the desired operation mode using the UP/DOWN key.
   Operation Modes
   F-1: Auto tuning mode. F-2: Hysteresis mode
   F-3: Independent 2 output mode. F-4: Window mode
3. Press the setting key.
   When the operation mode has been set, the display will change to N.O. (normal open)/N. C.

● N.O. (normal open)/N. C. (normal close) Switching.

1. Select N.O. or N. C. using the UP/DOWN key.
2. Press the setting key.
   When N.O. or N. C. has been set, the display will change to Response Time Setting.

● Response Time Setting

1. Select the desired response time using the UP/DOWN key.
   Response time: 2.5 / 5 / 100 / 500 (msec)
2. Press the setting key.
   When the response time has been set, the display will change to Value Display Color Setting.

● Value Display Color Setting

1. Select the desired value display color using the UP/DOWN key.
   Value display color 1-C: Red-only display
   2-C: 2 color mode
2. Press the setting key.
   When the value display color has been set, the display will return to measurement mode.

● Pressure Value Setting

Factory Default Setting Values

	Value A	Value B(b)	Value P
Meas.Chamber	-2kPa	Setting not needed	0
Sub Chamber	-2kPa	Setting not needed	0
Compressed Air	0.47MPa	Setting not needed	0
Chuck Vacuum	-55kPa	Setting not needed	0

Setting Method

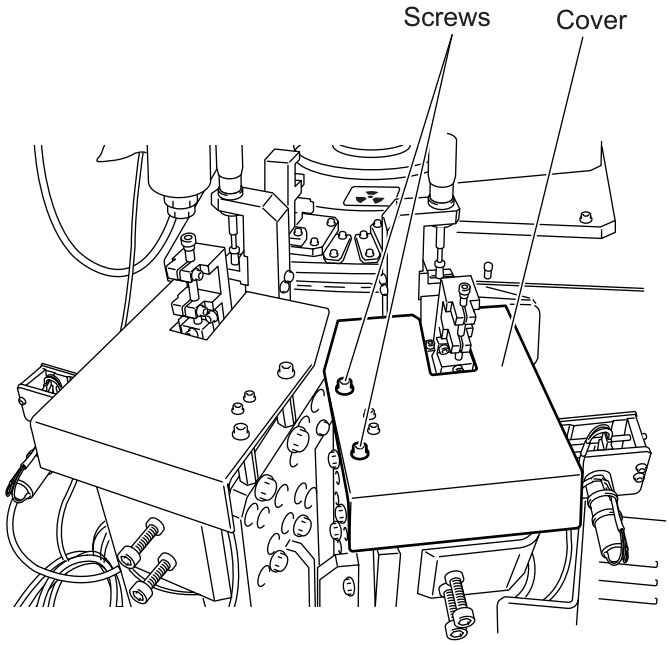
1. Press the setting key once in measurement mode.
   Value A and the present value will be displayed alternately.
2. Press the UP/DOWN key to set the above setting value (value A).
3. Press the setting key to confirm the value.
   Only value A is set, so if value b or value P is displayed, press the setting key repeatedly until the screen returns to the measurement mode.

❸ X-ray Tube Replacement

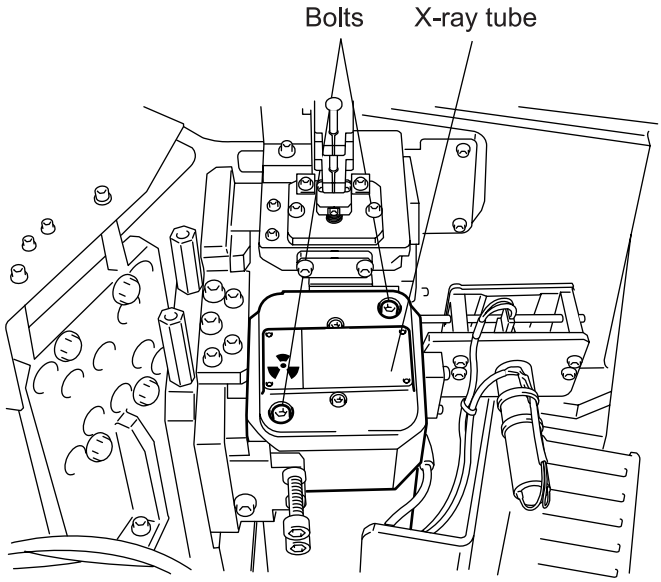
⚠CAUTION

- Before you replace the X-ray tube, make sure the unit is turned OFF.

1. Remove the 2 screws from the X-ray tube cover, then remove the cover.



2. Remove the 2 bolts, remove the X-ray tube and install the new X-ray tube.



WARRANTY

This machine is covered by warranty for a period of one year from the date of purchase.
Even if the warranty period is still valid, machine malfunction for the following reasons shall be excluded from warranty coverage.

1. Abnormal conditions caused by natural disasters and fires, etc.
2. Use of this machine for purposes it was not originally designed for.
3. Problems caused by unauthorized modification of this machine without the operator or a third party consulting with the manufacturer.
4. Problems caused by installation conditions greatly different to those prescribed.
5. Gross negligence (including machine breakdown due to operation error) or intentional misuse by the operator or thirdparties.
6. Wear of consumable items or the natural life of parts.
7. Breakdown caused by computer operation or malfunction.
8. Damage to the contents of computer memory devices.
9. Other malfunctions which cannot be considered the responsibility of Technos.

REVISION RECORD

Rev. No.	Date	Page	Change Location	Contents	Reason
0	25-Nov-00			New publication	
1	23-Feb-01			Control Program Revision	