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X-RAY INSPECTION SYSTEM

Part Ⅳ. Operation Manual (Common)

sec
e-beam pioneer

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1.Overview

1.1 Overview

This software manual describes various functions of XeyeSystems, the core software for X-eye SF160F. The XeyeSystems basically allows control of the tube and the detector, retrieval of the image of desired subject, hardware handling including a work table to provide a customized view, settings for image processing, and image correction. In addition, it can be used in connection with other optional programs for measurement or void inspection.

All X-ray Inspection systems uses XeyeSystems. Its available features may vary depending on the chosen equipment and hardware configuration.

1.2 Main Features

XeyeSystems has the following features:

- Provision of X-ray penetration images (on the image output window)
- X-eye inspection system controls through the XeyeSystems user interface
- X-ray On/Off and control for tube voltage and current
- Turning on/off of the detector and camera and settings for image processing effects and options
- Interworking with the measurement software
- Running and integration with X-ray navigation programs
- Work table initialization
- Pausing of the work table motion
- LED lamp On/Off
- Navigation panel control
- X-ray tube control (status check and focal spot size adjustment)
- Work table motion setting and control
- Teaching control
- CT imaging mode
- Histogram setting
- User change
- IO map monitoring
- Motor status monitoring
- Detector image optimization
- Other settings

* Available functions may be added or removed depending on the options.

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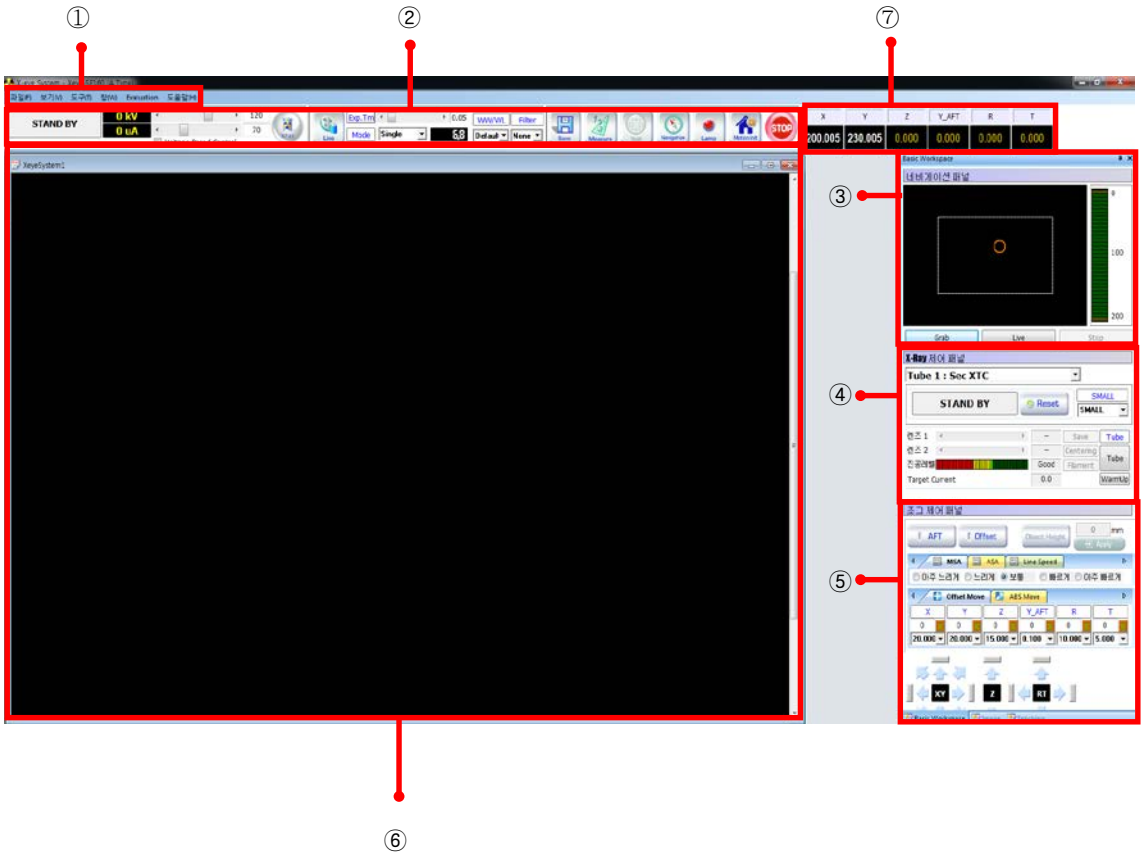
2.Program Menu

2.1 Main Screen

Main screen

After the program gets started for the first time and Home check is performed, the following screen appears.



No.	Name	Description
①	Menu	Displays menu items.
②	Command Button	Used for various controls.
③	Navigation Panel	Displays the navigation details.
④	X-ray Control Panel	Used to control the X-rays irradiation status and details.
⑤	Jog Control Panel	Used to control motors for each axis with the jog.
⑥	Video Output Window	Displays X-ray images.
⑦	Motion Information Window	Displays the positions of each axis.

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2.2 Menu

2.2.1 File

	Name	Description
File	New	Used to create a new display window.
	Open	Used to open a file.
	Close	Used to close the display window.
	Save	Used to save the file.
	Exit	Used to terminate the program.

2.2.2 View

	Name	Description
View	Application Program Style	Changes the program themes
	Workspace 1-5	Displays the workspaces.
	Set as Default Layout	Used to set the current layout as the default layout.
	Load Default Layout	Opens the default layout.

2.2.3 Tool

	Name	Description
Tool	Change User	Used to change the user.
	IO Map	Used to open the IO map window.
	Motor Status	Used to open the motor status window.
	Measurement Tool	Used to perform the measurement tool program.
	Void Measurement	Used to perform the void measurement program.
	Find Origin Point	Used to find the origin point of the table.
	Draw Cross	Used to display a crosshair on the video output window.
	Screen Navigation	Used to activate the navigation function on the video output window.
	Record Video	Used to record a video.
	Offset/Gain Corrected Image Registration (Batch job)	Used to start creating FPD correction images.

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	Gain Image Registration (One Shot)	Used to create the correction image of the current Exp.Tm (Gain).
	Offset Image Registration (One Shot)	Used to create the correction image of the current Exp.Tm (Offset).
	Create Pixel Map	Used to perform the DeadPixel correction program.
	Density Correction	Used to perform a cumulative video recording.
	System Configuration	Used to open the setup window.

2.2.4 Window Control

	Name	Description
Window	New	Used to create a new display window.
	Alignment	Used to align the displayed windows.
	Window Serialization	Used to serialize the displayed windows.
	Horizontal Alignment	Used to align the displayed windows horizontally.
	Vertical Alignment	Used to align the displayed windows vertically.

2.2.5 Evaluation

	Name	Description
Evaluation	MTF	Modulation Transfer Function
	NPS	Noise Power Spectrum
	HFM	High Frequency Model
	BNU	Brightness Non-Uniformity
	CNR	Contrast to Noise Ratio
	MFS	Measure Focal Sport

2.2.6 Help

	Name	Description
Help	About Xeye-System	Shows the program information.

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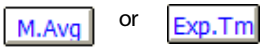
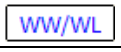
2.3 Command Buttons

Button	Description
	Displays the tube voltage and current of the current X-rays. You can control those values through the control panel.
	Press to turn the X-ray emission function On or Off. With On, the button turns to red.
	When pressed, the frame video is displayed in real time.
	Displays the averaged frames as many as the number set through the control panel. It is used to set the exposure time in case of FPD.
	Select inspection modes for each target subject without extra image processing.
	You can select various filters for pre-processing of the current image.
	Used to save the current image.
	Used to analyze various data for the current image. When pressed, the measurement tools appear.
	Used to analyze the void data for the current image. When pressed, the tool for Ball Void Detector appears.
	Displays the whole image of the recorded subject on the navigation window. You can use the navigation function to move to the target position of the subject by using your mouse.
	Press to turn the internal lighting lamp On or Off.
	Moves the current table to the origin point.
	Use this button to stop operation while driving each axis according to the settings or the specified positions.

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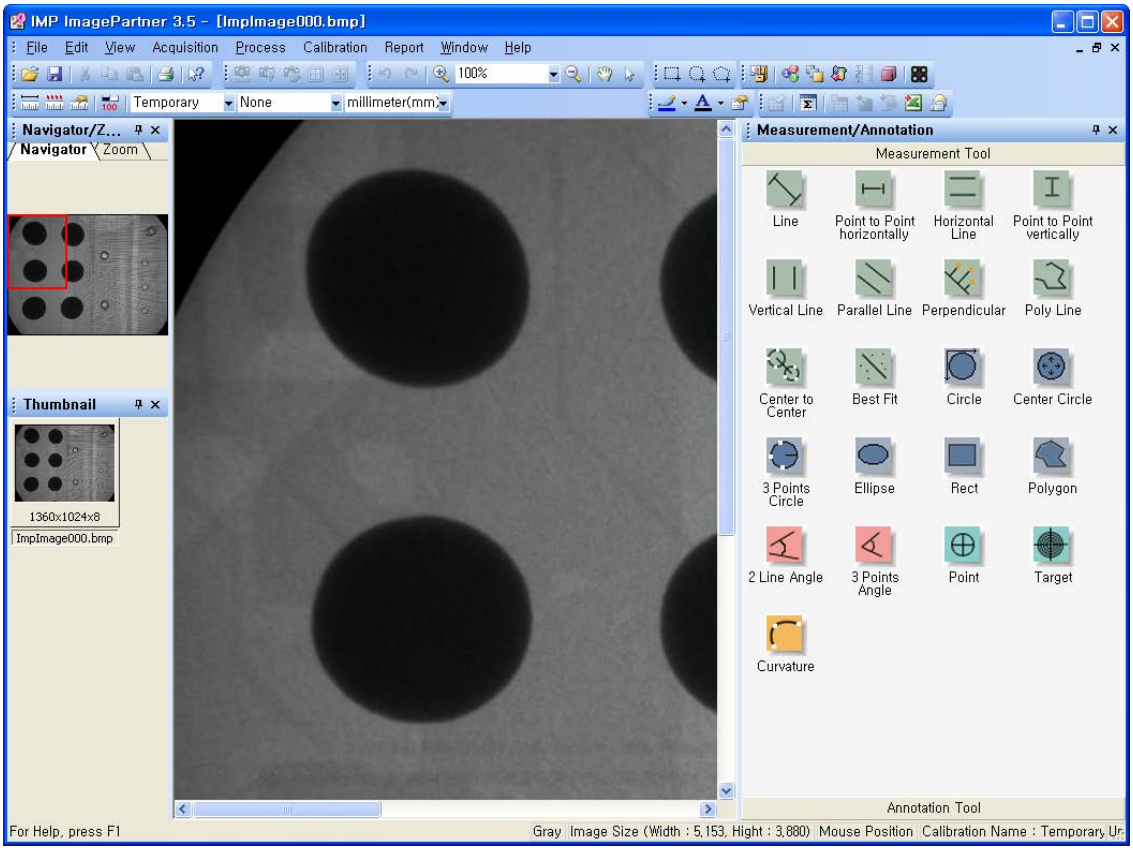
2.3.1 Measurement Tool (Optional)

The image partner tools are used to measure the actual distance and angles of the acquired image. When pressed, a new window appears.

The following screen appears when you press **Measure**.



(The user interface may change according to the integrated program.)

For more information, see "Appendix A, X-eye Measure Version 4.0."

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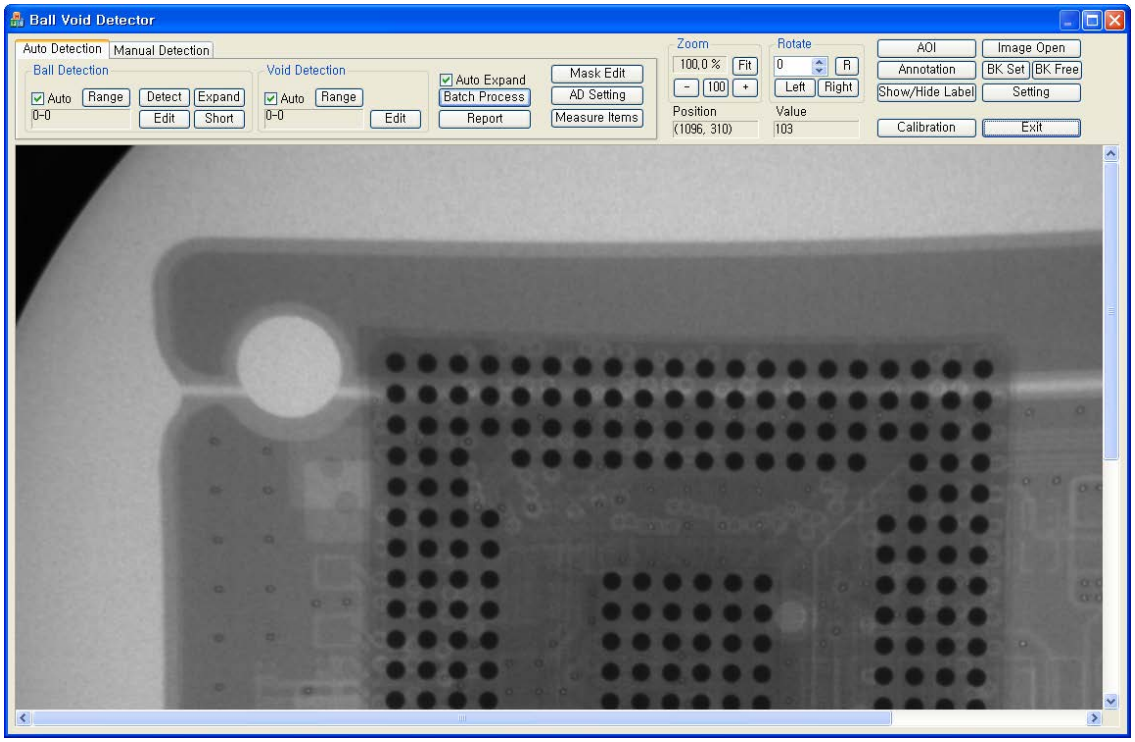
2.3.2 VOID Tools (Optional)

The ball void detector tools are used to automatically measure and report the void defects of the ball that is a component of BGA (Ball Grid Array).

The following window appears when you press **VOID**.



(The user interface may change according to the integrated program.)

For more information, see "Appendix B, Void Inspection Manual."

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2.3.3 X-ray Navigation

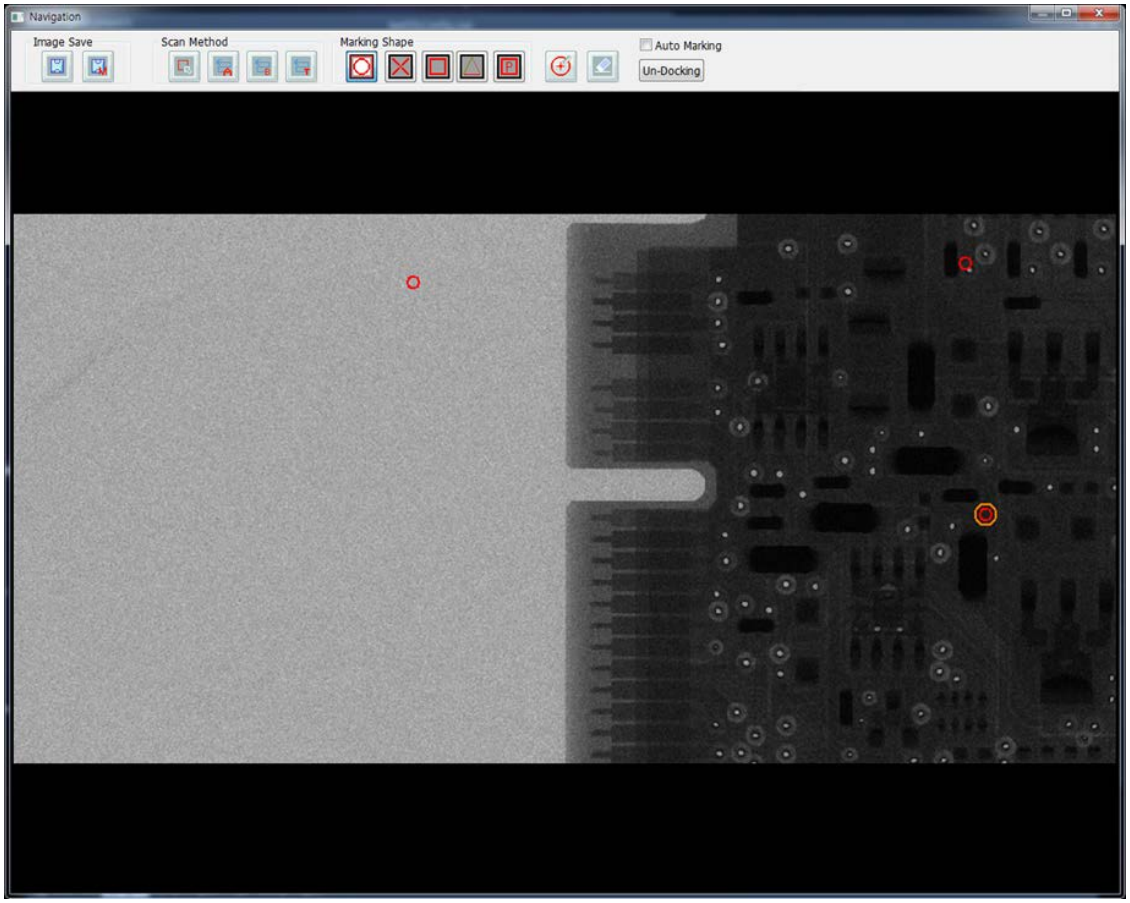
This function provides an X-ray image for the whole or part of the table through navigation. After seeing the entire image of the object on the navigation window, you can easily move the object to the desired position.

The user interface for navigation of the recorded X-ray image is as follows:

Action	Description
Left mouse click	Moves the table to the clicked position.
Right mouse click	Adds a mark on the clicked position.

In order to use the functions for position shifting and marking, an X-ray navigation image should have been recorded.

The following window appears when you press **Navigation**.



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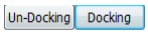
Command	Description
	Saves the original image except for the marking shape.
	Saves the image including the marking shape.
	Sets the area to scan in the Cam Navigation panel.
	Scans the selected area.
	Scans the area where the board exists.
	Scans the whole area of the table.
	Used to select the shape to mark on the navigation window.
	Deletes all marks on the window.
	Adds a mark on the current position.
	If you select a marking shape when the option is active, the mark is added on the current position. If the option is inactive, selection of a marking shape does not work.
	Performs docking and undocking for the navigation menu bar.

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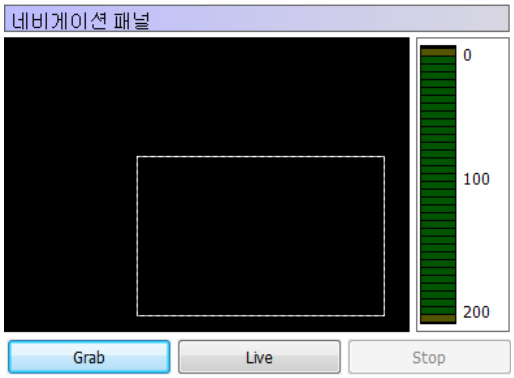
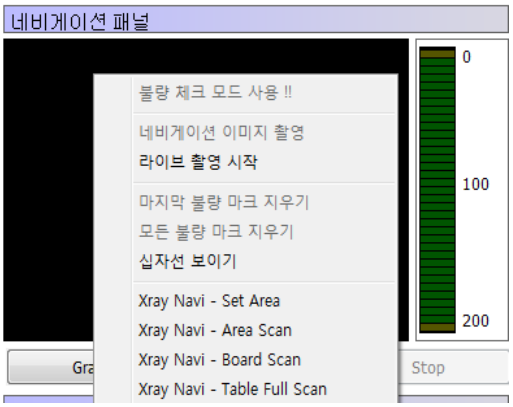
2.4 Navigation Panel

It is used to acquire the image through the embedded camera.



Grab	Saves the image as a file.
Live	Records the internal image in real time.
Stop	Pauses the image recording.



Use Defect Check Mode	Enables to check defects on the image.
Record Navigation Image	Image acquisition
Start Live Recording	Records the internal image in real time.
Delete Last Defect Mark	Deletes the last checked mark.
Delete All Defect Marks	Deletes all checked marks.
Show Cross	Shows a crosshair based on the center of the screen.
Xray Navi - Set Area	Performs the Set Area operation for X-ray navigation.
Xray Navi - Area Scan	Performs the Area Scan operation for X-ray navigation.
Xray Navi - Board Scan	Performs the Board Scan operation for X-ray navigation.
Xray Navi Table Full Scan	Performs the Table Full Scan operation for X-ray navigation.

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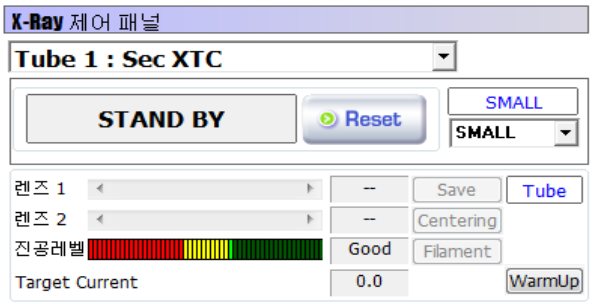
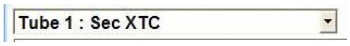
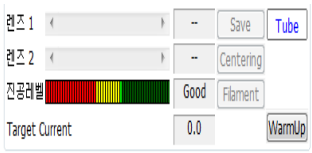
2.5 Xray Control Panel

It is used to control the X-rays irradiation status and details.



Command	Description
	Used to select X-ray tube to use.
	Displays the current operation status of the X-ray tube. ■ X-Ray ON: X-rays are being emitted. ■ Stand BY: Standby status after initialization ■ INTERLOCK: In case the door is not closed. ■ WARMING UP: In case warm-up is not processed.
	Used to reset an Over error while X-rays are emitting.
	■ Fine: Minimizes the X-ray focal size to provide a clearer image. ■ Small: Decreases the X-ray focus to make the image clear. (maximum: 10 W) ■ Middle: Increases the X-ray focus a little to increase the X-ray volume with a lower quality. (maximum: 18 W) ■ Large: Significantly increases the X-ray focus to increase the X-ray volume with the lowest quality. (Useful when observing a thick subject under low magnification)
	■ Vacuum Level: Used to check the vacuum status. You can operate the system only for Good. ■ Target Current: Fetches the target current of the tube.

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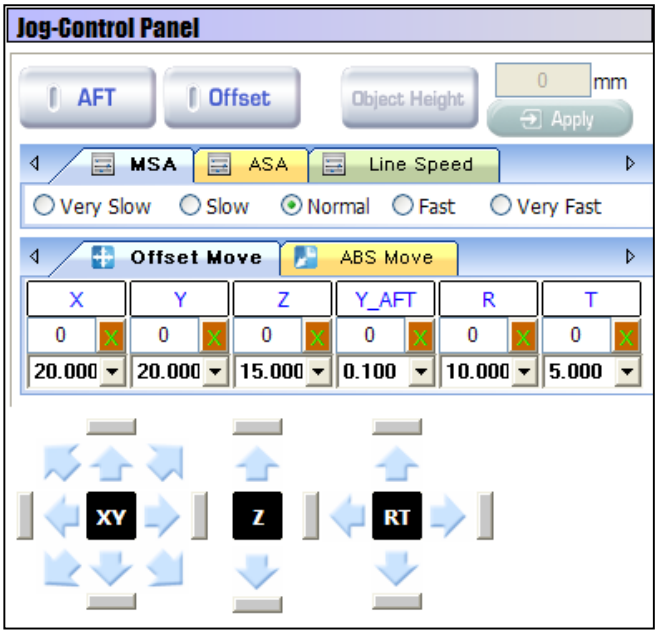
2.6 Jog Control Panel

It is used to control motors for each axis by using the jog.



Button or Panel	Description
	AFT (Auto Focus Tracing) When the inspection target is tilted or rotated, the scanning position and magnification may change. This function automatically adjusts the error to show the image as if it is in a fixed position. (Using the AFT button, you can determine the use of the function. When it is determined to use, the navigation window is inactive.) (Not available in the equipment without the tilt axis)
	Used to determine whether or not to use the Offset function. When it is determined to use, you can move the arrow at a predefined interval length when clicked..
	MSA: Adjusts the motion speeds for each axis. The same variable speed is applied regardless of the magnification. ASA: Adjusts the image speeds for each axis. The same variable speed is applied when auto-controlling the image speed meter that changes depending on the magnification, regardless of the magnification change. **Line Speed**: When clicked in the navigation window or when moved through Teaching, the axis moves at a predefined speed.

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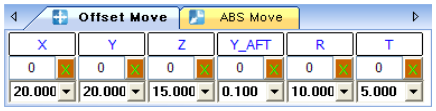
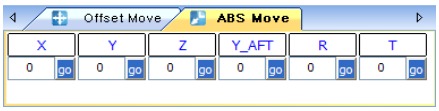
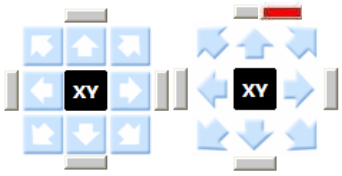
Button or Panel	Description
	You can use this function after pressing **Offset** at the top. When it is determined to use, you can set the offset values for each axis by using two different methods: Direct input and selecting values. It is very useful when you repeatedly moves or fine-tunes the motion within a specific block.
	If you press go after entering absolute values for each axis, it moves to the defined position. Be careful while using the function considering the product collision or equipment structure.
	Use when moving the work table and detector. The image of the control button changes when determined to use the Offset button (left) or not (right). The number and direction of movable axes may differ depending on the equipment type. When the motor cannot be moved, a red lamp lights to the direction of limit override.

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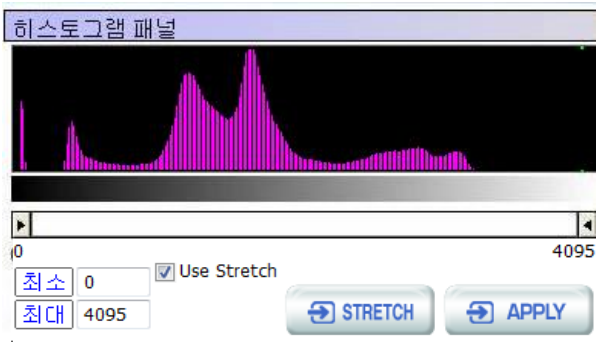
2.7 Histogram Panel

The histogram panel displays the brightness distribution of the acquired image with a graph. The X axis indicates the brightness (Gray value) and the Y axis indicates the distribution of the brightness of the X axis.

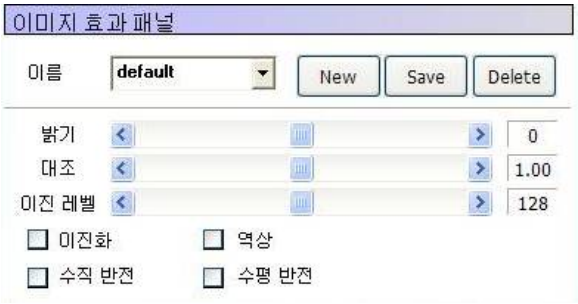


In the histogram panel, the image is represented by the gray level of 14 bit (2^{12}=16384).

(The gray level may differ depending on the detector type.)

After adjusting the values for minimum and maximum with the scroll bar or directly entering them, press **APPLY** to save the settings. Then more clear and bright images can be acquired.

2.8 Image Effects



Button	Description
Name	Can save or fetch the settings for the image effect.
Brightness	Can adjust the brightness of the image.
Contrast	Can adjust the contrast value of the image.
Binary Level	After making binarizing active, you can change the default value.
Binarizing	Can binarize the image value.
Inverted	Reverses the image value.
Vertically Inverted	Reverses the image value vertically.
Horizontally Inverted	Reverses the image value horizontally.

For more information, see "3.8 Setting Image Effect."

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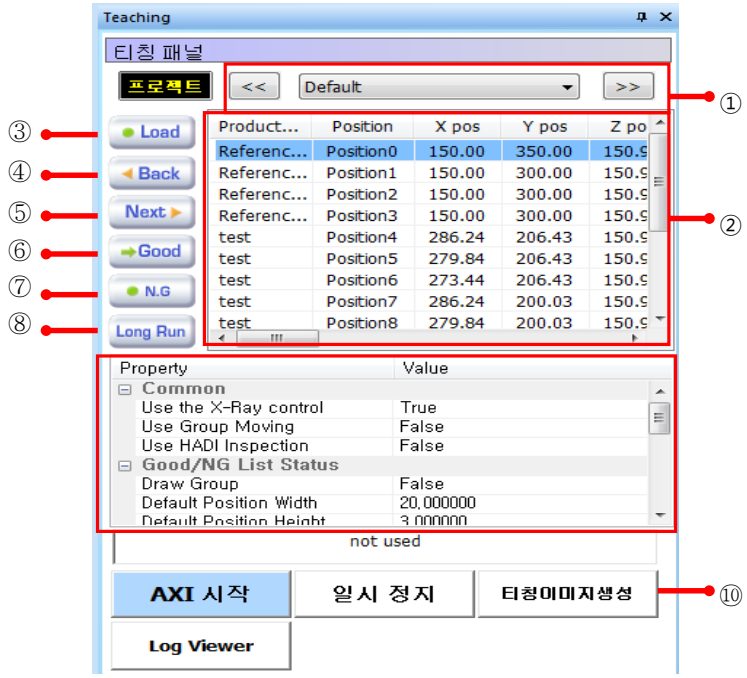
2.9 Teaching Panel

It manages the teaching data such as teaching positions and X-ray settings.

Each teaching data is called "record" in the list and the group of records is managed on the basis of project.



No.	Name	Description
①	Project List	Project list
②	Record List	Record list (When double clicked, it is moved to the specified position.)
③	LOAD	Moves the target subject to the loading or unloading position.
④	BACK	Moves to the previous record.
⑤	NEXT	Moves to the next record.
⑥	GOOD	Moves to the next position after judging the result of the target subject as Good. (Applied in Auto Teaching)
⑦	N.G	Moves to the next position after judging the result of the target subject as NG. (Applied in Auto Teaching)
⑧	Property	Can set the teaching properties.
⑨	Popup Menu	Can select a project/record manager command after right clicking.
⑩	Create Teaching Image	Creates a teaching image.

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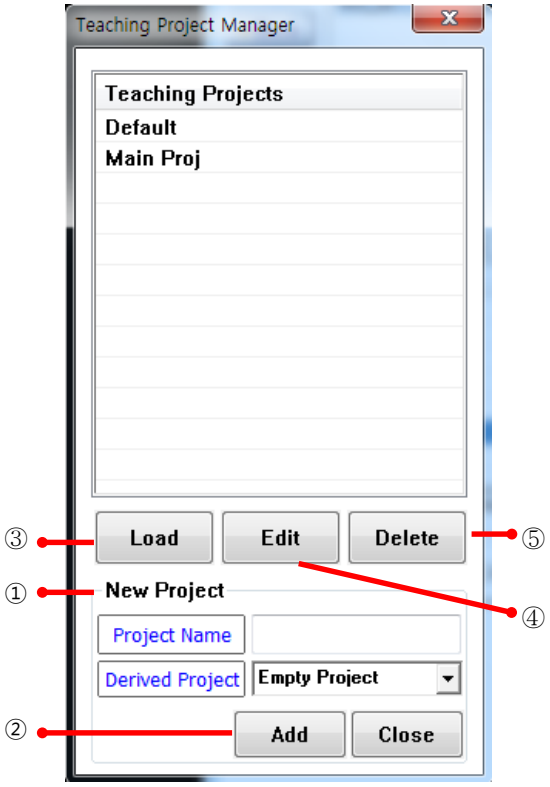
2.9.1 Project Manager

When Project Manager is selected in the teaching panel, the following window appears.



No.	Name	Description
①	New Project	Adds a new project. Project Name: Name of the project Derived Project: Project that brings the default data
②	Add	Adds a project.
③	Load	Fetches the records of the selected project into the teaching panel record list.
④	Edit	Can change the name of selected project.
⑤	Delete	Deletes the selected project.

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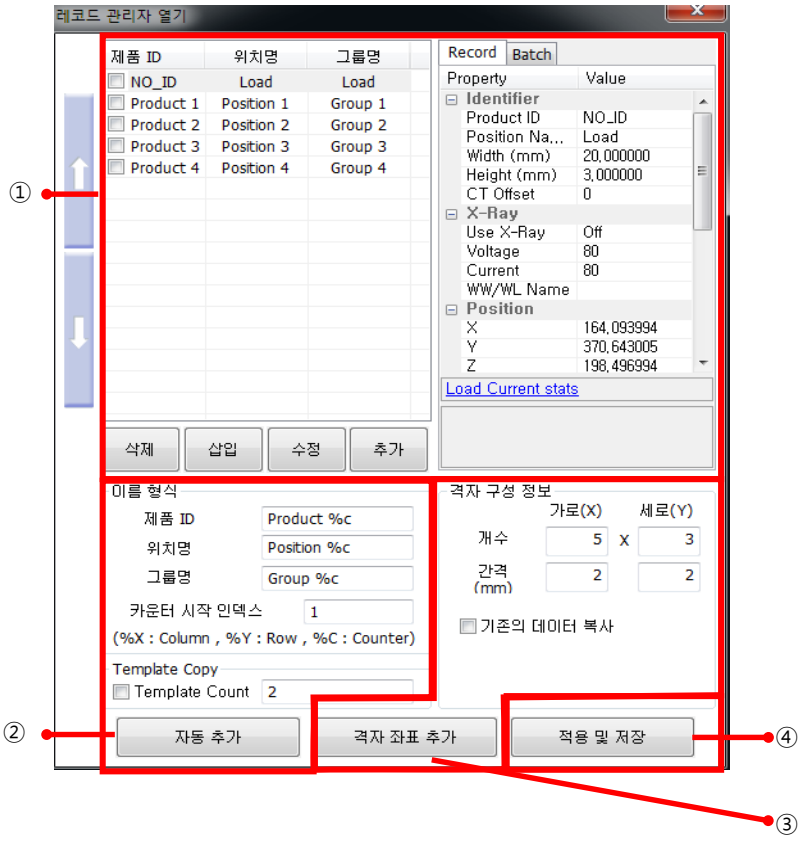
2.9.2 Record Manager

When Record Manager is selected in the teaching panel, the following window appears.



No.	Name	Description
①	Record List	Displays the record list and their attributes.
②	Auto Addition	Automatically adds the positions.
③	Add Grid Coordinates	Adds the grid coordinates.
④	Apply & Save	Applies and saves the settings.

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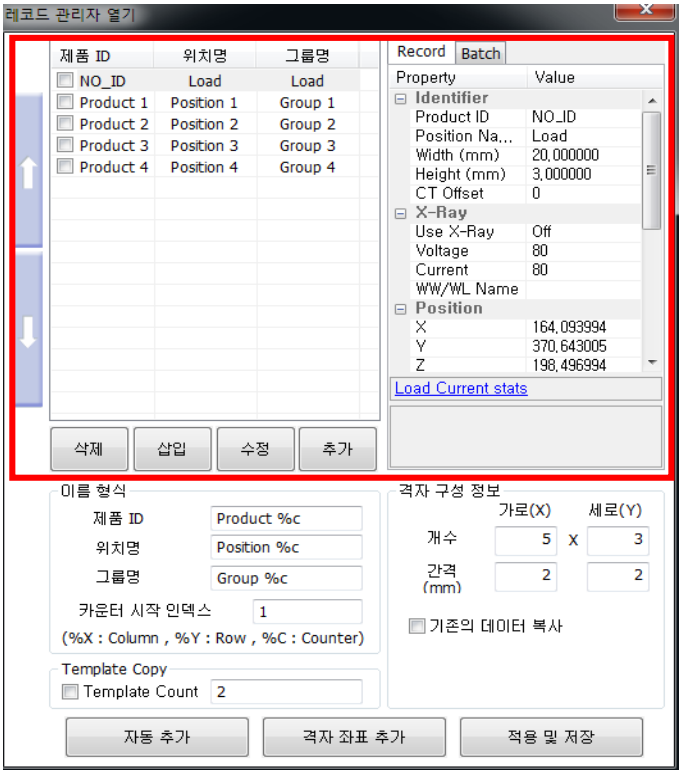
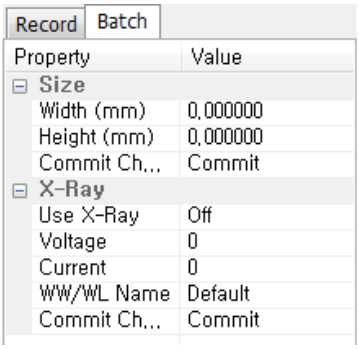
2.9.3 Record List Manager



① Add Record: If you press **Append** after entering record data on the right, the record is added into the list below. If you press **Insert**, the record is added just right below the selected record in the list.

② Edit Record: After selecting the record to modify in the list on the left, modify the data and press **Edit**.

③ Delete Record: After selecting a record, press **Delete**. The record is deleted from the list.



Batch change function

The Batch tab enables to change information for product size, whether or not to use X-rays, voltage, and current at the same time.

After entering the data, press **Commit**.

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2.9.4 Auto Addition

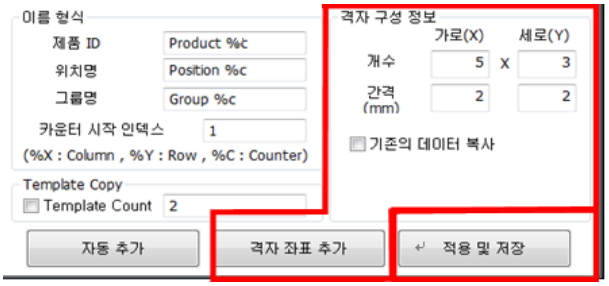
① Auto-add Record: Automatically adds the current position when **Append Automatically** is pressed.

② You can enter values for product ID, position name, group name, etc according to the naming convention.

③ The grid coordinates can be added in the position name and such by using %X and %Y.

④ You can enter the count that increases by 1 in the position name and such by using %C.

2.9.5 Adding/Applying and Saving Grid Coordinates



① If you press **Append Grid** after entering the numbers of X and Y values and their intervals, the grid coordinates can be easily added for teaching positions.

② When the record data is changed, press **Add & Save** to apply the changed data.

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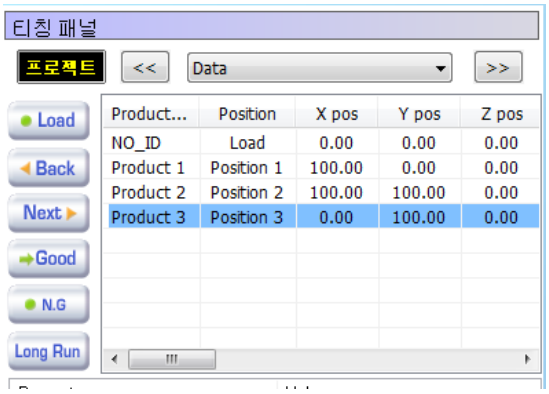
2.9.6 Good/NG Teaching



After entering records in the teaching panel, press to select Good or NG (you can also select the judgment value in the control panel) to start inspection.

The above window appears prompting you to enter a unique serial number.

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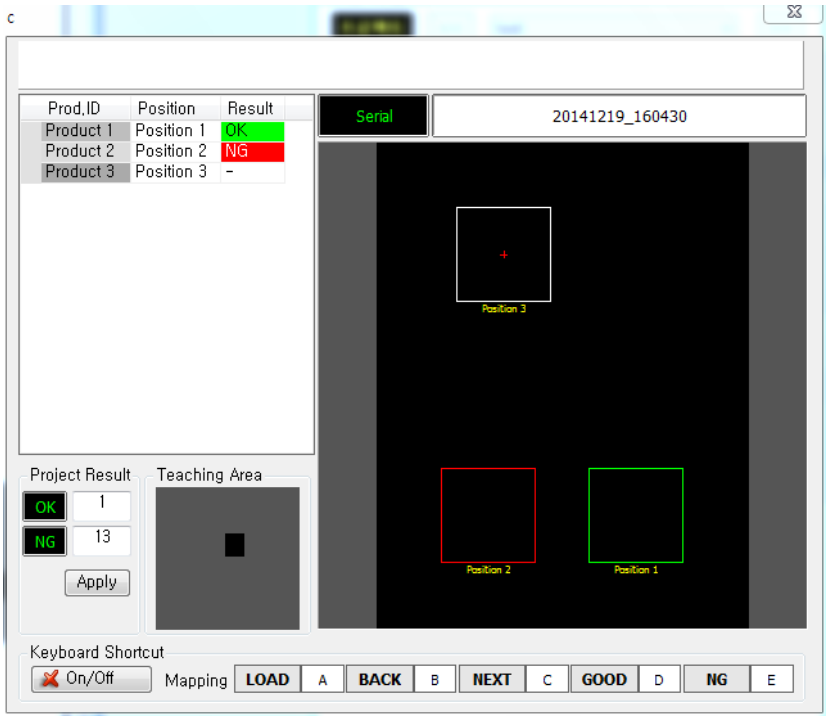

Press **Good** or **NG** on the control panel or teaching panel to start inspection.

GOOD: Judges the inspected result as Good and moves to the next position.

NG: Moves to the next position after judging the result of the target subject as NG.

After inspection, the image or PDF file is saved in D:\TEACHING.

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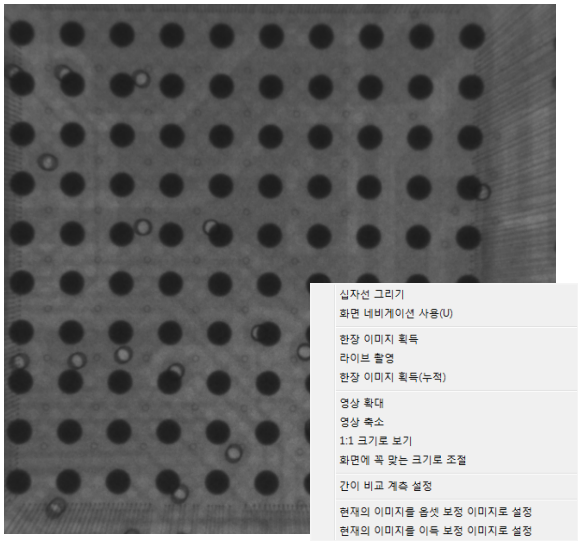
2.10 Image Display Window

Displays X-ray images. You can use various commands after right-clicking the mouse.



Command	Description
Draw Cross	Displays a crosshair based on the center of the screen.
Use of Screen Navigation	Used to set whether or not to use the screen navigation. If you click the image to observe by using the mouse, it is moved to the center of the screen for ease of observation.
Acquire a Sheet Image	Used to acquire the current image.
Capture Live	Starts/stops capturing X-rays in real time.
Acquire a Sheet Image (Cumulative)	Used to acquire the cumulative image of the current screen.
Zoom In	Magnifies the size of the current image.
Zoom Out	Reduces the size of the current image.
Display in 1:1 Size Format	Returns the current image to the original size.
Match to Screen Size	Magnifies/reduces the size of the current image to fit with screen size.
Setup for Simplified Measurement to Compare	Configures the settings for simplified measurement to compare.
Set Current Image as Offset Correction Image	Sets the current image as the offset image.
Set Current Image as Gain Correction Image	Sets the current image as the gain image.

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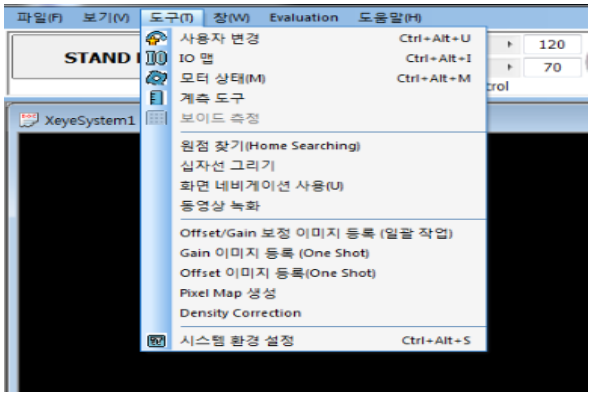
2.11 Tool Menu



Name	Description
Change User	The three different types of users are Operator, Administrator, and SEC. ■ Level 1: SEC—account for maintenance. ■ Level 2: Administrator—account for an administrator. ■ Level 3: Operator—account for a general user.
IO Map	Used to see the map for the ports that are connected to the I/O unit.
Motor Status	Used to perform AMP ON/OFF, HOME CHECK, and RESET for each motor axis.
Measurement Tool	Used to analyze various data for the current image. When this button is pressed, the measurement dedicated tools are activated.
Void Measurement	Used to analyze the void data for the current image. When pressed, the Ball Void Detector dedicated tool is activated.
Find Origin-point (Home Searching)	Used to perform HOME CHECK for each motor axis.
Display Cross	Used to display a crosshair based on the center of the main screen.
Use of Screen Navigation	If you click the image to observe using the mouse, it is moved to the center of the screen for ease of observation.
Record Video	Starts recording the video.
Register Offset/Gain Correction Image (Batch job)	Used in the FPD equipped equipment. It automatically acquires and saves the offset/gain image.
Register Gain Image (One Shot)	Acquires and saves the gain image of the current Exp.Tm.
Register Offset Image (One Shot)	Acquires and saves the offset image of the current Exp.Tm.
Create Pixel Map	Runs the XeyeImagingUtility program to remove dead pixels in the FPD.
Density Correction	Records and saves a cumulative image.
System Setup	Used to set various parameters.

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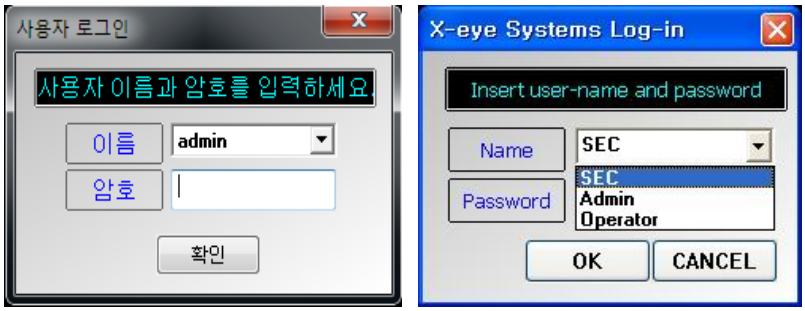
2.11.1 Changing User

The three different types of users are Operator, Administrator, and SEC.

Enter the password after selecting a level from the Name menu.

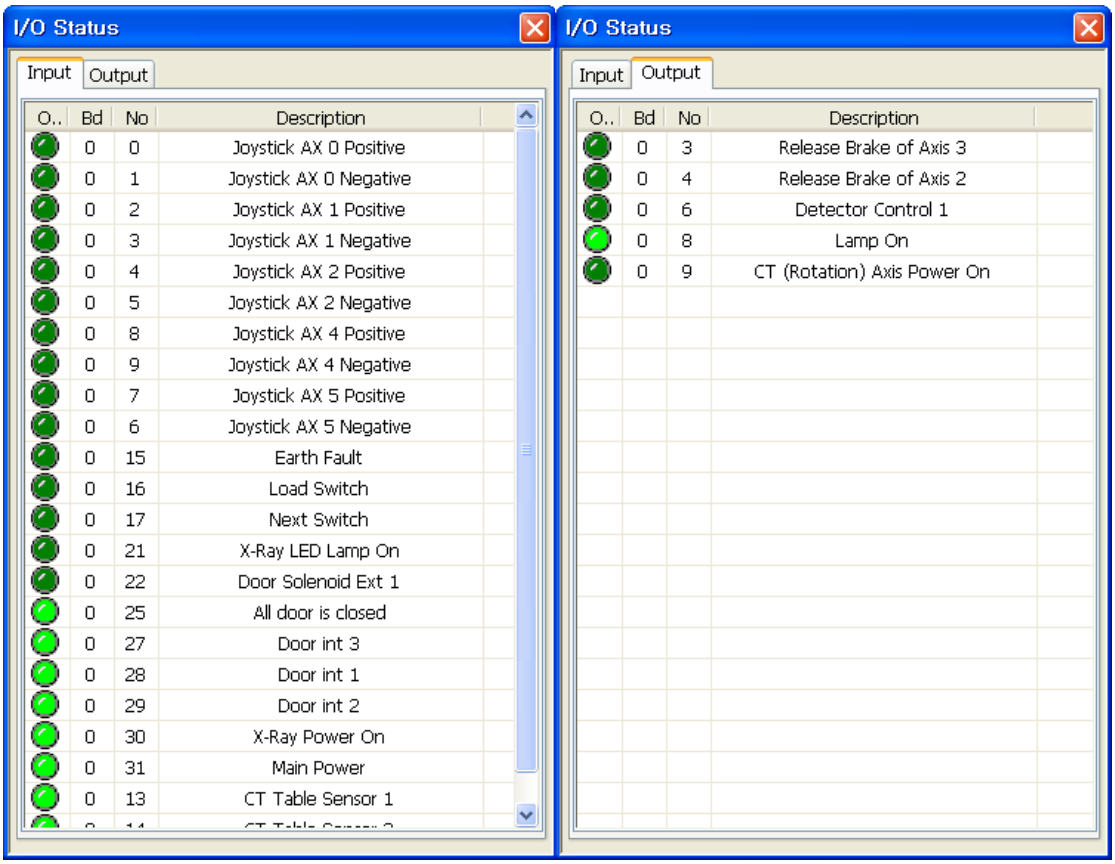
No functions are available if you do not enter the password.



2.11.2 IO Map

It is used to check various input/output states and display the map for I/O ports.

When the system encounters failures, check the following states to trace the root causes of them.



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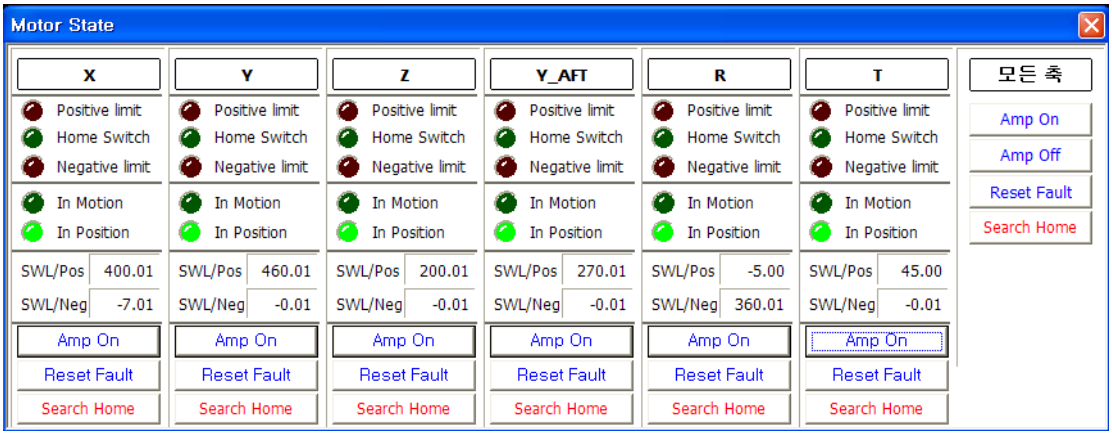


2.11.3 Motor Status

After selecting motors for each axis, perform AMP ON/OFF, HOME CHECK, or RESET.

When there is any abnormal operation or you press the emergency stop switch while the system is running, the AMP of the motor may change to OFF.

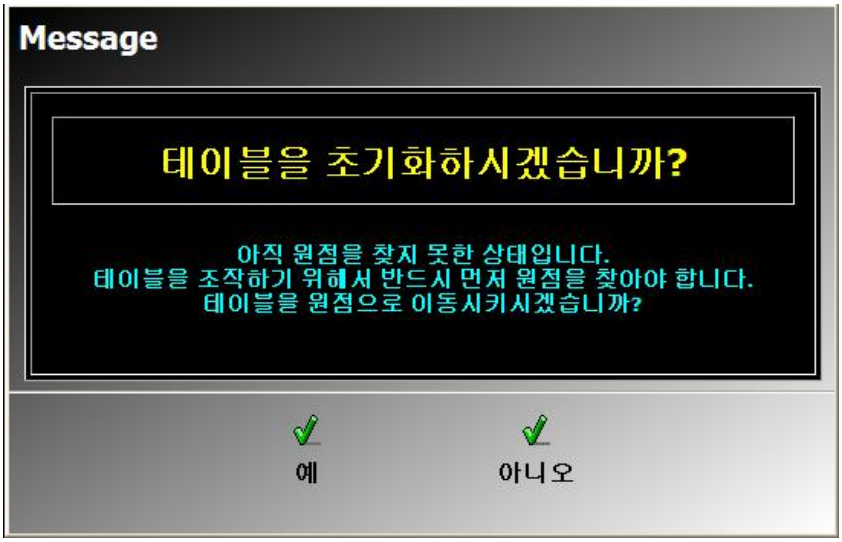
When the AMP is changed to Off, the motor information is reset. Be sure to perform HOME CHECK again after the AMP is On.

In this case, perform HOME CHECK by pressing AMP ON for all axes and pressing Search Home.

2.11.4 Home Searching

When the table initialization is performed, the following message appears. Press **Yes** to initialize the table values.

* Table must be initialized when turning program On/Off. If Home searching is not done, table cannot be manipulated.



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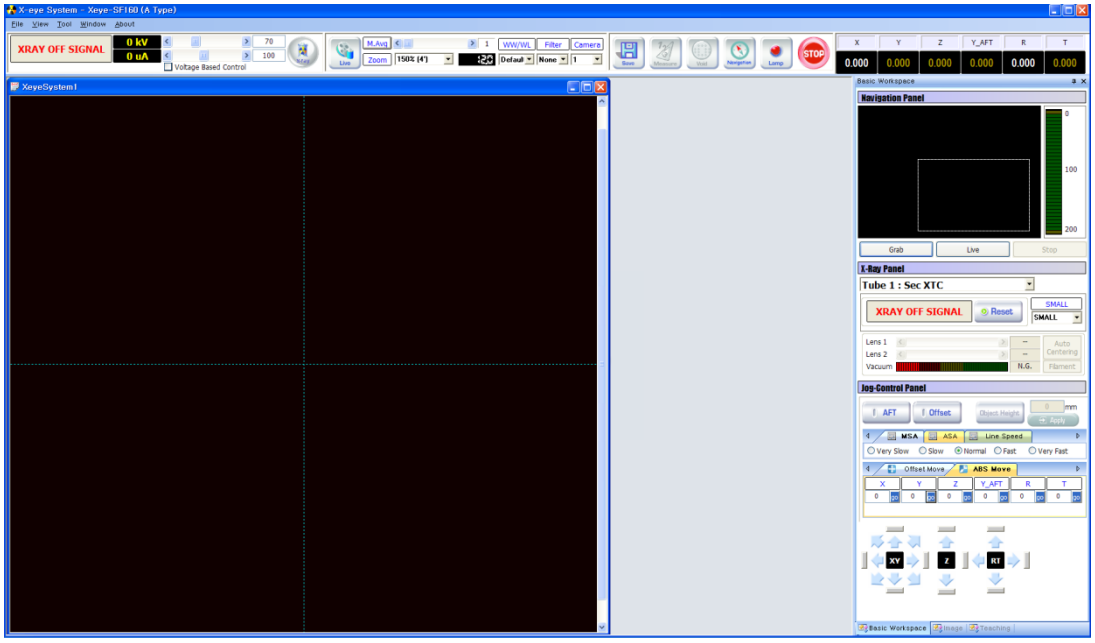
2.11.5 Displaying Cross

It is used to display a crosshair based on the center of the main screen. You can see the position of the screen center or set the CT position.



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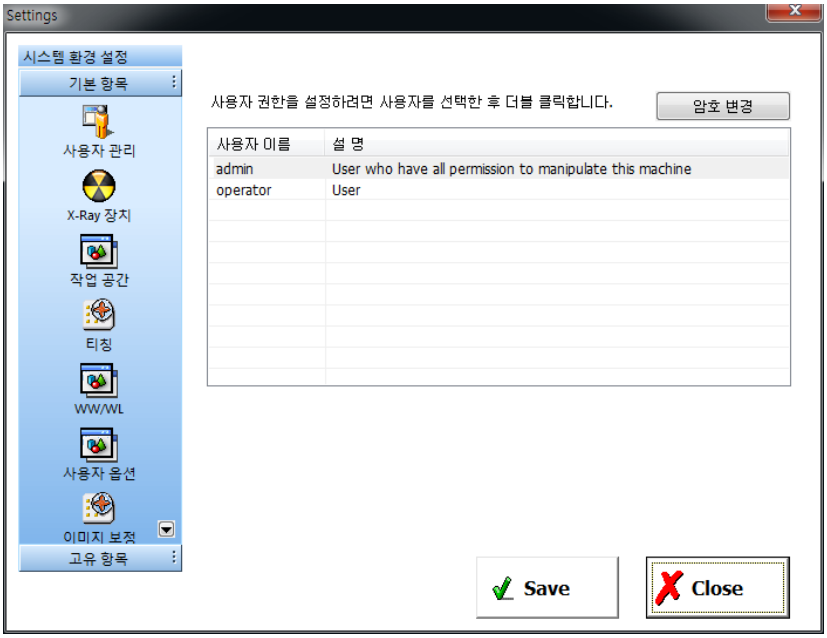
2.12 System Configuration

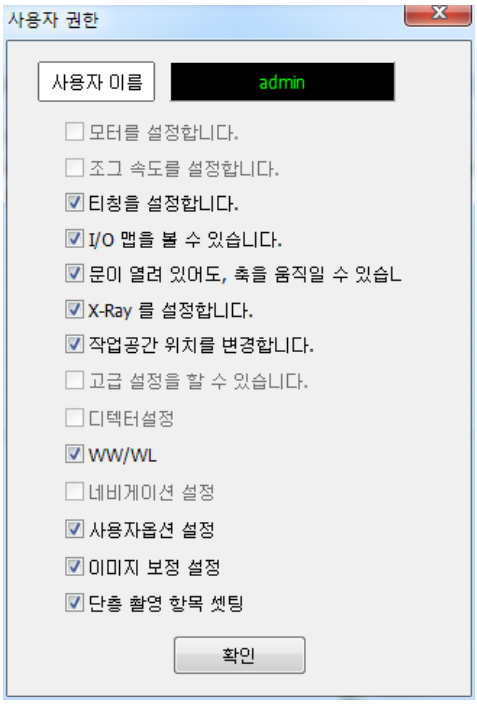
For each user level, different functions are displayed and you can set the parameters required for each stage.

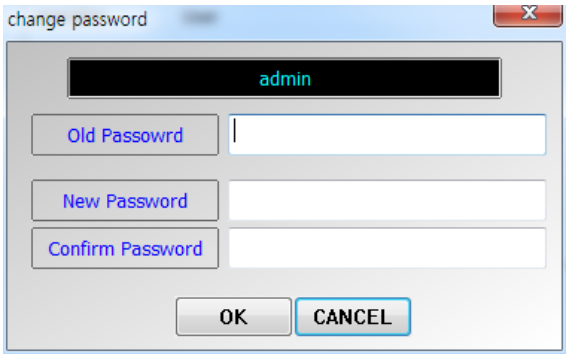
2.12.1 User Manager

You can assign different authorized functions for each user level or change the user password.



When changing the authorization, double click the user name. Upon change of the password, press **Change Password** after selecting a user.





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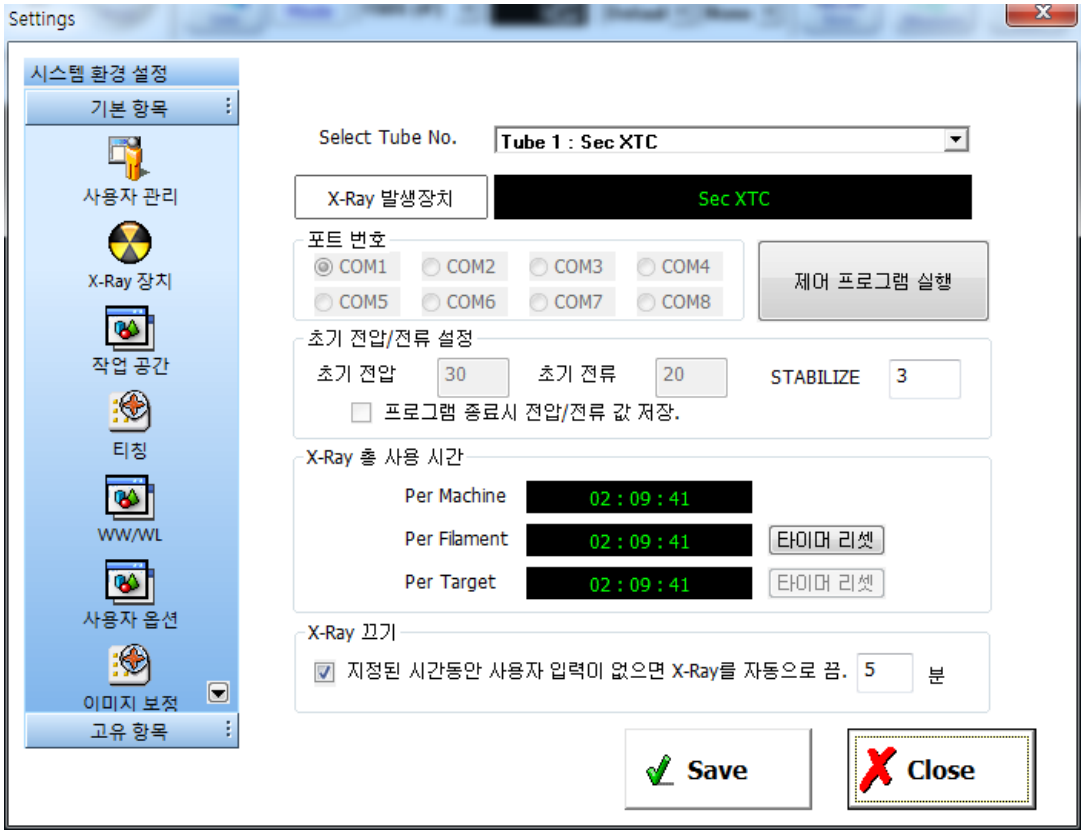
2.12.2 X-ray Tube



Name	Description
Port Number	Sets the RS-232 port to connect to your PC and X-ray controller.
Initial Value Setup	Sets the initial settings for program start-up.
Total X-Ray Used Count	Per Machine: Displays the total used time of the equipment. Per Filament: Displays the total used time of the filament. After replacing the filament, to set the used time to "0" click **Reset Timer**. Per Target: Displays the total used time of the X-ray target. After replacing the target, set the used time to "0" by clicking **Reset Timer**.
X-ray Turning Off	Sets the X-ray emission time. If not required, do not check it.

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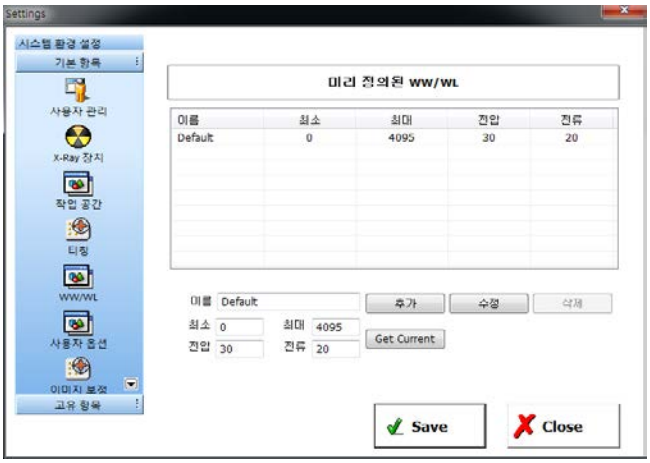
2.12.3 Workspace

Using this window, you can align the program work space as you want. After selecting a task window, move the window (or panel) to the left, select another task window, and move the window (or panel) to the right.

2.12.4 WW/WL

You can set or manage WW/WL values to use. Accordingly, you can easily use the predefined settings for the histogram.



Name	Description
Name	Used to set the name of a new effect.
Edit	Used to modify the current data.
Add	Used to add a new effect with a new name.
Minimum	Used to adjust the lower limits for the settings of the image effect.
Maximum	Used to adjust the upper limit value for the settings of the image effect.

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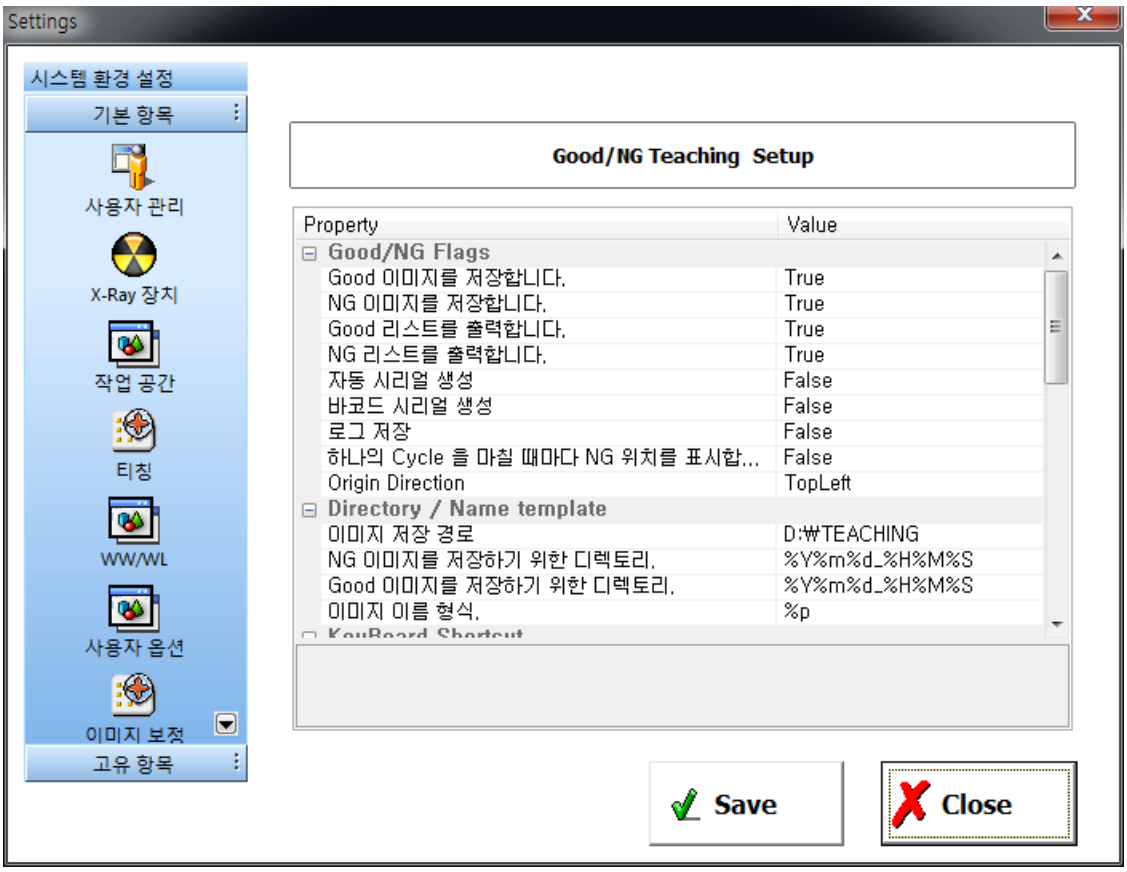
2.12.5 Teaching Setup



Name	Description
Good / NG Flags	Used to set whether or not to save the Good/NG image, to display the Good/NG list, or to create serial numbers.
Directory / Name template	Used to set the path to record the Good/NG image and the criteria to generate serial numbers.
KeyBoard Shortcut	Used to set Load, Back, Next, Good, NG functions as shortcut keys.
Image Format	Used to set the format to save images.
Long-Run	Used to configure settings for repetitive movement of the teaching position.
AXI (Automated X-Ray Inspection)	Used to set the module to reference for automated X-ray inspection, the model path, and whether or not to save the image.

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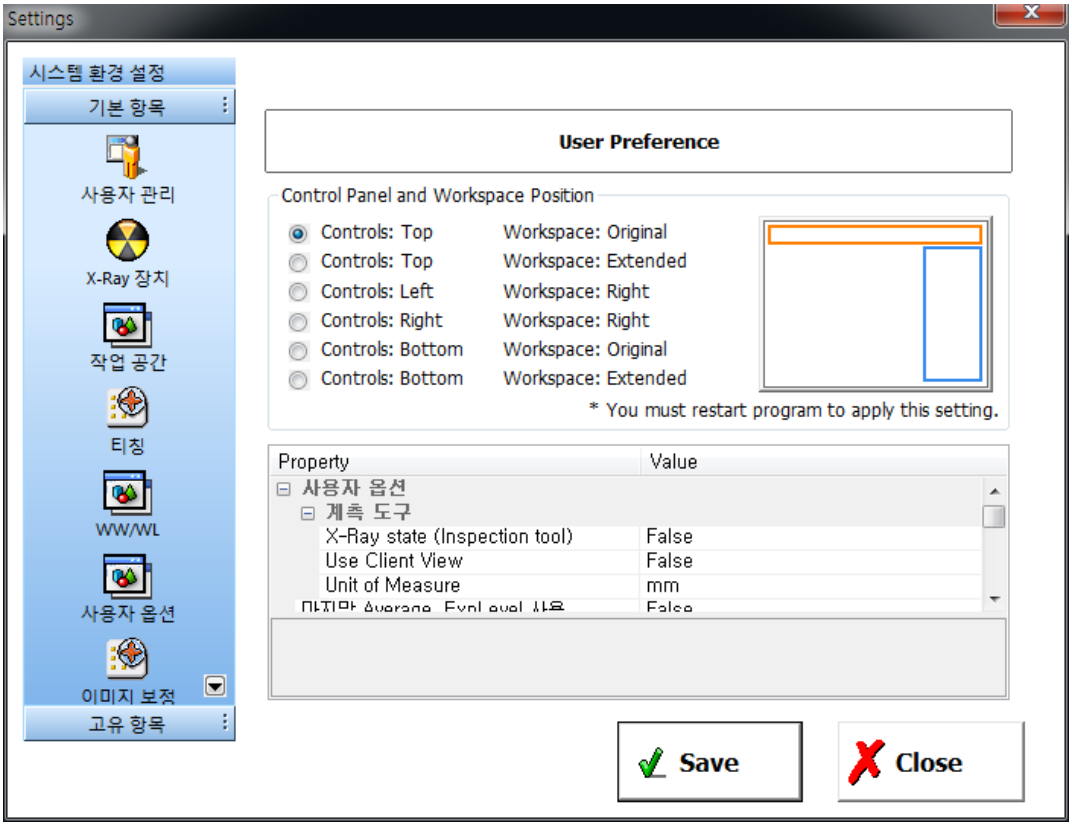
2.12.6 User Preference

Using this, you can configure the settings for screen layout, convenience option, etc.



Name	Description
Control Panel and Workspace Position	Used to set the positions for command buttons and workspace.
X-Ray state (Inspection tool)	Used to set whether or not to keep the X-ray state when performing the Measure or Void program.
Use the last Average	Set whether or not to keep the last averaged image values when running the program after saving the values.
Display of the image capture information	Displays the date, time, voltage, and current when recording the X-ray image.
View Rotation Angle (Dexela Only)	Used only in the FPD equipment. It is used to set the display direction of the screen that is determined by the FPD mounting direction.
Auto Live On	When the program starts, it is run live.
Draw Cross Color	Can change the color of crosshair displayed on the main screen.
Direction of screen navigation	Used to set the direction for navigation.

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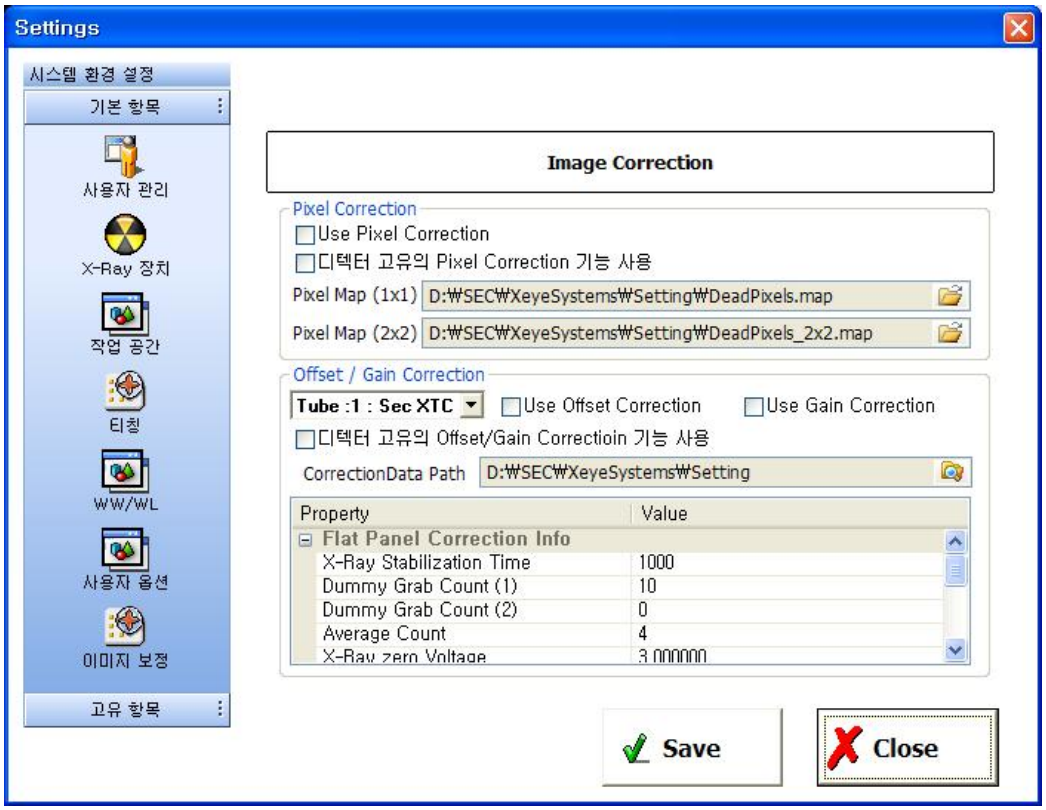
2.12.7 Image Correction

Can configure the settings for correction of the image entered in FPD.



Name	Description
Use Pixel Correction	Turns the dead pixel correction On or Off.
Use Pixel Correction of the Detector	Turns the pixel correction of the detector On or Off.
Pixel Map File Path	Sets the file path of the pixel correction map. (Individually set according to 1x1 (normal mode) and 2x2 (binning mode))
Use Offset Correction	Turns the offset image correction On or Off.
User Gain Correction	Turns the gain image correction On or Off.
Use Correction of the Detector	Turns the image correction function of the detector On or Off.
Correction Data Path	Sets the path to save the correction images.
Property	Configures the settings for the correction function.
Histo Stretching Range Setting	Sets the histogram range for On Demand Live.

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PART Ⅳ. Operation Manual (Common)

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