

Microfocus X-Ray Inspection Systems

SMX-1000 Plus SMX-1000L Plus



Taking Innovation to New Heights with Shimadzu X-Ray Inspection Systems

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SMX-1000 Plus SMX-1000L Plus

The SMX-1000 Plus and SMX-1000L Plus X-ray inspection systems are a further refinement of their popular predecessors, the SMX-1000 and SMX-1000L, which have become the benchmarks of the industry.

The operability so well received in earlier models has been further improved, resulting in much simpler and easier-to-see windows.

The enlarged fluoroscopic exterior image view provides a new level of visibility.

The measurement functions are so much easier to use that results can now be obtained with just a click, and require no complicated parameter settings.

New functions such as enhanced region-of-interest display have been incorporated, complementing a wealth of conventional functions including navigation via exterior images, step feed, teaching, and image browsing.

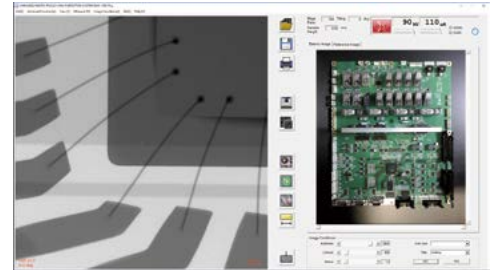


SMX-1000 Plus

SMX-1000L Plus

Further Improved Operability

Remodeled windows and an enlarged display with a simple, user-friendly layout ensure the intended operation is performed without guesswork.



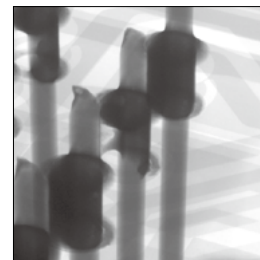
Clear Images

As with earlier models, the combination of flat panel detector with Shimadzu image processing technology leads to clear, distortion-free images.



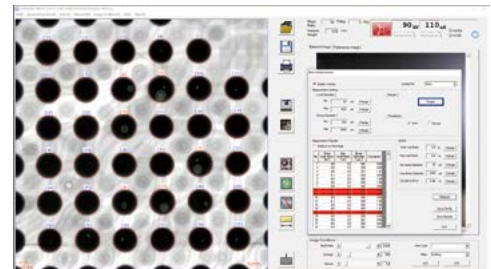
Inclined Fluoroscopy

The flat panel detector with a tilt angle of up to 60° enables fluoroscopy over an extensive range while maintaining constant magnification, so defects that are undetectable with vertical fluoroscopy can be detected.



Easy Measurements

Troublesome measurement parameter settings are automatically optimized, and thanks to our proprietary image-processing technology, measurement results are now obtained with simple mouse operations.



Contents

| | | | |
|-----------------------|-------|----------------|-------|
| Operability | P. 4 | Options | P. 15 |
| Features | P. 8 | Applications | P. 17 |
| Measurement Functions | P. 10 | Specifications | P. 18 |
| Convenient Functions | P. 12 | | |

Operability

Large Display and Simple Button Layout for Improved Visibility and Operability

1 Sample Placement

Position the sample and activate the X-ray source.



2 Positioning via Exterior Image

The external image is acquired with a single click, enabling intuitive positioning of the X-ray observation site with a distinctive, familiar image of the sample.

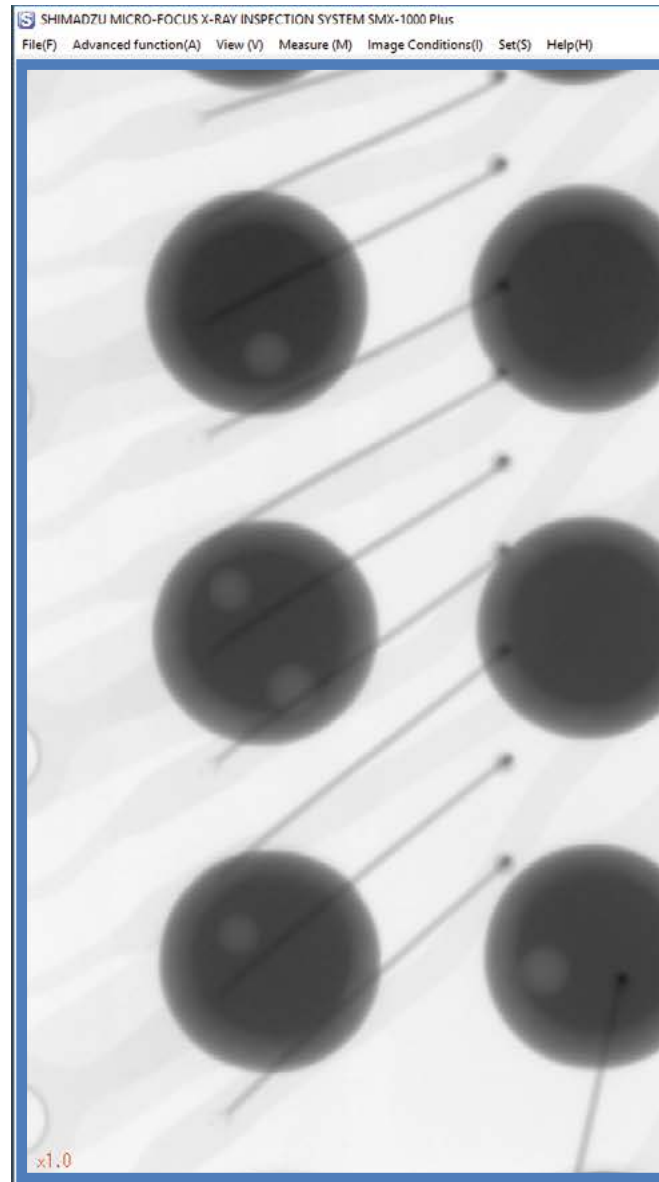
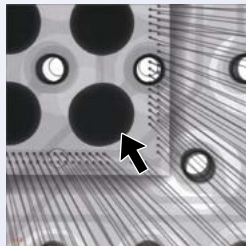


3 Fluoroscopic Observation

Simply click on the X-ray image to enable fine adjustments to the observation site.

Easy-to-view images are obtained with a few simple operations, thanks to image enhancement and contrast adjustment functions.

Furthermore, detailed data analyses can be performed with a mouse click using special measurement tools.

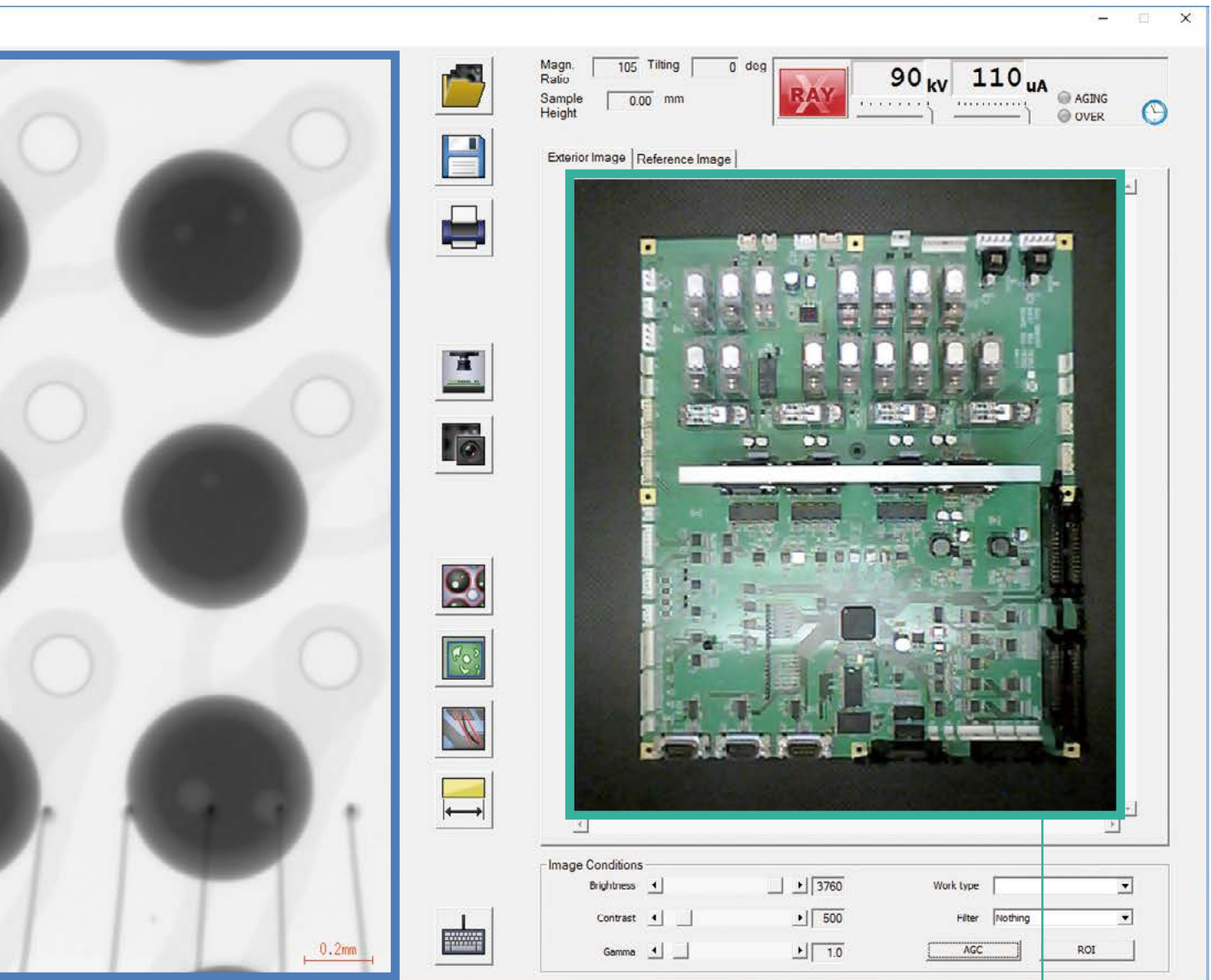


Larger Display

17 Inch

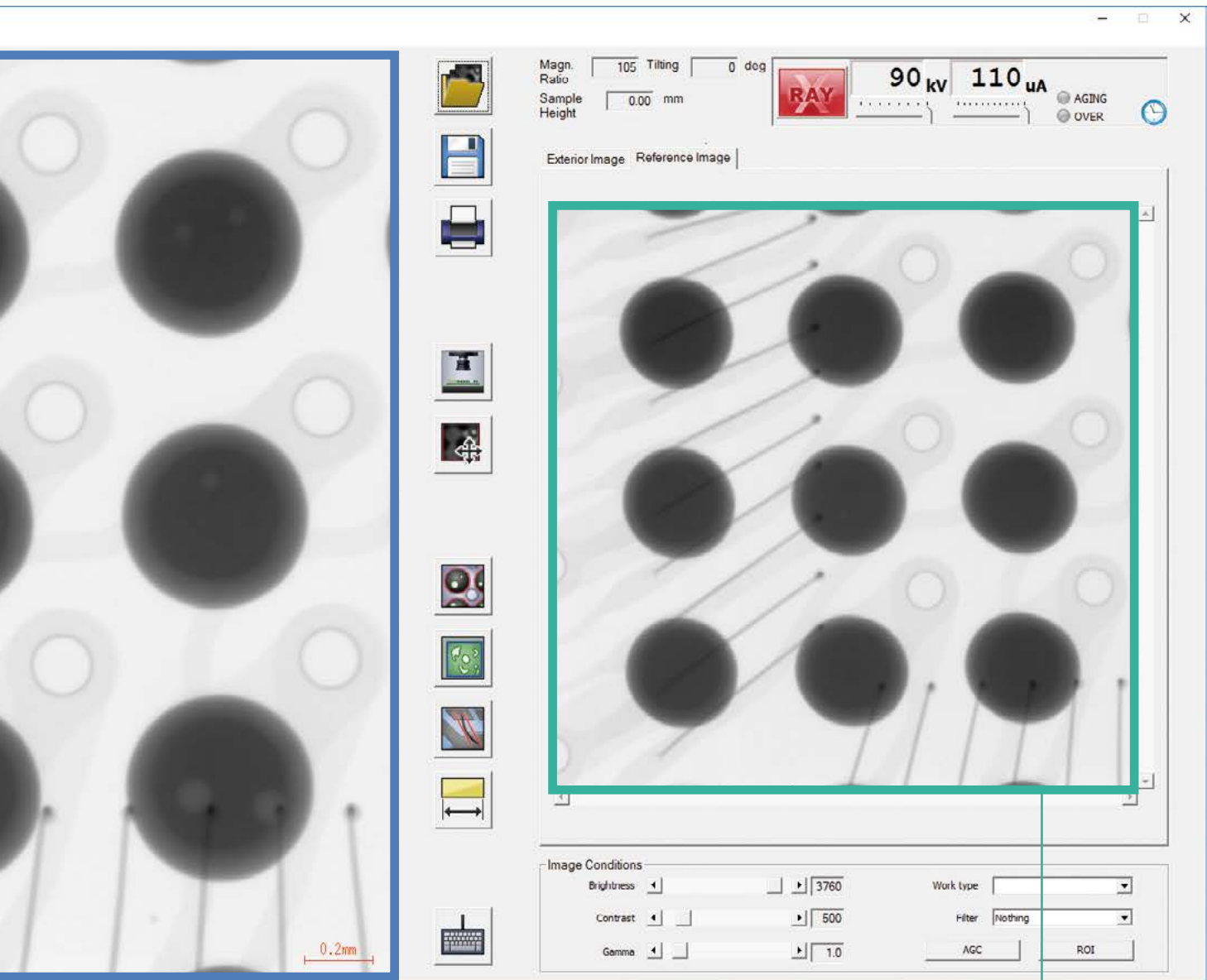
23-Inch Wide Screen





Exterior Image Display

A special camera is provided for taking exterior images, so you can photograph the entire stage region with a mouse click. Click anywhere on the exterior image to position the stage accordingly. The image can be enlarged to position the stage precisely at the component level. There is no need to peer at laser markers through an observation window.



Positioning via Fluoroscopic Image

Just click anywhere in the live display area to control all stage movements, including movement on the X-Y axis, tilting, and magnification changes.

The closer to the center of the display area you click, the slower the stage moves. Stage travel speed is automatically optimized to match the current fluoroscopy magnification.

Reference Image Display

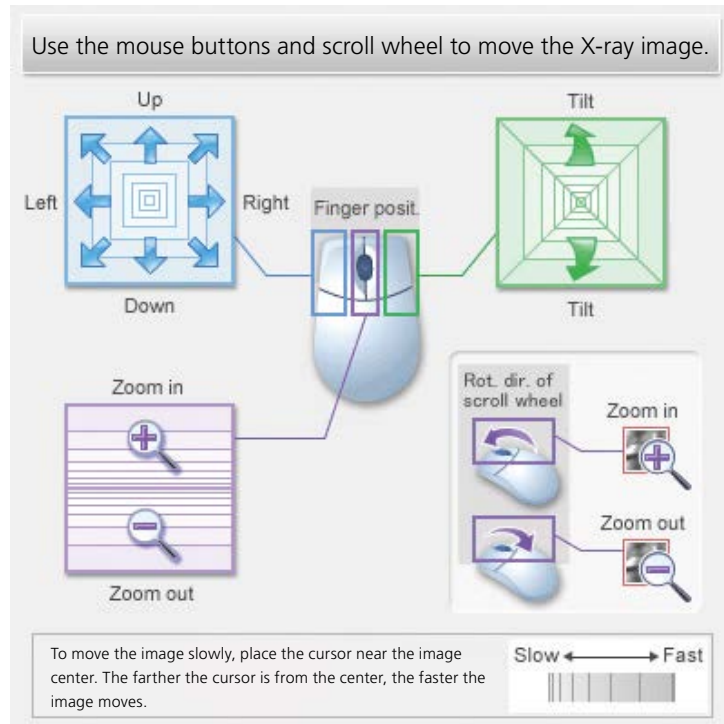
Switch between the exterior image and reference image, both of which can be enlarged.

A sample image is displayed in the reference image display area for use as a judgment standard, enabling comparisons with fluoroscopic images.

The reference image can be enlarged via digital zoom, enabling same-sized comparisons with fluoroscopic images.

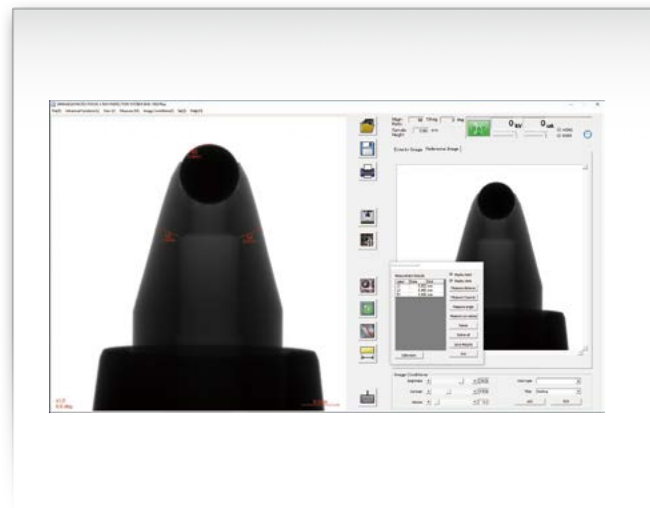
Positioning from Fluoroscopic Images (Mouse Operation Only)

All stage and manipulator positioning can be controlled with a mouse, allowing the operator to concentrate completely on examining the image on the monitor. In addition, the systems are equipped with a centering function that moves the mouse-click position to the center of the monitor.



Screenshot

With the screenshot function, you can save the image displayed as image data. It can then be added into reports to make them more specific.



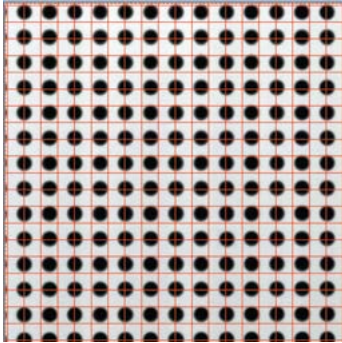
Features

Flat Panel Detector for Clear, Distortion-Free Images!

- In combination with the microfocus X-ray tube, this flat panel detector produces clear, high-resolution fluoroscopic images, even at high magnification.

1. Distortion-Free

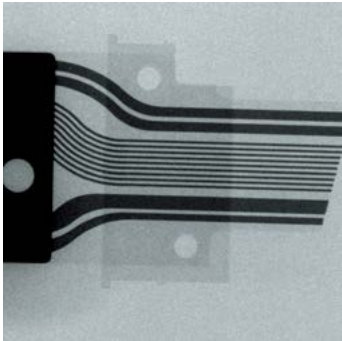
Flat panel detector image



- Flat panel detector images are free of the distortion typically produced by an image intensifier, ensuring accurate reproduction of surface shapes. (Gridlines added to show linearity.)

2. No Shading

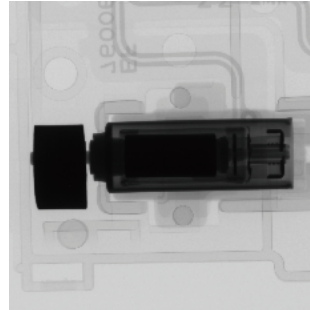
Flat panel detector image



- Flat panel detector images ensure uniform brightness across the entire image, without shading.

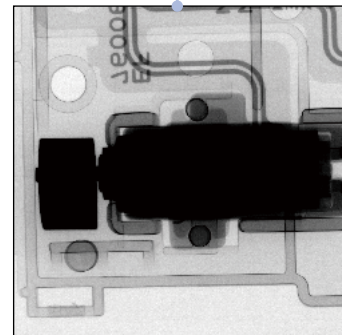
3. Wide Contrast Range

Flat panel detector image
12 bits (4096 gradations)



Brightness and contrast adjustment

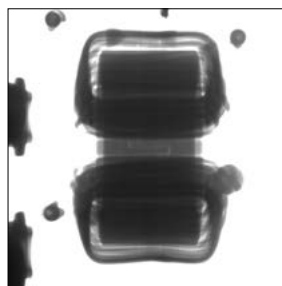
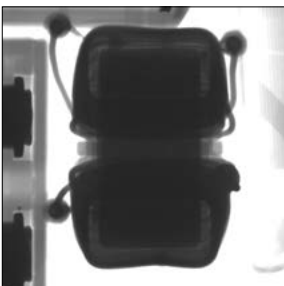
Brightness and contrast adjustment



- With a conventional image intensifier, setting X-ray parameters to allow observation of high-absorption interior motor parts causes the image's low-absorption peripheral plastic parts to appear white, making them difficult to observe. With the flat panel detector, however, a few simple brightness and contrast adjustments allow the operator to efficiently observe both the motor interior and peripheral plastic areas, even on images captured using a single set of fixed X-ray parameters. This improvement in visibility is possible thanks to a 16-fold increase in the amount of information in 12 bit images produced by the flat panel detector, compared to 8 bit images from an image intensifier.

Simple Settings for Enhanced Penetration

- A mode is provided to easily shorten the distance between the X-ray source and X-ray detector. This is useful when a little more penetration is needed.

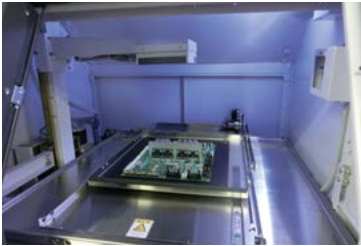


Fluoroscopy at up to a 60° Angle!

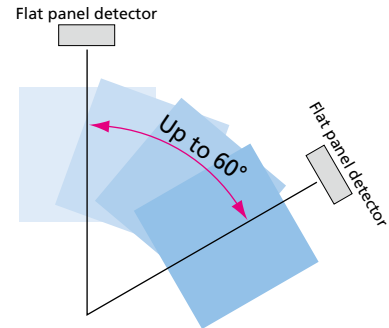
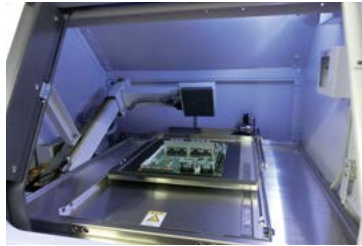
- With a tilt angle of up to 60°, the flat panel detector enables fluoroscopy over an extensive range, while maintaining constant magnification.

Tracking minimizes displacement of the fluoroscopy position, even when the C-arm is tilted, ensuring you never lose track of observation points.

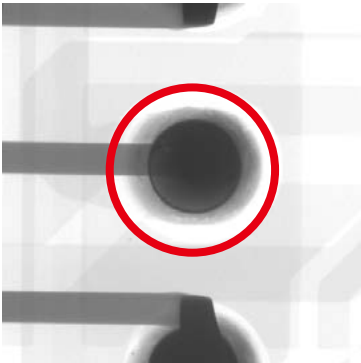
Flat panel detector not tilted



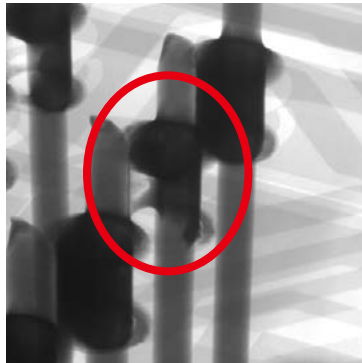
Flat panel detector tilted at 60°



Solder ball joint defects that cannot be identified at 0° (when viewed from top) can be easily identified when viewed at 60°.



50x magnification at 0°

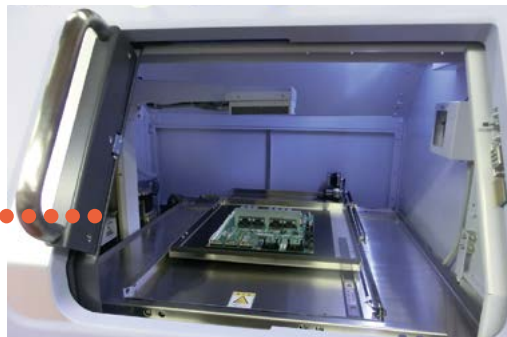


50x magnification at 60°

Large Doors on a Small, Integrated Body!

Ample opening and large stage make operation easy!

- New double sliding doors provide a large 535 mm × 400 mm opening, which is 2.2 times larger than in previous models, and is one of the largest in its class. (In case of SMX-1000L Plus, it provides a large 680 mm × 430 mm opening.)
- A generous 450 mm × 350 mm stage accommodates even large surface-mounted PCBs. (The SMX-1000L Plus accommodates large 720 mm × 570 mm PCBs.)



Measurement Functions

No Need for Complex Parameter Settings

BGA Measurements

BGA (ball grid array) bump diameter and void ratios can be measured.

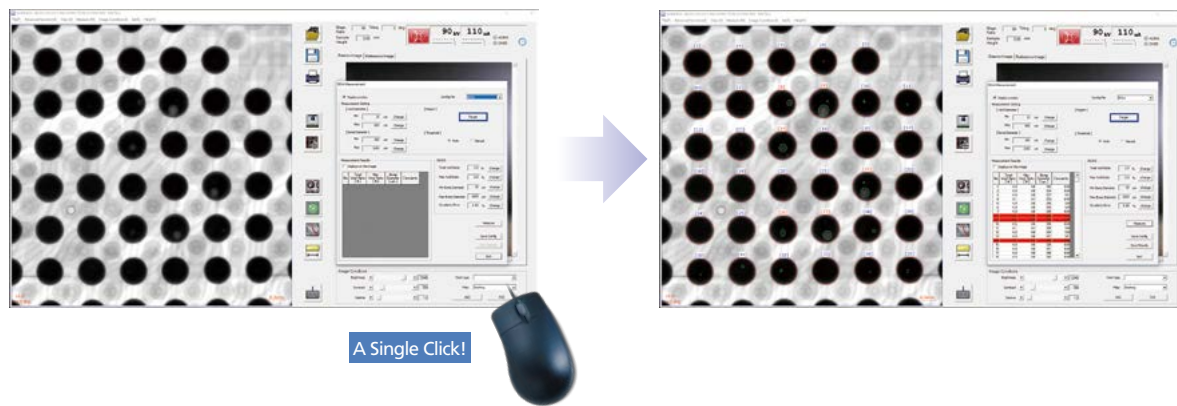
Shimadzu's proprietary image processing algorithm has significantly simplified complicated parameter settings.*

You can save multiple settings, and then call up different settings when measuring different inspection targets.

*Manual adjustments may be required depending on the sample.

(Measurable Items)

- Total void ratio
- Maximum void ratio
- Bump diameter
- Bump roundness



Area Ratio Measurements

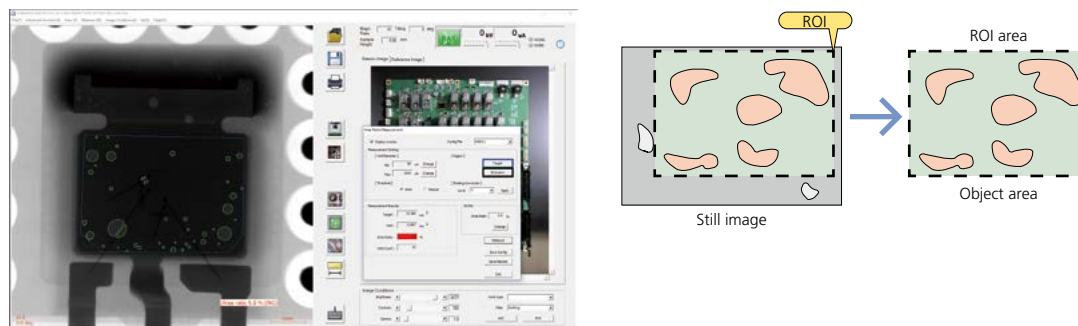
Measure area ratios for die bond and solder paste wettability.

Thanks to our proprietary image processing algorithm, complicated parameter settings are no longer required.*

You can save multiple settings, and then call up different settings when measuring different inspection targets.

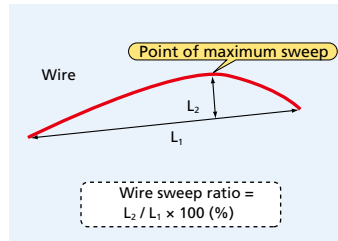
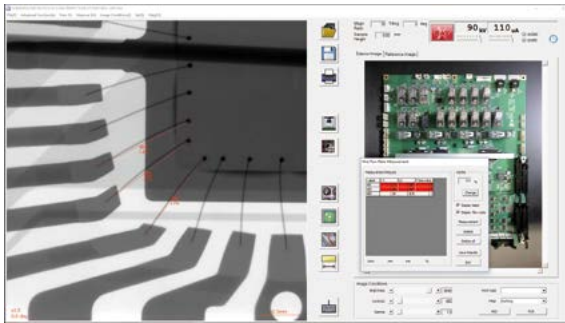
Pass/fail evaluations can be performed based on area ratios.

*Manual adjustments may be required depending on the sample.



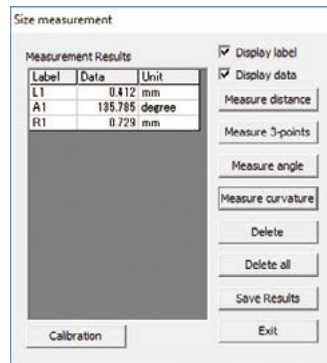
Wire Sweep Ratio Measurements

Specify both ends of a bonding wire and the point of maximum sweep to measure the wire sweep ratio. Pass/fail evaluations can be performed based on the wire sweep ratio.



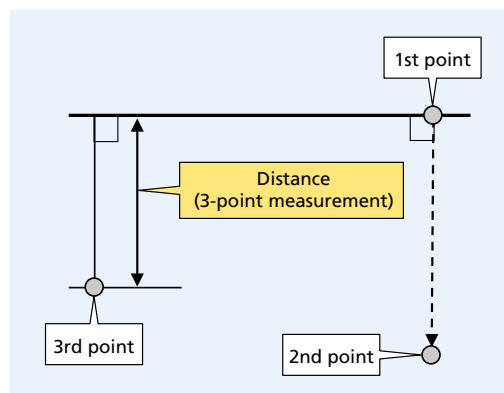
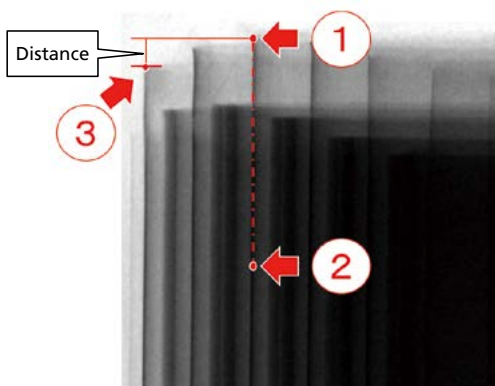
Dimension Measurements

Measure the distance between two points, as well as angles and curvatures. Correction data is internally calculated to match the fluoroscopy magnification rate, enabling efficient dimension measurements.



Three-Point Measurement

This function is useful for measuring the distance between electrodes in Li-ion batteries. If a reference line is drawn from an arbitrary point, and a second line is drawn from the same point but perpendicular to the reference line, then the system can measure the distance between this second line and another arbitrary point.



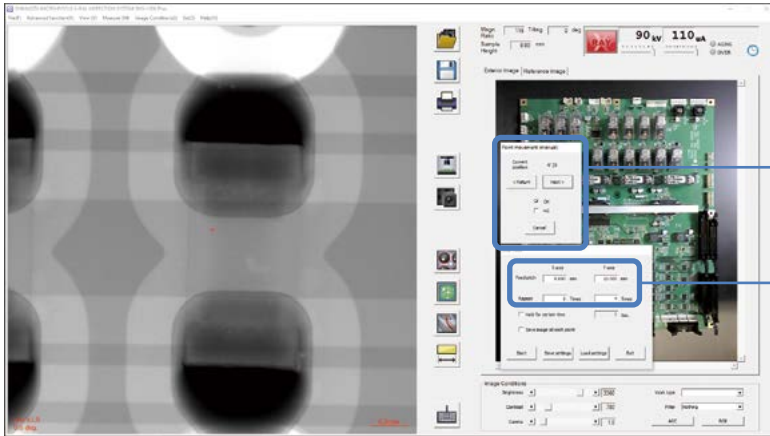
Convenient Functions

A Wealth of Functions That Improve Operator Efficiency

Step Feed

This function allows the stage to be moved in a sequence of equally spaced steps. It ensures efficient inspection of evenly-spaced samples, such as those on a pallet.

- The operator can easily evaluate images of sequentially displayed samples.



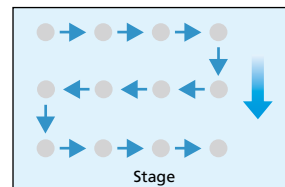
- Simply click points with the mouse to enter the visual evaluation results for each point.
- After inspection of all set points is completed, easy-to-see color-coded results are displayed in a table, as shown below. Refer to this table when sorting samples.

Judgement result

MEMO

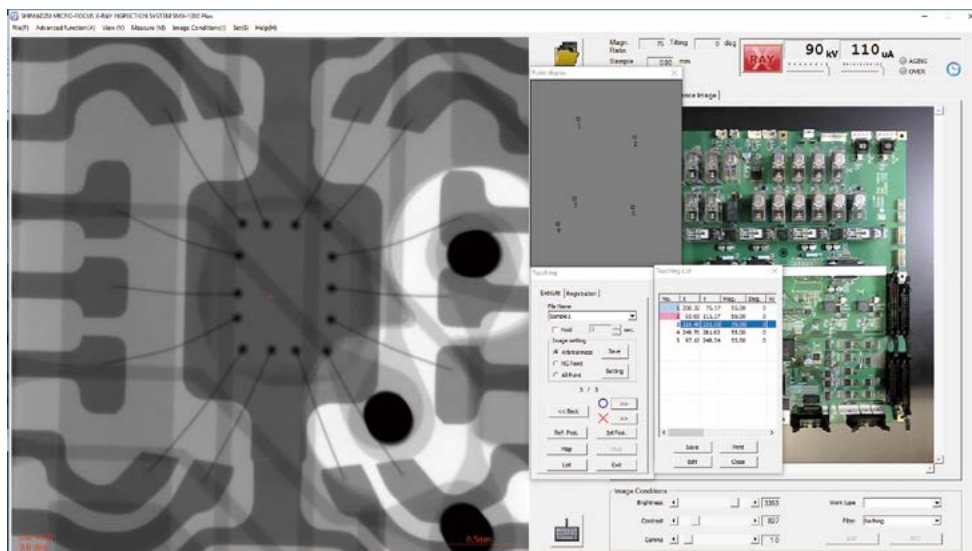
| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |

- Enter the feed pitch and number of repetitions.
- Inspection is repeated as the stage moves in a Z-pattern.



Teaching

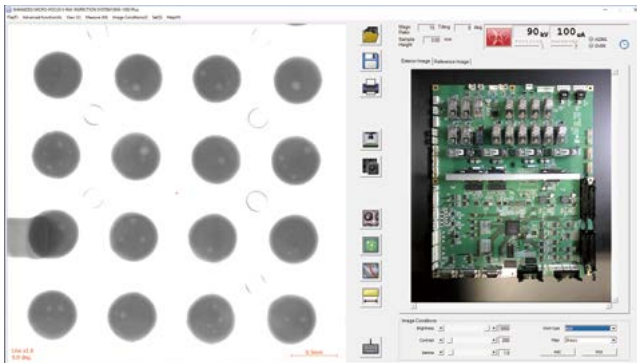
Teaching pre-registers inspection points and registers the observation conditions for each point. This function then automatically plays back the registered procedure to significantly enhance inspection efficiency during repeated inspections of multiple samples of the same type. The inspection position changes automatically during teaching, allowing the operator to concentrate on image evaluation.



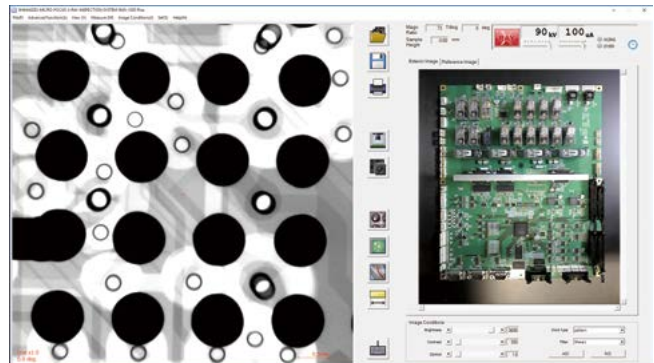
Note: Up to 10,000 points can be registered in a single file.

Preset Functions for Image Conditions

Simply select the desired work type from a list to instantly set the image display conditions for the target material.



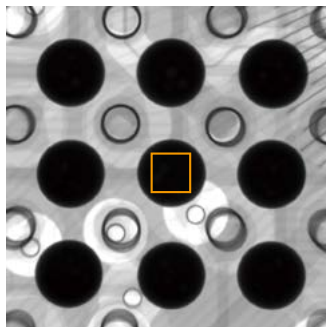
When [BGA] is selected



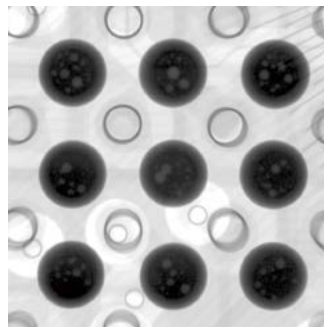
When [Pattern] is selected

Enhanced Region-of-Interest Display

The contrast settings are automatically optimized so that the region specified within the fluoroscopic image is particularly easy to see. Normally, with this sort of optimization function, the visibility of the area outside the region of interest deteriorates. However, thanks to our proprietary image processing algorithm, automatic adjustments ensure that the area outside the region of interest also stays as easy to see as possible.



Drag the mouse to select a region of interest in the fluoroscopic image.



The optimal image conditions are automatically calculated.

Image Rotation Function

Both live images and still images displayed in the fluoroscopy window can be rotated. The rotated images can be saved or loaded.

Note: This is not interlinked with the step feed function or the teaching function.

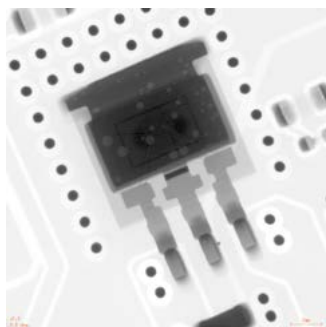


Image Before Rotation

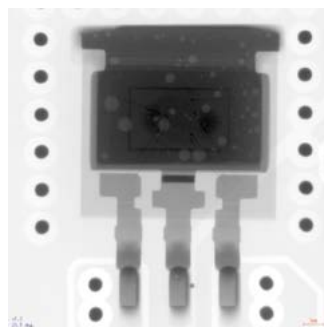


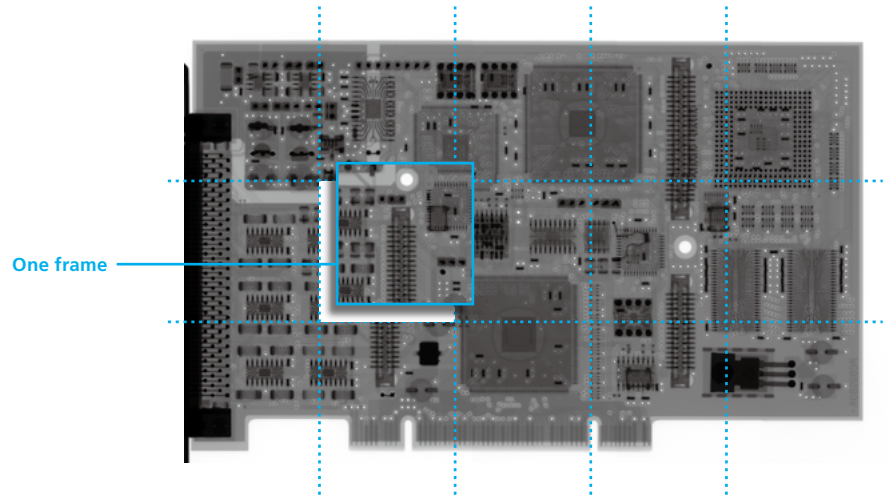
Image After Rotation

Convenient Functions / Options

Panorama Function

This function enables full image view for large samples that otherwise cannot be viewed within a single frame.

* If a scanned portion has some amount of thickness, the joint portion will show a difference in level.



Thumbnail View

Thumbnails of saved images are displayed for each folder. The thumbnail display provides the following wealth of functions to support the operator.

The screenshot shows the 'Image List Display' window. On the left, there is a sidebar with 'Inspection condition' settings and a 'Condition settings...' button. The main area is a grid of 16 thumbnails, each with a label like 'BGAT.tif', 'EGAZ.tif', etc. Blue lines connect callout boxes to specific features in the interface.

- Easily search for stored images using a Windows Explorer-like interface.
- Use the mouse scroll wheel to select a 2 x 2, 4 x 4, or 6 x 6 thumbnail display format. Double-click on any thumbnail to display the full 1000 x 1000 pixel image (original size).
- Inspection conditions used to capture an image are saved with the image, and can be displayed together with the image.
- Select any thumbnail and click [Condition settings] to automatically set all inspection conditions used to obtain the image. This allows easy repetition of the same inspection, and ensures identical images regardless of the user.

Functional Options Are Available.

Automatic Measurement System

P/N 362-85501-01

The system is used in combination with the SMX-1000 Plus teaching function or step feed function.

It enables users to perform real-time measurements of images obtained by the instrument and to perform pass/fail evaluations.

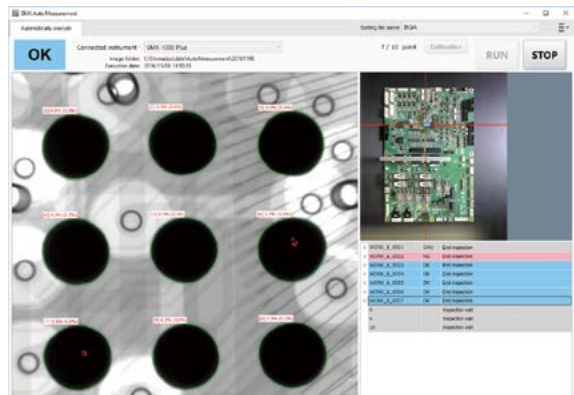
Select measurement functions to suit the application from two packages, one combining BGA void ratio and area ratio measurements and one for wiring deviation measurements in Li-ion batteries.

BGA Void Ratio/Area Ratio Measurement Package : P/N 362-85502-02

Main Specifications for BGA Void Ratio Measurements

- Measurement items
 - Total void ratio (%) / maximum void ratio (%) / bump diameter (μm) / roundness
 - maximum void diameter / number of bumps
- Measurement time
 - 2.5 seconds or less per image

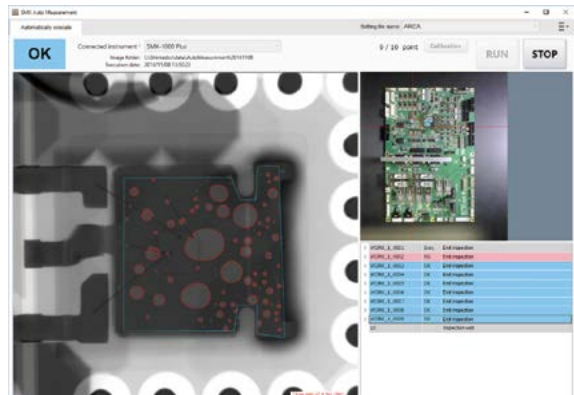
Note: The tact time for a system depends on the instrument stage's movement time and the image saving time.



Main Specifications for Area Ratio Measurements

- Measurement items
 - Area ratio (%)
- Measurement time
 - 2.5 seconds or less per image

Note: The tact time for a system depends on the instrument stage's movement time and the image saving time.

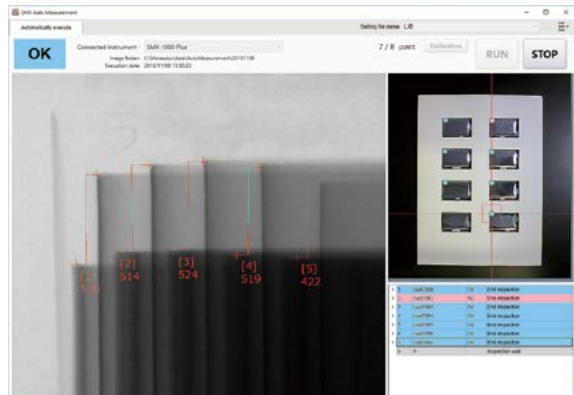


Li-Ion Battery Measurement Package : P/N 362-85502-05

Main Specifications for the Li-Ion Battery Measurements

- Measurement items
 - Height between different electrodes / width between electrodes / difference between different electrode heights (maximum and minimum)
 - Electrode meander width
- Measurement time
 - 2.5 seconds or less per image

Note: The tact time for a system depends on the instrument stage's movement time and the image saving time.



Options

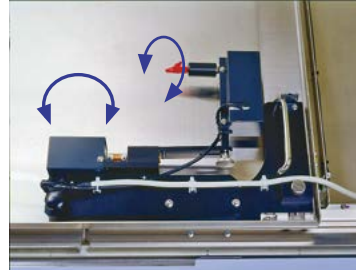
Rotating/Tilting Unit

P/N 362-63762-58

Attach the removable rotating/tilting unit and obtain X-ray fluoroscopy images of small components from multiple angles to minimize inspection errors.

Main Specifications

1. Max. load: 20 g
2. Rotation: Continuous
3. Inclination: $\pm 30^\circ$



Operation Boxes

Operation Box A : P/N 362-63982-58

Combining Operation Box A with the SMX-1000 Plus/SMX-1000L Plus allows manual operation of the X-Y stage using buttons and a joystick.

Main Specifications

1. X-Y movement: Joystick control (6 speeds)
2. Controls zoom ratio and tilt angle, and operates the rotation/inclination unit (via buttons).



Operation Box A

Operation Box B : P/N 362-63983-58

Main Specifications

1. X-Y movement: Joystick control (6 speeds)
2. Controls zoom ratio and tilt angle (via buttons).



Operation Box B

Seismic Unit

P/N 362-83950-58

The seismic unit is incorporated into the SMX-1000 Plus or SMX-1000L Plus to prepare for earthquakes.

If this optional unit is incorporated into an instrument, X-ray generation and stage activation will quickly be stopped if shaking equivalent to or stronger than 5 (80 gal) on the Japanese intensity scale occurs.

It can also be added to older existing SMX-1000 and SMX-1000L models.

VCT System

P/N 362-83650-51 (for SMX-1000 Plus)

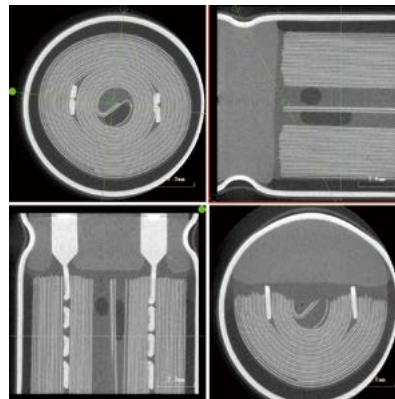
P/N 362-83650-55 (for SMX-1000L Plus)

If this VCT system (detachable) is added, both fluoroscopic and clear cross-sectional images can be obtained.

Note: For details, refer to the special catalog (C251-E025).

Main Specifications

1. Maximum mountable size*1: PCB: 50 × 100 mm (about 1 to 2 mm thick)
Parts: 30 dia. × 25 mm
2. Load capacity: Max. 100 g
3. Field of view (FOV): Approx. 5 to 30 mm
4. Scanning mode: Cone CT (normal mode)
5. Reconstruction matrix: 512 × 512 × 512 max.
6. Number of views: 600 or 1200
7. Display: MPR

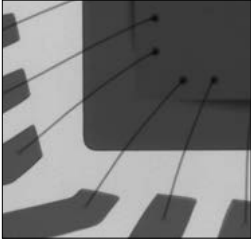


MPR image

*1: This does not mean that CT scanning is possible for all samples smaller than the maximum mountable size. Before purchasing this system, be sure to check its performance with your sample.

Applications

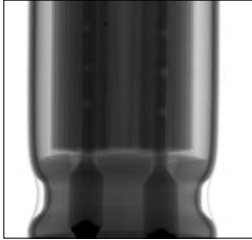
IC Bonding Wire



Batteries and Capacitors

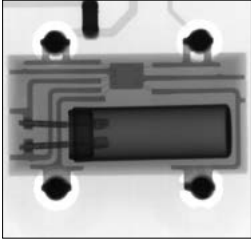


Li-ion battery



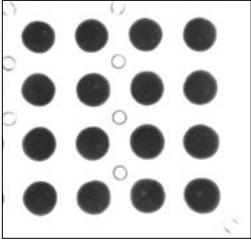
Electrolytic capacitor

Electronic Components

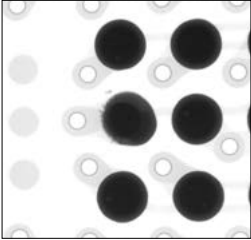


Crystal oscillator

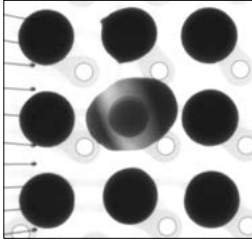
BGA



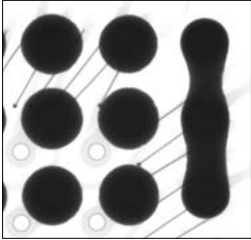
Void



Open

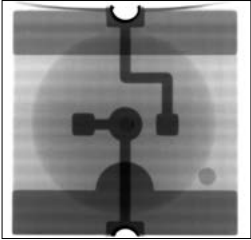
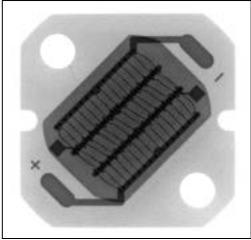


Deformation

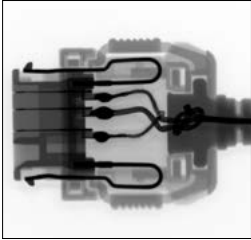
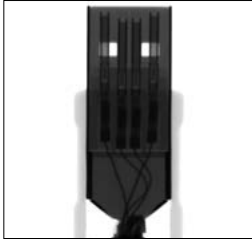


Bridge

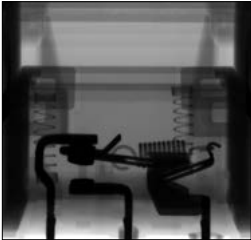
LED



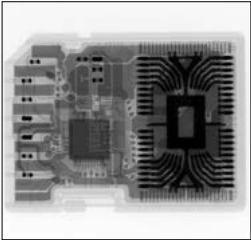
Connectors



Components



Switch



SD card



Camera lens

Bottles

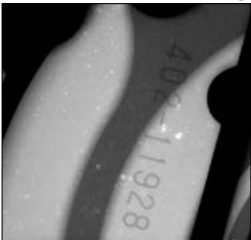


Spray mechanism

Resin Molded Products and Aluminum Die Casting



Resin (void)



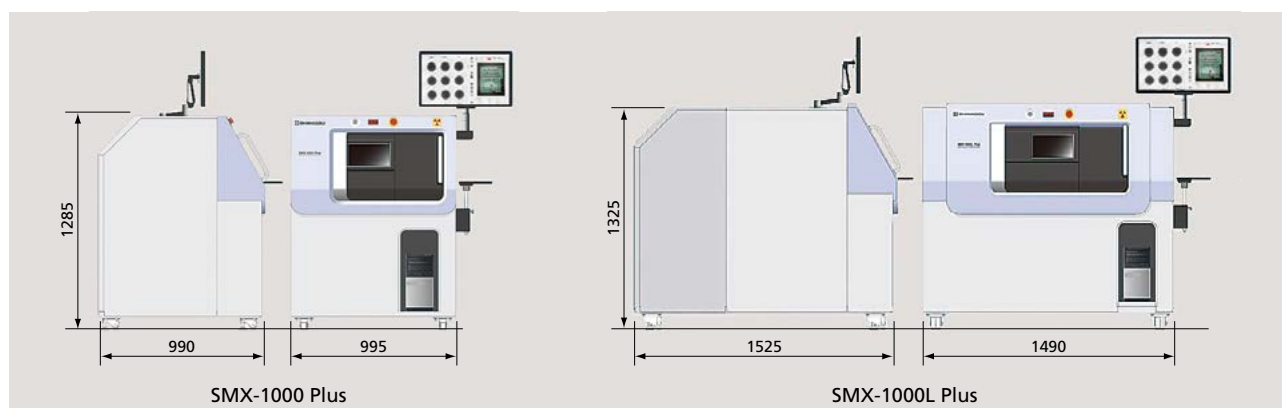
Aluminum die casting (void)

Specifications

| P/N | SMX-1000 Plus (P/N 362-84800-58) | SMX-1000L Plus (P/N 362-84900) |
|------------------------------|-----------------------------------|--------------------------------|
| Spatial Resolution | 5 μ m (JIMA chart resolution) | |
| Maximum Sample Size | 350 mm x 450 mm | 570 mm x 720 mm |
| Stroke | 300 mm x 350 mm | 520 mm x 620 mm |
| Maximum Sample Weight | 5 kg | |
| Maximum Detector Inclination | 60° | |
| Maximum Output | 90 kV (10 W) | |
| Detector | Flat Panel Detector | |
| Inspection Visual Field | Approx. 1.7 mm to 35 mm | |
| Magnification | Approx. 8x to 161x | |
| Power Supply | 100 to 230 V AC, 0.5 kVA | 100 V AC, 0.5 kVA |
| Dimensions | W995 x D990 x H1285 mm | W1490 x D1525 x H1325 mm |
| Weight | Approx. 570 kg | Approx. 970 kg |

- Windows 10 64-bit operating environment is required. Windows is a registered trademark of Microsoft Corporation.

External Dimensions (Unit: mm)



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