

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.

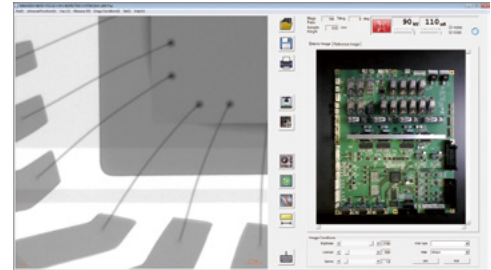


SMX-1000 Plus

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.



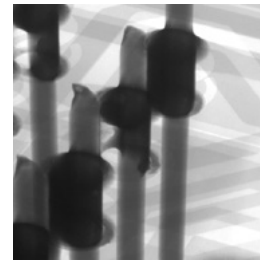
Clear Images

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



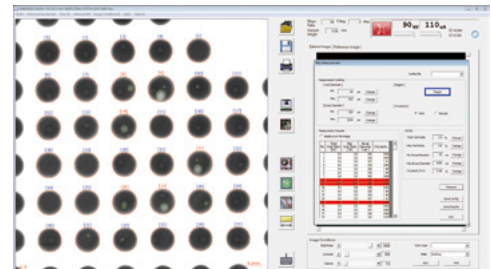
Inclined Fluoroscopy

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.




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Operability

Large Display and Simple Button Layout for Improved Visibility and Operability

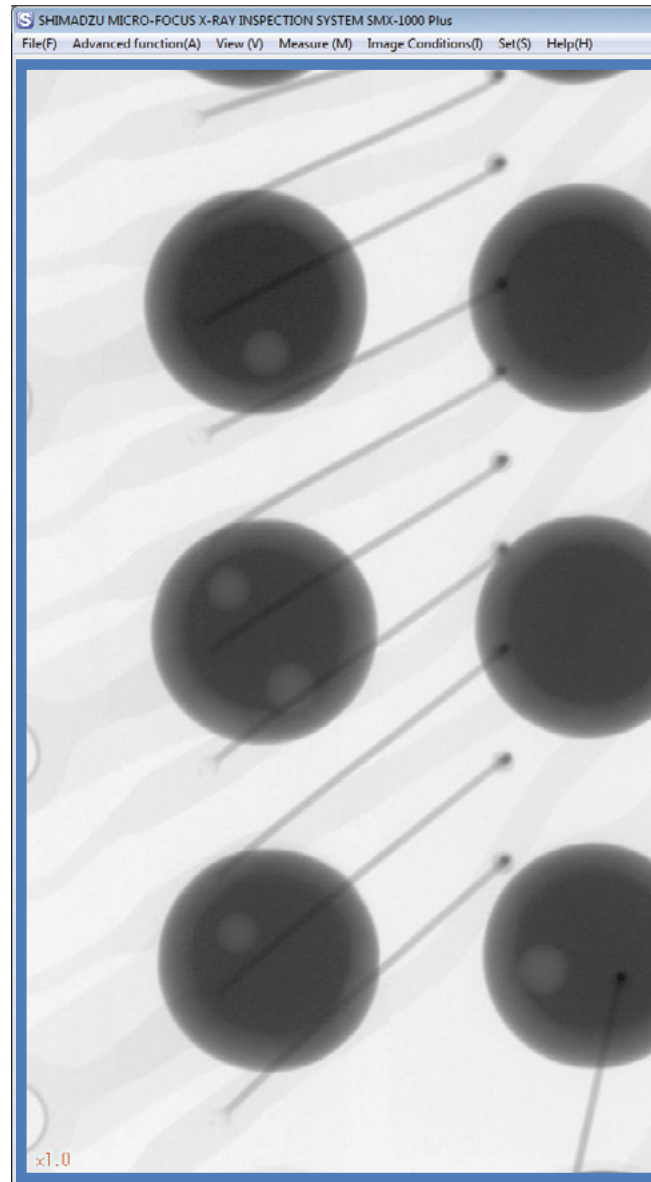
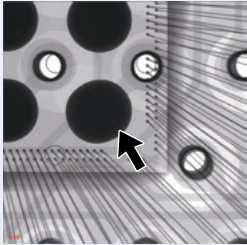
1 Sample Placement
Position the sample and activate the X-ray source.



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.

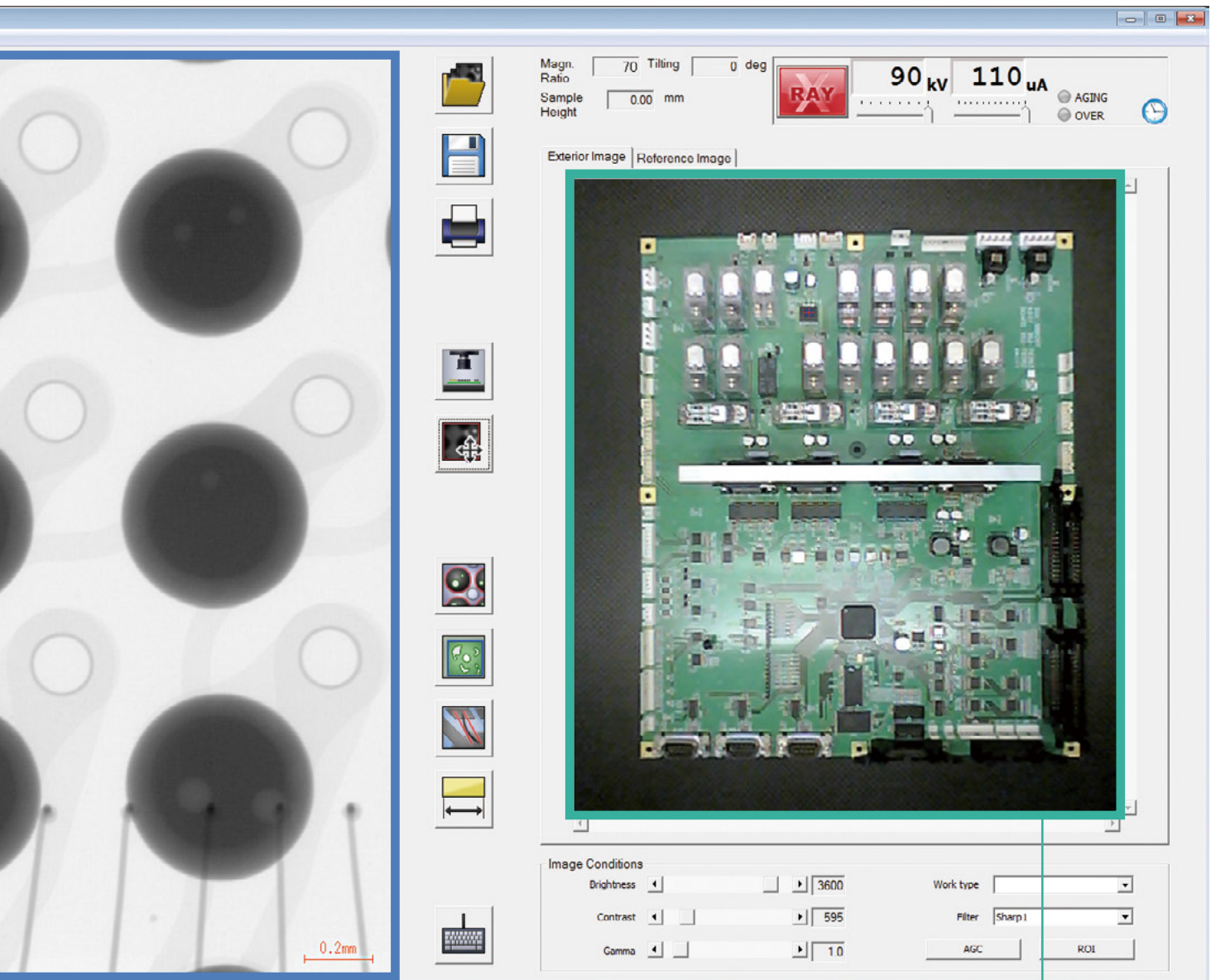


Larger Display

17 Inch

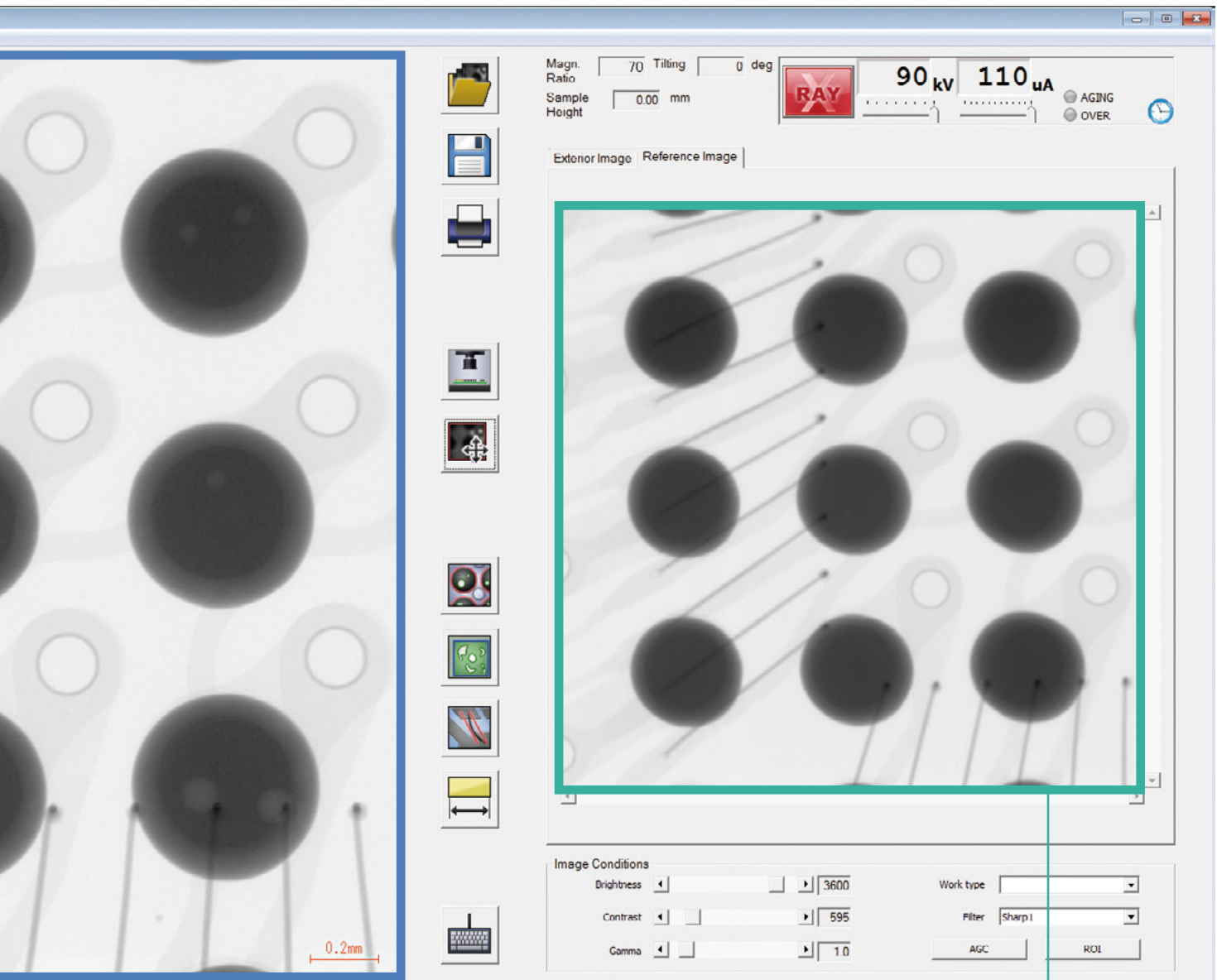
23-Inch Wide Screen





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

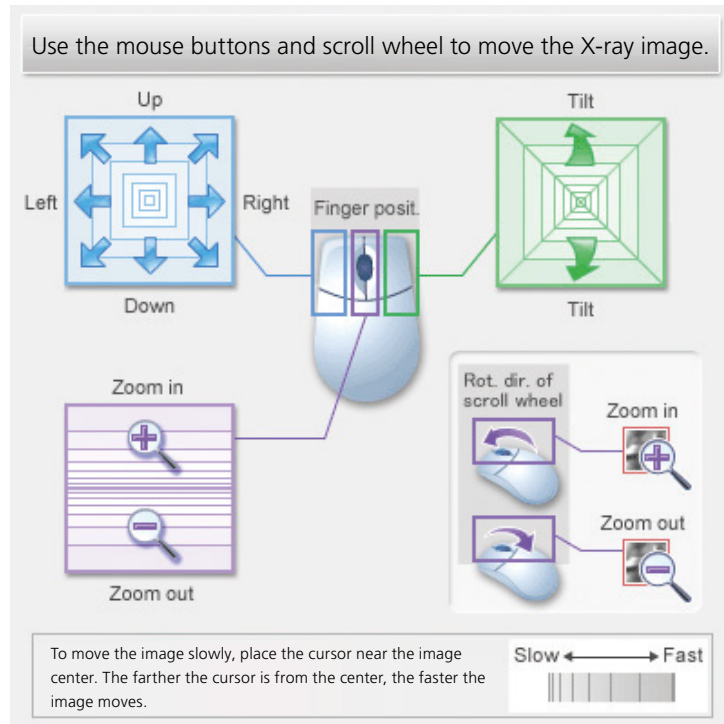
Switch between the exterior image and reference image, both of which can be enlarged.

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.

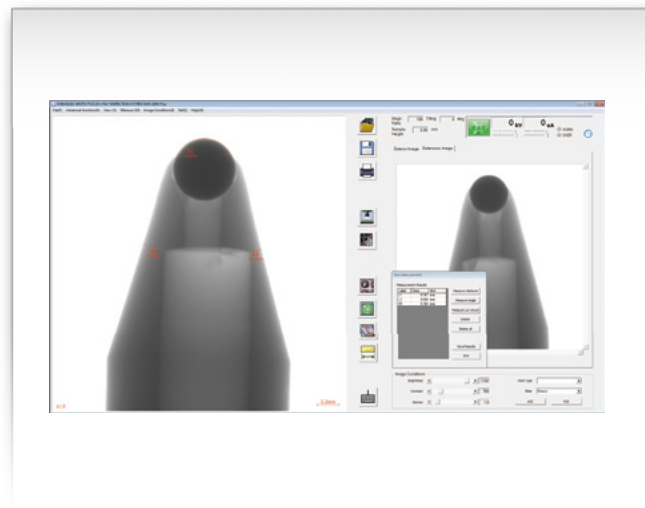
Positioning from Fluoroscopic Images (Mouse Operation Only)

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.



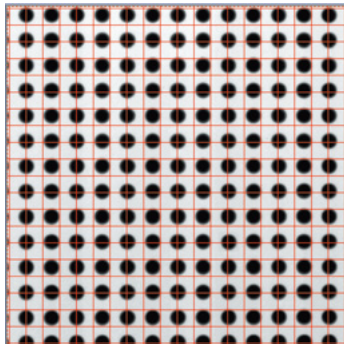
Features

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

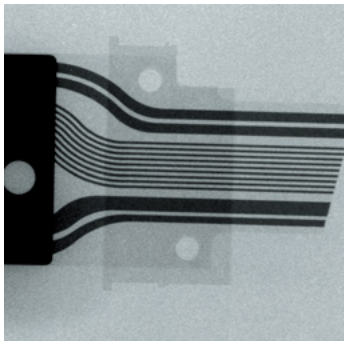
Flat panel detector image



- 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

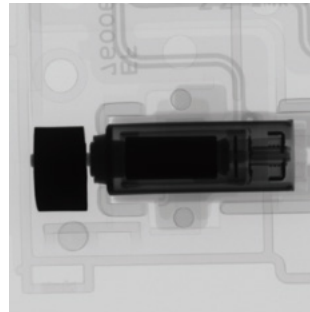
Flat panel detector image



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

3. Wide Contrast Range

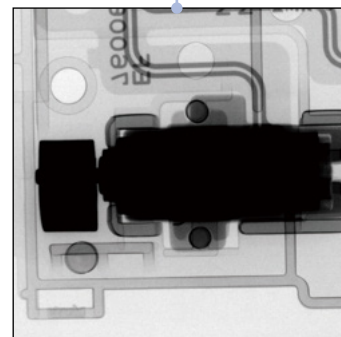
Flat panel detector image
12 bits (4096 gradations)



Brightness and contrast adjustment



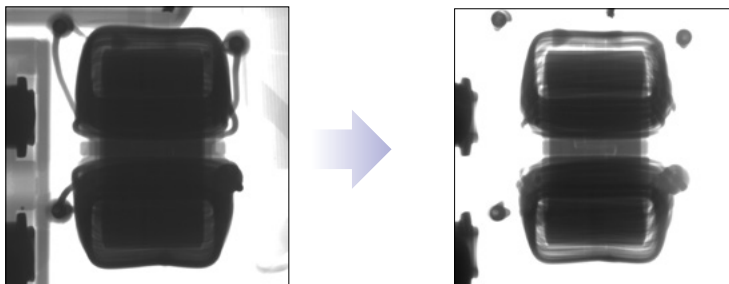
Brightness and contrast adjustment



- 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.

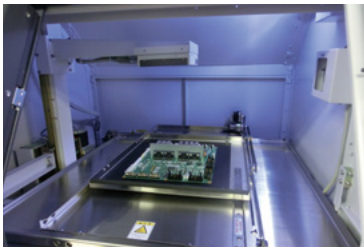


Fluoroscopy at up to a 60° Angle!

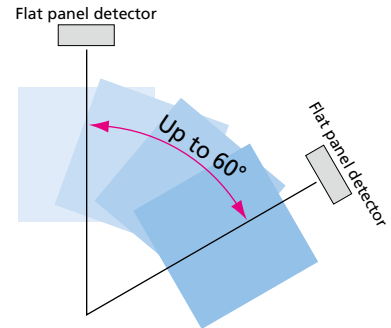
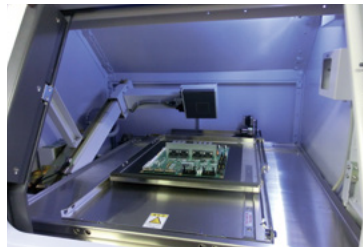
- With a tilt angle of up to 60°, the flat panel detector enables fluoroscopy over an extensive range, while maintaining constant magnification.

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

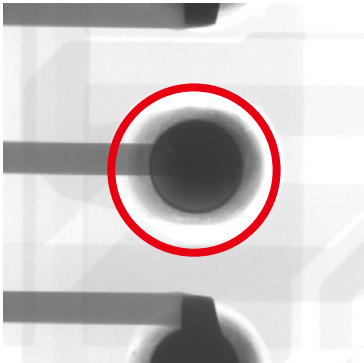
Flat panel detector not tilted



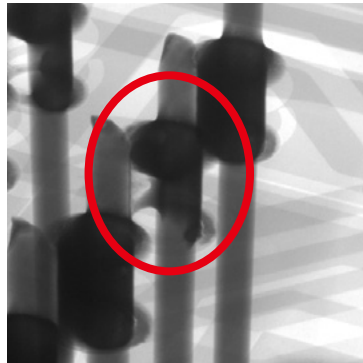
Flat panel detector tilted at 60°



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°

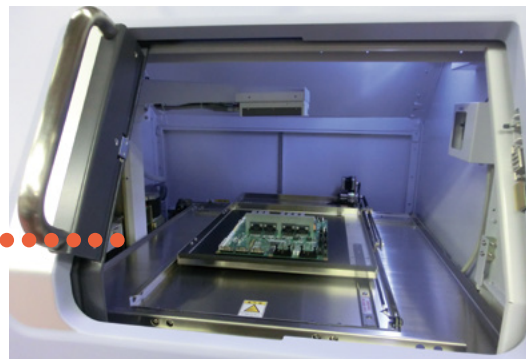
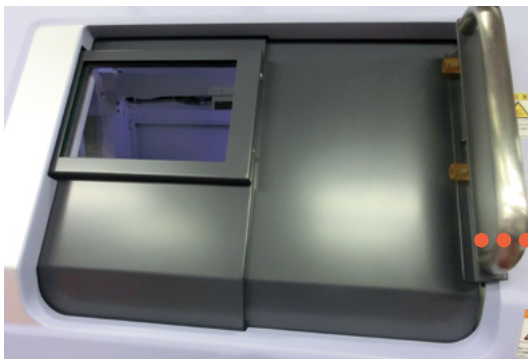


50x magnification at 60°

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.
- A generous 400 mm × 350 mm stage accommodates even large surface-mounted PCBs. (The SMX-1000L Plus accommodates large 570 mm × 670 mm PCBs.) The stroke is reduced 50 mm in each direction.



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

The screenshot illustrates the software's workflow. The top panel shows a raw grayscale image of a BGA bump array. A mouse cursor is shown clicking on the 'Target' button in the 'BGA Measurement' dialog box, with a callout 'A Single Click!'. A large blue arrow points down to the second screenshot, which shows the same image after processing. The bumps are now highlighted with red and green outlines, and each is numbered from [1] to [34]. The 'Measurement Results' table in the software is populated with data for each bump.

No.	Total Void Ratio (%)	Max Void Ratio (%)	Bump Diameter (µm)	Circularity (%)
1	0.0	0.0	302	100
2	0.0	0.0	302	100
3	0.0	0.0	302	100
4	0.0	0.0	302	100
5	0.0	0.0	302	100
6	0.0	0.0	302	100
7	0.0	0.0	302	100
8	0.0	0.0	302	100
9	0.0	0.0	302	100
10	0.0	0.0	302	100
11	0.0	0.0	302	100
12	0.0	0.0	302	100
13	0.0	0.0	302	100
14	0.0	0.0	302	100
15	0.0	0.0	302	100
16	0.0	0.0	302	100
17	0.0	0.0	302	100
18	0.0	0.0	302	100
19	0.0	0.0	302	100
20	0.0	0.0	302	100
21	0.0	0.0	302	100
22	0.0	0.0	302	100
23	0.0	0.0	302	100
24	0.0	0.0	302	100
25	0.0	0.0	302	100
26	0.0	0.0	302	100
27	0.0	0.0	302	100
28	0.0	0.0	302	100
29	0.0	0.0	302	100
30	0.0	0.0	302	100
31	0.0	0.0	302	100
32	0.0	0.0	302	100
33	0.0	0.0	302	100
34	0.0	0.0	302	100
35	0.0	0.0	302	100

Area Ratio Measurements

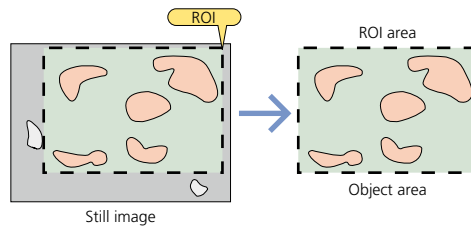
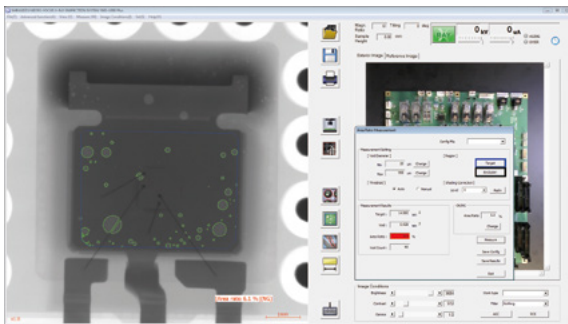
Measure area ratios for die bond and solder paste wettability.

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.

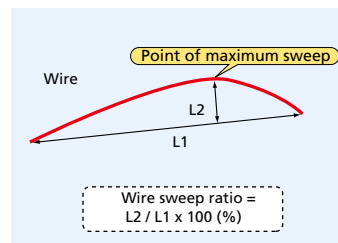
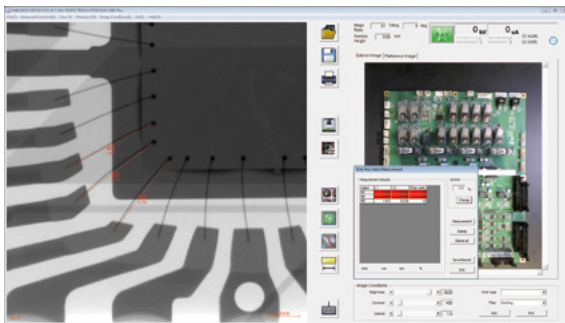
*Manual adjustments may be required depending on the sample.



Wire Sweep Ratio Measurements

Specify both ends of a bonding wire and the point of maximum sweep to measure the wire sweep ratio.

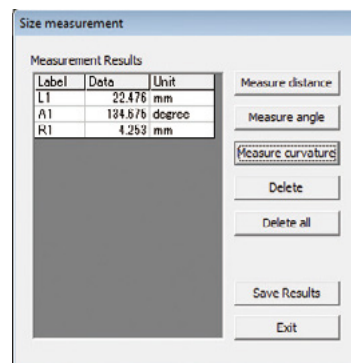
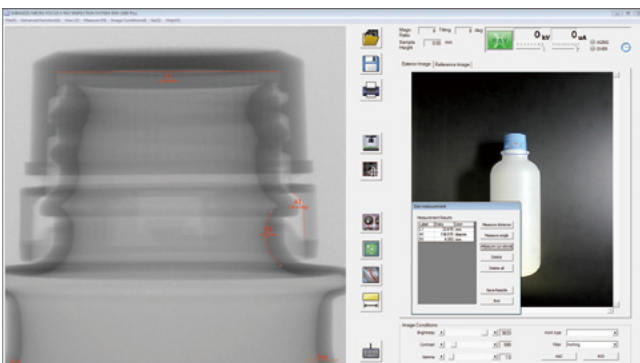
Pass/fail evaluations can be performed based on the wire sweep ratio.



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.



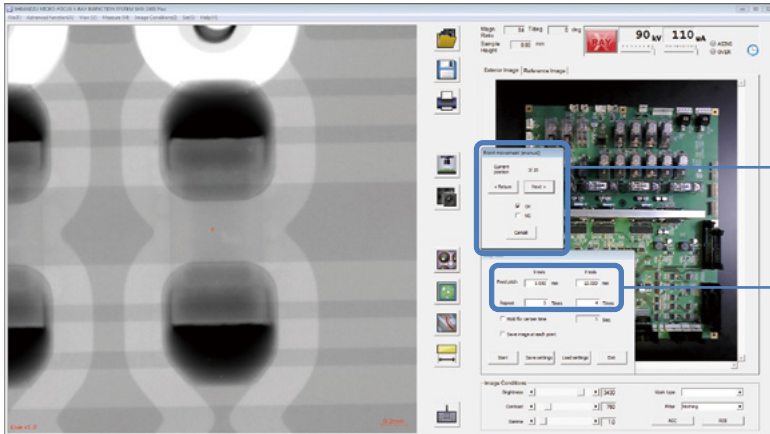
Convenient Functions

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.



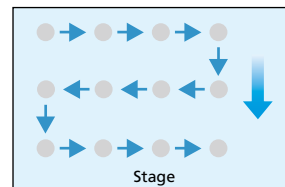
- Simply click points with the mouse to enter the visual evaluation results for each point.
- After inspection of all set points is completed, easy-to-see color-coded results are displayed in a table, as shown below. Refer to this table when sorting samples.

Judgement result

MEMO

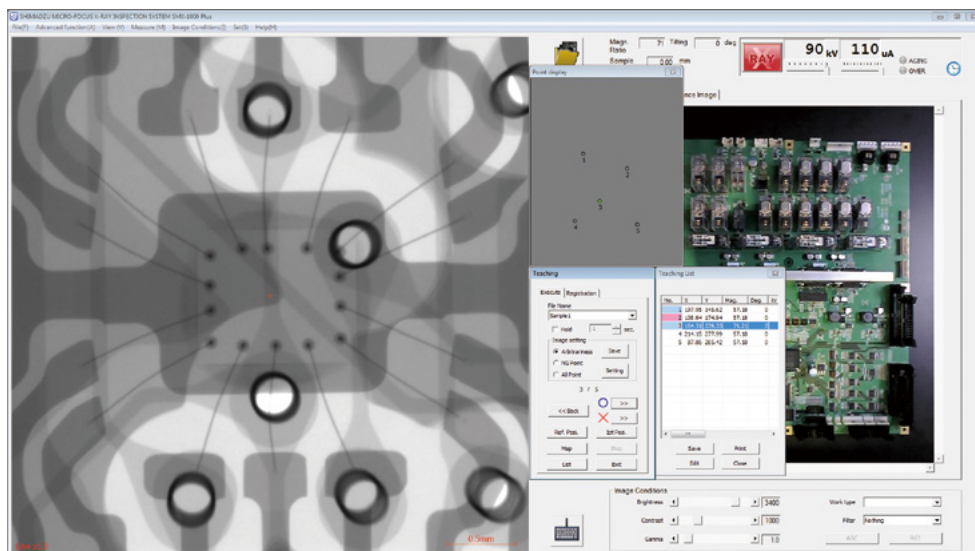
	1	2	3	4	5
1					
2					
3					
4					
5					

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



Teaching

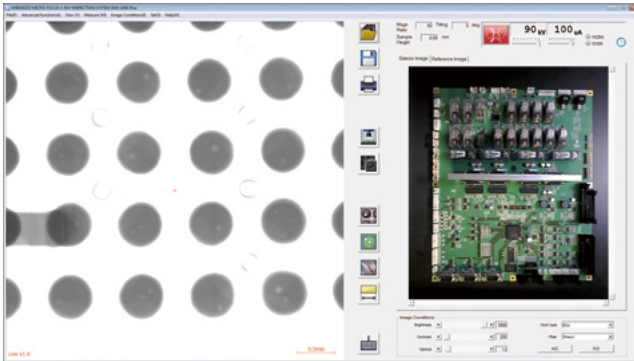
Teaching pre-registers inspection points and registers the observation conditions for each point. This function then automatically plays back the registered procedure to significantly enhance inspection efficiency during repeated inspections of multiple samples of the same type. The inspection position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



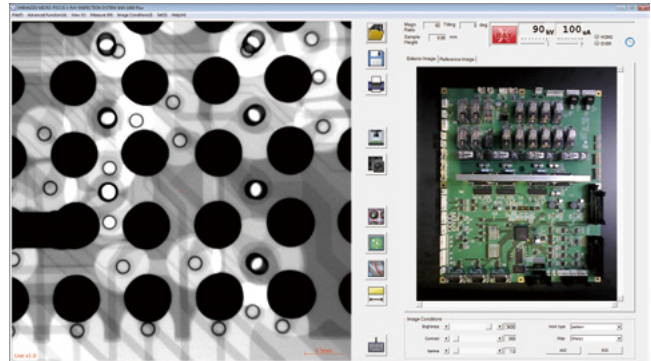
Note: Up to 10,000 points can be registered in a single file.

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.



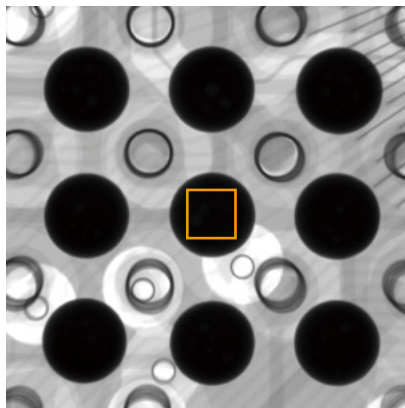
When [BGA] is selected



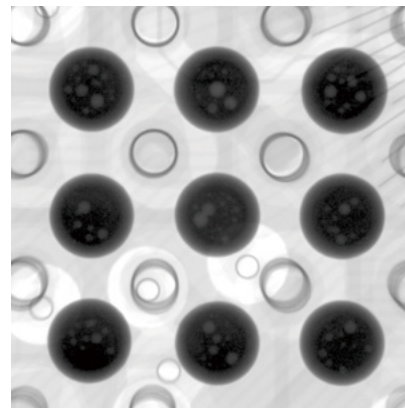
When [Pattern] is selected

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.

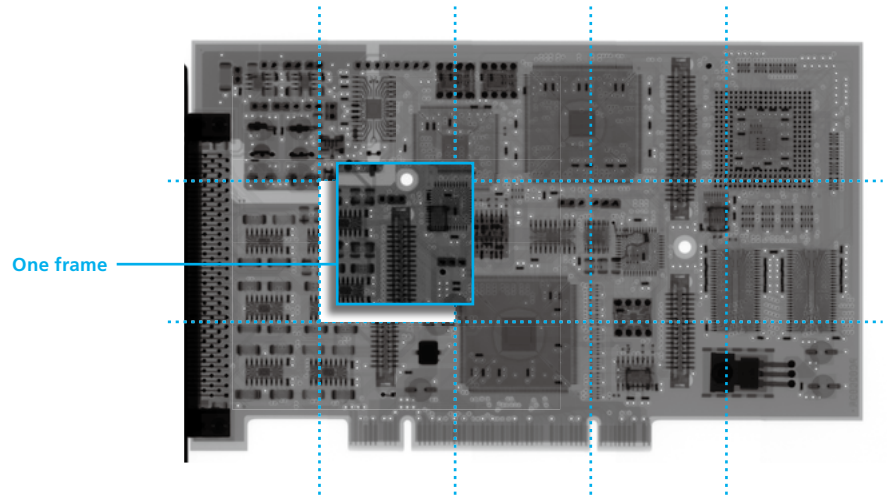


The optimal image conditions are automatically calculated.

Convenient Functions / Options

Panorama Function

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



Thumbnail View

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

- Easily search for stored images using a Windows® Explorer-like interface.
- Use the mouse scroll wheel to select a 2 × 2, 4 × 4, or 6 × 6 thumbnail display format. Double-click on any thumbnail to display the full 1000 × 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.

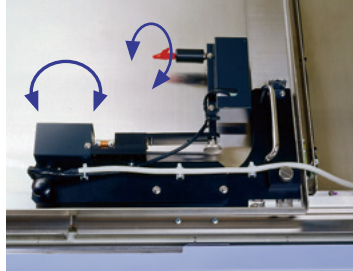
Rotating/Tilting Unit

P/N 362-63762

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

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

Main Specifications

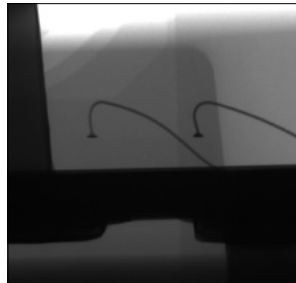
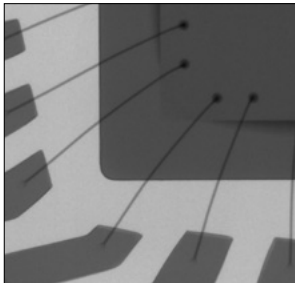
- 1. X-Y movement: Joystick control (6 speeds)
- 2. Controls zoom ratio and tilt angle (via buttons).



Operation Box B

Applications

IC Bonding Wire



Batteries and Capacitors

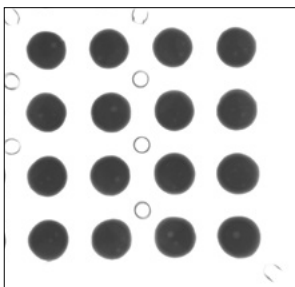


Li-ion battery

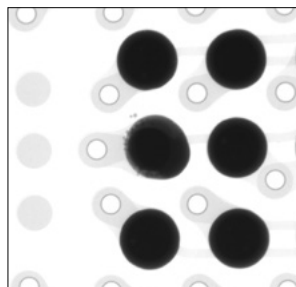


Electrolytic capacitor

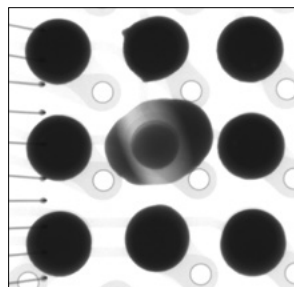
BGA



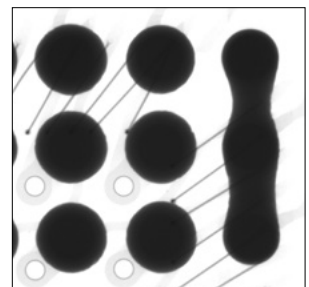
Void



Open

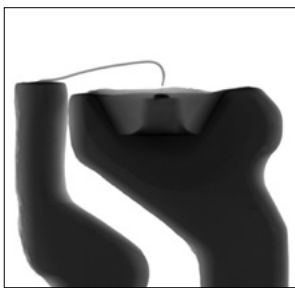


Deformation

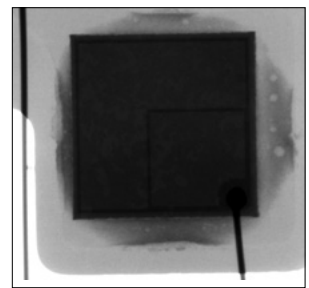
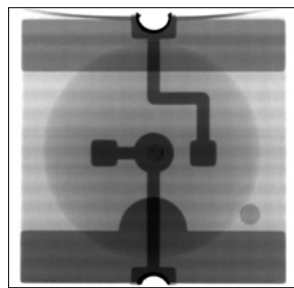
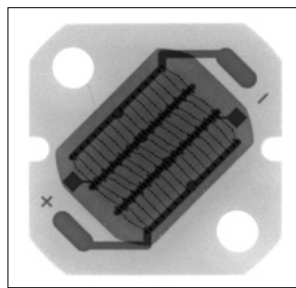


Bridge

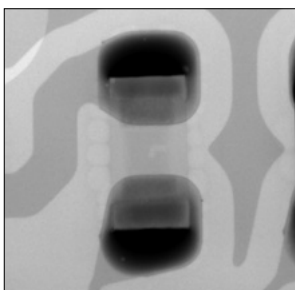
LED



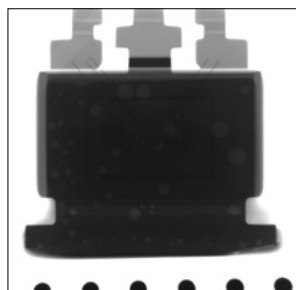
Fusing of wire



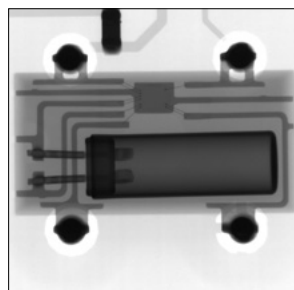
Electronic Components



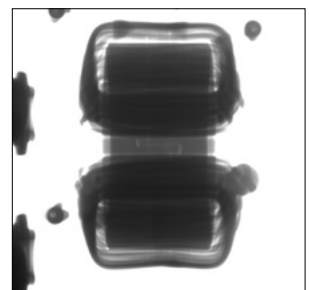
Chip



Regulator IC (void)

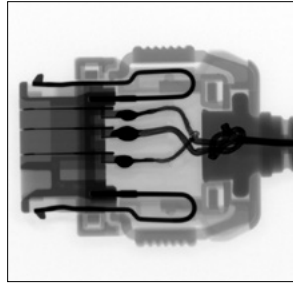
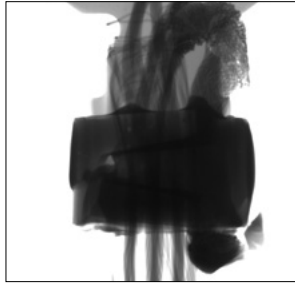
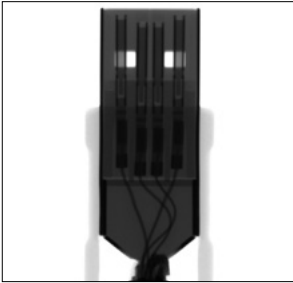


Crystal oscillator

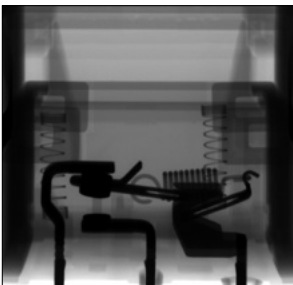


Coil

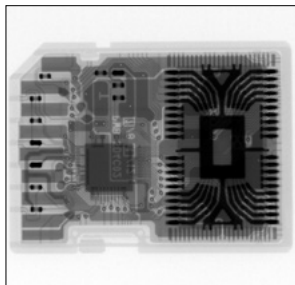
Connectors



Components



Switch

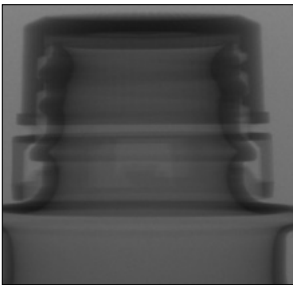


SD card



Camera lens

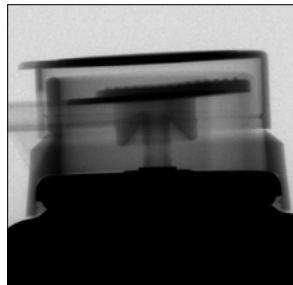
Bottles



Plastic bottle

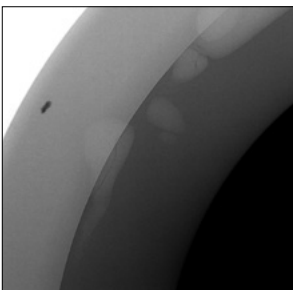


Spray mechanism

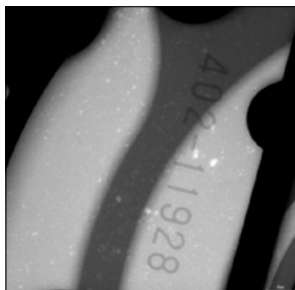


Spray mechanism

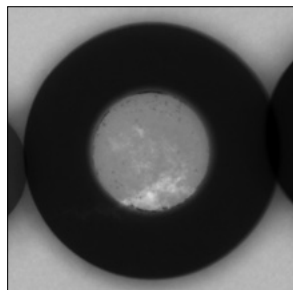
Resin Molded Products and Aluminum Die Casting



Resin (void)



Aluminum die casting (void)

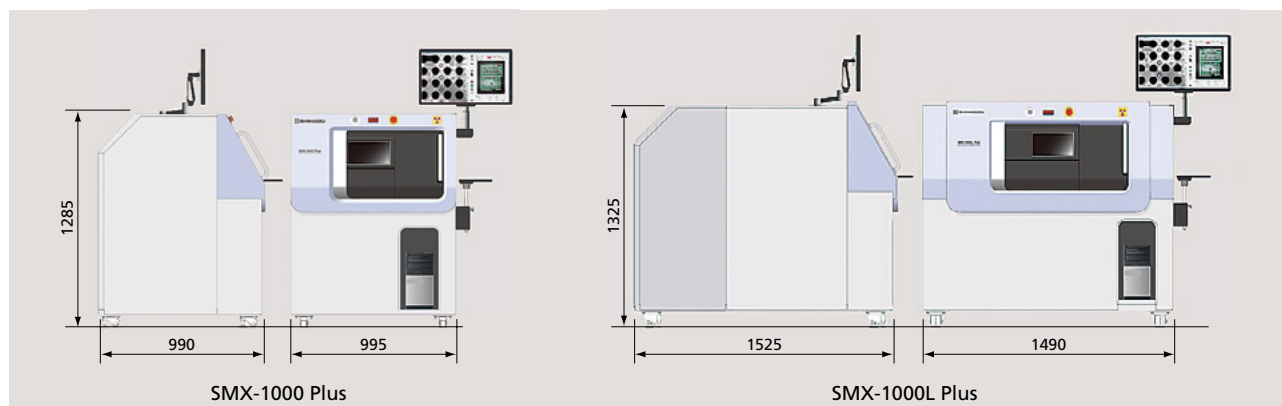


Aluminum die casting (void)

Specifications

P/N	SMX-1000 Plus (P/N 362-83200-92)	SMX-1000L Plus (P/N 362-83300-92)
Spatial Resolution	5 μ m (JIMA chart resolution)	
Maximum Sample Size	350 mm \times 400 mm	570 mm \times 670 mm
Stroke	300 mm \times 350 mm	520 mm \times 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. 8 \times to 161 \times	
Power Supply	100 V AC, 1 kVA	
Dimensions	W995 \times D990 \times H1285 mm	W1490 \times D1525 \times H1325 mm
Weight	Approx. 500 kg	Approx. 950 kg

External Dimensions (Unit: mm)



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