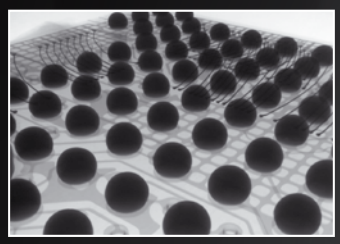
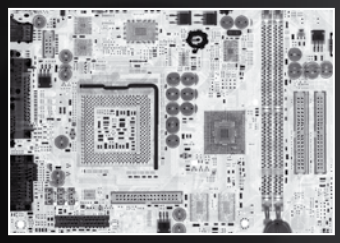
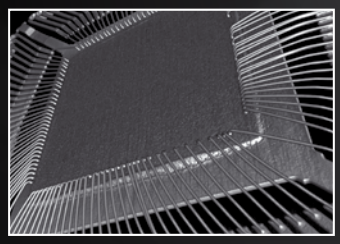
XT V Series







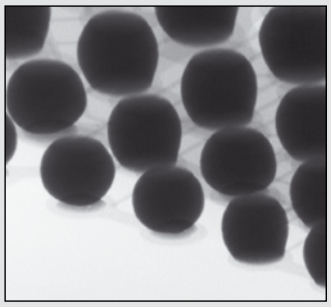
X-ray and CT technology for electronics inspection

NIKON METROLOGY | VISION BEYOND PRECISION

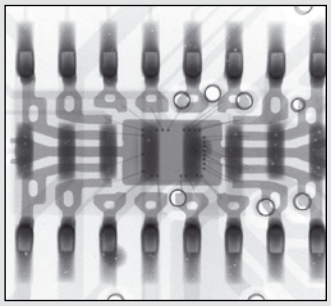
ELECTRONICS INSPECTION MADE EASY

There is an increasing demand for flexible, high-resolution and cost-effective X-ray inspection systems to cope with the evolution of ever-shrinking geometries within electronics components and to comply with tighter quality standards.
The XT V series enable insights into printed circuit board assemblies, components, or electrical devices in an intuitive, non-destructive inspection process. X-ray inspection provides many benefits to manufacturers and researchers, accelerating throughput and improving product quality whilst reducing costs.

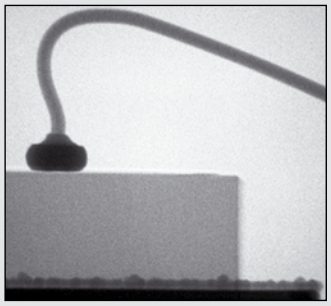
A WEALTH OF APPLICATIONS



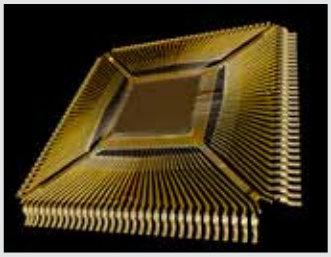
Head-in-Pillow defect



Top view QFN



Ball bond



CT image of package

With the constant demand for component miniaturization and 3D packaging technologies, modern X-ray inspection systems must provide the sharpest images and a vast range of applications in order to increase productivity.

SMD (Surface Mount Devices)	
BGA (Ball Grid Array) QFN (Quad-Flat No-leads) QFP (Quad Flat Package)	- BGA diameter and circularity - BGA and PAD array void analysis - Head-in-Pillow - Cold or dry joint - Missing BGA - Bridging - Form solder connection - Solder balls
Through-hole	- Filling of PTH - Cracks in through holes - Bridging between pins
IC Bonding	
Wire bonding (Au or Cu) Flip chip C4 (Controlled Collapse Chip Connection)	- Broken wire - Wire sweep analysis - Broken wedge bond - Lifted ball bond - µBGA void analysis - Cold joint - Package void analysis
Wafer level interconnectivity: WLFP or WL-CSP, 3D packaging, System in Package (SiP)	
TSV (Through Silicon Via) Micro-bumps Cu-pillar	- Voids in Cu filling - Remaining edge fluid - Voids analysis - Cold joint

Besides electronics inspection, XT V systems are also suited for X-ray and CT inspection of a wide variety of smaller components. The large tray can hold different samples for serial NDT analysis:

Micro-Electro-Mechanical Systems (MEMS, MOEMS) often used in consumer electronics such as smartphones, these can include accelerometers, pressure sensors, gyroscopes, action buttons, etc.

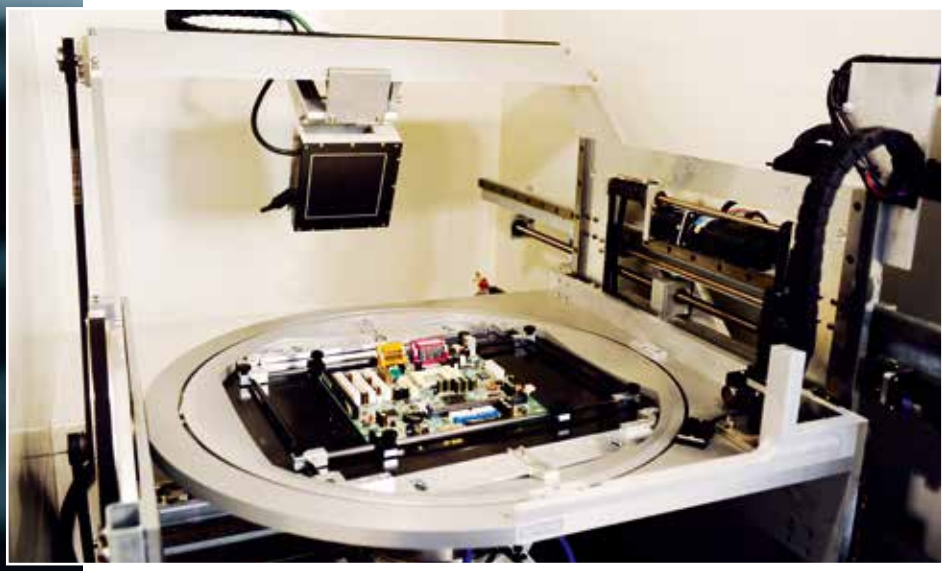
Series radiographic inspection of small components such as cables, harnesses, plastic parts, LED lights, switches, medical parts, etc.

AT THE CORE OF X-RAY TECHNOLOGY

Nikon Metrology X-ray sources are the core of our technology and are designed and manufactured in-house. This allows Nikon Metrology to quickly move with the market and develop complete and innovative solutions to the application demand.

Key benefits include low cost of ownership, lower maintenance and higher reliability through open tube design. The integrated voltage generator eliminates the need for a high voltage cable assembly that requires regular maintenance.

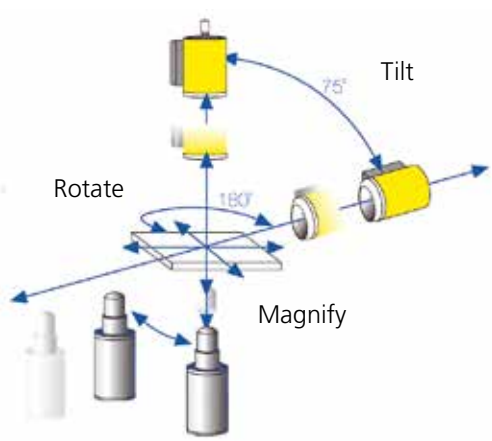
WITH INHERENT PRECISION



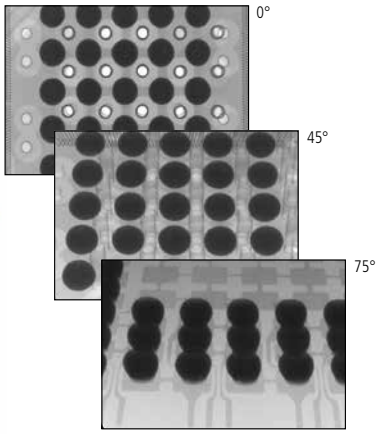
The XT V systems are supplied with a highly accurate sample manipulator with an optional precision CT rotate axis.

The vertical system configuration, with the X-ray tube below the sample holder and the tilting imager is controlled through user-friendly Inspect-X software or via precise joystick manipulation.

Capable of multiple rotations even at maximum tilt, the rotate table of the premium XT V 160 provides helicopter fly-around views of any region of interest even at maximum magnification.



Under any combination of rotate, tilt and magnification, true concentric imaging of the XT V 160 ensures that the region of interest remains locked into the center of the field of view.



Tilt angles up to 75° offers sufficient flexibility to trace connectivity

PREMIUM QUALITY

XT V 160 – Premium X-ray inspection

Specifically designed for use in production lines and failure analysis laboratories, the XT V 160 can be configured with a choice of premium system components to optimize the performance for your needs. Besides manual real-time inspection, the inspection process can be fully automated to maximize productivity.

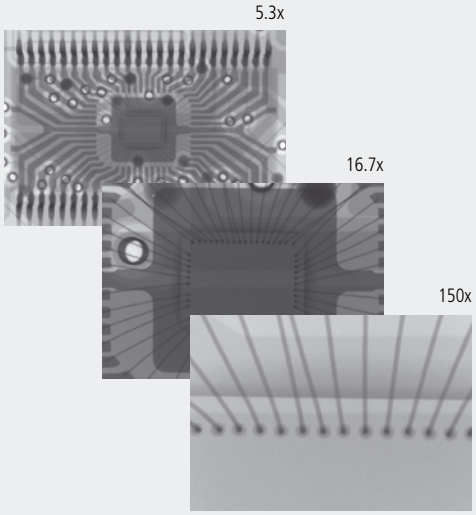
- Proprietary NanoTech 160 kV / 20 W microfocus source with submicron feature recognition
- 1.45 Mpixel 12bit camera with dual field 4”/6” image intensifier
- Optional flat panel detector
- 5-axis manipulator (X,Y,Z, Rotate, Tilt)
- 360° fly-around views while keeping region of interest consistently locked into the center of the field of view
- Real-time imaging or automated inspection
- Ready for CT applications (option)

INTUITIVE TO USE

- Intuitive joystick navigation for real-time X-ray inspection
- Collision-free sample manipulation
- Large single 30” display or dual 22” display for combined system control and real-time analysis
- Industry leading Inspect-X software
- Minimum training requirement - operational within 1 day
- Local language support

HIGH-QUALITY IMAGES

- In-house designed and manufactured microfocus sources
- Up to 2400x geometric magnification to zoom in on the smallest details
- 500 nm feature recognition on XT V 160
- 16bit image processing
- Max 75° tilt angle to detect cold joints and head-in-pillow
- Accurate control of the power and direction of the emitted X-ray beams



Unparalleled magnification, enables users to zoom in on any region of interest.

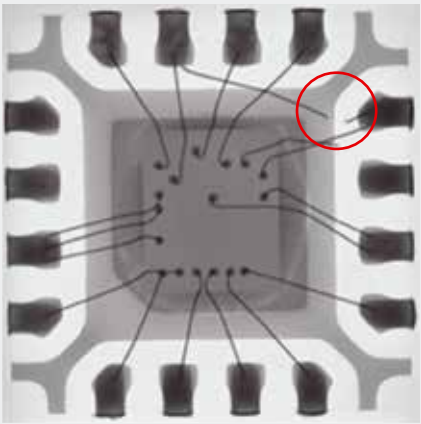
AND ECONOMICS

XT V 130C - Cost-effective X-ray inspection

The XT V 130C is a highly flexible and cost-effective electronics and semiconductor inspection system. The system features a 130 kV/10 W Nikon Metrology manufactured source, a globally recognized open tube design with integrated generator, and a high-resolution imaging chain.

A series of optional factory or field upgrades enable the users to configure the system to their own requirements and budget. Upgrades include a sample rotation stage, a high definition digital flat panel option, automated inspection software and CT technology

- Proprietary 130 kV / 10W microfocus source with 2 µm feature recognition
- 1.45 Mpixel 12bit camera with 6" image intensifier
- 4-axis manipulator (X, Y, Z, Tilt)
- Primarly focusing on real-time imaging



Broken bond wire

FOCUS ON PRODUCTIVITY

- Fast automated component inspection with immediate analysis and reporting
- Load position for quick and easy loading/unloading of sample
- Large door with automatic interlocked X-ray off function provides easy access to the inspection area
- Large tray to load multiple boards
- Barcode reader for automatic recognition of specimen serial number (optional)

LOW COST OF OWNERSHIP

- Unlimited source life time due to open tube design with user replacable low cost filaments
- Serviceable components are easily accessible
- Integrated source requires no high voltage cable
- No special floor treatment required

SAFETY AS A DESIGN CRITERION

- Continuous fail-to-safe monitoring
- Full protective enclosure requires no special badges or protective clothing
- Lead-lined cabinet fully complies to DIN 54113 radiation safety standards and CE regulation

REAL-TIME INSPECTION

Interactive and user-friendly software is essential in evaluating the complex internal structures, performing accurate inspection, providing defect recognition with confidence.

Inspect-X has been designed around the user experience, resulting in intuitive and productive X-ray inspection. Inspect-X features user friendly wizards to guide users through complex inspections, as well as utilizing the most advanced visualization and analysis function capabilities. XT V systems with Inspect-X enable rapid deployment of new product lines, within minutes, rather than hours or days.

INSPECT-X CONTROL SOFTWARE

- Workflow based – all necessary controls available to the user's workflow
- Various user access levels for supervisors and operators
- Quick access toolbar to most applicable functions
- Minimum training time
- Board map for quick sample overview
- Collision avoidance between all components of the system and sample
- All functions included as standard; no add-on modules required

REAL TIME X-RAY INSPECTION

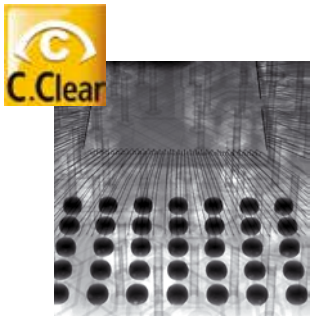
- On-screen joysticks and mouse gestures, as well as conventional intuitive joystick control, for interactive live part positioning
- Variable magnification and tilted viewing angle allow real time detection of defects such as head-in-pillow.
- Magnification, tilt and rotate in all positions whilst maintaining a region of interest consistently locked into the center of the field of view
- C.Clear imaging engine provides crystal-clear live images
- Real-time imager (30 frames per second) for interactive visualization

WITH ADVANCED ANALYSIS

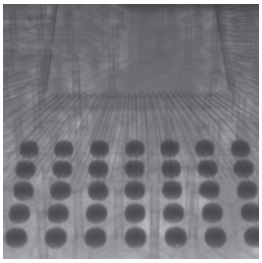
IMAGE ANALYSIS AND ENHANCEMENT

Making real-time correct decisions requires crystal-clear and sharp images. The C.Clear real-time image engine enables operators to identify defects with confidence without time consuming image enhancements.
C.Clear intelligently adapts to changing X-ray conditions and sample positions, automatically adjusting image controls, contrast and brightness in order to provide the clearest and sharpest images to aid in defect recognition.

- Real-time enhancements and filters stored as user profiles to suit different sample types or individual operator preferences.
- Image processing filters (sharpen, smooth, edge detect, emboss, background subtract, etc.)
- Image histogram



C.Clear improves X-ray image quality to facilitate real-time defect recognition



Real-time image without C.Clear

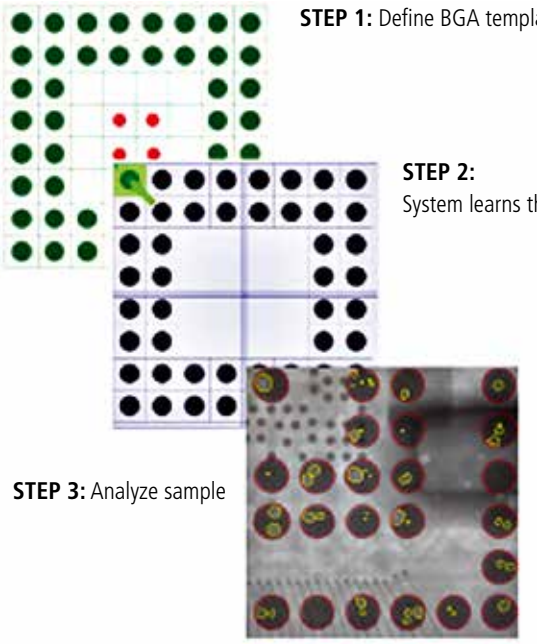
BGA DEVICE INSPECTION

The BGA device inspection functionality is an 'all-in-one' tool offering automatic analysis of:

- Voiding (single and total ball percentage)
- Ball circularity
- Ball count
- Bridging
- Pass/Fail detection

With its powerful image processing algorithm, the tool gives accurate results even in complex board assemblies with underside components.

The tool allows creation of an internal library of BGA templates using a wizard or via file import to reduce the time taken to build automated pass/fail inspection routines.



STEP 1: Define BGA template

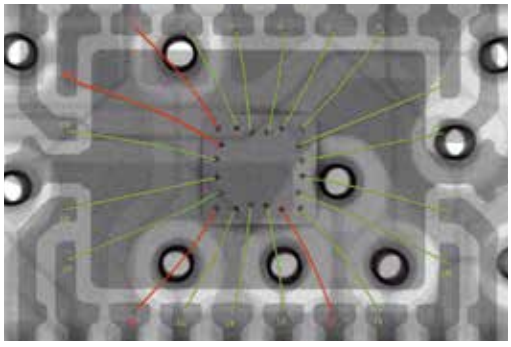
STEP 2: System learns the BGA

STEP 3: Analyze sample

BOND WIRE ANALYSIS

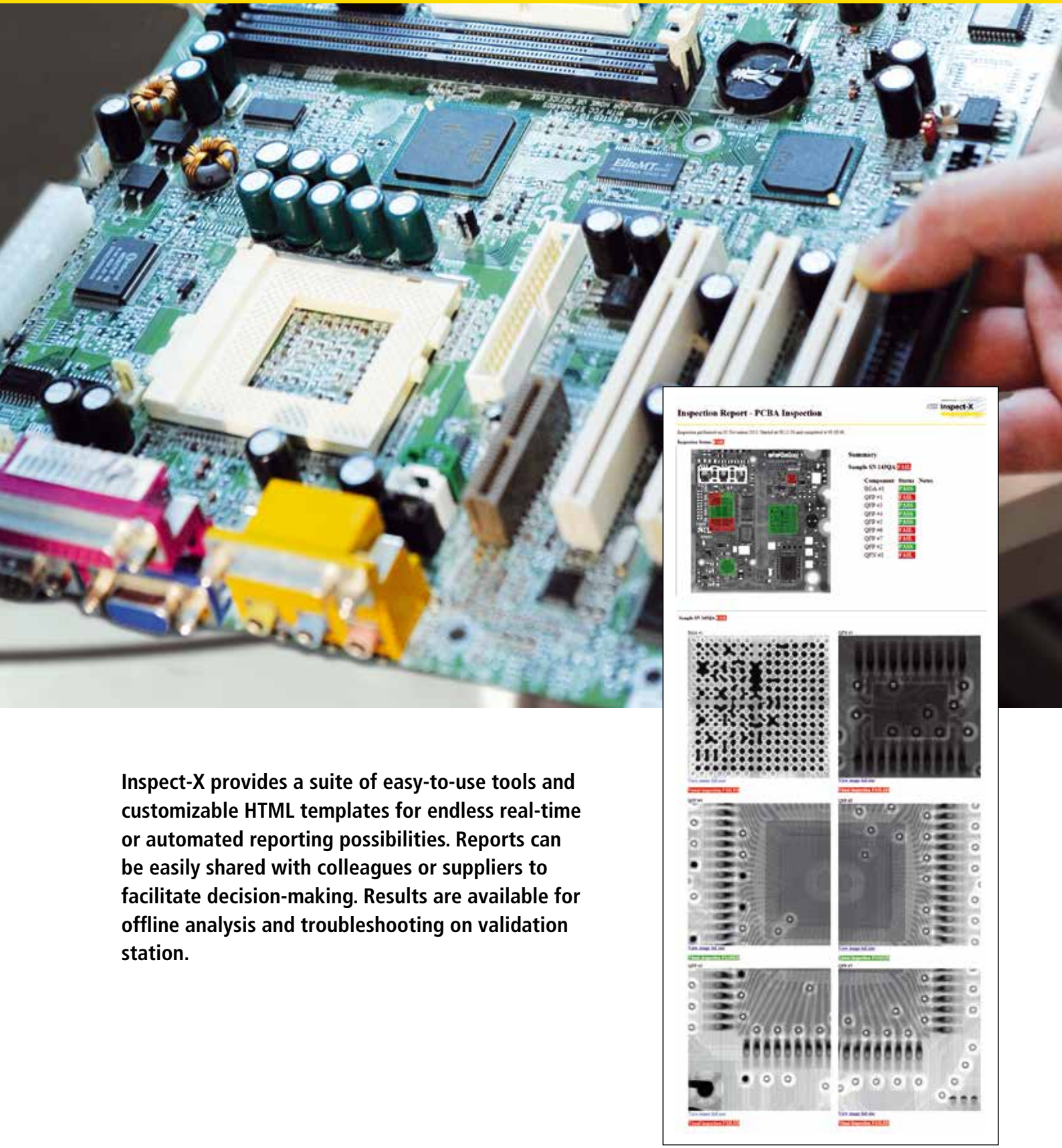
Featuring high magnification and (sub)micron feature detection, the XT V platforms equipped with Inspect-X are a powerful tool for advanced bond wire inspection. The new automated multi-bond wire tool provides repeatable inspection with the highest accuracy.

- Identify and detect broken bond wires and wire sweep with pass/fail status
- Automatically analyze multiple bond wires on a device in a single inspection
- Component templates can be saved to an internal library, aiding rapid future builds of inspection routines.



Bond wire analysis

INSIGHTFUL REPORTING

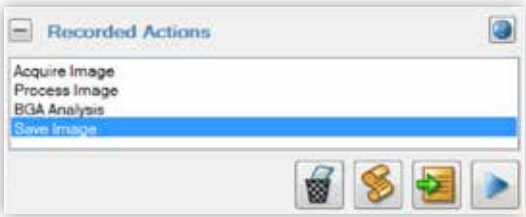


Inspect-X provides a suite of easy-to-use tools and customizable HTML templates for endless real-time or automated reporting possibilities. Reports can be easily shared with colleagues or suppliers to facilitate decision-making. Results are available for offline analysis and troubleshooting on validation station.

FOCUSING ON PRODUCTIVITY

Operating in automated inspection mode, the XT V combined with Inspect-X is a productive X-ray solution for repeated inspection of PCBAs, semiconductor components and complex high density boards. Creation and execution of inspection routines is straightforward, utilizing the graphical interface or teach and learn.
Users requiring detailed insight of (multi-layer) electronic components can benefit from the X.Tract or Computed Tomography functionality for a full 3D view of internal structure.

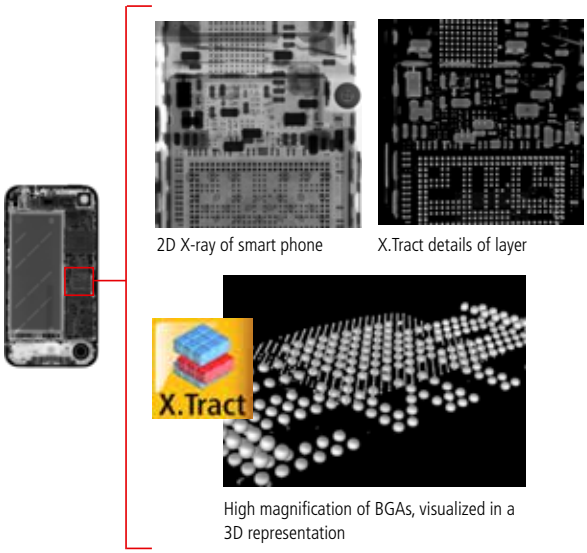
Intuitive icons help the user to interactively build an automated inspection routine



Macro-based recording enables the user to program for repeated inspection or batch analysis

AUTOMATED INSPECTIONS

- Macros for automating simple repetitive tasks
- Automated inspection and analysis of full boards or multiple components
- No programming skills required, utilizing graphical interface or teach and learn
- Intelligent Program Control (IPC) for customizable system control
- Off-line validation station giving maximum efficiency of the X-ray system
- HTML reporting function, readable on any PC with no special software
- Switch seamlessly between radiographic (2D) and CT (3D) modes in one single software
- Visual check during automated inspection allows interactive inspection



2D X-ray of smart phone

X.Tract details of layer

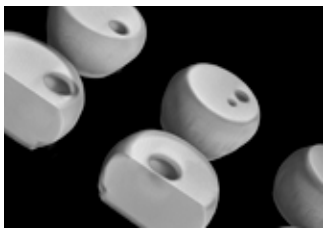
High magnification of BGAs, visualized in a 3D representation

SEE MORE WITH X.TRACT

X.Tract provides CT-quality inspection results of complex, multi-layer electronics assemblies without slicing them. In a rapid and user friendly process, it enables virtual micro-sections in any direction in the region-of-interest. X.Tract reveals defects that are obscured in 2D X-ray images of complex components such as Package on Package (PoP) or double sided boards. With X.Tract, users gain better insights leading to reduced false call rates and higher productivity.

READY FOR CT

- CT acquisition and analysis as factory option or field upgrade
- Easy, user guided, CT data collection
- Fast Rescan – rescan in only two steps
- World-leading reconstruction times
- Automatic reconstruction of CT data streamed from XT V system
- Powerful CT analysis in the software of your choice



Voids in BGA (CT image)

SPECIFICATIONS

	XT V 160	XT V 130C
Max kv	160 kV	130 kV
Max. electron beam power	20 W	10 W
X-ray source	Open tube transmission target	
Focal spot size [1,2]	1 µm	3 µm
Feature recognition [1]	500 nm	2 µm
Geometric magnification	2.5x - 2,400x	
System magnification	Up to 36,000x	
Imaging system (Standard)	1.45 Mpixel 12bit camera with dual field 4”/6” image intensifier	1.45 Mpixel 12bit camera with 6” image intensifier
Imaging system (Option)	1,45 Mpixel 12bit camera with dual field 4”/6” image intensifier (XT V 130C) Varian 1313DX (1 Mpixel, 16-bit) Flatpanel Varian 2520 (2 Mpixel, 14-bit) FlatPanel	
Manipulator	5-axis (X, Y, Z, T, R)	4-axis (X, Y, Z, T)
Rotate axis	Included	Optional
Tilt	0 - 75 degrees	
Measuring volume	Largest square in single map 406 x 406 mm (16x16") Absolute max 711x762 mm (28x30")	
Max. sample weight	5 kg (11 lbs)	
Monitors	Dual 22” flat screen 1920 x1080 pixels (standard) Single 30” flat screen 2560 x 1600 pixels (optional)	
Cabinet dimensions (WxDxH)	1,200 x 1,786 x 1,916 mm (48.0 x 71.3 x 75.4”)	
Weight	1,935 kg (4,266 lbs)	
Radiation safety	<1 µSv/hr at the cabinet surface	
Control	Inspect-X control and analysis software	
Automated inspection	Included	Optional
Computed Tomography	Optional	
Primary applications	Real-time and automated electronics and semiconductor inspection	Real-time electronics inspection

[1] at 80 kV, 80 µA
[2] below 2 W

XTV_SERIES_EN_0416– Copyright Nikon Metrology NV 2016. All rights reserved. The materials presented here are summary in nature, subject to change and intended for general information only.

NIKON METROLOGY NV
Geldenaaksebaan 329
B-3001 Leuven, Belgium
phone: +32 16 74 01 00 fax: +32 16 74 01 03
Sales.NM@nikon.com

NIKON CORPORATION
Shinagawa Intercity Tower C, 2-15-3, Konan,
Minato-ku, Tokyo 108-6290 Japan
phone: +81-3-6433-3701 fax: +81-3-6433-3784
www.nikon-instruments.jp/eng/

NIKON METROLOGY EUROPE NV
tel. +32 16 74 01 01
Sales.Europe.NM@nikon.com

NIKON METROLOGY GMBH
tel. +49 6023 91733-0
Sales.Germany.NM@nikon.com

NIKON METROLOGY SARL
tel. +33 1 60 86 09 76
Sales.France.NM@nikon.com

NIKON METROLOGY, INC.
tel. +1 810 2204360
Sales.US.NM@nikon.com

NIKON METROLOGY UK LTD.
tel. +44 1332 811349
Sales.UK.NM@nikon.com

NIKON INSTRUMENTS (SHANGHAI) CO. LTD.
tel. +86 21 5836 0050
tel. +86 10 5869 2255 (Beijing office)
tel. +86 20 3882 0550 (Guangzhou office)

NIKON SINGAPORE PTE. LTD.
tel. +65 6559 3618
nsg.industrial-sales@nikon.com

NIKON MALAYSIA SDN. BHD.
tel. +60 3 7809 3609

NIKON INSTRUMENTS KOREA CO. LTD.
tel. +82 2 2186 8400

More offices and resellers at **www.nikonmetrology.com**

FSC
www.fsc.org
MIX
Paper from responsible sources
FSC® C105085