Technical Data of the FXS-160.40
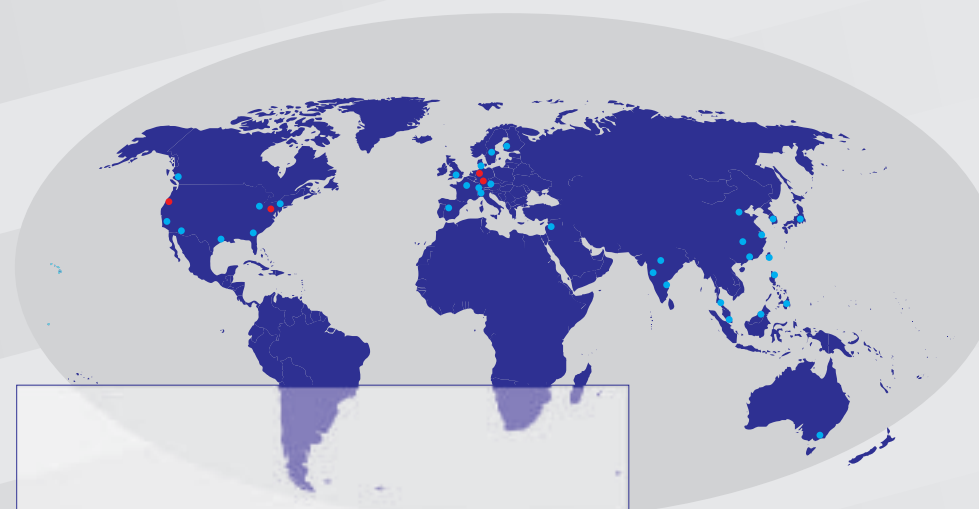
X-Ray Microscope	
High voltage range:	up to 160 kV
Tube current range:	max. 1 mA
Target:	Tungsten transmission target
TXI (True X-ray Intensity):	Control for long-term intensity stability
Manipulator	
Maximum sample weight:	5 kg / 11 lbs
Maximum sample size (standard):	610 mm x 508 mm / 24" x 20"
Optional: extra-large sample tray	610 mm x 610 mm / 24" x 24"
Maximum Inspection Area:	610 mm x 508 mm / 24" x 20"
Maximum field of view:	68 mm x 51 mm / 2.6" x 2"
Geometrical magnification:	up to 636-fold
Maximum magnification:	up to 2800-fold
Sample tray axes:	x- and y-axis
Tube axis (for magnification):	z-axis
Image intensifier axes:	B-axis (tilting 0°-60°),
	C-axis (rotating 0°-360°)
Integrated anti-collision mechanism	
Fully CNC programmable	
TV-Chain	
6" dual-field image intensifier	
CCD-camera	
Graphical User Interface (GUI)	
Flat panel monitor	
Image Processing Software FIP-600	
Real-time image processing	
Standard network connection	
Feature recognition	< 1 µm
BGA module	
Maintenance	
Easy front-side access to all components	
System Data	
Floorspace:	Not larger than footprint (L x W)
Measurements:	L 1880 mm x W 1700 mm x H 2120 mm
System weight:	3500 kg / 7716 lbs
Radiation safety:	Emission < 1µSv/h
Power:	220/380 V; 50/60 Hz
Duty cycle:	100%
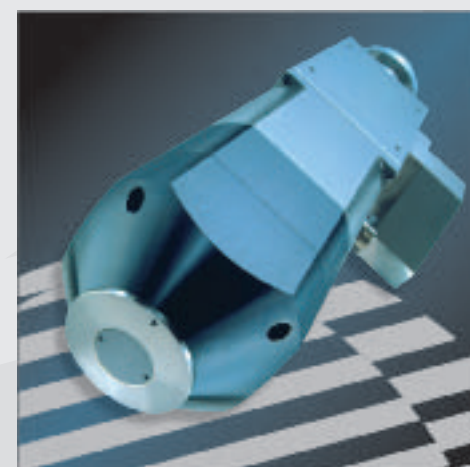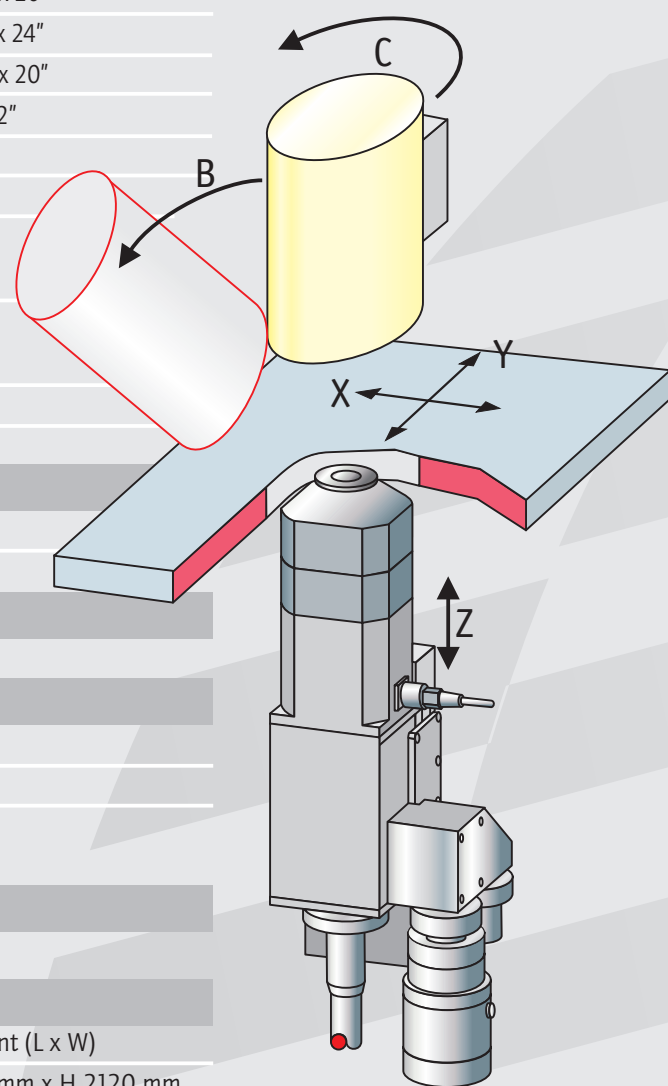
All FEINFOCUS FXE X-ray inspection products feature a demountable X-ray tube assembly, vacuum unit, and high-voltage generator. To meet specific application requirements, the FXE may be equipped with a variety of optional components, including an image intensifier, image processing unit, video printer, color monitor, and other options. The radiation head and radiation power employed (100kV, 160kV or 225kV) are determind by the material, sample size and maximum magnification required.

Features:

- Unlimited lifetime due to open-tube design
- Modular construction reduces maintenance requirements
- Highest direct magnification
- TXI (True X-ray Intensity) Control for long-term intensity stability
- Automated system warm-up and initialization
- Autofocus (automatic regulation of the microfocus according to the selected parameters)
- User-friendly, clearly organized operating console
- X-ray program storage for recurring applications
- Microprocessor-based control of all relevant parameters to ensure optimal performance (focal spot size, filament current, electron beam, etc.)

FXS-160.40 - The TIGER* Way of Inspection.

* Test and Inspection of Grid-Arrays by Easy Radioscopy

- FEINFOCUS Subsidiaries
- FEINFOCUS Representatives

FXS-160.40 - Ideal for Powerful Board Inspection

Features:

- **O**blique **V**iews at **H**ighest **M**agnifications
- Tilt (60°) and rotate (360°) detector for inspection under different angles
- Large field of view for PCBs of up to 24" x 24" (61cm x 61cm)
- Easy positioning of the sample using on-screen camera image
- FEINFOCUS exclusive AIM (**A**uto **I**socentric **M**otion) Technology
- State-of-the-art real-time image processing
- Integrated anti-collision feature
- Particularly user-friendly
- X-ray program storage
- Modern, ergonomically designed operation console including flat screen monitor
- Full CNC capability

Field of Application:

The trends in PCB manufacturing are toward more compact designs and more layers. In the production of Flip-Chips and BGAs, the highly selective, non-destructive testing and inspection capability of microfocus X-ray has become an even more important factor in quality control and process analysis.

With this in mind, FEINFOCUS has developed the FXS-160.40 microfocus X-ray system to meet the rigorous needs of the PCB assembly industry.

Particularly user-friendly and requiring a minimum of space, the FXS-160.40 is typically installed next to production lines for rapid random sample inspection 24 hours per day. Its exceptional ease-of-use allows operators without any prior application experience to accurately perform critical sample inspections.
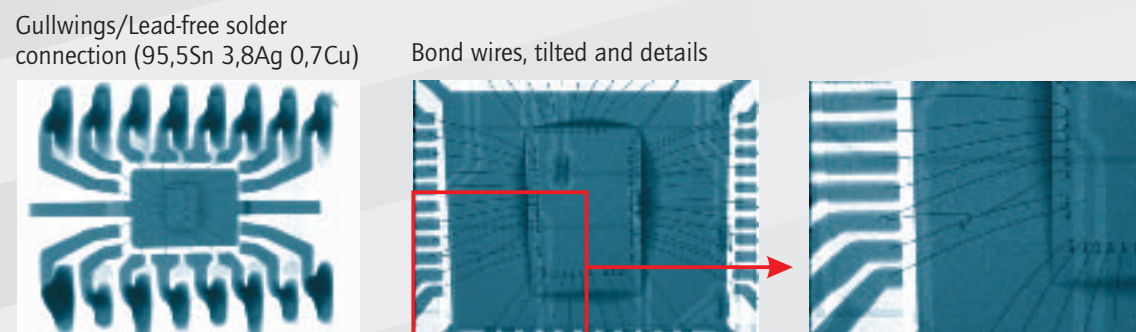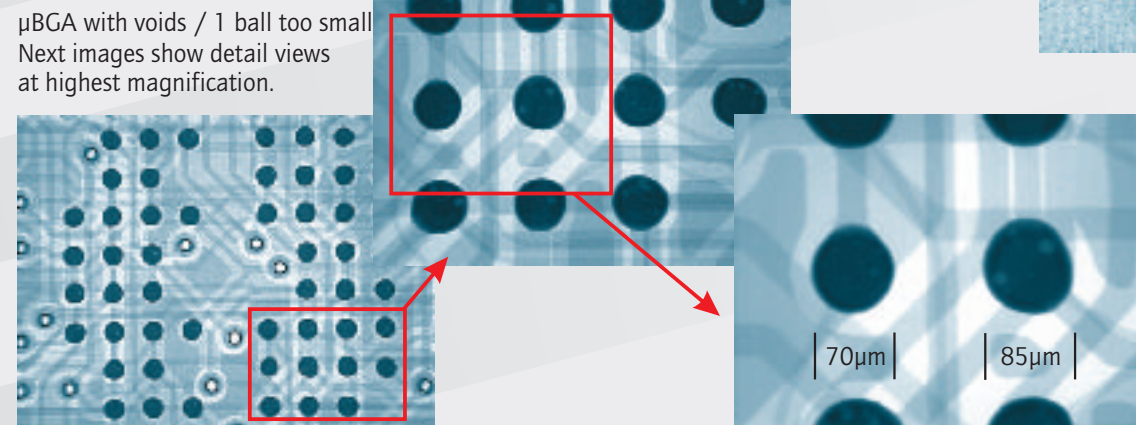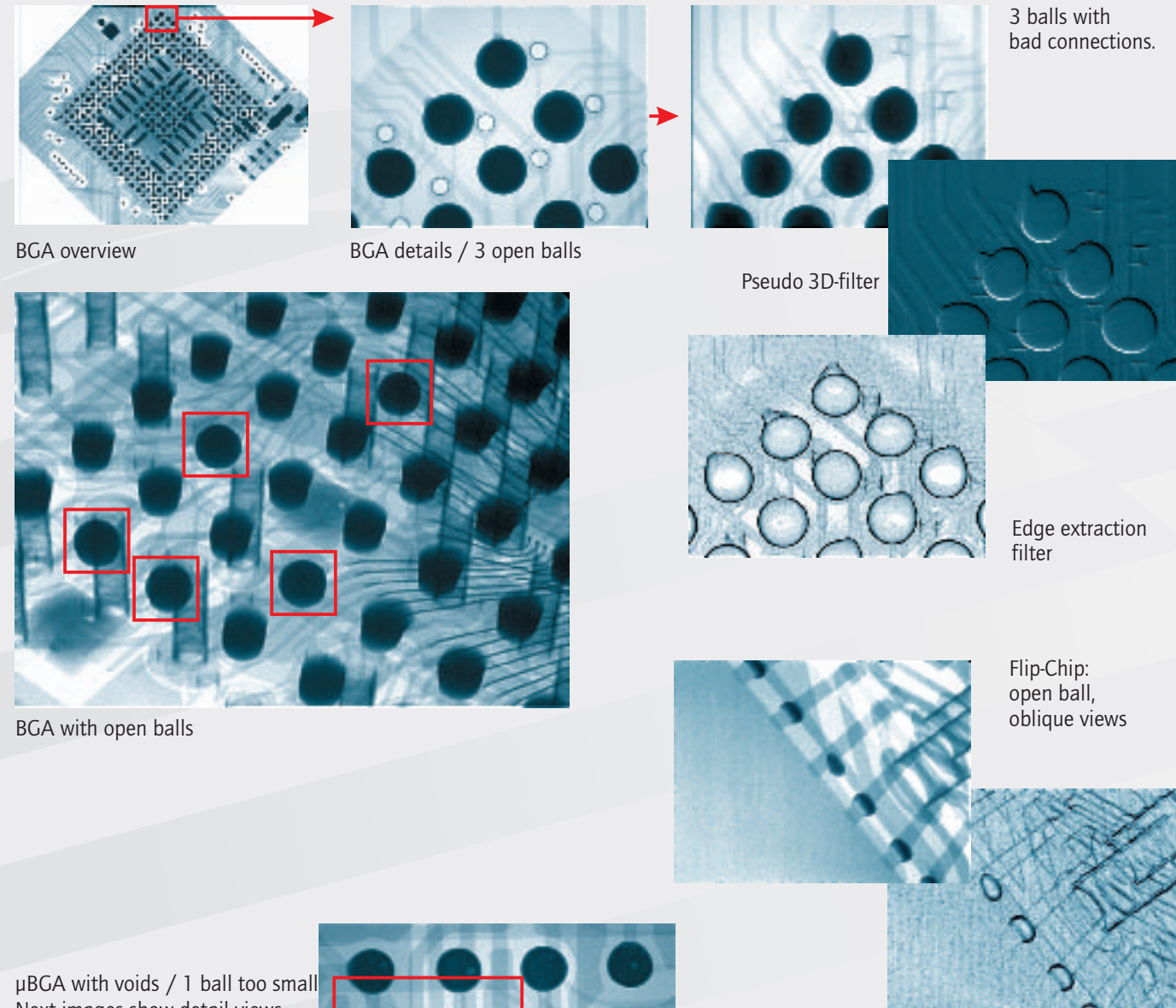
History / Development:

This latest FEINFOCUS X-ray inspection system was designed, developed, and assembled by an interdisciplinary project team addressing our customers' requirements and the most recent technological trends.

As the first new generation system developed by FEINFOCUS in the year 2000, the award-winning FXS-160.40 (TIGER) has been well received by the industry for its unique modular design, state-of-the-art software, and sophisticated technical capabilities.

Description:

The FXS-160.40 is a completely new and unique design. Cumbersome viewing windows have been eliminated, since all possible opportuniti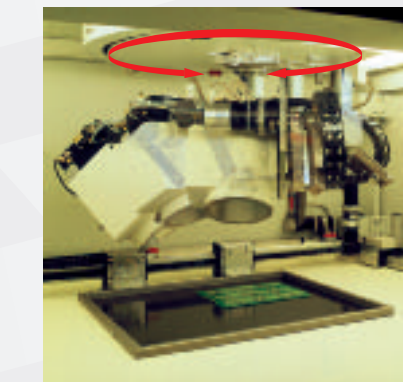es for sample and tube collision have been eradicated using software-controlled manipulation. Any sample can be positioned easily using the on-screen camera image. The graphical user interface (GUI) displayed on the flat-screen monitor offers sample positioning assistance through the use of on-screen icons, and a simple mouse click on the magnifying cross-hairs in the camera image moves the sample to your region of interest (ROI). Clicking on the screen's directional control grid triggers the image intensifier to tilt and/or rotate according to the specified angles. This is particularly important in real-time inspection of compact components requiring oblique views at highest magnifications (cf. "TIGER Technique" section). Adding to its user-friendliness is the system's modular design featuring front-access service doors for easier maintenance and reduced floor space requirements.

BGA overview

BGA details / 3 open balls

3 balls with bad connections.

Pseudo 3D-filter

BGA with open balls

Edge extraction filter

Flip-Chip: open ball, oblique views

µBGA with voids / 1 ball too small. Next images show detail views at highest magnification.

| 70µm | 85µm |

Gullwings/Lead-free solder connection (95,5Sn 3,8Ag 0,7Cu)
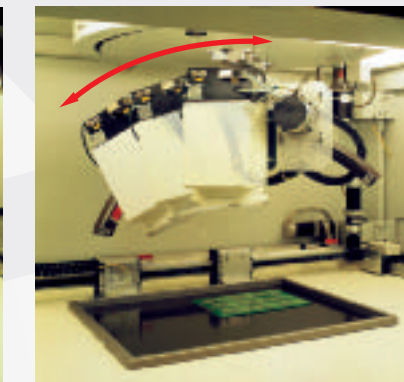

Bond wires, tilted and details

The FEINFOCUS TIGER Technique

More compact designs and more layers - these are the current trends in the electronics industry and the challenges facing X-ray system manufacturers.

Only oblique views ensuring deep insight into the solder fillet beneath the ball-grid can provide for accurate process analysis and quality assurance. However, the smaller geometries in BGA- and Flip-Chip-compon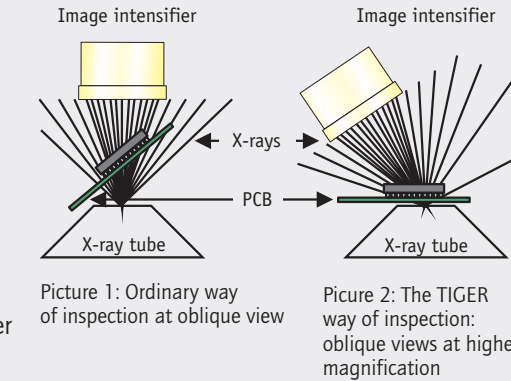ents need inspections from different angles at highest magnifications. This is only achieved by keeping the PCB near the X-ray focal spot. (Picture 2)

Other inspectors available on the market today tilt the PCB (instead of the image intensifier) for the oblique view, increasing the distance between the focal spot and the sample. The consequence is significantly lower magnification. (Picture 1)

With the TIGER system, all functions for µBGA and Flip-Chip inspection are included in one system. The integration of the proprietary **AIM technology** into the manipulator software design allows for 60° tilt and 360° rotation of the image intensifier and the ability to stop and view at any angle on the axis (Pictures 3 and 4), featuring **Frame and Zoom**, **Click and Center**, as well as **Tilt and Circle** while the ROI remains consistent in the viewing center, at any magnification.

Picture 1: Ordinary way of inspection at oblique view

Picture 2: The TIGER way of inspection: oblique views at highest magnification

Picture 3: Image intensifier in rotation

Picture 4: Image intensifier tilting
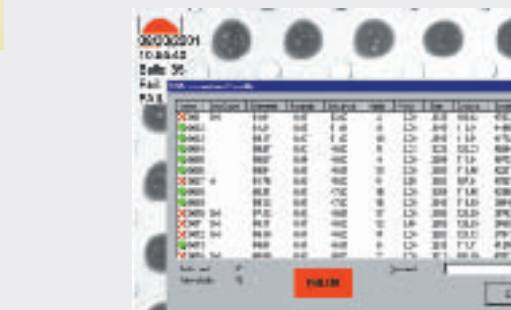
The Software

The TIGER GUI (graphical user interface) is clearly organized, comprehensive and easy-to-use. The system is equipped with the FEINFOCUS real-time image processing system FIP-600 including a fully CNC-programmable manipulator and BGA module. The **BGA module** allows for automatic BGA measurement and analysis. The user can choose from various criteria (shown in the form of operators), for:

- Fully automatic measurement of a large variety of solder ball properties, incl. ball diameter, roundness, number of balls, distances, void percentage, solder mass, etc.
- Detection of common failures like bridging, excess solder, solder voids, misalignment, and missing balls, as well as others.
- Automatic component classification according to user-defined threshold values, and automatic creation of result tables and files (in ASCII code).

The user can determine a particular chronological order of inspection processes (incl. BGA analysis), save and rerun the entire process repeatedly via a teach-in CNC program.
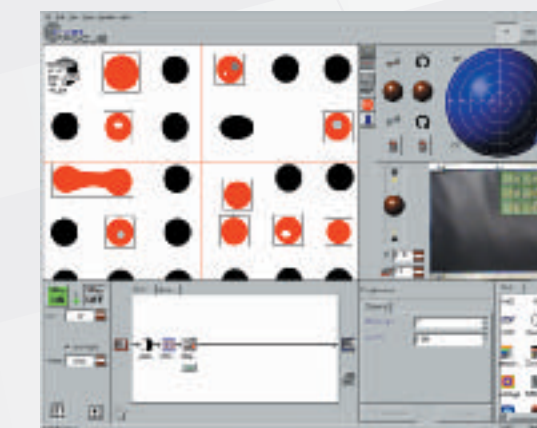
Picture 5: Graphical User Interface (GUI)