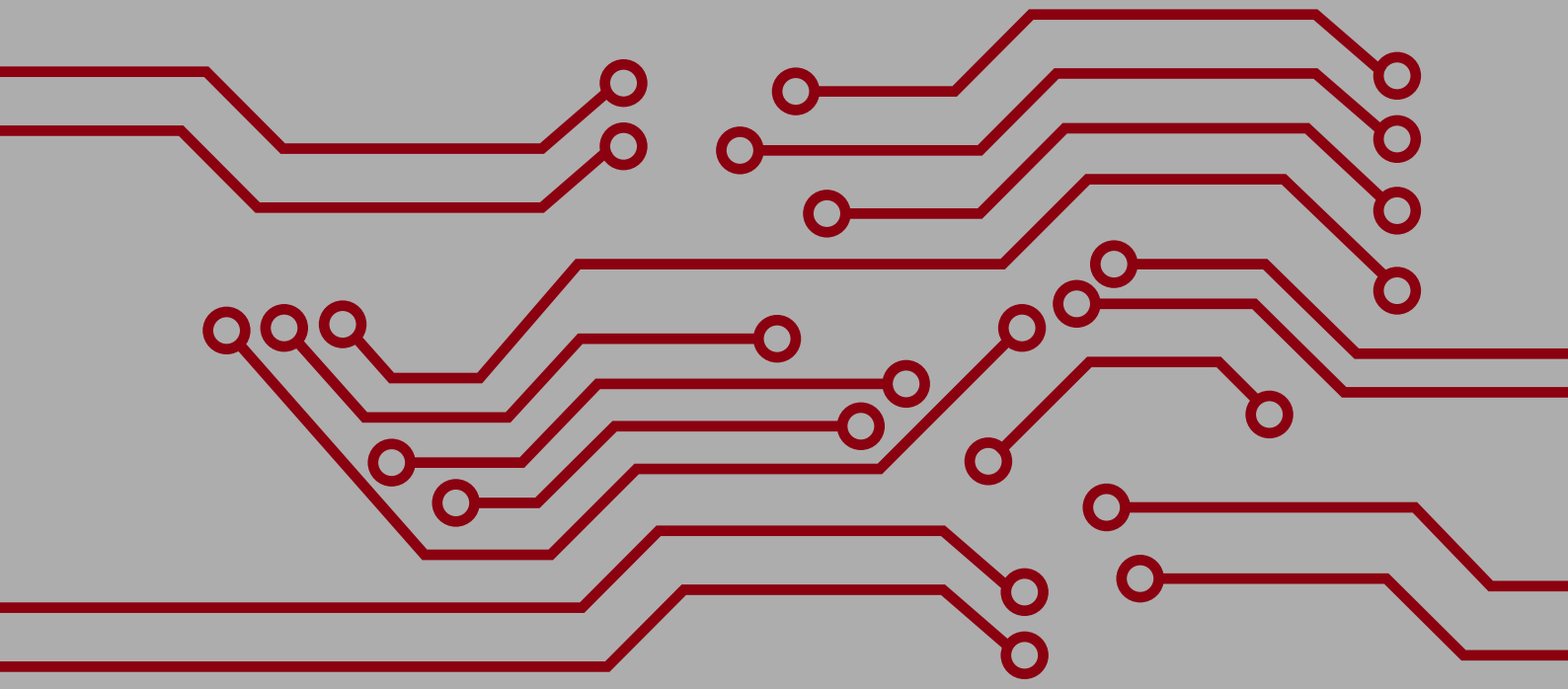
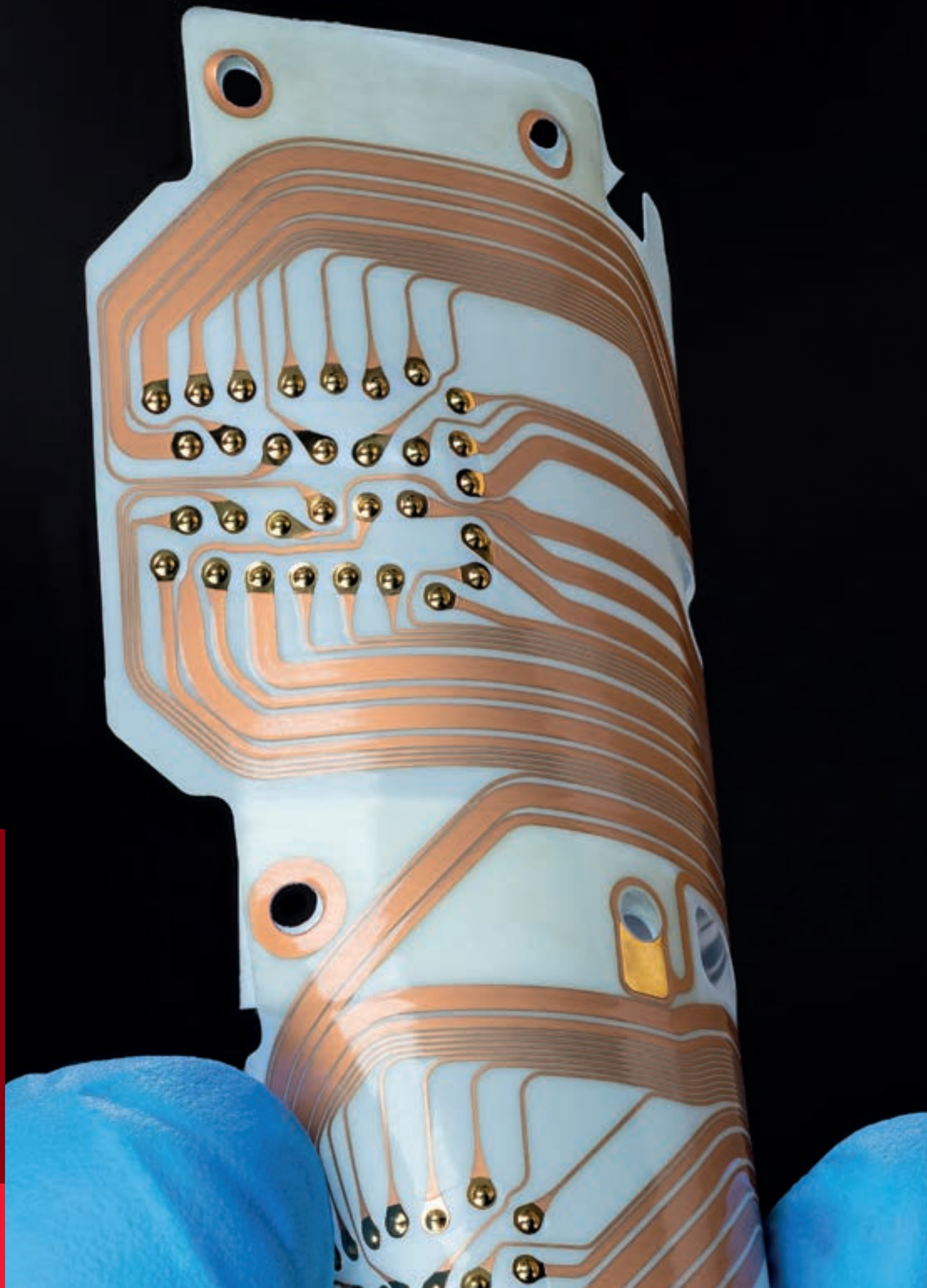
HITACHI
Inspire the Next

Analysis of PCB Final Finishes



FT230 FOR PCB



Introduction

PCBs are central to nearly every aspect of our lives, enabling us to communicate, travel, medicate, play, work and learn. They continue to become more advanced and miniaturized, increasing the packing density of more powerful components.

As industry moves toward 100% inspection to ensure products meet their expected lifetime, increased quality control and quality assurance testing of final finishes is anticipated. Improved quality control can also lead to reduced chemical consumption and scrap.

Board features and panel sizes may pose varying analytical challenges. However, all can benefit from simplified sample presentation and better precision to facilitate hundreds of XRF measurements each day.

Both the hardware configuration and software features of the XRF analyzer have significant impact on test programs. Having the right equipment in place allows operators to balance how much time will they spend working the production line and how much time they spend taking measurements with the XRF.

Analytical solutions

Hitachi specializes in high-tech solutions designed to help manufacturers maintain quality in a rapidly evolving environment which requires an XRF to be accurate, efficient, and easy to use. This combination allows for high testing volumes and frees up personnel to perform other tasks. Below are some features that can be found in Hitachi's XRF coatings analyzers, purpose built to improve your test program:

Focusing

Focusing is the process of establishing the distance from the X-ray tube to the part to the detector. This is a critical step, because changes to this distance may affect the accuracy and reproducibility of XRF results. Setting the focal distance can be done in several ways.

- **Manual focus:** a laser is shone onto the surface of the part and the operator moves the X-ray tube and detector up and down until the laser is positioning on the focus line. This is effective but can take time and requires the operator to make decisions.
- **Automated focus:** in this method the desired focal distance is selected during calibration setup. When setting up a measurement, the instrument uses a sensor to measure the distance and automatically moves the head into the right position. This is faster than the manual approach and removes operator influence.

The time needed to set up a 6-point program with parts of different heights can be reduced by 33% compared to manual focusing, saving 40 hours per year when running 50 batches per day.

- **Distance independent measurement:** this method doesn't require the analysis head to move. The instrument uses a sensor to measure the distance and updates the instrument's calibration to account for the geometry. This is the fastest method since the operator only needs to position the part under the X-ray tube before starting a measurement.

The time needed to set up a 6-point program with parts of different heights can be reduced by >60% compared to manual focusing, saving 76 hours per year when running 50 batches per day.

Camera view

The XRF has a camera for making fine adjustments to the position of the part being measured. The challenge for operators is first getting close enough to this location – the parts are small, and the chamber is large. In addition to the standard camera, a second wide-view camera can be used to get a view of the entire measurement area, then zoom in and select the feature to be measured. This means operators spend less time searching for the desired area.

The time needed to set up a 5-point program can be reduced by 20% compared to using only the standard narrow-view camera, saving 40 hours per year when running 50 batches per day.

Part and pattern recognition

Machine vision combined with powerful software recognizes parts or individual patterns to expedite measurement setup and increase testing volumes.

- **Find My Part™:** A part is loaded into the instrument, the recognition routine is started, the part is identified, and the instrument does the rest. The entire measurement routine is loaded – measurement locations, collimator sizes, calibrations, analysis time, data export rules and more. Operators do not need to make any decisions, and the setup takes seconds instead of minutes.

Starting a measurement using machine vision can be 72% faster – or quicker – than setting up a measurement manually, reducing the setup time from minutes to seconds

- **Pattern recognition:** The software looks for instances of key features and automatically makes fine adjustments to position the part precisely where needed. This is useful for measuring an area on a connector that is centered across the width and a defined length from the tip, for example, simplifying the task for the operator and ensuring parts are positioned and tested consistently.

Aperture style

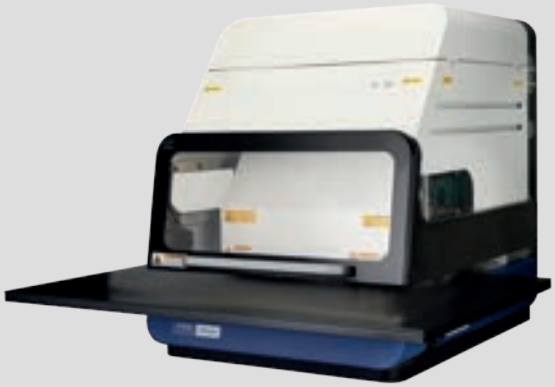
The X-ray beam generated by the XRF needs to fall within the size of the features being measured. If the beam is larger than the feature or part, the results will be inaccurate, as the analyzer will take the composition of the surrounding area into account. There are two main types of apertures that reduce the outlet from the X-ray tube to a usable size:

- **Mechanical collimator:** a metal block that has a hole drilled precisely through it. This stops a portion of the X-ray signal, only allowing a small amount to pass through the hole and reach the sample. Collimators can be round or rectangular and come in a variety of sizes.
- **Polycapillary optics:** a series of specialized glass tubes that collect more of the output from the X-ray tube and focus the output into a very small area – typically < 50 µm, which is smaller than what is possible with collimators. Since more of the tube output is utilized, more X-ray signal reaches the part, enabling an XRF to measure thinner coatings on smaller features with better precision in shorter measurement times.

XRF Coatings Analyzers for PCB

Our range of XRF analyzers help to ensure consistent and accurate coatings in electronics, measuring the smallest of features with a high degree of accuracy and reliability.

FT230



FT230: Advanced features for high-volume testing

Designed to simplify and accelerate testing of components and assemblies, the FT230 makes it easier to measure more parts in less time. Let your XRF make decisions for you.

The FT230 offers:

- Find My Part™ smart recognition for quicker setup times
- Automated sample focusing for increased throughput and ease of use
- Optional second, wide-view camera for easier feature locating
- Flexible connectivity for sending results to SCADA, QMS, MES and ERP systems, and diagnostics to Hitachi
- A large-area, high-resolution SDD for high precision on thinner and more complex coatings

	FT230
Detector	SDD
Aperture style	Mechanical collimation
Maximum number of apertures	4
Measure features < 50 µm	n/a
Manual focus (laser)	✓
Automated focus	✓
Distance-independent measurement	✓
Wide-view camera	✓
Part recognition	✓

X-Strata920

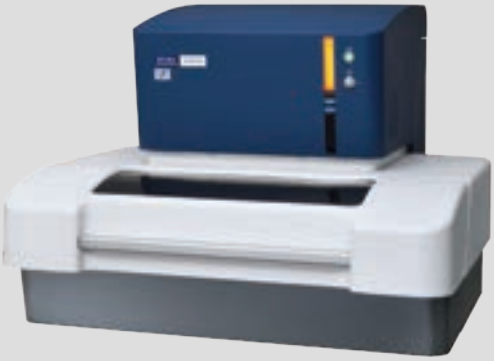
X-Strata920: XRF with your choice of analysis chamber

Designed to analyze samples of a wide variety of shapes and sizes, the X-Strata920 is ideal for many applications.

The X-Strata920 offers:

- A high resolution SDD option for complex coatings analysis
- Four configurations to fit samples of any shape
- A slotted chamber for small or long and skinny samples
- An optional mini-well chamber for taller parts
- An optional automated motorized stage for measuring several locations on a single component

FT160



FT160: Microspot analysis for miniaturized electronics

Designed for microspot and ultra-thin coatings analysis, the FT160's optics and detector technology are optimized for the smallest of features.

The FT160 offers:

- Polycapillary optics and a high sensitivity SDD detector for high precision
- Measurement of features smaller than 50 µm
- Fast results and simplicity of use to support high throughput
- A large door and stage for rapid part setup
- A large sample observation window to enable test viewing

X-Strata920	FT160
Proportional counter or SDD	SDD
Mechanical collimation	Polycapillary optic
6	1
n/a	✓
✓	✓
n/a	✓
n/a	n/a
n/a	n/a
n/a	n/a

Performance and results

Typical performance for common, representative applications is shown in the tables below. The precision was calculated from 30 repeat measurements. Precision is influenced by measurement time, collimator size, elements present and thickness range. In some cases, the error can be reduced by optimizing the calibration range for specific applications.

Typical performance for Au/NiP/Cu (ENIG, IPC-4552B) using a circular collimator with a diameter of 0.3 mm (12 mil)

Analyte	Tested range	Standard error	Precision (2σ)
Au	0.051 - 0.09 µm (2 - 3.5 µin)	0.025 µm (1 µin) or 5% relative whichever is greater	0.009 @ 0.09 µm (0.35 @ 3.5 µin)
NiP	0.45 - 5.7 µm (17 - 225 µin)	10% relative	0.012 µm @ 2.7 µm (0.5 µin @ 106 µin)

Typical performance for Au/Pd/NiP/Cu (ENEPIG, IPC-4556) using a circular collimator with a diameter of 0.3 mm (12 mil)

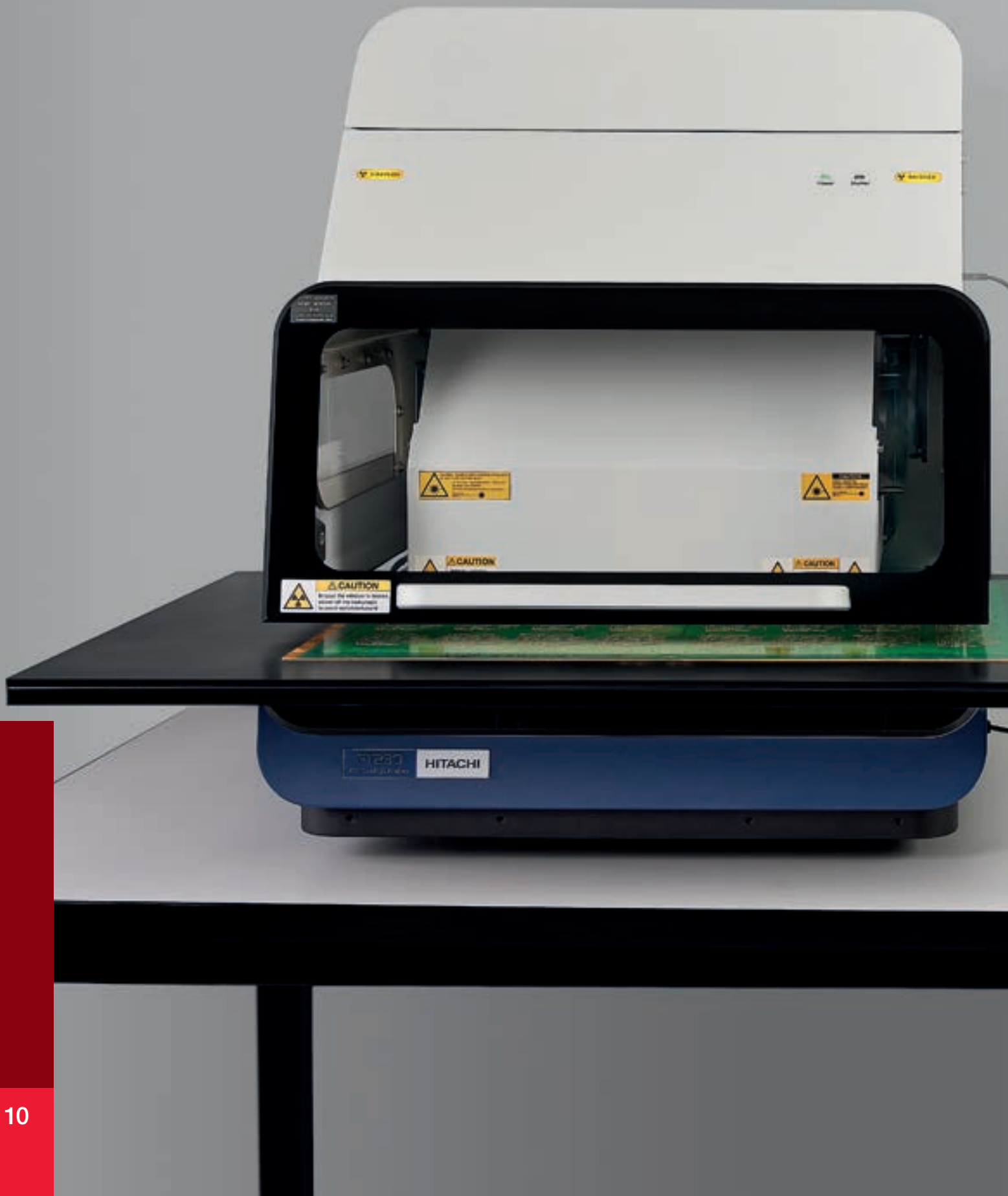
Analyte	Tested range	Standard error	Precision (2σ)
Au	0.051 - 0.49 µm (2 - 19 µin)	0.025 µm (1 µin) or 5% relative whichever is greater	0.003 µm @ 0.051 µm (0.11 µin @ 2 µin)
Pd	0.054 - 0.51 µm (2 - 20 µin)	10% relative	0.003 µm @ 0.054 µm (0.11 µin @ 2 µin)
NiP	2.4 - 5.7 µm (95 - 225 µin)	~15% relative	0.055 µm @ 5.7 µm (2.1 µin @ 224 µin)

Typical performance for immersion Ag/Cu (IPC-4553A) using a circular collimator with a diameter of 0.3 mm (12 mil)

Analyte	Tested range	Standard error	Precision (2σ)
Ag	0.105 - 0.5 µm (4 - 20 µin)	0.025 µm (1 µin) or 5% relative whichever is greater	0.009 µm @ 0.26 µm (0.35 µin @ 10 µin)

Typical performance for immersion Sn/Cu (IPC-4554) using a circular collimator with a diameter of 0.3 mm (12 mil)

Analyte	Tested range	Standard error	Precision (2σ)
Sn	2.16 - 4.9 µm (85 - 193 µin)	0.025 µm (1 µin) or 5% relative whichever is greater	0.087 µm @ 4.7 µm (3.4 µin @ 185 µin)


CAUTION
CAUTION
CAUTION
HITACHI

Summary

Hitachi's XRF products offer precise analysis of PCB final finishes.

Using Hitachi's traceable calibration standards, routine production samples can be simply and quickly measured by operators of any level. Results appear in seconds, allowing near instantaneous optimization of the production process. Over 1,000 applications have been optimized for Hitachi's coatings analyzers.

With its set of advanced productivity features and leading performance, the FT230 is the most comprehensive solution for measuring PCB final finishes.

To find out more about XRF analysis of your PCB final finishes visit **hhtas.net/electronics**

Contact one of our experts today at **contact@hitachi-hightech.com**

Hitachi High-Tech Analytical Science

ACCREDITED
CERT #3397.01

MIX
Paper from responsible sources
FSC® C007881