

Eagle Scope soars with Renishaw TONiC™ encoders



Customer:

Edec Linsey System Co.

Industry:

Electronics

Challenge:

Highly precise position feedback is required for the motorised positioning system of the Eagle Scope inspection microscope.

Solution:

Renishaw's compact non-contact TONiC encoder has been selected for the X and Y axes of the microscope motion stage.

Background

The production of high quality PCB assemblies is dependent upon the accuracy with which their basic elements: a substrate, conductive circuit patterns and electronic components, can be registered or aligned with one another.

Edec Linsey's latest inspection microscope, Eagle Scope, comprises three sub-systems: an image acquisition system, a mechanical positioning system and a micro-computer. The Eagle Scope is designed to support both surface mount technology (SMT) and photomask inspection. This model also supports passive electronic components as small as 0201 chips.

Precise movements are required to determine the X and Y coordinates of each target feature: the process of identifying each component in turn and obtaining accurate component data can be time-consuming.

The Eagle Scope CNC measuring microscope may be used to check the placement accuracy of components on a substrate whenever processes on a surface mount technology (SMT) or mask production line are changed and it can also be used for sample inspection of mass-produced substrates.

Smaller substrates and smaller components are increasingly used due to the continuing miniaturisation trend in electronic devices, which requires more accurate placement of components and detection of deviations in the order of microns to guarantee the highest quality.

// The accuracy of the microscope depends on the coordinate measurement accuracy of the X-Y stage. //

Edec Linsey System Co (Japan)

The microscope is expected to be widely used for SMT processes across a variety of industries both in Japan and overseas.

Challenge

Due to the high magnification of the Eagle Scope microscope, it is only possible to view a small region of the part (e.g. PCB) at a time. A motorised positioning system is, therefore, necessary for placing each region of interest within the field of view. The accuracy of the microscope depends on the coordinate measurement accuracy of the X-Y stage.



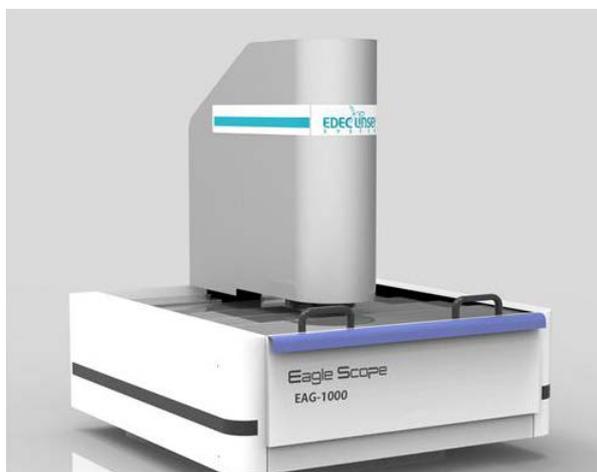
TONiC RELM encoder system

Edec Linsey System employed a position encoder on each axis to obtain highly accurate stage position data, and to improve motion control by a reduction in motion tracking errors along the X and Y axes.

Operation of the Eagle Scope is relatively simple and the operator needs only to input three reference points corresponding to the corners of a component. This gives the system enough information to draw the outline and determine component size. Furthermore, the inclination and centre of each component are calculated and stored in memory for comparison with nominal component position data. Offsets can then be applied to the SMT process to minimise placement inaccuracies. The Eagle Scope features a high degree of automation in order to maximise inspection throughput.

Solution

Renishaw's compact non-contact TONiC encoder has been selected for the X and Y axes of the microscope motion stage. TONiC readheads incorporate proven third-generation filtering optics, tuned for low positional jitter and further enhanced by dynamic signal processing including Auto Gain Control (AGC) and Auto Offset Control (AOC).



The Eagle Scope microscope

These functions are all integrated into the readhead and provide signals of unrivalled purity and ultra-low sub-divisional error of $<\pm 30$ nm. This enables the compact readhead to provide smoother velocity control for improved scanning performance and increased positional stability, which are essential parameters for motion stages.

The TONiC encoder system, capable of speeds up to 10 m/s in linear applications and providing a resolution of 1 nm when combined with Renishaw's Ti interface, is quick and simple to install with wide set-up tolerances and calibration at the push of a button. A set-up LED on the readhead also gives a visual indication of signal size and an optional diagnostic kit allows remote checking of the system performance when the readhead is integrated within the machine.

TONiC RELM scale was employed on both the X and Y axes of the Eagle Scope system. This low expansion 20 μ m-pitch scale is made from ZeroMet™, a nickel-iron alloy with an expansion coefficient (CTE) of $0.75 \pm 0.35 \mu\text{m}/\text{m}/^\circ\text{C}$. Its performance is equal to a fine-pitch glass scale and the total accuracy per metre is within $\pm 1 \mu\text{m}$ (including slope and linearity). The RELM scale was mounted on adhesive to allow for independent thermal expansion to that of the substrate (scale mastering).

FASTRACK™ carrier is also available for RELM scale mounting and provides similar independent scale thermal expansion. TONiC encoder systems provide improved signal stability and superior motion control performance in this application.



RELM linear scale

Results

The Eagle Scope is equipped with an Edec Linsey System-developed 25 megapixel camera, and supports wide-angle camera measurements at high speeds. Its unique, highly accurate stage control enables absolute position measurement with an accuracy of $\pm 5 \mu\text{m}$ over the full travel ranges of the X-axis (400 mm) and the Y-axis (300 mm), respectively. The Eagle Scope microscope also offers various convenient functions for users such as automatic measurement data generation based on CAD/Gerber data.



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About Edec Linsey System

Edec Linsey System Co., Ltd. (Edec Linsey System, Toyohashi, Aichi), a subsidiary of Fuji Machine Mfg. Co., Ltd., designs and manufactures production-line equipment, including image processing systems and CNC automatic measuring microscopes. It offers a wide range of products for applications in various fields from factory automation (FA) systems to information networks. Edec Linsey System has also established a reputation for creating innovative technology that offers customers some of the most advanced systems for image processing and wafer inspection solutions.

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