

Automated Optical Inspection

High-Tech made in Germany



Automated Optical Inspection (AOI)





OptiCon AOI System Series: High-Tech made in Germany

Innovative AOI Systems with traditional Know-How

The utilisation of innovative technology combined with traditional optical know-how and leading edge software architecture forms the core of the OptiCon systems' development philosophy. All core components primarily responsible for the systems' performance have been developed in-house by GOEPEL electronic. These are, for example, the camera module, illumination components and the communication system GigE_Connect. All additional modules are high-tech made in Germany, in cooperation with experienced

partners tailor-made for the inspection of mounted and soldered assemblies. In addition to short-termed customised adjustments, this development concept guarantees the immediate reaction to new test tasks and the integration of latest technologies. GOEPEL electronic's complete manufacturing range provides the key requirements for fastest possible implementations.

OptiCon AOI System Series: High-Tech at a Glance

Camera and Lens		Pixel adapted camera module for all system variants
		Telecentric lens for parallax-free image capturing
		Multi-directional image capturing by means of 360° angled-view module rotation
		Adapted focal plane at consistent image quality for angled-view inspection
Illumination		Multi-spectral illumination, selectable from IR to UV
		Selectable intensity and illumination direction
Measure and Test		Measuring functions with flexible parameter evaluation
		3D measurement by structured illumination
		Laser height measurement based on triangulation method
Inspection Software		Automatic detection algorithms without prior learning processes
		Adaptive detection software for changing objects based on neuronal structures
		Statistic measurement value analysis for test program optimisation
		User-specific GUI adjustment

AOI Systems for High-Mix and High-Volume

The wide range of the OptiCon system series and the flexible configuration variants make the system practical for small batches with high product variety as well as large scale production with highest yield. The fast inspection program generation and its convenient adaptability to manufacturing process variations also guarantees efficient utilisation for small batches.

Besides the AOI functionality, additional test methods (e.g. Boundary Scan)

can be customer-specifically integrated to increase fault coverage. The upgradeability of all components provides the AOI systems' adaptability to growing demands over a long period of operation.

Connections to MES or traceability systems are provided, ready to be adapted to meet requirements in specific production processes.

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OptiCon AOI System Series High-Tech in Detail

Image Quality

Ideal Selection and Adaption of Lens Components

A camera's pixel number or the information " $\mu\text{m}/\text{pixel}$ " are not the only critical quality criteria for the inspection of smallest components and required detail resolution. An ideal lens adjustment reduces diffraction effects and eliminates the "smearing" of image details. Having passed the lens, a light spot of minimum size will then cover not more than a single pixel of the sensor ensuring optimised contour sharpness and recognition of the smallest details.

Basis for ideal Fault Detection

A camera image's detail resolution is substantially responsible for a safe detection of components, solder joints and possible occurring faults. Together with a characteristic optimised image transformation, the OptiCon systems' pixel adapted camera module provides the highest optical resolution, providing the basis for the detection of solder joints and components down to size 01005.

360° Angled-View Inspection

Optical Know-How for a powerful Module

In addition to the optical resolution, the decisive criterion for angled-view inspection is the usable inspection panel's size. The limited depth of field of the used lens and the viewing angle are responsible for an inspection area reduction on a PCB. The depth of field's optical adaption to the PCB enables the utilisation of the entire field of view with consistent image quality.

The quick View into each Corner

By means of image detection in 1° steps, the 360° rotation of the angled-view **Chameleon** module provides the selection of suitable viewing angles, enabling the ideal inspection perspective in nearly all placement situations and pad geometries. The camera module offers excellent image quality within a large field of view, guaranteeing a time-optimised application.

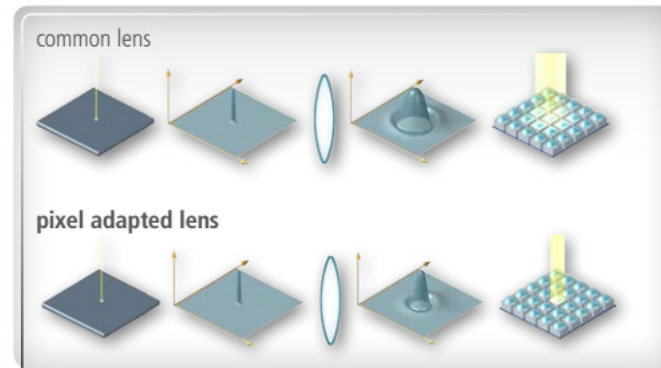
Flexible Multispectral Illumination

Contrast Enhancement by Illumination Variety

The illumination module of an AOI system is highly responsible for a safe separation of faulty solder joints and components from process variations. A flexible illumination concept provides the basis for ideal contrast ratio with respect to image analysis.

Freely selectable from Infrared to Ultraviolet

The OptiCon systems feature illumination modules with controllable wave length, intensity and direction. They also guarantee safe detection of low-contrast components, polarity marks, material differences and contaminations. These features provide the basis for safe high detection of production faults as well as false call rate minimisation. All illumination variants are predefined in library entries for automatic program generation and can be adjusted for a specific PCB if required.



Optical resolution with common and pixel adapted lenses

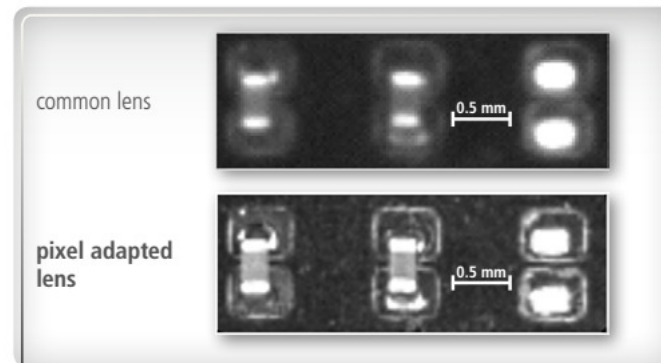
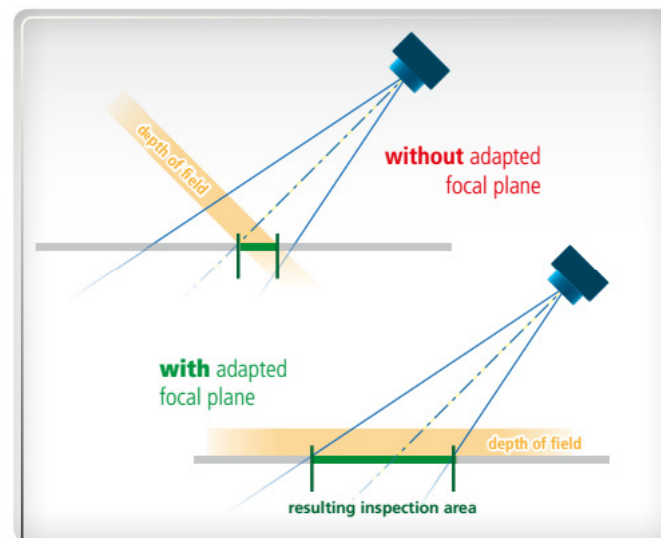


Image capturing of 01005 components with common and pixel adapted lens



Usable inspection area on PCB without and with adapted focal plane



Inspection of hidden fine pitch IC with angled-view Chameleon module

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OptiCon AOI System Series: High-Tech for efficient Utilisation

Flexible Measuring Functions for the third Dimension

Safe Laser Triangulation for variable Inspection Tasks

Component and material diversity is particularly challenging for 3D measurement procedures. Triangulation methods must provide precise results for anodised matt black as well as highly reflective surfaces. Height measurement systems with surface dependent controlled laser emission guarantee maximum measurement accuracy for such applications.

Fault Detection aloft

Optionally, the OptiCon AOI system series features laser height measurement systems that provide information about BGA coplanarity, height profiles of THT connectors or additional components independent of the test object. In parallel, shadow projection methods offer time-optimised measurement opportunities.

Modern Software Technologies

Adaptable Detection Algorithms

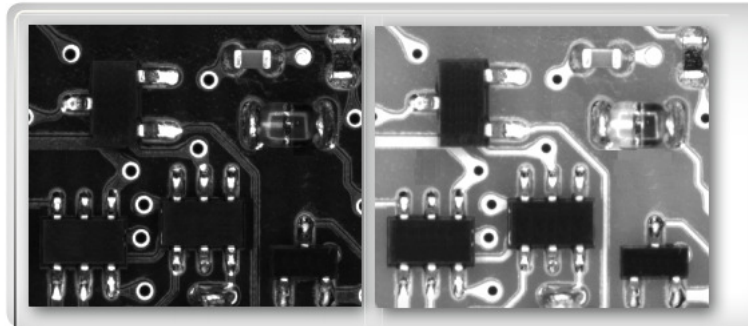
Due to various test tasks for electronic assemblies, there is a demand for flexible detection functions. Configurable image processing functions, adaptive inspection algorithms based on neuronal structures as well as detection software without prior learning processes provide an ideal basis for particular requirements.

Safe and documented Inspection Quality with high Operating Convenience

GOEPEL electronic's AOI system inspection software OptiCon PILOT provides a wide range of functions to perform test tasks and perfectly adapt component and process variations. Simple and convenient step-by-step operator guidance executes the automatic generation of inspection programs based on CAD data as well as the definition of new components.

The system software provides the creation of threshold values by means of statistically captured inspection data for an efficient transfer of generated test programs to the production process. Additionally, the integrated reference data base guarantees safe and documented inspection quality by test program verification through stored fault images.

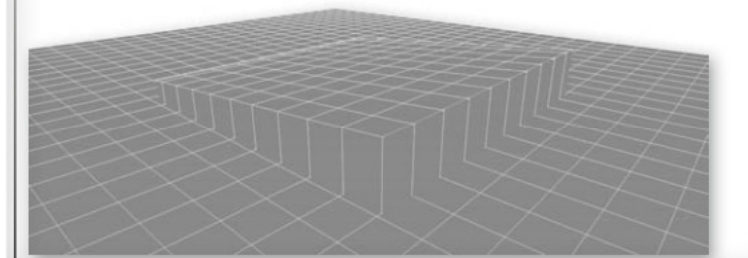
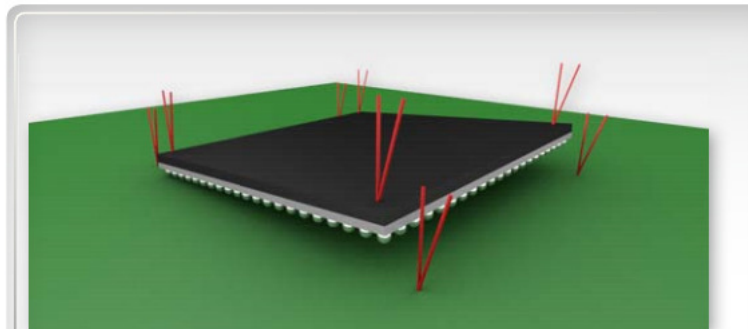
According to application and system operator, GUIs can be adapted to a specific user, providing maximum convenience for touchscreen operations.



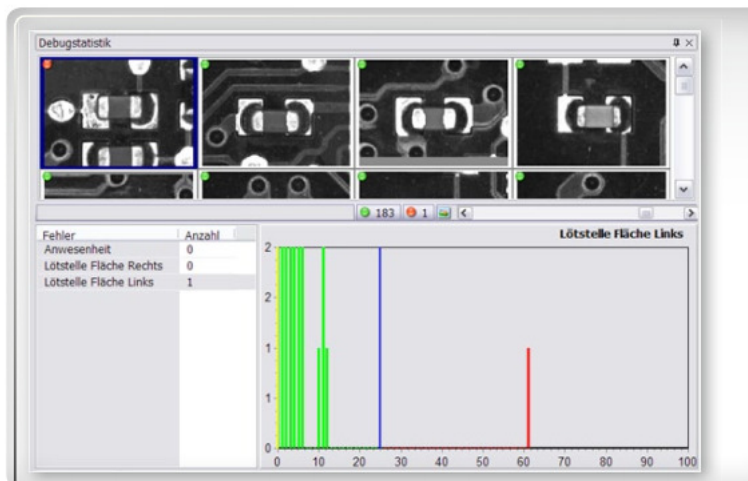
Component inspection with visible light and with infrared illumination



Fiducials detection with visible light and with ultraviolet illumination



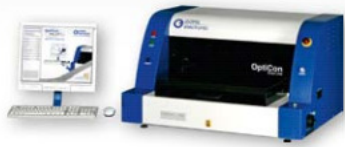
Coplanarity check at a BGA



Statistic measurement value analysis for program optimisation

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AOI Systems for High-Mix and High-Volume



OptiCon SmartLine

OptiCon SmartLine

Desktop AOI system for the efficient testing of small batches and single assemblies. The compact design enables the space-saving use at various places in the production environment.



OptiCon BasicLine

OptiCon BasicLine

Stand-alone AOI system for manual loading and flexible adaptation of different boards, single components and complex assemblies.



OptiCon AdvancedLine

OptiCon AdvancedLine

Stand-alone or inline AOI system for manual or automatic loading and flexible adaptation of different boards, single components and complex assemblies.



OptiCon THT-Line

OptiCon THT-Line

AOI System for the inspection of THT assemblies in a carrier. It can be used integrated in production lines as well as for work stations with manual loading.



OptiCon TurboLine

OptiCon TurboLine

Modular inline AOI System for shortest cycle times, configurable with camera modules for the inspection of PCB top and bottom sides.



Automated Optical Inspection (AOI)

Innovation and traditional Know-How



GOEPEL electronic's headquarters in Jena/Germany hosting business unit AOI

OptiCon AOI System Series: High-Tech for highest Demands

The OptiCon AOI systems are ideally suited for individual product mix and variable batches within a PCB production line, assured by more than 20 years of product evolution and several hundred system installations around the globe.

Excellent Support – GOEPEL electronic's Corporate Philosophy

In addition to technical highlights, GOEPEL electronic offers outstanding support on-site, via telephone and internet. A special customer-only website permanently provides the latest software updates and further useful information free of charge. Suggestions and requests are welcome at any time and implemented as soon as possible.

Industrial Location Jena – a Pool of Knowledge and Experience

For many years, Jena has been a place of technical and scientific progress. Masterminds such as Carl Zeiss, Ernst Abbe and Otto Schott founded the optical instrumentation manufacturing industry there and led it to world-wide acceptance through innovation and quality. The companies Carl Zeiss Jena and Schott became internationally established corporations, from which numerous high-tech companies were spawned in the early 1990s. They realised innovative ideas and successfully captured their market segments. One of these companies is GOEPEL electronic.



Ernst Abbe and Carl Zeiss around 1880

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GOEPEL electronic GmbH
Goeschwitzer Straße 58/60
••• 07745 Jena/Germany
Tel: +49(0)-36 41-6896-0
Fax: +49(0)-36 41-6896-944
E-Mail: sales@goepel.com
Internet: www.goepel.com

Authorised Distributor:

Accelonix
keeping you ahead.

Accelonix BV
Luchthavenweg 18b • NL-5657 EB •
Eindhoven • The Netherlands •
T: +31 40 750 1650 • E: info@accelonix.nl

sales@goepel.co.uk

sales@goepelusa.com

sales@goepel.asia

sales@goepel.fr

sales.india@goepel.asia