

120 megapixels for THT component inspection in the tightest spaces

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THT AOI: innovative and compact

Striving for the highest possible product quality results in increasing demands in all parts of the production of electronic printed circuit boards. That applies to assemblies with THT components, too.

Although THT technology had long been written off, it is once again playing a major role as a result of the strong growth in power electronics. It is not surprising, then, that there is also growing demand for optical inspection systems for THT assemblies. Special demands are being placed on AOI systems for THT assemblies by the necessary clearance heights of in some cases more than 100 mm or two-sided inspection. In general, the AOI systems should not of course become a bottle neck for throughput figures.

Looking at these demands, it could be supposed that AOI systems for THT inspection have a rather complex mechanical structure and as a result therefore require a large footprint. The innovative AOI system MultiCam Line from GÖPEL electronic GmbH shows that this does not necessarily need to be the case. With a system footprint of just 660 mm x 760 mm and an inspection area of 490 mm x 390 mm, the system has been developed especially for the integration of transport modules in production lines. The highlight of the whole thing is that the system manages without any kind of axis system for the camera module and thus operates completely wear-free.

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Figure 1: MultiCam Line

Key technology in multi-camera image capture

But what is behind this innovative concept? First and foremost, the AOI system stands out due to the integrated MultiEyeS image-capture module. This image-capture unit consists of a matrix arrangement of a defined number of cameras. The image capture from all cameras takes place virtually simultaneously, and the individual images are then assembled to form an overall picture. The system software also performs something which every amateur photographer appreciates when creating a panoramic photograph, known in the industry as "stitching". The individual images from the cameras are combined to form an overall picture using a stitching algorithm that is optimised for the application in question, meaning that there are a total of 12,000 x 10,000 colour pixels, i.e. a total of 120 megapixels, available for image capture of the inspection area. Since the image capture of the cameras is performed as far as possible in parallel and the stitching algorithm is trimmed for speed, a full-surface image of a component measuring 490 mm x 390 mm is available in less than 5 seconds. With a physical resolution of 40 μm , the MultiEyeS image-capture module focuses in particular on inspection tasks for THT placement monitoring and for inspection of protective coatings. A special advantage of this innovative image-capture concept is that no relative motion between the camera

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and inspection object is necessary for large-area image capture and that completely wear-free and maintenance-free AOI systems without an x/y-axis system are therefore possible.



Figure 2: MultiEyeS camera module

Modular system concept

The MultiCam Line can very easily be integrated in the manufacturing process, with minimal space requirements. One typical application is to set the system up on an existing conveyor belt. The extremely compact construction, with a footprint of just 660 mm x 760 mm, is particularly noteworthy. Despite these minimal space requirements, an inspection area of 490 mm x 390 mm is covered. This makes the system particularly interesting for production lines where THT placement is currently not being checked, or is being checked only by means of visual inspection. The system can easily be retrofitted here.

An essential requirement for AOI systems for THT placement monitoring stems from the height of the component to be inspected, which in some cases can be more than 100 mm. Accordingly, the clearance height and the inspection area must cover this area. Here, too, the MultiEyeS image-capture module scores well. Thanks to the optimised integration of the camera module, it has been possible to achieve a depth of field of more than 100 mm.

Creating test programs in the same way as on a tablet

Last but not least, an innovative device concept also involves an advanced operating concept. The newly developed PILOT AOI software uses numerous innovative software technologies: in addition to optimised data structures for test programs, libraries and test results, users have at their disposal additional algorithms for advanced inspection tasks thanks to advanced image-processing core

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software. A particular highlight is the integrated “SmartGuide”, with which GÖPEL electronic has developed an interface between operator and system in the style of touch-screen navigation for very fast, clear and neat creation of test programs. Even inexperienced users can create test programs quickly and conveniently. The clearly structured and smooth workflow in addition to the full touch-screen operation with large input fields make creating programs as easy as handling a smartphone.



Figure 3: PILOT AOI SmartGuide software

The PILOT AOI software also has, among other things, all of the features necessary for THT placement monitoring, such as presence, positional accuracy, polarity, colour verification and labelling (OCR). A flexible import module for all common insertion data, Gerber data and CAD formats is available for automatic test program generation.

PILOT Connect – The Future is Becoming Reality

PILOT Connect – this is the answer from GÖPEL electronic for all the challenges connected with the possibilities of Industry 4.0. First and foremost, PILOT Connect presents itself as a module for linking all the inspection data of automated optical inspection, solder paste inspection and X-ray inspection, with a full range of functions. The inspection, machine and operating data of the connected systems are centrally recorded and managed. Flexibility in particular guarantees the connection of various database systems: PILOT Connect can be linked both to MySQL servers, MSSQL servers and Oracle database systems. There is also an integrated interface with other MES systems. This ensures seamless

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traceability in the production process. The software still offers the opportunity for statistical evaluation of all the data. As a whole, there are therefore various possibilities for process optimisation.



Figure 4: PILOT Connect software

In the specific case of the MultiCam Line, all inspection data is captured by PILOT Connect and then supplied to a verification and repair station using the PILOT Verify software. Since the THT placement is typically monitored before the soldering process, incorrect placement can in this case easily be corrected.

Summary

For production lines where THT placement is currently not being checked, or is being checked only by means of visual inspection, integration of the MultiCam Line is the ideal opportunity to retrofit an AOI system. The completely wear-free and maintenance-free AOI system, which has no x/y-axis system, also offers the excellent opportunities for integration in other applications, too. The newly developed camera module MultiEyeS is the basis for the system's outstanding properties, such as maximum test

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speed, extreme depth of field and minimal space requirements. An advanced operating concept and extensive opportunities for process optimisation round off the innovative overall concept.

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