

Focus on the important - flexible inspection solution for selective solder joint checking

Selective soldering is always used when only a few THT components have to be soldered on a circuit board. In products with complex geometries selective soldering is often the only opportunity to realise solder joints. Such cases are met, for example, if an electronic circuit board is integrated into a housing. Car suppliers or customers from the aerospace industry in particular also expect automated, reproducible and traceable processes in the selective soldering of such assemblies. To ensure product quality, one thing is to be kept in mind here: the entire process chain is only as strong as its weakest link. A reliable automatic visual inspection of the selective solder joints is therefore indispensable. However, due to the complex geometry of the equipment being tested standard AOI systems are often unsuitable. That's why increasingly AOI integration modules are used, which are integrated into the periphery of the selective soldering systems.

Notwithstanding sustained miniaturisation, the use of SMD components and high integration density, THT components (Through Hole Technology) and wired components can often be found in many areas of electronics manufacturing. Particularly in the event of large electricity flows or high mechanical loads (e.g. switches and connectors) THT is almost irreplaceable. Usually all components are populated in the process of assembly production and soldered in a wave soldering process. If, however, an assembly is integrated into a housing later in the process and connected by the soldering of connection pins, large-scale wave soldering is not possible. Alongside these complex product geometries temperature-sensitive components made of plastic can also be responsible for the use of large-scale soldering not being possible.

Pressekontakt:

GOPEL electronic GmbH
Matthias Müller
Goeschwitzer Str. 58-60/66
D-07745 Jena

Tel: +49-3641-6896-739
Fax: +49-3641-6896-944
E-Mail: press@goepel.com
URL: www.goepel.com

GOPEL electronic GmbH • Göschwitzer Str. 58/60 • 07745 Jena, Deutschland

Tel.: +49-3641 - 6896 - 0
Fax: +49-3614 - 6896 - 944
E-Mail: sales@goepel.com
www.goepel.com



[Image 1: equipment being test with camera head]

Various selective soldering processes have established themselves for such applications. Induction, laser, piston and mini-wave soldering are classic examples. What's significant here is that every solder joint can be individually carried out and that the effectively soldered area is often only a few square millimetres in size, depending on the soldering process. Also, the soldering parameters can be individually and optimally determined for each and every solder joint.

For quality assurance in automated assembly production the use of visual inspection systems (AOI systems) have now established themselves as standard. Of course, errors cannot be ruled out in the process of selective soldering. For example, production errors on the solder side are short circuits, missing pins, insufficient soldering or solder beads.

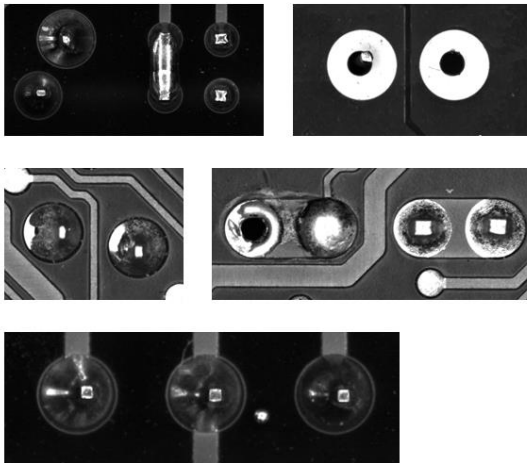
Pressekontakt:

GÖPEL electronic GmbH
Matthias Müller
Goeschwitzer Str. 58-60/66
D-07745 Jena

Tel.: +49-3641-6896-739
Fax: +49-3641-6896-944
E-Mail: press@goepel.com
URL: www.goepel.com

GÖPEL electronic GmbH • Göschwitzer Str. 58/60 • 07745 Jena, Deutschland

Tel.: +49-3641 - 6896 - 0
Fax: +49-3614 - 6896 - 944
E-Mail: sales@goepel.com
www.goepel.com



[Image 2: Possible production errors: short circuit, missing solder/missing pin, insufficient solder, missing pin, solder beads (from left to right, from top to bottom)]

Often the visual inspection of selective solder joints in already fitted assemblies is still a manual process. However, human errors cannot be ruled out: tiredness, varying estimations of error classification from person to person and missing traceability therefore also require an automated solution for the visual quality inspection in this area. The use of standard AOI systems most often fails because the assembly transportation is not set up for the handling of equipment to be tested with a complex geometry and would lead to an adaption with high costs. In order to still be able to realise an automatic visual inspection at the highest level GÖPEL electronic offers a flexible AOI inspection module for integration into the periphery of selective soldering systems.

Automatic visual inspection of selective solder joints

In the planning of assembly lines for electronic components it is increasingly required that as many installation steps are monitored with the help of automatic visual inspection. If the assembly line includes a selective soldering system, then this particularly applies to that process. The solder joints should be realised conforming to the IPC-610 guideline and furthermore be automatically visually checked. This ultimately leads to either the company responsible for automation or the supplier of the soldering cell receiving the order to integrate an inspection solution for the selective solder joints in the line. Only in seldom cases is the use of a standard AOI useful and possible. On the one hand, this is down to costs. On the other, the already mentioned geometry of the equipment being tested prevents its use. This means the optimum path to the realisation of a visual inspection of selective solder joints is sketched out and consists of integrating an inspection module directly into the soldering cell or into the periphery of the soldering system. It is precisely for this application that GÖPEL electronic offers a technologically sophisticated and flexibly adaptable inspection module.

Performance and hardware

Pressekontakt:

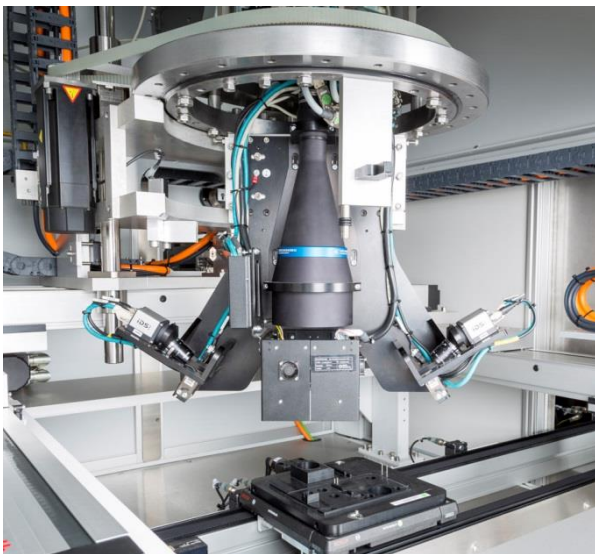
GÖPEL electronic GmbH
Matthias Müller
Göschwitzer Str. 58-60/66
D-07745 Jena

Tel.: +49-3641-6896-739
Fax: +49-3641-6896-944
E-Mail: press@goepel.com
URL: www.goepel.com

GÖPEL electronic GmbH • Göschwitzer Str. 58/60 • 07745 Jena, Deutschland

Tel.: +49-3641 - 6896 - 0
Fax: +49-3614 - 6896 - 944
E-Mail: sales@goepel.com
www.goepel.com

The basis of every inspection solution is the image processing hardware, made up of a camera, lens and acceleration modules. For the selective solder joint checking GÖPEL electronic has developed a modular camera and illumination head setup, which broadly covers all technologies of the image processing components of a standard AOI system. First of all, this includes a high-resolution camera, in which the basic idea of flexibility is met thanks to the use of various cameras with resolutions of up to 12 megapixels. The benefit for the customer is obvious: if only a small inspection area is required, a cost-efficient solution can be realised with a camera that has a resolution of less than 5 megapixels. Otherwise, with the specific arrangement of equipment being tested, additional angled-view cameras may be required. Even such an upgrade is possible in principle.



[Image 3: AOI module with angled view (image: EUTECH GmbH)]

However, the resulting image quality is not only determined by the camera chip, but crucially influenced by the lens used. In the GÖPEL electronic integration module only telecentric quality lenses are used. This has one very significant benefit compared to endocentric standard lenses: the imaging properties are consistent across the entire field of view. This is the only way that it can be ensured that solder joints in the centre and at the edge of the field of view are identically imaged. Identical imaging is, in turn, the basic requirement for the software algorithms being able to equally assess the solder joints.

In the selection of lenses to be used, flexibility in terms of customer-specific requirements is also right at the top of the list. This allows physical resolutions to be realised up to the range of 3 μm . Alongside the resolution, often other requirements, such as a large component clearance, that the use of an optimally adapted lens requires. As standard, the integration module has a component clearance of 50 mm. It is not uncommon, however, for electronic circuit boards fitted in the housing to require component clearances of 100 mm and sometimes more. Here, too, the system can be adapted by the selection of a correspondingly adjusted quality lens.

Pressekontakt:

GÖPEL electronic GmbH
Matthias Müller
Göschwitzer Str. 58-60/66
D-07745 Jena

Tel: +49-3641-6896-739
Fax: +49-3641-6896-944
E-Mail: press@goepel.com
URL: www.goepel.com

GÖPEL electronic GmbH • Göschwitzer Str. 58/60 • 07745 Jena, Deutschland

Tel.: +49-3641 - 6896 - 0
Fax: +49-3614 - 6896 - 944
E-Mail: sales@goepel.com
www.goepel.com

Last, but not least, a reproducible automatic evaluation of solder joints is only made possible by the illuminations integrated in the inspection module. Here Göpel electronic has paid very special attention to a particularly broad selection of illumination options in order to make the right solution available for all testing scenarios. This allows the creation of a multispectral and multidirectional illumination module, which comprises various coloured light sources, from the visible to the infrared and ultraviolet range, and with which the inspection object can be irradiated from various angles.



[Image 4: camera head with multispectral illumination]

The goal of the entire hardware deployment is ultimately to make high-resolution and meaningful images available to the software algorithms in order to reliably and reproducibly check the solder joints according to IPC-610.

Alongside the camera and illumination head, the entire package of the integration solution also comprises further components. This particularly includes a system PC, interruption-free power supply and a mini-control cabinet for adaptors and further accessories. All components are set out in such a way that a simple integration into test cells by third-party suppliers is possible.

Software – from creating test programmes to verification

The basis for the creation of the customer-specific inspection processes is the PILOT SL operating software. This software module first of all makes the entire control of the hardware components for image capture and illumination possible. Furthermore, all test functions required for the automatic inspection (e.g. meniscus or short-circuit detection or position correction mechanisms based on

Pressekontakt:

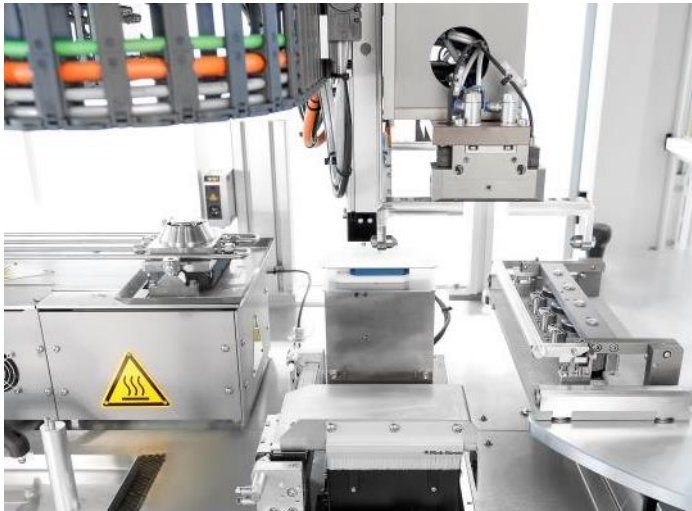
GÖPEL electronic GmbH
Matthias Müller
Goeschwitzer Str. 58-60/66
D-07745 Jena

Tel.: +49-3641-6896-739
Fax: +49-3641-6896-944
E-Mail: press@goepel.com
URL: www.goepel.com

GÖPEL electronic GmbH • Göschwitzer Str. 58/60 • 07745 Jena, Deutschland

Tel.: +49-3641 - 6896 - 0
Fax: +49-3614 - 6896 - 944
E-Mail: sales@goepel.com
www.goepel.com

expectations. The corresponding cable lengths included in the scope of delivery are simply to be adjusted for this.



[Image 6: soldering process with mini-wave (left in image) in a cell with the camera module protected against impurities (centre of image)(image: EUTECH GmbH)]

Summary

In order to be able to realise a reliable, automatic visual inspection of selective solder joints GÖPEL electronic offers a flexible AOI inspection module for integration into the periphery of selective soldering systems. The modular overall concept is the basic requirement so that individual demands of component clearance and scope of inspection can be taken into account. Furthermore, this is a consequence of various requirements for integration in various automation environments. Ultimately, for GÖPEL electronic it is a matter of preparing a sophisticated hardware and software package that allows the automation specialist to very effectively implement the requirement for an automatic visual inspection of selective solder joints. The close cooperation of project partners is essential for the successful realisation of such integration solutions, from the first feasibility evaluation to the final installation at the end customer. The very close cooperation with EUTECH should be mentioned here. The company develops special solutions in mounting and connection technology for the solution of complex soldering tasks that cannot be completed with standard processes. In the period since 2015, numerous projects have been successfully concluded for the mutual benefit of both partners, but, in particular, the benefit of the respective end customers.

Pressekontakt:

GÖPEL electronic GmbH
Matthias Müller
Goeschwitzer Str. 58-60/66
D-07745 Jena

Tel: +49-3641-6896-739
Fax: +49-3641-6896-944
E-Mail: press@goepel.com
URL: www.goepel.com

GÖPEL electronic GmbH • Göschwitzer Str. 58/60 • 07745 Jena, Deutschland

Tel.: +49-3641 - 6896 - 0
Fax: +49-3614 - 6896 - 944
E-Mail: sales@goepel.com
www.goepel.com

Author information

Dr. Jörg Schambach, Industrial Image Processing Product Manager at GÖPEL electronic GmbH

Matthias Müller, Public Relations Manager at GÖPEL electronic GmbH

Pressekontakt:

GÖPEL electronic GmbH
Matthias Müller
Goeschwitzer Str. 58-60/66
D-07745 Jena

Tel: +49-3641-6896-739
Fax: +49-3641-6896-944
E-Mail: press@goepel.com
URL: www.goepel.com

GÖPEL electronic GmbH • Göschwitzer Str. 58/60 • 07745 Jena, Deutschland

Tel.: +49-3641 - 6896 - 0
Fax: +49-3614 - 6896 - 944
E-Mail: sales@goepel.com
www.goepel.com