AOI programs with a magic click – automatically generated and with intelligent algorithms

A typical situation

For many manufacturing service providers, this is a daily challenge: Once again, the new job is just a series of 50 pieces. Important staff are on vacation, and component delivery times make your hair stand on end. The customer is determined to have AOI, but the layout of the assembly is highly 'customised', making it virtually impossible to use complete library entries. The customer is also demanding delivery at short notice.

In situations like these, an AOI program that is available quickly can make a crucial difference in significantly reducing the time from the start of production to delivery.
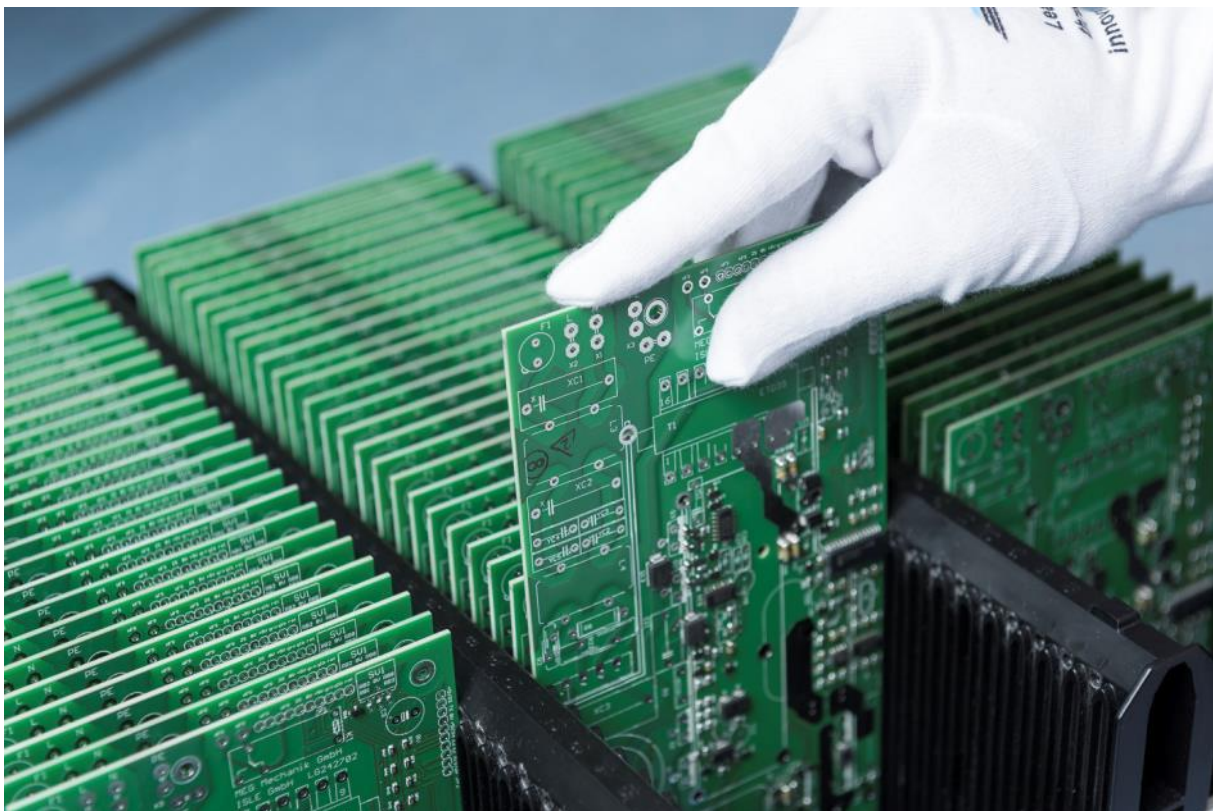

Figure 1: Production runs of between 10 and 1000 assemblies: everyday life for an EMS provider

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SK-Tronic – flexible manufacturing for a high level of diversity

SK-Tronic is an example of a medium-sized traditional EMS provider: its portfolio covers everything from PCB assembly of prototypes to producing complex equipment systems. The company handles conventional small batches as well as larger production runs. SK-Tronic provides its customers with advice and support with developing the layout and procuring materials. SMD assembly is carried out using a total of three Mycronic systems to guarantee highly flexible production without any downtime. Quality assurance is performed on the assemblies produced using a 3D AOI system called 'Vario Line 3D' from GÖPEL electronic, which is 'fed' by all three pick-and-place systems.

As is typical for EMS providers, SK-Tronic is also confronted with a wide range of products. There is always a high degree of time pressure, and customers demand an AOI inspection of all components as standard. In situations such as these, creating AOI programs can result in a bottleneck situation that can slow the production rate. That is, unless there is a tool you can use that takes care of the at times onerous task of creating a test program itself, as if my magic.

Figure 2: SMD production at SK-Tronic

The old way

The usual way of creating a test program starts with importing data. The next step of assigning item numbers to existing library entries is the most laborious, as each item code number has to be assigned manually. The final adjustment of the test parameters is also carried out manually. Of course, the complexity of the programming depends on the characteristics of the assembly. 'In the past, some test programs would take a day to create, and then there was a manual inspection on top of that,' explains Oliver Barth, Production Manager at SK-Tronic. That's why AOI was only scheduled for batch sizes of 100 to 200 pieces, as a manual visual inspection under the dynascope was more time-efficient that creating an AOI test program.

Figure 3: Quality assurance on all assemblies using 3D AOI

From now on, as if by magic

To make it even more economical to use AOI systems, GÖPEL electronic has developed the 'MagicClick' tool for the PILOT AOI system software. This enables test programs using 3D AOI to be created and optimised automatically. And the really special thing? A production-grade test program can be created in just a few minutes, complete with component library, without any library entries whatsoever. The parameters are also adjusted completely automatically, even taking into consideration actual process variations. At most only small manual adjustments are necessary afterwards. The aim of MagicClick is to enable efficient use of AOI, right from the second assembly. This is possible when used in combination with the AOI system Vario Line · 3D. What sets it apart is the 3D · ViewZ camera module, which combines various measurement and inspection technologies for maximum fault detection. In addition to the 3D measurement based on structured light, the module also include cameras for angled-view inspection.

Figure 4: Structure of the rotating camera module 3D · ViewZ (blue: cameras; red: projectors for structured light; yellow: lighting units)

Both 3D projections and 2D inspections are possible in 360° steps, thus guaranteeing maximum fault detection, even in critical component situations. 3D · ViewZ is available both in the in-line system Vario Line · 3D and in the stand-alone system Basic Line · 3D.

Figure 5: In-line and stand-alone AOI systems with the camera module 3D · ViewZ

MagicClick – intelligent algorithms in the background

Automatic generation of programs using MagicClick begins in the first step, with the import of insertion data and Gerber data. If available, the ODB++ format is also a suitable option, of course. This step therefore includes both component parameters (name, position, item number, etc.) and information and on the layout and pad. Detailed information is not available about the housing and the solder joint, however: dimensions, height, pin shape, etc. This is where a 3D AOI system really shines: unlike the 2D technology, where each pixel merely represents a brightness value, with 3D a height value can be assigned to each pixel. It is therefore possible to automatically generate an exact replica of the respective housing, including solder joint. In a next step, this information is accurately used to determine the particular housing shape based on intelligent algorithms and assign all the test functions necessary. At the same time, the test program is created and a component library is automatically generated based on item numbers. In the next and final step, the test parameters are adapted to the actual process variations as the test program is executed. In order to avoid slippage, tolerance limits are set close either side of the actual measured values closely and are corrected

according to the actual variations, taking into account plausibility criteria. This is based on an intelligent algorithm, which can be compared with AI (artificial intelligence) – a comparison that should be avoided at this point, however, on account of the overuse and ambiguous definition of the term.

Magical experiences at SK-Tronic

Because the automatic creation of test programs only requires Gerber data and insertion data, even users without any knowledge of the components can carry out the programming.

Two months after MagicClick was introduced at SK-Tronic, more than 1,300 package shapes had already been added to the component library. 'We get more "green ticks" every week, which means we have more and more known components and there are fewer and fewer for us to add,' explains Oliver Barth. MagicClick also learns over time: the more often a recurring project is run, the better optimised the adjustment of the parameters. Since the introduction of MagicClick, SK-Tronic has identified significant changes. '3D AOI and the automatic creation of test programs have enabled us to more than halve pseudo faults,' says Barth. 3D AOI significantly simplifies manual classification of the inspection in the event of a fault. It is barely worth even glancing at the actual component, as evaluation is made substantially easier thanks to the variety of 3D display options, such as the coloured TopoColor error images.

Figure 6: Fault statistics and test program generation on the system

Increased efficiency guaranteed

For EMS providers with a wide variety of products, AOI inspection is a time-consuming part of everyday business. However, by using automated test program creation with MagicClick, time savings of up to 80 per cent can be achieved on creation and optimisation. The result is efficient AOI use, even with the smallest batch sizes. What's more, you get a return on investment for an AOI system in a short space of time. It's clear the investment has paid off for SK-Tronic, says Oliver Barth: 'We have been able to cut the time needed to create a test program to a third. We were able to verifiably reduce pseudo faults, and test times were greatly reduced.' Now, AOI is used at SK-Tronic for production volumes of 30 assemblies or more – a substantial improvement compared with the past. The total throughput of manufactured and tested assemblies even increased by 300% over a ten-year period. Ultimately, the customer benefits as efficient use of AOI is also reflected in the final price and delivery quality.

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