

AOI comes of age

Around ten years ago, Automated Optical Inspection, or AOI, promised a breakthrough in quality management to electronics manufacturers, with great improvements in throughput and accuracy over manual inspection. However take-up was slow and the revolution didn't happen. More recently however, manufacturers have been buying in AOI and they appear pleased with the results. Andy Bonner of YESTech Europe looks at Basingstoke based electronics manufacturer EC Electronics' experience with AOI and reports on what's changed.

EC Electronics is a thriving electronics manufacturing services business, specialising in surface mount and through hole PCB assembly, cable harnesses and enclosure level systems assembly. Their production capacity is located in newly upgraded premises in Basingstoke and their factory in Petrosani, Romania. EC Electronics' customer base reveals a key component of their success; it includes defence, aerospace, medical, industrial and similar applications calling for low volume, high value and quality, rugged products and a flexible, fast and responsive approach. And fulfilling this approach calls in turn for a fast, responsive and flexible QA environment.

Twenty five years ago, EC started business by supplying cable harnesses. By the late 90s, EC's expanded CEM business included SMT and through hole PCB assembly. They countered continuous pressure from Far Eastern competitors by investing in lower cost European facilities, and by targeting the high tech applications they now serve. When AOI systems appeared, EC considered adopting the technology, with its promise of fast set-up for new product runs, and fast throughput during production. However at the time of their original investigation – about 7 years ago – EC did not proceed, for a number of reasons. System programming was complex, with a typical board taking from a half to a full day to set up. Once production was under way, too many false triggers were generated, which inevitably led to operators ignoring triggers arising from real failures. Cost was also a prohibitive factor in many systems investigated. EC's findings were reinforced as new employees reported similar results experienced by their previous employers. And, as the PCBs of the time were still small and lightly populated enough to allow manual inspection, the AOI idea was shelved.

However the ensuing years have brought significant changes on both the supply and demand side of AOI. Enhancements to EC's production facility, particularly the installation of a new, fully automated SMD assembly line, attracted new clients with requirements for higher technology, larger and more densely populated PCBs carrying BGAs and sub 0402 passive components. With somewhere between 2000 and 3000 possibilities for error on any one such board, manual inspection was no longer viable.

Accordingly, earlier this year EC decided to re-assess AOI's potential as a fast QA solution. From a short list of three contenders, including an existing EC equipment supplier, they organised 1-day onsite equipment trials for two. With YESTech emerging as the favourite, a YESTech B3 benchtop AOI system was run for a 3 weeks' extended trial as part of EC's live assembly line. After choosing YESTech, EC finally settled on an F1S in line machine due to its faster throughput and larger board capacity – and for its impressive appearance as visible proof of EC's commitment to leading edge QA technology.

EC also discovered another benefit of AOI that had not been possible with manual inspection. As well as definite go/no go failure decisions, AOI could detect conditions such as poor soldering that although not hard failures, still rendered the board unacceptable for shipment without rework.

The AOI system has made a major contribution to EC's QA strategy, partly from general advances in AOI technology, but also due to features specific to YESTech. AOI technology has four major components - cameras, lighting, computing power and software – and all AOI suppliers have exploited the steady advances seen in all these areas.

In the early days of AOI, the lighting was incandescent or fluorescent, the cameras were heavy, expensive and analogue, and PCs were slow and relatively expensive. The software and user interface lacked intuitive ease of use and flexibility. None of this however deterred a large number of companies entering the market offering AOI products which could command a good sales price while being relatively cheap to build. This resulted in the appearance of many systems that were expensive to purchase, and more troublesome than beneficial once installed.

Over time however these companies either disappeared or became absorbed into larger corporations who had the strength and commitment to drive AOI technology forward. Their efforts were facilitated by significant improvements and lower costs for the lighting, camera and PC components that remained essential to AOI design. Above all, developments in software and user interfaces have resulted in machines that are faster and more intuitive to set up, and more quickly and easily reprogrammed for short term production changes.

EC Electronics operates a strategy of running production projects that are highly specific to each individual customer. For example, they run separate purchasing contracts for each customer, assigning different internal part numbers and storage locations for the arriving kits. This is especially useful if two customers specify, say, a resistor of the same value, form factor and tolerance, but from different suppliers. EC's 'ring fencing' ensures that each customer is fully kitted with components that are right in every respect.

This strategy is supported by the AOI system as well. The customers in the above 'common resistor' example may also have used different CAD packages for their PCB layout, resulting in different pad sizes on the PCB. The AOI system can be set up for these different pad sizes, as well as for different component reflections, and different values and fonts printed on the component bodies. High speed boards, which tend to have components in non-orthogonal orientations to minimise track lengths can be handled.

EC can program the YESTech AOI for these boards and variations with no impact on production, because they have obtained a second dongle from YESTech. This allows the YESTech software to generate new inspection sequences on any off line PC while the primary software supports production inspection online.

The YESTech F1S AOI has been easy to integrate into EC's assembly process. For inspection, the system needs to know the parameters, X-Y co-ordinates and orientation of each component on the PCB; this information can be supplied easily by reference to the list already generated for the in line pick and place machine. The F1S can also capture the bar code for each PCB inspected. Rework stations elsewhere on the EC network can then use these bar codes to reference and download AOI pictures of faulty boards to aid rework activity.

The F1S's throughput capacity is allowing EC to maximise their ROI. They have optimised their QA procedure by performing 100% inspection because as Commercial Director Bill Green explained, they have no reason not to. And, now that it's installed, the F1S is being used to inspect simple boards as well as the complex products it was originally purchased for. These include multipanel arrays of smaller boards, where inspection is facilitated by the F1S's ability to correlate faults found on opposite sides of the same panel within an array.

In fact, EC has come to view the F1S as a flexible digital imaging comparator, and, accordingly, is now using it for applications beyond PCB inspection. Examples include metalwork silk-screening and punching patterns, with possibly more to follow.

The AOI facility created by the F1S's installation is being used for process improvement as well as its immediate role in board inspection. Some of this happens inevitably as a pattern of faults appearing during a production run will lead to investigation of causes such as blocked stencil apertures. Additionally though, EC is running Statistical Process Control (SPC) software provided by YESTech. This generates reports which EC's QA Team analyse to continuously improve their production process.

Bill Green commented on EC Electronics' current situation and the role of AOI: "Over the last 18 months we have completely upgraded our manufacturing operation. Volume production is carried out in our Romanian factory, while our new fully automated SMD assembly line in Basingstoke is handling new product introduction and high technology development and manufacturing. The F1S AOI system's value to

our business and place within our QA program is reflected by its forthcoming move into a dedicated QA room. It's solved the inspection problems related to the complex, high technology boards we are now producing, while performing a valuable inspection function on simpler boards and other products as well. Efficiency in terms of both board inspection and process improvement has been boosted by its easy programming and integration into our production process.

"We feel that YESTech offers the best of both worlds, with the resources of a large international corporation complemented by responsive local support from YESTech Europe. This was particularly valuable during our initial learning curve, and again when we wished to rapidly integrate a new software feature."

About YESTech Europe

YESTech Europe is part of YESTech Inc, the AOI and X-Ray inspection systems specialists. Based near London in the UK, YESTech Europe works with YESTech's European Demonstration and Support Facility in Maastricht, Holland and local sales and support offices throughout the region.

Since its inception, YESTech has been a consistent innovator in the electronic inspection industry. Founded and managed by a team of industry experts with a history of success, we bring the most powerful, cost-effective yield enhancement solutions to the electronics market.

YESTech's pioneering vision continues to develop and produce high-quality inspection systems that address their customers' ever-evolving needs. YESTech prides itself on its level of customer support and in providing local help with applications.

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