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Instrument OEM Secures Next-Level Quality with AOI

Based in south west England, less than a mile from Exeter airport, specialist instrumentation manufacturer Mantracourt recently decided to evaluate the AOI market in an effort to identify a system that would integrate into its SMT assembly line, taking automation, throughput and quality to the next level. Industry observer David Hughes visited the company to find out more.

Founded in 1974, Mantracourt is a key technology provider to leading OEM sensor manufacturers and a major supplier of standard measurement technology products. On its production floor, the company has an automated SMT assembly line headed up by a DEK 265 screen printer and comprising iPulse placement machine and Manncorp CR-5000 oven. Conspicuous near the end of the line is a Marantz 22XDL-520 AOI system, positioned immediately after the oven. A conversation with Production Engineer Darren Banks – who has over 14 years of Mantracourt experience – uncovered the reasoning behind the choice of system and its function within Mantracourt's facility.

Banks says that the AOI was desired for fault analysis that would improve the assembly process. "We were getting failures on test and wanted to weed them out," he explains, adding that it was simply a build up of issues over time that ultimately led to the company opting for AOI. "Everything was getting smaller and finer pitch, and we wanted process improvement. It's easier to inspect before test to pick up manufacturing faults and it's faster, which shortens the time to us being able to improve line reliability based on what we find."

In the evaluation process, Banks and his colleagues reviewed a number of AOI systems before shortlisting three vendors and finally selecting the Marantz 520. Managing Director David Willmington threw some light on his objectives for the AOI acquisition. "Repeat business is valuable to us and this depends heavily on our product quality, delivery and engineering

support. But of these, quality is critical. We typically place 10,000 components per hour and got to the point where we needed a machine to inspect our subassemblies as we could go no further manually," he explained.

One of the main concerns for Willmington was the possibility of a dry joint passing the manual visual inspection and electrical test process but later failing in the field. "We were looking at first-time yield of the pick & place process to improve quality which would also deliver a reduction in rework that would cut costs. Also, some Mantracourt boards are embedded deep inside OEM systems, making field service or replacement difficult and expensive," he added.

Mantracourt chose the Marantz L22XDL-520 on the basis of its flexibility and suitability to the type of process and inspection subjects used on the factory floor. Mantracourt makes six line changeovers per week and currently run a standard single day shift – but are just extending this to a daily 12-hour shift.

On a day-to-day basis, the 520 is the responsibility of SMT Specialist Jon Dixon. He expanded on the flexibility issue by pointing out that some of the systems investigated did not perform component recognition, just component presence and solder joint integrity. Dixon likes to100% inspect with the Marantz system wherever possible. For some batches of Mantracourt's own products' boards, the 520 has already refined the assembly process reducing test time. Additionally one customer takes large volumes of untested boards allowing a 1% failure rate, but even with double sided boards featuring 15 to 20 devices on each side, Dixon knows he can come dramatically under that target with the AOI in action, and he has proved this on batch runs of 5,000 boards.

He cites the example of a load cell amplifier board. "We used to manually inspect these assemblies. It took a day to inspect a batch by eye. Now there's a huge time saving as it essentially takes no time to inspect – it simply occurs in-line as part of the production process. The Marantz inspects components faster than we can place them."

"A 5,000 board batch is not really typical for us but it was a useful number with which to validate the AOI," says Dixon. "We do get the occasional run of several thousand, though a normal batch run would be 1,000 to 1,500 boards, usually around A5 in size and containing 400

to 500 components. The majority of these are in kits of one or two hundred, so it's very much high mix and low volume – perfect for the Marantz to process.

One of the advantages of the Marantz system that makes it especially suitable for low volume, high mix environments is its very fast programming and set up time. "This was in stark contrast to a couple of the other machines we reviewed," claims Dixon, adding that it was a major factor in the purchase decision. "It's earning its keep and our objective is to run everything through it ultimately." Mantracourt has had its Marantz system since the turn of 2007 and currently deploy it purely for SMT subassemblies, and this has had an impact on the company's design process. New products are consciously developed to include as much SMT componentry as possible in order to take advantage of the AOI system's intrinsic ability to refine the assembly process and keep end-of-line yields high.

As part of the equipment selection process, MD David Willmington and his team studied the market for a few months in 2006 and settled on a shortlist of three machines to demo. Two were delivered to the Mantracourt site; the other was reviewed at an existing user's factory. Among the advantages of the Marantz 520 which led to it being chosen were its excellent component recognition and the ability to inspect devices at variable angles, not only those mounted at 90 or 180 degrees. "And the Marantz was less expensive than the others systems, which while not our primary focus but did add to our perception of overall value," adds Willmington.

With responsibility for the programming and day-to-day operation of the AOI, Dixon explained that he sees the system's ease-of-use as a significant benefit. "Once it's programmed you can task anyone with operating it, as training is pretty much a 5-minute familiarisation procedure," he claims. Dixon also points to the intuitive nature of the programming method which he considers to be "well laid out". Programming essentially comprises three steps, with each increasing the depth of the inspection process.

According to Dixon, the first step is a simple CAD pick & place data download that automatically delivers details of component type and position. The second step programs solder fillet details to allow the AOI to verify joints and interconnections. The third and final step is the text checker, where the 520 can read the legends on devices and the board. "Any change to the

board is quickly and easily accommodated, which saves time when programming is needed," he says.

In the very initial stages of running through newly-programmed board, Dixon claims the 520 flags up a lot of faults, many of which are false errors. "It's very fickle to start with but at least no real faults can get past," he muses. "But debug is quick and easy; it simply means adding a few more images to the library, for example breaking down some of the components into a grid pattern for inspection, to reduce or even eliminate false alarms. You have enough selective control to widen the tolerance without any danger of letting faulty components or joints through," adds Dixon.

Also cited as a benefit is the large field-of-view the system offers. "The FOV is amazing, and far superior to other systems we reviewed," states Banks. "It means you can inspect a large group of components at a time, which directly impacts productivity as it shortens inspection time." For batches of board that are programmed into the L22XDL-520, Mantracourt 100% inspects at all times. "Our objective is to 100% inspect every board that we manufacture, so the AOI program will be developed concurrently with the board and the Marantz 520 deployed to its full potential," says Banks.

Banks and Dixon agree that selecting the Marantz was the right choice. "It has proved to be flexible and most suitable for our low to medium volume, high product mix process. We've also been impressed with the level of support from the Marantz team, the training provided, and the software upgrade plan that keeps the machine totally up to date." On the maintenance aspect the team is equally complimentary, claiming that routine maintenance consists of cleaning the telecentric lens with a cloth to remove dust – something made simple by the straightforward internal layout of the 520 which promotes easy access.

David Willmington summed up his company's AOI journey and experience: "We knew the pros and cons of AOI before we went into the evaluation process, so equally we knew what to expect. I was also impressed with the Marantz lease-purchase option. It's an attractive proposition that gave us an easy way to trial the machine with an inherent escape route if it didn't live up to expectations – and in some ways this also highlighted Marantz's confidence in their equipment. It's a good commercial idea. And I'm happy to report that the 520 doesn't disappoint in any area.

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