Lean, Mean Dual-Lane Machines

The latest screen printing platforms unlock more of the potential from dual-lane processing.

Simultaneous demands to enhance flexibility while increasing utilisation and overall throughput apply to manufacturers operating at virtually any point in the mix-volume continuum: capacity must work hard to deliver the required return. As these lean manufacturing principles hold sway from the US and Europe to the Far East, no modern assembler has a second to spare.

Speed-up Technologies

To satisfy assemblers who seek speed and utilisation advances to meet their own marketing and financial targets, equipment vendors now offer numerous upgrades and options to accelerate throughput, including high-performance machine vision for rapid board alignment, high-speed inspection/verification, and techniques to accelerate board handling and conveyors. Improvements to reduce the overheads associated with basic housekeeping functions provide another speed-up opportunity; one example is the improvement in understencil cleaning systems for screen printing, which have successfully cut cycle times and extended the typical cleaner-replenishment interval.

In practice the impact that a given tool or option will exert on overall units-per-hour produced can be difficult to quantify, as this will often depend on variables such as the type of assembly, the product-changeover rate, or the number and type of components to be placed. Dual-lane assembly, however, is one technology whose benefits are almost instantly understood. With two active lanes operating simultaneously on boards at the line beat rate, throughput can potentially be doubled.

Double the Throughput: What More?

Dual lane operation is also a source of valuable extra flexibility for assemblers. For example, the ability to assemble two different boards simultaneously enables concurrent assembly of a main-board/daughter-board combination for a given product, allowing complete board-sets to be delivered directly to final assembly.

Assemblers also gain extra power to manage capacity, since it is not necessary to wait for the line to finish building one product before loading another.

To deliver a continuous feed of boards to the placement stage, a typical screen-printer layout comprises two machines that are staggered to feed the two placement lanes directly, as shown in figure 1. Usually, the first machine images solder paste onto clean boards in the normal way and delivers these to the rear rails of the second printing machine. The boards then pass straight through to the placement machine. At the same time, a new board is presented at the front rails of the second machine. After imaging, this board is presented to the front rails of the dual-lane printer.

The staggered-printer arrangement represents a cost-effective way to double the maximum throughput of the line, requiring investment in one extra screen printer capable of supporting front and rear board loading. One drawback, however, is that the pair of staggered machines occupies a comparatively large footprint. This is at best undesirable, given the imperative to maximise utilisation of factory floor-space. In some cases, the required floor-space may simply not be available.

Next-Generation Dual Lane

At the same time, assemblers are also demanding greater flexibility to quickly change rail widths for high-mix production, and also to switch efficiently from dual-lane operation back to single-lane configuration to assemble larger boards as required. The new DEK Horizon Dual Lane solution provides an example of how next-generation dual-lane equipment is responding to customers' demands for greater space-efficiency and faster changeover and reconfiguration.

DEK Horizon Dual Lane delivers valuable savings in real-estate by allowing both machines to be installed in a direct in-line configuration. This has been made possible by ensuring that boards can be printed whether presented on the front or the rear rails. Configuring each machine as the inverse of the other, as shown in figure 2, allows a board printed on one to pass straight through the corresponding lane of the other. Compared to the traditional staggered arrangement, this in-line configuration also eases automated board handling for speed and efficiency and eliminates ancillary handling equipment.

The position of the front rail, Rail 1, is fixed. The position of the third rail, Rail 3, is configured at manufacture to meet the desired lane spacing. For example, Rail 3 position at 251.7mm from Rail 1 is commonly required, which matches the lane spacing of some European dual-lane placement machines.

Rails 2 and 4 are motor-driven under software control, which allows both lane widths to be adjusted automatically as the product file is loaded. This accelerates changeovers by eliminating time-consuming manual adjustment of rail widths, thereby allowing assemblers to benefit from significantly greater speed and flexibility.

The limits on acceptable board sizes for dual-lane assembly are dependent upon the lane spacing and the minimum allowable distance between Rail 2 and Rail 3. The ideal maximum combined width for both sets of rails is 508.5mm, equivalent to the maximum board size for a standard single-lane machine. However, the range of adjustment for Rail 2 is limited by the position of Rail 3. For example, in the case that Rail 3 is positioned at 251.7mm, Rail 2 certainly cannot be adjusted beyond this dimension. Practical constraints due to the machine layout also impose a certain minimum separation between Rail 2 and Rail 3. However, DEK's platform-machine design allows very close spacing: Rail 2 can be driven to within 34.5mm of Rail 3, which maximises the allowable width of Lane 1.

With Horizon Dual Lane, switching from dual-lane to single-lane operation is also fast and easy. Today's high-mix assemblers require this capability to process boards that are larger than the permissible dimensions for dual-lane operation. Automatic switching to single-lane operation allows printing of boards up to 450mm x 620mm.

Conclusion

21st century electronic manufacturing is transitioning from lean to mean, as assemblers demand multiple techniques to reduce cycle times and maximise utilisation, while also boosting flexibility. Dual-lane assembly is set to play a major role in this trend, as emerging dual-lane equipment including screen printers and

placement machines support greater flexibility and faster changeovers, in addition to higher raw throughput.

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