New roll-to-roll screen printing methods for close tolerances

Chris Walker explains the workings of a screen printer which can print a large array of small precision measuring instruments.

Dimensional stability is often a problem when working with many of the industrial grade films presently available for medical applications involving printing. Due to heating from the ink drying stage, distortion of the plastic often translates to erratic registration, even when product pre-heat stabilisation is employed. This becomes undesirable from an accuracy point-of-view.

Likewise from a cost standpoint, industrial print compositions for medical diagnostics are electrical, as well as exotic in nature. The range includes a host of conductive inks made from carbon and silver, to platinum and current-carrying liquid crystal mixtures. Other inks include dielectrics and reagents such as printable enzymes. Still others are entirely graphical in nature for advertising, for hiding the workings of the device and for photonic backlighting. These materials are expensive and poor production machinery and decisions cannot be afforded.

The Preco Web Mikron 50 screen printer was commissioned for close-tolerance work in the RFID or Radio-Frequency Identification industry (soon bottles of pharmaceutical preparations will be tagged with a wireless deterrence to counterfeiting and theft), and has proven itself in testing to be quite suitable for electrochemical medical printing applications as well.

In order to handle the ability to print a large array of small precision measuring instruments on a grand scale, the Preco Web Mikron 50 is equipped with four CCD registration cameras, with prism assembly probes embedded into the machine's platen or print bed. The web area to be printed is advanced into the locating position and fixed by way of vacuum holes to the platen surface. Working with printed information on transparent film, each camera searches for an identifiable mark or fiducial on the material to be printed, in order to compare it with a stored image in the main computer. When all four fiducials have been recognised, the print bed moves into register with the screen stencil above it, to a print accuracy (not machine repeatability, which is far more accurate) of better than ±50 µm at 3s.

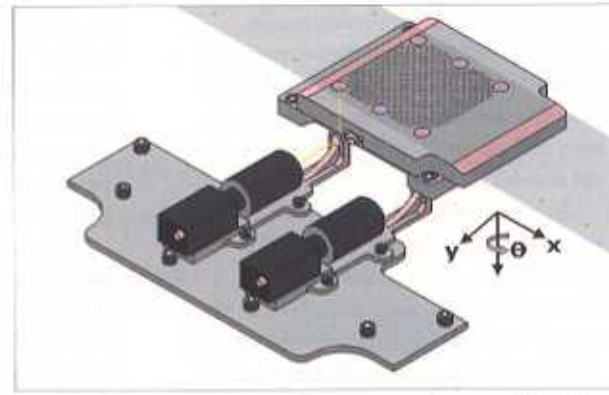

Fig. 1. Close tolerance web screen printing. Two of the four cameras used for print-to-print alignment are shown on one edge of the vacuum-held web. Each camera sites a fiducial (in green) through prism and flush quartz glass mount in the print bed (both in blue).

The process is a vast improvement to the traditional method of using the materials' cut edges to determine print accuracy. When a film distorts from heating, the printed features and their association to the dimensions of the substrate become more randomised. In contrast, since printed fiducials are produced at the same time as the essential graphics, they are tied more closely together.

The cost of using precious metals in a process accumulates quickly, especially when the press operator needs to make more than one adjustment to arrive at proper register alignment from the first pass of conductive ink to the next. The Preco Web Mikron 50 eliminates this task by automatically achieving image-to-image alignment on the initial print, thus avoiding the trial-and-error approach to producing the first acceptable part or index. Moreover, when using four-camera positioning, the system can be asked to produce a 'best fit' relationship to each set of fiducials on an index.

But the bottom line is that accuracy in industry counts. Any time a bodily function has to be tested, measured or monitored, close enough is not close enough. ■

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