

Synergistic Quality Control

Combining AOI and moving-probe ET.

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AOI and moving-probe electrical testing are too often referred to as replacements for one another. Each of these very different technologies has its advantages. When seen as complements rather than competitors, AOI and probe ET can team up to solve problems throughout the PCB manufacturing process, generate valuable archiving data for future production and process control, and create a powerful tool for error verification.

The technologies have similarities as well as differences. Both lend themselves well to quick-turn, low-volume, and prototype situations. They are both valuable in process control, particularly when combined with a verification station. In prototype and low-volume manufacturing, their collaboration can begin with handling photoplotter data at the CAM station, continuing through the final PCB processing stage.

A typical scenario exemplifies the combined usage of these technologies: An AOI system finds a nick, a splash, or a pinhole. The defect data is fed to the ET system's verification station, which locates the probable error site for verification or repair.

AOI Solves Upstream Problems

Functionality of the test device is critical. Consider CAM as the gateway for data entering the manufacturing facility, and assume that the file is the same as that used to prepare for phototools, ET, AOI, drilling, routing, etc. It is advisable to have the CAD file serve as the original source of customer information going through the plant and back to the customer, but the many intermediate steps between the customer's CAD file and the finished board can cause AOI problems. If the AOI system references CAD data, however, many problems are avoided.

The customer information being worked up in the CAM system also enters the AOI system, so that the PCB is inspected according to the customer's specifications, rather than comparing it at various points in the process to what the manufacturer feels is a golden board. Going from CAM to both AOI and ET can be very helpful, providing the test systems are compatible in terms of CAD referencing.

AOI inspections should be done at several locations. They may be done after phototooling, photoresist application, etching, or

drilling of the inner-or outerlayers. Used for inspecting the phototool, far upstream in the manufacturing process, AOI reduces the subsequent need for ET by detecting flaws on the film caused by handling or foreign matter. AOI's use after photoresist is cost-effective in that the board can be saved by simply removing the flawed resist. However, if AOI is bypassed at this point and the flaw is found after etching, the board must be repaired or discarded.

Postphototool Inspection, Test, or Both

Electrical test can be used to verify or support the results of AOI, and AOI can be used to minimize the amount of ET needed. Whether or not both are used depends on the process. Early in the production of a very advanced product, both test methods would logically be used; as confidence builds, less inspection is needed. Eventually, ET is only used on layer pairs, board segments, or the finished printed circuit board. Verification should always accompany automated optical inspection to provide the repair option before additional value is added to the product.

Archiving Data and SPC

The ET/AOI combination enhances both archiving and SPC. Suppose, for example, it is learned during verification that shorts and opens seen with a particular printed circuit board are due to over- and underetching. When the PCB is reordered, information already entered into the database forewarns manufacturing to maintain proper etching conditions.

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The continuous improvement goal of SPC depends on the constant examination of work flow, quality, problem areas and action items. Through the central hub of a verification station, data garnered from upstream AOI and downstream ET can be SPC-archived and work orders automatically tagged with instructions specific to any part number.

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