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An ITW Company

APPLICATION NOTE

Special Techniques for Detecting ESD Events in EMS Manufacturing Facilities

Finding ESD in Production Lines

Summary

Electrostatic control of production environments is, for the most part, a fairly straight-forward business, resting upon both general and industry specific experience. Proper workstation grounding, table-top mats, wrist-straps and other measures can greatly reduce or eliminate the risk to sensitive electronic components during assembly and test. However, determining that these measures are in fact operating effectively is something that has not been traditionally attempted. The usual approach has been to watch product fall-out and general yield measures to determine if a more effective approach has been adopted.

Fortunately, there is a cost-effective and more technical approach to characterizing the effectiveness of an ESD program as well as diagnosing yield and process problems. The effectiveness of this method allows the investigator to not only characterize the type of ESD event (HBM, CDM, etc.), but also to observe the activity which caused it at the moment it occurs. The payoff with this method is that 1) the location and severity of ESD events can be evaluated during the investigation, 2) specific remedies for each situation can be determined at that time, and 3) basic calibration requirements for ESD/EMI sensors can be recommended if continuous monitoring is desired.

How is this Done?

In any effective ESD/EMI evaluation, the critical elements for characterization are the separation of ESD and non-ESD events based upon sophisticated signal analysis, event amplitude evaluation for interference potential, waveform analysis to determine the type of ESD event, and determination of the exact location and cause of the detected event.

Not all ESD events are critical to the manufacturing process. In complex manufacturing environments and processes, a certain amount of ESD-caused interference energy may be unavoidable. In more common parlance, some problems may not be cost-effective to chase. However, for those events which signal real damage potential to products under assembly or test, this method of investigation is the best for finding and eliminating the risk.

In addition, a byproduct of this investigation is that the information gathered can be used to implement ESD/EMI sensors at selected

locations for continuous or periodic monitoring purposes. With the ESD pulse waveform analysis already performed, appropriate sensor types and settings can be determined. This assures that specific local areas and process points can be monitored by individual sensors for critical events and not just wide-area acquisition of unrelated events.

How Long Does it Take?

Typically, this is determined by what we call process density. In other words, if a large number of product assembly lines and significant clusters of automated process tools are involved, or the facility has a large processing area, the investigative process could take up to sixteen (16) hours. Typically, this type of investigation can be completed in eight (8) hours or less with very satisfactory results. The report produced contains the collected data as well as the conclusions and recommendations for specific process areas evaluated.

A Case in Point

At a facility where SMT PCBs were being manufactured, an ESD/EMI investigation characterized the production line from automated board population through PCB inspection to QA and packaging.

During this evaluation, it was discovered that some inspection operators had inoperative wrist-straps. In addition, heel-straps and the conductive coating on the cement floors were not adequately discharging operators before they touched sensitive components. Discharges between tools held by operators (tweezers, probes, etc.) and board traces and components were clearly occurring, as well as ESD events occurring between PCBs when the boards were placed into carriers. In some instances, HBM (human body model) ESD events were detected when employees handled boards during the inspection process. At the same time, product handling in the packaging area was found to be effective, with no ESD events occurring during that phase.

Conclusion

The efficiency provided by this investigative approach enabled the production manager to understand and address all of the problems discovered at the time of observation. It gave an immediately useful diagnostic for their ESD program effectiveness, and allowed rapid remediation for the problems found.

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