Problem Solved

组装问题的
实用解决方案

Peter Bollinger

Machine Capability Analysis

Using a mobile metrology system to tweak machine performance can reduce defects and improve productivity.

Problem:

Placing components such as 0201s, 0.4 mm fine pitch and flip chips in increasingly smaller package sizes requires tighter placement accuracy specifications in the surface-mount assembly process. Added to the drive for reducing defects, increasing throughput and improving productivity and efficiency rates were cause for a major automotive electronics producer to reevaluate equipment performance and processes.

A preliminary study of over 110 assembly process machines revealed that placement accuracy defects were at an unacceptable level. Additionally, when programs were transferred between production lines, it took over six hours to manipulate the pattern programs to adjust the equipment's placement accuracy to the product. The process was time consuming and contrary to equipment productivity requirements, and the human error was contributing to the defect rate.

Problem Solved:

Our studies revealed inconsistencies in placement accuracy from machine to machine. The company considered dedicating certain products to specific production lines. The idea was ruled out because it would restrict flexibility to react to fluctuating production volumes over multiple products and cause scheduling conflicts that could potentially add process inefficiencies.

The solution was to focus on operating the equipment within the capabilities of their placement accuracy specifications. However, the metrology tools and resources required for the job were not available internally, were too costly to acquire and would have caused unacceptable delays in launching a defect reduction program. Since the project mandated the expertise of an external source experienced in characterizing placement equipment accuracy, a company with mobile metrology services and software to analyze placement accuracy capability was brought in.

Characterizing Capability

The equipment used for the analysis was developed specifically to measure x, y and theta positioning for each placement spindle. It generates a statistical report to characterize placement capability. The process uses a portable vision coordinate measuring machine (CMM) that measures placement accuracy of components against expected placement positions. Highly accurate replica components and glass plates remove variability caused by materials other than the placement machine.

By characterizing placement capability, we can zero in on the mechanical attributes that can cause shifts in placement accuracy and affect repeatability. Once analyzed, specific features can be defined and corrective actions—such as replacing worn parts, making adjustment or trimming the machine with the appropriate offsets—can be accomplished easily.

Positive Results

The immediate impacts of the analysis and corrective actions were an 80% reduction in placement defects and an average increase in intrinsic availability of over 10%. Also, readjusting pattern programs when products were moved between lines was no longer necesary. The programs can be generated from CAD files to maintain quality standards so operators and technicians do not have to modify the x, y or theta locations. As a result, products can be moved from line to line in two hours, instead of six, and the human-induced error of adjusting programs by eye was eliminated.

Machine capability analysis is more than a tool or a method. It is a way of defining and implementing continuous improvement in the manufacturing environment. By characterizing machine placement performance, we can target specific corrective actions to decrease defects and increase machine efficiency and overall productivity. ■

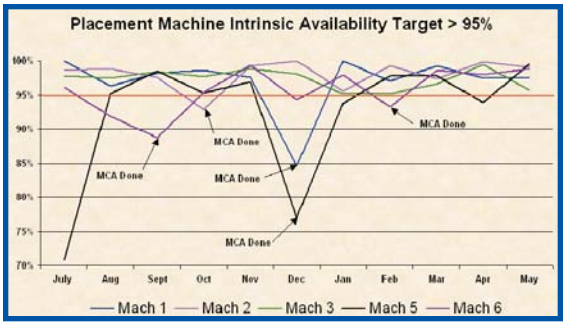

FIGURE 1: The impacts to machine intrinsic availability after performing the machine capability assessments (MCA) and implementing corrective actions.

Peter Bollinger *(bollinger@uic.com) is director of GSM platform products with Universal Instruments Corp., Binghamton, NY.*