Optimised cycle times

PC-based CNC for pc board machines

The trend in electronics production is moving towards the processing of pc board panels of increasing size and density. After assembly and testing, the extremely sensitive panels must be separated into single pc boards quickly, in a stress-free manner and with maximum precision. The Wiesbaden-based control and automation technology specialist ECKELMANN AG equips the pc board separation systems and special component assembly machines of IPTE GmbH with reliable and powerful CNC technology. Optimised tools for pc board production are produced thanks to the technically matured interplay of the machine construction and the controller.

IPTE (*Integrated Production and Test Engineering*) Germany GmbH, erstwhile IPE, arose out of the erstwhile production technology division of Grundig AG. A member of the Belgian IPTE group, the company possesses all test and production automation competencies. The development and production of both pc board separation systems and of machines for assembling special parts on pc board panels are of special importance. Both systems are based on the same machine platform and are integrated in assembly lines from leading manufacturers in the electronics industry.

The IPE Speed Mounter

With the Speed Mounter series, IPTE realises a new modular machine concept for the high-speed assembly of special components. Depending on the component, their assembly performance is up to 1,200 components per hour with a placing accuracy of 100 µm in 4s. Use of a twelve-segment revolving head permits sequential picking of twelve special components. Therefore, components are first gathered and then assembled in succession. At the same time, the distance travelled and naturally also the processing time can be minimised. Simultaneously with the placing operation, the twelve feeders can each provide a new component, thus additionally saving on process time. It goes without saying that the controller has to optimally support these two strategies.

Fig.: IPE Speed Mounter

The IPE Speed Router NTM-4133

The separation of high-tech multiple pc board panels calls for highly precise machining that places the lowest possible load on the workpiece. At the same time, in the case of inline production, the separation process must be adapted to the cycle of the production line. This means that all handling and tool components must be capable of being moved fast and yet without vibrations.

Precisely-positioning and almost wear-free linear motors with high acceleration and deceleration values as axis drives represent the highest attainable quality standard. To ensure that no disturbing vibrations occur despite the high acceleration values, the IPE inline panel separators are based on a stable granite base frame. Aluminium cast frame elements and also an aluminium cast plate to accommodate the linear axes in the roof element form a force-actuated and form-fitting unit.

To warrant machining of pc boards that is as stress-free as possible, the IPE models dispense with the stress and strain caused by punching as the separation method. Now, whether milling or sawing tools are used depends on the material and size of the panels and on the endeavoured machining rate. Depending on the pc board material, milling cutter diameter, and the type and shape of the webs to be separated, commercially available milling tools achieve a feed rate of 2-4 m/min. At higher speeds, the milling cutter breaks or the required accuracy can no longer be reached.

It is possible to achieve more than doubling of the separation rate if diamond-coated or diamond-equipped saw blades can be used instead of milling cutters. This separation method is reduced to straight cuts, but offers the advantage that not only is the separation rate higher, but less material is removed, which is especially advantageous for pc boards that were not designed for separation with a milling cutter or a saw and which would no longer be dimensionally true due to the removal of material.

Fig.: IPE Speed Router

ECKELMANN PC-based control

Besides depending on the choice of high-grade components in the mechanical structure, the drives and the tools, the productivity of pc board machines also depends quite considerably on the performance, reliability and convenience of the integrated control technology.

All IPTE pc board machines are operated with ECKELMANN PNC controllers. They consist of a PC slide-in card which contains all the functions of a CNC controller with an integrated PLC. The slide-in card has its own 32-bit processor and so the CNC and PLC application runs independently of the actual PC software. When the PNC is used, machine wiring is reduced to a minimum. The machine's inputs and outputs are

interfaced via a field bus system (CANopen), whereas the machine axes are linked via digital drive interfaces (SERCOS, CANopen). It goes without saying that all interfaces to previous and subsequent devices conform to the SMEMA recommendations, but can also be tailored to a customer's specific needs.

Fig.: ECKELMANN E•PNC55 controller

The powerful NC operating system covers all machining processes in pc board production. The integrated PLC permits free programming of the application-dependent machine functions in accordance with IEC61131-3. The powerful PNC-MMI operator control software permits convenient operation in all CNC modes and is executable under Windows 9x/2000/NT.

The user interface adapted to the processes indicates the systems' operating states and serves to program the distances and contours for assembly or pc board separation. Statistics functions additionally deliver, administer and archive valuable information about the production processes.

Control technology as a quality and success factor

In combination with the PNC control technology from ECKELMANN AG, the Speed Mounter and the panel separation module NTM-4133 from IPTE GmbH are optimised machine solutions for the automation of electronics production.

For the machine operator, the technical and design qualities of these machines are particularly manifested in ergonomically and conveniently designed operation and visualisation of the integrated controller. Well-coordinated cooperation between the machine manufacturer and the control system developer therefore lays the founding stone for long-term success in the end customer's pc board production processes.