NET New Electronic Technology

VisionPro® optimizes the production of thin-layer solar cells

Making energy from knowledge

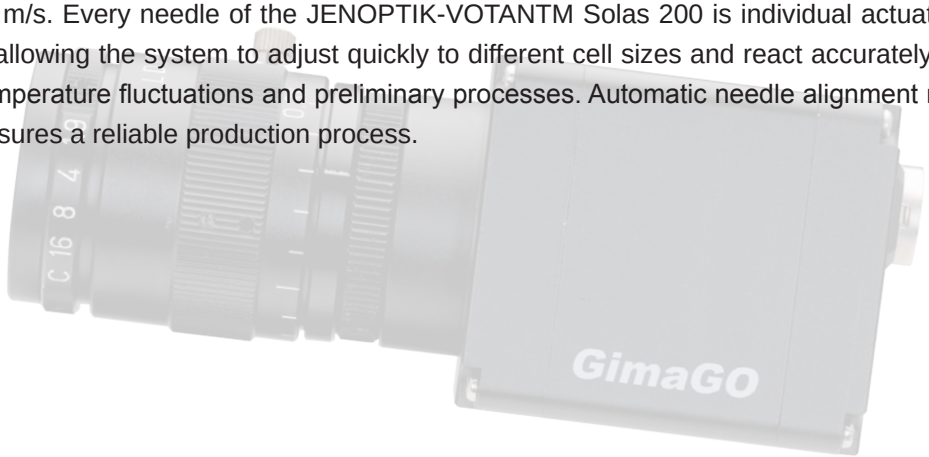
The father of the Germanic gods, Wotan, was not just a man of battle and prodigious consumer of mead, he was also a man who used the sky's light. As the god of thunder and lightning, he took light and used it in a specific way. This is the tradition now being followed by the JENOPTIK-VOTANTM Solas range of machines. The latest laser technology, high-end mechatronics and sophisticated vision technology are combining to take a new route towards improved energy generation.

The JENOPTIK-VOTANTM Solas 100/200 was designed to structure thin-layer solar modules using laser and/or needles for all the process steps (P1, P2 and P3). In the standard variant of these machines, six industrial cameras combine with VisionPro® from Cognex to ensure perfect calibration of the processing tools, determine their wear status and check that the solar modules have been processed correctly. The vision system was implemented using components from **New Electronic Technology GmbH (Finning, Germany)**. Setting-up, processing and the subsequent quality inspection all take just 60 seconds per module - a performance which gives manufacturers of solar modules a significant edge in the highly competitive technology market for regenerative energies.

Precision for fast lines

Thin-layer technology, which usually involves photoactive semiconductors vapor-deposited or sputtered onto a glass substrate, compares favorably with silicon-based solar cells due to its thinner layers. The lower consumption of energy and material reduces manufacturing costs, opening up significant market potential for the future, particularly as German government requirements dry up.

Modern thin-layer solar cells consist of a metal layer, a semiconductor layer and a transparent, electrically-conductive oxide layer. In the first step, the VOTANTM Solas 100 uses several lasers to structure the bottom layer, also called P1. On CIS/CIGS modules, mechanical tools process the two layers above this, P2 and P3, using the VOTANTM Solas 200. A needle-comb unit integrated in the system precision-scribes the desired structures into the surface at a speed of up to 1.5 m/s. Every needle of the JENOPTIK-VOTANTM Solas 200 is individual actuated and positioned in this process, allowing the system to adjust quickly to different cell sizes and react accurately to changes in structures due to temperature fluctuations and preliminary processes. Automatic needle alignment minimizes tooling-up times and ensures a reliable production process.



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A precision view of hot structures

This is made possible by the combination of inspection and microscope cameras with VisionPro® from Cognex. The vision system records the actual position of the tools in seconds. At the same time, three more cameras measure the P1 track of the automatically-fed solar panel. The cameras supply three reference points for so-called auto-alignment previously abraded from the molybdenum structure of P1 by a laser. Depending on the location and position of the P1 structures on the panel, VisionPro® provides data to adapt the machine's coordinate system and to correct the tools. The aim of the process is minimum displacement of the P1 structures in relation to those of P2 and P3, so as to achieve a high degree of cell efficiency. The P2 and P3 layers are then processed with the processing tools working to a positional accuracy of 5 µm.

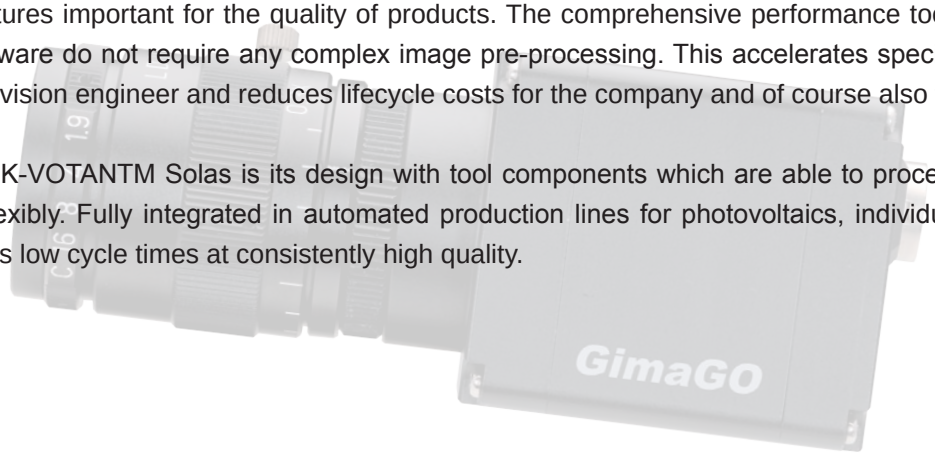
In the concluding quality control step, two more cameras examine the solar module closely again. Controlled by VisionPro®, they inspect the quality of the structures which have been applied. Temperatures of up to 600 °C act on the material during the P2 coating. At substrate thicknesses of 2 to 6 mm, some modules change enormously. The check also ensures minimum and maximum track width (laser: 15 to 100 µm, needle: 30 to 90 µm) and checks it is straight for optimum results.

As an option, the JENOPTIK-VOTANTM Solas 100/200 can use reflection and transmission measurement to check in a final step whether all the layers applied and processed are intact. In this case, high-quality cameras and VisionPro®'s software tools provide error-free detection of microcracks, broken glass and potential detachment of layer particles on an industrial PC.

Setting priorities intelligently

The JENOPTIK-VOTANTM Solas with Cognex vision software on board is quick and easy to integrate in complex production lines. It is not least due to VisionPro® that the system combines high process speed and maximum precision. The intelligent vision software ignores non-critical changes in the appearance of the solar panel and concentrates on the critical features important for the quality of products. The comprehensive performance tools of this world-beating vision software do not require any complex image pre-processing. This accelerates specific application development by the vision engineer and reduces lifecycle costs for the company and of course also for the end-customer.

A great benefit of the JENOPTIK-VOTANTM Solas is its design with tool components which are able to process different sizes of solar panel flexibly. Fully integrated in automated production lines for photovoltaics, individual actuation of the tools guarantees low cycle times at consistently high quality.



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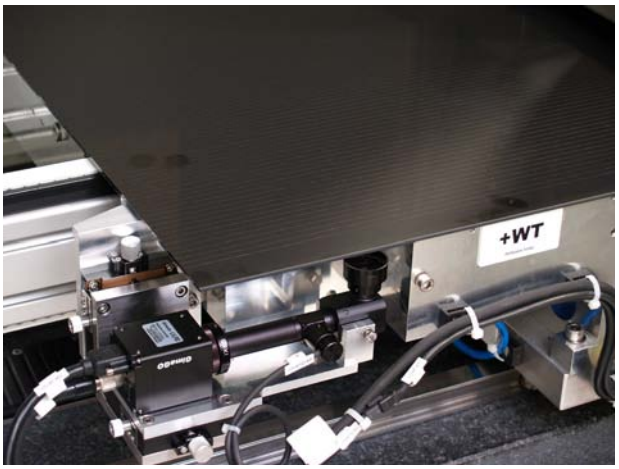
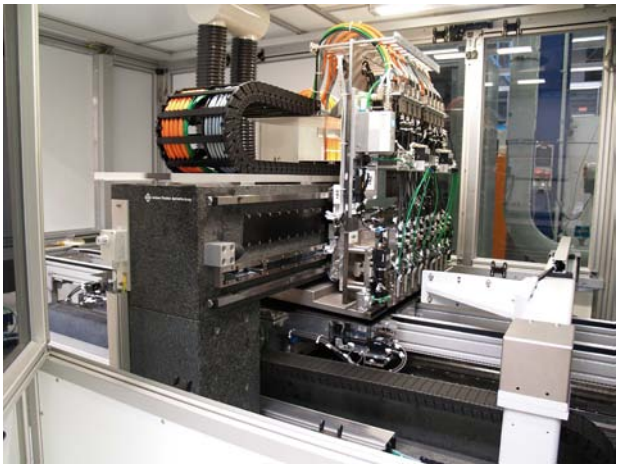
Optical tool calibration means that the mechanical scribing tools of the JENOPTIK-VOTANTM Solas 200 can be aligned accurately to within 5 µm. different sizes of solar panel flexibly. Fully integrated in automated production lines for photovoltaics, individual actuation of the tools guarantees low cycle times at consistently high quality.

Three of six gigabit Ethernet cameras supply the image data of the solar panel to VisionPro®.





The heavyweight with serious capabilities – the JENOPTIK-VOTANTM Solas and its precision core made of hard rock weigh over 10 tons.

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