

# In the Eye of Progress

## Greater Quality and Performance through Image Processing Systems

**A German domain on the world market is the building of special machines. In doing so, highly specialized machines for complex manufacturing processes help secure jobs even in the relatively "expensive" production location Germany. A major role in the realization of competitive advantages is played by the automation with the aid of vision sensors.**

For Rainer Beez, managing director of Beez Maschinenbau based in Untermünkheim-Kupfer (district Hohenlohe), the formula for success is clear: Innovation in special machine building means leaving worn-out paths and finding intelligent solutions in the electronics area –especially with regard to sensor technology – not as a supplement to the mechanics, but as a

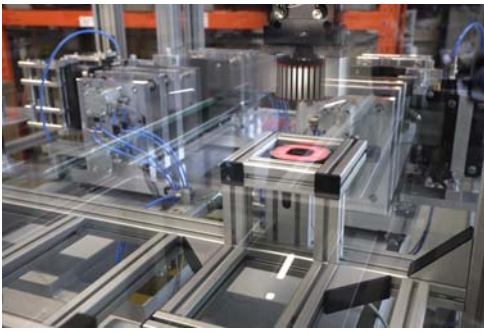
full-fledged replacement, which in their functionality oftentimes enters completely new dimensions.

A fitting real-life example is represented by a paper insulating machine for 4-pole and 6-pole external rotor stators with 24 or 36 grooves that Beez completed for the Rosenberg Ventilatoren GmbH located in the neighboring Künzelsau. The big advantage of this machine: A vision sensor Simatic VS120 from Siemens – in combination with a gripper system – ensures the correct positional arrangement of the stators prior to the injection of the insulating paper.

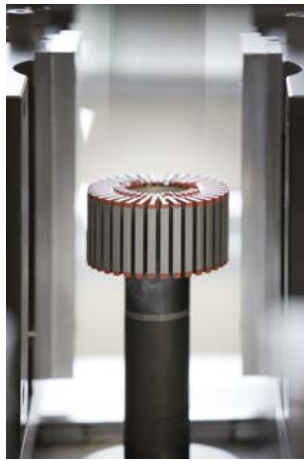
In doing so, the VS120 detects the position of the guide groove in the borehole of the stator. The sensor's analysis unit then computes the necessary rotation angle and transmits it to the machine controller, which sends a pulse to the gripper. The gripper then rotates the stator accordingly and places it in the machine. As a result, instead of the previous individual piece-by-piece production, a continuous operation is provided for that can be integrated seamlessly into the further production process.

### **Shorter Cycle Times**

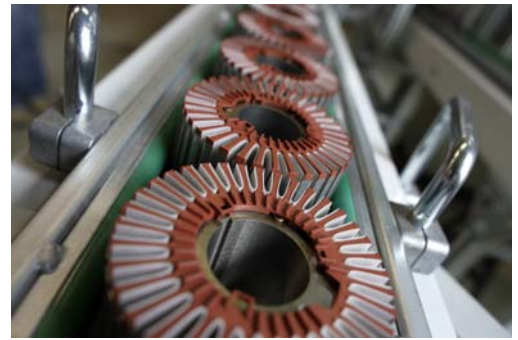
The machine was developed in close cooperation with the customer: "Our major concern was to considerably reduce the cycle time and thus increase the productivity," states Jürgen Große-Gehling, manager of equipment construction at Rosenberg Ventilatoren. "Regarding the method of the technical implementation, we were completely open to new solutions." Particularly in the construction of special machines is where Rainer Beez sees numerous possible applications for vision sensors to either simplify complex mechanical operations or to eliminate them altogether, just like – for example – in the supply and disposal of parts: "After recognizing the potential vision sensors offered for these tasks, we presented the possibilities to our customer and jointly decided to take this approach.



*Within half a second, everything is clear: The vision sensor Simatic VS120 checks the rotation and quality of the stator – into which the insulating paper is to be automatically inserted – in a single operation*



*Visually checked and found to be OK: Aligned stator body in the insulating station*



*Completed, insulated stator body: The guide groove in the central borehole used for the identification of the rotation and for the alignment can be clearly seen*

That an already developed section of the machine had to be discarded and completely reconstructed could easily be justified by the space-saving, labor-saving, time-saving and cost-saving benefits of the concept.”

Occupying a considerably smaller footprint, the new machine – for instance – offers a significant increase in performance compared to a conventional mechanical arrangement, since long conveyor belts and rotary take-up systems for the feeding of the stators in the proper orientation could be done without. Up to 15 stators can be placed pointing in any direction on a simple conveyor belt. The gripper then picks up the stators and takes them to the optical sensor, which is triggered and by means of the position of the guide groove determines and analyzes the precise rotation of the stator within a standstill duration of only half a second. Furthermore, the sensor also recognizes different stator types (with 24 or 36 grooves), which enables an automated mixed operation.

The resulting productivity is many times higher than with the previous solutions: While cycle times of approximately 3.5 minutes were achieved with the old method of manually inserting and removing the stators, the new machine now only requires 35 to 40 seconds – depending on the type – for a completely wound stator including the feed, positioning and extraction. At the same time, the vision sensor functions as automatic check of the stators' quality. If they are not up to standard, they are “not recognized” and thus rejected. A visual inspection by the operator than quickly reveals the location of the error.

### **Easy Setup and Integration**

The easy commissioning of the system is considered a further decisive advantage by the Messrs. Beez and Große-Gehling: The Simatic vision sensor does not need to be programmed, but can be trained on an OK part via a Web-based setup software. This also applies to the optimum alignment of the camera and lighting, which in the case of the VS120 are combined in the sensor module. In addition to two fixed-focus lenses with fields of view of 70 mm x 50 mm (working distance 12 cm) and 40 mm x 30 mm (working distance 8.5 cm), the sensor head is also available with a C-mount adapter for zoom lenses should other frame sizes and distances be required. The lighting – a red LED ring flash – is usually attached to the rugged aluminum housing, but can also be separated from the camera head. With a protection rating of IP65, the sensor head is optimally prepared for harsh industrial use and also withstands mechanical stresses, permitting a moving installation (via trailing cable).

The image taking is initiated by an external trigger. For this purpose, the analysis unit possesses a trigger input. For analyzing the recorded image, one of up to 15 trainable and storable parameter sets is called on as reference. The inspection result is provided at three control outputs:

- OK: Trained object/sample identified on the basis of the characteristics, degree of match greater than or equal to specified value
- N\_OK: Object/sample does not correspond to the characteristics, degree of match *not* greater than or equal to specified value
- Output of the position and rotation angle results via Profibus DP.

The analysis unit of the Simatic VS120 detects – depending on the object – up to 20 parts per second at a permissible parts speed of up to 5000 millimeters per second. This level of performance, however, is not even close to being utilized by the present application, where the cycle times worked with are significantly longer, even though the vision sensor would allow for a “faster” machine concept.

As is customary in special machine building, the customer largely specified the automation technology. “For us, integration is the top priority here, since we cannot afford to train our staff on different systems, let alone stock spare parts for multiple systems,” explains Große-Gehling the preference for choosing further products from the Siemens Automation & Drives range. Thus, the operator device of the new machine is an Operator Panel and the controller a Profibus-compatible Simatic S7-315-2 DP. Add to this drives of the Simodrive series and various axis motors from Siemens.

Past the end customer requirement, this integration also provides major benefits to the machine builder. “For me, it is crucial that all components in the plant can be monitored with the controller and – if necessary – clear information is received where something is not right.



*Integration from one source: Besides the sensors, the remaining controller technology and the drives also come from the Simatic product range by Siemens*



*Progress at a six times faster pace: The conveyor belt on the right is the materials buffer of the paper insulating machine; on the left, the insulated stators are transported away*

For this, coordinated technologies and a degree of freedom in the programming are required that many preconfigured controllers simply cannot offer – yet one still has to pay for the unnecessary configuration,” underscores Rainer Beez.

### **No Change “without Eyes”**

Such a close cooperation between machine builder and processor as seen with Beez and Rosenberg is of course not commonplace. Nevertheless, it is a co-requirement for the application of new technologies, since both partners have to adjust to them.

Although Beez Maschinenbau has only been on the market for about two years, it has already expanded substantially and succeeded in establishing itself as an expert for special machines, winding technology and automation technology. In the process, vision sensors have become a permanent component of the company’s innovative concepts – as in the follow-up project for Rosenberg, a winding machine for stators with multiple Simatic vision sensors. “Electronic systems are the key to the future in machine building, and I am personally convinced that 10 years from now, machines without a camera system will no longer be sold,” concludes managing director Rainer Beez.

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[www.siemens.com/simatic-sensors/mv](http://www.siemens.com/simatic-sensors/mv)