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CASE-STUDY: COMPACT ACTUATORS ADD FLEXIBILITY TO BAKERY MACHINES

WITH A NEED FOR FLEXIBLE, PRECISE, AND RELIABLE MACHINES TO CATER TO FREQUENT PRODUCT CHANGES IN THE BAKERY INDUSTRY, WP KEMPER COMPANY TURNED TO SIKO GMBH'S ACTUATORS IN THEIR SEARCH FOR SUITABLE MOTORS FOR THEIR HIGH-SPEED DOUGH DIVIDING AND MOULDING MACHINE. BY **MICHAELA WASSENBERG**, FREELANCE JOURNALIST

INDUSTRIAL producers of pastry and confectionery products today have to be able to offer a wide range of products and at the same time be able to react flexibly to fluctuating order quantities. High demands are placed on the individualised production of industrially manufactured bakery products.

The machines used should therefore be extremely variable in their way of manufacture—to cater to product changes that need to be done flexibly, precisely, and with great repeatability. Therefore, many manufacturers rely on the automation of their systems.

In 2015, the WP Kemper Company presented the Soft Star CTi, a high-speed dough dividing and moulding machine that automates the switch to new product types. But prior to this launch, the requirements for the drives to be installed were challenging in several respects.

First, adjustments of axis positions and contact pressures would be necessary during the product changeover in the areas of handling, portioning, and shaping. High repetition accuracy would also be required for all automated sub-processes in order to ensure process reliability when changing process variables. Moreover, force transmission necessitates high torques—the solution would need to

handle this. And lastly, large fluctuations in the size and weight of the dough pieces would also require compact sizes of all drive components in order to avoid interfering contours.

In the search for suitable motors, WP Kemper came across the AG26 actuators from Siko GmbH. These were then made responsible for the weight adjustment of the raw dough, the height adjustment for product transfers, and the height adjustment of pinch rollers.

HIGH ACCURACY IN WEIGHT AND PRESSURE

The machine is filled with 160 to 300 kg of dough mass. The dough is fed via the main funnel and slides down into the rolling area. There, the quantity defined in the program is separated from the remaining dough.

Depending on the processed recipe, dough pieces of 20 to 140 g are portioned in a measuring drum. The accuracy of the machine is ± 1 g. The dough pieces are then inserted into the bowls of the measuring drum via a feed piston. There, they are pressed together with a defined pressure to ensure the required density of the dough.

From the measuring drum, the dough pieces are transported into the rounding device via an internal belt.

Through rolling movements, the dough pieces are moulded in the same way dough is formed by the hands of a baker and, as the final step, are slightly flattened so that the dough balls do not inadvertently roll away during the subsequent processes.

DOSING OF THE FORCE TRANSMISSION

The special feature of the machine is the option to individually parameterise the force transmission. The precise control of the contact pressure flows directly into the quality of the end product. Excessive pressure would "stress" the dough and thus potentially result in undesirable baking results.

The correct contact pressure is achieved on the one hand by the repetition accuracy of the positioning and, on the other, by the sufficiently large torque while at the same time minimising the space requirement.

This is the decisive advantage of the Siko actuators: despite their small size, they integrate motor control, absolute encoder, power electronics, transmission and bus communication.

This makes it possible to sense the axis position directly on the shaft, which results in a significantly higher degree of precision than solutions that have an external gear

Despite their small size, Siko actuators integrate motor control, absolute encoder, power electronics, transmission and bus communication.



box. While the competition is in the range of one to two degrees in comparable applications, the drives can achieve accuracies of half a degree. The resolution is 720 increments per revolution.

NO SET-UP REQUIRED FOR PRODUCT CHANGES

The interaction of the actuators within the production unit is synchronised via the machine control. Bus communication takes place in this case via ProfiNET. It can also be realised via Ethernet/IP, Powerlink or EtherCAT at the customer's request.

The actuators are integrated into the overall control concept of the machine in the HMI. If a new product is



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Gericke Pte Ltd.
Singapore 787812
T +65 64 52 81 33
gericke.sg@gericke.net

Gericke AG
CH-8105 Regensdorf
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gericke.ch@gericke.net

gericke.net



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selected, all actuators go to the new position and production can be continued immediately. In addition to the drastic reduction of set-up times, another important advantage is the precise reproducibility of the baking results.

HIGH PROCESS RELIABILITY

The high degree of process integration makes monitoring the entire process much easier. If, for example, the shaft of the drive is blocked, the actuator sends an error signal to the machine control. The HMI acts as the master from which the higher-level process functions are coordinated.

However, individual program sequences such as the height adjustment of the rollers are handled independently by the actuators. The system-wide diagnostics make it possible to detect wear-and-tear at an early stage and to integrate maintenance procedures into the production processes.

LOW OPERATING COSTS

In order to ensure cost-efficient production over the entire product lifecycle of the machine, the machine has been specially designed for optimised maintainability. When replacing worn-out elements, there are significantly reduced assembly and set-up costs as compared to other prevalent solutions with a servo motor and an external gear box.

The actuator has to simply be mounted on the shaft and the torque support has to be tightened and secured with a clamping ring. No external control panel is required to facilitate the setup operation. The installer controls the axis positions easily with two pushbuttons located directly on the actuator.



Individual program sequences such as height adjustment of the rollers can be handled independently by the actuators.

Only a one-time referencing of the axes is required during initial commissioning. The use of an absolute encoder means that no further axis referencing is necessary, even when the shaft is rotated in a voltage-free state.

In order to prevent premature defects of the actuators, control-related protective functions have been integrated. In the case of a mechanically blocked shaft, starting the drive against the mechanical resistance would result in an overload on the motor and possibly even lead to defects.

With the drives by Siko, however, the company found that the position and the resistance are constantly balanced against one another, so that lag errors are detected if there are blocked shafts. In this case, the program stops and the fault is immediately reported back to the machine control, which in turn emits an alarm.

Thus, the motor's ability to function is preserved even in the event of a mechanical error. If a spindle becomes more and more difficult to move, the system reports that worn-out components need to be cleaned or replaced.

The production area and the drive/electrical area are strictly separated from one another and are located in their own enclosed areas. The power supplies of the control electronics and power electronics are also separate. Thus, the bus communication can be maintained even when the power electronics is turned off. This, in turn, enables an increased degree of safety during maintenance operations in which the control electronics power cannot be switched off.

WP Kemper is very satisfied with the integration of the actuators. With a support package for drive integration provided by Siko, the drives could be programmed by WP Kemper. The interface, defined by Siko, made it possible to integrate the components into the overall sequence smoothly. **APFI**

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