



PC-based control platform integrates robot kinematics

Pastry filling robot streamlines automated cream horn bakery

Once upon a time, only a skilled pastry cook could pipe the filling into a cream horn puff pastry, but pressure on prices in the food industry is so intense that such processes must now be carried out more rapidly and economically. Swiss company Pamatech System AG, known for implementing unique packaging and product handling solutions, was contracted to supply a fully automated robotic system for filling the signature cream horns. Given the stringent tolerances governing the shape, size, and consistency of the pastry, as well as the need for a uniform filling of the horns, this is far from a trivial task.

Pamatech System AG, located in Affoltern, near Zurich, Switzerland, specializes in packaging machines and special-purpose machines for the food industry. Besides boxing and specialized assembly machines for the primary and secondary packaging of a variety of food products, the extensive portfolio of the 25-year-old company also includes machines for everything from handling baking sheets to packaging rolled meat products. David Weber, managing director of Pamatech System, explains his business model: "We have frequently accepted unusually challenging projects that many of our competitors would not dare to attempt."

PC Control brings openness and flexibility to Pamatech

Given the wide variety of goods and products that must be handled, as well as frequent changes to packaging materials, a packaging machine is expected to be extremely flexible. "For example, we have created box sleeve machines that can not only package large products of varying geometries, but also process different shapes (round, oval, square, dual packages, etc.) and can still be

switched over automatically within one minute at the touch of a button. PC-based automation extends this functionality to an even higher level by linking the format data directly to the higher-level job data. PLC control technology from Beckhoff, integrating motion control and even HMI, offers a highly flexible solution," explains David Weber. He went on to add: "One important reason for our choosing the automation solution from Beckhoff was its openness with regard to the choice of drives. Many of our customers have a preferred drive supplier, so it is important to us that the automation platform is fundamentally open to the integration of third-party systems. At the machine level, we can use any stepper motor or large-scale servo drive without it having any effect on the higher-level programming. This means that our specialists can program in high-level languages and are therefore entirely independent of the lower-level drive systems." As David Weber further explains, it is also important that the complexity of the programming task can be represented in intelligible code, so that Pamatech has no need to depend on any external specialists, as had previously been the case.



The pastry cases are fed into the filling machine upright, placed at a specific height and a specific distance apart.



David Weber, Manager of Pamatech System AG



The control system of the filling station also integrates AM8831 servomotors with EHEDG-certified stainless steel housings

Integrated robot control with TwinCAT Kinematic Transformation

At present, Pamatech is working on a project for the Swiss Coop Cooperative – which also operates food markets – to develop a machine for filling puff pastry cases with a sweet cream. “Until now, cream horns have always been filled manually. To automate this task, our plant is designed to use a delta kinematic robot,” reports David Weber. “The challenge is mainly that the pastry cases come in different sizes, they all have to be filled right to the end with cream and all to the same level – within a specified tolerance – and the cream must adhere to the edge of the pastry so that it doesn’t collapse and separate.” Pamatech solved this problem by carefully positioning and orienting how the pastries are fed into the machine, and then filling them from the top using the delta robot. In addition to synchronizing with the continuously moving conveyor belt, the robot must execute a circular motion around the edge of each pastry without damaging its delicate surface. Further challenges for the plant engineers were to achieve the customer’s required filling rate and to stay within budget. David Weber is clearly satisfied with his filling machine, which is still undergoing further development: “Our trial fillings have already achieved some very encouraging results. The required filling depth is achieved using the height measurement given by a Baumer ultrasonic sensor.”

Pamatech’s machine uses a Majatronic delta robot that complies with the food industry’s stringent hygiene requirements. David Weber explains how the robot is integrated into the automation platform: “It’s controlled by servo-

motors and Servo Drives from Beckhoff. The system also incorporates AM8831 motors with stainless steel housings and EHEDG certification. To integrate the delta robot into the control system platform, we used the TwinCAT software library Kinematic Transformation (TS5112)”. TwinCAT NC I provides a flexible description of the filling process, with the necessary contours specified in G code so that a variety of filling methods can be programmed. In addition to the cream horns, an additional feed and filling concept enables the machine to pipe fillings into small round tarts, or to fill donuts with sweet cream. The procedure is similar to that used in filling the horns, except that the filling does not need to be so deep and the cases do not need to be so precisely presented or oriented on the conveyor belt. David Weber explains this further: “To solve this task, we have two vision sensors mounted above the incoming belt that detect the exact position of each pastry case. Given these transmitted coordinates, the robot can then accurately fill each one.

“Thanks to our modular system concept, the machine offers sufficient flexibility to be reusable in other applications,” David Weber adds. “Once an order or batch is completed, we can retool the system as desired. The necessary changes to the format are simply made by modifying the software.”

Further information:

www.pamatech.ch

www.beckhoff.ch