Pastry goodness begins with the production: gentle care is required during the motion sequences

Gentle production processes, under the control of SIMOTION SINAMICS S120 and D425, ensure taste and quality

Today there are countless variations of pastries: from brittle to soft, from crunchy to cookies with creamy chocolate or lemon filling. In the year 2007, over a billion tons of biscuits were manufactured in Italy, which corresponds to about a 15 kg consumption per capita.

Amidst this highly competitive and specialized market, the new complete production line of the Ricciarelli Group was recently introduced for the prepackaging and packaging of biscuits into boxes.

Founded in the year 1843 under the name “Garibaldo Ricciarelli,” then still active as a manufacturer of molds for pasta production, the historic brand, “Ricciarelli,” has been internationally known for over 150 years, and has become synonymous with quality and a guaranty in the world of packaging.

Ricciarelli is the world leader in the field of packaging, both in terms of the extensive product range as well as for what the latest level of technology and products is concerned. In the first part of the production line, the product is dosed and then forwarded to the actual packaging machine. Because of the fragility of the product, the maximum attainable speed, without having breakage of the pastry, is at 50 strokes per minute. The machine also has a level which can be tilted so that the pastry can be transported gently and controlled on its way down.

These sensitive procedures, where it not so much depends on speed but much more on gentle movements, are controlled by devices such as the Siemens SIMOTION D425 and SINAMICS S120. The use of a SIMOTION CPU in the entry format makes it possible for Ricciarelli SpA to offer a production line of the latest generation with powerful functions and features while, at the same time, limiting construction costs. In addition, the implementation of the SINAMICS S120 ensures the buyer of the packaging machine savings on the spare parts and in the training of the maintenance personnel.

With a single, dual-channel module, SINAMICS S120 is able to manage contemporarily a synchronous SIMOTICS S-1FK7 servomotor and an asynchronous motor for the unwinding of the plastic foil. The decentralized ET 200S peripheral unit, used for the recording of the I/O signals, is connected to the SIMOTION D425 via the PROFIBUS, while the user interface, consisting of a TP-177B panel, is connected via Ethernet to SIMOTION. The production line

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is thus well suited and equipped to monitor control steps remotely and to provide a preliminary diagnosis, thereby contributing to a significant reduction in the high costs incurred otherwise in the employment of local personnel.

SIMOTION also offers the possibility to implement the function of a web server and to create web pages, both to monitor the physical as well as the system variables or to modify the software parameters. The thus packaged product now approaches the area in which the cookies, via conveyor belts, are put into the boxes. These conveyor belts are driven by SIMOTICS S-1FK7 servomotors, controlled by the SIMOTION Motion Control System and connected to the SINAMICS drive system via the DRIVE-CLIQ connecting cable, which makes possible an independent identification of data from the engine power plate, and also simplifies the wiring.

To optimize the space in the cabinet, the department of Ricciarelli SpA responsible for the electrical equipment decided for a solution with SINAMICS S120 drives with a common DC bus. This architecture provides for a single power supply that sustains a DC bus for the low-voltage module. Thanks to its compact size of only 50 mm width, two SIMOTICS S-1FK7 servomotors can be operated. In parallel to this, a gripper with a suction function takes a carton from the magazine to form the box. Once this is formed, it is positioned in the drop zone.

The format and all other useful information for the user are available for viewing on the TP 177B touch screen user interface, which is connected via Ethernet to the CPU of the SIMOTION D controls. The ET 200S periphery unit, connected to SIMOTION D via PROFIBUS, was implemented for the management of the inputs and the outputs. All intelligent systems, from motion control up to machine logic, converge into a single point. This centralized solution will bring unquestionable advantages, both for the manufacturer as well as for the end users.

For this reason, there is not just a single Compact Flash, in which all project data, including codes and parameters of the axes, are included but, besides this, also just a single software for the programming, commissioning and axes management. In this way, the cost of maintenance and the inevitable problems encountered in the use of different software are drastically reduced. The cookie packages now reach the sorting area. Once the prescribed number is reached, they are taken up by a robotic manipulator arm, which then places them in the boxes. Depending on the entered format, it is possible to arrange several rows of the products in the same box or to rotate them during transport. The gripper has a recording system with a suction device and is also able to detect the absence of a product, to return and to carry out the take-up process again.

The handling functions are managed by SIMOTION D by means of a corresponding library: starting with the interpolation, in which the reference points of each axis are calculated on the basis of the mechanical configuration, on to the implementation of the desired movement, whereas linear motion profiles or circular motions with two or three axes are also possible. The Top Loading Library is available in the Scout software developer that is specifically designed for the handling in the packaging field and makes a much faster and more flexible programming possible. By the use of standard functions, motion profiles can be defined by the interpolation of the points.
of a Cartesian axis with specific areas of transition between the different profiles and profile switching in flight.

The dynamic limits of the axes with the SIMOTICS S-1FK7 (such as acceleration and jerk) can also be parameterized and can be used to calculate the velocity profiles. In connection with SIMOTION, there are three types of interpolation: linear, circular and polynomial (5th order) interpolation in 2D or 3D. The kinematic transformations in SIMOTION are available in various types and range from the Cartesian portal through SCARA up to the robot manipulator and Delta 3.

The technical planning department at Ricciarelli SpA could therefore implement these pick & place functions without having to create a separate program for therobotics, simply through the use of the structured programming language that is already stored in Scout and is compat-

### Highlights
- The use of Ethernet across the board for programming and monitoring
- Automatic recognition of the motor performance data to simplify commissioning and maintenance
- Only one CPU for the automation of the line and for performing motion control tasks
- Only one software for programming, commissioning and axis parameterization
- Handling library for simplified management of the pick & place movements

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Standard software modules used as basis for the modular machine solution
Consisting of the basic ingredients of flour, eggs, butter and sugar (formerly honey), biscuits have been incorporated into the culinary traditions of many countries. This is for two main reasons: because of their good taste and because they are durable over longer periods of time and do not lose their nutrients and properties. Although the time of the biscuit’s first appearance is unknown, we do know that it represented an ideal addition to the supplies of sailors and soldiers in the past. Thanks to the double backing process (hence the Italian name “biscotto” / derived from “twice-baked”), in which remaining moisture is removed, and thanks to the sugar content of the biscuit, it is well suited for storage. The cookie is undoubtedly a culinary asset, but also an appetizing stimulus for its industrial production.