



The multi-robot H 240 handling module automates handling in packaging processes effectively, efficiently and extremely dynamically with up to 240 pick-and-place cycles. It is also extremely hygienic through the use of AM8800 stainless steel servomotors.

TwinCAT robot kinematics and servo drive technology promote efficiency in food packaging

## MULTIVAC: Optimal hygiene safety ensured right down to the stainless steel motors

MULTIVAC successfully fulfills extremely strict hygiene requirements with its expertly-designed packaging systems for the food industry. This also applies to the company's handling modules with proprietary pick-and-place robots. In terms of control technology, the solutions are based on TwinCAT automation software with its robot kinematics as well as the ultra-fast EtherCAT communication system. Not only do AM8800 servomotors ensure highly dynamic movements, their "Hygienic Design" helps enable handling robots with a completely open construction that makes them effortlessly easy to clean.

MULTIVAC Sepp Haggenmüller GmbH & Co. KG, with its headquarters in Wolfertschwenden, Germany, is a full-range supplier of packaging solutions for the food, medical and consumer goods industries. In addition to packaging machines, the MULTIVAC portfolio includes handling modules for loading, unloading and channeling, inspection systems for quality control and detection of foreign bodies as well as marking and labeling solutions for different package types. The food sector represents the most important user industry for MULTIVAC solutions, where efficient, accurate, and above all, hygienic packaging of goods such as meat, fish, cheese, vegetables and ready-to-eat meals is imperative.

#### PC-based control technology for efficient packaging processes

MULTIVAC relies on PC-based control technology from Beckhoff to automate all of its standard packaging machines. Back in 2005 the company replaced microprocessor-based controllers in order to meet the growing demands of increasingly complex machines with ever greater functionality through more computing power and memory. Added to that, PC Control permitted communication connections, for example via Ethernet and OPC, to be simplified considerably through standard interfaces and standard software libraries, reducing the development overhead to a minimum as a result.

According to Alois Allgaier, who heads up the MULTIVAC Control Technology Division, another advantage of PC-based control technology lies in the excellent scalability: "On one hand we can always use exactly the right Embedded PC for machines whether small or large, but with the same functionality offered on the software side every time. On the other hand, the I/O equipment can be adapted exactly and cost-efficiently to the requirements of the application thanks to the modular and versatile EtherCAT I/O system." Optimal adaptability for Alois Allgaier means that the packaging machines can be modularized very efficiently by means of the flexible EtherCAT terminal system: "Our machines are controlled centrally from a CX1020 or CX1030 Embedded PC, but are split between three decentralized control cabinets at the I/O level. This means, for example, that all data acquisition and communication for one forming station can be realized in the associated control cabinet module. The required communication with the central controller is handled by the extremely fast EtherCAT system, which was also an important aspect when deciding in favor of PC Control. Ultimately, the clock speeds that can be achieved by the packaging machines depend directly on ensuring shortest possible cycle times of the control technology."

#### Flexible handling modules with numerous available robot types

The MULTIVAC handling modules automate a broad range of packaging tasks. This includes the loading of products, separation and orientation of packs, rejection of defective packs and box loading of packs. Depending on requirements, the systems can be equipped with robots that have two, three or four axes and can be used flexibly, for example, with a wide range of products, pack formats, weights and cycle times.

The handling systems can generate practically any pack pattern to ensure that the capacity of secondary packs is optimally used. Interlayers and dividers can also be inserted automatically. Thanks to this versatility as well as the hygienic and FDA-compliant stainless steel machine construction, which allows wet cleaning of the entire handling unit, the MULTIVAC modules are ideal for all products and production environments in the food industry.

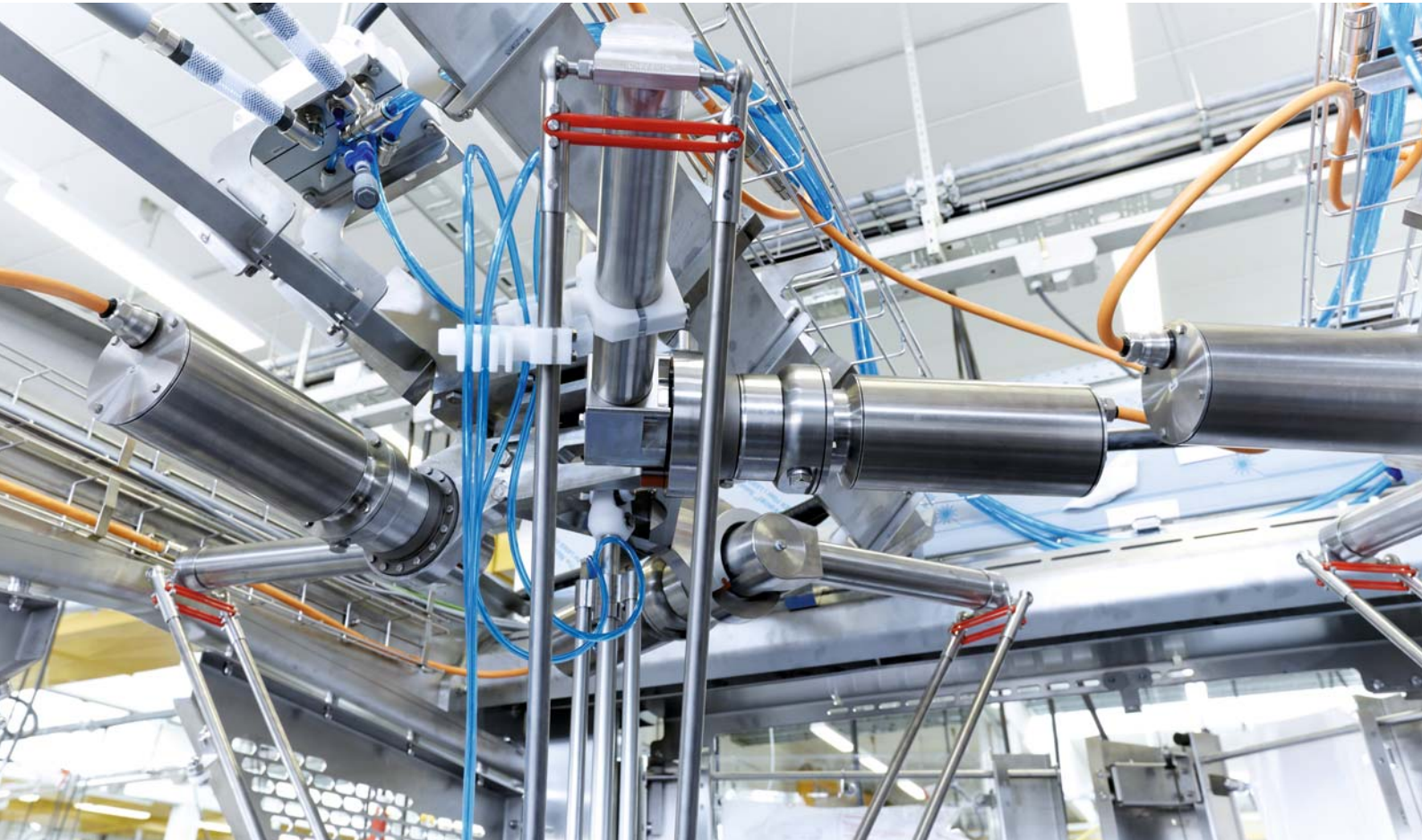


The AM8800 stainless steel motors can be used in open designs, i.e. without protective housings, facilitating optimal cleaning of pick-and-place robots.

#### Hygiene benefits from open frame construction and stainless steel motors

There were a number of reasons why MULTIVAC developed their own handling modules and robots explains Alois Allgaier: "We have implemented extremely strict hygiene requirements with our packaging machines for the food industry, which were also our benchmark in the area of handling and robotics. Because there were no suitable systems available on the market, we developed our own robot arm for the infeed area based on our own ideas and objectives. The result is a stainless steel frame construction that can be optimally cleaned because it is completely open. The FDA-compliant AM8800 stainless steel servomotors from Beckhoff also played their part as they can be installed simply without an additional protective housing."

The servomotors in the AM8800 series have a stainless steel housing that is designed according to the EHEDG (European Hygienic Engineering Design Group) guidelines in "Hygienic Design". The lubricants used are certified food-safe (FDA). The motor windings are implemented using salient pole-wound technology. This results in a high copper space factor and correspondingly high



One Cable Technology (OCT) offered in the AM8800 motors not only reduces the cabling overhead, it also minimizes the risk of dirt deposits by eliminating 50 % of the motor cables and connectors.

continuous torque. The fully potted stator provides a thermally ideal transition of the winding to the housing. A further advantage of this is the mechanical protection of the winding wires against vibrations. Since the housing and motor shaft are manufactured from scratch-proof stainless steel (AISI 316L), no corrosion creep or damage to the finish is possible. The motors are manufactured with standard IP 69K protection, allowing the use of steam and high pressure cleaners. An optional sealing air connection is also available to prevent the formation of condensation.

MULTIVAC uses the 2-channel AX5206 EtherCAT servo drive from Beckhoff for motor control with the pick-and-place systems, which enables operation of two of the same or even differently sized motors. The stainless steel servomotors used include the AM8843 types with 3.9 Nm rated torque, 4.5 Nm standstill torque and 16.5 Nm peak torque as well as the AM8852 with 5.1 Nm rated torque, 6.0 Nm standstill torque and 22.5 Nm peak torque. This enables the implementation of highly dynamic and precise handling tasks in conjunction with the fast EtherCAT communication.

#### **One Cable Technology improves hygiene and reduces costs**

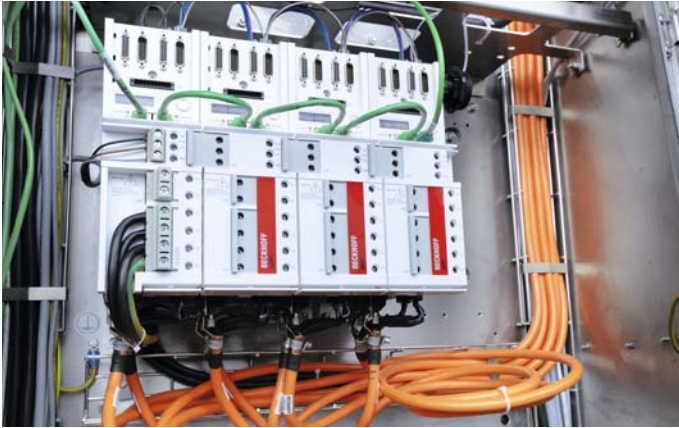
The cable gland of the servomotors is also implemented in "Hygienic Design" just like the housing. In terms of hygienic safety, One Cable Technology (OCT) from Beckhoff provides yet another advantageous point for Alois Allgaier

when connecting the AM8800 servomotors: "As one of the usual motor connection cables is not needed, there is also one less place for pockets of contaminants to form. That was another important factor for us when opting to use OCT."

In addition, the fundamental advantages of OCT such as reduced component and commissioning costs can be leveraged. Finally, because motor feedback signals are sent directly along the conductor to the power supply, a cable and plug can be omitted, which saves both material costs and cabling overhead.

#### **Robotics, motion control and PLC on one dynamic software platform**

TwinCAT automation software from Beckhoff combines PLC, motion control and robotics in one integrated platform, which was a decisive advantage of PC Control in Alois Allgaier's point of view from the very outset: "Even when developing the robot arm we were certain we did not want to use a separate robot controller. TwinCAT enables the entire control technology to be fully implemented in one software system and for commissioning to be performed extremely quickly. For example, the stainless steel motors can be incorporated with ease into the software by means of the servo amplifiers and the motion sequences of our applications can be realized very efficiently using TwinCAT NC PTP and the kinematics library."



MULTIVAC uses the 2-channel AX5206 EtherCAT servo drive for precise pick-and-place tasks.



A CX1030 Embedded PC, TwinCAT NC PTP and EtherCAT communication ensure fast and precise control sequences for the handling modules.

Alois Allgaier, Head of the MULTIVAC Control Technology Division: "Thanks to our own robotic system, we can offer excellent hygiene safety standards in our packaging and handling systems."



Robot functions can be mapped easily in the automation software using "TwinCAT Kinematic Transformation". This TwinCAT supplement integrates transparently into existing motion control systems. Robotic and motion control functions can therefore be synchronized optimally in one harmonious environment. For example, the 3D delta kinematics can be coupled without great difficulty with the "flying saw" functionality in order to synchronize with conveyor belts to pick or place packs. Various types of robot kinematics can be realized, with the movements programmed in Cartesian coordinates either with DIN-66025 commands or with the PLCopen-compliant components from the PLC. An integrated dynamic pre-controller ensures very precise movements even at high accelerations and speeds. TwinCAT Kinematic Transformation contains Cartesian portals, 2-D parallel kinematics, shear kinematics, crane and roller kinematics, 3-D delta and SCARA kinematics.

### Intuitive operator interface via FDA-compliant stainless steel Panel PC

The benefits offered by PC control to Alois Allgaier in terms of system flexibility are not limited to the control software: "We can offer the handling modules with two different control concepts, entirely according to demand: On the one hand this could be a modular system, in other words, with its own Embedded PC. On the other hand, the module could take the form of an element integrated at a deeper level into the packaging system, and running as software on the controller in the main packaging machine. Beckhoff automation technology offers a major advantage through this flexibility. The handling robot is operated accordingly, either by means of its own HMI or via the packaging machine terminal."

A custom-designed CP7201 Panel PC with 12-inch touchscreen in a high-quality stainless steel design is used as the display and operating terminal with an IP 65 rating. The Panel PC is characterized by its "Hygienic Design" as with the stainless steel servomotors, in other words, by gap-free housing design in a flush-fitting touch panel. The HMI 2.0 user interface from MULTIVAC allows simple, intuitive and reliable operation of the handling modules as well as the entire packaging machine. The plain text information display, rich graphics and video sequences, 200 freely assigned program presets, 36 available interface languages as well as a multi-level access rights management also contribute to intuitive and secure operation around the world.

The handling modules can either be operated via the HMI 2.0 user interface of the packaging machine or equipped with their own MULTIVAC-specific CP7201 Panel PC from Beckhoff.

