

As Flexible as Required

PC-Based Control in an In-Mold Labeling System Helps Decorate Plastic Lids

In-mold labeling is the ideal solution for today's customer requirements in the packaging industry. Companies need high-quality, durable machines with maximum availability that can produce a wide range of packaging designs with flexibility and economic cycle times. To implement such systems efficiently, Swiss specialty machine manufacturer Beck Automation implements PC-based control and drive technology from Beckhoff as its standard automation platform.



With IML systems from Beck Automation, a broad range of plastic containers and lids can be labeled efficiently and flexibly © Beckhoff Automation

The spectrum of customer requirements for in-mold labeling (IML) ranges from cost-effective basic systems through to customer-specific special machines. Beck Automation AG in Oberengstringen, Switzerland, is one of the pioneers in the field of IML systems with more than 30 years of experience. As a current example of the solution competence of the family-run company, which was founded in 1934, Nino Zehnder, Head of Sales and a member of the executive management team, cites a six-

way IML system for decorating plastic lids: "This machine is for plastic containers used in the food industry. The most common items being made with it are lids to cover 1-liter containers for products such as yogurt, but the same machine can also decorate the body of the container."

IML as a Particularly Flexible Process

With in-mold labeling, a previously printed label that has the same base color as the final product (for example,

the lid of a yogurt container) is placed in an injection mold. When the plastic is injected, cools down and hardens, it combines with the label to form the finished product. This process is more flexible than affixing printed labels, says Nino Zehnder: "IML is especially suitable for packaging design in the age of Industry 4.0 and lot sizes of 1 because you don't need to modify a printing machine for every change, which is expensive and time-consuming." The Beck Automation system can produce up to 5000 plastic lids per hour, each with its own design or even an individual QR-code if necessary.

For precision and durability, the IML system is mounted on a solid welded steel frame. The system attaches laterally to an injection molding machine so that its servo-controlled shuttle arm can reach into the mold. When the shuttle arm moves into the open injection mold, it picks up six finished lids on one side »



Fig. 1. In each processing step, the IML system takes six labels at a time from a magazine and places them into the open mold of the injection molding machine © Beckhoff Automation

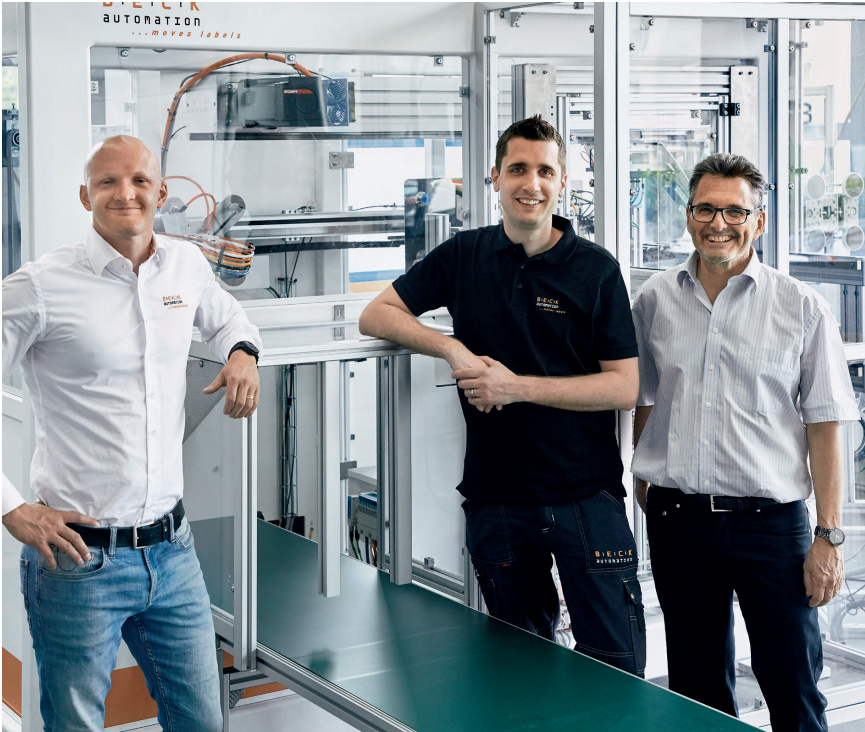


Fig. 2. Nino Zehnder, Head of Sales and a member of executive management, and Christoph Jenni, Head of Software Development, both of Beck Automation, and Robert Urech, Area Sales Manager of Beckhoff Switzerland (left to right), in front of the new six-way IML system © Beckhoff Automation

while simultaneously inserting six new labels for the next injection molding process.

During this process, the IML machine inspects the lids with a vision system for quality assurance before stacking them. During the stacking process, the machine also separates the next six labels in order to place them on the main shuttle arm for the next insertion pass into the injection mold (Fig. 1).

Nino Zehnder points out the performance capabilities of the IML machine: "The entire cycle with six plastic lids takes only about four seconds. The machine also features exceptional flexibility. It can be adjusted for other lid sizes, shapes or quantities very quickly and easily. Another advantage is the automatic magazine changeover, which makes it possible to refill the labels without interrupting the process."

Advantages of PC-Based Control Technology

As Christoph Jenni, Head of Software Development, explains, Beck Automation first decided to use PC-based control technology in 2011: "Even back then, PC-based control technology impressed us

with several basic advantages such as the ease with which you can implement remote access for effective customer support. Another outstanding feature of PC-based control from Beckhoff was the ability to make system changes online, i.e. re-loading modified program parts while the control program is running. Compared to the previous PLC-based solution, we also benefited from the powerful axis control with extensive diagnostic capabilities as well as from the fast and easy-to-use EtherCAT communication stan-

dard, which replaced the traditional individual wiring." Nino Zehnder also points out the benefits of a Windows-based software system: "Its openness ensures maximum flexibility. For example, we can easily export data as an Excel file or use Windows' many capabilities for a user-friendly operator interface."

According to Nino Zehnder, the worldwide availability of Beckhoff technology (Fig. 2) and support is also important for a globally active company like Beck Automation: "Since our systems are extremely durable, we must also make sure that the components are available for the long term. Even after ten years or more, spare parts and newer, yet fully compatible products are still readily available."

Another factor is the exceptional modularity and scalability of PC-based control, adds Christoph Jenni: "Depending on the machine's size and features, the control technology can be optimally adjusted without requiring much additional engineering. For example, we can easily adapt the number of servo axes to the respective requirements. And unlike other systems, PC-based control offers an unlimited number of I/O channels, which leaves all options open."

Servo Drive Technology Increases Machine Flexibility

Beck Automation also employs servo drive technology throughout its new six-way IML system. Its easy configuration results in significant benefits, particularly during setup changeovers. The machine features four AM8000 series servomotors, which are

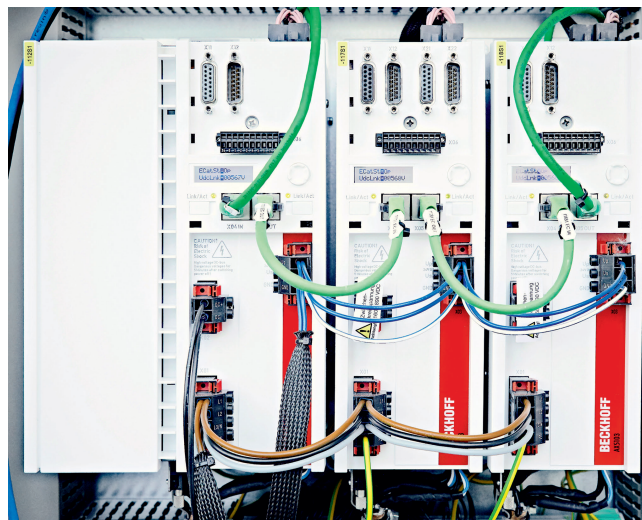


Fig. 3. Together with the AM8000 OCT servomotors, the AX5000 Servo Drives provide an efficient and dynamic motion control solution

© Beckhoff Automation

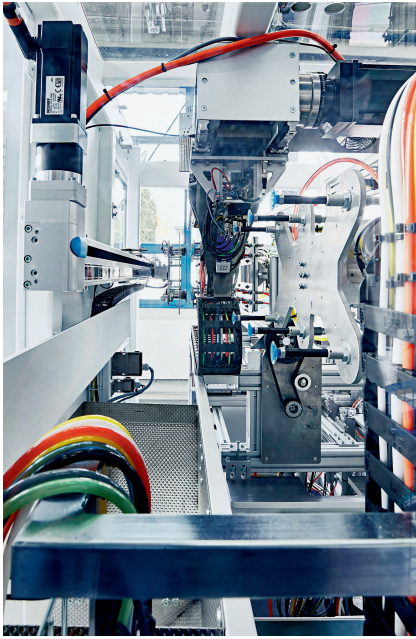


Fig. 4. Two of the machine's four AM8000 servomotors move the main arm (motor on the right, top) and the shuttle (motor on the left, top) © Beckhoff Automation

controlled by TwinCAT 3 NC PTP software (Fig. 3) via two single-channel AX5103 and AX5118 Servo Drives or a two-channel AX5203. The AM8063 servomotor with 29Nm of standstill torque makes for a highly dynamic main axis (Fig. 4).

There are also two AM8032 (2.37Nm) and one AM8033 (3.22Nm) equipped with holding brake, which are used to implement, among other things, the shuttle motion in order to guide the plastic lids along the inspection system with a sufficiently short cycle time, says Nino Zehnder. In addition, the servo drive technology is much less jerky than pneumatics, which increases the machine's durability due to the reduced inertia forces.

The other servo axes are used to take the labels from the magazine and to stack the finished lids. Another positive feature is the One Cable Technology (OCT) from Beckhoff, says Christoph Jenni: "OCT reduces the wiring and assembly effort significantly. And the electronic type plate makes it much easier to commission, troubleshoot and possibly replace devices."

Data Exchange also via OPC UA

A CX5130 Embedded PC (Fig. 5) with an Intel Atom processor running at a clock speed of 1.75 GHz provides sufficient performance for all control and motion sequences. The broad spectrum of the Beckhoff Industrial PC portfolio is another critical advantage, says Jenni: "Depending on the requirements or the size of the machine, you can easily deploy more powerful IPCs or multi-core processor technology without having to change the control software. This makes us highly flexibly as far as the system design is concerned."

The same applies to the TwinCAT software: "The existing motion control library has met all our requirements so far. We could even implement special features like data exchange via OPC UA very easily with the help of a corresponding TwinCAT function." And the integrated TwinSafe solution has delivered additional efficiencies, because the EL6900 TwinSafe Logic terminal and the optional AX5801 TwinSafe cards for the drives made it possible to significantly reduce the wiring and the space requirements for the safety doors and the emergency stop function. ■



Fig. 5. The CX5130 Embedded PC and the I/O level with EtherCAT and TwinSafe terminals are extremely compact © Beckhoff Automation

Advances at a Glance

Beckhoff Automation GmbH & Co. KG offers specially adapted solutions for the plastics industry, such as the six-way IML system for container lid decoration described here.

PC-Based Control in Practice:

- PC-based control and drive technology provides the basis for highly flexible machine design
- CX5130 Embedded PC as a powerful control device
- TwinCAT 3 NC PTP, AX5000 and AM8000 for precise and dynamic motion control
- OCT for minimized installation, troubleshooting and maintenance requirements
- Efficient, system-integrated TwinSafe safety technology

Customer Benefits:

- Compact and flexible system design
- Long machine design lifecycle
- Output up to 5000 plastic lids per hour
- Quick product changeovers down to lot size 1

➤ www.beckhoff.com/packaging

The Author

Dipl.-Ing. Thomas Kosthorst works in the Business Management Plastic Processing Machines/Hydraulic Applications at Beckhoff Automation GmbH & Co. KG, Verl, Germany.

Service

Digital Version

- A PDF file of the article can be found at www.kunststoffe-international.com/2020-5

German Version

- Read the German version of the article in our magazine *Kunststoffe* or at www.kunststoffe.de