Thermoforming machines for environmentally-friendly plastic packaging

Sustainable production with integrated, high-precision measurement technology

The US-based company Fabri-Kal uses environmentally-friendly plastics to produce packaging solutions for the food industry. For example, the Greenware® product line – which includes cups, lids, portion containers and lunch boxes – is entirely made of synthetic, plant-based, biodegradable resins. The production processes at Fabri-Kal also meet high standards for conservation of energy and resources. The company’s facilities use a PC-based control platform from Beckhoff with integrated measurement technology.
With three manufacturing facilities, including its headquarters in Kalamazoo, Michigan, Fabri-Kal is one of the USA’s market leaders for deep-drawn plastics, developing custom packaging solutions for major clients in the food industry. Their client base typically includes manufacturers of yogurt, smoothies, milk shakes, among other food products.

**Fabri-Kal focuses on sustainable production with PC-based control**

In 2010, the consistent use of environmentally-friendly materials and production processes at the Fabri-Kal factory in Kalamazoo earned the company the prestigious LEED award (Leadership in Energy and Environmental Design). At the same time, Fabri-Kal began gradually modernizing its plants’ control systems with the goal of improving production process efficiency and reducing energy consumption. “Integrating PC-based control hardware and software has given us a flexible way to upgrade our machines without coming into conflict with existing control systems as we migrate technologies,” says Dale Michaels, Electrical Engineer with Fabri-Kal.

---

**At a glance:**

**Plastic packaging for the food industry**
- PC and EtherCAT based control platform for extruders and deep-drawing plant

**Customer benefit**
- Improved performance through higher system speed
- Reduced energy consumption
- Various peripherals coupled via appropriate interfaces
- Real-time data processing reduces the consumption of raw materials

**Applied PC control**
- CX2030 Embedded PC for PLC, motion control and measurement technology
- EtherCAT as the universal bus system
- EtherCAT I/O for high-precision measurement of temperature and energy consumption
- EtherCAT AX5000 Servo Drives for high precision
Dale Michaels, explaining the control architecture. The fieldbus system used is EtherCAT, which enables communication speeds in the microsecond range. “EtherCAT significantly improves the performance of our machines,” confirms the electrical engineer: “For motion control as well, we are increasingly using AX5000 series EtherCAT Servo Drives, which offer us both high speed and precision.” The I/O stations and drives interspersed along the line of machines are connected via EK1100 EtherCAT Couplers.

Precise temperature control and performance monitoring ensure efficient use of energy

Precise temperature control plays a key role in the extrusion of high-quality plastics, affecting both resource consumption and product quality. “Now that we have an integrated PC-based control platform with EtherCAT thermocouple I/O modules, we can precisely maintain the desired temperature on the basis of process data that is captured in real-time,” emphasizes Dale Michaels. EtherCAT EL3403 power measurement terminals are used to record numerous energy consumption parameters that enable Fabri-Kal to determine whether or not the system is using its resources efficiently. The terminals monitor the transformers at the Fabri-Kal factory and record the power consumption on an hourly basis.

The temperature and pressure throughout the production process, notes Dale Michaels, explaining the control architecture. The fieldbus system used is EtherCAT, which enables communication speeds in the microsecond range. “EtherCAT significantly improves the performance of our machines,” confirms the electrical engineer: “For motion control as well, we are increasingly using AX5000 series EtherCAT Servo Drives, which offer us both high speed and precision.” The I/O stations and drives interspersed along the line of machines are connected via EK1100 EtherCAT Couplers.

Fast control technology conserves resources and improves product quality

Beckhoff CX2030 and CX1020 Embedded PCs serve as the control hardware for Fabri-Kal’s machines. “The CX2030 is equipped with a 1.5 GHz Intel® Core™ i7 dual-core CPU, which offers incredibly high performance for such a compact design. As well as the PLC and motion control, the Embedded PCs also govern the temperature and pressure throughout the production process,” notes Dale Michaels, explaining the control architecture. The fieldbus system used is EtherCAT, which enables communication speeds in the microsecond range. “EtherCAT significantly improves the performance of our machines,” confirms the electrical engineer: “For motion control as well, we are increasingly using AX5000 series EtherCAT Servo Drives, which offer us both high speed and precision.” The I/O stations and drives interspersed along the line of machines are connected via EK1100 EtherCAT Couplers.

Precise temperature control and performance monitoring ensure efficient use of energy

Precise temperature control plays a key role in the extrusion of high-quality plastics, affecting both resource consumption and product quality. “Now that we have an integrated PC-based control platform with EtherCAT thermocouple I/O modules, we can precisely maintain the desired temperature on the basis of process data that is captured in real-time,” emphasizes Dale Michaels. EtherCAT EL3403 power measurement terminals are used to record numerous energy consumption parameters that enable Fabri-Kal to determine whether or not the system is using its resources efficiently. The terminals monitor the transformers at the Fabri-Kal factory and record the power consumption on an hourly basis.

Fabri-Kal uses extruders to form a deep-drawing plastic sheet of precisely defined thickness, which is then shaped in a separate deep-drawing machine. In the extruder, PC-based control technology regulates the temperature and pressure, as well as the setpoint for the frequency inverter. In the deep-drawing machine, the PC control platform with TwinCAT NC regulates the drawing unit, along with the composition and separation of the end product. In addition, the PC-based automation technology monitors and documents the factory’s entire production process. “What we were aiming for was a dynamic control system with flexible connectivity solutions for linking to the other equipment in the factory, plus the option of capturing and centrally managing large amounts of data in an SQL database. Thanks to TwinCAT’s open architecture, we were able to achieve just that,” noted Dale Michaels, enthusiastically.

The CX2030 is equipped with a 1.5 GHz Intel® Core™ i7 dual-core CPU, which offers incredibly high performance for such a compact design. As well as the PLC and motion control, the Embedded PCs also govern the temperature and pressure throughout the production process,” notes Dale Michaels, explaining the control architecture. The fieldbus system used is EtherCAT, which enables communication speeds in the microsecond range. “EtherCAT significantly improves the performance of our machines,” confirms the electrical engineer: “For motion control as well, we are increasingly using AX5000 series EtherCAT Servo Drives, which offer us both high speed and precision.” The I/O stations and drives interspersed along the line of machines are connected via EK1100 EtherCAT Couplers.

Precise temperature control and performance monitoring ensure efficient use of energy

Precise temperature control plays a key role in the extrusion of high-quality plastics, affecting both resource consumption and product quality. “Now that we have an integrated PC-based control platform with EtherCAT thermocouple I/O modules, we can precisely maintain the desired temperature on the basis of process data that is captured in real-time,” emphasizes Dale Michaels. EtherCAT EL3403 power measurement terminals are used to record numerous energy consumption parameters that enable Fabri-Kal to determine whether or not the system is using its resources efficiently. The terminals monitor the transformers at the Fabri-Kal factory and record the power consumption on an hourly basis.

The CX2030 is equipped with a 1.5 GHz Intel® Core™ i7 dual-core CPU, which offers incredibly high performance for such a compact design. As well as the PLC and motion control, the Embedded PCs also govern the temperature and pressure throughout the production process,” notes Dale Michaels, explaining the control architecture. The fieldbus system used is EtherCAT, which enables communication speeds in the microsecond range. “EtherCAT significantly improves the performance of our machines,” confirms the electrical engineer: “For motion control as well, we are increasingly using AX5000 series EtherCAT Servo Drives, which offer us both high speed and precision.” The I/O stations and drives interspersed along the line of machines are connected via EK1100 EtherCAT Couplers.

Precise temperature control and performance monitoring ensure efficient use of energy

Precise temperature control plays a key role in the extrusion of high-quality plastics, affecting both resource consumption and product quality. “Now that we have an integrated PC-based control platform with EtherCAT thermocouple I/O modules, we can precisely maintain the desired temperature on the basis of process data that is captured in real-time,” emphasizes Dale Michaels. EtherCAT EL3403 power measurement terminals are used to record numerous energy consumption parameters that enable Fabri-Kal to determine whether or not the system is using its resources efficiently. The terminals monitor the transformers at the Fabri-Kal factory and record the power consumption on an hourly basis.
In the future, the company plans to install EL3403 EtherCAT Terminals in even more machines to further optimize its energy consumption.

“The increased performance achieved with our PC- and EtherCAT-based control solution impressively demonstrates that high-volume production and responsibility for the environment are not mutually exclusive in the production of high-quality plastic packaging,” points out Dale Michaels.

With PC-based controllers towards an “Internet of Things”

Integrating PC-based controllers into Fabri-Kal’s thermoforming machines has also improved their remote control and diagnostic capabilities. “Our management and production staff now access production and machine data in real time,” explains Dale Michaels. “We can now track the machine and production parameters much more accurately, so necessary adjustments can be made ahead of time to avoid costly equipment failures and downtime,” notes Dale Michaels, citing another instance of added value from PC-based control.

“Many technology companies are currently implementing measures for a ‘connected enterprise’ in the sense of an ‘Internet of Things’ and ‘Industry 4.0’. In my view, by implementing this PC-based control solution, we have made a great deal of progress, not only in terms of a trend, but with tangible successes that have a positive effect on the company’s results,” says Dale Michaels.

In view of this success for the company’s programming, machine performance, data collection and product quality, Fabri-Kal has continued modernizing the control technology of the packaging machines at its other production sites. “Due to the open architecture and flexibility of this PC-based automation platform, we can port all the control upgrades to our other machines, which greatly simplifies the conversion,” concludes Dale Michaels, contentedly.

Further information:
Fabri-Kal www.fabri-kal.com
www.beckhoffautomation.com

The production line is monitored from a Beckhoff Control Panel; the machine’s status and production data are automatically tracked as soon as the finished product leaves the machine.

Fabri-Kal is increasingly using AX5000 EtherCAT drives in its production lines.