



Modular design streamlines overall machine production

Siemens partnership provides big boost

With Siemens as its partner, beverage specialist Elopak updated its engineering processes to offer customers flexible machine designs with low cost-of-ownership

In a downturn, companies can follow one of two strategies: they can hunker down, avoid spending, and wait for things to get better or they can use the time to improve their methods and processes so they are ready to accelerate into recovery. Beverage packaging specialist Elopak recognized that their customers require not just flexibility from their packaging lines but economy.

Rather than just re-engineering a machine design to deliver that once, Elopak chose to redesign its engineering to enable them to provide it repeatedly. "We have a very clear strategic goal of being able to deliver to customers what they want and what they need with a low cost of ownership," says Hendrik Stoltz, Director of Equipment Supply at Elopak. The first result of that effort is the E-PS120UC, an ultra-clean form, fill, and seal machine that can produce up to 12,000 gable-top cartons of beverage, courtesy of Elopak's partnership with Siemens Industry, Inc. (see figure 1).

Elopak provides comprehensive support to the beverage industry, from manufacturing carton blanks to building the machines that erect, fill, and seal them (see figure 2). The company produces two basic classes of filling machines: aseptic machines, which allow liquids to be packaged and stored without preservatives; and ultra-clean machines for fresh or extended-shelf-life products such as orange juice (see figure 3). Their end-to-end support provides big benefits to their customers. "Our value proposition is that if customers are using our caps and our blanks with our filling equipment, we ensure efficiency and product integrity on that line," says Stoltz.

Packaging

Answers for industry.

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Figure 1
Assisted by 12 axes of motion, the E-PS120UC forms, fills, and seals as many as 12,000 cartons of fresh beverage per hour.



Figure 2
The bottom-seal turret area closes up the bottom of the carton.

Elopak has been building electromechanical machines for years. When it came time to engineer their next-generation ultraclean machine, however, they didn't just dive into another development cycle. Instead, they stepped back to evaluate their design and manufacturing process. How could they do it more efficiently? How could they reduce their customers' cost-of-ownership? How could they provide those customers with the flexibility and the choices they wanted without expending hours of non-recurring engineering (NRE) on each project?

Success hinged on finding a supplier who could provide more than just hardware and software. "[Our previous vendor] did not really look at our application to understand the principal purpose, so there were many gaps in that regard," says Stoltz. "It was not a partnership, especially not in the application of the technology." As part of the new strategy, the Elopak team wanted a vendor who would understand and support their strategic goals, not just in the near term but for years to come. Of course they needed high-performance components that would meet or exceed specifications, but they also wanted comprehensive training, global support, and a technology infrastructure. Most of all, they wanted a partner. "It was not enough to look for an alternative supplier," Stoltz says. "We wanted to find somebody who would really work with us."

After reviewing their options, they chose Siemens.

The E-PS120UC is a double-indexing, dual-line machine that produces four cartons of product per 1.2-s cycle. It can package any of four different carton sizes, selected by the operator through the HMI (see figure 4). Operating at top speed, the machine can turn out up to 12,000 cartons per hour.

Siemens engineers launched the relationship by examining Elopak's machines and working environment to ensure that they fully understood the application. They returned not with a list of catalog parts but with a proposal for a machine platform. The result is a machine that integrates Siemens technology from top to bottom, from the motors to the drives to the HMIs and of course, the main machine controller.

A key aspect of the project was developing a modular design that would lend itself to easy modification going forward. "Especially with the ultraclean machine, we have a lot of options [for the customer]," Stoltz says. "With a modular design, it's much easier for us to accommodate those options without having a lot of redesign engineering work. We achieve more functionality and do it in a properly structured way."

The machine features 12 axes of servo motion in a centralized architecture. Each axis combines IP65-rated servo motors with SINAMICS S120 drives. The drive system was connected together using Drive-CLiQ, Siemens' high-speed backplane. When used with components featuring electronic nameplates, Drive-CLiQ can confirm that the correct hardware is being wired into the system, speeding integration and minimizing errors.

For overall machine control, they chose the SIMOTION D445, which combines the functions of a PLC with the capability of a motion controller for high-efficiency operation in a centralized controller. The previous PLC used by Elopak required a scan time of 20 ms for just the machine PLC code. Any servo axes required an additional controller. With the Siemens platform, scan time dropped to just 3 ms for both the motion and machine logic code. For ease of maintenance all of the machine control and drive parameters are stored on compact flash cards. If a controller needs to be replaced in the field its flash card can be removed and inserted into the new unit for plug-and-play operation, minimizing downtime.

On the software side, Elopak adopted IEC 61131, the PLC standard, and the OMAC PackML state model, which allowed them to achieve a more standardized approach in terms of controls, communications, and operation.

“The technology that they provided was far better than our previous supplier,” says Michael Ballinger, Electrical Hardware Function Manager at Elopak. “They also provided a lot more of the aspects that we were looking for. For instance, integrated safety was not part of the design from the previous supplier and we were able to [get that from] the Siemens platform.” Although Siemens offers safety PLCs, the Elopak team chose to implement safety the easy way, by leveraging the certified safety functions already included in the S120 drives.

The machine also integrates a minimum of five ET200S or ET200M I/O stations; the number of distributed nodes can rise depending on the configuration. As used in the E-PS120UC, the I/O stations handle digital and analog I/O, as well as thermocouple inputs.

Of course, all of these components need to be connected together to form a system. Here, too, the engineering team went with simplicity by selecting Profibus, which not only simplifies communications across machines but allows shop floor-to-top floor data transfer and remote diagnostics and maintenance.

It wasn’t easy for the engineering team to juggle with multiple new approaches simultaneously, but the result more than justified the effort. “If you look at the inherent benefits in the Siemens control platform that we introduced on this machine with regard to diagnostics, flexibility, the Windows-based application environment, Profibus networking, these are individually not so new, but as far as our specific industry is concerned, it is quite novel,” says Stoltz.

Brave New World

We live in the real world and no project comes off without a single hitch. Redesigning not just a machine but the engineering supply line and process itself was an ambitious undertaking, and while engineers from both companies were enthusiastic, challenges arose along the way. “We underestimated the complexity of the system that we have,” says Stoltz. “We had some issues with regard to the technology, but Siemens stepped up to the plate and provided the correct resources to fix the issues or deal with it in a timely manner. They made sure we got the attention that we needed to be able to drive a successful project to the end.”

If there was any difficulty, it was that the Siemens platform was almost too powerful and too capable. “Siemens technology has a very open architecture,” says Ballinger. “It allows you to be very flexible but it’s easy to get lost if you don’t have somebody there to help keep you on the correct path.” This is where the partnership came into play. Siemens engineers reviewed the design throughout the process, suggesting changes to ensure optimal operation. The result was a design that delivered the adaptability Elopak was looking for. “Now that we have the hardware topology and configuration nailed down,” Ballinger says, “it’s pretty simple to add or remove pieces, making the machine more flexible.”



Figure 3
In the filler area, the machine draws up product on one stroke and injects it into the carton on the next.

An example is a variation of the E-PS120UC called the Combi-Filler, which features four additional axes that operate a rotary valve used in the filling function of the machine. Synchronized with electronic camming, the axes open and close the valve in 400 ms, drawing liquid from the product tank with one stroke and filling the carton with the next. There was a time that such a change might have required hours of work. Not with the new design platform. "Going from 12 to 16 axes at this point is as simple as adding the four drives in the modular enclosure, adding the servos on the machine, and then I believe they flip a bit in the program and it's up and running," Ballenger observes. Now, both the customer and Elopak can easily make modifications to the basic design. "It's kind of like ordering a car with automatic windows and cruise control—you just select what you want."



Figure 4
The operator area features a sophisticated HMI as well as safety controls like emergency stops.

As far as Elopak is concerned, the project has been a resounding success, producing multiple E-PS120UCs that have been shipped to customers in North America and Europe. "They're running extremely well at the moment as far as machine efficiency and so on," says Stoltz. "Siemens has been very good for us in terms of service and support." Indeed, Elopak has been so happy with the partnership that they are applying Siemens technology to a new aseptic machine being designed at Elopak's German facility. "As a direct result of this exchange and the strategic decision we made on the E-PS120UC, the machine that we are developing in Germany is deploying the same Siemens technology," Stoltz says. "Siemens has delivered against what they have promised and our expectation for the future is that will be sustained."

The business environment may have been challenging for the last year or two but with Siemens as a partner, Elopak has made good use of the time. It updated its engineering processes and upgraded its hardware and software to better deliver to customers the choices they need at the price point they want. "From the point of view of taking our whole engineering department to a higher level, this project was a ways to a means in terms of achieving that," says Stoltz. "I think in that regard we can say it was a huge success."

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