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Operators Learn From Machines: A Shrink Wrapper's Renaissance

Shrink wrap machine manufacturer, Conflex, maximizes machine design flexibility with centralized PC-based controls and industrial Ethernet

The original Renaissance (French for "rebirth"), spanning from the 14th to 17th centuries, was marked as a period of cultural enlightenment and learning. The term is applied in modern times to everything from government, to education and most certainly to technology.

The Germantown, Wisc. shrink wrapping machine builder, Conflex Inc., has been undergoing what Joe Morrissey, Product Manager at the company, refers to as a renaissance. In 2005 Conflex began the "rebirth" by substantially redesigning each machine in the product line and will continue redesigning machines until the end of 2007. The company's Modular CW and ServoFlex™ lines have had a complete mechanical and electrical redesign. To emphasize the learning aspect of a renaissance, the ServoFlex features detailed instructional programs that can literally teach end-users how to operate them.

Conflex wrapping machines are tailored to the food, consumer goods, electronic media and printing industries, among others. Typical applications for the company's machines include wrapping for frozen foods, bulk packaging for club stores, CD and DVD packaging, and the packaging of household products and toys. With the Conflex motto in mind – "Flexible People Make Flexible Systems" – Morrissey sought a controls system that could fully deliver true application flexibility to customers in these diverse industries. All of Conflex's customers demand user-friendly machines with intuitive interfaces. Mark Lorenz, Conflex Electrical Applications Engineer, said, "New technology is a critical factor for Conflex when tough competitors in our field are also promoting the latest and greatest technologies, but ease-of-use is also a must-have."

The choice for action over buzz

When servo technology started generating a high level of industry buzz in 2000, Conflex was one of the first companies to incorporate it successfully into shrink wrapping machines. "Today, as open, PC-based control and industrial Ethernet technologies are making a similar commotion in our industry, Conflex is again at the forefront of the movement to actually do something about it," Morrissey said.

In particular, the ServoFlex film seal wrapper saw dramatic changes from its previous incarnation. The old ServoFlex design utilized numerous intelligent drives that handled the automation and motion control aspects of the machine. The required programming

time for multiple drive controllers irritated Conflex. “This was a three servo system – each axis had its own controller that had to be individually programmed,” Lorenz said. The drives weren’t equipped for Ethernet connectivity, which hampered Conflex’s networking efforts.

Adding or removing I/O from the system further complicated the problem. “If even a single I/O point failed in the intelligent drive system, we’d have to replace entire boards. It was also very expensive to replace the drives themselves whenever we had a failure,” Lorenz added. “It became apparent that in order to be flexible and better manage our controls, we needed a new solution.”

The 11th hour transformation

In late 2005, Conflex encountered Beckhoff Automation’s Wisconsin Region Sales Manager, Don Seicther. “At the time, we had made what we thought was our final decision on a new platform from a major automation and controls vendor,” Lorenz said. “It was an acceptable motion controller with PLC functionality, but unfortunately didn’t have all the programming and design flexibility that we hoped for. We just accepted that we were going to put more time and effort into the controls design than what was ideal. The call from Don just happened to arrive at the last possible moment – he called on a Friday when we planned to order our controllers that following Monday.”

Conflex then learned about the DIN rail mounted Beckhoff CX1020 Embedded PC and TwinCAT IEC 6 1131-3 compliant automation and motion control software. “The solution put forward by Beckhoff turned out to be exactly what we were looking for and allowed us to create our ideal electrical controls system,” Lorenz said. “We were impressed enough with Beckhoff PC-based controls that we decided to make a major change of course at the last possible minute. Beyond the perfect technological match in terms of openness and flexibility, the Beckhoff system costs much less than the other vendor’s system.”

From January 2006 onward, Conflex had begun the design and construction of the revamped ServoFlex machines using the CX1020 with 1 GHz Intel® Celeron® M ULV processor and TwinCAT as the main control platform.

“Using the CX1020 with TwinCAT, we handle all PLC functions and motion control on a single device,” Lorenz said. The new Servo Flex machine is a four axis system – one master axis with three slave axes. This horizontal form, fill and seal wrapper delivers continuous motion at up to 100 ft of film per minute with an advanced reciprocating hot knife seal system. ServoFlex machines feature cradle-style powered film feed, which is easy to load and allows for fast change-overs.

Conflex found that several of the programming libraries in TwinCAT were particularly helpful. “The Flying Saw code library saved us time and effort by providing pre-written software functions to achieve a great deal of our motion programming,” Lorenz said. On the Servo Flex, a vacuum conveyor holds the wrapper film and leads it to the sealing area that features a reciprocating motion. “We have to hit a very specific mark on the film, so

the Flying Saw program handles the sealing motion of the knife moving back and forth on the machine. A pneumatic cylinder closes a sealing jaw while the cut is made," Lorenz said. "Also, built-in libraries for PID temperature control for the machine's film heaters and superimposed move for print registration are huge time savers in our area of packaging."

Any controller Conflex uses must provide very fast control of the film cutting knife to exactly match the speed of the incoming wrapper film. "The Industrial Ethernet fieldbus, EtherCAT helped immensely in terms of ramping up our control speed on the Servo Flex machines," Morrissey said. "Beyond top performance, Conflex had to choose a fieldbus that will be supported well into the future (like EtherCAT) and won't go obsolete in a few years." Conflex customers also enjoy remote diagnostic capabilities for troubleshooting via standard Ethernet connectivity with the EtherCAT-equipped machines.

Some EtherCAT I/O terminals are used on the ServoFlex to develop built-in special latching functions for hardware interrupt. The significance of the latch input is to allow the machine cutting and sealing operations to be synchronized to the printed film. This allows for a very professional looking finished product for the machine's end user. The EL5101 EtherCAT Terminal is an interface for the direct connection of incremental encoders with differential inputs (RS485). A 16 bit counter with a quadrature decoder and a 16 bit latch for the zero pulse can be read, set or enabled. Incremental encoders with alarm outputs can be connected at the interface‘s status input. Interval measurement with a resolution of 500 ns is possible.

"With the low-cost Beckhoff EtherCAT I/O system, we have the best solution available for our previous I/O board challenge," Lorenz said. "We only buy the I/O points we need and can replace as needed, one I/O card at a time. The simple, direct I/O connection to the CX1020 made this decision that much easier."

The main objectives of the Conflex machinery renaissance were to not only make the machines perform better, but also to make them more flexible and even easier for end users to operate. "ServoFlex machines feature pre-loaded training videos that can literally train end-users on how to quickly learn how to operate our machines," Morrissey said. "This is frankly a pretty cool feature enabled by industrial PCs that allows us to further differentiate with other machines. It's something that couldn't be easily done using conventional controls platforms."

"Because we run Windows CE on the CX1020 Embedded PCs, we were able to create a human-machine interface (HMI) that is virtually unlike any other in the industry," Lorenz said. "The new HMI was very popular with visitors to our booth at Pack Expo 2006 in Chicago. Another added bonus from the use of Embedded PCs is that all the software resides on a Compact Flash (CF) card so changes can be made very easily in the field if needed. Since the HMI software is also running on the CF card, customers can very easily find a replacement display without having to reload any software if a backlight fails on our seamlessly integrated non-Beckhoff monitors."

Renaissance on repeat
With the majority of the Conflex Renaissance redesigns complete, the company's product offering promises smaller machine footprints, more competitive system costs, greater flexibility and faster machine delivery. "Before 2006, Conflex machines had four separate control devices, each with different bits and pieces of the code for the whole machine spread throughout," Lorenz said. "Now with the CX1020, we have one device on our machines that contains all of our programming. This is obviously a much more streamlined approach."

TwinCAT proved to be a highly flexible environment for Conflex machine programming. "Conflex is able to use a standard set of programs for three different models of machines that vary depending on the application," Lorenz said. "We can simply choose the respective program to match our customer's application when the system boots up. Conflex is able to make immediate modular design changes in a few hours that would take up to several weeks of cumbersome work in the past."

To make sure that changes took a minimal amount of time while learning a new system, Conflex took full advantage of the engineering support available to them. "Beckhoff support is always available to assist with our questions and we all frankly learned quite a bit together as engineers in our technical discussions," Lorenz said. "Conflex machines are now better suited to integrate more seamlessly into lines with machines from a variety of manufacturers and extract data from the entire line. The Ethernet capability is a huge benefit for our customers and helps us deliver the most flexible machines possible."

The controls replacement cost on Conflex machines has been highly optimized. "The old drive system with integrated intelligence cost about triple what we're paying for a Beckhoff system that does more work." Morrissey said. "With the kind of success we experienced on the ServoFlex line, Conflex will be expanding the use of Beckhoff controls into other machine lines to fully apply our expanded PC-based control expertise. The Conflex Renaissance has been a great success in helping our customers become experts in the workings of our machines and will positively impact our company for years to come."

For more information:

www.conflex.com

www.beckhoffautomation.com

www.packexpo.com

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Picture Captions

Conflex_01 and Conflex_02
The ServoFlex™ line had a complete mechanical and electrical redesign and now perform better, are more flexible to program and can teach operators how to use the machine with automated instructional features.

Conflex_03
Conflex uses Beckhoff CX1020 Embedded PCs with TwinCAT, handling all PLC functions and motion control on a single device. Their CX1020s are directly connected to EtherCAT I/O – the next generation Industrial Ethernet fieldbus.

Conflex_04
The ServoFlex human-machine interface (HMI) software is virtually unlike any other in the industry. It also has on-board instructional videos to train machine operators.