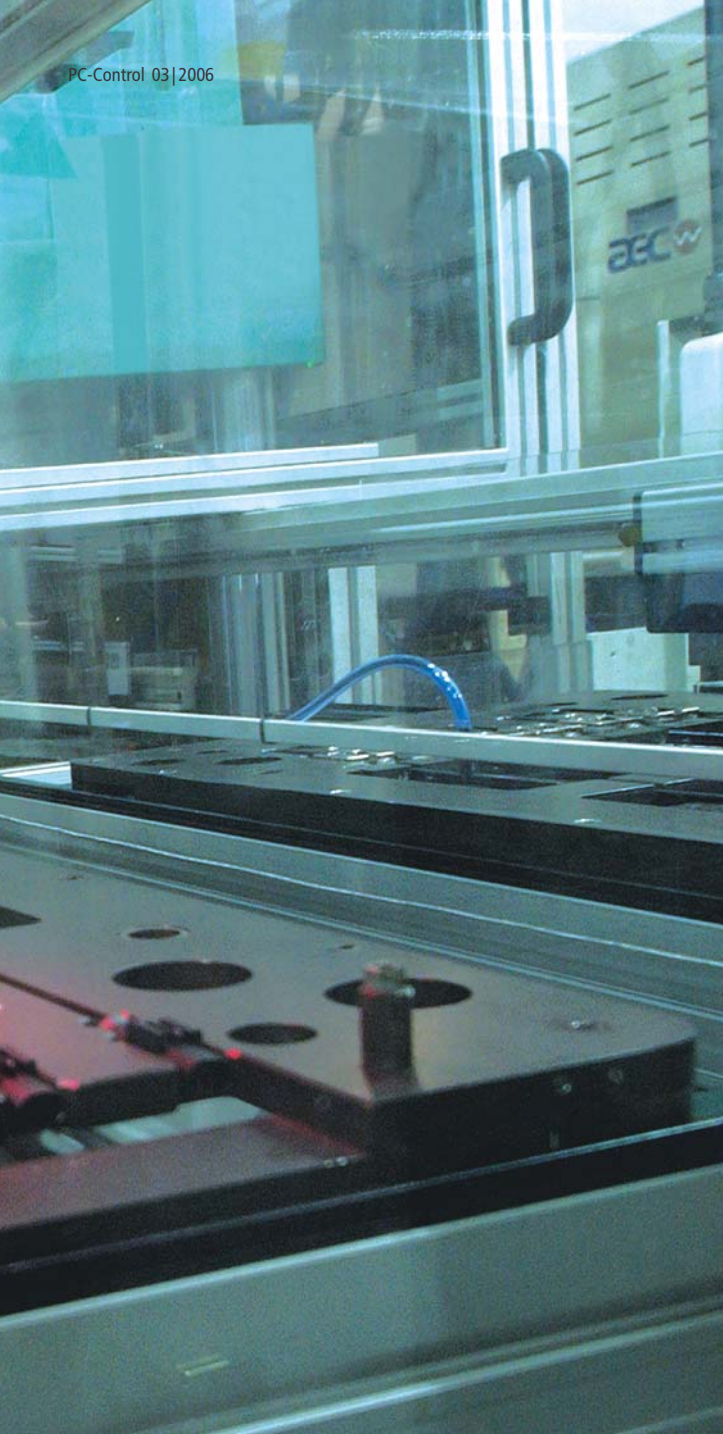


→ The Prettl Electric facility located in Greenville, South Carolina, specializes in wiring harnesses for the automotive industry. These harnesses are primarily used for anti-lock brake systems (ABS) and emission control systems. In order to best serve this ultra-competitive market and to stay at the forefront of the latest manufacturing techniques, Prettl decided to use PC-based control technology from Beckhoff.

## Prettl Electric harnesses the flexibility of open controls



Rigorous checks are made by the production machinery to inspect color, dimension and shape. Wires with any imperfections are quickly removed from the process for rework or disposal.



Prettl developed a new pick and place segment for their wire harness production line that automatically removes bad wires, ensures faultless quality control, and helps to establish uniform cycle times for the injection molding machine in the production line.

The company motto – “Quality in everything we do” – guides Prettl’s commitment to continually improve product design and production processes. Prettl wiring harness production utilizes a heavily modular machine line approach. They maintain short changeover to keep production costs down and decrease production cycles. The wire harness orientation, housings and clips need to be perfect every time. Therefore, rigorous checks are made by the production machinery to inspect color, dimension and shape. Wires with any imperfections are quickly removed from the process for rework or disposal.

### Fully automated quality control

By 2006, Prettl needed to implement a new pick and place segment for the production line that could automatically remove all imperfect wires and ensure error-free quality control. This project was part of a larger push to utilize automation systems more advanced than those used in the past.

Ralf Opper, electrical controls engineer for Prettl, sought a controls solution that provided openness and seamless integration into the existing infrastructure of the wiring harness production line. The controls platform had to be extremely adaptable to major change if machine and controls design took a radical shift. “Our engineering team wasn’t sure exactly how the machine would look at the end of the project,” states Opper. “At the beginning, we were mainly concerned with a conveyor control system that would take care of feeding wiring harness pallets to our injection molding machine. We decided later that we should also integrate



The US facility of Prettl Electric in Greenville, South Carolina.

## The Prettl Group

The Prettl Group is involved in four business areas: automotive, home appliances, industrial services, and consumer. With more than 30 independent companies and more than 5,200 employees worldwide, the Group generated a turnover of 500 million euros in 2005.

The automotive section specializes in wiring harnesses for the automotive industry. The product range includes

- | sensor lines for exhaust monitoring,
- | cable sets for brake systems, seat-belt tensioners and tank modules,
- | engine cable sets for the commercial vehicle industry.

The Prettl Group is headquartered in Pfullingen, Germany. The Greenville plant in South Carolina was established in 1989 and primarily produces fuel level sensors, special wire harnesses for lambda sensors, ABS wheel speed sensors, special wire harnesses for heavy duty vehicles and high-precision injection-molded plastic parts with inserts. The plant has an area of 14,000 km<sup>2</sup> and 200 employees.

With IE1010 Fieldbus Box modules in IP 67 protection Prettl was able to reduce the wiring time for local I/Os by more than half and the costs by 60 % compared with alternative solutions based on terminal boxes.

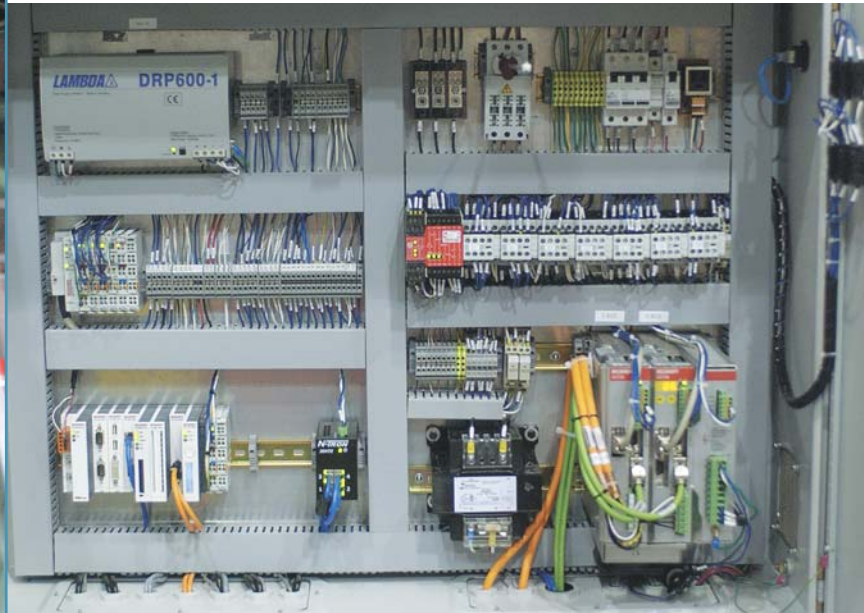
our clip assembly machine into the system and improve communications throughout the line.”

Opper and his team decided to use PC-based controllers. “If I have a controls preference, it’s for solutions that incorporate the latest technologies and are powerful, but also truly open. I don’t want any unnecessary roadblocks that keep me from creating systems exactly the way I envision them,” says Opper. Having already experienced positive results testing a Beckhoff CX1000 Embedded PC and TwinCAT IEC 61131-3 compliant software, Opper chose the Beckhoff system for the new Prettl pick and place machine segment.

“When using the IEC 61131-3 programming in TwinCAT, I’m essentially free to program the controls however I want. With six programming languages to choose from, I can logically select the language according to the complexity and type of project. The best programming language often depends on the application.”

## Digital interconnection of the individual modules

The pick and place system is networked via Modbus TCP/IP to the entire wiring harness production line. The BC9000 Ethernet Bus Terminal controllers create a digital handshake between injection molding and wire harness clip assembly machines on the production line. The Embedded PCs deal with this task in the pick and place line. The quality data required to identify bad parts in the line are transferred to the pick and place machine via a BC9000. The Prettl technicians can also remotely change the system’s programming on the fly through Modbus TCP/IP and establish controller-to-controller communication for all machines in the line through a secure online connection.



The pick and place machine features compact Beckhoff AX2500 servo drives that are networked with the CX1000 via CANopen.

## Valve terminals integrated in IP-Link system

The pick and place machine features BK5120 I/O Bus Couplers and compact Beckhoff AX2500 servo drives that are networked to the CX1000 via CANopen. For remote I/O, Opper also uses Festo CPV1x-VI-IP-8 valve terminals and connects via IP-Link to Beckhoff IE1010 8-channel digital inputs in IP 67 protection. The Beckhoff IP 67 I/O proved to be extremely cost effective for Opper. "The IE1010 solution was priced around \$80, while alternate junction box solutions that would have been required to do the same job would have cost over \$200," explains Opper. "The Beckhoff IP-Link option with the Festo valve terminals was more proof that the overall system is inherently open and flexible. When compared with the effort required to wire junction boxes to multiple PLCs over and over again, IP-Link helped Prettl cut remote I/O wiring time by over 50 percent."

## Consistent cycle time spreads through the line

The new pick and place machine has exhibited an immediate impact on Prettl's overall production. Prettl now keeps a steady and constant feed of wiring harness pallets into their machines. The new system ensures a consistent cycle time for the wiring harnesses, which could not be done previously because it was operator dependent. It also ensures that there is always the maximum of six cables in each pallet – an area that had the possibility of error because it relied heavily on operators' sight. "The pick and place machine has definitely extended its influence to other machines in our line. We can now ensure a constant molding cycle time, which is the most important thing in any injection molding application."

"With a lot of the PLC options I've used and considered for the project, the programming flexibility wasn't there and you were very restricted with your I/O options. The ADS feature in TwinCAT probably saved us dozens of hours in programming time."

## Program modifications during operation

Despite the radical controls changes and continuously evolving production approach, production at Prettl has not suffered. "With the flexibility of TwinCAT, I can do programming changes on the fly without having to shut down production, which is a feature not offered by all controls solutions", Opper sums up. "With production always running, even during the introduction of a major line component, we can continue to keep Prettl customers well-stocked and completely satisfied."

→ Prettl Electric Corp. [www.prettlus.com](http://www.prettlus.com)

→ Beckhoff USA [www.beckhoffautomation.com](http://www.beckhoffautomation.com)