


Continental Tire cruises through major curing press upgrade

New PC-controlled curing presses for larger tires



→ Continental Tire's Charlotte, NC plant decided to modernize its tire curing presses. The project involved replacing the hardware PLC with a PC-based controller, the CP7130 Panel PC from Beckhoff, leading to a 50 percent reduction in controller costs and installation time.

The modernization was prompted by the global shift towards larger SUVs. The existing presses had been in use since the early 90s and were designed primarily to mold tires for small to mid-sized cars. The Charlotte facility had to be able to mold more large tires – specifically, the ContiTrac™ and AmeriTrac™ lines – to meet the shifting demand. Demand has also been very high for UHP – ultra high performance tires.

Continental decided to change the design of 34 of their curing press machines away from “Two Piece Molds” (best suited to smaller tires) to “Segmented Molds.” As the name suggests, two-piece molds use two cupped pieces of steel to press “green tires” (those that haven't fully cured) around inflated bladders to achieve the proper shape and seam. Segmented Molds are better suited to maintain the mold uniformity and overall quality of larger tires.

The 34 presses slated for upgrade primarily used early 90s-era PLCs for control. Continental decided to look toward a more cost-effective and centralized PC-based control alternative. This was largely due to costs associated with the price of buying new PLC controls and the extensive wiring for decentralized control architecture on so many machines.

In addition, a fundamental design issue to resolve was that the PLC-controlled presses did not operate in a true manual mode. “It was more of a ‘semi-automatic’ system,” Continental Tire electrical engineer, Jack Plyler said. “Individual system sequences could be queued to operate, but not the individual components. As a result, individual components could not be tested in a stand-alone fashion.” These different requirements ultimately led to the decision of using a PC-based control solution with central intelligence.

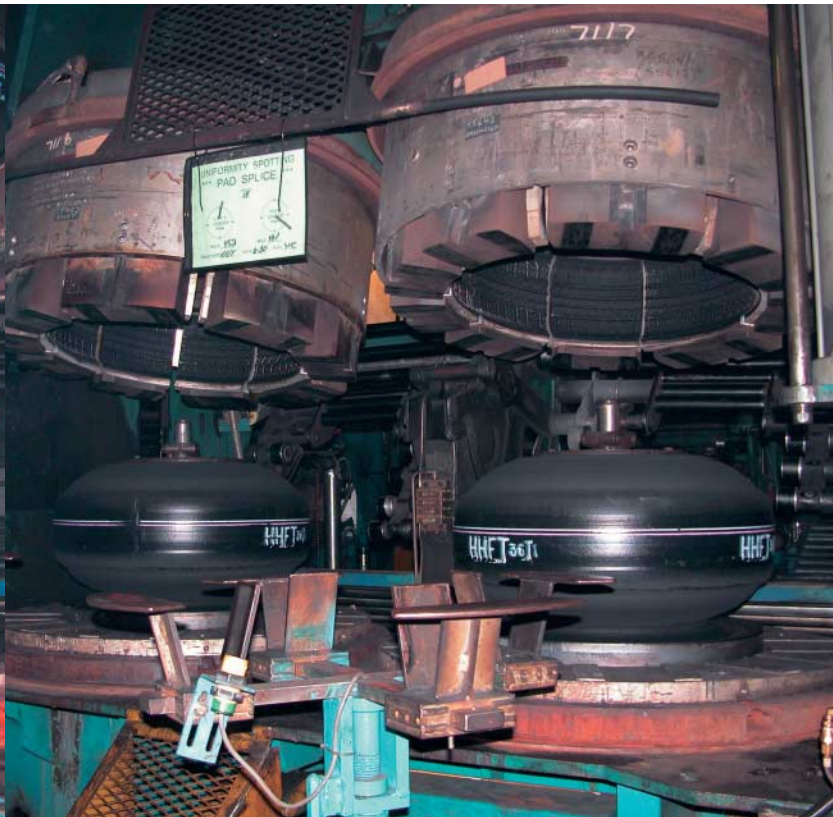
Industrial PCs take the heat

In order to succeed in implementing Industrial PCs, Continental required a motherboard that could withstand the harsh temperatures in their plant. “We have ambient temperatures that can exceed 100°F/38°C near the presses, which themselves reach a maximum curing temperature of 362°F/183°C,” Plyler said.

Continental FMF, Continental AG's machine manufacturing and specialist control division, was responsible for the electrical design of the new Segmented Mold machines and chose Beckhoff CP7130 Panel PCs as the control centerpiece.

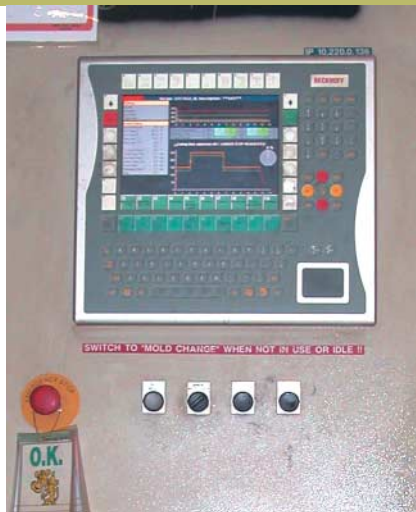


Bladders inflate inside green tires to achieve the proper shape and seam.



The new Segmented Molds use 11 steel segments to shape and seam green tires.

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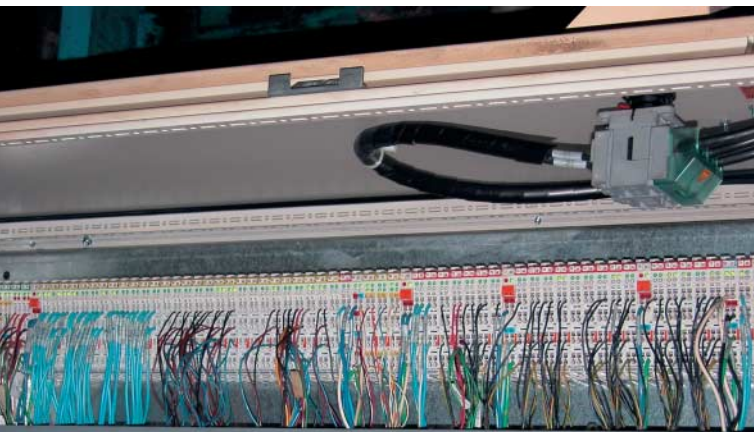
“Beckhoff is the global standard supplier for the majority of the Continental AG controls, so it was a logical vendor to start with. A key feature of the CP7130 was that we were able to spec 330 MB of compact flash memory running Windows XP Embedded rather than a rotating hard drive,” Plyler said. “This removed any last ditch arguments for keeping the old PLC approach. Plus, the Panel PC has a heat sink instead of a fan.”

Continental also chose to use Beckhoff Lightbus I/O for the curing press upgrade. Utilizing fiber optic technology, Lightbus features a transfer rate of 2.5 Mbaud

and with one Lightbus interface board, up to 255 decentralized modules can be operated at a maximum distance of up to 30 m between two modules. “While it’s probably known best for speed, we primarily chose Lightbus as the curing press fieldbus because the equipment is very cost effective, flexible and simple to wire,” Plyler said.

Flexible operating modes

The new presses were designed to have three true modes of operation: a “Manual Mode”, “Mold Change Mode” and “Automatic Mode”. In “Manual Mode”, all machine components can be manually actuated and all processes can be carried out manually. In Mold Change Mode tool change, maintenance and cleaning work are done. In automatic mode, not only tire loading and unloading functions are automated but also the whole process is controlled by pressure and temperature control loops inside of the IEC 61131-3 application. Curing and production data are monitored by the TwinCAT control system software, which is displayed on the Panel PC.



Continental chose fiber optic Lightbus as the curing press fieldbus due to reduced equipment cost and reduced wiring effort.

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TwinCAT OPC Server monitors production data

Because of Continental quality guidelines, facilities have to chart tire temperature and pressure throughout the tire curing process. In the past, Continental used 24 hour chart recorders with paper and pens, but by using TwinCAT OPC Server, they're able to tie the machines to a central server over Ethernet and view chart information online via a web browser and historian. "Diagnostics and troubleshooting with TwinCAT and TwinCAT OPC Server is straightforward and can be done with ease from my office. It usually takes only about 20 seconds to get a full view of what's going on the plant floor and determine if there's a developing problem with any of the presses," Plyler said. "Also, if I want to look at a chart dating back a month, I can find it in seconds instead of sorting through piles of paper charts."

Ethernet controller controls tire conveying system

Beyond the Segmented Mold machines, Plyler chose to design an additional controls upgrade on a tire drop and conveyor system with a Beckhoff BC9000 controller. Via Ethernet and TwinCAT ADS this Bus Coupler with integrated PLC functionality communicates with 34 Continental curing presses that feed tires to the conveyor. With 12 presses running at high capacity on each side, the controls had to be able to ensure that tires weren't piled on top of each other on the conveyor. "The BC9000 was a good, low-cost solution for us because it does the job and understands when the conveyor is clear for a new tire to be dropped in place," Plyler said. "Plus, the wiring is much cleaner than with the previous relay solution. Now, instead of spaghetti wiring to 24 different presses, there's just one Ethernet cable."

Working smarter, not harder

"The results of the PC-based design were immediately apparent in terms of cost-savings. New controls – electrical and mechanical – on the 34 upgraded curing presses were at least 50 percent less costly. There were even greater savings when

field installation – including wiring, pneumatics and hydraulics – were factored in. Electrical installation time was reduced by 50 percent over the previous presses, a savings of over 100 engineer hours."

"The centralized control strategy really helped here. The new control design was more streamlined than conventional press control systems. In the past, having intelligent controls distributed all over the place often meant a lot more wiring to deal with. Plus, I expect that we'll have a lot less downtime with the centralized approach," Plyler said.

Older Continental press designs would have as many as 20 push buttons and switches. The new Continental curing presses were scaled back to three push buttons, an emergency stop and a selector switch. Most manual functions and mode change functions are handled by function keys located next to the screen on the Panel PC. "All those extra push buttons added a lot of wiring, labor and equipment cost when you're dealing with 34 big machines. Having function keys already integrated into the Panel PC saved us a lot of grief," Plyler said.

With phase one of the curing press upgrades complete, Continental has been able to supply tires of all sizes in the quantities the market calls for without skipping a beat. To continue to stay in step, Continental's future plans include the upgrade of 18 additional presses to the same Segmented Mold presses with the CP7130 and PC-based control system.

→ Continental Tire www.continentaltire.com

→ Beckhoff USA www.beckhoffautomation.com