Beckhoff Embedded PCs offer optimum control platform

This tube forming machine can do the work of two

GWS President, Rick Sojak (left) and Electrical Engineering Manager, Cliff Bailey (right). GWS supplies a wide range of advanced servo-controlled hydraulic tube forming machines to tier one automotive manufacturers.

CNC tube forming has been a standard in the automotive industry for decades. GWS Tube Forming Solutions Inc.®, located in Bothwell, Ontario, Canada, is one of the pioneers of PC-based CNC control for tube forming and distributes its products and services in the USA and Canada as well as the growing markets in South Africa and Europe. The company supplies a wide range of advanced servo-controlled hydraulic tube-forming machines to tier one automotive manufacturers that produce exhaust systems and auto frame rails for vehicle interior structures.

Commonly, tube forming machines size tubes specific to either their outside diameter or inside diameter. To achieve the best rounded form, the tubes are expanded beyond the intended final diameter by an inner machine tool and subsequently forced back to the exact specified diameter by an outer machine tool. If the tube is formed only once, i.e. immediately to its final shape, variations in material properties (welded seams), spring-back, etc., can create an undesirable oval shape. Exactly how much a machine must over-expand a tube is determined by a manual trial and error process; i.e. several parts are produced until the specified dimensional accuracy is achieved. Modern CNC tube forming machines have the advantage that they can simulate forming variations without wasting valuable materials and setup time.

Dynamic machines – inconceivable without high-end CNC

"Using traditional controls, bending tubes that are 3 inches long at the end of the process often wastes up to 6 inches of material," explains Cliff Bailey, Electrical Engineering Manager at GWS. "GWS machines are specially designed to produce very short tubular parts efficiently, with much less waste." By means of a unique forming and cutting process, the machines can reduce the amount of wasted material to a 1/4 inch. In order to maintain this advantage, GWS needed a PC platform with the maximum available processing power.

In early 2006, GWS had to design two completely new, complex CNC machines for one of their largest customers. Cliff Bailey saw this as an opportunity to move towards a more reliable and higher performance PC control platform. "We had used PC-based control for a few years, but we were looking for an alternative that was free of rotating parts." Bailey says. Besides stable, vibration-resistant hardware, GWS sought to provide their customers with more process and production data and online diagnostics from the machine tools.

Robust industrial PCs – successors to outdated controllers

In order to fulfill the requirements of the automotive industry, GWS use the latest Industrial PC technology for the CNC control in their machines. After a thorough analysis of all major industrial PC suppliers, Bailey ultimately selected CX1000 and CX1020 Embedded PCs running TwinCAT NC PTP automation software for PLC and Motion Control functions.

Typical production of an exhaust part where one end of the exhaust tube is opened up and the other end is formed with a much smaller diameter. This would normally require two machines to manufacture. GWS offers an 'all-in-one' solution.

GWS houses the HMI hardware and Embedded PCs in the same control cabinet. Due to the compact design of the CX controllers and the I/O terminals, it was possible to reduce the size of the GWS control cabinets by almost 50 percent.

GWS relies on optical fiber technology for networking: a SERCOS interface as fieldbus and IP-Link for the cabling of the IP 67 Fieldbus Box I/Os. "Fiber optic cabling is ideal for our machines because it is highly immune to electrical interference," explains Bailey

"With the help of PC-based controls, we can easily do the work of two traditional tube-end forming machines with just one GWS machine," he says. "For example, typical production of an exhaust part where one end of the exhaust tube is opened up and the other end is formed with a much smaller diameter would normally require two machines to manufacture. GWS offers an 'all-in-one' solution for this type of application." Not only does this save the purchase price of a second machine, but, perhaps more importantly, it saves extremely valuable automotive factory floor space. It also reduces the amount of time operators spend walking back and forth to different machines during the manufacturing process. "The compact size of the CX controller and the use of remote Bus Terminals reduced the size of the control cabinets by almost 50 percent. We only use as many I/O terminals as we really need, 2-, 4- or 8-channel, exactly matching the respective requirement," Bailey explained. "We have also cut our required wiring time in half via the use of IP-Link fiber optic cabling and the ability to wire our sensors directly into the Beckhoff Bus Terminal blocks. The whole process of converting to Beckhoff equipment was extremely fast. The design process took less than three months from start to finish," Bailey emphasizes.

Today, GWS machines equipped with CX series Embedded PCs are widely used in factories. With high processing power, hardware reliability, small controller size and improved wiring efficiency, Bailey believes he's found the optimum control platform for tube forming machines: "GWS is converting all standard controls on CNC machines to a Beckhoff automation platform. We will only retain a traditional PLC platform for machines at the low end of the performance range."

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