



The BeamMaster system – distributed as the Ocean Challenger in the U.S. – runs 24/7 in the McCombs Steel facility in Statesville, North Carolina.

PC-based control optimizes automatic welding and cuts component costs in half

Precision robotic welding and 'automated programming' enhance efficiency in structural steel manufacturing

In the construction industry, steel beams are manufactured in many different dimensions and changing quantities. System integrator AGT Robotics used PC-based control to develop a robotic welding system that operates fully automatically around the clock at McCombs Steel. The ability of AGT's Cortex software to interface with TwinCAT even enables automation of the weld schedule programming. Drive technology from Beckhoff contributes to the high welding quality through the precise positioning of loads weighing several tons.

Beams for buildings require reliable, high-precision welding to ensure structural integrity and public safety. McCombs Steel Company, Inc. in Statesville, North Carolina, is certified by the American Institute of Steel Construction (AISC) and fabricates and erects structural steel and miscellaneous metals. As such, the company faces the challenges of maintaining high quality at the same time as lean manufacturing every day. The BeamMaster robotic welding system from AGT Robotics has helped McCombs meet these challenges.

Based in Trois-Rivieres, Quebec, Canadian system integrator AGT Robotics was founded in 1992 and specializes almost exclusively in robotic welding. The BeamMaster system was developed with the help of PC-based

control and uses AGT's Cortex software with built-in artificial intelligence (AI) and a proprietary simulation engine to optimize weld schedules. The standard version comprises two or more servo-driven beam rotators, an articulated robot that moves parallel to the beam along a track and an operator station. The circular rotators can handle beams from 4 to 48 inches wide and up to 90 feet long with a maximum weight of 10,000 pounds and can turn 360 degrees.

Flexibility for automated welding and programming

Louis Dicaire, General Manager and Co-owner at AGT, explains: "The automotive business produces a few parts maybe 100,000 times, so just a few robots repeat the same tasks for years. In structural steel, even though parts are similar, the beams have different widths, lengths, sections and accessories in an infinite num-

ber of combinations. That has slowed implementation of robotics in this industry." In order to minimize the time and cost of reprogramming for such individual parts, AGT set themselves the goal of developing a system that would automate not only the welding, but also the programming. For that purpose, the AGT Cortex software imports 3D beam models from the Tekla CAD software that the structural steel industry relies on and uses them to create complete weld schedules for beam manufacturing.

"All joint types are covered, whether multi-pass or single-pass, a quarter-inch weld or a half-inch weld. The sequencing and flipping of the beam are automatic as well," Dicaire says. "So not only is the operation automated, but the automation programming is also automated: You could say that it's automation squared."

A universal platform for robotic welding

Transferring these software capabilities to a real-time machine control environment, however, required a similarly flexible automation platform. While searching for an EtherCAT master controller in 2015, the AGT engineering team soon identified PC-based control technologies from Beckhoff Automation as a comprehensive solution. "The openness of the Beckhoff platform, from the company that invented EtherCAT and TwinCAT automation software, was key for AGT," Ted Sarazin, Regional Sales Manager for Beckhoff, says. TwinCAT 3 provides deterministic control from a software-based master for BeamMaster. Programming of all functions, from PLC and motion control to safety and HMI, is directly integrated into Microsoft Visual Studio®.

Regarding hardware, the BeamMaster uses space-saving 8- and 16-channel EtherCAT I/O terminals, EtherNet/IP Bus Couplers to interface with the robot controllers and TwinSAFE terminals for integrated functional safety. These ensure that operators approach a beam only when the robot is not active in that specific zone. The PLC code runs on a CX5130 Embedded PC from Beckhoff that boasts a dual-core Intel Atom® processor. It delivers enough processing power for all motion and sequence planning tasks, along with other applications such as HMI, SQL databases and more. A CP2918 multi-touch Control Panel with an 18.5-inch widescreen display and integrated push-buttons serves as the operator interface. All motion control for accurate beam positioning takes place with AX5000 series Servo Drives and AM8000 servomotors from Beckhoff.

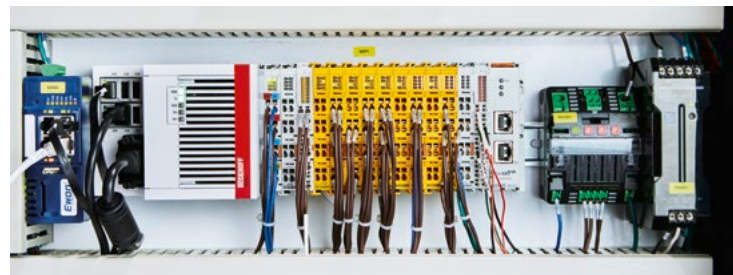
Reduced programming effort and costs

The development of Cortex software and careful system design of BeamMaster using off-the-shelf components from Beckhoff resulted in significant advantages for AGT. Programming of the first system took two months, but with easy code reuse, that is sped up to just half a day now. "Standardizing on Beckhoff also cut our component costs in half compared to previous solutions while providing more capabilities and options for customization," Louis Dicaire sums up.

Beckhoff Regional Sales Manager Ted Sarazin (third from left) visits the AGT Robotics team in Trois-Rivieres, Quebec: Marketing & Sales Manager Denis Dumas, Automation & Robotics Specialist François Béland, Mechanical Design Department Head Eric Gauthier, Electromechanical Technician Michel Toussignant and Electronmechanical Technician Étienne Paillé.



AGT Robotics implemented a CP2918 multi-touch Control Panel from Beckhoff for the system's operator interface.



A CX5130 Embedded PC from Beckhoff controls the BeamMaster, communicating standard and safety data over EtherCAT via standard I/O and yellow TwinSAFE terminals.

More information:

www.agtrobotics.com

www.mccombs-steel.com

www.beckhoffautomation.com