

Hudson Scenic Studio sets the stage for show applications of all sizes with scalable control technology from Beckhoff

Blockbuster effects, automated for any theatrical production

In William Shakespeare's celebrated play, "As You Like It", the legendary playwright famously wrote that "all the world's a stage, and all the men and women, players". Perhaps this kinship to the theater experienced by audiences is what continues to drive the success of plays around the world. Making the storytelling and action seem effortless, enabling the viewer to naturally step into the lives of the characters on stage, takes a herculean effort behind the scenes. This is where Yonkers, NY-based Hudson Scenic Studio comes into play, providing scene fabrication and automation services to the entertainment industry since 1980.



Chuck Adomanis, Senior Engineer at Hudson Scenic Studio, explains: "Over the years, we have built a solid reputation as a full-service theatrical automation and production shop. Our extensive experience in the entertainment industry provides us with the ability to offer custom artwork and stage pieces, scenic construction and automation for nearly any stage or show application. We serve the Broadway theater market and provide solutions for other live events, TV and film, and for permanent installations such as theme parks and cruise ships."

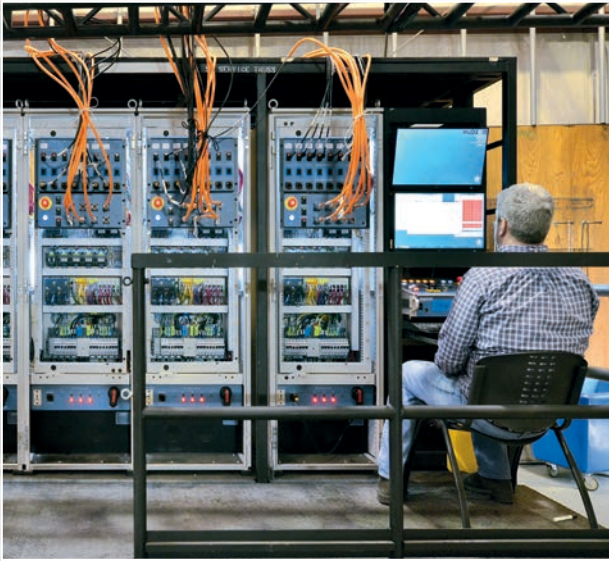
Flexible and scalable control technology for projects of any size and budget

Hudson Scenic Studio serves some of the largest and most successful Broadway shows to ever hit the stage. Their impressive repertoire include productions such as Disney's "Aladdin", and "Hamilton", the smash hit musical about the life of American founding father Alexander Hamilton. However, Hudson Scenic offers support for stage and show technology to customers of all sizes, as Adomanis continues: "I think the biggest differentiator for Hudson Scenic is flexibility and our willingness to work with any customer, big or small, to help them discover the best solution for their needs. Whether the production is a multimillion dollar Broadway show or a play at a small regional theater, we have the flexibility to tailor systems and components that ideally fit the client's application."

Hudson provides the means for creative directors and their crews to bring their boldest stage and show ideas to life. From the ground up, the company offers planning services, project management, fabrication and commissioning to help nearly any stage and show application earn rave reviews. To accomplish this, Hudson builds incredibly intricate scenery and stage props, and then makes that scenery dynamically move, shift and change to enhance the visual direction of the show. In the Aladdin project, for example, buildings that form the marketplace of Agrabah move and rotate across the stage while turrets raise and lower. Every individual action, or effect, such as opening a trap door in the stage floor, lifting a section of scenery or helping an actor fly across the stage, requires complex control technology. There are virtually no limits to the imagination here; however, the prerequisite for staging such blockbuster effects is that the mechanical systems, the software and the automation work smoothly.

A peek behind the curtain

Behind the scenes, large control cabinets house the automation and control systems for the show. The HMI software developed by Hudson is used to operate the whole system. Controlling all the complex moving parts in a large-scale theatrical production such as the Broadway shows served by Hudson requires a robust control system in the background. Specifically, Hudson uses Beckhoff CX2030 Embedded PCs with 1.5 GHz Intel® Core™ i7 dual-core CPU, as well as several CX5100 Embedded PCs with Intel® Atom™ processors. Hudson also uses 7-inch CP6606 Panel PCs with ARM Cortex™-A8 processors for testing effects before implementing them in the field. Chuck Adomanis explains the need for a variety of controllers: "Each of these devices acts as a primary system controller, running PLC, NC and HMI software as the main control devices in our automation system. The highly scalable range of



A peek behind the curtain: Hudson Scenic Senior Engineer Chuck Adomanis works at typical bank of controls for a production.

Hudson Scenic Studio breathes life into stage and show productions, such as the Broadway hit musical "Hamilton", pictured here.



Displaying the HMI programmed by Hudson is a series of 15-inch Beckhoff CP2916 multi-touch Control Panels.



Action and spectacular effects are the heart of any performance: for motion control, Hudson Scenic leverages AX5000 series EtherCAT servo drives and AM8000 series synchronous servomotors with OCT.

controllers allows us to choose the right performance level for the job, and it helps mitigate cost for the shows and for customers." When larger screens are required, the Hudson-programmed HMI is displayed on a series of 15-inch Beckhoff CP2916 multi-touch Control Panels.

TwinCAT 3 automation software provides the core underlying architecture for Hudson control systems. Adomanis continues: "We use a variety of TwinCAT 3 packages for PLC and motion control, given the varied nature of our projects, and we utilize the full range of available TwinCAT modules: TwinCAT PLC and NC for axis control, TwinCAT ADS, TwinCAT TCP/IP Server or TwinCAT OPC UA for horizontal and vertical communication. TwinCAT gives us remote access to show sites, ensuring that our customers receive timely service from our experts." Remote access enables Hudson to diagnose equipment issues anywhere in the world without engineering teams having to physically travel to the venues, providing significant cost savings which can be passed on to the customer.

Control-integrated safety solution meets complex requirements

As one can imagine, safety is paramount for stage and show applications. Hudson Scenic relies heavily on the TwinSAFE system from Beckhoff to integrate the wide range of necessary safety functions into the automation system, such as guard doors and e-stops. "Our previous e-stop solution was hard-wired to run a 24-volt signal, which required running additional cable," explains automation engineer Erik Nelson. "With TwinSAFE, we have a single cable and it connects everything, greatly simplifying our commissioning, increasing reliability, and allowing us to satisfy increasingly complex safety requirements."

Flexible, cost-effective and reliable: the high-speed EtherCAT system

Communication of the real-time relevant signals in the field takes place via EtherCAT. EtherCAT Terminals and EtherCAT Box Modules offer best-in-class speed, as well as a minimal footprint – essential in the space-constrained applications Hudson takes on every day. In addition, the low cost of the Beckhoff I/O terminals was especially appealing for Hudson Scenic, as Chuck Adomanis explains: "The EtherCAT I/O system offers a low price per point and with TwinCAT, we can quickly map and freely configure I/O, adding up to significant cost savings."

Beckhoff servo drive technology implemented as the standard

For motion tasks, Hudson relies on AX5000 series EtherCAT servo drives and AM8000 series synchronous servomotors from Beckhoff, a change from the three-phase induction motor systems used in the past. Beckhoff servo drive technology is now used as the standard motion system. "As the technical demands of our projects continue to grow and change, One Cable Technology (OCT) for the motors and drives, when coupled with absolute encoder technology, provides excellent value in our projects and will be our standard on new equipment," Adomanis said.

Increased performance and profitability earn critical acclaim

Beyond added flexibility in system design and maintenance, Hudson Scenic achieved impressive performance increases. Adomanis explains: "With our



A CX2030 Embedded PC serves as the master controller. This works in concert with additional CX5100 Embedded PCs to provide the necessary computing power across an entire production.



(left to right) Erik Nelson, Automation Engineer and Chuck Adomanis, Senior Engineer at Hudson Scenic Studio.

previous PLC and motion system, we were living in a world with scan times higher than 20 milliseconds for PLC commands and motion control. Now, our scan times are around 1 or 2 milliseconds, which could certainly be decreased further if necessary. When working with EtherCAT and TwinCAT, we can accomplish real-time, microsecond-level deterministic I/O communication, which was impossible in the past."

In addition, engineering costs have been greatly decreased while efficiency has increased. "Code written for one project is easily scaled from one effect to another without a lot of rework," said Erik Nelson. "We're no longer stuck manually addressing data registers and PLC memory." Adomanis also noted that though the specific cost savings are not easy to quantify, "we can say unequivocally that our margins have dramatically improved on projects and Hudson can go after applications large and small with PC-based control and EtherCAT technology and maintain high profitability."

"Beckhoff is able to go beyond the 'basic automation and controls' vendor with entertainment industry-specific technologies, such as I/O terminals with DMX communication and other standards used for lighting and multimedia equipment," Adomanis noted. "Working with an automation company like Beckhoff, with profound understanding of entertainment applications, provides considerable benefits to Hudson Scenic Studio and our clients."

As these projects grow in scope and technological complexity, the Hudson Scenic Studio team is ready to meet any entertainment engineering challenge that comes their way. With Beckhoff providing the controls foundation, these talented engineers have the necessary tools to keep bringing the artistic visions and dreams of stage and show professionals into reality.

Further information:

www.hudsonscenic.com

www.beckhoffautomation.com