

Historic Danish Theatre



G E T S A F A C E L I F T



Visual Act's Touring Desk control panel is one of four portable control desks (courtesy of Sprint Electric).

The Royal Danish Theatre has occupied the heart of Copenhagen for centuries and recently upgraded to a new control system featuring Sprint Electric DC drives to extend the lives of the existing motors, keeping replacement costs down. The Swedish stage design and technology company Visual Act retained most of the original motors and mechanics while providing a much-needed face-lift to the stage.

The refurbishing project included control electronics for 36 fly bar hoists driven by DC motors; a stage control system with four portable control desks and redundant servers; upgrading six lighting bridges to increase lifting capacity; installation of four manually portable point hoists; and the upgrade of the old revolving stage driven by DC motors.

"The refurbishing process at the Royal Danish Theatre in Copenhagen was in many ways special and in some ways unique," says Niklas Philipson, design engineer for Visual Act. "We could build on the experience gained in upgrading the flying system at the Norwegian Theatre in Oslo (where Sprint Electric DC drives helped save eight tons of cable).

"Often the old DC motors are exchanged for AC motors, but we have good experience in keeping them. It is

a cost efficient way, as the DC motor drives have very good capacity and durability," Philipson says.

The 36 fly bar winches, which serve as a counterweight system for hovering scenery, received new drives and electronics for their control. A new position-monitoring arrangement featuring an angular gear, absolute encoder and limit switch was mounted to each winch, or hoist. A Profibus communication channel was provided for the drives and another for the absolute encoders and safety I/O. A closed positioning loop was integrated by Sprint Electric specifically for Visual Act's purposes, and the on-board software modules of the PLX drives helped facilitate the entire system.

"On this occasion, the physical size of the drives was crucial due to the retrofitting requirement; they had to fit in the space left by the earlier drives," says Gary Keen, sales director for Sprint Electric. "Profibus communication was a requirement, and this is easily incorporated as an option in the drives. Also, this is not the first theater where these drives have been used successfully, so familiarization and speed of commissioning was of paramount importance as the window for installing and setting up the drives was narrow."

Motors, gearboxes and brakes were replaced in the six lighting bridges to increase load capacity to 800 kg. Angular gear arrangements similar to the ones used on the fly bars were installed for the light bridge encoders, slack wire detection was included to increase safety, and electrical cabinets with servo amplifiers and electronics were installed.

The revolving stage received new encoders and four movable point hoists. The point hoists are connected to the control system through Profibus, and they have individual control cabinets similar to those in the light bridges.

The control system commands every movement in the theater through a network combining Profibus and Ethernet. A double redundant ring is the basis of the Ethernet. Several hot-swap terminal boxes for the control desks are placed throughout the stage area. The system is capable of stopping all motion by a double emergency stop circuit connected in series through the e-stop switches.

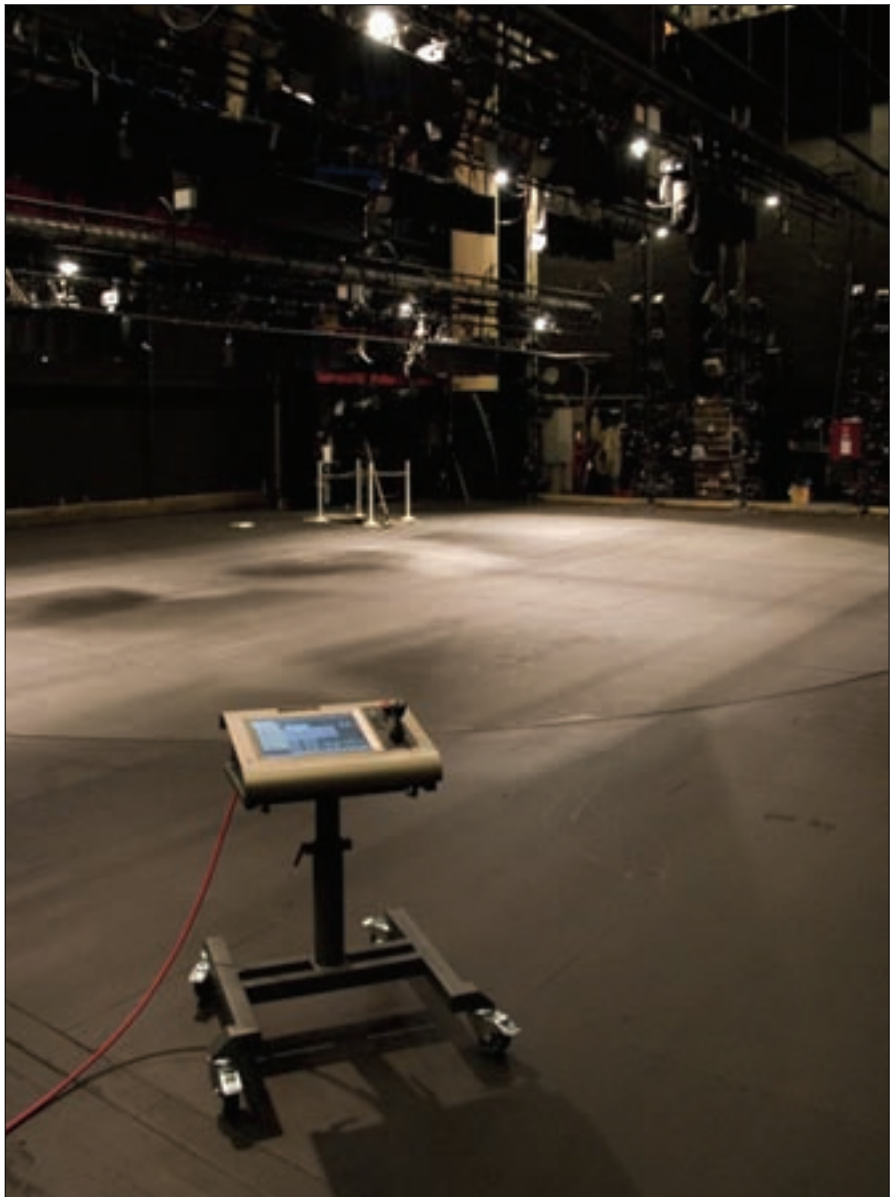
A total of 39 Sprint Electric PLX 4 Q DC drives were used in the project for the fly bar hoists and the revolving stage. Sizes ranged between 5 kW (12 amps) and 30 kW (72 amps). “The PLX range of drives are very versatile digital DC drives that offer excellent diagnostic facilities and are easily commissioned using (their) 40-character, two-line English text display and onboard MMI, or via a link to a Windows based program, all supplied free of charge with the drive,” Keen says. “One of the drive’s main advantages is its extensive built-in library of programmable software functions and high number of I/O connections, making complex tasks easily achievable within the drive itself.”

The PLX drives include two- and four-quadrant DC drives designed to be powerful, flexible and easy to program. Center winding macros, spindle orientation and a controllable field allow the motors to manage a range of industrial applications. They are used in many applications where DC drives provide advantages over AC drives. According to Keen, “The PLX range of drives are used extensively in the manufacturing and

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A total of 39 Sprint Electric DC drives were installed to extend the lives of the theatre’s existing motors (courtesy of Sprint Electric).



Several hot-swap terminal boxes for the control desks are placed throughout the stage for versatile mobility (courtesy of Sprint Electric).



converting industries, primarily plastics, steel, paper, wire and cable, cranes, printing and countless other traditional industries.”

Since the Royal Danish Theatre upgrade, Sprint Electric increased the PLX drives’ power to 1,850 Amps. “This is great news for our customers working in heavy industry,” Keen says. “We can now work with larger applications in the steel, plastics, rubber and paper industries.” 

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New slack wire detection was installed to increase safety (courtesy of Sprint Electric).



The PLX drives come in two- and four- quadrant models, and they’re designed to be powerful, flexible and easy to program (courtesy of Sprint Electric).