Modular, flexible, high-performance: PC-based control meets all requirements for modern stage management systems

EtherCAT and TwinCAT optimize stage processes

HFE Professional Studio Equipment, based in Leipzig, Germany, specializes in system solutions for theaters, opera houses and concert halls, as well as broadcasting corporations. The company's product range includes a state-of-the-art stage management system that can coordinate all technical operations of a theater performance. In view of the ever-increasing demands in the production of stage events, HFE developed a powerful and flexibly expandable solution that enables the connection of light signals, audio and video, call system and intercom. As an alternative to conventional versions of AV control systems for stage management, it combines ease of use with the performance and interface variety of the PC- and EtherCAT-based control platform from Beckhoff.

Stage managers are responsible for the trouble-free operation of theater performances. Using the stage management system, coordination of the whole performance and rehearsal sequences, including transformation of the stage settings for the next scene, light changes or timely use of tone sequences, sounds, and recordings, is all possible from a central location. The stage management console provides the communication platform for the stage operation, connected with all the rooms in the entire theater building via call and intercom systems, monitors, and cameras.

Industry-proven technology in the theater

In order to meet the complex technical requirements of modern theater performances, HFE uses the PC-based control platform from Beckhoff as the foundation for its stage management systems. "Theaters place high demands on system reliability. Therefore, it made sense to use components that have been tried and tested continuously in industrial applications. Many customers also ask for long-term availability of controls products, in order to protect their investment. All of this is available with Beckhoff control technology," says Christian Just, IT and Development Engineer at HFE. According to the specialists from HFE, the central control platform with local I/O modules is ideal for enabling functions at distributed locations in theater applications.
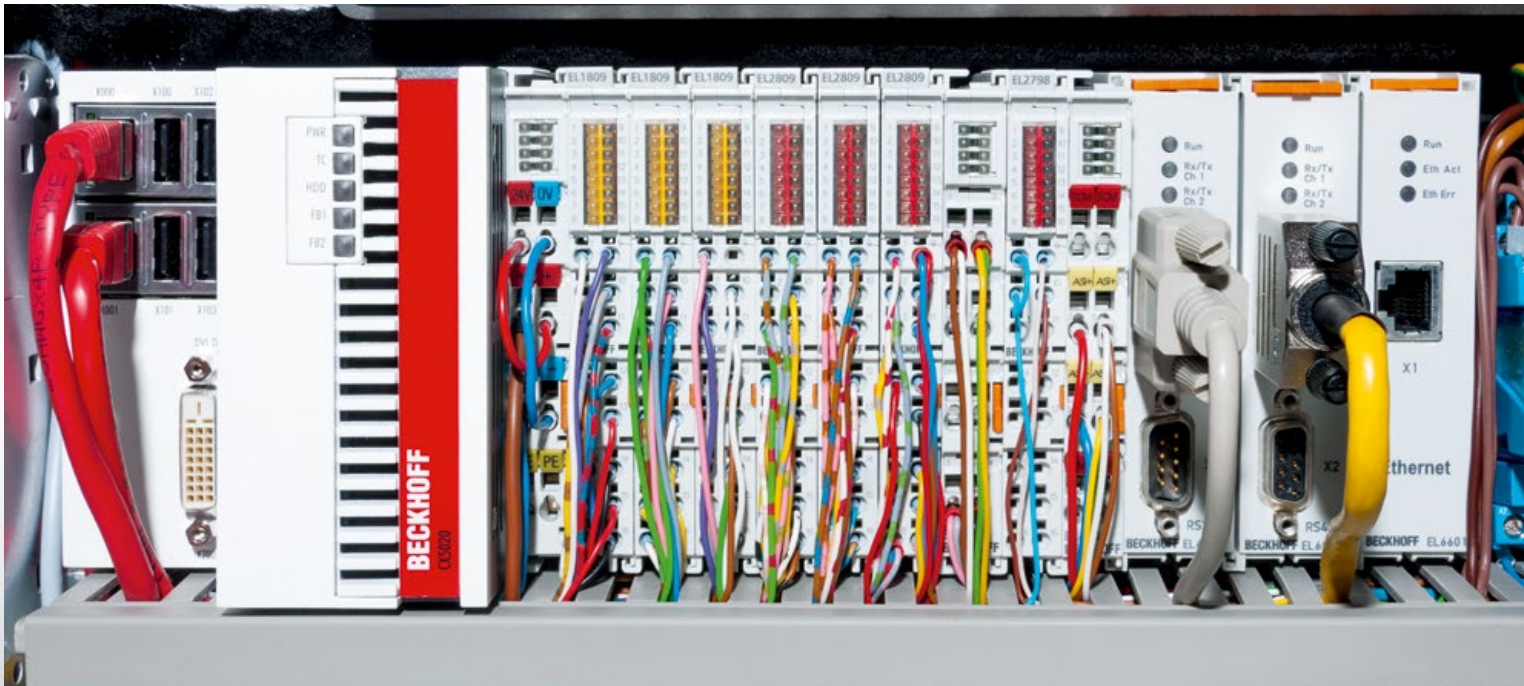
EtherCAT, the real-time communication backbone of the control system

The central control platform of the HFE stage manager console is a CX5020 Embedded PC with TwinCAT 3.1 automation software and EtherCAT, the high-performance industrial Ethernet system. The local system components with digital and analog I/Os are also connected to the control unit via EtherCAT. A modular star hub can be created by using several EK1122 EtherCAT junctions (or EK1501 for optional fiber optic connections) in a station. Individual devices

or complete EtherCAT segments can be connected at the junction ports. "The flexible bus topology offered by EtherCAT is a great advantage for theater applications. The Hot Connect function based on EtherCAT and enabled through defined bus segment groups is a big advantage compared to conventional solutions," noted Christian Just. "In this way, individual system groups, such as flexible operating points, can be exchanged during service operations. The short signal propagation and switching times, plus the high data throughput of EtherCAT are significant benefits: responses to user inputs occur in real-time, reducing latencies to a minimum." In addition to high performance, users also benefit from minimal cabling effort, as well as the full Ethernet compatibility of EtherCAT, i.e. support of external devices with Ethernet-based protocols.

Interface diversity sets no limits on creativity

Due to its wide range of interfaces, the PC platform allows the integration and control of all relevant components of a stage management system. "State-of-the-art performances require solutions that are versatile and expandable, in accordance with the requirements common to 'everyday life' in the events business," Christian Just states. "With our newly-developed stage management system, we are able to respond rapidly to user requirements. This applies to the integration of additional interfaces, as well as the functionality of the user interface and the control logic." The modularity and signal diversity of the Beckhoff I/O system are perfect for this purpose. Be it digital or analog I/Os, serial protocols (RS232/422/485), IP-based protocols, DMX or timecode: "The Beckhoff components, which are available centrally and locally, enable us to map virtually any application scenario," according to Christian Just. This makes it possible to integrate existing and external systems in the stage management system. For example, light control can be integrated via the EL6851 DMX terminal. Various Bus Couplers support the simple migration of data from existing bus systems to EtherCAT communication (e.g. EIB/KNX, M-BUS).

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The stage manager console developed by HFE provides a powerful and flexibly expandable solution for connecting light signals, audio and video, as well as call and intercom systems.

The Adunas software developed by HFE runs on Windows, Linux and Android-based operating systems. This also allows implementation of distributed user interfaces, such as operation via smartphone, for example.

The EL6001 (RS232) and EL6021 (RS422/485) EtherCAT Terminals enable the flexible connection of serial devices. EtherCAT Terminals with special functions deal with reading of the curtain status (EL5001 – SSI encoder interface) or the auditorium lighting level (EL3681 – multimeter terminal).

Customized solutions based on an open system

On the software side, HFE is excited about the flexibility and openness of the PC platform. With the integrated ADS interface in TwinCAT, the company is able to easily connect Adunas, its AV control software for stage management systems, with the Beckhoff control system.

Conventional, physical controls, such as buttons or knobs are still popular with the theater industry. HFE complements these with touch-enabled Panel PCs running their Adunas software. "For the stage manager, this means comfortable operation without compromising on familiar processes and conventional input and output methods," says Christian Just. The Adunas AV control software extends the functionality and usability of the overall system.

Currently, the system runs on Windows, Linux, and Android-based operating systems. This makes it possible to realize distributed user interfaces that can be configured according to each application.

The specific versions that HFE offers its customers range from the design of the stage manager console and the configuration of the operating elements and displays, to the actual system functions. "We pursue an open concept. Together with our customers, we develop systems to suit their needs, at a price that is comparable to a standard solution," explains Christian Just.

In addition to the further development of the existing system, HFE also intends to use its technological potential for system solutions in other areas. Currently, the company is working on the design for a digital information system for broadcasters.

Further information:
www.hfe.de