Revitalization of building automation system in Frankfurt’s Eurotheum high-rise building

PC-based control simplifies building revitalization

PC-based building automation from Beckhoff is characterized by its system openness, reliability, ease of use and long-term product availability. In the revitalization of the Eurotheum high-rise building in Frankfurt, Germany, Plüderhausen-based system integrator Herrmann GmbH & Co. KG, benefited from these features in several ways. Having implemented the building’s original automation platform and the smoke extraction system in 2000, the system integrator was able to upgrade it substantially in 2018 with minimal effort in terms of time and technology.
At 110 meters tall, the office and hotel complex in the center of Frankfurt stood out from the beginning due to its size and extremely flexible leasing options. While eight floors plus the lobby are occupied by a hotel with conventionally automated building operations, 21 of the 31 floors can be subdivided based on the tenant’s needs and leased even on short notice in units of 240 square meters or larger. Available layouts include open concept floor plans, office setups with rooms or cubicles or a combination of the above. Essential for the flexibility of use is easily adaptable room control for building services such as heating and cooling, lighting and shading, enabling customized floor layout with little effort. Hansjörg Ludwig, General Manager of system integrator Herrmann, explains the original requirements: “Room sizes and floor layouts had to be modifiable within a specified timeframe. We accomplished this by establishing a 1.35-meter-grid based on the width of the windows that allows each segment along a window axis to be flexibly assigned. This flexibility made it possible to achieve the original tenant’s goal of being able to configure e.g. three single offices or a single conference room in the same space for its frequently changing teams within 24 hours.”

Flexible building automation makes all the difference

Besides reconfigurable room walls, such a building requires highly flexible automation systems, says Herrmann Team Manager Rainer Daiß: “The infrastructure endpoints for HVAC control stay in place, as do all the sensors and actuators, blinds and the lighting control elements. The building operator, however, must be able to modify the interaction of these data points with higher-level building controls, and this can be accomplished via a user-friendly configuration tool in the central building control system. In addition, the advanced single-room controls feature three operating modes set for comfort, economy and nighttime operation. The rooms are controlled automatically, depending on the time of day and the presence of occupants determined via occupancy buttons, but can all be individually adjusted as well.”

Hansjörg Ludwig adds: “We used Beckhoff products in the Eurotheum from the start and have been particularly impressed by the system openness of PC-based control. Due to a requirement of the original tenant, however, we had to implement most of the automation systems with third-party Interbus components at the time. When the leasing relationship ended, the Eurotheum was to be fully renovated, which enabled us to implement all automation components with PC-based control technology from Beckhoff. We started in 2016 with a total renovation of the smoke extraction system. This was followed by a floor-by-floor renovation of the entire building as leases permitted.” Michael Herrmann, Assistant Technical Manager at Herrmann, confirms the success of this approach: “As part of the modernization project we installed state-of-the-art building technology over the last two years. Due to the modular control system from Beckhoff, the building is now much more flexible.”

Revitalization improves reliability and protects investments

Herrmann opted to implement Beckhoff Industrial PCs (IPCs) from the building start. Rainer Daiß explains the rationale: “Back then, we decided to use C6130 control cabinet PCs, because they were the only devices at the time with enough computing power for the variable room automation we needed. No PLC system with comparable performance was available back then. In addition, only IPCs could be equipped with plug-in cards as interfaces for the various bus systems used in the building. To connect the more than 40,000 data points in the building control system, 20 C6130s were distributed across three floors. Today, 20 compact C6915 control cabinet PCs perform this job. Since they are much smaller, they could be distributed across the individual floors in a more space-efficient manner with a floor manager on each floor. We benefit from the continuous advancement of control technology from Beckhoff while still being assured that components will be available for the long term. Even the originally installed C6130s are still available.”

Another major factor in the building revitalization project, says Michael Herrmann, was the high flexibility of PC-based control: “It provides us with a comprehensive toolbox that helps us implement all specific requirements of a building quickly and with minimum effort. We can integrate legacy systems that are still in good working order and carry out revitalization projects without having to interrupt building operation.” The same applies to TwinCAT automation software, adds Rainer Daiß: “No comparably flexible software system was available at the time. It also offers the benefits of efficient engineering and upward compatibility, which is critical for long-term operational reliability. The Eurotheum revitalization is a prime example, because we were
With its flexible building automation capabilities, the 110-meter-tall Eurotheum building in Frankfurt offers 21 floors of custom-tailored office space.
EtherCAT Terminals and Bus Terminals from Beckhoff snap into position much more securely, those problems are now in the past. In addition, the extensive diagnostic capabilities of the EtherCAT system make it much easier to find exact points of failure.

EtherCAT for smoke extraction and building automation
The complexity of the Eurotheum is reflected in its many physical data points alone after the revitalization: 100,000 for the building automation features and an additional 6,000 for the smoke extraction system. Accordingly, having powerful data communication capabilities is critical for Rainer Dais: "The huge volumes of data generated require an exceptionally fast and reliable bus system like EtherCAT that can operate over copper wires just as well as over fiber-optic cables, depending on the circumstances. Especially for the highly available smoke extraction system, EtherCAT stands out with its easy-to-implement cable redundancy and fast fiber-optic cable installation. We were able to upgrade all
The data transmission of the room automation systems for each floor also runs over an EtherCAT loop that connects the four switching panel alcoves as interfaces to the individual trade systems. Each of the 20 floors has 34 distribution racks and 38 BK1150 Bus Couplers to handle the typical building data via M-Bus, KNX, Dali and DSI, as well as the legacy Interbus network for the HVAC systems. In addition, each floor has 15 EP2008 I/O box modules linked to an EtherCAT loop that are used to control the heating valves in a particularly space-saving manner.

Using a window-based grid divided by 67 axes, each office floor space can be configured for single offices or cubicles, an open floor plan or a combination thereof.

30 control cabinets, each of which has two substations, in only two months. This was particularly important in terms of fire protection, because when the smoke extraction system was switched off for the modernization in ongoing building operation, a firefighter had to be stationed on each occupied floor as a costly safety measure.”

The smoke extraction system is controlled by two CX2030 Embedded PCs. They connect two separate EtherCAT loops that run through all building floors. The system employs a total of 74 EK1501 EtherCAT Couplers along with 450 EL1008 digital input terminals and 150 EL2008 digital output terminals. Based on the information supplied by these components, the smoke extraction system is able to identify one of approximately 50 smoke extraction scenarios and will accordingly turn the appropriate exhaust fans on or off and open or close fire dampers. To do this, the Beckhoff control system communicates with the building management system over an OPC server via ADS.

Further information:
www.eurotheum.de
www.herrmann-automation.de
www.beckhoff.com/building