

Top technology for top appliances

→ In many ways, the Aviva project in Munich (Germany) is a show object. It is Europe's largest office complex, designed according to Feng-Shui rules. With more than 25,000 I/O data points, the building automation system is also impressive. Thanks to the openness and consistency of Beckhoff technology with Ethernet networking, DALI and radio technology, a particularly flexible building automation system was realized.



The Aviva complex, which was completed in summer 2003, has office space totaling around 54,000 m², two thirds of which is rented by BSH Bosch and Siemens Hausgeräte GmbH. The complex offers space for approximately 1,500 staff, who had previously been distributed across different locations. For Imtech Deutschland GmbH & Co. KG, the general contractor responsible for the project, it was a very special project. "The conventional building services (HVAC) of the Aviva building are not really exceptional. But in terms of the individual room control with more

than 25,000 data points, it certainly wasn't an everyday project," Dieter Groß, manager of the Imtech division for interior works and electrics, explained.

Two buses are one too many

The company fisher & fey Ingenieurgesellschaft mbH was responsible for designing the building services, and also for the individual room control, which is networked via Ethernet. "We did not want to use a second bus system, such as EIB,



Beckhoff technology at Aviva Munich

The large number of 25,000 I/O data points gives an idea of the wide variety of Beckhoff products used for the Aviva Munich project. A selection of the components and their respective area of application is described below:

- | 4 C5102 Industrial PCs as building computers
- | 360 BC9000 Ethernet Bus Terminal Controllers as coupling stations
- | 795 digital 8-channel KL1408 Input Terminals for light and blind switches
- | 984 digital 4-channel KL2404 Output Terminals for the air-conditioning and heating system
- | 400 analog 4-channel KL3204 Input Terminals for set value generators or temperature sensors
- | 1,271 KL9260 Bus Function Terminals for the 230 V power supply
- | 3,302 2-channel KL2602 Relay Output Terminals for the lighting system
- | 2,455 KL2722 Triac Output Terminals for the blinds
- | 69 KL6023 Wireless Adapters for a total of approximately 140 radio switches and 40 room control units
- | 10 KL6811 DALI Bus Terminals for integrating the light management

More than 300 room controllers (BC9000) are "hidden" in the suspended ceilings at the Aviva office complex.

in parallel with Ethernet. Since the concept of individual room control via local Ethernet controller was significantly better, we decided to use Ethernet as the basis for the control system," said Thomas Leipold, group leader for facility management technology at BSH.

Flexible room control and design is a particularly important factor for BSH, because the wide product portfolio the company deals with means that new priorities and associated staff groups are formed on a regular basis. The building services had to be able to cope with the resulting modifications to the building layout, on average about 140 every year. Thomas Leipold said: "We segmented the office spaces in such a way that each room element covering the width of a window has two independent lighting circuits (i.e. near the window or adjacent to the corridor), a blind (one drive coupled for two or three windows) and a separate climate control ceiling, which are all flexibly controllable through room controller units networked via TCP/IP."



BSH Portrait

BSH Bosch und Siemens Hausgeräte GmbH, a joint venture between Robert Bosch GmbH Stuttgart and Siemens AG Munich, operates worldwide and has an annual turnover in excess of six billion euros. The main brands of Bosch and Siemens are the best-selling brands in Europe. With its five special brands, BSH serves individual and differentiated customer requirements in terms of brands and products. Six regional brands safeguard image and high market shares in their respective home countries. In its global development and production network, BSH produces appliances that are adapted to individual markets. The product range comprises large and small appliances and also a range of Internet-capable appliances.



Dieter Groß manages the division for interior works and electrics at Imtech Deutschland GmbH & Co. KG.



Proven Beckhoff know-how for flexible room control

Right from the outset, the automation concept was based on Beckhoff control technology, with intelligent data interfacing via the Bus Terminal system. It enabled us to achieve the required flexibility, modularity and Ethernet networking, supported by Beckhoff building automation know-how. One of the factors that convinced Dieter Groß was the large new Microsoft head office in Munich, completed in 2000, where Beckhoff products were also used. For Georg Schemmann, director for building automation at Beckhoff, the similarity with Aviva was mainly in the requirement for a particularly flexible solution, necessitated by the con-

tinuous changes in utilization. "But the Aviva complex is about twice the size, and the utilization requirements were even more demanding," he said.

"In such projects, the electrician will usually install the EIB system in parallel with the individual room control; a different contractor usually deals with the windows and blinds, and in the end the three systems somehow have to be linked with each other. The solution that was made possible by the Beckhoff Bus Terminals was the most consistent and integrated solution implemented by Imtech so far," Dieter Groß said. The benefits of simple connections and high-speed Ethernet networking are already clearly evident.

Imtech portrait

Imtech Deutschland GmbH & Co. KG is part of the Dutch Imtech group with more than 14,000 employees and an annual turnover of approx. 2 billion euros. Imtech N.V. offers design, implementation, system integration and maintenance services for building, plant, infrastructure and ship engineering projects, as well as information and communication technology. The group comprises more than 50 technical companies in Belgium, Germany, Great Britain, Luxembourg and Spain. Further facilities are located in Poland, the Czech Republic, USA, Canada, Brazil and Singapore.



Aviva Munich

- | **Building owner:** Atrion Immobilien GmbH, an Accumulata Immobilien Development company, www.accumulata.de
- | **General contractor:** Imtech Deutschland GmbH & Co. KG
- | **Building services design:** fischer & fey Ingenieurgesellschaft mbH, www.fischer-fey.de
- | **Tenant:** BSH Bosch und Siemens Hausgeräte GmbH
- | **Architects:** Denk, Mauder, Wisiol and Altenbehrend, Munich

“Particularly in terms of speed, the only solution suitable for this project was Ethernet TCP/IP,” Dieter Groß said. “LON as a control bus and EIB could not match the performance, particularly in terms of processing of analog values.” Thomas Leipold agrees that real-time capability was absolutely essential. The bus system has to be able to transport data quickly between the actuators and sensors to enable controlling, for example, the required end position of blinds.

System structure of the individual room control

In principle, the individual buildings of the Aviva complex are not divided into rooms, but into axes. The smallest control unit is the 1.35 m wide window axis. It contains the drives for the blinds for two windows, the lighting and, where appropriate, the climate control ceiling. These fields are wired individually and can be controlled via the individual room control. In some cases, optical fiber was used for networking. While Ethernet is appropriate for conventional wiring at distances of up to approximately 95 m, the use of optical fibers enabled us to eliminate any risk of impaired real-time behavior.

Four 19" C5102 IPCs from Beckhoff, equipped with Windows XP and the Beckhoff TwinCAT automation software, form the basis of the system structure. A separate IPC controls each of the four rentable spaces, so that they can be controlled independently by different occupants, if necessary. In addition, a standard PC acts as a management server, enabling a certain axis, for example, to be moved – on paper – and the individual room control to be re-allocated automatically via the Beckhoff software.

Radio technology makes changes in room layout straightforward

Another special BSH requirement was the use of flexible radio technology. The technology selected was EnOcean, enabling wireless operation of room functions without batteries. The KL6023 Wireless Adapter is a suitable radio receiver for the Bus Terminal system.

Particular emphasis on this new technology was placed in the executive offices and in offices with connecting doors. The flexibility required by BSH in terms of re-usable wall system meant that no services could be integrated within the walls. The radio switches are simply stuck on, so that the wall elements are not damaged if the room layout is changed. Given the 140 modifications per year, this is an invaluable advantage. Infrared-operated systems, for example, require much higher installation effort, since the IR receivers always have to be installed with-



Wireless adapter for
EnOcean radio technology



in the visible range, which means that the range is reduced significantly. Another factor is that other systems require additional energy, with an associated high maintenance effort, for batteries or rechargeable batteries. In contrast, EnOcean utilizes ambient energy, i.e. for a range of 30 m (inside the building) or 300 m (outdoors), a piezo element located in the switch and a small solar cell within the temperature sensor supply the required energy. Moreover, the low energy required reduces – in keeping with the Feng-Shui concept – the EMC load within the building.

EnOcean also ensures security of the data transfer: Each sensor is identified with a unique ID number and transmits at least three times for each command, in order to detect any data collisions. It uses its own frequency band, i.e. 868.35 MHz. This was another important factor for BSH, in order to avoid potential conflicts with any wireless company IT system that may be introduced in future.

Integration of the light management system via DALI

As well as the individual rooms, the radio technology had to be integrated into the management area with business lounge, meeting and conference rooms which were equipped with changeable "lighting scenarios". Another factor was the DALI technology as an additional control unit. The "Digital Addressable Lighting Interface" is a standard for the digital control of electronic ballasts.

For this purpose, Beckhoff offers the KL6811 Bus Terminal, comprising a DALI master and a DALI power supply. Around ten of these terminals are used in the sensitive BSH media areas. Each device can be connected with up to 64 DALI slaves.

Here too, Georg Schemmann sees benefits in integrated Ethernet networking: "The DALI protocol is implemented directly within the Bus Coupler and then converted to Ethernet TCP/IP. DALI applications normally deal with individual rooms. However, since we regard the configuration as a single system that is linked via software and TCP/IP, we can use it for several rooms, even complete storeys or

buildings." Thomas Leipold explained: "The same applies for the media technology, where pre-set lighting scenarios can be controlled via operating consoles. This, in turn, obviously requires an interface to the individual room control. The situation in the casino is similar. Lighting designers developed software for different lighting scenarios and lighting effects, which also affects the individual room control. Programming of both aspects was straightforward thanks to the open system, which is running very smoothly today."

From theory to practice

Thomas Leipold has no doubt that the design work over the last few months has paid off: "Routine operation has now caught up with us, i.e. we keep changing room layouts, and so far the system has met all expectations. Simple modifications can be realized without problem via the software. In terms of network behavior, the system runs absolutely smoothly, so that our experience to date has been very positive. Our technical service provider can implement software modifications himself. Due to the modularity, retrofitting of Bus Terminals is no problem. Simple manageability was one of the arguments in favor of the Beckhoff system." Dieter Groß also draws positive conclusions. He reckons that Imtech will actively promote PC-based building automation from Beckhoff in future. Several new projects are already being planned or implemented.

→ BSH Bosch und Siemens Hausgeräte GmbH www.bsh-group.com

→ Imtech Deutschland GmbH & Co. KG www.imtech.de