



The electronics developers from Miele moved into a new innovation center.



→ Miele develops and produces washing machines, washer driers, tumble driers, and electronic controls at their main site in Gütersloh, Germany. Gütersloh is also the location of the head office, the electronics plant, the distribution center and the central spare parts warehouse. The Miele facility at Gütersloh has a staff of around 4,900. One of Miele's new facilities uses state of the art automation controls from Beckhoff.

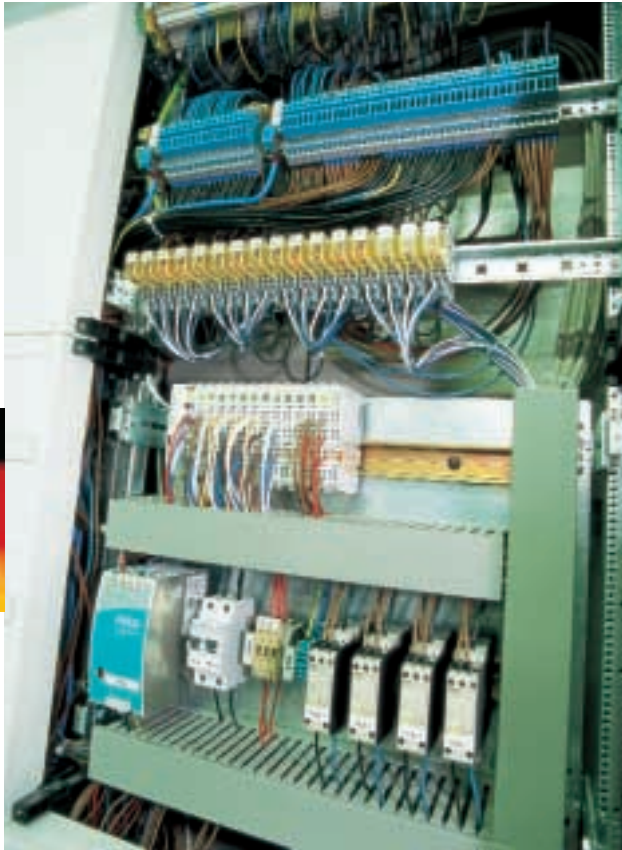
## One building – one integrated automation

In August 2003, the Miele electronics development department moved into a new innovation center. The modern building offers employees a creatively designed office and laboratory environment. The Miele construction division, comprising building construction, building services and interior design sections, was responsible for the design and the implementation. The design includes a space utilization concept with flexible partitions, a raised floor for the installation of the building services, underfloor box systems, data systems and a decentralized control concept for the building services and energy supply systems.



(left to right) Fred Kerkhoff from the Beckhoff building services section, Udo Siekaup from Miele's design and development section of building management, and Georg Schemmann, manager of the building automation section at Beckhoff.

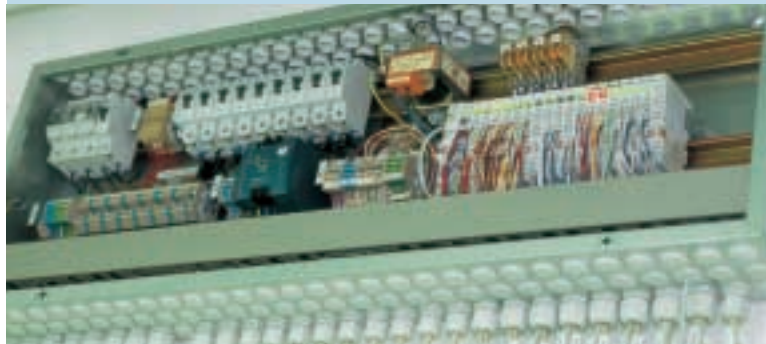
Currently, around 220 people work in the new Miele innovation center. They benefit from a modern building offering maximum functionality, of which only a small part is directly apparent. "The new building is intended to facilitate creativity and new ideas," as Udo Siekaup, who works in the design and development section of the Miele building management department and was responsible for the software and control implementation of the building automation services, describes the ambience the management had in mind. The whole innovation center intends to express this intention both through its architecture and through



The BC9000 Ethernet controller can also be used as an autonomous PLC for controlling the HVAC units. Even if more intelligence or memory would be required due to increased coupling depth or complexity, scalable solutions could be realized with other Beckhoff controllers (e. g. BX9000 Bus Terminal controller, CX1000 Embedded PC).

### Bit-precise internal billing

An important aspect of the automation solution results from the cost center principle of the Miele Group. Each individual service, be it air-conditioning, heating, electrical energy consumption or even IT infrastructure is accounted for independently within the Group. The consumption is recorded and billed, and the costs are assigned to the respective departments. The building automation solution in the Miele innovation center therefore also had to follow this concept. For Miele, the only bus system that was able to meet this requirement was Ethernet: "The infrastructure is available, and we were able to hire the required network capacity with access and integrated connections at fixed prices within the IT-sector, so that we can cost and use this bus technology very cost-effectively."



Ethernet Bus Terminal controllers, around 1000 Bus Terminals for approximately 3,000 data points, a central Industrial PC with Control Panel, and the TwinCAT automation software.

### A network for any application

During the project discussions between Beckhoff and the design engineers from Miele, two communication concepts were being considered: A network solution with Profibus as the bus system, and the Ethernet solution that Miele decided to use. While proprietary bus systems that are often used for electrical installations are configured and switched via specially integrated and function-related interface components in the installation devices (e. g. in light sensors, ballasts for flu-


its spatial design and the furnishings and fittings, and obviously also through its technical infrastructure. The building automation therefore not only had to meet functional expectations, but also aesthetic and emotional requirements.

Notwithstanding the exacting requirements regarding the aims and types of utilization, from an objective point of view the new innovation center has to be classified as a functional building, in which various technological services had to be installed and sensibly linked with each other. The technical building equipment, i. e. the infrastructure and the building automation, was therefore an important consideration. The building has a usable floor space of more than 5,300 m<sup>2</sup> (without basement). The plant rooms with HVAC and energy distribution systems, the IT room with the IT patch fields for the complete communications infrastructure and the building automation room are located in the basement.

The building services including the Beckhoff Building Automation contribute significantly to the building ambience. The building automation is based on decentralized intelligent control systems that are networked via the Ethernet communication system, and on a central building management system based on Industrial PC technology. The construction division commissioned the design and development section of the Miele building management department with the design, programming and commissioning of the building automation.

Udo Siekaup from Miele, Georg Schemmann, manager for building automation at Beckhoff, and Fred Kerckhoff from the Beckhoff building services section jointly developed a combination of intelligent building automation and conventional installation technology.

Ethernet- and PC-based technology from Beckhoff was used for the automation components. Georg Schemmann: "Beckhoff products are already being used in various sections of the Miele production plants, so that in addition to the technological benefits there are also logistical ones." The combination of intelligent building automation and years of experience with installation technology has already proved an advantage in many projects. Ethernet was the favored bus system for the building automation. The control system includes a total of 63 BC9000



A Industrial PC C5102 from Beckhoff with built-in Control Panel CP6802 in a 19" rack is used as the main building computer.

orescent lamps etc.), with Ethernet-based building automation any commercially available installation devices can be connected to the Bus Terminals. The freely programmable functions and logical links are realized via software. This makes the installation significantly more flexible, and cumbersome parameterization or address allocation (e.g. for extensions or in the event of changes in the utilization concepts) is avoided. Ultimately, the coupling depth of the application is almost unlimited, and commissioning is simplified.

Category 5 structured cabling was installed throughout the new Miele innovation center, involving around 40 km of Ethernet bus cable. Ethernet is thus available anywhere in the building and is the preferred building automation bus technology, rather than proprietary fieldbus concepts. For the connection of the Ethernet controllers, in addition to the usual office sockets RJ45 sockets were installed in those areas that were designated for the sub-distributions. Simple RJ45 patch cables were used for the connection to the BC9000 Ethernet controllers.

#### **Weather station, temperature control and light management within a single system**

The weather station includes a total of six ambient air temperature sensors mounted on the roof at certain angles covering all directions, whose signals are required for the HVAC systems installed in the basement. Based on these and the other sensor signals from the weather station – e.g. wind sensors that are activated when the wind speed exceeds 10 m/s, and a non-volatile rain sensor – decisions are made, for example about raising the blinds or closing the rooflights or bottom-hinged windows. The blinds and windows are controlled via the Beckhoff BC9000 Controller and a total of 260 KL2722 Triac Bus Terminals.

The electrical system for the laboratory spaces differs somewhat from the one that was implemented in the office and meeting spaces. In addition to the energy and process connections (e.g. sockets, water connections), the system includes light switches for the lighting control and heat sensors and regulators for the temperature control in individual rooms, which are connected via the Bus Terminals. Obviously, the radiator valves/cooling valves are also controlled via the Bus Terminals. "The temperature specification is 20 °C ± 3 K. It is controlled via the BC9000 Bus Terminal Controller, with the outlet valves of the ceiling-mounted cooling device and the space heating system in combination with a PI controller representing the actuators," explained Udo Siekaup.

The light management includes the new DALI Bus Terminal, which can be used to control the digital ballasts of fluorescent lamps and to realize lighting scenarios.

The DALI Bus Terminals, to which up to 64 digital ballasts can be connected, are used for the lighting control of the conference rooms at the Miele innovation center. The control functions include on/off switching and specification of the brightness levels.

Several devices also run via the Beckhoff Controllers. For example, the basement contains about 10 temperature-controlled cabinets for long-term climatic testing of electronic modules, which are controlled and temperature-monitored via the Bus Terminals.

#### **Software creates functional unit**

Staff from the Miele building management department programmed the automation solution in-house. This underlines the fact that, in principle, users are able to create control programs – without excessive effort – via the IEC 61131-3-compliant TwinCAT programming environment, even for decentralized, intelligent control concepts such as those realized for the Miele project.

For user programming, it is important to be able to re-use program blocks that can be used to implement identical or similar tasks such as controller functions uniformly and economically. "For supporting this kind of task, we offer the user special libraries, for example the TwinCAT PLC Building Automation library or the Controller Toolbox, which can be used to quickly adapt a control block to the respective task and to parameterize it," explained Georg Schemmann.

The complete programming of the Beckhoff Bus Terminal Controllers was quite straightforward, said Udo Siekaup: "Once programming for a distribution station has been completed, the program can simply be transferred to the other controllers as a basic block and then slightly modified according to the respective requirements."

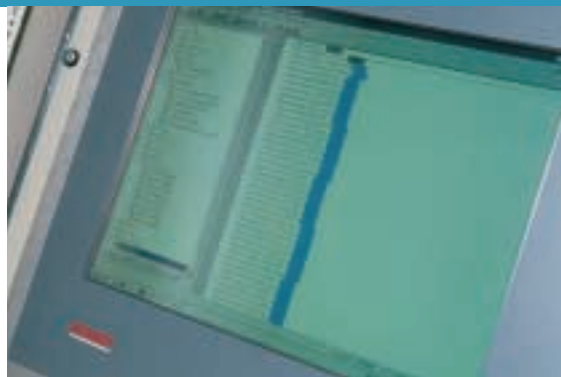
Miele staff took part in training for programming with TwinCAT at the Beckhoff head office, thus acquiring the required system and programming know-how even before the project started. For Udo Siekaup, the structure of the building automation is simply convincing: "It is important that the complete building technology is not controlled by a single central intelligence. We therefore implemented decentralized autonomous intelligence and use it locally, thereby potentially increasing operational reliability and availability."

#### **More operational reliability through decentralized intelligent units**

A BC9000 Bus Terminal Controller is not just a device for Ethernet-coupling of Bus Terminals, but an independent mini-PLC. This concept enables the respective ap-



As scheduled by the design department of the Miele construction division, the whole electric infrastructure including IT-oriented structured cabling was installed and successfully commissioned within only eight months.



lication to run decentralized, i.e. independent of the central building automation station of the Miele project that is installed centrally in the basement. Even in the event of a failure of the building automation or of sections of the building, the remaining sections can continue to operate, since all BC9000 controllers operate independently. The building automation computer – a C5102 Industrial PC from Beckhoff mounted in a 19 inch rack with an attached built-in CP6802 Control Panel – takes only those data from the 63 BC9000 devices (coupled via Ethernet) that it actually needs. Obviously, the building automation, based on the Beckhoff TwinCAT software system, can also send data, including program changes, to each connected BC9000 controller.

The data to and from all connected BC9000 stations can be monitored via the building automation station, and the so-called "sign of life communication" is also displayed at the Control Panel or via an LED flicker light. Udo Siekaup underlines the significance of the communicated light signal: "A lack of flicker indicates a station fault". From the building automation station, the building services engineer can also directly connect to every single BC9000 controller and monitor the program that runs on the controller. Any troubleshooting that may be required can therefore start from the central building automation station. Udo Siekaup comments: "I don't even actually have to be at the building automation station for these tasks. I can log into the building automation from my desk via our intranet and PC-Anywhere and carry out the network analysis in the same way as I would do directly from the building automation station." This is another one of the special advantages of the Beckhoff automation solutions, which offer new opportunities not only for building automation.

The building automation of the new innovation center is also connected to the centrally operated control station of the Gütersloh site. The Scada system is used, as an OPC client recording all data that are transmitted from the building automation (Beckhoff IPC with TwinCAT OPC server). For Georg Schemmann, system continuity is a significant advantage of the Beckhoff automation devices: "Beckhoff has deliberately concentrated on integrated control technology.

## Miele invests 10 million euros in a new building for the electronics development section

Miele has invested around ten million euros in the new electronics innovation center at the Gütersloh site. Currently, 220 employees occupy the four-story building that is designed for a staff of 290. Hans-Eckart Peters, works manager for electronics: "Electronics is an area showing strong development at Miele. This is why we have designed for growth." The building was ready within one year. The electronics development activities, which had been distributed across several Miele locations, have now been consolidated within one building. The development center is now directly connected with the electronics production plant that opened in 1997. "At long last, development and production can happen under one roof. The routes are now shorter, and communication between the departments is faster and simpler. A dream has come true", concluded Mr. Peters. Over the last 17 years, Miele has invested a total of 40 millions euros in electronics production.

Through the compatibility with open standards – including OPC functionality – we create integration options that are not only beneficial in industrial applications, but also in building automation."

### The result: completion on time

The design work started 6 months before construction commenced. After the construction phase was completed in January 2003, building services staff from Beckhoff started with the installation, and the building was commissioned at the end of June 2003. Staff moved into the new innovation center over a single weekend. "We all were positively surprised about how well this comprehensive project worked out," commented the construction division with considerable satisfaction.