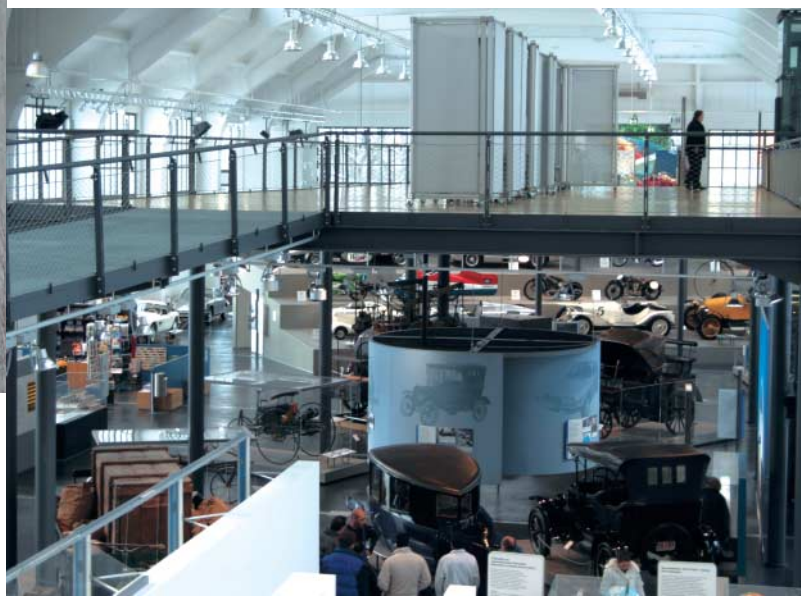
Building automation in the "Verkehrszentrum" branch (transport section) of "Deutsches Museum"

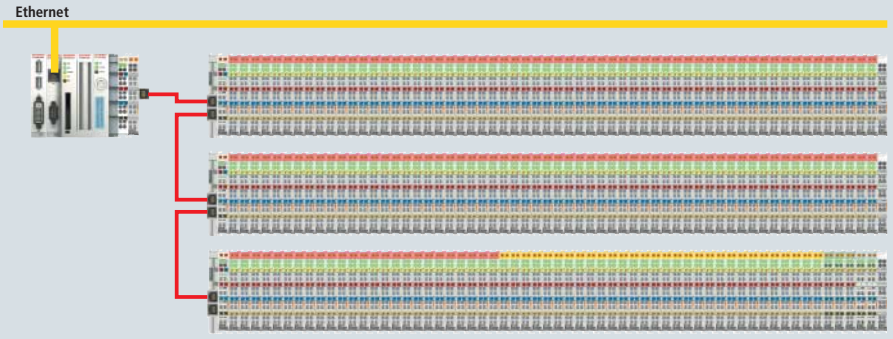
Is PC Control already a museum piece?

When it comes to the CX1000 PC-based embedded controller from Beckhoff, the answer is a clear "yes," because in the new hall of the Verkehrszentrum at the Deutsches Museum, the CX1000 deals with all aspects of building automation control. This proves that the device is indeed a "museum piece," albeit a very technologically advanced one.

On May 11, 2003, the "Mobility and Technology" exhibition opened in Hall III of the new annex, completing the first phase of the expansion of Deutsches Museum. Over the next few years, the Verkehrszentrum will be expanded and eventually extend to all three historic exhibition halls (which are listed buildings) at Munich.



The Verkehrszentrum of Deutsches Museum in Germany is equipped with PC- and Ethernet-based control technology from Beckhoff.



Each CX1000 controls around 180 Beckhoff Bus Terminals, which in turn deal with lighting, heating and ventilation control.

In Hall 3 of the former Munich exhibition grounds, located some distance away from the "Museum Island," Deutsches Museum now has an additional 2,200 m² of floor area and, thanks to a gallery, a total of 3,000 m² of available exhibition space. The Verkehrszentrum branch moved there recently, and by 2005 it will also occupy Halls 1 and 2. Just like the location, the complete building automation system is also new. It comprises around 1,000 relays for PC sockets, lighting, heating (bright radiator) and ventilation flaps, which were all realized with control technology from Beckhoff.

The building automation system is based on three modular, DIN rail-mountable CX1000 Embedded PCs from Beckhoff, each linked to approx. 180 Bus Terminals via a terminal bus extension. Peter Traut, responsible for security, technology and EDP at the transport section, explains the reasons for this configuration, "The tri-partition is mainly due to the spatial situation. One station is responsible for general building services, for example, the climate station. Furthermore, the hall is split into two due to sensitive exhibits. We need this kind of redundancy to protect the exhibits, in other words, things aren't too bad if the heating or lighting fails in only one half of the hall." A 19" slide-in IPC C5102 from Beckhoff operates at a higher level above this structure. It is used as input medium and deals with set value specification and control functions. In principle, the three controllers operate independently, although status messages and the web interface run on the 19" Industrial PC.

More computing power, simpler handling

The control system has proven to be rather complex and covers 30 PCs and several hundred lamps, among other devices. Georg Schemmann, manager for Building Automation at Beckhoff, said: "Due to the complexity of the control system, we proposed to use three CX1000 controllers, each of which has to deal with high data flow from up to 180 terminals." The Bus Terminals include analog temperature inputs, several digital switching inputs, and approx. 1,000 lamp controllers, which are configured as digital outputs. In addition, there are analog outputs for the frequency converters and for controlling the exhaust air from the heating.

Deutsches Museum contains a unique collection of vehicles, ranging from the first motor car to the "ICE-Experimental" high-speed train.

The PC-based control system offers clear benefits: Handling is simplified significantly, and installing new programs is much easier. A single computer deals with the control for a whole sector. In addition, PC technology facilitates integration of the three building services sections. The CX1000 computers also run pre-processing functions for the visualization software. "This would have been too much for ordinary small controllers," Georg Schemmann explained.

Why Beckhoff technology?

The decision by the Verkehrszentrum branch of Deutsches Museum to use PC- and Ethernet-based building automation technology from Beckhoff, rather than a solution based on networking via EIB or LON, for example, had several reasons: One requirement was integrated functionality for tasks such as heating control, monitoring functions (starting with the water detectors), and closing of windows, all with browser interfacing. EIB and LON are much less flexible and less versatile. A LON system, for example, would have required additional development effort and third-party components – deviations from the original scheme would have been difficult to realize. The Beckhoff system solution provides the required openness and is able to ensure the required speed and performance.

Parameter passing via XML file

A further basic requirement of Deutsches Museum was the option of remote monitoring. A single person is responsible for an area of 10,000 m^2 across three halls, so it is impractical to carry out full inspections of the heating system, several times per day. To this end, status monitors are installed in several locations, enabling manual intervention as required. Once the system is fully configured, 50 to 60 PCs will be installed near the exhibits. Thanks to integration into the IT network, the operator can use a laptop to connect to the WLAN and check that everything is running smoothly. This saves a tremendous amount of time.

The operating software was realized with Microsoft .NET technology and programmed in C#. The parameters or allocations are saved in XML format. When the configuration is changed at the control PC, the data are transferred to the CX1000 controller via TwinCAT ADS and saved. After a fault in the power supply, the controller re-starts automatically.

One technological highlight is the flexible and simple assignment of lighting scenarios, involving more than 900 lamps in 15 different groups. This enables the operator to implement changes at any time.

Data logger records temperature data

All temperature values across the hall have to be documented, since this is a very critical building where even very small fluctuations could have severe consequences. Peter Traut explains: "Even small temperature fluctuations in the heating can result in differences at the wall surface of 5° to 6° and lead to the formation of mold or condensation, for example." A data logger was implemented which, like the complete control system, was realized with the TwinCAT automation software from Beckhoff. The recorded data can be read and processed conveniently as an Excel file.

Eight analog temperature transducers are currently installed, corresponding to eight heating zones. The individual radiant heaters can be allocated flexibly to these zones, with the aim of distributing the heat as uniformly as possible.

→ Deutsches Museum Verkehrzentrum:
http://verkehrszentrum.deutsches-museum.de