

Ethernet inside – Lightbus outside



Implementation of BKN Strobel's concepts set some high targets: Top technological demands and compact automation units at a reasonable price/performance ratio – just the job for the engineering office of Kaiser Müller Gerdes GmbH (KMG) in Schortens, who were charged with the design. In close cooperation with the firm of Detlev Coldewey, Westerstede, a range of possible solutions was considered, and a decision was taken in favor of Beckhoff's technology. A modern plant, with 60,000 m² of growing area and a high level of automation arose from that. BKN Strobel are using a high level technology so that nothing in the growth and care of the high quality roses and nursery shrubs is left to chance.

TwinCAT and Beckhoff fieldbus technology for automation

From Beckhoff's comprehensive range, the Industrial PC C6250 was chosen as the hardware platform for the TwinCAT software PLC. The advantages of using the Beckhoff Lightbus to handle the input and output signals from the open-air areas and from the greenhouses were convincing:

- | Fast transmission of the field signals allows the watering trolleys to be positioned using standard input and output terminals.
- | Pulse sequences < 20 ms need to be evaluated over the optical fiber fieldbus to execute the positioning.
- | The optical fiber bus technology means that it is not necessary to take additional measures to protect the bus stations against lightning.
- | The fieldbus nodes in the optical fiber ring, which has a total length of 3,000 meters, are economical and can be installed quickly. Special glass fibers are not needed, which means that even the customer can wire them up on site using appropriate tools.

Since 1989 the Beckhoff Lightbus has been used around the world in a very wide variety of applications. Immunity from interference and high transmission speed mean that fibre optics are ideal for fieldbus systems such as Motion Control tasks with fast cycle times, or for applications that are widely distributed. An example of this is provided by BKN Strobel's tree nurseries at Holm, north Germany, which have an area of 65,000 m², making them one of the largest single tree nursery areas in Europe. Altogether 1000 I/Os are linked over a total reach of 3 km. The building automation inside the greenhouses uses Ethernet.



PC-Control: Mr Kaiser, what were the main reasons why you chose Beckhoff technology to automate the greenhouses and open areas?

Kaiser: The simple and economical configuration of bus stations, and also the very small number of necessary spare components. We of course found the integration of the optical fiber interface into the Bus Coupler very appropriate for the open-air applications. The maximum channel cost of 15 EUR for a simple station with 8 digital inputs and 8 digital outputs, including the fibre optic interface, was then crucial for the decision in favor of Beckhoff technology.

PC-Control: You are using the Beckhoff Lightbus for the open areas and greenhouses, and you are also using Ethernet for the building automation. What have you found to be the benefits of the continuity of the TwinCAT system in the configuration and programming?

Kaiser: The same function blocks can always be used in the controller for data exchange with all the components throughout the entire system. This leads to simple programs which, most importantly, can easily be understood, and the time saved as a result is noticeable, particularly when setting up and fault finding. Only one interface to the central engineering PC in the control room is necessary for remote servicing.

59 Bus Couplers in a 3 km fibre optic ring

The open-air installations and greenhouses are automated with the aid of BK2010 and BK2020 Bus Couplers, connected to the central C6250 automation controller via the FC2001 Lightbus PCI master card. At particularly critical locations, where local functionality must still be ensured during repair or servicing work on the bus system, the BC2000 intelligent Bus Terminal Controller is used. This mini PLC undertakes the automation tasks locally, and only transmits its data for display purposes or for data exchange with the fieldbus system's master. The Bus Terminal Controllers are also programmed by the same TwinCAT system that is used for the central automation tasks. The advantages of a consistent programming system and uniform tools are exploited here to the full.

OPC – free selection for the display of 8,000 data points

The TwinCAT OPC Server offers full selection facilities for the display of the data points, of which there are about 8000. All of the data points are directly available to the OPC client. It has access to the bus stations' process image and also to the central TwinCAT PLC's variables area. The data points configured in the TwinCAT system are available to the OPC server through a symbol file that is generated when the system is compiled. The following control functions are implemented for the open-air areas and the greenhouses:

- | Shade: Energy screens of fabric laminated with aluminum. Incoming sunlight can be restricted, and heating to protect from frost is not necessary for temperatures down to -3° C.
- | Watering: Individual time and location patterns for watering trolleys, overhead irrigation and fertilization
- | Ventilation: Supply of fresh air through continuous flap control
- | Heating: Heating pipes in the glass houses for winter operation

A weather station records all the weather data required for control, such as temperature, wind direction and strength, the presence and amount of precipitation. The data acquired in this way is processed by the Beckhoff automation system, and transferred over the Beckhoff Lightbus to the central TwinCAT software PLC.

Building technology using the ready-made solutions in the TwinCAT system

In building technology too, a decision has been taken in favour of an open system using solutions from Beckhoff. The TwinCAT function blocks and libraries offer the user ready-made solutions for the integration of standard functions such as intruder detection, access control, heating, ventilation, air conditioning, lighting and sun protection systems. The I/O terminal systems that have already been used for many years in industry are being applied in building technology as well with the BC9000 Bus Terminal Controller.

The BC9000 exploits the Ethernet infrastructure present in the building for communication. The design of the Ethernet network and the use of Ethernet switches allows "point-to-point" connections also to be implemented here with Ethernet's high transmission rates.



The existing Ethernet infrastructure in the administration area could also be used for the building automation, and this yielded considerable cost reductions. The same software is used for the programming and for managing the building automation, and the same standard components from the Beckhoff Bus Terminal system are used. The BC9000 Ethernet controllers in the different wings of the building can exchange data between themselves without using the central PLC controller. The telegram transfer times that have been achieved, and the insignificant degree of the increased Ethernet bus loading, confirm that our decision in favor of the Beckhoff solution was the right one.

PC-Control: Industrial PC C6250 with SCSI Raid Controller technology: What experience have you gained of the system as a whole in terms of reliability and data security? What advantages do you see in the use of Beckhoff Industrial PCs?

Kaiser: One partner when support or service are needed. Carefully thought out, solid industrial quality that can be integrated into a control cabinet, with no ifs or buts. The control cabinet constructor, for instance, finds a familiar connection technology using spring loaded terminals for connecting the mains power. Because both the necessary operating elements and the connections are located on the front of the PC, we do not need to use

a pivoting frame. We were impressed by the performance and the compact dimensions of the control computer. Through the UPS that has been designed for the control computer and the RAID system for mirroring the hard disks we have ensured sufficient security for the programs and data. Automatic system restart after a long power failure is also provided. The initial configuration of the installation was designed for only one-third of the number of data points. As the implementation proceeded additional ideas and extensions to the automation added a large number of additional field signals. The power of the PC hardware and of the Beckhoff Lightbus technology



Thomas Kaiser, General Manager of KMG Umwelttechnik GmbH

made it possible to make the final installation without upgrading the control platform. We are very happy with the whole system.