



Beckhoff automation equipment ensures smooth material flow within the distribution centre

Fast bus terminals for fast delivery

The Bertelsmann distribution centre, in Harsewinkel near Gütersloh, keeps large customers supplied at short notice with printed advertising material, forms, and every kind of office material. Other specialities are represented by POD printing, the dispatch of course materials and technical literature, and the distribution of mobile telephones, accessories and replacement parts. Customers receive the product they have requested within 24 hours of receipt of order. Innovative automation technology and precise project planning for the achievement of smooth package flow is supplied by Beckhoff of Verl.

The distribution centre presently consists of a total of 20,000 sq. m in eight halls. The basis for the automation of their handling equipment is provided by, currently, three Beckhoff Industrial PCs running with the TwinCAT control software, the optical fibre based Beckhoff Lightbus, and the extensive range of bus terminals. This enabled the user to do both without obsolescent PLC technology that is expensive to adapt, and without separate visualisation facilities.

The TwinCAT control software is open and universal

The TwinCAT PLC software from Beckhoff is at the heart of the equipment control system. It not only handles the full range of material flow control functions, but

also links these with the SAP level of business management data processing. It is years since, with TwinCAT, Beckhoff developers implemented an industrial software concept based on Windows NT. This does not just mean that every compatible PC is transformed into an IEC 1131-3 PLC for automation applications. NC axis controllers (minimum cycle time 50 μ s) also run entirely in software on a PC platform under the Windows NT operating system. TwinCAT also, however, provides a gateway to existing third-party systems. In Harsewinkel, the Beckhoff IPC also makes use of the parameters from the existing logistical operations system. This includes the registration, tracing and release of packaged units in dialogue with the logistical data.

The data is transmitted by means of fibre-optics over the Beckhoff Lightbus, keeping it safe from EMC interference. In contrast to other systems that only offer limited ranges, the effective distance between Lightbus modules is 300 m or more. For operators like Bertelsmann, whose plant is to some extent distributed, it is of particular interest that the optical fibre ring can be used to control up to 254 slave modules.

The hardware of the three Industrial PCs includes a total of six Lightbus interface cards for six optical fibre rings. The industrial computers are themselves installed close to the plant, so that the machine operator or shift foreman can deal with small faults, soiled photo-sensors for example, without additional assistance. Materials are

Bertelsmann Distribution relies on Beckhoff automation technology. The general-purpose conveyers are guided by industry computers located nearby.



traced through individual carton transport units at specific points by means of a goods scanner. The chains of transport units in each hall and on each level form closed circuits. The system presently consists of five sorting loops having a length of about 200 m, and an output conveyor. Three TwinCAT systems perform the control.

Fine modularity brings large space savings

From the automation engineering point of view it is interesting that the control components for each conveyor unit are housed in a

switching cabinet at the roller conveyor. All the peripheral equipment, consisting of bus terminals and bus couplers for the scanners and photo-sensors, is decentrally installed here. Even the motor protection switches and fuses are housed here. Communication with the two master computers is provided by the Beckhoff Lightbus, with its high immunity to electrical interference. Each individual automation component in the five conveyor lines and in the goods dispatch area is linked through the fieldbus to the IPC. This ensures that the transport data from the distributed

scanners and photo-sensors, required for the continuous flow of materials, can be exchanged and processed with extremely short reaction times.

This solution gives Bertelsmann, the operator of the equipment, the advantage of high flexibility when rebuilding the plant. In order to release a circuit module, and thereby the transport module, only six cables have to be disconnected. If the address list is then altered and the optical fibre loop closed once more, operation continues without that transport module, in smooth co-operation.



All drives communicate with the supervisory IPC via the Beckhoff bus terminal and through the Beckhoff Lightbus.

Packages whose processing is complete are booked out in the output conveyor after dialogue between the control computer and the logistics computer.



Around 1,500 monitoring locations in the Bertelsmann distribution centre contribute significantly to the progress of decentralisation. The Beckhoff range of 2-channel field-bus terminals play an important part in this. Thus each terminal box contains a terminal strip adapted to the requirements of the particular variety of different sensors, actuators and scanners. The Bertelsmann plant uses altogether about 900 bus terminals, most of which are digital. 45 serial bus terminals link the PCs and scanners into the system, while 95 Lightbus couplers from the BK2000/BK2010 series couple all the peripheral equipment via Lightbus to the three Beckhoff IPCs. The advantage of the Beckhoff bus terminal over competitors' 4-channel, 8-channel and 16-channel modules is that they are so flexible and save so much space. With more than 80 different field bus terminals, Beckhoff offers the maximum available modularity of digital or analogue inputs and outputs.

Tailor-made solutions through high variability

It is exactly this fine "patchwork" that reduces the space requirement in the non-central terminal boxes. However the Beckhoff range of fieldbus terminals satisfies another

The terminal range

With more than 80 different field bus terminals, Beckhoff now offer the maximum available modularity of digital or analogue inputs and outputs. The great advantage of these two-channel and four-channel field bus components is the scalable – and cost-effective – configuration to a tailored terminal bus. The field signals reach the higher-level automation equipment through the bus couplers, which are available for Profibus, Interbus, CANopen, DeviceNet, ControlNet, Lightbus, Ethernet TCP/IP etc.. Other extensions open up USB applications, while in the terminals, new varieties of resistance bridge (strain gauge), and analogue signals with 16-bit resolution complete the range on offer. All electronic terminal blocks are, with a width of 12 mm, mechanically equivalent to a double 6 mm terminal. The dimensions of 68 mm x 100 mm mean that the external form of the bus coupler fits the measurements of the terminal box with technical perfection. An informative connection panel having LEDs for status display, push-in contact labelling and removable labelling areas ensures clarity in practice. The two-wire and three-wire conductors, with an additional connection for a protective conductor, make it possible to wire sensors and actuators directly.

The new BusBox products represent an extension to the familiar terminal blocks. The compact, robust and economically priced modules, built to protection class IP 67, are designed for direct fitting to machines, and widen the spectrum of application of the familiar Beckhoff bus terminals. The small, new 170 mm x 30 mm BusBox modules are only 27 mm high. The product range is proof against dirt and water. It can be used with any mix of signals, and so can be ideally adapted to extremely varied requirements.



The idea of distributed automation is of particular value when parts of the plant are widely separated.

need: costs and the frequency of faults are both reduced, since each sensor only needs one 12 mm terminal.

Configuration of the bus terminals is also a matter of classic simplicity. In a purely digital application, as is the case at Bertelsmann, the pre-set standard terminals do not have to be specially configured, but are simply chained as a terminal block. The Beckhoff bus terminals deserve particular attention, due to the way they unite various measurement and control products into a consistent system family. The solution also benefits from consistent peripherals, uniform hardware/software interfaces, and a shared programming environment. Furthermore, complex configurations with different, hierarchically structured control levels and distributed architectures, such as are found at Bertelsmann, are implemented quickly and economically. Moreover, a scheme for the plant is made possible that can be very easily extended or flexibly adapted to changed requirements.

Open systems can easily be integrated. The TwinCAT control software is particularly suitable for the requirements of fully automated stores

and distribution centres. Being open, and compatible with the PC standard, means that communication with all popular stores and logistics solutions is possible. The result is continuous product tracing, since the output IPC is in dialogue – via Ethernet – with the SAP management system through the TwinCAT PLC software.

Distributed application brings huge cost savings

In a comparison of distributed automation systems with centralised systems, the reduction in expenditure on cabling and installation is quite significant. This advantage is of particular importance when parts of the plant are widely separated. Although the costs for each input or output can be considered approximately equal, the user makes great savings. In addition to this, the IPC system provides significant support for commissioning and fault diagnosis.



Scanners, communicating with the computer via the Lightbus, generate signals for the material flow.



One switching cabinet is responsible for each transport unit. An advantage of this solution is high flexibility when remodelling the plant. In order to release a circuit module, and thereby the transport module, only six cables have to be disconnected.