

PC Control

BECKHOFF

The New Automation Technology Magazine

8

products

Scientific automation in the I/O system

With the EL3602 EtherCAT Terminal Beckhoff presents a new generation of high-precision analog equipment.

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worldwide

High-tech control system for daily newspaper

The Swiss company Ferag AG developed a production system based on PC Control and EtherCAT for processing the daily newspaper NZZ.

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Special: PC Control for wind turbines

PC-based control technology from Beckhoff is in use in wind turbines up to a size of 5 megawatts.





PC Control 02|2008

From niche energy source to global standard

Wind energy meets PC Control for the next energy boom

With around 19,800 megawatts of newly installed wind power capacity, 2007 was a record year for the wind energy sector. The capacity installed worldwide increased to 94,000 megawatts. Germany was top of the international ranking list with 22,200 MW, followed by the USA with a total capacity of around 16,800 MW, Spain with approx. 15,200 MW and India with approx. 8,000 MW. China was in fifth position with an installed capacity of around 6,000 MW. The global wind power boom is a result of growing concern about climate change, security of supply and dwindling oil resources in combination with the fact that wind power is becoming increasingly cost-effective. Few would have believed predictions made in the early 1980s that today Germany would produce approx. 40 billion kilowatt-hours – i.e. around 7 percent of total electricity consumption – from wind power plants. At the time, such figures appeared just as utopian as the idea that PC-based automation could become established as a worldwide standard in a wide range of industries. However, in both cases expectations were not only met, but exceeded. According to calculations produced by the German Wind Energy Association (BWE), an installed capacity of 45,000 MW onshore and 10,000 MW offshore is quite a realistic prospect for Germany by 2020. This would correspond to around 150 billion kWh of CO₂-free electricity per year, equivalent to 25 percent of total electricity consumption. In order to achieve this ambitious target, existing wind power installations will have to be expanded and so-called first generation systems will have to be replaced with new, high-performance multi-megawatt systems (repowering), and new wind farms will have to be built. In August, the go-ahead was given for the construction of “Alpha Ventus”, the first German offshore wind farm at sea, located around 45 kilometers off the coast of the island of Borkum. Beckhoff contributed its expertise as control equipment supplier for this pilot project consisting of six wind energy converters from the Multibrid M5000 5 MW class (see p. 39). Beckhoff entered the wind power market as an automation supplier at an early stage, and today we have a wind power competence center at our Lübeck branch offering sound industry know-how. Compared with a conventional solution, the Beckhoff PC-based control system has the advantage that only a single computer is required for control and data

interfacing purposes. EtherCAT, our high-speed-fieldbus system, is able to demonstrate its strengths: maximum performance, flexible topology, integration of subordinate fieldbus systems (e.g. for the connection of autonomous pitch control systems), 200 kHz sampling rate in the field for future expansion of the control system to form a condition monitoring system, and cost-effective conversion between copper and optical fiber technology (e.g. for the fieldbus connection between the tower base and the nacelle). The Beckhoff system also offers superior safety performance: While previously, the nacelle and tower were “hard wired”, today all safety sensors and actuators are integrated in the Bus Terminal system via TwinSAFE technology. Beckhoff is probably the only supplier able to offer control systems, automation components, control cabinets and even system management software from a single source – a considerable advantage for customers. In addition to Europe and the USA, we are also active in the Chinese market as an automation partner for producers of wind energy converters. The Chinese wind power market is also booming, which is not surprising in view of the voracious appetite for energy associated with the country’s rapid economic growth. The Chinese government has an ambitious target of 30,000 MW installed wind capacity by 2020. This means that China is likely to become the leader in the wind power market over the coming years. Meanwhile, there are around 60 manufacturers of wind energy converters in China. The majority are currently still owned by foreign investors, although the number of Chinese business start-ups is increasing steadily. Beckhoff supplies control equipment for e.g. Mingyang (see p. 40) and Goldwind, the market leader in China. Goldwind supplied the wind energy converters for the recently opened Beijing Guanting Wind Farm, which is the first wind farm in Beijing and served as a showpiece for clean energy generation during the 2008 Olympics. The wind farm meets 5 percent of the electricity demand of the Olympic stadium. On this note, we hope you enjoy reading PC Control 02/2008 and the integrated “Wind Special” and wish you high availability for your systems. Dirk Kordtomeikel
Wind power expert and manager of the Lübeck branch

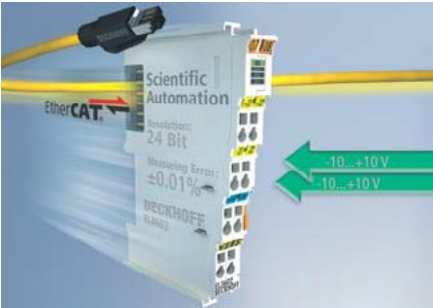
PC Control 02|2008

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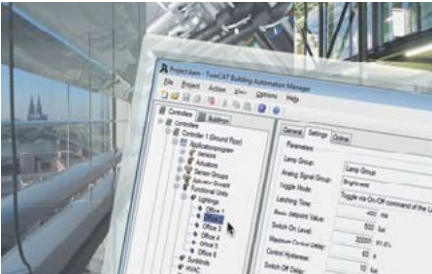
- Beckhoff Automation increases turnover by 22 % to 232 million euros in 2007
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- Beckhoff KL2791 Bus Terminal saves energy
- worldwide
Talon Manufacturing, USA: Optimized machine performance leads to increased profit
- New Beckhoff branch office in Turkey



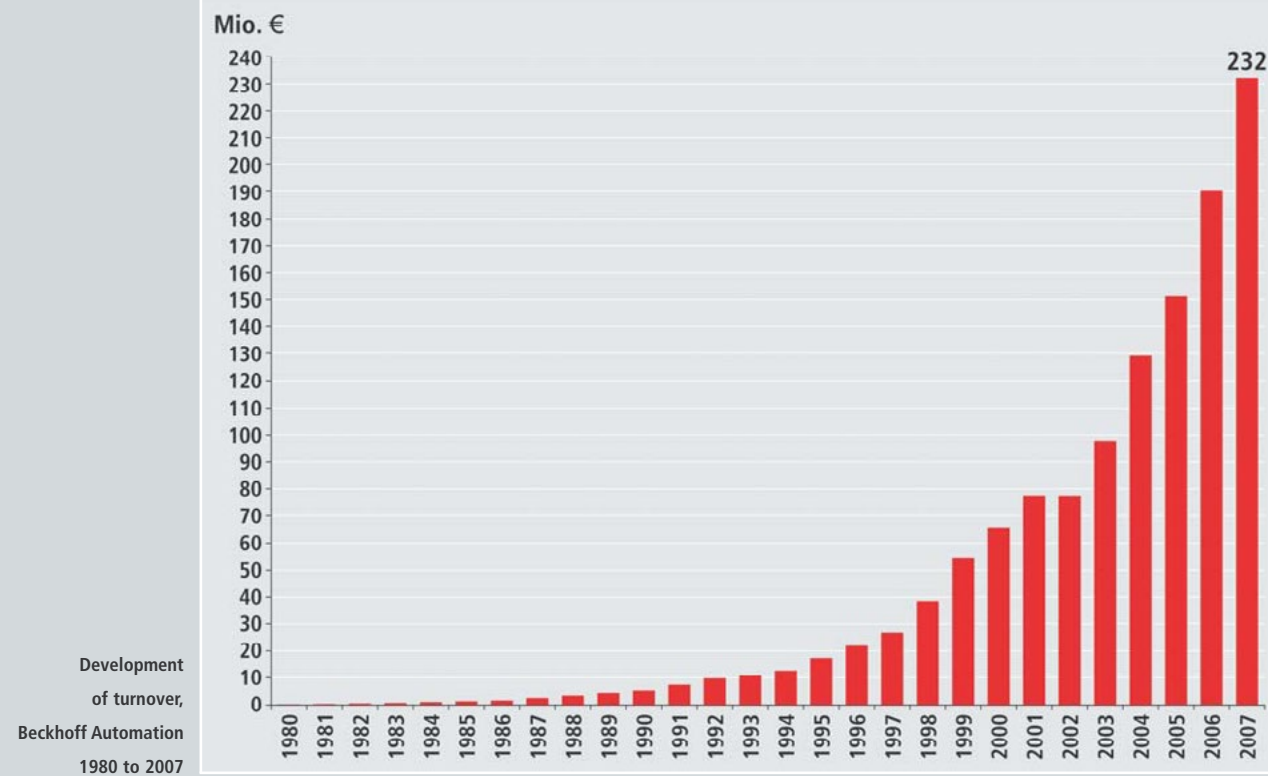
- Ferag AG, Switzerland: Hightech for the Neue Zürcher Zeitung (NZZ)
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- Open automation solutions for wind power
- Husum WindEnergy 2008, Germany – leading international wind energy trade show
- TwinCAT supports wind power industry standards

- DeWind, Germany: New design for the emerging U.S. wind energy market
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- Beckhoff opens subsidiary in Slovenia
- RUAG Aerospace, Switzerland: Engine testing in a helicopter hangar
- CitizenM Hotels, Netherlands: Modular control technology for a modular hotel



- IFA – Ingenieurgesellschaft für Automation, Germany: Cost-effective solution for niche application using standard components
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- Automatica 2008: Integrated control platform for all robot types
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Beckhoff Automation increases turnover by 22 % to 232 million euros in 2007



Trendsetting technological innovations, the consistent further development of its product range and the expansion of its worldwide sales network are the three pillars on which the success of Beckhoff Automation stands. The company finished the preceding financial year once again with a strong growth rate of 22 % and achieved global turnover of 232 million euros with its 1,050 employees.

"In 2007, the export proportion of the total turnover of Beckhoff was 44 %. Our mid- and long-term growth prospects continue to be globally orientated," explains Managing Director Hans Beckhoff. "Accordingly, we will be consistently densifying our global sales network still further." Activities on the Indian market and in the United Arab Emirates were strengthened last year by the foundation of Beckhoff branch offices.

Beckhoff Roadshow generates significant interest



Under the title "Automation UpDate" Beckhoff offers its customers a forum for practice-oriented discussions with experts. This technology seminar provides information on current topics and was established several years ago, with events taking place throughout Europe. Recent Roadshow venues included Frankfurt, Nuremberg, Balingen and Munich in Southern Germany, Linz (Austria), Barcelona (Spain) and Aveiro (Portugal). The events, some of which had more than 100 participants, focused on

TwinCAT, IPC, Embedded PC, EtherCAT and XFC. Later this year, further events will take place in Northern Germany (Hamburg, Moers, Bad Oeynhausen), Sweden and Denmark. "In our experience, industry fairs offer ideal opportunities for detailed discussions on technology issues," said Roland van Mark from the Industrial PC product marketing division. "With our Roadshow we want to offer a suitable platform and enhance contact between customers, sales and local applications."

XFC technology increases profitability and improves the ecobalance

German chancellor Angela Merkel visited Beckhoff at Hanover Fair

On her round tour of this year's Hanover Fair, to mark the opening of the industrial trade fair on 21 April 2008, the German Chancellor Angela Merkel visited Beckhoff at the booth in the Application Park. Managing Director Hans Beckhoff explained the trendsetting "eXtreme Fast Control Technology" to Dr. Merkel.

The graduate physicist Hans Beckhoff presented the XFC fast control technology to the German Chancellor as a technological highlight. Angela Merkel was accompanied by Annette Schavan, German Minister of Education and Research; Christian Wulff, Prime Minister of Lower Saxony; and Sepp D. Heckmann, Chairman of the Board of Directors of Deutsche Messe AG.



Hans Beckhoff demonstrated PC Control technology – made in Germany – to the German Chancellor Angela Merkel.

"Beckhoff is the world leader in the field of high-speed machine controllers. The XFC technology introduced by Beckhoff currently allows an improvement in the reaction rate of a machine controller by a factor of 10", explains Hans Beckhoff.

German Open final at Hanover Fair 2008

RoboCup – Beckhoff sponsors Eindhoven University of Technology

EtherCAT Robots win German Open and come second in the world championship in China



Equipped with EtherCAT, the soccer robots of the Dutch Team Tech United Eindhoven won the RoboCup German Open in Hanover, Germany. In the semi-final they defeated the acting world champion of the Middle Size League, the Brainstormers Tribots from Osnabrück, Germany; a team that had not been beaten since 2004. In the finals it took a penalty shoot-out to beat the current number 3 in the world ranking, the CoPS Team from Stuttgart. At the RoboCup World Championship from 14 to 20 July 2008 in Suzhou, China, the Tech United team was beaten by the Portuguese Cambada team in the final. The Tech United Robots use EtherCAT for interfacing to drives, sensors and actuators.



The TechUnited team of the Eindhoven University of Technology at the RoboCup at Hanover Fair 2008. Right: Thomas Koslowsky, Sales Manager at Beckhoff headquarters in Verl, Germany. Third from left: Jos Out, managing director of IAL, Beckhoff distributor in the Netherlands

Six players form a team in the Middle Size League, the largest and fastest division in the RoboCup competition. Top speed is approximately 4 m/s. Each of the three-wheeled robots weighs around 35 kg and acts autonomously without

remote control. The robots have different roles such as goalkeeper, defender or striker and cooperate with each other in a team effort. Communication with the other team members is established through wireless Ethernet. Vision is provided by a camera pointing upwards towards a parabolic mirror, thus creating a 360° view of its surroundings. Using this image, the robot is able to determine its position. A feature that distinguishes Tech United of the Eindhoven University of Technology from other mid-size RoboCup teams is the active ball-handling mechanism. With two levers equipped with motor-driven wheels, the ball can be pulled as well as pushed. The kicking mechanism device can produce flat shots as well as lob shots – a feature that proved to be very effective in the semi-final. The robot controller is a mini PC with an EtherCAT Open Source master. EtherCAT was chosen for its superior performance at low CPU load while not requiring any hardware extensions on the mini PC. Furthermore, it was easy to implement; and all required devices and components were available.

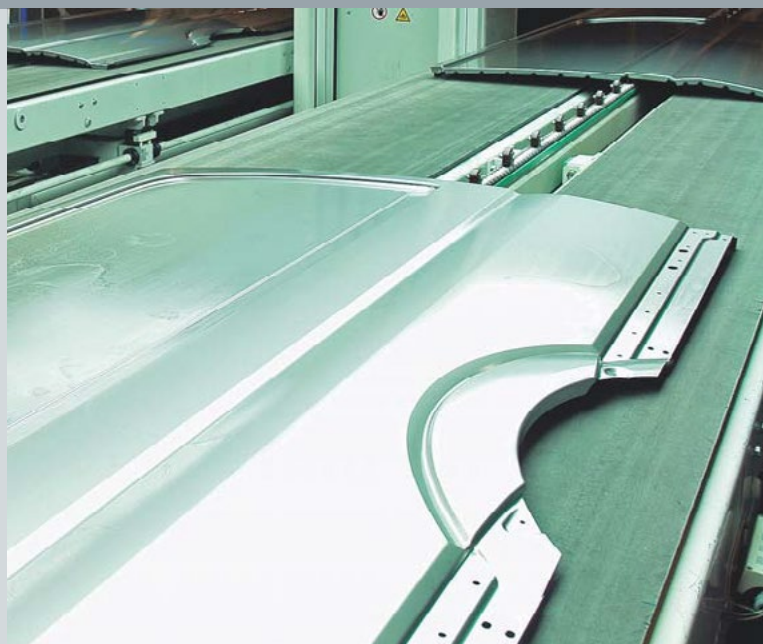
The ultimate goal of the RoboCup project is to develop a team of fully autonomous humanoid robots by 2050 that can win against the human world champion team in soccer.

→ RoboCup www.robocup.org



EuroBlech 2008, Germany: Hall 11, Booth G13

PC-based Control for sheet metal working



The main information at a glance:

- | EuroBlech 2008, Hanover, Germany
- | 21 – 25 October 2008
- | Opening hours: Tuesday – Friday: 9 am – 6 pm,
Saturday: 9 am – 4 pm
- | Beckhoff booth: Hall 11, Booth G13

Further information:

- www.euroblech.com
- www.beckhoff.com/forming

At the 20th EuroBlech fair in Hanover, Germany, between 21 and 25 October 2008, 1495 companies will present sheet metal working innovations. This year's EuroBlech will spread across eight halls for the first time, with exhibition space totaling 87,000 m² fully booked.

The sheet metal working industry is booming. An increasingly wide variety of products, varying batch sizes and strong cost awareness require maximum flexibility in the face of global competition. This is where PC-based control technology from Beckhoff offers a significant competitive advantage through scalable and flexible solutions with high performance and high precision.

Sheet metal components come in all shapes and sizes, requiring a wide range of machining processes including rolling, cutting, stamping, folding, drawing, joining, cleaning and finishing. Production is based on processing machines, machining centers or fully automatic production lines comprising sheet metal working equipment as well as handling devices, storage facilities, automatic material feeding and integration into the company network.

The production systems should be highly productive, precise, reproducible and, of course, cost-effective. This requires optimally adapted processes with minimum stoppage and setup times. In addition, large forces in combination with high velocities, as required for pressing, call for advanced control technology. Manufacturers of production machines demand expandability and flexibility in order to be able to meet customer requirements efficiently and cost-effectively.

The scalable and modular range of Beckhoff products enables customized solutions with regard to computing power, complexity and costs. Compared with conventional control systems, they significantly increase the productivity and flexibility of sheet metal working machines. The benefits of PC-based control technology, which integrates all processes including control, regulation, motion and HMI on a single PC, have been demonstrated in a wide range of applications in pressing, cutting, bending and



welding systems worldwide. The high processor power offered by PC technology eliminates the need for special hardware: position and pressure controllers for hydraulic valves, for example, can be replaced with software. The PC effortlessly deals with even the most complex control algorithms and offers additional capacity for other functions such as measuring tasks. Complex and expensive special controllers and hardware PLCs with limited programming flexibility are no longer required.

High performance thanks to EtherCAT

Sheet metal working processes have to be fast and precise and offer high repeat accuracy. These are perfect conditions for EtherCAT, which improves the update and reaction times by at least a factor of 10 compared with conventional fieldbus technology. Conventional fieldbus systems such as PROFIBUS or CANopen can easily be integrated into the EtherCAT I/O system via gateways. Simple and reliable connection technology reduces the cabling effort and therefore the costs. EtherCAT offers full Ethernet compatibility, maximum utilization of the Ethernet bandwidth, and outstanding real-time characteristics.

The benefits of EtherCAT for sheet metal processing systems:

- | Higher speed for punching, stamping or laser treatment, since time stamp actuators with exactly defined rate time enable switching with an accuracy of < 100 ns and axis movements with maximum reproducibility.
- | Exact determination of signal curves through oversampling for high-resolution measurements, as required for weld seam monitoring. Oversampling involves repeated sampling of process data within a communication cycle and data transfer in an array. For example, oversampling terminals sample analog values with a resolution of 10 µs per measured value.
- | Reproducible processes through reduced cycle times, oversampling and time stamps enable a repeat and parallelism accuracy of ±0.01 mm for press brakes, for example. Force curves can be set more exactly, thereby reducing delays and tolerances.

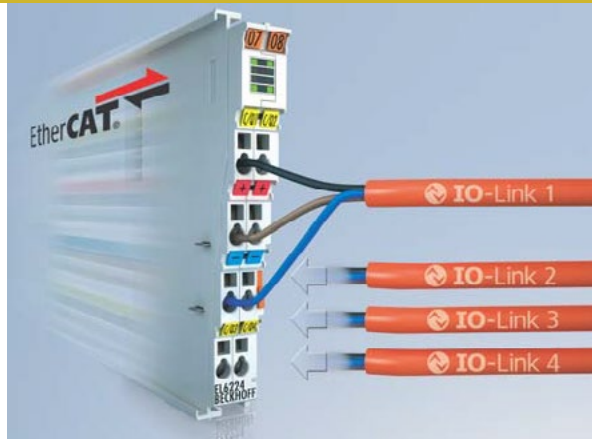
| Motion control with many axes, synchronized through distributed clocks, with reproducible accuracy in the nanosecond range, e.g. for bending of sheet metal involving several synchronized axes. Distributed clocks precisely synchronize the EtherCAT devices such as axes, die cushion controllers or synchronism controllers for hydraulic cylinders. All EtherCAT devices have their own local clocks, which are automatically and continuously synchronized with all other clocks through EtherCAT communication. The current distributed clock time is always available across the whole system. Distributed clocks also enable simultaneous reading of all measuring systems and synchronized outputs. EtherCAT measuring systems such as linear scales adapt to the distributed clocks and even synchronize their internal measuring cycle for position measurement.

TwinCAT – all functions integrated in one software

Precise sheet metal processing through bending, punching, stamping, cutting or joining requires synchronization of several axes with high repeat accuracy. TwinCAT NC and TwinCAT CNC replace the complete motion control hardware for all servo axes, including feed, ram or transfer components. Machine manufacturers can customize sheet metal working processes based on their system-specific control expertise. Even complex bending algorithms can easily be programmed in TwinCAT. With TwinCAT, subsequent modifications and revisions and the high degree of flexibility required for sheet metal cutting or nibbling are no longer a problem. Comprehensive TwinCAT libraries with temperature, cam and hydraulic controllers, flying saw and cam plates simplify the programming. From the PLC drives can be programmed with the Motion Control library, cam plates, according to VDI Guideline 2143, with TwinCAT NC camming, or temperature compensation with the TwinCAT PLC Temperature Controller library in accordance with PLCopen. TwinCAT enables system manufacturers to create their own industry- and system-specific libraries, making them stand out from the competition despite the fact that identical control components are used.

Open control technology:
IO-Link integration for EtherCAT Terminal system

Compact IO-Link solution



EL6224 IO-Link terminal for connecting up to four IO-Link devices

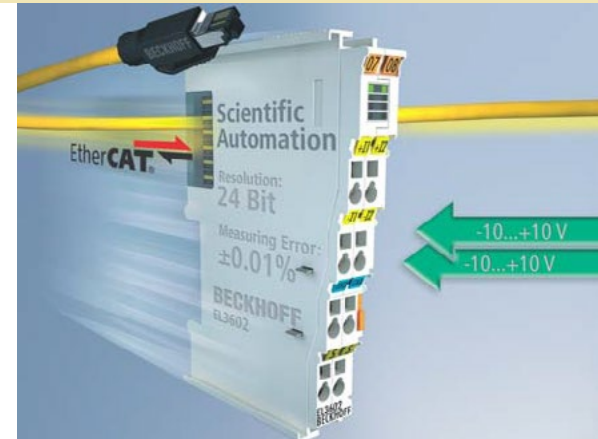
The EtherCAT Terminal system from Beckhoff offers a comprehensive I/O construction kit for a wide range of applications. The EL6224 IO-Link terminal was added in order to make the system compatible with the new standard for the lower field level. The IO-Link integration hardware is very compact: Up to four IO-Link devices can be connected in a standard terminal housing with a width of 12 mm.

A point-to-point connection is used between the terminal and the device; therefore, existing wiring topologies are maintained. The terminal is parameterized via the master, for example through TwinCAT. Any number of EL6224 devices can be used in an EtherCAT station. Connections to EtherCAT or other fieldbuses are established via EtherCAT Couplers or Embedded PCs from the CX series. The high performance of EtherCAT offers an ideal basis for connecting a large number of IO-Link devices. Additional 24 V and 0 V connection points can be realized via the EL918x potential distribution terminal.

Transfer rates of 4.8 baud, 38.4 baud and 230 baud are possible with a cable length of up to 20 m. Power is supplied via the internal terminal bus (E-bus) and the power contacts.

Measurement and automation technology in one dynamic system

Scientific Automation: EL3602 for high-precision measurement technology



Scientific Automation:
EtherCAT Terminal
EL3602 for high-precision measurement technology

The Beckhoff EtherCAT Terminal system, which combines maximum performance with maximum accuracy, will be greatly extended again with new I/O terminals. With the EL3602, Beckhoff offers a new generation of high-precision analog equipment: The measurement readings are sampled with a resolution of 24 bit and accuracy within $\pm 0.01\%$, providing an optimal basis for high-performance and high-precision measurement technology. This seamless integration of measurement technology into the automation solution makes separate specialized components unnecessary.

Beckhoff refers to the integration of engineering functions that go beyond traditional PLC and motion technologies into the automation software as "scientific automation". It builds on the ever-increasing performance of PC-based control technology and an ultra fast communication system such as EtherCAT. A prime example of scientific automation is measurement technology, which up to now has been performed by specialized devices for many high performance applications. The EL3602 EtherCAT Terminal enables measuring signals to be sampled directly in a standard I/O system. The analog 2-channel EL3602 input terminal handles signals in the range between -10 and +10 V. The voltage is digitized with a high resolution of 24 bit. The high precision of 0.01 % at 25 °C enables the execution of high-precision measuring tasks, at a machine or for test rig automation, for example.

With XFC terminals (eXtreme Fast Control Technology) for oversampling and time stamp technology, Beckhoff already offers solutions for maximum performance requirements. The new terminal generation for high-precision measurement technology also offers maximum accuracy.

The high-performance EtherCAT Terminal system is a modular I/O system consisting of electronic terminal blocks. The EtherCAT protocol is maintained right down into the individual terminal. An I/O station consists of an EtherCAT Coupler and almost any number of terminals (up to 65,535 devices). EtherCAT Terminals are available for all common digital and analog signal types encountered in the world of automation. Fieldbus devices, e.g. for PROFIBUS, PROFINET, CANopen, DeviceNet, Interbus or Lightbus, can be integrated via local fieldbus master/slave terminals. Any Ethernet device can be integrated locally via switch terminals.

The EL6692 EtherCAT bridge terminal achieves distributed clock calibration between EtherCAT masters

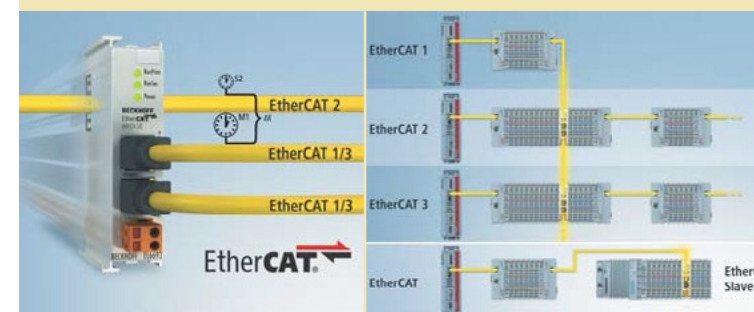
EtherCAT master synchronization via I/O system

The EtherCAT Industrial Ethernet system offers industry leading performance and highly flexible topology characteristics. In complex machines and systems with several EtherCAT masters, data may have to be exchanged between individual EtherCAT systems or the distributed clocks of different systems may have to be synchronized. An ideal solution for these applications, the new EL6692 bridge terminal for the Beckhoff EtherCAT terminal system implements these tasks directly in the I/O system.

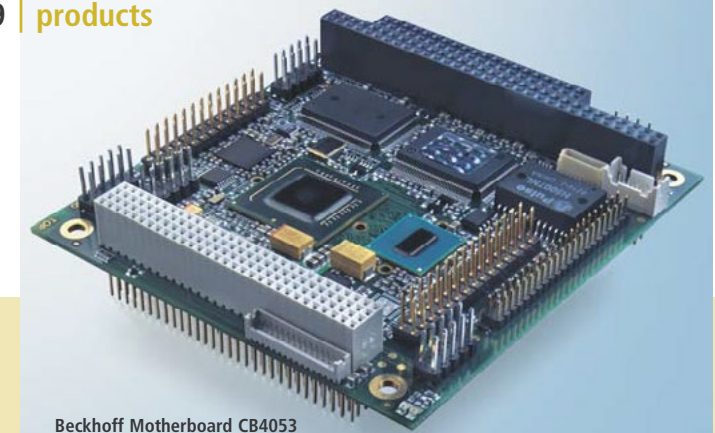
EtherCAT masters such as the TwinCAT automation software suite from Beckhoff can exchange data in real-time via network variables. The EL6692 EtherCAT bridge terminal optionally provides this functionality directly in the I/O system. In addition to "normal" data exchange, the EtherCAT bridge permits distributed clock synchronization (exact calibration of distributed clocks) between several EtherCAT masters, for example, in exact drive synchronization in spatially distributed machines.

In addition, the EtherCAT bridge terminal can integrate subordinate PCs – e.g. Beckhoff Embedded PCs from the CX series – as EtherCAT slaves in an EtherCAT network. In this case, the bridge terminal of the CX system is coupled with the higher-level EtherCAT system.

The EL6692 bridge terminals have a separate power supply for both EtherCAT networks in order to prevent an interruption of data communication due to power loss in one of the systems.



EtherCAT bridge terminals enable data exchange and distributed clock synchronization between several EtherCAT masters.



Beckhoff Motherboard CB4053
in PC/104 format produced by Intel® in 45 nm technology

CB4053 extends Beckhoff Motherboard series

Intel® Atom™ platform opens up new opportunities for the PC/104 form factor

With the CB4053, Beckhoff complements its comprehensive product range of Industrial Motherboards and presents a PC/104plus board for the first time. The platform consists of the Atom™ processor produced by Intel® in 45 nm technology and the Intel® system controller hub with integrated graphics. Both components are characterized by low power consumption and enable system configurations without active cooling and with advanced processor clock frequencies up to 1.6 GHz.

The Beckhoff in-house motherboard and BIOS development facilities enable the company to respond rapidly to new trends in PC technology. This means that customers have access to state-of-the-art products at an early stage. The CB4053, a fully fledged PC/104plus motherboard with single-board design, is a good example.

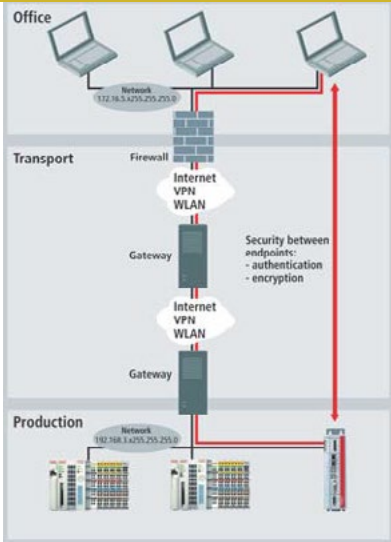
The Atom™ platform is consistently optimized for low power consumption and therefore ideal for mobile and embedded applications. In typical application scenarios the processor and chipset together consume less than 5 W, which means that no fans are required. While the focus is on power saving, the processor and chipset nevertheless offer advanced performance and comprehensive features.

The Atom™ processors are single-core CPUs with 512 kB L2 cache. They communicate with 400 or 533 MHz FSB frequency. The clock frequencies of the models announced so far range between 1.1 and 1.6 GHz. On the CB4053 board DDR2RAM modules with 400 or 533 MHz memory frequency are inserted in the existing SoDIMM200 slot.

The CB4053 offers a comprehensive set of interfaces. An area of only 90 x 96 mm features the PC/104 and PC/104plus connector (ISA and PCI) plus a wide range of other interfaces, including CRT and LCD connection options (the latter via LVDS 18/24), IDE, Gigabit LAN, HDA sound, 8 x USB 2.0 (including 1 x device option), 2 x COM, LPT and PS/2 keyboard/mouse.

Network communication via TwinCAT OPC UA

Platform-independent and secure data exchange



The Beckhoff OPC UA solution supports secure and platform-independent data exchange.

Beckhoff implements the new OPC UA specification in its PC-based controllers. OPC is an established and recognized standard for data exchange between control and HMI in manufacturing and process automation. The new “Unified Architecture” specification creates the basis for a platform-independent communication and information technology. UA offers scalability, network capability, platform independence and security. Therefore, it can be used in a wide range of applications, including the control, MES and ERP layer. At the Hanover Fair in the “Application Park” Beckhoff demonstrated the potential of OPC UA based on production technology and robotics applications.

As an early OPC UA adopter Beckhoff had already successfully tested its products by the end of 2007, resulting in the TwinCAT OPC UA server and client for Windows XP and CE. The existing OPC technology was based on the Microsoft COM/DCOM model and was therefore limited to Microsoft-based operating systems. The new OPC UA standard is based on TCP communication and is therefore platform-independent. Integrated UA data encryption based on international security standards guarantees secure communication between client and server. The TwinCAT OPC UA components are ideally suited for large and small control platforms such as the Beckhoff Embedded PCs from the CX series running under Windows CE.



OPC UA applications at Hanover Fair

In the Application Park at Hanover Fair 2008 Beckhoff and its partners demonstrated the new OPC UA technology based on selected production and manufacturing control and robotics application examples. The Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) recognized the potential of the new UA standard at an early stage and extended the control system of the mobile robot Secur-o-bot for communication with OPC UA. IPA project manager Matthias Bengel said: “OPC UA offers a high-performance transport layer based on international standards. UA communication features integrated security consisting of authentication and encryption and is ideally suited for safe and flexible communication with mobile robots.” The standardized communication protocol makes integration into larger systems straightforward, and the robot can realize higher-level functions such as automatic patrol, sampling of sensor data, automatic alarm messages or remote query of individual sensor values safely and in real-time. The mobile robot is controlled by a Beckhoff Industrial PC C6920 with Windows XP Embedded. Using TwinCAT I/O it was easy to integrate the existing IPA control software with the real-time capable EtherCAT fieldbus.



OPC UA live presentation in the Application Park at Hanover Fair in Germany: Matthias Bengel, project manager at Fraunhofer Institute IPA (Institute for Manufacturing Engineering and Automation), Thomas Burke, Executive Director OPC Foundation; Stefan Hoppe, OPC expert at Beckhoff; and the mobile robot Secur-o-bot

The application of TwinCAT OPC UA servers is straightforward, since OPC requires almost no network configuration: Direct UA-TCP communication is available as soon as a PLC is available in the network. The UA server detects the variables identified for UA access in the PLC program and makes them available in the network. In addition to standardized exchange of PLC process data, the UA solution from Beckhoff now also offers device-specific information and services. Parameters that can be read include hardware information such as platform and fan speed as well as software information such as the operating system version, the MAC-ID, available memory and screen resolution. The Beckhoff UA client supports communication with other UA servers such as controllers from other manufacturers, which are directly integrated in the data exchange with TwinCAT. Data exchange between the office/service level is routed via several transport gateways right down to the machine level.

Wireless data transmission with Beckhoff Bus Terminals

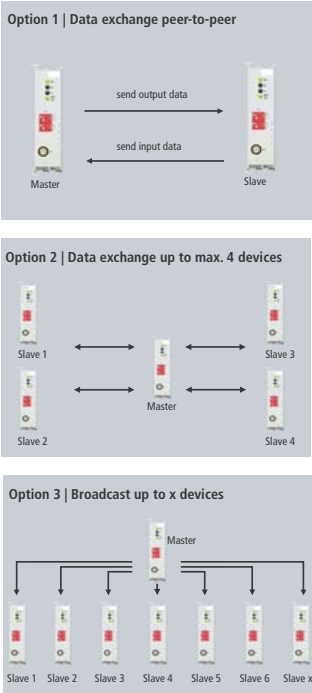
Wireless data exchange

In addition to all common bus systems and I/O signals, the universal Beckhoff Bus Terminal system also supports data transmission via radio. The KM6551 wireless terminal enables various types of transmission, based on the IEEE 802.15.4 standard.

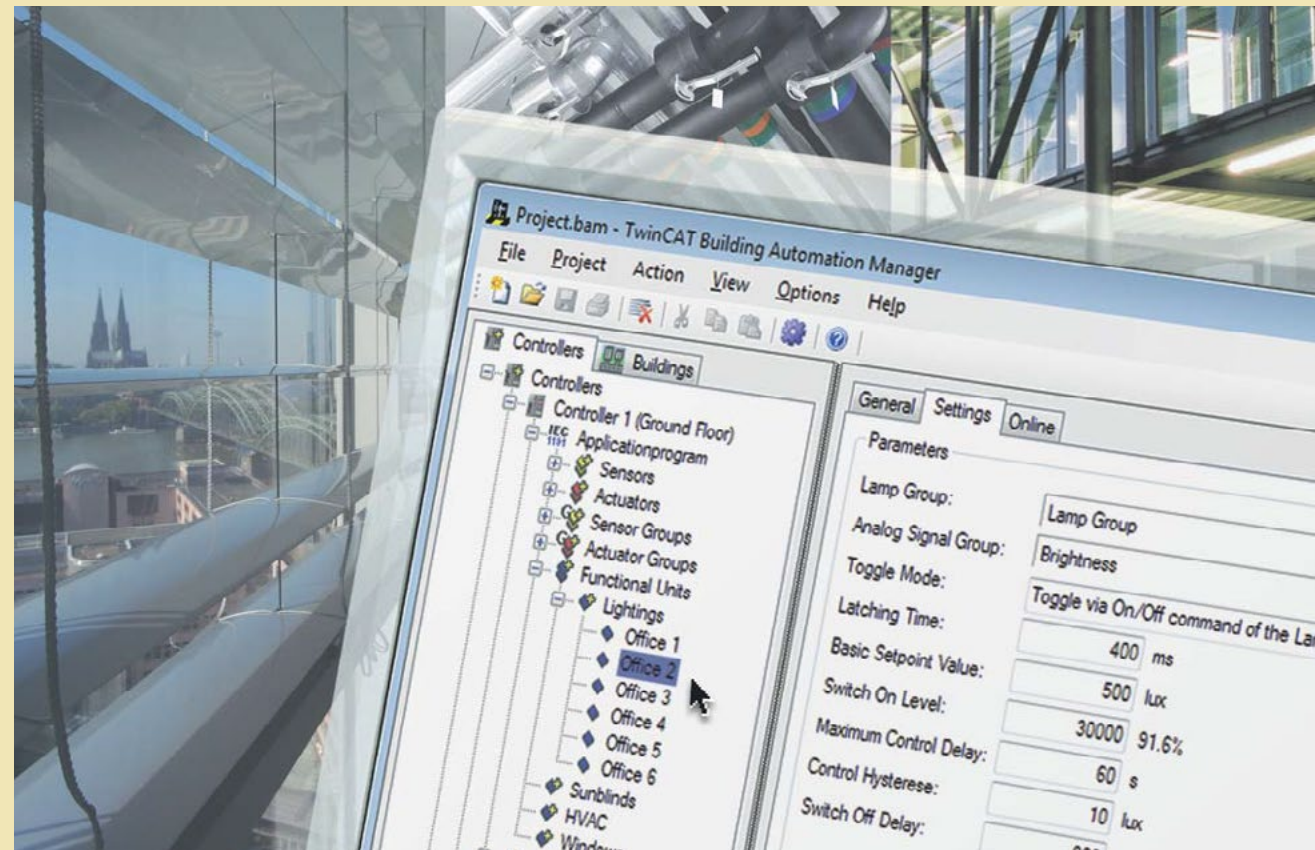


The KM6551 wireless terminal supplements the extensive range of Bus Terminals. The compact construction with a width of only 24 mm and simple connection technology supports space-saving, fast mounting. The KM6551 exchanges data wirelessly at a gross rate of 250 kbit/s and therefore meets the requirements of industrial applications. The Beckhoff radio technology supports bidirectional data exchange between a master and one slave (peer-to-peer), a master and up to four slaves, and unidirectional data transfer from a master to n devices (broadcasting). Radio transmission takes place with 10 bytes of user data, independent of the bus system used. A diagnostic system integrated in the KM6551 enables monitoring of the radio link. The data exchange terminal uses the 2.4 GHz ISM band, which is available worldwide. A total of 16 channels are freely selectable for several transmissions in one application. Signals from other radio services, such as DECT, UMTS or GMS, do not interfere with the system; therefore, high availability is guaranteed. With a free line of sight, data can be transmitted over distances of up to 300 m and more. The KM6551 enables fast, highly flexible and mobile applications, which could not be achieved at all or only at great expense using cable connections. The elimination of cables and sliding contacts not only reduces wear, but also cost. Users do not need to “rethink” with regards to the operation and maintenance of the system; the process image remains identical from their point of view. The data exchange terminal has a standard reverse SMA plug (Straight Medium Adaptor), to which various radio antennas can be connected. Directional, rod and omni-directional antennas with different directivities are offered as accessories.

Radio transmission in the Bus Terminal system: The KM6551 wireless terminal enables data transmission via radio, based on the IEEE 802.15.4 standard.



TwinCAT Building Automation Framework



→ “Configuring instead of programming” is the motto of the TwinCAT Building Automation Framework. This approach markedly simplifies engineering and commissioning and does not call for any programming expertise. It enables system integrators, operators and building users to quickly and easily incorporate new functions, modify scenarios or re-assign sensors and actuators – all with just a few clicks.

Configuring instead of programming

Beckhoff offers two ways of setting up and commissioning building projects. Complex projects are programmed using TwinCAT PLC automation software, which conforms to international IEC 61131-3 programming standards. There are already comprehensive PLC libraries available for TwinCAT PLC, for example for HVAC, lighting systems or for integrating subsystems such as EIB or LON.

The new TwinCAT Building Automation Framework offers an alternative approach to supporting system integrators engaged in developing and commissioning. The Building Automation Framework incorporates the Building Automation Manager and the application program. The Building Automation Manager is the system's configu-

ration control centre. This is where the available components, such as Industrial PCs, Embedded PCs, Bus Terminals and data points are entered and assigned to the appropriate functions.

The status of all the system's sensors and actuators can be viewed and controlled via the TwinCAT Building Automation Manager. The actuators can also be triggered by hand – for instance when the system is being commissioned. Configuration wizards are also provided to enable users to easily link actuators and sensors.

Beckhoff Building Automation: maximum flexibility through PC Control

Comprehensive software library for HVAC

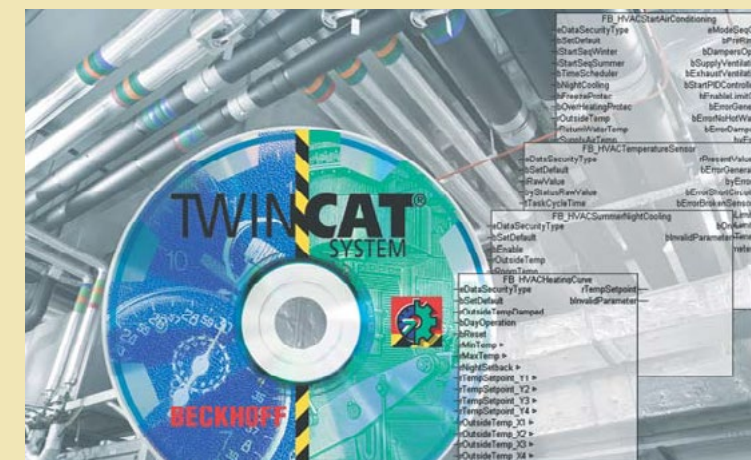
PC-based control technology from Beckhoff enables all building functions to be realized based on software. This means maximum flexibility and low engineering costs. The comprehensive TwinCAT building library covers all main building functions. The new TwinCAT HVAC library contains more than 70 function blocks for automation of heating, air-conditioning, ventilation and sanitary installations.

The HVAC library is a comprehensive PLC library for TwinCAT automation software with more than 70 functions that simplifies engineering significantly for applications in the area of building technology. Function blocks are available for handling sensors/actuators, for example temperature sensors, analog valves, 3-point valves or single-stage fans.

The TwinCAT PLC HVAC library allows complex control tasks to be performed:

- | time schedulers
- | start-up programs
- | sequence controller
- | operating hours counter
- | summer night cooling
- | setpoint generators

The uniform look and feel is common to all function blocks. A variety of parameters can be used to tailor the function blocks individually to suit their respective tasks in the system being automated. For example, a general pump block can be parameterized with ease to meet the requirements of a cooling, heating, heating circulation, circulating or charge pump. Management of the internal parameters is standardized for all blocks.



The HVAC library for TwinCAT automation software contains numerous function blocks for the areas of heating, air-conditioning and ventilation. Use of this PLC library simplifies engineering significantly for applications in this area of building technology.

i Product announcement estimated market release 4th quarter 2008

Beckhoff KL2791 Bus Terminal saves energy

Efficient speed control for pumps and fans



Speed control of single-phase AC motors directly in the I/O system: The KL2791 Bus Terminal enables the direct connection of pumps and fans.

The new KL2791 Bus Terminal enables direct connection of single-phase AC motors up to 100 W. In this way, the speed of capacitor, universal and shaded-pole motors can be reduced. This technique is particularly suitable for drives with quadratic load characteristic such as fans and pumps. The speed controller is extremely compact and is housed in a standard bus terminal with a width of 12 mm.

In many industrial nations, electric motors account for more than half of the electricity consumption so that they offer enormous energy saving potential. Speed control can easily reduce the excess energy requirement to the necessary degree. Beckhoff has expanded its Bus Terminal I/O system for this application. The KL2791 Bus Terminal is suitable for use as a speed controller for single-phase AC motors up to 100 W. Besides the saving of energy, a decrease in speed also offers a reduction in noise and an increase in the service life of the motor.

The KL2791 Bus Terminal can be used in any bus system supported by the Beckhoff Bus Terminal system. The set value for the motor speed is specified by a 16-bit value. The motor is switched on and off with a practice-proven mains-synchronous pattern, so that the motor consumes less power and the speed falls significantly. This method is well suited to motors with fixed loads, such as pumps and fans, in order to achieve a setting range for the flow rate from 10 % to 100 %.

PC-based control system ensures flawless popcorn packaging

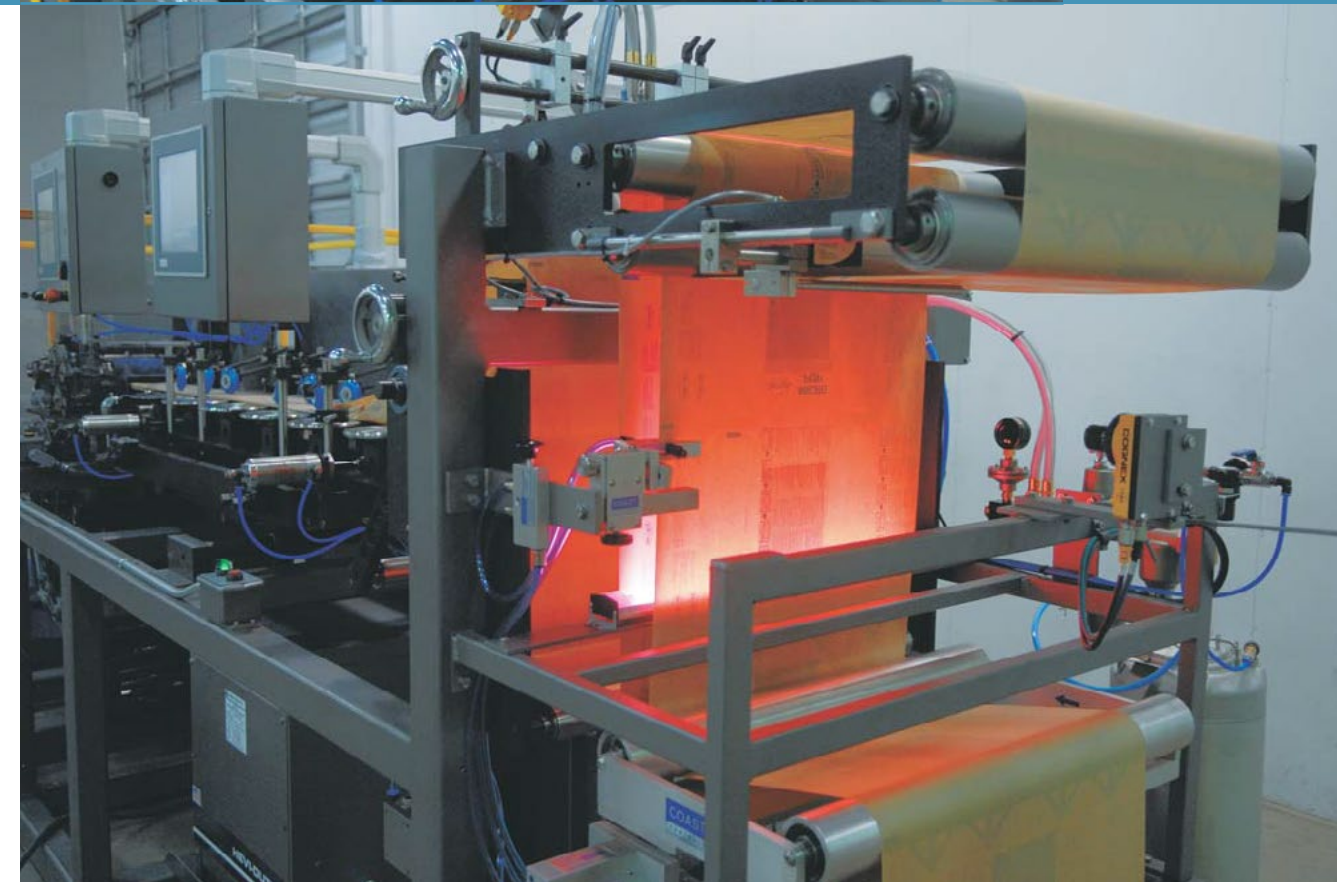
Optimized machine performance leads to increased profit

As a snack with its own button on most microwaves, popcorn is about as iconic as you can get in American comfort foods. Despite its all-too simplistic convenience, a great deal of technology goes into those microwave popcorn bags before they puff kernels into steaming bowlfuls of that essential movie night treat. Talon Manufacturing of Spring Park, Minnesota, equipped its latest microwave popcorn packaging systems with a PC-based control platform from Beckhoff in order to offer its customers even better performance, more cost-effectively.



Dennis Hohn, President, Talon Manufacturing

Talon Manufacturing is a leading supplier of packaging systems for microwave popcorn and exports its machines worldwide. The company was established in 1994 and relies on technical innovations and resulting cost savings in order to expand its market position further.



Special paper with aluminum/polyester heating element film being fed into Talon machine for folding and cutting into microwave popcorn bags

High-performance popcorn machines

After deciding he reached the limits of traditional PLCs, Dennis Hohn, managing director of Talon Manufacturing sought a high-performance automation platform the company could use as its standard for years to come. In the main architecture of the previous system, Talon relied on multiple suppliers – the PLC, operator interface and servo system were all supplied by different vendors. “We sought to streamline these elements and purchase them all from

a single supplier if possible. The controls had to be more cohesive, with more features and better performance, while passing on cost savings to our customers at the same time,” Hohn said.

“As panel space is obviously very important, the new supplier would have to provide more control in a smaller device format. With the more traditional PLC type approach, we found that we had to make our panels bigger and bigger as we added hardware to keep up with our machine control require-



The redesigned Talon popcorn bagging machines are controlled by a CX1020 Embedded PC with TwinCAT NC PTP.



Talon uses CP62xx Panel PCs for "all-in-one" control and display devices and CP69xx Control Panels for simple display and control functions.

ments," Hohn added. "Also, the complexity of wiring all these devices was compounded every time we tried to significantly increase performance – especially as we increased the number of motion axes."

PC-based control platform from one source

The redesigned Talon popcorn bagging machines now include the CX1020 Embedded PC with TwinCAT NC PTP software for automation and control functions, various standard I/Os, EtherCAT and TwinSAFE terminals, and AX2000 Servo Drives paired with AM3000 servomotors. In addition, Talon uses two types of Beckhoff 12" display panels – CP62xx Panel PCs for "all-in-one" control and display functions and CP69xx Control Panels for operation and monitoring. "The CX1020 Embedded PC was selected largely due to its small housing format. Its design as a high-end Industrial PC that fits on DIN rail became a major space-saver for us when compared with the old PLCs," Hohn said. "Also, the Embedded PC's direct connection to Beckhoff I/O terminals made its selection that much easier. Windows XP is used as the operating

system, which provides numerous helpful tools from the office world for use on our machines."

Talon selected the TwinCAT NC PTP software package, which includes axis positioning functionality (set value generation, position control), an integrated software PLC with NC interface, an operating program for commissioning and I/O communication to motion axes. TwinCAT NC PTP replaces conventional positioning modules and NC controllers. The TwinCAT Modbus RTU library offers quick and convenient interfacing with all Modbus devices.

Simplified cabling improves competitiveness

Using EtherCAT as the system fieldbus brought ultra high-speed, deterministic control into the equation for Talon. "Even though it provides extremely high performance, EtherCAT I/O is actually less expensive than most traditional I/O systems through the use of standard Ethernet-based components and cabling," Hohn said. "Avoiding expensive fieldbus cards and even more expensive fieldbus cabling is critical to protecting our machines' cost competitiveness."



The PC-based control system offers maximum precision: The popcorn bags now have more precise cuts and a more consistent length.

Also, Beckhoff Bus Terminal I/O – connected to EtherCAT via BK1120 Bus Coupler – replaced many of the simple terminal blocks used in Talon's previous system design. "This eliminated numerous connections that had to be wired back to the PLC. The fewer number of contacts, the better for overall system reliability," Hohn added. TwinSAFE terminals are used on the Talon machines to flexibly integrate safety functions with the existing Bus Terminal system. TwinSAFE does not require a special safety network and can be installed alongside "non-safe" Bus Terminal I/O without restriction. "TwinSAFE is a highly streamlined way to implement safety tasks so this also helped us reduce the space used in our cabinets that much more," Hohn added.

According to Hohn, a further advantage of the PC-based control platform is the programming time savings: "Previously, we had to spend considerable amounts of programming time with each new PLC or drive that we added," Hohn said. "With TwinCAT and Beckhoff hardware, it's now easier to program one central controller and conduct slight modifications as we modify our machine and add functionality."

Optimizations right down the line

Within a three month time window, Talon went from a new automation and motion control platform specification to full controls design, received UL approval and completed all programming. "Equipping our machines with Beckhoff controls really became a win-win for Talon and our customers," Hohn said.

"With the PC-based controls, we're also seeing a higher degree of accuracy in our machines' finished product," Hohn said. "The popcorn bags they produce now have more precise cuts and have a more consistent length. We experienced this improved performance at a reduced cost: Talon's controls cost today is about 30 percent less per machine than the previous PLC system. We were also able to increase our free panel space by over 50 percent," Hohn stated. "By doing

more control and communication with less hardware, Talon was able to make some significant strides in cabling reduction. We now wire directly into the I/O terminals without wiring first through terminal blocks."

Prepared for the Future

The newly equipped machines will help Talon feed the demand for microwave popcorn machines, which account for about 80 percent of their business. After focusing almost exclusively on popcorn applications for nearly five years, Talon has recently re-entered the bagged snacks market in a big way with revitalized stand-up pouch packaging machines. "Talon plans on implementing Beckhoff as the complete control system for these machines too so we can expect more significant savings utilizing PC-based controls in the future. We've also actively begun retrofitting existing packaging machines with Beckhoff technology," Hohn said.

→ Talon Manufacturing www.talonmfg.com

→ Beckhoff USA www.beckhoffautomation.com

New Beckhoff branch office in Turkey

→ The opening of a subsidiary in Istanbul in March 2008 signifies a continuation of Beckhoff's export offensive. After several years of successful presence in the Turkish market through a distributor, Beckhoff intends to strengthen its sales activities in Turkey further in response to strong economic growth in the country, particularly in machine and plant construction.

"We have already been active in the Turkish market since 2001 through Siskon as a distribution partner. Siskon will continue to co-operate with us and look after the Izmir region," said Kenan Aktaş, Area Sales Manager for Beckhoff. "With our own Beckhoff branch we intend to increase our market share in Turkey and enhance support for our customers."

The head office in the financial metropolis of Istanbul offers access to other important industrial regions such as Bursa, Kocaeli and Tekirdag. In the medium-term the intention is to open a second office in Izmir. "Local accessibility and guaranteed support are decisive

arguments for our customers when they choose our technology," said Cem Ayday, Managing Director of Beckhoff Turkey. With almost 20 years of professional experience, Cem Ayday is a recognized specialist for PC-based automation technology. "We see tremendous potential in the Turkish market, particularly for Beckhoff Embedded PCs, small controllers and our versatile I/O systems. With the new AX5000 drive range, we are well prepared for the requirements of the motion sector and intend to open up further areas of application."

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Cem Ayday, Managing Director of Beckhoff Turkey

Kenan Aktaş, Area Sales Manager for Beckhoff in Germany

The Grand Bazaar in Istanbul with its 4,000 shops has been in existence since the 15th century.

The bridge across the Golden Horn connects Europe with Asia.





Since the timeliness of printed news depends on how quickly it reaches the reader, the production of daily newspapers is continuously subject to extreme deadline pressures. The Swiss company Ferag AG, located in Hinwil near Zurich, specializes in the necessary conveying and manufacturing processes for further processing of newspapers that follow the initial printing process. Ferag has developed production modules with high-tech controllers for NZZ Print, the print shop of the 'Neue Zürcher Zeitung' (NZZ = New Zurich Times), equipped with Beckhoff CX1020 Embedded PCs, the TwinCAT software PLC and EtherCAT.

Ferag AG: EtherCAT ensures fast, precise newspaper printing

PC-based control is "in the news" for the Neue Zürcher Zeitung (New Zurich Times)

The end product, the 'Neue Zürcher Zeitung', comes folded and cut out of the printing press line. Depending on the size of the issue, special newspaper sections and supplements, which make up a considerable share of the revenue, must be laid automatically inside the main newspaper. At least that is the case at NZZ Print, which has fully automated this process using the state-of-the-art machines from Ferag AG. After the inserts, the address of the recipient is printed on the newspapers and on the accompanying tickets for the newspaper parcels. Finally, the dispatch units are created by wrapping them with a plastic film. Tracking the newspapers through the entire production process is an essential part of the application.

Modularity as a matter of principle

NZZ Print uses virtually the entire range of processing modules offered by Ferag. "From the point of view of the newspaper manufacturer, one buys a powerful print line and the modules necessary for further processing. Ferag offers a great variety of powerful modules so all our needs are covered," comments Yvonne Hug, Finishing Dept. Manager at NZZ Print, who is responsible for the entire NZZ further processing area.

The linking conveyor equipment is a most spectacular sight for the observer: as if on a string of beads, the newspaper sections are conveyed on the typical Ferag yellow clips at breakneck speed in all directions through the plant – horizontally,

vertically, crossing the room – everything works with absolutely no errors. "Even if the conveyor equipment is impressive, it is by no means an extraordinary technical specialty," explains Yvonne Hug, and she continues: "The processes that have to take place in the modules linked by the conveyor equipment are much more interesting." Roland Kunz, Project Manager for Software Engineering at Ferag AG, agrees with her: "We have been able to convey quickly for ages, but insertion, addressing and packaging are much more important. It is just a compulsory requirement for the correct addresses to be in the respective bundles." Even sorting, as a downstream task, is prepared and supported in this way. The NZZ weekend edition in particular is very extensive and is produced in several different printing runs. "For the Finishing Dept., this means that the previously printed newspaper sections have to be stored intermediately and, during the night production phase, integrated in the complete product in the appropriate order," says Yvonne Hug, explaining the sequence.

Ensuring optimum availability

"The high availability of all processing stations represents a decisive factor for us," explains Roland Kunz, adding: "In many cases there was still a need for optimization during the implementation and adaptation of the individual processing modules on site. Therefore, it was preferable to create redundant plant concepts rather than having to accept a failure rate."

"The reliability of the plant components is decisive for their numbers, whereby we have two of virtually everything in the Finishing Dept.," says Yvonne Hug. "This type of security is indispensable in any newspaper production facility, because the



Printing on the fly: for a perfect finish, the positioning of the newspaper and the printing of the address in the field provided on the cover sheet must be synchronized precisely.



Newspaper processing at NZZ Print: the plant capacity is designed for 220,000 copies. The newspapers are transferred to the clips of the chain conveyor system and transported to the respective processing stations.



newspaper produced during the night is supposed to be available to the reader by the early morning." The high demands on the machines or modules result from this expectation. This concerns, for example, the machine operation, flexibility in adapting production conditions, interaction in the form of visualization, display of process status and the like. "Since these functional features are also considered by NZZ Print to be very important, we have ported the previous control concept to the modernized, powerful platform from Beckhoff," Roland Kunz reports. As Yvonne Hug explains, the implementation of the project at NZZ began about two years ago; the awarding of the order to Ferag and the first talks between Ferag and Beckhoff took place as early as 2003/2004. "We assembled, commissioned and integrated the new plant parts in the existing area without having to interrupt the production process. The implementation took place step by step as we approached the expectations that had been set very carefully," Roland Kunz remembers. "Above all, we had to carry out various tests for the printing of the addresses. For this reason, older parts of the plant were still operated in parallel during the conversion phase."



The Beckhoff CP77xx and CP69xx Control Panels are used as operating terminals and were manufactured as custom versions especially for Ferag. The CP62xx Panel PC version is also used.

The stacker requests a cover sheet, whose labeling is assigned by the control system to the inkjet printer via an Ethernet connection. The master computer manages the address or logistic data. The synchronization of the printing process and the positioning of the newspaper are controlled by the stacker, or rather the CX1020 Embedded PC.

Leading control technology for today's complex tasks

On the control side, the individual workstations are controlled by the CX1020 Embedded platform with EtherCAT Terminals, networked via EtherCAT. Embedded PCs are overlaid by a control technology that was developed by Ferag. In deciding in favor of Beckhoff, one important argument was that Ferag already had experience with TwinCAT control software. After all, a large number of software components had to be ported when replacing the previous control system. Besides that, as Gerhard Meier, Managing Director of the Swiss Beckhoff branch office reports, the desire was also to erase the capacity limitations of the previ-



ous control system: "The use of EtherCAT with all of its technological benefits was a decisive argument here. Previously, a great many special solutions were used with proprietary hardware and local I/O components. In contrast to that, EtherCAT offers flexible topology and extremely high performance. Specialized modules that were previously implemented in hardware form can now be realized in software."

As the first Ferag modules, the three most important stations were equipped with the CX1020 Embedded PC: the stacker, for packaging; the release controller, which controls the inlet of the newspapers to the stacker; and the MultiSert insertion drum. "Those are the areas that we have been able to convert to the new control platform so far," comments Kunz and he continues: "The conversion required a considerable degree of dedication because on the one hand, training on the new platform is important, and on the other, the project planning for the machines must be adapted to this new control platform strategy."

High-performance EtherCAT permits synchronization with microsecond accuracy

Using EtherCAT as the fieldbus system has proven to be the right decision for Ferag. Besides the real-time characteristics, the simple installation, ultra precise diagnostics and the possibility to communicate with older CAN-based devices in the plant via gateways have all proven to be important.

One special feature of the control solution used at the NZZ is the use of the

EtherCAT bridge module, which enables the bidirectional transfer of data from one EtherCAT strand to another. Both strands can also be synchronized via the bridge. An external infeed ensures that the main branch can continue to communicate when the auxiliary branch is switched off. Roland Kunz explains that, for example, the release controller handles the exact positioning of the 'released' newspaper in front of the ink-jet labeler and that this process must neither be interrupted nor allowed to get out of control. Reliable release can only be guaranteed using EtherCAT and fast I/O modules. "On account of the high speed involved, the synchronization of the controllers is also very important with respect to the transfer of the newspapers from one transport system to another, which means that we cannot do without cross-communication between the Embedded PCs", explains Roland Kunz. "Synchronization between communication devices that are far apart is further improved by the use of the EtherCAT 'Distributed Clocks' function. Synchronization with microsecond accuracy," says Gerhard Meier, "is only possible with EtherCAT."

→ Beckhoff Switzerland www.beckhoff.ch

→ Ferag AG www.ferag.com

→ NZZ Print www.nzzprint.ch



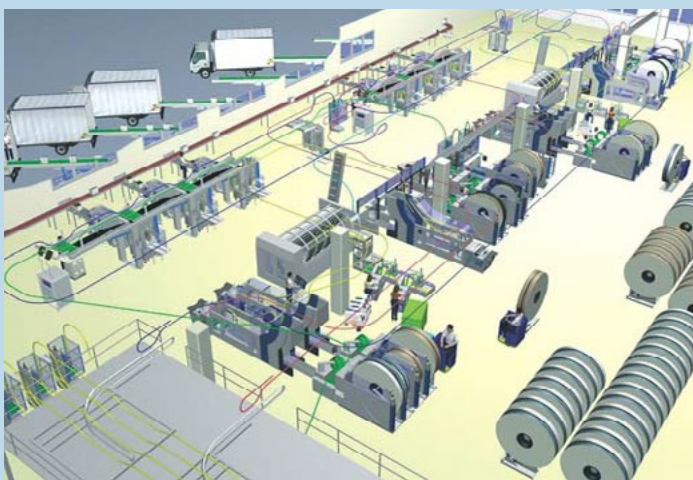


Neue Zürcher Zeitung: Generation 3 in production

NZZ Print put two new Ferag further processing lines into operation in the summer of 2007, concluding a complete renovation project that has lasted several years. The third mailroom generation by Ferag is now in use, with two Multi-SertDrums, RollStream, MultiDisc and MultiStack.

A distinctive new building has highlighted the NZZ building complex in Schlieren near Zurich since 2004. A year before its 225th anniversary, the Neue Zürcher Zeitung began production on one of the world's most modern newspaper printing machines.

Three years later, the complete renovation of the printing center was completed with the commissioning of the two dispatch lines by Ferag. In no less than 25 conversion steps, the previous plant was replaced by two high performance systems of the latest generation. As opposed to the original plan, according to which the old printing press wing was supposed to offer space for the further processing machines, the system was installed in the same space, whereby daily production was not to be affected and two lines always had to be available. To make matters more difficult, the floor surface was also renovated during the course of the installation. Only the dedication of both sides made the smooth implementation of this demanding task possible. "Ferag mastered the challenge with flying colors. The care and skill with which the planners and assemblers worked was impressive," testifies Yvonne Hug, Further Processing Manager.



A matrix points system connects the printing press to the Ferag systems and allows flexible control of the insertion lines with the four UTR transporters linked to the folded deliveries. That allows a high degree of freedom in production planning with constant optimum utilization of capacities. "We evaluated the system and the individual components precisely from the technical and economic points of view. Ferag offered the best solution to our requirements in every aspect. The high degree of flexibility and the usage possibilities are outstanding features of the Ferag system and played an essential part in us selecting this supplier once again," says Yvonne Hug.

Around 150,000 copies of the Neue Zürcher Zeitung run through the two production lines every night; in the case of the NZZ am Sonntag (NZZ on Sunday) it is over 160,000 copies, with lengths of 140 pages and more in broadsheet format. The Sunday edition has a large number of inserted products. To cope with the high volumes, supplements are inserted in the preliminary products during the day and placed at the ready on the MultiDisc for the night production. "We have gained on performance. Compared to the previous plant, which was almost 18 years old, we are achieving an increase in the insertion speed of almost 30 percent," Yvonne Hug points out. "We use the increase in production performance primarily for the manufacture of the 'NZZ am Sonntag'. In addition, it is possible to set the press deadline to a correspondingly later time."

Source: Ferag AG

Special: PC Control for wind turbines



Open automation solutions for wind power

→ The use of renewable forms of energy such as wind power has become well established in the global energy supply. This was given vital impetus in particular by the global efforts to reduce emissions of CO₂.

In the course of this development, besides the European markets which were dominant until recently, new markets such as China and India or – once again – the USA, are pushing themselves to the fore at terrific speed and placing new demands on wind turbines and their automation. Representative of these demands are the requirements made by different conditions for feeding the grid and by greatly extended climatic operating conditions. Whereas up until a few years ago the use of wind turbines under Arctic or desert climatic conditions was an exception for research purposes, nowadays the fulfillment of these extreme conditions has almost been elevated to an industry standard. Manufacturers of wind turbines therefore face the task of retaining maximum flexibility in face of the continually changing demands of the market in order to keep their products competitive.

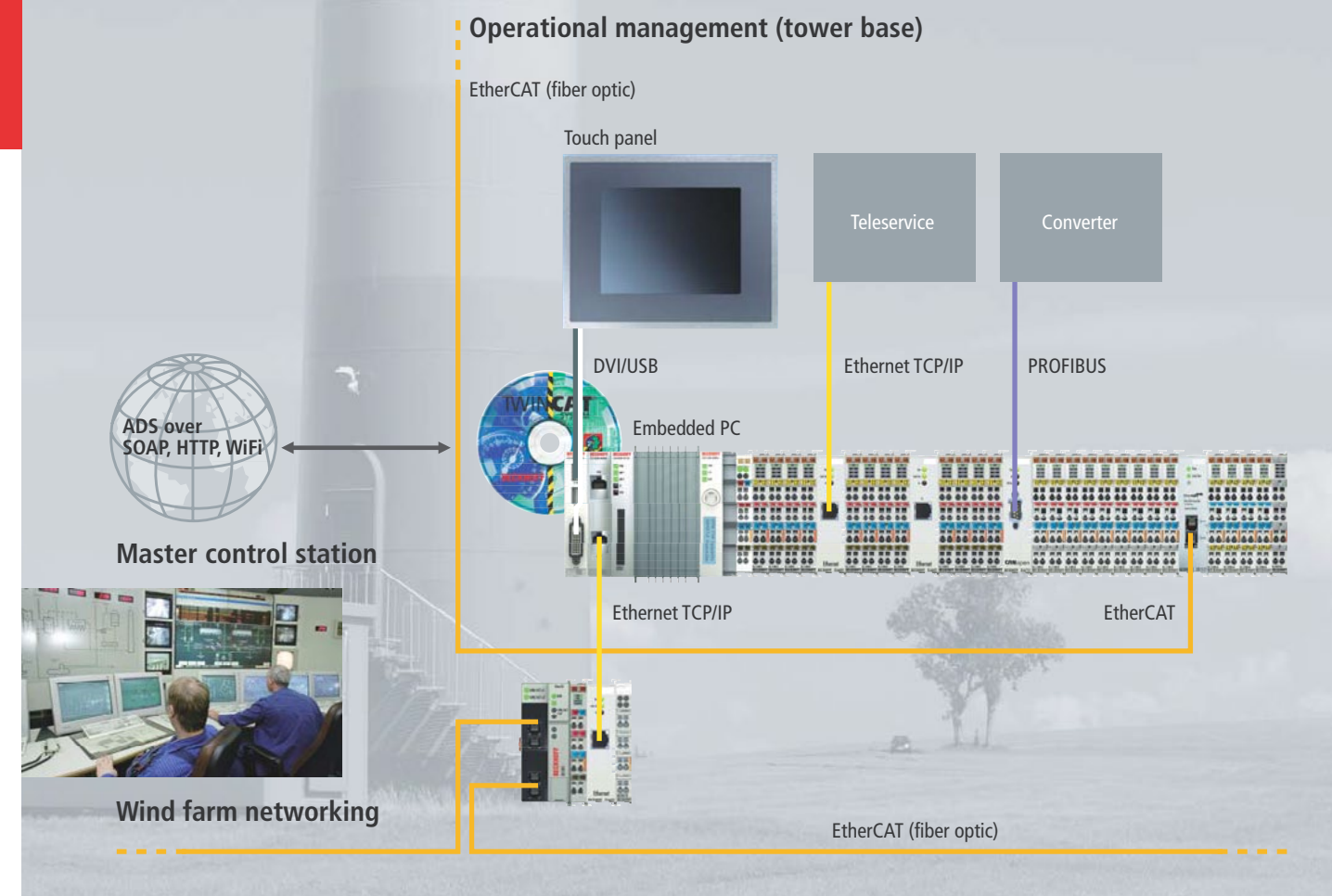
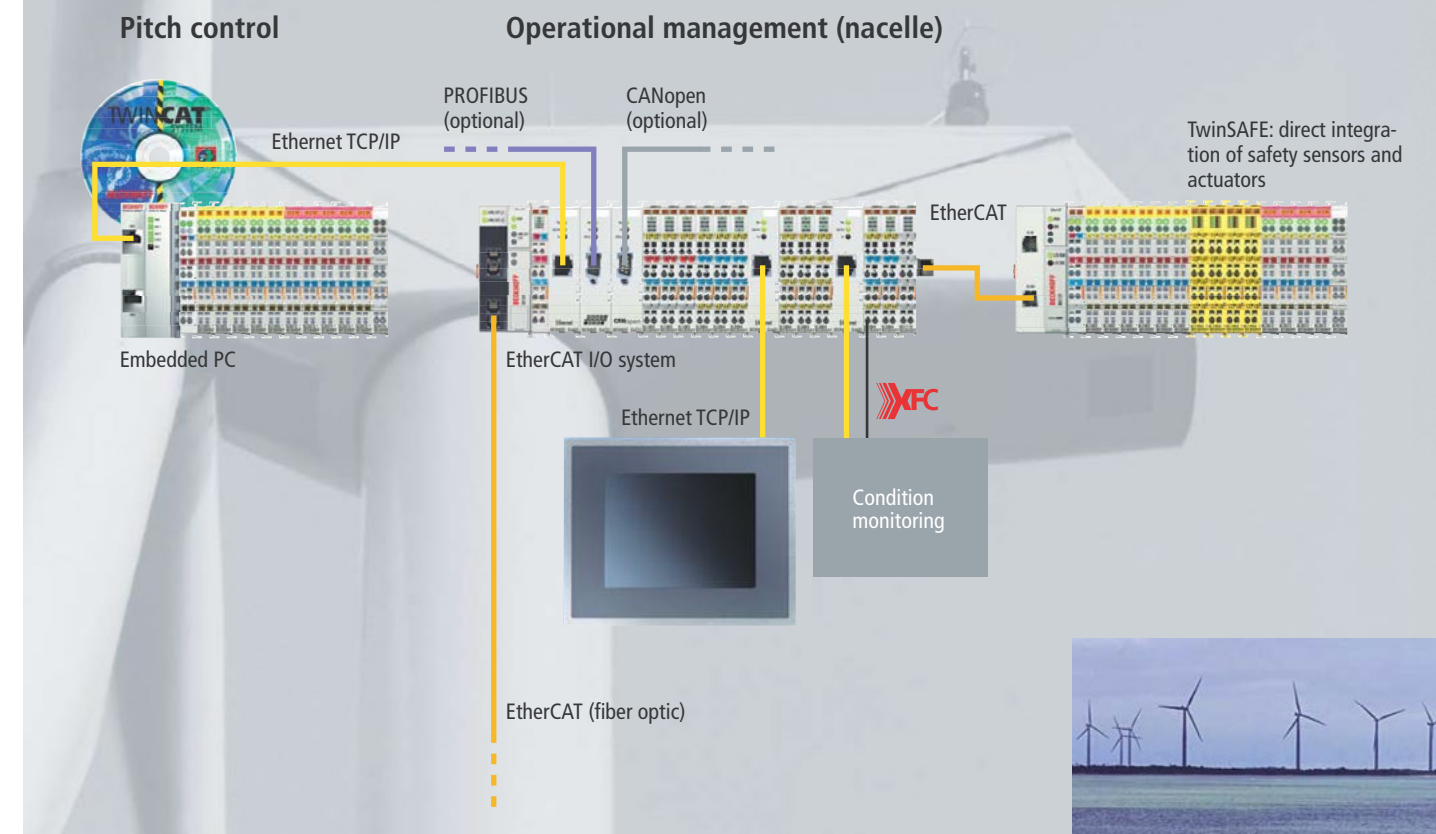
Beckhoff PC-based control technology and automation components are nowadays in use in wind turbines up to a size of 5 MW – including cold climate regions such as the North Cape and extreme climatic regions such as Inner Mongolia.

Continuity and flexibility using PC-based control

Beckhoff implements open automation systems on the principle of PC-based control technology. This openness in relation to the software and hardware interfaces enables the turbine manufacturers to adapt their systems to varying demands both in the first draft design and also for later system expansion or modification at low cost.

The open, scalable TwinCAT automation software is a software PLC for PCs. Programming in accordance with the international IEC 61131-3 standard guarantees the turbine manufacturers high investment security. The utilization of technological standards based on the Windows operating system opens up numerous expansion options and allows the user to benefit from the rapid development of the computer industry. It also enables the universal use of one technology for all types of turbines.

Data provision and data management in particular occupy a key position for control and evaluation of turbine performance both vertically (from the machine to the central control room) and horizontally (between the individual intelligent components and sub-systems of the turbine and





Advantages of Beckhoff technology for wind turbines

- | advanced technologies, tried and tested in a wide range of industrial applications
- | flexible, modular system, consisting of: Industrial and Embedded PCs, controllers, displays, Bus Couplers, Bus Terminals and fieldbus systems
- | special terminals available as standard: 3-phase power measurement terminal, oscilloscope terminal, PWM, etc.
- | straightforward integration with any relevant industrial bus system, no limits regarding combination options: EtherCAT, Ethernet, DeviceNet, CANopen, PROFIBUS, Modbus, Interbus, RS232, RS485, etc.
- | integrated safety Bus Terminals (TwinSAFE)
- | single software tool (TwinCAT) for all automation hardware platforms
- | open industrial standards: (IEC 61131-3, Ethernet TCP/IP, PLCopen, OPC)
- | genuine real-time characteristics (jitter < 10 µs)
- | wind-specific customer know-how encapsulated in application software

also between the turbines within a wind farm). Local data banks as a basis for the higher ranking data backup and data preparation do not pose any problems for the PC whatsoever. Porting all functions to PC hardware also simplifies data transfer – generally via Ethernet – to the production databases and ERP systems.

EtherCAT: High-performance communication system for the tower/nacelle and the control room

Beckhoff supplies a complete range of fieldbus components for all common I/O and fieldbus systems. The Bus Terminals and EtherCAT Terminals available are sufficient for the complete range of signal types and fieldbuses that are of relevance for wind power. EtherCAT, the fast Ethernet-based fieldbus, offers optimum real-time properties for time-critical process requirements without the need for special hardware in the central processing unit. With XFC technology (eXtreme Fast Control Technology) a time resolution of < 100 ns is possible with the time stamp technique. Sensor signals can be read with sampling times of less than 10 µs.

Integrated safety using TwinSAFE

In recent years, operational safety and work safety have played an ever larger part in machine construction. With TwinSAFE, Beckhoff offers an integrated system solution with optimum synergy between automation technology and safety technology. TwinSAFE integrates safety functions in the existing control architecture and in particular helps to significantly reduce the wiring costs for the higher-level hard-wired safety chain in the wind turbine.

→ www.beckhoff.com/wind



Husum WindEnergy 2008 – leading international wind energy trade show



Robert Müller, Branch Management Wind Energy at Beckhoff, has been dealing with automation and control systems for wind energy converters for more than 20 years.

The Husum WindEnergy was the scene of the world’s largest wind energy trade show from 9th to 13th September 2008. Around 700 companies, manufacturers of wind turbines and sub-suppliers from 35 countries were presenting their solutions in four halls. Beckhoff was presenting its open automation solutions for wind turbines. Robert Müller, Branch Management Wind Energy at Beckhoff, predicts healthy revenue growth in this segment: “A recent survey of manufacturers carried out by the German Wind Energy Institute (DEWI) indicated that last year the German wind industry clearly maintained its leading position in the world market. In 2007, German manufacturers and suppliers had a 28 percent share in worldwide sales totaling 22.1 billion euros. The export ratio increased from 74 percent in 2006 to more than 83 percent in 2007. With our PC- and EtherCAT-based control technology, we offer an integrated solution that has been tried and tested worldwide and covers pitch control, operation control for the tower and the nacelle, wind farm networking and the control room.”



Goldwind wind farm supplied electricity for the Olympics in Beijing. The company Goldwind is the market leader among wind energy converter manufacturers in China. Goldwind supplied the wind energy converters – equipped with Beckhoff control technology – for the recently opened Beijing Guanting Wind Farm, which is the first wind farm in Beijing and a showpiece for clean energy generation for the 2008 Olympics: The wind farm meets 5 percent of the electricity demand of the Olympic stadium.

Standardized wind turbines communication according to IEC 61400-25

TwinCAT supports wind power industry standards



The “TwinCAT PLC IEC 61400-25” PLC library simplifies communication for monitoring and controlling wind turbines.

Beckhoff is announcing a new PLC library for its automation suite in “TwinCAT PLC IEC 61400-25”. The IEC 61400-25 standard defines communication for monitoring and controlling wind turbines. Its integration in TwinCAT will simplify the control of heterogeneous wind farms considerably.

Regenerative energies are on the advance. More and more wind turbines are being installed worldwide, both onshore and offshore; most of them are organized into wind farms. In wind farms with wind turbines made by different manufactures, the IEC 61400-25 communication standard is intended to make communication possible. It is based on the IEC 61850 basic standard and will be available from mid-2009 as a PLC library as one of the TwinCAT supplementary products.

Like IEC 61850, IEC 61400-25 is object-oriented. This approach allows particularly simple configuration, diagnosis and maintenance of the communication. In addition to the IEC 61850 basic standard, the IEC 61400-25 contains descriptions for wind power-specific objects. However, the same communication services are used, as a result of which TwinCAT users can also access IEC 61850 data objects. The basic standard defines a general transmission protocol for protective and control equipment in medium and high voltage electrical substations.

The communication is physically based on Ethernet technology. TCP/IP and the Manufacturing Message Specification (MMS) have been implemented as protocols in TwinCAT PLC. The hierarchical data objects are communicated between a master control station and a wind turbine via MMS as the application layer.

DeWind develops new drive system for D8.2 wind turbine

New design for the emerging U.S. wind energy market

→ The German wind turbine manufacturer DeWind is in the news again with a radically new design. The new DeWind D8.2 is primarily intended for the U.S. market. Beckhoff was the central partner for the development of the control and automation system.

On January 7, 2007 DeWind had cause for celebration. It was the day the new DeWind D8.2 was commissioned at Cuxhaven, Germany. It marked an energetic comeback to the wind sector by the Lübeck-based manufacturer with a fully revised design for its flagship model.

From the outside, the DeWind D8 seems unchanged. Only the windows in the nacelle roof provide a little more insight than in the past. Otherwise, the spectacular Porsche design has been retained: like all large modern wind turbines the system is pitch-controlled. The hub height (80 and 100 meters) and the rotor diameter (80 meters) are the same as in the previous model. With a rating of 2 megawatts, the capacity also remained unchanged.

However, almost everything changed inside. The reason is that DeWind, following the sale of the company to an English-American investor, repositioned its wind

turbines primarily for the U.S. market. Accordingly, the special characteristics of the American energy supply system had to be taken into account. To start with, the U.S. grid is operated with 60 Hz, as opposed to 50 Hz in Europe. In addition, the American supplier General Electric has a patent on field-oriented converter systems for wind turbines and was blocking access to the U.S. market.

Breaking new ground for wind energy

DeWind therefore decided to use a radically new design, breaking with its own technological tradition. DeWind had used variable-speed systems since it was established in 1995. In such systems uniform voltage and associated high current quality is ensured by a double-fed induction generator and a converter. Strong variations in wind speeds on the rotor side must be converted to constant fre-

quency on the grid side. The design enables DeWind to build systems that can be used economically onshore in areas with relatively low wind speeds. Systems of this type are successfully sold in Europe.

The move into the U.S. market forced the company to find new solutions. These efforts led to a design that is unparalleled in the wind energy sector. At the core of the new design is a variable-speed hydraulic gearbox. The three-stage planetary spur gear unit used in the European DeWind D8 model was replaced with a two-stage gear unit. The third stage was replaced with a WinDrive® unit, a highly dynamic mechatronic drive system from Voith Turbo.

This proven technology has been used for decades in the energy sector, particularly in applications where the focus is on operational reliability, precise control dynamics and low operating and maintenance effort.



The prototype for the DeWind D8.2 was commissioned at Cuxhaven, Germany, in January 2007.



DeWind D8.2 in the Argentinean Andes at an elevation of 4,300 meters (over 14,100 ft)

With the aid of WinDrive®, the DeWind D8.2 converts the variable speed of the wind rotor into constant speed for the synchronous generator, which is directly connected to the grid. The converter that deals with this task in a double-fed induction generator is no longer required. This means that a complex electronic component is replaced with a low-wear drive system without any power electronics. In this way, DeWind is presenting a technology that is vastly different than the GE patent and can position its systems freely and without additional costs in the United States. At the same time DeWind is able to fully – and more effectively than the competition – meet current and emerging grid connection regulations. In Germany wind turbines fed nearly 40 billion kWh into the country's electrical grid in 2007, equivalent to more than 7 percent of total German demand. This success leads to new challenges: wind turbines must be integrated into the grid



A 60 Hz version of the DeWind D8.2 was built in Sweetwater, Texas, in March 2008.



management arrangements, which becomes particularly relevant in the event of malfunctions, voltage drops or short circuits. Systems with synchronous generators are better suited for this purpose than systems with other generator systems. More than 95 percent of all electrical energy is generated with synchronous generators, which is why transmission and protection systems are designed for their inherent fault characteristics. Despite elaborate solutions, it is difficult for converter systems to reach the harmonic mains quality of a synchronous generator.

EtherCAT and TwinSAFE help put a new spin on wind turbine control

The redesign of the turbine system also required a redesign of the control and automation system. DeWind had developed the control system for the D8 in close cooperation with Beckhoff. It is based on a Beckhoff Industrial PC and TwinCAT

automation software from Beckhoff. The application software was developed by DeWind. The control system analyzes around 350 I/Os. The real-time system requirements are within the range of a deterministic cycle time of 10 ms or around 1 ms with grid feeding and monitoring. The DeWind D8 already used flash drives for mass storage, not least in view of the harsh operating environment. The open Beckhoff control system permits connection via all commercially available PC interfaces.

EtherCAT was selected as the communication system: the DeWind D8.2 is equipped with two separate high-speed EtherCAT communication circuits for system and wind farm networking. The communication is based on optical fiber. System safety and availability are guaranteed via a redundant configuration. The safety chain, which is usually hard wired in wind energy applications, was integrated in the automation hardware with TwinSAFE, the safety solution from

WinDrive® is a highly dynamic mechatronic drive system from Voith Turbo and replaces the IGBT converter. In this way, DeWind is presenting a technology that is vastly different than the GE patent and can position its systems freely and without additional costs in the U.S., while at the same time being able to fully meet current and emerging grid connection regulations.

Picture usage rights:
Voith Turbo Wind GmbH & Co. KG



DeWind D8.2: a proven solution thanks to real-time test environment

In order to complete the D8.2 project in such a short time, DeWind decided to take a new development route. The physical elements of the wind turbine and the drive system were simulated, tested and adapted to each other based on an advanced computer model. In this way, the turbine had already run in simulation for several hundred hours and mastered all conceivable operating situations before the power switch between the turbine and the grid was closed for the first time. As part of this development process WinDrive® was equipped with a separate Beckhoff control, into which controller systems were downloaded directly from the simulation during the trial phase. After the test phase, the WinDrive® control system was integrated into the turbine control system.

With support from Beckhoff, the development team also designed a real-time test environment for simulating the physical forces acting on the turbine and the real response of the turbine: the D8.x Real-Time Test Environment (RTSim). Both sides of RTSim consist of Beckhoff components and are, just like the real turbine, wired to the turbine control terminals. With RTSim it was possible to carry out detailed simulations of the dynamic system characteristics in advance of the installation and commissioning. The option of "dissecting" the model at any point in order to test various components and devices in the hardware loop is a tremendous advantage. The simulation not only replaces the actual test operation, it also enables existing turbine operation experience to be taken into account in advance of a new development in order to test the system characteristics and optimize the design. In this way, pilot production becomes much more reliable than in the past.

Besides its high performance and low system costs, EtherCAT also stands out due to its flexible topological characteristics. The maximum distance between two stations is 100 m (328 feet) using a standard Ethernet cable (100BASE-TX). With the new fiber-optic modules, greatly extended networking up to 2 km (1.24 miles) is possible (100BASE-FX).

Beckhoff. Beckhoff makes safety systems more flexible through streamlined expansion and adaptation options, without loss of reliability in the event of an emergency.

Rapid development propels DeWind

The kick-off meeting between DeWind and Voith Turbo, the supplier of the WinDrive® drive system, took place in December 2005. Only twelve months later, in December 2006, a prototype was built at Cuxhaven, Germany, and commissioned in January 2007. DeWind is pleased: only one year passed between the decision to use Voith's WinDrive® solution and commissioning of the system. This would not have been possible without a motivated, competent and bold team. In the meantime, DeWind built two additional systems of this type, one of which is installed at a record elevation of 4,300 meters (over 14,100 ft) in the Argentinean Andes. The third system, a 60 Hz version, was built and commissioned in Sweetwater, Texas, in March 2008. This third system was built by DeWind's strategic production partner Teco Westinghouse at Round Rock, Texas. Teco Westinghouse is currently setting up a production line with a capacity of five systems per week. The company expects to build and install up to 80 systems in the United States during 2008.

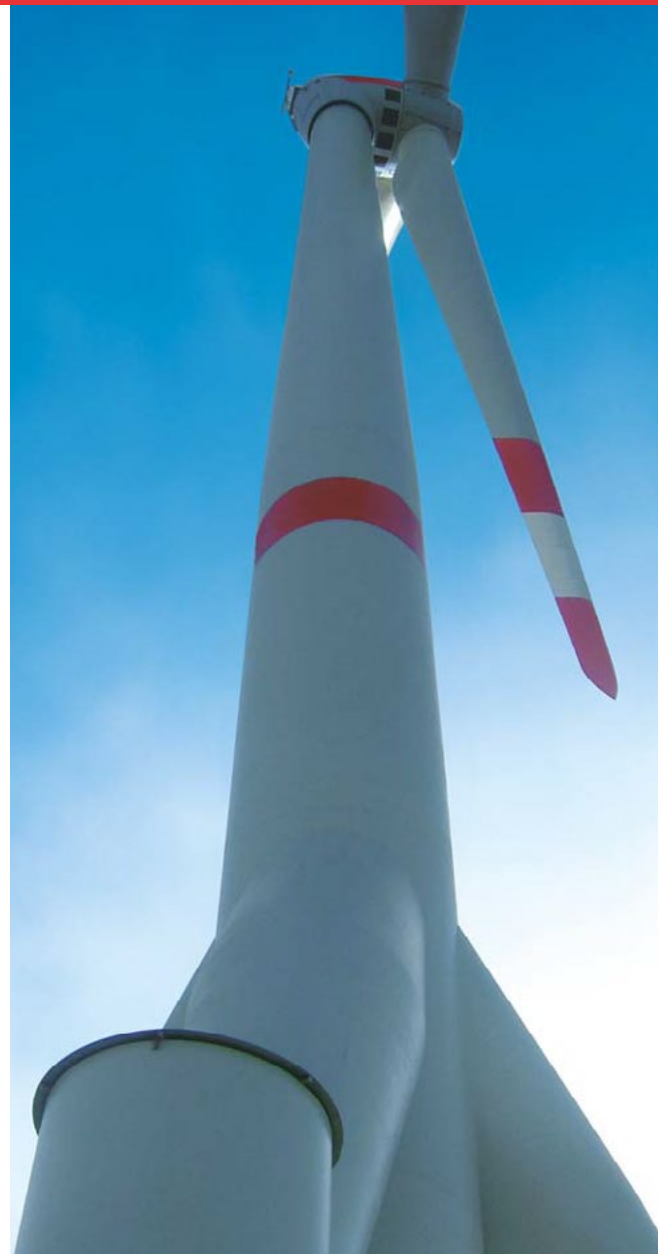
→ DeWind Inc. www.dewind.de

→ Voith Turbo Wind GmbH & Co. KG
www.voithturbo.com/wind-technology

From prototype to series production: Multibrid M5000 for offshore applications

PC Control for an offshore wind farm

Multibrid GmbH never bothered with onshore wind farms: the 5 MW M5000 turbine was designed for offshore wind energy applications from the outset. Multibrid revised the control scheme in close cooperation with Beckhoff and based it on an integrated platform for the mass production of these turbines.



M5000 specifications

Rated capacity:	5 MW
Rotor diameter:	116 m
Rotor speed:	4.5 – 14.8 rpm
Maximum blade speed:	90 m/s
Offshore hub height:	90 m (prototype 102 m)
Head weight/swept area:	< 30 kg/m ²

Multibrid developed the first prototype of its wind turbine back in 2004, although it took another three years before it was ready for series production. Assembly of the Multibrid M5000 with a rotor diameter of 116 meters and a hub height of 90 meters started in mid-2007 at Multibrid's own production facility at Bremerhaven, Germany.

When project manager Bernd Zickert joined the company in 2005, he found a typical technical situation: The control and automation systems for the turbine were not based on an integrated platform. The hardware components came from four different manufacturers, which meant that the Multibrid engineers had to familiarize themselves with diverse systems. Coordination of the components and data acquisition were also problematic.

For Multibrid's prototype this internal diversity made sense, because it was intended to demonstrate resilience of the design and form a basis for the final decision on series production. To this end, the company had to test various options. The first field test for the M5000 took place two years earlier. This test showed that the approach basically passed. The next challenge for Multibrid was to prepare for series production and offshore operation.

The prototype was tested through detailed simulation of the complex environmental influences affecting a wind turbine, including a wide range of possible fault and malfunction scenarios (hardware-in-the-loop). "For the simulation we created an exact model of all system interfaces," said Bernd Zickert. "We were able to implement further developments for improving system performance." The focus was on system feasibility in terms of production, installation, operation and

service. In 2008 Multibrid intends to build up to 13 systems, six of which are scheduled for the Alpha Ventus offshore wind farm (see page 39). Alpha Ventus is the first German offshore wind farm on the high seas. It is a pioneering joint project in which E.ON Climate & Renewables, EWE and Vattenfall Europe New Energy are all involved.

Low-wear technology minimizes system failures

The Multibrid design is ambitious. Unlike most other wind turbine manufacturers, Multibrid uses permanent magnet synchronous generators. While most electricity suppliers use synchronous generators, the wind industry tends to prefer asynchronous (induction) generators. Multibrid's decision to use a multi-pole synchronous generator with a ring design means it is based on proven technology and has the additional advantage of significantly less wear. This provides major benefits, particularly for offshore operations where service, maintenance and repairs are much more difficult than onshore, especially during periods of poor weather. Any equipment or feature that is less prone to faults and failures helps make the turbines more reliable.

Less weight facilitates construction and installation

To facilitate transport and ensure safe and fast installation, a key design requirement for the M5000 was minimized weight of the nacelle and the rotor. Multibrid placed a single-stage gear unit between the rotor and the generator, which reduced the speed variance of the rotor by a factor of almost 10: 1. The generator



The production facility at Bremerhaven, Germany has direct access to a port for transport by ship.

is linked to the grid via a four-quadrant inverter, which enables variable-speed operation. At the same time it meets the requirements stipulated by grid operators for advanced wind turbines. With this design Multibrid reduced the total weight of the rotor, hub and nacelle to around 310 t.

Despite the high rated capacity, Multibrid turbines are very compact: The two-level nacelle is only 7 meters high and 10 meters long, making the system significantly smaller and lighter than comparable units. This has several advantages: The tubular steel tower, which rests on tripod foundations, can be dimensioned differently. The nacelle can be pre-assembled on land and installed at sea as a complete unit.

A key requirement for offshore operation is hermetic sealing of the nacelle: an air treatment system separates salt and water particles from the ambient air and generates a positive pressure in the nacelle, which keeps out the aggressive sea atmosphere and protects the sensitive control elements from corrosion.

Integrated control platform simplifies system management

The revision of the control and automation system carried out by Bernd Zickert and his team simplified the system. The number of controllers was reduced from five to two. In addition to the main computer in the tower, there is a hub computer that provides redundancy and prevents data loss during transfer via the slip ring coupling.

The complete hardware platform was converted to Beckhoff components, creating an integrated control system that offered coordinated and simpler handling, interfaces and data flows. The system processes no less than 500 digital and analog signals. This is particularly beneficial when it comes to service and maintenance: the service technicians only have to familiarize themselves with one operator guidance system, which drastically reduces the training and commissioning effort.



Multibrid

Multibrid was established in 2000. The company develops and builds the Multibrid M5000 offshore wind turbine. In collaboration with suppliers, a team of specialists for all key system components continuously develops and enhances the Multibrid technology. Through the affiliation of the Prokon Nord Group, Multibrid technology can draw upon long-standing experience with wind farm implementations.

The project design company Prokon Nord ventured into the offshore sector at an early stage and designed three wind farms in the North Sea and off the coast of Normandy, the latter featuring 181 turbines with a capacity of 5 MW each. Prokon's involvement was very useful: backed by large demand, the new development was economically viable. The involvement of the French energy company Areva, which acquired 51 percent of the Multibrid shares in September 2007, provided a secure financial basis for Multibrid. The company was able to turn a good idea into good business. Meanwhile, Multibrid production is up and running.



M5000 control architecture

Control system

- | Main computer: CX1020 Embedded PC with Windows XP
- | Hub computer: CX9000 Embedded PC with Windows CE
- | Automation software: TwinCAT PLC

HMI

- | Built-in Control Panel CP6832

I/O

- | Bus system: EtherCAT (PROFIBUS with EtherCAT Terminals)
- | I/O systems: Bus Terminals/EtherCAT Terminals
- | I/O terminals:
 - Various digital/analog I/Os
 - Power measurement terminal
 - Relay terminal
 - SSI angular measurement terminal
 - Incremental encoder interface
 - Serial interface



The M5000 test stand is used primarily for reducing the time for function tests and commissioning and for optimizing the operating procedures and control processes.



Open system philosophy facilitates further development

In order to minimize the effects of possible component failures, the sensors, actuators and auxiliary systems are also designed for redundancy. This particularly applies to the air treatment, oil supply and hydraulic systems, the battery chargers for the hub and the cooling system.

PC-based control technology ensures openness of the system. Multibrid engineer Zickert regards this as a particularly significant feature, because it offers scope for further development of the control and automation system: "After all, we operate in a highly dynamic sector that is constantly changing." Third-party equipment can easily be integrated via the available interfaces. The openness of the system also enables integration of I/O terminals with new functionalities.

The fact that the TwinCAT control software from Beckhoff is based on the Windows standard simplifies operator guidance and ensures compatibility with conventional user interfaces. This also has positive effects on the visualization of the data streams and information provided via a SCADA system. The control system offers secure access on site and in the control center by multiple users. Parameters can be modified and adapted to specific requirements. The error analysis capability of the system is improved. The system is monitored in real-time via the Internet Protocol over an optical fiber cable.

An integrated ORACLE database system can store data offline for up to 50 days (in the event of system communication malfunctions, for example) before forwarding them to the control center. The storage capacity depends on the size of the flash card used. The system stores all data that are relevant for managing the wind farm, including operational data (10-minute mean values, trace, coun-

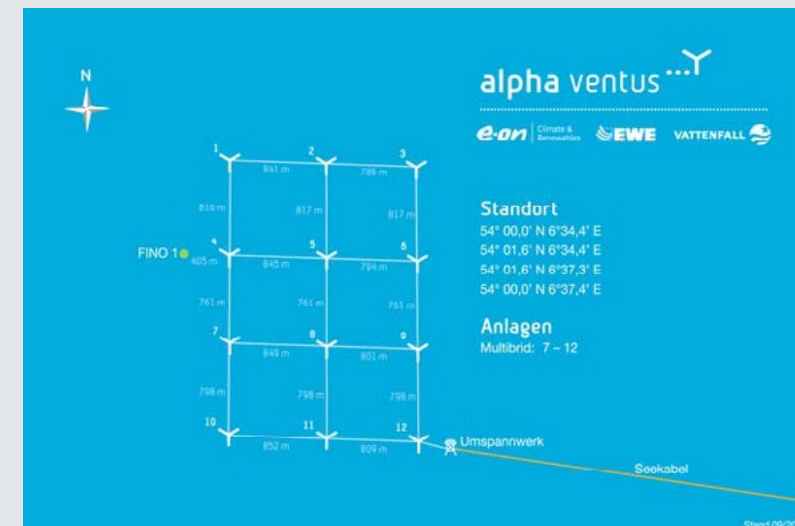
ters), error log analysis, power curve, production, reactive power, internal consumption and mode.

Comprehensive and complex simulation ensures quality

Of particular significance is the quality of the simulation software developed by the Multibrid team in close cooperation with ISET (Institut für Solare Energieversorgungstechnik, University of Kassel, Germany). It enables real-time simulation of the system states and data exchange via TwinCAT. Beckhoff supplied the associated hardware and was involved in the development of the SCADA system.

The test stand is used for initial plausibility checks for theoretical assumptions and concepts as well as staff and customer training. In addition, Multibrid developed it into an efficient and effective quality assurance tool: All system control components are mapped on the test stand. The system is able to simulate all actuators and sensors, as well as the communication with the turbine control equipment. In this way, the functionality of the control system and other systems can be fully tested in advance of installation. Rather than having to install components with unproven functionality under difficult conditions at sea, the quality of the components and subsystems can be ensured before delivery. This is also beneficial for the installation of updates and retrofit measures, which no longer have to be field-tested as beta versions, but can be installed with extensive function tests included.

→ Multibrid GmbH www.multibrid.com



Alpha Ventus: first German wind farm in high seas

The Alpha Ventus offshore wind farm is a pioneering joint project in which E.ON Climate & Renewables, EWE and Vattenfall Europe New Energy are involved. It is located on the North Sea, around 45 kilometers (28 miles) north of the island of Borkum, at a water depth of 30 meters (98.4 feet). Alpha Ventus is the first German wind farm to be built on the high seas under real offshore conditions. The design, construction, operation and grid integration of the Alpha Ventus research project will provide highly valuable insights for the future commercial utilization of offshore wind farms. The 2008 project schedule includes construction of the southern half of the wind farm with six Multibrid M5000 turbines and the offshore substation. The wind farm is expected to be connected to the grid in autumn 2008. Construction of the northern half of the wind farm with six further turbines of a different type is scheduled for summer 2009.

The wind turbines are prefabricated on land as individual components. The nacelle, rotor blades, tower segments and foundation structures are assembled at sea into a complete wind turbine.

The 12 turbines will be spread over an area of 4 square kilometers (1.5 square miles). They will be positioned in the form of a rectangle, with four parallel rows (from north to south) of three turbines each. Within this grid-like formation, the turbines are spaced with a distance of around 800 meters (approx 0.5 miles) from each other. The Multibrid M5000 turbines are anchored to the seabed with tripod-type foundations. The water depth at this location is around 30 meters (98.4 feet). To reach around the triangular 255 m² footprint of a tripod would require 56 men. The 1,000-ton weight of a turbine is equivalent to around 200 fully grown elephants or 22 railway wagons. The area swept by the rotor is around one and a half times the size of a soccer field. At the maximum rotational speed of the rotor, the blade tips cut through the air with around 300 km per hour (186 mph).

The average wind speed at the location is 10 meters per second (m/s), which corresponds to a 5 on the Beaufort scale of wind force (19 – 24 mph or 30 – 39 km/h). The designers expect the farm to operate at full capacity for around 3,800 hours per year. For comparison: good onshore locations offer around 5 m/s and 2,200 to 2,500 full-capacity hours.



Alpha Ventus key data

- | No. of turbines: 12
- | Total capacity: 60 MW
- | Expected energy yield/year:
approx. 220 GWh (= annual consumption
of approx. 50,000 3-person households)

→ www.alpha-ventus.de

Wind energy helps keep the future bright for China

Mingyang relies on Beckhoff wind industry expertise

In recent years China has been experiencing a wind power boom. Now that the main international wind turbine manufacturers have established production plants in China, Chinese machine manufacturers are racing to gain a foothold in the wind energy sector. The Mingyang Group, originally based in southern China, started with a 1.5 megawatt system using control technology and industry expertise from Beckhoff.

Meanwhile China has become the country with the world's most wind farms. The reasons for using wind energy are obvious: With a population of more than 1.3 billion or approx. a quarter of the world's population, China uses around 10 percent of the global primary energy resources. Coal is the main energy source for China, with all the consequences associated with generating electricity from coal. Existing coal-fired power plants have a very poor environmental balance, due to their high CO₂ emissions and other polluting attributes. Economic growth creates an incredible challenge: China must build new clean, advanced power plant capacities faster than the dramatic increase in energy consumption. Wind energy is becoming one of the assets in China's dynamic energy market, with up to 40 GW of capacity expected to be installed by 2020. By the end of 2007, around 6 GW capacity had already been installed, of which approx. 3.3 GW were installed in 2007 alone.

Mingyang: wind turbines for the domestic market and abroad

Mingyang Electric Group Co., based in the southern Chinese province of Guangdong, was established in 1993 and became active in the wind energy sector several years ago. Last year the company built its first wind turbine with a nominal capacity of 1.5 MW at Zhanjiang in the far south of China. An additional 33 units are expected. Mingyang is currently establishing production capacities not only to satisfy the Chinese market, but also for export: In 2008 the company expects to export 72 systems to the USA. Over the coming years Mingyang intends to build systems with a total capacity of 2,000 MW, around half of which destined for the United States. In addition to the lower price, high system performance and reliability are further key arguments in favor of this wind energy market newcomer.

System design made in Germany

Mingyang relies on a tried and tested design originating from Aerodyn Energiesysteme GmbH, a firm of consulting engineers based in Rendsburg, Germany, who have been developing wind turbines since the early 1980s. Beckhoff supplies the control and automation system. "The basic design is proven and has been used successfully in the market for years," said Robert Müller, Beckhoff project manager and wind power branch manager, commenting on the basic idea for the Mingyang system. The wind turbine has a nominal capacity of 1.5 MW, with a hub height and a rotor diameter of 80 meters. Mingyang offers the system in strong wind and light wind versions as well as a cold climate version. The pitch-controlled, variable-speed system is equipped with a double-fed induction generator. All these features are familiar and have been proven in the market. The project was nevertheless ambitious: The order for the development of the control system was issued in late autumn 2006. A prototype was built only a year later and commissioned in October 2007.



Extreme conditions: the control system must adapt to the harsh, rapidly varying ambient temperatures and weather conditions such as wind speed and direction in order for the installation to meet the stringent electrical quality requirements.

PC controller in the tower:
CX1020 Embedded PC with
TwinCAT automation software



Mingyang built one of its first wind turbines with a nominal capacity of 1.5 MW at Zhanjiang in the far south of China.



Control concept for extreme operating conditions

The specific operating conditions for automation components in the wind energy sector differ from other industrial applications and require special automation expertise: harsh, rapidly varying ambient temperatures and weather conditions such as wind speed and direction have to be mastered in order for the systems to meet stringent electrical quality requirements. While the wind quality in the southern Chinese province of Zhanjiang is generally high and uniform, the region is at risk from typhoons all year round. Two typhoons already passed through during the construction phase and left their mark. The wind turbines have to cope with wind speeds in excess of 50 m/s (180 km/h) in conjunction with strong precipitation. The South China Sea location just north of the 20th degree of latitude generally has a more extreme climate than Central European locations. "The control system has to be adapted to such extreme conditions," said wind power expert Robert Müller. "It must be able to respond very quickly, the emergency systems must be designed with redundancy in mind, and the installation must meet stringent safety criteria." The automation system automatically responds to changes in environmental parameters. The operating states are monitored both locally and remotely via remote data communication in order to enable full control of the system. The data are stored for retrospective fault analysis, for example following disruptions in system communication.

PC-based control platform offers openness for future developments

The PC Control system in the tower is based on a CX1020 Embedded PC with TwinCAT automation software. The modular CX system is equipped with a CAN bus interface for communication with the autonomous converter for the double-fed induction generator and standard interfaces (USB, DVI and Ethernet TCP/IP). Further I/O stations for interfacing sensors and actuators are connected via the high-speed EtherCAT communication system. The autonomous pitch sys-

tem with PROFIBUS master is integrated into the EtherCAT I/O system via suitable fieldbus terminals. The safety sensors and actuators in the nacelle and the tower base are also directly integrated into the EtherCAT system. Therefore, an additional safety bus system is not required.

Current and historic operational data can be displayed on Beckhoff Control Panels in the nacelle and the tower base. The individual units can be integrated into a wind farm communication system or a control master station for remote monitoring, although this has not yet been implemented in the Zhanjiang installation. This functionality can be retrofitted if required.

In addition to the automation components, Beckhoff also supplied the application software and provided support for Mingyang's engineers during commissioning. The open nature of the application program enables Mingyang to adapt and refine the software. This is a big advantage of open, PC-based control technology.

The use of Windows as an operating system and Ethernet as the communication platform opens up new potential in terms of communication and data processing speed. Control or communication components such as laptops can be connected at any time. In the future, any component can be replaced with state-of-the-art modules as required.

→ Guangdong Mingyang Wind Power Technology Co., Ltd
www.mingyang.com.cn



EtherCAT ensures maximum precision in lithography system

Beckhoff technology controls blue laser light

The lithography system uses shortwave, blue laser light to create tiny structures on masks for producing flat screens.

→ Kleo Halbleitertechnik GmbH, based in Tettngang, Germany, produces state-of-the-art lithography systems for masks used in the production of LCD screens. The systems create tiny structures using shortwave, blue laser light. Artec Engineering GmbH based in Baienfurt, Germany, dealt with automation of the high-precision processes using Beckhoff control technology.

The requirements for lithography systems are very stringent: They are supposed to quickly, reproducibly and cost-effectively produce large quantities of high-precision masks with sizes up to 4 m². A key requirement is the positioning accuracy of the laser beam. This is based on a low-vibration machine frame with high-precision geometry, robust and fast automation technology and exact measured value compensation.

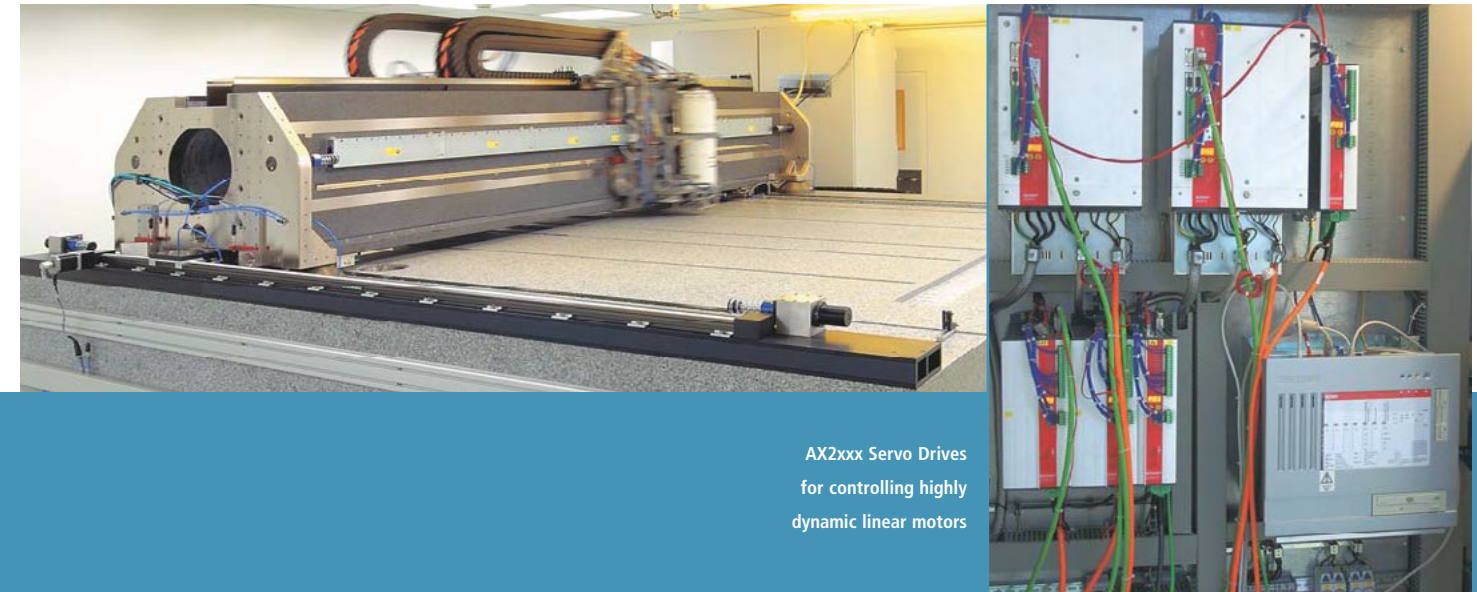
Tobias Reiter, managing director of Artec Engineering GmbH, comments on the company's decision to utilize Beckhoff as the control equipment platform: "Our choice of PC-based automation technology from Beckhoff was based on the stringent requirements for system accuracy and robustness. Based on our own experience we knew that this system is capable of meeting high demands in terms of performance, stability and control characteristics."

In parallel, Kleo carried out market research and concluded that Beckhoff technology can achieve high velocities without interfering side effects, such as vibrations. Stefan Scharl, lithography system product manager at Kleo, said: "Follow-

ing our own research, the results of a study undertaken by FISW Steuerungstechnik GmbH in cooperation with the University of Stuttgart on the issue of drive dimensioning for a laser lithography system, and the recommendation by Artec, we had absolutely no doubt that Beckhoff technology is the right choice for us."

Mechanical design is the basis for precision

The machine frame consists of a vibration-absorbing granite base that is manually ground with a precision of 2 µm, an air-suspended granite gantry and two air-suspended slides. The laser and an auto-focus system are mounted on the slides, which move the laser diodes longitudinally over the substrate with a velocity of 1 m/s and an acceleration of 10 m/s². The three-ton granite gantry moves the unit in transverse direction with a positioning accuracy of 2.5 µm. Piezo systems control the focus and the lateral offset of the laser beam. To produce the required structure, the laser beams are variably pulsed during the motion.



AX2xxx Servo Drives for controlling highly dynamic linear motors

Top speed with EtherCAT

At the core of the control system is a Beckhoff C6140 control cabinet Industrial PC with Windows XP Professional operating system and TwinCAT automation software. "Fast data transfer and processing are prerequisites for precise laser positioning. Therefore, we only use high-performance components such as the C6140 IPC, EtherCAT as the bus system and EtherCAT Terminals," said Tobias Reiter. Stefan Scharl added: "This enables us to achieve short sampling rates, short cycle times of around 50 µs and stable real-time capability as the basis for high-precision positioning of the laser beams."

Each axis of the lithography system features a Fieldbus Box with a separate cable to the control cabinet. "This reduces the cabling effort and trailing cables, which is a particularly important factor for us", said Stefan Scharl. "We seek to limit trailing cables to glass fiber in order to reduce the scope for mechanical faults." "We use PROFIBUS for interfacing the Fieldbus Box modules and control units, including the PC and handheld devices. Thanks to the openness of EtherCAT, other protocols, such as PROFIBUS, can easily be integrated via the Bus Terminal system," said Tobias Reiter.

High-precision positioning with Drive Technology from Beckhoff

"Linear motors are used for moving the gantry and the slides, while parts of the auto-focus system are driven by a servomotor. The motors are driven by digital AX2xxx Servo Drives from Beckhoff. In combination with TwinCAT automation software, we are able to position the laser precisely and with high repeat accuracy", said Tobias Reiter. "Notwithstanding the highly dynamic slide movement, we achieve uniform motion with a velocity tolerance of less than 0.01 m/s after a short acceleration phase." The linear motors are counter-rotating. "In this way we avoid high torques and can compensate the impulse," said Stefan Scharl. "In order to prevent jamming, the two electrically independent linear motors in the gantry are synchronized with a precision of 5 µm through coupling via TwinCAT NC PTP."

Each movement of the gantry and slides requires activation and deactivation of the air bearings. "This must happen quickly, precisely and without change in position," said Stefan Scharl. "The controllers from Beckhoff meet this challenge. They are robust enough to avoid peaks even during the transition from friction-free to friction status."

Length measurement sensors monitor the current gantry and slide positions, and the measured data are processed directly by the Servo Drives. Interferometers

measure the current position of the laser beams. The position data are analyzed in the measured value compensation unit and serve as a basis for controlling the piezo systems for positioning the laser beams. "Even the integration of external drives, such as the piezo systems, into the automation solution with Beckhoff components does not lead to a reduction in the performance of the overall system," said Stefan Scharl.

"Thanks to small dimensions, integrated EMC filters and pluggable connections, we can simply install the Servo Drive in the control cabinet," said Tobias Reiter. Due to the heat sensitivity of the position instrumentation, the power electronics are located in a control cabinet outside the cleanroom. "To ensure an efficient exposure process, the glass fiber must not be too long. A second control cabinet containing the laser fiber coupling and the instrumentation is installed in the cleanroom close to the system and travels in parallel with the gantry during the process," said Stefan Scharl. The linear motors for the gantry and the drives for the control cabinet are coupled as master and slave axes via the PLC controller.

Fit for series production through flexibility

An important success factor for series systems is flexibility. "Thanks to the modularity of the Beckhoff I/O system subsequent extensions, modifications and reconfigurations are easy to implement. This enables us to deal with customer-specific modifications, such as changing the number of light sources without trouble," said Stefan Scharl. Tobias Reiter added: "In addition, we created many features, such as safety functions, with software instead of hardware: Through the introduction of safety terminals in the Bus Terminal system, we can easily implement safety functions, such as emergency stop and safety door circuits or other modifications by adapting or replacing the software."

→ Kleo Halbleitertechnik GmbH, www.kleotech.de

→ Artec Engineering GmbH, www.artec-engineering.com

Sales network expanded in Central and South Eastern Europe

Beckhoff opens subsidiary in Slovenia



→ Beckhoff commenced sales business in Slovenia in the middle of May 2008 with the opening of Beckhoff Avtomatizacija d.o.o. in Medvode in the northwest of Ljubljana. The distribution partner for Croatia is also new. Beckhoff has thus further expanded its position in Central and Southern Europe in order to increase customer acquisition in the former Yugoslavian states.

"With its good motorway and airport connections, the convenient location of the office to the northwest of the capital city Ljubljana offers the best conditions for the optimum support of our customers," says the Executive Manager of the Slovenian subsidiary, Bogdan Rojc. "Thanks to earlier activities, Beckhoff is already well known in Slovenia. Our goal is to position ourselves more strongly in the automation market with PC Control, our embedded devices and our drive technology. However, there is also great demand for our integrated TwinSAFE safety solution," explains the new Executive Manager.

Machine building in particular is one of the up-and-coming branches of the economy in Slovenia. "Our goal is, amongst other things, to support machine building companies in their growth and to grow with them," explains Area Sales Manager Jens-Olaf Brede at the headquarters of Beckhoff in Verl, Germany. However, Jens-Olaf Brede also anticipates good sales prospects for Beckhoff technologies in the process industry. "With our local support, we can react to customer requests much quicker and provide the appropriate assistance," says Bogdan Rojc.



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Bogdan Rojc, Executive Manager of Beckhoff Avtomatizacija d.o.o., is an expert in the field of automation technology and very well acquainted with the Beckhoff product portfolio.



Jens-Olaf Brede, Area Sales Manager at the headquarters of Beckhoff in Germany

Impressions from Ljubljana: The dragon symbol, view across the city and the Tromostovje bridge across the river Ljubljanica (left)

The roof of St. Marco church in Zagreb (bottom)

Distribution partner for Croatia

Beckhoff has a new distribution partner for Croatia in Zagreb in Krovel d.o.o., which has access to the corresponding markets, excellent technological know-how, but also close ties with the Technical University of Zagreb. In this way, Beckhoff will establish itself as supplier of PC-based automation solutions in Croatia.

"In the long term, we will get further involved in the former Yugoslavian states of Serbia, Bosnia-Herzegovina, the former Yugoslav Republic of Macedonia, Kosovo and Montenegro from our subsidiary in Slovenia," explains Jens-Olaf Brede.



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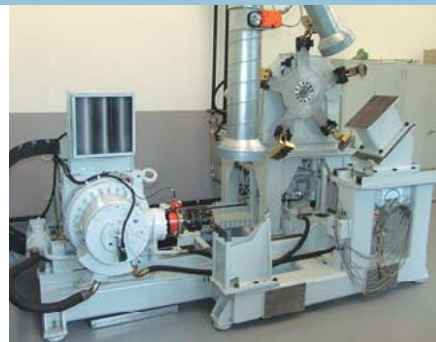
RUAG's MGB gearbox test rig: the cables are connected to the measurement points on the gearbox.

RUAG test rigs for
'Super Puma' transport helicopter

Engine testing in a helicopter hangar



RUAG Aerospace, based in Stans, Switzerland, is a pan-European operative aerospace company that, among other things, takes care of the maintenance, repair and overhaul of helicopter engines for the Swiss Air Force. BSR Automation AG, which was responsible for the electrical engineering, selected a Beckhoff control platform comprising a CX Embedded PC plus I/O components for a relaunch of the gearbox test rigs.



Test rig for testing the tail rotor gearbox



Rotor gearbox of the Puma



Tail rotor gearbox of the Puma



Control cabinet of the gearbox test rig for the tail rotor with the CX1000 Embedded PC

The Swiss Army helicopters in question are so-called medium transport helicopters of the type, AS-332 Super Puma, which are checked for airworthiness and functional capability at regular intervals. Among other items, this involves removing the gearboxes and testing them on the RUAG test rigs. "Naturally, our test rigs are certified. They are inspected by the manufacturer at intervals of two years and, in particular, compliance with limit values is thereby checked," explains Werner Vogler, Software Engineer from the RUAG Test Facilities Department.

"The test criteria with which gearboxes are tested include the speed of the rotor, the torque, the oil pressure of the gearbox, the temperature of the lubricants and the oil temperature. In addition, these variables are measured for compliance with limit values as the gearbox is under load," says Vogler.

Testing takes place in simulation mode

Neither the main rotor drive of the helicopter nor its tail rotor drive are placed completely on the test rig. In fact the respective gearbox is tested without a pro-

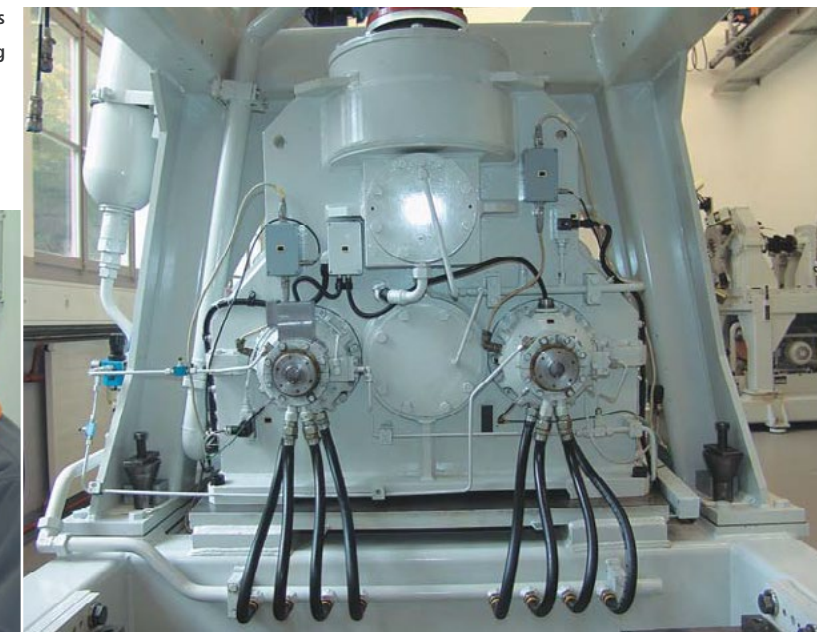
peller, but with an infinitely variable 377 KW direct current drive instead. In this manner, the driving power of the two helicopter turbines – two Turboméca Makila turboshaft engines – are simulated electrically. If one or more of the measured values for speed, torque, pressure or temperature exceed the tolerance limits during the approximately one hour long test, it must be assumed that there is some damage. For example, a part in the gearbox can rotate simultaneously and cause a mechanical fault.

The speed measurement using strain gauges and telemetry represents particularly high performance from the point of view of measurement. The turbine speeds ranging from 12,000 to over 20,000 rpm result in a rotor speed of 340 rpm. The radio measurement section must therefore offer very high performance. "The classic measured values for the other mechanical variables are generated by appropriate sensors and acquired as analog values. These analog values, which are in the form of voltage values from 0 to 10 V or -10 to +10 V as well as current values from 4 to 20 mA, are recorded electrically via Beckhoff Bus Terminals,

View of the coupling of the two hydraulic motor drives as a coupling of the turbine spindle on the MGB test rig



André Duss (right), from BSR Automation AG, and Robert Urech, from the Swiss branch of Beckhoff Automation AG, in front of the control cabinet of the MGB test rig



View of the coupling of electric motor drive and main rotor gearbox on the MGB test rig

processed in the CX1000 Embedded PC and then transmitted to the central test computer channel-by-channel," explains Vogler. The measured values are graphically displayed and documented in the test computer. "Naturally, we can also specify the limit values graphically," says Vogler, and he adds: "The progress of the test is also monitored digitally-graphically; this means we are able to terminate borderline or hazardous situations from the test rig using an emergency stop function."

Test rig with integrated acquisition of measured data

The first Puma MGB test rig for the main rotor gearbox was put into operation as early as 1995. The electronic components installed at that time had aged in the meantime and were no longer available in part; the visualization and the test rig controller were based on MS-DOS. That is why RUAG Aerospace decided to install new test rig equipment, including measured data acquisition, and commissioned BSR Automation AG from Kriens in Switzerland to carry out the work. The soft-

ware for the visualization and recording was newly created by RUAG in collaboration with BSR. BSR replaced the existing controller with a PC-based automation platform from Beckhoff: in order to acquire the measured data from the test rig, a Bus Terminal system with a BK2000 Bus Coupler was installed and networked with the remotely installed CX1000 Embedded PC via Lightbus.

"All measured data is acquired locally via analog terminals and the Bus Coupler, evaluated in the machine control and relayed via Ethernet to the test computer, on which the visualization runs," reports André Duss, Project Manager from BSR Automation, and he concludes: "The use of Beckhoff automation technology was not new territory for us, because we had already converted RUAG's smaller Puma test rig to Beckhoff equipment for checking the tail rotor gearbox."

→ Beckhoff Switzerland www.beckhoff.ch

→ RUAG Aerospace www.ruag.com

→ BSR Automation AG www.bsr-automation.ch



The innovative CitizenM hotel concept won the prestigious 'Worldwide Hospitality Award' before any customers had even crossed the hotel threshold.

Beckhoff Building Automation helps provide the best in comfort and customer service at the CitizenM design hotel

Modular control technology for a modular hotel

→ The new Dutch hotel chain CitizenM is arousing interest with its high-tech room fittings that offer guests every possible electronic comfort. The guest can regulate the LED lighting, WiFi for wireless Internet access, Voice-over-IP, the music system and TV individually according to the guest's wishes. Each room is controlled individually by a Beckhoff Embedded PC. The first CitizenM hotel opened in June 2008 at Schiphol Airport in Amsterdam. Further hotels are planned in Europe, America, Asia, Australia and the Middle East.

The CitizenM hotel chain offers its guests affordable luxury. Partner and Director of Marketing, Robin Chadha explains that low price and luxury do not have to be contradictory: "First of all, the construction costs for this hotel are relatively low. The rooms, which are about the same size as a sea freight container, are prefabricated in a factory and subsequently assembled at the building site like a construction kit. As soon as the four cables and the water and drain systems are connected, the room is completely ready for use. In addition to that, we have a relatively small advertising budget and there are fewer visible employees than in a high-price luxury hotel."

The CitizenM concept is based on surveys, according to which the modern traveler places the highest value on the quality of the bed, followed by the shower, the electronic equipment and the fittings. The architectural consultancy, Concrete, designed the hotel rooms on the basis of these four basic requirements. The rooms are equipped with an extraordinarily large bed, a so-called "rain shower," designer fittings and the latest technical appliances –all at an affordable price. Each hotel room has LED lighting, WiFi for wireless Internet access, Voice-over-IP, a music system and TV, all of which are controlled by a single remote control, the 'Moodpad' by Philips. "The backbone of the system is the IP network in the hotel," explains Project Manager, Peter Boon from Philips Applied Technologies.

"All systems, plus a central computer system are connected to this network, in which the personal tastes of the users are saved. Next time the guest visits a hotel from the chain, the room will be automatically adjusted to his profile from his last stay."

Each room has its own controller, the CX9000 Embedded PC with the associated I/O terminals. The CX controller regulates and controls all of the room functions, for example, the lighting (including the colors in the room), access control, the temperature and the curtains. Each guest is given a personal card containing an RFID chip, which they can take home with them. The RFID chip also serves to lock and unlock the room. In this way, the hotel staff can see which rooms are currently occupied at any time in the central computer system.

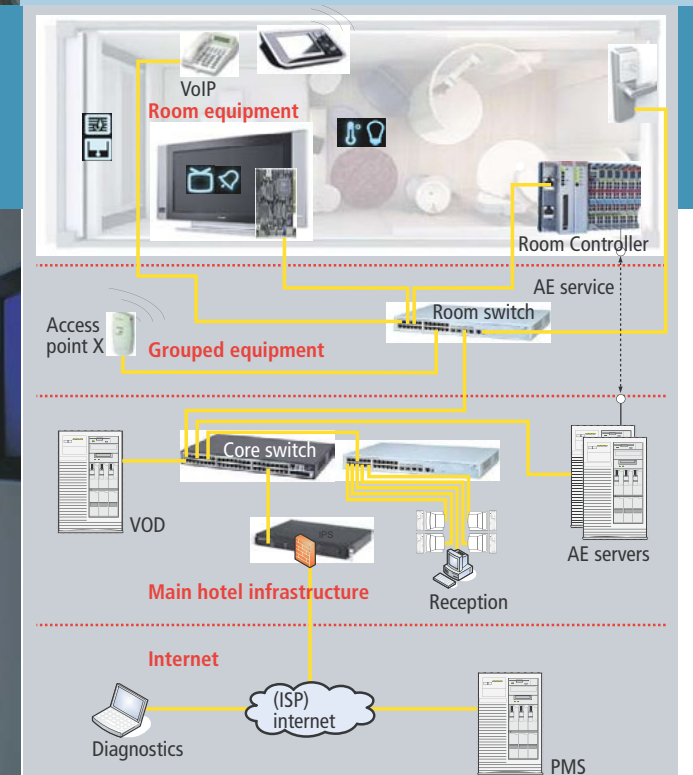
→ CitizenM Hotels www.citizenm.com

→ Industrial Automation Link www.ial.nl



Each hotel room is fitted with LED lighting. The color can be changed for different lighting scenes.

Control structure in the CitizenM hotel



The rooms are adapted precisely to the guest's wishes: they are equipped with a large bed, a "rain shower," designer fittings and the latest electronic appliances.

Optimized waterway management:
Reliable recording
and transmission of
water levels



Flow measuring point Sulz – Berching, Germany: Ultrasonic probes determine the total runoff. A float system is used for measuring the water level. An Embedded PC collects, compares and stores the level and flow values and transfers them to the lock via radio modems and the Modbus protocol.

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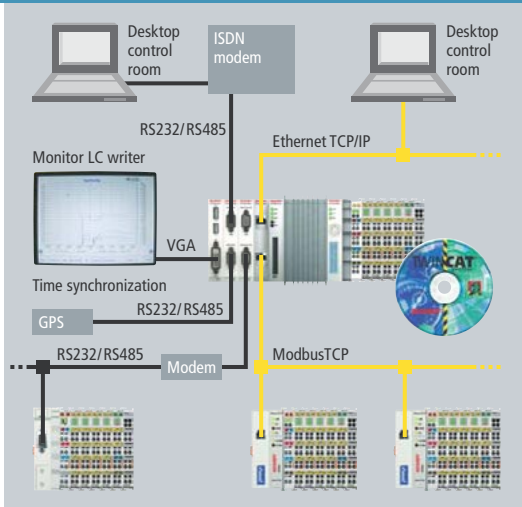
Precisely timed, high-resolution measurement technology for configuration and optimization of electric drives

EtherCAT-based test rig for eco-friendly electric car



OSCAR is a sporty, emission-free and safe city car for two people that runs on electricity and can reach speeds of up to 130 km/h (80.7 mph). With around 6 kWh of electricity, OSCAR can travel around 100 km (62 miles). This is equivalent to the amount of energy a modern car engine can extract from 1 liter of diesel. A further OSCAR advantage is that the electrical energy can be generated by renewable sources such as the sun, wind and water.

→ Ingenieurgesellschaft für Automation (IFA) mbH, based in Heddesheim, Germany, has been highly active in the area of waterway monitoring for many years. IFA is able to offer cost-effective, long-term solutions through adaptation of industrial equipment to water management applications. The company uses the CX10xx Embedded PC from Beckhoff for data logging and transfer.



More complex data acquisition systems use multi-level information processing. At the lowest level, Bus Terminal stations collect the measured data. A central Embedded PC is used for data processing.

The level, flow velocity and flow rate are displayed as a progressive curve on a TFT monitor via the IFA visualization system.



Applications such as shipping, hydropower plants and dams, waterway operators and residents of areas that are susceptible to flooding require reliable and current information about water levels in watercourses, flow velocity and flow rate. IFA provides complete solutions for sampling, recording and transferring such data. "The data have to be current and reliable," said IFA managing director Martin Weinläder. "We achieve this by using a number of data sampling points along watercourses and through safe and fast data communication. Of key significance are data transfer systems that can be used independent of the location and environment while offering maximum reliability and safety. This is where automation technology from Beckhoff comes in."

The application of general standards enables integrated communication

In Germany, IFA has already installed more than 100 data logging stations with Beckhoff technology at locations such as the Elbe Seitenkanal (Elbe lateral canal), the Mittellandkanal (midland canal), the Moselle River, the Rhine-Main-Danube Canal and the Neckar River. Radar systems, hydrostatic immersion probes, floats with absolute encoders or ultrasonic measuring systems measure the water level and velocity. Beckhoff Bus Terminals pick up the measured data with high precision and link them with information processing systems. At the heart of the recording and transmission technology are Embedded PCs from the CX10xx series with Windows CE and TwinCAT as automation platform. This is where the data are collected, compared and stored. An internal Compact Flash card is used for data storage.

More complex data acquisition systems use multi-level information processing. At the lowest level, Bus Terminal stations collect the measured data and transfer them to the Embedded PC via Modbus TCP. The measured data are displayed as a progressive curve on a TFT monitor via the IFA visualization system. The system is programmed in C++ and is integrated in the TwinCAT-based process control system via ADS. The measured data are continuously available via WLAN, dedicated SDSL lines, ISDN, GSM/GPRS or ISM radio, or they can be retrieved as required. "The solution offers clear advantages", said Martin Weinläder. "We can use a standard product for a niche application and meet specific requirements through our own software. This ensures cost-effective and robust solutions. Depending on the application, we use different fieldbus systems such as PROFIBUS, CANopen, DeviceNet or Modbus and serial RS232/RS485 interfaces, which can be integrated easily and conveniently into the terminal system via the Bus Couplers and the system interfaces on the Embedded PCs. The device interfaces and protocols are based on general standards for convenient interfacing with automation and control systems."

→ IFA mbH – Ingenieurgesellschaft für Automation, Deutschland
www.ifa-mbh.de

OSCAR creates zero emissions and provides energy efficiency through an innovative drive solution. It consists of a high-speed asynchronous machine (running at 25,000 rpm), an automatic two-speed gearbox, new high-energy batteries and advanced IGBT power electronics. The 1-liter car was developed by Akasol e.V., the academic solar engineering group at Darmstadt University of Technology in Germany. The test rig for configuration and optimization of the drive is controlled by Beckhoff equipment and was supplied by CuroCon GmbH, a partner company of Akasol.

Akasol validates this drive solution on a fully automated drive test rig that controls the drive train while dynamically taking into account different load cases, measures performance and other characteristics, and parameterizes it so that the drive efficiency is maximized under all driving conditions. "Key requirements are deterministic, precisely timed, high-resolution measurement technology and correspondingly fast and exact data acquisition and processing. The PC-based control platform from Beckhoff offers exactly the right solution," said Felix von Borck, director of Akasol.

EtherCAT enables sampling rates of < 1 millisecond

At the core of the control system is a Beckhoff Industrial PC C6901 with Windows XP operating system and TwinCAT PLC as the control software. EtherCAT, the Ethernet-based fieldbus, is used as bus system. In combination with the analog and digital EtherCAT input and output terminals, the test rig features sampling rates of less than a millisecond. "We were able to assemble the I/O elements required for the drive test rig from the comprehensive range of Beckhoff Bus Terminals. The openness of the system also enables convenient integration of serial interfaces (RS232) and subordinate bus systems, such as CANopen, directly into the terminal system," said Joachim Petersen, project engineer at CuroCon. "Sensor readings for temperature, motor current, switched motor voltage, speed and torque of the drive axes and the motor shaft are sampled and processed in real time." Based on the LabView system, CuroCon developed the flexible CuroControl test rig software that controls the test rig and creates test schedules in conjunction with TwinCAT PLC software from Beckhoff. A Beckhoff Control Panel



Technical data
6 kWh/100 km
range: 100 to 300 km
max. speed: 130 km/h
length: 2.50 m
height: 1.55 m
width: 1.20 m

OSCAR, the sporty, emission-free city car for two people, only uses 6 kWh of electricity per 100 km (62 miles). This is roughly equivalent to the amount of energy a modern combustion engine can extract from 1 liter of diesel.



The electrical drive consists of high-speed, high-efficiency asynchronous motors with copper rotors and compact dimensions. The gear system is designed for high input speeds. An automated drive test rig with control equipment from Beckhoff optimizes the energy consumption of the drive system.

is used for visualization. Joachim Petersen is convinced: "The speed, modularity and flexibility of the Beckhoff hardware and software speak for themselves. The components are individually configurable, simple and practical to handle. We have no doubt that the next three test rigs will also be equipped with technology from Beckhoff."

→ Akasol e. V. www.akasol.de
→ CuroCon GmbH www.curocon.de



52 events



PC Control 02|2008



PC Control 02|2008

53 events



Impressions Hanover Fair 2008



AX5000 Servo Drive:
EtherCAT-based Drive Technology



New: IPC series C65xx for control cabinet
installation for Intel® Core™ Duo/Core™2 Duo



Application Park

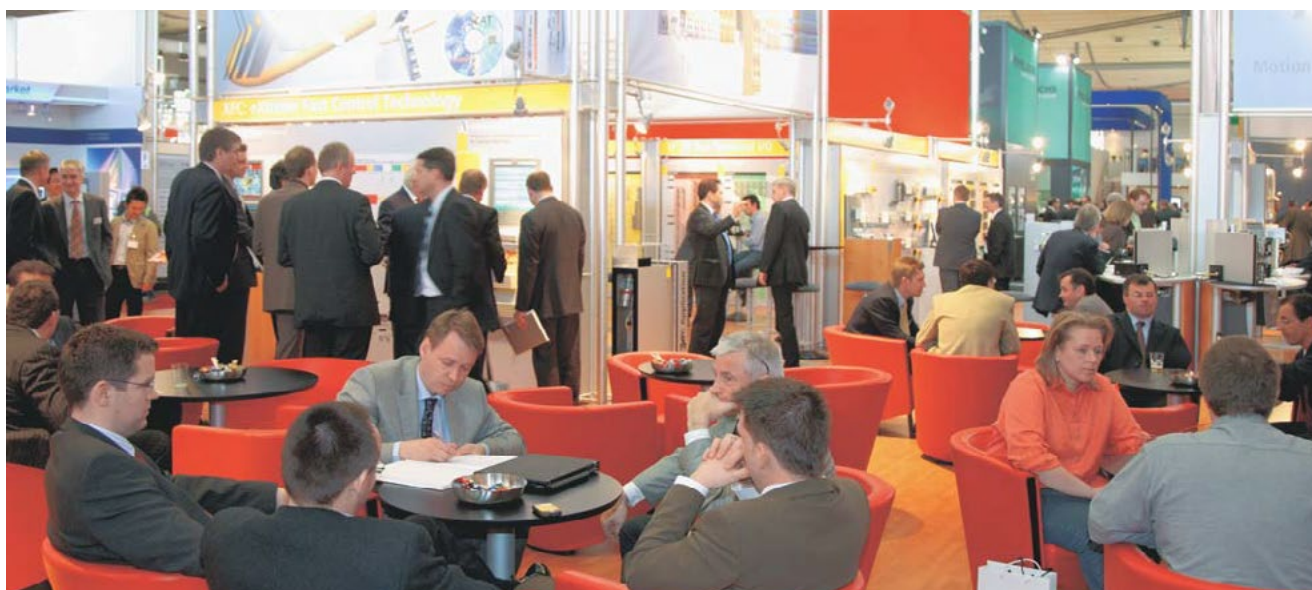
Automatica 2008: Integrated control platform for all robot types

At Automatica 2008, which took place between 10 and 13 June at the trade fair site in Munich, Germany, Beckhoff presented its PC-based robot control solution for handling, manufacturing and assembly applications. Gantry robots, SCARA, articulated or parallel kinematics – the right robot for any machining step, yet only one automation platform. PC-based control technology from Beckhoff enables the whole process chain for individual processing machines and complete production lines to be controlled and monitored: feeding, joining (welding, gluing, etc.), assembly, checking, handling and palletising.



Beckhoff Building Automation at Light+Building 2008

At Light+Building 2008 in Frankfurt a.M., Germany, Beckhoff presented its complete range of PC- and Ethernet-based control technology for intelligent buildings. Beckhoff rounded off its building automation components with innovations and additional products from the fields of building, storey and room controllers, I/O systems for data acquisition and building software.





Trade shows 2008



Europe

Germany

EuroBLECH
October 21 – 25, 2008
Hanover
Hall 11, Booth G13
www.euro-blech.com

Forum Maschinenbau
November 5 – 7, 2008
Bad Salzungen
www.forum-maschinenbau.com

SPS/IPC/DRIVES
November 25 – 27, 2008
Nuremberg
Hall 7, Booth 406
www.mesago.com/SPS

Austria

Vienna-Tec
October 7 – 10, 2008
Vienna
Hall D, Booth D0411
www.vienna-tec.at

Belgium

Mocon-Hydromech
October 14 – 15, 2008
Gent
Hall 8, Booth 8010
www.easyfairs.com

Finland

Tekniikka
October 1 – 3, 2008
Jyväskylä
Booth C-309
www.jklpaviljonki.fi/tekniikka2008/eng.php

France

SCS Paris 2008
December 2 – 5, 2008
Paris
www.scs-expo.com

Italy

Save
October 21 – 23, 2008
Verona
www.exposave.com

Russia

PTA Moscow
October 1 – 3, 2008
Moscow
www.pta-expo.ru

Hi-Tech Building & House 2008
October 20 – November 1, 2008
Moscow
www.hitechhouse.ru

PTA Ural
December 2 – 4, 2008
Ekaterinburg
www.pta-expo.ru

Industrial Electrical Engineering
December 9 – 12, 2008
Saint-Petersburg
www.farexpo.ru

Spain

MATELEC
October 28 – November 01, 2008
Madrid
Hall 5, Booth 5E05
www.ifema.es



North America

USA

Fabtech International &
AWS Welding Show 2008
October 06 – 08, 2008
Las Vegas
Booth 12269
www.fmafabtech.com

ISA Expo
October 14 – 16, 2008
Houston
Booth 2505
www.isa.org/isaexpo2008

Pack Expo
November 09 – 13, 2008
Chicago
Booth 6425
www.packexpo.com

Asia

China

China Brew & Beverage 2008
October 20 – 23, 2008
Beijing
Hall 3, Booth 3205
www.chinabrew-beverage.com

Industrial Automation Show 2008
November 04 – 08, 2008
Shanghai
www.industrial-automation-show.com

World Tobacco Asia 2008
November 11 – 13, 2008
Macau
Booth K8
www.worldtobacco.co.uk

Miconex 2008
November 18 – 21, 2008
Beijing
www.miconex.com.cn

India

Automation 2008
September 25 – 28, 2008
Mumbai
www.automation2008.com

Industrial Automation India
December 10 – 13, 2008
Bangalore
www.ia-india.com

United Arab Emirates

Working Buildings Middle East
November 17 – 18, 2008
Abu Dhabi
www.workingbuildingsme.com

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www.beckhoff.com

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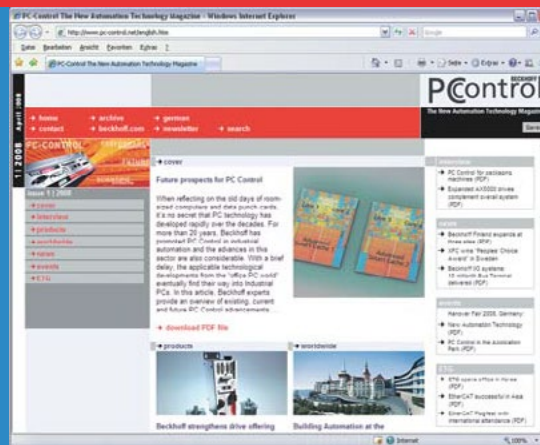
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