Beckhoff strengthens drive offering
The AX5000 EtherCAT Servo Drive range has been expanded with new versions and options.

Building automation at the Grand Hotel
The Dolder Grand, one of the largest construction projects in the Swiss hotel sector, was modernized with intelligent building automation.

Future prospects for PC Control
PC-based control technology has by no means tapped its full potential. What could the IPC achieve with amplified processing power?
The new Panel PC generation

- Panel PC with Beckhoff Motherboard
- Intel® Core™ Duo/Core™2 Duo technology
- 12-, 15- or 19-inch TFT display
- Slimline housing design
- Only 98 mm housing depth
- All-round IP 65 protection

- www.beckhoff.com,cp72xx

The Industrial PC with mounting arm and 3½-inch motherboard

The CP72xx Panel PC series with high-performance Core™ Duo technology in an ultra compact slimline housing:

- Intel® Core™ Duo or Core™2 Duo processors
- 512 MB DDR2RAM, expandable up to 2 GB
- 1 Mini PCI slot free for fieldbus or Ethernet interface
- 1 x 10/100BASE-T, 1 x 1000/1000BASE-T Ethernet
- 1 x SATA hard drive, 2½-inch
- 1 x Compact Flash slot (optionally second hard drive)
- SATA RAID 1 controller for hard drive mirroring
- Mounting arm installation optional from above or below (rotatable and tiltable)
- Customised options available

For further information and international sales contacts see: www.beckhoff.com

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EtherCAT Coupler and junction terminal with glass fiber technology for long network distances
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Port multiplier: Connection of eight independent Ethernet networks to one PC
New small controllers for Bus Terminal system: Comprehensive Ethernet controller family
DVI splitter CU8810 with four DVI/USB channels

AX5000 EtherCAT drive series expanded
CX1020: High-performance Embedded PC with “Economy” CPU
Software library for TwinCAT PLC expanded: Telecontrol protocols now complete
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Machine Solutions Inc., USA, utilizes PC Control, EtherCAT and TwinSAFE

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BSAutomatisierung GmbH, Germany: Farm waste recycled into biogas

ETG
EtherCAT successful in Asia

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30 | worldwide
Ilsenburger Grobblech GmbH, Germany: “Global Control” in action
Visitors to Scanautomatic, the largest Scandinavian trade show for industrial and process automation, awarded the prestigious Scanautomatic prize to eXtreme Fast Control Technology (XFC) from Beckhoff.

The conclusion from the trade show, which takes place every two years in Gothenburg, was that Sweden’s machine manufacturers must aim for maximum performance and flexibility in order to maintain their leading position in the world market. This requires high-end automation technology, as is provided by XFC. Beckhoff was also awarded the highly sought-after Scanautomatic system prize in 2003 for EtherCAT as the most innovative automation solution.

XFC wins “Peoples’ Choice Award” at Scanautomatic 2007 in Sweden

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Beckhoff Finland expands at three sites

The Beckhoff branch office Beckhoff Automation Oy has been recording continual growth in the Finnish market for eight years. With the relocation of the headquarters to the “Technology Centre TechVilla”, the company is acknowledging the good business development and creating the conditions for further growth. The sales offices in Seinäjoki and Tampere will also move to new premises shortly.

Beckhoff Automation Oy began the year 2008 by opening the new, modern office in the “TechVilla” in Hyvinkää. “With optimally planned office spaces, the enlarged warehouse and a modern support and service area, we can offer our customers an optimum service. Well-equipped, spacious training rooms are now also available,” explains Mikko Uuskoski, managing director of the Finnish Beckhoff branch office.

The traditional annual seminar “Automation in Motion” took place at the same time as the opening. Hundreds of guests, customers and business partners were informed about the latest trends and developments in PC-based automation technology from Beckhoff and visited the new premises.

“Scanautomatic was a great success for Beckhoff, not only because of the award for XFC, but also because our New Automation Technology attracted substantial interest,” said Håkan Brandt, Managing Director of Beckhoff Sweden. “With eXtreme Fast Control Technology, we have further strengthened our position in the automation market and demonstrated that high-tech system solutions can be based on standard components.”
The Beckhoff Bus Terminal system is a universal I/O system designed in protection class IP 20 and consists of electronic terminal blocks for direct sensor/actuator wiring. Since its market introduction, it has been continuously developed: More than 300 Bus Terminals and Bus Couplers are now available for almost all signal types and fieldbuses. The Bus Terminal system stands for maximum openness: All major fieldbus and Industrial Ethernet systems are supported. It is used in a wide range of applications, including machine construction, processing and building automation.

The compact design of Beckhoff Bus Terminals and their modularity (available in 1-, 2-, 4- and 8-channel versions, with KM modules even in 16-, 32- and 64-channel versions) offer the user significant competitive advantages. The Bus Terminals’ small footprint in control cabinets and simple wiring save time and costs. The fine granularity of the Bus Terminal system means that the user only has to buy the I/O points that are needed.

Uwe Prüßmeier, Product Manager for I/O Systems, said: “An important step in the further development of the Bus Terminal system was the direct integration of PC Control at the I/O level. In combination with the Bus Terminals, the Embedded PCs of the CX series offer a high-performance system for centralized or local control. In addition to standard functions, special Bus Terminals increasingly deal with PLC, Motion Control and measuring tasks with stringent requirements in terms of accuracy and particularly fast sampling. The integration of TwinSAFE terminals into the Bus Terminal system enables optimal synergy of standard automation and safety technology and has opened up further application areas.”

Michael Jost, Product Manager for I/O Systems, added: “In addition to the technological advancement of the Bus Terminal system, Beckhoff always focuses on cost optimization. We want to continue setting technological standards while making existing technologies more cost-effective. Even after 13 years the Bus Terminal system is still enjoying significant growth.”

www.beckhoff.com/busterminal
The international showcase trade show for automation will take place between 21 and 25 April 2008 in Hanover, Germany. In addition to Factory Automation, Interkama and Industrial Building Automation, there will be no less than seven further trade shows. Beckhoff will have two booths at Hanover Fair 2008. In Hall 9, Booth F06, Beckhoff will exhibit the major technology areas of “New Automation Technology”: IPC, I/O, Motion and Automation. In the “Application Park”, in Hall 17, Booth D26, which focuses on PC Control, Beckhoff will present basic and future technology for PC-based control systems such as “Scientific Automation” in collaboration with Intel, Microsoft and other partners.

**PC-Control | Industrial Core™ Duo**

In the IPC Forum Beckhoff will present its integrated hardware and software platform for Intel® Core™ Duo and Intel® Core™ 2 Duo processors. A new, fanless IPC series for control cabinet installation with very compact design is also equipped with Core™ Duo technology.

“Plenty of computing power within minimum footprint” is also the motto of the new Beckhoff Motherboard based on the new Intel® Menlow platform with Silverthorne CPU. The first Beckhoff Motherboard with Silverthorne processor for PC/104 sets a new PC power density milestone.

The IPC segment will also focus on an extended visualisation concept: The DVI/USB splitter simultaneously distributes the image from a PC to up to four displays at a distance of up to 50 m. With the new ADD2 cards any Core™ Duo IPC from Beckhoff can show two separate images with different resolutions, again at a distance of up to 50 m.

**EtherCAT | Motion Control**

At Hanover Fair 2008 Beckhoff will focus on drive technology and motion solutions. The AX5000 EtherCAT Servo Drive range has been expanded by new versions with rated currents of 18 and 25 A respectively, the safety optional card with restart lock as well as the AM3500 series servomotors, which are now also available with BISS encoders.

Extended options for the “small” drive segment in the form of the modular Bus Terminals will also be presented. In addition to stepper and DC motors the new KL2791 Bus Terminal can also be used for modifying the speed of single-phase AC motors up to 200 W. In this simple way the speed controller can significantly reduce the capacity of pumps and fans.

The EtherCAT terminal range, which combines maximum performance with maximum accuracy, will be extended with further I/O blocks. With the EL3602, Beckhoff presents a new generation of high-precision analog equipment: The measurement readings are sampled with an accuracy of 0.01% and therefore offer an optimal basis for high-performance and high-precision instrumentation. EtherCAT is also the basis for the XFC eXtreme Fast Control Technology, which enables users to improve the quality of their machines and to reduce response times. XFC increases efficiency and therefore the sustainability of machines and offers machine manufacturers significant competitive advantages.

**The main information at a glance:**

- **Hanover Fair 2008, Germany**
- 21 to 25 April 2008
- Opening hours: Monday–Friday 9 am–6 pm

**Beckhoff – 7 times at Hanover Fair 2008:**

- Beckhoff main booth: Hall 9, Booth F06
- PC Control in the “Application Park”: Hall 17, Booth D26
- Special “Energy Efficiency” exhibition: Hall 6
- EtherCAT Technology Group: Hall 9, Booth F13
- PROFIBUS user organisation: Hall 11, Booth A41
- PLCopen: Hall 9, Booth H68
- TectoYou, an initiative for young people: Hall 26

Further Information:

- [www.hannovermesse.com](http://www.hannovermesse.com)
Hanover Fair 2008: PC Control in the Application Park in Hall 17, Booth D26

The trade show presence in the “Application Park” in Hall 17, Booth D26, is based on the motto “PC Control – Open Platform for Advanced Automation”. Together with Intel, Microsoft and other partners, Beckhoff presents current and future technologies based on PC-based control technology, such as leading edge “Scientific Automation”.

PC Control – Open Platform for Advanced Automation

In the Application Park Deutsche Messe AG intends to convey practice-orientation with live demonstrations. The Beckhoff presentation focuses on PC Control as the basis for open, high-performance and future-proof control technology. The main topics are:

- PC Control
- Performance in Automation
- Future of Automation
- Scientific Automation
- PC Control Applications

In keeping with the prediction of the joint founder of Intel, Gordon Moore, PC Control technology brings a doubling of the CPU power for control applications every 18 months. Hence the question can already be asked today: “What can an Industrial PC with 32 GB RAM and a 64-core CPU achieve?” Beckhoff will provide answers in the “Application Park” at Hanover Fair.

Today’s Industrial PCs are already regarded as the most efficient control platform. With increasing processor power they will be able to perform additional tasks, in addition to basic functions such as PLC, motion and HMI. This means that special functions, such as vision, robotics and measurement technology, which are usually implemented as special hardware units today, will soon become part of the software PLC.

Further Information:

www.beckhoff.com/PC-Control-Live/
In PC Control technology, Beckhoff has created a standard that has established itself worldwide and is used in the widest variety of applications and industries. Its universality and versatility will be demonstrated in the “Application Park” through several application examples, including a CNC timber processing centre and a micro-injection molding system for medical products. With the high-speed “SpiderCam” camera system, Beckhoff offers an interesting example for an application outside machine and system engineering.

CNC machining center

The Venture series from Weeke Bohrsysteme GmbH, based in Germany, handles all machining functions such as drilling, milling and sawing, as well as grooving of workpieces in a single clamping and remains flexibly expandable based on a modular system. The control equipment is based on PC Control from Beckhoff.
The SpiderCam is used regularly in shows or sports events in German television. Different cameras can be fitted to the camera head, or dolly, according to need. The image signals are transmitted to the director’s booth or the transmitter van along the glass fiber that is embedded in the plastic cables.

PC-based Control becomes a film star

In the SpiderCam, the company of the same name has developed a camera robot that moves the camera freely in every direction, like a remote-controlled aircraft. A cable winch system can be attached to four masts, to the ceiling or to other available fixed points to hold the camera in the desired position. Cable winches that shorten and lengthen the cables and coordinated controls drive the system, making it fast and agile. Speeds of up to 9 m/s (32 km/h) are possible.

In order to control this complex process, spidercam GmbH is using a CX1000 Embedded PC running Windows CE as an operating system for the central controller. Each winch station incorporates a CX9000 Embedded PC with TwinCAT software that communicates through network variables with the CX1000 in the central control unit. Integrated TwinSAFE I/O terminals ensure maximum safety, particularly at critical times such as commissioning or when under manual control.

In spite of the complex technology, it is relatively easy to use the SpiderCam. Only two people are needed to operate the camera system. While one flies the SpiderCam through space with the aid of a joystick, the second operates the camera itself. A control monitor with online display provides accurate information about the exact position of the camera at all times.

High-precision, micro-structured components through PC Control

In the Application Park Beckhoff will present a micro-injection molding system with linear drive, which was developed in cooperation with the Department for Medical Engineering at TU München. The machine was developed as the core of a compact production cell for the manufacture of micro precision parts for medical applications.

PC-based control technology from Beckhoff was selected for the implementation of the real time control and regulation of the machine processes. The task of the micro injection molding machine is to move and mould small masses with high precision and repeatability. This demands extremely short reaction times and high sampling rates from the controller. This is where XFC technology is used. It enables deterministic system reactions in the order of microseconds.

The booth partners

- Intel, www.intel.de
- Microsoft, www.microsoft.com/embedded
- Microsoft Research, www.microsoft.com/emic
- Weeke Bohrsysteme, www.weeke.de
- IPA Robotersysteme, www.ipa.fraunhofer.de
- spidercam, www.spidercam.tv
- Delmia, www.delmia.com
- Hasso Plattner Institut, www.hpi-web.de
- TU München/Medical Engineering, www.medtech.mw.tum.de
- Cologne University of Applied Sciences, www.fh-koeln.de
- University of Kassel, Embedded Systems section, www.uni-kassel.de
Beckhoff delivered the first PC controller in 1986. How has automation software changed over the last 22 years?

Andreas Thome, Product Manager PC Control: Rapidly, but also consistently. An important step was the introduction of the IEC 61131-3 programming standard as a versatile PLC programming language. This led to a certain degree of consolidation, and suppliers have become a little more comparable from the customer’s perspective in terms of software features. Real-time capability within the respective operating system was and remains another key issue in the development of automation software. It is interesting to note that the world of automation implemented real-time capability robustly and reliably. Using Beckhoff as an example illustrates this clearly: The company managed to implement hard real-time with response times of 1 millisecond or less under all Microsoft operating systems, starting with DOS and followed by Windows 95/98, NT, 2000, XP and Vista.

Ramon Barth, Manager Software Development: Today, automation software has a significantly higher degree of abstraction than in 1986. This is supported by higher programming languages. Since the introduction of IEC 61131-3, Instruction List and Ladder Diagram are in retreat in terms of usage. A further trend is increasing modularization of the software with the aim of better reusability and maintenance. Advanced PC processors can easily satisfy higher computing power requirements. Thanks to PC technology, the integration of automation devices in IT networks is well advanced.

How have Industrial PCs changed over the last 22 years? What is your vision for the future for a new generation of Industrial PCs?

Roland van Mark, Marketing Manager Industrial PC: 20 years ago large, clunky and heavy PCs were installed on mounting arms directly at the machine or in housings, because PCs and displays were inextricably linked. Beckhoff was the first manufacturer 10 years ago to introduce displays with CP-Link, which enabled distances of up to 100 m from the PC. The PC can be installed in the control cabinet; two coaxial cables lead to the CP-Link Control Panel, a slimline, elegant control device with a depth of only 3 cm that is installed at the machine operator’s workstation. The increasing complexity of applications led to an increase in the number of fieldbus cards and data cables connected to PCs. Over recent years, Beckhoff responded to this trend with different IPCs and now offers a wide range of devices – in other words, the right PC for almost any application.

One example for a new generation of IPCs is the CP72xx IP 65 Panel PC from Beckhoff. It offers machine operators a compact Panel PC that can be optimally positioned at the machine. Only two or three Ethernet cables and the power supply run through the mounting arm. No space is required in the control cabinet for PC installation. For large machines, additional control units can be installed as Ethernet Control Panels.

Existing Industrial PCs are also continuously optimized: Every year new, high-performance processors find their way into all Industrial PCs of our comprehensive product range. Time and again we develop additional PC designs that open up new application areas. PCs are becoming smaller and smaller thanks to energy-saving processors, more integratedmoth-
erboards, elimination of plug-in cards and the application of Compact Flash as data storage.

What is your vision for the future for a new generation of Industrial PCs/Embedded PCs?

Andreas Thome:
The focus is on developments offering high-performance processors with minimum heat output. The forthcoming Intel products – particularly the Intel® Atom™ processors (Menlow platform with Silverthorne CPU and Poulsbo chipset) – enable a further change in the power density of Industrial PCs. Plenty of computing power within the minimum footprint – this inspires the imagination of engineers and designers, and it will be interesting to see what new form factors they come up with. A hot topic for Embedded PCs is fanless design in view of rising processor power. For Industrial PCs, I expect increasing consolidation of display and computing units, since the PC as a smaller and smaller accessory will no longer be the determining element for device design but rather act as an “add-on” for the display. Moreover, I wouldn’t be surprised if PCs began to be used in power controllers for motors or individual machine components. This will once again raise the issue of centralized versus local control technology. The further miniaturization of processors progresses, the more topical the issue of local intelligence will become. In turn, this will require more powerful development tools for controlling and programming a complex system consisting of many individual CPUs. As a result, the programming standards in the automation technology will have to develop further towards distributed systems.

Industrial multi-core

What effects do dual- and multi-core processors have on new control architectures?

Ramon Barth:
The high computing power of PC controllers enables the creation of software-based automation solutions that in the past required dedicated hardware components. Multi-core processors will reinforce this trend further, since processor-intensive fast algorithms will be able to use one of the cores exclusively.

Andreas Thome:
Currently in automation technology, it is mainly the operating system that benefits from dual- and quad-core technology. Immediate benefits for the user arise from faster visualization software, which runs smoothly despite simultaneously operating real-time automation and offers fast image switching cycles and 3-D graphics. For the future, however, this is not sufficient. Automation software can also be distributed to individual cores in order to run several tasks simultaneously within the overall system, for example.

Since Beckhoff develops its own motherboards it can quickly respond to new processors or chipsets. What developments are to be expected over the next few years?

Andreas Thome:
Beckhoff expects developments to go in two directions: On the one hand, support for new processors with low thermal output.
(keyword: Intel® Menlow platform); on the other hand, implementation of the latest multi-core technology, e.g. Intel® Core™ 2 Quad processors. In this way, continuity and performance increases for all Beckhoff products are guaranteed. A further form factor in addition to ATX, Slot, 3½”, Compact and PC/104 will be COMExpress. Custom designs will also be available for the new processor family on request.

Communication

What are the demands of PC-based control technology for the fieldbus or communication system?

Uwe Prüßmeier, Product Manager I/O Systems: PC-based control technology vastly differs from standard, PLC-based control technology in terms of hardware performance. By integrating new and more powerful CPUs, the PC can be greatly enhanced with comparatively little effort. A wide range of available tools facilitate integration in other systems, and the human-machine interface is also much more user-friendly. This results in increasing bandwidth for the underlying bus system. More and more parameters and interfaces are transferred via the bus system, in parallel with the process data. The computing power of a PC enables processing of larger and larger programs and data quantities. At the same time sensor technology supplies larger and larger data quantities, which also results in increasing bandwidth. Increasing CPU performance enables faster processing of programs. Computing algorithms are becoming more exact – with smaller dead time and smaller jitter. Positioning tasks can become up to ten times more precise if sampling takes place without jitter. The communication system must be equivalent in performance. Larger control programs, and therefore more extensive I/O systems, require system-based diagnostics and maximum topology flexibility. The bus system should support any topology and be able to carry out automatic diagnostics for troubleshooting. Redundancy is an important cornerstone for high availability in large systems.

Which benefits does EtherCAT offer for PC-based control technology?

Uwe Prüßmeier: EtherCAT satisfies the above requirements in an excellent manner. For the foreseeable future, the performance of EtherCAT is likely to be more than adequate, and its implementation represents an intelligent investment in the future. A wide range of equipment is already available today that offers users a future-proof, open and flexible interface with large reserve capacity for more than a decade.

What cost benefits does EtherCAT have for machine construction and system engineering?

Uwe Prüßmeier: EtherCAT offers customers a single bus system for all applications, with the advantages of lower storage and training costs. The large system reserve enables fast, simple and robust design of the communication solution. Because the system is topology-independent, practically no additional structural components are required. The fact that EtherCAT is so widely used offers a healthy competitive environment between similar suppliers and helps avoid a high-price policy for third-party EtherCAT devices. In addition to the price advantages for the individual I/O components, the elimination of a special fieldbus master card and the cost-effective Ethernet cables and connectors offer further savings potential.

How does XFC technology contribute to higher energy efficiency?

Uwe Prüßmeier: XFC – eXtreme Fast Control Technology – is based on an optimised control and communication architecture comprised of an Industrial PC, ultra-fast I/O terminals, EtherCAT and TwinCAT. With XFC it is possible to achieve I/O response times ≤ 100 µs and jitter in the reaction time << 1µs. This technology opens up new process optimization options for the user that were not possible previously with traditional components. By reducing the cycle and response times, tolerances are reduced. As a result, product quality increases. Furthermore, more exact control also means that fewer defective products are produced.
By means of very short reaction times, XFC reduces the times in which the machine is “waiting” for the controller. In this way, the same machine can produce more with greater precision. In addition, energy consumption is significantly reduced, because a machine requires additional energy in waiting mode. The savings range from a few percent to double-digit percentages. At the same time, the energy use for production is reduced, since XFC enables the same quantities to be produced with fewer machines. In turn, less production floor space is required, leading to even greater savings potential.

In servo systems XFC reduces motor losses, since the set values are output more exactly. The motor operates quieter and generates fewer losses; and the mechanical system is subject to less wear.

Do today’s communication systems still have room for innovations?

Uwe Prüßmeier: From a technical perspective, there is always room for new innovations. The only issue is cost-effectiveness. As long as an existing design can be adapted to technical progress through continuous development – while safeguarding the compatibility of the installed base – new development can be too expensive, particularly from a user perspective. Ethernet-based solutions will continue to benefit from further development in office applications, just like PC technology has done for years. In this way, transfer rates can be increased further without high costs. Over the next few years, there will be no leeway for another system from an economics point of view.

Which benefits does integration of these functions into PC Control offer?

Josef Papenfort: If the special functions are realized in software, the programmer has opportunity for intervention. Special filters or controllers, for example, can be programmed by the user himself.

How is PC-based measurement technology integrated in the overall Beckhoff automation concept?

Josef Papenfort: Measurement technology is a key component of an automation system. Only integration in a CPU enables all functions of a measuring system to be utilized optimally. Many filters and controllers can already be used through PLC libraries. In addition, interfacing with commercial tools such as LabView or Matlab/Simulink is possible.

Which specific products are already available today? Which further developments are planned?

Josef Papenfort: Measured data can already be transported to the central PLC via the high-performance fieldbus. A number of PLC libraries with different filters and controllers are already available for this purpose and are utilized intensively by customers. In the future we will offer even better integration with tools such as LabView and Matlab/Simulink.

What is your vision for the future for PC-based measurement technology?

Josef Papenfort: One aspect is optimal utilization of EtherCAT in order to feed measurement readings into the PLC quickly and with exact timestamps. The EtherCAT distributed clock feature is a key component for achieving this. In addition, libraries with digital filters and controllers must be available and – based on these – familiar and reliable measuring and control products must be integrated more closely.
linking of all data. The control solution could be distributed or local, although the user must be able to set up and maintain such an interwoven network. In my view this is best done based on a central device that enables reliable debugging, checking and revision. With a local solution the communication effort is comparatively more complex than with a centralized one. Backup of all parameters and programs with a central PC is a proven procedure that is easy to handle.

Future of Automation

What could an Industrial PC with 32 GB RAM and a 64-core CPU achieve?

Josef Papenfort: The IPC will no doubt continue to do what it already does at Beckhoff, i.e. running I/O, PLC and Motion Control on a single device. A trend in moving to more and more complex PLC programs is already apparent. Cycle times are becoming shorter and shorter. The number of axes to be controlled synchronously will increase, and the type of coupling between the axes will become more complex. Electronic cam plates and gearing will also increase. In the future, many axes will be operated based on interpolation. However, in a few years’ time, an advanced CPU will easily be able to cope with this. Integrated vision and robot systems will no doubt be possible in software. With sufficient CPU power, advanced and familiar control algorithms – such as neural networks – may become suitable for industrial applications. More complex machines require more diagnostics and maintenance. Expert systems and sophisticated diagnostics will make life easier for the end user. New input and output options such as voice input, for example, will simplify machine operation.

Uwe Prüßmeier: “Faster, higher, further” is always possible, although it should not be an end in itself. Higher performance must offer users clear benefits. Initially higher performance is not likely to be associated with rising costs. The main question therefore is: “What do we do with it?” General requirements are simplification of the operation, improvement of the integration in other systems and optimization of visualization. Improvement opportunities also exist for control tasks: Faster program execution, shorter cycle times, forward-looking maintenance and improved diagnostics. Online quality control of the production processes may also become possible.

Andreas Thome: Starting from the early days of PC technology people have dreamed of AI – artificial intelligence. Unfortunately, no intelligence that can match human intelligence has been created to-date, although in the future, this dream might come closer to reality through multi-core systems and brute computing force. In future computer generations, gesture, voice and image recognition procedures will be able to access terabytes of local data and at least provide support as sophisticated expert systems. In industry (and elsewhere) this can be used for improving process operation, more human interaction, faster troubleshooting and product quality checks. Each system component or machine module could be allocated to a core, so that parallel processing with high clock frequencies might become possible. However, experience over recent decades indicates that sudden technological developments – simply on the basis of faster computers – are not to be expected: Many applications will become faster and better; and this in turn will lead to a wide range of new options. After all, who would have thought a few years ago that a small GPS ‘box’ could show us the way, offer voice directions and at the same time provide commentary on places of interest?
At Hannover Fair 2008, Intel is a co-exhibitor at the Beckhoff PC Control booth. What made you decide to participate and what will Intel be exhibiting?

Intel regards the embedded market as a growth area that is strongly shaped by automation technology. Beckhoff Automation offers an ideal platform for presenting Intel technology in the embedded sector. We will show the benefits of dual- and multi-core processor technology in PC Control, explain the wide range of Intel solutions, including software tools and one-chip solutions, and offer visitors insights into future 45 nm technology developments.

Which processor technology trends led to the development of multi-core processors?

Miniaturization of the internal feature size (from 90 nm to 65 nm and 45 nm) enables Intel to integrate several processor cores into a single chip. In this way, we can increase the performance of the processors, and at the same time, their energy efficiency. With the introduction of 45 nm High-k based transistors, for example, we were able to reduce the power consumption by 50 % compared with the previous generation, or increase performance by 38 % with the same power consumption. In addition, our advanced software tools enable our customers to utilize the new options outside the server arena through parallelization.

What general advantages do dual- and multi-core processors have compared with single-core processors?

As soon as the software is able to operate in parallel mode, dual-core processors offer users significantly higher performance than their single-core counterparts. In addition, a multi-core configuration enables optimal utilization of platform technologies such as virtualization and execution of separate applications and/or operating systems. In a recent article (PC Control 03/2007) Beckhoff described how a dual-core CPU enhanced the real-time capability of the system without additional power consumption. The multi-core CPU helped minimize latency periods.

Beckhoff uses embedded processors from Intel for the company’s Industrial PCs and Embedded PCs. What are the differences of the embedded versions compared to the desktop and notebook processors?

The embedded group within our product range guarantees availability of selected processors from the desktop and notebook roadmap for a minimum of seven years. This enables our customers to be successful in embedded markets with lifecycles that are many times longer than those in the consumer PC market.

At the Embedded World fair in February 2008, Intel presented embedded processors based on 45 nm HKMG semiconductor technology. Which processors are available with this technology, and for which applications were they developed?

All Intel 45 nm-based processors already use High-k transistors. This development enables us to offer platforms that set new performance standards in the high-end range without an increase in power consumption, and to develop systems together with our customers for Embedded PCs such as the Beckhoff CX series and other miniature types.

Is a 64-core CPU a utopian dream, or do you expect such multi-core processors to be available in the future?

There is a clear trend towards multi-core. As a leading manufacturer, Intel already presented an 80-core chip referred to as Polaris with the power consumption of today’s dual core processors. Even though this is still a research project, it nevertheless indicates the need for our customers to prepare their software for multi-core technology.

Intel GmbH www.intel.de
The EtherCAT I/O system from Beckhoff is being expanded with new fiber optic-compatible hardware. Using the EK1501 EtherCAT Coupler and the EK1521 junction terminal, more flexible topologies are now possible with glass fiber technology. The distance between two fiber-optic stations can be all the way up to 2 km (1.24 miles).

Besides its high performance and low system costs, EtherCAT also stands out due to its flexible topological characteristics. The EtherCAT Terminal system from Beckhoff supports all topology variants: line, ring, tree and star. This flexibility is continued in the wiring and the selection of different cables. The distance between two fiber-optic stations can be all the way up to 2 km (1.24 miles) 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).

The EK1501 EtherCAT Coupler connects EtherCAT to an arbitrary number of EtherCAT Terminals. Connection is made via SC duplex sockets. A further fiber-optic module can be optionally connected via a second port; an additional switch is not required.

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The EK1501 fiber-optic coupler connects EtherCAT to an arbitrary number of EtherCAT Terminals. Connection is made via SC duplex sockets. A further fiber-optic module can be optionally connected via a second port; an additional switch is not required.

The EK1501 EtherCAT Terminal with fiber-optic interface enables conversion to multimode glass fiber technology within a terminal line. The combination of line and branches or stubs is particularly useful for system wiring. Applications for the fiber-optic module will primarily be in widely distributed systems, such as wind farms or high tension systems. Even cable-redundant systems with fiber optic can be realized using the EtherCAT branch.

TwinCAT supports PROFINET IO controller and device profile

The PROFINET master from Beckhoff

Besides a large number of standard fieldbus systems, the TwinCAT automation software supports all market-relevant Industrial Ethernet solutions. Beckhoff continues its philosophy of open control technology on Ethernet. In addition to EtherCAT, TCP/IP and Modbus TCP, the PROFINET IO profile has now been added both as controller and device.

The ‘TwinCAT PROFINET IO Controller’ software module turns every Beckhoff Industrial PC or Embedded PC into a PROFINET master. One of the Ethernet interfaces on the PC is used as a PROFINET master port. Alternatively, a PROFINET EL6631 EtherCAT Terminal can be integrated anywhere in an EtherCAT network. In this case, the PROFINET messages are tunneled to the remotely mounted EL6631 via the high-performance EtherCAT system. Every EtherCAT network is now able to exchange data with PROFINET IO devices. The EL6631 can be configured as a PROFINET controller or a PROFINET device.

On the hardware side, the BK9103 PROFINET Bus Coupler joins the long list of Bus Couplers for the Beckhoff IP 20 Bus Terminal system. For IP 67 systems the IL230x-B903 PROFINET Coupler Box has been added. In addition to hardware slaves, TwinCAT-driven systems can become PROFINET slaves using the ‘TwinCAT PROFINET IO Device’. 
The CU2508 real-time Ethernet port multiplier has a gigabit uplink from the PC and eight independent 100 Mbit/s output channels. Each of the eight different ports can support any of the real-time Ethernet protocols. The PC transmits data at high speed to the port multiplier. A multi-protocol driver has been implemented in the TwinCAT automation software for the CU2508 Ethernet multiplier. This driver allows the use of different real-time Ethernet protocols on one device. The port multiplier analyzes each packet and according to the frame prefix transmits the data to the appropriate 100BASE-TX port in a time-controlled manner with µs precision. Received frames are also assigned a prefix including a time stamp and transmitted back to the PC on the gigabit port.

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All Ethernet controllers offer a wide range of application options, including industrial automation and intelligent building services.
Large machines and widely branched applications increase the demand for local information access. The CU8810 DVI/USB splitter with its compact design offers diverse options for connecting multiple displays. Up to four displays with identical resolution showing the same image or two separate images can be connected to a PC.

Flexible connection to multiple displays

The CU8810 enables users to display the same images or two different images on up to four monitors. While the images are transferred via DVI, the integrated USB ports enable transfer of command signals from touch screens, function keys, keyboards and other USB devices. The CU8810 contains a 2:4 DVI splitter with 4-port USB 1.1 hub and USB Extended ports. With the extended technology, the DVI splitter and each Control Panel can be located up to 50 m apart. The integrated DIN rail adapter facilitates easy installation in control cabinets. The DVI splitter has two DVI-D inputs and four DVI-D outputs. All
inputs and outputs operate over the full DVI data rate range up to 1.65 Gbit/s. Unused inputs and outputs can be switched off to save energy. The DVI splitter also features a USB 1.1 upstream port and four USB-E downstream ports.

The CU8810 is particularly suitable for the CP69xx and CP79xx “Economy” Panel series, since the USB extension is already integrated into these panels. In conjunction with TwinCAT, this results in a flexible solution for multi-screen applications.

The four DVI outputs on the CU8810 are freely configurable via DIP switches. The following options are available:

**Version 1**
A PC with DVI output transfers an identical display image to up to four Control Panels. Command signals can be transferred to the PC via USB from each Control Panel.

**Version 2**
If two PCs with one DVI output each are used, two different images can be transferred to the Control Panels. The two images may have different screen resolutions.

**Version 3**
The two-PC principle also works using a PC with Core™ Duo technology. If two DVI outputs are used, two different images can be transferred to the Control Panels. The two images may have different screen resolutions. The two-channel C9900-A185 ADD2 card offers a simple option for installing an additional DVI output. The card has two external DVI ports and enables direct connection of two DVI/USB Control Panels to C5102, C6140, C6150, C6240 or C6250 PCs. Via the CU8810, these two DVI outputs can be branched further to up to four Control Panels.

**Version 4**
If a Panel PC with DVI output is used (e.g. “Economy” Panel PC CP62xx), the DVI splitter can be used to transfer an image that differs from the main image on the Panel PC to up to four Control Panels. In this case commands can also be transferred via USB from the individual Control Panels to the Panel PC.
Beckhoff strengthens drive offering

AX5000 EtherCAT drive series expanded

The AX5000 EtherCAT Servo Drive range has been expanded by new versions with rated currents of 18 and 25 A, the safety option card with restart lock as well as the AM3500 series servomotors, which are now also available with BISS encoders.

The AX5000 Servo Drive series is designed as a single or multi-channel version for an optimum in functionality and economy. The integrated fast control technology supports highly dynamic positioning tasks. EtherCAT as a high-performance system communication enables ideal interfacing with PC-based control technology.

Since its product introduction, the AX5000 has been approved worldwide and is available in the basic versions AX51xx (1-channel) up to 12 A and AX52xx (2-channel) up to 2 x 6 A rated motor current. The AX52xx 2-channel servo drive enables operation of two motors with identical or even with different capacity, up to a total current of 12 A. The multi-axis drives with variable motor output allocation optimize packaging density and the cost per drive channel.

New drives for higher performance

The Beckhoff Drive Technology range is constantly being expanded. The Servo Drive range has been expanded by the new versions AX5118 for rated currents of 18 A and AX5125 for rated currents of 25 A. Further variants with rated currents up to 75 A will follow.

The AX5000 quick connection system enables simple and fast connection of several AX5000 devices to form a multi-axis system. The pluggable supply and connection module combines power supply, DC-Link and 24 V DC control and braking voltage.

The AX5000 drives are extremely flexible with regard to the size and type of the connectable motors: synchronous, linear, torque and asynchronous motors can be connected with no additional measures being required. Besides the common standards Encoder, BISS and EnDAT, the multi-feedback interface now also supports resolver.

As a further innovation, the Synchronous Servomotors from the AM3500 series are now also available with BISS encoders and form a highly dynamic drive unit in combination with the AX5000.

The AX5801 TwinSAFE option card offers safe restart lock in accordance with category 3 (EN 954).

www.beckhoff.com/ax5000

The AX5000 EtherCAT servo drive range has been expanded by the new versions AX5118 (18 A rated current) and AX5125 (25 A rated current).
Expanded AX5000 drives complement overall system

In an interview with PC Control, Andreas Golf, Beckhoff Product Manager for Drive Technology, provides an overview of the current status and motion-related innovations.

PC Control: What characterizes an advanced servo drive? What are the key features of the AX5000?

Andreas Golf: Compact single- and two-channel modules enable very efficient cabinet mounting. Since control cabinets are becoming smaller and smaller, the current/volume ratio is a crucial parameter. In the design of the AX5000 Servo Drive series, we took this into account by integrating additional components such as mains filters, ballast resistors or mains chokes in the device.

The devices must be suitable for application worldwide and cover a wide range of voltage specifications. The AX5000 meets this requirement: The basic unit can be operated with mains voltages between 1 x 100 V AC -10 % and 3 x 480 V AC +10 %.

The AX5000 benefits from optimal control quality and dynamic control characteristics. It has a very small current controller cycle time of 31.25 µs, which enables trouble-free operation of low-induction motors or ironless linear motors.

The AX5000 offers the maximum resolution even with poor matching of motor and controller current. Since the current controller always operates in the optimal resolution range, a 6 A controller can operate a 1 A motor, for example.

Short commissioning times and simple handling during service are crucial today. In view of the worldwide deployment of their machines, users cannot always be sure that qualified personnel are available locally. In conjunction with TwinCAT, the AX5000 takes pressure off commissioning staff through central parameter management. Parameterization does not require a variety of tools. Default motor value sets or – even more convenient – electronic name plates reduce the machine setup effort to a minimum. After replacement of hardware components, data are automatically downloaded to the drive so that the machine is immediately ready for use again.

PC Control: The AX5000 was developed specifically for PC-based control technology. Which tasks does TwinCAT handle? Which does the drive handle?

Andreas Golf: The development objectives for the AX5000 included size reduction to a minimum without loss of convenience and control quality, and removal of needless, costly intelligence from the drive in order to make the device as uncomplicated as possible. This helps the user through greater transparency. Users don’t have to worry about issues such as "What do I have to do next in the drive?" or "How should I prioritize the control system?" Everything is simply programmed centrally in TwinCAT. Drive tasks are limited to current and speed control and position interpolation. The profile computer is always at the top in the control system, where the parameters of the other drives are also managed.

The user doesn’t have to pay for complex intelligence in the drive, a significant factor in applications with many axes. Such a system configuration has only become possible with EtherCAT as the communication backbone between the drive and control system. Complicated internode communication between the axes is no longer required; even highly complex cam plates or multi-axis path interpolation is solved centrally.

PC Control: One advantage of the AX5000 series is the versatile multi-feedback interface. Which feedback systems are supported and which servomotors does Beckhoff offer in combination with the AX5000?

Andreas Golf: These days a servo drive must be able to handle all established feedback systems. The AX5000 supports BISS, EnDat, Hiperface and resolver systems as standard. This is part of our multi-feedback and multi-motor concept and also applies to the AX5000. It is able to operate synchronous and asynchronous motors with and without feedback, iron core and ironless linear motors, and direct torque motors. The Beckhoff motor range includes three product lines: As rotational options, we offer the tried and tested AM2000 motors, the dynamic, pole-wound motors of the AM3000 series, and the pole-wound AM3500 high-inertia motors. Each range has different features for specific application areas: The AM2000 is recommended for standard applications, the AM3000 for highly dynamic applications, and the AM3500 as a "workhorse" with high inherent inertia.
for optimal mass adaptation. Our linear iron core motors are available in three different widths covering the range between 120 N and 6750 N. The ironless linear motors AL3800 are mainly used in the semiconductor industry and panel production. Due to the lack of cogging, users can achieve maximum positioning accuracy and synchronism.

PC Control: With EtherCAT as system bus, the drives have access to a fast communication system. In what way does the overall motion system benefit from this?

Andreas Golf: In the past, the serial fieldbus used to be the bottleneck of the overall system. As a result, more and more intelligence was shifted into the drives, thereby making the system significantly more expensive and complex – particularly for multi-axis applications. Through the introduction of EtherCAT, it is now possible to deal with all tasks, including current control, in the control system. The drive can be assigned set values very quickly, which greatly simplifies the system configuration. Many scalings become redundant, resulting furthermore in reduced computing power requirements in the drive. Even highly complex applications can be simplified significantly through central data and parameter management.

PC Control: With the new product lines for 18 A and 25 A, the Servo Drive range was expanded further. What further developments are to be expected?

Andreas Golf: With the AX5118 and AX5125 series, the AX5000 family already covers the majority of our applications, although some applications require even higher performance, which is why we are expanding the AX5000 series further with the development of controllers with current levels up to 100 A for the high end of the spectrum.

PC Control: How is the AX5000 commissioned?

Andreas Golf: The development objective for the AX5000 was fast, straightforward commissioning in order to minimize setup times for the customer. Today the required commissioning time is increasingly considered in conjunction with the device price. What use is a good, cost-effective device if commissioning takes twice as long? A matched system offers the optimal solution. Our central data and parameter management was a major step forward; default value parameters, the electronic motor name plate and soon-to-be-introduced auto-tuning make commissioning even simpler.

The AX5000 drive is optionally available with integrated safety functions. Which functions are supported?

Andreas Golf: The restart lock of the AX5801 prevents unintentional restart of the motor according to category 3 of EN954-1. We are currently in the process of developing extended functionality that will cover safely reduced speed, safely reduced torque, safe direction of rotation and brake management – all expected to be available towards the end of 2008.

PC Control: Electrical drive technology offers tremendous savings potential in terms of energy efficiency. How does the AX5000 contribute to energy efficiency?

Andreas Golf: The individual devices offer significantly higher DC-Link capacity than usual. This means that far more energy can be stored loss-free in the condenser, which is then available for subsequent acceleration processes. In addition, all DC-Link devices can be connected, resulting in further savings potential.

A further device currently under development is a capacitor module that offers additional capacities that can simply be integrated between existing devices in order to be able to store even more energy loss-free. Furthermore, this enables to supply the drives and/or the PC with 24 V DC control voltage, which offers UPS functionality in the event of a current interruption.

As an alternative to energy exchange and buffering within the DC-Link, we will soon offer regenerative power supply units which will feed back excess energy from the DC-Link to the mains. Current regeneration is advantageous if larger loads are decelerated regularly. For smaller loads the DC-Link solution is more cost-effective.
Embedded PC CX1020 with Intel® 1 GHz, zero second level cache

High-performance Embedded PC with “Economy” CPU

The basic equipment of the CX1020 Embedded PC from Beckhoff features an Intel® Celeron® M 1 GHz processor with 512 kbyte L2 cache. However, many applications do not require the full power of this CPU. For this reason Beckhoff offers a less expensive version with the option “zero second level cache”.

In this variant, a processor without a second level cache (L2 = 0 kbyte) is used instead of the 1 GHz processor with 512 kbyte second level cache (L2). The advantage of this option is that costs can be saved while retaining compatibility; none of the basic characteristics of the CX1020 are changed, apart from the slightly lower CPU power.

The controller does not require a fan or other rotating parts. The main memory is selectable: 256 MB DDR RAM as standard, expandable to 512 MB or 1 GB. The basic configuration of the CX1020 includes a 64 MB Compact Flash card and two Ethernet RJ 45 interfaces. The CX power supply units offer a direct interface between the CX1020 and the Beckhoff Bus Terminals or EtherCAT Terminals. The operating system can be Windows CE or Windows XP Embedded.

www.beckhoff.com/cx1020

Software library for TwinCAT PLC expanded

Telecontrol protocols now complete

The powerful Embedded PC from the CX1020 series is optionally available with a CPU without second level cache and is therefore offered at an optimised price.

The TwinCAT automation software for PLC and Motion Control applications has been completed with new PLC libraries for telecontrol in accordance with IEC 60870. IEC 60870 describes a general, open communication standard for telecontrol and network control technology. TwinCAT now supports the user standards for serial communication (IEC 60870-5-101), transmission of integrated totals (-102), protection data transmission (-103) and TCP/IP communication (-104).

With the implementation of the IEC 60870-5-102 protocol, all IEC 60870 protocols have now been implemented. The 102 protocol serves for the transmission of counter states of electrical energy quantities. These values are usually transmitted at longer periodic intervals. Special safety measures ensure that the values cannot be falsified.

The TwinCAT PLC library implements a serial interface, via which the individual ASDUs (application-layer service data units) can be sent or received. The serial interfaces of PCs, Embedded PCs or Beckhoff I/O terminals KL6xxx (serial Bus Terminals) or EL6xxx (serial EtherCAT Terminals) can be used. Within the protocol structure, the interface lies above the connection layer and already integrates the required procedures and transmission telegram formats.

Application functions, such as retrieval of the individual counter states or product identification are not implemented in the interface. Examples of the implementation of application functions are included in the documentation.
The EtherCAT terminal product range covers a wide range of different I/O terminals and special versions for the time stamp, oversampling and fast I/O XFC technologies.

Beckhoff I/O terminals with oversampling and time stamp technology

EtherCAT Terminals for XFC

The EtherCAT Terminal system from Beckhoff offers a comprehensive I/O construction kit for a wide range of applications. The EtherCAT protocol is maintained right into each individual I/O terminal, thereby enabling high data throughput and distributed clock synchronizations with a jitter of $< 1 \mu s$. In order to meet extreme performance requirements, the system was extended with the XFC terminals, which offer, for example, oversampling or time stamp capability. XFC (eXtreme Fast Control Technology) offers gains in performance and efficiency for high-end and standard machines.

XFC represents a control technology that enables very fast and highly deterministic responses. Its implementation requires integrated support of all hardware and software components involved in the control system: EtherCAT as fieldbus, EtherCAT Terminals as I/O system, IPCs as hardware platform, and TwinCAT as higher-level software.

Standard EtherCAT Terminals already offer full support for XFC technology. Synchronization of the I/O conversion with the communication or – more precisely – with the distributed clocks is a standard feature of EtherCAT and is therefore supported by a wide range of terminals. Newly developed XFC terminals offer additional special features that make them particularly suitable for fast or high-precision applications:

- EtherCAT Terminals with time stamp latch the exact system time at which edge changes occur. Output of digital values can occur at exactly predefined times.

- EtherCAT Terminals with oversampling enable actual value acquisition or set value output with significantly higher time resolution than the communication cycle time. Distributed clocks with a jitter of $< 1 \mu s$ and a time resolution of $1 \mu s$ are used for time synchronization across the whole system.

- Fast I/O is supported by digital EtherCAT Terminals with very short input delays or switching times of $< 1 \mu s$.

XFC terminal overview:

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<td>oversampling</td>
<td>2-channel digital input 24 V DC</td>
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<td>EL2262</td>
<td>oversampling</td>
<td>2-channel digital output 24 V DC</td>
</tr>
<tr>
<td>EL3702</td>
<td>oversampling</td>
<td>2-channel analog input -10 V…+10 V</td>
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<tr>
<td>EL3742</td>
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<tr>
<td>EL4732</td>
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www.beckhoff.com/XFC
Modern homes offer more than the proverbial “roof over the head” – high technical standards and comfort have long since become a matter of course. In the past, energy efficiency was not cost-effective in many cases. Additional expenditure for energy conservation often matched or exceeded the calculated savings. With rising energy costs, the situation is changing: Assuming the price increases over recent years continue, many “green” investments will also make economic sense in the near future. In the simplest case, significant energy savings can be achieved through networking of commercially available components and intelligent controls.

Networking helps save energy

The greatest savings potential is associated with heating systems, which in private households account for approx. 76% of total energy consumption. For example, the heating can be turned down on the south side of the building when the sun shines through the windows. Without networking with solar sensors, the heating system will only respond once the temperature exceeds the setpoint. The residual heat in the radiator therefore leads to temporary overheating. If the heating system is connected to a solar sensor for the shading system via an intelligent controller, the relevant data can be retrieved and processed. Via Internet access to weather forecasts, the heating system can also operate in forward-looking mode by adjusting itself to the climate data.

Scalable CX control platform

Together with the automation kit, consisting of I/O modules and different gateways, the Beckhoff CX Embedded PC series allows all devices to be controlled directly or networked. Powerful, compact solutions can be created by simply plugging the hardware together with the required signals. The TwinCAT control software integrated in the CX and the Windows operating system offers a high-performance and flexible platform for fast processing of large data quantities via different communication routes. The CX serves as a link between IT, multimedia and video on the one hand and sensors, actuators and sub-buses on the other.

Future-proof, guaranteed

The CX series is certain to be compatible with foreseeable future requirements. Based on tools and software from the PC sector, additional increases in computing power can be expected so the CX will likely be able to handle future integration of video and audio processing, for example. In addition, the CX is highly expandable through add-on modules, i.e. users will be able to maintain system continuity when faced with increasing demands. The continuous development of the Bus Terminal range opens up options for accommodating almost any signal type by adding further flexible components. The internal interfaces developed by Beckhoff are versatile and easy to handle. Future systems can be mapped and integrated in existing solutions. Additional benefits of the scalable Embedded

Energy conservation has been a hot issue for years and remains very topical. Increasing environmental awareness, resource shortages and rising energy prices keep energy awareness high on the agenda. There is significant potential for energy savings without negative effects on comfort. The key is efficiency. Large energy savings can be achieved with new technologies or with a combination of existing technologies.
Controllers include USB and DMI interfaces for straightforward connection of all operator control elements such as LCD displays, mouse and keyboards.

Demand-based lighting
For the Light+Building 2008 fair, the Beckhoff automation kit will be complemented with new I/O terminals and software libraries so that it meets all requirements for advanced, innovative building control based on standard components.

Demand-based lighting, depending on daylight/sunshine, day of the week, day or night-time and occupancy, can be integrated into the Beckhoff system through a range of interfaces. The simplest case is direct connection of a lamp to a dimmer. The universal KL2751 (300 VA) and KL2761 (600 VA) dimmer terminals detect the lamp type and adjust themselves accordingly. Built-in short-circuit resistance simplifies maintenance, i.e. the fuse no longer has to be changed if a filament fails. The dimmer is controlled directly without additional connection cables, switches or parameters.

More sophisticated lighting devices operate with built-in interfaces such as DALI or DMX. The control system can communicate with them through the KL6811 (DALI) and EL6021 (DMX) I/O terminals. A wide range of lighting scenarios can be controlled for maximum energy efficiency and comfort.

Efficient speed control for pumps and fans
Circulation pumps in older systems are throttled mechanically, resulting in the shifting of the operating point and particularly inefficient operation. A simple control scheme enables the volume flow to be adjusted to demand and the pump speed reduced accordingly. In small heating systems the circulation pump is usually grossly oversized and offers significant savings potential. The logical connection of the pump with the central controller can be easily achieved with the 230 V KL2791 output terminal. This terminal contains power electronics that can vary the speed of a single-phase motor within a wide range (10 % to 100 %). Interrelationships such as external and internal temperature or occupancy and wind speed influence the heat demand and therefore the required volume flow of the circulation pump.

An air demand profile ensures good air quality while saving heating and electricity costs. As for pumps, interfaces between fans and the control system require a certain degree of sophistication. With the KL2791, the software only “writes” a digital value for controlling the capacity.

Pressure measurement directly in the Bus Terminal
The KM37xx pressure measuring terminals measure the volume flow based on dynamic pressure and are able to determine the degree of filter contamination.
With innovations such as Bus Terminals and TwinCAT libraries, Beckhoff extends its automation kit to offer a complete system for buildings. New Bus Terminals for HVAC and lighting not only enhance functionality and comfort, in combination with TwinCAT they also contribute to improving energy efficiency.

The DMX Bus Terminal completes the lighting control range: In addition to intelligent dimmer terminals up to 600 VA, all standards such as digital/analog, DALI, LED control and PWM are supported.

“Configuring instead of programming” is the motto of the TwinCAT Building Automation Framework, which simplifies engineering significantly. System integrators, operators and building users can modify scenarios or re-allocate sensors/actuators quickly and conveniently.

In this way, operation within the specified limits can be guaranteed. As a result, fewer consumables (filters) are used and energy use is reduced compared with scenarios where dirty filters remain unnoticed for months.

Energy measurement

Exact consumption measurements are a prerequisite for savings and more efficient use of energy. Targeted intervention and performance assessment requires measurement of individual consumers and small groups. In this way, savings potential can be spotted easily, while less promising options are also identified and can be avoided.

The KL3403 energy measurement terminal offers each fieldbus a comprehensive network analysis that can be used for “self-learning” purposes: Switching on and off of equipment is associated with typical energy consumption patterns. Absence of such patterns can be used for fault diagnosis and notification of a technician (via remote maintenance) where appropriate.

User-friendliness

Most devices feature high-performance electronic components for monitoring the desired function. Optimal utilization requires correct parameter settings. Access to these parameters is usually difficult, and operation is complex. Displays are too small, and a small number of keys have to be used for navigating through a whole hierarchy of submenus. For specialists with good product training this may be adequate, but end users will find parameter modifications daunting.

For cost reasons not all devices can be equipped with self-explanatory user guidance and a graphical interface. For economic reasons and in the interest of user-friendliness, central operation is required. Ideally, the networked devices should not all be shown individually at this central point, but consolidated into typical application profiles. Via the “Absence” menu item, the heating system is turned down, the lighting is switched to simulated occupancy, the alarm system is activated three minutes after the occupants leave the house, and the water supply is switched off once the dishwasher has completed its cycle. Of course, the central display can be accessed from any PC via the Internet, enabling remote operation.
Microsoft demonstrated this new technology using a scenario from the field of home automation, because it is precisely in this field that Microsoft sees a great potential for the use of WSD. Microsoft chose its Gold Partner Beckhoff as development partner due to their vast experience in the field of PC-based control technology and also building and home automation.

Like USB, WSD is a plug-and-play technology that connects devices such as printers, scanners and mobile telephones to the PC, which then recognizes and operates them. In WSD, Microsoft has expanded plug-and-play technology to the field of “Ethernet-based devices”. Microsoft’s intention here is to open up the field of home automation.

An important constituent of the presentation of the new operating system was the Beckhoff prototype for demonstrating the home automation scenario, in which typical data points of a building are controlled via a Beckhoff CX1020 Embedded PC with Windows CE 6.0 R2 as the operating system. Besides a weather station and proximity sensors, the dimmable lamps and the venetian blind are recognized automatically by the operating system and integrated in the system. The Embedded PC and the end devices are integrated via WSD. To this end, the new “Web Services on Devices” technology is integrated in all components by means of implementing profiles based on the international standard “Device Profile for Web Services”. All profiles are available on the CX1020 Embedded PC. In the future, the Windows CE controllers from Beckhoff will support the new WSD technology. In this way, the data points connected to the controller (sensors and actuators) can be recognized automatically and integrated in the overall system.

Microsoft launch of Windows Embedded CE 6.0 R2 in Japan. The operating system recognizes connected Ethernet devices automatically via the Web Services on Devices technology and integrates them in the overall system.

Automatic device detection using Microsoft Windows Embedded CE 6.0 R2 and Beckhoff technology

WSD: Plug-and-play for building automation

www.microsoft.com/windows/embedded
Part 2 of the “Global Control” report:
“Global Control” in action

Precision cutting through heavy plate

The heavy plate production output of Ilsenburger Grobblech GmbH, a subsidiary of Salzgitter AG, was around 800,000 tons in 2007. High quality steel sheets are cut around the clock with modern flame cutting technologies from Messer Cutting & Welding GmbH. The flame cutting installations are equipped with the new “Global Control” PC Control concept based on Beckhoff technology.

Ilsenburger Grobblech GmbH produces steel sheets with a thickness ranging from 5 to 120 mm. The raw material in the form of continuous casting slabs is delivered by Salzgitter and is fabricated into steel sheets in a modern rolling mill. “The know-how of Ilsenburger Grobblech GmbH is reflected on the surface of the heavy plates produced,” says Dipl.-Ing. Björn Lecon, Senior Project Engineer at Ilsenburger Grobblech GmbH, “it can be seen in the steel itself, both with respect to the steel types as well as the manufacturing process technology.”

All heavy plate related markets, such as shipbuilding, steel construction, crane construction, pipe factories and also the wind turbine construction market are served.

Just in time production capacities
Particularly wind turbine construction has grown in the past few years. Ilsenburger Grobblech GmbH has aligned their investment both technically and technologically for this development. The customers from the wind turbine systems market require precision sheet metal with tight dimensional tolerances for foundations, towers and components.

The cycle time is an important factor during order processing. “The customer wants his steel sheet delivered just in time,” says Lecon. This requirement has to be fulfilled by Ilsenburger Grobblech GmbH by means of the corresponding JIT processing capacity, of which the flame cutting technology is also a part.

Flame cutting installations at Messer Cutting & Welding GmbH
The demand for the cut heavy plate sections prompted Ilsenburger Grobblech GmbH to build the cutting hall. The new production line has three Messer Cutting
Full acceptance for a new operating concept: changeover of the control technology was completely straightforward for the machine operators. The employees found all the previous button functions once again in the user menus and were thus able to easily manage the touch screens.

The heavy plates undergo two important processing steps in the shipping area: The geometrical dimensions are realized with profiled sheet cuts (I or vertical cuts). The edge processing also required by the customer (Y or K cuts) allows further heavy plate processing to be carried out directly later on, e.g. by welding. Of course the flame cut edge is a more important quality factor for the customer.
& Welding flame cutting installations. “The output demand meant that we wanted to develop new flame cutting technology, namely using two flame cutting machines with three burners for I, Y and K cuts and one machine exclusively for I cuts,” explains Lecon. In this respect Ilsenburger is focused on the flame cutting installations market. “The concept of the new “Global Control” technology with its touch screen user interface and break away from classical operation philosophies using ‘fragile’ controls has been brought completely into the computer age,” says Lecon.

Increased functionality through new control concept

The “Global Control” concept is based on Beckhoff technology, from Industrial PC to the drives. Ingo Göller, “Global Technology Team” Project Manager at Messer Cutting Systems, says that the development of the control platform is carried out from top to bottom: “First of all we implemented the technology in the more complex machines where the functionality sets certain requirements.” This concerned the OmnMat® flame cutting installations, which are fitted with a DAFL triple burner unit that is used for I, V, Y, X and K cuts and that has correspondingly controllable degrees of freedom (e.g. infinite rotation). “We have completely re-built this unit due to the range of control options which were made available by the Beckhoff technology,” states Göller.

Control concept covers future requirements

The order situation at Ilsenburger Grobblech GmbH led them to comparing the previous flame cutting control technology concept with the multiple possibilities of Global Control in which the most important future perspectives regarding order situation, market trend and resulting flexibility requirements were included. “The potential of Global Control is just amazing, and since we are linking our cut area into our internal network, future aspects have also been accounted for,” says Lecon. The two flame cutting machines purchased by Ilsenburger Grobblech in 2005 use Global Control. In addition to this, the existing Messer flame cutting installations were retrofitted with Beckhoff technology, “so that the machine operator on every flame cutting machine has the same operating concept,” states Lecon.

Ingo Göller, Project Manager, Messer Cutting & Welding GmbH; Frank Saueressig, Manager office Balingen, Germany, and CNC expert at Beckhoff; Günther Raulf, Northeast Regional Sales Manager at Messer Cutting & Welding GmbH, and Dipl.-Ing. Björn Lecon, Senior Project Engineer at Ilsenburger Grobblech GmbH (from left to right)
EtherCAT Terminals: The I/O system for EtherCAT

- Real-time Ethernet down to the I/O level
- Large selection of I/O terminals
- Easy configuration
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Extremely fast I/O technology

- Flexible I/O system for the EtherCAT real-time Ethernet fieldbus
- The EtherCAT protocol is maintained right down to each device.
- Line, tree or star topologies can be freely selected and combined.
- Cost-effective wiring via standard Ethernet cables
- Almost unlimited network size: up to 65,535 devices
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- Decentralised connection of Ethernet devices via switch ports
- Breaking point detection, exact location of faults
- Integrated safety: TwinSAFE terminals for Safety over EtherCAT

For further information and international sales contacts see: www.beckhoff.com

BECKHOFF New Automation Technology
Catheter balloons can be life-savers for people with vasoconstriction. During medical procedures, a physician guides the catheter balloon through the blood vessel to the vasoconstriction where the balloon attached to catheter is expanded with 8–20 bar. This extends the vessel so that the blood can flow freely again. Different balloon sizes and shapes are used, depending on the type and location of the constriction.

Expandable balloons are produced using a hot air technique: Balloon preforms are formed into balloons in glass or metal molds under defined pressure and heat. After cooling they are checked, attached to the catheter, and folded. Traditional balloon blowing/forming machines produce balloons of a particular size using a blow mold adapted to the size of the balloon. The limitation of a particular mold type can make the manufacturing process very inefficient for manufacturers of various balloon types with small batch sizes.

**Advanced systems for more flexible production**

“A major goal for the project was to ensure that this production equipment was the most advanced and flexible in the market segment,” Brent Bohmont, Software and Electrical Engineer at MSI, said. “Being a new product offering for the machine, we had to meet the industry standard and offer significant features and benefits improvement over existing technologies to clearly differentiate.”

“Flexibility is key,” said Paul Reiss, Mechanical Engineer at MSI, “especially because regulatory body approvals for invasive medical devices are so stringent. When our customers incur such large costs to build and get approval for their balloon molds, machine flexibility to a variety of molds is critical.”

“When we change the blow mold we should be able to adapt the control system via software without having to add separate motion controller hardware,” software expert Bohmont said. “This could mean adding motion axes or changing heating circuits simply through software modification.” A prerequisite is high-performance and flexible automation and control technology.

**PC-based controls and modular I/Os for flexibility and safety**

MSI chose to use PC-based controls for the new MSI balloon blowing/forming equipment with powerful processors to handle all control aspects with a single device, ridding themselves of separate motion controller hardware. MSI chose advanced control technology from Beckhoff: specifically, the C6920 Control Cabinet IPC with the TwinCAT PTP software, EtherCAT as the fieldbus system, EtherCAT Terminals and Bus Terminals for data interfacing, and TwinSAFE for the safety functions. The safety terminals are integrated into the EtherCAT system via the BK1120 EtherCAT Bus Coupler.

MSI uses high-speed EtherCAT I/O terminals to handle the force-feedback on the...
tube stretching functions of their machine. "EtherCAT proved to be an ideal fit for our needs," Bohmont said. "Typically, analog I/O used in an application like this has a long conversion time. Fast analog I/O via EtherCAT eliminated this – we’re simply limited by the signal conditioner. Thanks to the openness of EtherCAT it is possible to integrate not only Beckhoff motors but also motors and system parts from other manufacturers. All connections to our devices and back to plant networks are via simple, standard Ethernet cables rather than bundles of messy wires."

**TwinSAFE: Simple safety integration**

For the safety functions MSI chose TwinSAFE technology from Beckhoff. "TwinSAFE is a highly streamlined approach to machine safety when compared with traditional safety PLCs and their safety-specific networks, since the TwinSAFE safety protocol utilizes the existing EtherCAT network as a transport medium. This also reduces the cabling effort," Bohmont said. MSI uses TwinSAFE to create emergency stop circuits and light curtain systems. TwinSAFE is also used to monitor parameters such as mold pressure, heater temperature and pinch points where an operator could be hurt. "Additional functions can be easily added," Bohmont said. "Another helpful feature in TwinSAFE is that we can more easily get status reporting on all the inputs and outputs to see exactly how and when an E-stop is pressed or a light curtain is activated."

**Clean bill of health for powerful, safe system**

With PC-based controls, one new MSI balloon blowing/forming machine is able to accommodate either glass or metal molds of different sizes. "Many machines on the market can only be equipped with one or the other. End-users are also free to experiment with non-traditional materials for molds," Bohmont said. "Our balloon blowing/forming machine can achieve both motion and force moves. Depending on the balloon size or shape and the material used for the blow mold it may be appropriate to control the process based on motion or force. With TwinCAT we are able to offer customers both options with the same machine," Reiss added.

"Beckhoff PC-based controls are significantly more powerful than any of the controls tools we used in the past," Bohmont said. "The ability to read our load cells and force feedback in real time – at 500 Hz – and use it as input information for the controller makes a huge difference." The flexibility of mounting the devices also proved to be a time saver when designing the machines. "With the new IPC controller, distributed I/O and easy connections via Ethernet cables, we can install our devices in the most space-saving methods possible," Bohmont said. "We’re confident that a PC-based controls approach with Beckhoff gives us all the flexibility and high-end performance we’ll need to exceed our competition. So with that position, we intend that all first generation MSI balloon blowing/forming machines will be equipped with Beckhoff PC-based controls, EtherCAT and TwinSAFE," Bohmont concluded.
What made Beckhoff decide to have a presence at Interpack for the first time this year?

Frank Würthner: A wide range of existing applications in the packaging industry indicate that automation technology from Beckhoff can significantly enhance the productivity and flexibility of packaging machines. PC-based control technology can control and monitor the complete process chain for individual packaging machines and complete packaging lines. All processes, from filling, forming, sealing, labeling, collecting and re-packing to palleting, can be controlled throughout with our Industrial PCs and TwinCAT automation software.

At Interpack, Beckhoff will demonstrate the potential of PC-based control technology for the packaging industry. The company will present itself to end customers as a leading edge and well-established supplier of complete control solutions that meet the challenges of this high growth market.

What are the most urgent issues facing the packaging industry with regard to automation technology?

Frank Würthner: The packaging machines of tomorrow should be flexible, productive and space-saving. They should keep products safe, fresh and hygienic, while at the same time meeting design criteria. This requires a wide range of packaging shapes, styles and materials, and in some cases even for the same product. In the future, packaging machines will have to become increasingly flexible and productive in order to be successful in the market. Another important issue for the packaging industry is traceability and, accordingly, consistent documentation of all process data. Open, PC-based control technology from Beckhoff, which supports convenient connection to databases and ERP systems, represents a comprehensive response to these requirements.
What role does automation technology play for the development of packaging machines?

Frank Würthner: Advanced automation technology drives technological progress in packaging machines and significantly improves their competitiveness. The ultra-fast XFC (eXtreme Fast Control) technology from Beckhoff, for example, increases the output and, therefore, productivity of packaging machines. The automation components also benefit from compact and simple connections, which reduce space requirements and installation effort.

Which control concepts are successful in this sector?

Frank Würthner: Central control technology offers substantial benefits compared with a decentralized approach. The fact that all programs and process data are available in a central CPU simplifies the engineering process and reduces commissioning and maintenance costs. A prerequisite for a central approach is a high-performance fieldbus for I/O and Motion Control, such as EtherCAT. Naturally Beckhoff components can also be used for a distributed, decentralized approach. The trend to replace mechanical gearing and cam plates with electronic solutions leads to an increase in the number of servomotors in conjunction with digital servo drives. They are highly suitable for positioning tasks with particularly high demands in terms of dynamics and stability. Beckhoff recommends its AX5000 series Servo Drives. In view of the steadily rising number of servomotors in a machine, a central Motion Control solution with synchronization of all axes has clear advantages.

What does “open automation system” actually mean and why is it important?

Dr. Josef Papenfort: In automation technology, “openness” refers to software and hardware interfaces. At the core is the open, scalable TwinCAT automation software from Beckhoff. It is a pure software PLC and Motion Control solution for PCs. PLC programming is based on the international IEC 61131-3 standard. Open communication interfaces support integration into existing visualization, control and database systems. Through the open interfaces and the different abstraction levels of the TwinCAT system, applications will run with almost any fieldbus, I/O components and drive technology from different manufacturers without further adaptation. The openness of the TwinCAT system supports machine manufacturers in their efforts to adapt their systems to varying requirements, without excessive implementation costs and time.

Which components does Beckhoff offer for packaging machine manufacturers?

Frank Würthner: For the packaging machine sector the Beckhoff product range offers compact, high-performance IPCs with motherboards especially designed for industrial applications, Embedded PCs, a wide range of electronic I/O terminals, versatile Servo Drive Technology, cost-effective Stepper Motor technology, the high-speed EtherCAT fieldbus, TwinCAT automation software, and special panels. From these integrated, scalable,
and modular control components, the optimal solution can be configured for any task with regard to computing power, complexity and costs.

What does the Beckhoff PLC and Motion Control solution look like in practice?

**Dr. Wilfried Plaß:** TwinCAT integrates PLC and Motion Control functionalities. PLC libraries with function blocks based on the PLCopen Motion Control and the OMAC PackSoft standard (PackAL) facilitate programming. Standards such as the OMAC Packaging Guidelines offer a consistent interface for packaging machines worldwide. OMAC (Open Modular Architecture Controls) is a North American user association for the definition of open automation architectures. The TcPackAL PLC library offers software modules for different packaging tasks. TwinCAT ScopeView supports commissioning.

Can Beckhoff meet the special Motion Control requirements of a packaging machine such as format-dependent cam plates and online modification of cam plates?

**Dr. Wilfried Plaß:** The Motion Control functionality of TwinCAT satisfies these requirements with PLCopen-compliant function blocks. Cam plates can not only be controlled as point values with spline interpolation, but also section by section based on motion laws directly from the TwinCAT NC platform. Online modification is possible through changes in individual segment points, for example. These are executed in the next cycle or from an activation position. Complete cam plates can be exchanged for creating typical start, operating and stop curves. The “flying saw” can be used for synchronization of a slave (which may be in motion) with a master. The powerful TwinCAT CAM Design Tool is available for configuring the cam plates (according to VDI Guideline 2143).

EtherCAT is characterized by particularly fast communication. How does this benefit machine manufacturers and operators?

**Frank Würthner:** EtherCAT, the real-time capable Ethernet fieldbus with leading performance, flexible topology and particularly simple handling, is ideal for packaging machine applications. The fast communication between the I/O signals and the controller, with update and response times that are at least 10 times faster compared with the conventional field-

buses, offers machine manufacturers unimagined possibilities based on Motion Control with a large number of synchronized axes and reproducible accuracy in the nanosecond range. The redundancy enshrined in the EtherCAT fieldbus system offers added safety in the event of broken wires. Simple and reliable connection technology can significantly reduce the cabling effort costs. EtherCAT offers full Ethernet compatibility, maximum utilization of the Ethernet bandwidth, and outstanding real-time characteristics at a low cost. Legacy devices can easily be integrated through gateways to conventional fieldbuses such as PROFIBUS or CAN. This ensures compatibility and continuity with “traditional” systems. In addition, EtherCAT technology is characterized by a high degree of openness: The EtherCAT Technology Group (ETG) currently has more than 680 members. As a result, more and more devices from different manufacturers worldwide are available with EtherCAT interfaces.

Customers increasingly expect their automation suppliers to offer seamless integration of drive and control technology. How does Beckhoff meet these requirements?

**Dr. Josef Papenfort:** Beckhoff uses different approaches for this purpose: On the one hand, TwinCAT has always combined PLC, Motion Control design and run-time in a single software. On the other hand, EtherCAT as a fast fieldbus guarantees deterministic exchange of data both with I/Os and drives.

With XFC, the combination of a high-performance CPU, the PC; software such as TwinCAT; a high-performance fieldbus such as EtherCAT, and fast I/Os such as the XFC terminals, any programmer is able to realize very fast and highly precise control solutions for packaging machines simply and elegantly based on standard components. In addition, the AX5000 Servo Drive series offers maximum performance and dynamics. The AX5000 series is available in single- or multi-channel form and is optimized in terms of function and cost-effectiveness. The integrated, fast control technology with a current control cycle of up to 31.25 µs supports highly dynamic positioning tasks. EtherCAT as a high-performance communication system enables ideal interfacing with the central controller.
Using PC-based control technology by Beckhoff, the entire process chain of a packaging line can be automated: all processes, from filling, forming, sealing, labeling, collecting and re-packing to palleting, can be realized throughout with Industrial PCs and the TwinCAT automation software as the control platform.

Open and freely scalable automation technology
Beckhoff offers open and flexible automation solutions on the basis of PC-based control technology. The scalability of the hardware and software components makes customized solutions possible, which, as compared to conventional controllers, significantly increase the productivity and flexibility of packaging machines. The range of products from Beckhoff includes high-performance IPCs, a large variety of electronic I/O terminals, the EtherCAT high-speed fieldbus, the TwinCAT automation software and flexibly deployable Servo Drive Technology. TwinCAT integrates PLC and Motion Control functions and controls the individual process steps of the packaging machines with high performance. In addition, various software modules for different technical packing tasks are available: cam plates, corresponding to the laws of motion in accordance with VDI directive VDI 2143; ‘flying saw’ for synchronizing the position and speed of the packed goods and the machine, as well as the interpolating movements of several axes.

EtherCAT – top performance right down to the I/Os
The basis for the ultra-fast process communication is the EtherCAT Industrial Ethernet system, which is ideally suited for use in packaging machines. The fast communication between the I/O signals and the controller – without special hardware – offers the machine manufacturer undreamt-of possibilities: Motion Control with multiple axes, synchronized through distributed EtherCAT clocks, with nanosecond precision.

Fast control technology increases machine efficiency
With XFC technology (Xtreme Fast Control Technology) Beckhoff presents a new, fast control solution: XFC is based on an optimized control and communication architecture comprising an advanced Industrial PC, ultra-fast I/O terminals, EtherCAT and TwinCAT. This technology opens up new process optimization possibilities to the user and increases the efficiency and precision of packaging machines. In this way, the Distributed-Clock functionality allows high precision printing mark control, for example; the time stamp EtherCAT Terminals offer very fast touch-probe inputs of 1 µs.

The main information at a glance:
- Interpack 2008, Messe Düsseldorf, Germany
- 24 – 30 April 2008
- Opening hours: daily 10 am – 6 pm
- Beckhoff booth: Hall 15, Booth D25/E26

www.beckhoff.com/interpack
www.interpack.com
The move to the CX1020 Embedded PC for PLC and Motion Control was straightforward as the existing Bus Terminal I/O system and TwinCAT programming tools could be used.

Marden Edwards, based in Wimborne, Great Britain, has so far produced more than 8,500 overwrapping systems and exported to more than 150 countries. It is a measure of the reliability and lasting quality of the machinery that many of the early machines produced more than 40 years ago are still in operation.

Overwrapping machines produce a high-quality folded, sealed and fully enclosed wrap around a product or group of products. They are energy efficient, as little heat is required to seal the film, and are well placed to use the latest generation of starch-based biodegradable films.

"A requirement to have both a flexible control system that allows customers to quickly change pack sizes, plus having the ability to adjust the wrapping speed on-the-fly where key to the design," explains Marden Edwards Technical Director Jeremy Marden. "We have used the Beckhoff BC9000 Bus Controller for a number of years and found the flexibility and range of the I/O Bus Terminals very effective. It was therefore the natural step to move to the CX1020 Embedded PC for PLC and Motion Control as we could use the existing Bus Terminal I/O system and TwinCAT programming tools. This made the transition simple."
PLC, Servo Motion Control and improved visualization on a single platform
The new TM100 packaging machine required a user interface to present production information as well as enabling the customer to visually change the pack size up to a maximum of 200 x 100 x 300 mm. By utilizing the CX1020 Embedded PC plus the CP6901 Control Panel, Marden Edwards were able to implement the PLC, Servo Motion Control and enhanced user visualization on a single platform. Marden Edwards developed the TM100 to be modular, allowing options such as a stacker unit to be attached easily. This is quickly implemented just by adding extra Beckhoff Bus Terminals. The CX1020 in combination with the TwinCAT automation software controls the AX2500 Servo Drive over Ethernet. Utilization of the flexible control system dramatically reduced the development phase from several months to a record time of just a few weeks.

More efficient machines for new packaging options
The new TM100 overwrapping machine is designed to provide an extremely high quality of wrap with all seal positioning parameters placed under the operator’s control. Changeover from one size to another takes less than 10 minutes and is assisted by the Beckhoff Servo Drives and motors, which meter the film and control the infeed pusher. This enables the machine timing to be optimized for any given pack size resulting in highly efficient operation. The built-in film slitter, which enables one size of film roll to be used for many different pack sizes, automatically winds waste material onto a separate reel allowing for easy changeover between sizes. In addition, an individual pack separation system is used to transport the box through the folding sequence. This assists in keeping boxes square and accurately positions the dot end seals.

CX1020 facilitates expansion
The next stage of development for Marden Edwards is to migrate to the new AX5000 EtherCAT Servo Drives. This will reduce both installation time and cost by using the dual servo axis option of the AX5000 family. “By having a control system based on PC rather than PLC architecture, we no longer need to have extra peripheral products such as a separate PC for SCADA,” highlights Jerry Bugler, Marden Edwards Software Engineer. “Our customers are always asking for production data and efficiency figures to be made available to their own management information systems. As we can easily implement an OPC server on the CX platform, it allows the data to be served to any compliant third-party package. This would be very difficult, if not impossible, to do using traditional PLC solutions. We even download all documentation and electrical drawings onto the CX and display these on the CP6901 as PDF images,” continues Jerry Bugler. The addition of print registration, also implemented in the CX1020, not only reduced wastage of the wrapping film but allows the printed face to be placed on any side of the package.

Marden Edwards Limited www.mardenedwards.com
Hayes Control Systems Ltd www.hayescontrols.co.uk
Plastic blow molding machines such as those made by Bemaco are used to produce hollow plastic bodies such as drums and canisters for the packaging industry, fuel tanks for cars and technical components for the automotive industry, or – using smaller machines – vials and small bottles for cosmetics.

Blow molding machines operate according to the following principle: Plastic granulate is melted in an extruder and is transported into an accumulator where the hot, viscous melt is collected and, once a specified quantity has been reached, ejected from the extrusion head in the form of a plastic tube. During the ejection process, the required wall thickness in vertical and/or horizontal direction is generated through servo-hydraulically operated cylinders. The plastic tube is subsequently formed in a water-cooled blow mold through injection of air.

The main control criteria for the plastic molding process are:
- observance of the melting temperature for preventing qualitative impairment and creating a visually uniform surface of the plastic part,
- control of the wall thickness of the extruded tube to ensure the required wall thickness for geometrically complex parts,
- fast and precise control of the clamping unit to ensure high productivity and low wear of the expensive blow mold.

All axes of the blow molding machine are hydraulically operated. Modular safety technology serves as protection of operators and the machine.

“We met these requirements with modular automation technology from Beckhoff,” said Jörg Johannpasedag, Electrical, Electronics and Software Manager at Bemaco Engineering. “Computing power, data interfacing, safety technology and the controllers are scaled and modularly configured according to the requirements of the system. This means we only use what we actually need, which minimizes costs. This kind of modularity also gives us flexibility for subsequent extensions or modifications.”

Bemaco Engineering based in Langenberg, Germany, produces plastic blow molding machines and offers upgrades for existing systems. The plastic blow molding industry is a very competitive market. Only cost-effective and highly productive machines for fast and reproducible production of high quality plastic components can succeed in this competitive environment. Bemaco therefore uses innovative control technology from Beckhoff.

Modular safety technology saves engineering costs
Tailored computing power
At the core of the control system is the CP6622 built-in Control Panel with Windows CE and TwinCAT as the control platform. The Control Panel has two RJ 45 Ethernet ports for connection to the corporate network and for an EtherCAT connection. The EtherCAT connection does not require a fieldbus card. In addition, two USB interfaces and a serial RS232 interface are available. The Control Panel offers access to all system components such as the heater, clamping unit, blow station, and hydraulic drive. Jörg Johannpaschedag explained: “The data points of the system components are directly and locally integrated via Bus Terminal stations. For each data point we selected the ideal Bus Terminal from the large and modular I/O terminal system and configured an individual I/O station for each system component. We installed the Bus Terminal stations locally in terminal boxes at the system components. This shortens the wiring routes for the actuators and sensors and makes the wiring configuration more transparent.”

EtherCAT offers higher precision for wall thickness cylinders
Bemaco uses fast Ethernet-based EtherCAT as the fieldbus system. “With EtherCAT we achieve sampling rates of less than one millisecond,” said Ralf Gösmann, Mechanical, Hydraulic and Pneumatic System Manager at Bemaco. “This increases the precision of the production processes and, as a result, the parts quality. One example is the setting of the wall thickness via the wall thickness cylinder. Due to its mass, precise and smooth process control can only be achieved with fast control.”

TwinSAFE - modular safety technology
In the past, safety components such as emergency stop switches were wired conventionally. With the TwinSAFE terminals from Beckhoff the safety functions are integrated directly in the bus system. Ralf Gösmann is delighted: “Safety terminals save wiring effort and associated costs. We chose the safety terminals
according to the safety functions required at the system components and directly integrated them into the Bus Terminal system locally. For example, we connected the emergency stop switch directly in the heater terminal box."

The strategies for safety-critical situations are implemented in software. A library provides pre-assembled function blocks that can be configured and adapted according to each unique application. "Implementation is straightforward," said Jörg Johannpaschedag. "Our developers quickly mastered the function blocks and were able to configure the required safety strategies very efficiently."

The right control for any application

"We achieve precision and reproducibility through optimized control technology based on TwinCAT automation software," said Jörg Johannpaschedag. TwinCAT makes implementation of the complex control system for the plastic blow molding machine very easy. Controller libraries are available for this purpose. The TwinCAT PLC hydraulic positioning library is used for controlling the hydraulic axes. Temperature control is implemented via the TwinCAT PLC temperature controller library.

"The production of high-quality plastic components requires consistent observance of the melting temperature in order to avoid damage to the material through excessive temperature fluctuations. The TwinCAT PLC temperature controller fully meets our process control requirements. Automatic determination of controller parameters results in good transformation of the control path properties," said Jörg Johannpaschedag.

Michael Gottschalk, Commercial Director at Bemaco Engineering, added: "Convincing factors for us were the high-performance PC-based automation technology without special hardware and the comprehensive range of Bus Terminals – including safety terminals. This technology enables us to provide customer-oriented solutions with lower engineering costs."

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Bemaco Engineering, Germany, [www.bemaco-engineering.de](http://www.bemaco-engineering.de)
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→ Standard and safety I/Os in a single system
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The integrated safety-system from I/Os to drives:
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→ Modular | secure and standard signals in a single I/O system
→ Universal | a single safety solution, covering individual machines and groups of machines
→ Available | comprehensive diagnostic options
→ Convenient | secure signals automatically also in standard control system

For further information and international sales contacts see:
www.beckhoff.com

BECKHOFF New Automation Technology
The primary focus of the alterations at the historic Dolder Grand Hotel at Zürichberg was not "return on investment", but on the restoration of an old, historic landmark and its adaptation to modern requirements, which was only possible thanks to investments from passionate patrons.

Under the lead management of London-based architects Foster and Partners, internationally renowned for (among many other projects) the conversion of the Reichstag in Berlin and the Swiss Re-Tower building in London, new and old were combined in a unique way, with innovative building technologies creating maximum comfort and luxury. Set in a unique location between the lively city and the invigorating outdoors, the Dolder Grand offers many facets of a luxury class hotel: 173 lavish rooms and suites, a 4,000 m² spa area, exquisite catering as well as spacious banquet and seminar facilities – all to offer guests maximum comfort. A special highlight is the ballroom.

Combining energy efficiency and luxury

The energy supply system for the Dolder Grand is based on a pioneering idea: Heating and cooling demand is largely met with a 400,000 m² geothermal energy storage system. 70 geothermal energy probes with a length of 152 meters each are buried below the foundations of the new buildings. In the summer the probe array is used for providing pleasant cooling in all rooms. In the winter it extracts heat from the ground that is supplied to the heating system. Hot water for bathrooms and kitchens accounts for about half of the total heat demand. The heat from waste water is also recovered. Natural gas is used for supplementary heating. The advanced geothermal energy system reduces electricity consumption and heating costs substantially. A prerequisite for this intelligent energy concept to succeed is equally intelligent building automation: It controls all systems, enables efficient maintenance and rapid response in the event of malfunctions, stores all main data for continuous energy optimization and is so advanced, it is in some ways comparable to the human nervous system.

Inside, the Dolder Grand looks spectacular: Traditional design elements and craftsmanship were combined with advanced materials and a warm color scheme. The new "Spa Wing" and "Golf Wing" nestle against the historic main building, linking past and future. The high quality interior includes integral room automation with user-friendly operation that enables setting of individualized room comfort levels, complemented by an outstanding audio/video system. Thanks to the flexible technology, the room automation data are also available for the Beo5 remote controller from Bang & Olufs, enabling integrated operation of all room systems.

Fully integrated building automation

The building automation system was designed and executed based on advanced concepts and technologies. Panthek AG, the company commissioned to imple-
The Dolder Grand Hotel combines new and old in a unique manner and creates maximum comfort and luxury with innovative technologies.

For maximum individual comfort: integral room automation in all guest rooms.
Management of the Dolder Grand Hotel, Zürich

The Dolder Grand is among the largest construction projects in the Swiss hotel sector. Under the lead management of London-based architects Foster and Partners, new and old were combined in a unique way, with innovative building technologies creating maximum comfort and luxury. The building automation consists of:

- **Control**: 280 CX9001 Embedded PCs or CP6719 Ethernet touch panels
- **Software**: TwinCAT PLC, TwinCAT Building Libraries, Webfactory (web-based operating system)
- **Communication**: Ethernet TCP/IP, subsystems: MP-Bus, DALI, M-Bus
- **Data points**: 100,000 (25,000 I/O terminals)

The fine art of system integration

In such a large project with more than 25,000 wired and more than 250,000 virtual data points, systematic and efficient engineering is crucial for ensuring that the work can remain profitable for the contractor. This is especially true in view of the need for the flexibility to cope with constant modifications during the execution phase. Panthek developed a number of customized solutions based on its long-standing experience as system integrator. The main tool is a so-called “generator”: From the wiring diagram, Excel tables corresponding to the terminals and connections used in the building are created based on templates. From these the “generator” creates exp files for the Beckhoff controllers, thereby completing basic programming tasks. The entire control system is based on such program blocks developed by Panthek. Building on the basic programming, staff must add certain program components as a second step. With support from the “generator”, many man-hours can be saved considering the large number of controllers used in the hotel rooms.

The serial connection of DMX lighting systems for the ballroom is another special feature of this project. DMX is a standard for show and theater lighting. Therefore, the chosen solution involves serial communication via DALI, which operates impeccably in conjunction with a commercially available DALI-DMX gateway.

The majority of the lighting systems communicate via DALI, thereby considerably reducing the cabling effort compared with digital outputs. Here too, special tasks

Hotel guests can operate all functions, from lighting to audio/video, via the innovative Beo5 remote control from Bang & Olufsen.
had to be solved such as control of the door-level LED displays outside the spa treatment rooms indicating the remaining treatment time. A very important aspect in a building of this class is simple operation of lamps, blinds, curtains, and audio/video equipment in the rooms and suites without requiring labels or instructions. International guests do not want to have to read the user guide in order to set the required comfort level. The innovative Beo5 remote controller with a small display communicates with the TV set via infrared, through which the room automation data is transmitted to the CX controller via a special protocol. In this way, guests have all the data available that are required for individual fine-tuning. Dolder Grand features a first in HD TV technology for a Switzerland hotel: All TV programs and Pay-Per-View TV programs are distributed via the IP network as streaming video to the decoder boxes in the suites. System integration for this complex installation was carried out by AVS Systeme AG. Standard components enable customization

Some readers may well think that high-end building automation is only suitable for luxury buildings. Not so, as demonstrated in a wide range of other projects. Thanks to the modularity of the hardware and software used (tailored exactly to the requirements of each individual building), the availability of interfaces for all subsystems and the utilization of "normal" network technology available in any modern building, this solution also offers an optimal tool for first-class system integrators in office and industrial buildings, schools, cultural institutions, transport facilities and even networked homes. With the Dolder project, Panthek has proven its place in this top league. Until the hotel opens in April 2008, the system will no doubt be fine-tuned and optimized even further.

Panthek Building Automation AG
Panthek Building Automation AG was established in 2007 with branches in Zurich, Chur and Lucerne. The new company bundles the competency of two system integration suppliers for building automation and intelligent living. Panthek combines sound advice with technology-based service and accompanies customers with comprehensive experience along the complete project planning chain in different roles: as visionary, developer, implementation planner, system integrator and operator.

www.panthek.com
The LTU arena in Düsseldorf is a highlight among stadiums in Germany. As a multi-purpose arena with a capacity of 51,500 seats, movable roof and “Media Screen” facade, it offers an ideal venue for sporting events and concerts. GTE Gebäude- und Elektrotechnik GmbH & Co. KG has equipped the arena with state-of-the-art building services and is responsible for day-to-day operation. In order to present their Building Automation over IP (BAoIP) effectively, GTE has been reserving a 65 m² box with a capacity of 24 seats at LTU arena since February 2007. All room functions are controlled via the Internet-based software platform raumtalk®, which offers flexible expansion of building automation standards such as climate and lighting with safety, multimedia, facility management, office automation and other functions.

**Multi-functionality in the VIP box**

The VIP box is a multi-functional space that meets all requirements for meetings, presentations, workshops and catering. In addition to state-of-the-art presenta-

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Over recent years, Beckhoff has made a name for itself in building automation technology, particularly for industrial buildings. In addition, several German football (soccer) stadiums are among the high profile application examples from the company: For example, all lighting at Allianz Arena in Munich, including the famous facade, and the movable football pitch at Veltins Arena in Gelsenkirchen are controlled with Beckhoff technology. The innovative building automation system for the VIP box of GTE Gebäude- und Elektrotechnik GmbH at the LTU arena in Düsseldorf is also based on hardware components from Beckhoff.

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Elaborate LED illumination of walls and dimmable ceiling lighting offer optimal light conditions for any occasion. Green-bluish light provides an objective atmosphere for workshops or business meetings. Red and yellow tones provide atmospheric warmth and comfort for lunch.
Embedded PC becomes the lighting control VIP

The controller centerpiece is the CX9001 Embedded PC with Windows CE as operating system and TwinCAT PLC as the PLC controller. The small-format Industrial PC is directly mounted on DIN rail and located within the VIP box in a glass terminal box and is illuminated with colored LEDs. On the CX9001 all functions are made available through the raumtalk® software via standard Web service directly in the network. This enables operation via PDA/mobile phone, PC, touch panel or IP phone. The control units communicate with the CX9001 Embedded PC directly via Ethernet web service technology. Communication with the IP phone takes place via web server. "Due to its high transfer rate, Ethernet offers adequate capacity reserves for image and voice data and multimedia functions – in addition to data communication for the building services," Eric Giese said. "In the VIP box we use an integrated data infrastructure for the IT network and building management purposes. The use of standard technologies reduces installation, maintenance and service costs."

Ideal lighting for any situation or mood

All actuators and sensors for the VIP box are connected via the Beckhoff Bus Terminal system. For example, the ceiling spotlights and colored LEDs are directly controlled individually or in groups, depending on the required illumination scenario. In addition to color nuances, the light intensity is crucial for the atmosphere in a room. "This is where the KL2751 dimmer terminals from Beckhoff come in," Eric Giese said. "We are able to select light intensity values via the controller process data according to the required atmosphere."

User-friendly with versatile operation

"A further highlight is the integrated operation of the room functions in the VIP box via raumtalk®," Eric Giese said. "We require only one light switch with EnOcean technology for basic illumination. All other control options are implemented via Internet applications through so-called SoftControls based on PCs, touch panels, PDAs/mobile phones or IP phones. The light switch with EnOcean technology is connected via the KL6023 wireless adapter from Beckhoff. "The KL6023 enables mixed operation via SoftControls and EnOcean radio switches," Eric Giese said. "In this way, we can create cost-effective and flexible operating systems without significant cabling effort." The controller for the VIP box is integrated into the higher-level building controller via LON Bus Terminals, which means that SoftControls can also be used to control higher-level functions such as air-conditioning.

Flexible and easy to adapt

"Subsequently, modifications or extensions are no problem for us," said Eric Giese. "They are implemented in the building floor plan via the management software and automatically realized in the controller through raumtalk® at the push of a button. Thanks to the flexible and modular Bus Terminal system from Beckhoff, hardware extensions and upgrades are also not a problem."
The 4-star hotel “Holiday Inn Samara” with views of the Volga River lies in the historic district of Samara. The atrium was awarded first prize in the “Public interior” category of the international “Under the Rooftop IX” competition for architecture and interior design. The hotel has nine floors and two basement levels containing 177 guest rooms, nine conference rooms, catering and wellness facilities. All rooms are equipped with individually controlled air conditioning, LCD TV or projector and an Internet connection.

Beckhoff technology controls all automated systems

The design objectives for the “intelligent hotel” were maximum comfort for the guests, reduced energy consumption and flexibility regarding future adaptation and modifications. All supply systems for air-conditioning, heating, ventilation, de-smoking, warm/cold water and waste water are automated through PC- and Ethernet-based controllers from Beckhoff. “The crucial factors in the decision in favor of Beckhoff technology included the convenient integration of all common building services bus systems such as EIB or LON and the integrated programming interface of TwinCAT automation software,” Ivan Golubtsov, director of the Beckhoff agency in Moscow, said. Project design, installation and on-site commissioning were carried out by Bliss GmbH Samara, a Beckhoff integration partner in Russia.

Enhanced comfort – optimized energy consumption

Beckhoff Embedded PCs and Bus Terminal Controllers are used for monitoring and controlling the supply systems. Data exchange between the PCs and the Bus Terminal Controllers takes place via Ethernet. Bus Terminals log and control more than 20,000 data points distributed across the hotel.

TwinCAT automation software forms the centerpiece of the control system. At “Holiday Inn Samara” it deals with monitoring and controlling the following functionalities:

| Signaling functions: error messages and building monitoring with central logging and communication activation via SMS |
| Room control: temperature and climate control |
| Power management: measurement, logging and optimization of energy consumption |

The freely programmable PC controller offers almost inexhaustible functionality. Modifications or extensions of functions can be conveniently configured or amended via software. To make programming according to IEC 61131-3 easier, a standard library for solving basic functions is available. TwinCAT supports connection of all common fieldbuses and PC interfaces, as well as data interfacing via open standards such as OPC. “A commercially available SCADA system for visualization and monitoring of the supply systems is integrated in the control system at the Holiday Inn Samara via OPC,” Ivan Golubtsov said. “Functions such as remote diagnostics and maintenance can be realized in conjunction with TwinCAT. In the event of a problem with the gas burner for the warm water system or the ventilating fan, for example, the control system generates an error message, which is displayed on the monitor of the central control station.”
A control cabinet with CX1000 Embedded PCs and CAN master is located on each level of the hotel. Via CANopen, the Embedded PCs control a total of 200 “Low Cost” LCS100 Bus Couplers.

Architects “Samogorov & Pastuschenko” (Samara) were awarded first prize in the “public interior” category of the international “Under the Rooftop IX” competition for the atrium of the Holiday Inn Samara hotel.

Communication from rooftop to basement for added safety

The control technology is basically the same on all 11 levels of the hotel (see topology diagram). Each floor control system consists of a CX1000 Embedded PC with Windows CE as the operating system and subordinate CANopen slaves:

message specifying the type and location of the fault and sends it to the service technician via SMS.”

The building data are analyzed for optimizing the control of components and minimizing energy consumption.
17 or 30 I/O stations with LC5100 Bus Couplers monitor the fire protection flaps and extract fans of the smoke extraction system. A hand switch for manual activation of the smoke extraction system is located on each floor. The hand switches are connected via the EIB bus system and with the higher-level Ethernet bus system via the KL6301.

The supply systems for air-conditioning, heating, ventilation, warm/cold water and waste water are controlled via 40 I/O stations with BC9100 Ethernet controllers. "A key advantage of this control system is that all safety-relevant functions are maintained in the event of a network failure," Ivan Golubtsov said.

The I/O stations are distributed across the upper level, the basement levels and the heating plant room.

A switch for data exchange between the CX1000 Embedded PCs and the BC9100 Bus Terminal Controllers is located on each floor. The switches are redundantly connected via optical fiber cables, which ensure cross-level communication of the PCs. The central data are brought together and analyzed in the host computer via Ethernet.

Ethernet integrates the IT and automation worlds
Ethernet as an integrated communication system connects the data worlds of office and building services. In addition to data communication for building services, high-performance Ethernet with high transfer rates offers sufficient reserve capacity for image and voice data or multimedia functions. Accordingly, the Holiday Inn Samara utilizes the data infrastructure for the IT network and for building management. The common Ethernet-based data network covers the sensor/actuator, PC and management levels. This means that the sensors and actuators such as temperature sensors and motors for the ventilation and extract fans can communicate with the higher-level control system. Dual data management is no longer required.

Integration of more than 20,000 data points
Beckhoff Bus Terminals integrate all 20,000 data points of the supply systems and support their monitoring and control functions. For example, they control the room climate based on individual user requirements. They log air quality sensor readings, transfer them to the bus system and send the control value to the ventilating fans. LON and EIB Bus Terminals integrate the corresponding components such as buttons for activating the smoke extraction system into the higher-level Ethernet or CANopen bus systems.

KL6023 wireless adapters receive radio signals from the EnOcean based smoke detectors and convert them to RS485 signals, which are processed by the KL6021 serial Bus Terminal and used for controlling the smoke extraction system. EnOcean is supported by the TwinCAT Serial Communication library. Serial devices such as modems for remote maintenance or diagnostics are also connected via serial Bus Terminals.

Convincing technology
Bliss GmbH successfully met the client's demanding requirements for an "intelligent" hotel through innovative and intelligent building services. Based on the positive experiences with this project, Bliss also intends to use Beckhoff technology for automating the cancer research center currently under construction in Samara.
The biogas-to-electricity plant was developed and funded by MethCap, a WSP Group company, the Central Energy Fund, NRG, a group of empowerment investors, and CO₂ emission rights generated under the Clean Development Mechanism (CDM) of the Kyoto Protocol.

The 4.2 MW power plant is equipped with a smokestack that houses a flaring apparatus from which excess gas escapes. In conventional systems this gas is flared. Over the lifetime of the power plant a gross heat value of at least 1300 GWh would be wasted in this way. “Not in this plant,” Charles Liebenberg, managing director of MethCap, said. “From the exhaust gases we generate electricity which PetroSA uses to reduce the amount of electricity it obtains from the grid. Over the lifetime of the power plant this reduces the carbon dioxide emissions of the public grid by more than 500,000 tons.”

“The construction of this biogas power plant shows that projects for promoting renewables are not just a government dream but are actually being implemented,” said Minerals and Energy Minister Buyelwa Sonjica.

A blower in the chimney of the power plant compresses the gas to 8 kPa. The gas is then burnt in three gas engines, each driving a 1.4 MW generator. Fans protect the plant from excessive temperatures. A CX9000 Embedded PC from Beckhoff with Windows CE operating system and the TwinCAT PLC automation software control the blowers, the fans and the heat exchanger and monitor temperature, pressure and gas quality. The system components are connected to the controller via Beckhoff Bus Terminals.

“We chose Beckhoff technology due to its very good price/performance ratio and the straightforward connection system. For example, the Bus Terminals with Cage Clamp® mechanism can quickly be connected to the cable ends on site,” said Charles Liebenberg. The CX platform is integrated in the PetroSA control system and the higher-level fire and gas leak detection systems. The Ethernet programming and monitoring port of the CX9000 enables high-speed logging of system variables via the Adroit monitoring system. In addition, Charles Liebenberg is convinced that TwinCAT is the optimal development and runtime environment: “In compliance with the IEC 61131-3 standard TwinCAT supports all main high-level languages. This makes it straightforward for us to create our functions with Structured Text. The utilization of function blocks from the comprehensive TwinCAT libraries has reduced our programming effort and simplified commissioning.”

The state-controlled Petroleum, Oil and Gas Corporation of South Africa, or PetroSA for short, has been operating the first biogas-to-electricity plant of its kind in South Africa at its gas-to-liquid refinery near Mossel Bay since October 2007. The environmentally friendly and sustainable generation of energy from excess biogas that was not used in the past is controlled with Beckhoff technology.
BSAutomatisierung GmbH from Rosenfeld, Germany, provides complete automation solutions for manufacturing and assembly plants for machine construction and for plants in the regenerative energy industry. In Geislingen, Germany, they installed and programmed a biogas plant for the operating company, Bio-Energie Heuberg GmbH & Co. KG, with automation technology from Beckhoff. The main areas of use for Beckhoff automation technology are high-tech applications in machine and plant construction. However, Beckhoff technology is so universal in use that simpler tasks, such as the control of a biogas plant can also be achieved without problem.

PC-based automation technology controls biogas plant

Farm waste recycled into biogas

Feeding screws convey the biomass into the fermenters.

The biogas plant has an output of 500 kW. It is fueled with biomass such as corn silage or liquid manure.
The plant has an output of 500 kW and was put into operation in summer 2006. It is powered with biomass such as corn silage or liquid manure. The biomass ferments at a temperature of 38.5 °C (101.3 °F) in two fermenters. This produces the flammable gas methane, plus auxiliary products such as carbon dioxide, water and trace gases, e.g. hydrogen sulfide. The gas is purified and converted into electricity in a combined heat and power plant.

Four farms are connected to the operating company. The biogas plant is distributed locally over the farms. The fermenters and the gas purifier are located on one farm, while gas storage as well as a combined heat and power plant are on the other. The four operators feed the generated electricity into the grid. The heat generated by the conversion into electricity is used to heat houses and stables for drying wood. In this way, an overall efficiency of 80 % is achieved. “One of the challenges lies in the coupling of all of the parts of the plant and the users over distances of up to 500 meters,” explains Thomas Maier, Software Development and Construction Manager at BSAutomatisierung. “The operators wanted a PC-based controller with a connection to the house network, so that the plant can be monitored and its efficiency evaluated from there. A further challenge was to integrate the existing prototype plant. The PC-based controller from Beckhoff allows the integration of existing bus systems in the new plant. In addition, databases can be tied in very simply as a basis for evaluations.”

High-tech connection to farms

The core of the controller is a commercially-available PC with the Windows XP operating system and the TwinCAT control platform. It controls and monitors all parts of the plant in which Beckhoff Bus Terminals are used. The controller from the old plant was replaced by a BX9000 Ethernet Bus Terminal Controller. Existing cables continue to be used on the framework of CANopen and are connected to the SSB interface of the BX9000. SSB is a CANopen-based sub-bus system for connecting peripheral devices. The new parts of the plant were connected via fiber-optic cables using Ethernet TCP/IP and real-time Ethernet. “This way, we achieve fast, secure data transmission – even over large distances. The different Bus Couplers integrate the various bus systems easily in the overall system of the biogas plant and in the operators’ network,” explains Thomas Maier, and he continues: “The terminals used from the Bus Terminal system connect all sensors and actuators locally. Thanks to the modular I/O structure, we can assemble the Bus Terminal systems simply and easily in accordance with our exact requirements.”

Combining distributed process parameters

The biomass is fed to the fermenters in portions of approx. 350 kg (approx. 772 lbs). The operator specifies the daily quantity of biomass to be fermented via the PC. On the basis of this and the predefined portion size, the program calculates the required number of filling processes per day and both initiates and monitors them. Scales weigh the portions and feeding screws convey the biomass into the fermenters, where agitators provide for thorough mixing. Analog Bus Terminals acquire the data from the scales. The KL3403 three-phase power measurement terminals monitor the power consumption of the motors for the feeding screws and the agitators. “High power consumption on the part of the screw feeder points to a blockage. The power consumption of the agitators gives an indication of the viscosity of the biomass. If this is too thick or too thin, liquid or solid biomass must be added. In addition, maintenance of the operating temperature is important for an optimum fermentation process. To this end, PT100 sensors monitor the operating temperature in the fermenters. The sensors are connected directly to the bus system via the KL3202 2-channel input terminals,” explains Thomas Maier, adding: “Using the comprehensive range of Beckhoff Bus Terminals, we can optimally connect all data points. Even the measurement data from the calorimeter in the combined heat and power plant, which is based on the M-bus protocol, can be connected conveniently via a serial interface without using additional hardware.”

Controller increases plant efficiency

Beckhoff TwinCAT PLC automation software monitors and controls all processes in the biogas plant. Thomas Maier explains: “The system communicates with the AWITE gas analyzer via the TwinCAT ADS interface. The visualization is tied in via TwinCAT OPC. In addition, TwinCAT supports the output of process data in the form of CSV files and accommodates the use of the data in Excel and Access for further processing and archiving. Based on the stored data, the operator can track the consumption of biomass and the amount of electricity generated, derive the efficiency and intervene via the controls if necessary.”

Albert Eberhart, one of the operators of the biogas plant, makes clear: “Plant downtime must be avoided at all costs. Following a downtime event, the entire plant must be restarted via an elaborate process. This unnecessarily wastes resources and reduces the quality of the fermentation process. For these reasons, a secure error messaging system is indispensable.” If the system detects an error, the controller reports the error directly to the operator’s mobile phone by SMS and to the PC via e-mail. Thomas Maier is satisfied with the control solution for the biogas plant and looks toward the future potential: “On account of our positive experience, we will continue to equip plants in the regenerative energy sector and in machine and plant construction with Beckhoff Automation technology in the future.”

BSAutomatisierung GmbH, Germany, www.bsautomatisierung.de
ETG opens office in Korea

The EtherCAT Technology Group has opened a regional office in Seoul, South Korea. The office is supported by the new ETG Regional Committee, which was established to promote EtherCAT in this important market. EtherCAT is already widely used in Korea, in applications ranging from semiconductor and flat panel display manufacturing via robotics and machine control to ship building.

The new ETG office is based in Seoul and hosted by the industrial automation company Tri-TEK. It is managed by Mr. Key Yoo, CEO of Tri-TEK, who has been deeply involved in EtherCAT promotion and support in Korea since 2004. Chairman of the Regional Committee Korea and official ETG Representative Korea is Prof. Dr. Yong Seon Moon, CEO of RedOne Technologies. Prof. Moon is a well known researcher in the field of robotic controls and has been involved in numerous Korean technology projects.

Samsung Electronics and LS Industrial Systems, the two largest Korean suppliers of factory automation equipment, introduced EtherCAT motion controllers and drives at the Kick-off Meeting of the ETG Korea Office.

Samsung Heavy Industries, one of the large Korean ship builders, presented why they chose EtherCAT for their application. RedOne Technologies showed their humanoid modular robot, an EtherCAT-based autonomous research robot whose control architecture is based on the analysis of the human nervous system.

South Korea is world market leader in ship building, where EtherCAT is already applied in various applications. Korea is also the home of the world’s largest flat panel display manufacturer, Samsung, who developed its first EtherCAT device for the ultra high resolution hybrid stage control as early as 2005.

Young Youl Ha from Samsung Heavy Industries presents at the ETG Korea Office Kick-off Meeting in Seoul.
EtherCAT successful in Asia

The Far East activities of the EtherCAT Technology Group begin to bear fruit, EtherCAT quickly gains in importance in Asia as well. Driven by demand also from the domestic market, more and more leading controls vendors implement devices with EtherCAT interface. The ETG has 120 members in Asia.

At the EtherCAT Technology Group booth at the System Control Fair in Tokyo – the Japanese equivalent to the SPS/IPC/DRIVES trade show – several Japanese companies showed EtherCAT devices for the first time. Hitachi introduced both an EtherCAT motion controller and EtherCAT drives; EtherCAT is now part of their communication network strategy. There was enormous interest in EtherCAT at the show. Several other important Japanese vendors are currently implementing their EtherCAT devices.

At the Industrial Automation Show in Shanghai the ETG booth was also well frequented. In China several device vendors have started to implement the fastest Industrial Ethernet Technology as well. After the Shanghai show, Dr. YanQiang Liu of the ETG Office China held an EtherCAT implementation workshop which was well received.

At the Kick-off Meeting of the ETG Office Korea the two largest Korean control equipment vendors Samsung and LS Industrial Systems introduced EtherCAT motion controllers and drives. EtherCAT is used in Korea in a large variety of applications, including the most important local industries semiconductor manufacturing and ship building.

Martin Rostan, Executive Director of the ETG, is happy about the good start in Asia: "Even though the markets in Japan, Korea and China are very different, they have one thing in common: the need for high-performance communication technology. Many companies are currently launching the development of new device generations, and EtherCAT is the perfect fit: simple to implement at low costs, best performance, and a truly open technology to which all companies have access in equal measure. I had expected that Japanese vendors would support EtherCAT for the export market at first – and now we see the pleasant surprise that large Japanese machine building companies ask their suppliers for EtherCAT technology. Thus EtherCAT is establishing itself as ‘Japanese’ Fieldbus Technology as well."

EtherCAT Plugfest with international attendance

The 5th EtherCAT Plugfest, hosted by Baumüller in Nuremberg, Germany, was well attended: 10 master and 22 slave device vendors from Europe, Asia and North America tested and proved the interoperability of their devices. The technical focus of this Plugfest was the CiA402 Implementation Guideline for Servo Drives and the Modular Device Profile, which enables the easy integration and configuration of such modular products into EtherCAT networks.
Trade shows 2008

Europe

Germany

Hanover Fair
April 21–25, 2008
Hanover
Main booth: Hall 9, Booth F06
Application Park: Hall 17, Booth D26
www.hannovermesse.com

Interpack
April 24–30, 2008
Düsseldorf
Hall 15, Booth D25/E26
www.interpack.com

IFAT
May 5–9, 2008
Munich
Hall A1, Booth 220
www.ifat.de/en

Drupa
May 29–June 11, 2008
Düsseldorf
Hall 3, Booth F33
www.drupa.com

Automation 2008
June 3–4, 2008
Baden-Baden
www.automatisierungskongress.de

AUTOMATICA
June 10–13, 2008
Munich
Hall B1, Booth 311
www.automatica-muenchen.com

Husum WindEnergy
September 9–13, 2008
Husum
www.husumwind.com

Motek
September 22–25, 2008
Stuttgart
www.motek-messe.com

EuroBLECH
October 21–25, 2008
Hanover
www.euro-blech.com

Forum Maschinenbau
November 5–7, 2008
Bad Salzuflen
www.forum-maschinenbau.com/en

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

Austria

Vienna-Tec
October 07–10, 2008
Vienna
www.vienna-tec.at

Belgium

Buildings of Belgium
May 28–29, 2008
Brussels
Booth 1000
www.easyfairs.com

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

Finland

Teknikka
October 1–3, 2008
Jyväskylä
Booth C-309
www.jklpaviljonki.fi

France

Building Innovations Méditerranée
May 28–29, 2008
Marseille
Booth D6
www.easyfairs.com

SCS systèmes-composants-solutions
December 2–5, 2008
Paris
www.scs-automation.com

Italy

Bias
May 27–30, 2008
Milan
Hall 11, Booth K31
www.fieremostre.it

Norway

Eliaden
May 26–29, 2008
Lillestrøm
Booth C01-13
www.eliaden.no

Spain

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

USA

ATX East
June 03–05, 2008
New York
Booth 3209
www.devicelink.com

SEMICON West
July 15–16, 2008
San Francisco
Booth N-5220
www.semiconwest.org

Fab Tech
October 06–08, 2008
Las Vegas
Booth 12269
www.fmafabtech.com

ISA Expo
October 21–25, 2008
Houston
TBD
www.isa.org

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

Asia

China

Chinaplas
April 17–20, 2008
Shanghai
Hall E1, Booth E11
www.chinaplasonline.com

The 9th International Automation & Instrument Exhibition for Southwest China
April 24–26, 2008
Chengdu
Booth T119, T121
www.aii.com.cn

CWEA 2008
April 25–27, 2008
Shanghai
Hall E5, Booth T019R
www.cwea.com.cn

The 10th International Automation & Instruments (Qingdao) Exhibition
July 28–31, 2008
Qingdao
Hall 2, Booth 2K26
www.zd-yiqi.com

IAS 2008
November 04–08, 2008
Shanghai
www.industrial-automation-show.com

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

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

INDIA

India Packaging Show 2008
August 07–10, 2008
New Delhi
www.indiapackagingshow.com
PC-based control for the tire industry: Tire Technology Exp in Cologne, Germany, now in its eighth year, is the main trade fair for the tire production sector worldwide. Experts from around the globe visit the exhibition and the conferences at the Koelnmesse site. The trade fair activities of Beckhoff focused on PC- and EtherCAT-based automation solutions for the tire industry and XFC technology.

The Embedded World 2008 was the meeting place for the international embedded scene in Nuremberg, Germany. On around 25,000 m² of exhibition space more than 600 exhibitors presented the latest trends in the embedded world. Beckhoff presented its Embedded product range from compact Embedded PCs to high-performance industrial motherboards with Intel® Core™ Duo and Intel® Core™ 2 Duo processor technology and new developments based on EtherCAT, the ultra-fast real-time Industrial Ethernet system.

CeBIT 2008: Industrial PC solutions for IT and automation

CeBIT, the main show for the digital industry, took place between 4 and 9 March in Hanover, Germany. The focus was on industrial IT, industrial communication and building automation. The versatile Industrial PC technology from Beckhoff offers a wide range of application options including factory automation and IT solutions integrated into the production process. Almost 500,000 visitors came to CeBIT with a total of 5,845 exhibitors from 77 countries.
Further information about Beckhoff products and technologies or contact addresses for our worldwide subsidiaries and partner companies can be found on the Beckhoff website.

All PC Control articles are available online at www.pc-control.net.
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⇒ High-speed EtherCAT: short cycle time, synchronicity/simultaneity
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For further information and international sales contacts see:
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