Extremely robust
Extremely compact
Extremely flexible

The C6930 Beckhoff IPC
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### imprint

**PC Control – The New Automation Technology Magazine**

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Beckhoff founded its first subsidiary on September 9, 1999. The opening of a subsidiary in Switzerland was the starting gun for the sprint to consistent international corporate expansion. At that time, the name Beckhoff was known only to insiders in Switzerland. We, a small team of three colleagues, took over the distribution of Beckhoff automation products with great dedication. The Sales and Support Center in the west of Switzerland opened just two years later, in 2001. Today, we are geographically positioned so that our local customers – and those in each respective Swiss language region – are always supported by a contact person. Our customers mainly come from the machine building industry and plant construction. Due to the universality of Beckhoff PC-based control solutions and our extensive range of products, we are represented in almost every branch of industry in Switzerland. A significant proportion of our turnover is generated in the field of building automation.

The fact that we have developed such a good image and are so well known in the market today is due not only to the innovative Beckhoff products, but also to our technical competence in consultation, application assistance and support. Our strength lies in our close proximity to the customer – and we don’t just preach that – we practice it too: together with customers, we develop solutions that are precisely tailored to their needs. Customer relations with strong partnerships are win-win for all involved. On this basis, we have continued our further technological development together with our customers. Many ideas for new Beckhoff products have been born out of specific requirements in the field. In return, we have lifted our customers to new technological heights again and again through innovation and, in this way, made them more competitive. In recent years, for example, we have set new standards in automation with the development of EtherCAT and XFC (eXtreme Fast Control Technology) and have continuously lived up to our reputation as a dynamic, innovative technology company.

Requirements in automation have become increasingly complex in recent years and have changed: there is a clear trend emerging on the market towards complete automation solutions from one source. We at Beckhoff can provide that from start to finish – including application support, after-sales support and product training.

Following the founding of the first Beckhoff subsidiary in Switzerland, which is viewed by many suppliers as a test market due to high export share, several subsidiaries have been founded in the last ten years. Today, with 23 subsidiaries and distributors worldwide, Beckhoff is well positioned in over 60 countries, as a result of which local service and support in the respective native language are guaranteed.
Entrepreneur of the Year Award in East Westphalia, Germany

Hans Beckhoff has been named Entrepreneur of the Year by the Bielefeld Bank Association and "Die Familienunternehmer – ASU" (The Family Entrepreneurs – ASU). The honorary title of "Entrepreneur of the Year" in East Westphalia is awarded every two years. 15 successful entrepreneurs in the region have won the award so far. The award winners are CEOs of mid-sized enterprises, who stand out due to their visionary company leadership, innovative personnel management and product development, and by setting an example in and beyond the region as well as through honorary activities and social work. In justifying the award, Werner Dressler from the Bielefeld Bank Association says: "Hans Beckhoff’s visionary knowledge of the considerable growth perspectives of the global automation market is the basis for a consistent, organic growth strategy that has been pursued for years. In association with this, Beckhoff has expanded its international direct sales network in a goal-orientated manner in recent years. Not only that, Hans Beckhoff holds honorary positions in business associations in addition to his entrepreneurial activities. He promotes education and study for young people as well as sport in Verl, Germany.”

Multimedia on www.beckhoff.com

On the Beckhoff web site you can find different multimedia files: 3D animations about new products, technical multimedia presentations or videos about exhibitions. The multimedia library is constantly extended with additional files. Take a look: www.beckhoff.com/multimedia
The Power Pack for Big Automation Tasks

The Beckhoff C6650 IPC with RAID System

www.beckhoff.com/C66xx

Beckhoff C66xx Control Cabinet PC Series

- Compact IPC series for installation in control cabinets
- Beckhoff ATX motherboards
- Processor: Intel® Core™ 2 Duo or Core™ 2 Quad
- Free slots: 3 PCI, 3 PCIe x1, 1 PCIe x16 graphic card slot
- Main memory: up to 8 GB DDR3RAM
- Options: CD/DVD-ROM, multi DVD, Blu-ray multi DVD
- C6640: compact version
- C6650: on-board RAID controller for RAID 1 system with two mirrored hard disks

www.beckhoff.com
Beckhoff C6930 control cabinet PC: High data security and high performance with space-saving design

1 Mini PCI slot for fieldbus interface, Ethernet port or NOVRAM (option)

2 free plug connector panels for interfaces installed ex works, e.g. RS232, sound or 2 USB ports (option)

Ethernet adapter: 1 x 10/100BASE-T and 1 x 10/100/1000BASE-T

4 USB 2.0 ports

DVI-I connector

COM1: 1 serial interface RS232

1 Mini PCI slot for fieldbus interface, Ethernet port or NOVRAM (option)

1 slot for Compact Flash card

2 slots for 2½-inch hard disks or SSD

Lithium battery

Power supply socket
Ultra compact Industrial PC with RAID system

The new C6930 control cabinet PC from Beckhoff combines everything a cutting-edge Industrial PC requires in a compact aluminum housing: a 3 1/2-inch Beckhoff Motherboard designed for Intel® Core™ Duo or Core™ 2 Duo, a wide range of PC interfaces, up to three Ethernet ports, e.g. for EtherCAT-based controllers and optional fieldbus interfaces for conventional bus systems. The C6930 offers high data security through an integrated RAID system for mirroring hard disks.

The compact C69xx control cabinet PC series currently includes four devices with compact designs, ranging from the C6915 mini PC with Intel® Atom™ CPU to the new compact C6930 IPC with impressively small dimensions of only 89 x 231 x 119 mm (W x H x D). The compact Industrial PC is designed for control cabinet installation and features a 3 1/2-inch Beckhoff Motherboard for Intel® Core™ Duo or Core™ 2 Duo. Cooling fins behind the right-hand side panel enable fanless operation of the PC at temperatures up to 55 °C (131 °F).

The C6930 has an on-board SATA RAID controller for mirroring two hard disks. It can be used for convenient configuration of RAID applications supported by TwinCAT automation software. In addition to or instead of the hard drive, a flash disk can be integrated in the form of a Compact Flash card (CF) or a solid-state disk (SSD). The result is high data security that can be enhanced further through optional UPS functionality.

The C6930 features two free plug connector panels for additional interfaces installed ex works such as RS232, sound and two additional USB ports. Optional fieldbus interfaces, e.g. for PROFIBUS, CANopen, DeviceNet or SERCOS, a third Ethernet port or a NOVRAM memory module for fail-safe storage of process data can be connected via a free Mini PCI slot.

The compact C6930 control cabinet PC is ideally suited for application as a central controller in an EtherCAT-based control system. It is equipped with two standard and an optional Ethernet port and offers optimum performance for all EtherCAT control tasks.

www.beckhoff.com/C6930

Technical data:

- Industrial PC for space-saving control cabinet installation
- processor Intel® Core™ Duo or Intel® Core™ 2 Duo
- 3 1/2-inch motherboard
- 512 MB DDR2RAM, expandable ex factory to 3 GB
- on-board graphic adapter, Intel® GMA950, DVI-I connector
- on-board dual Ethernet adapter with 1 x 10/100BASE-T and 1 x 100/1000BASE-T connectors
- on-board SATA RAID 1 controller, Intel® Matrix Storage Technology
- 11 hard disk, 2 1/2 Zoll, 40 GB (optional: second 2 1/2-inch hard disk or SSD instead of hard disk)
- 1 serial RS232 interface, 4 USB 2.0 ports
- slot for 1 Compact Flash card behind front flap
- optional: Mini PCI card with fieldbus interface, Ethernet port or NOVRAM
- optional: second serial port led out as RS232, RS422 or RS485, sound line inputs and outputs or 2 USB 2.0 ports
- operating system: Microsoft Windows XP Embedded or Windows XP Professional
- protection class: IP 20
- operating temperature range: 0...55 °C (32 ...131 °F)
- weight of the basic configuration: 2.1 kg (4.6 lbs)
- dimensions (W x H x D): 89 x 231 x 119 mm, without mounting plate
In building automation it is becoming increasingly important for operating panels to have an attractive, stylish appearance. In order to meet this need, the Beckhoff Ethernet Control Panels from the CP6608 series with 5.7-inch display are now available with a variety of front designs to optimally match building ambience.

**Individualized front designs for compact Beckhoff Control Panels**

The CP6608 Ethernet Panel from Beckhoff can be operated as a stand-alone PC or with the CP-Link 3 desktop transfer software as a client of another Beckhoff PC. The Ethernet Control Panel serves as an extremely compact controller when used in combination with TwinCAT automation software. Possible applications include building or room control in industrial buildings and hotels as well as office and residential buildings.

In this panel series, the user can choose from numerous front designs: for example, pure aluminum with a refined, contemporary appearance or in black, white and anthracite – all available from order quantities of one. In addition to these standard colors, the front panels can also be manufactured in all standard RAL colors on request.

The new CP6608 Ethernet Panel is optionally available with an interface package which is specially trimmed to the requirements of building automation. The C9900-E197 building automation kit contains two additional inputs and outputs, a sound line output and a microphone input as well as the option to connect a temperature sensor.

At the heart of the Ethernet Control Panel is an Intel® IXP420 processor with XScale® technology and 533 MHz clock frequency on a Beckhoff Industrial Motherboard. The CP6608 panel has a 32 MB on-board flash and 128 MB on-board RAM as standard. Two Ethernet ports with 10/100BASE-T and two USB 2.0 ports are available as external interfaces. Windows CE is used as the operating system.

www.beckhoff.com/CP6608
www.beckhoff.com/building
High-precision temperature measurement in the EtherCAT Terminal system

Reproducible measurements through certified precision

The EL3201-0020 temperature measurement terminal is a new addition to the generation of high-precision analog equipment from Beckhoff. Due to the high basic accuracy, the measuring error is reduced to ±0.1 K of the temperature measuring range. The factory calibration is recorded in an individual certificate, as required for high-precision measuring equipment. Such dedicated measurement technology is the basis for integration of high-performance and high-precision measurement technology without special components.

The EL3201-0020 EtherCAT Terminal enables direct connection of a resistance sensor (PT100) using 4-wire technology. The characteristic curves of the sensors are implemented over their complete measuring range and are made available to the higher-level control system in a suitably linearized form.

The EtherCAT Terminal system offers users simple solutions for integration of high-precision measurement technology without the need for complex familiarization. Reliable reproducibility of results is becoming increasingly important in a wide range of automation applications in order to optimize parameters and ensure verifiability, for example for online quality monitoring in running processes. Beckhoff meets these requirements with a calibration certificate that authenticates the measuring accuracy of the terminal and the exact measuring error. Online download of the certificate based on the serial number and terminal handling similar to common analog terminals make the application of high-precision measurement technology very convenient.

www.beckhoff.com/EL3201
The concept of the Fieldbus Box was presented for the first time at Hanover Fair in 1999. The Fieldbus Box modules are “fieldbus-neutral” and are distinguished by their compact design, rated for protection class IP 67. Beckhoff has now developed a new, high-performance IP 67 solution especially for EtherCAT applications: the EtherCAT Box.

The PC Control editorial staff spoke to Beckhoff’s Product Manager Dirk Bechtel on the subject of the IP 67 world and on the new features that are available to the user with the EtherCAT Box.

10 years of the Fieldbus Box – an interview with Product Manager Dirk Bechtel

EtherCAT Box: Continuous high-speed Ethernet extended to the IP 67 world

The Fieldbus Box celebrates its 10th birthday this year. Where are the IP 67 modules primarily used and what are the main areas of application?

Dirk Bechtel: A tendency towards miniaturization can be seen in all areas of daily life, that is to say, everything is becoming smaller and more compact – and this trend is affecting automation technology, too. The market is demanding more and more electronics in the smallest space or in the smallest format. Beckhoff has not just followed this trend with its Fieldbus Box modules, but in fact set the trend very early on. The compact IP 67 modules are installed directly on the machine and do not require a control cabinet. They are therefore used primarily where there is limited space for installation and where costs need to be saved. – Eliminating a control cabinet naturally also reduces the costs. – Typical fields of application are, for example, handling and assembly technology as well as the packaging and semiconductor industries.

To what extent are the Fieldbus Box and the EtherCAT Box modules compatible with one another?

Dirk Bechtel: The Fieldbus Box and the EtherCAT Box modules have identical housing form factors and the same dimensions, allowing the user to convert to EtherCAT conveniently with no additional mechanical engineering expenditure. To put it simply, we have upgraded Beckhoff’s
previous IP-Link technology using EtherCAT. Analogous to our IP 20 I/O systems (Bus Terminals and EtherCAT Terminals), the EtherCAT Box is not intended to replace the successful IP-Link Box, but to allow entry into the world of ultra-fast high-speed automation, for example with the eXtreme Fast Control (XFC) modules. We will be consistently developing both IP 67 series into the future.

The new EtherCAT Box modules have enlarged the IP 67 product range from Beckhoff. What are the main differences with the Fieldbus Box solution?

Dirk Bechtel: The fieldbus box modules with IP-Link communicate via the Coupler Box with the superimposed controller. This converts the respective fieldbus, e.g. PROFIBUS, DeviceNet, CANopen, etc. to IP-Link. IP-Link is a fast fiber optic bus that connects the local Extension Box modules with the Coupler Box. This conversion is eliminated in the EtherCAT Box. Each box is a 100 percent EtherCAT device and a self-contained EtherCAT slave, which can be connected directly to any other EtherCAT device via an Ethernet cable with 100BASE-TX.

Does that mean that you can connect two EtherCAT modules with a conventional Ethernet cable over a distance of 100 m?

Dirk Bechtel: In theory, yes. In practice, too; however, not all cables are created equal. By that I don’t mean so much the transmission properties of the cable, but rather its industrial suitability, such as shield properties, flexibility or handling when fitting plugs on site. For this reason, we offer our users a range of Ethernet or EtherCAT cables as well as connectors that are optimized for the most diverse industrial purposes.

How has the EtherCAT Box been received by the market?

Dirk Bechtel: Acceptance was virtually instantaneous – as if the market had been waiting just for the EtherCAT versions of the Fieldbus Box! On the one hand, this development gives many EtherCAT users the ability to process signals directly with an IP 67 box in the field without an additional control cabinet. On the other hand, there are many IP-Link users who can now simply switch to EtherCAT with the same IP 67 design. By means of direct connection, a transparent, continuous communication

Beckhoff EtherCAT Box

The Beckhoff EtherCAT system has been extended with EtherCAT Box modules rated with protection class IP 67. The modules can be connected directly to an EtherCAT network via an integrated EtherCAT interface. The impressive EtherCAT performance of 100 Mbit/s is therefore retained right into each IP 67 box. With dimensions of only 126 x 30 x 26.5 mm (H x W x D) – the same as the Extension Box modules – the modules are exceptionally small and are particularly suitable for applications where space is tight. The EtherCAT modules cover the typical range of requirements for IP 67 I/O signals: digital inputs with different filters (3.0 ms or 10 µs), digital outputs with 0.5 or 2 A output current, analog inputs and outputs with 16 bit resolution, thermocouple and RTD inputs, and stepper motor modules. XFC modules such as inputs with time stamp are also available.

The Fieldbus Box, the Beckhoff I/O system for IP 67 applications, was unveiled for the first time at Hanover Fair in 1999.
structure is created that offers considerable advantages in engineering, operation and service.

What types of signals are available for the EtherCAT Box?

**Dirk Bechtel:** First of all, we have developed the digital 24 V DC EtherCAT Box modules. Besides the pure input and output modules, there are also combination box modules with four input and four output channels, as well as modules in which the input or output function is freely selectable for each channel. The digital EtherCAT Box modules have been in series use since the beginning of 2009. Analog I/O modules will now follow, along with a stepper motor box that allows the direct connection of a stepper motor (50 V DC, 5 A), incl. encoder and digital inputs/outputs.

The EtherCAT Box also enables use in XFC applications (eXtreme Fast Control). What XFC modules are there? What are the fields of application?

**Dirk Bechtel:** The EP1258, a digital input box with a time stamp function, is one of the first XFC modules in IP 67. It acquires the system time – simultaneously with the digital event – with a resolution of one nanosecond! In this way, many high-precision, dynamic applications can be realized, or their optimization is made possible. A further advantage is that expensive special equipment can be replaced by less expensive sensors using XFC. For example, the measurement of torsion in a shaft can be accomplished using two markings and simple digital sensors. The precisely timed resolution of the digital signal due to XFC technology enables the momentary torsion of the shaft and thus the torque, for example, to be calculated via a powerful IPC.

The compact IP 67 system also supports Motion applications. What types of motors can be used and what are the advantages in comparison with the IP 20 EtherCAT Terminals?

**Dirk Bechtel:** With our first 'Motion Box,’ we can control stepper motors up to 50 V DC and 5 A. Such a solution obviously only makes sense if you can also directly acquire all of the signals associated with the motor. For this reason, the EP7041 also offers an encoder connection, two digital inputs for limit switches and an output for the brake. All relevant signals can be acquired in the compact 126 x 30 x 26.5 mm (H x W x D) box without any additional wiring expense. Due to the compatibility of the software to the IP 20 terminal, migration to the IP 67 world could not be simpler.

Beckhoff is increasingly integrating measurement technology into its I/O systems. Which measurement technique signals does the EtherCAT Box system support? Which modules will follow?

**Dirk Bechtel:** The analog current/voltage input/output box modules offer an entry into the world of industrial measurement technology. The 16-bit resolution represents a solid foundation for solving most tasks in the IP 67 field. We can also contribute to temperature measurement technology with the PT100 and thermocouple inputs. Additional boxes will follow, in which our experience in the IP 20 field will make the conversion considerably easier.

What can we expect from Beckhoff in the future in the IP 67 I/O field?

**Dirk Bechtel:** One large package will no doubt be the integration of safety into the IP 67 world. However, alongside that, the continuous expansion of product variety and the range of accessories in the fields of communication, power and sensor cabling will shape the future.
Material handling technology meets IT

As the prices of photovoltaic (PV) products fall, the demand increases. This places the industry under enormous cost and innovation pressures. Reducing production costs and increasing competitiveness requires efficient and highly available production facilities in which the automation platform is of critical importance. Therefore ACI-ecotec, specialists in production systems for crystalline and thin-film photovoltaic modules, depends on Beckhoff control technology.

ACI-ecotec, located in St. Georgen, Germany (relocating to Zimmern in winter 2009), was formed in 2004 by the strategic takeover of Ecotec Automation by the ACI-group. In the process, the company redirected its focus towards the photovoltaic and automotive supply industry. In the photovoltaic product division, ACI-ecotec is a worldwide market leader thanks to innovative developments in the area of material handling technology and contacting, including thin-film modules. ACI-ecotec also works with its partners to develop turnkey solutions.

PC Control replaces conventional PLC technology
While focusing on the photovoltaic industry, ACI-ecotec’s heritage of precision engineering and production plant construction has proven to be highly fruitful. The best example of this is the ecoTrans transfer system developed by the company. Originally, this patented transfer system was used in the construction of assembly lines. Now the refined version, ecoTrans Solar, connects the process stations in the production of silicon-based and thin-film solar modules. ACI-ecotec is currently installing its material handling technology in a 30 MW thin film solar production line. ACI-ecotec’s supply program encompasses 144 trades which take up around half of the 500 m long production line. ecoTrans Solar integrates a variety of process steps including marking and identification systems, measurement technology and thermal processes as well as special handling tasks such as contacting and dispensing to solar modules. ACI-ecotec uses identification- and laser-marking systems from bo-
boraIdent, another member of the ACI-group. boraIdent uses Beckhoff control technology in its products.

“It is one of my jobs to ensure optimum incorporation of Beckhoff control technology at ACI-ecotec,” reports Ralf Berger, Software Manager at ACI-ecotec and responsible for overall coordination of the automation and software strategy. The handling system is divided into 14 processing islands. Each segment is equipped with a C6920 Industrial PC as the control computer and a 12-inch CP6901 panel as the user interface, both from Beckhoff. There are additional floating operating panels that can be connected to any point on the production line as required for servicing and maintenance purposes. As soon as the operating panels are plugged in, they are integrated into the emergency-stop circuits of the handling system via the Beckhoff TwinSAFE Terminals.

EtherCAT is an integral element in the automation concept and is used as the primary fieldbus system. The Equipment-to-Equipment communication is via either EtherCAT or PROFIBUS interfaces, which are operated on the EtherCAT Couplers as a secondary fieldbus. Communication with the various subsystems integrated into the handling system is via ADS, Ethernet, other fieldbuses or RS232 interfaces depending on the manufacturer.
Handling system with highly efficient IT and communication interfaces

“In reality, the ecoTrans Solar handling system is a massive IT project that succeeds thanks to highly effective communication interfaces,” explains Ralf Berger. “The transportation is closely linked to various sub-processes such as identification and inspection. Measurement and image-processing systems in various forms, x-ray inspection systems and our “ecoFlasher” systems with integrated measurement technology all have to be integrated into the handling system.” Information technology is becoming ever more important in these processes. “We have standardized the horizontal flow of information from machine to machine (Equipment-to-Equipment),” comments the automation expert. “In addition, we had to take into account the vertical flow of information from the equipment, including the handling system and all its integrated subsystems to the MES level.” The MES is the work of ACI-ecotec’s sister company, acp-IT and meets the SEMI standards applicable to the photovoltaic and semiconductor industry. It permits expansion of any stage, from data collection to full remote control of the production line by the MES as well as coupling with ERP systems from different manufacturers, e.g. SAP. Together with acp-IT, ACI-ecotec has developed a product which it is using for the connection of handling technology and process machinery to the MES. This MES interface adapter enables the control systems of the related machinery and systems to connect to the MES. This product uses the standardized SECS interface protocol and satisfies, as does the MES itself, the valid SEMI standards. Therefore, this product can be operated on the MES of any manufacturer provided it meets the required standards. The MES interface software communicates with the related control system via Ethernet and the TCP/IP protocol. Along with TwinCAT PLC, it also supports PLC controllers from other manufacturers. “These flexible communication interfaces,” says Ralf Berger, “have never before been available in this concentrated form in photovoltaic production. With conventional control technology it would have been simply impossible to implement within the time and budget available to us.”

Open automation platform permits flexible solutions based on toolbox principle

ACI-ecotec offers its customers a differentiated solution spectrum, i.e. the various photovoltaic production modules are available in different design variants from manual via semiautomated to fully automated MES-coupled operation. To achieve this breadth of variation, ACI-ecotec employs the toolbox principle. For example, a system can be supplied with manual workstations, which can be replaced at a later date with automated processing machinery. ACI-ecotec also offers scalability in terms of equipping the machine modules with special functional features. Otherwise, customers can operate the PV production in an autonomous line without MES connection and retrofit it at a later time. “We don’t need to replace any hardware in the process,” comments Berger. “As long as we are using an Industrial PC from Beckhoff, there are simply no problems when loading and operating the MES interface adapter.”

Automation expert Berger rates the Beckhoff I/O system as particularly flexible: “In the ecoTrans Solar we are using EtherCAT as the central bus system and preferably EtherCAT Terminals. We use PROFiBUS to connect...
the local handling modules since several of the subsystems integrated into the handling system as well as drives are fitted with PROFIBUS interfaces.”

TwinCAT PLC lets you create all types of communication interfaces efficiently and in a very short time. Ralf Berger and his team learned to appreciate this special characteristic of the TwinCAT system when developing the extremely demanding Ethernet-based MES interface adapters. Particularly the fact that TwinCAT runs reliably on any PC with the Windows operating system without requiring any adjustments to the PLC software has proven to be an enormous benefit. “With control systems from other manufacturers,” according to Ralf Berger, “we had to individually test and adapt dozens of hardware configurations with different CPUs and communications modules. You simply don’t have these kinds of compatibility problems or the associated test and development costs with Beckhoff. The EtherCAT fieldbus and the Beckhoff terminal system let us integrate different peripheral devices and subsystems in a very short time whether via secondary fieldbuses or other communication interfaces, such as RS232 or analog interfaces.” The developer team managed to produce a library of software modules in double-time to enable the integration of devices from different manufacturers with extremely varied communication interfaces. “The resulting ‘toolbox’ drastically reduces the development time for follow-up projects,” explains Berger, of the benefits from the open control platform.

Equally convenient is the security aspect of the PV production modules. “Subsequently, retrofitting a plant with additional security modules is not a problem since we decided to use the Beckhoff TwinSAFE security sys-
A particular advantage of the Beckhoff safety solution is that the TwinSAFE Terminals are used throughout the handling system modules rather than centrally and the fieldbuses can be used to transmit the safety-related signals to the control system. This considerably reduces wiring costs and commissioning costs as a whole. As they are programmable, the TwinSAFE Terminals are highly flexible and can be adapted to meet individual site requirements.

Integration of measurement and control systems into the PC controller

For both surface inspection and quality assurance, ACI-ecotec uses image sensors with and without intelligence on-board. Additional measurement tasks typically used in photovoltaic production relate to the insulation and high-voltage measurement of the photovoltaic cells. Particularly in the case of thin-film solar cells, the so-called “flashers” are used for classification. This takes place at the end of the substrate processing and enables the assignment of the substrate to performance classes which determine its ultimate purpose.

ACI-ecotec also uses automation components from Beckhoff in the ecoCure, a new type of machine for curing substrates. “Due to the heating equipment, this involved a great deal of control technology,” reports Berger. “Traditional PLC systems would either collapse under the weight of control loops or would require additional hardware solutions, which would cost substantial amounts of time and money. Beckhoff’s Bus Terminals and TwinCAT software offer huge benefits in this area.”

Achieving high levels of communication and integration

The development of ACI-ecotec from simple machine manufacturer to process and system provider requires the corresponding expertise in communication technology and software. Ralf Berger is delighted that the Beckhoff platform meets all of these requirements: “The PV industry is closely related to semiconductor production so attention is increasingly focused on data-linking between the equipment and the production control level. Against this background, the subjects of software interfaces and data exchange have become immensely important. We are particularly impressed by Beckhoff’s integration of the PC-based control system into the Microsoft world and its easy programming.” The TwinCAT Libraries couple an extensive range of communication systems -- whether they be Ethernet, EtherCAT or other fieldbuses -- offering variable solution concepts. “ACI-ecotec uses any opportunity to use the functionalities provided in the TwinCAT Libraries,” assures Ralf Berger.

Efficient and successful

The flexibility of the Beckhoff platform offers great benefits in terms of the straightforward connection of peripheral process equipment. However, in the opinion of Ralf Berger: “It is surpassed by the impressive software possibilities and communication options. We also capitalize on the benefits of being able to couple drive technology and the fast I/O terminals. In one project, for example, which involved coupling our handling system with a process module from another manufacturer also fitted with Beckhoff control technology, we came up with an extremely elegant solution to the transfer of the substrates. The challenge was to feed the substrates, which are supplied with specific voids, flush into the process station. For this purpose, we coupled the Beckhoff Controllers via an EtherCAT bridge, then linked in the drive controller of the process station in real-time and controlled the AX5000 EtherCAT Servo Drives from Beckhoff to consistently guarantee flush transfer of the substrates. The problem was solved in just two days both efficiently and successfully.”

ACI-ecotec GmbH  www.aci-ecotec.com

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ACI-ecotec also uses automation components from Beckhoff in the ecoCure, a new type of machine for curing substrates.
The Swiss window and door manufacturer EgoKiefer develops, produces, sells and installs window solutions in PVC, PVC/aluminum, timber and timber/aluminum as well as entry doors. In 2008, the company produced approx. 660,000 m² windows and over 2,250 doors. In order to meet the exacting demands on its production systems, EgoKiefer recently commissioned a fully-automated Schirmer cutting and processing center fitted with Beckhoff control components.

At its plant in Altstätten, Switzerland, EgoKiefer AG relies on a new cutting and processing center from Germany’s Schirmer Maschinenbau GmbH. It is designed to facilitate a two-shift operation for window production. “Our long-term objective is to expand the production from currently 8 hours to 10 or 11½ hours,” explains Hans Beutler, Technical Services Manager at EgoKiefer. The new production plant was implemented in record time. Just 12 months separated the issue of the order and commissioning. “One of the biggest challenges lay in the translation of the system design into available space,” reports Hans Beutler. “The dimensions in which the processing stations plus interlinking were to be fitted were extremely tight. The plant, with layout developed in close cooperation with Schirmer, is therefore extremely compact.”

Working in partnership generates confidence
Schirmer Maschinenbau undertook the design of the processing modules, all mechanical engineering and installation while Beckhoff was responsible for the system automation and programming. “There are already two Schirmer production plants with a Beckhoff automation platform in operation at the production site in Villeneuve in the west of Switzerland. These were installed some years ago. Another plant was installed at the Altstätten site in 2006. We have benefited greatly from the long-term cooperation between Schirmer and Beckhoff,” says Hans Beutler. “Until we had fully mastered the system, we were in almost daily contact with the machine suppliers and the Beckhoff specialists.” External machine control is also possible in the context of remote maintenance. If program modifications are required for optimization purposes, the Beckhoff programmers can arrange to that effect with the EgoKiefer staff on site.
No refitting for profile changes

EgoKiefer produces its current EgoKiefer MPR2, MPR3 and XL+PVC windows systems fully automatically with the new, high-performance PVC window element cutting and processing center. This means the capability to process three different profile types fully automatically with no refitting, and the assembly of customized windows to order from the pre-produced profile sections.

The cutting and processing center includes several processing modules: a total of 16 interlinked stations are required for the complete processing of every PVC window element. Starting with the profile bar, a second production line takes care of the cutting, insertion and screw fastening of the steel reinforcement with continuous welding of the steel profile, assembly of the various locking elements, incl. safety locking elements, and fully-automated stacking of the profile sections into compartment trolleys, in which they are sorted and transported for further processing. This is one of the largest processing centers for window production with a footprint of approx. 1,500 sqm.

EgoKiefer, according to its own information, is the leading manufacturer in the Swiss door and window market and is part of the windows and doors division of AFG Arbonia-Forster-Holding AG. The doors and windows division incorporates the brands EgoKiefer, RWD Schlatter and Slovaktual. In 2008, the division reported net sales of 382.5 million CHF (approx. 250 million Euros), which, thanks to the acquisition of Slovaktual and internal growth, represents an increase of 28.3 percent compared with the previous year. EgoKiefer employs around 950 staff. As an integrated overall supplier, EgoKiefer develops, produces, sells and installs window solutions in PVC, PVC/aluminum, timber and timber/aluminum as well as entry doors. Its registered office is in Altstätten in the St. Gallen Rhine Valley, where the company was founded in 1932. Production also takes place in Villeneuve in French-speaking Switzerland. EgoKiefer has an active presence in all regions of Switzerland: the distribution network comprises eight branches, several sales offices and over 350 workshops. It also has a national window/door service with more than 80 employees.
Fully-automated production down to batch size one

We might not instantly envision window production involving a highly complex production process. However, the variety of designs and sizes and the fact that rather than producing large quantities of standard windows, windows are produced exclusively to order down to batch size one. This places specific demands on the precision and flexibility of the production system. The fully automated cutting and processing center employed at EgoKiefer can process PVC profile bars up to 6.5 m length. It can produce work pieces from min. 230 mm (clear dimension) to max. 3,500 mm (clear dimension); the maximum outside dimension is 3,726 mm. The PVC profiles are fitted with steel reinforcement, which is cut to size, inserted and screwed in place by the fully-automated Schirmer cutting machine.

The individual window elements are then processed further in two Schirmer BAZ 1000 processing centers. The first processing station is loaded with PVC profiles from a feed magazine by an insertion unit. Drainage and ventilation boring, lock case milling, millings for the basic ventilation system, center-boring for the transom welding and locking element marking is carried out here. Two sets of transport tongs with linear drive move the profiles via an interim station to the BAZ 1000-VU processing center. This is a horizontal drilling station with a single-spindle drilling unit, a basic ventilation milling unit with three milling motors, a locking element marking station, a stamping station for notching the central sealing web on the frame, a double stamp for punching out the glass support for the XL® window sashes, a VU double sawing unit (2 x 45°) for simultaneous first and last cut and V-cut for transoms to be welded in and a 90° and 45° saw unit. A conveyor belt for removal of PVC waste and an automatic extraction station for residual pieces (which are removed via a conveyor belt) ensure an uninterrupted process flow.

The steel reinforcement processing starts with the manual insertion of the 6 m long steel profile. A total of six Schirmer steel machining centers are in use throughout the plant. They all have automatically adjustable pro...
file guides. The profiles are initially welded into a continuous profile by a welding machine, sawed to length for matching the PVC profiles, inserted fully automatically by linear drive insertion units into the PVC profiles and screwed into place. Inside the insertion unit, the steel reinforcement is fitted using the tongs positioned by the NC and linear drives at a process-capable positioning speed of up to 180 m/min.

High-performance automation platform
From a control perspective, the system is in two parts; each sector has a controller in the form of a C6140 Industrial PC from Beckhoff. All plant statuses of the respective sector are displayed on the associated Control Panel. Hans Beutler says: “We wanted all error messages to be displayed on a central Control Panel.”
All automation modules, from the IPC through the Bus Terminals to the Panels, are networked via the EtherCAT Industrial Ethernet bus system. The peripherals are connected by Bus Terminals to EtherCAT Couplers. In addition, the entire plant encompasses around 40 servo-axes and six linear axis drives with travel paths of 15 to 20 m plus displacement measuring systems for absolute values. The installed software includes TwinCAT PLC and TwinCAT NC PTP for positioning applications.
EgoKiefer’s window production program is data-coupled with the system controller and supplies the order data (such as production data records). This is processed first in the order preparation and translated into effective machining programs.

Outlook for plant operation
During the commissioning of the processing center, the main focus lay in optimizing individual processes. Firstly, this involved achieving the planned production capacities, and secondly, ensuring that the processes run smoothly, safely and problem-free. “In this respect, we have retrofitted an automatic mechanical traction testing during the continuous welding of the steel inserts,” explains Hans Beutler. This is because, for the first time, the continuous welding is not done by spot welding, but by an 8 mm welding bead. “We must be sure that the welding is sound and will hold,” comments Hans Beutler. This testing cycle was implemented by enhancing the TwinCAT control program.
According to Hans Beutler, 10 to 15 years utilization are expected from these kinds of production plants. Components vulnerable to wear however, e.g. welding equipment, may need to be replaced after 10 years. The cutting and processing line has been designed according to the PC-based control platform in order to sustain such replacements and can be modified for future products.

EgoKiefer AG  www.egokiefer.ch
Schirmer Maschinen GmbH  www.schirmer-maschinen.com
Health care: Matrix Controller for simple, accurate control of non-constant, cyclic set profiles

Complex control technology, simple implementation

Matrix Controller is the universal controller algorithm from Otto Bock HealthCare GmbH that was primarily developed for a machine that tests prosthetic feet. However, it is also suitable for pneumatic servo positioning of the type which occurs in robot technology or when monitoring cyclic, non-constant process sequences in CNC machines and when controlling non-constant processes in drive technology, for example. The Matrix Controller was built with PC-based control technology from Beckhoff. The controller algorithm was programmed in IEC 61131 and implemented directly in TwinCAT PLC. The aim of this development was a software-based solution that enables the use of standardized hardware.
Otto Bock Healthcare, the MedTech company based in Duderstadt, Germany, manufactures products for people with physical disabilities and limited physical mobility. It has a wide range of products, from prosthetics, wheelchairs, and rehabilitation aids including orthopedic splints/braces. The company, which is owned and managed by the third generation of the Bock family, can look back on a 90-year success story founded on innovative drive and an early international focus. The Otto Bock company holds the property rights for 670 granted and 524 registered patents in total.

Prosthetic feet fulfill more than just a cosmetic purpose. Depending on the type of patient and whether he or she has age-related limitations or is a highly active amputee, these aids support the entire process during walking and standing. Testing machines, which repeat the standardized stress and angle profiles during the stance phase (diagram 1) evenly two million times, are needed for performing standardized tests on newly developed prosthetic feet according to ISO standards. The aim is to bring components for prosthetics onto the market that are contemporary, highly functional, and reliable over a long time.

This kind of testing machine is equipped with a standard pneumatic cylinder with two proportional valves, an AX2010 Beckhoff Servo Drive with EtherCAT interface, an AM277S Beckhoff servomotor and planetary gear unit with a power of 4.5 kW, various power and position sensors as well as TwinCAT PLC software running on a Beckhoff Industrial PC (diagram 2). The IPC controls up to four test modules simultaneously via EtherCAT.

The problem: the combination of a prosthetic foot and pneumatic cylinder produces a complex interaction which constantly changes throughout the simulated stance phase and is also influenced by both the type of foot construction as well as its size and wear in the testing machine. The prosthetic foot reacts differently to stresses with every rolling motion.
System design
The servo drive chosen for the foot plate controls the foot position with the necessary precision even under considerable stress. The pneumatic system is controlled via two proportional pressure valves according to the direction in which the piston moves. In this way, the force can be controlled in both directions (up/down) and controlled via the air introduced. The system is controlled via the PLC with a cycle time of 5 ms (200 Hz). A walking cycle lasts 1 s (1 Hz). The foot position is crucial for the measurement. For this reason, a PID position controller is used at the end of the stance phase when the force controller is no longer active. The state machine decides when the position controller or the force controller is activated (diagram 3).

System analysis
In order to examine the system responses, the force progression was regulated by the valve controllers. In the process, the position controller and the force controller were used, the former in closed control loop and the latter in open control loop. In this mode, however, the desired force progression curves did not tally with the actual ones (diagram 4).

The obvious phase shift was the result of the PLC cycle time, the delay caused by the fieldbus, the dead centers of the valve controller, the low-pass behavior of the pneumatic cylinder and the system response time of the foot. In order to eliminate this phase shift, the output signal was shifted by means of a FIFO buffer to 18°/Hz (18° at 1 Hz test cycle), depending on the test speed. Although the difference in amplitude was minimized, it was not entirely removed (diagram 5). An additional force error had to be compensated. At every angle of the foot, the amplitude deviates from the set value by a different amount according to the system characteristics of the prosthetic foot.

The Matrix Controller
Using a PID controller with different parameterization for each point of the curve did not produce a stable signal. Since the foot system also changes with each angle of the plate, a separate PID controller was used for each plate angle.

The stance phase is produced with a cycle frequency of 1 Hz and a PLC cycle time of 5 ms with 120 PID controllers. The remaining cycle time is
needed for repositioning the prosthetic foot. Each PID controller works in its area of the total curve. Information from the last test series is used to correct the force errors in every point. The standard PID algorithm consists of functions for the proportional ($K_v$), integral ($T_n$) and differential ($T_d$) area. These can deviate from one another from controller to controller. Together they produce the PID parameter matrix:

$$M = \begin{pmatrix} K_{v0} & K_{v1} & \ldots & K_{vN} \\ T_{n0} & T_{n1} & \ldots & T_{nN} \\ T_{d0} & T_{d1} & \ldots & T_{dN} \end{pmatrix}$$

Changing the parameters of each individual controller makes it possible to justify the controller output for each area of the curves separately.

### A five-fold increase in precision

This simple method for controlling the force profile produced an immediate improvement. Diagram 6 shows the behavior of the system after only 200 test cycles. There is only approx. 3 percent deviation with two million stress cycles. While the controller matrix works in cycles, the output signal can be displaced by $18^\circ$ to compensate the dead center and the system-related delays.

As long as the feedback signal is located within a defined curve tolerance, the Matrix Controller will not intervene. If the force progression changes within the two million stress cycles because the prosthetic foot wears out, the Matrix Controller will control up to a specified number of correction settings subsequently. If this number is exceeded, the prosthetic foot has not passed the test. The measured data facilitate the analysis of possible design faults or production weaknesses.

The Matrix Controller is easy to implement and manages systems with complex control requirements. For this it needs only the computing power of a single PID controller for the PLC cycle. "A cycle time of 5 ms (200 Hz)," Erik Albrecht-Laatsch explains, "proved sufficient to regulate the pneumatic control. Neither simulations nor other complex technologies were needed to control the system."

### Patented Matrix Controller has many uses

Controlling cyclic occurrences with non-constant processes places considerable demands on control technology. The Matrix Controller introduced here offers a surprisingly simple solution: The non-constant control profiles are divided into many constant control sections. This produces a time-control matrix in which each matrix column is represented in two ways: the short time section of a non-constant set profile is process-related; the autonomous, constant set profile is segment-related. Traditional PID controllers can be used to control the process within this section. This innovative approach illustrates a new model in control technology for all types of non-constant and constant periodic signal profiles. For a license holder, the patented Matrix Controller (EP 1 982240B1) is effective, safe and relatively inexpensive to use in many other contexts as well, such as testing machines, robots, CNC machines and when controlling positioning and force for other pneumatic and hydraulic applications.

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Otto Bock HealthCare GmbH www.ottobock.de
The Swiss branch office, the first international subsidiary of Verl, Germany-based Beckhoff, was founded on September 9, 1999. In addition to the headquarters in Schaffhausen, the Swiss Beckhoff Automation AG today has four additional offices in Zurich, Derendingen, Yverdon and Tessin. With a total of 18 employees, Beckhoff Switzerland achieved turnover of around 15 million Euros last year.

Beckhoff Switzerland celebrates its 10th birthday

Beckhoff Switzerland, with its head office in Schaffhausen, was founded 10 years ago. In the beginning, just two employees took over sales of Beckhoff automation components together with Managing Director Gerhard Meier, but the sales and support center in West Switzerland, managed by Philippe Monnin, opened only two years later in 2001. "We have achieved respectable market success in Switzerland, not least due to our dedicated participation in trade fairs and the organization of roadshows," says a satisfied Gerhard Meier.

The Beckhoff Switzerland customers mainly come from the areas of machine building and plant construction. "Thanks to our large range of products and the openness and flexibility of our control solution, we are present in almost all industries in Switzerland," explains Gerhard Meier, and he goes on: "A significant proportion of our turnover is generated in the field of building automation, where we now have very good references." "The fact that we have such a good image and are so well known in the market today is due not only to the innovative Beckhoff products, but also to our technical competence in consultation, application assistance and local support," explains Gerhard Meier. Beckhoff’s strength is its proximity to the customer. "If the customers so wish, we develop solutions together with them that are precisely tailored to their needs," says the managing director. Beckhoff Switzerland is geographically positioned such that the local customers – and those in each respective language region – are always supported by a contact person. "There is a clearly recognizable tendency on the part of customers to want a complete automation solution from one source," says Gerhard Meier. "We can do that: we offer Industrial PCs, I/O components, drive equipment, software, application support, after-sales support and product training. Our own Application Department is supplemented by a nationwide collaboration with solution partners."

The founding of the first international subsidiary in Switzerland was followed by others; today, Beckhoff is represented by 23 subsidiaries and distributors in over 60 countries worldwide. "In that way, we can guarantee local service and support in the respective national language to our mechanical engineering customers, who export worldwide. This is an important consideration for our customers in choosing Beckhoff as their control supplier," explains Gerhard Meier.

Beckhoff Switzerland www.beckhoff.ch
“On the basis of what we have achieved, we want to strengthen and further expand our position in Switzerland. We see potential for growth in all industries and all regions and we are striving to occupy a key position in the field of control technology. In order to achieve this goal, we will be growing our sales network even further and strengthening our team according to growth.”

Meier, Managing director of Beckhoff Switzerland
The Swiss company Ferag AG specializes in the conveying and manufacturing processes that are necessary for the further processing of newspapers following the printing process. On the basis of PC- and EtherCAT-based control technology, Ferag has developed, among other technologies, production modules with high-tech controllers for the ‘Neue Zürcher Zeitung’ (New Zurich Times) printing facility.

www.ferag.com

The Swiss punching machine manufacturer Bruderer AG has been relying on PC-based controllers from Beckhoff since 1998. Bruderer punching machines perform up to 2,000 strokes per minute, producing plug contacts, rotor sheets or screens for mobile phones. The automation equipment controls and monitors system operation in order to ensure high manufacturing quality.

www.bruderer-presses.com

Besides the main market of mechanical engineering, numerous projects have been completed in Switzerland in the field of building automation. One very special reference project is the 5-star luxury hotel, the Dolder Grand. Its operation is significantly influenced by the advanced Beckhoff building automation equipment, which is integrated in the hotel’s own IT network.

www.thedoldergrand.com
Beckhoff Switzerland celebrates its 10 year anniversary this year. What were your expectations at the start and to what extent have these been fulfilled?

We set ourselves five-year and 10-year goals. We have easily exceeded both these markers although it took a little luck and the right timing to launch our products onto the market. A great advantage was the fact that many internationally operating companies see Switzerland as a test market since 80 to 90 percent of the products here are exported. Any manufacturer able to gain a foothold in this market will be successful internationally. This has been proven to be true in the case of Beckhoff in the last 10 years.

Before the subsidiary was founded you started with your own sales office in 1995. Presumably, launching a little known manufacturer into the Swiss market was no easy task?

In the beginning, I was the lone voice in the wilderness as they say. At this time the name Beckhoff was known above all to companies making woodworking machines and in the window manufacturing machines sector, which is where we began. It was in this environment that Beckhoff gained its first customers at the beginning of the 1980s and from there it grew in control technology acceptance. There are still window manufacturers operating huge plants with our control systems in Switzerland today. Although these customers knew our name, most of our present customers – manufacturers of plants and machinery – had not heard of Beckhoff. In the last 10 years, we have built up a strong, effective sales team, support/application support, customer training and administration. We now have 18 staff distributed around several locations and are strategically located for our customers. I am delighted to work with such a motivated team and I would like to thank all our employees for the work they have done over the past several years.

Who was the first 'big fish' you caught?

A very big one was the Bruderer company who needed a control system for a high-speed press. We used this opportunity to build a complete control system for Bruderer. Subsequently, having Bruderer as our champion opened even more doors for us in Switzerland. Generally we gained a foothold wherever advanced technology was required and customers had to establish more advanced processes in order to stay competitive. Beckhoff control technology has helped them succeed.

Where will Beckhoff Switzerland be in 10 years’ time?

By then, I hope we will be able to look back on another equally successful 10 years. There is no reason to doubt Beckhoff Switzerland’s chances. We are still the market’s technology leader and the PC-based Control and EtherCAT success stories are far from over. In addition, I can say with pride that even in difficult times we have been able to increase market share via new customers in Switzerland and are establishing newfound success in building automation. We are confident we will continue to grow in the next 10 years as well.

Extracts from the interview in Aktuelle Technik 08/09.
See www.beckhoff.ch/presse for the complete interview.
Beckhoff PC-based control is used in the fully automated Tuboly folding and welding machine to manufacture tank panels for transformer housings. Twelve hydraulic servo axes and 25 electric motor-driven servo drives are controlled from the PC-based automation platform. The production of the specification, the engineering and the commissioning of the complex production plant was undertaken by Brütsch Elektronik in cooperation with Tuboly.

The Swiss firm Tuboly, which today belongs to Astronic Industries AG with headquarters in Dottikon, has supplied the electrical industry with machinery for advanced production technology for over 20 years. Astronic’s core cutting lines represent a complementary product portfolio and the amalgamation of the two companies has resulted in an extended product range with a considerable center of expertise for the electronics industry.

Fully automated production from coil stock to the finished transformer housing
The Tuboly-Astronic business model comprises the design and production of winding machines, folding machines, condenser bushing winding machines as well as special machines and system accessories. The modular corrugated-panel folding and welding machine is a fully-automated, computer-controlled production unit for folding, forming and welding panels for the transformer housings. These are produced fully automatically from the coil to the finished housing. “In the planning department, the operator creates order-controlled batch sizes depending on the sheet type and sheet width to be used. The resulting production programs are loaded into the system controller and executed,” explains Michael Tretter, Electrical & Software Manager of Tuboly-Astronic AG. The automatic setup function guarantees simple, rapid switching from one dimension to another so that even smaller batch sizes can be manufactured economically. The other production steps are equally remarkable: the sheet metal is folded with two x 250 t hydraulic thrust. Beading is applied while the sheet is precisely positioned and reinforcements are spot welded to both sides. The folded cooling fins are then welded using a mobile feed table and two lateral welding systems.

Exceptional cooperation from engineering to commissioning
Tuboly-Astronic’s production volume is dauntingly high. “More than 50 machines – primarily customer-specific designs – are manufactured each year in Dottikon,” reports Michael Tretter. Tuboly-Astronic works very closely with system partners
in order to manage the associated planning and development work. One of these is Brütsch Elektronik AG, based in Uhwiesen, Switzerland. The two companies have tested their synergy in several projects already. Beckhoff has also been a supplier of controllers to Tuboly-Astronic for many years. Since Brütsch Elektronik is one of the solution partners of Beckhoff Switzerland, the partners already collaborate closely.

The order for the folding machine was placed with Tuboly-Astronic at the end of 2007. This was followed by planning talks with Brütsch Elektronik. Herbert Friedrich, Automation Team Leader at Brütsch Elektronik, says: "The requirements included, among other things, the design of the data flow models for the production system. The inclusion of a PROFIBUS master gateway is required to link to the independent welding controller. Various analog Bus Terminals are used along with the binary I/O Bus Terminals. These are used to connect the servo valves and various measurement circuits, e.g. for pressure measurement, regulator control and position recording. The servo axis positions are recorded by absolute and incremental encoders.

Precise folds using TwinCAT PLC Hydraulic Positioning

The system features 12 hydraulic servo axes and 25 Servo Drives from Beckhoff’s AX2003 series. The control of the folding machine’s servo axes, and in fact all the electrically and hydraulically driven axes, have been programmed using the TwinCAT PLC Hydraulic Positioning library from Beckhoff. This PLC library provides code for PTP movements with which the hydraulic axes can be positioned and controlled. The standard control algorithms are used here, for example, operators can work with time- or path-dependent ramps. The axis parameters can be saved as files and loaded via TwinCAT.

The folding machine processes are graphically displayed on the C3640 with its 15-inch TFT display. The graphical display system has been developed by Tuboly itself based on Delphi (Borland) and TargetVisu. Task communication is carried out by TwinCAT ADS.

A total of 12 hydraulic servo axes produce two x 250 t hydraulic thrust in order to fold the cooling fins.

Control components keep lines of communication open

The modular production plant uses four C3640 Panel PCs from Beckhoff. The system is controlled by TwinCAT PLC automation software, including the TwinCAT Hydraulic library paired with the Microsoft operating system Windows XP Professional. The peripheral devices are connected with EtherCAT via the Beckhoff Bus Terminal.
Messe Basel: high-speed redesign of building services

Advanced building automation in historic Basel exhibition hall

Hall 2 at the Messe Basel (Basel Trade Show), with its landmark large clock on the glass facade above the main entrance, has been listed as a historic building since 2008. So that the building can continue to meet the tough requirements of modern trade fair operations, it has been fitted by Scherler AG of Basel with the latest building automation technology based on Beckhoff components with Ethernet communication.

“The Swiss sample fair in Basel has been struggling against an ever increasing lack of space for years.” This finding, which has lost none of its topicality, dates back to 1951, as the Zurich architect Prof. Hans Hofmann was commissioned with the task of planning a new proposal for the exhibition site and an extension to the buildings. The result was the large exhibition site, now traffic-free, and the new hall, known today as Hall 2, with a total floor area of 44,000 sq. meters. Due to the small size of the property, an exhibition hall with three stories was erected in 1954 on a square footprint with a side length of 145 meters. The eye-catcher in the interior is the architecturally unique, round, open courtyard with a diameter of 44 meters. This contains four open staircases, elevators and open connecting galleries. What is special about this exhibition center architecture is that all three stories have a great deal of available daylight for illumination.

Tight schedule for renovation
The large numbers of visitors and the competitive situation among exhibition centers made the replacement of the building services by more efficient technology unavoidable. Within the scope of planning...
the building services for the ‘Messe Basel 2012,’ the Basel-based company Scherler AG was also commissioned with the project planning and implementation of the building automation in Hall 2. Daniel Mangold, an experienced automation specialist from Scherler, describes the particular challenges of this project: “There were no longer any functional descriptions of the existing system, so everything had to be redefined from scratch. Above all though, the timeframe for the renovation was very tight, from December 08 to January 09. That meant planning and preparation had to be 100 percent accurate.”

Use of modular technology and Ethernet communication
Eight systems ventilate one eighth of the building each; the controller is placed on the first basement level. The local I/Os on the ground floor control the reheaters, the fire protection flaps and the swirl outlets from the ground floor to the second floor. The outside air is drawn in to the facade and fed via ducts to the ventilation system on the first basement level. It is filtered there and heated or cooled as necessary. The air supply fan pumps the prepared air via ducts into the air supply shaft, where reheaters are mounted on each floor, to special swirl outlets with actuators in the ceilings of the halls. The exhaust air is either fed back into the air supply circulation via circulating air flaps or exhausted to the outside via exhaust flaps.

Three modes of operation are distinguishable in automatic mode: standby operation, assembly and disassembly operation, and trade fair operation. In addition, emergency operation of the individual components and manual operation from the control cabinet and building management system are provided. The heating/cooling requirement is communicated from the new system to the heating/refrigeration plant via an OPC interface.

The PC-based building automation consists of Beckhoff Bus Terminals, Ethernet Bus Couplers and Embedded PCs. Each of the eight substations features a CX9010 Embedded PC functioning as a controller and a BK9100 Bus Coupler functioning as a data point controller. Due to the large distances involved and in order to avoid EMC problems, fiber-optic cables were installed between the central building distributor, where the server for the building automation is housed, and the substations. In the existing switching device combinations, only those building automation components were replaced that integrate the already existing sensors and actuators via Bus Terminals. Operating and event messages, including virtual data points, are displayed on the SCADA software in plant diagrams and event lists. Error and alarm messages are displayed at the substation by a touch panel.

Web-based building management system
Scherler utilizes the building management system Webfactory 2006, a complete Web-based SCADA software solution, for visualization, control, monitoring and analysis. All process data are displayed and analyzed online on a clear, Web-based user interface. It can be displayed on any browser worldwide with the corresponding access data. In this project, the Beckhoff substations are integrated consistently via Ethernet interfaces. A total of 655 digital inputs, 248 digital outputs, 195 analog inputs and 163 analog outputs were used. The CX9010 Embedded PCs employed, with Windows CE as the operating system, communicate all data via the TwinCAT ADS protocol.

TwinCAT building libraries simplify engineering efforts
The TwinCAT universal software platform forms the heart of the Beckhoff control system on the software side. Software libraries with extensive function blocks for building automation and interfaces to other systems, such as LON, EIB, EnOcean, etc., simplify the engineering decisively. “We have an absolutely modular and flexible hardware system with complete continuity, thanks to the serial communication via Ethernet. Engineering is considerably simpler with TwinCAT than with other systems and the price/performance ratio is extraordinarily good,” says the satisfied project leader, Daniel Mangold.
Test engineering solutions for the household appliance industry are an important business segment for inotec AP GmbH. The systems are generally one-off designs, and are used worldwide by household appliance manufacturers for quality assurance and product refinement. Automation technology from Beckhoff is responsible for simplifying the operation of the generally complex applications and documenting the test results for inotec AP.

Test rig for electric toothbrushes helps ensure longer lasting products

Test engineering from inotec AP in Wettenberg, Germany, is widely utilized by the household products industry to test products according to the real conditions faced by consumers. Electric razors or electric toothbrushes, for example, are endurance tested. Particular value is placed on ease of operation of the test equipment, documentation of the test parameters and, of course, the results.

The ZP-03 is a test rig specifically for electric toothbrush endurance tests. The system can accommodate up to 24 toothbrushes which face one another in rows of 12. Toothbrush designs are tested according to their expected lifecycle over approx. 100 hours using artificial sets of teeth and toothpaste emulsion. Pneumatic bellow cylinders and force sensors guarantee even pressure of the brushes onto the teeth. To achieve conditions that are as realistic as possible, the devices are used on different tooth shapes and are subjected to frequent idle periods. The systems are used for quality assurance tests but also to test new designs. Interchangeable holders allow the test rig to be used with the most diverse brush types and to be adapted to new models.

Beckhoff Panel PC for control and visualization

The test rig is controlled by a Beckhoff C3340 19-inch Panel PC. It not only controls the sensitive proportional pressure technology used to apply the cleaning forces and the mechanical actions, but also records all relevant parameters, such as current consumption, runtime, failures etc. The data are received by the Bus Terminals via 150 analog and 100 digital inputs and outputs and are transmitted by PROFIBUS to the PC where they are stored and statistically analyzed. The PC controller and operating unit are housed in a separate cabinet which the operator can position anywhere. The system has a graphic interface for ease of operation and rapid understanding of the comprehensive test possibilities.
The system’s compact design and standardized Windows interface provide the user with further benefits such as essential interfaces to company networks. The TwinCAT PLC and the Visual Basic graphical display provide system clarity and ease-of-use. In addition, the test rigs, which are used worldwide, can be accessed at any time via remote desktop and are accessible for remote servicing. An additional uninterruptible power supply is included as standard to ensure a stable system overall.

inotec AP GmbH www.inotec-ap.de
Beckhoff has continuously expanded its global sales network over the last 10 years. Eight years ago, Beckhoff opened its own agency in Beijing. The PC Control editor discussed development and future prospects in China with Liqiang Liang, Managing Director of Beckhoff China, and International Sales Manager from the Beckhoff Headquarters in Germany, Kai Ristau.

Rapid growth continues in China

Beckhoff has continuously expanded its global sales network over the last 10 years. Eight years ago, Beckhoff opened its own agency in Beijing. The PC Control editor discussed development and future prospects in China with Liqiang Liang, Managing Director of Beckhoff China, and International Sales Manager from the Beckhoff Headquarters in Germany, Kai Ristau.

Mr Liang, Beckhoff China was founded eight years ago. What was the background to this milestone?

Liqiang Liang: Beckhoff has already been active on the Chinese market since 1997. We started with only one distribution partner; however, due to the rapid growth of the economy in China, we wanted to expand our activities there. So in 2001, we founded a Beckhoff agency in Beijing. Offices opened in Shanghai in 2003 and Guangzhou in 2004 followed next. Another important milestone for our development was founding the 100 percent subsidiary, Beckhoff Automation Company Ltd in Shanghai on May 16, 2007.

What is Beckhoff’s position on the Chinese market today?

Liqiang Liang: All the international suppliers of automation systems are highly active in the Chinese market, which proves how open the industries here are toward European technology. Since Beckhoff supplies complete automation systems and overall solutions tailored to machine builders, the focus of our sales activities is in the relevant vertical markets for plastics machines, packaging lines, tobacco machines, printing machines, etc. Beckhoff is also heavily involved in technology for wind turbines and we are recording above average growth in that area as a result.
**How is the sales network of Beckhoff China structured?**

Liqiang Liang: In the early days of Beckhoff China when we were staffed with a small team, we built up a number of distributors who sold our components to end customers in some large cities. The market, above all the OEM customer base, is increasingly demanding system solutions as well as components. In order to meet the great demand for support among OEMs and end users, we are now collaborating with a network of skilled system integrators as partners to expand our technical support and application teams.

**How have you succeeded in getting Beckhoff products and solutions established in China?**

Liqiang Liang: In order to familiarize our customers with our innovative technology, we are using the complete spectrum of communications technology and marketing activities, such as trade fairs, seminars and advertising campaigns in trade magazines. We set a high value on keeping our website up to date as well as publicizing product innovations and application reports and we regularly send newsletters and press releases to customers and the media. Our marketing strategy includes seminars that highlight our technology and products; these are regularly held at various locations. Naturally, we also organize special technical training for our customers. In addition, we have become established through our expert solutions, based on the technological expertise of our parent company on the one hand, and on our Chinese staff on the other.

**Mr Ristau, how do you see Beckhoff’s role on the automation market in China?**

Kai Ristau: We regard it as our role to launch and establish innovative and alternative control concepts on the Chinese market. We are making every effort to develop the market towards PC Control in place of traditional PLCs.

Liqiang Liang, Managing Director of Beckhoff China

We intend to set new standards in the Chinese market with our control technology based on PC and EtherCAT systems, making Chinese manufacturers more competitive on the local and global markets.

**The Chinese automation market is vitally important for the world’s market leaders. Which particular strategies is Beckhoff China pursuing?**

Kai Ristau: Of course, China is seen as a country with enormous growth potential. Many of our international customers either export to China or manu-
facture in China. On the other hand, dynamic development is taking place by domestic Chinese companies so that more and more of our customers are locally run. This means we not only need innovative technologies and products, but also strong technical support that is application-specific, a reliable repair and spare parts department and technical training for our customers. At the moment, we have about 70 employees handling these services. In order to strengthen our market position, we plan to open even more agencies in the near future and employ more staff there.

How do you expect Beckhoff China to continue to develop financially in 2009?
Kai Ristau: In spite of the worldwide economic crisis which, naturally, affects the automation sector as well, we are optimistic. We will probably achieve our ambitious aim for 2010 – turnover of over RMB 200 million (approx. EUR 20 million) by 2009. Without playing down the challenges of the present economic situation, we are armed for the dynamic growth of Beckhoff China in the future. We have a clear vision: we want to become one of the leading automation suppliers in China and offer Chinese industries the opportunity to optimize machines and production processes on the basis of our technology.

What do you think are the reasons for the ongoing success of the wind turbines sector on the Chinese market?
Kai Ristau: The Chinese wind power market is booming, which is not surprising in view of the voracious appetite for energy associated with the country’s rapid economic growth. In the next few years, China is likely to become number one on the global wind power market. At present, there are approx. 60 wind turbine manufacturers in the Chinese market which are largely owned by foreign investors. However, the number of Chinese companies being founded is growing continuously and we are assuming that an increasing number will become involved in the market for pitch and converter systems. The control cabinets for these control systems will certainly be built by local suppliers in future as well. Naturally, this has a direct influence on suppliers of automation technology. Our open, powerful control system is already responding to this challenge. In EtherCAT we have the optimum fieldbus solution for wind turbines and we will obtain additional benefits for manufacturers of wind turbines with the introduction of additional software modules in the future: for example, modules for integrating diagnostic systems such as condition monitoring into control systems. In addition, our customers can rely on a 70 person-strong team of Chinese colleagues to provide on-site support for their plants.

The Beckhoff subsidiary in China underwent considerable expansion in recent years. Is further investment in China planned?
Kai Ristau: In order to cope with the rapid development of the business, we have recruited more staff and stepped up our activities in the last 12 months. This will also be the objective for the coming years. Compared to other international automation companies in China, we are a relatively young company. Therefore, we have some time to make up and will do so with an aggressive drive to expand our own sales network both geographically and in terms of staff. Our aims are set high but we have a strong, motivated team so we are confident regarding further strong business development.
One of the areas of expertise at the research center for carbon fiber technology at Shandong University on the east coast of China is the development of solutions for scientific and technical problems related to high-performance carbon fibers, analysis and production of high-strength carbon fibers with high modulus of elasticity, and the development of carbon fiber composites. The research institute uses PC-based control technology from Beckhoff for improving process quality.

PC-based production of carbon fiber precursors for high-performance materials

One of the areas of expertise at the research center for carbon fiber technology at Shandong University on the east coast of China is the development of solutions for scientific and technical problems related to high-performance carbon fibers, analysis and production of high-strength carbon fibers with high modulus of elasticity, and the development of carbon fiber composites. The research institute uses PC-based control technology from Beckhoff for improving process quality.

Without carbon fibers, solutions to a wide range of technical challenges would be unachievable. Examples include large structural components in commercial aircrafts, the construction of wind turbines or hydrogen pressure vessels, and reduced fuel consumption in cars through weight reduction. Modern medical technology or the production of sports equipment is also hard to imagine without the application of carbon fiber reinforced plastic.

The most common technique for producing carbon fibers is based on polyacrylonitrile (PAN) as the raw material (precursor). The production involves several process stages, including stabilization of the precursor, carbonation, treatment of the fiber surface, application of a preparation and winding of the fiber onto reels.

As a polymer raw material, the precursor is crucial for the quality of the carbon fibers and the composites produced from them. Uniformity of the precursor fibers is important for ensuring ideal workability of the material and for achieving the required strength of the carbon fibers. Process parameters such as temperature, pressure and speed therefore have to be controlled very precisely during production of the PAN precursor, in order to avoid problems and quality fluctuations during carbon fiber production. In view of the stringent control requirements, the research center for carbon fiber technology based in Shandong province decided to use a PC-based control system from Beckhoff in the production of high-performance PAN precursors.

Embedded PC integrates all control functions into a single platform

As the centerpiece of the automation platform, the CX1010 Embedded PC offers high process control stability and precision. It is connected to a CP6901 Control Panel via DVI/USB. The CX handles PLC, temperature control, Motion Control and HMI. The existing Ethernet interface and the Windows operating system offer convenient remote maintenance and diagnostics options and reduce the development time and maintenance costs for the whole control system. Other benefits of PC-based control include simplified commissioning and the significantly faster startup of the production control system.

In the PAN precursor plant 10 AX5000 Servo Drives are connected to a total of 19 AM3000 servomotors; additionally, the I/O is networked via EtherCAT. At the same time, the flexible expandability of the EtherCAT I/O system permits the connection of equipment from third-party suppliers via corresponding fieldbus interfaces, offering scope for simple system extensions.

Carbon fibers are used in a wide range of applications, including wind turbines and car parts, primarily for the purpose of weight reduction.
With traditional hand-operated concrete mixers, quality was mostly left to chance. Today, mixing and producing concrete requires accurate control of the individual process steps, precise dosage of the various materials for different recipes, recording production data and monitoring the condition of the machines. The Danish firm Skako A/S, manufacturers of ready-to-use systems for the ready-mix concrete and precast concrete component industries, uses Beckhoff control technology for this purpose.

Accurate concrete production boosts competitiveness

Skako, with headquarters in Faaborg, Denmark, supplies system technology for manufacturing concrete, both as standard solutions as well as in client-specific configurations. The company’s range of applications extends from large, complex turnkey projects right down to small, simple mixing systems with a capacity of 1/2 to 3 m³. Furthermore, Skako also supplies conveying systems such as transport vehicles and conveyor belts for liquid concrete. The systems are mostly used for stationary operation on land, but can also be used in deep water without any problems. For example, Skako has supplied offshore concrete batching plants for casting the pylons and pillars for diverse bridge projects (Öresund, The Great Belt).

Effective control and documentation
The batching plants are controlled via the Skakomat 600 SQL system developed by Skako. It processes the recipes, adjusting them to the composition of the materials by means of continuous calculations. The necessary process data is recorded, using scales, flow and moisture gauges, etc. at various points in the system. "Our customers depend on maximum data security and operational reliability," explains Skako electrical engineer, Ejvind Jensen. "These guarantee both the Beckhoff control components and the SQL database for local data backup as well as the RAID controller with two hard disks. If one hard disk fails, the other takes over process control automatically."
Moreover, the system offers complete data tracking and process control as well as the monitoring of key functions, with the result that the operator is informed about possible faults immediately. The Skakomat 600 enables the complete automation of all the processes: ordering, dosage, mixing and delivering together with all the accompanying documentation. “The system is configured so that it fulfills the individual customer’s particular requirements and makes the operator’s work easier,” Ejvind Jensen explains.

**PLC, SCADA system and process control, all on one PC platform**

A Beckhoff C5102 19-inch, slide-in Industrial PC controls the machine. This single PC runs TwinCAT PLC automation software for machine control, the plant’s SCADA system and the Skakomat 600 process control system. Data must be imported at various points near the concrete batching plants, e.g. in the filling trench where the trucks unload the sand, at the top of the silo and on the mixing platform where the proportions of the different materials in the mixture are monitored. Communication between the Industrial PC and the I/O takes place via EtherCAT. Furthermore, the PC is connected to the company’s administration system and, if necessary, externally to Skako’s service department via remote support over Internet.

The advantage of the Industrial PC and the TwinCAT software PLC is, above all, the high processing power. Program parts which are critical in terms of time no longer have to be executed in a fixed task as with a traditional hardware PLC. PC performance enables everything to be executed in the same task, which eliminates the need for special communication between the different program parts.

The global presence of Beckhoff is a great advantage when exporting the machines. “Last but not least, changing to the Beckhoff control platform has made Skako more competitive in terms of price,” Ejvind Jensen emphasizes.
Wireless emergency warning system fulfills regulations for historic buildings

Cleverly hidden evacuation system for the Sisi Museum

In the case of an alarm, hidden loudspeakers broadcast spoken instructions to the exhibition visitors in the Silver Chamber to leave the building: “Please remain calm; there is no cause for panic. Follow the green lamps to the emergency exit and wait for further instructions from the staff.” These requests that are heard by the visitors seem to come from nowhere, because there are no loudspeakers to be seen anywhere in the showrooms. The challenge of installing a comprehensive emergency warning system within such noble, protected walls lies in leaving no visible traces. This means: chiseling work was absolutely forbidden in this project. Therefore, other ways and means had to be found in order to fulfill the safety features required by law.

Klenk & Meder, the electricians responsible for all electrical work at the Vienna Hofburg, were charged with the task of implementing the emergency warning system in the Silver Chamber of the Sisi Museum and sought an appropriate partner in IMBS: “Of course, this wasn’t the first loudspeaker system that we had to install. But the main problem in the showrooms was that we weren’t allowed to lay any cables,” explains Helmut Fahrnberger from Klenk & Meder.

Wireless emergency warning system

The safety regulations for electro-acoustic emergency warning systems are clearly defined. The top priority is the 100 percent availability and operating reliability of the evacuation system and the associated constant self-monitoring of the system. This means that the complete sound signal path and the necessary peripherals have to be checked constantly so that there is no sudden radio silence in the event of a real emergency. Safety-relevant signal sources (evacuation messages, sirens), amplifiers and redundancy amplifiers, loudspeakers and their cables as well as the emer-
Emergency power supply are also subject to this compulsory checking. This scenario is precisely where things start to get difficult in historic buildings. For this purpose, the system integrator IMBS developed a wireless loudspeaker controller that can be cleverly hidden in the approx. 30 x 30 cm empty spaces between the showcases and behind the cover grilles of the drain system, all of which is connected via EnOcean technology.

The control center of the evacuation system consists of a Beckhoff CX1010 Embedded PC, various digital input and output terminals, four KL6021 EnOcean radio receivers, two KL2602 alarm annunciators on the outside and a C6925 Industrial PC for the visualization.

Measuring tone allows the condition of the loudspeakers to be checked

A measuring tone, broadcast five times a day for five seconds at an inaudible frequency of 16,000 Hz, provides information on the condition of the loudspeakers. If this tone is not detected by the measuring microphones mounted on the wide-range loudspeakers, the loudspeaker controller then raises the alarm via the Beckhoff building services. “Our measuring system evaluates the acoustic data from the individual loudspeakers and, as soon as anything lies outside the programmed range, this information is relayed via EnOcean to the Bus Terminals and to the Beckhoff IPC on which the visualization is running. The automation system collects all safety-relevant data, presents it clearly on a monitor and saves it in a database. “In the event of an error message, we can then read precisely whether a loudspeaker is outside the radio range or whether it just cannot correctly reproduce the 16 kHz tone,” explains Josef Donnerer, CEO of IMBS. In addition to that, a kind of anti-theft system is integrated in the portable loudspeakers – to put it precisely, a second radio channel via which their presence is reported to the building management once per minute. If this signal is absent, the system similarly raises the alarm and the staff can set off immediately in search of the ‘lost’ loudspeaker.

IMBS Intelligente Multimedia- und Bussysteme www.imbs.at
Klenk & Meder www.klenk.at
Beckhoff Austria www.beckhoff.at
IWF at Technical University (TU) Berlin, Germany, uses PC Control for advanced research projects

Open, PC-based control technology enables high-performance, versatile machine tools

"Beckhoff control technology is characterized by openness, modularity and short cycle times and enables us to create robust and flexible machine tools for high-precision, high-speed production of components with different complexity and size," said Thomas Friedrich, research associate at IWF. As part of the collaborative research project, Transregio 29 Industrial Product-Service Systems – Dynamic Interdependency of Product and Service in Production Area, IWF is examining a modular manufacturing system designed for in-house and service production, resulting in different requirements in terms of system flexibility and robustness. The manufacturing system must enable flexible changeover depending on the type (size, geometry, surface characteristics, complexity) and lot size (single, small-volume production, mass production) of the micro-components to be produced. Flexible configuration requires exchangeable manufacturing process components, clearly defined interfaces and smooth data exchange between the components. "We use control technology from Beckhoff for implementing these requirements.

TwinCAT CNC is particularly advantageous for this purpose," said Thomas Friedrich. "On the one hand, this tool offers comprehensive CNC functionality for implementing demonstration units based on pure, PC-based software solutions. On the other hand, it simplifies system modularization and interface definition. In addition, the openness of the control platform enables us to integrate new control concepts and strategies developed in-house, including condition monitoring and lifecycle management."

The open technology facilitates the application of Beckhoff control technology for the 3-axis milling machine with adaptive headstock, an in-house development of IWF. IWF integrates newly developed, adaptive control strategies into TwinCAT and individually defines the parameters for the controllers from the TwinCAT library. "This gives us plenty of room to maneuver," said Thomas Friedrich. "In conjunction with EtherCAT and high-performance Beckhoff Drive Technology, we’ve created a new generation of high-precision, highly productive milling machines." EtherCAT, in conjunction with AL2815 and AL2830 linear motors from Beckhoff and AXS125 Servo Drives for fast, highly dynamic control tasks, offers improved precision and higher speed than was possible in the past. The aim is to make the milling machine commercially available in the long term and use it in-house for education and research.

IWF www.iwf.tu-berlin.de/fachgebiete/wzm/
EtherCAT Technology Group opens new Conformance Test Center in Japan

To best serve the large number of EtherCAT device vendors in Japan, the EtherCAT Technology Group (ETG) has opened the first EtherCAT Test Center (ETC) outside of Europe in Kyoto, Japan. This new ETC is operated by the Advanced Software Technology and Mechatronics Research Institute of Kyoto (ASTEM).

At the opening ceremony for the Kyoto ETC, ASTEM President and Professor, Dr. Yukihiro Nakamura underlined the extensive experience of his institute with conformance testing. ASTEM has been in charge of operating fieldbus testing facilities since 1996. "We are proud that with EtherCAT we are now supporting the most exciting and newest generation of communication technology, for which many implementations in Japan and Asia are already under way," Dr. Nakamura said. Martin Rostan, ETG Executive Director, and Dr. Nakamura signed the ETC cooperation agreement at the event. For the “ribbon” cutting ceremony, the ribbon had been replaced with a yellow Ethernet cable, reminiscent of the core technology used by EtherCAT.

Takeshi Kameda, ETG Representative Japan, highlighted the short but successful history of EtherCAT in Japan: “By establishing the first test center outside Europe in Kyoto, the ETG clearly honors both the rapid growth of the organization in this country as well as its strong automation device vendor community, which is adopting EtherCAT at a rapid pace,” he said. “Having an EtherCAT Test Center here will further increase the acceptance of EtherCAT in Japan.”

The opening ceremony was attended by representatives from the city of Kyoto as well as from local ETG member Omron, who is providing initial technical support to establish the test center, but is not involved in its operation. ASTEM’s EtherCAT Test Center personnel are receiving training at the original EtherCAT Test Center in Nuremberg, Germany, in order to ensure a uniform test process regardless of the Test Center location. The Kyoto Test Center will be fully operational in a few weeks from now, serving the Japanese as well as the overall Asian EtherCAT community.

EtherCAT Technology Group opens new Conformance Test Center in Japan

EtherCAT Test Center in Kyoto: Martin Rostan (Executive Director, EtherCAT Technology Group) and Prof. Dr. Yukihiro Nakamura (President, ASTEM) after signing the co-operation agreement.

 EtherCAT Test Center in Kyoto: Takeshi Kameda (ETG Representative Japan), Prof. Dr. Yukihiro Nakamura (President, ASTEM), Martin Rostan (Executive Director, ETG) and Eiji Ikeno (General Manager Motion Control, Omron) at the opening ceremony.
Trade shows 2009

Europe

Germany

Motek
September 21 – 24, 2009
Stuttgart
Hall 9, Booth 9108
www.motek-messe.com

FachPack
September 29 – October 01, 2009
Nuremberg
Hall 9, Booth 240
www.fachpack.de/en

FMB
November 04 – 06, 2009
Bad Salzuflen
Hall 23.2, Booth A11
www.forum-maschinenbau.com

SPS/IPC/DRIVES
November 24 – 26, 2009
Nuremberg
Hall 7, Booth 406
www.mesago.de/SPS

Belgium

ECL Brussels
September 23 – 24, 2009
Brussels
Hall 4, Booth 1061
www.easyfairs.com

Mocon Hydromech
October 14 – 15, 2009
Brussels
Hall 7, Booth 7025
www.easyfairs.com

Energies+
November 13 – 15, 2009
Marche-en-Famenne
www.energiesplus.be

Finland

Automaatio
September 23 – 25, 2009
Helsinki
Hall 6, Booth 6b19
www.finnexpo.fi/automaatio

France

Mecatronic Expo
October 12 – 23, 2009
Toulouse
www.mecatronicexpo.com

Siane
October 13 – 15, 2009
Toulouse
www.salonsiane.com

In Machine
November 26, 2009
Paris
www.in-machine.com

Poland

Protech
November 18 – 19, 2009
Wroclaw
www.targi-protech.pl

Russia

PTA
September 22 – 24, 2009
Moscow
www.pta-expo.ru/moscow

Austria

Smart Automation
October 07 – 09, 2009
Linz
Booth 235
www.smart-automation.at

France

Mecatronic Expo
October 12 – 23, 2009
Toulouse
www.mecatronicexpo.com

Siane
October 13 – 15, 2009
Toulouse
www.salonsiane.com

In Machine
November 26, 2009
Paris
www.in-machine.com

Austria

Smart Automation
October 07 – 09, 2009
Linz
Booth 235
www.smart-automation.at

Poland

Protech
November 18 – 19, 2009
Wroclaw
www.targi-protech.pl

Russia

PTA
September 22 – 24, 2009
Moscow
www.pta-expo.ru/moscow

Austria

Smart Automation
October 07 – 09, 2009
Linz
Booth 235
www.smart-automation.at
Automation
December 02 – 04, 2009
Saint-Petersburg
www.en.farexpo.ru/ais2009

Hi-Tech Building & House
December 08 – 10, 2009
Moscow
www.hitechhouse.ru

PTA Ural
December 08 – 10, 2009
Ekaterinburg
www.pta-expo.ru/ural

Asia

China

China Wind Power
October 21–23, 2009
Beijing
Hall E1, Booth 1C19
www.chinawind.org.cn

Industrial Automation Show
November 03 – 07, 2009
Shanghai
Hall E2, Booth A088
www.industrial-automation-show.com

Marintec
December 01 – 04, 2009
Shanghai
www.marintecchina.com

Korea

Kormarine
October 21 – 24, 2009
Busan
Booth 051
www.kormarine.net

North America

Canada

Canadian Manufacturing Technology Show
October 19 – 22, 2009
Toronto
Booth 4010
www.cmts.ca

USA

Pack Expo
October 05 – 07, 2009
Las Vegas
Hall S, Booth 5357
www.packexpo.com

Isa Expo
October 06 – 08, 2009
Houston
Booth 1701
www.isa.org/expotemplate.cfm

Fabtech
November 15 – 18, 2009
Chicago
Booth 1300
www.fmafabtech.com

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