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Focus on new solutions for process automation

Hannover Messe 2017 ended on a very positive note for Beckhoff again this year, not only as an extremely successful trade show, but also one where we were able to present many outstanding product innovations. Moreover, we will be able to say some years from now that this was the starting point of the successful convergence of industrial automation and process technology. With the presentation of specific products and solutions designed for the automation of process technology systems, we have now opened the door to an automation landscape with many interesting challenges and enormous potential.

The most important market segments in process technology, and the oil and gas sector in particular, have recently persevered through some difficult years. The rapid, continuous drop in prices on the crude oil market has increased cost pressures in terms of production and transport to a massive extent. In order to meet these competitive requirements, forward-looking automation solutions that help reduce costs are in high demand. At the same time, in the engineering of new petrochemical plants a special focus is placed on efficiency, safety and cost optimization. What is needed to achieve these objectives is system-spanning, sometimes even global connectivity. This results in a greater need for automation with a specific interest in “IoT” solutions – a field in which we have always felt very much at home due to our many years of experience, as well as with the ongoing convergence of automation and the IT world.

However, it’s not only process technology applications in the petrochemical industry that require innovative solutions for automation. Current concepts under development such as “Smart Cities” also include a wide range of process technologies. Renewable energy, biogas power plants, as well as water and wastewater treatment are all applications that will need centralized monitoring and control. Thus, it is safe to say that the discrete and process technology automation worlds will continue to converge – not least due to the efforts being made with respect to global networking. Based on the company’s tried-and-trusted automation philosophy, this creates enormous market potential for Beckhoff.

Consequently, we are happy that we have also been able to open the door of modern automation architectures to process technology customers with the far-reaching integration of explosion protection capabilities into our product portfolio. With the new, highly compact “blue” I/O terminals in the ELX series for explosion protection, we enable our customers to seamlessly integrate intrinsically safe field devices into their automation systems. As a result, the reduction in wiring requirements and the smaller footprint provide an end-to-end, economically impactful solution. In addition, with the CPX panel series, we are introducing advanced multi-touch operating technology in a robust, yet highly attractive package to the explosion-protection sector. Rounded off by many innovations in the field of interfaces and in system integration, we now offer a fully integrated toolbox to accommodate even the most complex automation requirements.

The process industries await us with exciting new applications in very interesting areas of application, and it’s a good thing that Beckhoff is well prepared. Find out more about our entry into process automation on page 16 and following.

Benjamin Bruns,
Business Management,
Process Industry
Continuous product development opens new technology areas and improves production efficiency

Beckhoff Automation increases sales by 9.5 percent to 679 million euros

Beckhoff Automation generated global sales of 679 million euros in 2016, an increase of 9.5 percent over the previous year. This success can be credited to the company’s development of new products, broad market penetration and improved distribution network coverage.

“We are very pleased with these business results. Although the growth rate was moderate compared with last year’s 22 percent increase, it is very respectable relative to the much slower growth of the automation industry as a whole,” says Managing Director Hans Beckhoff. “If you combine the last two years, we averaged an outstanding 15 percent.”

Europe was the region with the strongest growth for Beckhoff in 2016, particularly in the central European countries of Germany, Austria, Switzerland and Italy with sales increases well above industry averages. This is a good indicator for renewed European growth, as Asia had been the main growth driver in recent years. “Beckhoff expects business to keep growing on all continents. Despite recent political challenges and conflicts, the outlook is positive for a stable and growing global economy,” says Hans Beckhoff. All in all a continuation of the very positive development in Europe can be expected for 2017, according to Beckhoff.

Beckhoff becomes even more international
Beckhoff also continues to expand its worldwide distribution network. Earlier this year, the company acquired its Dutch distributor, so now customers in the Netherlands can be served directly by Beckhoff. Currently, Beckhoff has 34 subsidiaries, with offices and distributors located in 75 countries. This means Beckhoff provides local service to all major markets. “We are confident that our ever more tightly knit global sales organisation, coupled with development of new technology markets, will enable us to further increase sales,” says Hans Beckhoff. Most of this growth centres on the PC-based automation technology developed by Beckhoff, which is employed in a wide range of industries and applications. “With our technologically diverse portfolio, we are well positioned to serve customers with the most diverse requirements,” explains Hans Beckhoff.

Continuous product and technology development
By systematically advancing all product families, Beckhoff is continuously opening new markets and applications. The company took another important step at this year’s Hannover Messe (the world’s leading industrial trade fair in Hanover, Germany) by introducing new products designed specifically for process technology applications. The new ELX series EtherCAT Terminals and CPX series Control Panels for use in hazardous areas feature a modular design and exceptional robustness, which are ideal for meeting the requirements of the process industries. Hans Beckhoff remains optimistic: “The process industry market is generally considered to be larger than the discrete machine automation market, which is the traditional domain of Beckhoff. Thus, our new products should provide us with excellent opportunities for additional growth.”

For over 30 years, Beckhoff has been known for exceptionally powerful PC-based control technology and continues to advance this technology. This year, Beckhoff engineers proudly presented what is ostensibly the world’s smallest Industrial PC. Measuring only 82 x 82 x 40 millimetres, the new C6015 features a quad-core CPU for extremely compact and powerful control solutions.

Even more advanced in terms of power density is the DIN rail mounted CX2000 series, which pushes the envelope for intelligent applications to entirely new
levels with up to 12-core Intel Xeon CPUs. “More intelligence in the machine improves efficiency, conserves energy and minimises raw materials usage. This kind of performance increase makes machines more profitable and also improves their ecological footprint. In this way, our engineers play a small role in making the world a better place,” says Hans Beckhoff.

“Moreover, Industrie 4.0 and the Internet of Things play an exciting role in today’s world of automation, because they enable users to realise new functionalities and capabilities,” says Hans Beckhoff with conviction. Connecting controllers directly to the cloud makes it possible to outsource functionalities and/or integrate cloud-based services into the machine. “Our customers can now employ highly advanced technologies based on artificial intelligence such as ‘deep learning’, for example. In practical terms, this leads to solutions such as predictive maintenance, which help increase the availability and efficiency of production systems. Virtual control applications in the cloud can be useful for many purposes – simulations and analytics come to mind. Machines can also employ cloud-based image processing or voice recognition,” explains Hans Beckhoff.

Investments in training and academic studies
The continuous business growth is accompanied by a steadily rising workforce. Beckhoff currently employs roughly 3,350 people worldwide. Almost 2,300 of these work in Germany, with about 2,100 located at the company’s world headquarters in Verl. Around 1,100 of these employees are trained engineers, which means the company is always recruiting highly qualified experts. With a total of seven professional training fields and two practice-oriented degree courses, Beckhoff is strengthening its position as a technology-oriented training organisation. In addition, the company functions as a ‘training engine’ at its Verl location, employing 100 apprentices and 90 university students at present. According to Managing Director Hans Beckhoff, the company invests about 3.5 million euros annually into these training initiatives for junior staff. The practice-oriented college education concept has proven highly successful and will soon be expanded. Starting in the 2017 winter semester, Beckhoff plans to offer training for master’s degree programmes at the University of Applied Sciences in Gütersloh, in addition to its bachelor programmes in mechatronics/automation. “We want to give technologically-oriented young professionals incentives to stay in the region,” says Hans Beckhoff.

Investments in production expansion
To ensure that production capacities keep up with Beckhoff’s rapidly rising sales, roughly 30,000 square meters of manufacturing and assembly space are being added at the company’s Verl headquarters. With Industrial PC production already taking up approximately 10,000 square meters of floor space, I/O production will occupy another 10,000 square meters in a new building scheduled to open in mid-2017. Circuit board and motherboard production will also be expanded with another 10,000 square meter building expansion. For its drive technology business, Beckhoff is building a new mechanics manufacturing facility to supply the servomotor production at its Marktheidenfeld, Germany location. Ground has already been broken for the new building, which will cover 3,500 square meters.
Creating value.
With PC-based control for Industrie 4.0

At Hannover Messe 2017, Beckhoff has presented its comprehensive product portfolio for control and drive technology: With PC-based control implementations for Industrie 4.0 and IoT, trade show visitors were shown how to create added value with cloud-based automation – not only live in a Beckhoff showcase on the main booth, but also on the partner booths of SAP, Microsoft and Amazon Web Services. Another highlight presented by Beckhoff was the new system-integrated solution designed for use in hazardous areas of process technology applications.

More info and Trade Show TV coverage: 
www.beckhoff.com/hannovermesse
One of the innovations presented by Beckhoff at Hannover Messe was the new system-integrated solution for explosion protection requirements including a comprehensive portfolio of Ex-proof components for barrierfree concepts up to Zone 0/20.

In its “Industrie 4.0” theme park Beckhoff showcased its extensive product portfolio for seamless integration of Industrie 4.0 and IoT applications into the overall control system.

The new XTS Hygienic in stainless steel: With IP 69K protection rating, it opens up a wide spectrum of new applications in the food and pharma industries and in primary packaging.
The mood during the ISH trade show was excellent! It’s evident that the industry is doing well, and on the Beckhoff booth we registered an increase in visitor numbers of about 20 percent,” is the conclusion drawn by Georg Schemmann, Business Manager Building Automation at Beckhoff. Highlights on the Beckhoff booth drawing a lot of visitor attention were the showcases on the Microsoft HoloLens™ and digital voice assistant Alexa from Amazon. “The topics of IoT communication and the diverse benefits of using cloud systems for centralised energy data analysis, clearly recognisable trend monitoring and simplified handling of big data volumes were received with great interest, especially by project planners. In this regard we are one step ahead of the competition,” adds Georg Schemmann.

For Frank Würthner, Business Manager Packaging, the focus of the solutions shown by Beckhoff at Interpack was definitely on the eXtended Transport System: “With a minimum of components, XTS enables completely new packaging concepts – with format changes in just a few seconds, radically reduced machine footprints and the opportunity to take advantage of new savings potential. This could also be seen at the trade show in the 21 new series machines on display. In addition, the new ‘Hygienic Design’ version also promises all of these technological advantages for use in primary packaging and the food industry. Accordingly, diverse new XTS applications were discussed directly at the show to take the NEXTSTEP towards innovative solutions for food, non-food and cosmetics packaging.”

"The mood during the ISH trade show was excellent! It’s evident that the industry is doing well, and on the Beckhoff booth we registered an increase in visitor numbers of about 20 percent,” is the conclusion drawn by Georg Schemmann, Business Manager Building Automation at Beckhoff. Highlights on the Beckhoff booth drawing a lot of visitor attention were the showcases on the Microsoft HoloLens™ and digital voice assistant Alexa from Amazon. "The topics of IoT communication and the diverse benefits of using cloud systems for centralised energy data analysis, clearly recognisable trend monitoring and simplified handling of big data volumes were received with great interest, especially by project planners. In this regard we are one step ahead of the competition,” adds Georg Schemmann.

More info and Trade Show TV coverage:
www.beckhoff.com/ish

More info and Trade Show TV coverage:
www.beckhoff.com/prolight-sound
Ligna
In keeping with the motto of “Creating Value: With one Integrated Control Platform”, Beckhoff demonstrated the many and varied advantages of an integrated control system for woodworking machines at their tradeshow booth: From operation and maintenance to engineering, the field connection and the IoT connection, the integrated control solution from Beckhoff simplifies all processes, delivering the optimal platform for driving integrated manufacturing strategies in line with Industrie 4.0. “With PC-based control, mechanical engineers are able to take advantage of an end-to-end tool chain for PLC, HMI and IoT. This means that all machine functions can be realised on the basis of a consistent hardware and software platform, which simplifies engineering overall,” explains Stefan Sieber, Beckhoff Business Manager Woodworking.

Sensor + Test
Beckhoff was an exhibitor at Sensor + Test 2017 in Nuremberg this year to present their new series of devices for high-end measurement technology. Extremely accurate, fast and robust, these measurement technology modules have been specially designed to meet industrial requirements and are ideally suited for use in test-bench applications. “In terms of accuracy, reading and time precision, synchronisation and long-term measuring accuracy, the new EtherCAT measurement technology modules open up new possibilities that could only be implemented using expensive special equipment up to now. With the integrated Beckhoff solution, the user can now take advantage of an end-to-end measuring chain: from the electronic connection of all common sensors to I/O modules with different protection ratings to the measurement technology EtherCAT fieldbus and right on up to a variety of different ‘on-premises’ TwinCAT software modules. The cloud connection is also part of the overall control system,” emphasises Martin Podrouschek, Product Manager Fieldbus Systems at Beckhoff. “This makes it possible to also correlate the acquired measurement data centrally in networks or cloud systems – as intended for Industrie 4.0 and IoT.”
eXtended Transport System in stainless steel for use in the food and pharmaceutical industries

**XTS in “Hygienic Design” for compact and highly flexible motion solutions with optimal cleanability**

XTS Hygienic, the stainless steel version of the eXtended Transport System from Beckhoff, opens up a wide spectrum of new applications, first and foremost in the primary food and pharmaceutical industries and for processing and filling liquids in general. Enabling optimal cleanability with the high protection rating of IP 69K, very good chemical resistance and without any hidden corners, edges or undercuts, the version in Hygienic Design offers a lot of potential for innovation in these industries. The advantages of the standard system as a highly flexible motion solution are combined with ease of cleaning, thus enabling process optimisations and maximum production line availability even when the demands made on hygiene are high.
The XTS replaces mechanics with software functionality to allow for a high degree of design freedom in realising completely new machine concepts. As a result, applications with difficult environmental conditions, such as in product handling for the food, pharmaceutical and cosmetic industries and in the production of paints and varnishes, will benefit from the new Hygienic Design.

**Benefits for machine builders and end users**

Through a significant reduction in mechanical engineering requirements, machines can be set up with the XTS more compactly, at a lighter weight and with less wiring. In addition, compared to conventional solutions, the systems are much more flexible, the processes quicker and maintenance needs lower. Thus, machine builders can now offer smaller, more powerful and more efficient systems and the end user benefits accordingly from a smaller footprint, higher productivity and quicker product switchovers.

These advantages become particularly apparent in the Hygienic Design environment because ease of cleaning is one of the highest priorities. With the XTS Hygienic, which is so much easier to clean compared to more complex mechanical systems, the routine cleaning tasks along with those for product switchover – which are optimally supported by the XTS as standard – can be performed much more quickly. And there’s more: up to now, it was virtually impossible to implement mechanical solutions at all in many applications due to their high requirements for cleaning – the XTS Hygienic now allows for the automation of many of these processes as well.

**Developed in close co-operation with the EHEDG**

The XTS Hygienic was developed in close co-operation with the European Hygienic Engineering & Design Group (EHEDG). As a result, it meets all the requirements for system certification according to EL Class I AUX. The most important properties of this stainless steel version include the high IP 69K protection class, which guarantees the highest-possible degree of protection against ingress of dust and water. In addition, it exhibits very good chemical stability so that the surfaces are able to stand up to surfactants, acidic and alkaline cleaning agents, different alcohols and disinfectants and even hydrogen peroxide.

The mechanical components used in the XTS are made of V4A stainless steel, while the seals and covers consist of very resistant plastic materials. In addition, all the joints between the individual components are protected against the ingress of dirt and liquid by a high-quality, elastic joint seal.

Once installed, the XTS components form an even, smooth surface together with the machine that is easily accessible in all areas, which also makes it very easy to clean. These properties also apply to the movers, with the rollers placed at such a distance to the mover’s body that the gap can be cleaned with e.g. a finger. The rollers of the mover are sealed against the axis in such a way that it is possible to reliably prevent the ingress of dirt and any leakage of the bearing grease.

Further information:

www.beckhoff.com/XTS
Hans Beckhoff in an interview with Christian Vilsbeck of A&D

"Trust reduces complexity"

Beckhoff is well-known in the world of automation for PC-based control systems, EtherCAT and other sophisticated technologies. Talking with Christian Vilsbeck, editor-in-chief of automation magazine A&D, Hans Beckhoff reveals why he wasn’t taken seriously at first, why not every component has to be intelligent, and why digitization without a human touch will fail.
We manufacture the motherboards for our Intel® Xeon® processors over-dimensioned?

Beckhoff is very much technology-driven, but software is becoming increasingly important, especially due to digitization. Is your focus shifting accordingly?

Hans Beckhoff: We’ve also been a software company for a very long time. Software is a core component of our products at every level. Moreover, there’s still a great deal of potential for innovation in the hardware. So we have aligned our business strategies with all product lines; in other words, we want to be the leading specialists for IPCs, I/O, drive technology and software for our customers. We are always on the right track if we master technology well, deliver high-quality products and, in addition, guarantee innovation and exceptional value. Hardware and software are foundational technologies – and we develop both of them intensively. As a technology provider, it is our duty to develop our own ideas that positively surprise our customers, so to speak – and we succeed in doing so regularly.

Modularity and flexibility in system design are important topics for machine builders. What solutions and advice do you have here?

Hans Beckhoff: A great many! It starts with our new standard, EtherCAT P. This combines EtherCAT communication with integrated power on a 24, 400 and 600 Volt basis, enabling the connection of machine modules with a single plug connector that integrates communication, power supply and safety functionality. Of course we also offer many small controllers that cost only a few hundred euros and have both a Microsoft operating system and Ethernet onboard. These are perfectly suited for communicating from one cell to the next. However, we also analyze our customers’ machine types to learn what is better – centralized or decentralized control. There are organizational, manufacturing and economic reasons why one would want to provide machine components with integrated intelligence. However, there are also functional aspects. If you can picture a machine that must control a large number of motion sequences in correlation, we always recommend entirely central approaches. The actuators, sensors and drives should be as “stupid” as possible – the intelligence needs to be in the central processing platform. Only then do these elements remain easily exchangeable for the machine manufacturer, independent of any specific functions.

Central intelligence naturally needs computing power. But aren’t your new DIN rail-mounted PCs with 12-core Intel® Xeon® processors over-dimensioned?

Hans Beckhoff: Many-core architectures and automation technology go together very well! The machine becomes much more powerful because multiple processes can operate in parallel by nature. “More powerful” also means that we can have the machine run with shorter cycle times. With one of our controllers, we are currently in the midst of a transition from a cycle time of two or five milliseconds to 100 to 200 microseconds. We need significant computing power for this acceleration, however. Wherever control takes place, the machine runs more smoothly and generates fewer overshoots if cycle times are reduced. The throughput increases due to a cycle time reduction of two to five percent. These are enormous benefits. Or just consider advanced algorithms, integrated image processing and measurement technology – there are many possible applications where high processor performance is advantageous.

On the other hand, would you also see a Raspberry Pi as a viable alternative for inexpensive PC Control?

Hans Beckhoff: If you were to pack a Raspberry Pi into a robust housing with a proper power supply unit and industrial interfaces, while guaranteeing EMC immunity, then it would cost just as much as our ARM processor-based standard products. That said, we find the Raspberry Pi software environment exciting. For quite a while now, we’ve been discussing whether to bring a Raspberry Pi variant onto the market that combines this ecosystem with our products. The decision ultimately depends on whether we can identify enough specific customer benefits.

Your company also focuses strongly on integration of measurement technology into PC Control solutions. Do you see the advantage of simplified communication here?

Hans Beckhoff: Absolutely! The control system knows the timing of the machine and can record correlated measured data. With external measurement devices, you first have to establish correlation via synchronization signals. In EtherCAT, we have a communication bus at our disposal that is ideally suited to measurement technology and can push input data into the memory of the PC in real-time. Additionally, we’ve added measurement technology properties to our TwinCAT software that make it possible to measure the machine itself and/or the workpiece. Both run better when they are integrated into the control platform when compared with separate measurement technology devices.

Extracting added value from all the measured data from machines poses problems for many machine builders and industrial enterprises. You have tools such as TwinCAT Analytics software, but how much consulting is involved in the digitization business?

Hans Beckhoff: In particular, we believe that automation and digitization are rather complex topics, and we are committed to providing consulting services. That’s why we’ve expanded our sales network in Germany with field offices every 150 km. Ultimately, our business is a human affair because the customer’s automation engineers and ours have to understand each other well. They must tackle complex tasks and problems together, which means sticking together through thick and thin. Thus, an integral part of our offering to the customer is that we not only supply the software and hardware, but also the intensive support that goes with it.
The cloud very quickly comes into play when considering the analysis of data. Which solution do you favor here?

Hans Beckhoff: As far as technology, services and worldwide data centers are concerned, the big infrastructure providers Microsoft and Amazon – and in special areas SAP and IBM – are clearly ahead of the automation providers. That’s why there are more and more third-party applications that run in these ecosystems. At an early stage, and as one of the first automation companies to do so, we prepared our control technology for data exchange with the large cloud providers in order to optimally integrate their deep learning services and cloud storage resources. Our customers can thus use the best cloud solutions on the market “at the click of a mouse”.

Let’s move from the cloud back to your beginnings. You originally had 30 employees and now there are more than 3000. Has your management style changed from then to now?

Hans Beckhoff: I perceived it to be a harmonious, progressive development – nothing really disruptive. We’re still a technology-driven company. In the creation of this technology I value employees who are very original, and who are not only masters in the state of the art, but also develop ideas of their own. Everyone can do some thinking “outside the box” and have fun; every idea is discussed democratically and no one is made to feel a fool of themselves. However, that is followed by a leadership decision as to whether we follow up on an idea or not.

From that point of view, not much has changed. The principle of “trust reduces complexity” still applies. If you trust people, they’re much easier to work with and you can expand much faster on a global scale. In my experience this trust almost never leads to disappointment. However, you have to be prepared to take risks and occasionally bounce back from an unexpected setback.

Will Beckhoff soon surprise us again with a technical revolution as a result of this “blue-sky thinking”?

Hans Beckhoff: Yes, of course! But I’m not about to say what that is just yet.

What distinguishes Beckhoff from other full-service automation providers?

Hans Beckhoff: Despite all our focus on state of the art technology, we are and remain a very human, down-to-earth company. Our customers feel that too when they get to know our employees. Not only that, we are regarded as a very reliable company in particular because we assign such great importance to human trust and have proven our ability to deliver this in the long term. One decisive point is also our technological drive: we will continue improving automation technology and offer customers new and even revolutionary strategies for machine automation. I believe that’s what we stand for, and it’s what absolutely distinguishes us from other mid-size enterprises and large companies, because they are sometimes less open to change.
Two worlds are converging

With the introduction of specific solutions for the process technology market, Beckhoff is not merely introducing new components, but bringing together two automation concepts that for decades developed separately, side-by-side. While traditional PLC-based systems were optimized predominantly for short cycle times as a replacement for complex relay technology in machine controls, DCS (Distributed Control Systems) for classic PID (Proportional Integral Derivative) closed-loop control focused mostly on scalability and system integration.
Driven by customer requirements and technological progress, both DCS and PLC have advanced and increasingly converged over the years. As a result, PLC systems have acquired ever more extensive visualization systems. These are very similar to those that process engineers have used from the start, and are implemented to manage many wide-ranging and complex processing workflows. Distributed control systems, on the other hand, were optimized with regard to their performance and cycle times. Improvements such as these help accommodate even highly time-critical processes and equip process plants for safety-related requirements such as emergency stops and fire protection.

**Growing requirements bring separate worlds together**

The systems also converged in terms of scalability. Distributed control systems, which were designed from the start for large installations with tens of thousands of I/Os, were successful with simple engineering and retrofit capabilities. However, for today’s PLC-based systems, even I/O points in the high...
five digits don’t pose a challenge anymore. In addition, modern engineering environments like TwinCAT 3 software feature a broad range of libraries and plenty of function blocks so that even highly complex closed-loop control structures can be designed quickly and reliably.

Developments regarding system architectures also deserve special attention. Distributed control systems focused almost from the start on distributed I/O chassis, for example. These systems can collect data from areas exposed to explosion hazards with little wiring complexity and accommodate installations that are spread over large areas. PLC-based systems, on the other hand, initially concentrated on self-contained machines in small areas.

This has changed as simple machines have evolved into highly complex production lines within tightly networked plants, and operators have become more interested in using distributed peripherals that can be linked to fast fieldbus systems and deliver the bandwidth needed to accommodate
Process technology and automation combined into one system: The new ELX series EtherCAT Terminals feature intrinsically safe inputs/outputs and enable direct connection of field devices located in hazardous areas up to Zone 0/20.

the resulting flood of data. As a result, systems that can offer distributed intelligence, like the DIN rail-mountable Embedded PCs in the CX series from Beckhoff, are now a prevailing option, enabling direct connection of the EtherCAT based I/O system. In addition, deploying EtherCAT communication throughout allows operators to implement extremely time-critical and highly synchronized control processes across distributed production steps. This includes the ability to integrate with central production control systems, and to perform data analysis and optimize processes.

The PLC system offers maximum innovation potential
In terms of system architecture, the developments mentioned above have already made PLC systems very similar to the remote I/O systems that users are familiar with from the process control field. Especially in the context of Industrie 4.0 concepts, the PLC approach has proven to be an innovation driver, and has taken on a highly advanced structure that is clearly superior, particularly in terms of performance.

It is above all the vision of the Internet of Things (IoT) which has led PLC-based systems to take on some characteristics of distributed control systems in the past few years, especially in terms of integration capabilities. This, in turn, has increased support for mature protocols that offer cross-system data exchange, for example based on OPC UA, but also for communication between the supervisory control level and the cloud through protocols such as MQTT and AMQP.

While machine builders use these capabilities to implement the Industrie 4.0 concept in its totality, process engineers require fully integrated solutions for a variety of reasons. They must cover all hierarchy levels ranging from data acquisition in hazardous areas to remote diagnostics of globally distributed systems via centralized process control systems. The goal is to reduce the required number of operators and maintenance staff. While this reduces costs, it also opens up new opportunities to make systems more efficient and reliable through the use of extensive diagnostics and analytics tools.

Open and modular automation technology as a complete solution
With PC-based control, Beckhoff offers the ideal automation toolbox to imple-
The new ELX series EtherCAT Terminals with intrinsically safe interfaces and highly compact design enable direct connection of field devices located in hazardous areas – classified Zones 0, 1 and 2. PC-based control from Beckhoff now seamlessly combines automation and process technology, including all the benefits of integrated and comprehensive diagnostics from the EtherCAT system.

Beckhoff offers a system-integrated solution for explosion protection requirements – a comprehensive range of explosion-proof components facilitate barrier-free solutions across hazardous areas up to Zone 0/20. In addition to the ELX series EtherCAT Terminals with intrinsically safe interfaces, the portfolio also includes new Control Panels and Panel PCs in the CPX series, suitable for use in Ex Zone 2/22, and TwinCAT control software with a wide range of interfaces specific to process technology.

The ELX series expands the comprehensive Beckhoff EtherCAT Terminal system, which already offers more than 100 different signal types, with I/O terminals that feature explosion protection. The combination of remarkably compact I/O modules and integrated safety barrier functionality results in high-performance EtherCAT Terminals for connecting intrinsically safe field devices. The slim terminals reduce space requirements in the control cabinet by up to 50 percent. This solution offers clear advantages, particularly in hazardous areas with confined spaces that typically require elaborate and expensive enclosure technology. Eliminating the need for external barriers significantly reduces installation efforts and costs.

With the upcoming certification in compliance with ATEX and IECEX, the ELX series meets all industry-specific guidelines for explosion protection and can be used in nearly all markets worldwide. The I/O terminals have either 12 mm housings with up to four intrinsically safe inputs or 24 mm housings with up to eight intrinsically safe inputs.

With the new ELX terminals, users with explosion protection requirements can benefit from ultra-fast and sophisticated EtherCAT technology. Benefits include time stamp functionality, which ensures high measurement accuracy and highly precise synchronisation – even in widely distributed process applications. In addition, integrated EtherCAT diagnostics capabilities with 100 Mbit data rates enable fast and convenient error identification. In this way, downtime can be minimised, maintenance simplified and system availability increased.

The openness of the PC-based control concept deserves special mention, as support for all major bus systems allows the easy integration of Beckhoff controllers into existing architectures. In addition, long-term product availability and backward compatibility provide the best-possible investment protection and ensure outstanding spare parts supply. As an example, even first-generation EtherCAT components can still communicate with the latest product introductions. Benefits like these also make it easy and affordable to upgrade existing systems, for example by adding cloud connectivity and IoT functions.

The benefits of integrated and open automation systems from Beckhoff become especially apparent when designing new plants. On the field level, the use of ELX-series EtherCAT Terminals for the direct connection of intrinsically safe field devices enables significant reductions in space requirements, and thus cost requirements. In addition, the elimination of the need for separate safety barriers delivers clear advantages with regard to installation and diagnostics. DIN rail-mountable Embedded PCs from the CX series, equipped with up to 12 CPU cores, make it possible to distribute the execution of even the most complex control tasks with their high processing performance. Comprehensive product certifications ensure compliance with explosion protection requirements and enable installation in close proximity to the actual process.

**PC-based control simplifies plant operation and engineering**

On the control level, the finely scalable portfolio of Industrial PCs from Beckhoff enables custom-tailored solutions that can not only perform a wide range of control tasks, but also provide easy integration into process control systems. Support for many standards and protocols ensures cross-system data communication on both the higher-level control and field system levels.

The advanced TwinCAT HMI software solution enables the implementation of visualization tasks according to the highest standards for efficient and reliable plant operation. In addition, the responsive TwinCAT HMI runs just as well...
Available as integrated or standalone models, the explosion-proof Control Panel solutions in the CPX series combine high-quality build and elegant design with advanced, capacitive multi-touch technology.

The full integration of the HART protocol into TwinCAT software enables the use of extensive functions directly from the engineering interface. Through the integrated FDT container, additional field device DTMs can be opened inside TwinCAT, offering all configuration options on one software platform.
High-quality build and elegant design:
Multi-touch panels for Ex Zone 2

By systematically integrating advanced multi-touch technologies into its Control Panel and Panel PC portfolio, Beckhoff has provided machine builders, manufacturers and other industries with forward-looking operator interface concepts for years. With the company’s new CPX Control Panel series, applications in hazardous areas, classified Zone 2/22, can now also benefit. The high build quality and robust aluminium enclosures ensure reliability and durability under harsh and potentially explosive environmental conditions. This delivers significant advantages in terms of operation, look and feel, and design to applications in the process industries.

Beckhoff offers a system-integrated solution for explosion protection with the addition of a new and extensive portfolio of explosion-proof components. These solutions enable barrier-free concepts through to Zone 0/20. In addition to the Control Panels and Panel PCs in the CPX series, Beckhoff has also introduced the new ELX series EtherCAT Terminals with intrinsically safe interfaces for field device connection through to Ex Zone 0/20, as well as TwinCAT control software with numerous interfaces specific to process technology.

The CPX portfolio offers a wide selection of screen formats, sizes, installation options and features. The range of formats includes 15 inch (4:3), 19 inch (5:4), and 21.5 inch (16:9 widescreen) versions. This means that process industry applications can now also benefit from advanced capacitive multi-touch technology, enabling the realisation of intuitive and feature-filled operating concepts.

To ensure that all application requirements are fulfilled, both the CPX29xx and CPX39xx series offer Control Panels for integration into control cabinets, as well as IP 65-rated standalone panels for mounting-arm installation. The same applies for the fanless Panel PCs in the CPX27xx and CPX37xx series. Equipped with heat-resistant, energy-saving Intel® Atom™ processors, they ensure reliable and high-performance system control.

Further information:
www.beckhoff.com/process

Benjamin Bruns,
Business Management
Process Industry
Seamless integration of hydraulic axes in standard control technology

The lightweight construction material Lisocore®, manufactured by Lightweight Solutions GmbH, in Bad Aibling, Germany, is used for a number of highly innovative applications where conventional wooden materials reach their limits. For example, lightweight yet strong construction materials are required for building ships or mobile homes. Beckhoff was involved right from the start in the development of the new machines required for producing the material – with PC-based control, and in particular with TwinCAT Hydraulic Positioning for seamless integration of hydraulic servo axes.
Beckhoff controller at the high-pressure press
Lightweight Solutions was established as a startup business with a background in university research. Initially, their core process — the production of an innovative, lightweight construction material — had to be tested for readiness and implemented in series production within a short timeframe. Beckhoff was involved right from the prototype phase. The deciding factor for the selection of PC-based control technology was Lightweight Solutions' intention to start prototype production as quickly as possible, and with maximum software flexibility.

At the time, PC-based control proved to be a great advantage, as the approach enabled a direct fieldbus connection between the I/O system and valve control without any additional hardware. In addition, the synchronization control for the hydraulic drives on the twin-punch press and the control of the supply unit were easy to implement based on the TwinCAT Hydraulic Positioning library. The first three-dimensionally shaped core structures were produced with a press built entirely by Lightweight Solutions as early as 2006. The machine not only provided prototypes for testing and sampling, but produced series parts over several years.

High potential for innovation through TwinCAT 3 hydraulic positioning

Today, a spacious production hall houses four much larger successors to the first press, which are networked via EtherCAT and each controlled by a C6920 Industrial PC from Beckhoff. They form the end stations in the production lines where the core structures are assembled to create finished products. In the meantime, the TwinCAT Hydraulic Positioning library has been ported to TwinCAT 3, while retaining the tried and tested functionality.

In the new machine generation, operational reliability was further improved. In two- or four-punch presses, there is a risk of the powerful cylinder drives damaging the machine if a valve failure remains undetected or is detected too late. In order to identify developing problems at an early stage, the hydraulics library provides software functions that are used for monitoring the valve operation. The fact that not only the encoders benefit from EtherCAT interfacing, but also the valves, has proven to be advantageous. In this way, a variety of diagnostic data, including the current slider position, are available without additional effort. Comparison with a model calculated in the hydraulics library enables analysis of the valve behavior, so that warnings or alarms can be issued as appropriate. Problems can then be recognized and addressed proactively, such as malfunctions in a pilot valve supply or a main stage blockage caused by accumulated particles from the process.

Controlling complex production processes as efficiently as possible

In the highly-automated lines, cover layers are joined with the Lisocore® core structures to form sandwich elements. This process is more demanding than it may appear at first glance. A form-locking connection with a total of 15,000 mounting points is achieved in 20 seconds, which makes highly-dynamic positioning essential. Since the slabs are continuously moved forward during these operations, the milling units have to synchronize with each row based on the “flying saw” principle, perform the processing steps and return as quickly as possible so they are ready for the next row. More than 20 servo axes are installed in this part of the plant alone.
Once the protective layers and the core structure have been joined correctly, the “sandwich material”, which is still quite fragile, is transferred to a hydraulically operated, scissor-type lifting table. This table transfers the incoming products to a multi-level press, where the individual elements are joined in a dimensionally accurate, permanent manner with a hardening adhesive.

An undesirable characteristic of such scissor-type lifting tables is their tendency to oscillate. This is difficult to avoid, even in the end position. This creates increased waiting time, which unnecessarily delays the forwarding of the sandwich slabs, resulting in reduced production throughput. It also has a negative impact on the dimensional accuracy, due to a possibly undefined hardening of the adhesive. As a solution to this problem, condition feedback was implemented, in which correction values derived from the chamber pressures of the hydraulic cylinder are offset with the valve control signals. The electronic attenuation generated in this way ensures fast stabilization in the target position.

A multi-core Industrial PC with TwinCAT 3 controls the entire system
The transfer between the scissor-type lifting tables and the multi-level presses requires intensive communication, because there are no fixed rules to determine which of the four levels the next product is conveyed to. In addition, the position of the levels changes continuously, due to the stack-type design of the press. Here, TwinCAT 3 shows its strength in conjunction with the C6650 control cabinet Industrial PC with cutting-edge multi-core CPU (Intel® Core™ i7, 4 cores). This is also found in the numerous other synchronous transfer stations between conveyor belts and processing zones. The realization of the entire plant software on a single PC-based platform eliminates the need to exchange and transmit data and signals between different controller types.

Even the wide mix of technologies in this plant is no longer a drawback: the hydraulic axes with an adapted technology software library, complex motion control for the Servo Drives, and even the modules for waste heat recovery work seamlessly together. To this end, almost 900 EtherCAT slaves (IP 20 I/O terminals, IP 67 I/O modules and AX5000 Servo Drives with AMB8000 OCT servomotors) are linked via two EtherCAT masters, according to Jens Hülsebusch, Project Manager of Systems Engineering at Beckhoff. The set values for 130 NC axes are calculated within a 2 ms task interval.

“Without TwinCAT 3 and its multi-core support, it would not have been possible to realize such a system,” emphasizes Michael Schäpers, Managing Partner of Lightweight Solutions. “Four processor cores were available to execute the various tasks separately. Plus, with the integrated EtherCAT-based technology from Beckhoff, we didn’t have to worry about the communication routes in the plant. What’s more, the process data obtained from the machines can simply be fed back into the plant. This special feature helps us develop new processes and products more easily. It is essential that we operate the machine flexibly and access the controller data easily. Another argument in favor of the Beckhoff system is TwinCAT 3 Scope. This software oscilloscope can be used to achieve detailed analysis of the process sequence, and it is possible to retrieve all required data for a new process. All in all, this means a tremendous speed advantage in terms of product and process development.”

The entire automation technology is already linked to SAP via intelligent solutions. Looking ahead, Michael Schäpers notes that “As manufacturers of special purpose machines, we will continue to collaborate with Beckhoff on projects by leveraging the concepts of Industrie 4.0.”
A helium leak detector like the Phoenix L500i from Leybold detects leaks and the corresponding leak rate, i.e. the gas flow caused by the leak. The part under inspection is first evacuated in order to allow gas from outside – in this case helium – to enter through a potential leak as a result of the difference in pressure. This is then evacuated by the leak detector. The partial pressure produced by the helium in the detector is measured by a sector field mass spectrometer and displayed as the leak rate.

**Fast, reliable and convenient measurement functions**

The two key characteristics of a leak detector are its range of measurement and time performance, that is the response time. This is where the Leybold device sets new standards, according to Thomas Palten, Senior PLM/SLM of High Vacuum Systems: “We think the Phoenix L500i is the fastest leak detector on the market. It also enables extremely reliable measurements, and the ergonomic design – winner of the 2014 Red Dot Design Award – sets it apart from other equipment.”

Dr. Magnus Janicki, Head of the Electronic/Software Product Group adds: “The high helium suction capacity of up to 50 L/s ensures a response time of less than one second, resulting in extremely short inspection times. Added to this are other factors such as notable ease of operation, an optimized display of measurement results, and integrated data storage to generate inspection reports for efficient quality assurance.”
PC-based control as the foundation for efficient inspection processes

The Beckhoff CX9020 Embedded PC, equipped with a 1 GHz ARM Cortex™-A8 CPU, provides ample performance for fast measurement and visualization processes. The CP3915 Control Panel with 15-inch screen, in combination with TwinCAT 3 automation software, ensures user-friendly visualization that ideally matches the sophisticated design of the unit, as Thomas Palten explains: “When the leak detector was launched, an off-the-shelf, design-oriented tablet PC was used as an operating interface. However, in order to meet the full range of industrial requirements, for example in the field of nuclear power engineering, we have now switched to a Control Panel from Beckhoff. The panel, which also won the Red Dot Design Award in 2013, is the ideal fusion of our exacting design standards with an extremely robust construction, providing an IP 65 rated multi-touch unit in a robust aluminum housing with high-quality glass cover. Ideal for industrial applications, the PC-based control system also meant that we were able to significantly reduce hardware and software maintenance efforts when compared with the app-based user interface.”

The numerous functions provided by the visualization were implemented using TwinCAT 3 PLC HMI software, ensuring highly efficient operation and simplified leak detection. A standby/timer function makes sure the device is ready to use from the start of the shift, saving time and energy. Various user and product profiles minimize operating errors and increase efficiency. Other features include reporting functions for different inspection methods, optional barcode scanning to increase operating speed, and an “eco mode” that deactivates the auxiliary pump during long measurement runs, saving energy as a result. Thomas Palten adds: “Users of the leak detector generally require intuitive operation and ease of use. TwinCAT 3 PLC HMI (TF1800) enabled us to implement exactly this type of user interface experience in an easy and inexpensive way. It includes special features such as logarithmic trending functions using the histogram object, making it possible to represent the leak rate signal over time with a resolution of up to 100 ms in order to detect leaks quickly and reliably.”

The Phoenix L500i also uses other components from the Beckhoff portfolio. The 2-channel EL4732 EtherCAT analog output terminal is used to generate a sinusoidal acoustic signal with a frequency of up to 2 kHz. The EL6002 and EL6022 serial interface terminals support communication with a higher-level control device or a mass spectrometer. There are additional digital EtherCAT I/O terminals to control pumps and valves. Leybold has worked with PC-based control technology from Beckhoff since 2010, and Dr. Magnus Janicki sums up this relationship: “We benefit from a very wide portfolio of control, drive and software components. What is more, PC-based control offers a more powerful and convenient programming environment, as well as better component management when compared with the systems we previously used.”

Further information:
www.leybold.com
www.beckhoff.com/CP39xx
www.beckhoff.com/TF1800
Ready for the real thing:
Fire simulation system supports firefighter training

Fire simulation systems help firefighters, rescue teams and other emergency staff train by recreating complex scenarios under realistic conditions. Fitra Systems & Software, a subsidiary of Hoka GmbH, specializes in the production, maintenance and optimization of such fire simulation systems. The software solutions developed by Fitra (short for fire training) are based on TwinCAT automation software from Beckhoff in connection with Industrial PC technology, EtherCAT as the communication platform, and a selection of corresponding I/O components.
There is a differentiation between "hot" and "cold" systems for fire simulation. The former involves real fire, which is produced and controlled with gas as the fuel source, while the latter simulates flames via LED bars. Electronic control technology is used to simulate complex fire emergency scenarios with various flame heights and smoke outbreaks. Audio-controlled calls for help and mobile rescue mannequins complete the setting for fire simulations.

Fire simulations require complex control scenarios
In 2014, Fitra was commissioned to develop an emergency simulation system for the State Fire Academy in Würzburg, Germany. "Their training hall is the largest in Germany. The size of the space, and the multitude of the technical building systems that had to be integrated, made this job highly demanding," explains Karl Keupp of the Würzburg Building Authority's technical department. The academy can create a multitude of scenarios ranging from fires in underground parking garages, to room fires in nursing homes or hospitals and remotely control them via computer. Sound and light effects as well as fog machines are used to realistically simulate fire outbreaks in
which more than 70 lifelike, articulated mannequins as “residents” must be rescued from buildings. Fitra had to meet the following requirements for this project:

- Enable a central server for networking and coordinating six buildings
- Create a central audio server to simulate calls for help, either automated or via announcements
- Network LED bars for firelight simulations
- Synchronize 38 mannequin cabinets, shutters and switches
- Provide hot-connect options for 60 mobile simulation racks (smoke, light, sound, etc.)
- Integrate safety technology
- Facilitate interfaces to real fire alarm systems

The project’s control topology shows the implementation approach of the solution:

- Measuring 4 height units (4U), a C5102 rack-mount computer in the control cabinet integrates the server functionality for the six downstream CX5130 Embedded PCs used as controllers. The C5102 also runs the database for the deployment scenarios, audio files, and the web server for visualization. The cabinet also houses the KL6301 KNX master terminal for interfacing with the room and hall lighting as well as window shutters.
- The audio hardware components (DA converter, pre-amplifiers, power amplifiers, etc.) take up two sections of the neighboring control cabinet.
- Each of the CX5130 Embedded PC controllers runs an EtherCAT network for the process data. EtherCAT is also used as the backbone for the EL6851 DMX master that communicates with the LED bars.
- The safety technology is integrated into the EtherCAT network via EK1914 TwinSAFE Couplers.
- The connect and disconnect cycles for up to 60 mobile simulation racks are implemented by configuring EtherCAT hot-connect groups on Beckhoff CU1128 EtherCAT junctions and via unique device IDs.
The developers at Fitra paid special attention to the software structure. Besides the basic requirements for automated or manual fire simulations, various scenarios had to be configurable via prefabricated function modules, in a user-friendly manner that did not require any additional programming. The results were impressive. The developers specified various layers with defined interfaces, and since each layer can be maintained and replaced individually, modifications for service purposes can be implemented quickly and efficiently.

**Hardware configuration with TwinCAT**

The TwinCAT System Manager forms the lowest layer of the software architecture. This is the level on which bus systems are selected, various settings for fieldbus components are made, and basic links to software variables are established. It also provides various diagnostic pre-check functions prior to commissioning and troubleshooting features for ongoing operations (wiring, etc.).

The hardware server generates application-specific process objects, such as:
- combining process variables into application modules
- generating standardized formats and arranging them in classes
- scaling data to application-specific values (e.g., actuator drive opening by percentage, temperatures in °C, etc.)
- adding object properties such as threshold or limit values, statuses (stands, moves, opens, closes) as well as complete motion profiles for actuator drives and monitoring functions

These objects are available to higher-level layers within these defined interfaces.

**The Fitra Server – a framework for fire simulations**

At the core of the system is the Fitra Server, a framework that provides the complete fire simulation functionality in a modular, structured manner. It combines individual modules, including:
- flame height management (simulated via LED bars)
- mannequin scenario management (sequence control of mannequin cabinets)
- sound generation and distribution (types and locations of calls for help)
- general fire scene simulation

These elements are joined together in logical scenarios, which can then be controlled manually or run automatically. Each module has a basic functionality and an associated sequential control application, which the user merely has to parameterize or configure. Let’s take a rescue mannequin scenario as an example: The user starts out by defining when a mannequin will be activated. This is followed by automated event sequences and user-defined actions. An example of an automated event would be the opening of the mannequin cabinet doors. User actions are required when windows must be opened or when the speed and position of a mannequin is determined, etc. The scenarios of the pre-programmed modules and event sequences are also handled via a graphical XML configurator.

The Fitra Server also functions as a web server for the Fitra visualization. Designed as an HTML5-based web page, the visualization can run on any platform. All that is needed is an HTML-capable browser, which is typically available for virtually any device ranging from PCs to tablets and smartphones.

"With our fire simulation system for the State Fire Academy in Würzburg, we have achieved an unprecedented level of automation. As a result, all simulation scenarios can be mapped in a realistic manner in accordance with official regulations to notify security authorities and organizations in case of fire. In the past, the lack of integration made this level of realism impossible," says Andreas Hovestadt, Managing Director of Hoka GmbH and Fitra Systems. "The fieldbus master terminals for EtherCAT and K-bus from Beckhoff were a great help when it came to integrating building technology communication systems like KNX or DMX into our standard automation environment. They made it easy for us to marry the standard automation
systems with the building automation systems with no need for special editors or configurators for the building technology applications. The capabilities Beckhoff offers in this field are unique; no other vendor offers this level of completeness.”

A 4U C5102 rack computer from Beckhoff in the control cabinet integrates the server functionality for the six downstream CX5130 Embedded PC controllers.

Further information:
www.fitra-systems.de

Fitra Systems & Software GmbH & Co. KG

Since the company’s foundation in 1992, Hoka GmbH has focused on the development of highly specialized measurement and control solutions for processing and energy technology applications. In order to embark on a new field of business – the development of fire simulation systems – the company set up Fitra Systems and Software GmbH & Co. KG as an affiliate. Its core business is the planning, production, maintenance and improvement of fire simulation systems for training firefighters, emergency technicians and disaster relief workers.
Studying energy efficiency in the Real Living Lab

New building at the University of Antwerp integrates building automation for optimum energy efficiency

If you let a team of budding electrical and civil engineers automate their own new building, you can expect an innovative and technically-sophisticated solution. The University of Antwerp in Belgium has followed this path at its Groenenborger campus with the “Z” building. The result is a highly sustainable “passive house” with an intelligent building management system that features advanced HVAC control. As the central building automation platform, a Beckhoff CX2020 Embedded PC controls approximately 4,000 I/O points. Moreover, the openness of the PC-based control architecture enables budding engineers to use the building as a “Real Life Lab”.

With the TP10, Fixsus has developed a compact device that collects all climatic values in the room. The 10 sensor keys can be freely programmed by the user. Control takes place via the central Embedded PC.
The topics of energy efficiency and sustainability are accorded significant importance in the Electromechanics Engineering and Architecture degree programs at the University of Antwerp. It was therefore only natural that the Faculty of Applied Engineering Sciences would implement an innovative and energy-efficient concept in the construction of the new "Z" building. Leveraging excellent thermal insulation and the use of heat exchangers to avoid ventilation heat losses, the building is constructed as a passive house according to European standards and requires no traditional building heating. An unusual aspect in the design is that the building services were installed visibly for the most part, so that the building can serve both as an object to study and for student research projects.

The system integrator Fixsus, which implemented the building automation technology, will also use the data collected in the "Z" building for further system optimizations to be used in future projects. "For example, we use the data to further improve the control systems and the algorithms in the software we develop," explains Koen Verschuere, managing director of Fixsus. To achieve this, all measured values in the building – over 1,500 of them – are recorded every three seconds for a period of 10 years.

**Passive house principle plus integrated building automation maximize energy savings**

"In the past, we conducted research projects on the subject of climatization in which we asked ourselves, 'How can comfort and low energy consumption be balanced efficiently while also considering the investment costs?'" says Eddy Janssen, lecturer and spokesman of the Energy Department at the University of Antwerp. "As numerous simulations have shown, the concept of controlling each room separately with a variable throughput that depends on the measured values is best suited to achieve our goals." This principle has been successfully implemented in the "Z" building on the Groenenborger campus, which opened in June 2016. However, the room automation as realized is significantly more extensive: it includes illumination and solar protection,
opening of windows and the ventilation, as well as heating and cooling. The scope of functionality also includes heat storage and natural cooling by opening windows.

“The controller is decisive for the passive house principle,” adds Prof. Ivan Verhaert. “For example, if you wish to make maximum use of natural cooling by opening the windows, increased air throughput must be achieved in extreme cases, even while the impulse fans are switched off. For the heating, internal heat gains in a room are best utilized by having the controller calculate them in advance.”

The fact that the building contains a great deal of heating and cooling technology makes the control requirements even more complicated. Apart from two classic gas boilers for absorbing the peaks, the system can make use of a 6-pipe heat pump, a gas absorption heat pump, a buffer cylinder, a geothermal probe field and a dry cooler. Eddy Janssen also points to the so-called “waste hierarchy”, a principle applied to sustainable waste management. There, avoidance comes first, followed by re-use, then recycling and, finally, incineration. Translated to the cooling of a building, this means: first, heating up of the building is avoided by solar protection and the economical use of illumination; then, the cooler night air is used for air conditioning, for example; the next step is heat recovery and so on.

Individual room control provides high level of comfort

A Beckhoff CX2020 Embedded PC serves as the central intelligence for the building automation. “The concept of decentralized intelligence no longer exists in the Fixsus philosophy. This means that the entire system logic is bundled in the central controller. The CPU is connected via EtherCAT with 89 decentralized I/O stations – one per room – with more than 700 I/O modules in total,” explains Tim Verheyden from Fixus. The number of measurements is significantly larger, however. Various measured values are recorded from each room, such as temperature, relative humidity, CO₂ content, the concentration of volatile organic compounds (VOCs), CO value, light intensity as well as the intensity of infrared radiation. The measurement of the latter even enables system calculations for the perceived room temperature – an important variable to achieve the appropriate control for a high degree of comfort.

All measured values required for the climatization of the room are collected in the TP10 module as developed by Fixsus. The compact device, which is about the size of a light switch, contains 10 sensor keys that can be freely programmed by the user. “The TP10 is connected to a digital input and a digital output of the PLC, through which a value can be queried from the 512 registers of the TP10 every 0.2 seconds. You need fast I/Os for that – but of course that’s no problem with Beckhoff,” explains Koen Verschuere. “If a device should fail, it can be easily replaced without having to adjust anything in the programming or configuration.”
Maximum flexibility and system openness

"Closed systems are still frequently used in building automation, which can lead to problems especially when components must be replaced," says Johny Vangeel, Business Manager of Building Automation, Infrastructure, Energy at Beckhoff. "With the building automation system from Beckhoff, we can replace or add components while the application is active in operation. The fact that all the logic is located in the PLC gives the system maximum flexibility when making adjustments and extensions in the periphery." A typical problem in traditional building management systems is, for example, that the software for monitoring and data management runs on a separate PC. Sooner or later conflicts arise between hardware and software components, for example, when new versions no longer communicate with old systems. "With the PC-based controller from Beckhoff, this all takes place on the same CPU and new developments in hardware have no effect on the software," noted Vangeel.

Another advantage of the open system is that users can adapt the software themselves. A conventional facility manager has to contact the system integrator that supplied the system to make changes. However, it’s an entirely different matter if the users are professors and students specialized in climatization and building management. Projects are now planned regularly in the Engineering courses at the University of Antwerp, in which measured values from the university’s own building are used, or new algorithms are tested on the controller. Every control loop can be bypassed for this and replaced with a manual operation or a new software module. The complete building controller is stored on a memory card, so it is simple to exchange the card afterwards to restore the original operating conditions if needed.

"There is a lot of talk about sustainability in building management, but one aspect that is frequently forgotten is that a system is only sustainable if it is reproducible and usable on a large scale," says Eddy Janssen. "A system must also be able to grow with new requirements and findings. This is an important criterion for us and was decisive in our selection of the PC-based automation solution with Fixsus."
Integrated automation system optimizes wire binding

Durrer Spezialmaschinen AG, based in Küsnacht am Rigi, Switzerland, develops a wide range of specialized machines and has built up comprehensive expertise, in particular with regard to complex motion control systems. Based on integrated PC-based control and drive technology from Beckhoff, such a system was recently implemented in a line for the production of desktop calendars and notepads, which has an overall length of almost 20 m.
The complexity of the production process is evident from the size of the line alone, which is almost 20 m long, 1.4 m wide and 2 m high. A total of 69 servo axes, which feature AX5000 Servo Drives from Beckhoff and various One Cable Technology (OCT) servomotors from the AM8000 series, are used for the conveying and precise processing of calendar sheets. Patrick Suter, Head of Development at Durrer, explains: “The system consists of a SIX-CUT cutting machine with 18 servo axes, which is controlled by a CX2020 Embedded PC, and a WIRO4 punching and binding line, which is equipped with a C6640 control cabinet Industrial PC and 51 servo axes. It can produce print products with wire binding and in formats ranging from 140 x 90 mm to 380 x 240 mm. An innovative feature of the plant is the format- and thickness-independent processing capacity of around 2200 products per hour.”
In the SIX-CUT machine, the sheets are cut to the appropriate size and transferred to the WIRO4 main system for binding via a grip feeder. This system starts with two feed stations for optional advertising pages – on the front and back of a desktop calendar or notepad. The products, which are conveyed in a horizontal position, are raised into a vertical position and then divided into 1 to 2 mm thick subunits for punching. Patrick Suter explains: “The punching technology and the drive performance would allow the processing of larger paper bundles. However, the punching quality would be inferior. Therefore, the book blocks transported through the system are split into piles and distributed across two to eight lanes in a two-stage unit, depending on the thickness of the finished product. The subunits are then recombined and put down, so that the front and back covers and the binding wire can be added. In this way, the system operates with a high degree of flexibility, making format and product changes possible with minimal changeover times.”

Connectivity for Industrie 4.0
The hardware and software of the system was designed so that it is Industrie 4.0-ready and guarantees seamless integration with higher-level systems. The transfer of production data to an ERP system is also enabled. In addition, the system operates in a network of different machines from different manufacturers without communication problems.

A gathering machine from a renowned Swiss manufacturer is installed upstream from the WIRO4 and SIX-CUT machines from Durrer. An external label printer and a comb former are also integrated within the Durrer system, and a packaging system is installed downstream of the line. All of these machines are interconnected and coordinated in order to achieve the highest possible performance and productivity of the overall plant.

Large number of moving mechanical components require high-performance control technology
According to Patrick Suter, the large number of moving mechanical components places high demands on the control technology: “The system integrates a great deal of drive technology, including about 100 pneumatic and hydraulic functions. This requires highly-efficient control technology in combination with high-performance drive technology, ensuring that the system capably meets future demands. PC-based control from Beckhoff offers all of this, plus the benefits of an open, highly flexible and innovative system. An additional benefit is excellent support for the optimization of servo axes, for example, both from Beckhoff Switzerland and from the experts at the Beckhoff company headquarters in Verl, Germany.”

For Patrick Suter, the modularity of PC-based control is particularly important in several respects: “With the wide range of Beckhoff Industrial PCs available, the computing power is optimally scalable to suit each individual application. In addition, the I/O system can be conveniently realized via decentralized I/O “islands”, which can be expanded as required. This is especially true for the EtherCAT Box I/O modules, through which 80 percent of all I/O data is captured in our current system. On the control side, modularity is also well supported through simple engineering and convenient machine-to-machine communication via the EtherCAT Automation Protocol (EAP). EAP exchanges ready signals as well as speed and product data between the SIX-CUT and WIRO4 machines. The same applies to the software, which also constitutes

Eight of the dynamic AM8000 servomotors from Beckhoff are used in this small WIRO4 sub-segment alone.

The AM8000 servomotors’ One Cable Technology (OCT) makes the cabling extremely easy for such extensive systems.

The AX5000 Servo Drives, combined with high-performance EtherCAT communication, ensure fast, highly dynamic and precise motion sequences.
an open, modular and easily expandable system. This means that we can adapt basic programmed functions without great effort and reuse them in new projects."

Due to the size of the line and the large number of drive technology components incorporated in the overall system, One Cable Technology (OCT) is another key benefit for Durrer. Patrick Suter explains: "Most drive technology cables have a length of 20 m or more. Accordingly, the OCT single-cable solution enables significant cost savings. In addition, cable routing and handling are simplified enormously, not to mention the fact that we can use smaller drag chains and the need for cable channels is reduced."

**One software for all control tasks**

TwinCAT control software ensures efficient implementation of the numerous motion tasks. The visualization based on TwinCAT PLC HMI provides a comprehensive overview of machine status information, while TwinCAT NC PTP enables highly accurate and dynamic positioning of the servo axes. Patrick Suter points out: “Our system makes extensive use of electronic and dynamic transmission units for reliable coupling of servo axes. In addition, the override function is used to vary speeds within the system for synchronization with the upstream gathering machine, which communicates with the SIX-CUT via OPC UA. All of this can be realized very conveniently via the corresponding PLCopen function blocks from the extensive motion control library provided by Beckhoff.”

According to Patrick Suter, the implementation of safety functions within the machine, such as emergency stops, light curtains, protective doors and gates, also benefits from the universal system integration of PC-based control: "This high degree of integration enables the TwinSAFE logic EL6900 safety control to access the machine states stored in the PLC. This information can be transferred very conveniently to the AXS000 drives equipped with AXS805 TwinSAFE cards via the Safety-over-EtherCAT protocol. They can also be easily processed using the safety function blocks for the SOS, SS1, SS2 and SLS safety functions. The two EL6900 safety controllers in the SIX-CUT and WIRO4 machines also communicate via EAP in a multi-master network."

**Innovative control technology for future-proof engineering**

Consistent development of advanced control technology opens up high potential for innovation in engineering. According to Patrick Suter, the broad, scalable range of PC-based control components is already well proven in many ways: "So far, we have been able to meet all the diverse requirements of our special-purpose machines with the control and drive technology supplied by Beckhoff. Alternative options are available should the components in the standard range reach their limits. For example, eXtreme Fast Control (XFC) and oversampling were used in some machines to realize extremely fast signal processing, with seamless integration into the overall system. This optimum scalability applies to all areas, from small controllers to high-performance Industrial PCs, from compact drive technology in I/O terminal format to complex servo applications. PC-based control also helps us find the optimal solution for future requirements with innovative approaches, such as the XTS linear transport system."
Open and modular: The Beckhoff control platform ensures optimal results in high-end additive manufacturing applications

Maximum speed and repeatability for 3D printing

With the development of the MetalFAB1 system, Dutch startup company Additive Industries took a major step toward the efficient industrial utilization of 3D printing processes. In addition to printing modules, the modular system for additive manufacturing with metallic materials also includes a heat treatment unit and a storage module. This ensures significant increases in productivity, flexibility and repeatability, according to Additive Industries. The end use application options are varied and range from aerospace and the semiconductor industry to the food industry. For drive and control technology, the company places its trust entirely in a PC-based control solution from Beckhoff.
The success of 3D printing is based, above all, on the high degree of design freedom it provides. Due to the fact that workpieces are built up layer by layer, even products with complex shapes can be produced economically, which otherwise could only be realized with additional processing steps. "The challenge, however, is to continually increase the speed and repeatability of our 3D printers," points out Mark Vaes, CTO at Additive Industries. "3D printers that can accomplish series production tasks very quickly and with the highest precision are particularly sought-after in high-end manufacturing applications such as in aerospace, for example. Our response to these demands is the MetalFAB1." The faster production made possible by this new machine type is, above all, due to fact that the individual process steps have largely been integrated and automated. The entire machine control is based on EtherCAT, including transitions from one process step to the next. "That means we are way ahead of the competition. In many existing 3D printer solutions, these process steps are still carried out manually. In the MetalFAB1, we were able to reduce manual labor to a minimum," explains Mark Vaes.

Modular system configuration for more flexible application options
The modular design of the MetalFAB1 is just as important as its speed and repeatability. The basic version consists of three modules: the control module, the printer itself and the exchange module, which acts as an interface for the operator. It is also used to feed in new plates and unload the finished products. The standard configuration can be extended to include up to 11 modules. "By adding different modules, we can easily increase printing capacity and add various post processing steps. The configuration we tested at pilot customers consisted of six modules," says Mark Vaes. "This extended version included an optional second Additive Manufacturing (AM) core for the printing process. By adding up to maximum four AM cores enables to print with different materials simultaneously," explains the CTO. "For example, a product made of steel can be manufactured in one chamber, while a component can be printed with titanium powder in another chamber. Through optional implementation of a heat treatment unit, the component can automatically pass through the next process step, where the internal stress generated during the printing processes are reduced. This is followed by an optional storage module for empty build plates and finished products and, finally, the HMI."

CX2040 Embedded PC as the central control platform
"We made the decision to use a Beckhoff PC-based control solution back in 2014," says Mark Vaes. "This control system was required to meet the high industrial demands for robustness, speed, functionality, standardization and costs. Another important argument in favor of the PC Control platform was EtherCAT. The fast communication system meets our requirements with regard to the speed and determinism of the entire system. It also provides added benefits as

[Image: A heat exchanger produced with the 3D printing method]
The 3D printing process of the MetalFAB1 is based on the “Powder Bed Fusion” principle. Also called powder bed laser melting, this is a process that starts by applying a thin layer of metal powder, such as titanium, to a plate. A laser travels across the powder bed at high speed, fusing the powder with high precision. When a layer is completed, the plate moves downwards, and the powder application and laser fusion process is repeated. To increase the production capacity, the MetalFAB1 can be equipped with up to four lasers or Additive Manufacturing modules. In addition to titanium and aluminum, Additive Industries uses other print materials, including steel and nickel alloys. After the printing process, the excess powder has to be removed from the process chamber, which poses a significant challenge due to the complex workpiece shapes. The MetalFAB1 fully automates this step for user convenience. Once the printing process is complete and the powder has been removed automatically, the component enters the heat treatment module, where the residual stress is reduced. The finished product is then transferred to the storage module. Since all production steps are automated, no operator intervention is required.
In the Welex® Evolution® series, Graham Engineering Corporation has created a machine portfolio that provides robust, customizable sheet extrusion for wind- ing, sheeting and in-line thermoforming systems. The state-of-the-art systems operate with a co-extrusion process, where up to nine extruders can be included in the system, for example to manufacture multi-layer products. The application-specific machine configurations from Graham Engineering Corporation feature, among other things, high-performance screen changers, melt pumps, mixers and co-extrusion feed blocks.

The XSL Navigator® machine control platform, which was developed by Graham Engineering Corporation, provides efficient operation of the Welex sheet extrusion machines. The basis of this control platform is a Beckhoff Industrial PC with TwinCAT automation software.

Graham Engineering Corporation optimizes extrusion process
The raw material for the extrusion process is a plastic granulate, which is often mixed with recycled material. This granulate mixture is conveyed into an extruder. The rotating extruder screw, housed in a heated metal barrel, mixes and melts the filled material while conveying the material forward. The molten plastic is pressed through a metal screen to filter out any particulates before it enters the melt pump. The screen is continually changed and cleaned in an auxiliary unit. The resulting homogeneous plastic melt is fed to a pump in order to generate an adequate plastic melt pressure. “The melt pump provides a reliable, continuous material flow through the slot die, which can be adjusted to provide the desired material thickness,” explains Justin Kilgore, Vice President of Engineering at Graham Engineering Corporation. The material then flows onto polishing rolls. These rolls counter-rotate, pulling the material through and feeding it down through the rest of the line to be delivered either to a winder or directly into a thermoformer, where it is given its final shape.

Graham Engineering Corporation standardized on PC-based control from Beckhoff for its blow-molding machines 10 years ago. The company has now chosen to integrate the Beckhoff platform into its new control system, the XSL Navigator®. This powerful, feature-rich control system has been adapted for use in sheet extrusion lines. “The flexibility and scalability of the PC-based solution are the two biggest reasons why we chose to standardize on this platform,” says Justin Kilgore. “The open control architecture makes it fast and easy to integrate with any downstream equipment we choose.”

Universally PC-based: from PLC to motion control to safety solutions
The control platform of the Welex sheet extrusion lines is based on a C6640-0040 Industrial PC with an Intel® Core® i3, dual-core processor running Windows 7. Justin Kilgore explains: “The C6640 has been our workhorse for many years and is used on a number of our systems. It provides ample pro-
cessing power for anything we’ve thrown at it, and has proven to be a reliable control platform.”

Digital EtherCAT I/O terminals, thermocouple inputs and analog inputs for pressure measurement, all from Beckhoff, provide high-speed communication across the machine and with all field devices, including those for safety. “Standard on the sheet extrusion machines are EL-series TwinSAFE I/O terminals, networked via Functional Safety over EtherCAT (FSoe) to implement numerous safety functions in the system,” as Kilgore explains: “We use RFID-enabled switches for safety doors, as well as numerous emergency stops. Some applications also integrate a light curtain into the control system via TwinSAFE. With this integrated solution, we can dispense with standalone safety controllers. The built-in diagnostic functionality in EtherCAT helps us precisely pinpoint any errors and push notifications to operators, increasing machine value.”

Customized Control Panel forms robust machine front end

The XSL Navigator® control system integrates a customized Beckhoff CP3921 multi-touch Control Panel with 21.5” screen, providing superior access to machine data via the HMI software. “The Beckhoff control panels provide a modern and elegant look that enhances the appearance of our machines. In addition, integrating the push button extension and an RFID reader into the panel adds a high level of security, functionality and a uniqueness that sets our solutions apart in the industry,” notes the engineering expert.

Openness of TwinCAT permits integration of customer expertise

The machine control is based on TwinCAT PLC software and Graham Engineering Corporation takes full advantage of the numerous programming tools offered by TwinCAT. Justin Kilgore explains: “Overall, the TwinCAT development environment gives us the flexibility to program all necessary process functions, regardless of the machine type or application we’re working on. We were also able to develop our own software libraries, including everything from PID temperature control to function blocks for integrated winder control. The ability to create a library of function blocks that we can then reuse across all of our extrusion lines is another way Beckhoff helps us maximize the value of our intellectual property (IP).”

Cost savings all along the line

“In terms of hardware costs, we’ve achieved cost savings of approximately 15 percent by switching to PC-based control, mainly due to the reduced wiring and installation labor cost,” Justin Kilgore explains. “When we discussed the introduction of TwinSAFE, we quickly identified potential savings: routine queries are eliminated and the search for error sources can be minimized.”

XSL Navigator is now the standard controls system for Graham Engineering Corporation’s Welex sheet lines. The demand for plastic products will not slow in the foreseeable future, and Graham Engineering Corporation has the tools and expertise to continue innovating for the market via best-in-class solutions engineered to meet this demand.

Further information:

www.grahamengineering.com
www.beckhoffautomation.com
Full-motion simulator for ultra-realistic driving simulation

PC- and EtherCAT-based controller provides highly dynamic, precise axis control in advanced vehicle simulations

Modern driving simulators are capable of replicating the sensations of motion, such as in the cockpit of an aircraft, in a car, on a train or on the bridge of a ship. These simulations are so realistic that they are often indistinguishable from the actual driving or flying experience. Full-motion simulation systems are used, for example, in professional pilot training as well as in “edutainment” and entertainment applications. The Italian brand Xesa Systems owned by GIEI s.r.l. specializes in this market segment, leveraging automation products from Beckhoff to bring simulations to life.
The core of the Xesa motion simulator is a parallel kinematic machine built on a hexapod or Stewart platform. It has up to six degrees of freedom (three translatory and three rotary), enabling the generation of realistic motion sequences that are highly dynamic and accurately-positioned. The software produces a dynamically changing virtual environment that is in sync with real physical movements, completing the simulation. The physical drive of the motion platform is located at the lowest level of the system and uses linear or rotary actuators. Each axis is equipped with at least three sensors, and in some cases up to five. Feedback from these sensors—in conjunction with the feedback from an encoder mounted on the motor—enables absolutely precise movements to each of the individual positions. The axes are moved using Beckhoff AM8052 servomotors which are connected to AX5000 Servo Drives via One Cable Technology (OCT). A DIN rail mounted CX5020 Embedded PC serves as the central control platform.

The controller communicates with the drives after receiving data from the so-called washout filters (high-pass and low-pass software modules). This comes from the application software, where the simulation system and the inverse kinematics are located. After the physical model in the upper software layer has calculated the behavior of the system, and the inverse kinematics has performed the respective conversions, the information is transmitted to the automation system in the form of points where the simulator must drive to. This simulates a highly realistic driving experience for the driver.

**PC- and EtherCAT-based controller as a universal platform**

"Xesa Systems and Beckhoff have collaborated closely for many years," explains Lorenzo Vicini, who is the engineering manager responsible for automation at Xesa Systems. "Our engineering successes certainly rely on the high degree of innovation offered by automation solutions from Beckhoff. One of the most substantial reasons why we chose a PC-based controller was that it enabled us to streamline our systems. We now only need a single CPU, TwinCAT as a universal software platform, and EtherCAT as the high-performance communication system for the entire application. Our software developers are far more flexible and gain a familiar, universal development environment with Visual Studio® embedded into TwinCAT 3. Additional benefits include the ability to link MATLAB®/Simulink® projects and the option to use C++ as a programming language. Further, the scalability of the Beckhoff components—from the PCs and drive components to the software—offers us a system with which we can create very precise controller designs that ideally fit the respective application."

"EtherCAT also plays an important role for us," continues Lorenzo Vicini. "On the basis of this fieldbus, we can achieve a controller accuracy that is higher than what is possible with any other system. A further advantage is the possibility of remote control as enabled by TwinCAT. We can fully access all devices: even if our simulator is located on the other side of the world, we can easily access it anytime via smartphone or tablet."

**Controller-integrated safety solution**

Xesa has also solved the issue of safety controllers in a simple manner with the integrated Beckhoff control architecture. The safety functions are implemented easily by adding safety option cards to the AX5000 drives. Even if safety requirements are not critical in the testing industry, extremely high precision is required. In order to connect the velocity and current controller to the AX5206 drive via the built-in encoder on the AM8052 servomotor, Xesa Systems uses a second external encoder to control the outer controller. "The performance that we achieve is impressive in this case, too," says Lorenzo Vicini. He emphasizes that: "With the integrated system from Beckhoff, we can achieve an individual axis precision of 10-5 m. Further advantages include the availability of a dual-axis drive and the OCT technology. This has made our machine designs and cabling much leaner. Connecting through OCT also allows us to start up one axis quickly and validate the system with the help of the TwinCAT NC PTP software library," concludes Lorenzo Vicini.

From right to left: Lorenzo Vicini, Engineering Manager for automation at Xesa Systems, Elena Briganti, Marketing Communications from Beckhoff Italy and Gabriele Vercesi, Area Sales Engineer from Beckhoff Italy.

Further information:

www.xesasystems.com
www.beckhoff.it
The global success of the EtherCAT communication technology is based on its exceptional bandwidth and speed, high flexibility and open interfaces. With its superior performance, EtherCAT is inherently well-suited to meet and exceed the requirements of the digital transformation, such as e.g. the integration of big data applications in control networks. In addition, the high flexibility of EtherCAT makes it possible to establish cloud connectivity in existing systems without having to alter the control system itself or manually update the slave devices. The open interfaces permit the easy integration of any IT-based protocol within the master or directly into the slave devices. Ultimately, this enables direct connection from the sensor to the cloud without any protocol discontinuities. The fact that all these properties were already part of the technology from the outset highlights the long-term sustainability of the EtherCAT architecture. Should further features become relevant in future, these can be easily integrated without having to change the protocol itself: EtherCAT has been and remains stable as version 1 since its introduction in 2003. The ETG has also contributed to the development of TSN (Time Sensitive Networking) from the very beginning. Years ago, when TSN was still known as AVB, EtherCAT experts were already actively involved in the TSN working group within IEEE 802.1.

EtherCAT and the ETG are perfectly equipped to support all future developments towards Industrie 4.0 and IoT concepts.
EtherCAT Plug Fest in Bad Pyrmont

The 2017 Spring European EtherCAT Plug Fest took place from 9 to 10 May in Bad Pyrmont, Germany. This time, the event was hosted by ETG member company Phoenix Contact Electronics GmbH, manufacturer of highly integrated electronic components. A total of 63 attendees joined the developers’ meeting in Bad Pyrmont and tested 28 slave devices to ensure interoperability with 12 master devices. Purpose of the EtherCAT Plug Fests, taking place annually in Europe, Asia and USA, is to offer EtherCAT developers a platform to test their EtherCAT devices for interoperability with those of other manufacturers before the market launch. The high number of participants as well as the good balance between the number of slaves and masters brought to the Plug Fests demonstrate how highly the developers appreciate this initiative by ETG and how high the benefit of the event is for the attendees.

Further information:

ETG reaches 2,000 member mark in Europe

When the EtherCAT Technology Group started its efforts to support the EtherCAT technology in 2003, nobody could have foreseen how successful the technology and thus the ETG would be today. When this issue was printed the world’s largest fieldbus user organization counted 4,280 member companies, and since then this number might have grown further still. The strongest region for ETG is Europe where the association now has more than 2000 member companies. The second largest continent is Asia with around 1,600 member companies, followed by the USA with about 600. As an international association of users and manufacturers from diverse industries, the ETG promotes and advances the EtherCAT technology actively and successfully.

EtherCAT Technology Group releases EtherCAT P specification documents

Following the introduction of EtherCAT P as an extension of EtherCAT by Beckhoff in November 2015 at SPS IPC Drives in Nuremberg, Germany, the EtherCAT Technology Group (ETG) has included support for the technology in its activities. The organization first published a draft of the official EtherCAT P technology specification in autumn 2016 as well as the extension of all corresponding documents. In the frame of the recently held ETG Technical Committee Meeting, the EtherCAT P specification documents have been officially released and are now available for ETG members.

At the same time as the specification draft, an Application Note on the topic was published and further developed by Beckhoff in the meantime to serve as additional support for EtherCAT P implementations. In the upcoming weeks and months, the ETG will continue to develop the “EtherCAT P Testing” documentation. Work on the corresponding test specification, as well as test cases for the EtherCAT Conformance Test Tool, are nearly complete. Further information about EtherCAT P, EtherCAT, EtherCAT testing, as well as the ETG itself, can be viewed online at www.ethercat.org.
## Trade shows 2017

### Europe

#### Germany
- Drinktec
  - 11 – 15 September 2017
  - Munich
  - Hall C1, Booth 452
  - [www.drinktec.com](http://www.drinktec.com)

#### Belgium
- Cool & Comfort
  - 18 – 19 October 2017
  - Leuven
  - Booth 3.4
  - [www.coolandcomfort.com](http://www.coolandcomfort.com)

#### Denmark
- HI
  - 03 – 05 October 2017
  - Herning
  - Hall G
  - [www.hi-industri.dk](http://www.hi-industri.dk)

#### Finland
- Puumessut
  - 06 – 08 September 2017
  - Jyväskylä
  - Hall B, Booth 216
  - [www.puumessut.fi](http://www.puumessut.fi)

#### Great Britain
- PPMA
  - 26 – 28 November 2017
  - Birmingham
  - Booth F50
  - [www.ppmashow.co.uk](http://www.ppmashow.co.uk)

### Belgium
- Bedrijvencontactdagen
  - 06 – 07 December 2017
  - Kortrijk
  - Hall 4, Booth 4204
  - [www.bedrijvencontactdagen.be](http://www.bedrijvencontactdagen.be)

### Finland
- Elintarviketeollisuus
  - 13 – 14 September 2017
  - Tampere
  - Booth A312
  - [www.elintarviketeollisuus.fi](http://www.elintarviketeollisuus.fi)

### Denmark
- AVITA Audiovisual Expo
  - 26 – 27 September 2017
  - Helsinki
  - Hall 1, Booth 1c28
  - [www.audiovisualexpo.messukeskus.com](http://www.audiovisualexpo.messukeskus.com)

### Finland
- Teknologia
  - 10 – 12 October 2017
  - Helsinki
  - [tekno logia.messukeskushelsinki.fi](http://tekno logia.messukeskushelsinki.fi)

### Great Britain
- Robot Investments Communication Forum and Exhibition
  - 04 – 06 October 2017
  - Istanbul
  - Booth H31
  - [www.robotyatirimlari.com](http://www.robotyatirimlari.com)

### Italy
- Forum Telecontrollo
  - 24 – 25 October 2017
  - Verona
  - [www.forumtelecontrollo.it](http://www.forumtelecontrollo.it)

### Norway
- Aqua Nor
  - 15 – 18 August 2017
  - Trondheim
  - [www.aqua-nor.no](http://www.aqua-nor.no)

### Sweden
- Euro Expo Sundsvall
  - 20 – 21 September 2017
  - Sundsvall
  - Hall Main
  - [www.euroexpo.se](http://www.euroexpo.se)

### Turkey
- Robot Investments Communication Forum and Exhibition
  - 04 – 06 October 2017
  - Istanbul
  - Booth H31
  - [www.robotyatirimlari.com](http://www.robotyatirimlari.com)
Africa

South Africa

KZN Industrial Technology Exhibition
26 – 28 July 2017
Durban
Booth A19
www.kzndustrial.co.za

Industrial Showcase Cape
15 – 17 August 2017
Cape Town
Booth F9-F12
www.industrialexpo.co.za

Asia

China

AHTE
05 – 08 September 2017
Shanghai
www.shanghaiahhte.com

China Wind Power
17 – 19 October 2017
Beijing
www.chinawind.org.cn

India

Industrial Automation Show
07 – 11 November 2017
Shanghai
www.industrial-automation-show.com

EP Shanghai
20 – 22 November 2017
Shanghai
www.epchinashow.com

Japan

Systems Control Fair
29 November – 01 December 2017
Tokyo
scfms.jp/en

Malaysia

Automex
24 – 27 May 2017
Kuala Lumpur
Hall 6, Booth 6100
www.automex.com.my

North America

USA

Pack Expo Las Vegas
25 – 27 September 2017
Las Vegas, NV
Hall South Lower, Booth 6302
www.packexpolasvegas.com

Automotive Testing Expo
24 – 26 October 2017
Novi, MI
Booth 14005
www.testing-expo.com/usa

Fabtech
06 – 09 November 2017
Chicago, IL
www.fabtechexpo.com

Canada

Canadian Manufacturing and Technology Show
25 – 28 September 2017
Mississauga, ON
1143
www.cmts.ca

South America

Brazil

ISA Expo Campinas
18 October 2017
Campinas
www.isaexpocampinas.org.br

Further information:
www.beckhoff.com/trade_shows