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PC control

The New Automation Technology Magazine

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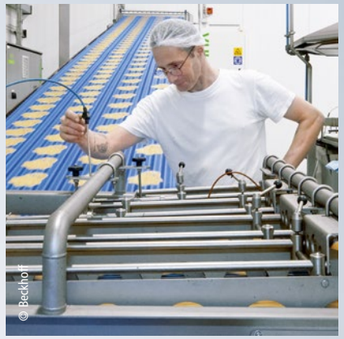

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The New Automation Technology Magazine

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Economic success and innovative power

Beckhoff increases its global sales by 28% to 1.515 billion euros

Beckhoff Automation successfully continued its growth trajectory in 2022, as this specialist for high-performance automation technology increasing its sales to 1.515 billion euros. This represents an increase of 28 percent in comparison with the previous year's sales of 1.182 billion euros and has seen the company set a new record for its highest sales ever. Some 5,680 employees worldwide, including over 2,200 engineers, currently contribute to the company's success.

"Some aspects of the past financial year were challenging due to global conditions. Nevertheless, we can look back on a successful year with great satisfaction, having achieved growth of 28% for the second year in a row," enthuses Hans Beckhoff, founder and Managing Director of the family-owned company. He goes on to add, "Growth is something we have come to expect now. We have achieved average annual growth of 15% since 2000, but the 64% cumulative growth over the past two years, 2021 and 2022, has been exceptional, even for us!" However, rather than focusing on the past, the automation visionary has his sights set firmly on the future. Beckhoff will continue to grow sustainably, develop pioneering innovations, and bring new product lines onto the market in line with its New Automation Technology concept. To this end, the automation specialist will continue to consistently invest 80 million euros annually in its research and development activities.

Beckhoff also expects healthy double-digit growth for the current year, 2023, secured by a high number of orders in hand. However, a significant decline in order intake is currently being observed worldwide, largely attributable to the technical reaction to shortened delivery times, and which is only in small part due to the slight economic downturn.

The past two years have been characterized by tough supply bottlenecks in the semiconductor product sector, which forms an essential component of all Beckhoff products. This has led to extremely long delivery times for Beckhoff and the automation industry as a whole. Nevertheless, Hans Beckhoff believes that this situation is easing, "By the end of the year at the latest, perhaps even by quarter three, we will be in a position to generally confirm normal delivery times for our customers again."

Countless technological milestones

Beckhoff has always been renowned for high-performance control and the way it continually pushes performance limits in the world of automation. "For 43 years, we have been a driving force behind innovative automation technology around the world. We are proud of our innovative spirit and the technology that has been born from it. This year, we are celebrating 20 years of EtherCAT," Hans Beckhoff proclaims, highlighting one of the company's most significant technology milestones. Indeed, this communication system, which was developed by Beckhoff and premiered at Hannover Messe 2003, has certainly established itself as a high-performance real-time Ethernet solution in a wide range of applications. It has consolidated its position on the market thanks to its continuity and technical development, even becoming an open IEC standard. EtherCAT has now become a world standard, a status that the protocol disclosure and the founding of the EtherCAT Technology Group (ETG) at SPS 2003 have made a huge contribution to. With over 7,000 member companies from 72 countries (as of March 2023), ETG is the world's largest fieldbus user organization.

"2022 was a particularly big year of innovations for us," reports Hans Beckhoff, summing up the past fiscal year. With the MX-System for control cabinet-free automation, a revolutionary approach has been presented that can replace the conventional control cabinet completely, thereby opening up entirely new methods of plant automation. This is complemented by a comprehensive hardware portfolio for machine vision, which expands the TwinCAT Vision software solution that was launched in 2017 into a complete system. As all components are EtherCAT-based, including the cameras, lenses, illumination, and complete units, they offer all the advantages of seamless integration into the control technology, such as highly accurate synchronization with all machine processes, reduced engineering and hardware costs, and simplified commissioning and support.

Another prime example is the ATRO (Automation Technology for Robotics) modular industrial robot system, which can be used to individually and flexibly assemble optimal robot structures for a wide variety of applications. A highlight of the system is the internal media feed for data, power, and fluids. This was implemented in such a way that all axes are designed to rotate endlessly, which enables better Cartesian accessibility as well as short positioning paths. ATRO's innovative potential has also been recognized by the expert jury of the Hermes Award, which was announced during the Hannover Messe, with the system receiving a nomination for this year's prestigious technology award.

From April 17 to 21, the Beckhoff exhibition booth at Hannover Messe has showcased not only these technological milestones, but also a whole host of innovations in line with the exhibition's central theme of 'Digital Transformation of Production Processes'. One example is the implementation of innovative chatbot technology to increase productivity in control programming and optimize direct support: For this purpose, the TwinCAT Chat Client developed for the TwinCAT XAE engineering environment. This makes it possible to use Large Language Models (LLMs), such as ChatGPT from OpenAI, conveniently in the development of a TwinCAT 3 controller. In this way, for example, missing code from a function block can be completed automatically, or existing code can be optimized, documented, or restructured (refactored) for better readability.

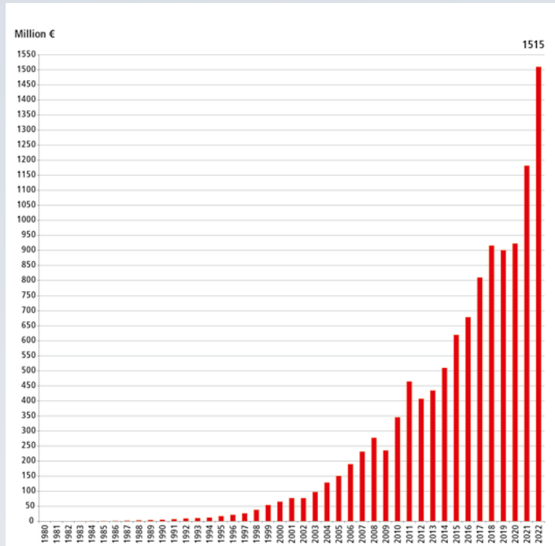
Employees spark innovation

The company currently employs 5,680 people worldwide, with more than 2,200 holding engineering qualifications. "At Beckhoff, it is not uncommon for employees to remain loyal to the company, often for their entire careers. This is crucial and very important to us because they possess a great deal of knowledge and spark innovation – and this expertise, as well as their great enthusiasm, are what make us a technology leader in PC-based control technology," explains Hans Beckhoff.

The company currently employs a total of just under 200 apprentices and students. To ensure the demand for highly qualified specialists can be met, Beckhoff trains young people for careers through many different apprenticeships. The company has also been focusing on work-integrated study programs since 2010. In cooperation with the Gütersloh campus of the Bielefeld University of Applied Sciences, five engineering degree programs are offered in the form of Mechatronics/Automation, Industrial Engineering, Product Service Engineering, Digital Logistics, and Digital Technologies. Every year, an average of 100 students from Beckhoff are trained there in engineering professions. "Our goal is to keep talented young people in the region," says Hans Beckhoff, explaining the idea behind the work-integrated engineering courses. This cooperation model of work-integrated studies is also interesting for external parties – countries such as the USA, Mexico, Finland, Malaysia and China are in discussions with the Bielefeld University of Applied Sciences to find out more about this study model and potentially implement it themselves or set up exchange programs.

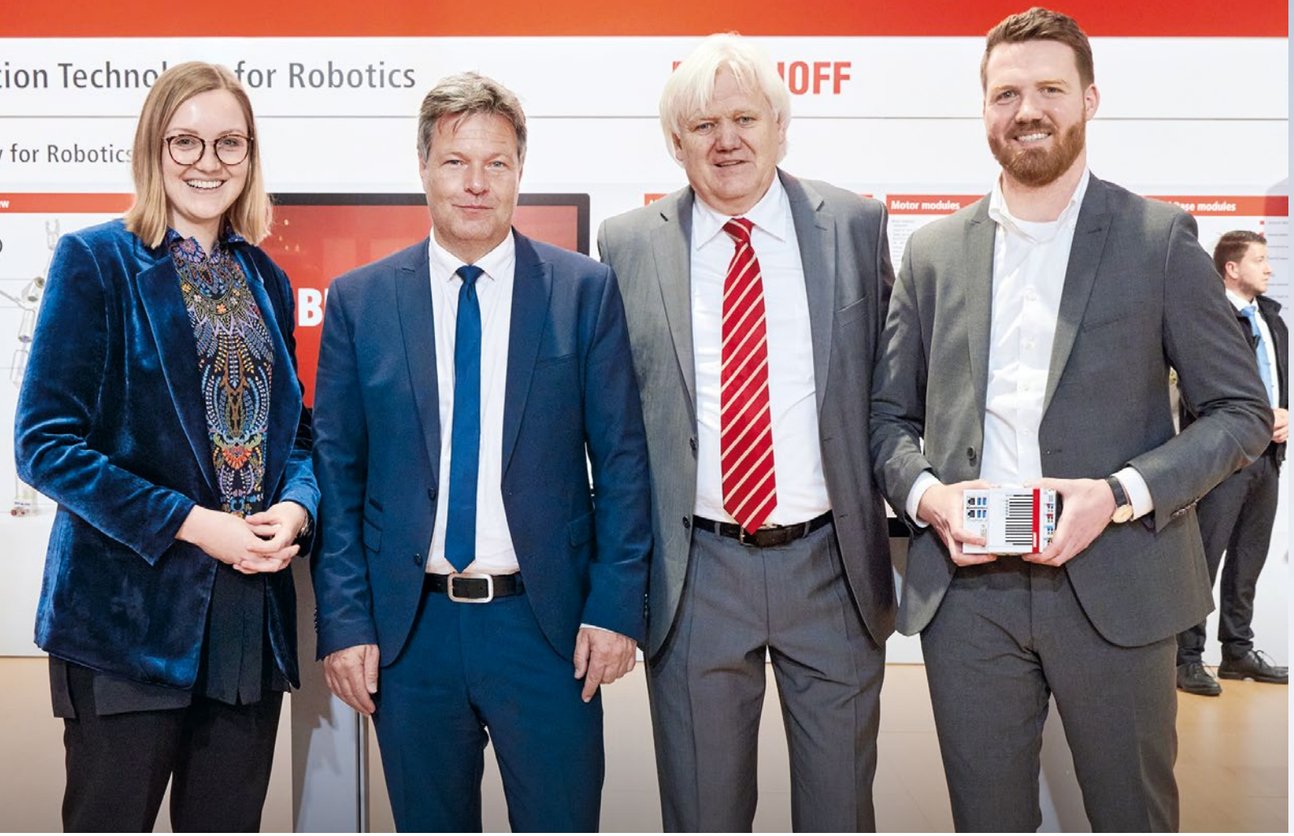
Hans Beckhoff, founder and Managing Director of Beckhoff Automation:

"With our innovative pioneering spirit, we want to continue to grow sustainably, develop trend-setting innovations, and bring new product lines onto the market with our New Automation Technology concept."



The sales curve at Beckhoff Automation continues to rise exponentially, with the Verl-based automation technology specialist recording an average annual growth of 15% since 2000.

More information:
www.beckhoff.com



Frederike Beckhoff, Robert Habeck, Hans and Johannes Beckhoff (from left to right) during the Federal Minister for Economic Affairs and Climate Action's visit to the Beckhoff booth at Hannover Messe 2023.

Automation technology boosts sustainability

Vice-Chancellor Robert Habeck visits Beckhoff Automation at Hannover Messe

As part of a tour of Hannover Messe organized by the ZVEI (German Electro and Digital Industry Association) and VDMA (German Machinery and Equipment Manufacturers' Association), Dr. Robert Habeck, Vice-Chancellor and Federal Minister for Economic Affairs and Climate Action, visited the Beckhoff Automation booth. His conversation with Hans Beckhoff, Managing Director of Beckhoff Automation, focused on how automation technology can assure greater sustainability in all areas of life and thus significantly contributes to protecting our environment.

On his tour of Hannover Messe, Vice-Chancellor Robert Habeck stopped at the booth of automation technology specialist Beckhoff Automation. He was welcomed by Hans Beckhoff and his children, Frederike Beckhoff, Assistant of General Management, and Johannes Beckhoff, R&D department. Following a brief presentation of the company from Frederike Beckhoff, Hans Beckhoff went through the Beckhoff product range, PC-based control technology, and the essentials of automation technology operation with the Minister for Economic Affairs and Climate Action.

Automation: A blanket technology for all areas of life

"Automation is being used in all sectors worldwide. It is a basic technology that is used across the board throughout society for everything from packaging for medicines, to bottling clean water, to producing cars," explained Hans Beckhoff, adding: "The performance capacity of automation determines production efficiency, or in other words, the consumption of resources. We want to make our automation technology more powerful every year, and that's why our motto is 'Engineers must save the world!'" In almost all areas of life, automation can pave the way to greater sustainability and accelerate the change needed to achieve it. Robert Habeck agreed, adding: "We can't do without engineers, but they have to be guided by the needs of society, so that we can use their expertise to achieve sustainability."

Saving resources and reducing the ecological footprint

Hans Beckhoff then presented various automation solutions for resource conservation and greater sustainability. Beckhoff automation technology is used in a wide range of applications, such as battery cell production for e-mobility, photovoltaic plants, solar cells, and wind turbines. "Every third wind turbine in the world is equipped with our control technology," the entrepreneur stated, giving an example of Beckhoff's role in generating renewable energy. In addition, targeted implementation of automation concepts can save resources and thus significantly reduce the ecological footprint of industrial production across all industries.

Artificial intelligence opens up a world of opportunities

During the discussion on the possibilities that result from Beckhoff's futuristic automation solutions, Robert Habeck and Hans Beckhoff both hit upon the topic of how artificial intelligence is used. Beckhoff is already implementing artificial intelligence in the software sector. "We should explore the possibilities that this technology offers; it can bring huge benefits. We should recognize that. Once again, the government needs to provide a social framework for their use," said Hans Beckhoff. The minister added, "The political question is: do you regulate artificial intelligence or do you focus on its application? I would say the latter. Wherever human life is involved, no artificial intelligence can be allowed to make the final decision. We have to ask ourselves how artificial intelligence will impact humanity as a whole."

Appreciation of a huge lifetime achievement

At the end of his visit, Robert Habeck was visibly impressed by the diversity of Beckhoff Automation Technology: "Over 40 years ago, when you founded the company, it was not clear what you would make of it. It's not just the size of the company, and the many people who work for you; the terrific speed at which you make technological progress is also astounding. As a lifetime achievement, it's really impressive," said the Vice-Chancellor.

Beckhoff currently employs over 5,600 people worldwide, of which more than 2,200 hold engineering qualifications. This results in in-depth expertise in automation, which is channeled into developing new technology and products. Beckhoff wants to continue growing sustainably, developing pioneering innovations, and bringing new product ranges onto the market in line with its New Automation Technology concept. To this end, this automation technology specialist will continue to invest €80 million annually in its research and development activities.

More information:
www.beckhoff.com/hannover-messe
www.beckhoff.com/smart-city
www.beckhoff.com/wind-turbines

Michael Nielsen is 53 years old and has been working for Beckhoff Automation ApS for 18 years, most recently acting as managing director for eight years.

Michael Nielsen is new DIRA Chairman

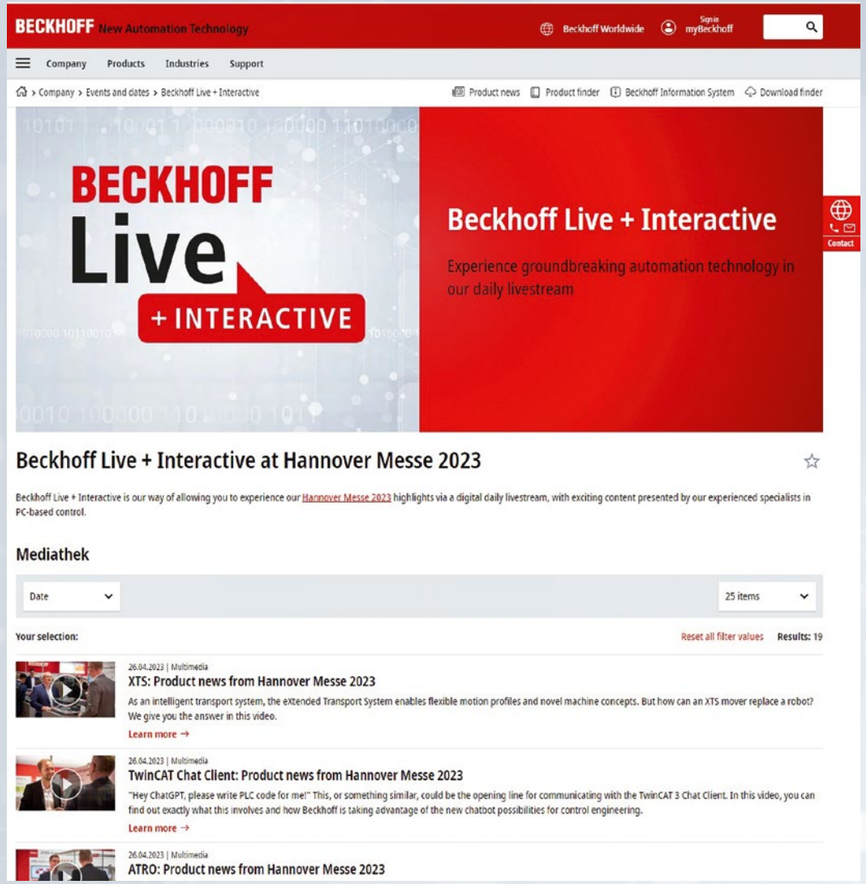
The Danish Industrial Robot Association (DIRA) has elected Michael Nielsen, Managing Director at Beckhoff Denmark, as new Chairman of the Board of Directors. The organization was established 40 years ago and is the biggest, active network in Denmark for stakeholders with an interest in robot technology.

As Managing Director for Beckhoff Denmark during the past 8 years, Michael Nielsen is a well-known face in the Danish robot and automation industry. A couple of years ago, he was elected Vice Chairman at DIRA. The purpose of DIRA is to create a strong platform for, among others, developers, suppliers, end-user organizations, educational institutions, and authorities to help them strengthen their network relations and expand their knowledge on the robot and automation industry.

Michael Nielsen is thrilled that he has been given the opportunity to step in as Chairman in these exciting times: "I am incredibly happy and honored to be elected Chairman of the Board of the Danish Industrial Robot Association, and I look very much forward to work with the entire Board. We form a strong community, and we can pull together and strengthen the national focus on robots and automation. We will not only continue the great work made by DIRA already but also launch new initiatives to promote innovation in the Danish robot and automation industry even more. Most members have a commercial interest in DIRA, no matter if they are startups, machine builders, system integrators, suppliers, or knowledge institutions. Therefore, DIRA is the place to connect and create more business together."

Both societal changes and technological innovation strengthen the growth of robots and automation in the future, Michael Nielsen argues: "As the population grows worldwide, and our living standards rise, we will need more of everything – food, medicine, and consumer goods. This requires faster and smarter machines that can produce intelligently and with greater output. End-customers demand production optimization, higher PPM (Parts Per Minute), and smaller CO_2 footprint, and in general, the market for innovative and flexible robot solutions is on the rise. We have a strong robot cluster in Denmark, and at DIRA, we will do our utmost to support and evolve the robot and automation ecosystem."

More information:
www.dira.dk
www.beckhoff.com/atro



The first highlight listed on the Beckhoff website for Hannover Messe takes you right to the media center which contains the live and topic videos.

See all Beckhoff's Hannover Messe highlights live – after the event

The Hannover Messe is practically unparalleled in terms of its international appeal. As a technology leader and pioneer in PC-based control technology, Beckhoff showcased its groundbreaking innovations there once again in 2023. The exhibition has closed its doors, but you can still see how Beckhoff is driving the automation industry and the digital transformation of production processes forward with revolutionary product development in a total of 18 videos produced live on-site.

A total of 18 videos from the exhibition are available on the Beckhoff website for Hannover Messe 2023: four Beckhoff Live + Interactive daily round-ups as well as 11 product news videos focused on individual highlights and three videos focusing on specific topics. There is also a supplementary application video on how the XPlanar planar motor system is being used in bus terminal production. This provides a comprehensive and exciting overview of the floating XPlanar movers, the ATRO (Automation Technology for Robotics) modular industrial robot system, the MX-System for control cabinet-free automation, and Vision as a system-integrated image processing system. In addition, there is exciting product news from all other Beckhoff product sectors, such as I/O, TwinCAT, and IPC, as well as the topic videos on Federal Minister Dr. Rudolf Habeck's visit and our "20 years of EtherCAT" technology anniversary.

More information:
www.beckhoff.com/hannover-messe

Interview with Michael Jost on 20 years of EtherCAT and EtherCAT I/Os

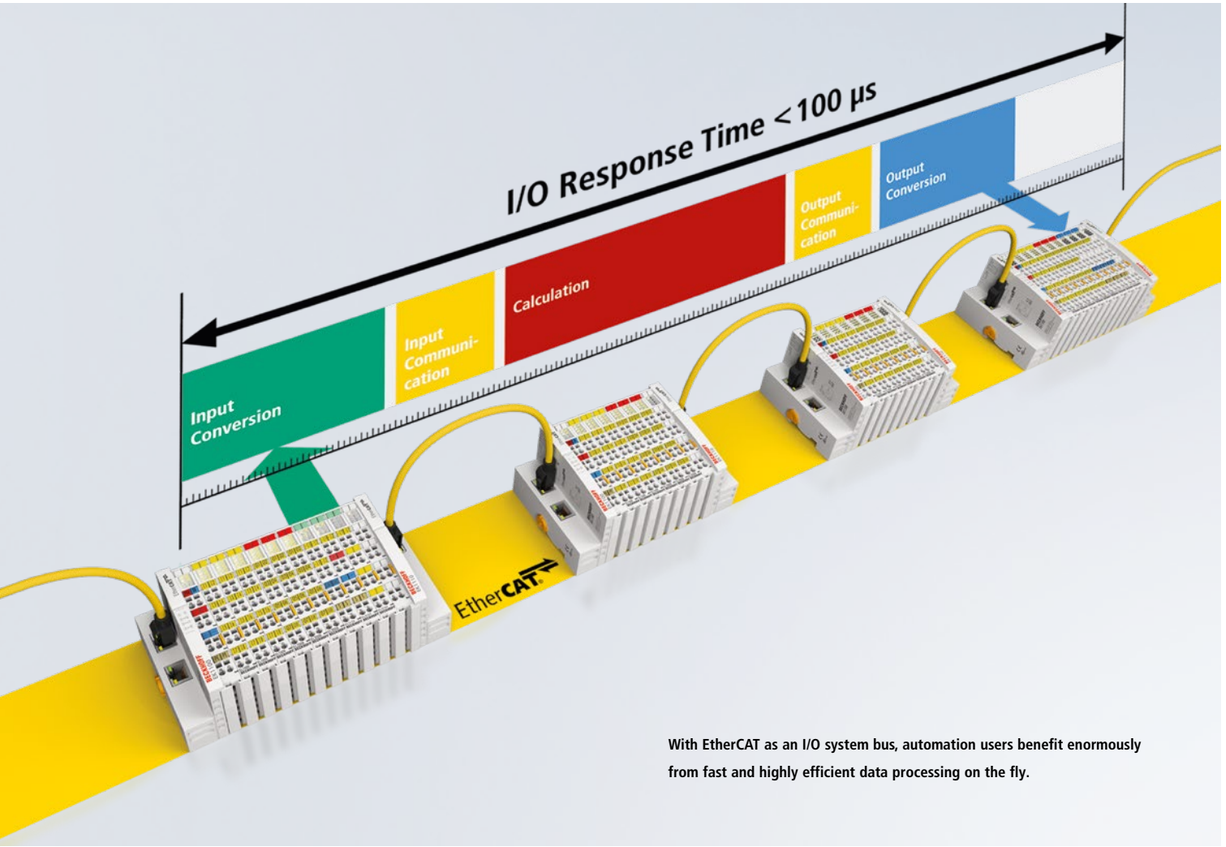
I/O portfolio with EtherCAT technology benefits offers virtually unlimited application diversity

EtherCAT and the EtherCAT I/O range from Beckhoff are both celebrating their 20th anniversary. In this interview, Michael Jost (Senior Product Manager I/O Systems and EtherCAT) describes the technological advantages of combining the ultra-fast communication system with the diverse I/O spectrum and how quickly the application possibilities have expanded over the past two decades.

Michael Jost, Senior Product Manager I/O Systems and EtherCAT, Beckhoff Automation:

“The decisive factor is that EtherCAT has been not only implemented as far as the bus coupler, but also continued into each terminal.”

The ultra-fast EtherCAT technology developed by Beckhoff has already been used successfully for 20 years and is long since established as an open, global standard for real-time Ethernet communication.



With EtherCAT as an I/O system bus, automation users benefit enormously from fast and highly efficient data processing on the fly.

Michael Jost:

> "The EtherCAT Terminal were used across all application areas right from the start, but especially where faster update times offered significant advantages."

EtherCAT is celebrating its 20th anniversary alongside the EtherCAT Terminals from Beckhoff. What was the motivation behind these two developments from an I/O point of view?

Michael Jost: EtherCAT as a technology is the logical continuation of the PC-based control philosophy represented by Beckhoff. To fully leverage the performance capabilities of modern CPUs for PLC, motion, and other applications, the communication interface of the IPC also has to keep pace with the automation technology world in terms of speed and synchronization. The decisive factor here is that EtherCAT has been not only implemented as far as the bus coupler, but also continued into each terminal. This ensures that all EtherCAT features are also available in the I/O system. As a result, we have (almost) no limitations regarding the achievable EtherCAT Terminals in terms of communication performance.

What special advantages does EtherCAT offer as a system bus in the I/O area, from both a purely technical point of view and functionally – for example, with distributed clocks, eXtreme Fast Control (XFC) technology, and Safety over EtherCAT?

Michael Jost: The main advantage is that nobody has to worry about the speed of data transmission – neither us during development, nor our customers in their applications. Quite simply, it is sufficiently high for >99% of products and applications. The EtherCAT bandwidth is also highly advantageous for safety I/Os, since all safety protocols are quite long due to the additional safety mechanisms and the bandwidth of slower systems is quickly exhausted or, in other words, cycle times are slowed down. With regard to safety applications, this can be a disadvantage, for example, because greater distances are required between protective devices and the hazardous area. Distributed clocks as an EtherCAT synchronization mechanism form the basic technology for synchronously operating output modules – from glue nozzle control in synchronization with motion sequences through to servo terminals with interpolated motion sequences. On the input side, this function is essential for synchronous position or measurement data acquisition. Optimized timing of machine sequences through XFC (eXtreme Fast Control) technology also makes it possible to increase the efficiency of a machine – without any mechanical changes.

The world of EtherCAT Terminals combines all relevant application areas, including standard digital I/Os, TwinSAFE terminals, ELM measurement terminals and ELX terminals for the direct connection of intrinsically safe devices.

The original bus terminal portfolio has been expanded enormously with the EtherCAT Terminals. How has the range of IP20 EtherCAT I/Os developed since then and what were the most important development steps?

Michael Jost: We always develop platform-based solutions, which usually lead to a whole new group of products. Notable examples include:

- XFC technologies for time stamping, oversampling and microincrements
- cost-effective solutions through multi-channel terminals
- comprehensive solutions in the field of I/O system-integrated compact drive technology for servo, stepper, DC, and BLDC motors
- high-end measurement technology in the ELM series

In which application areas did the new EtherCAT Terminals break through most quickly and how has this developed over time?

Michael Jost: We decided from the beginning not to market the EtherCAT Terminals as a high-speed/high-price system, as the prices were actually slightly lower than those of our existing systems, so they were used in all areas right from the start. Of course, they have been especially popular in applications where the faster update times offer significant advantages. One of the first machines to be equipped with these terminals was a hydraulic press, where EtherCAT enabled the rapid detection of position (SSI terminal) and pressure (analog input terminal), as well as the rapid control of the hydraulic proportional valves (analog output terminal) and complete control in TwinCAT. As a result, the machine builder was able to improve plant performance and product quality independently without depending on a purchased control assembly.

The EtherCAT I/Os from Beckhoff cover virtually all application requirements in different designs – shown here are the basic form factors EJ plug-in module, EP box module and IP20 terminal.

Michael Jost:

“We offer the optimal I/O solution for any application, whether that’s an IP20 terminal for use in the control cabinet or an IP67 module for control cabinet-free environments.”

Compact drive technology from Beckhoff has been combining the advantages of EtherCAT, terminal technology and servo technology for ten years now and remains highly innovative. This is demonstrated by the recently expanded ELM servomotor terminal range for rotary and linear actuators and electric cylinders.

How many EtherCAT Terminal variants are currently available and what signal spectrum do they cover?

Michael Jost: There are currently around 700 different EtherCAT Terminals that cover almost all signals relevant to the market.

Several design variants have also been added over the past two decades, including the EtherCAT Box modules in the EP series with an IP67 protection rating. What was the reason for this development and how quickly did this design establish itself on the market?

Michael Jost: We like to offer the optimal I/O solution for the respective application, whether that’s an IP20 terminal for the control cabinet, or entirely control cabinet-free in IP67. Developments like these are prompted by customer needs, which also show increased demand for IP67-protected products. The circuitry and firmware are usually based on a uniform basic design, which means we can vary the design of proven solutions without having to develop completely new ones.

And how did the HD terminals and the EtherCAT plug-in modules in the EJ series come about as further variants?

Michael Jost: The development of the HD terminals allowed us to set a new market standard for packing density in modular I/O systems. Incidentally, we were also able to reduce the prices per channel for many signals, which means customers can save on costs in addition to space in their control cabinet. It’s clear to see why it didn’t take long for us to achieve market success with these benefits. The EJ variant as a ‘bus terminal’ designed for the printed circuit board optimized control cabinet design, especially in high-volume machine building, by replacing labor-intensive point-to-point wiring with industrially manufactured circuit boards featuring application-specific connection technology. This results in significantly shorter wiring times and a reduced risk of errors. Generally speaking, the machine can be wired up as efficiently as a car, complete with electronics and pre-assembled harnesses, without compromising on the flexibility and ease of maintenance of a fine-modular I/O system.

Does the same apply to the ELM terminals in the metal housing?

Michael Jost: With the ELM housing, we have laid the foundations to innovate and introduce new product categories within the I/O system. The prime example here is our high-precision measurement technology, in which optimum shielding and signal-optimized connectors represent two key features. Together with the appropriate circuit design and the sophisticated calibration process, these ensure a level of accuracy that is often 30 times higher than the industry standard. Furthermore, the metal housing can dissipate higher power losses,

The ELX6233 EtherCAT Terminal enables the compact integration of field devices in accordance with the new Ethernet-APL standard in process control, demonstrating once again that Beckhoff continues to be innovative and progressive with its EtherCAT I/O portfolio – even after 20 years.

which enables completely new performance classes and multi-axis solutions in the field of compact drive technology.

The topic of connectivity is of particular importance in the field of I/O. What sets the corresponding developments such as EtherCAT P and the Beckhoff hybrid connectors apart?

Michael Jost: Time-to-market is not only crucial for machine builders, but also for many innovative end customers. This is where One Cable Automation (OCA) from Beckhoff creates the optimum conditions. Our scalable hybrid connectors enable combined communication and power transmission for almost all application requirements. They offer the additional advantage of a high degree of modularity, which allows a wide range of variants for a host of different applications, while also providing mechanical coding and connection security. They also feature a uniform data core in all four connector sizes – B12, B17, B23, and B40. This is all fundamental to these connectors becoming successfully established as the ideal solution for decentralized automation – i.e., OCA. Another key selling point is that our hybrid connectors are among the first products to comply with the future IEC 61076-2-118 standard.

The 20th anniversary of the EtherCAT Terminals is not the only milestone we are celebrating, as this occasion also marks the tenth anniversary of the compact drive technology. How did this new development come about in 2013?

Michael Jost:

“Our claim is to support all market-relevant signals, to be competitive in all individual areas, and – true to our slogan of ‘New Automation Technology’ – to increase the performance of PC- and EtherCAT-based control technology continuously.”

Michael Jost: With some products, the simple answer is that, “It was possible.” The increasingly efficient power semiconductors meant we were able to integrate the power output stage into a single terminal. After all, making advances in semiconductor technology that can be used in automation technology is all part of our mission, you could say. Of course, part of the success was also our correct market assessment that users would feel strongly inclined to use a solution that is already optimally system-integrated instead of having to use external power output stages with analog setpoint control or pulse train input.

What are the development highlights here in terms of application areas and portfolio expansions – for example with the ELM servomotor terminals with increased power output?

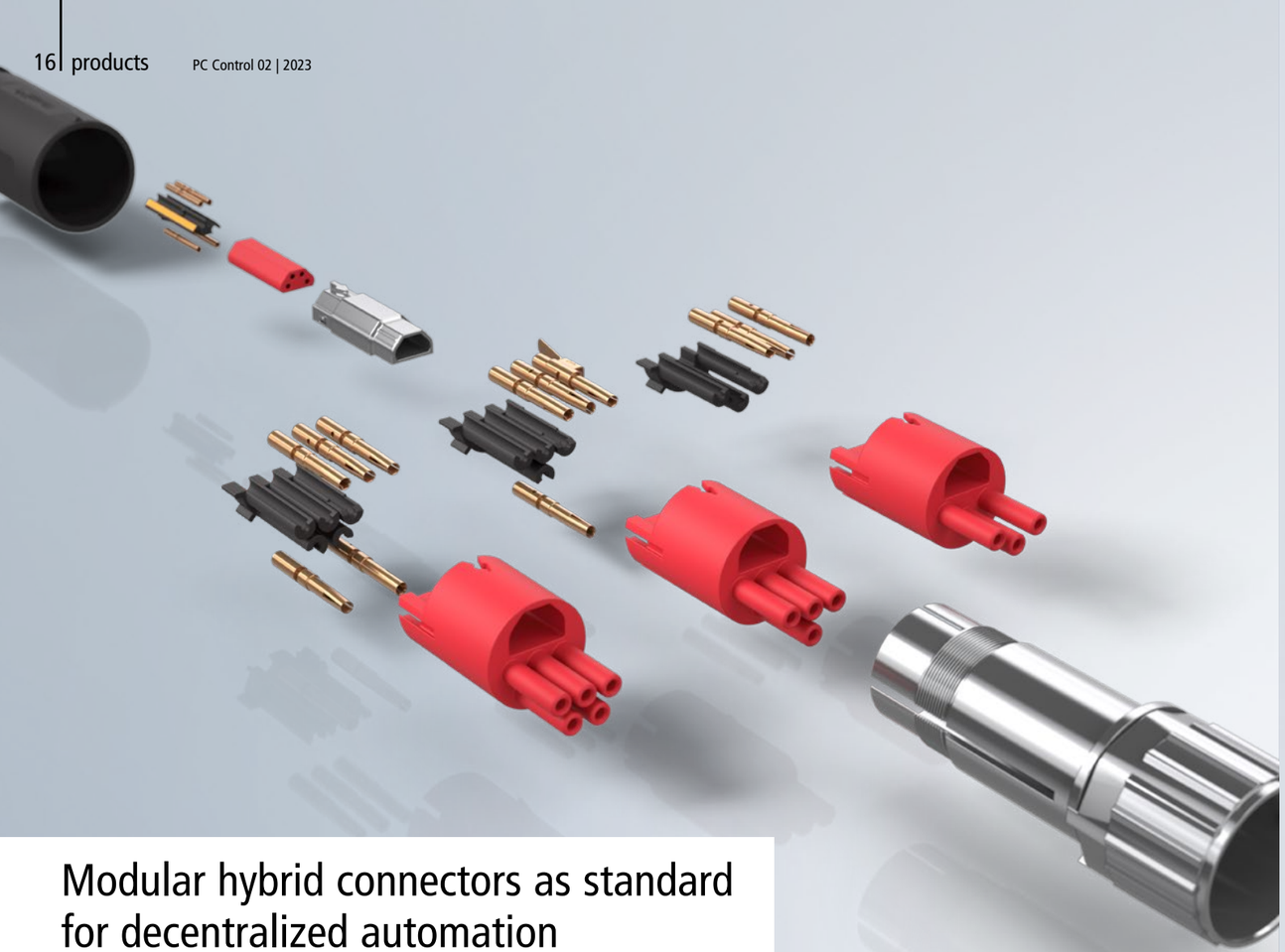
Michael Jost: The compact drive technology now follows on almost seamlessly from the performance of the large drive technology (AX8000/AX5000 Servo Drives). With regard to the integration of the brake chopper function and safe motion, the feature set is now very consistent. This makes it easy for users because they can make their choice based entirely on power requirements while the achievable properties will be almost identical – regardless of whether the supply voltage is 48 V DC or 400 V AC. It therefore goes without saying that compact drive technology now plays a key role in our motion portfolio.

Are you able to hint at any future developments in the field of EtherCAT I/Os, both in terms of new terminal products and with regard to EtherCAT as a system bus?

Michael Jost: Our claim is to support all market-relevant signals, to be competitive in all individual areas, and – true to our slogan of ‘New Automation Technology’ – to continuously increase the performance of PC- and EtherCAT-based control technology. In the analog segment, for example, we are working on a number of products with enhanced features and optimized prices. We will also continue to implement the proven EtherCAT Terminals in other designs to provide optimum wiring options for every machine. Further details on this will be revealed at upcoming exhibitions.

This interview was conducted by Stefan Ziegler, Editorial Management PR, Beckhoff Automation

More information:
www.beckhoff.com/ethercat
www.beckhoff.com/io



Modular hybrid connectors as standard for decentralized automation

The Beckhoff portfolio of hybrid connectors, and thus One Cable Automation (OCA), has already proved itself thousands of times in the field. In addition to the technical advantages of consistent modularization with a uniform data core, standardization via the future IEC 61076-2-118 standard is set to boost the importance of these connectors for decentralized automation.

Hybrid connectors are essentially used to transmit power and data via a single line to save on cables and connectors. This solution, developed by Beckhoff together with a partner, offers the additional advantage of a high degree of modularity, permitting a wide range of variants for a host of different applications while also providing mechanical coding for connection security. There is thus a uniform data module that can be used in all four sizes – B12, B17, B23, and B40. This modularity actually simplifies matters hugely rather than creating additional work. What's more, the clear color markings on the contact carrier match the wire color of the cable, which means that complex assignment plan detailing each individual pin assignment are no longer needed. Beckhoff hybrid connectors also comprise just ten individual components – significantly fewer than comparable third-party products. As the individual parts can only be assembled in one direction, the whole process is essentially intuitive and prevents any possibility of incorrect assembly from the outset. In combination with the data module, this usually reduces assembly time by two-thirds.

The aforementioned technical advantages provide the basic foundations for successfully establishing this connector as the connector for decentralized automation, i.e., One Cable Automation – especially since some 95,000 connectors have already proved themselves in the field. In addition, the Beckhoff hybrid connectors are among the first products to comply with the future IEC 61076-2-118 standard. This standard is expected to be published at the end of 2024. The primary aim of establishing a global standard like this is to ensure security for the customer or user, not only with regard to supply chains and second-source strategies, but also in terms of the level of product reliability defined by established and widely adopted standards. The key focal points here are always technology and future-proofing, and our hybrid connectors already tick these boxes with their modularity, uniform data core, and optimal design for OCA.

More information:
www.beckhoff.com/hybridconnectors

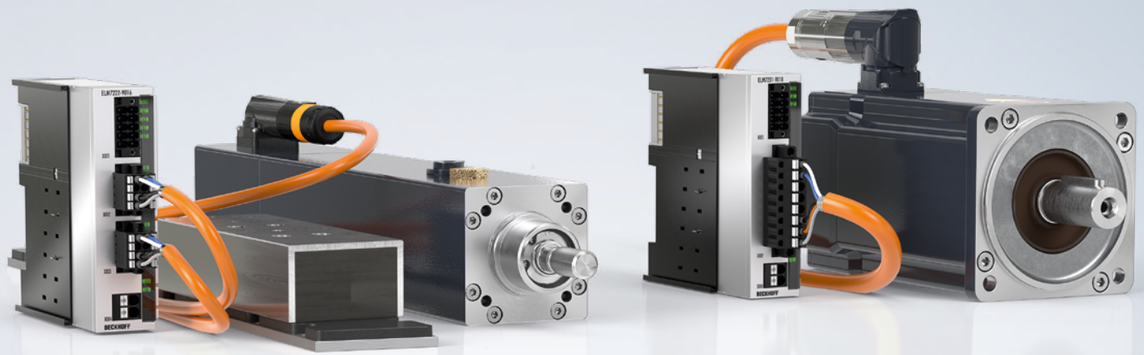
TwinCAT Analytics: Easy analysis of detailed image data in the engineering environment

TwinCAT Analytics from Beckhoff offers a low-code approach to facilitate the evaluation of machine data by means of very simple engineering, providing various configuration options in addition to automatic PLC and HMI dashboard generation. Now, in a bid to expand the analysis options further still, the algorithms of the TwinCAT Vision library have also been integrated.

The TwinCAT Vision library is extremely comprehensive, with a wide range of algorithms ranging from color image analysis, segmentation, and contour analysis through to object measurement. With the integration into the TwinCAT Analytics workflow, these functions are now available in a non-real-time environment as a configuration solution, meaning they can be used even without programming in the IEC 61131-3 languages.

The Vision algorithms can be conveniently dragged and dropped into the analytics interface and combined with other algorithms to form an analysis chain. As for input and output images, these can be visualized in no time via the quick view. If images of different analysis levels are to be compared with each other, the image gallery offers the possibility to freely place several images in a single interface. These are continuously updated during the recording and can then be edited with appropriate tools, whether that involves manual measuring, determining positions and colors, or adding texts and symbols. Individual images or entire image groups can be exported to common image formats so that they can be used in resources such as PDF reports. A major time-saver is the automatic PLC code generation, which can be used to convert the graphically configured image analysis chain into transparent PLC code based on the TwinCAT Vision library. This can be loaded either directly into the machine controller or onto a remote device for continuous execution and monitoring.

More information:
www.beckhoff.com/twincat-analytics
www.beckhoff.com/twincat-vision



ELM servomotor terminals also control electric cylinders and linear motors

The ELM72xx EtherCAT Terminals offer high performance and functionality in the field of compact drive technology from Beckhoff. In addition to the ability to execute rotational movements in this small form factor in connection with the AM8100 servomotors, it is now also possible to perform translatory movements with the AA3100 electric cylinders and the AL8100 linear motors.

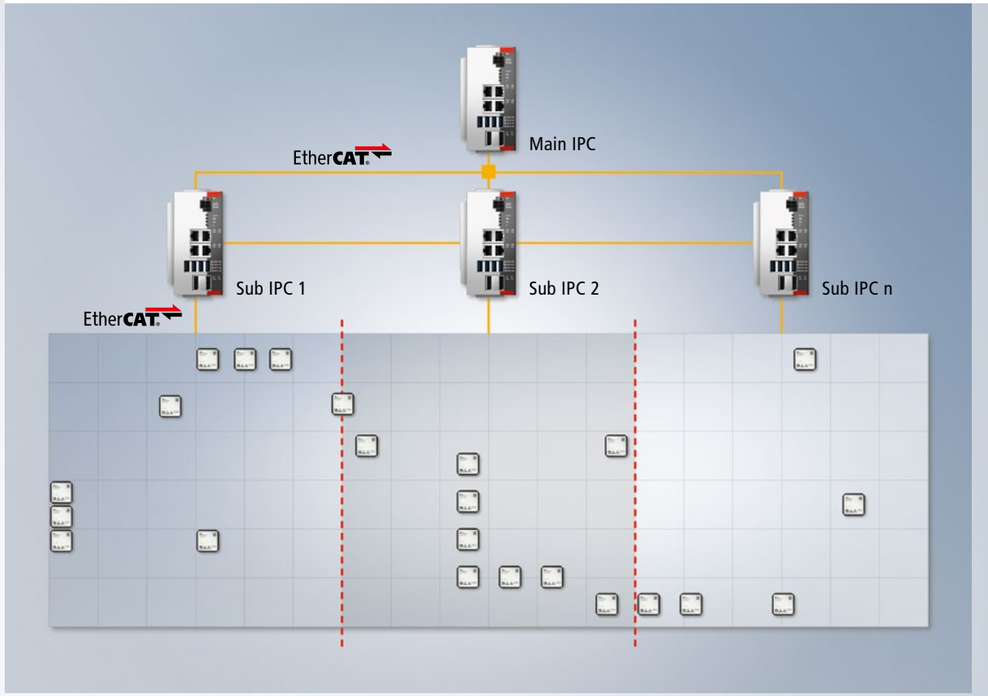
As full-fledged servo drives in a robust metal housing, and with up to 16 A output current (I_{rms}) at a power supply voltage of 48 V DC, the ELM72xx EtherCAT Terminals expand the Beckhoff portfolio of compact drive technology in terminal format. What's more, they also include all the latest technological features along with increased performance and functionality when compared to the EL versions. The latter include the convenient connector front end, an integrated absolute value interface, One Cable Technology (OCT), and the STO/SS1 and TwinSAFE Logic safety functions.

The new AA3100 electric cylinder series designed for the ELM72xx for the extra-low voltage range from 24 to 48 V DC extends the range of applications of Beckhoff electric cylinders to include compact drive technology. This makes them ideal as direct drives for linear applications, particularly with high process forces. It also means that virtually the same forces as in the AA3000 series are now also available for 48 V applications, without compromising on functionality or robustness. The two available flange sizes offer a peak force of 2,650 to 12,000 N and a maximum speed of 0.12 to 0.56 m/s, depending on the lead.

The new AL8100 linear motors also enable the highly dynamic, modular linear technology from Beckhoff to be used in the field of compact drive technology. They are available with a width of 50 mm (AL812x) and are optimally matched to the ELM72xx. In addition to their wide availability and flexibility, the fact that the motors are developed and produced in Germany guarantees a consistently high level of manufacturing quality, which in turn ensures that durable and highly reliable applications can be executed with linear motor technology.

More information:
www.beckhoff.com/aa3100
www.beckhoff.com/al8100

XPlanar: Multi-computing for handling floating product transport on a very large scale



The Beckhoff XPlanar planar motor system for floating product transport with up to six degrees of freedom was launched on the market in 2018 and its functionality has been continuously expanded ever since. Available through a simple software update, the new multi-computing functionality now enables modularization of the overall system – and thus an even greater number of tiles and movers per system – for handling applications on a huge scale.

With XPlanar multi-computing, the overall system can be divided into individual subsystems, each controlled by a sub-IPC, to implement particularly large and modular XPlanar systems. This allows computationally intensive tasks to be optimally distributed to the corresponding system segments. The dynamic handover of a mover between two subsystems is ensured by the communication between the sub-IPCs, while the superordinate main IPC controls the operation of the entire system. It is also centrally responsible for application programming and diagnostics – i.e., for using the familiar functionalities of TwinCAT 3 XPlanar (TF5890). Access from the application to the subordinate sub-IPCs is not required for this, nor is it necessary for the mover transfer during segment changeover, which makes application creation and system operation just as simple as before.

With XPlanar multi-computing, the number of XPlanar movers and tiles within an overall system can be conveniently increased to a practically infinite amount. Beyond the basic system enlargement, further optimization possibilities result from a modularization of the machine, with the ability to mechanically couple new subsystems to the existing system if required. What's more, the subsystem can be easily integrated into the overall system process by simply adjusting the program in the main IPC.

More information:
www.beckhoff.com/xplanar

ELX6233: Ethernet-APL field devices up to zone 0 can be connected directly to the modular I/O system

Ethernet-APL-capable field devices from the hazardous areas of zones 0/20 and 1/21 can be connected directly to the ELX6233 EtherCAT Terminal from Beckhoff. The combination of flexible EtherCAT system architecture and the extensive ELX portfolio now facilitates the integration of Ethernet-APL, HART, or simple digital signals in the same terminal segment.

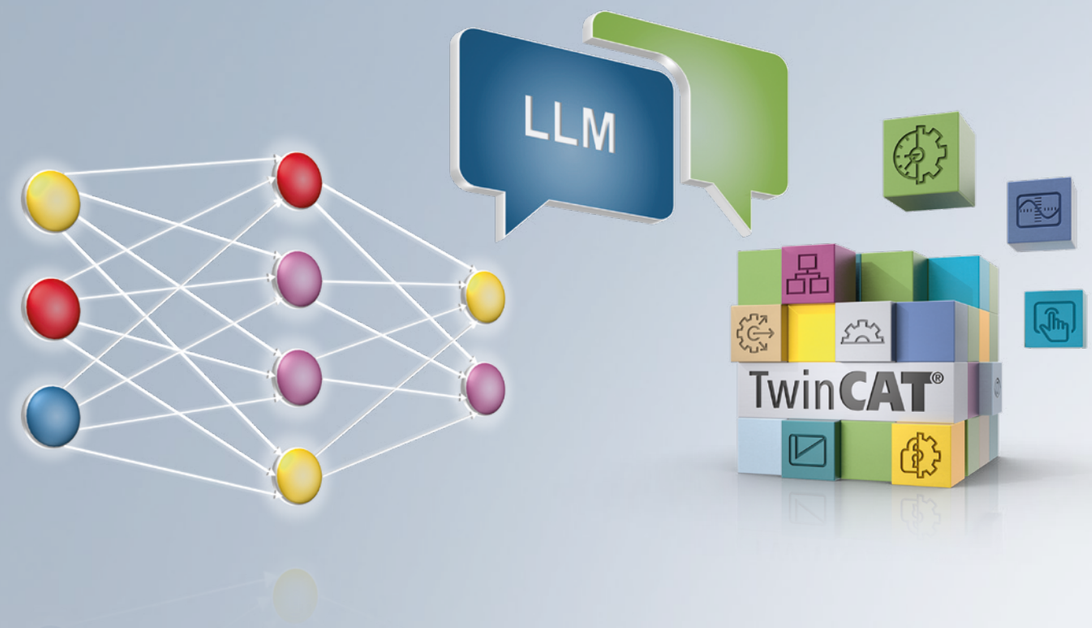
The rise of digitalization, especially in the areas of plant diagnostics and monitoring, is currently one of the major topics in the process industry. Processing plants are generally very widespread and have particular requirements that are met by the specially developed standard Ethernet-APL, which offers a transmission rate of 10 Mbit/s and a cable length of up to 1,000 meters.

When it comes to connecting corresponding field devices, the ELX6233 EtherCAT Terminal now offers a modular approach along with a whole host of associated advantages:

- compact installation space and high channel density
- easy expandability and an adaptable number of channels to suit each application
- simplified integration even in existing plants
- improved cycle times compared to field switch solutions
- compatibility with all EtherCAT Terminals and Couplers

The ELX6233 supplies the sensors according to the SPAA (TS10186) port profile and integrates them into the system via PROFINET. Two APL ports are available for this purpose in the compact 24 mm terminal housing. This allows the data from the connected sensors to be transmitted to the controller and to the higher-level process control system (DCS) via the ultra-fast EtherCAT communication.

More information:
www.beckhoff.com/ethernet-apl



TwinCAT Chat: More productive control programming with AI-assisted engineering

Beckhoff has developed the TwinCAT Chat Client for the TwinCAT XAE engineering environment. This makes it possible to use Large Language Models (LLMs), such as ChatGPT from OpenAI, conveniently in the development of a TwinCAT project for increased productivity in control programming. It also opens up optimization potential for direct support.

Large Language Models are created based on a neural network and trained with a large number of texts. LLMs have become widely used in recent years and are used for a whole host of tasks, including as the basis for chatbots or language translation tools.

The TwinCAT Chat Client enables AI-supported engineering to automate tasks such as the creation or addition of function block code, and even code optimization, documentation, and restructuring (refacturing). Implemented in TwinCAT XAE, this client connects to the host cloud of the respective LLM (e.g., Microsoft Azure™ in the case of ChatGPT), provides a user interface, and provides communication to the PLC development environment via the Automation Interface. This is available via a corresponding chat window in Visual Studio, whereby the LLM functionality has been optimized especially for TwinCAT 3 users – i.e., extensively supplemented with TwinCAT-specific content.

More information:
www.beckhoff.com/llm

TwinCAT Weighing Library: Dynamic weighing directly integrated into control

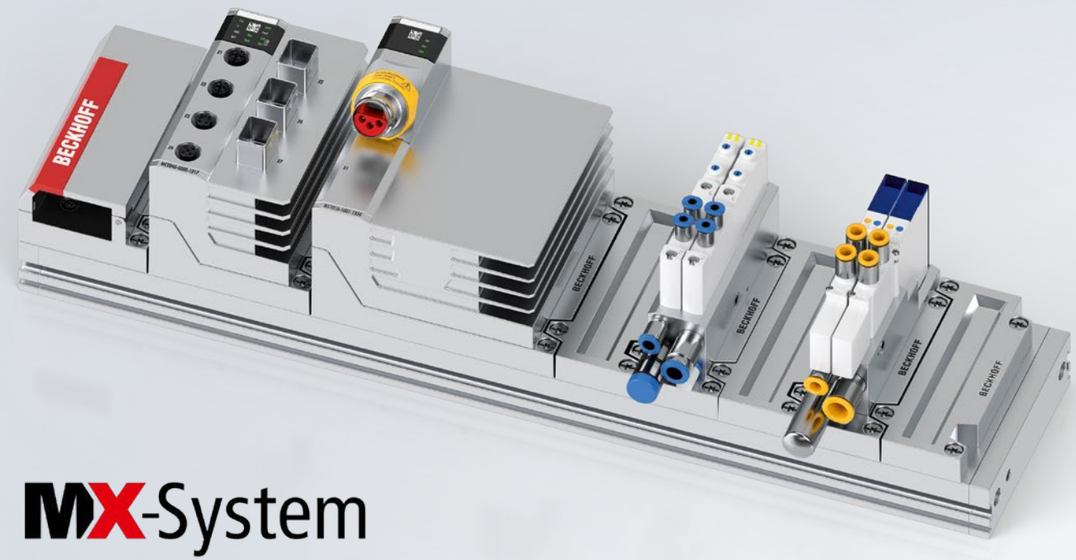
With the new TwinCAT 3 Weighing Library (TF3685), a fast and precise scale for weight measurement can be integrated directly into the PC-based machine control system, and is particularly effective when implemented with ELM35xx and EL3356 EtherCAT Terminals. At the same time, high-performance signal filtering ensures accelerated process sequences.

The TwinCAT Weighing Library primarily focuses on the dynamic weighing process. This is particularly challenging in terms of the signal filtering, as the weighing time has a significant influence on the overall processing time of the relevant machine. High-speed signal filtering with consistent precision provides a weight result faster, and this optimizes machine processes.

Since a load cell and measured value acquisition via the corresponding EtherCAT Terminals do not constitute a scale, this is exactly where the TF3685 PLC library comes in. It can also be used to connect several load cells together to form a complete scale. In addition, the scaling of the measured values is adopted. Functions such as zeroing and taring are also covered by the new PLC function blocks. In addition to manually triggering the weight measurement, automatic measurement can be performed, where the production material is detected and the measurement is taken directly. This is a significant advantage that eliminates the need for previously required external triggers, such as photoelectric sensors and initiators.

More information:
www.beckhoff.com/tf3685

MX-System: Control cabinet-free automation now also includes pneumatic valves



In November 2021, Beckhoff presented the MX-System: a completely new, holistic concept which aims to eliminate control cabinets. The basic concept aims to replace control cabinet wiring with a baseplate that allows a wide range of electronic modules to be automatically interconnected via standardized interfaces. All classic control cabinet functions are covered and pneumatic valves from Festo and SMC can now also be integrated directly with the help of two new modules.

Beckhoff has developed two socket modules – MO2414 for Festo and MO2424 for SMC – with the standard MX-System interface for the respective valve type. The air supply for up to two Festo VUVG or SMC JSY3000 valves (with up to 500 l/min flow rate, depending on the manufacturer) can be connected to it. These can be mounted directly on the modules, and different variants such as 3/2-, 5/2-, or 5/3-way valves can also be combined with each other. While the MX-System socket module provides the valve air supply and the control signals, the outgoing hoses are connected directly to the respective valve.

The new MO2414 and MO2424 pneumatic modules expand the functional scope of the MX-System and consolidate its integrated approach to automating machines and plants. The basic idea of setting up the control cabinet as a distributed system and mounting the control system for actuators and sensors close by is now also an option for pneumatics. This is a particularly appropriate solution when there are only a few pneumatic functions on a machine part: the MX-System assembly offers an extremely simple way to control them. In addition, the MX-System allows valve terminals to be controlled with a wide variety of interfaces. Furthermore, the advantages of simplified project planning and component reduction can now also be applied for pneumatics. Plus, no additional installation space is needed on the machine for the valves. Another advantage is that the Beckhoff Service App, which was developed specifically for the MX-System, now also minimizes maintenance work for the pneumatics.

More information:
www.beckhoff.com/mx-system

MX-System receives Red Dot Award in the highest category as well as iF Design Award

DESIGN AWARD 2023

reddot winner 2023
best of the best

In the MX-System, Beckhoff offers a flexible, space-optimized, and intelligent system solution that completely eliminates conventional control cabinets and can thus revolutionize the world of automation. Its pioneering product design contributes massively to its potential for innovation, and this was confirmed by the jury for the renowned Red Dot Award, as they have honored this product with the highest "Best of the Best" award category. This was further confirmed with the iF Design Award.

The MX-System is a standardized modular automation system consisting of an aluminum baseplate and function modules that can then simply be plugged into it. The system assembly, consisting of the baseplate and modules, is waterproof and dustproof and can be mounted directly on the machine without additional protective housing. The MX-System aspires to integrate into an incredibly diverse range of machines, both functionally and visually. The Beckhoff development team therefore worked closely with the Adrian and Greiser design agency right from the outset. The result is a design concept that gives the MX-System a visual and ergonomic edge that reflects its unique range of functions. The design demonstrates the compactness and continuity of the system. Components such as IPCs, drives, and I/O assemblies have their own character, yet assembly and installation of the MX-System have been simplified to the maximum.

This innovative design concept also won over the Red Dot jury, consisting of around 50 international product design experts. Every year, this award honors industrially manufactured products which are outstanding in terms of their design quality: the products must be aesthetically pleasing, functional, smart, or innovative. In fact, the MX-System offers so many special features and benefits here that it was honored with the Red Dot: Best of the Best Award for groundbreaking design, the highest award in the competition. According to the jury, only the best products in a category receive this award. Another renowned jury, consisting of 132 design experts from 20 countries, is equally convinced. They awarded the MX-System the iF Design Award 2023.

More information:
www.beckhoff.com/mx-system

Beckhoff Vision receives Red Dot Award and iF Design Award Gold

Beckhoff Vision now includes a complete hardware portfolio in addition to the TwinCAT Vision software solution that was introduced in 2017. From the very beginning, its development was oriented around an optimal design and concepts for industrial use. The expert jury for the renowned Red Dot Award recently confirmed that these goals have been successfully achieved as they honored Beckhoff with an award in the automation category. This prize is only awarded to products that have an excellent design. This was further confirmed with the iF Design Award Gold, the highest distinction in this competition.

reddot winner 2023

GOLD AWARD 2023

The Beckhoff portfolio of Vision hardware includes area scan cameras, C-mount lenses, multi-color LED illumination, and complete vision units that meet industrial requirements perfectly, both as individual components and as an entire machine vision system. The Adrian und Greiser design agency has developed a consistent design concept for Beckhoff that gives this product range a look and feel that marries sophisticated optics and electronics with industrial robustness. Relevant design aspects include the IP65/IP67 anodized aluminum and tempered anti-reflective glass housing, smooth glass surfaces that provide high resistance to cleaning agents and other chemicals, various options for flexible mounting and application, and optional shatter protection. For example, the lenses have a sleek and streamlined look, and are very easy to mount, with reliable, lockable adjustment options.

This product design, which is perfectly suited to its application, also won over the Red Dot jury, consisting of around 50 international product design experts. Every year, this award honors industrially manufactured products which are outstanding in terms of their design quality: the products must be aesthetically pleasing, functional, smart, or innovative. Beckhoff Vision prevailed, winning the "Red Dot Winner 2023" label.

The following statement was made regarding the iF Design Award 2023 Gold: "The strong but sensitive type: Beckhoff vision system combines the precision of a laboratory instrument with the robustness of an industrial machine. These products are all about control, and this is reflected in the solidly attractive design language."

More information:
www.beckhoff.com/vision

ATRO nominated for Hermes Award and receives iF Design Award

DESIGN AWARD 2023

The new ATRO (automation technology for robotics) system from Beckhoff is a modular system that can be used to custom-build the ideal robot structure for any application, thus offering great flexibility. Defined mechanical and electrical interfaces enable fast, precise, and tool-free assembly of any robot kinematics. The modular mechanics are supported by modular software that provides functions such as image processing, artificial intelligence, or scientific automation in addition to robot motion. This innovation has now been recognized with a nomination for the Hermes Award, announced at the Hannover Messe. In addition, ATRO was awarded the iF Design Award 2023.

The ATRO modular industrial robot system beat many submissions to be nominated as one of the top three innovations for the 2023 Hermes Award, selected by a jury of experts from politics, business, research, and society sectors. According to Deutsche Messe AG, this international technology prize honors outstanding products and innovative solutions that demonstrate a particularly high degree of technological innovation as well as offering benefits to industry, the environment, and society. ATRO fits both criteria in many respects.

Hans Beckhoff commented: "Beckhoff Automation represents innovation and, with our ATRO system, we seem to have succeeded in creating another small revolution. Naturally, we are very proud of that! I would like to thank our mechanical, electronic, and software engineers who worked together in perfect harmony to create our ATRO!"

More information:
www.beckhoff.com/atro

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Controlled by PC-based control, the SEALPAC Traysealer A7max achieves a high processing capacity of up to 120 packages per minute.

© Beckhoff

PC-based control and drive technology in packaging machines for the food industry

Open and integrated automation unlocks optimization potential

SEALPAC GmbH, a globally active manufacturer of food packaging machines headquartered in Oldenburg, Germany, found that their old automation technology had reached its limits. The open and integrated PC-based control system solution from Beckhoff brought SEALPAC up to speed, and in the process uncovered a variety of options for optimization in engineering and machine operation, with full conversion achieved at just 14 months.

© SEALPAC

The customized stainless steel multi-touch control panel (the CP3918 for the A6max is shown here) and the display created with TwinCAT HMI enable optimal machine operation.

SEALPAC offers solutions for a wide variety of food products and packaging.

Thomas Hegeler, project manager at SEALPAC, confirms that PC-based control and drive technology can be implemented quickly: "The control system for the entire packaging cycle, including the safety application, took a mere six months to convert, meaning that we could start delivering packaging machines to customers in just over a year. We have implemented this for a variety of systems, including our Amax tray sealer series, and will successively replace the control technology in our other machine types as well."

The Amax series tray sealers are high-performance machines for automated food packaging in a variety of performance classes. Machines need to be able to reliably process sustainable materials, which are becoming increasingly lightweight, but equally, they must also be efficient, economical and precise. This means that the demands in terms of machine technology are constantly growing, while the operation and maintenance of the machines need to be simplified.

PC-based control for more efficiency

PC-based control is an open, integrated and, above all, tried-and-tested system for control and drive technology that provides the perfect solution to elicit more efficiency in machine automation. Thomas Hegeler explains the impetus for SEALPAC: "We needed end-to-end automation, right up to the HMI, to provide a holistic machine concept with a wide variety of machine types. The technology that we had at that point was holding us back from reaching this goal. PC-based control has significantly reduced the time and integration work here."

Beckhoff Sales Engineer Thomas Kaiser clarifies a particularly important aspect here: "PC-based control can be finely scaled and thus optimally adapted to the respective application, and even to more stringent requirements later on if needed. For the tray sealers, for example, an industrial PC with the average

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Thomas Hegeler (right), project manager at SEALPAC, and Thomas Kaiser, sales engineer at Beckhoff, in front of the A6max tray sealer

processing power of an Intel Atom® processor would suffice, but a C6032 ultra-compact Industrial PC with Intel® Core™ i5 CPU is used due to the powerful HTML5 visualization implemented with TwinCAT HMI." In particular, visualization and machine data processing are of great importance to SEALPAC, as Thomas Hegeler confirms: "This is a main focus for us, which will certainly lead to heightened control requirements in the future. As a modular software platform that is also easy to use, TwinCAT offers all possibilities, e.g. with functions for motion, HMI, vision and machine learning. In addition, the hardware can easily be scaled, meaning that if we need to, we can simply use the C6032 with a more powerful processor without having to change the IPC form factor and thus the machine design."

Packaging machines need to be extremely capable, especially in the motion sector. With EtherCAT-based drive technology from Beckhoff, SEALPAC was able to improve here in three aspects, according to Thomas Hegeler: "Overall, working with the Beckhoff experts, including our direct contacts in product development, was a huge advantage. In drive design, which is incredibly complex, this has really paid off and has cut development time massively. The second aspect is the high quality and performance of the Beckhoff drive technology – the AX8000 multi-axis servo system and AM8000 servomotors. With our previous servo technology, we had reached our limits in terms of speed. Thirdly, we need fewer types of motors and, with the AX8000 system, we have machines that are suitable for all voltages worldwide, up to the 200 V/3-phase grid in Japan. This also resulted in a significant reduction in inventory."

Convenient machine operation as an important criterion

Optimum machine operability is a crucial for SEALPAC. Customized CP39xx stainless steel multi-touch Control Panels from Beckhoff are used as hardware to assure this, with a 15.6-inch display for smaller machines and an 18.5-inch version for larger systems. Thomas Hegeler explains: "Multi-touch, high-quality full-HD graphic displays and a CI-compliant design with labeling and matching push button extension constitute clear quality criteria for us in machine building. Their importance will definitely grow in the future, due to the increased use of graphics and animations and the increasing prevalence of smartphones and how they shape operators' expectations and habits. In some instances, machine operators already have a say in choosing machinery."

Thomas Kaiser describes some of the implemented customer-specific features of the control panel: "One requirement was to be able to easily integrate SEALPAC's own RFID solution. This was easy to implement with minor adjustments, based on our standard housing. Furthermore, the housing, including the stainless steel mounting arm adapter was precisely matched to the appearance of the sandblasted machine housing by sandblasting it with the appropriate grain size."

The basic prerequisite for fast and smooth visualization is sufficient computing power, as provided by the C6032 ultra-compact Industrial PC. According to Thomas Hegeler, the extremely compact design swung the decision, as control cabinet space is always in short supply. As a modular IPC variant with scalable interface and function extensions, the C6032 also offers excellent connection adaptability for future system additions and has proved its worth in this application by running without any failures.

Fast EtherCAT communication, efficient One Cable Technology

With regard to data communication, PC-based control from Beckhoff also offers numerous application advantages for SEALPAC. The system's openness and the wide range of EtherCAT Terminals make it easy to integrate third-party components, such as valve terminals, frequency inverters, and IT into the control technology. In Thomas Hegeler's experience, EtherCAT has also made good on its claim of being the fastest Industrial Ethernet system on the market, demonstrating this in practice with its excellent performance.

The EtherCAT-based servo drive technology from Beckhoff also simplifies machine design in other ways, clarifies Thomas Hegeler: "One Cable Technology (OCT) from Beckhoff significantly reduces the time and material required for cabling. In addition, the machine looks far cleaner and is more ordered. In addition, the electronic identification plate makes commissioning easier." Customization also played an important role here: "The motors that we had previously used were connected in the classic way, via two cables, but the cables were very thin, making them easy to lay within the machine. However, in close cooperation with Beckhoff, a comparable solution was found here for the OCT motor connection cable: since the motors do not require brakes, two cable leads could be dispensed with, thus reducing the cable diameter. Furthermore, a motor connection plug angled at 60° has been developed, which saves additional installation space. All of this has helped us a lot."

Future-proofed with PC-based control

The continuous further development and portfolio expansion within the scope of PC-based control offers an additional high level of investment protection with a view to future machine requirements. Beckhoff's TwinCAT/BSD operating system is included in the latest product innovations that SEALPAC will test. It was designed as a multi-core-capable, Unix-compatible operating system for TwinCAT 3 real-time applications and unites the advantages of Windows CE, namely that it is low cost with a small footprint, with the numerous features of the major Windows operating systems. Thomas Hegeler states: "We see the advantages here in the high performance, despite the small footprint, and in gaining independence from Windows, which some customers want for security reasons, among other things."

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Above: The AX8000 multi-axis servo system, in conjunction with the AM8000 dynamic servomotors, ensures that the packaging processes are run with precision.

Below: The C6032 ultra-compact Industrial PC offers sufficient computing power for both machine control and powerful visualization.

More information:
www.sealpac.de/en
www.beckhoff.com/packaging

XPlanar in deep-learning-based optical component inspection in the automotive segment

Floating movers for efficient, flexible and reliable quality assurance

The XPlanar movers move the components through the testing process in an optimized 3-second cycle.

Achieving the shortest possible inspection times – even when working with different components – is paramount when it comes to series production. This is precisely what Memmingen-based stoba Sondermaschinen GmbH set out to achieve with its InspectorONE optical inspection system, which is based on deep learning and features the Beckhoff XPlanar planar motor system at the conveyor system core. The system allows automotive suppliers to achieve extremely short cycle times of just 3 seconds when inspecting high-pressure injection valves, for example, and so inspect around 6 million parts per year in three-shift operation.

In the words of Michael Berkner, a sales expert for laser technology at stoba, the Memmingen-based special machine builder primarily sets itself apart through its expertise in the field of automated production. Berkner emphasizes, "This expertise is built on extensive experience in laser material processing, which requires a high level of precision and the optimal combination of automation, laser technology, and optical test systems. The result is the InspectorONE test system – a self-learning machine for the visual inspection of all kinds of components and products." Modularity is also a crucial factor here, as Simon Mohr, laser technology expert at stoba, adds: "Depending on the application and testing process, the system includes not only different types of stations, but also different numbers of stations, such as camera systems for surface inspection, and measurement technology for component measurement or code

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The CX2072 Embedded PC with directly connected EtherCAT and TwinSAFE terminals controls all motion and test sequences.

© Beckhoff

The XPlanar transport system supports the compact design of stoba's testing facility.

readers. This can be defined on a modular basis according to requirements, just as XPlanar as the central handling unit can be optimally adapted via the respective number of tiles and movers."

Quick and error-free testing

The system currently being implemented is an optical testing machine for high-pressure injection valves, which has been specially configured for an automotive supplier. It is loaded and unloaded via robots and integrated directly into the end customer's production line. XPlanar forms the conveyor technology basis for product transport, with the floating movers moving the components to the various camera and measuring stations as needed in a process-optimized manner. This allows incredibly short inspection times to be achieved for different components, meaning it was possible to achieve the specified cycle time of 3 seconds – and thus the high number of 6 million inspected parts per year – in three-shift operation.

Equipped with cameras and deep-learning software, the system operates quickly, automatically, and with continuously improved capabilities, such as scanning components and detecting features or anomalies. Functional examples include parts inspection with 360° rotation, simultaneous inspection of different components on one machine, and detection of surface defects, contamination, and particles in liquids or air bubbles in the material.

XPlanar for speed and flexibility

The XPlanar movers not only transport the components to the individual inspection stations, but they also optimize the process flow due to the many degrees of freedom in movement. According to Simon Mohr, for example, the rotation of the mover simplifies and accelerates component measurement from all sides. In terms of the objectives behind the selection of the transport system, he explains: "XPlanar enables short cycle times, which would be difficult to achieve even with a rotary indexing machine. It is also an extremely flexible and easily customizable modular system. The floating movers represent a wear- and abrasion-free conveyor technology, which makes them ideal for use in clean rooms. This would not have been feasible with linear guides or rotary indexing machines."

According to Michael Berkner, alternative concepts such as a rotary indexing machines would require significantly more mechanical design, which XPlanar replaces with its high level of software functionality. Although it is also possible to measure several parts at the same time in a rotary indexing machine, it would be necessary to couple corresponding rotational axes to implement rotational inspection. This would make it impossible to achieve the required inspection time of 3 seconds while trying to accommodate this kind of coupling and subsequent decoupling. With XPlanar, on the other hand, this can be achieved simply using software functionality for 360° rotation.

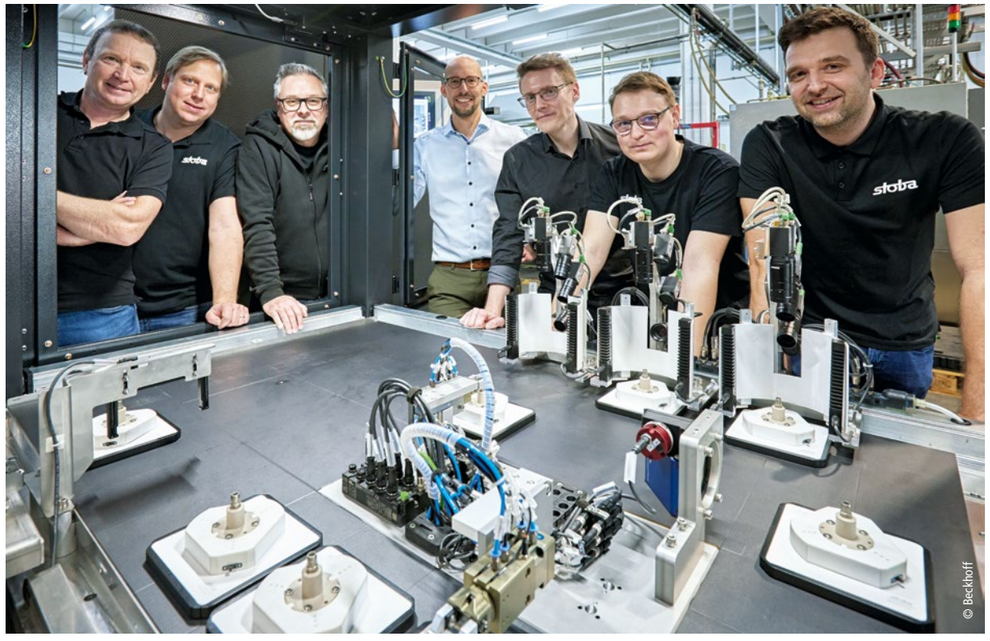
Errors at a minimum in a low-maintenance testing system

Michael Berkner also mentions two other aspects: "XPlanar eliminates mechanical abrasion for an extremely low-maintenance overall system. This has a positive effect, especially with the frequent product changes throughout the year. XPlanar has also allowed us to achieve a particularly compact machine design, saving us around 15 to 20% floor space compared to conventional systems." According to Simon Mohr, the accessibility of the system has also improved: "The new design has made it possible to accommodate the control cabinet under the XPlanar tile surface. This is the only way to ensure service doors can be fitted on all four sides of the machine, thereby facilitating access to the system."

The reduced need for maintenance also affects the overall efficiency of the system, as less maintenance ultimately frees up more time for effective testing. According to the stoba experts, this is also directly evident in testing operations, in that the floating product transport avoids abrasion and thus minimizes contamination of the components with microparticles. In the event that particles of this nature are present, they are detected as an anomaly by the high-precision deep-learning software, even if it is not an actual component defect.

© Beckhoff

The multi-touch built-in Control Panel in the CP29xx series enables convenient machine operation and process control.



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The team of experts: (left to right) Markus Günther (Head of Electrical Processes, stoba), Markus Gleich (IT Systems Engineer, stoba), Günter Herbrik (Technical Product Designer, stoba) and Christopher Kleinert (Head of Sales Office Kempten, Beckhoff), Michael Greiner (Application Engineer, Beckhoff) as well as Tobias Steidele (Trainee, stoba) and Michael Schneider (Electrical Planner, stoba). Not pictured: Michael Berkner and Simon Mohr from stoba.

Software functionality increases adaptability

Simon Mohr also sees the high software functionality of XPlanar as a major advantage with regard to the adaptability of the test system to changing requirements: "If you consider the long service life of the system as well as the different product life cycles, replacing mechanics with the software functionality of XPlanar becomes decisively more important. A flexible system such as InspectorONE can be adapted to new components or changed inspection requirements over many years without much effort by simply replacing or adding the respective inspection stations. As far as the changed product transport goes, it is sufficient to perform updates via software." Michael Berkner adds, "This still has great potential for the future. For example, we are looking into component-specific formulas for the motion profiles of the XPlanar movers so that we can test different components batch by batch without interrupting the production process. This would simply not be feasible with a mechanical conversion."

More information:
www.stoba.one
www.beckhoff.com/xplanar

XPlanar in a hygienic design used in a handling system for sliced foods

Floating product transport cuts footprint in half and speeds up handling and cleaning

Provisur Technologies GmbH in Flawil, Switzerland, has developed an extremely compact, flexible, and hygienic handling system for sliced foods such as cheese, salami, and bacon. At the heart of the machine is the Beckhoff XPlanar planar motor system with its stainless-steel housing, which not only significantly reduces the machine footprint, but also significantly improves system performance, flexibility, and cleanability with incredibly flexible floating product transport.

Headquartered in Chicago, USA, Provisur Technologies has established a strong reputation for the development of innovative industrial food machinery as well as integrated production systems for processing a wide variety of food products. The same also applies to the Swiss subsidiary in Flawil, which is active in the pressing and slicing sectors with its Hoegger and Formax brands, among others, and has developed a new handling system for use in conjunction with the tried-and-tested Hoegger presses and Formax slicers. This Free Movement System (FMS) is designed to be more compact, flexible, and hygienic, revolutionizing product handling between the slicer and the packaging line, according to the Swiss experts at Provisur.

Maximum system performance in minimum space

According to Gerd Stratenwerth, Sales Manager Slicing at Provisur, the Formax FMS significantly reduces the space required compared to conventional systems. At the heart of the system is a handling and buffering system built from 48 XPlanar tiles and a flexible number of XPlanar movers. Through its modularity, XPlanar optimally supports the FMS concept as an individually adaptable standard machine. With the control technology placed underneath the stainless-steel worktop to save space and maximize functional reliability, the result is a particularly compact design – especially since the additional modules otherwise required, such as the turning station, buffer, inliner, and overlapper,

The XPlanar planar motor drive system also meets the high hygiene requirements of Provisur's Formax Free Movement System (FMS) by using non-magnetic stainless steel for the tiles and movers.

A C6670 control cabinet industrial server (left) with TwinCAT controls the entire system, including XPlanar as well as the AX5000 servo drives (right) and the AM8800 stainless-steel servomotors of the infeed and outfeed conveyors it controls.

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Equipped with a specific comb-like structure for the respective end customer's application, the XPlanar movers pick up the food flexibly and as required from an infeed belt (right).

are no longer required. The core task of the FMS is to buffer products for the downstream packaging machine to ensure a continuous supply during the slicer's loading pause. In conventional lines, this task is solved with belt systems, which require more space and cleaning effort. The FMS can also be used to perform tasks such as turning portions or else merging or distributing product streams.

Explaining the advantages for the end user, Gerd Stratenwerth notes, "Thanks to the fast, free-floating movers, the portions can be processed with a high output for this typical application segment. Even multi-type portions can be put together flexibly and in the smallest possible space. Because the XPlanar movers can move to any point on the work surface and rotate freely, the whole process of picking up cut products for transport is more straightforward than ever. This also means that the transported food always arrives at the packaging station in the optimal orientation. The entire process is characterized by an enormous amount of flexibility, because handling a new article or a different packaging variant does not require a changed system design, just an adjustment in the software program."

Stainless-steel design for optimum hygienic properties

The FMS offers excellent hygienic properties due to the stainless-steel housing of the XPlanar tiles and the use of stainless-steel XPlanar movers. The sliced products are transferred directly from the slicer to one of the movers, whether in shingles, stacks, folded slices, or multi-variety or overlapping portions, depending on the specifications. Once the products have been transferred to the packaging line, the movers can be cleaned and sterilized by an optional cleaning station during operation, generally on the return trip to the slicer. In addition, according to Fatih Yaman, automation engineer at Provisur, the floating and non-contact transport avoids any kind of abrasion: "Not only does this offer

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The PS3031-2420-0001 power supplies – 3-phase, 24 V DC devices with 20 A output current and 480 W output power – reliably supply the control technology and, with high efficiency and low heat loss, have a positive effect on system availability and energy costs.

direct protection for the food against contamination, but it also noticeably simplifies the level of cleaning compared to the often more convoluted assembly work associated with conventional systems. This is becoming an increasingly important consideration, not least in light of the current staffing issues currently affecting food processing companies."

Gerd Stratenwerth adds, "The FMS eliminates the need to touch the product and thus the human factor as a source of contamination. This also has a positive effect on product shelf life." Another important aspect is the increased plant availability. Due to the lower number of mechanical components – for example, as a result of the conveyor belt structures being reduced by around 90%, the time required for cleaning is reduced to roughly 10 min and the associated maintenance effort is also lower.

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Project participants (from left to right): Thomas Gubser, Technical Support at Beckhoff Switzerland, Automation Engineer Fatih Yaman, Product Developer Klaus-Dieter Schroff, and Sales Manager Slicing Gerd Stratenwerth (all Provisur), as well as René Zuberbühler, Managing Director Beckhoff Switzerland

Software functionality replaces mechanics

The flexibility of XPlanar does not simply stop with the customization of the FMS either, as Fatih Yaman makes clear: "The system is also completely open in terms of packaging type. Thermoforming machines, for example, usually operate on multiple lanes, while form-fill-seal machines tend to operate on a single lane. This can be responded to flexibly and quite easily via a corresponding requirements profile in the software, which is particularly useful since changes to customer orders can happen over and over again in the world of food packaging. In conventional scenarios, the complex handling area between the slicer and the packaging machine would have to be replaced and mechanically adapted each time. The same applies to the product handling itself, which allows faster and safer manipulations than the mostly manual activity associated with conventional applications. In the case of multi-variety portions, for example, the different cutting directions sometimes required can be taken into account simply by turning the mover."

Replacing mechanics with the software functionality of the XPlanar has even more decisive practical advantages for Fatih Yaman, "Wear is a crucial issue that crops up time and again in our discussions with customers. This is because a conventional handling system consists of a very large number of mechanical components, such as conveyor belts, and is accordingly subject to a high level of wear. What's more, the level of cleaning effort is significantly higher, but also indispensable due to the constant contact with the food. Then there's the fact that there are always numerous transitions between the individual belts in systems like this, and each of them can change the position of a food portion, which in turn can lead to complications during subsequent insertion into the packaging. Generally speaking, a mechanical system is much more susceptible to a decline in positioning accuracy. But with XPlanar, all of these aspects are eliminated."

Easy implementation in line with Industrie 4.0 concepts

The fact that the software partially solves tasks previously solved mechanically, does not mean that the effort required for implementation is increased on the software side. Instead, with the TwinCAT 3 XPlanar Function (TF5890), systems can be easily commissioned or new configurations created via an XPlanar configurator that is seamlessly integrated into the familiar engineering environment. As Fatih Yaman explains, "With the functions of the default library, the XPlanar system can be handled in the same way as conventional drive technology with a corresponding number of axes. The complete control of the entire system via the central TwinCAT controller also enables perfect synchronization between the movers and the infeed and outfeed conveyors."

With their inherent system openness, TwinCAT and PC-based control are also proving advantageous with regard to the increasingly important topic of Industrie 4.0, as Gerd Stratenwerth adds, "The connection of our machines to higher-level control systems at our customers's sites is becoming immensely important. However, since these vary greatly depending on the customer, we need open control technology if we want to be able to work with as many different platforms as possible. And for this, the PC-based solution is much better suited than our previous conventional control technology."

More information:
www.provisur.com
www.beckhoff.com/xplanar

XTS Hygienic: Stainless steel version of the XTS in the pharma industry

Dynamic and flexible product transport increases output of sterile filling lines

With XTS Hygienic, Dec Netherlands has revolutionized product transportation of its pharmaceutical filling lines, moving away from chain drives in favor of dynamic yet careful transport of different containers. Specially designed for the food and pharmaceutical industries, the stainless steel version of the linear transport system from Beckhoff forms an integral part of Dec's modular DecFill PS platform.

© Dec Netherlands

The C6032 ultra-compact Industrial PC with TwinCAT XTS Extension, Collision Avoidance, and NC PTP controls the movers precisely and without sloshing any liquids during start-up and braking.

© Dec Netherlands

The XTS Hygienic linear transport system is the perfect fit for Dec Netherland's modular machine concept: depending on the number of process stations, the motor modules are as-sembled and equipped with the required number of movers (typically 4 meters in length with 12 to 16 movers).

"I don't know of any other linear magnetic transport system that meets the requirements of the pharmaceutical industry," says John van Veen, technical director of Dec Netherlands B.V. in Breda. The company had been looking at linear, magnetically driven transport systems for some time in a bid to avoid the production downtimes caused by the link chain system that they previously used. Unfortunately, there was no solution that met the requirements of Dec Netherlands and the pharmaceutical market for filling pharmaceuticals at that time, but that all changed in 2017 when Beckhoff introduced XTS Hygienic, an IP69K-compliant variant of the linear transport system. "We immediately contacted Beckhoff Netherlands, and when it was clear that XTS Hygienic had the necessary properties for use in pharmaceutical production, we immediately started an internal development and implementation process," recalls John van Veen. Fast forward to today and a whole host of customers are now using XTS Hygienic in a variety of filling lines.

Dec Group provides powder handling solutions for various industries and consists of several divisions, including Powder Handling Technologies, Particle Size Technologies, Containment Solutions Technologies, Continuous Processing Technologies, and Filling Solution Technologies. The headquarters are located in Switzerland with production facilities in Poland, UK, the USA, India, and the Netherlands, and sales offices around the world. Dec Netherlands is part of the Filling Solutions Technologies business unit and specializes in sterile filling of active ingredients. The containers transported with XTS Hygienic include the vials, syringes, dual-chamber syringes, and even cartridges and (infusion) bags commonly used in the pharmaceutical industry. The active ingredient can be dosed as a powder, for example, using a technique specially developed by Dec; liquids and gels can also be dosed and filled.

Faster, more flexible primary processes

With XTS, the syringes, ampoules, and vials fixed in special brackets mounted on the movers are transported quickly and vibration-free within the filling machines, from infeed through the individual process stations (filling, weighing, closing, and sealing), to discharge from the hermetically sealed system. Before XTS Hygienic, it was common to transport the containers along all stations using a chain-based system; however, this rigid chaining technique meant that the overall process could only ever be as fast as the slowest station. XTS, on the other hand, decouples the process stations, thus giving the option to continue the downstream process if one of the stations stops. "This allows us to guarantee less production downtime and so achieve a higher output," enthuses John van Veen, highlighting a USP of Dec Netherlands' filling lines.

The filling lines are all built in line with customer specifications. Depending on the requirements, Dec Netherlands configures a new filling line by adding or omitting stations. Individually assembled from straight and curved motor modules, the XTS accommodates the modular machine concept and can be flexibly adapted to the plant layout and the number of process stations required. A typical system is around 4 meters long (8 meters for rotary systems) and uses between 12 and 16 movers for product transport.

Each XTS mover picks up the containers to be filled on the infeed side from a star wheel. As soon as all brackets on the respective mover are loaded with vials, the mover moves to the first station. At each station, the mover either stops or moves synchronously with the axis of the process module. At the end of the filling process, the containers are removed from the mover and the mover returns to the input side.

The structure, design, and material selection of XTS Hygienic meet all the requirements for the pharmaceutical industry, including regular decontamination with hydrogen peroxide gas.

© Dec Netherlands

XTS was installed vertically to streamline the machine and allow operators to access the relevant areas of the machine via glove ports.

© Dec Netherlands

Optimized design and material for every application

The transport system is mounted vertically, which ensures not only optimal cleanroom and air flow conditions during the filling process, but also excellent ergonomics. This arrangement, with container transportation at the top and mover return at the bottom, allowed the designers to create a narrower machine. "Operators can only access the hermetically sealed machine using permanently mounted rubber gloves which ensure that sterile conditions are maintained," stresses John van Veen. The encapsulation of the system also serves to protect the operator: In the event of direct contact, some of the medications being filled could cause the machine operators to experience skin or respiratory irritation or even build up resistance.

In some cases, the drug may also be toxic. This is why it is common practice to have a wash down (CIP) system and to decontaminate the hermetically sealed area of the machines with hydrogen peroxide gas before each new batch of product is loaded. "For this reason, it was important to test the material compatibility of XTS Hygienic with aggressive gases like these," emphasizes John van Veen, highlighting an important selection criterion. The XTS Hygienic also assures sterility through elements including the combination of materials used, their surface finish and simple design, as well as their pre-cleaning and suitability for pharmaceutical cleaning processes.

XTS Hygienic's flexibility, namely being able to move each individual mover separately and independently, is another huge argument in its favor. In this way, each process station can be operated with its optimum cycle time, because XTS decouples the process steps that were previously rigidly connected via the chain. Another aspect relates to temperature development, which could potentially affect the airflow in the machine that is necessary to ensure sterility.

Synchronizing the movers with the servo axes of the various stations proved to be yet another challenge, not least since end customers in the pharmaceutical sector sometimes insist on a machine controller from specific manufacturers. To handle the synchronization, a coupling between the C6032 ultra-compact Industrial PC used to control the XTS and the third-party system had to be developed. As John van Veen recalls, "The PROFINET connection was easy to configure and program in TwinCAT." The interface is structured in such a way that only the number of XTS movers and process stations along the route have to be specified.

Ready for larger installations

In addition to TwinCAT Motion Collision Avoidance, Dec Netherlands uses TwinCAT NC PTP for motion control. TwinCAT receives the respective positions from the higher-level controller, and the gear-in-position function is used to synchronize the movers with the axes of the process stations. To enable flexible scaling of the physical synchronous axes, Dec developers have created virtual axes with configurable acceleration factors. "This means that the system can be easily converted to fit new products," notes John van Veen, pointing out the potential of TwinCAT.

TwinCAT and PC-based control allow classic controls to be combined with an advanced transport system such as XTS if required. This applies not only to XTS integration, but also to the addition of other motion functions such as leading and synchronous axes. "PC-based control offers sufficient potential for this and for future, larger installations," explains John van Veen.

Practical advantages of XTS Hygienic

- increased output through individual mover movements
- compliance with all pharmaceutical standards, including cleaning with hydrogen peroxide gas
- flexible system layout due to variable number of stations
- variable installation position for ergonomic operation, making it easier to clean
- open interfaces and diverse software functionalities

More information:
www.dec-group.net
www.beckhoff.com/xts

PC-based control facilitates data integration in food manufacturing

From the kitchen into the cloud – Digitalization recipe for the pancake of tomorrow

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The open PC-based control technology from Beckhoff serves as the backbone for a cloud platform that helped achieve a 7 to 8% gain from saved raw materials.

Through complete automation, even the most diverse pancakes can be produced efficiently – for example these special pancakes for Halloween.

Yummy Bakery's pancakes are "hot" and end up on the shelves of virtually every major retail chain in Belgium. The secret behind this success? Using the authentic ingredients and preparation method on a baking plate. A recipe that perfectly combines with digitalization as CTRL Engineering successfully demonstrated. Besides 7 to 8% raw material savings, the automation of dough dosing with control technology from Beckhoff also helped provide data for ongoing process optimization.

Annie Alderweireldt's life in Bruges didn't always revolve around pancakes. But when her pregnancy forced her to stop working in 1984, they did give her an outlet. "She started experimenting in the kitchen until she had the recipe for the perfect pancake, using the neighbors as guinea pigs," says her daughter Sara Geldhof, who runs the business with her brother Tom today. "She then went to the local bakers and butchers in Dudzele near Bruges to market her pancakes." A snowball effect, because before she knew it, they were on the shelves of convenience stores and the big supermarket chains also discovered her. "Mom's arm pouring the dough onto the baking plate over and over again in the same fluid motion with a ladle ... that was actually our first machine. But at some point that was no longer feasible. So we built a carousel that worked semi-automatically at least," Sara Geldhof recalls.

Authentic preparation method, authentic taste

In 1995, they had the opportunity to purchase a piece of land in an industrial park in Bruges. A first industrial pancake machine went up and running there. But authenticity was still as hard-won as ever. Sara Geldhof explains: "We achieved the typical taste by opting to prepare via griddle. Compared to using infrared technology, the pancake is then seared immediately, so the dough inside stays soft and creamy. In addition, only natural ingredients enter the recipe, no preservatives or colorings, just pure nature." A philosophy that Yummy Bakery also applies to their new products. For example, they already have organic pancakes in the product range and are working behind the scenes on the first vegan pancakes. "And will continue do so until the taste is completely right," Sara Geldhof says. What started with the industrial production of traditional pancakes from Bruges, now also serves current trends, for example with motif pancakes for Halloween.

Complete automation enables growth

The acquisition of a second production hall followed eight years ago. Maybe a happy twist of fate, because only a year and a half ago, Yummy Bakery could use the space to increase its production capacity from 10,000 to 22,500 pancakes per hour. And still the growth curve is going up: last year, sales increased 25%. "We couldn't ignore automation and digitalization anymore if we wanted to keep up with our growth. We are all about fresh products, so everything we produce goes straight out the door. In the past, you could manage that with a good team that had all the necessary know-how in their heads. Today, though, you have to secure that knowledge using technology. The goal is to create a complete digital flow that improves our process stability and minimizes repetitive work for our employees." To achieve this, Yummy Bakery partnered with CTRL Engineering who have a background in automotive. "In automotive production lines, the goal is zero errors. Because profit margins are limited, the entire process is completely purged of inaccuracies. We want to introduce these principles to other sectors as well. Together we look for ways how our customers' processes can be improved to produce more with the same machines and people. What we offer

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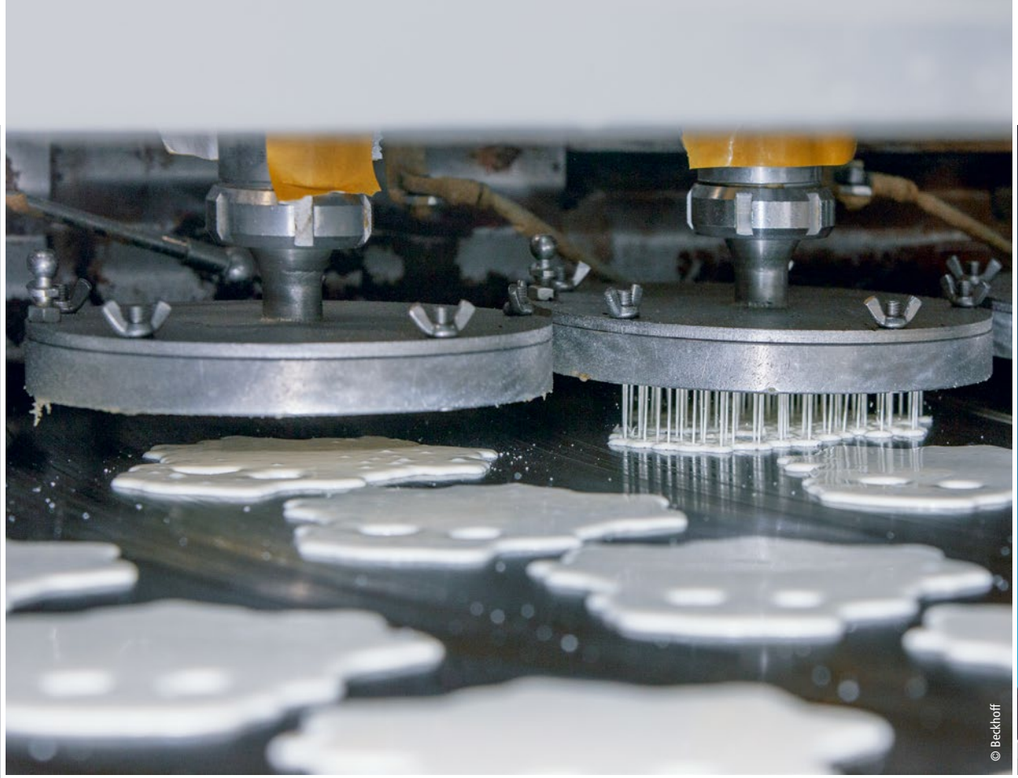

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The previously manually adjusted dough dosing was converted to servomotor-based control including evaluation of all data in a cloud platform.

TwinCAT and a CX5240 Embedded PC (below) combined with a CP3916 Control Panel in stainless steel (center) facilitate the integration of data from all possible systems, such as this floor scale, and thus form the backbone of a cloud-based solution.

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Mathieu Dutré, CTRL Engineering, Sara Geldhof, Yummy Bakery, Pieter Meseure, CTRL Engineering, and Cedric Sabbe, Beckhoff Automation (from left), successfully demonstrated that tradition and progress need not be a contradiction – after fully automating the pancake production, a digital twin enables fine-tuning.

is efficiency as a service," Managing Director Pieter Meseure summarizes the mission of the company.

Fast Return on Investment

Although Yummy Bakery and CTRL Engineering both wanted to set the bar high, they decided to start small. "We started looking for the low-hanging fruit. Something that would give us immediate profit, so that we had more resources to take the next steps in digitalization," says Pieter Meseure. The lack of stability in the weight of the pancakes was the first item on the agenda. Mathieu Dutré, Director of Innovation and Business Development at CTRL Engineering, explained: "We were wondering, if we can save 10% overweight, what impact would that have on the bottom line? A calculation pointed to an ROI of less than a year. That was a no-brainer!" Until then, dosing had been done pneumatically, that is, depending on the recipe, operators would have to adjust the compressed air flow rate manually. As a result, a pack of pancakes with a nominal weight of 500 g could weigh between 500 g and 560 g. CTRL Engineering used virtual engineering to see how they could best address the problem and what hardware would suit the specifications they found.

Servomotor as a virtual sensor

The first step was introducing pressure control on the four nozzles of the machine. Pieter Meseure says: "Now it is calculated as a function of a motor's torque. Because in order to achieve the proposed weight savings, the settings need to be continuously improved. To this end, we created a closed control loop using the servomotor as a virtual sensor. In addition, we process input from a scale that is used to monitor the average and trend in the pancakes' weight to detect deviations. The data from a checkweigher located at the end of the packaging line is also integrated into the model. After all, the cooling tower the pancakes have to pass first also has an impact on the weight."

Seamless integration of data

All measured data are converged on a cloud platform, an in-house development by CTRL Engineering. In this way, the deviation in the pancakes' weight has already been reduced to 0.4 g, which corresponds to a 7 to 8% gain through raw materials that are not wasted. "And we are also already seeing how we can get to a 0.1 g deviation over time," Mathieu Dutré adds. It all sounds surprisingly simple, and it is for the operators, who need only click on the right recipe. In the background, however, complex algorithms and models are running to calculate a digital twin of the physical machine. "For this, integration of data is key, which is why the backbone of our solution consists of Beckhoff control technology. Their PC-based control platform allows you to add functionalities through software, without having to change the hardware," Mathieu Dutré says. Pieter Meseure also cites the openness of the system as an asset: "In TwinCAT, we can seamlessly link all kinds of systems and data, allowing us to respond quickly to changes." On the shop floor a Beckhoff CX5240 Industrial PC serves as controller. Furthermore, the CP3916 Control Panel catches the eye. "In stainless steel execution it is perfect for application in the food industry," says Mathieu Dutré. "Not only does the Beckhoff technology do everything it is supposed to do on the shop floor, there is a knowledgeable team behind it that is always available."

One digital flow to mirror the production process

In terms of digitalization, this is just the tip of the iceberg for Yummy Bakery. The next step? "Automating quality inspection at the end of the packaging line by adding vision capabilities. We are just waiting for the OCR functionality to be introduced. Behind the scenes, Beckhoff is already training a machine learning model to recognize even more fonts. The potential profits from that should in turn serve to eventually install a second production line in the new building, adding another 50% of capacity. Then we can transfer all production facilities from the first building to here and repeat the process until we achieve one perfect, digital flow," Pieter Meseure concludes with an outlook into the future.

More information:

www.yummybakery.eu

www.ctrlengineering.eu

www.beckhoff.com/cx5240

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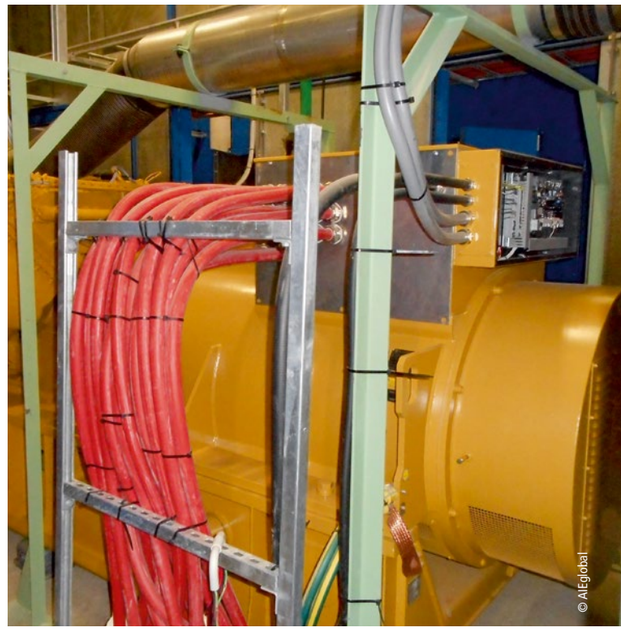
Implementing EtherCAT communications on each generator considerably reduced the wiring requirements and also the central control cabinet size to a single 800 mm tier.

The 8-MW trigeneration plant provides clean electricity for Melbourne Airport and provides backup power when the grid supply is lost.



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8 MW energy plant provides power, heat and cooling for Melbourne Airport

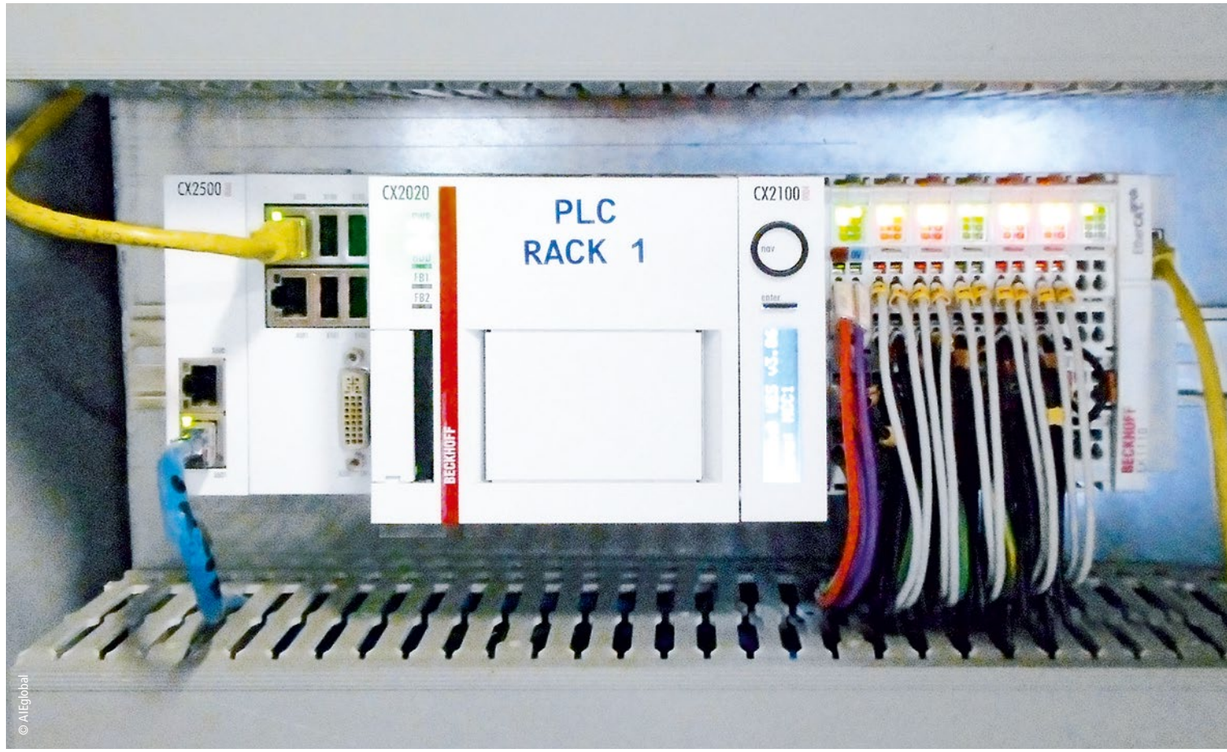
85% efficiency in trigeneration plant with fast process control

In thermal power plants, more than 50% of the energy is usually lost in the form of heat. The natural gas driven power plant at Melbourne Airport, on the other hand, uses the waste heat to generate heat and cooling, thus achieving a much higher energy yield. This is helped by Beckhoff Embedded PCs and EtherCAT I/Os enabling fast control and regulation of the plant, which automatically switches to emergency power supply in the event of a power failure.

Ideally, important facilities such as public authorities, hospitals or airports can at least partially maintain their operations when the grid supply is lost. To this end, the 8 MW power plant at Melbourne Airport is able to provide backup power. In normal operation, the plant covers part of the airport's energy needs with the grid-parallel supply of clean power. The contract to design and install an automation system for the complex power generation plant was awarded to engineering firm AIEglobal, based in Lake Wendoree, Australia. It specializes in automation and electrical engineering services for the manufacturing and building sectors. The project was implemented under the direction of lead electrical engineer Gary Brown.

The system comprises four sets of 2 MW natural gas driven generator sets. Heat exchangers on the engine exhausts provide hot water for general airport consumption and a source of heat for one of the two absorption chillers, which can generate cooling using the heat energy input. Further water heat exchangers on the engine jackets provide heat energy for the second chiller, which is used in times of higher cooling demands. As a result of trigeneration, also called combined cooling, heat and power generation, the overall plant has proven to be capable of transferring 85% of the gas energy input into usable energy for the airport.

The EtherCAT I/Os installed on each genset significantly reduced the amount of cabling required for connecting to the central control room.



Seven CX2020 Embedded PCs were selected to automate the four 2 MW generator sets, the heat exchangers and the overall plant control system, as well as the connection to the SCADA system.

Substantial cost savings

AIEglobal used seven CX2020 Embedded PCs for the automation of the generator sets (gensets), hot water reticulation and overall plant control including HV substation circuit breaker switching. For fail-safe plant operation, the controllers are configured in a ring topology network along with a primary and secondary redundant SCADA system, with all communications using OPC UA.

Heat exchangers on each generator's engine exhaust and engine jacket feed two separate heat exchanger systems, with high-temperature hot water being generated by the exhaust gas boilers. Distributed EtherCAT I/O are used on each generator set for system networking. Implementing EtherCAT communications on each generator considerably reduced the amount of electrical wiring required for connecting to the central control room. The central control cabinet size could also be reduced to a single 800 mm tier. The cost savings of this approach are substantial, and by using EtherCAT there is no performance degradation as is common with several other fieldbus types in extensive installations. The I/O scan time for the four gensets and central controller I/O is less than 1 ms, which enables optimum response times for fast PID control and control during emergency power conditions. To further ensure a high reliability level, EtherCAT redundancy was implemented on all remote I/O modules.

Short cable runs in the Modbus RTU network

The system comprises over thirty variable speed drives for pump and fan control controlled via ten Modbus RTU serial communication networks. Each Modbus network uses an EL6021 EtherCAT Terminal as Modbus master terminal connecting to an average of four VSDs (variable speed drives). This approach keeps the RS485 cable runs short, enables connections based on required functionality and consequently achieves the high performance necessary for PID control of important process variables by the relevant CX2020 controller.

Common protocols in process automation

The automation of the trigeneration project required the use of a broad range of communication protocols. The CX2020 controllers, along with the directly connected EtherCAT I/O proved very powerful in this respect. Listed below are the protocols used and their communication functions:

- OPC UA: CX2020 to CX2020 and SCADA system to CX2020
- Modbus/RTU: CX2020 to variable speed drives, circuit breakers and energy meters (electrical and gas)
- Modbus/TCP: CX2020 to gensets, Ethernet gateways to third-party genset controls, Modbus RTU gateways, circuit breakers, HV and LV systems and HMI units for the gensets
- M-Bus: CX2020 to gas energy meters (implemented in TwinCAT)
- DNP3: CX2020 to SCADA system

Productivity in IEC 61131-3 programming

By far the biggest expense in implementing modern control systems is the cost for software application. This includes the functional description in the initial design, coding, commissioning as well as ongoing support and fault diagnostics. Gary Brown explains: "Based on many decades of experience, I have found that the use of the IEC 61131-3 line-based graphical function blocks provide the highest level of useful information on the PLC programmer's screen. The TwinCAT Engineering platform, based on Visual Studio, provides a very fast and efficient method for program entry, debugging and ongoing support. Most conventional PLC systems use a spreadsheet type of presentation for programming, which is often slow and tedious to use and limits productivity."

He concludes: "I have noticed over recent years the software implementation of control system projects using high-level languages that were not designed for real-time control, doesn't always work as intended. IEC 61131-3 has evolved over many decades, and for very good reasons. So we were very glad that TwinCAT Engineering provided us with a user-friendly interface for IEC 61131-3 programming."

More information:
https://aieglobal.com.au
www.beckhoff.com/cx2020
www.beckhoff.com/twincat

Zinu Shop is an automated grocery store that offers a high level of customer convenience.

PC-based automation of a 24/7 automated convenience store

Control technology for round-the-clock food provision which offers true convenience

The fully automated Zinu Shop convenience store operates 24 hours a day, seven days a week, all year round. It was developed by Delfin, which has been supplying small communities in Poland with general goods for more than 20 years. The project launched in 2017, with the first full-scale, open tests taking place just four years later – including those on the underlying PC-based control technology from Beckhoff.

Zinu Shop is a fully automated store that offers a similar range of products to traditional convenience stores and, with the exception of holidays, remains open continuously throughout the year. The huge total capacity of 300 to 400 storage locations and exceptional reliability, both of which are key to consumer acceptance and trust, are essential for this concept. The store is set up in an insulated cuboid enclosure, which can also be used to store products to be refrigerated, maintain constant temperatures regardless of external weather conditions, and even house additional equipment such as advertising media, parcel lockers, and coffee machines. One of the key features of the project is the hybrid concept for packaging and dispensing products, which combines the conventional solutions of vending machines with the new possibilities afforded by 3D printing. This makes it possible for the store to offer virtually any type of product – from small and delicate items such as lollipops or packets of spices through to larger packs containing paper towels or potatoes, for example.

The desired products can be selected conveniently via the screen which was developed in-house.

Designed for maximum customer convenience

Perhaps the main highlight of Zinu Shop is the fact that purchases and deliveries can be made at the same time. This option is not available with conventional vending machines, as it would require the front to be opened, whereas the Zinu Shop can receive deliveries in the rear loading areas, which also protects against temperature exchange and contamination from the outside environment. What's more, two separate points of sale mean two customers can make their purchases at the same time.

Another special feature of Zinu Shop is its high capacity of approximately 350 sales units (SKUs). Every product offered here has a different type of packaging – from cans, bottles, and trays to bags, cartons, and cups – and each of these behaves in a different way that can be difficult to define in advance. To reduce the risk of unpredictable behavior, the products are described by several parameters – notably their dimensions, weight, resistance, and position. The corresponding algorithm takes these into account when creating the picking routes and pays attention to both the expiration date of the products and the optimization of the process time. This results in a high level of reliability with a complaint rate of less than 0.5‰ to date. The average output time of Zinu Shop is 10 seconds per product. Taking current customer demand into account, around 50,000 products are sold annually.

The Zinu Shop offers a complete product range from bread, vegetables, fruit and dairy products, cold cuts and meat to beverages, sweets, ready meals, cosmetics, and cleaning products.

PC- and EtherCAT-based control architecture

The objective of the project was to create an efficient, error-free unit. Therefore, the internal shelves needed to be designed to allow customers to access a range of different retail sizes. During the testing phase, the speed of the machine was significantly increased and the power supply was changed from three-phase to single-phase, enabling Zinu Shop to be connected to a conventional power outlet. According to Zinu experts Piotr Ostrowski, Krzysztof Marmol, and Artur Kowalski, the biggest challenge came from trying to supply the entire machine via a conventional power outlet while still maintaining the required acceleration and speed of the drives. Fortunately, the AX8000 modular servo drive from Beckhoff with the AX8620 dual-axis module and an additional mains choke (AX2090) for the AX8620 power supply module provided the ideal solution to this issue. Another essential feature involved developing a motion path optimization system to speed up the product release process while defining collision zones. This required a high-performance IPC with a sufficiently powerful processor and at least 4 GB of main memory. The Zinu developers found the perfect solution here in the form of the C6017 ultra-compact Industrial PC from Beckhoff, equipped with an Intel Atom® E3845 processor.

The control architecture is distributed across three separate control cabinets:

- The main cabinet contains the C6017, the main I/O level with EtherCAT Terminals and TwinSAFE Terminals, and the AX8000 servo drives with Safety over EtherCAT (for STO of the AM8023 servomotors) or the EL7211-9014 servomotor terminals (for STO of the AM8112 servo motors). An EL2911 EtherCAT Terminal with integrated TwinSAFE Logic serves as the safety controller. An EL6022 serial interface (RS485) with Modbus RTU protocol and an EL3204 analog input terminal for temperature measurement via Pt1000 sensors are used for communication with the HVAC system and the temperature and humidity sensors.
- The second control cabinet solely contains the EL2889 digital EtherCAT output terminals for controlling the automated racks.
- The third control cabinet was placed on a mechanical Cartesian system for controlling the X-axes.

The screen developed by Zinu experts includes an interface for a self-service checkout system, a warehouse system, a delivery management system, and a monitoring system. The TwinCAT 3 control is connected to the higher-level system that manages the control panels, shopping cart, product availability, product expiration date, and payment process. The PLC checks whether and how a product has been removed from the shelf before exchanging data with the host system to determine the next action. This may be either confirming product removal, locking the shelf, removing an identical product from the storage shelf, or ending the purchase. The project managers recognize the advantages afforded by TwinCAT, notably integration into Visual Studio, fast and automatic device detection via EtherCAT, and the transparency of device parameters such as the drive axes.

Conclusions

Piotr Ostrowski, Krzysztof Marmol, and Artur Kowalski draw a positive conclusion across the board: "By purchasing most of the devices directly from Beckhoff, we were able to save time and resources. Beckhoff delivered everything to us quickly and efficiently. The modularity of the control system is another major advantage for research and development work, as it greatly simplifies configuration as well as expansion in later project phases. Thanks to the compact drive technology – i.e., with the EL7221-9014 servomotor terminal and the EL7031 stepper motor terminal – we were able to build the entire X-axis and conveyor system in a small control cabinet. In addition, the EK1818 EtherCAT Coupler with integrated I/Os is a great alternative to the EL1008 and EL2008 EtherCAT Terminals when a large I/O count is not required." The company also benefited from One Cable Technology (OCT), which simplifies the connection of the drive technology, takes up less space, and does not require large cable runs. Furthermore, the powerful C6017 eliminates the need for a separate PC for the visualization application. Overall, the engineers are proud that the Zinu Shops have become a household name for the people of Krakow. The search for investors aims to promote this automated form of grocery shopping even more strongly in the future.

More information:
www.zinu.pl
www.beckhoff.com/food-industry

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Founded in Como in the early 1960s, Bennet now runs 73 stores and 45 shopping centers in Italy.

Bennet benefits in particular from lighting that is considerably more energy-efficient at its sites due to PC-based building automation.

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PC-based control and DALI-2 in building automation

Modern control technology for more flexible lighting and increased energy efficiency

Whether it's in a showroom, on a display, or on sales shelves, lighting makes all the difference. The Italian department store group Bennet SpA has extensive experience in this field and is gradually equipping its 73 stores and 45 shopping centers with modern building automation. Established system integrator INTEREL Trading uses PC-based control from Beckhoff and DALI-2 to meet the operator's requirements for flexible designs to create different lighting environments and high energy efficiency.

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According to INTEREL, implementing Beckhoff technology is a benchmark for reliability and deployment: TwinCAT 3 is used to control between 1,000 and 1,500 lights on average.

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The CX8180 Embedded PCs communicate with the Intermod substations via a serial protocol.

The retail business is known for continuously adding new items and restructuring the existing product range. As a result, the entire building automation system needs to be both flexible and modular. INTEREL's solutions fulfill this need with a robust, decentralized I/O distribution system with its own dedicated protocol called Intermod, which networks multiple control panels in different shopping centers. The control panels are used to record signals from devices, such as the uninterruptible power supplies or burglar alarms, and control a wide variety of actuators and loads.

Beckhoff's distributed intelligence plays a crucial role in INTEREL's open, cross-platform automation philosophy. The TwinCAT 3 software platform's versatile nature helps specialists to implement a wide variety of projects. What's more, the broad range of supported interfaces plays an equally important role, for example in expanding and modernizing the Intermod automation stations. This is where CX8180 Embedded PCs with an RS232/RS485 interface come into play. Due to their E-bus/K-bus interface connection, specialists have access to the complete range of Beckhoff I/Os, including the EL2xxx series EtherCAT Terminals for direct control of LEDs or communication interfaces – ranging from BACnet to DALI-2 and KNX – commonly used in building automation.

Flexibility goes hand in hand with openness

Featuring an ARM Cortex™-A9 CPU (800 MHz), the CX8180 Embedded PCs provide sufficient computing power for processing the logic section. In addition to the KL1408 (8-channel digital input) and KL2408 (8-channel digital output) Bus Terminals, the system integrator primarily uses the KL6821 1-channel communication interface. This DALI/DALI-2 master enables up to 64 DALI/DALI-2 slaves and 64 DALI-2 input devices to be controlled or read in. Using this configuration, each Bennet store is able to operate an average of 1,000 to 1,500 lights.

What's more, INTEREL's strategy uses standard protocols between the SCADA/HMI units and field controllers which allows them to maintain a unified management and application philosophy, without having to integrate special communication methods. Established drivers such as Modbus TCP/RTU, MQTT, or OPC UA are used to communicate with the control center, while TwinCAT ADS is used between the automation station and the control. The advantage of this configuration is that the tags generated by the control application are automatically adopted by the control center's communication driver.

The lighting controllers of the shopping center are distributed among several PLCs with master functions, which other PLCs are connected to as independently operating slaves. This structure and the multiprotocol-capable CX8180 Embedded PCs enable INTEREL to optimally meet the individual requirements of each site and its existing infrastructure. This is because the required communication protocol can be installed on the Embedded PCs as required.

Energy savings of up to 92.5%

The Bennet sites saw the greatest increase in efficiency by converting lighting control to the DALI-2 bus. Savings have been made in terms of cabling and control components during installation and beyond. Light and occupancy sensors enable corrections to be integrated into the controller logic and support efficient lighting of the retail premises. What's more, intelligent lighting controllers allow for more freedom – something Bennet has quickly adopted to create individual lighting environments tailored to the type of products presented, customer traffic, and the shop floor design.

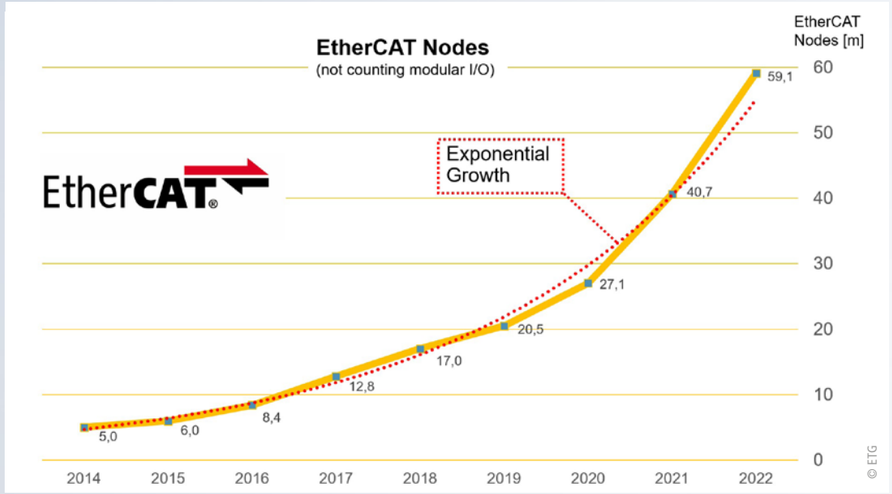
Dynamic dimming and LED lighting improve the lighting quality while also dramatically reducing electricity consumption and CO_2 emissions. In some warehouses, the switch from T8 fluorescent lamps to LED lamps alone has already resulted in energy savings of 43.5%. Combined with intelligent lighting automation, the savings were as high as 92.5%.

However, engineering and operation were not the only areas to benefit – maintenance and servicing saw positive effects as well. The control centers permanently monitor the status of each light spot, detecting the status (switched on or off) or type of fault (driver failure, lamp failure) in real time and alerting the right employees for the task at hand. This means that the maintenance technicians are already aware of the measures and spare parts needed on-site to carry out repair before the alarm is raised by the sales staff.

This open feature of PC-based control makes it possible to implement new automation philosophies as needed without having to change the installed hardware. Current technology trends focus on the interoperability between platforms and integration of secure communication protocols to protect against cyberattacks. The ability to handle IoT protocols such as MQTT and OPC UA and security standards such as TLS 1.2 means that both of the above requirements are already integrated into Beckhoff's TwinCAT 3 platform.

More information:

www.interel-trading.eu
www.bennet.com
www.beckhoff.com/building



In 2022, 18.4 million EtherCAT chips were sold. This brings the total number of EtherCAT nodes – not counting Bus Terminals – to 59.1 million. The growth is exponential.

EtherCAT: Almost 60 million nodes and exponential growth

For the first time since EtherCAT was introduced 20 years ago, the EtherCAT Technology Group (ETG) is publishing node figures. Excluding modular I/O devices, ETG counts 59.1 million nodes, with recent growth being particularly impressive. Since 2014, growth has been exponential, with 18.4 million nodes added in 2022 alone.

These figures include EtherCAT chips sold in a respective year, though this does not include the chips for Bus Terminals. Thus, a modular I/O station counts as a single node, even if it consists of many more EtherCAT Bus Terminals.

"The chip numbers are accurate figures, but there is a certain time lag: not every chip becomes an installed EtherCAT device in the same calendar year, " comments Martin Rostan, Executive Director of the ETG, on the counting method. Martin Rostan is also in charge of all EtherCAT licensing, on the behalf of Beckhoff Automation. EtherCAT, similar to CAN, requires only the chip manufacturer to license their hardware, the cost of which is included in the purchase of the EtherCAT chips. Beckhoff Automation finances the EtherCAT Technology Group with the chip license income, and membership in the world's largest fieldbus association is free of charge.

"Because we don't know the exact unit numbers of FPGA IP core-based implementations, we have held back on publishing node numbers so far," says Martin Rostan. "But the reported unit numbers of the current 12 EtherCAT chip vendors are now so large that any possible fuzziness in estimating FPGA numbers is no longer a factor: they enter the totals at less than 10%. We have also included multiprotocol chips in proportion to the market share of the protocols. Thus, on the one hand, the figures are based on very reliable sources, and on the other hand, they are determined very conservatively: there are probably significantly more EtherCAT devices."

Except for 2019, where EtherCAT unit numbers were also unable to escape the sideways trend of the automation market, growth has been exponential for several years. "Three years ago, we still believed in an upward outlier, but now the trend has solidified: the exponential growth continues," says Martin Rostan. "The Asian market is developing the fastest, especially China. But EtherCAT is also making better and better progress in North America. And in Europe, where EtherCAT has its origins, EtherCAT has been going strong for quite some time."

ETG member 7,000: Image Engineering

The membership growth of the EtherCAT Technology Group (ETG) continues during the EtherCAT anniversary year: recently, ETG surpassed the 7,000 member mark. With more than 400 new members every year since 2014, the ETG is not only the largest fieldbus organization by far, but also the fastest growing.

Member 7,000 is Image Engineering. Based in Baltimore, USA, Image Engineering designs, builds and integrates special effects systems for the world of live entertainment. They provide laser, flame, atmospheric, lighting, and pyrotechnic effects to clients ranging from NFL teams to artists such as Metallica, Lady Gaga, and BTS to create unforgettable visual experiences.

Shep Dick, Development Engineer at Image Engineering: "At Image Engineering, we use EtherCAT to facilitate fast, reliable control of our special effects systems in permanent installation settings. EtherCAT allows us to implement remote configuration of our equipment and real-time feedback which gives our control systems a huge advantage compared to traditional entertainment industry control protocols. In addition, Safety over EtherCAT enables us to incorporate the most important parts of our special effects units, the safety systems, into the same cabling and software we use for network control. The flexible topologies and interoperability of EtherCAT-based technologies give us the adaptability and reliability we need to efficiently integrate our special effects systems."

"EtherCAT has a very strong position in the entertainment industry, especially in the United States," explains Martin Rostan, Executive Director of the ETG. "If you go to a show in Las Vegas, a big pop or rock concert, a festival or a theme park, you are very likely to encounter stage equipment and special effects systems controlled by EtherCAT."

About two thirds of ETG member companies are manufacturers of EtherCAT devices, the rest consists of users and universities. According to the statutes, individuals are only accepted as honorary members. When looking at the worldwide distribution of ETG member companies, the high distribution in Asia is particularly striking. More than 2,500 members come from China, Taiwan, Japan or and Korea. Overall, more than 40% of the members are from Asia. These figures show that EtherCAT technology has fully arrived in Asia. The number of countries with ETG members also continues to increase: recently ETG welcomed companies from Cyprus, Saudi Arabia and Oman, so ETG now has members from 72 countries. Another milestone in ETG's success story: last year, membership in Europe exceeded 3,000.

Image Engineering's special effects development team is pleased to receive the certificate of recognition from the EtherCAT Technology Group.

The membership development reflects the spread and worldwide success of EtherCAT technology. It is largely due to the quality of the EtherCAT technology itself, but also to the comprehensive support and information offered by the ETG, to which members have unlimited access.

More information:
www.ethercat.org

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