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PCcontrol

The New Automation Technology Magazine

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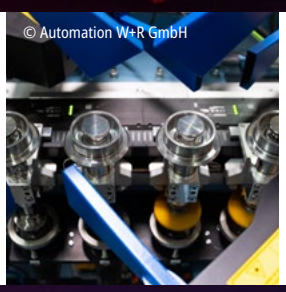

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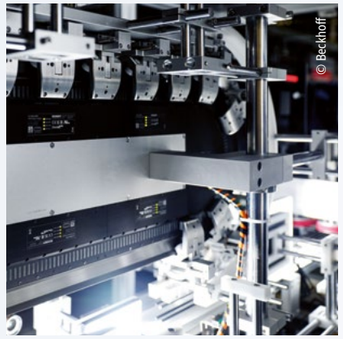

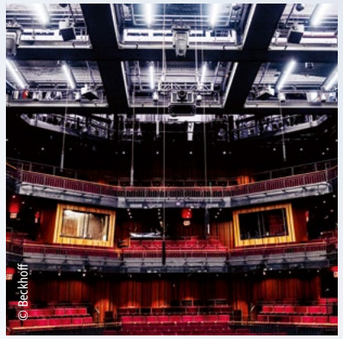

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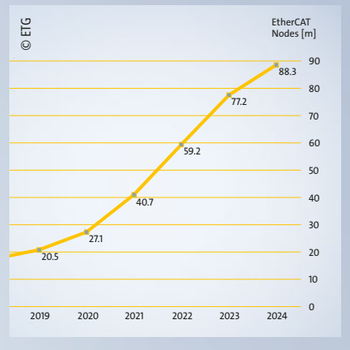

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The New Automation Technology Magazine

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Beckhoff Automation records €1.17 billion in sales worldwide

Beckhoff Automation recorded sales of €1.17 billion in the 2024 financial year.
This shows a sharp decline of 33% compared to the 2023 annual result of €1.75 billion.

However, this decline in sales had been expected due to the huge boom trend observed over previous years. Cumulative growth of over 80% was achieved in the three years, from 2021 to 2023. This exaggerated trend was followed by a significant market correction in 2024. The economic bubble that had developed burst, as predicted. “This is my sixth crisis in 45 years of business and almost all of them have followed a very similar pattern,” explains Hans Beckhoff, owner and managing director. “You can be sure that there will be a recovery, but you have to tackle the crisis head-on and see it as an opportunity for innovation and optimization!” The company believes that it has already bottomed out. The Verl-based, family-run technology company will keep focusing on continuous innovation and high-tech engineering in order to lay the foundation for future growth.

Research and development

Beckhoff employs around 5,300 people worldwide, including around 2,000 engineers, who fortify the company with their technological expertise and thus form the basis of its innovative power.

Numerous new product launches are planned in all areas of software and PC-based control technology. “We are intent on further expanding our position as a global automation technology company. “We remain dedicated to our mission of evolving our portfolio with strong developments every year and introducing revolutionary new technology every five to seven years,” explains Hans Beckhoff. To this end, the company consistently invests €80 million a year in research and development.

Strengthening its global presence

Beckhoff is present in more than 75 countries via its subsidiaries, representative offices, and distributors. This global sales network opens up numerous synergies and advantages, particularly in applying new technology. Through close cooperation with users and a deep understanding of their needs, we can drive forward cutting-edge technology together. The company is making targeted investments in its local market presence and strengthening its global position in growth markets and sustainable future markets, such as the electrical systems for energy supply sector. Beckhoff supplies intelligent automation and measurement technology for energy distribution, energy transfer, and energy storage, enabling all energy flows to be recorded and energy systems to be controlled.

Positive market signals

The globally uncertain political situation also presents the company with challenges for the current year. However, incoming orders are currently showing signs of recovery. “Our customers’ warehouses are slowly emptying and we expect them to have used up their extra stocks by the first quarter of 2025, at the latest,” predicts Hans Beckhoff.

Outlook for long-term development

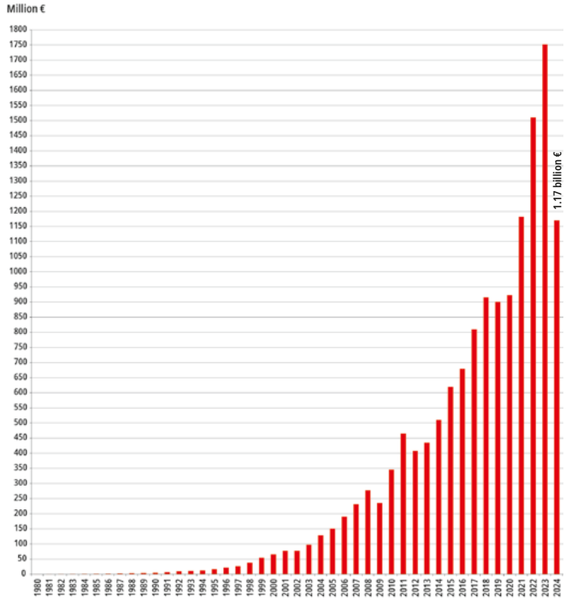
Beckhoff has been a driving force in the global automation industry for 45 years. “Automation is an important basic technology in many areas of life and society – we benefit from it, but we also make a significant contribution to it,” explains Hans Beckhoff. The technological milestones that Beckhoff has shaped the market with include the PC-based control technology concept, the bus terminal, which is now an indispensable building block for automation solutions, the ultra-fast EtherCAT communication system (which has been published as an international standard), the innovative XTS and XPlanar product transport systems, and the MX-System as a pluggable system solution for control cabinet-free automation. Overall, Hans Beckhoff is positive about the future, saying: “We love automation and we keep having good ideas for pushing its performance limits or making it simpler and cheaper. This puts us in a great position to compete globally!”

Product highlights at Hannover Messe

Beckhoff has presented exciting innovations in all of its product areas at Hannover Messe 2025. Highlights include the new multi-touch panels and next-generation industrial PCs. The new generation of control panels offers improved user-friendliness for intuitive and safe operation. The advanced, cost-optimized series further expand the diversity of Beckhoff’s portfolio and constitute a future-proof panel platform as they integrate the latest standards. Beckhoff is also focusing on new energy measurement solutions for precise measurement and analysis of energy consumption. In the field of software, new machine learning solutions and TwinCAT PLC++ – a new PLC generation in the TwinCAT system – are now available.

Hans Beckhoff, founder and managing owner of Beckhoff Automation:

> “Our innovative power and commitment to the highest quality will continue to ensure our success in the future.”



Since 2000, Beckhoff Automation has achieved an average annual growth rate of around 13 percent.

More information:
www.beckhoff.com/company

Beckhoff at automatica 2025

The leading exhibition for intelligent automation and robotics, automatica, will open its doors in Munich from June 24 to 27, 2025. As a technology leader and pioneer of PC-based control technology, Beckhoff will be demonstrating how PC-based control can be used to implement future-oriented solutions for smart automation, digitalization, and artificial intelligence in hall B6, booth 310. A comprehensive range of high-performance products is available to increase the efficiency of assembly and handling processes. With functions such as TwinCAT Machine Learning and TwinCAT CoAgent, the TwinCAT 3 automation software simplifies the integration of artificial intelligence into automation solutions and connectivity for IT infrastructures via IoT interfaces. Visitors to the Beckhoff exhibition booth will be able to experience the entire range of PC-based control first hand, from the modular ATRO industrial robot platform to the comprehensive hardware and software portfolio for machine vision, as well as the Next multi-touch panel generation and the AX1000 and AF1000 economy drive systems, which combine a high level of functionality with economic efficiency.

More information:
www.beckhoff.com/automatica

ATRO is a modular industrial robot platform that is fully integrated into TwinCAT and can be used to assemble optimal robot structures for different applications on an individual and flexible basis.

TwinCAT CoAgent combines generative AI models with AI agents which have been designed to accelerate PLC programming, I/O configuration, HMI design, and knowledge management, and to make them more efficient.

With Beckhoff Vision, real-time image processing can be easily integrated into both new and existing control environments, as well as optimally synchronized with all machine and plant processes.

The new economy drive systems from Beckhoff – AX1000 servo drives and AF1000 variable frequency drives – combine a high level of functionality with economic efficiency.

Beckhoff offers two intelligent handling systems that set new standards: XTS (shown here) for maximum freedom in one dimension and high dynamics, and XPlanar for contactless product handling with up to six degrees of freedom.

The Next multi-touch panel series is advanced and cost-optimized, and further expands the diversity of the broad Beckhoff portfolio. As usual, all devices offer user-friendly operation and a high-quality look and feel.

AI-assisted engineering with TwinCAT CoAgent

Evolving from chatbot to intelligent agent

Industrial automation is evolving rapidly, with new AI forms of technology acting as key drivers of innovation. Beckhoff recognized this early on and developed TwinCAT CoAgent, an AI-based engineering assistant as an advanced development based on TwinCAT Chat. This functionality enables significantly greater speed and efficiency in industrial development processes. Its very name illustrates its role as an active, intelligent companion that helps companies achieve their optimization goals.

TwinCAT CoAgent offers comprehensive, intelligent support in engineering. As a digital assistant, it uses generative AI models as a basis for custom-designed AI agents to accelerate development processes in PLC programming, I/O configuration, HMI design, and knowledge management, helping users achieve better results in a faster and simpler process. The technological foundation is built on the most advanced generative AI models, which Beckhoff has optimized and integrated to meet the specific requirements of industrial automation. With their exceptional ability to quickly and accurately analyze and process natural language, images as well as complex technical relationships, these AI models deliver high-quality solution proposals that significantly accelerate the engineering process.

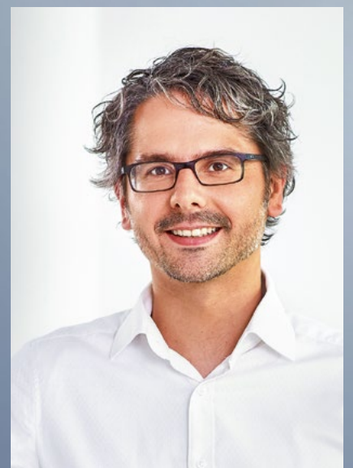
The relevant AI agents work independently to suggest concrete actions and actively assist engineers in developing control systems. In doing so, they specifically access the Beckhoff Information System to incorporate industry- and product-specific knowledge into the solutions they propose.

Placing people at the heart of automation

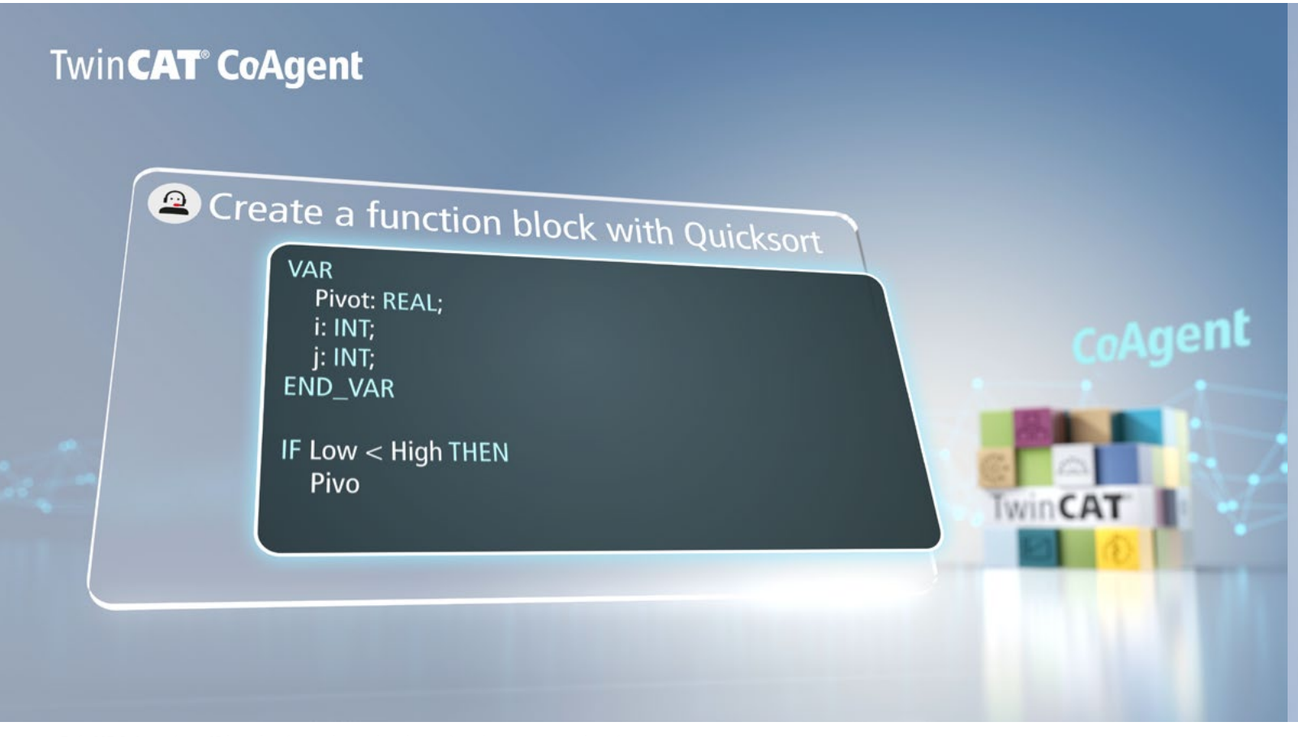
TwinCAT CoAgent was developed to effectively support and simplify the demanding work of engineers and developers. Final decisions and control over the AI-generated output always remain with the specialists involved, who can review, confirm, and approve all results for execution. The AI technology handles routine tasks, suggests efficient solutions, and frees up time for more complex activities.

Dr. Fabian Bause,
Product Manager TwinCAT, Beckhoff Automation:

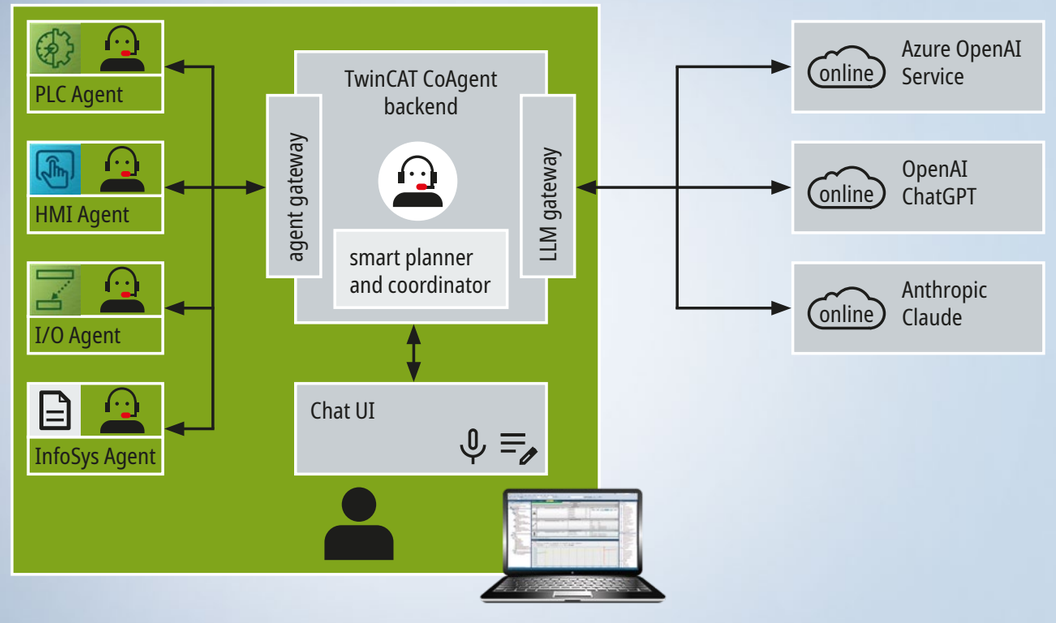
> **“The aim of TwinCAT CoAgent is to increase a programmer’s productivity – not least as one of the key ways to combat the skills shortage.”**



TwinCAT CoAgent from Beckhoff provides support for a wide range of tasks in control software engineering, from precise code suggestions and smart code optimization to automatic creation of comprehensive documentation.



TwinCAT CoAgent is an AI-based assistant that makes the engineering process much easier.



With access to specialized AI agents, the TwinCAT CoAgent architecture provides streamlined support for a wide area of engineering tasks.

Features of TwinCAT 3 CoAgent

TwinCAT 3 CoAgent (TE1700) is the intelligent AI assistant that provides efficient support for PLC development, I/O configuration, and human-machine interface creation. Requirements can be specified in normal language and TwinCAT CoAgent suggests suitable code and configurations, taking existing project structures into account. The flexible choice of different operating modes enables tailored support depending on the task at hand. In addition, TwinCAT CoAgent offers direct access to the documentation in the Beckhoff Information System and provides context-related recommendations for accelerated, high-quality project implementation – with the following features:

- PLC code suggestions based on natural language and project context
- AI-supported I/O configuration suggestions via chat
- human-machine interface layouts and design proposals from sketches
- direct access to the Beckhoff Information System for context-related recommendations
- flexible mode selection for custom support based on the task at hand

AI technologies deliver sustainable benefits in software development, with clear competitive advantages derived from shorter development cycles, higher-quality programming results, and increased productivity. One of the ways TwinCAT CoAgent does this is by suggesting and generating automated unit tests for PLC code. This strategy significantly improves software quality and helps identify errors early on in the development process.

The AI agents within TwinCAT CoAgent

To implement the functionalities described above, TwinCAT CoAgent includes several specialized AI agents, each with their own logic. With their help, different areas of automation can be supported and optimized as required. Initially, AI agents will be available for the following functions:

- Simplified PLC programming: Creating PLC code becomes faster and more intuitive. Users can define individual requirements conveniently in natural language, after which TwinCAT CoAgent creates suitable Structured Text code. Libraries and existing project structures are automatically taken into account, ensuring that all suggestions are relevant and context-specific. Integrated code search functions and simple referencing of libraries further simplify the development process and help improve code quality.
- Streamlined I/O module configuration: Configuring I/O topologies and communication interfaces becomes much easier. Hardware modules can be created, named, and configured via the chat function. The AI provides detailed suggestions for I/O configuration, helping reduce errors and accelerate commissioning. However, users retain full control over decisions and fine-tuning at all times, ensuring both flexibility and customization.
- More innovative creation of HMI controls: TwinCAT CoAgent creates advanced user interfaces with little effort. It uses simple sketches to automatically create complete HMI screens, identify controls, flexibly adapt design themes, and suggest suitable codes for server extensions. Automatically linking PLC variables reduces the time required during the creation process. Whether the user is building comprehensive layouts or making quick adjustments, every step can be conveniently controlled via chat. The AI handles all the groundwork while leaving the user in full control to verify results and make individual adjustments as needed.
- More direct use of Beckhoff Information System: TwinCAT CoAgent has direct access to documentation in the Beckhoff Information System, enabling the AI to search it as required. This allows users to receive customized suggestions and recommendations in line with their current requirements and project context. As a result, information retrieval is streamlined, making everyday tasks much easier.

Jannis Doppmeier,
Product Manager TwinCAT,
Beckhoff Automation:

> “With TwinCAT CoAgent, Beckhoff is making an important contribution to the integration of LLMs into industrial applications.”

More information:
www.beckhoff.com/twincat-coagent

Next multi-touch panel generation: advanced, cost-optimized multi-touch series for efficient operating concepts

Following over 25 years of successful in-house panel production and 12 years of expertise in multi-touch design, Beckhoff is bringing out a new smart panel design: the Next multi-touch panel generation. With its revised electronics concept and standardized connection solution for electronics and mechanics, this device platform maintains its future-proof technological lead and builds on it. The consistently high quality of Beckhoff Control Panels and Panel PCs is thus combined with an optimized price/performance ratio.

The Next multi-touch panel series is advanced and cost-optimized, and further expands the diversity of Beckhoff's broad portfolio. As usual, this generation of control panels and panel PCs offers user-friendly operation thanks to advanced multi-touch technology, a high-quality design, and a wide choice of formats and options. These devices, which are manufactured entirely in Germany, are characterized by a smart, sleek electronics and device design, EtherCAT communication (FSoE) at the push of a button, and high-quality industrial-grade displays with multi-finger touch function.

The Next multi-touch panels with IP20 or IP65 protection ratings are high-quality and will be available long-term. They can be provided in display diagonals from 7 to 24 inches in various formats, as installation and support arm variants, and the panel PC version is available in a wide range of CPU performance classes. This includes a variety of accessories and mechanical extensions. The latest standards have been integrated to provide a future-proof panel platform that makes it easy to optimize costs without changing the system design and also provides tried-and-tested touch technology with anti-glare and anti-ghosting effects.

The introduction of the Next multi-touch panel generation starts with the CP49xx built-in Control Panel with an IP20 protection rating and the CP59xx Control Panel with an IP65 protection rating for mounting arm installation. The latter are intended for direct mounting on a VESA monitor mount by the customer and can optionally be fitted on a mounting arm with a 48 mm round tube.

More information:
www.beckhoff.com/next-panel-generation
www.beckhoff.com/cp49xx
www.beckhoff.com/cp59xx

TwinCAT PLC++ featuring advanced chatbot functionality

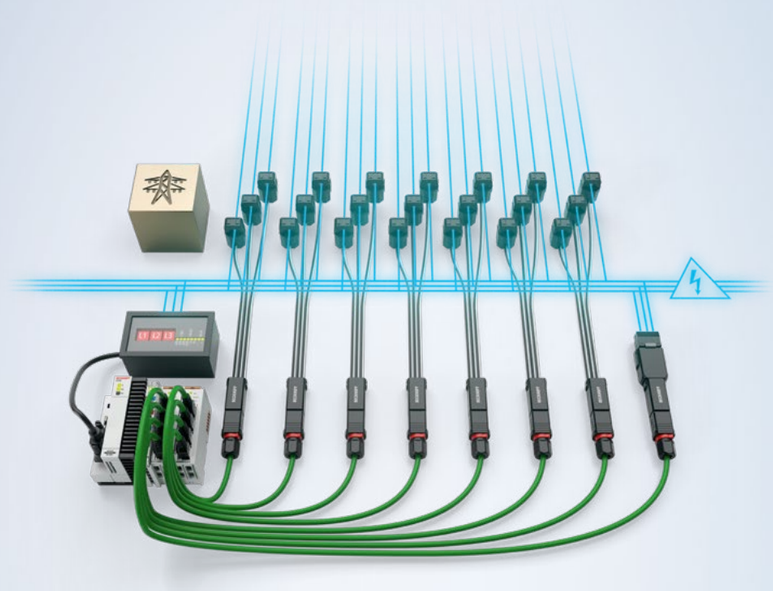
Beckhoff is taking automation technology to the next level with TwinCAT PLC++. Both engineering and runtime are noticeably faster, without compromising on TwinCAT's signature strengths of seamless integration, compatibility, and openness. Leveraging state-of-the-art compiler technology and a new system structure, the advanced chatbot function TwinCAT CoAgent is now fully embedded as an efficient programming assistant.

In TwinCAT PLC++ runtime, the same control code runs up to 1.5 times faster compared to the previous TwinCAT PLC version. A major highlight is the new TwinCAT PLC++ compiler, which further optimizes control code execution time, delivering an overall performance boost of up to 3 times. The new TwinCAT PLC++ architecture also supports even deeper integration of TwinCAT functions. This allows TwinCAT CoAgent, the evolution of TwinCAT Chat, to be efficiently integrated as a programming assistant that supports both textual and graphical code generation.

TwinCAT CoAgent takes control engineering to the next level by seamlessly integrating cutting-edge technology directly into TwinCAT projects. The agent provides effective support for a wide range of tasks, from precise code suggestions and smart code optimization to automatic creation of comprehensive documentation. The content generated by TwinCAT CoAgent can be easily incorporated into established engineering projects once it has been checked by a user. TwinCAT CoAgent also provides direct access to Beckhoff's comprehensive documentation and supports the development of user-friendly HMI controls. This means that user interfaces can be designed and configured faster and more intuitively than ever before. The option is even available to create I/O topologies effortlessly via chat, including renaming terminals and configuring new I/O modules. In the future, it will be possible to adjust parameters individually, while an intelligent assistant will provide support with the optimum configuration. This not only speeds up the I/O configuration, but also makes it particularly flexible for specific requirements. TwinCAT CoAgent's comprehensive functionality positions it as a personal digital assistant with the potential to revolutionize engineering workflows.

More information:
www.beckhoff.com/twincat-plcpp
www.beckhoff.com/twincat-coagent

A secure energy supply with PC-based control



PC- and EtherCAT-based control technology from Beckhoff opens up new possibilities for greater security and decarbonization in the energy supply. These forms of technology allow energy flows to be reliably controlled and monitored, increasingly heterogeneous power grids to be used more efficiently, and the required applications to be simplified with an IEC 60255-118-1-compliant modular phasor measurement unit and innovative connection technology for energy measuring points.

Beckhoff offers a cost-optimized solution for recording power distribution energy flows with its easy-to-retrofit power sensors and the new EL3475 EtherCAT measurement terminal. Analog measuring devices can thus easily be replaced by split-core current and voltage transformers from the SCTxxxx series or the new SVL1xxx and SCL6xxx series and a seamless measuring chain can be created to monitor, analyze, and optimize processes. Power measurement on all outputs provides greater transparency for distribution grid operators and effective load management for companies. The energy revolution gives rise to many requirements: a stable power supply despite bidirectional energy flows with distributed power generation, and they can be met with Beckhoff products. The EL3475 EtherCAT Terminal is a 12-channel analog input module that provides precise and detailed measurements in supply grids with 24-bit resolution and an input voltage of 333 mV. With four RJ45 connections which can each connect three current or voltage transformers, it is versatile and offers the optimal solution for demanding applications while being easy to install.

Beckhoff also has a new synchronization terminal with distributed clock function via a direct connection to a GNSS (Global Navigation Satellite System); the EL6689 EtherCAT Terminal. An antenna for this can be connected to the terminal directly via an antenna (SMA) connector. All active GNSSs are supported: NAVSTAR GPS, GLONASS, Galileo, Beidou. This means that separate systems can be kept synchronized worldwide at as low as 100 ns, which offers many advantages, e.g. for distributed measuring systems for monitoring supply networks.

The TwinCAT software also offers numerous functions for the field of energy measurement. New additions:

- TwinCAT 3 Power Collector (TF8330) provides software modules for programming applications for power measurement and thus a standardized interface for the EL34xx EtherCAT Terminals. Parameters such as converter ratio and frequency range can be configured automatically and interfaces for advanced transmission protocols such as MQTT, HTTP REST, and OPC UA are already implemented. Telecontrol protocols such as IEC 61850 and IEC 60870 are also available.
- TwinCAT 3 Power Technologies (TF8350) provides software modules for programming in-depth diagnostics for electrical power measurement based on the EL37x3. In combination with the EL3783 and EL6689 EtherCAT Terminals, the TF8350 can be used to implement a phasor measurement unit (PMU) that enables time-synchronous and precise phase measurement in distribution and supply grids in accordance with IEC 60255-118-1.
- TwinCAT 3 Power Control (TF8360) provides software modules for implementing controllers for power plants. This is required for all power-generating systems in order to meet the grid requirements, in accordance with the standards of the individual European countries, e.g. VDE-AR-N 4110 and VDE-AR-N 4120 in Germany.

The TwinCAT 3 IEC 60870-5-10x (TF6500) connectivity function enables communication from the PLC in accordance with IEC standard 60870-5-10x, whereby both server and client operation are possible. With TwinCAT 3 IEC 61850/IEC 61400-25 (TF6510), a convenient graphical user interface is now available for protection and control technology communication in electrical substations.

More information:
www.beckhoff.com/electrical-energy-systems

New EtherCAT Box modules for distributed integration of intrinsically safe signals

Beckhoff provides a compact acquisition solution for intrinsically safe signals up to zone 0/20 with the IP67-protected EtherCAT Box modules of the EPX series. Three additional devices have been added to the existing I/O range.

Using EPX modules with IP67-rated housing units offers numerous advantages for applications with explosion protection requirements, both in processing plants and in traditional mechanical engineering. The fully encapsulated modules in an industrial housing unit can be installed directly and individually in machines and systems, even in wet, dirty, or dusty conditions, and enable connection of up to eight field devices. This facilitates reliable data acquisition in hazardous areas where control cabinets and terminal boxes cannot – and should not – be installed. Furthermore, safety barriers are no longer required, which not only saves on space but also reduces costs. Pre-assembled cables are connected to the EtherCAT Box module, thus cutting down on installation and commissioning time and preventing wiring errors caused by incorrect contact assignments. What's more, the distributed signal acquisition concept also simplifies the modularity of plants. The new additions to the portfolio are:

- The EPX2004-0022 EtherCAT Box module (see picture), which provides an output voltage of 24 V DC and a maximum output current of 50 mA per channel as a 4-channel digital output. The total current is 200 mA. The signal state of each individual channel is indicated by an LED.
- The EPX3204-0022 EtherCAT Box module, which can operate temperature sensors (Pt100) in 2-, 3- and 4-wire technology as a 4-channel analog input. Linearization is performed across the entire, freely selectable temperature range. The terminal is set by default for Pt100 sensors in 4-wire technology. The EPX3204-0022 uses LEDs to indicate signal status and sensor faults (e.g. wire break).
- the EPX3314-0022 EtherCAT Box module, which can operate thermocouples in 2-wire technology as a 4-channel analog input. Linearization is performed across the entire, freely selectable temperature range. Wire break is indicated by error LEDs. Cold junction compensation is performed by internal temperature measurement. Voltage measurement in the mV range is also possible.

More information:
www.beckhoff.com/epx

EtherCAT plug-in modules and measurement terminals in test system for batteries and power electronics

Modular, compact, and flexible for minimized development and testing times

Baumann GmbH, Amberg, develops turnkey automation systems for the automotive supply industry and electronics, pharmaceutical, and medical technology industries, as well as other sectors. These systems range from robot cells to fully automated production lines. The product range includes the MTS (Modular Test System), a flexible way to implement test applications for cell, module and battery test benches as well as for power electronics and more. PC-based control from Beckhoff provides the basis for compact design and system openness, in particular with the EtherCAT plug-in modules from the EJ series and the EtherCAT measurement terminals from the ELM series.

The project participants in front of the modular MTS test system (from left to right): Uwe Kraus, Head of the Beckhoff Nuremberg sales office, and Baumann experts Jörg Seybold, Head of Standard Solutions and Products, Heiko Hochmuth, Head of Development for Measurement and Test Technology, and Martin Lehmeier, Team Leader for Software Test Systems

Baumann has been relying on PC-based and EtherCAT-based control technology from Beckhoff for its test systems since 2005 already. According to Jörg Seybold, Head of Standard Solutions and Products at Baumann, the decisive factor in this choice was not simply the performance, but the system's variety of interfaces and openness – useful both for integrating a wide range of measuring devices and for communicating with higher-level systems and the Internet.

Specific requirements for automotive test systems

Electromobility is currently not only fundamentally changing production technology in the automotive sector, but also the required testing technology. Jörg Seybold explains: "Whereas in the past, it took several years to develop a new product in the automotive industry, we are now seeing continuous development in battery technology with product changes occurring every quarter. That means we need to develop a test system for customers that is modular, scalable, and easy to adapt to new requirements. The result is the MTS, which provides a complete test system within a compact control cabinet, meaning it can be used to replace conventional systems with up to five control cabinets."

In addition to the small footprint, the MTS benefits the user through significant time savings: For new applications, the test system no longer has to be converted over a period of several weeks. The modular design with 19-inch slide-in units and plug-and-play functionality enables a quick and flexible response to changes – often by the end users themselves and without Baumann's involvement. "The measurement scope is immense, with amperes ranging from micro-amperes up to several 100 A. The same applies to the variety of voltages, from 4.2 V cell voltage measurement to testing in the 1,000 V range, e.g., for complete truck battery storage systems," explains Jörg Seybold.

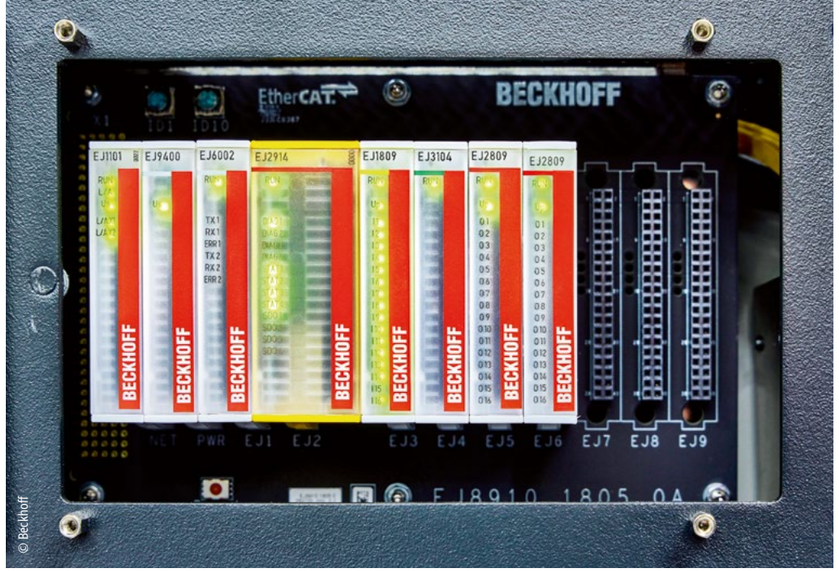
Heiko Hochmuth,
Head of Development for Measurement and Test Technology at Baumann

> "Mounted on the customer-specific signal distribution board, the EJ modules can be used to create a very compact I/O level. Secondly, they eliminate the need for complex wiring."

This is implemented in the MTS with the two basic modules CCU (Control & Communication Unit) and PDU (Power Distribution Unit), as well as with the MDU (Measurement Distribution Unit), HVDU (High Voltage Distribution Unit), and HCDU (High Current Distribution Unit) components, which can be selected as required. Added to this is a test framework that users can easily adapt to their individual test recipes and sequences and operate conveniently via the CP2924 multi-touch built-in Control Panel from Beckhoff. The framework offers graphical diagnostic and analytic functions, standardized data interfaces to MES systems, process monitoring, and more.

Control technology with compact, powerful I/Os

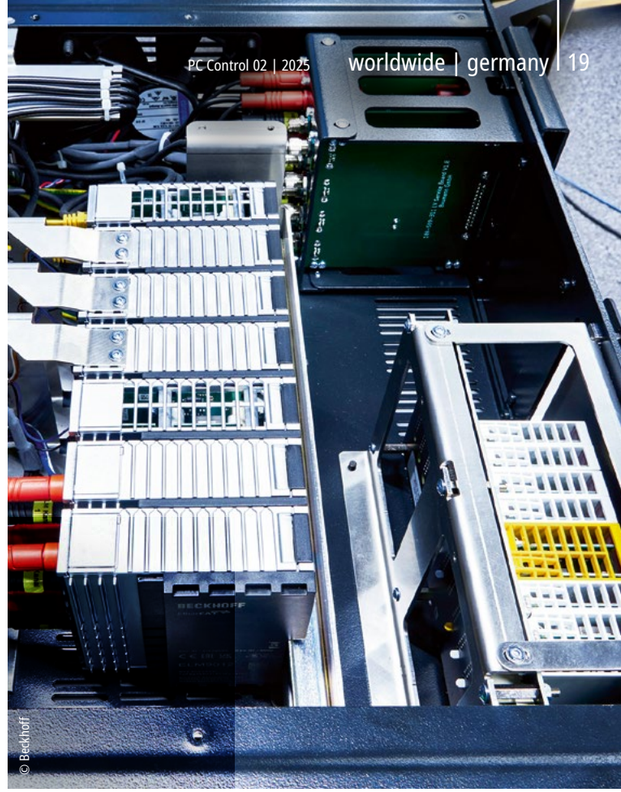
The complete MTS control technology and the Baumann test framework run on a C6032 ultra-compact Industrial PC with TwinCAT 3 software. Heiko Hochmuth, Head of Development for Measurement and Test Technology at Baumann, explains: "The main advantages of the C6032 are the small



The EtherCAT modules from the EJ series – mounted on the customer-specific signal distribution board – enable a highly compact I/O level.

The MTS modules MDU, HVDU (with the EJ modules visible without the cover plate), and HCDU

With the CP2924 multi-touch Control Panel, even complex diagrams and test sequences can be displayed clearly on the 24-inch display, also allowing tests to be carried out manually if required.



In addition to the EJ modules (right) and EtherCAT Terminals from the EL series, the MTS also uses the high-precision EtherCAT measurement terminals from the ELM series (left); shown here in the MDU module.

installation space required and the flexible mounting options. With the MTS, it often comes down to the millimeter." And his colleague Martin Lehmeier, Team Leader for Software Test Systems, adds: "With regard to the software, TwinCAT 3 gives us a number of benefits, including the powerful debugging and the wide range of functions. Also the very diverse programming options, including in high-level language, because without this, our test framework based on it would not have been possible."

The use of EtherCAT plug-in modules from the EJ series offers Baumann significant advantages, as Heiko Hochmuth explains: "Mounted on the customer-specific signal distribution board, the EJ modules can be used to create a very compact I/O level. Secondly, they eliminate the need for complex wiring, which means that wiring errors and the associated troubleshooting are avoided and costs are reduced. For all MTS modules, we use the same signal distribution board, which is appropriately equipped for each use case. This simplifies warehousing while maintaining the necessary flexibility." Furthermore, in contrast to a solution with EtherCAT Terminals, he adds that cable channels are no longer required, which contributes to the compact design of the overall system. According to Hochmuth, the flexibility of PC-based control is demonstrated not least by the variety of EtherCAT plug-in modules used in the MTS, such as:

- EJ1101-0022 EtherCAT Coupler,
- EJ1809 16-channel digital input modules,
- EJ1859 combination modules with eight digital inputs and eight digital outputs,
- EJ2809 16-channel digital output modules,
- EJ3104 (4-channel, ±10 V) and EJ3202 (2-channel, RTD) analog input modules,
- EJ1904 (4-channel digital input) and EJ2914 (4-channel digital output) TwinSAFE modules and
- EJ6002 2-channel communication interfaces (RS232/RS422/RS485).

According to Heiko Hochmuth, another major advantage of the wide Beckhoff I/O portfolio is the highly precise measurement terminals from the ELM series: "With the MTS, we primarily use the ELM voltage measurement terminals, which can be chosen to suit the respective application – with galvanic isolation, up to four analog inputs, and different voltage ranges up to ±1,200 V. The wide range of functions and measurement variables of the ELM terminals help us a lot. Added to this is the high measurement precision, including high temperature stability, as well as flexible data pre-processing via selectable additional parameters. And this high level of functionality is housed in a highly compact form factor and can replace previously separate measurement devices to save space and costs, which certainly makes the measurement technician's heart beat faster." Connected via the EKM1101 EtherCAT Coupler with ID switch and diagnostics, the following measurement terminals are used with the MTS, among others:

- ELM3002-0000 (2-channel) for flexible voltage measurement from 20 mV to 30 V in eleven measuring ranges,
- ELM3002-0205 (2-channel) for high-voltage measurement on batteries and generators in the measurement ranges ±60, 360, 600, and 1,200 V,
- ELM3004-0000 (4-channel) for flexible voltage measurement from 20 mV to 30 V in eleven measuring ranges and
- ELM3102-0100 (2-channel) for voltage and current measurement in the measuring ranges +60 V to -20 mV and ±20 mA with a fast sampling rate of 20 ksps per channel.

This compact I/O level is supplemented as required by various EtherCAT Terminals from the EL series. In particular, this includes the EL3443 3-channel analog input terminal for power measurement (max. 480 V AC/DC, 1 A). It can be used to measure the values of current and voltage, as well as active, reactive, and apparent power or energy, together with cos φ, frequency, THD, and harmonics (up to the 40th harmonic). With the MTS, the EL3443 enables detailed monitoring of the grid feed-in.

More information:
www.baumann-automation.com
www.beckhoff.com/automotive
www.beckhoff.com/ej
www.beckhoff.com/elm

XTS in quality assurance for complex and safety-relevant automotive components

Fully automated integration platform for objective and repeatable testing

The safety and quality requirements for components are growing continuously, particularly in the automotive industry. To meet these requirements, it is essential to implement clear, objective, traceable, and efficient quality inspection processes for these components. As a solution, Automation W+R has developed an integration platform that, as they say, takes production processes and product quality to the next level using high-speed 3D inspection. The core element in this is the XTS linear transport system from Beckhoff, which connects the three basic modules for supply, inspection, and sorting.

Based in Munich, Automation W+R GmbH is a leading system integrator for turnkey inline testing systems with a focus on the automotive industry and battery production. The company is also active in rail transportation, the steel industry, fuel cell production, and the aerospace sector. A special feature of the systems for weld seam inspection and surface testing is the combination of robotics, inspection, and measurement technology. Managing Director Paul Gruber explains the strict requirements in the automotive industry: "Safety through automated quality inspection is of the utmost relevance in this industry. After all, the safety of everyone involved – from the manufacturing company to the user of the vehicle – is based on the quality of the individual components, and therefore their quality inspection." COO Markus Schmid adds: "In addition to high quality requirements and unequivocal traceability, the large quantities and tight production spaces pose particular challenges."

Advantages through integrated and PC-based quality assurance

End-of-line control requires batches to be delivered just-in-time. This means that 100% of the components produced must undergo an outgoing goods inspection before they can be further processed or installed. The components are not only inspected visually, but also in a wide variety of ways, including precise mechanical classification. Michael Zinßer, Head of Engineering at Automation W+R, explains: "The relevant machine is already designed as a very compact unit from the concept phase on to avoid unnecessary parts handling, while integrating all necessary test functions. The aim is to ensure that all stations are utilized optimally and the system throughput is maximized."

The test systems from Automation W+R are ideal for applications with high requirements in terms of throughput and process times and, according to Dennis Hildebrandt, Head of System Development at Automation W+R, require appropriately powerful control technology: "Communication with the test heads, triggering in real time, and communication with the test software on the industrial PCs are basic requirements for our solutions. And this is exactly what the PC-based control technology from Beckhoff makes possible. In addition, the modularity, scalability, and openness of the system mean that new modules and additional functions can be added with little effort and without any new hardware – and with optimal support through decades of excellent collaboration with Beckhoff."

With the 4-in-1 complete solution for drop-forged parts, the bevel gears are transported precisely and dynamically through the system using the XTS movers.

When testing connecting rods, both simple and complex sequences can be performed based on the flexible motion profiles possible with XTS.

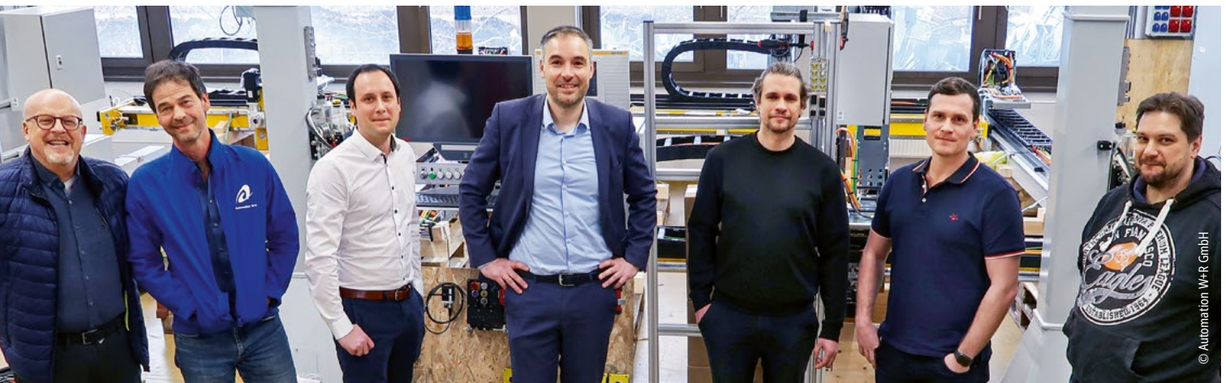
PC-based control from Beckhoff – the C6032 ultra-compact Industrial PC, TwinCAT, EtherCAT I/Os, XTS, and rotary drive technology – takes over the higher-level control of the system and the individual functions in real time. Powerful automation software is crucial when it comes to minimizing setup times and keeping required production spaces small, not least due to the large component variance and the corresponding requirements for generic component handling. As Dennis Hildebrandt explains: “Anything that can be controlled by software to adapt to different component avoids time-consuming hardware changes, enabling quick changeovers to be completed at the push of a button.”

The system operation and visualization – via a CP3921 multi-touch Control Panel – have a consistent focus on the production processes and system utilization. At a subordinate level, maintenance requires additional functions and a view of individual modules. Manual functions, monitoring, and testing of individual steps are therefore also mapped in the control architecture and efficiently integrated via the modular software-based PLC. The object-oriented programming in TwinCAT enables the necessary scalability for a solution that requires no complex interfaces and permits expansion throughout the entire system life cycle without great effort. The following TwinCAT Functions are used:

- TwinCAT 3 XTS Extension for controlling and monitoring the XTS system and with many configuration options,
- TwinCAT 3 NC PTP as motion control for axis movements with simple operation and numerous configuration options,
- TwinCAT 3 OPC UA as a service-oriented communication architecture and interface for visualization and the customer network,
- TwinCAT 3 TCP/IP and TwinCAT 3 Database Server for further data exchange.

The central handling element is the XTS linear transport system, which, like the entire system, is controlled by a powerful C6032 ultra-compact Industrial PC. This is enabled by high-performance data communication via EtherCAT, which also offers the advantage of hot connect functionality for exchanging network devices during ongoing operation. According to Dennis Hildebrandt, PC-based control from Beckhoff also benefits Automation W+R due to the system-integrated safety functionality with TwinSAFE, which offers central programming in TwinCAT, reduced wiring requirements, and a wide range of ready-to-use function blocks. He adds that the broad Beckhoff I/O system of EtherCAT Terminals offering flexible expansion options – such as the EL1809 16-channel digital input terminal and the EL2522 2-channel incremental encoder simulation terminal – is just as versatile. He considers the main advantages to be the compact design, high level of flexibility, and easy expansion capabilities. In his view, the same applies to the EtherCAT Box modules from the EP series, which can be mounted in a decentralized solution and can be used with plug-and-play functionality with little installation effort. Finally, Dennis Hildebrandt says that the rotary drive technology from Beckhoff, i.e., the AX8000 servo drives and AM8000 servomotors, can also be installed efficiently due to the One Cable Technology (OCT).

The project participants on site (from left to right): Darius Wala (Head of Beckhoff Munich sales office), Markus Schmid (COO of Automation W+R), Florian Schütt (Beckhoff application), and the other experts from Automation W+R, Patrick Vockner (Project Manager), Paul Gruber (Managing Director), Michael Wagner (Sales Engineer), and Dennis Hildebrandt (Head of System Development)

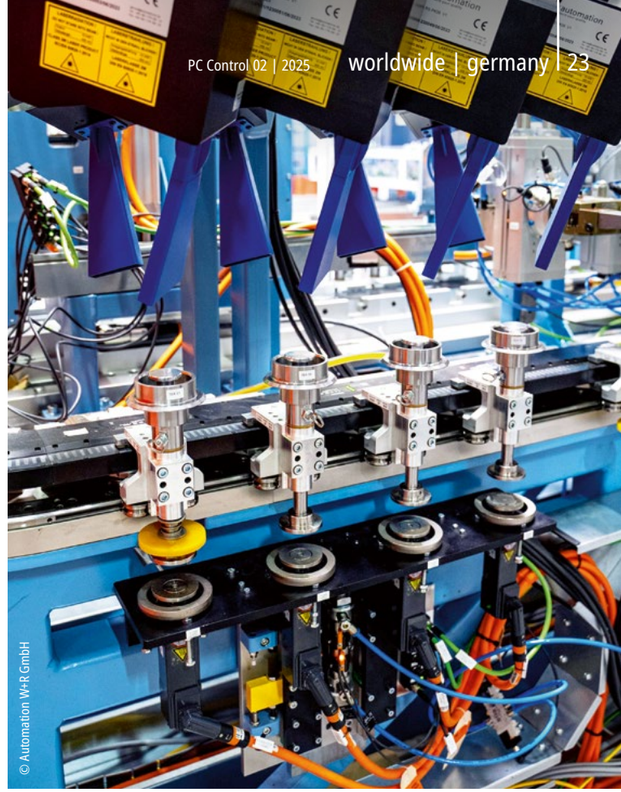


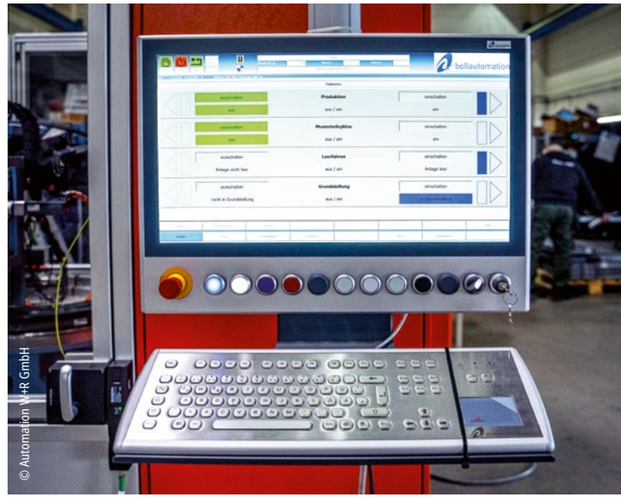
Specific implementation examples with XTS as core element

A prime example of the implementation of Automation W+R’s integration platform is a 4-in-1 complete solution for drop-forged parts. The multi-inspection system checks four bevel gears in parallel for impact marks on the top and bottom, as well as for plug connections, dimensions, and hardness. A high-speed cycle time of 1.5 s is achieved with maximum accuracy and with XTS over a minimum test distance. The modular concept covers a wide range of applications due to specific test scenarios for different component series, which can be changed quickly and easily. As a genuine end-of-line inspection, the system monitors the entire production process with a large number of test steps, all while guaranteeing 100% traceability through visualization of defects, documentation of all test steps, and production data acquisition.

The components to be inspected are picked up by a robot from fed-in baskets and placed four at a time on a workpiece carrier mounted on the XTS mover on the 9.5 m-long XTS line (with a total of 36 movers). They are then cycled into the first station for visual inspection. This is where the impact mark test is conducted on the underside of the component. The workpiece carrier is rotated vertically in this process to enable a 360° image capture of the bottom of the component. To check the top, the workpieces are turned horizontally 180° in the turning station. This is followed by two mechanical tests: The internal gearing is checked using a gauge. For this purpose, the components are moved by the movers to the corresponding workstation and lifted using an AM8000 servomotor to prevent process forces acting on the XTS. For installation distance classification, the workpiece carriers are transported to the next station, then lifted again, and moved against a stop with a measuring sensor for height measurement. Before the components leave the XTS line and are transferred to the outfeed line, all good parts are laser-marked. The final test is the hardness test on the run-out section, where the component is cycled under a coil and lifted out.

In the area of forging technology, Automation W+R implemented another integration platform for testing connecting rods. In addition to a compact footprint, this platform is characterized by the option to make finely scalable adjustments in terms of geometry, number of XTS movers, range of functions, and process speeds. According to Dennis Hildebrandt, this is made possible by XTS and flexible motion profiles, which allow simple or complex sequences to be implemented so that the entire production process can be optimized. The connecting rods are fully inspected and classified on all surfaces with a minimum cycle time of less than 3 s.





Top: The bevel gears transported with the XTS movers are lifted via Beckhoff AM8000 servomotors, both for testing the internal gearing and for installation distance classification.

Bottom: The CP3921 multi-touch Control Panel with keyboard extension enables convenient system operation.

More information:
www.automationwr.de
www.beckhoff.com/automotive
www.beckhoff.com/xts

Laboratory automation and workflow optimization with TwinCAT control

Pioneering work in the digital transformation of industrial laboratories

The first large-scale application of IoT technologies in the laboratory operations of Automotive Catalysts, a division of Umicore in Hanau, aimed to use IoT technologies and digital workflows to increase efficiency in laboratories and make work easier for laboratory technicians. The TwinCAT control platform from Beckhoff has been instrumental in the successful digital transformation of important laboratory equipment.

Umicore is a circular materials technology company with extensive expertise in materials science, chemistry, and metallurgy. A total of seven divisions are based at its largest German site in Hanau, including the Automotive Catalysts division, a leading manufacturer of exhaust gas catalytic converters for gasoline and diesel engines for road traffic, power generation, and industrial processes.

As part of the company's digital transformation strategy, Automotive Catalysts has implemented digital workflows and IoT technologies in its laboratory operations for the first time. "This work focused on modernizing key equipment that was not previously IoT-enabled to improve its functionality, rather than replacing it with new equipment," said Dr. Barry Van Setten, Head of Competence Center Lab Methods and project manager for this IoT initiative at Umicore. The aim was to relieve the burden on laboratory technicians who spend valuable time manually recording data on individual items of equipment, monitoring the equipment, and checking the progress of experiments.

"In the laboratories of many organizations, scientific equipment is still in use that cannot be integrated into advanced IT structures due to a lack of suitable interfaces and open software, as well as insufficient computing power," says Stefan Brandmeier, head of the Beckhoff branch in Frankfurt am Main. Smaller items of equipment in particular (infrared scales, for example), were and are not designed for IoT integration or automation. "However, many devices have a serial interface that was originally intended to print out measurement data," adds Klaus Kalkowski, Application Beckhoff Frankfurt am Main. The IoT integration of the laboratory equipment was implemented via this printer interface.

© Umicore

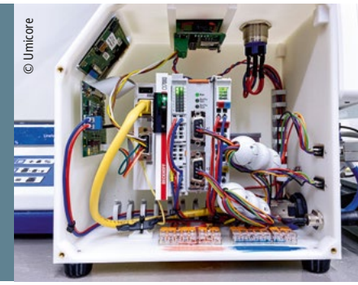
The IoT Box implemented with the TwinCAT small controller, in connection with the digital tools from Umicore Automotive Catalysts, creates the basis required for the transformation of laboratory operations.

IoT Box with small controller and TwinCAT 3

The digitization strategy is based on a compact IoT Box with a CX7080 Beckhoff compact controller featuring an ARM®Cortex®-M7 processor and TwinCAT 3. The data from the laboratory equipment is retrieved via an EL6002 EtherCAT Terminal with two RS232 interfaces and processed as JSON messages using the pre-installed TwinCAT 3 IoT functions of the CX7080. These messages are then sent via ADS to two other embedded PCs from Beckhoff, which communicate with the cloud application as redundant edge devices and cache the messages if necessary.

Umicore developed a "Sample App" via which laboratory staff receive push notifications on their smartphones containing information about the progress of the tests. Employees therefore no longer have to stand by equipment until the analysis of a sample has been completed. "Instead, they receive the data promptly via Microsoft Teams in parallel with data acquisition in our cloud," says Barry Van Setten. Zeno Verboven, from Corporate Digitalization at Umicore, who played a key role in the development of the IoT Boxes, adds: "The IoT Boxes significantly improve laboratory operations and increase efficiency through automated monitoring of experiments." Frank Diekmann, from the Competence Center of Lab Methods at Umicore, who designed the IoT Box and was responsible for CE certification, continues: "With the IoT Box as a standardized hardware PLC for fume hoods, we can implement measurement requirements very quickly." Szabolcs Katona, also from the Competence Center of Lab Methods at Umicore, adds: "It's great to be able to use my industrial programming skills for smaller applications now too. Using the IoT Box, we are able to meet all requirements within the business unit faster and more efficiently."

The CX7080 compact controller receives the data from the laboratory devices via their serial interface and uses TwinCAT 3 IoT functions to convert the information into JSON messages, which are then sent to redundant edge devices via ADS.



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Integration into digital workflows

A key benefit of the IoT Box and Sample App is that they put technicians at the center of laboratory activities, improving the accuracy of data and automating data acquisition in the lab. This minimizes manual intervention and optimizes processes. The data transferred to Umicore Automotive Catalysts' cloud-based LIMS with the TwinCAT controller creates a holistic view of all laboratory operations, including data visualization with Microsoft Power BI.

Barry Van Setten concludes: "The Sample App and IoT Box are not just tools; they are a testament to Umicore's commitment to digital innovation, seamlessly aligning with our sophisticated lab workflows and operational expertise. This holistic approach marks a substantial leap in lab efficiency and data processing accuracy."

End-to-end automation from laboratory to production

The transformation has enabled Umicore Automotive Catalysts to take an innovative approach to streamlining laboratory operations at its Hanau site. The project is also of strategic importance, as Barry Van Setten underlines: "The use of TwinCAT 3 in the IoT Boxes as well as in the production plant control systems makes scaling easy, increases standardization in our business area, and thus significantly increases operational efficiency."

Umicore can now also integrate smaller laboratory devices with the IoT Boxes and thus complete the automation ecosystem of the entire Automotive Catalysts business unit. Stefan Brandmeier adds: "Umicore is an impressive example of how everything can be automated with Beckhoff technology – from production through test benches and beyond to R&D laboratories." This flexibility takes the company a decisive step further on the path to complete digitalization.

More information:
www.umicore.de/en/
www.beckhoff.com/cx7080
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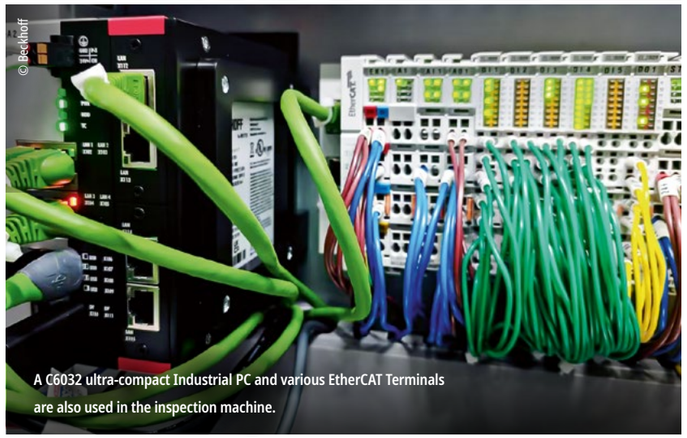
XTS has enabled Shinva Medical to double the inspection performance of its new inspection machine for liquid-filled pharmaceutical bottles while halving the length of the machine.

XTS linear transport system in the pharmaceutical industry

Health protection through stringent drug quality control



A C6032 ultra-compact Industrial PC and various EtherCAT Terminals are also used in the inspection machine.

Headquartered in Zibo, Shandong Province, Shinva Medical Instrument Co., Ltd. (Shinva Medical) is a leading medical device manufacturer with many years of experience that specializes in four major business segments: medical devices, pharmaceutical equipment, medical services, and medical e-commerce. The company has continuously invested in new technologies – for example, deploying the XTS linear transport system from Beckhoff in several pieces of pharmaceutical testing and inspection equipment.

In particular, Shinva Medical has built a state-of-the-art pharmaceutical equipment platform based on four core segments: sterile preparation, solid preparation, traditional Chinese medicine preparation, and biopharmaceuticals. These key pharmaceutical production lines have a direct influence on the quality of drug manufacturing, so the associated testing equipment is a crucial aspect of Shinva Medical's technological innovation. In its quest to achieve the highest possible quality and efficiency, Shinva Medical has been supported since 2016 by Beckhoff China, as illustrated by the use of XTS in the area of production control.

Inspection speed doubled and machine length halved

With the increasing demand for higher production capacity from pharmaceutical manufacturers, Shinva Medical needs to provide ever more efficient equipment. According to the experts, the performance of the transport system is crucial to the efficiency of the entire production line. Although conventional product transport via conveyor belts has so far been able to meet production requirements to a certain extent, these systems have a number of disadvantages. For example, their positioning accuracy is greatly affected by installation factors and they are limited by fixed production cycles, resulting in slow inspection speeds and reduced efficiency. Shinva Medical remedied this situation with the XTS transport system, an innovative automation technology that is characterized by the fact that it can be individually adapted to the application in question. As a result – according to the experts at Shinva Medical – the layout of workstations has been revolutionized thanks to a high degree of flexibility, minimized space requirements, optimized production cycles, and significantly improved testing efficiency.

During the design process of a vacuum decay leak detection machine, Shinva Medical initially used the XTS Viewer of TwinCAT 3 XTS Extension to perform comprehensive simulations of the process cycle times. By simulating operation under various parameters, it was possible to clearly visualize the machine's operating state, which made it easier to define the XTS transport line in terms of the system's track length and number of movers. According to Wang Dangqi, electrical supervisor at Shinva Medical, this optimization strategy not only ensures reliable operation of the machine, but also improves the efficiency of the workstation with the longest cycle time. While the inspection station is in operation, the use of XTS enables the conveyor line to maintain exceptionally high-speed and reliable performance, as well as allowing bottles to be loaded and unloaded at other stations while this inspection is still in progress. "With this machine design, the inspection speed has been increased from 30 to 60 test specimens per minute, doubling production efficiency. Furthermore, the machine length has been reduced from 4 to 2 m, significantly decreasing the footprint of the machine and lowering the investment cost per unit area of the factory."

Optimized quality with optical inspection

According to the experts at Shinva Medical, this automatic pharmaceutical inspection machine is indispensable when it comes to conducting quality inspections on liquid-filled pharmaceutical bottles such as ampoules using optical, mechanical, and image processing technologies. To ensure the purity and safety of the pharmaceuticals, it rapidly and accurately detects imperfections in pharmaceuticals, including cracks, color unevenness, foreign materials, etc. When designing the optical inspection machine, Shinva Medical took full advantage of the flexibility of XTS and innovatively harnessed the option to control each mover individually to simulate the manual shaking of bottles. This causes the bottles to vibrate slightly during transportation, allowing any flaws and defects on the bottle surface to be detected more reliably. "By simulating the effect of manual bottle shaking, our optical inspection machine can capture more detailed information, improving the accuracy and reliability of the visual inspection. This not only optimizes inspection quality to ensure high product quality, but also reduces the labor intensity of manual inspection, thereby increasing production efficiency," explains Wang Dangqi.

Wang Dangqi, Electrical Supervisor at Shinva Medical

> "With this machine design, the inspection speed has been increased from 30 to 60 test specimens per minute, doubling production efficiency. Furthermore, the machine length has been reduced from 4 to 2 m."

By collaborating on innovative projects, such as the implementation of the XTS linear transport system, Beckhoff China has successfully met Shinva Medical's stringent requirements for automation and control technology in the manufacture of medical devices. From the provision of complete control solutions to high product quality and from comprehensive technical service to a strong international brand image, Shinva Medical confirms it has benefited in many ways from its cooperation with Beckhoff – and has been able to strengthen its competitiveness in national and international markets as a result.

More information:
www.shinva.com
www.beckhoff.com/xts

XPlanar boosts productivity in medical device assembly

Floating movers increase throughput and shrink machine footprint in cleanrooms

The specialists at Automation NTH managed to reduce the space requirement of an assembly machine for medical diagnostic devices by a factor of 10. In addition, the throughput accelerated from 5 min to 5 s per device. The intelligent transport system XPlanar from Beckhoff provided the basis for the innovative system concept. With floating movers it enables entirely free product transport and handling with up to six degrees of freedom.

Automation NTH, founded in 1999 and headquartered in LaVergne, Tennessee, started as a systems integrator and became a specialized solution provider for life sciences applications. “Most custom automation equipment, especially in medical device assembly, has a high emphasis on software,” says Peter Sarvey, Head of Sales at Automation NTH. That’s why the life sciences specialists like to deploy new technologies to automate the often highly complex and data-intensive applications.

Case in point: an innovative Diagnostics Device Assembly Machine that leverages the XPlanar adaptive transport system from Beckhoff. The electrically passive XPlanar movers, which levitate above electrically active motor modules, provide six degrees of freedom in motion control with extremely high precision and repeatability. According to Automation NTH, this enabled excellent traceability, a compact footprint in costly cleanrooms and maximum product integrity when dosing sensitive reagents.

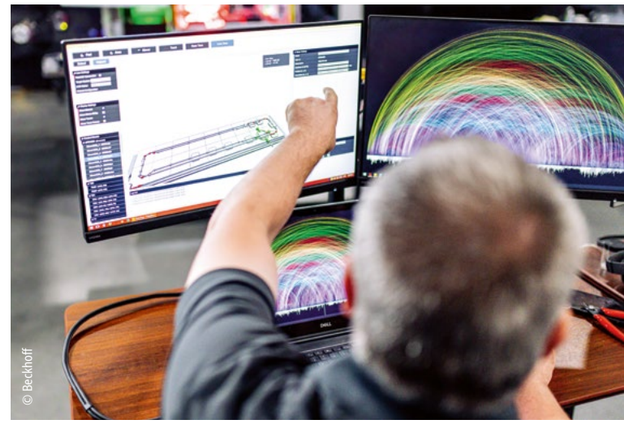
“We selected XPlanar due to its flexibility to transport numerous products with high variability and accommodate all kinds of future changes,” explains Automation NTH Project Manager Rich Snodgrass.

From manual to automated assembly

To define the scope of automation requirements for the previously manual assembly process, representatives of a startup company met with Automation NTH Director of Strategic Accounts Molly Blazek and Head of Sales Peter Sarvey in 2023. The customer needed an automated system with fillers for roughly 50 different reagents, supporting dispense locations that change for the three different device types.

“Moving the dispense heads to the product – with conveyors, robotics or other material handling technologies – would create massive price and space requirements,” Peter Sarvey says. “Then we realized we should move the product, not the dispense heads.”

A graphical configurator for XPlanar simplifies how engineers create motor tile layouts, add movers, define paths and stations, and simulate motion.



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The highly flexible Diagnostics Device Assembly Machine can fill three different device types, each transported by an XPlanar mover, with a selection from 50 reagents depending on the formulation and then inspect them.

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A Beckhoff C6670 industrial server with Intel® Xeon® technology offers ample computing power for the demanding control of the XPlanar transport system and third-party devices.

Automation NTH uses a wide variety of EtherCAT and TwinSAFE I/O terminals on the assembly machine and the reel feeder for sealing the diagnostic devices.

At Automation NTH headquarters in LaVergne, Tennessee (from left to right): Head of Sales Peter Sarvey and Sr. Controls Engineer Joseph Cocchini (both Automation NTH), Regional Sales Engineer Richard Smith (Beckhoff USA), Co-Presidents Jeff Buck and Greg Young (Automation NTH), Applications Engineer Adam Hoffman (Beckhoff USA) and Director of Strategic Accounts Molly Blazek (Automation NTH)

The equipment would operate in a cleanroom, with square footage at a premium due to the necessary environmental controls for temperature and humidity. So the system needed to be as compact as possible while being able to support future product changes. Traditional dial tables and linear transport systems didn't check any of the boxes, according to Molly Blazek.

Automation NTH Sr. Controls Engineer Joseph Cocchini began evaluating options. After testing a competitive product, Cocchini ran through the same requirements with Todd Thollot, Advanced Applications Group Manager at Beckhoff USA. "I had a list of lofty goals. We needed to dynamically coordinate the XPlanar movers to use a spring-loaded hook to hold and then release product, park movers on the motor tiles to unload, and ensure the lift, tilt, 360-degree rotation and other capabilities matched the advertised specs," Joseph Cocchini says.

Joseph Cocchini, Sr. Controls Engineer at Automation NTH

> "That nearly infinite configurability is why we ended up going with XPlanar."

"Todd had already programmed in several scenarios that validated most requirements right away. Beyond that, the levitation height was better with XPlanar than with the previously tested system, so the movers could tilt more," he adds. "Overall, Todd's implementation was much cleaner because the Beckhoff system allows you to access every motion aspect of each individual mover, right down to the ABC and XYZ coordinates. That nearly infinite configurability is why we ended up going with XPlanar."

Adaptive automation via flying motion

In the finalized Diagnostics Device Assembly Machine, operators manually infeed specific devices via a drawer. Then a robot places the device on one of the 18 XPlanar movers. Custom tooling locks the device in place on the mover. Then the device undergoes a vision inspection using 360-degree rotation.

The movers fly the devices through a variety of dispense stations lining the 18-motor-tile work surface. The hovering movers stop only at the dispense stations specified in each device's recipe, with a second vision test halfway through. For filling, XPlanar mover rotates the device so the reagent is placed in the correct location for that formulation.

After a final vision inspection, the device is positioned at a reel feeder, which seals it with an adhesive plastic cap with ± 30 µm repeatability. The mover then delivers the finished product to an operator station. The mover slides the release hook into a groove, edges forward to release the device, and then parks with power off on the tile below so that it no longer levitates. An operator can then reach in safely through the light curtain to remove the finished device.

Powerful software and hardware

TwinCAT provided an end-to-end engineering and runtime platform for automation. Integrated into Microsoft Visual Studio®, TwinCAT empowers engineers to program in the languages that best fit the application. In addition, the software includes a graphical configurator for XPlanar that helps with creating motor tile layouts, adding movers via simple drag-and-drop, defining paths and stations, and simulating motion profiles.

On the hardware side, a C6670 control cabinet industrial server from Beckhoff supports the control of XPlanar and third-party devices. This 40-core Industrial PC (IPC) possesses ample computing power with some cores reserved for future needs. What impressed Joseph Cocchini even more is the C6017 ultra-compact IPC that powers the four-axis reel feeder system.

"The C6017 has 8 GB DDR4 RAM, a 320 GB hard drive, four Ethernet ports, and four USB ports," Cocchini explains. "That little Windows 10 computer drives our smartphone-sized HMI with a custom Solid JavaScript, as well as a Python Web server and a MongoDB database for OEE, recipes, configs and more. I haven't seen anything like it in my career."

Fast real-time communication and exact synchronization with EtherCAT is crucial for the precise control of the XPlanar system. Enabling communication with the various cameras, dispense heads and other devices via EtherNet/IP was possible by the simple addition of the appropriate bus coupler. All safety-relevant data are transmitted via Safety over EtherCAT (FSoE) to the TwinSAFE terminals installed in the standard I/O segment for evaluation with the necessary safety logic. So, if an e-stop or light curtain is triggered, the system will enter a safe state without any need for hardwiring. Along with numerous EtherCAT Terminals for standard signals, Automation NTH also uses I/O modules from Beckhoff for overcurrent protection and other functionality.

New assembly concept for medical devices

The completed Diagnostics Device Assembly Machine offered the solution for automating the end user's inefficient manufacturing process. In addition, the system reduced footprint by a factor of 10 compared to what a traditional linear approach would require. According to Automation NTH, XPlanar also reduced power supply requirements compared to competitive solutions, which reduced heat concerns and cooling requirements.

"The reagents are very sensitive to humidity, temperature and movement, so the smoothness of XPlanar's contactless motion and the cooling option Beckhoff offers all played into the compatibility with the customer's product," Molly Blazek concludes.

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

PC-based control powers innovative theater concept on the World Trade Center campus

There's a stage for every story at PAC NYC using flexible automation

The Perelman Performing Arts Center in New York (PAC NYC) offers visitors a truly unique theater experience. Advanced stage technology makes its three performance spaces extremely versatile. Modular automation technology from Beckhoff provides the necessary flexibility and reliability for converting walls, floors and backdrops according to the performance schedule.

Each Kid module from Flyhouse features a Beckhoff CX9020 Embedded PC with EtherCAT and TwinSAFE terminals so that it can be used in concert with other modules or standalone.

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With flexible stage technologies from The Chicago Flyhouse, Inc., PAC NYC's main stage can transform, support moving set pieces, and safely fly performers through the air.

© Beckhoff

At the foot of Manhattan's One World Trade Center building and across from the 9/11 Memorial & Museum stands the PAC NYC. While it offers programming similar to other major New York City theaters, the mission of this gathering space is distinctly communal. "PAC NYC is a place of civic healing," says Miranda Palumbo, Director of Digital Content at PAC NYC. "Because we are on the World Trade Center campus, it's our responsibility to help everyone celebrate life."

The venue features three performance spaces that can flexibly combine or divide into over 60 configurations. The backstage technology also supports dynamic set changes and flying performers through the air. "We could produce three different pieces of work at the same time or just one," Palumbo explains.

To harness the necessary engineering behind the performance art, PAC NYC directed The Chicago Flyhouse, Inc. and its programming partner, ELPLANT, to implement a safe, reliable, and flexible stage automation system. Flyhouse provides rigging, hoisting, and performer flying equipment for venues across the world ranging from hospitals and high schools to theaters and arenas.

Top: The backstage crew at PAC NYC: (from left) Hunter Cole, Jon Weston, and Mark Witteveen of The Chicago Flyhouse, Inc. meet with Jason Toon of Beckhoff USA.

Bottom: The PAC NYC building exterior gets its unique look from panes of glass and thinly sliced marble.


© Beckhoff


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Advanced stage technology needed for unique project

"The Perelman was a unique and exciting project," says Mark Witteveen, Founder and Senior Project Manager at Flyhouse. "You rarely build new theaters in New York City, especially in Manhattan's Financial District. Plus, the design team and consultants wanted to develop a very flexible space."

Therefore, Flyhouse used its distributed "MoM-and-Kid" control concept. A central server (Master of Machines, MoM) communicates to distributed modules (the Kids). The more than 30 Kid modules at PAC NYC each have their own Beckhoff CX9020 Embedded PC and EtherCAT I/O wired to control Flyhouse's ZipLift hoists and other equipment. The modules can be easily moved, connected to other hoists, or swapped for maintenance.

Still, the large number of Kid modules and their associated motion axes throughout the theater level raised the bar on the facility's networking capabilities. The Flyhouse technologies also needed to interface with other vendors' solutions, for example, the systems to raise and lower the massive walls or change the floor configuration to be flat or stairstep up. So, safety zones had to adjust dynamically as spaces changed to ensure human and equipment safety.

"You can lose 10 years of reputation with one component that's acting erratically, so it's vital to partner with the right companies," Witteveen says. "Even though the duty cycles are relatively short in theaters, we need the reliability that comes with industrial automation."

Here, Beckhoff supplied an ideal solution. The EtherCAT and PC-based control technology provides a foundation for seamless operation and high adaptability.

Industrial automation – combining safety with flexibility

Flyhouse collaborated with Beckhoff USA and ELPLANT to design next-generation control modules. ELPLANT, an ISO 9001-certified systems integrator based in Serbia, brought expertise in industrial automation and entertainment applications. "For this project, Beckhoff was undoubtedly the logical choice, as few systems could provide such a modular and configurable architecture," says Aleksandar Arsić, CEO of ELPLANT. "For this system, we used TwinCAT PLC, NC PTP motion control, TwinSAFE safety systems, extensive EtherCAT communication, TwinCAT PLC visualizations, TwinCAT HMI, database communication, and ADS with third-party applications, such as C# WPF (Windows Presentation Foundation) operator consoles and similar solutions."

Another key enabler of the modular design was the EtherCAT industrial Ethernet System, explains Aleksandar Arsić: "This real-time communication allowed us to configure the topology so that each embedded PC or other EtherCAT device operated as an independent sync unit." Much of the equipment also features EtherCAT P, which combines data and power on one cable. This configuration allows techs to remove or add kid modules without taking all the others offline. Beyond sheer speed and robust diagnostics, the EtherCAT supports free selection of topology. It also offers hot connect functionality and automatic addressing of devices, simplifying component exchange and plug-and-play installation.

As part of the World Trade Center campus, Perelman Performing Arts Center helps artists across New York City foster communal healing in this special place.

Flyhouse also harnessed integrated functional safety with TwinSAFE terminals. Here, safety information is transmitted via Safety over EtherCAT (FSoE) over the standard EtherCAT network, rather than a separate, hardwired system. Beyond the reduction in wiring effort and cost, TwinSAFE simplified implementation of the configurable theater concept.

Flyhouse deployed its Ease® Control Console in each theater space, simplifying axis operation with joysticks and a multi-touch screen with a visualization built with TwinCAT HMI. The consoles can't access axes outside the operator's line of sight for safety reasons, according to Mark Witteveen. So, when raising walls to combine spaces, the consoles now need to control all the axes in that larger room. Likewise, E-stop buttons need to halt all motion in combined spaces if required, meaning that the mom-and-kid architecture must change on the fly. "This seemingly simple idea proved incredibly complex to implement," Witteveen says. "But with the flexibility of EtherCAT and software capabilities in TwinCAT, we pulled it off seamlessly."

Magical language of art and engineering combined

Every aspect of PAC NYC was intentional. The building's foundation was acoustically isolated to ensure subway trains and other underground activity wouldn't affect performances. The unique outer walls are made of thinly sliced slabs of marble and glass, letting sunlight in during the day and making the theater glow as a New York City beacon in the evening. The lobby level features a restaurant run by a celebrity chef and a stage where musical acts and other artists give free performances most days of the week.

The stage automation needed to be equally intentional. The modular system will continue to support upgrades, and with a scalable, future-proof automation platform, this process won't require a rip-and-replace of infrastructure. Instead, technicians can simply make changes in software or replace a device with a newer version. Beyond reducing costs, this approach avoids unwanted intermissions to find obsolete components. To Mark Witteveen, ensuring that the show will go on remains the most important goal. "When the lights dim and the stage comes to life, the audience isn't thinking about automation," he says. "They're simply immersed in the magic. That experience makes all the effort worthwhile."

More information:

www.pacnyc.org
www.flyhouse.com
www.elplant.com
www.beckhoff.com/entertainment-industry

© Philippe van Geloven

The fully automated machine for pressing window and door frames is the result of an exciting collaboration between Calvet, CNC Solutions and Beckhoff (from left to right): Stefan Nees, managing director of Calvet, Maarten Knevels and Cédric Sabbe (both Beckhoff Belgium), with Edward Baekelandt, Eddy Marissens and Lander Debruyne from CNC Solutions.

PC-based control in window and door production

Motion control and electric cylinders replace manual process steps

Using a unique machine concept, Belgian machine builders CNC Solutions and Calvet are automating previously manual processes in aluminum window and door production. High-performance drive technology, motion control, and the AA3000 electric cylinders from Beckhoff proved crucial in equipping the machine with the necessary finesse when pressing the window frames.

Zellik-based machine builder Calvet N.V. aimed to extensively automate various processes in window and door production with a new machine concept. "Together with CNC Solutions, a machine builder specializing in customized systems like Calvet, and the specialists from Beckhoff, we were able to bring this sophisticated concept to life," explains Stefan Nees, managing director of Calvet. "We were delighted to contribute our expertise in CNC and robot applications," adds Lander Debruyne, managing director of CNC Solutions BV in Menen, Belgium.

Quality and productivity boost in window construction

Until now, the method of joining aluminum window profiles has involved corner presses. A number of manual steps are still necessary in advance, requiring production teams to exercise great care to assure the final quality of the window or door frame. "We have combined and automated these manual steps, namely assembly, gluing, pressing, checking, and polishing, at a central workstation," notes Stefan Nees.

In the future, the operator will place the window frame profiles on a mover. Sensors then check that the correct parts have been inserted and that they fit together. Once approved, the profiles are positioned, clamped over brackets, and then pressed together with the required force. "This automated process allows us to raise the bar in terms of quality and really boost the efficiency of our window production."

Three electric cylinders make one gripper

In addition to quality and productivity, flexibility was another top priority for the machine specifications. After all, there are various profile types, pressing positions, and bonding techniques to consider. This is why two 6-axis robots serve as the core of the installation. Depending on the size of window being produced, which ranges from 300 to 4,500 mm, the robots are positioned and ready to automatically pick up the corresponding tool for each production step. "What really sets our process apart is the special gripper for pressing the corners together," enthuses Lander Debruyne. Three AA3000 electric cylinders with spindle drives form the basis of the gripper. "By evaluating the currents and torques of these drives, we were able to give the machine a sense of the pressing force and control it dynamically," clarifies Stefan Nees.

It is no coincidence that CNC Solutions uses PC-based control and other components from Beckhoff for the machine. Lander Debruyne explains, "We switched to the Beckhoff platform and CX2043 Embedded PCs as standard controls around two years ago because we were constantly having availability problems with our supplier at the time." CNC Solutions also uses Stäubli robots as standard, which can be integrated and efficiently controlled via EtherCAT and uniVAL drive. "Changing the control technology is not something that can be done overnight," says Lander Debruyne, "but with application engineer Maarten Knevels by our side, we always had a true expert on hand." As many as seven machines with PC-based control are now being used by customers. "Our application engineers provide support during the transition period to ensure a seamless launch and even help existing customers to implement new technology," adds Cédric Sabbe, account manager at Beckhoff Belgium.

In addition to the robots, 15 CNC axes (AM8000 servomotors and AA3000 electric cylinders) are controlled via TwinCAT 3 and the AX8000 multi-axis servo system. Calvet and CNC Solutions also use EtherCAT Terminals along with numerous EtherCAT Box modules with an IP67 protection rating to read the signals and control the actuators, which are mounted directly on the movers. Cédric Sabbe notes, "The compact drive system coupled with the OCT connection technology of the servomotors have facilitated a space-saving and swift installation."

Flexible combination of robots, CNC, and motion control

"The major challenge of this project was to ensure every last process was perfectly coordinated," says Stefan Nees. This is precisely where TwinCAT 3 NC PTP, NC I, and CNC came into play to manage the demanding coordination of all axes. The operator receives instructions for order setup via the CP2918 Control Panel and can use it to track machine operations. The order data is loaded from the central order management system via a barcode on the window profiles. Calvet achieves the necessary connectivity with the bar code scanner and IT via TwinCAT 3 Serial Communication (TF6340) and TwinCAT 3 Database Server (TF6420). "To keep operation as simple as possible, there are just two buttons allowing the machine operator to navigate to the next or previous step," says Stefan Nees. It couldn't be any simpler.

The first system has been set up at a window manufacturer in Brussels, where the machine is being put through its paces in the field. "This practical feedback will help us to develop the prototype even further into a high-performance standard machine," concludes Stefan Nees.

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The compact AX8000 multi-axis servo system controls the AM8000 servomotors and AA3000 electric cylinders.

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Prior to pressing the frames, the fixings are positioned according to the window size.

© Philippe van Geloven

CNC Solutions has been using PC-based control and CX2043 Embedded PCs to control a wide variety of projects for the last two years.

More information:
www.calvet.eu/en
www.cncsolutions.be/en
www.beckhoff.com/window-production-machines

Integrating fire alarm systems into building management systems

Flexible gateway due to finely scalable control technology

Fire alarm systems work independently of the building automation system. Having detailed information about the state of the fire protection technology would make the work of many facility managers easier. Schrack Seconet has developed a flexible gateway using ultra-compact industrial PCs and TwinCAT from Beckhoff, which can be used to flexibly convert a customer-specific communication protocol to a wide range of transmission standards such as BACnet or OPC UA.

"Customers told us that they needed further interfaces in addition to the protocols supported by our fire alarm systems," says Paul Panzitt, product manager for fire alarm systems at Schrack Seconet in Vienna, outlining the starting point of the development project for the gateway. During their research, the developers quickly became aware of the open PC-based control technology from Beckhoff.

Schrack Seconet offers the gateway as a supplement to the fire alarm systems, allowing operators to integrate the status and alarm messages of the systems into their building management technology. Due to the variety of building management systems that are available, it must be possible to implement a wide range of different transmission protocols. "TwinCAT 3 Connectivity provides a wide variety of protocols for this purpose, from classic TCP/IP-based protocols to SMS/SMTP servers, JSON, MQTT or HTTPS/REST and WebSockets to direct integration with databases and cloud storage such as Amazon AWS and Microsoft Azure," emphasizes Balazs Bezeczky, head of the Beckhoff sales office in Vienna. In the projects implemented to date, integration has been implemented with BACnet (TF8020) and OPC UA (TF6100).

ISP-IP protocol recoded

The fire alarm systems send the status and alarm messages via ISP-IP to a C6015 or C6030 ultra-compact Industrial PC. "The conversion of the specific protocol to – currently – BACnet and OPC UA was realized as a C# program and implemented in TwinCAT," says Georg Schemmann, Head of Industry Management Building Automation at Beckhoff. Due to the openness of PC-based control and TwinCAT as an engineering platform, the program can be combined with any other TwinCAT function in order to allow the fire alarm systems to communicate with the respective management technology.

The gateway primarily provides the building management system with alarms or status messages, which can then be integrated into the building visualization. As communication via the gateways is bidirectional, the building technician can shut down individual detector groups or adjust the operating mode during maintenance. "All of this can be operated centrally via the visualization of the building management system using the gateway implemented with Beckhoff technology," says Georg Schemmann. Paul Panzitt adds: "Schrack Seconet already supports such use cases via its own service platform, to which our fire alarm systems send all relevant information." In principle, TwinCAT could be used to extract further information from the transmitted data, such as the degree of contamination of a smoke detector, and make it available to different end devices via TwinCAT HMI Server (TF2000), for example.

Simple scaling and retrofitting

Depending on the size of the fire alarm systems, Schrack Seconet uses a C6015 or C6030 ultra-compact Industrial PC. "The easy scalability of the computing power is important as we have fire alarm systems ranging from 200 to over 50,000 data points," says Paul Panzitt. A C6015 is used up to around 10,000 data points; above that, the even more powerful C6030 comes into play. In addition to flexibility and scalability, simple implementation without the need for in-depth training was another criterion when choosing the system.

The clear separation between the gateway and the fire alarm system also enables easy implementation in existing buildings without the fire alarm system having to be approved again. "We can use the converter solution to integrate with any control system. We only get positive feedback from our customers because it is easy to implement and it works," says Paul Panzitt. Even systems that are several decades old can be retrofitted with advanced communication protocols without having to replace the entire fire alarm system. "With TwinCAT, we support a wide variety of communication protocols used in industry, building automation, and IT, and are constantly implementing new standards as required," says Balazs Bezeczky.

Using fire protection technology for room automation

Schrack Seconet's converter solution currently focuses on exchanging fire protection data with the building management system, i.e., alarms and status messages. However, the fire detectors also register additional information, such as the temperature or CO concentration in the air. It would be conceivable to evaluate these measured values in the next generation of fire alarm systems and to use them in the building management system to monitor air quality and for room air conditioning. "Looking to the future, this is an exciting idea that would save a lot of additional sensors and therefore costs," concludes Paul Panzitt.

Schrack Seconet integrates fire alarm systems into a wide variety of building management systems in a flexibly scalable manner via ultra-compact industrial PCs and TwinCAT functions.

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More information:

www.schrack-seconet.com/firealarm
www.beckhoff.com/c60xx
www.beckhoff.com/tf6xxx
www.beckhoff.com/building

Linear servomotors and TwinCAT for a high-speed 3D laser machining center

Precision interpolation with laser synchronization

With accelerations up to 12g, micrometer-level precision, and 500 microdrillings per second, Bi.Lab Advanced Engineering in Bologna showcases the cutting-edge capabilities of its laser processing center by synchronizing linear drives with laser pulses. When it comes to automation, the machine builder relies on the flexibility and performance of Beckhoff control and drive technology.

Founded in 2002 as a mechanical design office in Casalecchio di Reno near Bologna, Bi.Lab has developed extensive expertise in various fields, including laser technology, assembly automation, robotics, and image processing. Their developments are incorporated into prototypes and customized machines for customers in various industries, including production lines for packaging, textiles, automotive parts, medical technology, printed materials, and food. The secret to their success in so many different sectors also lies in the advanced automation technology provided by Beckhoff. "Looking back, this partnership that began all those years ago was a pivotal moment for our company," recalls Marco Faretra, partner and managing director at Bi.Lab.

© Beckhoff

The specialist machine builder Bi.Lab from Bologna relies on the openness, flexibility, and performance of PC-based control for its demanding projects.

By precisely synchronizing the laser source with highly dynamic AL8000 linear servomotors – supported by the AX5206 servo drive (left) and CX5140 Embedded PC (right) – the system achieves pinpoint parts machining at up to 500 laser points per second.

A benchmark for success

To meet growing customer demand for turnkey special machines, Bi.Lab started looking for a standard automation platform. "We've always depended on our customers' resources and implemented automation with their preferred systems," explains Marco Faretra. Nevertheless, the rising complexity of projects created the need for a single platform that could handle diverse technologies and varying levels of complexity. This led to a benchmarking process to find a strategic partner offering a flexible and high-performance solution for all requirements.

Lorenzo Bruscoli, automation developer at Bi.lab

> "This open system architecture ensures Bi.Lab can always select the ideal components."

Every automation project at Bi.Lab is now implemented using PC-based control technology from Beckhoff, which provides the flexibility, reliability, and high performance needed to meet specific customer requirements. No matter how different the applications are, they all share the benefits and flexibility of PC-based control technology, combined with the simplicity and power of TwinCAT as an engineering platform. "The modular and comprehensive Beckhoff portfolio also supports seamless integration with third-party hardware and software when requested by customers or required by specific applications. This open system architecture ensures Bi.Lab can always select the ideal components," explains Lorenzo Bruscoli, automation developer and partner at Bi.Lab.

Highly dynamic cutting and drilling

Bi.Lab recently developed one of its most cutting-edge projects to date for a customer in the automotive industry. The challenge was to develop a system for cutting and drilling pipes using a highly dynamic 3D laser processing center. The project required accelerations of over 3g on a cutting surface of 800 x 600 mm, with laser-point positioning accuracy within tolerances of hundredths of a millimeter. With Beckhoff's automation technology, the first prototype achieved an extraordinary dynamic of 12g on the secondary axis. "This result was also due in part to the support of the Beckhoff product specialists," explains Marco Faretra. This solution laid the groundwork for a wide variety of subsequent applications. The dynamic nature of the process and the need to increase accuracy to within a few hundredths of a millimeter required an extremely rigid structure. "When developing the frame for the laser processing center, we used virtual prototyping techniques and relied on our experience in highly dynamic system design," adds Davide Carati, mechanical engineer at Bi.Lab.

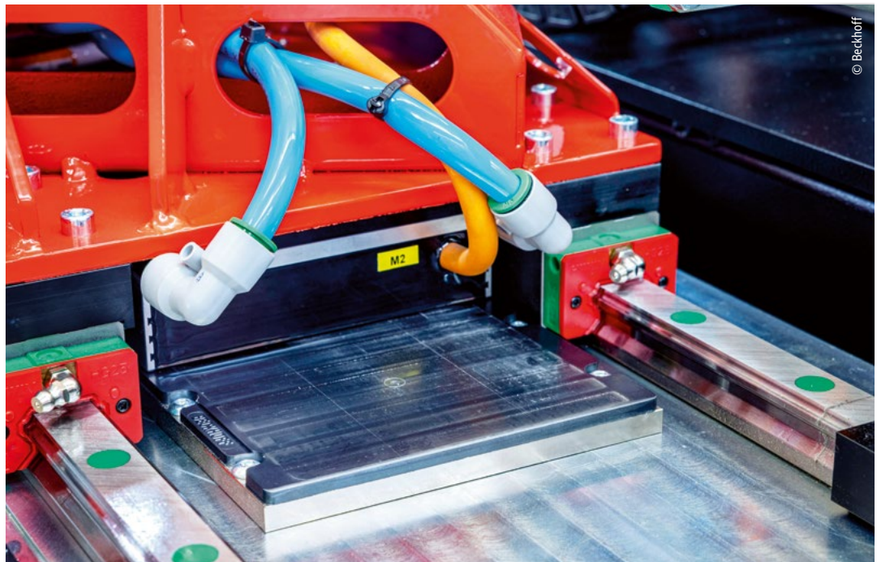
cessing, meaning the pipes had to be processed without leaving any residue inside – even with a large material thickness-to-diameter ratio. This required exceptional precision and repeatability in laser positioning.

The Beckhoff system played a decisive role in meeting the customer's requirements and delivering the machine on time. At the heart of the controller is a CX5140 Embedded PC powered by an Intel Atom® quad-core processor (1.91 GHz clock frequency). For the gantry axes, Bi.Lab relies on AL8000 linear servomotors and an AX5206 2-channel servo drive, ensuring the necessary high dynamics and positioning precision. Positioning and path control are handled by the TwinCAT NC PTP and TwinCAT NC I motion software modules, with the latter enabling seamless G-code execution and interpretation. TwinCAT takes care of axis interpolation, efficiently processing kinematic data from both linear motors while also accounting for mass and inertia values. As Lorenzo Bruscoli explains, "This enabled us to calculate the torque and speed setpoints for each axis precisely and transfer them cyclically to the servo drives via EtherCAT." The entire process, including the safety functions implemented with TwinSAFE components, was programmed with TwinCAT.

Maximum flexibility and precision

The laser processing center showcases the full potential of Beckhoff's PC-based control, an open control platform that delivers exceptional flexibility, intuitive operation, and seamless integration of third-party hardware and software modules. Thanks to its precise synchronization of drive axes with pulses from the external laser source, the system can create up to 500 micro-holes per second with pinpoint accuracy in a predefined pattern.

Bi.Lab's experience in research and development, combined with rigorous testing of potential dynamic performance, allowed the company to deliver a fully functional machine to the customer in just two months. This fast turnaround was achieved by leveraging an established automation and control architecture, with PC-based control ensuring the required dynamics and precision. One of the customer's requirements was to achieve 'clean' pro-

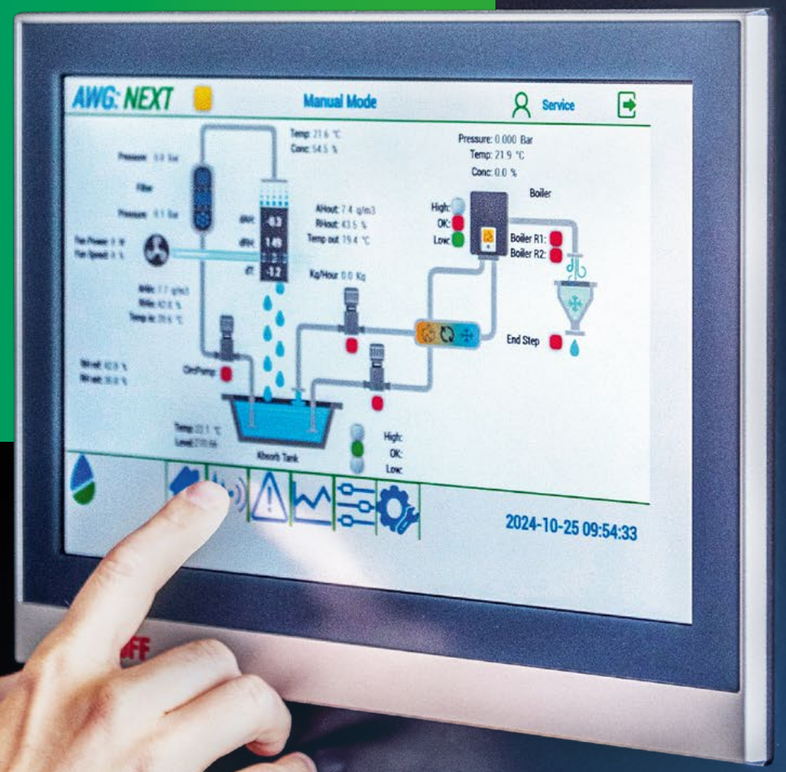


Highly dynamic AL8000 linear motors move the gantry axes of the laser processing center with speed and precision.

More information:
www.bilab.tech
www.beckhoff.com/machine-tools

PC-based control regulates innovative dehumidifiers

Open control technology reduces energy consumption and carbon footprint



The dehumidifier parameters can be called up and adjusted on the control panel via the visualization implemented with TwinCAT HMI.

"PC-based control is the ideal control platform for us," say CEO Bo Tiderman (right) and operations manager Jonas Högström, both from Airwatergreen.

With NEXT, the Swedish company Airwatergreen AB is breaking new ground in the dehumidification of air in industrial buildings and warehouses. The patented CVP technology reduces energy requirements and ensures an indoor climate that prevents corrosion and mold growth. PC-based control from Beckhoff regulates this innovative process and – due to its open nature – enables networking and remote maintenance of the systems, including energy tariff-optimized and thus cost-saving operation.

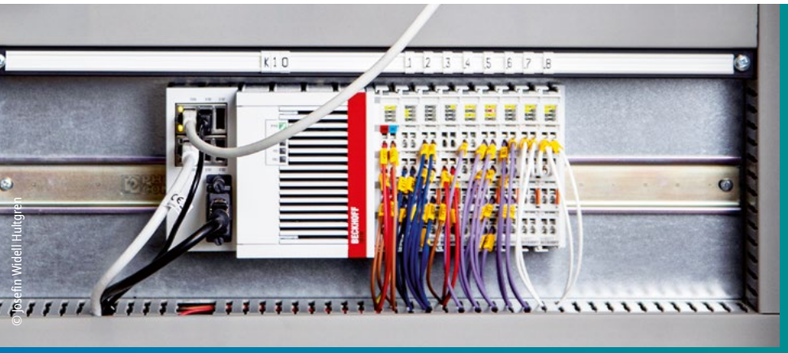
Airwatergreen specializes in indoor climate solutions that reduce energy consumption by between 30 and 70% compared to conventional technologies. Their CVP technology works with a liquid drying agent and uses the principle of absorbing water vapor from the air. The temperature and concentration of the solution, i.e., its vapor pressure, determine its ability to extract water vapor

from the air or to add it in. The concentration can be regulated so that, when the device releases the air it has previously drawn in, it has a relative humidity of between 30 and 90%. “Our technology generates the optimum air quality in terms of humidity directly in the production hall or warehouse, eliminating the need for complicated evacuation systems,” explains Bo Tiderman, CEO of Airwatergreen.

Indoor climate is relevant to the process

NEXT meets the specific humidity control requirements of many industries, including food production and storage, logistics, water and wastewater management, and the preservation of historically significant buildings. In all of these industries, there is a need to regulate humidity levels to prevent damage to structures, materials, or equipment.

As the NEXT devices only need to discharge the water collected during dehumidification, installation is much simpler than with conventional air conditioning systems. In addition, the control system implemented with TwinCAT 3 avoids operation at times of day when electricity prices are high, without compromising on cooling or dehumidification performance. “This sustainable, energy-optimized operation is something that many interest groups are calling for across a range of industries,” says Bo Tiderman.



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A fanless CX5130 Embedded PC with its multi-core Intel Atom® processor forms the basis for dynamic regulation of the vapor pressure and control of the fan motor and circulation pump.

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Airwatergreen dehumidifiers automated with PC-based control consume between 30 and 70% less energy than conventional systems due to a patented process.

Fanless embedded PC as control center

After evaluating various alternatives, Airwatergreen opted for a CX5130 Embedded PC as the controller because its multi-core Intel Atom® processor with a clock frequency of 1.75 GHz provides sufficient computing power to evaluate the data and control the vapor pressure, the circulation pump, and the fan motor. “The compact, fanless design and low power consumption of the embedded PC, as well as TwinCAT 3 as a flexible engineering platform, made PC-based control the ideal choice for us,” says David Johansson, development engineer at Airwatergreen. For operation, Airwatergreen uses a compact CP29xx multi-touch built-in Control Panel with visualization implemented by means of a TwinCAT 3 HMI, which supports comprehensive remote monitoring. “If, for example, there is an unexpected deviation in humidity, an alarm is triggered immediately so that the operator can take action right away,” says David Johansson.

David Johansson, development engineer at Airwatergreen

> “The compact, fanless design and low power consumption of the embedded PC, as well as TwinCAT 3 as a flexible engineering platform, made PC-based control the ideal choice for us.”

One or more NEXT units are installed and networked with each other, depending on the size of the building and the different indoor climate requirements. Sensors in the rooms and parts of the building provide the necessary data to control dehumidification. The wide range of connection options via the EtherCAT Terminals and gateway functions facilitate networking with other building automation components and the integration of sensor technology at I/O level.

High market expectations

Airwatergreen has installed around 20 NEXT systems since the market launch. “The potential is considerable due to the wide range of applications,” says Bo Tiderman confidently. He expects sales to increase to several hundred devices per year in the foreseeable future. As the machines are suitable for different indoor climate control systems with temperatures from 0 to +40 °C, they can be used in a wide range of industries. According to Bo Tiderman, the ROI of the dehumidifiers is usually two to three years, regardless of whether existing humidification systems are being replaced or NEXT is being integrated into new construction projects as part of the ventilation infrastructure.

More information:
www.airwatergreen.com/en
www.beckhoff.com/building

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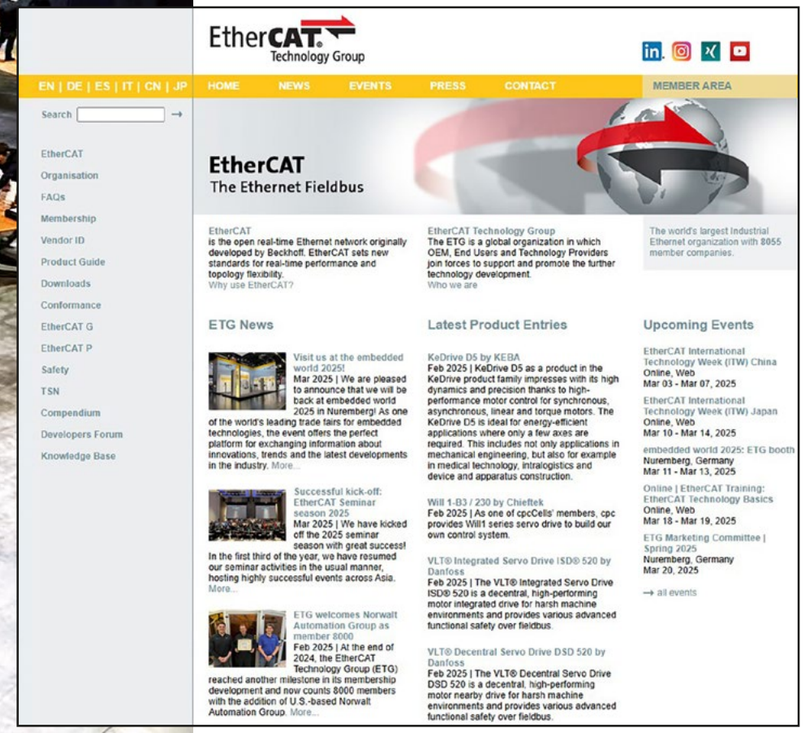

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The EtherCAT Technology Group website gives members access to a wide range of EtherCAT-related offers and services.

The EtherCAT Plug Fests are a pragmatic approach to testing the interoperability of EtherCAT devices from different manufacturers under real conditions (picture: EtherCAT Plug Fest at ETG member Panasonic).

Do you actually know... EtherCAT Technology Group?

EtherCAT has established itself as a powerful real-time Ethernet fieldbus system in industrial communication. At the same time, the EtherCAT Technology Group, ETG for short, has become the world's largest fieldbus user organization. This article deals with the structure and work of the ETG as well as the services it provides to its members and thus contributes significantly to the success of EtherCAT.

The EtherCAT Technology Group is the user organization that deals with the development and distribution of EtherCAT. It was founded in 2003 and is now the largest fieldbus user organization in the world with over 8,000 members from 76 countries. ETG members include suppliers and users of EtherCAT devices, users of EtherCAT technology as well as research institutes and universities.

The ETG forms the ecosystem around EtherCAT technology. To this end, it works on the further development of the technology, promotes the interoperability of EtherCAT devices from different manufacturers and actively supports companies in their implementation.

Technological development and standardization

The technical development of EtherCAT takes place in working groups, the so-called Technical Working Groups (TWGs). These groups are made up of experts from the member companies and deal with various aspects of the technology, such as specification extensions, development of device profiles or the definition of standardized implementation guidelines.

The international team of the EtherCAT Technology Group supports ETG members all over the world.

A central principle is the downward compatibility of the EtherCAT specification: there is a single technology version that is supplemented by extensions instead of new, modified versions being published regularly. This ensures that devices in old systems can be replaced by current devices without having to pay attention to version differences and keep track of historical firmware and hardware versions. Long-term stability and interoperability are among the advantages of EtherCAT.

EtherCAT is recognized as an international standard and is standardized in IEC 61158 and IEC 61784. There are further standardizations for specific industries, for example in the semiconductor industry through SEMI (E54.20).

Interoperability and conformance assurance

To ensure that EtherCAT devices from different manufacturers can communicate with each other without any problems, the ETG requires the use of the official EtherCAT Conformance Test Tool (CTT). The CTT software tests the devices for compliance with the EtherCAT specification and also checks the EtherCAT SubDevice Information (ESI) file for valid values. There are also device-specific protocol tests, for example for the CiA 402 drive profile. The test results are saved for analysis and documentation purposes. The CTT is continuously maintained and expanded with new test cases; its use is already helpful during the development phase in order to detect errors in the interface implementation at an early stage. The test procedure and test content are defined and further developed by a corresponding working group within the ETG, the Technical Working Group Conformance.

In addition to the mandatory in-house tests with the EtherCAT Conformance Test Tool, manufacturers can have their devices tested in EtherCAT Test Centers (ETC) accredited by the ETG. Comprehensive tests are carried out there that go beyond the automatic protocol test. A successful test in an ETC is confirmed with an EtherCAT Conformance Tested certificate. For safety-critical applications, there are special tests for Safety over EtherCAT (FSoE), which are carried out by independent testing organizations such as TÜV.

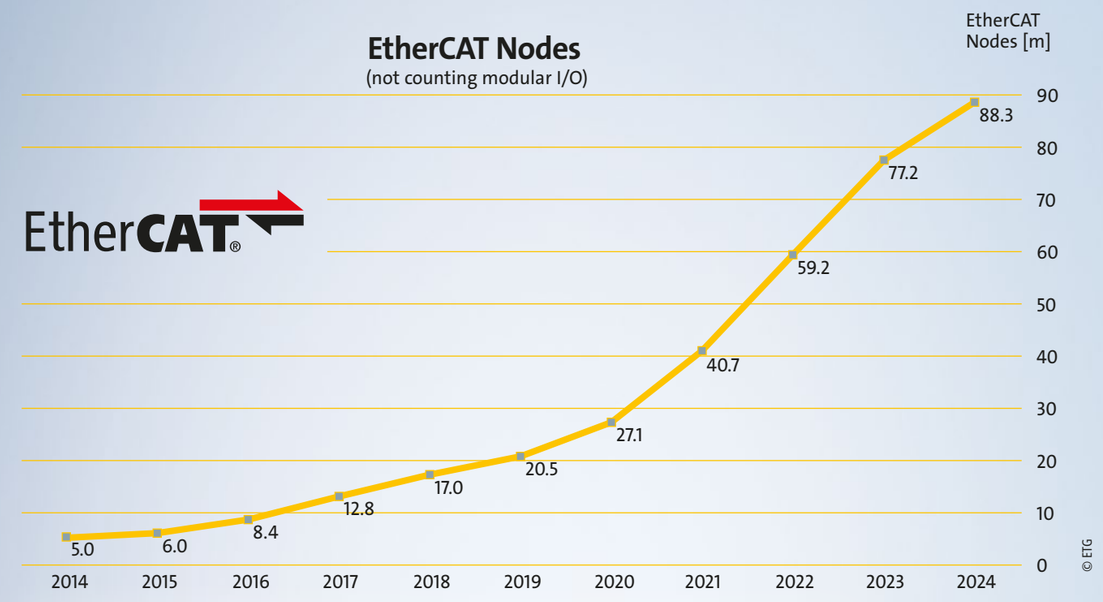
In addition, the ETG offers further measures for conformity testing. These include the EtherCAT Plug Fests, regular developer meetings at which manufacturers can test their EtherCAT devices in a shared test environment. Possible interoperability problems are identified and resolved at an early stage. These events take place several times a year in Europe, Asia and North America.

Support for members

In addition to the above-mentioned offers and tools, the EtherCAT Technology Group provides its members with various other services, including technical documentation and specifications in several languages, software stacks and development tools, training courses and workshops as well as support for the implementation of EtherCAT from the five regional ETG offices in Europe, Asia and America. In addition, the ETG organizes numerous events such as trade fairs, seminars and webinars every year to disseminate information about EtherCAT.

Through its comprehensive support services, strict conformity tests and continuous further development, the EtherCAT Technology Group contributes significantly to the worldwide dissemination and future-proofing of EtherCAT.

Christiane Hammel, Public Relations, EtherCAT Technology Group



Solid growth figures thanks to precise chip statistics: The ETG reports around 88 million total EtherCAT nodes worldwide as of 2024.

EtherCAT: 88 million nodes worldwide

The EtherCAT success story continues as the ETG now reports around 88 million EtherCAT nodes in the field worldwide. And even if the pace of growth in recent years could not be maintained due to the current global economic climate and the after-effects of chip overstocking, the result is impressive: another 11 million EtherCAT nodes were added in 2024 – an outstanding result in a challenging market environment.

These node figures are very reliable as they are based on actual chip sales, which are reported by the chip manufacturers to Beckhoff Automation, the inventor of EtherCAT technology. “And they have no interest in exaggerating these figures, as this would entail additional costs for them,” explains Martin Rostan, Executive Director of the EtherCAT Technology Group. With EtherCAT, the technology license is included directly in the chip, so there are no additional license fees for device manufacturers and users. Beckhoff uses the license revenue to finance the activities of the EtherCAT Technology Group and thus the ecosystem surrounding the technology.

The number of FPGA-based EtherCAT devices, which can only be estimated, remains an uncertain factor when calculating the number of nodes. “We assume that these implementations make up around 10% of the total number. The figure is probably even higher, but we are being deliberately conservative in our estimate,” continues Martin Rostan. Multi-protocol chips are also taken into account, but only proportionally in relation to the market share of EtherCAT at the respective manufacturers.

Despite continued global economic challenges, EtherCAT remains on course for robust growth and reasserts its leading position in industrial communication with the publication of these latest node figures.

More information:
www.ethercat.org

PCcontrol
The New Automation Technology Magazine

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