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PC control

The New Automation Technology Magazine

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Safety first as classic car takes perfect flight

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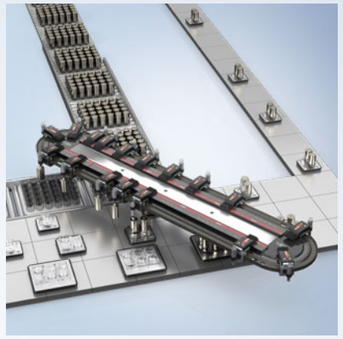

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The official award ceremony for the German Sustainability Award (GSA) for companies was held in Düsseldorf end of November 2023, where Anne Schaper (right) and Johannes Beckhoff (left), who are responsible for sustainability at Beckhoff, happily accepted the award in the transformative measurement and control technology category.

Sustainability and growth

Humanity is growing steadily and, fortunately, prosperity is increasing worldwide. But this also increases the need for raw materials and energy, which our planet does not have in endless quantities. In order to meet the needs of all people, continuously improved production processes are therefore needed to help reduce energy and material use.

Beckhoff Automation receives the 2024 German Sustainability Award

The German Sustainability Award for the transformative measurement and control technology industry goes to Beckhoff Automation. This is the biggest European award for commitment to ecological and social causes.

There are successful solutions to sustainability challenges in every industry. The German Sustainability Award Foundation wanted to bring more attention to these innovative products, and to this end, they honored sustainability pioneers from 100 sectors of German industry for the first time this year. In cooperation with the German Federal Ministry for the Environment, the German Chamber of Industry and Commerce (DIHK), and other partners, data from 6,000 companies was researched and the companies were evaluated based on their sustainability profile. The awards were given to 100 companies that are truly driving sustainability as part of their corporate strategy. With innovative products, high ecological standards in production, or a high degree social commitment in their supply chains, they make valuable contributions to the transformation towards a more sustainable economy.

Beckhoff Automation won over the independent jury of experts for the transformative measurement and control technology category. Measurement and control technology plays a crucial role in achieving sustainability goals. It enables precise monitoring and control of energy consumption systems, industrial and production processes, and the environmental impact across various industries. Companies can reduce their energy consumption and conserve resources by optimally controlling their processes. "We are delighted to receive this award. We believe that it demonstrates exactly how deeply the work we have done and exemplary solutions we have developed are appreciated. It motivates us to continue pushing our current sustainability activities forward," explains Anne Schaper, energy management officer at Beckhoff Automation.

Sustainability and responsibility

Beckhoff has been setting standards in the world of automation for over 40 years. With its PC-based control technology, the company helps its customers to optimize the effectiveness of their processes by reducing energy and raw material consumption while improving quality and profitability. Beckhoff technology paves the way for greater sustainability and Beckhoff constantly works to develop advanced innovations as a leading automation tech company. Many of these innovations are used for generating renewable energy, e.g. in wind power or biogas plants. In the field of wind energy in particular, Beckhoff controllers are used in a large share of the world's wind turbines to optimize control.

Responsible value chain

For Beckhoff, environmental awareness does not begin within the company, but further back in the chain with the suppliers. Beckhoff monitors its supply chain using a sustainability and compliance assessment and works with regional suppliers wherever possible. Beckhoff's production is based in-house in Germany, and the company guarantees its customers high-quality technology with long-term availability, thus providing long-term investment protection for the machines. "In addition to all of our innovations, a great many smaller sustainability measures also add up to constitute our holistic approach to environmental protection. Together with our employees, we strive to become a little more environmentally friendly every single day," states Anne Schaper.

This challenge must be overcome by engineers in all areas of technology worldwide, be it in mechanical engineering, water treatment, medical technology or energy management, to name a few examples. Therefore, Beckhoff is convinced that "... engineers must save the world!"

Beckhoff Automation provides the necessary basic technology for this. PC control technology enables extremely short cycle times that improve the throughput of machines and thus increase their effectiveness; powerful CPUs enable the realization of complex optimization algorithms; the interaction of information technology with automation technology combines the best of both worlds and enables very simple integration into modern cloud and edge applications. The latest scientific findings can be used directly on the controller with Beckhoff Scientific Automation; artificial intelligence and machine learning are integral parts of Beckhoff control technology.

All these technologies help to optimize the effectiveness of processes; this means reducing energy and raw material consumption and improving quality and cost-effectiveness. Ecological and economic requirements can be met at the same time and do not oppose each other!

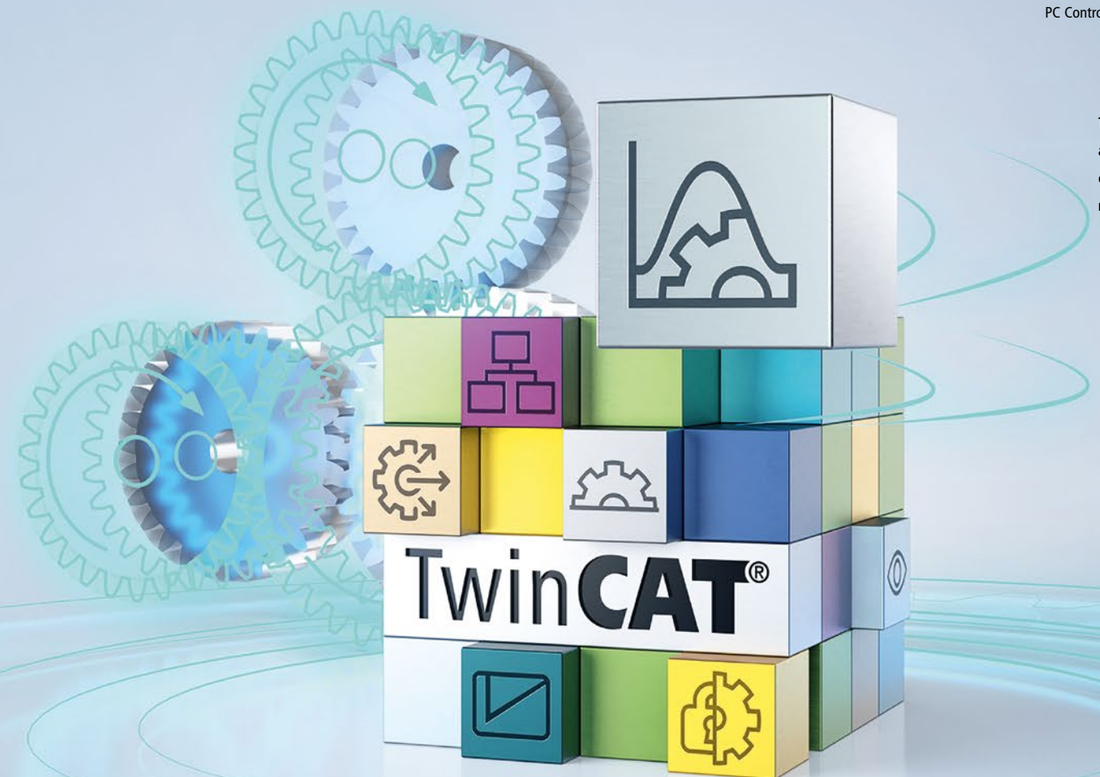
Generating "green energy" with Beckhoff

The greatest contribution that Beckhoff makes as a company to the protection of our planet are innovations. Many of these innovations are therefore also used in the generation of "green energies", whether in wind turbines, solar systems or biogas plants. In the field of wind energy in particular, Beckhoff controllers are used in a large part of the world's wind turbines to optimize control. Wind power is a technological focus at Beckhoff; experienced engineers and scientists are working on a continuous optimization of the energy yield. Apart from our product-based technology projects, Beckhoff is also committed to a number of campaigns for protecting the environment, achieving carbon neutrality, and sustainable handling of natural raw materials.

With trendsetting products and technologies Beckhoff enables the customers to manufacture sustainably and use resources more efficiently. These aims are also reflected in our own behavior. Beckhoff Automation audits the carbon emissions generated by its business activities across all of its global locations and makes a financial contribution to protect the climate that is equivalent to its own emissions.

Beckhoff Automation and Smyczek GmbH, which belongs to the Beckhoff Group, have been successfully operating an energy management system since 2016. Both companies are certified to the international energy management standard ISO 50001. In addition, an energy audit according to DIN 16247 is regularly carried out at Fertig Motors GmbH, which also belongs to the group. This successful energy management involves monitoring the company's energy consumption, taking measures to save energy and continuously improving our energy efficiency. In recent years, for example, we have been able to increase the energy efficiency of our buildings and infrastructure. This was achieved by using energy-efficient lighting, insulating buildings during roof renovations or installing an automatic night cooling system that helps to cool the production halls during the summer months. In doing so, Beckhoff Automation fulfills all legal obligations and contributes to the implementation of the German Federal Government's goal for the turnaround in energy policy.

More information:
www.nachhaltigkeitspreis.de/en
www.beckhoff.com/sustainability



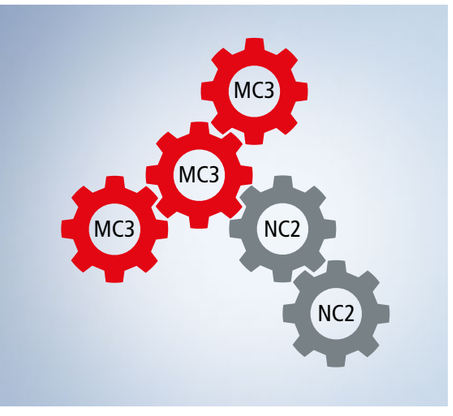
TwinCAT MC3 is a new generation of motion control that offers all the advantages of a modular architecture.

TwinCAT MC3: Next-generation motion control

Future-proof modular architecture with multi-core and multi-task support

TwinCAT MC3 is an all-new generation of motion control, characterized by comprehensive multi-core and multi-task support. Based on a modular architecture, it enables the seamless integration of axes already implemented with the proven TwinCAT NC2 solution while also facilitating the straightforward integration of future motion requirements.

Motion control has been an essential component of the automation platform since TwinCAT first launched in 1996. The long-standing success of the TwinCAT NC2 solution is testament to the well thought-out and practical concept behind its inception. With axes abstracted into axis objects, users can simulate and program axes independently of hardware. What's more, they can also access a wide array of functionalities ranging from basic single-axis movements through to complex axis couplings and subsequent path planning, catering to diverse application needs.



MC3 axes can be coupled with NC2 axes that have already been implemented.

Complete system integration and advanced architecture

The key features of the previous motion control solution from Beckhoff are also present in TwinCAT MC3, allowing for seamless integration into the TwinCAT system and facilitating axis abstraction. TwinCAT MC3 also offers a host of additional advantages through a new and modular architecture. These notably include comprehensive multi-core and multi-task support with the possibility of synchronized movements across all processor cores in use, and the fact that the previous restriction on the number of axes no longer applies.

The seamless integration of TwinCAT MC3 into the TwinCAT system means that the motion control solution can not only be operated in parallel with the other TwinCAT functions in one system, but can also interact with the other TwinCAT functions. The highlights are as follows:

- TwinCAT MC3 can be operated in parallel with the previous NC2 motion control solution, and MC3 axes can also be coupled with existing NC2 axes. This makes it possible to implement new machine components with TwinCAT MC3 without having to adapt existing machine components that use NC2.
- TwinCAT Drive Manager supports the commissioning of Beckhoff drive solutions and, as is typical for NC2, can also automatically create MC3 configurations and MC3 axes with standard parameters.
- TwinCAT Scope is a powerful diagnostic tool that can be used to record movements and dynamics and then analyze them manually using various toolboxes.

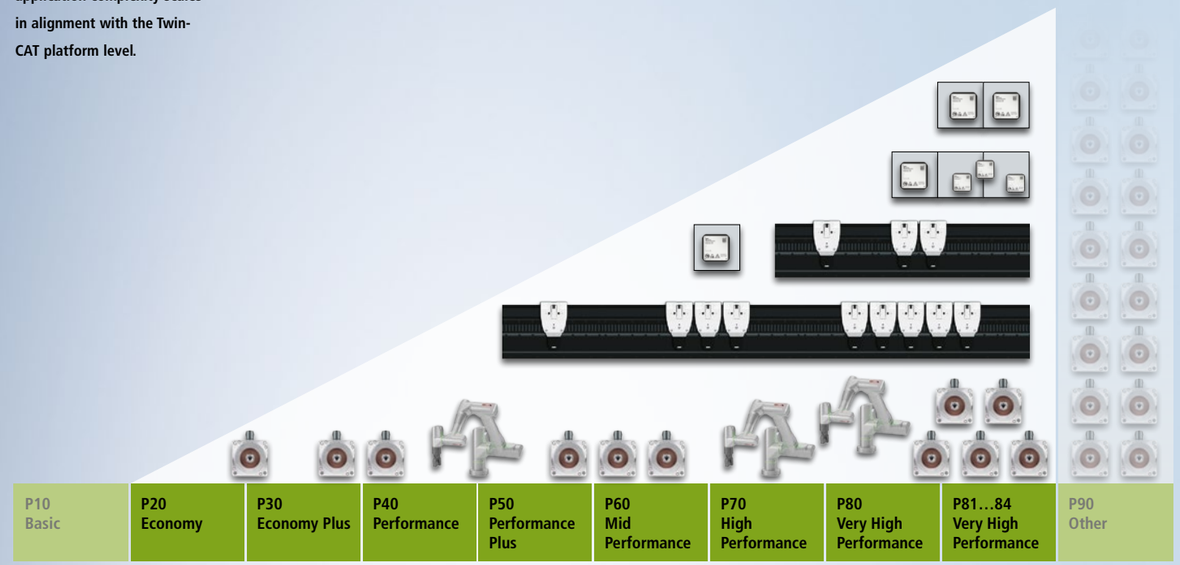
Scalable performance with multi-core and multi-task support

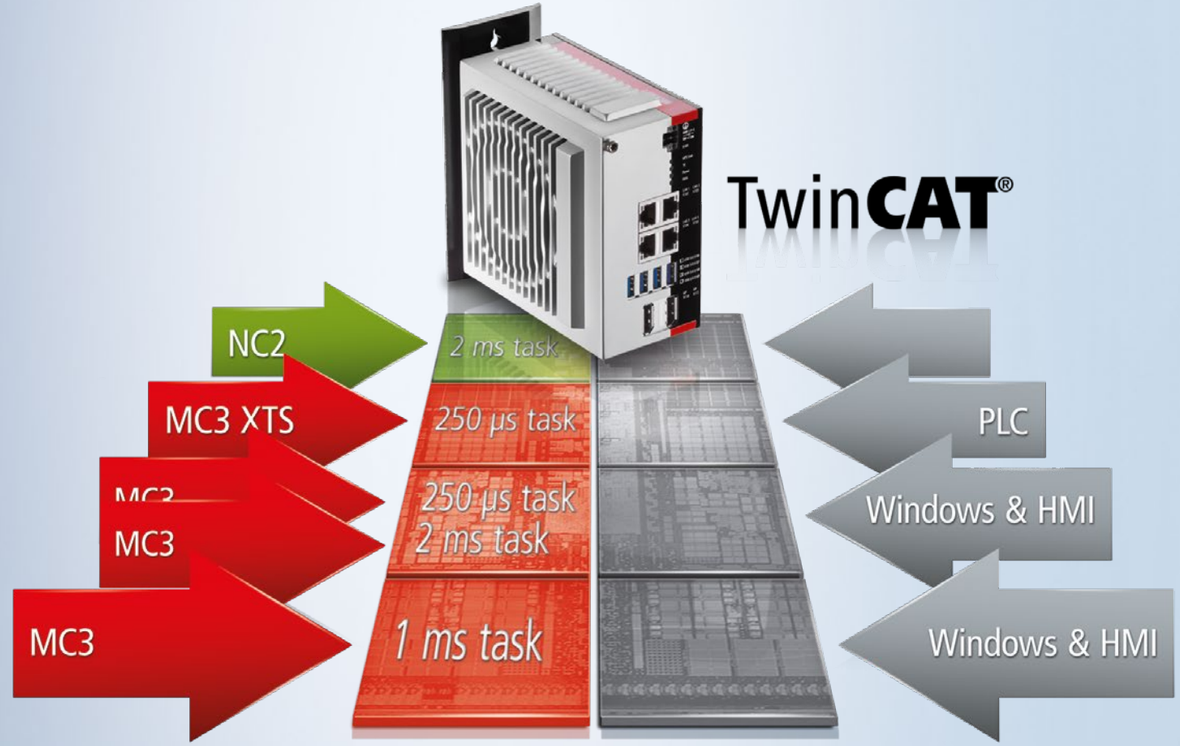
TwinCAT MC3 maximizes the utilization of the control computer's CPU performance through its comprehensive multi-core and multi-task support. As a result, the potential number of axes and application complexity scales in alignment with the chosen TwinCAT platform level:

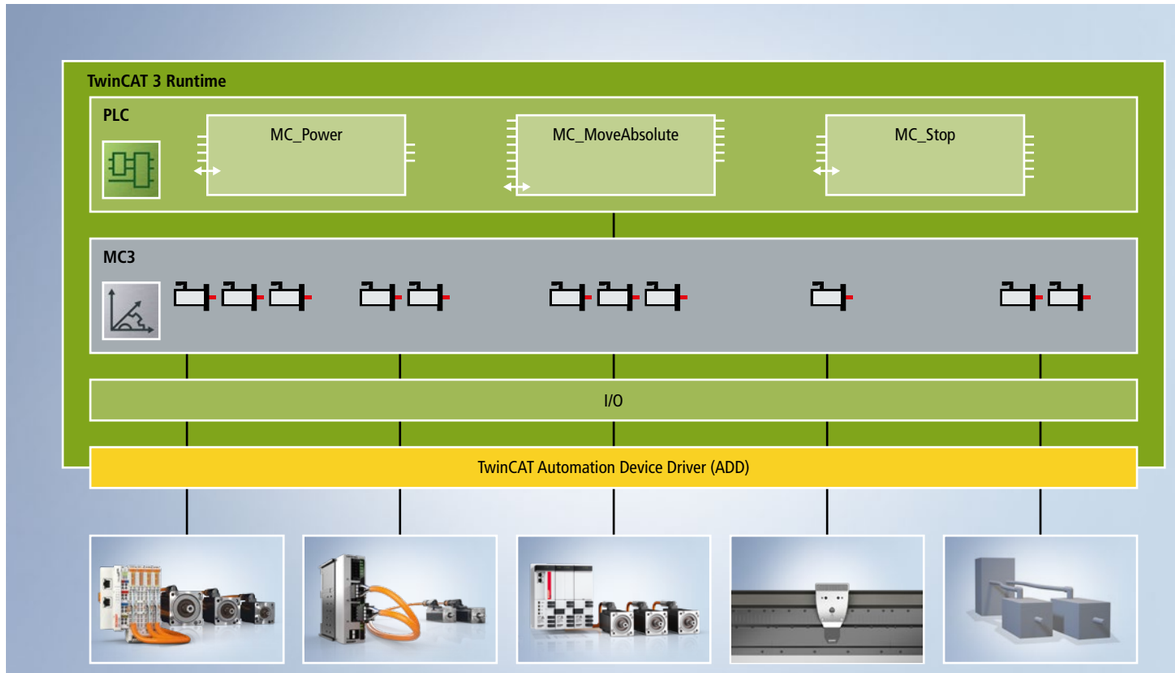
- In this context, multi-core support means that TwinCAT MC3 can be distributed to several CPU cores as required. Movements can be synchronized across all CPU cores in use.
- Multi-task support means that axes with different cycle times can be operated on a single CPU core, precisely matching the speeds and tasks of the respective axes. This facilitates optimum utilization of a CPU core, as the "fastest" axis does not necessarily dictate the clock rate for all axes. In this way, the axes of a conveyor belt with a delta picker can be operated with a cycle time of 1 ms to ensure that the workpieces are picked up quickly, while the axes for width adjustment of the conveyor belt are operated with a cycle time of 4 ms on the same CPU core.

Marlene Arntz, TwinCAT Product Management – Motion Control and Robotics, Beckhoff Automation

With TwinCAT MC3, the potential number of axes and application complexity scales in alignment with the TwinCAT platform level.







Thanks to the principle of abstraction into axis objects, TwinCAT MC3 is independent of the motion hardware used.

Advantages of hardware independence

As with the previous motion control solution, TwinCAT MC3 abstracts the axes into axis objects that separate the hardware from the programming process. This creates hardware independence, the advantages of which can be seen in the following features:

- Axes can be simulated, whereby a mixture of real and simulated axes is also possible within a project. Switching between the real and simulated axis can be carried out in the configuration with a single click, for both an individual axis and a group of axes. This makes it possible to program the axes without a connection to the hardware and reduces the commissioning time on the real machine.
- TwinCAT is an open control platform that supports the EtherCAT high-performance communication system as well as all other common fieldbus systems.
- A wide variety of drive systems, such as servo, stepper, and DC motors, as well as the XTS product transport system, can be equally abstracted into axis objects and therefore be programmed uniformly. Programming is facilitated by the TwinCAT Tc3_Mc3 library, which offers PLCopen-compliant function blocks that users may recognize from NC2.
- With TwinCAT MC3, hydraulic axes are now also supported and fully integrated. General programming is carried out using the same PLCopen-compliant function blocks that are used for electric axes. There is also a library with supplementary function blocks for special fluid power functionalities.

Modular architecture and high functionality

TwinCAT MC3 is based on a modular architecture, which provides a future-proof foundation. Building upon this new architecture are features such as multi-core and multi-task support. This architecture will also facilitate or enable the implementation of new capabilities in the future, such as the customization of profile generators, drivers or filters to meet customer-specific requirements. TwinCAT MC3 also incorporates the familiar and proven functionalities of NC2. The first release of the next-generation motion control solution will commence with point-to-point (PTP) movements and couplings, covering a broad spectrum ranging from simple linear axis couplings to non-linear couplings in motion.

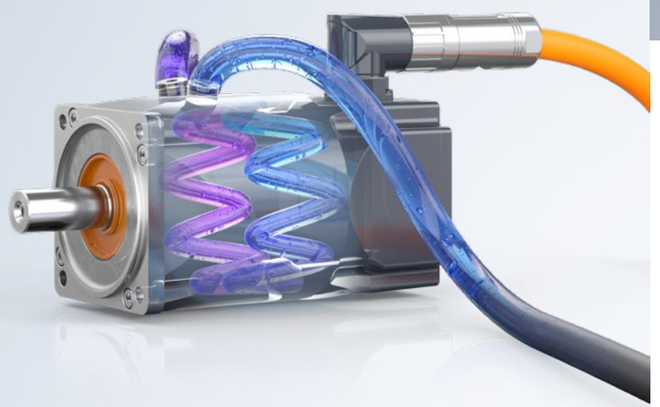
More information:
www.beckhoff.com/twincat-mc3

AM8300: Servo technology for extreme performance and dynamic requirements

The AM8300 servomotors expand the Beckhoff portfolio to include a modular motor series with integrated water cooling. Due to the efficient cooling, an extremely high power density is achieved, so that a rated power of up to 40 kW can be delivered in the smallest installation space, depending on the size. Compared to similar conventional convection-cooled motors, the standstill torque is three times higher.

In terms of technology, the AM8300 series is based on the tried-and-tested AM8000 series and its advantageous modular system with its wide range of options and consistent availability. The servomotors offer maximum dynamics, as the torque increases with water cooling, but the rotor moment of inertia remains constant. These are particularly suitable for applications with higher speed and torque requirements. Five flange codes, each with three lengths – with standstill torques from 5.1 to 274 Nm – cover an extremely wide range of applications.

The AM8300 motors can optionally be equipped with a backlash-free permanent magnet holding brake, shaft seal and keyway. Depending on the size, they are available with various feedback systems such as resolvers or batteryless single and multiturn encoders with One Cable Technology (OCT) or Hiperface. With its water cooling system and high IP65 protection rating, the AM8300 is also suitable for demanding environmental conditions – particularly those with high ambient temperatures. Depending on the size, the AM8300 is equipped with a 1/8'' or 1/4'' thread for connecting the cooling circuit.



More information:
www.beckhoff.com/am8300

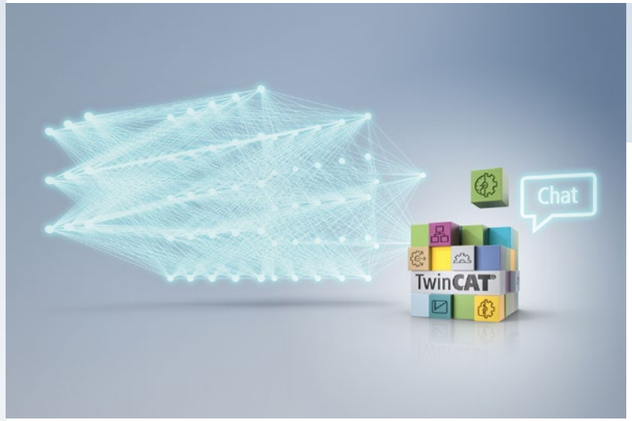
EL4374: Two analog inputs and two analog outputs combined in one 12 mm terminal

The analog EL4374 EtherCAT Terminal combines two analog inputs and two analog outputs that can be individually parameterized for current or voltage mode via TwinCAT (via CoE). Depending on the setting, the channels process signals at 1 ksps in the range of –10/0 to +10 V or –20/0/+4 to +20 mA.

The EL4374 is a powerful combined input/output terminal for 10 V/20 mA that can be used for standard automation tasks at a conversion rate of 1 ksps per channel. The analog inputs are digitized with a resolution of 16 bits and transmitted to the higher-level automation device under galvanic isolation. The 16-bit resolving outputs have the same properties. With a technical measuring range of +107% of the nominal range, this terminal also supports commissioning with sensor values in the limit range and evaluation in accordance with NAMUR NE43. The outputs can provide up to 107% of the nominal value. In addition, the high output power allows a load of up to 750 Ω at 20 mA.

EtherCAT

More information:
www.beckhoff.com/el4374



TwinCAT Chat: Fast and efficient through AI-supported engineering

With TwinCAT Chat, large language models (LLMs) such as ChatGPT from OpenAI can conveniently be used in the TwinCAT XAE engineering environment to develop projects. Efficiency potential can thus be exploited, from control programming to corporate management.

Large language models offer a number of benefits for both automation engineers and enterprise management. For automation engineers, LLMs have the potential to revolutionize the development process by automatically generating and completing code. This speeds up the entire process. In addition, you can even have LLMs create personal tutorials and specifically ask for solutions to problems that arise. From an enterprise management perspective, LLMs promote knowledge transfer within the organization. They can act as a central knowledge base, storing valuable information and making it available when needed. In addition, LLMs can relieve the pressure on the support team by serving as the first point of contact for customer inquiries.

TwinCAT Chat was developed to deeply integrate LLMs into control engineering, giving users a clear benefit when compared to using ChatGPT traditionally in a web browser, for example. This greatly simplifies the development process, as communication and code exchange are seamlessly integrated. Furthermore, the basic initialization of the LLM has been tailored specifically to TwinCAT requests. You can thus ask specific questions directly and don't have to tell the LLM that you are using TwinCAT first and that the code examples are expected in Structured Text. In addition, the generated code can easily be transferred, which not only saves developers time but also prevents the errors that occur when transferring code manually. For efficient interaction with TwinCAT Chat, simple one-click pre-tested requests can be used that are specifically designed to improve the user's workflow. Other current development work includes automated creation of TwinCAT HMI controls and a chatbot interface to the extensive Beckhoff documentation system.

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

ASI8100: Compact and integrated EtherCAT stepper motor drives

The integrated ASI8100 stepper motor drive from the range of compact drive technology products (up to 48 V DC) combines a stepper motor, stepper motor output stage, and fieldbus connection in a space-saving design. As an EtherCAT slave, it can be placed directly on the machine without a control cabinet or upstream I/O level, allowing for highly compact, control cabinet-free machines.

The series covers all motion requirements for stepper motors in the power range up to 250 W. Drive monitoring is indicated by integrated status LEDs in this case. With the integrated travel path control, simple function blocks for motion applications are already pre-integrated. The standardized M8 (for EtherCAT) and M12 (L-coded, for power) connectors also provide cost-effective, industrially compatible connection technology. The two additional I/Os allow drive-related functions, such as the detection of end positions or the latching of positions, to be executed efficiently.

The series starts with NEMA 17 drives (42 mm), available in two stack lengths with a 0.29 Nm or 0.8 Nm holding torque. This is followed by four NEMA 23 devices (56 mm) with holding torques of 0.75 Nm, 1.4 Nm, 2.35 Nm, and 2.5 Nm. Pre-assembled cables and infrastructure components, such as IP67 distribution box modules, are available as accessories.

More information:
www.beckhoff.com/asi8100

EP3751-0260: Precise detection, even of complex rotational movements, with sensor fusion

The EP3751-0260 EtherCAT Box module connects an acceleration sensor with an inertial measurement unit (IMU), i.e. with a gyroscope. This unit measuring just 30 x 86 x 22 mm thus provides accurate detection of acceleration and rotational motion in addition to shock, vibration, and tilt measurement, both as pre-processed values and as raw sensor data.

An ultra-low-noise 3-axis accelerometer with a 20-bit resolution and an adaptable measuring range of ±2, ±4 and ±8 g are integrated. The sampling frequency is 4 kHz. The built-in sensor is suitable for applications where low frequencies need to be monitored with as little noise as possible – e.g. monitoring building work, bridge monitoring, robotics or condition monitoring. In addition, the I/O box module also features a low-noise, temperature-stable 3-axis MEMS gyroscope sensor (6DoF IMU) to record rotational motion across the three axes. With these two sensors, a wide variety of motion applications can be measured using just one I/O box module, and even complex rotational motion can be recorded precisely.

The high-performance EtherCAT connection also ensures virtually delay-free transmission to the evaluating measuring system. The sensor data is parameterizable and can be transmitted as raw values (unprocessed/unfiltered) or as pre-processed measurement data. The latter can then be filtered, processed, and evaluated using TwinCAT Analytics, for example.

More information:
www.beckhoff.com/ep3751-0260

XPlanar: Larger tiles for efficient use of space and challenging applications

Two new tiles – the highly compact XPlanar drives – are now available for the planar motor system. Their larger dimensions enable 1- or 2-route operation of XPlanar movers with a width of 155 mm on a minimal footprint. The new form factor can reduce the space required and costs by up to 50%, especially in applications with transport weights between 800 and 3000 g. In addition, the new tiles open up numerous additional applications due to increased precision, dynamics, and mover packing density. Variants with STO functionality are also available.

The APS4244 and APS4242 XPlanar tiles represent a new form factor in the system and feature dimensions of 320 x 320 mm and 320 x 160 mm respectively. For the first time, this allows 1-track operation (APS4242) or 2-track operation (APS4244) that is optimized for the APM43x0 movers, enabling more flexible and significantly more cost-effective routes to be achieved. The two new tiles also offer improved precision and reduced minimum mover spacing, which means increased mover packing density. In addition, there is a powerful integrated power supply unit for increased dynamics. Depending on the variant, STO functionality is implemented to enable the easy integration of manual workstations, for example.

More information:
www.beckhoff.com/aps4242
www.beckhoff.com/aps4244

C6043: Execute AI applications with a small footprint and an external graphics card

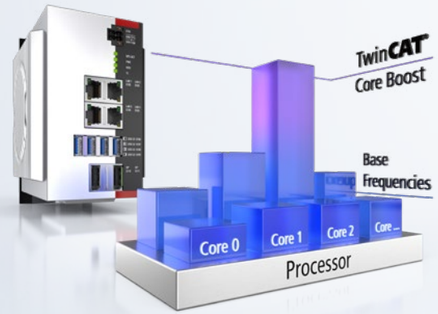
The C6043 is a particularly powerful addition to the ultra-compact industrial PC series, which is characterized primarily by the second board level for an NVIDIA graphics processing unit (GPU) integrated ex factory. The computer thus provides the ideal hardware foundation for high-intensity computing applications, particularly in the artificial intelligence field.

With the ex-factory assignable slot for powerful graphics cards, the C6043, which measures just 132 x 202 x 127 mm, can be equipped with highly parallelizing and long-term available NVIDIA GPUs in addition to its modern Intel® Core™ processors. This makes it ideal as a central control unit for challenging applications, e.g. applications that place high demands on 3D graphics or with deeply integrated vision and AI program modules with minimal cycle times. The TwinCAT 3 automation software can map these functions fully integrated alongside the classic controller, without additional software or interfaces. With the additional freely assignable PCIe compact module slot, the C6043 can also be flexibly expanded with additional interfaces. The C6043's power supply and cooling system provide enough power to fully exploit the potential of the external graphics card and the latest Intel® processors.

With the 12th and 13th generation Intel® Core™ processors, the C6043 already offers excellent computing without an external graphics card. For the very first time, the Intel® Core™ i5, i7, and i9 processors have been installed in a hybrid architecture. As with the previous processor generations, Intel® Celeron®, Pentium®, and Core™ i3 offer classic performance cores; Core™ i5, Core™ i7, and Core™ i9, on the other hand, also have four, eight, and sixteen efficient cores, respectively. This combination of performance and efficiency cores allows applications to be implemented on a total of up to 24 real processor cores. While performance cores are primarily suitable for high-performance, single-thread applications, many additional threads can be executed in real time or in user mode on the additional efficiency cores. What's more, each individual core can be configured individually via TwinCAT in the clock frequency.

More information:
www.beckhoff.com/c6043

TwinCAT Core Boost: Enormous leap in performance with processor cores in turbo mode



TwinCAT 3 consistently supports modern multicore processor technology. The multi-thread capability enables the application to be distributed across several cores. Supplemented by TwinCAT Core Boost, the computing performance of individual real-time or user-mode cores can now be increased by up to 50% in order to get the maximum performance out of the system and adapt it optimally to the respective requirements.

With TwinCAT Core Boost, the clock frequency of the processor cores can be configured individually and as required, so they no longer all have to be clocked at the same rate. The clock rate per core can be defined for real-time transmission and user-mode applications. It is also possible to operate individual cores permanently and in real-time in a so-called turbo mode. This results in the following application benefits:

– up to 50% more computing power for one or more processor cores,
– possibility of using more cost-effective CPUs.

The permitted power consumption and temperature of each processor core (and of the overall system) is monitored by TwinCAT Core Boost, so that reliable operation is ensured even when turbo mode is used. TwinCAT Core Boost can be used with all Industrial PCs with Intel® Core™ I processors from the 11th generation onwards.

More information:
www.beckhoff.com/twincat-core-boost

AX8820: Intelligent energy recovery for maximum efficiency

The AX8820 universal regenerative unit is used to feed regenerative energy back into the grid. It is suitable for use with the AX8000 multi-axis servo system, AX5000 digital compact servo drives, and third-party devices. The energy is regenerated sinusoidally, preventing the grid distortions that are common with block-shaped regeneration.

The AX8820 regenerative unit is designed for a nominal supply voltage of 400 to 480 V AC, nominal output of 7 kW, and a maximum DC link voltage of 848 V DC. For effective energy management, the regenerative energy is initially stored in the DC link. The AX8820 only starts feeding power back into the grid just before the overvoltage threshold of the connected devices is reached. Several AX8820 regenerative units can be operated in parallel to optimally adapt the regenerative power to the needs of the machine.

No communication via EtherCAT is required to carry out energy recovery. However, extended parameterization – to adapt the voltage levels to the connected devices, for example – is possible via EtherCAT. With the help of the extended diagnostics via EtherCAT, the current regenerative energy can also be analyzed. The online data can be used to record the timing of the machine processes. This means that an investigation to see whether the efficiency of the machine can be increased by staggering the machine processes can be performed.

More information:
www.beckhoff.com/ax8820

AL8000 and AL8100: Integrated OCT feedback system makes using linear motors exceptionally easy

The AL8000 and AL8100 linear motor series now offer integrated position detection thanks to the addition of a feedback system. This makes the entire process of integrating the motor into the machine much easier, as users no longer have to mount the scanning head themselves. What's more, users benefit from all the advantages of Beckhoff One Cable Technology (OCT).

The linear drives feature an integrated feedback system – a scanning head and a scale tape – to form a new type of functional unit. One Cable Technology (OCT) from Beckhoff enables signal transmission directly via the periphery of the motor. As a result, only one cable is required for the power supply, the feedback system, and the thermal sensor. This not only reduces the wiring to the control cabinet, but also enables extremely simple commissioning via the electronic nameplate which contains all the relevant motor parameters. The scanning head is also pre-aligned and directly coupled to the coil unit, eliminating time-consuming assembly and alignment procedures for the feedback system. The linear motors are available for both the 400 V (AL8000) and 48 V (AL8100) ranges. When combined with the ELM72xx servo terminals, the AL8100 therefore offers a complete linear motor solution for the low voltage range for the very first time.

More information:
www.beckhoff.com/al8000
www.beckhoff.com/al8100

MX-System: Increase in power range and modularity of control cabinet-free automation

Beckhoff offers a flexible and highly efficient control cabinet alternative in the form of MX-System, a modular and pluggable automation toolkit. The new baseplates and modules in size 3 can be combined with size 1 and 2 modules in the usual system, expanding the range of applications in which the MX-System – a byword for control cabinet-free automation – can be used.

The MX-System baseplate in size 3 offers an additional row of data slots, opening up a new set of possibilities. There are now significantly more slots available to accommodate even more function modules within the same width. The baseplate is compatible with all function modules in the existing sizes, but also with the new 3-row function modules. The principle of passive cooling remains the same in size 3, although the larger cooling surface means that other performance ranges can be achieved. The first size 3 modules are a 600 V DC supply with 40 A nominal current, a servo controller with 28 A nominal current, and a power supply for up to 63 A. More options based on size 3 will be added in the future – such as modules for switching AC loads of up to 16 A or frequency inverters with up to 15 kW. It will also be possible to implement feeds of up to 125 A.

This addition to the portfolio significantly increases the range of applications in which the MX-System can be used. Up to now, machines requiring high power inputs could only be implemented to a limited extent and in a hybrid manner using the modular MX-System. However, the 3-row baseplates are now able to replace the control cabinet for power distribution that was previously required in these cases, allowing more and larger machines to be configured entirely control cabinet-free. In the topology of a machine, a 3-row baseplate will likely always be positioned above the 1-row and 2-row baseplates that have been provided up to now, serving as a central point in a combined star and daisy-chain topology. For a small, compact machine, the 3-row baseplate can be used to fit as many size 1 and 2 modules as possible on a minimal surface area, providing a full replacement for the control cabinet and making it possible to benefit from the MX-System's wider range of functions.

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

CX5300: Up to 60% increase in computing performance

The new CX5300 Embedded PC series uses Intel Atom® processors from the x6 series (Elkhart Lake), helping it to offer up to 60% more computing power than the proven CX5200 series. Further application advantages result from the modern DisplayPort for HMI integration as well as the UPS OCT-capable power supply unit and the capacitive 1-second UPS.

The CX5300 is a fanless embedded PC and is available in two device variants:
- CX5330: with x6214RE Intel Atom® processor (1.4 GHz, two cores)
- CX5340: with x6416RE Intel Atom® processor (1.7 GHz, four cores)

In the basic configuration, the devices are equipped with 4 or 8 GB of DDR4 RAM, two independent, gigabit-capable Ethernet interfaces as well as four USB 3.1 interfaces and one DisplayPort. A wide range of additional connection options or gateway functions are available thanks to the optional interface, which can be fitted ex factory, and the I/O level, which can consist of either E-bus or K-bus terminals. In addition, a system module or fieldbus module from the CX2000 series can be plugged in via the high-pole connection on the left-hand side of the device. Furthermore, the CX5300 is characterized by an internally electrically isolated power supply unit with UPS OCT capability, the built-in capacitive 1-second UPS for persistent data storage, and low power consumption.

More information:
www.beckhoff.com/cx5300

Efficient battery production needs PC-based control technology

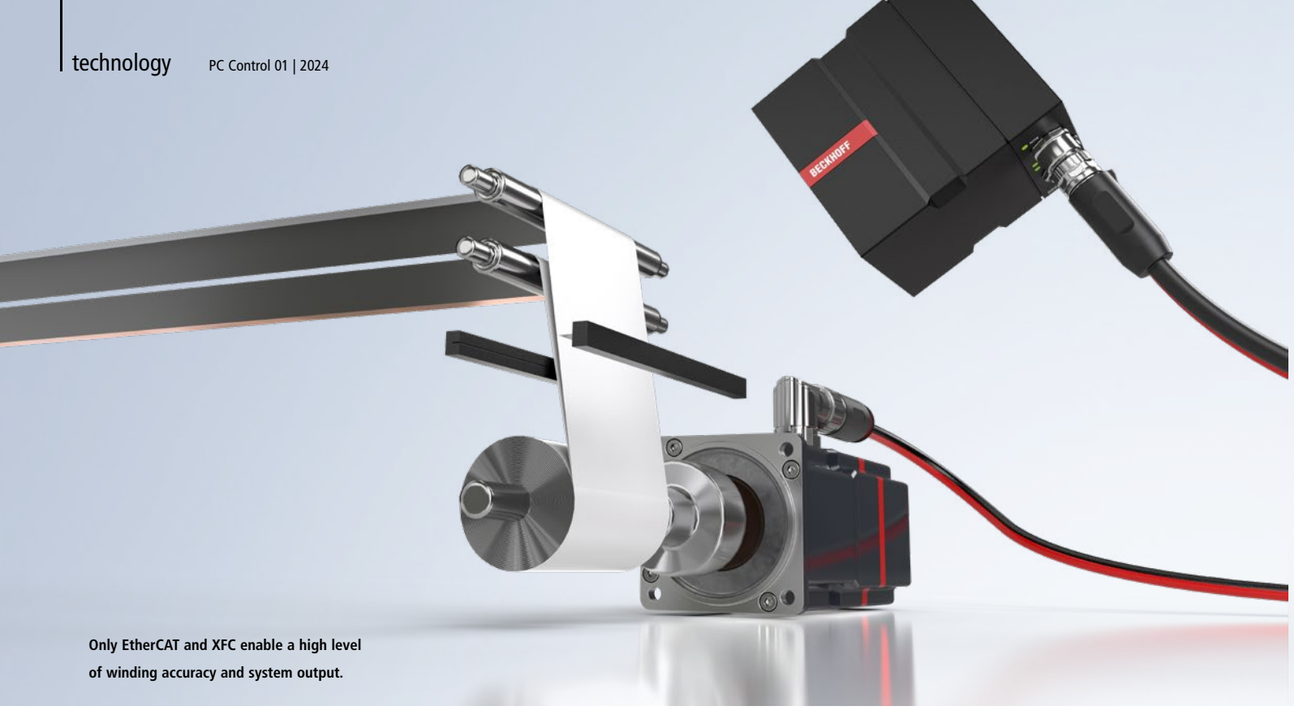
The fast-growing e-mobility market is placing high demands on battery cell production in terms of speed and efficiency. This is why high-performance PC-based automation solutions are needed to control sophisticated processes, from electrode production to module and pack assembly, on a central platform.

Tilman Plaß,
Automotive Industry Manager, Beckhoff Automation:

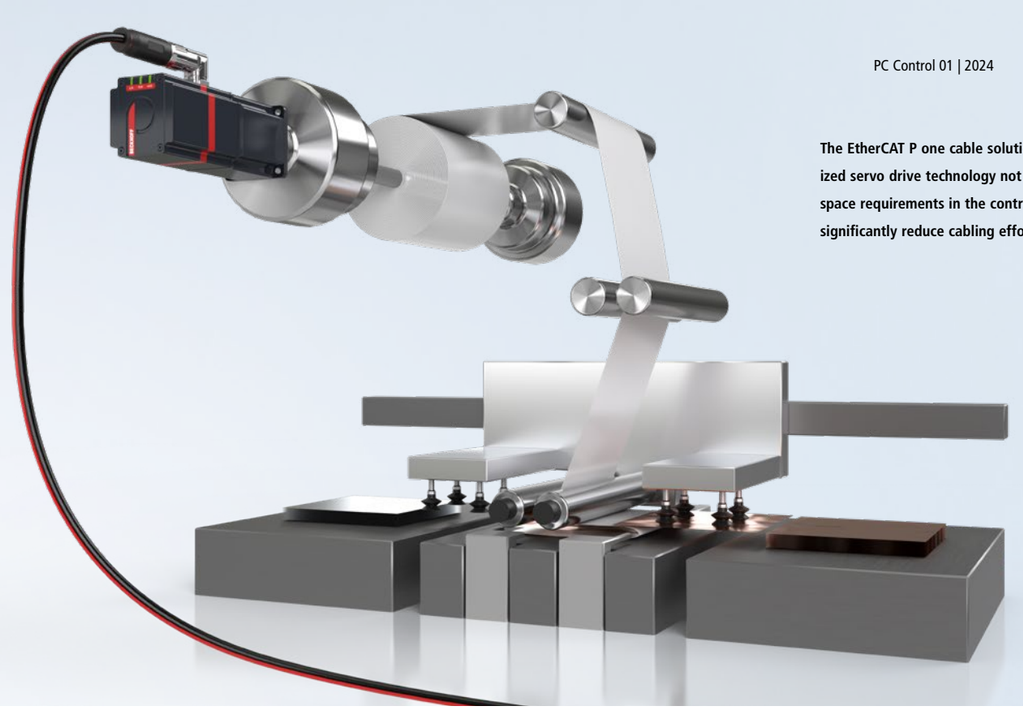
“A minimal equipment footprint and fast processes are crucial contributors to scalability in battery cell production. These can be achieved with flexible product transport systems and PC-based control technology. Changes to processes can also be implemented quickly and easily through software.”

The PC-based XTS and XPlanar intelligent transport systems offer unparalleled efficiency potential in battery production.

XTS® XPlanar®



Only EtherCAT and XFC enable a high level of winding accuracy and system output.



The EtherCAT P one cable solution and decentralized servo drive technology not only minimize space requirements in the control cabinet, but also significantly reduce cabling effort.

Jörg Rottkord, Automotive Industry Manager, Beckhoff Automation:

“When it comes to multiplying modern gigafactories quickly in the future, battery producers have recognized the importance of correlating process data – i.e., formulations – with the corresponding control parameters of the plants. This is where PC-based controls such as IPCs with TwinCAT are invaluable for building on the accumulated experience at the next location and on the associated production lines. The central management of these setting parameters on the controller instead of, for example, in the drive amplifiers themselves, allows this data to be ‘cloned’ and shared at any time. And this doesn’t even take into account the additional possibilities of virtual commissioning.”

In the mass production of battery cells, even the smallest time or energy savings in individual production steps are crucial. When added together, these optimizations result in a significant increase in the output of a production line, and can even have a positive effect on costs and carbon savings. In order to make fully automated battery production as efficient as possible, it is worth taking a closer look at the control technology used in machines and systems: the shorter the cycle times, the higher the output. This can be illustrated by a simple example: If a line scan camera can record a 5 mm strip in one cycle, it achieves a speed of exactly 5 mm/s with a control technology cycle time of 1 second. With PC-based control technology, on the other hand, the 50 µs cycle time achieves a 20-fold higher speed while maintaining the same information density.

PC-based control technology from Beckhoff runs all control functions on a central PC platform, which allows it to offer the highest possible production speeds. The programming and control of all functions are carried out in a single software system executed on an industrial PC. This ensures efficient interaction of all components as well as maximum synchronization, since all information is available with a common time reference. It also avoids friction losses or latencies, such as those that tend to occur during communication between different systems.

The high performance of advanced processors, which form the core of the PC-based control platform, allows for the centralized execution of computationally intensive tasks. This means that a large number of axes, such as those required for winding battery cells, can be controlled synchronously via an industrial PC, enabling maximum precision and speed in even highly sophisticated processes. Vision applications and machine learning scenarios can also be integrated directly into the control system using powerful PC-based systems. Due to their easy scalability on both the software side (adding modular software blocks) and hardware side (processors with higher performance, multi-core), PC-based automation solutions provide an optimal foundation for machine control in battery production lines, regardless of whether this involves pouch, round, or prismatic cells, and even when considering future requirements.

PC-based control technology not only enables outstanding efficiency and speed, but also a completely new approach to production processes. High-performance industrial PCs can be used to control the intelligent Beckhoff XTS and XPlanar transport systems, for example, which facilitate the individualized transport of each battery cell: Individual movers transport the cells either along a linear transport rail or by floating two-dimensionally over a field of application-specific magnetic tiles. These individualized transport routes minimize the system footprint as well as enabling a maximally flexible production environment and permanent, uninterrupted product tracking.

PC-based control for cell production

PC-based control offers advantages for all battery production processes. These are particularly evident in the stacking and winding processes for pouch or round cells, where the requirements for precision and speed are exceptionally high.

The rolling process used in round cell production involves winding a jelly roll from an anode strip, a cathode strip, and two separator strips. This is subsequently inserted into a metal housing as part of the production process. Accurate web edge control is critical when winding the jelly roll to ensure precise positioning of the various belts. This requires perfect coordination between the vision system and the NC on the control side. PC-based control technology allows for the direct integration of image processing into the control platform, thereby optimizing synchronization with motion control. The EtherCAT high-speed communication system offers a further advantage, as its ultra-fast data transmission with exact timestamp function means no time is lost during communication with sensors, actuators, or the vision hardware. With XFC technology (eXtreme Fast Control Technology), even response times of under 100 µs can be achieved to ensure not only precise winding accuracy, but also high output.

Pouch cells are produced in a stacking process: Electrode sheets of cathode or anode material are placed between separator layers – for example, with a Z-fold. Similar to the winding process for round cells, a high level of accuracy and speed are also crucial in Z-folding.

By consolidating all control functions into a powerful PC platform, even highly sophisticated motion tasks in the stacking process of battery cells can be executed with high precision. This makes it possible to control a high number of axes both centrally and synchronously. Robot kinematics can also be seamlessly integrated into the control system. Additional software functions for motion control include the rapid and accurate synchronization of continuous to clocked processes. Even on the hardware side, new automation solutions offer advantages with regard to the assembly of pouch cells: Traditional drive technology in the Z-fold can be replaced by decentralized servo drive systems, for example. These integrate the servo drive directly into the motor saving valuable space in the control cabinet. EtherCAT P is used to reduce the machine footprint further still, with this solution combining power and feedback lines into a single cable.

More information:
www.beckhoff.com/battery-production

PC-based control offers end-to-end automation of the entire process, from the blow molding machine to the packaging machine – i.e., from the plastic granulate raw material to the filled, labeled, and packaged bottle.

Interview with two industry experts on automation synergies in the plastics and packaging industry

Plastics meets packaging – for consistent and efficient process control

PC- and EtherCAT-based control and drive technology from Beckhoff is a universal solution that transcends industry and application boundaries. This standardized and scalable automation platform offers numerous advantages, from integrated, open EtherCAT communication through to simplified handling in the context of development, service, and warehousing. In this interview, industry experts Christian Gummich and Frank Würthner delve into how machine builders and end users in the plastics and packaging industry can capitalize on these advantages, particularly when working in close collaboration.

Frank Würthner, Global Business Management Packaging at Beckhoff Automation:

“End customers in particular are increasingly mindful of selecting the same automation provider across all industries.”

PC-based control is a universal technology that has proven its worth time and again on account of its impressive performance – especially in the challenging packaging sector. What are the main advantages that a Beckhoff solution offers for a typical packaging line?

Frank Würthner: The key here is integration, meaning we can technologically map the entire machine with our TwinCAT software. Our PC-based control technology is also extremely fast, which is an absolute must in this demanding industry. The high-performance EtherCAT communication system provides the perfect fieldbus backbone for this. With its mechatronic products and innovations, such as the XTS and XPlanar transport systems, Beckhoff continues to have a significant influence on machine building concepts.

Plastics machines benefit from PC-based control in a similar way. What are the key aspects of this mechanical engineering sector?

Christian Gummich: Its outstanding performance, coupled with the open, PC-based automation technology concept, helps our customers to develop their own innovations. The option of a scalable platform also plays a key role here, allowing the control system to be chosen in line with system requirements and customer needs.

In addition to technical insight, how important is it to offer comprehensive industry expertise? What makes Beckhoff stand out here?

Frank Würthner: Comprehensive industry expertise is hugely important for an automation specialist. After all, this is the only way to fully comprehend what machine builders need for their projects. This fundamental understanding of specific customer needs is not only essential for providing machine builders with optimal support, but it also paves the way for the most technically appropriate solutions.

Christian Gummich: I couldn’t agree more. Industry expertise is incredibly important. After all, if you want to engage in meaningful discussions and fully comprehend every aspect of your customer’s requirements, in-depth application knowledge is simply indispensable. This, in turn, is essential to properly align any developments and have a positive impact going forward. In line with customer requirements, we have developed a Plastic Framework for the plastics machinery sector that is based on the TwinCAT 3 Engineering environment. This framework offers additional functions tailored to plastics applications in both the HMI and PLC areas, and enables customers to seamlessly integrate our cross-technology products, such as electric and hydraulic axes. It also includes industry-specific HMI controls and templates with sample code to cut down on development times.

The universal nature of PC-based control simplifies the implementation of cross-industry automation solutions. How does this end-to-end control impact packaging and plastics machinery, which is commonly closely interconnected, particularly in terms of comprehensive production processes?

Christian Gummich: There are many factors that can be mentioned here, ranging from the overall appearance across applications or departments through to even larger, but not visible factors such as the consistent use of EtherCAT and TwinCAT in both engineering and service. As far as customers are concerned, there are so many benefits to this approach.

Frank Würthner: In the packaging sector in particular, there are many points of contact with other industries, such as process and printing technology, and especially with the plastics industry. One of the major strengths of our

solutions is Beckhoff's ability to cater to various vertical industries, drawing on its specialized expertise while also consistently tapping into the same reliable technical foundations. As we have already mentioned, notable aspects include the high-performance EtherCAT fieldbus and our TwinCAT tool as a modular and fully comprehensive "Swiss army knife" of automation.

What are the general advantages for respective machine builders and end customers?

Frank Würthner: Here, too, the main advantage is TwinCAT, as the software team only has to be trained on one system. This keeps necessary investments to a minimum and means employees can provide support in other areas as required without a great deal of training.

Christian Gummich: And on top of the training benefits, there are further advantages in terms of supply chains and warehousing, as components can be used across applications and departments. This creates even more advantages in terms of purchasing and maintenance processes. And then, of course, there are the technical benefits: As an end-to-end solution, EtherCAT eliminates the need to support multiple different communication protocols, which may only cooperate to a limited extent and require significant effort from personnel in terms of training, commissioning, and servicing. EtherCAT is also open for the integration of subsystems.

Frank Würthner: That's right, we have found that end customers are now becoming more and more focused on integration, particularly when it comes to maintenance, where it is especially important. With this in mind, end customers are increasingly mindful of selecting the same automation provider across all industries.

Christian Gummich,
Industry Manager Plastics Machines and Product Manager Hydraulics at Beckhoff Automation:

"If you want to engage in meaningful discussions with customers and fully comprehend every aspect of their requirements, in-depth application knowledge is simply indispensable."

How do end customers stand to benefit from a technical point of view – for example, through the optimally scalable Beckhoff solution in software and hardware, the universal EtherCAT communication, and the continuously evolving portfolio including innovations such as XTS and XPlanar?

Christian Gummich: The comprehensive solution approach and the deep integration of various innovative products into a single development environment are crucial to success, particularly where end customers are concerned. The latest innovations, such as Beckhoff Vision, the MX-System as a solution for control cabinet-free automation, and the ATRO modular industrial robot system, enhance the portfolio considerably. This opens up completely new application possibilities, which – in combination with established products such as IPC, motion, and I/Os – also make life easier for the end customer. As a result, functions that were previously integrated externally can in many cases now also be mapped in TwinCAT.

Frank Würthner: The Beckhoff innovations we have talked about here are of notable interest to end users. Major brand manufacturers, for example, are increasingly recognizing that the XTS transport system in particular can significantly influence and optimize their product handling processes. As a result, they are demanding this level of machine functionality from machine builders, which accelerates the implementation of these innovations in machine design.

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

The optimal efficiency of processes on the complex journey from raw material through to final packaging relies on the close integration of automation technology between plastics and packaging machinery.

More information:
www.beckhoff.com/plastics-meets-packaging
www.beckhoff.com/packaging
www.beckhoff.com/plastics

PC-based control for packaging

- In the field of packaging machinery, the Beckhoff PC-based control system, TwinCAT, boasts numerous features that offer distinct advantages. Notable examples include:
- TwinCAT MC3: This new motion control generation is notably characterized by its modular architecture and consistent multi-core and multi-task support.
- OMAC PackML: TwinCAT offers the OMAC PACKML PLC library, providing convenient access to the standardized Packaging Machine Language.
- Collision avoidance: TwinCAT 3 Collision Avoidance (TF5410) enables active collision avoidance when operating multiple axes in linear and/or translatory dependency. This function can also be used to accumulate axes in a controlled manner during linear movements – for example, with the XTS product transport system.
- PLCopen function blocks: TwinCAT offers a wide range of PLCopen-compliant motion control modules, allowing for quick and easy handling of motion tasks.

TwinCAT Plastic Framework

- The TwinCAT Plastic Framework offers all the software features required for the automation of plastics machines and integrates essential industry-specific and customized control functions and HMI controls. It comprises four components:
- TwinCAT 3 Plastic Processing Framework (TF8540): The software library brings together Beckhoff's many years of expertise in plastics, seamlessly integrating essential industry-specific control functions into the familiar TwinCAT environment. It enables comprehensive software-based temperature control in plastics processing, including a software temperature controller that is specifically designed to handle slowly responding control loops in plastics applications.
- TwinCAT 3 Plastic HMI Framework (TF8550): This software library is a TwinCAT HMI package specially developed for the plastics industry, enabling visualizations and full-featured HMI applications with minimal development effort. Graphic objects can be configured for visualization in extrusion systems, in blow molding technology, and for injection molding machines.
- TwinCAT 3 Plastic Technology Functions (TF8560): This technology package includes field-proven, pre-developed standard blocks for typical motion applications in plastics machines. The available motion functions are specially prepared to offer an integrated safety solution with TwinSAFE, while the intuitive axis commissioning and virtual commissioning are supported through integrated simulations.
- TwinCAT 3 PLC Plastic Application: This application consists of both an HMI and PLC project and includes the conversion of generic technology functions for specific axes as well as sample code for extrusion, blow molding, and injection molding machines.

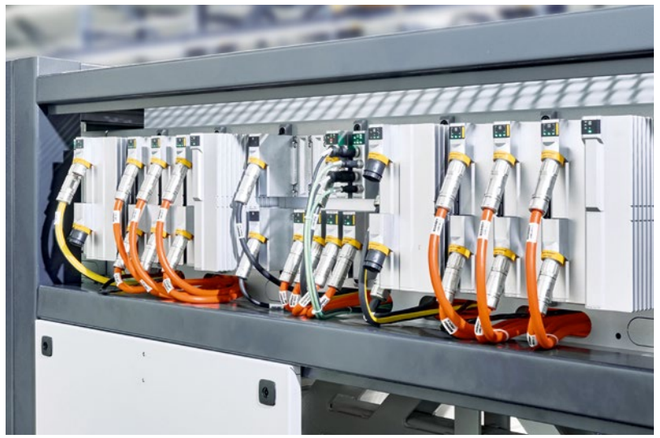
PC Control 01 | 2024 worldwide | germany

In this 14-meter-long Schirmer machine for the fully automatic processing of PVC window profiles, all previously required control cabinets were replaced with the MX-System for the first time.

MX-System for a window profile processing machine

Control cabinet-free automation as a game changer in machine and system engineering

"The MX-System is changing the face of design and installation in the world of machine building," explains Ludger Martinschledde, Managing Director of Schirmer Maschinen GmbH. In its initial use in a system for processing profiles, the pluggable system solution for control cabinet-free automation from Beckhoff ticked all the boxes in every project phase, from planning and design through to installation and commissioning.



Double-row baseplate of the MX-System: The open installation on the base frames simplifies machine wiring and facilitates diagnostics.

© Beckhoff

Window and door construction is a high-tech business. This much is evident right from the first process step, with the fully automatic processing of raw bars on a profile processing machine from Schirmer Maschinen GmbH. Schirmer was founded in 1979 and was Beckhoff's first customer. The company has relied on PC-based control technology from Beckhoff for over 40 years now, from the first positioning controller to the new MX-System. This pluggable system solution for control cabinet-free automation aligns particularly well with Schirmer's machine concept: the development of custom machines based on largely standardized process modules to create customer-specific solutions with high output and flexibility in terms of profiles and processes. The company has been a member of Beckhoff Automation Group since 2016 and currently employs around 250 people.

What does a Schirmer machine do?

Schirmer machines can be used for a variety of different processes: The individual parts for window frames and sashes are produced from approximately 6-meter long profile bars in a continuous process. As far as possible, all drilling, milling, and punching operations are carried out on the raw bar, followed by cutting and processing the ends. While the profile bars are being processed, the reinforcement profiles are cut to size on a separate line with the option to automatically insert and position them in the PVC profile. This is followed by further processes such as screwing in the profile and reinforcement, steel processing (drilling, milling), and inserting and screwing in the locking mechanisms.

As the Schirmer machines are required to handle a wide variety of frequently changing profile geometries, the conversion process takes place automatically. "Manual set-up is definitely out of the question for us," says Ludger Martinschledde. With this being the case, many stops and brackets have to be positioned on a fully automatic basis. "Last year, for example, we implemented a line with a total of 210 axes," recalls Ludger Martinschledde, outlining the requirements profile for the control platform.

Control cabinets determine production processes

The electrical equipment used in Schirmer machines to date reflects the current standards. Drive amplifiers, power supplies, power distribution, and PC-based control technology are all installed in control cabinets. On Schirmer machines, there are typically several of these stations set up along the machine, where cables from usually 2 to 3 process modules of the machine are routed and connected. EtherCAT I/Os are also used in sub-distributors. These are used to collect actuator and sensor signals from each of the individual process modules; however, combining several process functions in a single control cabinet and using sub-distributors to which the signal lines are clamped rather than plugged in represents a compromise for modular machine building.

Ludger Martinschledde describes the disadvantages of this solution as follows, "This means that most of the electrical installation and commissioning will only take place during final assembly, which is precisely when we are aiming to commission the system as quickly as possible before taking it apart again for delivery." The discrepancy between the modular machine concept and the central control cabinets has long been identified by Schirmer as an obstacle to achieving a more efficient project workflow.

When Ludger Martinschledde and the design engineers at Schirmer heard about the possibilities of completely control cabinet-free automation with the Beckhoff MX-System in 2021, they were understandably intrigued. "The design engineers and Ludger immediately recognized the potential of the MX-System for their modular machine building projects," recalls Daniel Siegenbrink, Product Manager MX-System at Beckhoff.

Completely new and control cabinet-free machine design

Schirmer is pioneering the MX-System on one of its machines for the first time, marking a new direction with the primary aim of optimizing the lead times and processes involved in machine building. In place of the control cabinets that used to stand next to the machines, MX-System baseplates can now be seen directly on the steel frames of the process modules. As for the sub-distributors, their tasks have either also been accommodated in the MX-System or else been replaced by decentralized I/O modules (EtherCAT Box modules) from Beckhoff. This combination of MX-System and EP box modules allows all cables to the motors, sensors, and valve terminals to be pluggable.

For Schirmer, the crucial advantage of the MX-System lies in restructuring internal processes. After all, this pluggable system solution allows the ma-

The back of the system is particularly interesting for automation engineers, as each machine module has its own MX-System baseplate onto which the various function modules are attached and screwed.

"The MX-System allows us to prioritize added value in our manufacturing processes and achieve much more efficient production," explains Ludger Martinschledde, Schirmer Maschinen GmbH (right), pictured alongside Daniel Siegenbrink, MX-System product manager at Beckhoff.

The complete machine is set up and operated via a customer-specific Beckhoff Control Panel.

chine builder to install all the electrical components of a machine module during pre-assembly and connect them with ease using pre-assembled cables. Another crucial aspect is that, during pre-assembly, the machine modules are freely accessible from all sides, which makes it much easier to lay and connect the cables. As Daniel Siegenbrink explains, "This saves a lot of time and significantly increases the efficiency of our workflows." This not only applies to assembly, but already begins with planning, preparatory work, and material provision in the production phase.

The function modules of the MX-System also eliminate the need for the complex individual wiring of numerous sub-components that is common in conventional control cabinet design. This prevents wiring errors and streamlines the diversity of parts. As a result, the required components (MX-System baseplates and modules as well as the pre-assembled system cabling) can be picked from the warehouse for pre-assembly directly after the electrical planning. "The aim here is to achieve an order-independent warehouse that we can manage with minimum stock levels, requirements, and replenishment times," explains Ludger Martinschledde.

For Schirmer, this initial development project has also provided two further insights: Last-minute change requests are much easier to implement and require less effort – even in a late project phase. And with modular partial commissioning, any functional errors can be detected at an early stage and rectified without time pressure.

Fast and efficient to the end customer

In the final assembly phase, the machines take up a large area, so processes have to run quickly at Schirmer to make room for the next systems in the queue. Ludger Martinschledde notes that the upstream processes – particularly electrical installation and partial commissioning – significantly reduce downtimes and increase space efficiency in the process. This allows Schirmer to assemble, inspect, and deliver more systems in the same hall. As a machine builder with an export share of 75%, the universal use of the automation solution is another important aspect for Schirmer. While previously the future installation location had to be taken into account during electrical planning and material procurement, the machine can now be used worldwide without requiring any time-consuming modifications since the MX-System is IEC-, UL- and CSA-compliant. This stands in stark contrast to the situation with conventional control cabinets, and further increases the degree of standardization at Schirmer.

But it's not just Schirmer that benefits from control cabinet-free automation, as the MX-System also offers tangible benefits for end users. These notably include better accessibility to the machine structures, and the reduced space requirements due to the elimination of control cabinets. This means that the production facilities can be positioned closer together on the shop floor, optimizing the valuable space without, for example, violating escape route requirements. The 10-fold reduction in the number of components also reduces the size of the spare parts warehouse. The Beckhoff Diagnostics App, which is being launched on the market together with the MX-System, is a tool that makes it easier for maintenance personnel to localize and rectify faults. "The end-to-end pluggability and the use of the diagnostic app as a replacement for the multimeter means that no specially trained electricians are required to connect or replace the MX-System modules," emphasizes Daniel Siegenbrink.

Successful start to control cabinet-free automation

The use of the Beckhoff MX-System has resulted in significant advantages and optimizations throughout the entire process chain at Schirmer. This includes a reduction in the previous workload for electrical planning by around 50%, as the usual two to three weeks of assembly time for conventional control cabinet design was cut down to just a few hours of system assembly. Ludger Martinschledde also expects a significant reduction in downtimes at the final assembly stage.

The new machine was presented for the first time at Fensterbau Frontale 2024, the industry's leading international trade fair, and Ludger Martinschledde believes that this will certainly not be the last system of its kind on the way to a new era of control cabinet-free automation: "Schirmer will continue to rely on this innovative solution from Beckhoff. We are fully on-board with transitioning our machines to control cabinet-free automation with the MX-System, and this will also apply to the product lines for aluminum and steel profiles in the future."

Features of the Fensterbau Frontale machine

- 14 m system length
- 11 machine process modules
- 67 axes
  - 23 AM8000 synchronous servomotors
  - 4 AL8000 linear servomotors
  - 28 AM8100 synchronous servomotors
  - 12 three-phase asynchronous motors
- 18 valve terminals
- 11 MX-System baseplates
- 118 MX-System function modules
  - 1 IPC module
  - 39 system modules
  - 34 I/O modules (including 28 for compact drive technology)
  - 7 relay modules
  - 37 drive modules
- 64 EtherCAT EtherCAT Box modules
- 1 customer-specific control panel

The loading magazine only requires two 48 V servo drives and a few digital signals, for which the compact single-row MX-System baseplate with twelve data slots for MX modules with 24/48 V DC supply voltage is ideally suited.

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

TwinCAT Analytics for inline quality control
in automotive production

Integrated data analysis tool ensures flawless spot welds

Resistance welding is a battleground of extremes, where extremely high currents and minimal movements have to be controlled and monitored to create reliable connections. Vitesco Technologies in Nuremberg relies on TwinCAT Analytics from Beckhoff to provide seamless control of these crucial parameters in its inverter production processes for hybrid vehicles.

© Beckhoff

Inverters with contacts welded in production facilities monitored by Beckhoff technologies at Vitesco are key components in the powertrain of electric vehicles.

As a supplier of system solutions and components for combustion, hybrid, and electric powertrains, Vitesco Technologies demands the highest standards of quality and reliability for its manufactured components. "This is why the continuous monitoring of our resistance welding systems is so important," emphasizes Eduard Fackelmann, Head of FF2 Industrial Engineering at Vitesco Technologies. Two systems, each equipped with multiple welding stations, are used to weld a different number of pins per inverter. This can equate to up to 30 connections depending on the variant, and requires precise alignment and gentle, uniform compression of the copper busbars. The busbars are then contacted by the two electrodes and welded to the surfaces with high currents of up to 7,000 A and substantial resulting heat accumulation. The slight pressure that occurs during the welding process causes minimal movement of the welding guns, between 400 and 800 µm depending on the pin type.

The current strength and the movement profile of the welding contacts during the welding process are key quality parameters. If the measured welding path exceeds a certain limit, for example, the wear on the electrode may be too great, indicating that it needs to be replaced. "The main idea was to monitor these key metrics online and analyze them statistically, so that we could detect any deviations in the relevant parameters early on and take corrective action right away, before any welding issues could arise," explains Eduard Fackelmann, outlining the objectives of the project.

Comprehensive data analysis and visualization

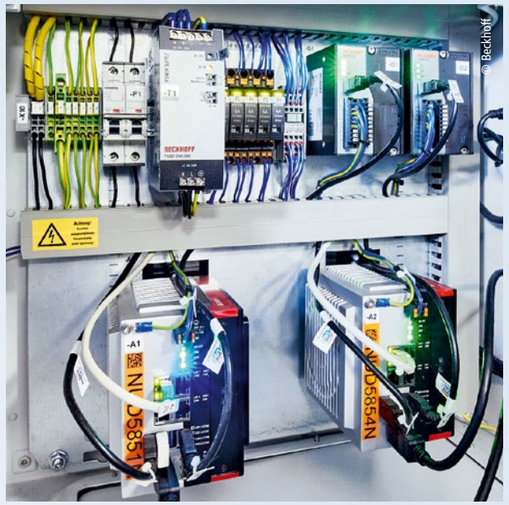
Since Vitesco Technologies has been automating with PC-based control from Beckhoff for over 20 years, these systems were also programmed with TwinCAT 2. "This obviously made it a straightforward process to inte-

© Beckhoff

The automotive supplier Vitesco Technologies relies on PC-based control with TwinCAT Analytics for the statistical monitoring of inverter contact welds.

Eduard Fackelmann (right), head of FF2 Industrial Engineering at Vitesco Technologies, and Christoph Rügheimer, application engineer at Beckhoff Nuremberg, confirm that the status display smileys are very well received by the production staff.

The incorporation of smileys into the dashboards implemented using TwinCAT Analytics captures the attention of the machine operators. Existing HMI controls were connected with the developed algorithms for these dashboards.



Data acquisition with TwinCAT 3 IoT Data Agent and continuous data evaluation via TwinCAT 3 Analytics Runtime is deliberately distributed across separate C6032 Industrial PCs so that additional systems can be easily integrated into the monitoring concept.

grate TwinCAT 3 Analytics as a statistical evaluation tool," notes Christoph Rügheimer, application engineer at Beckhoff. With the TwinCAT 3 IoT Data Agent, the data is retrieved cyclically from the controller and sent to a message broker running on a C6032 ultra-compact Industrial PC. This sends the data to a second C6032, which runs the continuous 24/7 data analysis using TwinCAT Analytics and the web server for TwinCAT HMI. This separation of data acquisition and data evaluation was deliberately chosen to keep all options open for future expansions. "The experts at Beckhoff supported us with developing the algorithm and integrating it into the existing infrastructure," recalls Eduard Fackelmann.

The analysis evaluates the welding path for the last "N" inverter assemblies for each pin and assigns it to one of three classes: 1 (green), 2 (orange), or 3 (red). The correct data had to be identified and defined from the system's existing control program to facilitate the desired displays. In the detailed overview, the weld for each individual pin is depicted in the form of a smiley. On another dashboard, the results of each connection made on each individual welding station can be displayed – also in the form of smileys, which were implemented in the dashboards at the request of Vitesco Technologies. A green peak indicates that an inverter module has been manufactured. The time interval between the peaks allows the machine operator to instantly determine the current cycle time of the machine, whether the machine cycle is changing, and even how many minutes the machine has already been idle, if applicable. "This simple visual representation significantly increases the technical availability of the two welding systems and avoids errors," underlines Eduard Fackelmann.

Another screen visualizes the chronological status progression for each individual station. This allows machine operators to analyze the chronological progression of the metric separately for each station and determine whether the metric is currently hovering between green and orange or still far from the threshold. The delta between the classes is minimal, specifically 40 µm in each case.

"Existing HMI controls were linked to the algorithms developed for the dashboards," explains Christoph Rügheimer. And since the projects automatically generated with TwinCAT Analytics for the controller are completely open source, the industrial engineering team at Vitesco Technologies can easily incorporate their customer-specific extensions.

Integrated and flexible analysis workbench

Vitesco Technologies uses two C6032-0060 ultra-compact Industrial PCs, each with a CU8130-0120 battery-backed UPS and PS2001-2420-0000 power supply, to evaluate and visualize the data on the two systems. As mentioned, the software used includes TwinCAT 3 Analytics Workbench (TE3500), TwinCAT 3 Analytics Runtime (TF3550), TwinCAT 3 IoT Data Agent (TF6720), and TwinCAT 3 PLC (TF1200).

"The ability to freely interconnect TwinCAT Analytics Workbench algorithms with each other and to add inputs, outputs, and parameters to new algorithms as templates to the existing project has significantly accelerated the development process," reports Christoph Rügheimer. This also meant the algorithm for evaluating one pin could be easily instantiated and parameterized for all others.

By creating networks, the individual analysis sections could be readily grouped, abstracting the structure of the machine or process, and then incorporated into the TwinCAT Analytics project.

The flexibility of TwinCAT Analytics is also demonstrated by the fact that continuous data analysis can be expanded at any time, allowing additional production lines from Vitesco Technologies to be integrated into the monitoring system.

More information:
www.vitesco.com
www.beckhoff.com/analytics

Control technology and data monitoring for containerized biogas power plants

Highly compact implementation and automation of sophisticated process technology

Just flip the switch – that could quite easily be the motto of Reverion's biogas power plants on the way to a climate-friendly energy supply. As if the compact design housed in a single transportable container didn't make using this energy technology easy enough already, its exceptionally high efficiency of 80%, reversible usage option, and seamless data monitoring with PC-based control from Beckhoff all serve as prerequisites for achieving a high level of automation.

The control architecture uses two computers: a CX2043 Embedded PC (bottom) and a C6930 control cabinet Industrial PC (top, to be replaced in the future by a C6030 ultra-compact Industrial PC).

The Reverion biogas power plants are housed in a highly compact container, achieve a high efficiency of 80%, and allow reversible operation.

Founded in 2022 by Dr. Stephan Herrmann along with a small team of engineers and scientists from the Technical University of Munich, Eresing-based Reverion GmbH has already grown to more than 80 employees. Sven Bettendorf is an application engineer at Reverion, who explains that the company's goal is to help solve two of the biggest problems facing humanity by creating a truly sustainable energy system and removing gigatons of CO_2 from the atmosphere. The new generation of biogas power plants makes it possible to maximize the potential of biogas and also benefit from surplus solar and wind energy that would otherwise remain unused.

Highly effective and reversible use

Among the technical highlights of Reverion biogas power plants are their high efficiency and reversible usage, enabling not only power generation, but also the storage of biogas or green hydrogen when the grid is saturated. Addressing the subject of system efficiency, Sven Bettendorf explains, "The current market standard for the use of biogas is represented by combined heat and power plants; however, they only achieve an efficiency of around 40%. Alternative systems based on fuel cell technology, such as our biogas power plants, already achieve around 60%, whereas our systems are more efficient still at 80%." The main reason for this enormous increase in efficiency is the high level of system integration and the associated exploitation of all optimization potential in the interaction of the many different process sequences. Julian Schauseil, Senior Software Developer at Reverion, is keen to emphasize the high potential significance for the energy supply: "What we are talking about here is quite relevant amounts of energy. If all biogas power plants in Germany were converted to our technology, the base load currently covered by coal-fired power generation could be completely replaced."

Reverion's biogas power plants offer excellent potential for flexible energy storage through their reversible operation capability. As Julian Schauseil explains, "When the energy supply grid is saturated, which can happen when we have optimal conditions for solar and wind energy, for example, the available power can be used for biogas production and storage. The gas network currently available for this purpose in Germany corresponds to around 100,000 times the storage capacity of available electrical storage facilities." As a result, the biogas power plant not only serves as a local power plant that feeds electricity from biogas into the grid, but it can also act in reverse as a kind of buffer. One of the ways it does this is by generating biogas or green hydrogen when electricity prices are low or when there is an abundance of wind or solar energy, and then feeding power back into the grid when demand is high or prices are high. As a result, the power plant is able to achieve a negative carbon footprint. This is because, unlike in combined heat and power plants where the CO_2 from the biogas is released uncontrollably back into the environment via the exhaust gases, this approach stores it in the system so that it can be bottled in food-grade quality for specific applications.

Sophisticated processes automated with PC-based control

Given the high level of integration and reversible usability, the underlying process technology encompasses numerous subprocesses and demands a substantial array of sensors. This is where high-performance automation technology

The team of experts (from left to right): Daniel Hausdorf (Application team at Beckhoff), Julian Schauseil (senior software developer at Reverion), Christian Spiegel (Augsburg/Swabia Sales team at Beckhoff), and Sven Bettendorf (application engineer at Reverion)

is essential for reliable and optimized control of all the different process variants as well as seamless data monitoring. Reverion relies on PC-based control from Beckhoff, which was already being used for research work at the Technical University of Munich before the company was founded. As Sven Bettendorf explains, "In the beginning, easy access to the TwinCAT software was crucial, as this allowed us to carry out extensive testing without initially purchasing any software. Further major benefits included the simple expandability, including the Beckhoff TwinCAT visualization, and the outstanding support from the Beckhoff experts. When it comes to a new development like our biogas power plant, the flexibility and scalability of PC-based control represent particularly crucial factors. After all, the structure and processes change significantly on the way from prototype to series production." Julian Schauseil adds, "It's also worth mentioning the wide range of hardware options, which we consider to provide excellent value for money."

In addition to reliable and safe system operation, the main aim of the automation technology from the operators' point of view was to offer plug-and-play functionality. Streamlining to a simple on/off operation provides end users with remarkable flexibility, making it easier to replace existing energy supply systems with minimal effort. The container-based design simplifies the search for suitable installation locations, requiring only a compatible power line and connection to the gas network, both of which are already available to operators of combined heat and power plants.

In terms of hardware, the automation technology has been implemented with two computers: a CX2043 Embedded PC (main control computer) and a C6930 control cabinet Industrial PC or, in future, a C6030 ultra-compact Industrial PC. Sven Bettendorf explains the reasons for this: "The idea to use two industrial PCs in communication with each other came about during system development, as the level of complexity increased and this approach made it easy to scale up the performance of the control technology and adapt it to the respective platform. The resulting redundancy also has its advantages in terms of reliability during operation." The hardware package is rounded out by over 450 EtherCAT Terminals for around 1,200 sensors and 300 actuators. These include more than 220 analog terminals, such as the EL3024 (4…20 mA), EL3064 (0…10 V), EL3208 (Pt100), EL3255 (potentiometer), and EL3318 (thermocouple) analog input terminals.

The data from all of these I/Os is evaluated via the Beckhoff TwinCAT software, which, according to Julian Schauseil, can also be used to map such complex systems: "The object-oriented programming supported by TwinCAT, the automatic unit testing, and the modular software architecture are particularly advantageous for very extensive and continuously developed control programs. This makes it easy to introduce changes without creating errors in the rest of the program. The necessary abstractions can also be implemented well, which makes structuring much easier by encapsulating functions such as controller and analog value processing." The communication functionality within TwinCAT is yet another important factor. This allows comprehensive sensor data to be easily and flexibly transferred to higher-level databases with TwinCAT 3 IoT Communication (TF6701) via the MQTT protocol.

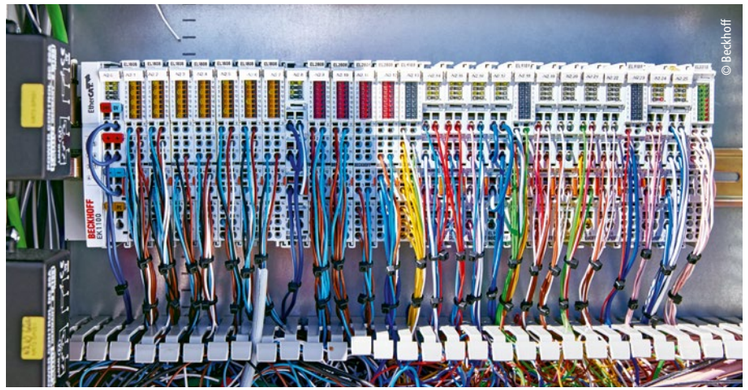
Efficient and integrated visualization

Comprehensive data monitoring is used not only for process control, but also as a basis for further technical development as well as for generating the necessary evidence and billing-relevant metrics. To this end, Reverion has developed its own HMI extension for data monitoring, which was very well supported by TwinCAT according to Sven Bettendorf: "TwinCAT 3 HMI Engineering (TF2000) facilitates rapid overall application development and results in an easily expandable HMI. What's more, the openness of the TwinCAT PLC and the training provided by the Beckhoff experts have been a huge help."

The strong communication mechanisms within TwinCAT were pivotal for enhancing the visualization's performance. According to Sven Bettendorf, efficient data processing is particularly important for this application, especially due to the large variety and volume of data and the numerous HMI controls required. Another requirement for the HMI and the HMI extension was simplicity in operation for both short and long-term recordings. The industrial PCs from Beckhoff provide sufficient computing power and main memory to process and display the large amount of data and facilitate instant switching between different HMI screens (with quad-screen capability) if required.

Continuous further development

With the first biogas power plant prototypes achieving an output of 100 kW, development at Reverion is certainly not standing still. Series production will start in 2024, and larger systems with an output of 500 kW are already in the pipeline. In addition to the use of biogas, Sven Bettendorf sees further market potential in hydrogen as a basic energy source. Julian Schauseil adds, "The container design and simple connection technology alone open up a whole new world of application possibilities. This supports the modularity of the energy supply very effectively, as higher demand can be easily met by deploying several systems."

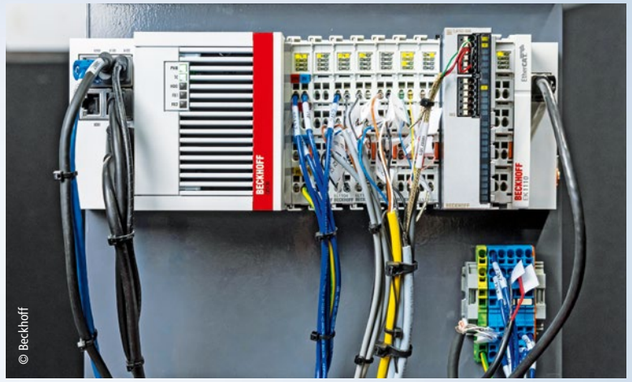


One of numerous EtherCAT Terminal segments in one of the nine control cabinets for control technology and power supply

More information:
www.reverion.com
www.beckhoff.com/energy-industry
www.beckhoff.com/twincat-hmi

PC-based control and EtherCAT automate compact sporting goods test machine

Motion control and measurement data acquisition in perfect sync



The CX5130 Embedded PC (left) and ELM3502 measurement terminal (metal module on right) save space in the control cabinet of the compact test machine for lab environments.

ADC's redesigned ASTM-compliant Impact Tester combines high-end measurement with intuitive operation.

The modernized Impact Tester from Automated Design Corporation (ADC) demonstrates the benefits of seamlessly integrated control and measurement technology from Beckhoff. In the dynamic testing of cushioning elements for sports shoes, the system delivers precise measurement results using standard components from the automation specialist. The hardware costs were cut by around 4,000 U.S. dollars per machine.

ADC's redesigned Impact Tester shows how well the traditionally disparate disciplines of measurement technology and industrial automation can work together. "The impact testing system, like most others, is more industrial than typical desktop lab-type boxes, but it now offers extended data acquisition (DAQ)," says Thomas Bitsky, Jr., Vice President and Lead Developer at ADC. Founded in 1986 by Thomas Bitsky's parents, the company based in Romeoville, Illinois, today supplies R&D systems to numerous renowned sporting goods manufacturers.

ADC needed to meet several requirements when upgrading the Impact Tester. Precision motion control, real-time fieldbus communication and fast cycle times were necessary, and a more intuitive HMI was mandatory. Beyond that, ADC wanted the solution to overcome the boundaries between traditional measurement and control technology. The DAQ industry has remained siloed for far too long, according to Thomas Bitsky. In the past, however, the high sample rates needed to ensure the required measurement quality could only be found in the components from select vendors. But when using a legacy DAQ controller running LabVIEW™ software, automated test handling requires a separate PLC, Thomas Bitsky explains: "These scenarios add cost, communication delays and cabling nightmares." Also, the motion control and DAQ technologies must synchronize perfectly for accurate, reproducible test results, which creates challenges when using separate solutions. In order to minimize losses at the interfaces, ADC decided to use system-integrated measurement technology in a flexible control platform from Beckhoff.

High-end measurement technology in a standard I/O system

EtherCAT offers many benefits, but the main advantages for ADC are speed and bandwidth. For analog data acquisition during impact testing, EtherCAT measurement terminals from the ELM series with oversampling capabilities are used. Oversampling means reading data multiple times per control cycle for enhanced time resolution of a signal and increased accuracy. With this high level of performance, ADC was able to use commercial off the shelf (COTS) measurement terminals from Beckhoff to eliminate expensive, specialized hardware. The high-end ELM3502 measurement terminals are fully integrated into the standard Beckhoff I/O system and offer dual-channel measurement in a ruggedized metal housing. With sampling rates up to 20 ksps, the terminal covers most advanced

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Thomas Bitsky, Jr. (left), Vice President and Lead Developer at ADC, works closely with Dave Zimbrich, Applications Engineering, and Mike Rauch, Regional Sales Engineer, both from the Beckhoff team in the Chicago area.

measurement requirements for ADC. However, the scalable ELM series also offers terminals that support sampling rates up to 50 ksps.

"We had been using other Beckhoff measurement terminals – particularly the EL3356 analog input terminal, which works well for industrial applications. But our test and measurement customers needed sampling in the kilohertz range that only legacy DAQ vendors offered previously," says Thomas Bitsky and adds: "The ELM terminals delivered the sampling rates we needed, along with perfect synchronization to the controller via EtherCAT. Now, the machines can execute a test very quickly. In one scan, I get all motion and load data, and our measurement accuracy and repeatability look as good if not better than what we got with the traditional chassis-style controller."

Scalable, standard components

TwinCAT 3 delivered a universal engineering environment, which facilitated the implementation, according to Thomas Bitsky, and also easily integrates LabVIEW™ and other third-party software. With TwinCAT, engineers can program in the languages that they are most familiar with or that best fit the project, including the available IEC 61131-3 languages and their object-oriented extensions, function blocks and computer science standards found in Microsoft Visual Studio®. "We lean on TwinCAT to save programming time," Bitsky explains.

On the controls side, ADC relies on a Beckhoff CX5130 Embedded PC. The DIN-rail-mounted, fanless machine controller saves machine space and delivers ample computing power for data acquisition and motion control in the test systems. The scalability of the Embedded PCs from Beckhoff also allows ADC to increase performance levels when needed, they say.

Compact drive technology from Beckhoff ideally complements the needs of the test systems that usually have to fit in limited lab environments at sporting goods manufacturers. The EL7211 servo terminals (driving the AM8100 servomotors) and EL7041 stepper motor terminals deliver high-performance drive technology in an I/O slice form factor, and are installed in the control cabinet along with the EL5101 encoder interface.

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EtherCAT communication ensures synchronization of load versus position for test integrity.

© Beckhoff

A variety of highly compact servo and stepper motor technologies (here: an AM8121 servomotor) are added advantages of the fully integrated and scalable automation platform from Beckhoff.

"We can also use third-party motors and drives, and if they're EtherCAT-based, the integration is incredibly simple. We use the motion control libraries in TwinCAT for all of these devices," Thomas Bitsky says. "Most of our applications require simple point-to-point motion. We apply a specified load to the material, which requires synchronization between the load cell input and motion controller, and then read the position. If you go past that load, the test will fail to execute.

"The legacy, chassis-style controllers just don't have the power to support this functionality," he adds. "But the distributed clocks in EtherCAT ensure synchronization of load versus position. So with the integrated Beckhoff technologies, we're able to do things that would be impossible otherwise."

Reduced time and costs

The modernized impact tester machine adheres to the ASTM F1976 and F1614 standards for testing the impact attenuation of cushioning in athletic shoes. The use of standard automation components, including the high-end measurement technology in an I/O module format, led to cost savings of about 4,000 U.S. dollars per machine. The Beckhoff solution also reduced wiring, assembly and programming time. The 24/7 support from Beckhoff proved reliable and efficient when ADC needed assistance.

Since ADC fills a unique gap in testing and automation, it's important for the company to safeguard its intellectual property. Here, TwinCAT serves up additional value-add, according to Applications Engineer Dave Zimbrich from Beckhoff: "The OEM Certificate feature that we offer allows ADC to encrypt and password-protect its code. This means no matter where their test machine ends up, their code is safe."

More information:
www.automateddesign.com
www.beckhoff.com/elm
www.beckhoff.com/measurement

Robotic solution for adhesive tape application with PC-based control

Flexible controls for mobile robots and compact machine cells

The RoboTape system offers a scalable, automated solution for applying industrial adhesive tapes, which can take on complex part geometries using its highly maneuverable and compact application head.

© Beckhoff

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A Beckhoff CP6706 Panel PC offers machine control and an intuitive operator interface for pulling up recipes and toggling functions.

In industry, even elaborate processes such as the application of adhesive tape to parts with varying geometries are automated. For robotic taping systems, however, the feeding of tape material presented a pain point. With RoboTape, Innovative Automation has developed a platform with Beckhoff control technology and a remote feeding module, which increases productivity and enables flexible customization for different requirements.

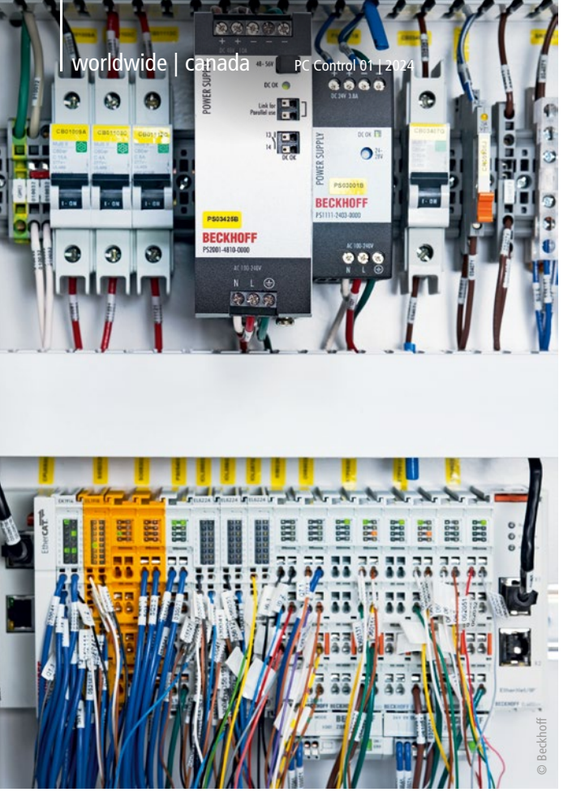
The world of adhesives keeps expanding to accommodate applications with highly tailored tapes, foams and other products. However, automated tape dispensing systems have not kept up and offer little flexibility to adapt to wide-ranging industry requirements. Here, RoboTape offers a way out of the dilemma. Innovative Automation, a Canadian custom machine builder and systems integrator headquartered in Barrie, Ontario, developed the platform and then spun it off as a new business unit. Leveraging advanced robotics and flexible controls technology, RoboTape delivers a solution suitable for everything: from B2B with a focus on the automotive industry through to large CPG companies, and all sorts of part geometries and adhesive types.

The entry-level solution of the RoboTape business unit in Newmarket, Ontario, is the compact, "RoboTape Lite" work cell. The RoboTape standard cell with an enclosed industrial robot supports a higher production throughput. The impressive capabilities led to a collaboration with 3M, a leader in industrial bonding solutions, and the development of the RoboTape™ System for 3M™ Tape.

Tape feeding from outside of the machine cell

The main pain point of existing solutions was robot size and maneuverability, because most systems place the tape spool at the end of the robot arm, along with an empty spool to catch the waste liner. Also, operators have to wait until the systems run out of tape, put them into a safe machine state, and enter the cell to add more, which takes away valuable production time.

"We came up with the idea of a remote feeding module that positions the spool outside of the work cell. That's now patent pending worldwide," says Zac Cutt, Research and Development Group Leader at Innovative Automation. "It also helps with the robot sizing issue, allows for larger spools and increases system uptime. This is why big automotive clients are latching onto it; it's currently the only solution that actually solves the entire problem."



From integrated safety with TwinSAFE terminals and standard I/Os to different bus couplers (below in the picture), the comprehensive EtherCAT Terminal portfolio from Beckhoff covers all requirements; the Beckhoff power supplies of the PS series (above in the picture) reliably supply the RoboTape system with power.

The RoboTape system's remote feeding system allows operators to change spools without entering the robot cell.

RoboTape catches and chops up the waste liner at the remote feeding module. The design optimizations drastically reduce the size of the robot needed, Michael Lalonde, Co-owner and President of both RoboTape and Innovative Automation explains: "We were aiming for the 10-kilogram robot class, so keeping the applicator tool light and compact was a top priority. This allows the tool to work in tighter areas and to reduce the overall size and cost of the work cell. These are all things our customers have been requesting."

Before RoboTape was ready for use, a variety of challenges had to be removed first. The team had to effectively accommodate a wide range of robots and enable the solution to continuously adapt to new parts for taping processes and gather massive amounts of sensor data for rapid processing.

New Automation Technology facilitates implementation

"In 2020, we created a decision matrix comparing four control system providers," Zac Cutt recalls. "We compared all of the technologies offered, the benefits, the costs, etc., and ultimately, we decided that Beckhoff provided the best fit for the RoboTape system." Innovative Automation worked closely with the sales and support teams at Beckhoff Canada. Regional Sales Manager Paul Pierre and Application Engineer Jim Fallowfield offered advice and technical assistance on everything from TwinCAT 3 automation software programming to EtherCAT networking. This helped accelerate design, commissioning and operation.

Sean Robillard, Controls Department at RoboTape, appreciates the user-friendly software approach: "With a TwinCAT project, we have one folder with files for each PC-based controller. Within that code, we have all safety and I/O functions, so development of the system can be easily managed. This helps us implement different recipes, which tell the system how much tape to dispense and how quickly."

"Operators can view all their inputs and outputs, toggle cylinders, lights and sensors, and adjust other aspects of the machine," says Josh Vander Doelen, Project Manager at RoboTape. "That's all bundled into the same TwinCAT package, so it speeds up engineering and keeps the HMI design clean."

A CP6706 economy built-in Panel PC from Beckhoff offers ample processing power for the application. It is equipped with a dual-core Atom® processor, 4 GB RAM, 40 GB CFast card and a 1-second uninterruptible power supply (UPS). The IPC includes a 7-inch touchscreen for operator interface and in conjunction with TwinCAT automation software is ready for cloud connectivity right out of the box.

The control system utilizes the EtherCAT industrial Ethernet system for real-time communication to the robot and other field devices. The openness of EtherCAT with regard to integrating other protocols helps the RoboTape team connect a vast range of different robots and third-party devices such as sensors and encoders in customer facilities. "For example, we use many IO-Link sensors to gather as much data as possible," Zac Cutt adds. "We simply add EL6224 IO-Link terminals from Beckhoff to the main I/O segment as we need more sensors."

The engineering experts at Innovative Automation and Beckhoff at the RoboTape facility in Newmarket, Ontario: (back row, from left) Jim Fallowfield (Beckhoff) with the Innovative Automation team of Josh Vander Doelen, Sean Wilson, Sean Robillard, Quinton Potts, Carter Metcalf, (front row) Michael Lalonde, Mike Likernyy, Zac Cutt, John Marinuzzo and Paul Pierre (Beckhoff).

With TwinSAFE for system-integrated functional safety, the platform can best protect plant personnel and equipment, according to the RoboTape experts. The remote feeding module will enter a safe state when operators open its enclosure. This level of safety is required because inside the feeding module a cutting blade utilized to chop the spent liner and other pinch points are contained. For that purpose, TwinSAFE safe input and output terminals are used that can be connected directly to the door of the robot cell, light curtains or floor mats, for example. These TwinSAFE I/O terminals use Safety over EtherCAT (FSoE) for safe communication over the EtherCAT network using a "black channel" approach, and in this way eliminate the need for the conventional and complex hardwiring between safety devices.

Support for end users

"Our systems average eight hours of runtime before refills, but this can be greater depending on the material," Zac Cutt says. "For instance, one customer processed 14,000 feet (more than 4,000 m) of felt on a single spool, so they're making enough parts for about 2,000 cars a day and only changing spools once a week."

Another Tier 1 automotive supplier shrank the overall footprint of its assembly area by removing two manual taping stations. In addition, it reduced labor requirements at a time of skills shortages. As a result, the customer saved roughly 225,000 Canadian dollars per year on adhesive applications in one plant.

"Our new IoT capabilities can allow us to see which machine modes are activated and for how long. So if a system is in service mode for long periods of time, it could indicate it needs maintenance or that a particular operator requires more training to meet uptime goals," Zac Cutt says. "We can see the machine's overall equipment effectiveness (OEE), along with metrics like internal and ambient temperature, to continue to optimize and improve reliability."

"The consistent support and availability are reasons why Beckhoff has proven to be a great choice, and we're excited to continue working together in the future," Michael Lalonde says.

More information:

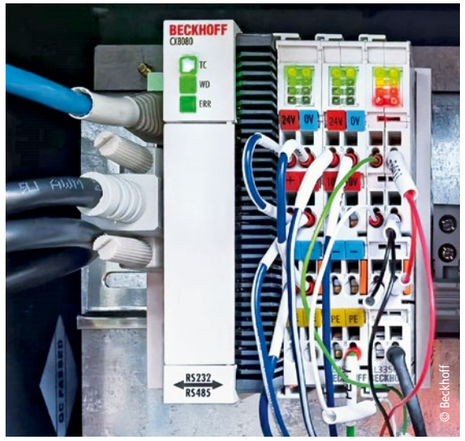
www.robotape.com
www.innovativeautomation.com
www.beckhoff.com/twincat
www.beckhoff.com/ethercat

PC Control 01 | 2024 worldwide | china

PC-based control technology in the semiconductor production for photovoltaic equipment

Flexible automation of single-crystal furnaces increases competitiveness

For growing monocrystalline semiconductors, the Chinese company Jingsheng Mechanical & Electrical originally used a separate process and temperature control system. Since the changeover to PC-based control technology from Beckhoff, it not only helps to save costs, but also facilitates the implementation with its scalability. As added value for the customer, the TwinCAT software enables the protection of intellectual property.



A platform consisting of an Embedded PC (shown here: CX8080), TwinCAT automation software and EtherCAT Terminals controls the semiconductor production for photovoltaics.

Jingsheng Mechanical & Electrical from China is a leading provider of single-crystal furnaces for growing semiconductors for photovoltaic equipment.

© Beckhoff

Headquartered in the Zhejiang Province, Jingsheng Mechanical & Electrical Co., Ltd. (JSG) is a globally operating and leading supplier of high-end equipment for the semiconductor and photovoltaic industries. With many years of development experience, JSG is an established supplier of crystal-growth technology for photovoltaic equipment. For automating its single-crystal furnaces, JSG previously used a conventional PLC and a temperature control system. The temperature control, however, offered only limited functionality and, in combination with the PLC, had become too unflexible. Therefore, JSG adopted a Beckhoff control platform consisting of an Embedded PC, the TwinCAT automation software and various EtherCAT Terminals to easily and flexibly connect the field devices via the industrial Ethernet system EtherCAT. The integrated control platform replaces two separate devices and according to JSG offers more flexibility by far for adaptation to individual requirements.

Stable process control is key requirement

The growth of monocrystals is possible only under specific conditions. Silicon is melted in the furnace and a monocrystalline seed crystal on a metal rod is dipped into the melt, starting the crystallization process. While the melt has to be kept at a certain temperature, the rod is slowly rotated and pulled upwards in a way that the material can deposit, until the crystal column, known as an ingot, reaches its final diameter. The advantage of a monocrystalline semiconductor, which is cut into wafers and used in solar modules, is its high efficiency due to uniform crystal orientation.

The prerequisite is precise sequential control and stable process control for longer periods of time – between several days and half a month. Temperature control is essential in this, because uneven temperatures can cause polycrystalline material to grow creating structural defects in the crystal lattice. For continuous furnace operation, the control system must be able to process large amounts of data. However, this is no problem for the Embedded PCs from Beckhoff. The industrial-grade DIN rail controllers also cope well with harsh environmental conditions. While JSG started out with a CX1030 Embedded PC, a CX9020 or CX8080 now serves as the central machine controller, depending on project requirements. The company benefits from the scalable performance of its controllers, which are always available with new CPU generations, by being able to continuously optimize its production and reduce costs, which increases competitiveness.

While JSG mainly uses TwinCAT 2 control software, the switch to TwinCAT 3 is easy, should extended functionality be needed. When migrating a control project, it is simply expanded and upgraded with only minor changes to the code itself. In addition, TwinCAT supports a wide range of communication protocols, enabling communication between the main control system and subsystems, such as for heating and generating magnetic fields. Seamless data transmission and exchange creates synergies and improves the overall efficiency of the system. Mr. Wang, Senior Specialist at JSG, says the following about the Beckhoff software platform: "The TwinCAT software is mature and field-proven, and its flexible programming facilitates the processing of all kinds of data. In addition, the PC-based control architecture makes it easier to connect the controller to an MES system in order to exchange data between production and enterprise systems."

Prerequisite for growing high-quality monocrystalline semiconductors is continuous furnace operation in intervals of several days through to two weeks.

Flexible configuration with EtherCAT

For real-time communication via EtherCAT, JSG can choose from the wide range of available EtherCAT Terminals. Mr. Wang explains: "EtherCAT distributed I/O modules bring great convenience to project implementation, with unrestricted topology flexibility and a huge range of diverse configuration options. Thus, we can select them based on the needs and cost requirements of different projects. The EtherCAT products from Beckhoff are easy to use, compatible, and can be used to replace slave products from different manufacturers without affecting overall performance and stability, while also ensuring the consistency of the EtherCAT products. Since EtherCAT eliminates the need for switches or other active devices, the cost of purchasing and maintaining hardware equipment are reduced, as well as simplifying wiring and commissioning of the system."

Code protection through sub-division of tasks

One of the core components in single-crystal furnace control is temperature control, and customers need to keep this part of their intellectual property highly confidential. An advantage of the modular automation software TwinCAT is that users can easily separate the entire control program into sets of subtasks based on their priority, and assign different users to manage them independently. Data exchange between the different subtask programs can be achieved through variable mapping. The single tasks will be called up in the runtime by TwinCAT. The modular design makes software development and maintenance more flexible and efficient. Also, JSG adopts multi-PLC task processing to encapsulate the core process algorithm into a single PLC program. In order to protect the security of the core algorithm program, JSG saves the program as binary code that cannot be decompiled. The deployment is very convenient, as the complete program can be downloaded simply by copying these binary code files to the target controller.

Following the company's latest technological innovations, Mr. Wang says: "JSG has launched its fifth-generation single-crystal furnaces based on an open platform architecture. Their biggest advantage lies in the transition away from a traditional closed control system model towards configuration with software-based control with an open architecture. The platform enables the automatic creation of TwinCAT XAE configurations via high-level language programming, based on the TwinCAT Automation Interface. Using this interface, end customers can turn valuable knowledge regarding their own manufacturing processes into software modules. This greatly increases the capabilities of end users to develop customized processes and protect their innovations in order to improve their competitiveness."

More information:
www.jsjd.cc/en
www.beckhoff.com/twincat
www.beckhoff.com/process

In 2023, a delegation from Jingsheng Mechanical & Electrical visited the Beckhoff Automation headquarters in Verl, where they were warmly received (from left to right): Dr. Chao He (Area Sales Manager for China, Beckhoff Germany), Dr. Changsheng Hua (Manager for Data Science and Engineering, Beckhoff China), Xingkai Ma (Managing Director of Beckhoff China), Hans Beckhoff (Managing Owner of Beckhoff), Dr. Jianwei Cao (Chairman of Jingsheng), Jin Tu (Assistant President, Jingsheng) and Kai Ristau (Head of International Sales, Beckhoff Germany).

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The e-Comm³ line for the production of sustainable padded envelopes can be conveniently operated via a customer-specific control panel from Beckhoff (on the right).

PC-based control promotes innovation in paper converting

Challenges in the production of sustainable envelopes efficiently solved

When developing a system for producing sustainable padded envelopes, the Spanish Lemu Group relied on PC- and EtherCAT-based control technology from Beckhoff. This facilitated the implementation of the entire production process starting from the roll material through to the envelope ready for dispatch. A particular challenge was making padding only from paper.

More than just a passing trend, the increasing e-commerce has become ingrained in our daily lives. In the face of this global development, the need for sustainable solutions is more urgent than ever, and businesses must adapt. If they want to remain competitive, they have to manage the balancing act between satisfying changing consumer demand and using sustainable shipping packaging, according to the experts of Lemu Group.

Lemu Group has taken a bold step towards sustainability with the production of equipment for manufacturing envelopes and bags entirely made from paper. One of these systems was custom-designed for the manufacturing of 100% paper padded envelopes. Not only does the e-Comm³ line improve production efficiency by fully automatic operation, it also embraces sustainability by eliminating the use of plastic in the padding layer. Within the production line, several stations are coupled for converting paper from roll material into padded envelopes ready for dispatch. The system can be optionally equipped with end-of-line modules for automatic carton packaging and palletizing. To ensure that the industry's high quality standards can be met, artificial intelligence is integrated into the process for error detection and quality assurance.

Powerful control technology and expert partners

Lemu Group has wide expertise in manufacturing machinery designed for paper conversion and has corresponding research and development capacities. However, when it comes to bringing in expertise on industrial automation, Beckhoff is the primary choice as a partner, they say. For the equipment manufacturer, one of the greatest advantages of the PC-based control philosophy lies in the fact that TwinCAT automation software can transform any Windows-based PC into a real-time controller. This enabled Lemu Group engineers to execute and refine the PLC code for the new system conveniently on a laptop. This is because the TwinCAT engineering platform offers unique possibilities for simulation that differ greatly from those of conventional simulators. In addition, Lemu Group was able to benefit from the expertise of Beckhoff employees through direct support, with the trusting collaboration facilitating the demanding innovation process.

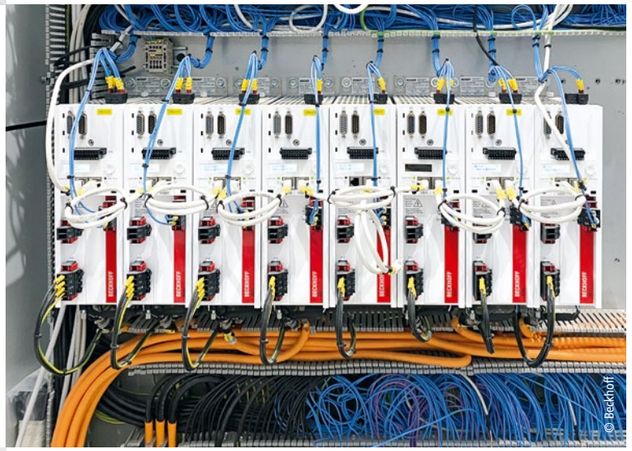
In the conception of their equipment, Lemu Group focuses on OEE (Overall Equipment Efficiency), prioritizing efficiency and productivity without compromising the quality of the final product. This enables the machine builder to achieve maximum customer satisfaction and helps companies stand out in a changing market.

© Beckhoff

The challenge for the new implementation was the processing of multi-layer paper material into padded envelopes with high accuracy and speed.

The control platform from Beckhoff makes significant contributions to the high production efficiency ensuring low program execution times. The powerful CX2033 Embedded PC achieves cycle times of 62.5 µs in EtherCAT real-time communication with the servo drives of the AX5000 series. With fast control of position, speed and force for all drive axes, EtherCAT ensures precise synchronization of all processes in the system – from feeding, folding and separating through to packaging. In addition, there are no restrictions on the number of axes supported by the fieldbus, as the EtherCAT process image is 4 GBytes.

The collaboration between Beckhoff and LemuGroup emerges as a role model in the industry, effectively combining their expertise in industrial automation and machinery manufacturing. The collaboration is not limited to a specific project but is projected as a lasting alliance focused on innovation, efficiency and customer satisfaction.



© Beckhoff

With a current control cycle of up to 62.5 µs, the AX5000 servo drives support fast and precise synchronization of all system components via real-time communication with EtherCAT.

More information:

www.lemugroup.com
www.beckhoff.com/packaging
www.beckhoff.com/ax5000

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Waterjet cutting systems place some very specific demands on control systems. IGEMS meets these by using PC-based control from Beckhoff.

TwinCAT and PC-based control for waterjet cutting systems

A precise and fast way to the perfect contour

Control systems are subject to very specific demands from every form of production technology – including waterjet cutting. IGEMS from Sweden set itself the goal of taking this process to a new level in terms of precision and speed, and achieved it with the help of PC-based control. Users such as the machine builder Kimtech are now benefiting from the results.

© Jamie Steinbichler

Despite the many axes, the control cabinet remains compact and clearly arranged, with the AX8000 multi-axis servo system (bottom) and the C6030 ultra-compact Industrial PC (top).

Waterjet cutting is an effective and versatile process for cutting a wide range of materials, including metals, plastics, glass, ceramics, stone, and composites, and can even handle unusual applications such as portioning fish fillets and dessert cakes. "We love waterjet cutting because of its versatility, precision, cleanliness, eco-friendliness, and cost efficiency," says Jesper Kimblad, Technical Manager at IGEMS, a company based in Borås, Sweden, specializing in CAD/CAM software for waterjet cutting systems. However, it takes more than these credentials to achieve the perfect cut: "We have studied the physics of the waterjet in depth and developed software that takes its constantly changing nature into account," says Jesper Kimblad. "In the same way as water cutting requires specific CAD and pre-production software, it also needs an optimized control system." TwinCAT 3, equipped with a range of functions and other Beckhoff components, forms the basis for the IGEMS control platform.

Flexibility and openness deliver benefits

According to Jesper Kimblad, no other system offered the necessary flexibility and functionality: "One problem with conventional control systems is that the digital outputs cannot be controlled quickly and synchronously enough during the path movements of the nozzle." It is exactly this level of control that waterjet cutting requires, however: The water and abrasive materials must be precisely metered because even the briefest of stops or delays will leave marks on the cutting edges. Citing a further advantage of PC-based

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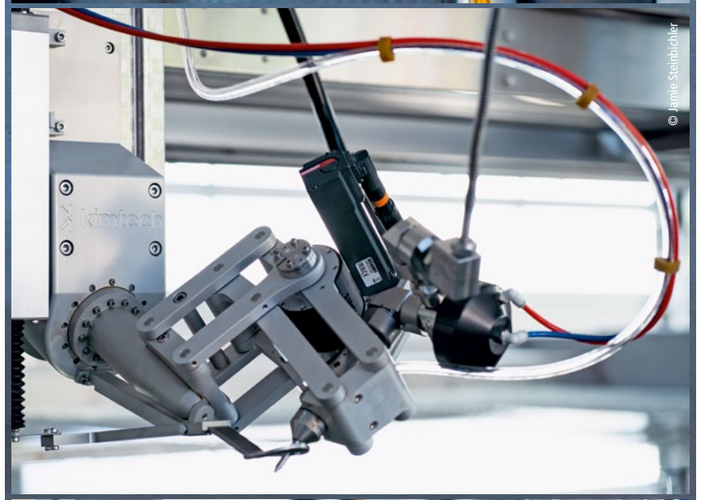
Left: PC-based control helps to optimize offcuts: The contours of panels can be captured by a camera and read into the control system. The machine operator can then set the zero point of the pending production order in the user interface.



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Center: One axis of the Tilter, as it is known, is driven by a compact AM8000 servomotor.

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Below: The highly dynamic linear motors from the AL8000 series are controlled via the AX8000 multi-axis servo system and TwinCAT 3.

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Stefan Hanhela, Senior Sales Specialist Motion at Beckhoff Sweden, together with Kimtech CEO Gustaf Kimblad and Jesper Kimblad from IGEMS (pictured left to right) in front of a waterjet cutting system with a CP3921 stainless steel multi-touch Control Panel providing the HMI.

control technology from Beckhoff, Jesper Kimblad adds that no other controller would be able to switch the feed rate from mm/minute to inverse time during operation. This function is particularly useful when cutting pipes and in 5-axis operation.

IGEMS went through a total of four iterations with other control providers before Jesper Kimblad finally found the right platform with the open approach of PC-based control and TwinCAT 3: "We simply couldn't implement the necessary adaptations in the other systems. In addition, the other providers had a limited range of hardware, so IGEMS control system users would always have had to purchase the additional control components they needed from different suppliers and integrate these themselves."

Single sourcing in hardware and software

As Jesper Kimblad explains, however, Beckhoff's wide range of technologies allows it to provide all the electrical components required for waterjet cutting machines – anywhere in the world. This is vital for IGEMS' customers, who sell their water cutting systems worldwide. "Most importantly, however, TwinCAT 3 ensures that a machine does not have to stop while the program is running, which means it can perform multiple cutting tasks in one operation and ensure a straight cut," says Jesper Kimblad.

IGEMS uses Beckhoff's TwinCAT software, in particular the TC1200 (PLC), TF5000 (NC PTP), and TF5060 (NC FIFO Axes) functions to calculate the trajectories of the motors, control the drives and movements, perform axis interpolation, track I/O changes and transfer all this data to the FIFO (First In, First Out) buffer integrated in TwinCAT. All data is communicated in real time via the EtherCAT network protocol from Beckhoff. Jesper Kimblad comments: "I really appreciate the open nature of TwinCAT. The software handles difficult tasks involving flowing positions very quickly and ensures a precise and perfect cut. It's ideal for monitoring values and runs on an industrial PC, which means we can carry out the entire development process on laptops. Setting up and programming the water cutting system is also very quick – between just 5 and 30 minutes.".

And thanks to the openness of PC-based control, machine builders can easily integrate additional functions into the control system and automate them with Beckhoff hardware.

IGEMS itself uses this flexibility for optional functions – when preparing work and performing calibration, for example. In most cases, leftover pieces of sheet metal are stored for subsequent orders and clamped several times on the cutting systems. An optional camera above the cutting systems scans these pieces and transmits the images to the control system. The contour is scaled there and displayed in the "cutting pattern" of the upcoming processing program. The machine operator can then set the zero point of the NC program directly on the image and adjust the position of the parts if necessary. IGEMS has also integrated a system calibration function into the control system; together with the optional IGEMS Rounder, this measures and compensates for deviations in the X, Y, and Z directions. "Machine builders used to need half a day to a whole day for this calibration; with our software and the measuring head, it only takes 9 minutes," says Jesper Kimblad, highlighting the benefits of an open control architecture.

Machine builders benefit from sector segmentation

The company Kimtech in Stockholm has now installed 15 machines with control systems from IGEMS and ordered a further 30 complete systems from Beckhoff. CEO Gustaf Kimblad comments: "We are delighted with the control system, which is specially tailored to waterjet cutting. The control system optimizes operation, monitoring, and remote maintenance. It also enables precise calibration and reduces the amount of work involved in programming. The HMI is user-friendly and the integrated tools are intuitive. Overall, the control system simplifies the structure of the waterjet cutting machines and reduces their complexity." Gustaf Kimblad cites Beckhoff's One Cable Technology (OCT) as an example: "OCT allows us to connect the drives with just one cable and requires fewer components, which makes us much more competitive. As a machine builder, we can now concentrate more on what we do best." And Kimtech is not the only company to benefit from having just one contact partner in IGEMS, which provides the complete control system together with Beckhoff. Jesper Kimblad refers here to other projects in the USA and China.

More information:
www.igems.se
www.kimtech.se
www.beckhoff.com/cnc

Automobile museum installation controlled by EtherCAT-based drive technology and TwinCAT control

Safety first as classic car takes perfect flight

A lovingly restored 1965 Citroën 2CV stands on a pedestal. Suddenly, the scene comes to life as a series of pulleys allow the individual parts of this iconic car to float up to the ceiling and back down as if by magic. Designed by Kvorning Design and delivered by All Stage Production, this installation is the latest attraction at the Classic Car House in Copenhagen. And what is it that ensures this crowd-pleaser functions precisely, reliably, and safely? PC-based control from Beckhoff.

The Classic Car House museum showcases a segment of Danish and international automotive and cultural history from the 20th century with its vintage car collection. K.W. Bruun & Co, the company behind Classic Car House, traces its roots back to 1914 when Karl Wilhelm Bruun began importing cars in the early 1900s. Fast-forward to today and the company is now one of the largest private providers. The museum aims to contribute to the preservation of our shared cultural legacy.

Quiet, safe, and precise operation essential

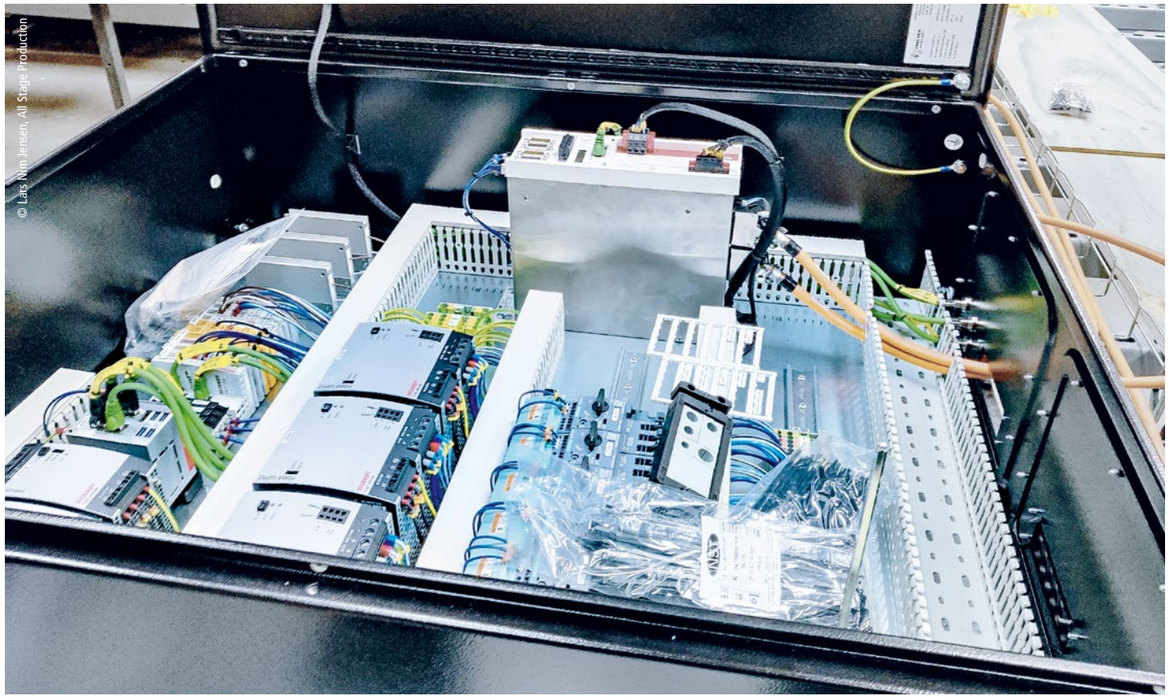
The idea and concept behind the installation came from the internationally renowned agency for experience and exhibition design, Kvorning Design ApS, which has delivered all of the exhibitions and special effects throughout Classic Car House to date. The "flying 2CV" is their latest in a long line of impressive creations, and the logistics behind it are far from simple. The ceiling-mounted drives not only have to be capable of lifting and lowering car parts weighing up to 100 kg at the same time, but they also have to do it quietly, reliably, and precisely based on their surrounding environment.

With the exception of the chassis, wheels, and engine, all the larger body parts are slowly hoisted on steel cables from the floor to the ceiling and then lowered back down to land exactly where they started. Museum visitors can observe this process directly in front of the vehicle on the first floor, or alternatively from the upper floor. From this higher level, they also have a direct view of the entire setup, featuring the AM8000 servomotors for the heavy body parts and the AMI8100 distributed servo drives for the lighter components.

The company entrusted to bring the 2CV installation to life was All Stage Production ApS, which boasts extensive experience in the entertainment industry.

The whole scene is like something straight out of the theater, with cable drums and drives visible on the ceiling, and the AM8000 servomotors featuring One Cable Technology and AMI8100 distributed servo drives making for an aesthetically pleasing installation.

An impressive 2CV installation based on Beckhoff drive technology and TwinCAT has been brought to life at Classic Car House in Copenhagen.


© Lars Nim Jensen, All Stage Production

Control cabinet during assembly with a two-channel AX52xx servo drive, a C6017 ultra-compact Industrial PC, and several PS3000 power supply units for the AMI8100 distributed servo drives

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AMI8100 distributed servo drives complete with backlash-free permanent magnet holding brake and TwinSAFE STO/SS1 safety function move the smaller body parts, with everything controlled via TwinCAT alongside the AM8000 synchronous servomotors.

"Industrial automation is increasingly finding its way into theaters, music venues, and museums, as the drive technology is much more precise and durable than conventional motor controls," explains Lars Nim Jensen, project manager at All Stage Production. When it comes to continuously lifting and moving heavy car parts with maximum precision, reliable solutions are essential. After all, the solution has to function perfectly for years with minimal maintenance requirements. It is with precisely these considerations in mind that Lars Nim Jensen was so keen to have Beckhoff on board as a trusted automation partner.

"When we first started working on this project, we had a different motor solution in mind than the Beckhoff drive technology favored by All Stage Production," admits Lennart Skjødt, project and production manager at Kvorning Design, "but All Stage Production's professional approach and planning convinced us to have faith in Lars Nim Jensen's expertise when it comes to drive and control technology." After all, there is a significant difference between raising and lowering an object for a one-off show and a permanent installation that has to function flawlessly 350 days a year from morning till night. "An industrial solution also offers the highest level of safety, including emergency shutdown and remote access capabilities," notes Lars Nim Jensen.

OCT and distributed drive technology

Together with Beckhoff Solution Provider Holtec A/S, All Stage Production has developed a complete solution based on TwinCAT 3 and drive technology from Beckhoff. "We opted for this drive technology because it is reliable, compact, and – in the case of the AM8000 servomotors – only requires a single connection cable thanks to One Cable Technology (OCT). In an installation like this, where the motors, cables, and suspensions are all visible, this is not only efficient, but also aesthetically pleasing," emphasizes Lars Nim Jensen. Another essential aspect to consider in the entertainment industry is that Beckhoff motors are quiet.

A total of nine servomotors make the body parts fly, including two AM8000 servomotors controlled by a two-channel AX52xx servo drive. There are also seven AMI8100 distributed servo drives with integrated servo amplifiers, a TwinSAFE extension, and a backlash-free permanent magnet holding brake. This showcases yet another advantage of the Beckhoff product range, in that more powerful drives can be combined and synchronized freely with the compact drive technology (nominal voltage up to 48 V DC) for the various components. A positive side effect of this configuration is that the integrated AMI8100 servo drives generate less heat in the control cabinet. "This allowed us to dispense with a resource-intensive water cooling system for the control cabinet and make do with conventional fan cooling," explains Lars Nim Jensen.

Efficiency in design, project planning, and engineering

Kvorning Design gave All Stage Production the green light for the project in spring 2023. After just seven weeks of development, production, and installation, the project was completed. "Our idea was brought to life without a hitch and we couldn't be happier with the automation solution installed by All Stage Production," enthuses Lennart Skjødt. Holtec created the software using TwinCAT 3. All processes are fully automated and controlled by buttons and I/Os via a central control panel. All Stage Production can log in via a VPN gateway and make adjustments from the head office in Varde as needed. A DMX master terminal is already in place for future extensions, allowing for the integration of various audio, video, and lighting scenarios for synchronization with the motion sequences.

All Stage Production has been collaborating with Beckhoff for ten years and uses its solutions in 80% of its projects – especially when rotation or lifting is required. "We always know what to expect when we work with Beckhoff. What's unique about the entertainment industry is that we only ever build one prototype for each project, which has to work immediately. This is why we always strive for maximum precision and reliability," summarizes Lars Nim Jensen.

More information:
www.classiccarhouse.dk
www.kvorning.dk
www.allstage.dk
www.holtec.dk
www.beckhoff.com/motion

© ETG

More than 40 people participated in the second FSoE Plug Fest of the ETG.

Safety-over-EtherCAT (FSoE) Plug Fest

In December, the EtherCAT Technology Group (ETG) invited to an FSoE-excklusive Plug Fest for the second time.

In addition to the regular EtherCAT Plug Fests, the ETG has offered FSoE-focused interoperability meetings since 2019. Developers and manufacturers use these events to test FSoE MainInstances and FSoE SubInstances as well as FSoE software stacks and tools with Safety over EtherCAT technology.

With over 40 participants, the event was once again very well attended, which shows there is a definite need for this type of gathering. During the two-day FSoE Plug Fest, a total of seven FSoE MainInstance and 15 SubInstance implementations were tested for interoperability. The tests were supported by the FSoE Conformance Test Tool (CTT) maintained by the ETG for SubInstances and MainInstances with FSoE functionality. In addition, attendees at the event had the opportunity to exchange ideas with the ETG's FSoE experts and address open questions.

The large number of safety controllers (FSoE MainInstances) that were tested is particularly noteworthy. Dr. Guido Beckmann, Head of the Safety Working Group at the ETG, summarizes: "The large number of participants at this specific FSoE Plug Fest reflects the widespread acceptance of FSoE technology. With well over 50 manufacturers of FSoE devices listed in the ETG, this protocol is the most widely used safety communication protocol in industrial automation. Truly, the number of safety controllers with FSoE support is unique." The EtherCAT Technology Group is already planning future Safety over EtherCAT Plug Fests. All dates can be found on the ETG homepage as they are scheduled.

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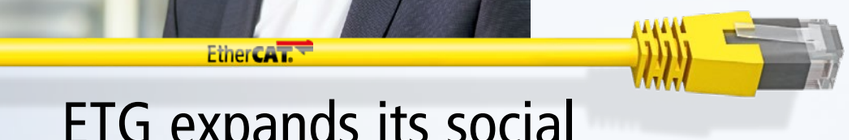
Dr. Guido Beckmann, Head of the Safety Working Group at the ETG



ETG expands its social media activities

The ETG has expanded its social media portfolio and now also has its own Instagram account.

The background to this is the ETG's desire to make news from the association and information about its numerous events even more easily accessible to a wide audience. In addition, the account @ethercat_technology_group is intended to provide entertaining insights into the association's everyday life and the international team structure.

© ETG

The ETG can now be found on Instagram under @ethercat_technology group.

Ionautics is ETG member 7,500

With member number 7,500 joining its ranks, the ETG has reached a new milestone in its membership development. The Swedish company Ionautics has pioneered innovative processes and products in the field of thin film technology, and by joining ETG, the company plans to develop future breakthroughs using EtherCAT.

With the 7,500th member joining, the EtherCAT Technology Group shows once again that it is not only the world's largest fieldbus user organization, but also the fastest growing one. For over ten years, more than 400 new companies and institutions have joined the ETG every year, future-proofing their technologies, processes, applications and products by leveraging EtherCAT. One such company is Ionautics from Sweden, which specializes in the use and further development of modern processes in thin-film technology. Johan Ahlström, CEO at Ionautics, explained: "We provide the tools and expertise to meet the increasing demands for performance, product quality, cost reductions and environmental compatibility of advanced materials, including thin film coatings and nanoparticles. EtherCAT is a great fit for us and our work, and it is the fieldbus of choice in many of the industries we serve."

Martin Rostan, Executive Director of the EtherCAT Technology Group, said: "We are pleased to welcome Ionautics as member 7,500 in our organization. With the decision to utilize EtherCAT, Ionautics will be able to secure a long-term foothold in other industries that have long relied on the technology."

Johan Ahlström, CEO at Ionautics, with the membership certificate of the EtherCAT Technology Group

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EtherCAT Semiconductor Technical Working Group publishes further standards

At the 24th meeting of the ETG working group four new profile specifications for the semiconductor industry have been published.

The EtherCAT Semiconductor Technical Working Group, founded in 2011, has set itself the task of developing EtherCAT standards for the semiconductor industry. While EtherCAT as a basic technology, i.e. the "how" of communication, naturally remains unchanged, the device profiles define the "what" for industry-specific devices, such as mass flow controllers, high vacuum pumps, plasma and high-frequency generators. To develop these profiles, the working group meets twice a year for meetings lasting several days, alternating between Silicon Valley in California and online.

The most recently published standards are the profiles for mass flow controllers, temperature sensors for wafer processing chambers, sensors for voltage and current frequency analysis and for special process control valves. Four further profiles are currently in progress. In addition to the work on the profiles, a new task group was also launched during the meeting, which will develop the device profile for Optical Emission Spectroscopy (OEW). This profile will primarily benefit from the efficient bandwidth utilization of the EtherCAT protocol. After all, up to 500 bytes of cyclic raw data must be transmitted to the controller per communication cycle. With the newly adopted standards, the series of EtherCAT device profiles specifically for the semiconductor industry has grown to a total of 24 specifications.

More information:
www.ethercat.org

PCcontrol
The New Automation Technology Magazine

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