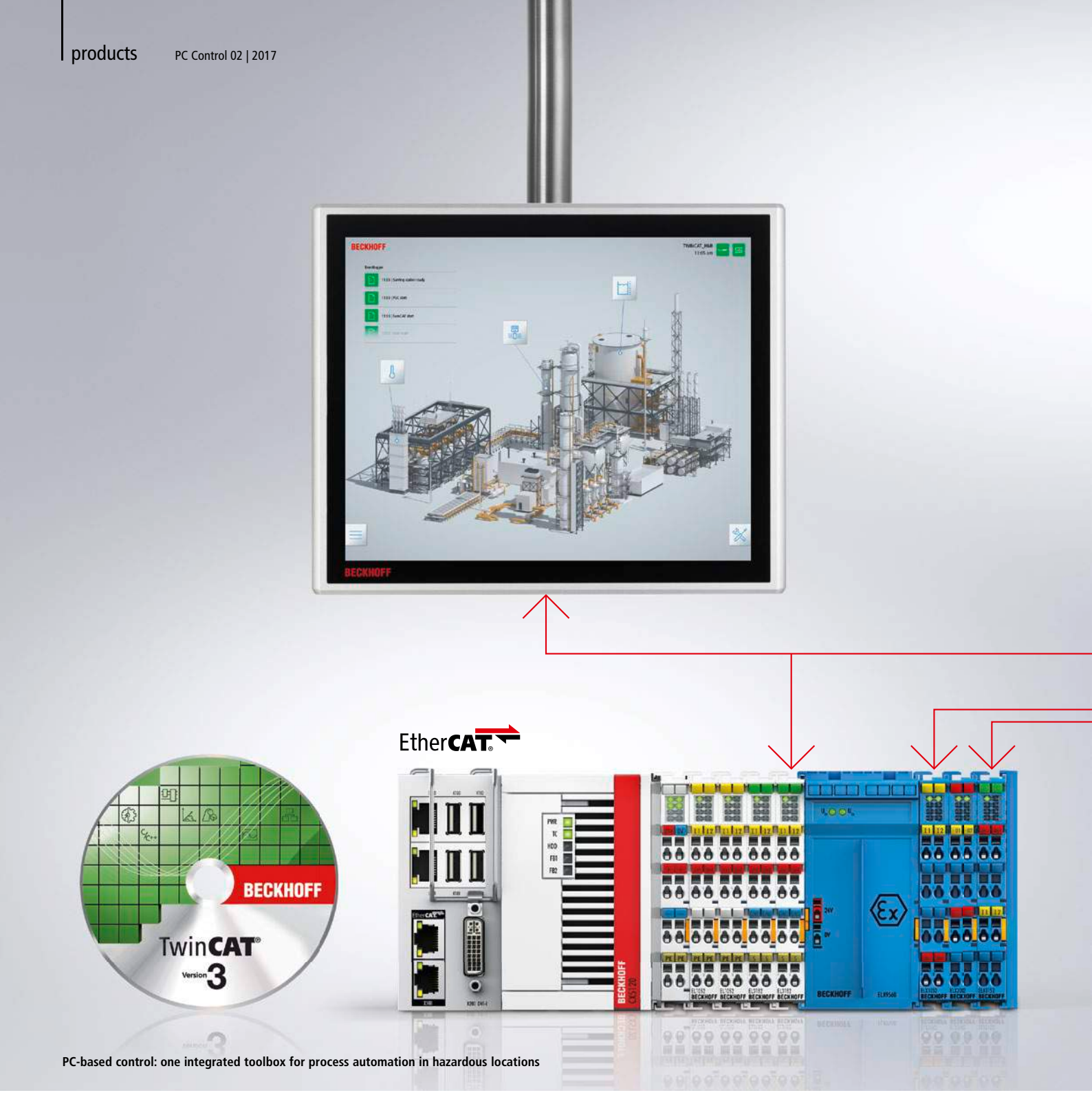
PC-based control as an integrated solution for automation and process technology

Two worlds are converging

With the introduction of specific solutions for the process technology market, Beckhoff is not merely introducing new components, but bringing together two automation concepts that for decades developed separately, side-by-side. While traditional PLC-based systems were optimized predominantly for short cycle times as a replacement for complex relay technology in machine controls, DCS (Distributed Control Systems) for classic PID (Proportional Integral Derivative) closed-loop control focused mostly on scalability and system integration.



PC-based control: one integrated toolbox for process automation in hazardous locations

Driven by customer requirements and technological progress, both DCS and PLC have advanced and increasingly converged over the years. As a result, PLC systems have acquired ever more extensive visualization systems. These are very similar to those that process engineers have used from the start, and are implemented to manage many wide-ranging and complex processing workflows. Distributed control systems, on the other hand, were optimized with regard to their performance and cycle times. Improvements such as these help accommodate even highly time-critical processes and equip process plants for safety-related requirements such as emergency stops and fire protection.

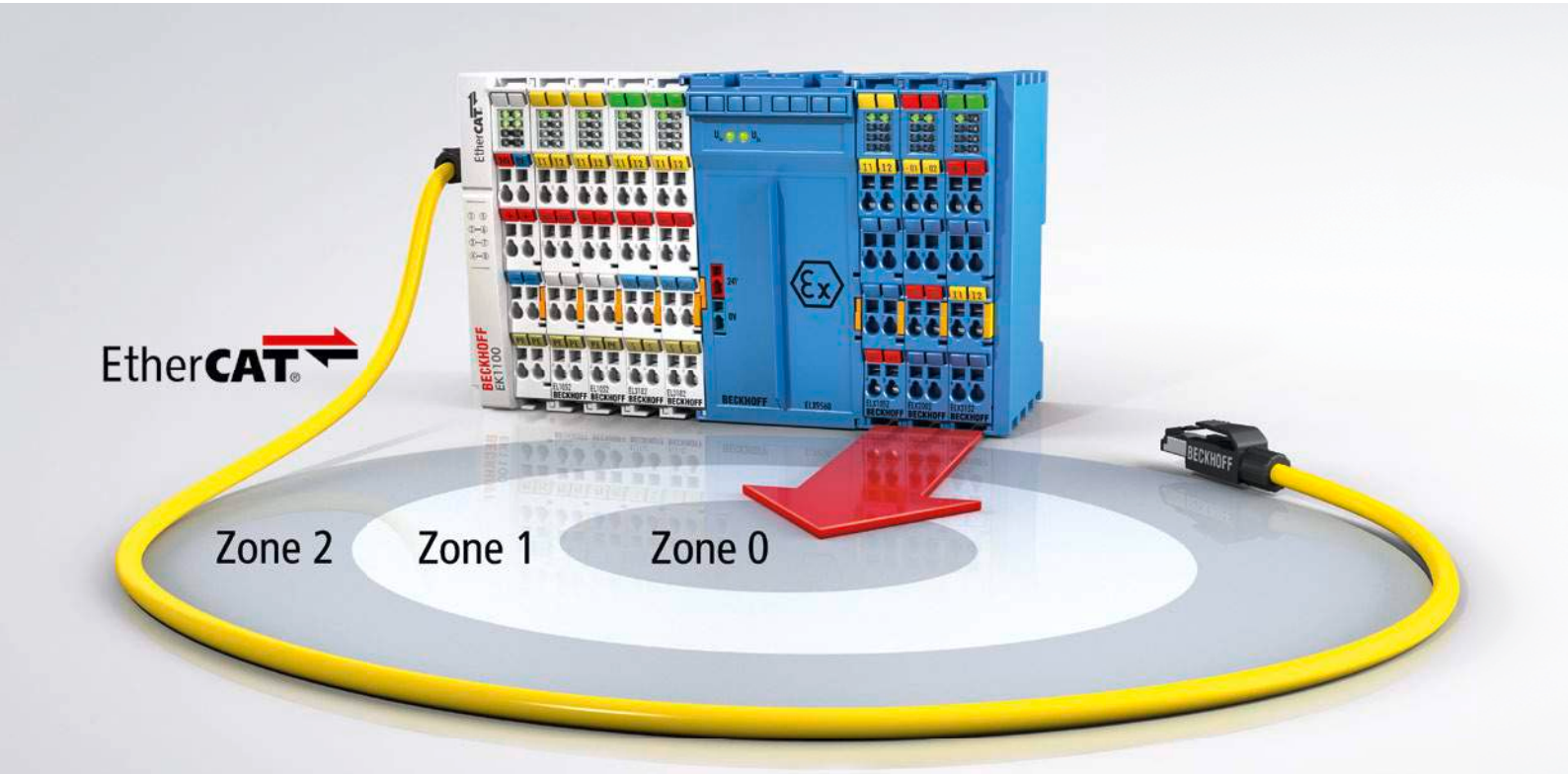
Growing requirements bring separate worlds together

The systems also converged in terms of scalability. Distributed control systems, which were designed from the start for large installations with tens of thousands of I/Os, were successful with simple engineering and retrofit capabilities. However, for today's PLC-based systems, even I/O points in the high

five digits don't pose a challenge anymore. In addition, modern engineering environments like TwinCAT 3 software feature a broad range of libraries and plenty of function blocks so that even highly complex closed-loop control structures can be designed quickly and reliably.

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

This has changed as simple machines have evolved into highly complex production lines within tightly networked plants, and operators have become more interested in using distributed peripherals that can be linked to fast fieldbus systems and deliver the bandwidth needed to accommodate



Process technology and automation combined into one system: The new ELX series EtherCAT Terminals feature intrinsically safe inputs/outputs and enable direct connection of field devices located in hazardous areas up to Zone 0/20.

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

The PLC system offers maximum innovation potential

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

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

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

Open and modular automation technology as a complete solution

With PC-based control, Beckhoff offers the ideal automation toolbox to imple-

Exceptionally compact with intrinsically safe I/O: New EtherCAT Terminals directly connect with field devices located in Ex Zone 0

The new ELX series EtherCAT Terminals with intrinsically safe inputs/outputs and highly compact design enable direct connection of field devices located in hazardous areas – classified Zones 0, 1 and 2. PC-based control from Beckhoff now seamlessly combines automation and process technology, including all the benefits of integrated and comprehensive diagnostics from the EtherCAT system.

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

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

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

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

ment all these requirements in a complete and integrated solution. Through the addition of specific innovations for process technology applications, process engineers now have access to the same automation system that has long been proven in machine design and factory automation.

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

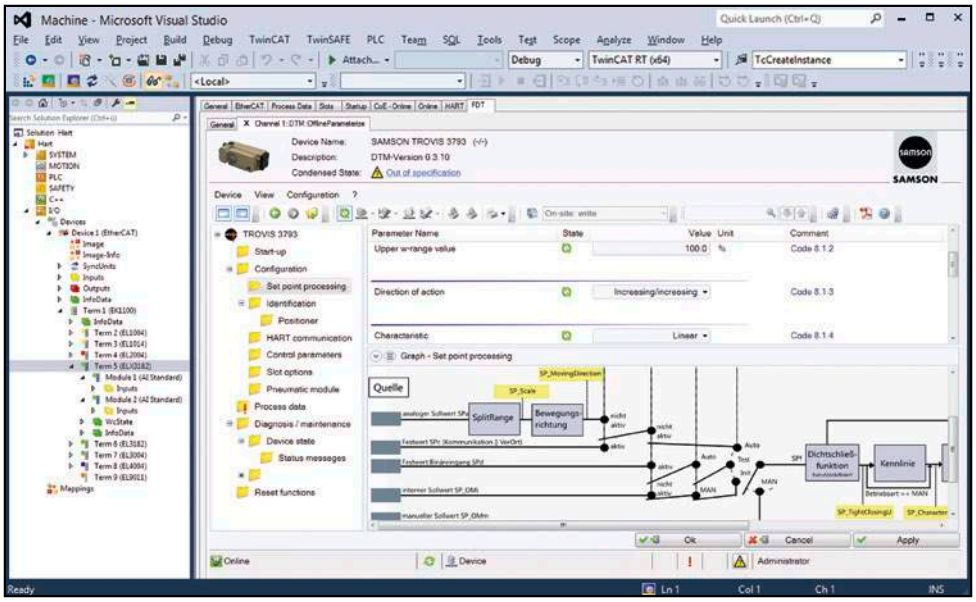
The benefits of integrated and open automation systems from Beckhoff become especially apparent when designing new plants. On the field level, the use of ELX-series EtherCAT Terminals for the direct connection of intrinsically safe field devices enables significant reductions in space requirements, and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

PC-based control simplifies plant operation and engineering

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

The advanced TwinCAT HMI software solution enables the implementation of visualization tasks according to the highest standards for efficient and reliable plant operation. In addition, the responsive TwinCAT HMI runs just as well

Available as integrated or standalone models, the explosion-proof Control Panel solutions in the CPX series combine high-quality build and elegant design with advanced, capacitive multi-touch technology.



The full integration of the HART protocol into TwinCAT software enables the use of extensive functions directly from the engineering interface. Through the integrated FDT container, additional field device DTMs can be opened inside TwinCAT, offering all configuration options on one software platform.

High-quality build and elegant design: Multi-touch panels for Ex Zone 2

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

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

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

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

on mobile devices as on industrial Control Panels and Panel PCs. For process visualization and control in hazardous areas (Zone 2/22), specific devices are available in the form of the highly attractive CPX panel series with state-of-the-art multi-touch technology and robust aluminum enclosures.

With the wide range of TwinCAT functions available, engineering for the entire plant operation and data transmission to a higher-level control system or cloud services become highly intuitive processes. Many diagnostic options and interfaces, such as the TwinCAT FDT container for integrating field device drivers (DTM), ensure quick and productive commissioning and easy access to the world of Beckhoff control technology. The integrated Beckhoff automation toolbox 'for both worlds' is up to the task whether the requirements originate in the discrete, or in the process automation landscape.

Further information:
www.beckhoff.com/process

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