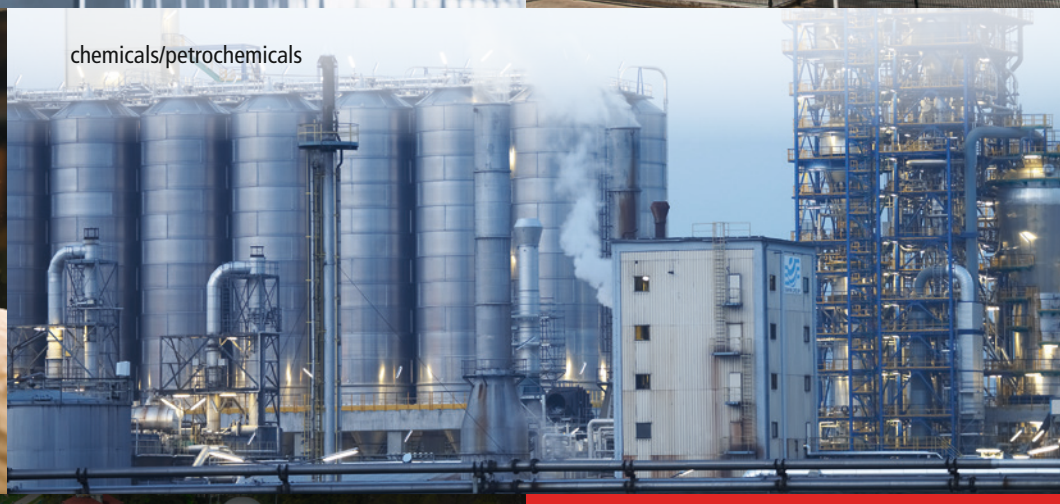
BECKHOFF New Automation Technology

The control system for the process industry: PC-based Control

One integrated control concept for all vertical markets in the process industry

oil and gas production



PC-based Control for:

- oil and gas production
- chemicals and petrochemicals
- mining
- metalworking
- coating processes
- timber processing
- water and waste water treatment
- energy economy

PC-based Control: all control tasks on one platform

Optimised sequential control

PC-based Control realises efficiency advantages in process engineering applications.

Integrated cloud communication

Open communication standards enable simple, system-integrated connection to the private or public cloud.

Simplified data analysis

TwinCAT Analytics supports data analysis and predictive maintenance concepts.

All-purpose control platform: from explosion protection applications to large-scale process engineering plants

With a universal component construction kit and profound, cross-industry know-how, Beckhoff realises open automation systems on the basis of PC-based control technology. Through the consistent bundling of control intelligence in the software and the use of established standard technologies from the worlds of IT and automation, PC-based Control combines all functions such as PLC, measurement technology and motion control in a single system. For the process industry, a comprehensive portfolio of explosion-proof components is available for the realisation of integrated solution concepts for barrier-free communication from zone 0 to the cloud. These include the EtherCAT Terminals of the ELX series with intrinsically safe interfaces, the Control Panels and Panel PCs of the CPX series with high-quality finish, the TwinCAT control software with specific process technology interfaces, hardware and software modules for simple IoT communication, and the application of cloud-based services and system networking. In the case of new plants, the explosion protection

The proven components for PC-based Control: IPC, I/O, Motion, TwinCAT

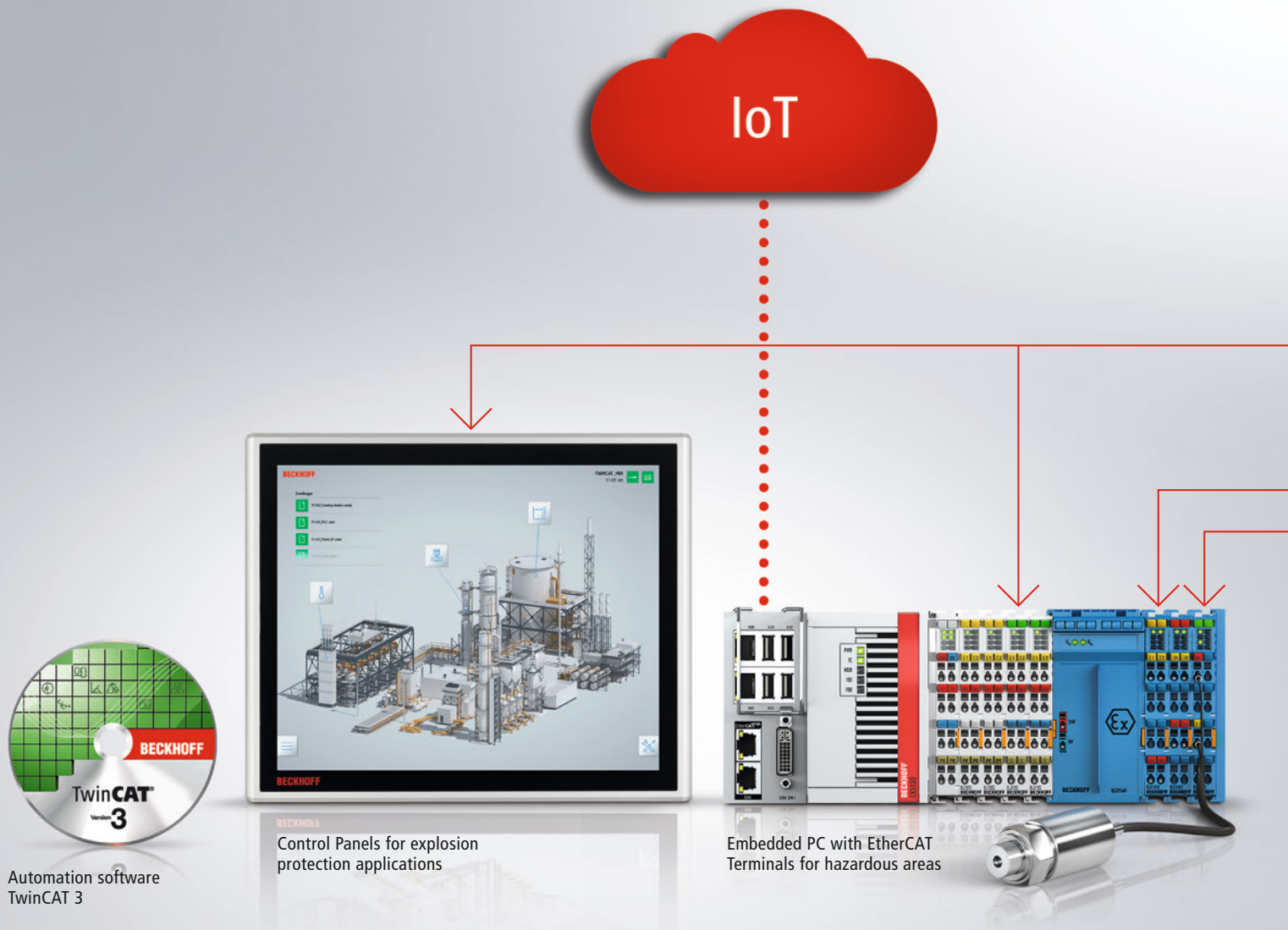
can be integrated directly into the overall controller; in the case of existing plants the Beckhoff PC-based controller can be simply extended. With the embedding of process-specific interfaces such as NAMUR, HART, FDT/DTM, the standards commonly used in the industry are covered. The full integration of these standards in TwinCAT offers transparency even for users who have previously worked in other software environments.

The system-integrated solution from Beckhoff offers an interesting alternative to traditional providers and is suitable for use in numerous industries such as oil and gas production, chemicals and petrochemicals, mining, metal-working, coating processes, timber processing as well as water and energy management.

Beckhoff combines automation, process engineering and IoT communication in one system:

- integrated hardware and software platform
- barrier-free process technology integration from zone 0/20 to the cloud
- EtherCAT Terminals with intrinsically safe interfaces, explosion-proof Control Panels and Panel PCs and process-specific interfaces
- PC-based control technology is established worldwide and across all industries

The Beckhoff control architecture: barrier-free from zone 0 into the cloud



Automation software
TwinCAT 3

Control Panels for explosion protection applications

Embedded PC with EtherCAT Terminals for hazardous areas

The Beckhoff product portfolio for control concepts in the process industry

From barrier-free explosion protection to cloud connectivity: Beckhoff offers an integrated automation concept for different markets and applications in the process industry. Automation, process technology and cloud applications are combined on a single hardware and software platform. In addition to the extensive product portfolio of industrially proven Control Panels and Panel PCs, the CPX series from Beckhoff offers specific solutions for use in Ex zone 2/22. The EtherCAT Terminals of the ELX series,

which have been developed completely in-house, are complex signal terminals for use in hazardous areas. Up to four intrinsically safe inputs are integrated into the 12 mm terminal housing and enable the direct connection of intrinsically safe field devices from zones 0/20 and 1/21 to the Beckhoff overall control system. The development of customer-specific variants is also possible.

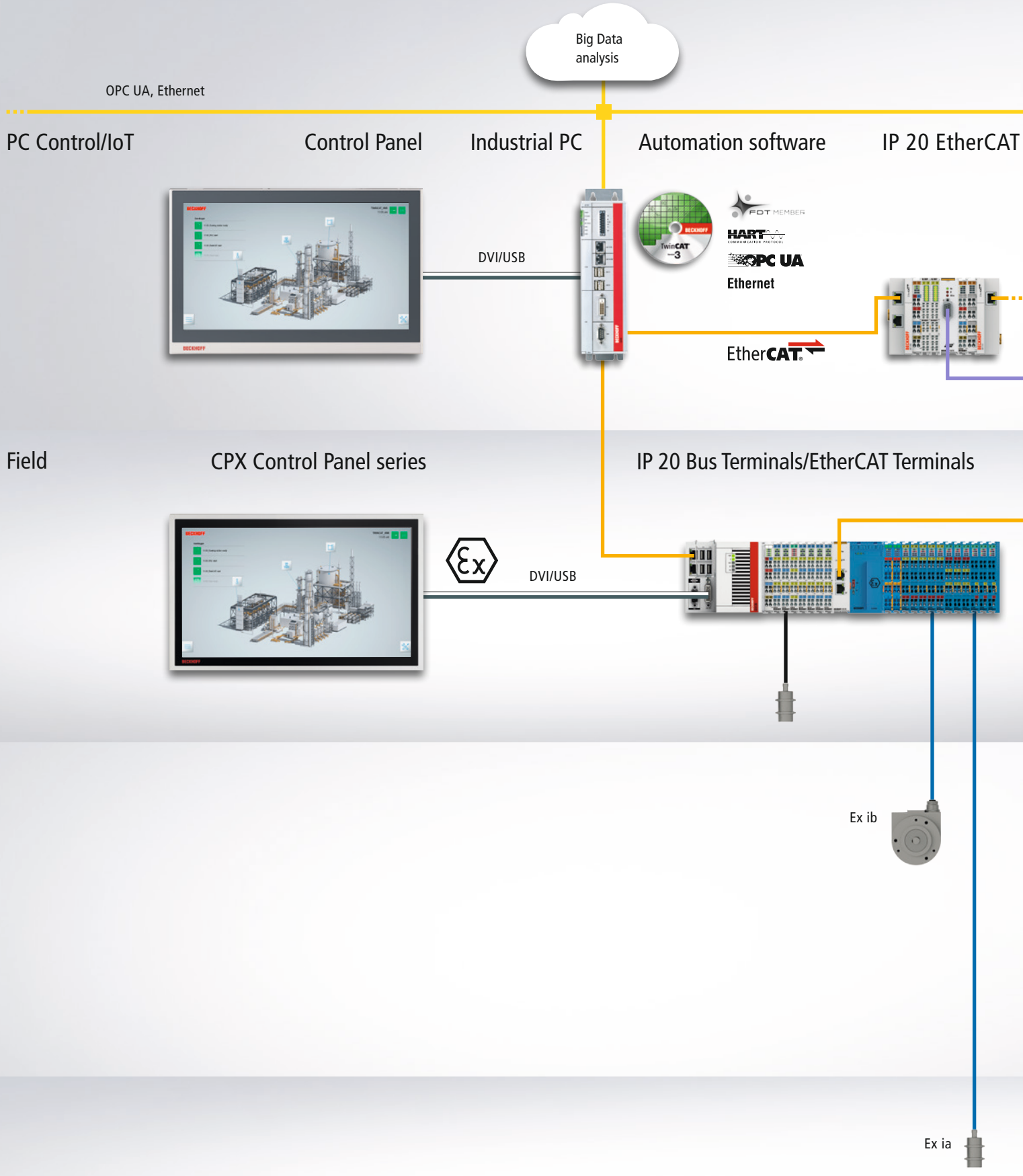
The universal explosion-proof range moreover reduces vendor dependencies: PC-based control integrates all essential automation functions in one system. This also applies on the software side: In addition to the HMI and the use of IoT and cloud applications, TwinCAT control software supports NAMUR requirements for digital and analog signals as well as the HART protocol and FDT/DTM technologies.

All Beckhoff components meet the requirements of high product, service and delivery quality: on the one hand through production "made in Germany", on the other hand through compliance with comprehensive European and worldwide standards such as ATEX and IECEx.

Barierr-free system integration from zone 0 to the cloud:

- CPX series: Control Panels and Panel PCs for use in zone 2/22
- ELX series: EtherCAT Terminal integrates safety barrier in 12 mm housing
- direct connection of intrinsically safe field devices from zones 0/20
- extensive HART integration
- integration of the FDT/DTM technology
- certification to ATEX and IECEx

The Beckhoff solutions for explosion protection

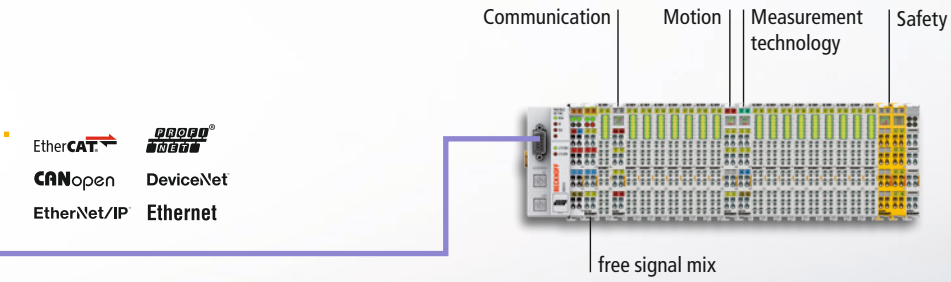


The safe area

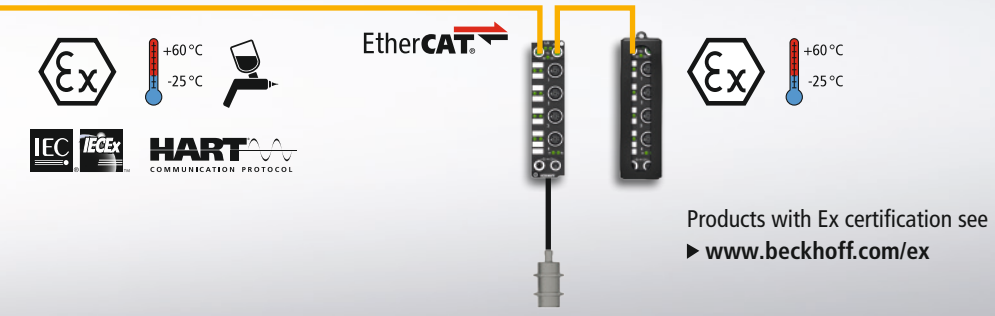
The Beckhoff product range includes all the components required for process automation: from PC-based control and the remote I/O level for all common signal types and bus systems to high-quality IP 65 Control Panels.

Terminals

IP 20 Bus Terminals



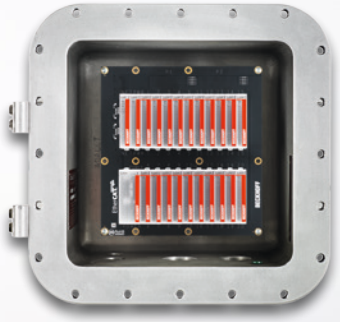
IP 67 EtherCAT Box



Products with Ex certification see
▶ **www.beckhoff.com/ex**

Zone 2/22

In addition to the IP 20 Bus Terminals/EtherCAT Terminals for control cabinet mounting, Beckhoff also supplies IP 67 modules (for direct mounting in the process environment) for use in zone 2/22. Products with an increased temperature range and optional coating are available for use under harsh environmental conditions. All components for zone 2/22 are tested by external certifying bodies.



IP 20 EtherCAT plug-in modules

explosion-proofed in Ex-d housing

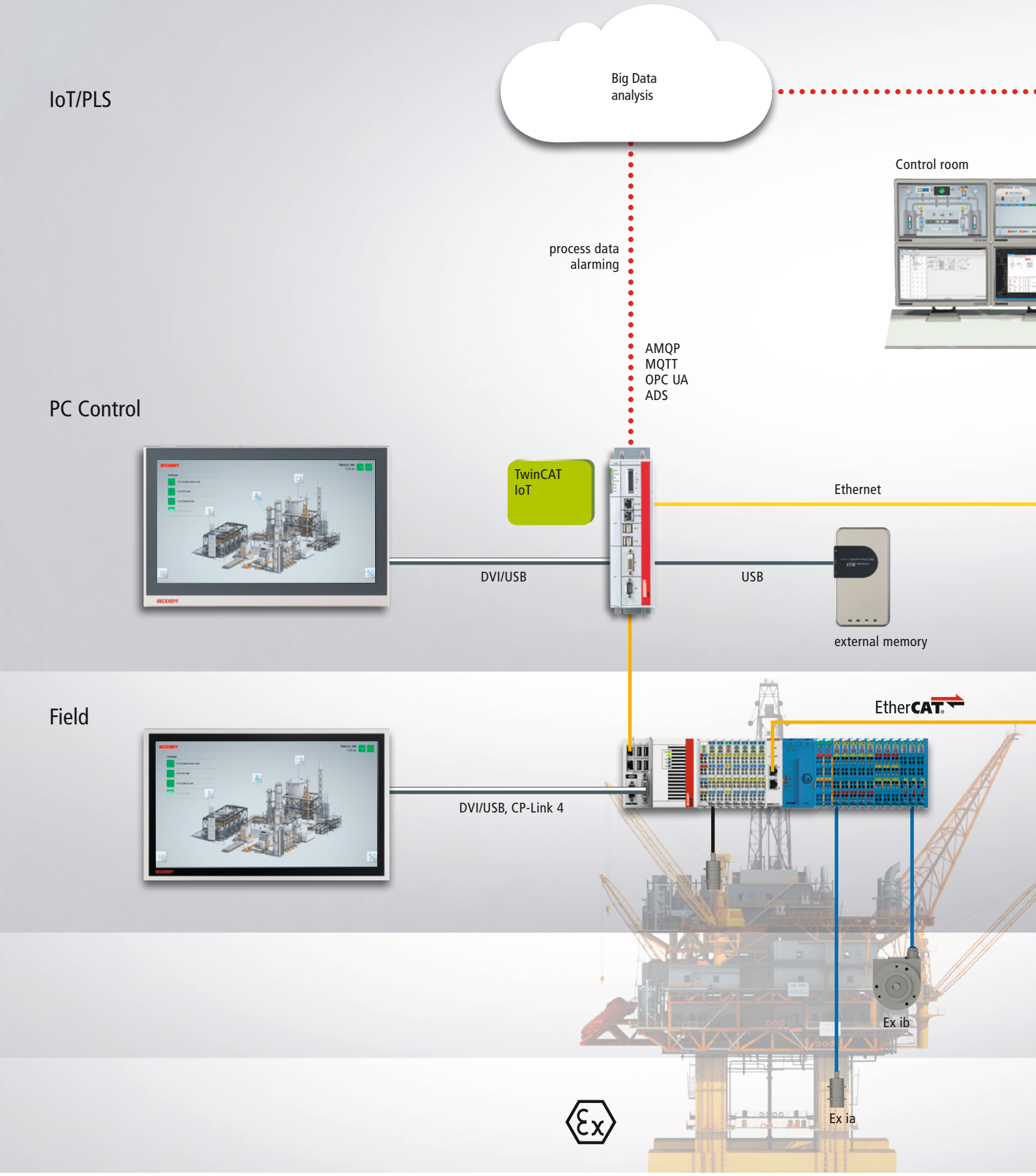
Zone 1/21

The connection of field devices from zone 1/21 to the bus system can optionally be accomplished using Ex-d-/Ex-e connection technology or, in the case of intrinsically safe field devices, by means of a direct connection to the terminals from the ELX series. In addition, the space-saving EJ plug-in module system for use in Ex-d housings can be used to achieve maximum channel density.

Zone 0/20

Intrinsically safe field devices in zone 0/20 can be integrated directly into the automation system via the connection to ELX modules.

Beckhoff solutions for process automation



The safe area

Whether centralised or decentralised: control solutions on the basis of powerful Beckhoff Industrial PCs enable various control topologies.

Due to the support of all important communication standards recorded process data can be forwarded to the local control room to be easily visualised or even to be analysed in the cloud in the central control room.

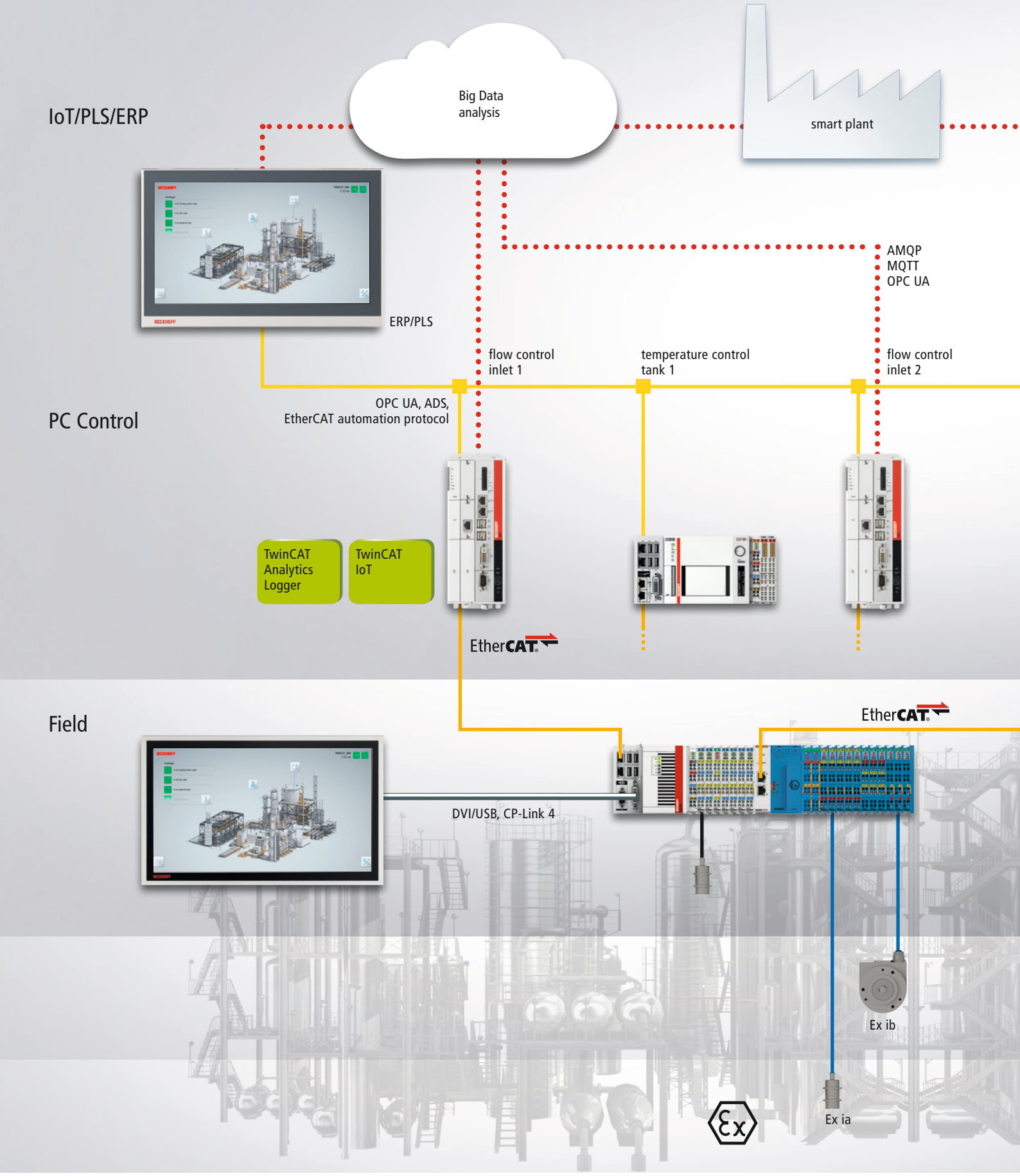
printer

Zone 2/22

Zone 1/21

Zone 0/20

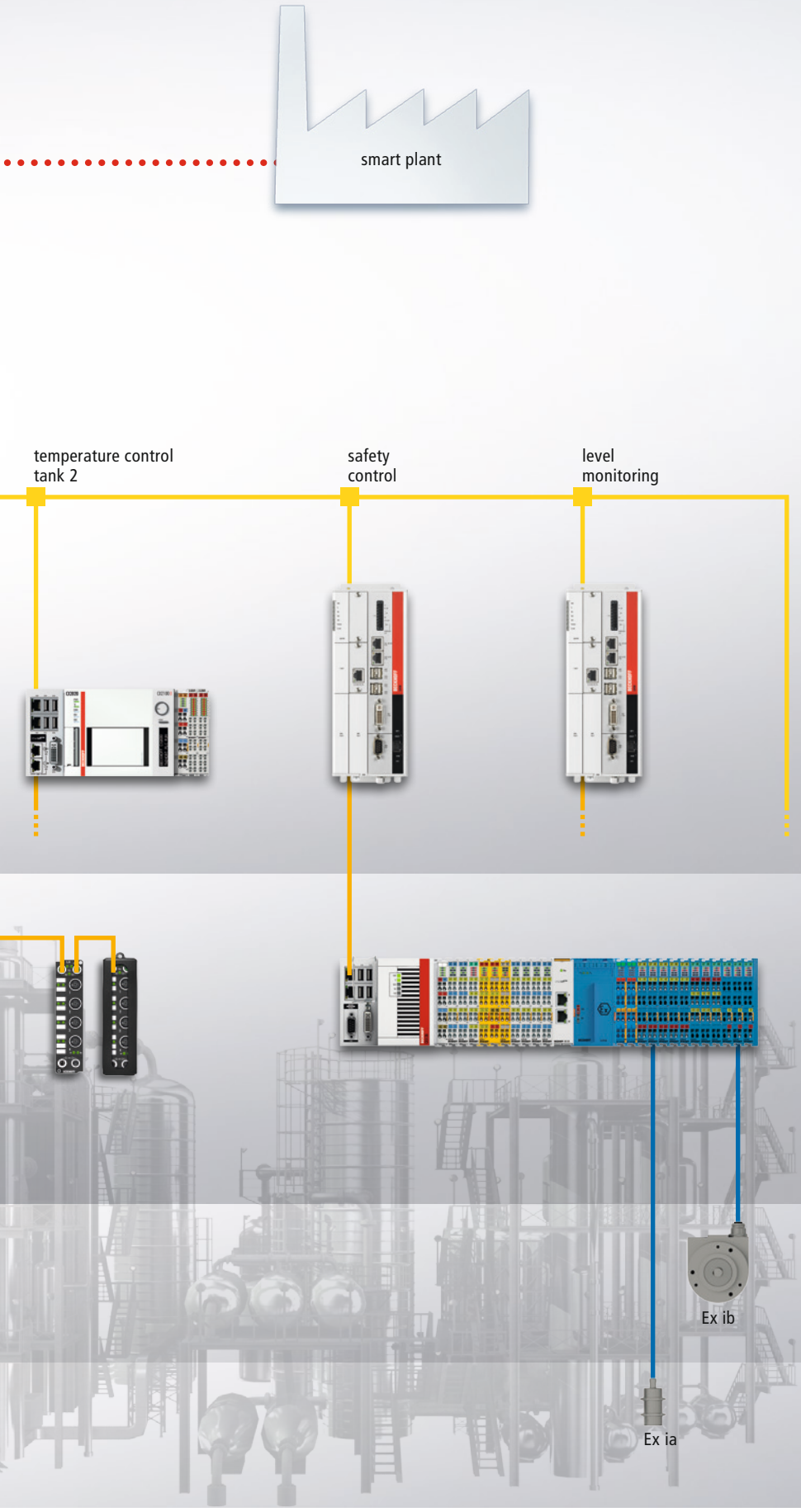
Automation solutions for large plants



The safe area

The integrated scalability of Beckhoff control technology enables various decentralised automation solutions. Plant sections can be modularly designed and easily integrated into the comprehensive control system.

Due to diverse connectivity solutions production plants can be easily connected and provide detailed information on the system status to the plant operator at any time.

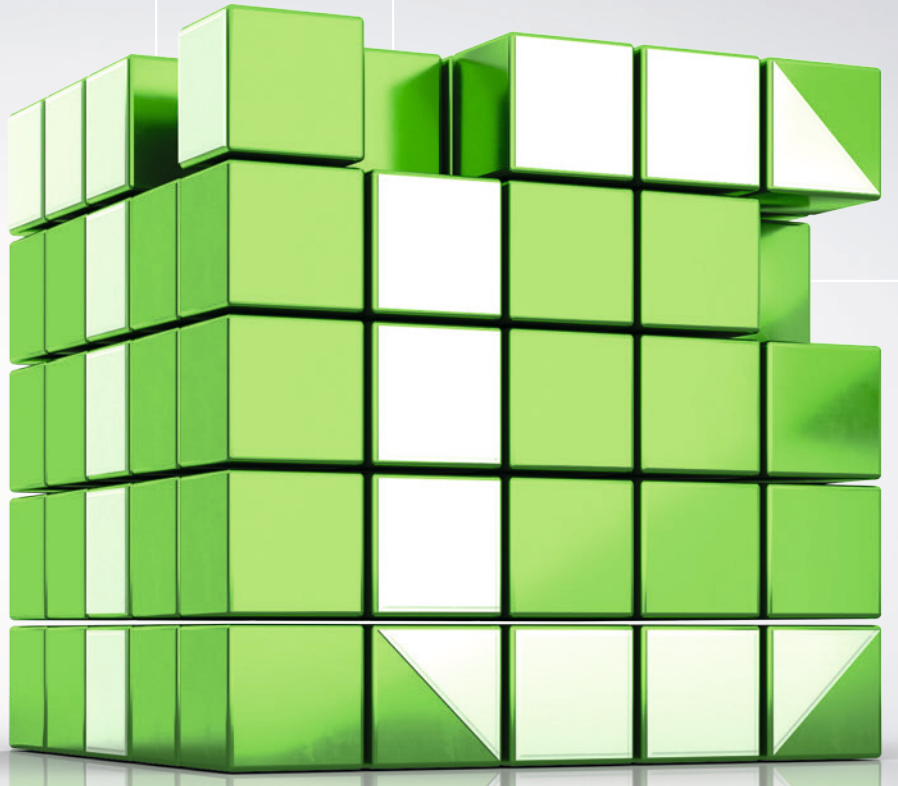


Zone 2/22

Zone 1/21

Zone 0/20

Full HART integration and comprehensive libraries: the TwinCAT control platform



TwinCAT: the control platform for process engineering

In the TwinCAT control software Beckhoff provides a central platform for the control of even highly complex systems. Apart from classic PLC sequences, algorithms written in C++ or MATLAB®/Simulink® can also be executed in real time. Moreover, TwinCAT includes the HMI, the secure cloud connection via TwinCAT IoT and the use of cloud-based analytical functions via TwinCAT Analytics. The field of application of PC-based Control is expanded with the extensive integration of specific process technology proto-

OPC UA

Based on OPC UA (OPC Unified Architecture according to IEC 62541), secure, reliable and vendor-independent communication for transporting process data to the control system is very easy to implement. The use of Beckhoff OPC UA servers and OPC UA clients enables the exchange of data in a secure and reliable way. Data access is controlled via a user management interface in such a way that only authorised users can communicate permissible data securely.

TwinCAT IoT

Beckhoff has developed the TwinCAT IoT software library for the communication between the machine controller and cloud-based services. It supports the standardized protocols OPC UA, AMQP and MQTT for communication with common cloud systems such as Microsoft Azure™, Amazon Web Services and private cloud systems in the company's own network.

Beckhoff CommDTM

Beckhoff CommDTM enables seamless integration of TwinCAT controllers into existing process control systems. DTMs from the field devices connected to the HART-capable EtherCAT Terminals can be integrated in any desired FDT containers with the help of the CommDTM. This allows field devices to be configured and parameterised remotely in the containers without the need for access to the PLC.

TwinCAT Analytics

TwinCAT Analytics enables complete and cycle-synchronous acquisition of all machine and process data. They serve as the basis for extensive analyses, which can be used to realise predictive maintenance to reduce machine downtimes. Moreover, cloud-supported big data evaluation concepts can be created in combination with TwinCAT IoT to ensure sustainable process quality control.

HART and FDT

Thanks to the comprehensive integration of the HART protocol in TwinCAT, the functions from the Engineering interface can be used. The integration of the FDT container enables opening of the field device DTMs within TwinCAT, so that all configuration options are available from one software.

cols and interfaces. TwinCAT supports all common protocols such as NAMUR, HART and FDT/DTM, covering all application areas. The full integration of the HART functionality both in the remote I/O system and in the TwinCAT Engineering ensures simple project planning and commissioning. HART integration enables users to integrate HART field devices directly into the controller. TwinCAT also reduces the engineering effort: The TwinCAT FDT container allows integration of field device DTMs directly into TwinCAT Engineering and thus a comprehensive HART configuration from one tool. The Beckhoff CommDTM provides for the integration of the TwinCAT controller into existing process control systems. This enables the parameterisation of the field devices in the familiar FDT containers and pares down the plant operation to the essential elements. Global distribution of process data and convenient system control as well as the comfortable remote maintenance are implemented via the Beckhoff OPC UA server and client.

Automation and process technology on a single platform:

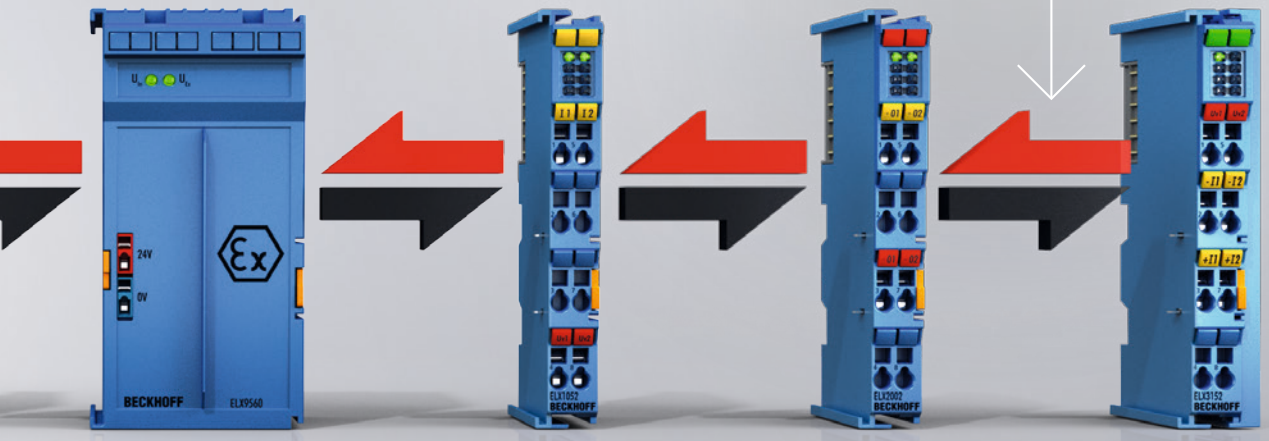
- one tool for engineering and runtime
- controller-integrated Industrie 4.0 and IoT applications
- extensive HART integration
- TwinCAT FDT
- Beckhoff CommDTM

Fast, open and ideally suited as a fieldbus for process engineering: EtherCAT

Established across all industries: the high-speed EtherCAT fieldbus

The EtherCAT fieldbus system developed by Beckhoff has been in use around the world since 2003 and is now regarded as the communication standard in many industries: More than 4,710 members* – including over 100 master device manufacturers – have joined forces in the EtherCAT Technology Group, the EtherCAT user organisation. As a universally usable and open high-speed fieldbus for PLC, Motion, I/O sensors, measurement technology and safety technology, EtherCAT is also suitable for explosion-proof connection. In other words, users only need one single communication technology. They can put their trust in the profound know-how of the EtherCAT pioneer Beckhoff and benefit from the safety and flexibility of the universal EtherCAT architecture. EtherCAT-based control systems are flexible and open, permitting the integration of third-party EtherCAT devices as well as many other fieldbus systems. With this openness, EtherCAT optimises existing and new systems alike and ensures investment protection. This is aided by the fact that there is no need to worry about revision control: EtherCAT exists in one version only, which means that new developments based

EtherCAT – the global communication standard: The EtherCAT Technology Group brings together over 4,710 manufacturers* and users from 65 countries.



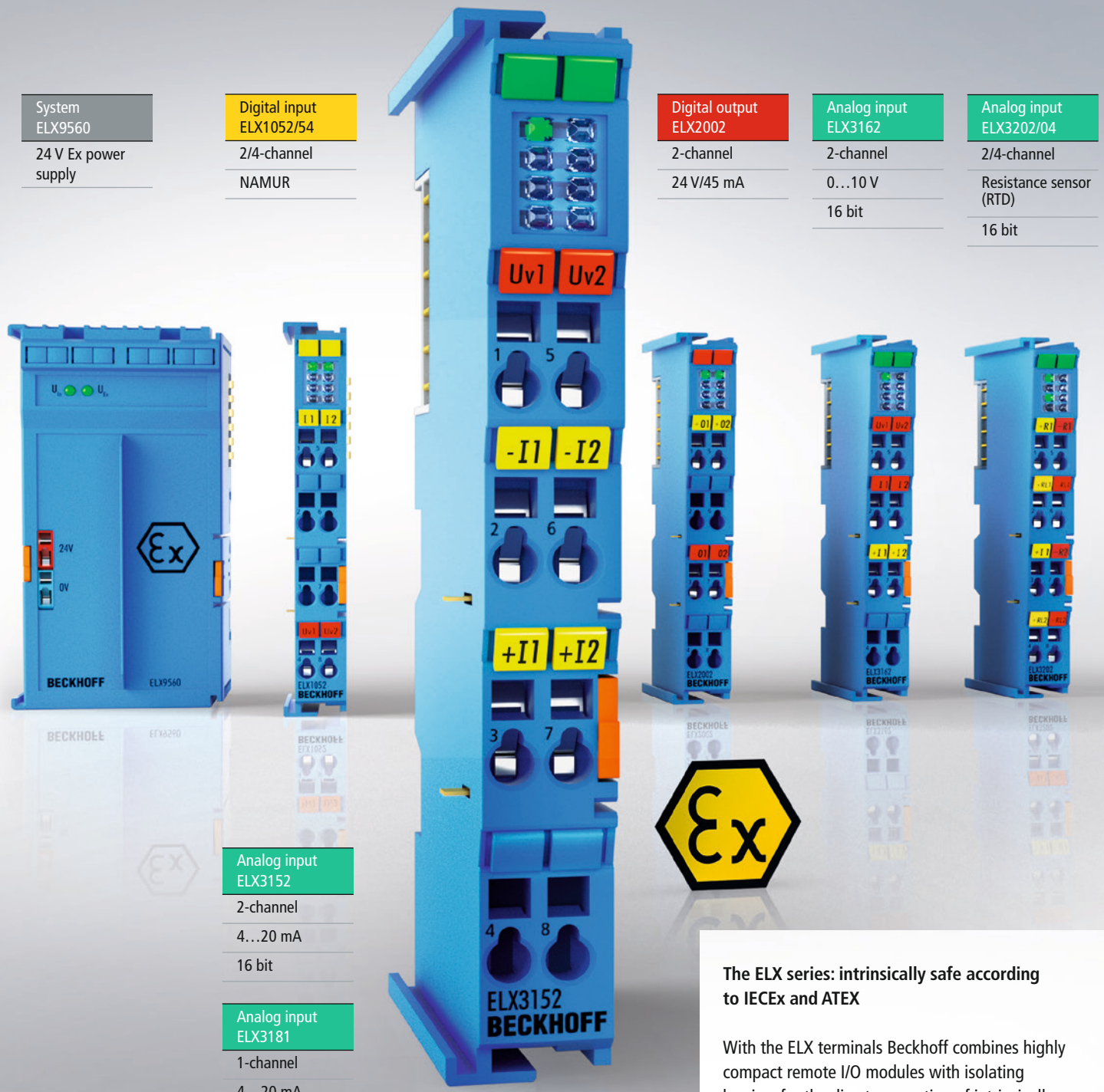
on EtherCAT are always compatible with older device generations. Users in hazardous areas also benefit from EtherCAT's time stamp functionality, which guarantees high measuring quality and highly precise synchronisation – even in extensive systems. Moreover, the EtherCAT concept with a 100 Mbit data rate and complete diagnostics integrated, enables fast error identification in systems and plants: downtime is minimised, while maintenance is simplified and uptime is increased. Via the ELX modules, the full performance of EtherCAT communication is supported right into each I/O terminal. The explosion-proof terminals enable the direct connection of field devices from zones 0/20, 1/21 and 2/22. Due to the isolation from the fieldbus side, which is fully integrated in every single terminal, the otherwise normally interconnected barrier and thus the second DIN rail in the control cabinet can be dispensed with, which saves further installation work and reduces the system footprint.

*as of April 2018

EtherCAT optimises the control architecture in the process technology:

- worldwide established high-speed fieldbus
- only one communication technology for the entire system
- flexible topologies
- complete diagnostics
- via the ELX modules, the full performance of EtherCAT communication is supported right into each I/O terminal.

Highly compact and intrinsically safe: EtherCAT Terminals for explosion protection



System ELX9560
24 V Ex power supply

Digital input ELX1052/54
2/4-channel
NAMUR

Digital output ELX2002
2-channel
24 V/45 mA

Analog input ELX3162
2-channel
0…10 V
16 bit

Analog input ELX3202/04
2/4-channel
Resistance sensor (RTD)
16 bit

Analog input ELX3152
2-channel
4…20 mA
16 bit

Analog input ELX3181
1-channel
4…20 mA
HART
16 bit

The ELX series: intrinsically safe according to IECEx and ATEX

With the ELX terminals Beckhoff combines highly compact remote I/O modules with isolating barriers for the direct connection of intrinsically safe field devices. The result: very slim EtherCAT Terminals for direct connection of intrinsically safe sensors and actuators. The high resolution and accuracy of the Beckhoff ELX terminals guarantee the same measuring quality that is familiar from the non-Ex area. The compact design of the I/O terminals provides a further advantage: there are up to four intrinsically safe inputs available in

Analog input ELX3312/14
2/4-channel
Thermo-couple/mV
16 bit

Analog input ELX3252
2-channel
Potentiometer
16 bit

Analog input ELX3351
1-channel
Strain gauge
16 bit

Analog output ELX4181
1-channel
0/4…20 mA
HART
16 bit

Encoder ELX5151
1-channel
NAMUR
32 bit

System ELX9012
Bus end cap

the 12 mm housing and up to eight in the 24 mm housing. Dispensing with interconnected external barriers leads to a significant reduction in the space requirements inside the control cabinet and thus to cost advantages. With ATEX and IECEx certification, the ELX terminals comply with all industry-specific guidelines for explosion protection and can be used in nearly all markets worldwide, which reduces the user's dependence on different suppliers for different regions. The wide range of uses is also supported by the enormous variety of signals handled by the Beckhoff I/O range: there is a suitable I/O module for every application. Using the ELX terminals, process technology users can realise extremely compact and economical control architectures where the outstanding diagnostic function of EtherCAT helps to minimise system downtimes.

The ELX terminals optimise virtually all process technology applications:

- Highly compact design of 12 mm housing width reduces space requirement by up to 50%.
- isolation barrier and signal terminal combined
- direct connection of intrinsically safe field devices
- EtherCAT right up to the terminal
- wide variety of signals
- fulfils a comprehensive range of certificates
- considerable cost advantages

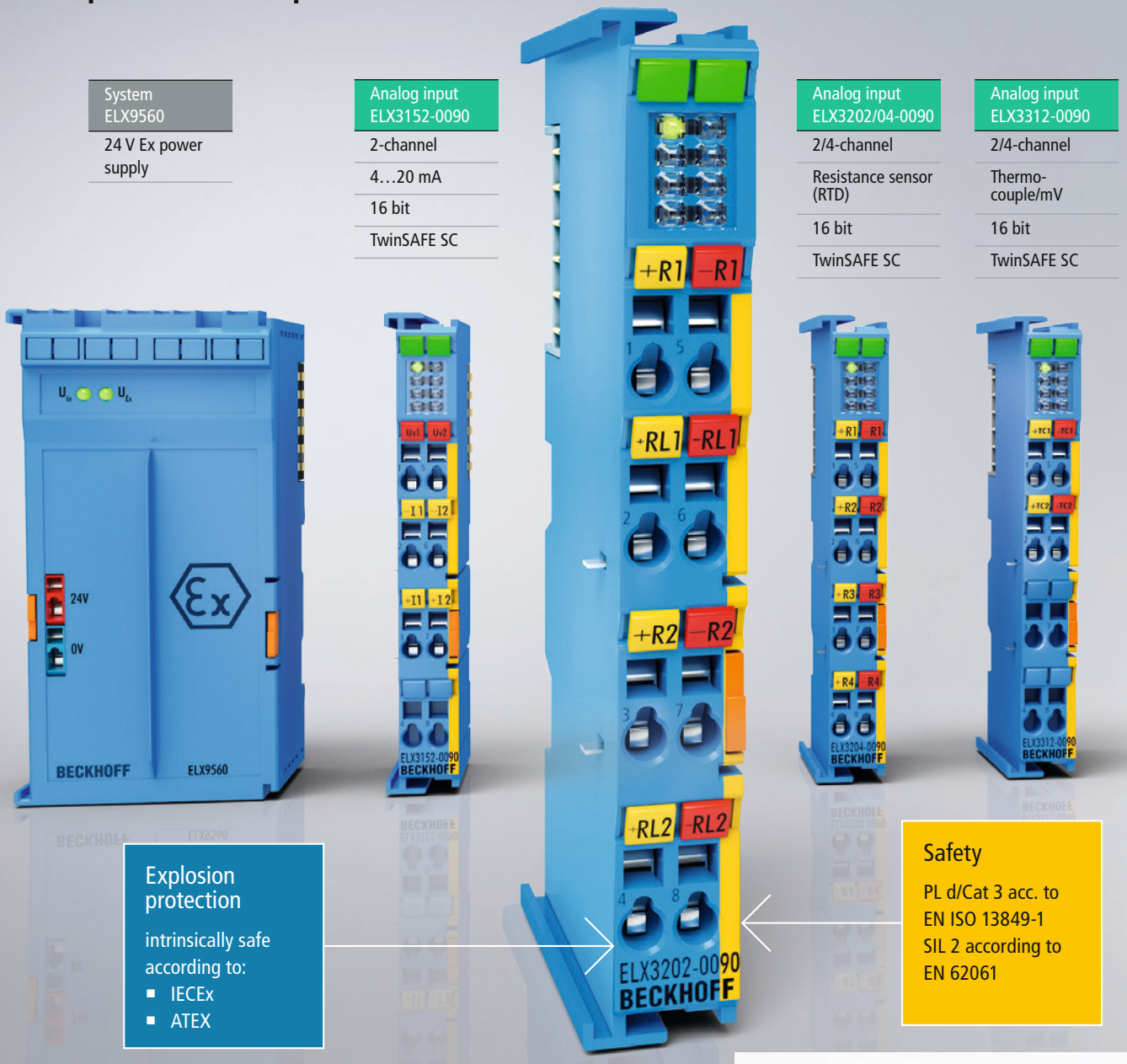
Twice as safe: The safety solution for explosion protection

System ELX9560
24 V Ex power supply

Analog input ELX3152-0090
2-channel
4…20 mA
16 bit
TwinSAFE SC

Analog input ELX3202/04-0090
2/4-channel
Resistance sensor (RTD)
16 bit
TwinSAFE SC

Analog input ELX3312-0090
2/4-channel
Thermo-couple/mV
16 bit
TwinSAFE SC



Explosion protection

intrinsically safe according to:

- IECEx
- ATEX

Safety

PL d/Cat 3 acc. to EN ISO 13849-1
SIL 2 according to EN 62061

ELX terminals for intrinsically safe signal transmission and functional safety

Beckhoff meets the increasing demands on process control technology with regard to functional safety by fully integrating safety technology into the automation system. The compact and modular design of the TwinSAFE safety solution integrates seamlessly into the control platform. Thanks to the fieldbus-neutral safety protocol (TwinSAFE/Safety-over-EtherCAT), the TwinSAFE devices can be integrated into any fieldbus system. These safety I/Os form the interfaces to the safety-relevant sensors and actuators.

Analog input ELX3314/-0090
2/4-channel
Thermo-couple/mV
16 bit
TwinSAFE SC

Analog input ELX3351-0090
1-channel
Strain gauge
16 bit
TwinSAFE SC

Encoder ELX5151-0090
1-channel
NAMUR
32 bit
TwinSAFE SC

TwinSAFE-Logic EL6910
Analog value processing
Customizing
512 FBs
212 connections

System ELX9012
Bus end cap

The TwinSAFE SC (TwinSAFE Single Channel) technology enables the use of standard signals for safety tasks in any networks of fieldbuses. The data of a TwinSAFE SC terminal are transferred to the TwinSAFE logic for secure processing in multiple channels. The data from various sources are analysed, plausibility-checked and subjected to "voting". Certified function blocks such as Scale, Compare/Voting (1oo2, 2oo3, 3oo5), Limit etc. are used for this purpose. For safety reasons, however, at least one of the data sources must be a TwinSAFE SC component. In this way, all process data available in the system can be made accessible to the safety technology.

In combination with the ELX terminals, TwinSAFE SC technology offers a highly compact solution for applications with requirements for intrinsically safe signal transmission and functional safety. The ELX terminals extended with TwinSAFE SC enable direct connection of intrinsically safe field devices up to zone 0/20, with safety levels up to PL d/Cat 3 according to EN ISO 13849-1 or SIL 2 according to EN 62061.

Safety and intrinsic safety in one system:

- highly compact solution with up to four channels across only 12 mm
- large analog signal diversity
- ELX terminals with TwinSAFE SC function enable direct connection of intrinsically safe field devices up to zone 0/20
- safety level up to PL d/SIL 2 achievable
- considerable cost advantages

Explosion-proof panel solution: the elegant CPX series in robust aluminium design

Robust:
all CPX models have a high-quality, resistant aluminium housing.

Intuitive:
all CPX models offer the advantages of the Beckhoff multi-touch technology.

Adaptable:
all CPX models impress with a wide variety of mounting concepts.

Installation

CPX29xx/CPX27xx series



CPX29xx multi-touch built-in Control Panel:	**CPX2915-0000** 15-inch display 1024 x 768 resolution 4:3 format	**CPX2919-0000** 19-inch display 1280 x 1024 resolution 5:4 format	**CPX2921-0000** 21.5-inch display 1920 x 1080 resolution 16:9 format
CPX27xx multi-touch Panel PCs for control cabinet integration:	**CPX2715-0010** 15-inch display 1024 x 768 resolution 4:3 format Intel® Atom™	**CPX2719-0010** 19-inch display 1280 x 1024 resolution 5:4 format Intel® Atom™	**CPX2721-0010** 21.5-inch display 1920 x 1080 resolution 16:9 format Intel® Atom™

Stand-alone

CPX39xx/CPX37xx series



CPX39xx multi-touch Control Panels:	**CPX3915-0010** 15-inch display 1024 x 768 resolution 4:3 format	**CPX3919-0010** 19-inch display 1280 x 1024 resolution 5:4 format	**CPX3921-0010** 21.5-inch display 1920 x 1080 resolution 16:9 format
CPX37xx multi-touch Panel PCs:	**CPX3715-0010** 15-inch display 1024 x 768 resolution 4:3 format Intel® Atom™	**CPX3719-0010** 19-inch display 1280 x 1024 resolution 5:4 format Intel® Atom™	**CPX3721-0010** 21.5-inch display 1920 x 1080 resolution 16:9 format Intel® Atom™

Control Panels and Panel PCs for multi-touch operating concepts in zone 2

With the models from the CPX Panel series, the proven multi-touch technology of the Beckhoff Control Panel and Panel PCs is available in a particularly robust version and thus fulfils the requirements for use in in hazardous areas of zone 2/22. The high functionality and high quality of workmanship ensure the durability of the CPX panel even under harsh environmental conditions. Local operation is comfortable as usual thanks to the capacitive touch technology. The appealingly aesthetic appearance of the Beckhoff Panel with regard to feel and design of the aluminium housing is virtually unchanged, making it a visual highlight in the explosion-proof system environment. The extensive CPX range includes a large selection of formats, sizes, mounting options and performance features. Depending on the area of application, panels for control cabinet installation and stand-alone panels for free mounting in the room are available in the CPX29xx and CPX39xx series. The fanless Panel PCs from the CPX27xx and CPX37xx series additionally offer a reliable system controller.

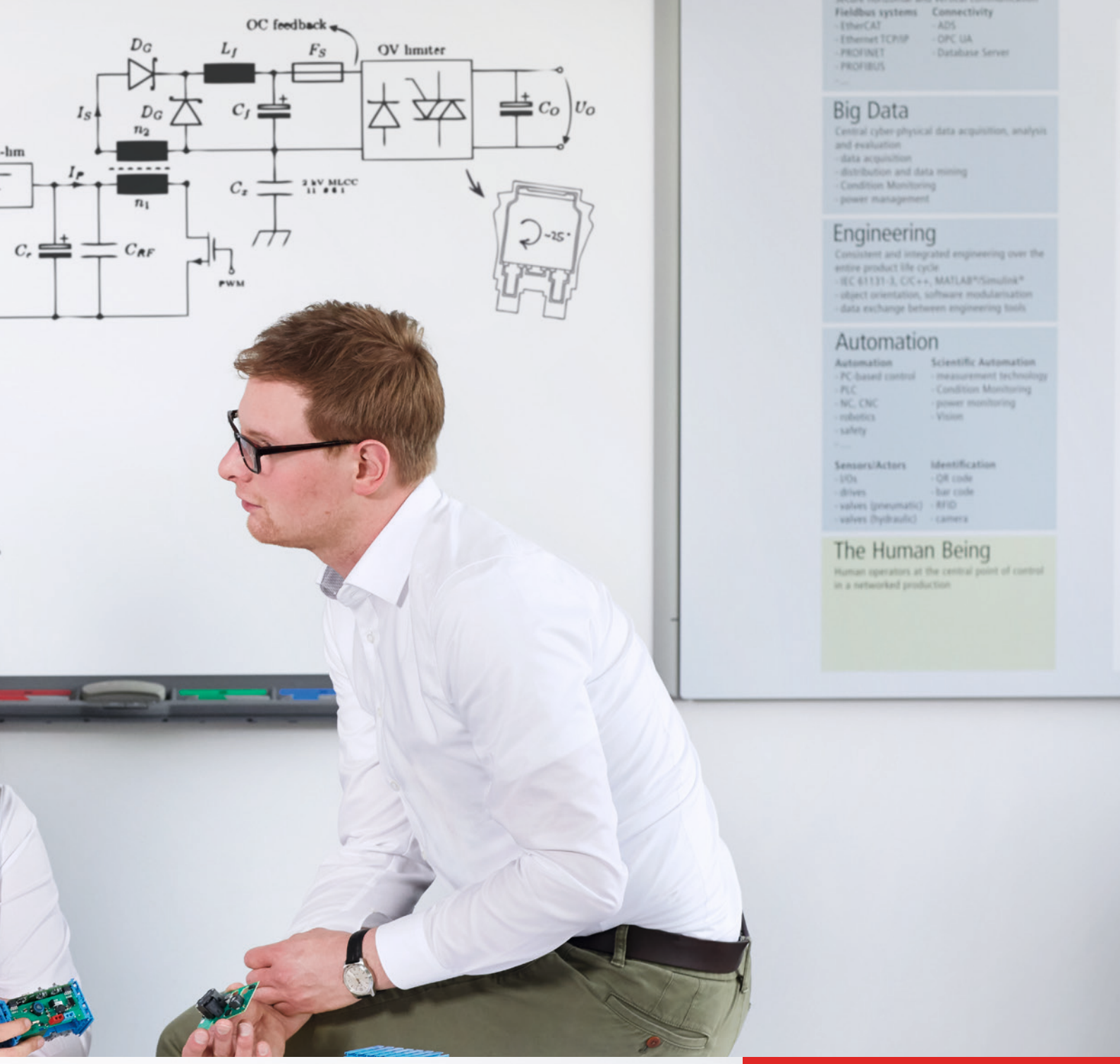
Multi-touch for process technology:

- capacitive touch technology for optimised operation
- high-grade design
- robust and durable
- large selection of Control Panels and Panel PCs
- flexible mounting

Maximum availability and reliability: Beckhoff as an experienced partner in the process industry

Trust matters: in explosion protection as well as in investment protection

With control solutions from Beckhoff, users choose the comprehensive expertise of a globally successful and reliable partner. With stocks of raw materials and finished products lasting up to 24 and six weeks respectively, Beckhoff guarantees short delivery times and ensures its customers' production reliability. A clever concept for the long-term availability of Beckhoff products ensures that replacement devices are available in the long term, thus providing customers with high investment protection. With an extraordi-



narily high depth of manufacturing at the Verl site, all Beckhoff products meet the highest quality requirements for the intended use in the hazardous areas. The products are tested without exception by reputable testing laboratories; in the interest of its customers, Beckhoff always dispenses with manufacturer's declarations. Beckhoff's explosion-proof products are manufactured by employees with many years of experience; the entire development expertise is available in-house at the company's headquarters in Verl. The Beckhoff production facilities have been inspected according to ATEX and IECEx directives and for compliance with all necessary standards and ensure a constantly high quality of production through ongoing quality management as well as internal and external audits. This is accompanied by a global service network and experienced sales specialists so that process technology users can obtain fast and competent local support.

Beckhoff guarantees investment protection:

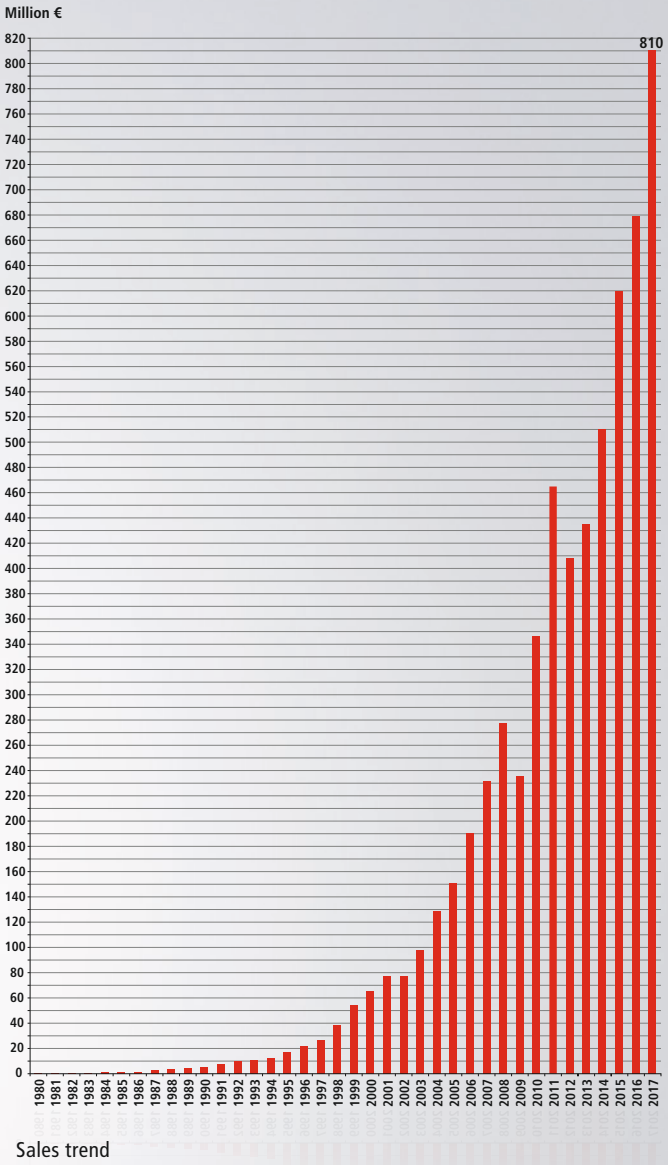
- long-term availability of products
- delivery reliability through extensive stock-keeping
- high degree of vertical integration
- many years of know-how
- global sales and service network

Globally available: Beckhoff expertise for the process industry

Headquarters
Subsidiary
Headquarters Distributor
Subsidiary Distributor

Beckhoff – New Automation Technology

Beckhoff has been developing open automation solutions based on PC-based control technology for more than 35 years. The product range covers the main areas of Industrial PCs, I/O and Fieldbus Components, Drive Technology, and automation software. Product lines are available for all areas and are used as individual components or as complete system solutions. New Automation Technology from Beckhoff stands for innovative and industry-independent control and auto-



Sales trend

mation solutions that are used worldwide in a large variety of different applications, ranging from CNC-controlled machine tools to wind turbines to intelligent building control.

Worldwide presence on all continents

Thanks to Beckhoff's presence in 75 countries, globally active Beckhoff customers benefit from fast service worldwide and technical support in the local language. In addition, Beckhoff regards geographic proximity to the customer as a prerequisite for a profound understanding of the technical challenges facing customers.

Beckhoff at a glance

- Headquarters: Verl, Germany
- Sales 2017: € 810 million (+19%)
- Staff worldwide: 3,900
- Branch offices Germany: 22
- Subsidiary companies/representatives worldwide: 37
- Distributors worldwide: 75 countries

(as of 04/2018)

▶ **www.beckhoff.com**

DK3672-0418

Secure your lead in the process industry
with PC-based Control:

▶ **www.beckhoff.com/process-industries**

Beckhoff Automation GmbH & Co. KG
Huelshorstweg 20
33415 Verl
Germany
Phone: + 49 5246 963-0
info@beckhoff.com
www.beckhoff.com