

**BECKHOFF** New Automation Technology

Create ultimate guest experiences!  
PC-based control for the  
entertainment industry





# PC-based control from Beckhoff handles any automation task



## One control system for all automation tasks in different industries worldwide

PC- and EtherCAT-based control technology from Beckhoff provides you with a universal automation platform that has been successfully used for 40 years in many different industries worldwide. The application spectrum ranges from traditional machine automation to wind farm connectivity, intelligent building automation and – for 20 years now – the entertainment industry.

All over the world, projects implemented with Beckhoff technology prove that PC-based control is ideally suited to the entertainment industry, a market where productions strive to constantly

surpass past efforts – or those of competitors – and offer new attractions. We know that the tools needed to translate creative ideas into technical solutions must be fast and flexible. System integrators act as the interface between artistic vision and technology. In most cases, they are our customers, and we provide necessary support for their work as creativity to technology translators.

The performance of our PC- and EtherCAT-based control technology makes the implementation of nearly any control task in the entertainment industry possible. There are no limits to your creative ideas! As a matter of fact, Beckhoff technology has not only realized numerous customer applications, but also provided the initial inspira-

tion for many. And since all control functionalities are software-based, our automation systems can adapt to varying stage shows quickly and flexibly. Users also benefit from our control platform's unique level of connectivity because we support all communication standards and interfaces that play a role in the entertainment industry. Furthermore, the modularity and scalable performance of our components allow you to tailor your control architecture exactly to your specific application requirements. In addition, advanced capabilities for diagnostics, remote control, status monitoring and predictive maintenance ensure optimal availability of your controller for a smooth-running show or performance.

► [www.beckhoff.com/entertainment-industry](http://www.beckhoff.com/entertainment-industry)



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# From the concept to the final product: Create ultimate guest experiences with Beckhoff!

Investment

Design

Integration

Operation

## Your advantages as an investor

- low investment costs due to finely scalable and modular hardware and software
- high investment protection due to an industrial control system with long-term availability – made in Germany
- continuous product enhancements and technological innovations from Beckhoff ensure solutions for future requirements
- global service and support in more than 75 countries

## Your advantages as a system designer

- integrated automation of all technical systems on one platform
- integration of all relevant entertainment industry interfaces and fieldbuses for implementing virtually all creative ideas
- compatibility of all hardware and software components
- maximum flexibility in terms of design changes and expansions due to modular and scalable components
- compact design of the hardware makes it perfectly suitable for retrofits

## Your advantages as an integrator

- standardized and open programming supporting you in your role as creativity to technology translator
- standardized PLC function blocks
- integration of C++ and MATLAB® code
- integration of nearly all third-party systems
- one engineering tool for everything, integrated in Visual Studio®
- free and hardware-independent engineering
- scalable control platform that grows with your project
- free support hotline

## Your advantages as an operator

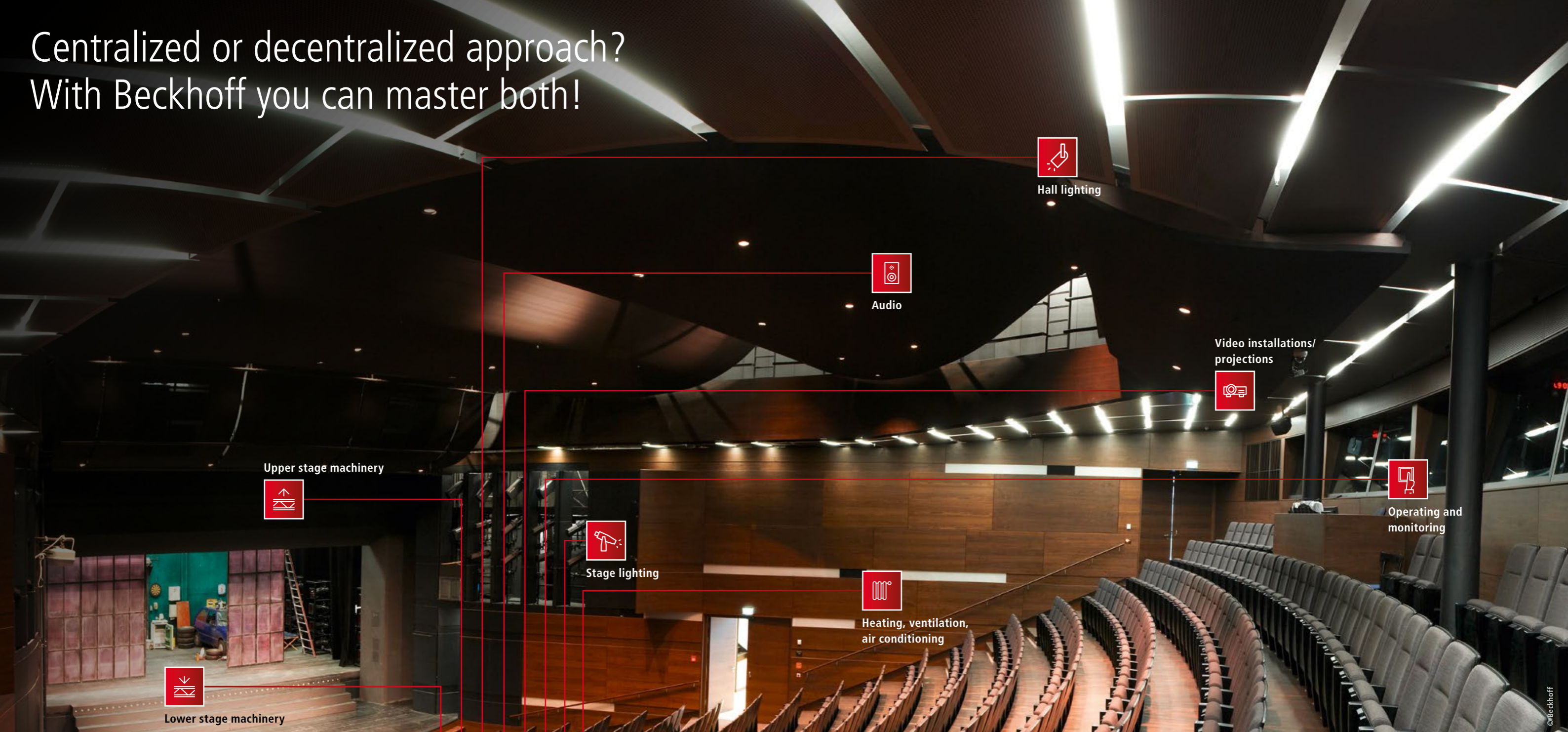
- industrial control proven in round-the-clock operation ensures complete availability and shows which run smoothly
- flexible operating options ranging from modern web visualization tools to manual/emergency system operation
- PC-based remote access
- long-term service of up to 20 years or more for components
- predictive maintenance functions: in the cloud or locally on the controller

## Benefit from our holistic Beckhoff approach

- EtherNet as standard communication system
- integrated communication from the sensor to the cloud
- scalable Beckhoff system: from small projects to large projects of global corporations
- use as an individual controller or as a super-imposed controller for the coordination of all technical systems
- worldwide service and support



# Centralized or decentralized approach? With Beckhoff you can master both!



Lower stage machinery

Upper stage machinery

Stage lighting

Heating, ventilation, air conditioning

Audio

Hall lighting

Video installations/ projections

Operating and monitoring

IPC      I/O      Motion      Automation

Beckhoff implements high-performance automation systems

### PC-based control integrates all functions in a single system

When choosing between a centralized or decentralized control approach, the only determining factor is your application. Because of its modularity and open software and hardware interfaces, our PC-based control technology works equally well for both centralized and decentralized control of individual or all technical functions. Individual technical functions implemented with Beckhoff technology, such as stage machinery, animatronics, lighting controls or the stage manager's desk, can be integrated effortlessly into existing control environments. On the other hand, the great vari-

ety of Beckhoff interfaces also makes it possible to control all technical functions over a central platform.

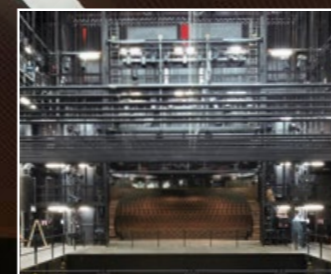
For all your different technical systems and projects, decide whether a centralized or decentralized approach best meets the specific requirements of your application when designing the operator interfaces, control cabinet layout, and system cabling. Hybrid forms – such as a control concept without control cabinet via EtherCAT P, the One Cable Technology for the field level – are also possible.

### Ultimate guest experiences realized with PC-based control

- continuity: one control platform for all technical functions
- openness: interfaces for all common communication standards in stage, media and building technology
- scalability in terms of performance, design and price
- modularity as basis for flexible control design
- connectivity: from horizontal communication to cloud connectivity



# Extensive connectivity translates your creative ideas into technical solutions



## Movable objects

- TwinCAT ADS
- EtherCAT Automation Protocol (EAP)
- PosiStageNet
- CAN



## Lighting technology

- DMX
- ArtNet™
- sACN (MA Lighting)
- Conductor
- Pharos Architectural Controls
- light design tools
- PosiStageNet



## AV and media technology

- QRC (QSC)
- AES 70 (d&b audiotechnik)
- SNMP (L Acoustics)
- Pixera Control
- Crestron Control
- Synchronorm
- PJLink
- SMPTE timecode
- OSC
- Dante®

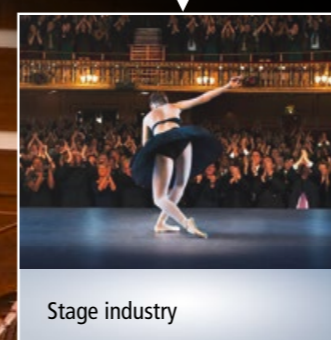


## Building automation

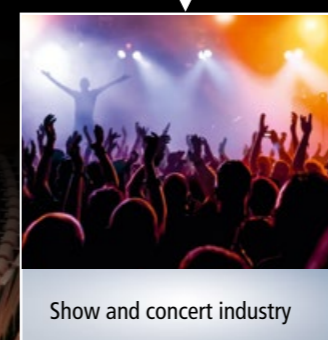
- DALI-2
- KNX/EIB
- DMX
- BACnet
- SMI
- MP-Bus

## Automation platform

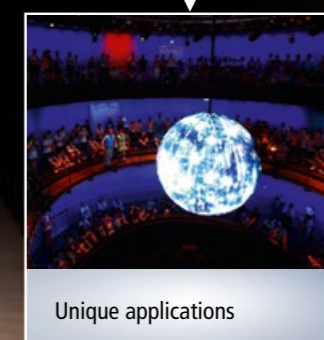
- real-time control
- decentralized I/Os
- motion control
- data processing
- connectivity
- visualization
- energy management



Stage industry



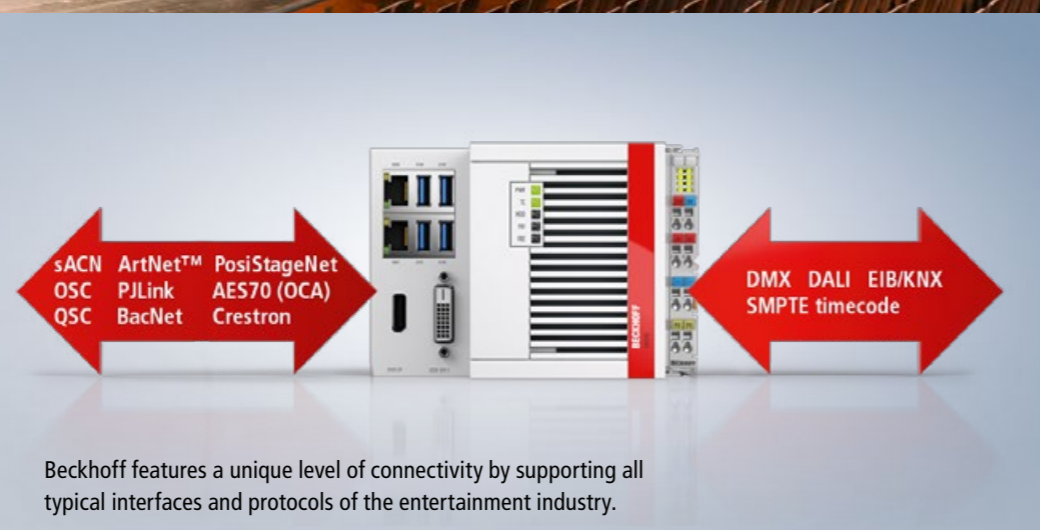
Show and concert industry



Unique applications



Attractions industry



Beckhoff features a unique level of connectivity by supporting all typical interfaces and protocols of the entertainment industry.

## Beckhoff supports all industry-specific communication standards

The comprehensive connectivity of our PC-based controls enables simple integration of all technical systems – from stage technology and audio/video controls to lighting technology and the control of show effects. As a result, all system information is available on a single platform. In addition to the integration of DMX, sACN, Art-Net™, PosiStageNet, DALI, KNX/EIB, dimmers and LEDs for lighting controls, our PC-based control solution also supports the most common interfaces for connecting AV and multimedia systems. With SMPTE timecode, PJLink, AES 70 (OCA), OSC, Crestron and QSC (QRC), we

have mastered the relevant “languages” of this industry. This way, you can control the most diverse devices in your entertainment applications using standard control components. For example, you can easily use your existing console with the Beckhoff control platform – a unique feature in the field of industrial controls! In addition, wide ranging communication options such as ADS, EAP, OPC UA and 25 more fieldbus systems are available within the Beckhoff environment to establish connections to countless other systems relevant for the entertainment industry.

## All technical systems on a single platform

- support for common communication standards to connect stage, media and building technology devices
- easy use of third-party software (audio players, C#, C++, graphical tools, etc.)
- use of standard components, programming standards and networks
- integration of all technical systems makes all information available on a single platform



## Stage industry

For all stationary performances

- Theaters
- Operas
- Concert halls
- Musical theaters
- Cruise liners
- Convention and media centers

Page 12



## Applications

## Show and concert industry

For all mobile performances

- Concerts/tours
- Music festivals
- Shows
- Awards/contest shows
- Sporting events

Page 16



## Technical systems

## Movable objects

Beckhoff control components for:

- Upper and lower stage machinery
- Stage wagons
- Chain hoists and winches
- Kinetic objects
- Animatronics
- Acoustic elements

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## Unique applications

Installations with water, light and kinetics

- Art installations
- Media installations
- Corporate trade shows
- Corporate presentations
- Brand experience
- Concept stores

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## Lighting technology

Beckhoff control components for:

- Stage lighting
- Lighting effects
- Hall lighting
- Building lighting

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## Attractions industry

For entertainment applications

- Entertainment parks
- Theme parks
- Entertainment districts
- Motion picture studios
- TV studios

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## AV and media technology

Beckhoff control components for:

- Audio installations
- Video installations/projections
- Stage managers desks
- Interactive systems
- Water effects

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## Building automation

Beckhoff control components for:

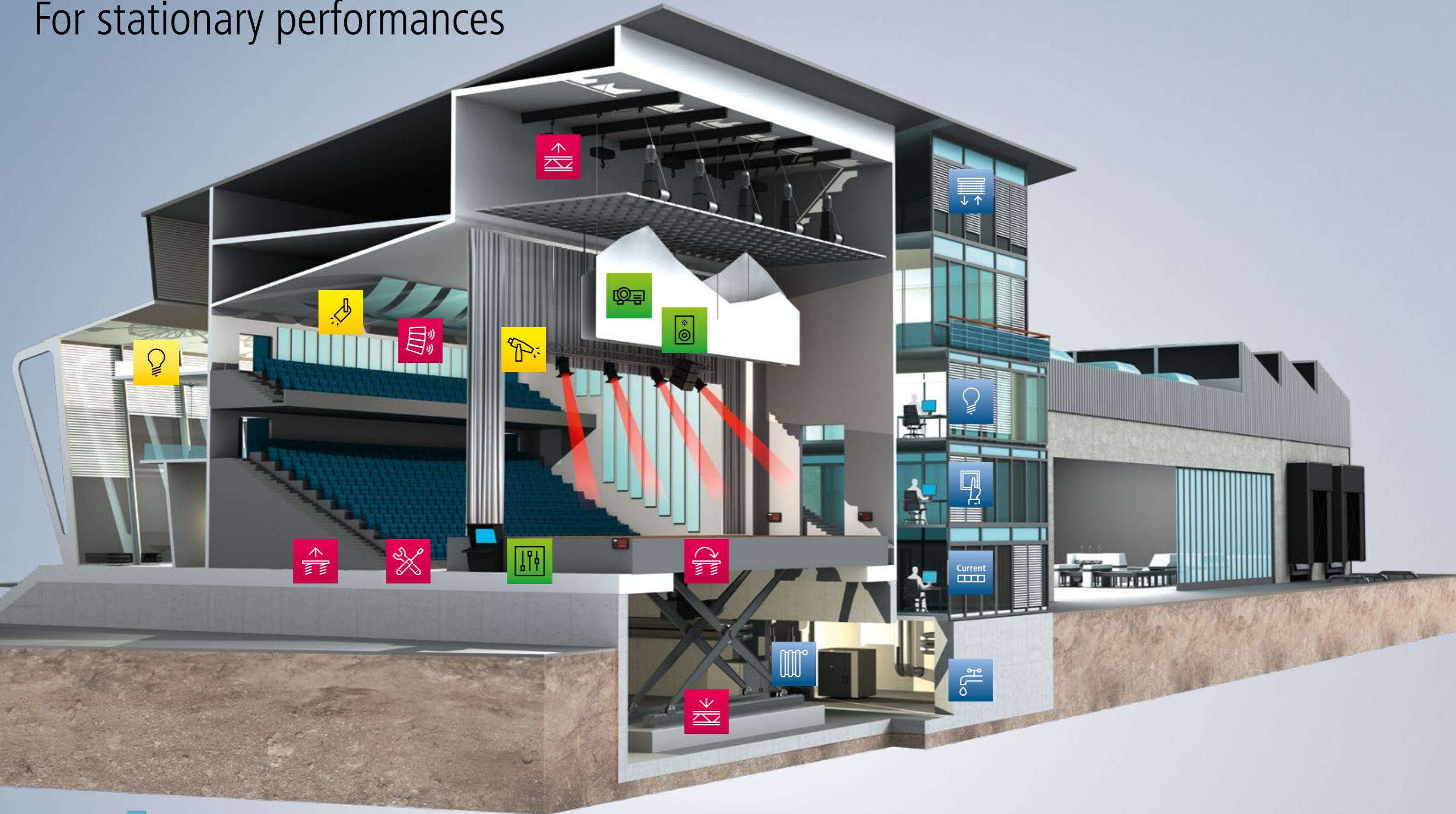
- Operating and monitoring
- Lighting
- Heating, ventilation, air conditioning
- Facade control
- Energy management

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# Stage industry: For stationary performances



## Movable objects

Beckhoff control components for:

- Upper machinery
- Acoustic elements
- Hall floor adjustment
- Turntables/revolving stages
- Lower machinery
- Condition monitoring

## Lighting technology

Beckhoff control components for:

- Stage lighting
- Hall lighting
- Building lighting

## AV and media technology

Beckhoff control components for:

- Audio installations
- Video installations/projections
- Stage managers desks

## Building automation

Beckhoff control components for:

- Facade/shading
- Lighting
- Operating and monitoring
- HVAC
- Water supply
- Energy data acquisition and data logging



PC-based control: the software and hardware platform for the most diverse applications



# Stage industry References



## References for stage industry, selection

### Movable objects

- ACR/Elettrica Ducale srl, Italy:
  - Scala di Milano, Milan, Italy
- Beijing Jindong High-tech Co., Ltd., China:
  - Nishan Sacred Land Theater, China
- Drivecontrol, s.r.o., Czech Republic:
  - Janaček Theater Brno, Czech Republic
  - Fomenko Theater, Moscow, Russia
- Flying by Foy, NV, USA:
  - American Idiot, Broadway NY, USA
  - Billy Elliot, Broadway NY, USA
  - Mary Poppins, Broadway NY, USA
  - Spamalot, Broadway NY, USA
- Füllung & Partner Ing. GmbH, Germany:
  - "Das Wunder von Bern", Theater an der Elbe
  - German Pavillon, World Expo 2015
  - Rocky, Stage Palladium Theater, Germany
- Helsinki Music Center, Finland
- HOAC Schweisstechnik GmbH, Germany:
  - Royal Theater Copenhagen, Denmark
- Hudson Scenic Studio, NY, USA:
  - Hamilton
- Salzbrenner media, Germany:
  - 3D microphone winches, WDR Cologne
  - 3D microphone winches, Festspielhaus Baden-Baden
- Sibelius Hall, Lahti, Finland
- Stakebrand Technische Toneelinstallaties, NL:
  - Carré-Theater Amsterdam, Netherlands
- STB Steuerungstechnik Beck GmbH, Austria:
  - Seebühne Bregenz, "Rigoletto"
  - Seebühne Bregenz, "Turandot"
- Theatertechnische Systeme GmbH, Germany:
  - Schauspielhaus Nürnberg, Germany
  - Schauspielhaus Düsseldorf, Germany
  - Malmö Opera, Sweden

### Lighting/multimedia

- Ferry Porsche Congress Center, Austria
- Helsinki City Theater, Finland
- Imatra Theater, Finland
- Kuopio City Theater, Finland
- Microsoft Deutschland GmbH, Cologne, Germany
- People's Grand Theater, Jilin City, China
- Stage Entertainment GmbH, Germany:
  - "Das Wunder von Bern"
- Tampere Hall, Finland
- Wiener Staatsoper, Vienna, Austria

### Stage managers desk

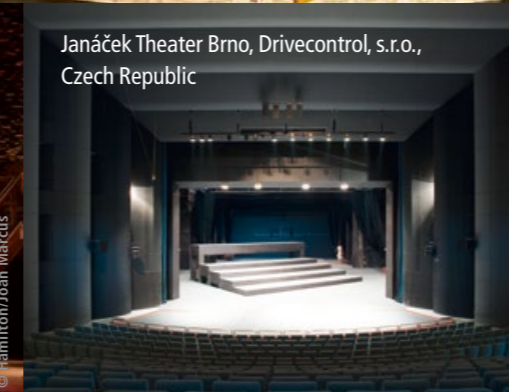
- HFE professionelle Studiotechnik GmbH, Germany

### University collaborations with Beckhoff

- Anton Bruckner Privatuniversität, Linz, Austria
- University of Wisconsin, USA
- University of Shanghai, China:
  - Robots for Beijing Opera
- Yale School of Drama/Yale Repertory Theater, CT, USA



"Hamilton", Musical by Lin-Manuel Miranda,  
Broadway, Hudson Scenic Studio, NY, USA



Janaček Theater Brno, Drivecontrol, s.r.o.,  
Czech Republic



"Das Wunder von Bern", Stage Theater an der Elbe,  
Stage Entertainment GmbH, Germany

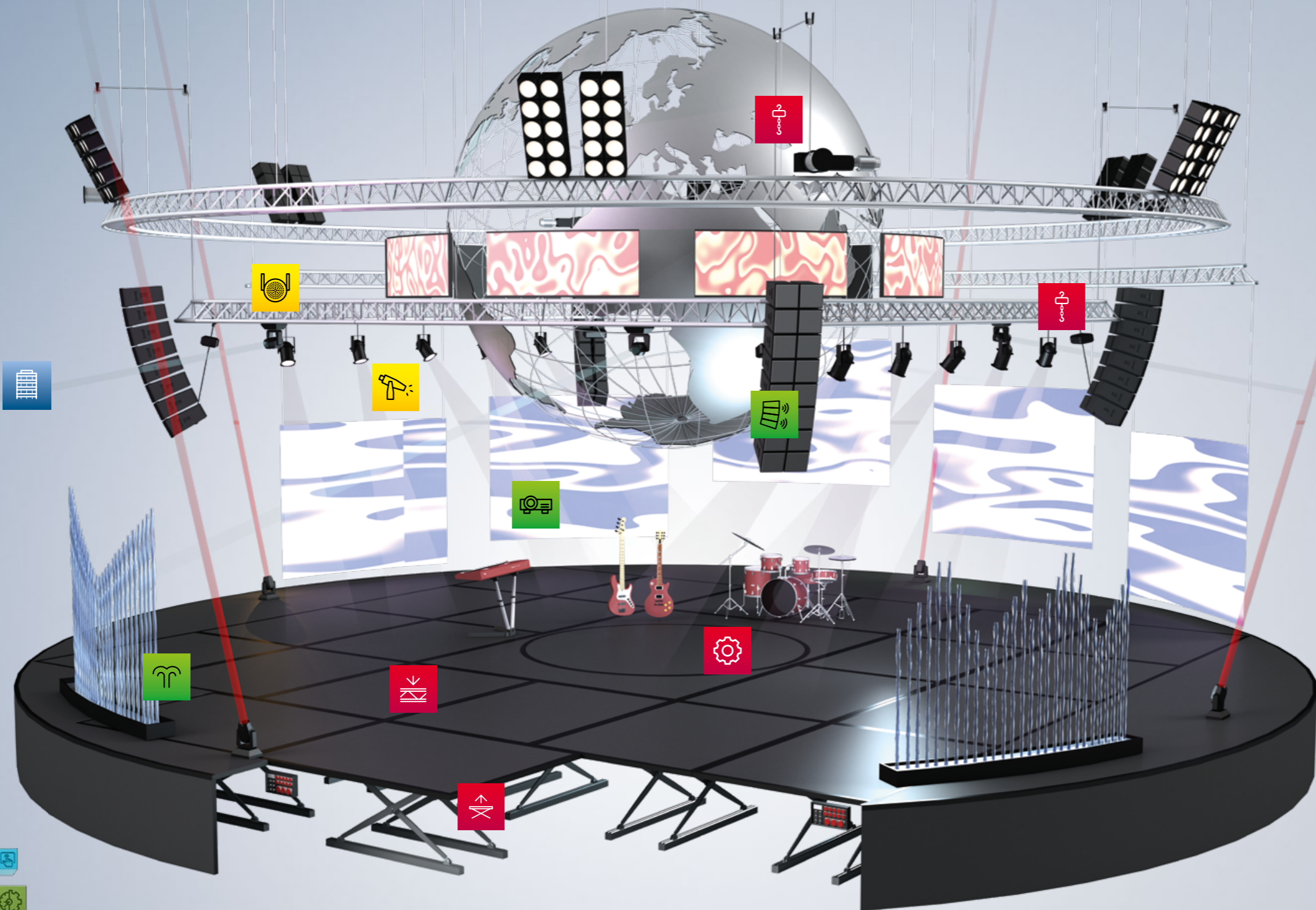


Nishan Sacred Land Theater, Beijing  
Jindong High-tech Company, China

Seebühne Bregenz, "Rigoletto",  
STB Steuerungstechnik Beck GmbH, Austria





# Show and concert industry: For mobile performances



PC-based control: the software and hardware platform for the most diverse applications



## Movable objects

Beckhoff control components for:

-  Hoists and winches
-  Stage machinery
-  Platforms




## Lighting technology

Beckhoff control components for:

-  Stage lighting
-  Lighting effects

## AV and media technology

Beckhoff control components for:

-  Audio installations
-  Video installations/projections
-  Water effects/fountains

## Building automation

Beckhoff control components for:

-  Optional integration into existing building automation



# Show and concert industry References

## References for show industry, selection

### Concerts/tours

- SGPS/Show Rig, NV, USA:
  - Sir Paul McCartney
  - Justin Bieber
  - Miley Cyrus
  - Beyonce
  - Aerosmith
  - Justin Timberlake
  - Guns N' Roses
  - Rihanna
- Sigma Services Inc., FL, USA
- TAIT/Fisher Technical Services, NV, USA:
  - U2
  - Lady Gaga
  - Bon Jovi
  - Black Eyed Peas
  - Shakira

### Music festivals/dance events

- SGPS/Show Rig, NV, USA:
  - Coachella Music Festival
  - EDC – Electric Daisy Carnival
- Statecore Innovative Entertainment Technology BV, Netherlands:
  - "Sensation White", Amsterdam, Netherlands
- The Factory CVBA – VSO, Belgium:
  - "Pukkelpop" Festival, Hasselt, Belgium

### Shows

- Ehrlich Entertainment, Germany:
  - various magic shows with water effects, Germany
- Flying by Foy, NV, USA:
  - "A New Day", Caesar's Palace, Las Vegas, NV
- Rigging in Motion, Hungary:
  - various shows
- SGPS/Show Rig, NV, USA:
  - Cirque Arenaline, Hongkong, China
  - J-Lo, Las Vegas, NV, USA
  - Mariah Carey, Las Vegas, NV, USA
- Skjonberg Controls for Entertainment Industry, CA, USA:
  - various shows

### Awards/contest shows

- SGPS/Show Rig, NV, USA:
  - Academy Awards/Oscars
  - Grammy Awards/Emmy Awards

### Sporting events

- Böckstiegel Automation/GTG GmbH, Germany:
  - MetLife Stadium, NJ, Super Bowl
- SGPS/Show Rig, NV, USA:
  - NBA All-Star
- Sigma Services, FL, USA:
  - Cleveland Cavaliers
- spidercam GmbH, Austria:
  - mobile camera system spidercam®
- TAIT/Fisher Technical Services, NV, USA:
  - various sporting events



"Sensation White", dance event,  
Statecore Innovative Entertainment  
Technology BV, Netherlands

MetLife Stadium, NJ, Böckstiegel  
Automation/GTG GmbH, Germany

Aquagraphic® Aquatique Show,  
France

SpiderCam®, Austria

U2 360° Tour



# Unique applications: Installations with water, light and kinetics



## Movable objects

Control components for:



Kinetic objects

## Lighting technology

Beckhoff control components for:



Lighting



Lighting effects

## AV and media technology

Beckhoff control components for:



Audio installations



Video installations/projections



Water effects/fountains



Interaction via kinect sensor



Interaction via smartphone



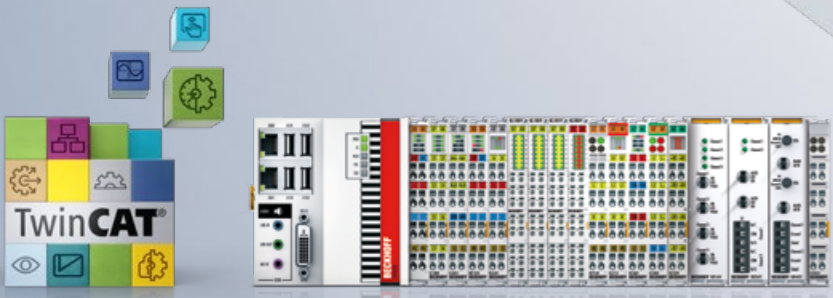
Interaction via wearables

## Building automation

Beckhoff control components for:



Optional integration into existing building automation



PC-based control: the software and hardware platform for the most diverse applications



# Unique applications References



## References for unique applications, selection

### Art installations

- MKT AG/ATELIER BRÜCKNER GmbH/TAMSHIK MEDIA + SPACE GmbH, Germany:
  - State Museum of Archaeology in Chemnitz, Germany
- MKT AG/Art+Com AG, Germany:
  - "Kinetic Rain", Changi Airport, Singapore
- MKT AG/HB-Laserkomponenten GmbH, Germany:
  - 3D KineMatrix
- LightHive, London, U.K.

### Media installations

- AquaDom, saltwater aquarium, Berlin, Germany
- Aquatique Show, Aquagraphic®, France
- as systems GmbH, Germany:
  - Waterdoor, Flimser Wasserwelten, Switzerland
- Ferry Porsche Congress Center, Austria
- GTG GmbH/Böckstiegel Automation, Germany:
  - Digital Tower, Changi Airport Singapore
  - Super Bowl, MetLife Stadium, NJ, USA
- Magical Production L.C.C., UAE:
  - Artificial waterfall, Dubai, UAE
- Microsoft Deutschland GmbH, Cologne, Germany
- MKT AG/HB-Laserkomponenten GmbH, Germany:
  - 3D KineMatrix
- Simtec Systems, Germany:
  - Digital Signage ScreenFlite®

### Movable objects

- Frenckel clock tower, Tampere, Finland
- Milla & Partner GmbH, Germany:
  - Energy center, German Pavillon Expo 2010
- MKT – Fine Exhibition Engineering, Germany:
  - State Museum of Archaeology in Chemnitz, Germany
  - "Kinetic Rain", Changi Airport, Singapore
  - 3D KineMatrix
- Scandinavian Design Group, Norway:
  - "Breaking the Surface", Lundin Norway, Norway
- Simtec Systems, Germany:
  - Digital Signage ScreenFlite®
- spidercam GmbH, Austria:
  - mobile camera system Spidercam®
- TAIT/Fisher Technical Services, NV, USA:
  - Lincoln Center, New York, NY, USA
  - Shanghai World Expo Sphere Array
- Utinam, horloge monumentale, Besançon, France

"Kinetic Rain", Changi Airport, Singapore  
MKT AG/ART+COM AG, Germany

"Time-dynamic Model of Saxony", SMAC,  
MKT Fine Exhibition Engineering, Germany



"Breaking the Surface", Lundin Norway,  
Scandinavian Design Group, Norway



Digital Signage ScreenFlite®,  
Simtec Systems, Germany



Artificial waterfall, Dubai, Magical Production  
L.L.C., UAE



### Corporate trade shows/corporate presentations




- Ehrlich Entertainment, Germany:
  - "Jules Verne & Porsche", Germany
  - "175 years railroad in Germany", Germany
- Scandinavian Design Group, Norway:
  - "Breaking the Surface", Lundin Norway
- SGPS/Show Rig, NV, USA:
  - CES



# Attractions industry: For entertainment applications





## Movable objects

Beckhoff control components for:

-  Stage machinery
-  Movable water features
-  Kinetic objects
-  Animatronics
-  4/5D cinema effects
-  Predictive maintenance






## Lighting technology

Beckhoff control components for:

-  Stage lighting
-  Lighting
-  Infrastructure lighting
-  Lighting effects

## AV and media technology

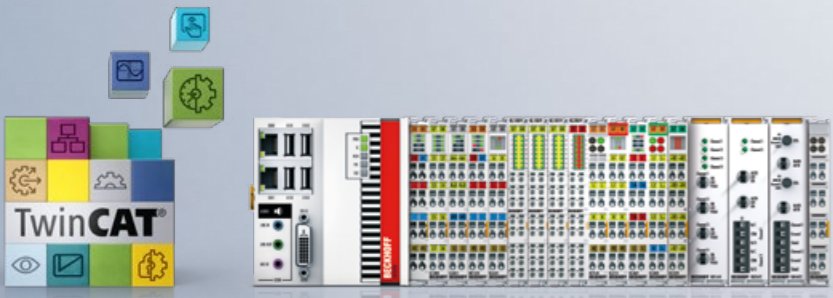
Beckhoff control components for:

-  Audio installations
-  Video installations/projections
-  Interactions
-  Water effects/fountains
-  Air effects

## Building automation

Beckhoff control components for:

-  Facade/shading
-  Lighting
-  Operating and monitoring
-  HVAC
-  Infrastructures
-  Visitor management
-  Energy data acquisition and data logging

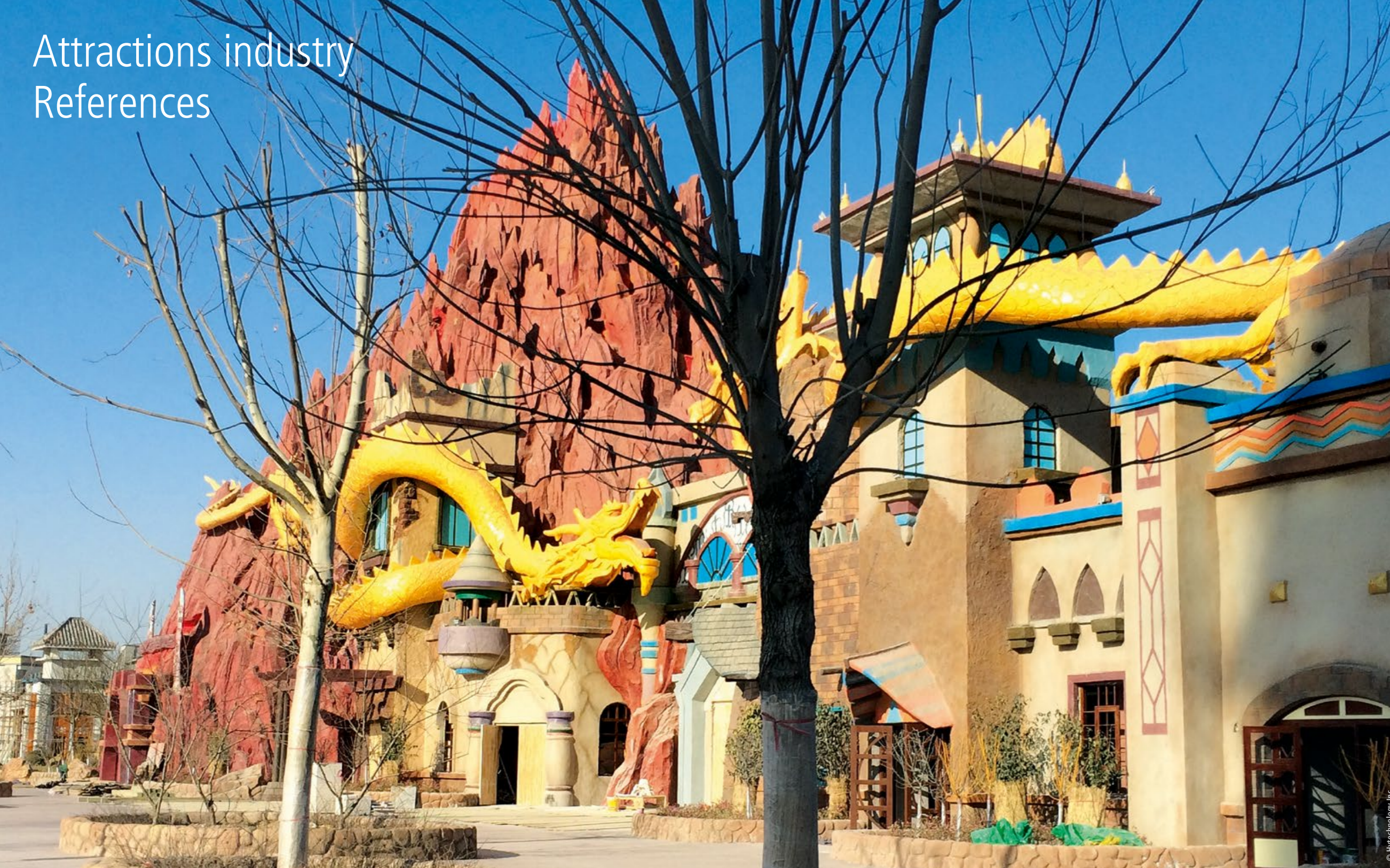


PC-based control: the software and hardware platform for the most diverse applications



# Attractions industry

## References



### References for attractions industry, selection

#### Entertainment parks

- Walt Disney Imagineering (WDI), Burbank, USA
- Alterface Projects S.A., Wavre, Belgium:
  - Interactive cinema with 4/5D special effects
- Bette Project, China:
  - Romantic Show of Tanhe, China
  - Wuxi Taihu Show Theater, China
- Boren Culture and Technology Co. Ltd., Jiangsu, China:
  - Zhejiang Yueqing Tieding Yo-Yo Park
  - Dalian Fu Cube Super Park
  - Shandong Jinan Movie Town
  - Suzhou H. Brothers Movie World
- Hytechnology Inc., Shenzhen, China:
  - Songs of birds, Wuhu Fantawild Culture-tech Inc.
  - Nuwa patches up the sky, Jinan Fantawild Culture-tech Inc.
- K. D. Decoratives Ltd., Huddersfield, U.K.:
  - "The Night before Christmas" (Sundown Adventure Land)
- La ProPoint Inc., CA, USA:
  - Movie theater attraction for Great Wolf Lodge Resorts
- Sigma Services Inc., FL, USA:
  - Paramount Wonderland, Canada
- Simtec Systems, Germany:
  - Hexaflite® Flying Theater, China
- Steel Construction and Robotic Machinery (S.Co.R.E), Lebanon:
  - Race simulator "Real-Motion"
- Xesa Systems – Full Motion Technology, Italy:
  - Full-motion simulator

#### Entertainment districts

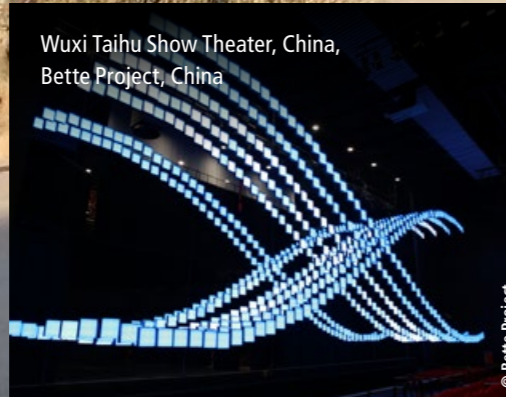
- City of Dreams Casino, Macau, China:
  - various entertainment districts

#### Motion picture studios/TV studios

- SGPS/Show Rig, NV, USA:
  - Fast & Furious 7
  - Transformers: Age of Extinction
  - Ironman 3
  - The Muppets

#### TV shows

- SGPS/Show Rig, NV, USA:
  - Big Brother
  - Biggest Loser
  - The Voice



Wuxi Taihu Show Theater, China,  
Bette Project, China



Hexaflite® Flying Theater, China,  
Simtec Systems, Germany



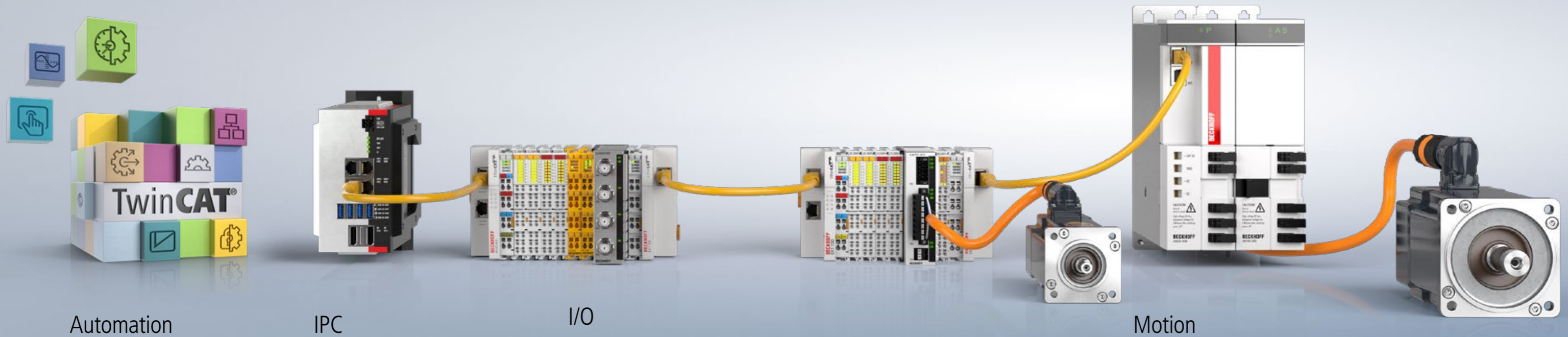
Full-motion simulator,  
Xesa Systems, Italy



Movie theater attraction for Great Wolf Lodge  
Resorts, La ProPoint Inc., CA, USA



# The Beckhoff system: A modular and scalable automation kit



Automation

IPC

I/O

Motion

## Controls for every application

Beckhoff is a pioneer in PC-based automation. You can choose the control system that best fits your needs in terms of performance, design and price from our extensive portfolio of industrial PCs. All performance classes from single-core to multi-core as well as all connection types and display sizes are available along with many form factors and types of protection. TwinCAT 3, the multi-core-capable automation software, can be used on all PC platforms.

► [www.beckhoff.com/ipc](http://www.beckhoff.com/ipc)

## The Beckhoff I/O portfolio

Beckhoff offers a comprehensive range of fieldbus components for all common I/Os and bus systems in various designs. Roughly 1,000 I/Os provide the basis for our modular automation tool kit, from which you can assemble your control system as you like – with the option of future function expansions. As our IP20 bus terminals and IP67 Fieldbus Box modules cover the most important signal types and fieldbus systems, we offer the right product for every application. In addition, you can easily

## ... more than 1,000 components

integrate further fieldbus protocols into the EtherCAT network. Next to standard functionalities, the I/O portfolio includes products for special applications such as safety technology, power measurement, motor controls or the evaluation of various encoder interfaces. The EtherCAT fieldbus developed by Beckhoff provides an ultra-fast communication system based on standard Ethernet. EtherCAT P, the One Cable Automation on the fieldbus level, reduces your cabling effort by half.

► [www.beckhoff.com/io](http://www.beckhoff.com/io)

## Scalable drive technology

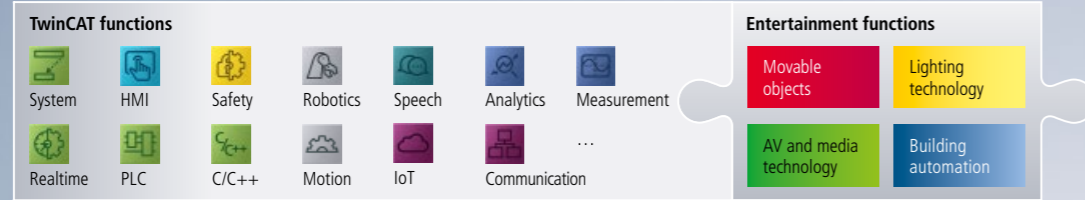
To move scenery, point hoists, show elements, kinetic installations or attractions in theme parks, we offer a broad spectrum of scalable drive components: from dynamic servo drive series and matching servomotors to distributed servo drive systems and compact drive systems, either as terminal blocks or as robust EtherCAT Box modules with an IP67 protection rating for installation directly on the machine.

► [www.beckhoff.com/motion](http://www.beckhoff.com/motion)



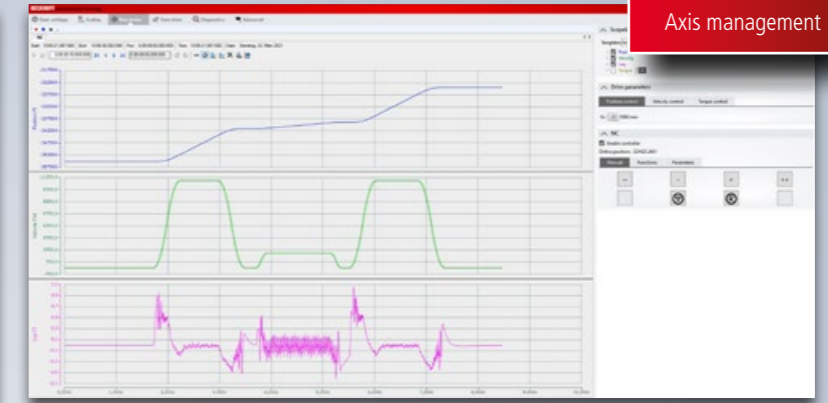
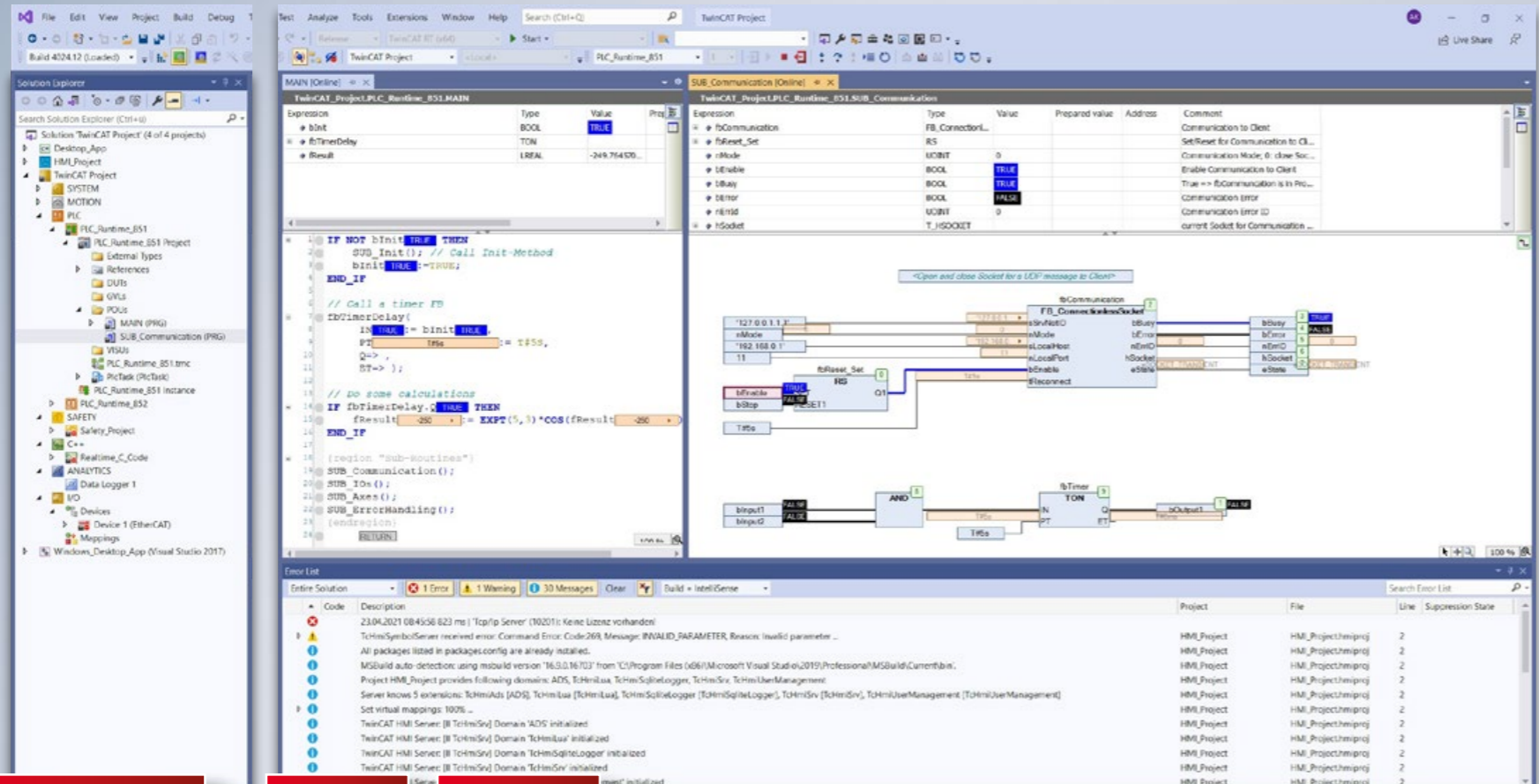
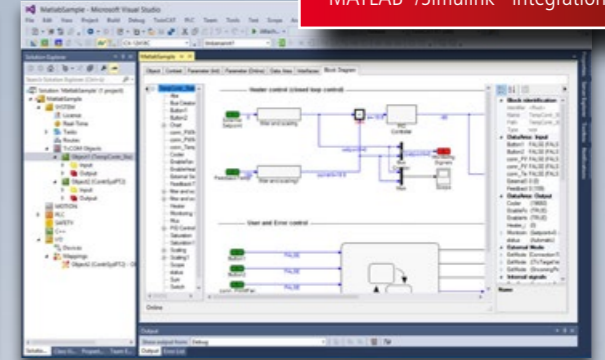
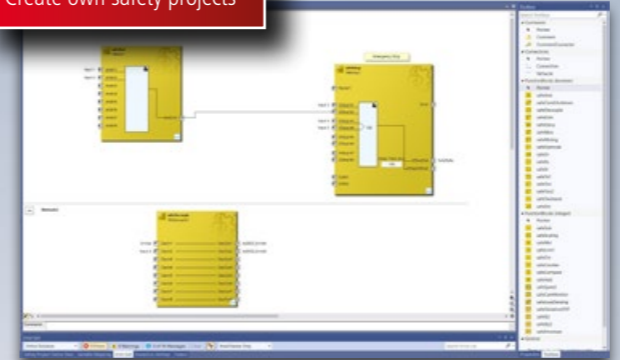


# TwinCAT, the integrated engineering platform: A single tool for all automation tasks!

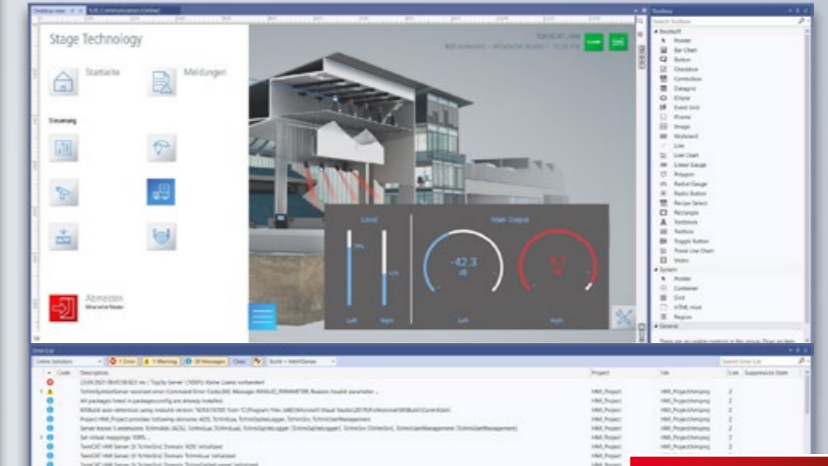


Create own safety projects

MATLAB®/Simulink® integration



Axis management



Creating an operator interface

One tool for configuring the system and hardware

Writing the PLC program

Writing code in a C++ module



## TwinCAT is the heart of PC-based real-time control from Beckhoff

As an integrated tool for engineering, runtime and modeling, TwinCAT makes complex automating processes easy. One software program is all it takes to program and configure your control system. Since TwinCAT 3 supports C/C++ and MATLAB®/Simulink® in addition to the IEC 61131-3 programming standard, you can choose the programming language that works best for your application. Open interfaces support expandability and the adaptation to existing tool environments. In addition, the integration of TwinCAT into Microsoft Visual Studio®

allows you to program automation objects in parallel using IEC 61131-3 and C or C++, making it easier to manage projects and work in teams. The resulting objects (modules) can exchange data and call each other, irrespective of the language in which they were written. With TwinCAT 3 Scope, you can visualize timelines with resolutions down to the µs range. The software oscilloscope, which is fully integrated into the TwinCAT control architecture, allows you to easily display signal flows via its charting tool.

## General TwinCAT benefits

- PC-based real-time control with IEC 61131-3 (incl. OOP)
- powerful and flexible motion controller
- one tool for all control platforms
- online view for variables in the runtime
- engineering in Visual Studio®
  - .Net integration in the same solution
  - Git-based source code control
  - IntelliSense
- runtime can be used directly on work PC (e.g., laptop)
- free engineering tools
- free runtime trial licenses

## TwinCAT engineering tools

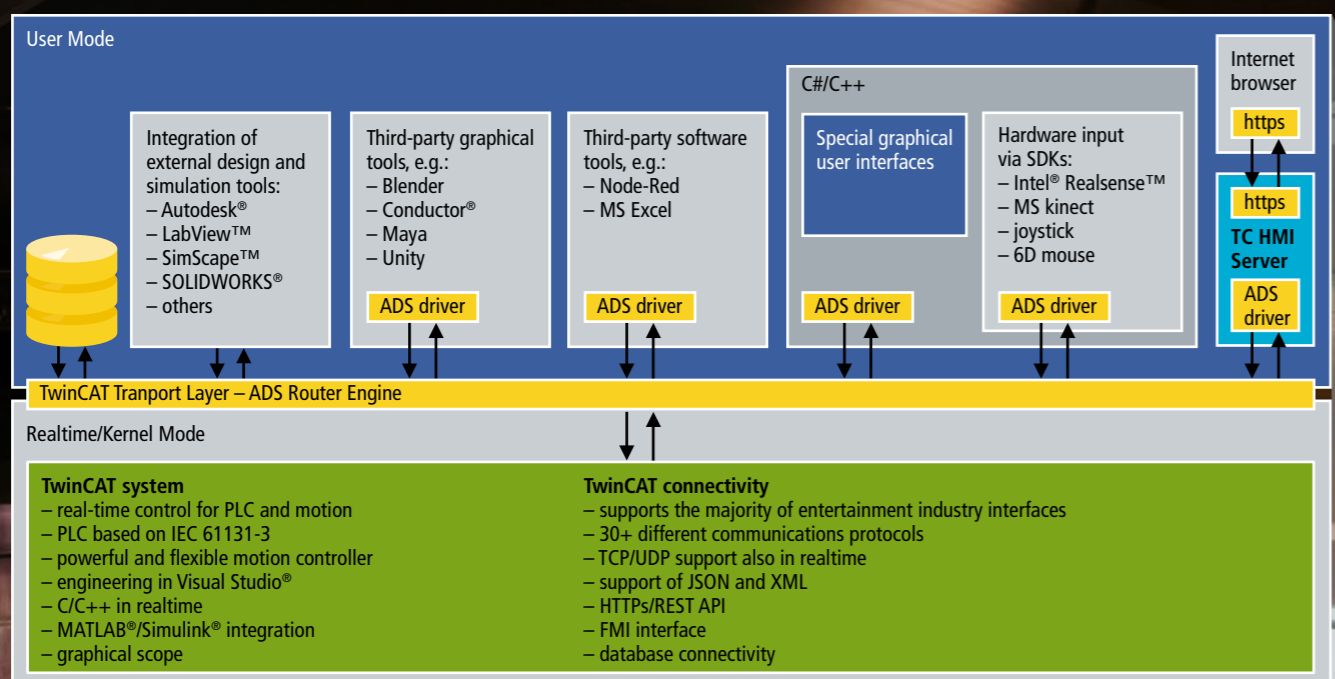
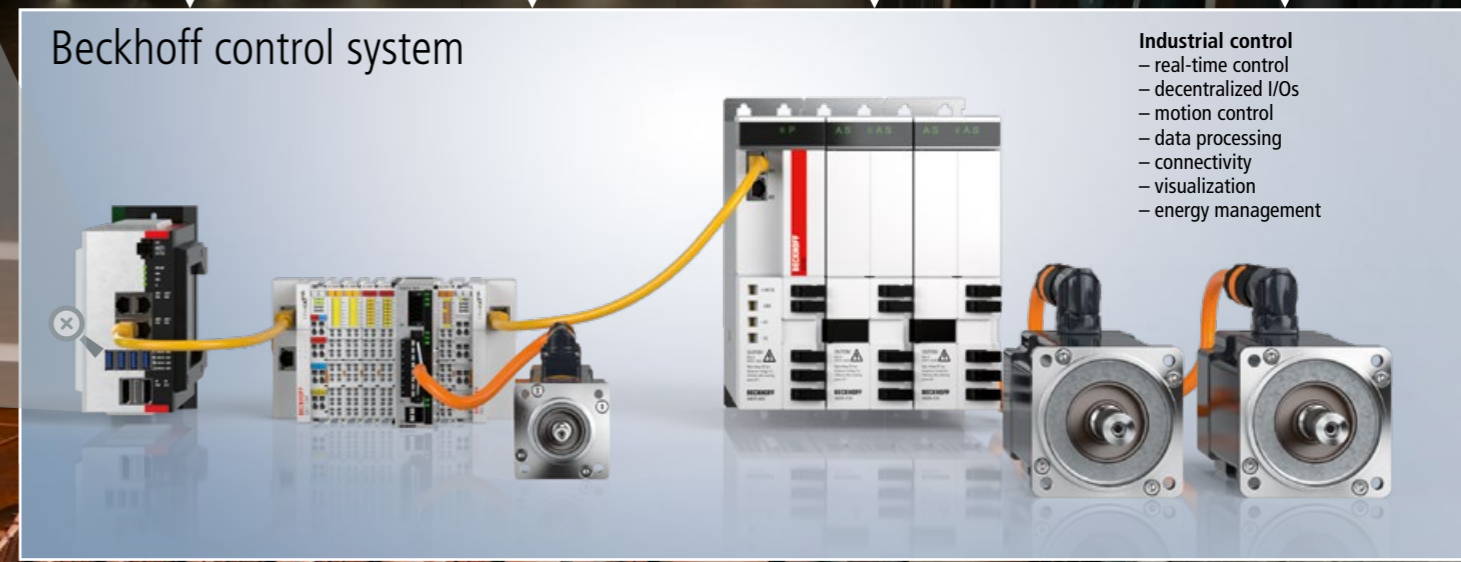
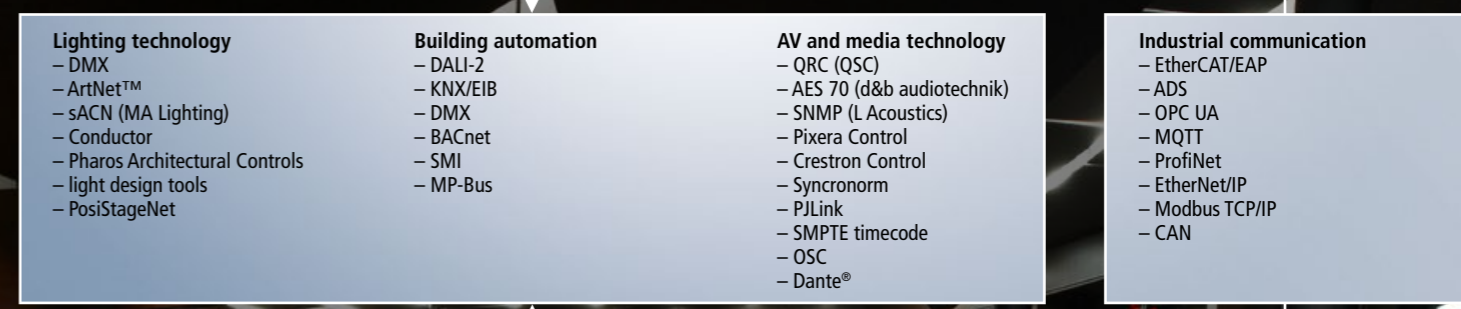
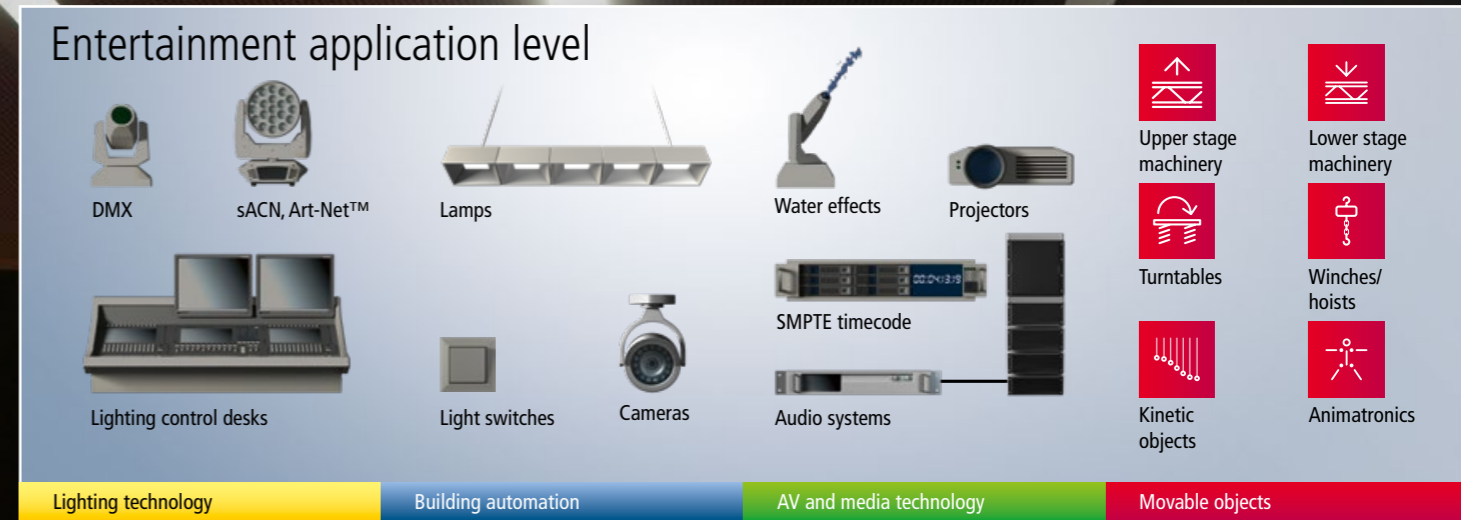
- General:
- configuration manager
  - graphical TwinSAFE editor
  - graphical TwinCAT Scope
  - EtherCAT network analysis tools
  - Event Logger
  - static code analysis
  - Cloud Engineering
  - knowledgebase: Infosys.Beckhoff.com
- Motion:
- Drive Manager 2.0
  - Motion Designer
  - Cam Design Tool

## Technical highlights

- cycle times down to 50 µs
- different editors (IEC 61131-3, C++)
- controlling up to 255 axes per controller
- diagnostic options from the HMI to the field level
- reusability on all Beckhoff control systems
- multi-core support
- application know-how protection
- support for Windows and TwinCAT/BSD
- diverse networking options and connection via ADS



# How the Beckhoff system communicates with the entertainment world



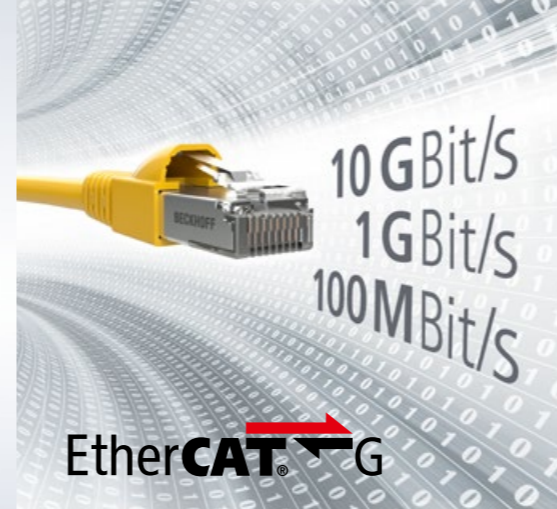
Overview of the communication model with PC-based control from Beckhoff



## Open by design: TwinCAT provides perfect connectivity with the entertainment world

The key competitive advantage of PC-based control technology from Beckhoff is its openness. Via its ADS protocol, TwinCAT automation software can communicate with the entire Windows or TwinCAT/BSD world of operating systems: with databases and various third-party software tools, with special graphical user interfaces and software development kits and with TwinCAT HMI. TwinCAT Cloud Engineering also provides the option of transferring the TwinCAT architecture entirely to the cloud.

An additional unique selling point of Beckhoff in terms of scope is that TwinCAT makes it possible to communicate with the entire world of entertainment. As it supports all industry-specific protocols and interfaces, such as sACN, Art-Net™, PJLink, QSC (QRC), AES70 (OCA) and DMX, you can use TwinCAT to control or integrate almost any entertainment industry device into your control platform. TwinCAT also sets no limits to the combination of different technical functions and devices, thus further empowering your creativity.



## EtherCAT: The high-performance fieldbus technology

Introduced by Beckhoff in 2003, the specification of this fast communication system remains unchanged. EtherCAT has become the de-facto standard in the entertainment industry. Its unique functionality and outstanding performance enables the implementation of highly complex applications, for example, involving synchronous motion control for 1,216 axes. Many devices specifically designed for the entertainment industry are based on EtherCAT. To date, over 6,000 companies worldwide have joined the EtherCAT Technology Group, including some of the most prestigious entities in the entertainment industry.

## Optimal networking with PC-based control

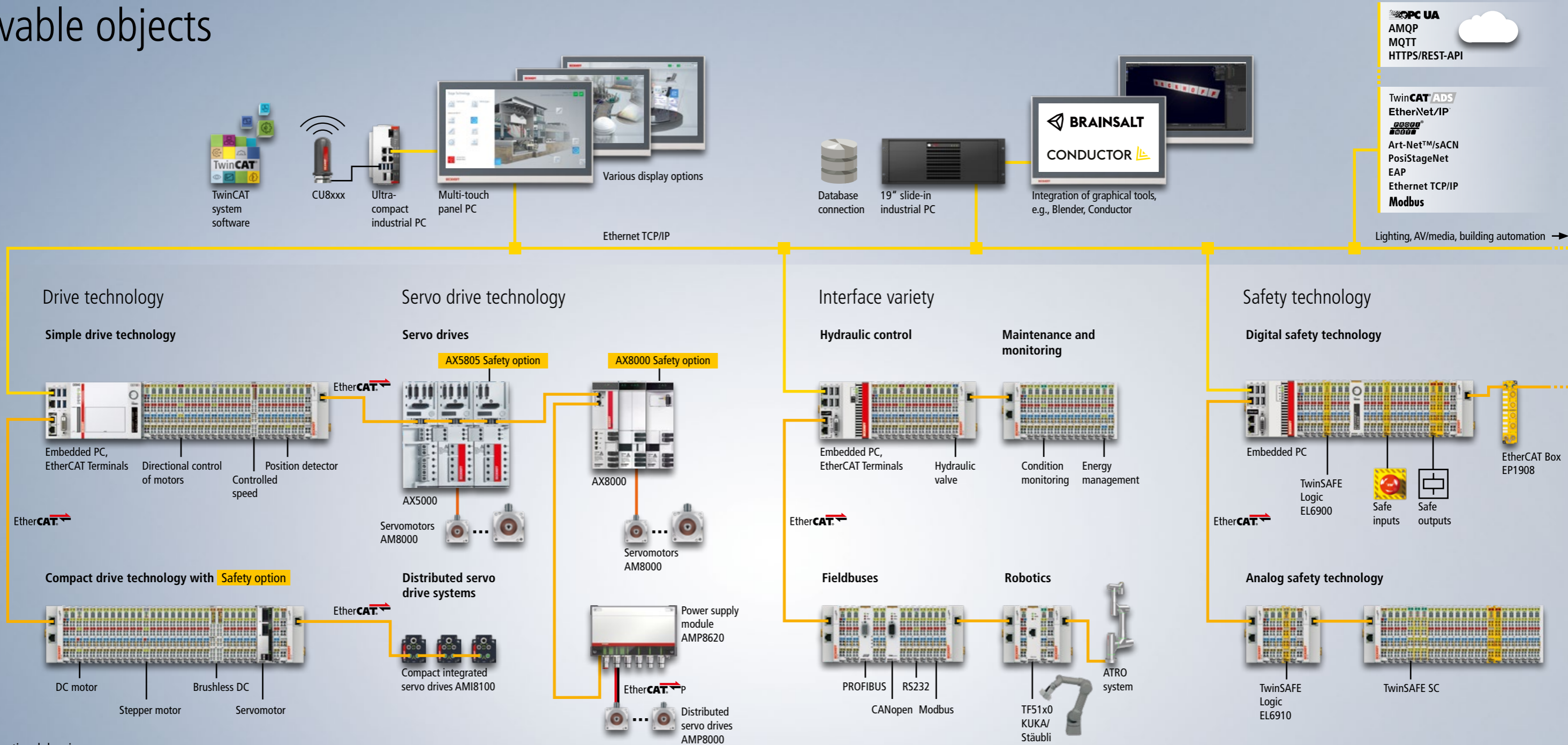
- All communication is based on TwinCAT, the open engineering platform.
- ADS provides an open communication layer across multiple systems.
- All typical industrial interfaces are supported.
- All entertainment-relevant interfaces are supported.
- Standard Ethernet ports, which are integrated into almost all Beckhoff control devices, handle 90 % of the communication.
- The powerful EtherCAT fieldbus technology enables real-time communication.



# Movable objects

Management level

Field/Control level



Technical functional drawing



Beckhoff offers a broad range of scalable drive components for all motion control applications in the entertainment industry.

## Highly scalable and flexible: Control technology for movable objects

Beckhoff supplies a broad range of scalable drive components for motion control applications such as fly systems for moving scenery or point hoists, audio/visual show elements or kinetic installations. The performance spectrum of our comprehensive drive technology portfolio ranges from compact servo terminals, which integrate an entire servo drive into a standard terminal block housing, to highly dynamic servo drives with up to 120 kW output. This allows you to configure the ideal solution for every application in terms of design, performance

and price. A high-performance Beckhoff Industrial PC running TwinCAT automation software is able to control up to 255 axes. Next to the hardware and software needed to control movable objects, we also offer the connectivity to third-party software tools for designing creative motion sequences. Both are required to implement kinetic installations like "Kinetic Rain" where 1,216 axes are moved synchronously to generate different scenes that morph into each other in a flowing motion.

With our integrated and scalable safety solutions, which range from safety I/O modules to drives, you can realize applications up to SIL 3. Support for all common fieldbus systems

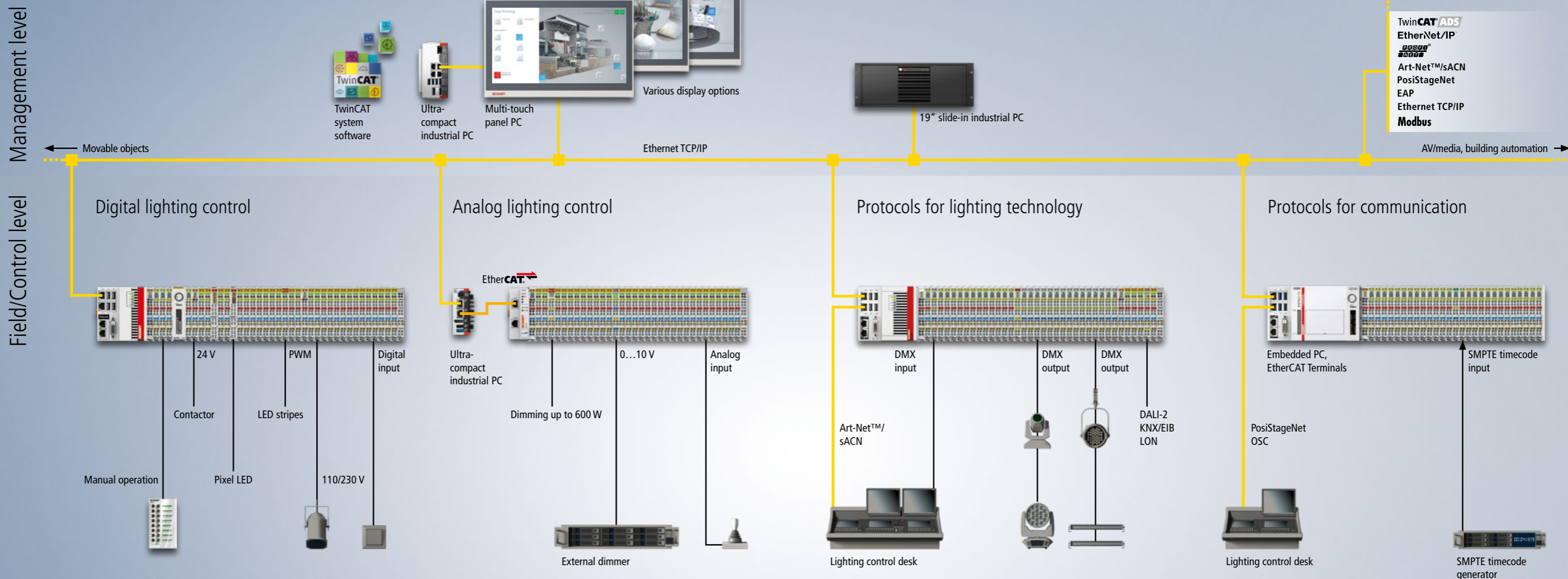
and a broad range of communication interfaces ensure the openness of our control system needed to connect third-party devices. A large selection of industrial PCs in all performance categories and designs, along with multi-touch panels for ergonomic operation and the modular TwinCAT automation software, allow you to implement a wide range of control desk concepts. Various data connectivity options and cloud connectivity solutions complete the portfolio.

## Control components for movable objects

- motion control
  - setpoint specification
  - position capturing (limit value switches, encoders)
  - load measurement
  - drive components for stage movements
- contactor and relay switching
- capturing of special signals (temperature, other maintenance-relevant information)



# Lighting technology



Technical functional drawing



## Beckhoff I/Os integrate lighting technology into the control platform

Our scalable and modular portfolio of I/O components helps you implement your lighting concepts for stage and show productions as well as unique applications and attractions. Our solutions range from stage lighting to special effects to hall and building lighting. The entire spectrum – from digital lighting control for simple switching operations to analog dimmer functions through to protocols for controlling complex lighting systems – is supported by our I/O terminals and seamlessly integrated into the control platform.

With the DMX master terminal for stage and effect lighting, we integrate DMX connectivity into our PC-based control platform. The high transmission rate of EtherCAT enables a higher refresh rate for the light settings and ensures that light intensity and color changes appear harmonious to the human eye. Besides DALI, DMX, sACN and Art-Net™, the SMPTE timecode and PosiStageNet communication protocols are also available. SMPTE timecode is used for the exact and highly repeatable synchronization and sequence control of various technical functions in complex stage shows. Via PosiStageNet, for example, you can send the position data of moving objects to the light controller for

automatic tracing. You can also select a lighting scenario in relation to a specific position. With a wide selection of industrial PCs in all performance categories and designs, along with multi-touch panels as ergonomic operating units and the modular TwinCAT automation software, we offer everything you need to implement a wide range of control desk concepts. Various data connectivity options and cloud connectivity solutions complete the portfolio.

## Control components for lighting technology

- control of multiple DMX masters directly in the I/O system
- connection of lighting consoles via DMX, sACN, Art-Net™ or OSC
- flicker-free LED control
- control of numerous load relays
- assignment of lighting control privileges
- general hall lighting via DALI
- control of external dimmers
- dimming of up to 600 W from the I/O system

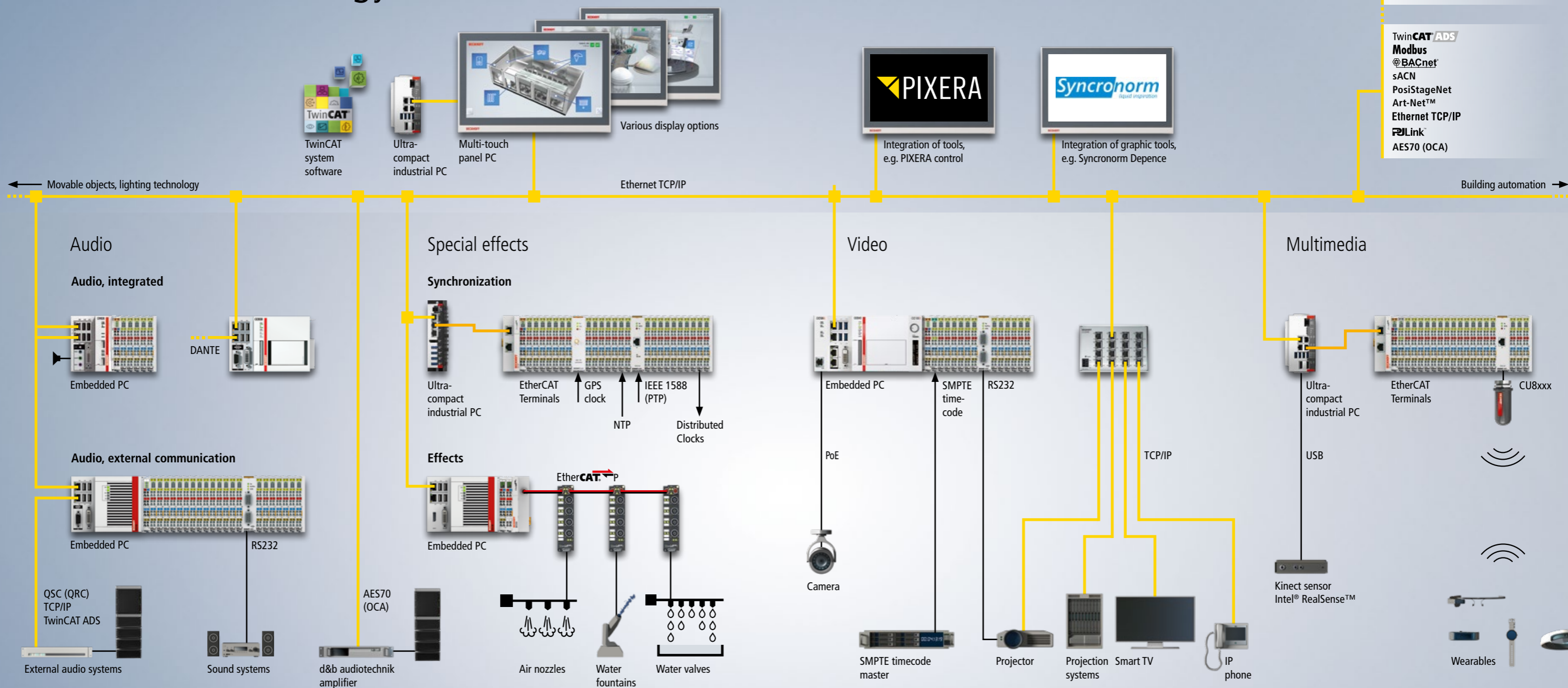


# AV and media technology

Management level

Field/Control level

Technical functional drawing



## A single platform for audio and video devices, water effects, interactions and stage managers' consoles

In addition to Ethernet TCP/IP, serial protocols and OPC UA, our control platform supports all relevant protocols in the field of media technology, such as Open Control Architecture (AES70), PLink, SMPTE timecode, Crestron, Bang & Olufsen, Art-Net™, Streaming ACN (sACN) and QRC. For example, the integration of the QRC protocol allows you to control Q-SYST™ devices remotely from the TwinCAT PLC. Conversely, the devices can also send information to the automation system.

With a unique level of connectivity, our PC-based automation system makes it possible to control the broadest spectrum of media devices. Audio and video systems, monitors, multimedia servers or streaming services – all devices can be operated on a single platform and over a single network.

The user benefits by not having to worry about any manufacturer-specific protocols when selecting media devices. The Beckhoff platform provides a universal gateway with multi-protocol support that ensures smooth communication between devices and delivers optimal usability.

Due to the scalability and modularity of the Beckhoff software and hardware portfolio,

users can tailor their control system precisely to the scope of a specific control task in terms of performance and cost as well as available installation space. For example, our embedded PC line features extremely powerful and modular controllers with multi-core processors. They allow you to combine audio, PoE DisplayPort and DVI on a single platform.

## Control components for AV and media technology

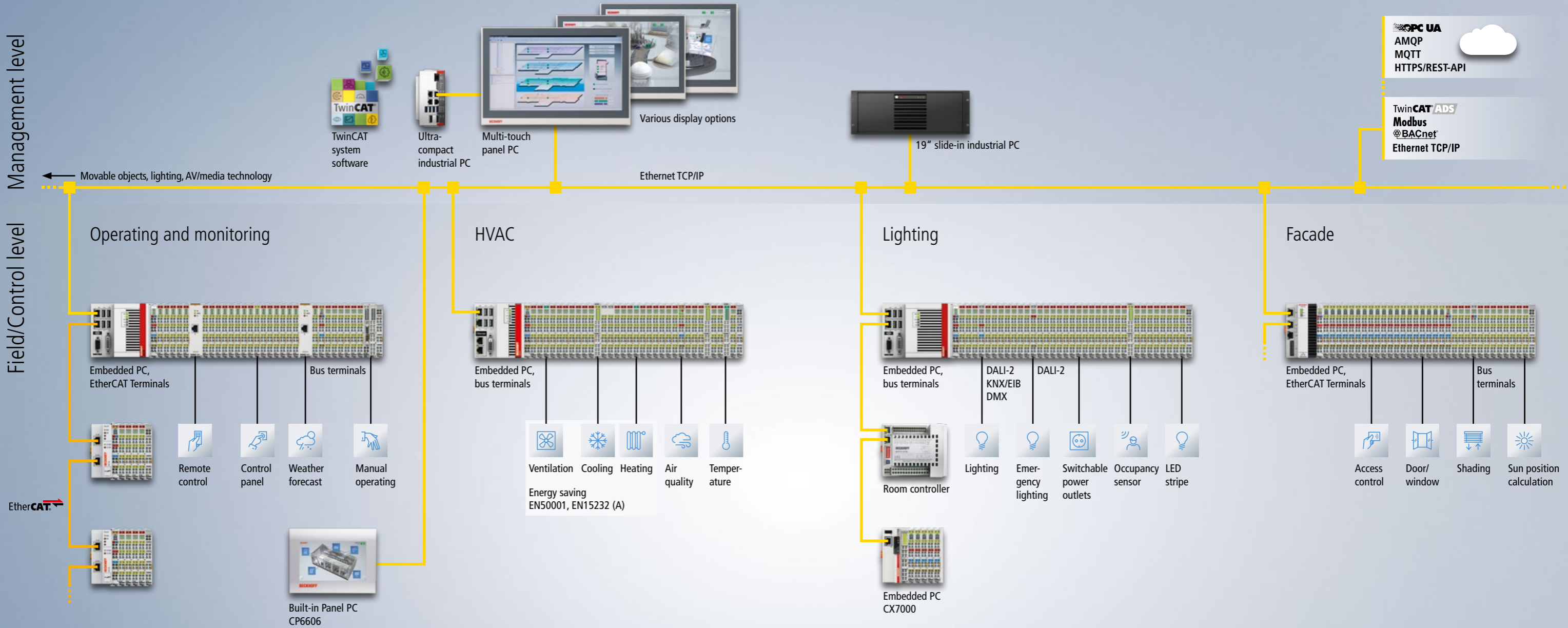
- interface integration for:
  - audio: QSC, Crestron AES70 (e.g., d&b audiotechnik)
  - video: PLink, DisplayPort
  - lighting: DMX, sACN, Art-Net™
  - tools: PIXERA control, Synchronorm and others
- high-precision output signal control
- special effects
- drive components for:
  - stage elements
  - moving show elements



With support for the QRC protocol, Q-SYST™ devices can communicate bidirectionally with the Beckhoff PLC.



# Building automation



Technical functional drawing



With TwinCAT BACnet, Beckhoff offers a complete line of BACnet-certified controls featuring outstanding scalability.

## More comfort and less energy consumption with intelligent building automation

With the support for building automation communication standards, you can intelligently link all technical functions of a building with our PC-based control system to create valuable synergies.

The TwinCAT 3 Building Automation software library (TF8040) offers you an extensive package of preconfigured, field-proven function modules that help you to be more effective as a system integrator or technician. All control objects in heating, ventilation and air conditioning (HVAC) technology as well as room automation can be

implemented much more effectively. Shading, lighting, ventilation, heating and cooling can be coordinated depending on time and presence to achieve significant energy savings in room automation. Here, lighting controls can be correlated with facade controls. This makes it possible to save lighting energy by using as much daylight as possible without glare while guaranteeing constant light intensity. With our TwinCAT Lighting Solution (TF8050), a ready-made lighting control system for building lighting is available, which only needs to be configured.

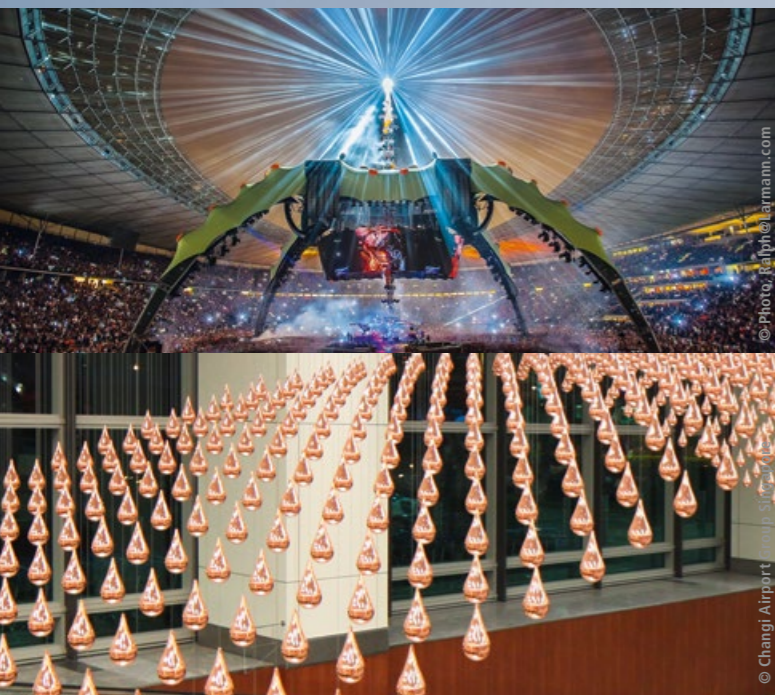
Energy savings can also be realized by means of the presence-dependent control of building functions with the help of our HVAC function

modules. For example, a building can be regulated in different operating modes depending on the time of day so that heating and cooling energy are saved when occupants are absent for a longer period of time. At the same time, the controller must ensure that the system quickly generates the desired comfortable temperature and good air quality during core usage times.

## Control components for building automation

- HVAC control
- single-room control
- constant lighting control for increased comfort and energy savings
- facade lighting
- facade control
- energy data acquisition
- monitoring is also possible from third-party devices





### Creative solutions need innovative technology!

- The performance and openness of PC- and EtherCAT-based control technology set no limits to the realization of your projects.

### We redefine performance!

- Powerful state-of-the-art processors and the ultra-fast EtherCAT fieldbus provide the foundation for the precise control of spectacular entertainment applications.
- EtherCAT enables synchronization times in the  $\mu$ s range and synchronous control of up to 255 motion axes per controller.

### All technical functions on a single platform – made possible by the extensive connectivity of our control system.

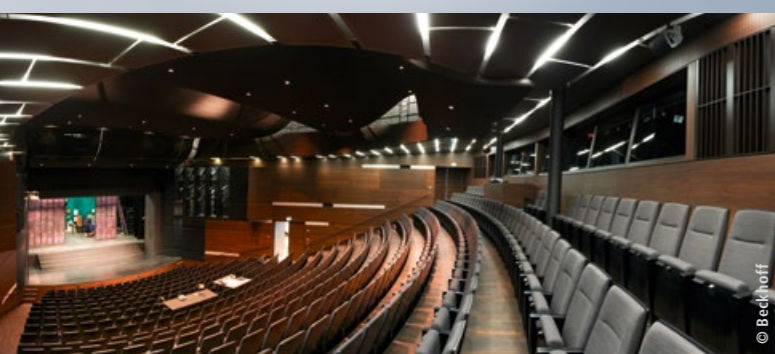
- To combine all functional elements in entertainment, media and building technology on a single platform we support nearly all industry-specific interfaces and communication standards.

### Centralized or decentralized control approach? PC-based control masters both!

- Your application alone determines the choice of a centralized or decentralized approach.

### We offer flexibility with a broad range of operating options.

- Advanced operating functions are supported via multi-touch Control Panels and TwinCAT HMI.
- You can also operate the system via your console – a unique feature for industrial controls.



### Benefit from the flexibility of a modular and scalable control system!

- The scalability of Beckhoff components in terms of performance, installation space and budget enables universal use in entertainment projects of any size and complexity.

### Ensure your success with economical and sustainable control technology!

- Economic efficiency begins with designing a control system that is effective in terms of performance and cost.
- The use of state-of-the-art technologies with modular expandability makes the Beckhoff control platform future-proof.

### Protect your investment with an industry-proven control system!

- Industry-proven components with long-term availability ensure reliable 24/7 operation.
- Our production location in Germany guarantees the highest quality made in Germany.
- The stable growth of a family-run company provides certainty for investors.

### Benefit from local presence on a global scale with Beckhoff as your experienced automation partner.

- Beckhoff is represented in over 75 countries around the globe with its own subsidiaries and distributors.
- We offer complete application support and fast on-site service – worldwide.

### Long availability of our control system ensures investment security

- Beckhoff components feature exceptionally long availability and durability.
- We promote the use of open standards.
- Predictive maintenance functions are available locally as well as in the cloud.





## More about Beckhoff



Company



Global presence



Events & dates



Jobs



Products



Industries



Support

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