



Martin Rostan, Head of Technology Marketing, Beckhoff

Has EtherCAT changed the world?

When we introduced EtherCAT at the 2003 Hannover Fair, it became clear very quickly that EtherCAT would be another major technological milestone in the history of Beckhoff.

Even before the official market introduction we had decided to open up EtherCAT technology and make it available to every interested organization once we had completed the basic development work. This openness is exactly why we established the EtherCAT Technology Group (ETG) in November 2003. Soon thereafter, the ETG's popularity exceeded even our wildest expectations. Today the association has a little under 2,500 member companies from almost 60 countries. EtherCAT has become an international IEC standard and is part of many national standards. In the early days, the experts were amazed by the innovative functional principle of the technology; today we are amazed by the diversity of applications and the worldwide use of EtherCAT.

EtherCAT was originally designed as a machine control bus for packaging and printing machines, assembly and placement systems, machine tools, presses, plastics processing machines, etc. Today you can find EtherCAT in virtually any type of machine. But that's not all: EtherCAT is also used to control stage shows. It is equally at home on Broadway as it is in Las Vegas spectacles, in theme parks or in "Sensation," the world's largest dance event. Employed in robots, EtherCAT welds ships, plays soccer and will soon leave earth's boundaries to fly into space. Humanoid EtherCAT robots can save people in danger and carry heavy loads. EtherCAT controls power plants, baggage sorting systems, test stations, as well as racing and flight simulators. A steel plant that is completely based on EtherCAT is currently under construction. In addition, the semiconductor industry tells us that it has agreed to use EtherCAT as the sole bus system for the

450 mm generation of its manufacturing equipment. EtherCAT is used in the world's largest telescopes, in particle accelerators, audio systems, X-ray machines and nuclear medicine. Medium-voltage switchgear and high-voltage DC transmission systems depend on EtherCAT, as do logistics centers, submarines and tractors.

After 10 years, EtherCAT has evolved into much more than "merely" the fastest Ethernet fieldbus, which on top of that is very easy to use, highly cost-effective and exceptionally flexible: Since so many manufacturers have selected EtherCAT as their system bus (we know of over 150 suppliers of EtherCAT masters), an EtherCAT system architecture has developed that is on the same level as those of the global market leader and its U.S. counterpart. The EtherCAT system architecture is neither European nor American, but global. That's why EtherCAT is the only bus system so far that has managed to not only get a foot in the door in Japan, but to be adopted by virtually all relevant manufacturers.

Which position EtherCAT occupies today among the global "top three" doesn't really matter. It is just as unimportant as the numbers published by some market researchers, who regularly penalize us because we refuse to invent total node count numbers. But let's keep in mind that our licensing model reflects the openness of EtherCAT in such a way that we ourselves don't know the unit numbers churned out by our fellow EtherCAT marketers.

EtherCAT may not have changed the "whole world," but it certainly has changed the world of automation for the better. We are thrilled by these developments, of course, and they serve as a great incentive for us to guide EtherCAT successfully through the next 10 years.

A look back at the first presentation of the real-time fieldbus at Hannover Messe 2003

10 years of EtherCAT

EtherCAT was presented for the first time at Hannover Messe 2003 and has since become an established standard in numerous industries worldwide. Meanwhile, the international user and manufacturer association for EtherCAT, the EtherCAT Technology Group, has almost 2,500 members that support and disseminate EtherCAT technology and drive future developments. Martin Rostan, Head of Technology Marketing at Beckhoff, looks back on the early days of the "Fast Lightbus."

EtherCAT is basically Lightbus technology adapted to Ethernet. Lightbus, the first Beckhoff fieldbus, was launched in 1989 and already derived its then exceptional performance from the "processing on-the-fly" concept that EtherCAT also utilizes. The working title of the project, from which EtherCAT later emerged, was "Fast Lightbus." It is the unique operating principle that also makes EtherCAT so special: fast, flexible, easy to use, cost-effective, compelling, and therefore successful.

The presentation of this pioneering communication technology at Hannover Messe 2003 was a highlight in the company history of Beckhoff: virtually the whole industry visited our booth and was amazed – many even congratulated us. Right from the outset we announced our intention to develop the technology into an open standard. The consistency we showed in following through with our intentions surprised many again. The foundation of the EtherCAT Technology Group and publishing the specification as a global IEC standard were important milestones that Beckhoff is celebrating 10 years later in 2013.

Meanwhile, most competitors in the market have followed our active invitation to implement EtherCAT. EtherCAT slave interfaces are today available on standard microprocessors – for the master any Ethernet port can be used. We continue to be surprised by the diversity of EtherCAT applications: examples include ultra-fast packaging machines, whole steel plants, robots, cutting systems, wind tunnels and wind energy systems – EtherCAT is currently in use across the globe in an unrivalled range of applications. After 10 years EtherCAT is still faster than the fastest CPUs – in a manner of speaking we have been beating Moore's law for 10 years. And this is why a single version of EtherCAT is sufficient, namely the first one. Everything that has been added since are extensions, not modifications: EtherCAT devices from 2003 and 2013 are therefore still compatible. All of these points are excellent prerequisites for approaching the next 10 years of EtherCAT with strength and confidence.



EtherCAT debuts at Hannover Messe

Hans Beckhoff presents EtherCAT (Ethernet for Control Automation Technology), the real-time Ethernet solution, as a major technological breakthrough.



Establishment of the EtherCAT Technology Group (ETG)

The user and manufacturer association is established at the SPS IPC Drives fair in Nuremberg, Germany, with more than 30 members.

2003



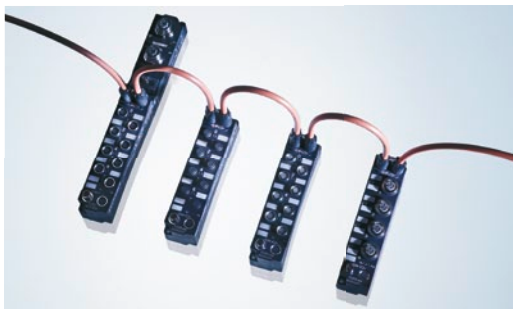
EtherCAT Terminals with IP 20 rating

The first EtherCAT products: With high-performance EtherCAT Terminals, the EtherCAT protocol remains fully intact at 100 Mbit/s down to the individual I/O terminal via processing on-the-fly technology.



EtherCAT Bus Coupler for Bus Terminal I/O

To increase I/O terminal selection, the proven standard Bus Terminal solution can be connected to the BK1120 Bus Coupler; the EtherCAT protocol is converted to the internal K-bus communication.



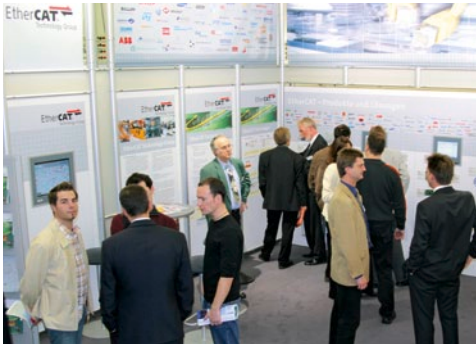
Fieldbus Box I/O in IP 67 protection for EtherCAT

The EtherCAT Coupler Box extends EtherCAT outside of electrical cabinets and into the IP 67 world of harsh industrial environments.



Servo drives with EtherCAT interface

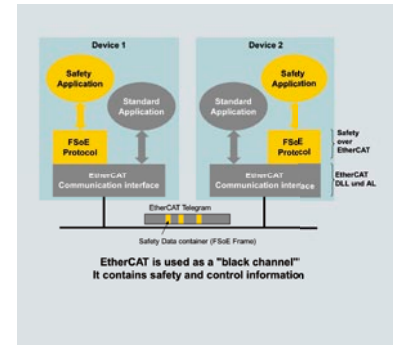
Continuous EtherCAT integrated into drive technology: The AX2000 digital compact servo drives are offered with EtherCAT interfaces.



ETG attends SPS IPC Drives fair for the first time
Together with 28 co-exhibitors, the EtherCAT Technology Group makes its first appearance with its own trade fair booth at SPS IPC Drives 2004 in Nuremberg, Germany.



First EtherCAT Roadshow in the USA
The ETG kicks off the first EtherCAT Roadshow in the USA to present EtherCAT technology to the wider engineering public.



Safety over EtherCAT

To implement safe data communication using EtherCAT, the ETG makes the Safety over EtherCAT protocol openly available to group members.

2004



Embedded PC for EtherCAT Terminals

The first Embedded PC for EtherCAT Terminals. EtherCAT I/O terminals can be directly connected to the power supply module of the CX1020 Embedded PC.

2005



AX5000 EtherCAT Servo Drive

EtherCAT servo drives in single- or multi-channel format for highly dynamic positioning tasks set new standards in drive technology.



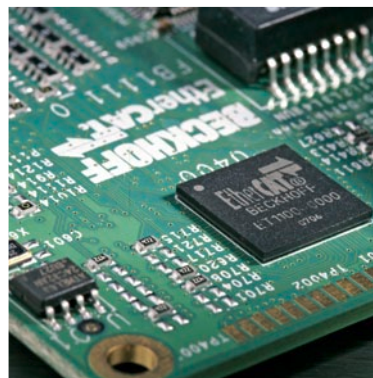
EtherCAT Safety Terminal

The expanded TwinSAFE safety solution for the EtherCAT Terminal system enables the implementation of simple, flexible and inexpensive local safety controllers.



EtherCAT Bus Coupler in ultra-compact format

The BK1250 "Compact" Coupler converts the EtherCAT E-bus signal to K-bus, enabling mixed application of EtherCAT Terminals and Bus Terminals and increasing I/O system flexibility.



EtherCAT ASICs

EtherCAT Slave Controller blocks offer a cost-effective and compact solution for other manufacturers to design new EtherCAT slaves.



ETG office opens in Japan

The ETG opens a regional office in Japan in order to meet the fast-growing demand for EtherCAT technology in Asia.



EtherCAT Plug Fest debuts

The first EtherCAT Plug Fest takes place at AMK Antriebstechnik in Kirchheim u. T., Germany.



ETG welcomes its 500th member

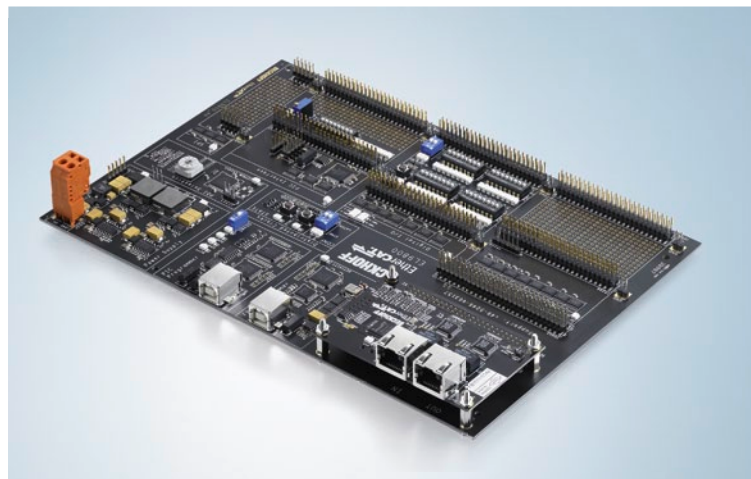
The Italian mechanical engineering company, Salvagnini becomes the 500th member of the EtherCAT Technology Group.

2006

2007

EtherCAT development products

The EtherCAT development products facilitate the simple and inexpensive integration of EtherCAT technology into proprietary products from various vendors.



Scientific Automation

With EtherCAT it is possible to integrate additional functions into a standard controller, such as measurement technology, Condition Monitoring and robotics.



EtherCAT becomes official SEMI standard

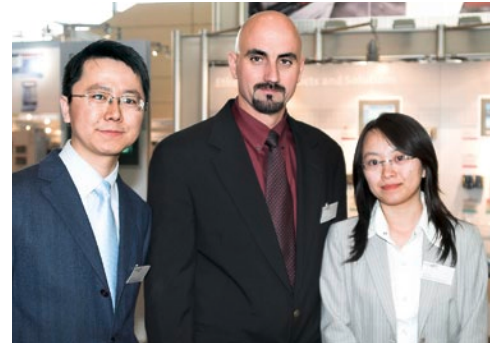
SEMI (Semiconductor Equipment and Materials International) approves EtherCAT for use in its applications and recognizes the technology as a SEMI standard.

EtherCAT becomes IEC standard

The EtherCAT specification becomes an international IEC standard.

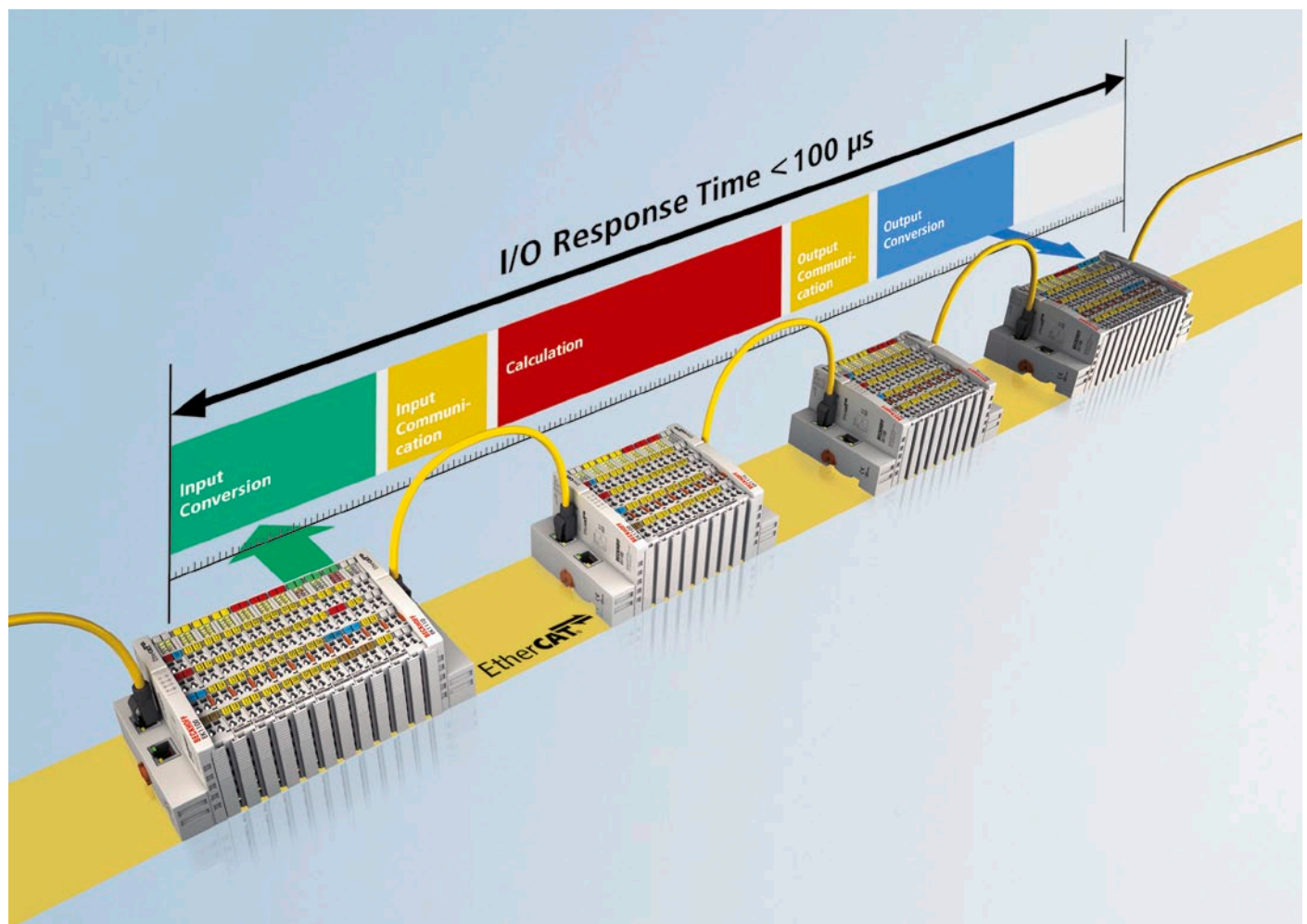
ETG accredits the first EtherCAT Conformance Test Center

The first EtherCAT Test Center opens in Nuremberg, Germany.



ETG opens regional offices in China, Korea and the USA

In order to enhance its service for members around the world, the ETG opens offices in China, Korea and the USA, which promote the EtherCAT technology in close coordination with ETG headquarters in Germany.



XFC – eXtreme Fast Control technology

EtherCAT enables very fast PC-based control solutions with I/O response times < 100 μ s.



First EtherCAT Plug Fest in Asia

The ETG holds the first EtherCAT Plug Fest on the Asian continent – at Sunchon National University in Suncheon, South Korea.



The ETG reaches 1,000 members

After just over five years, the ETG has signed on more than 1,000 members from 45 countries.

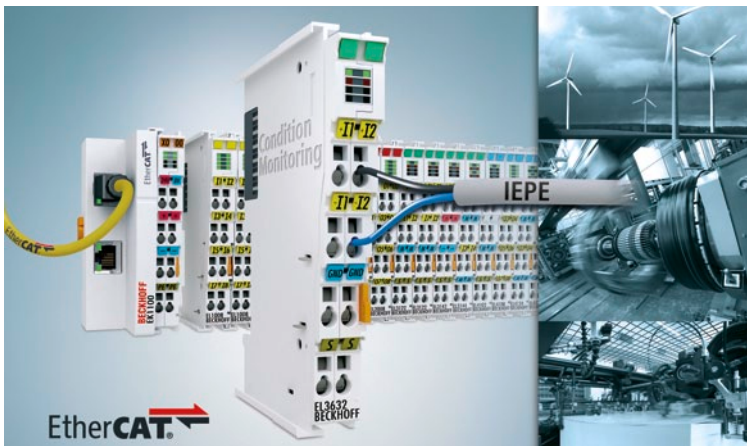


First EtherCAT Plug Fest in North America

The ETG holds the First EtherCAT Plug Fest in North America at the offices of ETG member company, National Instruments in Austin, Texas.

2008

2009



EtherCAT Terminal for Condition Monitoring

The EL3632 leverages the high bandwidth of EtherCAT for Condition Monitoring solutions. Advanced Condition Monitoring functions can be integrated easily into a PC-based control system.



PCI EtherCAT slave card

The PCI card can be used to integrate a PC as a slave in an EtherCAT network.



EtherCAT Embedded PC

The exceptionally compact CX8010 Embedded PC with EtherCAT slave interface can accommodate EtherCAT Terminals or Bus Terminals as the I/O system.



EtherCAT Box in IP 67 protection

The I/O modules with integrated E-bus technology bring the high performance of EtherCAT to harsh industrial environments.



First EtherCAT Test Center in Germany

The EtherCAT Technology Group accredits the first official EtherCAT Test Center in Nuremberg, Germany.

EtherCAT Test Center in Japan

The first EtherCAT Test Center outside Europe is operated by the Advanced Software Technology and Mechatronics Research Institute of Kyoto.

First EtherCAT roadshow in India

The first EtherCAT seminar series in India takes place in five cities and offers delegates detailed information on EtherCAT technology.



First EtherCAT roadshow in China

The ETG uses the first EtherCAT roadshow in China to present EtherCAT technology to Chinese engineers in three cities.

2010



TwinCAT 3

TwinCAT 3 is the systematic further development of TwinCAT 2 software, with which the world of automation technology is being redefined with advanced new tools. TwinCAT serves as an engineering environment and runtime for EtherCAT applications.



Fast communication with the "DMX world"

The DMX EtherCAT Terminal integrates lighting and stage technology in the EtherCAT I/O system for entertainment engineering applications.



High Density EtherCAT Terminals

The HD terminals (High Density) with high I/O point density feature 16 digital channels in the housing of a 12 mm electronic terminal block.



EtherCAT interface in standard μ P and μ C
EtherCAT becomes part of standard microprocessor and microcontroller product lines.

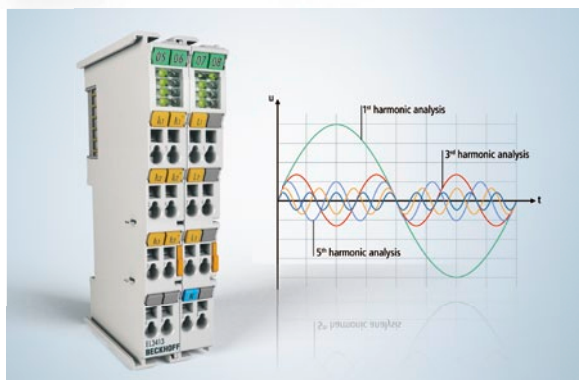


EtherCAT becomes national standard in Korea
The South Korean ministry for knowledge-based economy announces the recognition of EtherCAT as Korean industrial standard.

2011

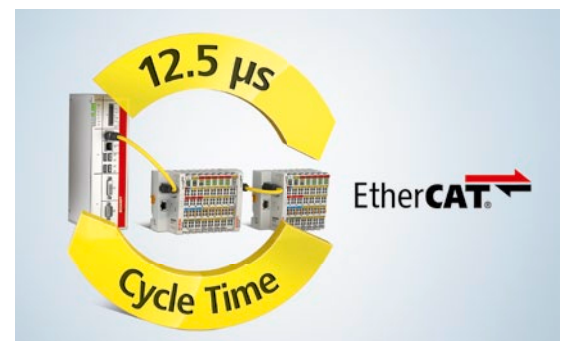


EtherCAT servo terminal
The EL7201 EtherCAT Terminal is a complete servo drive with a system-integrated, compact design for motors up to 200 W.



Integrated power measurement in the I/O system
Fast power monitoring terminals enable the direct measurement of all relevant electrical data of the supply network in the EtherCAT I/O system, eliminating "black box" measurement devices.

2012



EtherCAT PLC with 12.5 μ s cycle time
Implemented entirely with standard components: Beckhoff Industrial PC, TwinCAT 3 control software, ultra-fast I/O components and EtherCAT.

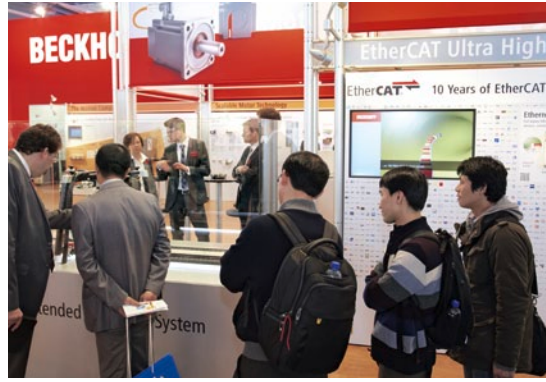


Measurement technology in an EtherCAT Terminal
Scientific Automation integrates high-precision temperature measurement and dynamic load cell analysis in the control system



Profiles for the semiconductor industry

The ETG develops special device profiles for the semiconductor industry.



EtherCAT celebrates 10-year anniversary at Hannover Messe

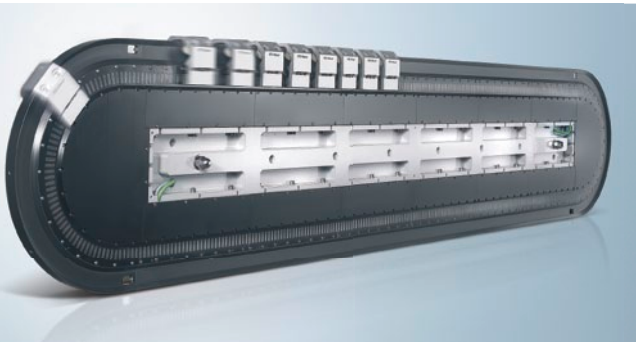
The diversity of EtherCAT applications ranges from ultra-fast packaging machines to whole steel mills – EtherCAT is widely used around the world.



EtherCAT Test Center in China

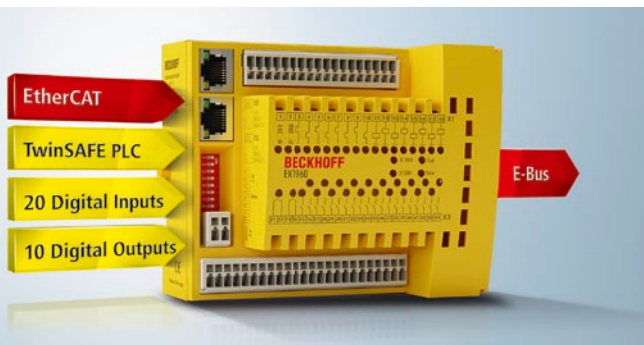
The ETG accredits an EtherCAT Test Center at the Laboratory of Numerical Control and Automation at Beihang University in Beijing.

2013



XTS – eXtended Transport System

The linear transport system: revolutionary mechatronic solution enabled by EtherCAT.



Safety controller – The all-in-one safety solution

Beckhoff extends its safety offering with a complete compact safety controller with numerous integrated I/O channels via the new EK1960 TwinSAFE Compact Controller.



Stainless steel-clad EtherCAT Box

Rugged I/O modules in IP 69K protection for direct use on machines with wash down procedures.

EtherCAT applications worldwide

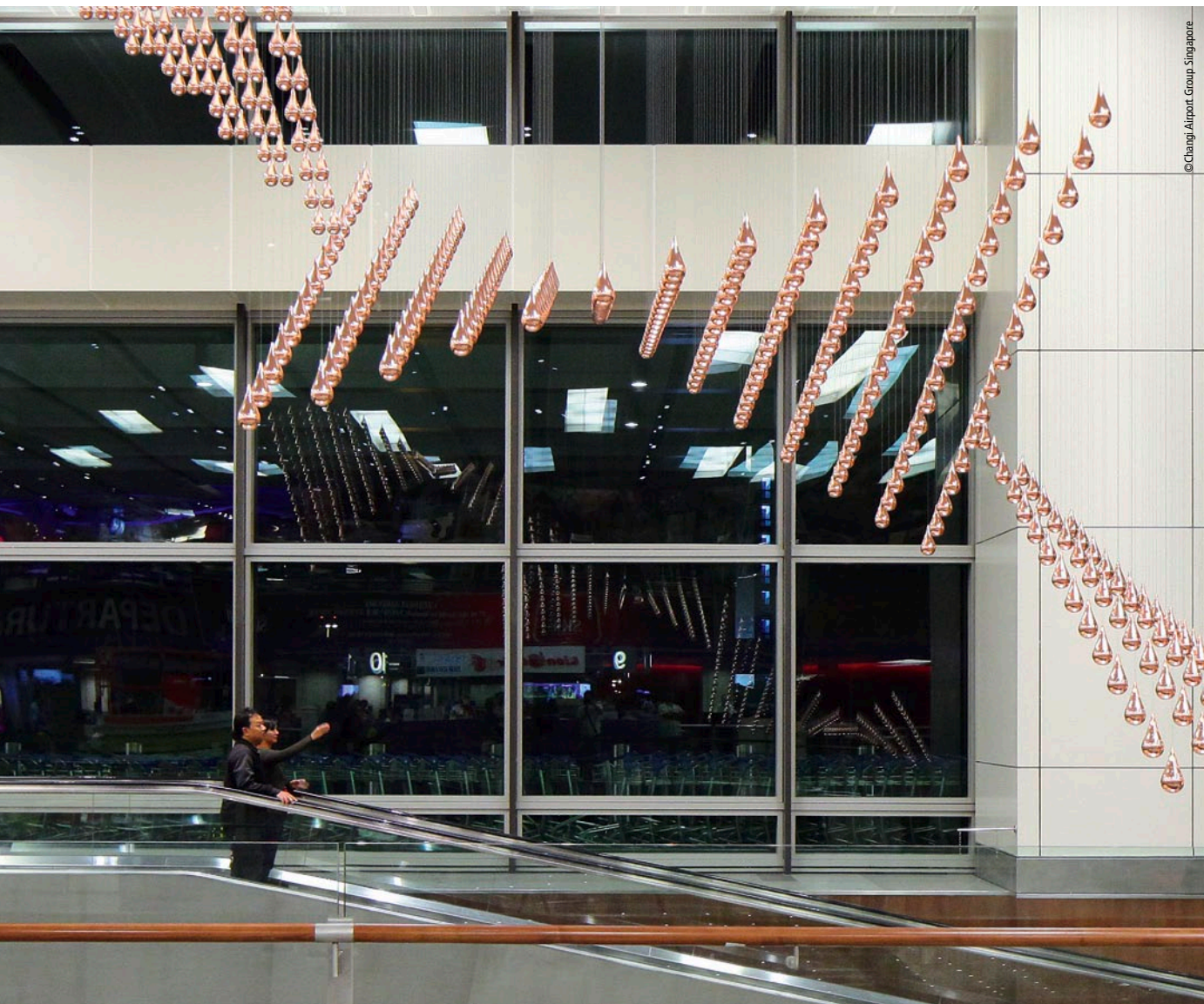
Impressive variety: the EtherCAT application portfolio ranges from high-performance transfer presses and ultra-fast packaging machines to full control systems for kitchen production, from high-precision test procedures and humanoid robots, logistics centers, wind turbines to stage and show technology.

▼ Kinetic Rain stage and show technology

Changi Airport Group Pte Ltd., Singapore

MKT AG/ART+COM, Germany

2012: The kinetic installation involves synchronous movement of 1,216 servo axes based on EtherCAT.





▲ **Metal forming/sheet metal processing, transfer presses**

Schuler AG, Germany

2003: EtherCAT pilot project: EtherCAT is used for the first time as the communication system between system periphery and PC-based control.

▲ **Stage and show technology, flight simulation in the stage show "A New Day" by Celine Dion**

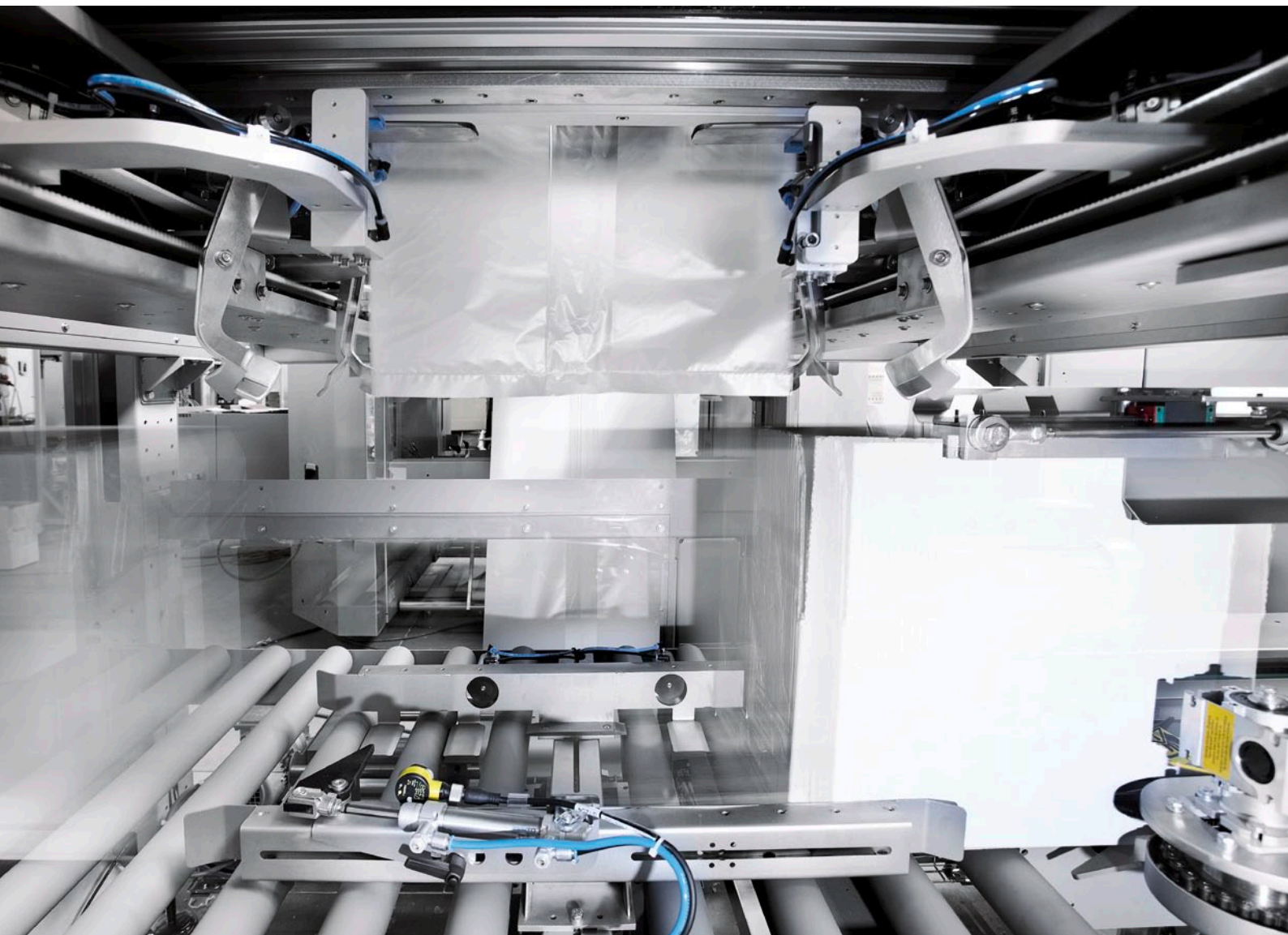
Flying by Foy, USA

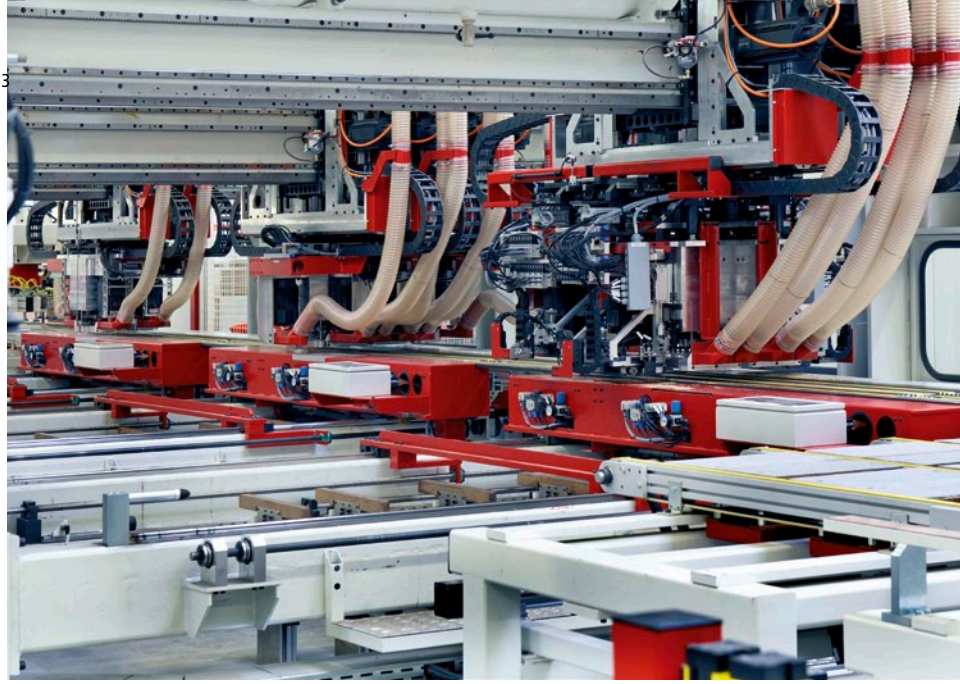
2011: EtherCAT enables precise flight simulation with maximum repeatability.

▼ **Packaging machine construction, bag-in-box packaging of food products**

Pattyn Packing Lines, Belgium

2011: The openness of EtherCAT enables seamless integration of packaging machines in food production processes.





▲ **Metal forming/sheet metal processing, punching machines**

Bruderer AG, Switzerland

2006: Thanks to the fast cycle time of EtherCAT, the cam controller could be cost-effectively implemented directly in the PLC.

▲ **General mechanical engineering, kitchen production**

Nobilia-Werke J. Stickling GmbH & Co. KG

Hüttenhölcher Maschinenbau GmbH, Germany

Since 2005: Application of EtherCAT as an integrated communication medium – from control to the command level – and as a real-time capable drive bus.

▼ **Packaging industry, thermoformers**

MULTIVAC Sepp Haggenmüller

GmbH & Co. KG, Germany

2008: EtherCAT enables faster signal sampling and optimization of machine cycle times.





▲ **Transport and logistics, pick rotor system for textile fulfillment business**

Dürkopp Fördertechnik GmbH, Germany

2007: EtherCAT offers significant performance gains for transfer of large data quantities.

▼ **Beverage industry, beer brewing**

Saugatuck Brewing Company, USA

2012: The PC- and EtherCAT-based control platform ensures consistent carbonation levels in beer brewing processes.



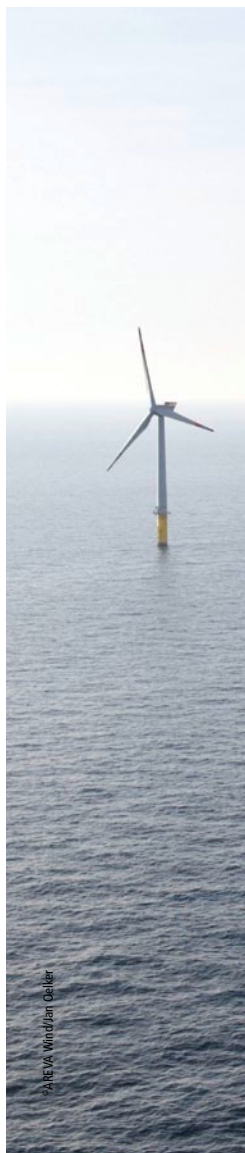


▲ **Energy industry, tidal turbine**

Scotrenewables Tidal Power Limited, U.K.
2012: The EtherCAT platform is ideal for research and development projects, since it enables a modular approach.

▼ **Transport and logistics, real-time distribution system**

Numina Group, USA
2009: EtherCAT helps address speed and precision challenges.





- ▼ **Wind energy, offshore wind turbines**
 Areva Wind GmbH, Germany
 2007: Integrated PC- and EtherCAT-based control platform simplifies system management.

- ▲ **Testing procedures, temperature measurement and signal acquisition in a climatic chamber**
 Miele & Cie. KG, Germany
 2010: High-precision temperature measurement via EtherCAT Terminals.

- ▼ **Robotics, mobile robots „Rollin’ Justin”**
 German Aerospace Center, Germany
 2010: The fast communication required for advanced robotic movements takes place via EtherCAT.

