



- Comprehensive technical assistance in the application of individual Beckhoff products or with wide-ranging services
- Support in all matters of after-sales service
- Worldwide training for Beckhoff system components

# Support, Service, Training

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# Support, Service

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Beckhoff and its partners around the world offer comprehensive support and service, guaranteeing fast and competent assistance with all questions related to Beckhoff products and system solutions.

## Beckhoff Support



Beckhoff offers you comprehensive technical assistance, helping you not only with the application of individual Beckhoff products, but also with wide-ranging services:

- worldwide support
- design, programming and commissioning of complex automation systems
- training program for Beckhoff system components

## Beckhoff Service



The Beckhoff service center supports you in all matters of after-sales service:

- on-site service
- repair service
- spare parts service
- hotline service

Beckhoff support and service are available to you wherever you are in the world, and can be reached by telephone, fax or e-mail. The contact addresses for your country can be found in the list of Beckhoff branches and partner companies: [www.beckhoff.com/support](http://www.beckhoff.com/support)



# Training

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Beckhoff offers a comprehensive training program worldwide for Beckhoff system components. The training takes place at training centres at the headquarters in Germany or at the Beckhoff subsidiaries. Please contact the appropriate companies in your country with regard to training with the partner firms around the world. For addresses see page **12**



## TwinCAT 3 Training

### TR3010, TR3012 | Maintenance, repairs and service

Information	TR3010	TR3012
Content	TwinCAT PLC: introduction to TwinCAT eXtended Automation Technology (XAT); TwinCAT system architecture: configuration and diagnostics, basics of IEC 61131-3 programming; TwinCAT NC PTP: basics of axis commissioning and Motion Control blocks	same as TR3010, additionally overview of Structured Text programming
Requirements	sound knowledge of basic Windows functionalities; basics of PLC systems	
Duration	4 days	5 days
Further information	<a href="http://www.beckhoff.com/TR3010">www.beckhoff.com/TR3010</a>	<a href="http://www.beckhoff.com/TR3012">www.beckhoff.com/TR3012</a>

### TR3020 | Basic PLC programming

Information	TR3020
Content	basic PLC principles: introduction to TwinCAT eXtended Automation Technology (XAT); eXtended Automation Engineering environment (XAE), Microsoft Visual Studio® integration; hardware configuration; IEC 61131-3 programming; FBD and ST editors; basic principles of ADS communication; TwinCAT NC PTP: basis of axis commissioning, motion control function blocks, TcMC2 library
Requirements	sound knowledge of PLC programming; no prior knowledge of TwinCAT 2 or IEC 61131-3 is necessary
Duration	5 days
Further information	<a href="http://www.beckhoff.com/TR3020">www.beckhoff.com/TR3020</a>

## TR3030 | PLC basics, NC PTP, ADS

Information	TR3030
Content	TwinCAT PLC: introduction to TwinCAT eXtended Automation Technology (XAT), eXtended Automation Engineering environment (XAE), Microsoft Visual Studio® integration, hardware configuration, IEC 61131-3 programming, FBD and ST editors, TwinCAT NC PTP: principles of axis commissioning, motion control components: TcMC2 library, basics in ADS communication, ADS: communication interface, high-level language link
Requirements	sound knowledge of PLC or high-level language concepts such as declaration of variables, variable classes and structures; no prior knowledge of TwinCAT 2 is necessary
Duration	5 days
Further information	<a href="http://www.beckhoff.com/TR3030">www.beckhoff.com/TR3030</a>

## TR3040 | How to switch from TC2 to TC3

Information	TR3040
Content	TwinCAT PLC: introduction to TwinCAT eXtended Automation Technology (XAT), eXtended Automation Engineering environment (XAE), Microsoft Visual Studio® integration, basic differences between TC2 and TC3, principles of object-oriented programming in the PLC, integration of TcCOM modules, MATLAB®/Simulink®, C/C++
Requirements	sound knowledge of TwinCAT 2 programming; basics of high-level language programming
Duration	2 days
Further information	<a href="http://www.beckhoff.com/TR3040">www.beckhoff.com/TR3040</a>

## TR3042 | C++ module creation, wizards, TMC editor

Information	TR3042
Content	TwinCAT PLC: TwinCAT architecture, TwinCAT XAE (Engineering) and XAR (Runtime), opportunities and limitations of C++ programming in the TwinCAT 3 real-time environment, requirements on the development PC; TwinCAT Class Wizard: creating and debugging examples, TwinCAT TMC editor, real-time settings, task configuration multi-core support, consolidation of the above topics using practical examples
Requirements	sound knowledge of the C++ programming language
Duration	2 days
Further information	<a href="http://www.beckhoff.com/TR3042">www.beckhoff.com/TR3042</a>

## TR3044 | Object-oriented programming with the PLC

Information	TR3044
Content	introduction to OOP, keywords of IEC 61131-3 3 <sup>rd</sup> edition, implementation of a PLC example in a FB with OOP elements, inheritance, overwrite, interfaces
Requirements	sound knowledge of PLC programming with TwinCAT 3, training contents of TR3030
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR3044">www.beckhoff.com/TR3044</a>



## TR3050 | NC Point-to-Point

Information	TR3050
Content	operation of TwinCAT NC: functional plan, operating modes; NC control with NC MC2 library, cyclic interface, axis function blocks; TwinCAT Measurement: recording of set value profiles; programming examples; TwinCAT cam plates and MC function blocks for cam plate functionality
Requirements	assured handling of TwinCAT 3 PLC programming; solid knowledge of PLC programming; level of knowledge corresponding to courses TR3020/TR3030, or corresponding experience in IEC 61131-3 programming; programming languages: ST
Duration	2 days
Further information	<a href="http://www.beckhoff.com/TR3050">www.beckhoff.com/TR3050</a>

## TR3052 | NC Point-to-Point and NC Interpolation

Information	TR3052
Content	TwinCAT NC PTP: same as TR3050 without cam plates; TwinCAT NC I: creation of interpolation channels for single axes, creating CNC programs in accordance with DIN 66025, sequential control with the System Manager, PLC libraries for creating NC channels and for controlling the interpreter, sequential control from the PLC, communication between NC and PLC program (M functions), exchange of parameters between NC program and PLC (H, S and T), set value path monitoring with TwinCAT Scope
Requirements	assured handling of TwinCAT PLC programming; solid knowledge of PLC programming; level of knowledge corresponding to courses TR3020/TR3030, or corresponding experience in IEC 61131-3 programming; programming languages: ST
Duration	3 days
Further information	<a href="http://www.beckhoff.com/TR3052">www.beckhoff.com/TR3052</a>

## TR3054 | CNC

Information	TR3054
Content	introduction to TwinCAT CNC, creating and processing CNC configurations in the System Manager, creating NC programs compliant with DIN 66025 and extensions of the CNC kernel, operating CNC interfaces via structures in the PLC, data and communication exchange between PLC and CNC using M functions and V. E. variables, recording and displaying CNC quantities using ScopeView, system diagnostics facilities, operation and use of the "HLI" (high level interface), kinematic transformations, commissioning of servo drives using the CNC
Requirements	basics of programming and automation technology using TwinCAT; familiarity with TwinCAT 3 system configuration and programming; in-depth knowledge of PLC programming; contents of the courses TR3030/TR3020, or equivalent experience of IEC 61131-3 programming (we recommend advanced TwinCAT 2 users to first take the course "TR3040   How to switch from TC2 to TC3" as a basis); ST programming language
Duration	2 days
Further information	<a href="http://www.beckhoff.com/TR3054">www.beckhoff.com/TR3054</a>

## TR3056 | Beckhoff XTS – eXtended Transport System

Information	TR3056
Content	presentation of the XTS system: mechanical structure, initial commissioning, module diagnostics; integration of the TcIoXts TcCOM module; configuration with the help of the XTS wizard; encoder system teaching procedure, error diagnostics; introduction and tuning of the TcSoftDrive, introduction to the TC3 XTS extension (automatic accumulation and collision avoidance); diagnostic options
Requirements	confidence in dealing with TwinCAT 3 NC PTP; solid knowledge of PLC programming; knowledge level of the TR3020/TR3030 courses; programming languages: ST and Sequential Function Chart
Duration	2 days
Further information	<a href="http://www.beckhoff.com/TR3056">www.beckhoff.com/TR3056</a>

## TR3060 | Basic training: TwinSAFE Terminals

Information	TR3060
Content	introduction to the TwinSAFE system, integration of TwinSAFE Terminals, development of a TwinSAFE project, overview of the TwinSAFE function blocks
Requirements	experience in handling of TwinCAT 3 software, experience in dealing with EtherCAT
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR3060">www.beckhoff.com/TR3060</a>

## TR3061 | TwinSAFE AX5805 drive option card

Information	TR3061
Content	overview of the functions of the AX5805 option card, development of an example project, configuration of the option card
Requirements	experience in handling of TwinCAT 3 software, experience in TwinCAT NC PTP, training contents of TR3060, experience in TwinSAFE Terminals
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR3061">www.beckhoff.com/TR3061</a>

## TR3064 | Extended training: TwinSAFE Terminals

Information	TR3064
Content	presentation of new analog function blocks; TwinSAFE SC; group parameterisation, replacement values and deactivation; user management
Requirements	experience in handling TwinCAT 3 software, experience in dealing with EtherCAT, training contents TR3060
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR3064">www.beckhoff.com/TR3064</a>



## TR3066 | TwinSAFE: Servicing and maintenance

Information	TR3066
Content	introduction to the EtherCAT bus system; diagnostics and service; introduction to the TwinSAFE system; development of a TwinSAFE project; diagnostics of the TwinSAFE system; hardware exchange service case
Requirements	training contents TR3010/TR3012
Duration	2 days
Further information	<a href="http://www.beckhoff.com/TR3066">www.beckhoff.com/TR3066</a>

## TR3072 | OPC UA

Information	TR3072
Content	overview and benefits of OPC Unified Architecture (OPC UA); basic components of TF6100 TC3 OPC UA; operating principle of the TwinCAT OPC UA Server (architecture, configuration, symbol files, communication patterns, security, setup scenarios); operating principle of the TwinCAT OPC UA Configurator (architecture, online panel, diagnostics, certificate management); operating principle of the TwinCAT OPC UA Client (architecture, function blocks of the PLCopen_Opc_Ua library, read/write workflow, MethodCall workflow, security)
Requirements	knowledge of handling the TwinCAT system is required, such as I/O configuration, PLC handling, linking of PLC variables
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR3072">www.beckhoff.com/TR3072</a>

## TR3076 | EtherCAT

Information	TR3076
Content	EtherCAT basics, diagnostics, Hot Connect, XFC, redundancy, simulation
Requirements	knowledge of handling the TwinCAT 3 software
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR3076">www.beckhoff.com/TR3076</a>

## TR3080 | Automation Interface

Information	TR3080
Content	basic functions of the TwinCAT Automation Interface (combination of two technologies: Visual Studio® and TwinCAT XAE, adding TwinCAT configurations); using TwinCAT I/O functions (adding I/O devices, managing I/O templates); using TwinCAT PLC functions (adding PLC projects, adding POU, modifying PLC program code, managing libraries, placeholders and repositories); using TwinCAT TcCOM functions (adding and parameterising TcCOM modules); using TwinCAT measurement functions (adding TwinCAT measurement projects, adding and parameterising charts, axes and channels); mapping between I/O, PLC and TcCOM modules
Requirements	knowledge of handling the TwinCAT system is required, such as I/O configuration, PLC handling, linking of PLC variables
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR3080">www.beckhoff.com/TR3080</a>

## TR5041 | Fieldbus systems in building automation programming

Information	TR5041
Content	TwinCAT PLC: TwinCAT handling, IEC 61131-3 programming; TwinCAT ADS: communication interface, high-level language communication; introduction to the communication between TwinCAT control systems; introduction to building fieldbus systems and programming concepts; network analysis with Wireshark; functions in room automation
Requirements	assured handling of Windows operating systems, experience in PLC programming
Duration	5 days
Further information	<a href="http://www.beckhoff.com/TR5041">www.beckhoff.com/TR5041</a>

## TR5042 | Connectivity in building automation programming

Information	TR5042
Content	TwinCAT PLC: TwinCAT handling, IEC 61131-3 programming; TwinCAT ADS: communication interface, high-level language communication; introduction to the communication between TwinCAT control systems; introduction to building automation protocols and libraries; basic knowledge of the Modbus/RTU, Modbus/TCP and M-Bus communication protocols; network analysis with Wireshark; programming of building automation functions with the HVAC library
Requirements	assured handling of Windows operating systems, basic knowledge of PLC systems
Duration	5 days
Further information	<a href="http://www.beckhoff.com/TR5042">www.beckhoff.com/TR5042</a>

## TR5050 | Building automation programming with BACnet and TwinCAT HMI

Information	TR5050
Content	TwinCAT PLC: TwinCAT handling, IEC 61131-3 programming; TwinCAT ADS: communication interface, high-level language communication; introduction to the communication between TwinCAT control systems; BACnet basics and possible implementation scenarios; BACnet basics in the TwinCAT 3 development environment; getting to know the TC3 BA TwinCAT Library
Requirements	assured handling of Windows operating systems, experience in PLC programming, knowledge of PLC programming with high-level languages, such as e.g. variable declaration, variable classes and structures, basic knowledge of BACnet
Duration	5 days
Further information	<a href="http://www.beckhoff.com/TR5050">www.beckhoff.com/TR5050</a>

## TR7050 | Basics TwinCAT HMI

Information	TR7050
Content	presentation of the system architecture; introduction to the development environment of TE2000 TC3 HMI; page switching and navigation; language and unit switching; creation of user controls; creation of specific themes; administration of alarms and messages; administration of users and groups; historical data and trend charts; responsive and fluid design; brief introduction to programming interfaces; presentation of diagnostic options; transfer of HMI to TF2000 TC3 HMI Server; configuration of TF2000 TC3 HMI Server
Requirements	assured handling of Windows operating systems
Duration	3 days
Further information	<a href="http://www.beckhoff.com/TR7050">www.beckhoff.com/TR7050</a>

## TR7060 | Add-on TwinCAT HMI Controls

Information	TR7060
Content	HTML, CSS and JavaScript basics; introduction to framework API; creation of individual framework controls; introduction to package management; integration of external libraries
Requirements	assured handling of Windows operating systems; experience with high-level languages; experiences with HTML, CSS and JavaScript are of advantage; contents of TR7050
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR7060">www.beckhoff.com/TR7060</a>

## TR7065 | Add-on TwinCAT HMI Server Extension

Information	TR7065
Content	presentation of TF2000 TC3 HMI Server; introduction to TF2200 TC3 HMI Server Extension SDK; creation of an individual server extension in C# .NET; introduction to package management; enhancement of the extension with a settings page, messages and individual error codes; integration of external libraries
Requirements	assured handling of Windows operating systems; experience with high-level languages; experiences with C# .NET are of advantage; contents of TR7050
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR7065">www.beckhoff.com/TR7065</a>



## TwinCAT 2 Training

### TR1000 | Compact programming

Information	TR1000
Content	TwinCAT PLC: TwinCAT handling, IEC 61131-3 programming; TwinCAT NC PTP: basics of axis commissioning; TwinCAT ADS: communication interface, high-level language communication
Requirements	sound knowledge of Windows operating systems; experience in PLC programming; knowledge of PLC or high-level language concepts such as declaration of variables, variable classes and structures
Duration	5 days
Further information	<a href="http://www.beckhoff.com/TR1000">www.beckhoff.com/TR1000</a>

### TR1020 | Programming for those switching from PLCs

Information	TR1020
Content	TwinCAT PLC: TwinCAT handling, IEC 61131-3 programming; TwinCAT NC PTP: basics of axis commissioning
Requirements	sound knowledge of Windows operating systems; experience in PLC programming
Duration	5 days
Further information	<a href="http://www.beckhoff.com/TR1020">www.beckhoff.com/TR1020</a>

### TR1010, TR1012 | Maintenance, repairs and service

Information	TR1010	TR1012
Content	TwinCAT PLC: TwinCAT handling, commissioning, IEC 61131-3 programming; TwinCAT NC PTP: basics of axis commissioning; TwinCAT ScopeView for diagnostics	same as TR1010, additionally overview of Structured Text programming
Requirements	sound knowledge of Windows basic functionalities; handling of PLC systems, such as logging in and out, saving PLC programmes, etc.	
Duration	4 days	5 days
Further information	<a href="http://www.beckhoff.com/TR1010">www.beckhoff.com/TR1010</a>	<a href="http://www.beckhoff.com/TR1012">www.beckhoff.com/TR1012</a>



## TR2020 | NC Point-to-Point

Information	TR2020
Content	operation of TwinCAT NC: functional plan, operating modes; NC control with NC MC2 library, cyclic interface, axis function blocks; TwinCAT ScopeView: recording of set value profiles; programming examples; TwinCAT cam plates and MC function blocks for cam plate functionality
Requirements	assured handling of TwinCAT PLC programming; solid knowledge of PLC programming; level of knowledge corresponding to courses TR1000/TR1020, or corresponding experience in IEC 61131-3 programming; programming languages: ST, Structured Text
Duration	2 days
Further information	<a href="http://www.beckhoff.com/TR2020">www.beckhoff.com/TR2020</a>

## TR2030 | NC Point-to-Point and NC Interpolation

Information	TR2030
Content	TwinCAT NC PTP: same as TR2020 without cam plates; TwinCAT NC I: creation of interpolation channels for single axes, creating NC programs in accordance with DIN 66025, sequential control with the System Manager, PLC libraries for creating NC channels and for controlling the interpreter, sequential control from the PLC, communication between NC program and PLC program (M functions), exchange of parameters between NC program and PLC (H, S and T), set value path monitoring with TwinCAT Scope
Requirements	assured handling of TwinCAT PLC programming, solid knowledge of PLC programming, level of knowledge corresponding to courses TR1000/TR1020 or corresponding experience in IEC 61131-3 programming, programming languages: ST
Duration	3 days
Further information	<a href="http://www.beckhoff.com/TR2030">www.beckhoff.com/TR2030</a>

## TR5010, TR5012 | Basic course in building automation for electricians

Information	TR5010	TR5012
Content	TwinCAT PLC: TwinCAT handling, overview of IEC 61131-3; handling Embedded PC CX; building automation library	same as TR5010, additionally overview of Structured Text programming
Requirements	sound knowledge of Windows operating systems	
Duration	3 days	4 days
Further information	<a href="http://www.beckhoff.com/TR5010">www.beckhoff.com/TR5010</a>	<a href="http://www.beckhoff.com/TR5012">www.beckhoff.com/TR5012</a>

## TR5030 | BACnet training: Basics of BACnet communication

Information	TR5030
Content	BACnet – the idea of an open standard for building automation; BACnet network media (data link layer); BACnet objects, structure and areas of application; services for data processing; alarms in BACnet; calendar and timer functions; logging objects (trendlog, eventlog); device and network management; analysis tools, diagnostic options; planning and tendering; BACnet certificate: what are the key issues?; Common directives and customer requirements for BACnet projects: What is required?; PICS, BIBBS – How is interoperability specified?; Integration of BACnet/IP in IT infrastructures; current status of BACnet for IPv4; IPv6 outlook; BBMD – area of use and application; MS/TP – The BACnet master/slave fieldbus; outlook on future developments: Web services, new objects, CSML
Requirements	beginner's seminar; no special knowledge required
Duration	2 days
Further information	<a href="http://www.beckhoff.com/TR5030">www.beckhoff.com/TR5030</a>

## TR8010 | TwinSAFE

Information	TR8010
Content	integration of TwinSAFE Terminals, handling the TwinSAFE configurator, using the TwinSAFE library
Requirements	experience in handling TwinCAT software
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR8010">www.beckhoff.com/TR8010</a>

## TR8011 | TwinSAFE AX5805 drive option card

Information	TR8011
Content	overview of the AX5805 option card functions, development of an example project, configuration of the option card
Requirements	experience in handling of TwinCAT software, experience in TwinCAT NC PTP, training contents of TR8010 or experience in TwinSAFE Terminals
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR8011">www.beckhoff.com/TR8011</a>

## TR8016 | TwinSAFE: Servicing and maintenance

Information	TR8016
Content	introduction to the EtherCAT bus system; diagnostics and service; introduction to the TwinSAFE system; development of a TwinSAFE project; diagnostics of the TwinSAFE system; hardware exchange service case
Requirements	training contents TR1010/TR1012
Duration	2 days
Further information	<a href="http://www.beckhoff.com/TR8016">www.beckhoff.com/TR8016</a>

## TR8020 | EtherCAT

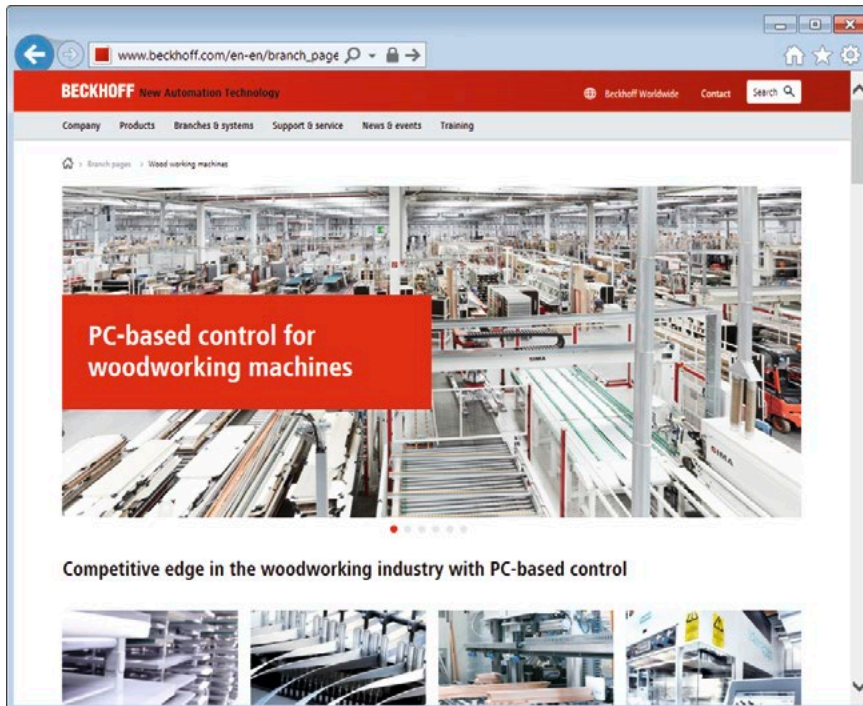
Information	TR8020
Content	EtherCAT basics, configuration in the System Manager, EtherCAT diagnostics (topology view, emergency scan), oversampling terminals
Requirements	experience in handling of TwinCAT software
Duration	1 day
Further information	<a href="http://www.beckhoff.com/TR8020">www.beckhoff.com/TR8020</a>

## TR1900 | TwinCAT Training: Individual

Information	TR1900
Content	agreed upon with the customer
Requirements	agreed upon with the customer
Duration	by arrangement
Further information	<a href="http://www.beckhoff.com/TR1900">www.beckhoff.com/TR1900</a>

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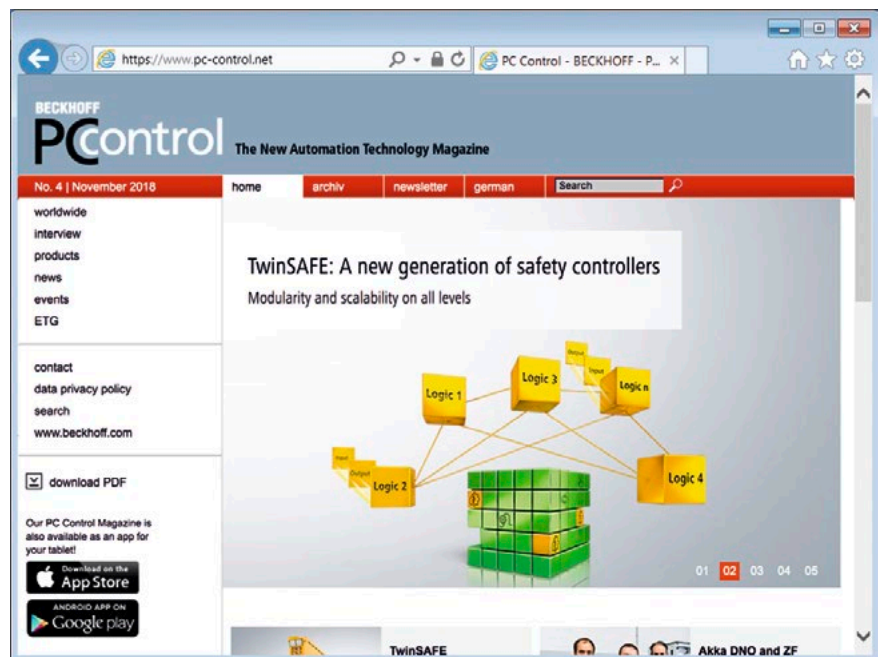
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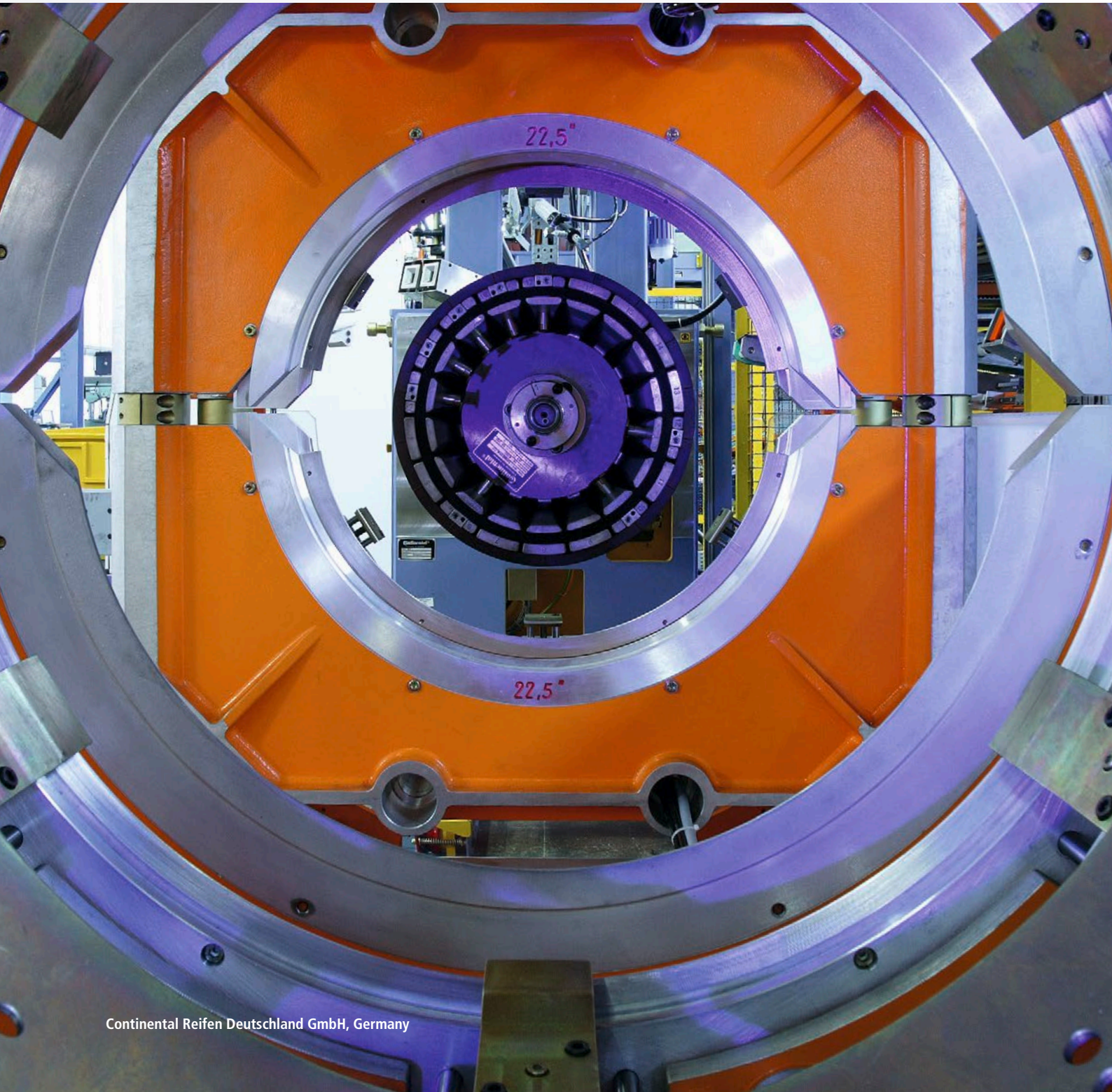
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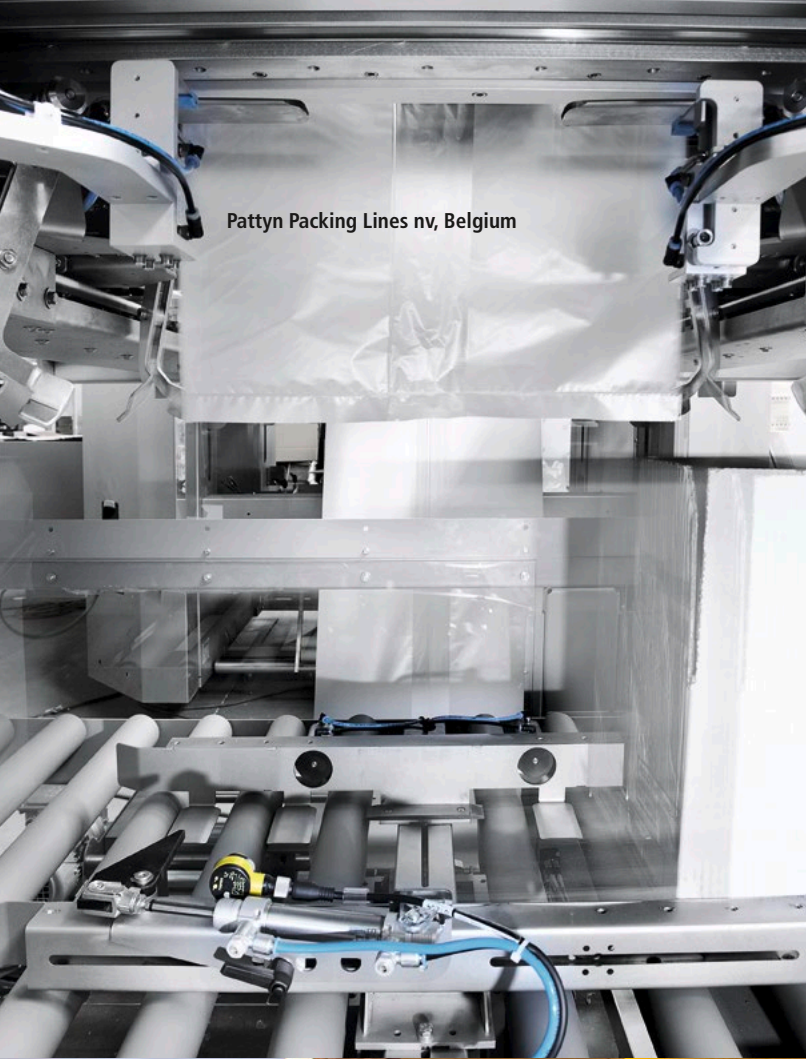
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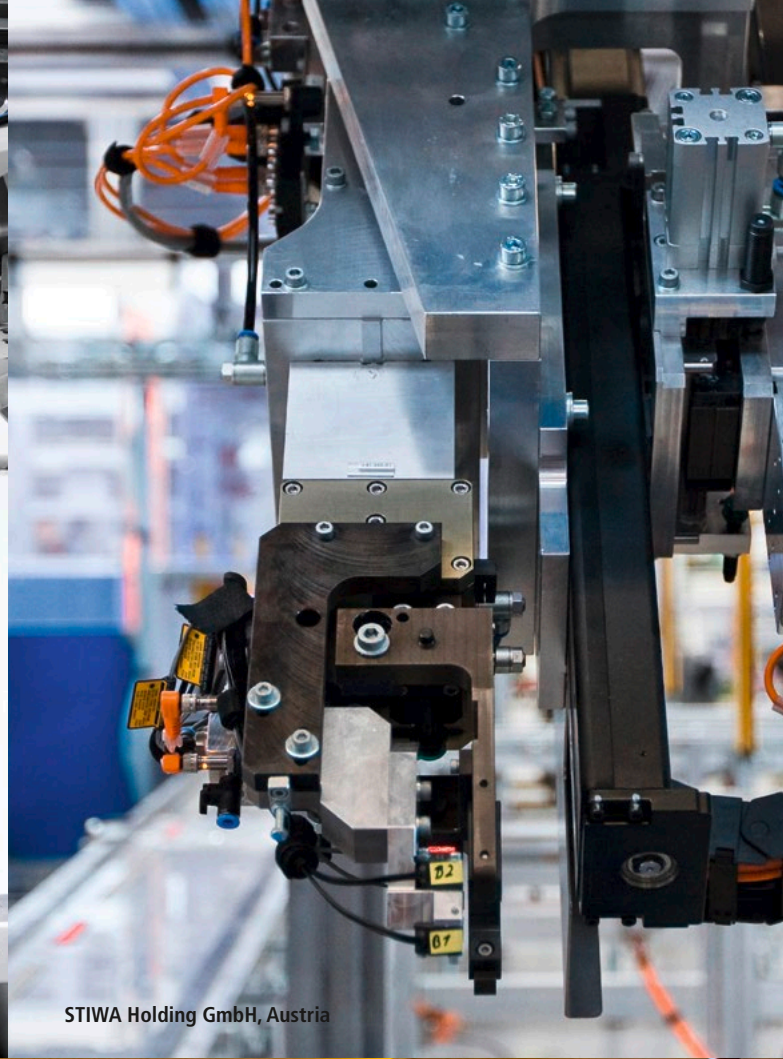


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# International units | Measures, weights and temperature

Linear measures	
1 inch (in)	25.4 mm
1 foot (ft)	30.48 cm

Square measures	
1 square inch (sq in)	6.4516 cm <sup>2</sup>
1 square foot (sq ft)	0.09290306 m <sup>2</sup>

Weights	
1 pound (lb)	453.59237 g
1 ounce (oz)	28.3495 g

Fahrenheit (°F)	Celsius (°C)
$t_F = 9/5 * t_C + 32$	$t_C = 5/9 * (t_F - 32)$

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