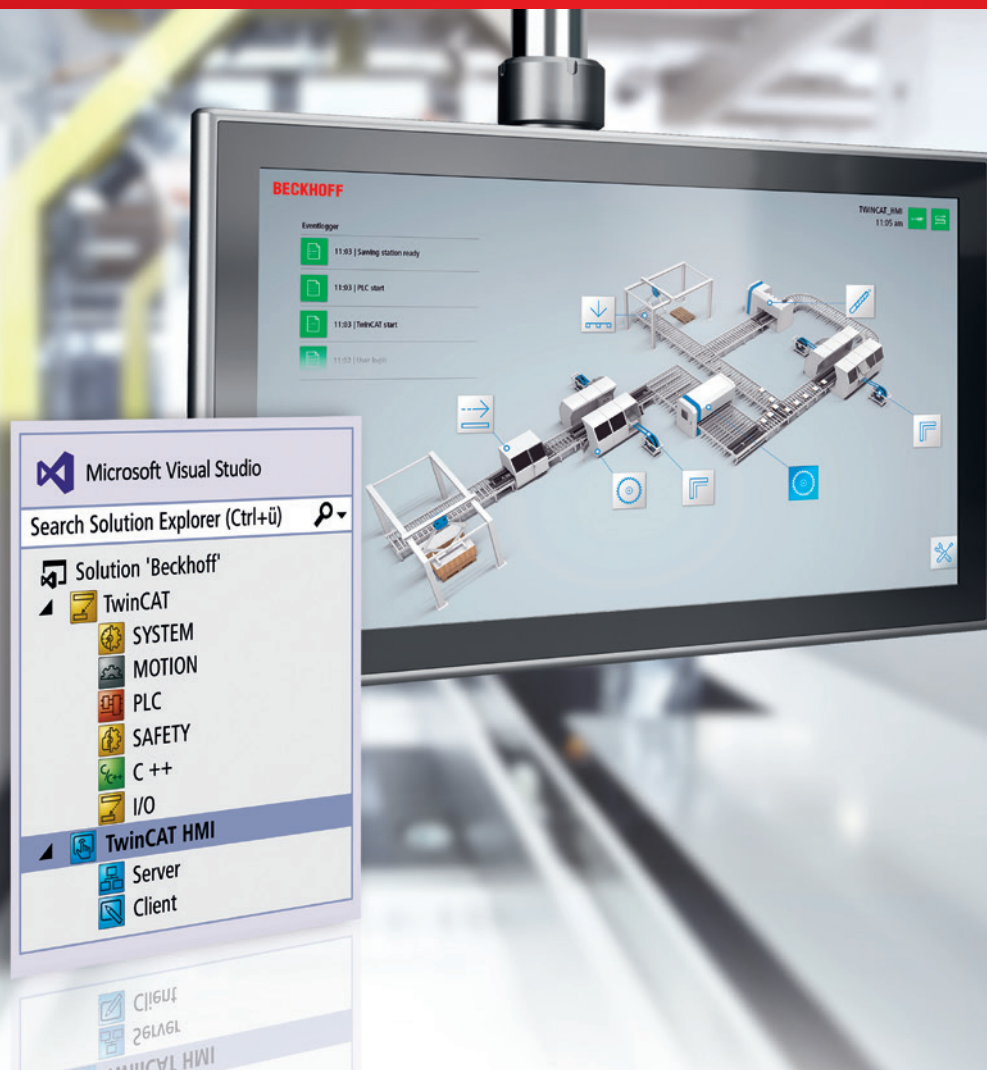# BECKHOFF New Automation Technology

Training information

Training

Beckhoff UK offer a selection of training courses for our products and technologies. Covering the topics found in the document below, these courses can be held at our regional training centers or at customer premises.
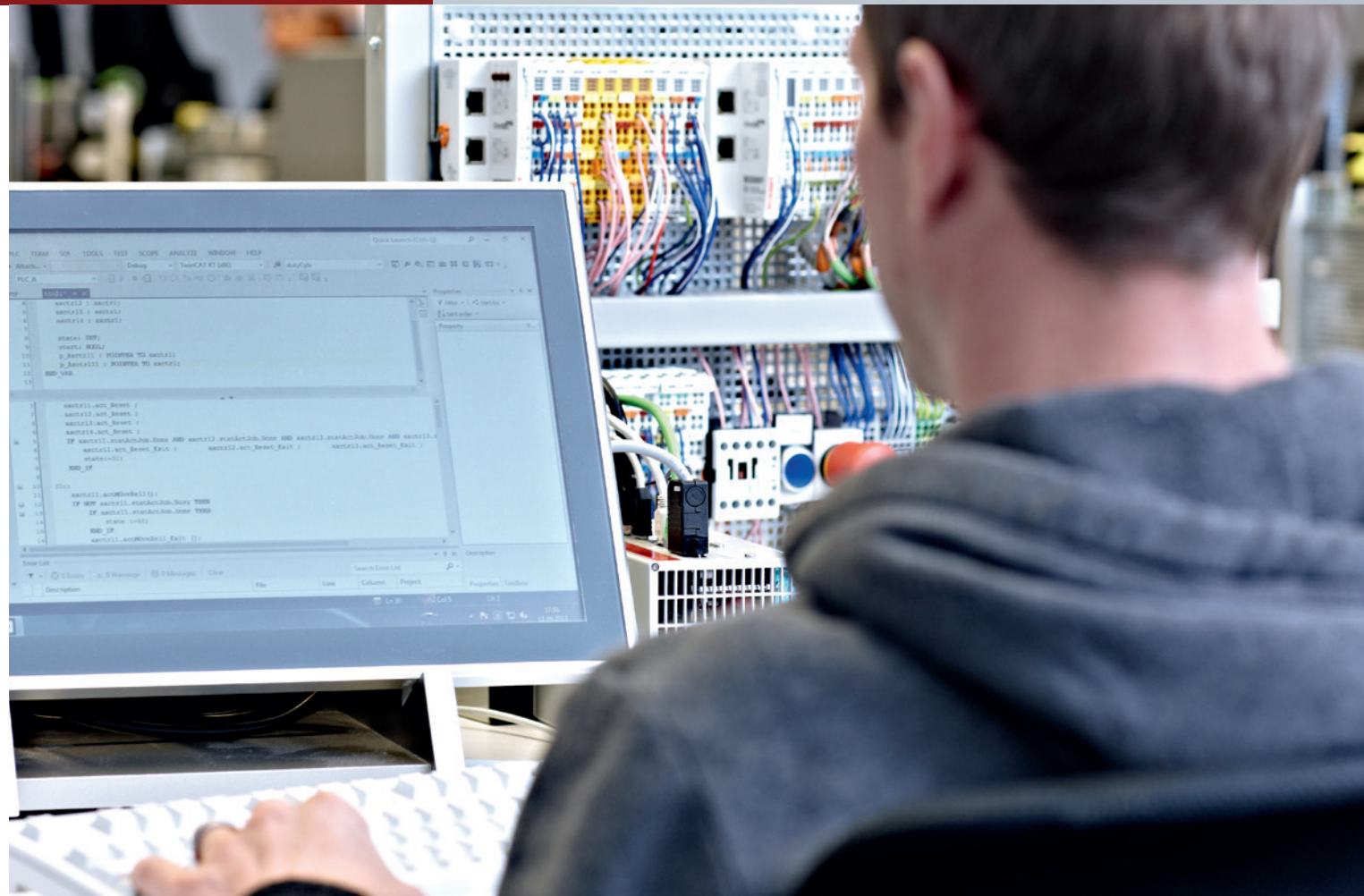
Please note that we offer both traditional classroom and online training courses to best suit your needs.

In addition to the standard training courses, we also offer – among other things – training courses with specialised content, based on your individual needs. The content of these courses will be discussed directly with you.

Please contact
training@beckhoff.co.uk
for more information.

Contents

TwinCAT 3 IEC 61131 PLC programming

Overview
This course focusses on PLC programming and hardware configuration using the TwinCAT 3 platform. Participants will learn about PLC programming with TwinCAT 3 and how to configure the hardware of a system using the Visual Studio shell. The training is based on the IEC 61131-3 standard. Advanced options such as object-oriented extensions of the IEC standard, module generation in C++ or high-level language visualisation interfaces are deliberately not included.

Goals
Understand the parts of TwinCAT 3 covered:
- navigate TwinCAT 3 Visual Studio shell
- navigate and configure TwinCAT Scope
- configure fieldbus and hardware
- understand ADS
- understand how to use the Beckhoff documentation
- fault-finding using Beckhoff documentation by applying the correct document to the fault
- be able to recreate the programs/systems studied after the completion of the course

Training code	BAGB-TRUK-3030-1000
Duration	2 days, 9:15 am – 5:00 pm
Prerequisites	Knowledge of programming and PC literacy

Agenda	
Day one	– General PLC Architecture – TwinCAT 3 Installation – First Project – Setting the PLC Cycle Time – Running in Simulation – IEC 61131-3 Introduction – Programs, Function Blocks and Functions
Day two	– Conditions – Structures and Arrays – Loops – Measurement Projects – Deploying onto hardware – EtherCAT configuration and diagnostics

TwinCAT 3 IEC 61131 PLC programming – online course

Overview
This video-based course covers the same topics as the in-person TwinCAT 3 PLC programming course, with modules that can be completed at your own pace. It focuses on PLC programming and hardware configuration using the TwinCAT 3 platform and the Visual Studio shell, based on the IEC 61131-3 standard. Advanced options like object-oriented extensions, C++ module generation, and high-level language visualization interfaces are excluded.

Goals
Understand the parts of TwinCAT 3 covered:
- navigate TwinCAT 3 Visual Studio shell
- navigate and configure TwinCAT Scope
- configure fieldbus and hardware
- understand ADS
- understand how to use the Beckhoff documentation
- fault-finding using Beckhoff documentation by applying the correct document to the fault
- be able to recreate the programs/systems studied after the completion of the course

Training code	BAGB-TRUK-3030-1010
Duration	Approx 2 days, up to a maximum of 14 days
Prerequisites	Knowledge of programming and PC literacy

Agenda	
	– General PLC Architecture – TwinCAT 3 Installation – First Project – Setting the PLC Cycle Time – Running in Simulation – IEC 61131-3 Introduction – Programs, Function Blocks and Functions – Conditions – Structures and Arrays – Loops – Measurement Projects – Deploying onto hardware – EtherCAT configuration and diagnostics

TwinCAT 3
IEC 61131 object oriented programming

Overview

This course focusses on the object orientation extensions of the IEC 61131 standard, and their implementation in TwinCAT 3. It assumes an existing familiarity with Object Oriented programming concepts but does cover some useful patterns that work well in the Industrial Automation environment.

Goals

Understand the parts of TwinCAT 3 covered:

- the benefits and limitations of OO programming in TwinCAT 3
- the 4 pillars of OO programming
- the differences between a Function Block and a Class
- Methods, Properties and Interfaces

Training code	BAGB-TRUK-3044-1000
Duration	1 day, 9:15 am – 5:00 pm
Prerequisites	TwinCAT 3 PLC programming course, OO programming experience

Agenda	
	– Classification
	– Basic idea of OO programming
	– Machine application
	– Elements
	– Observer Pattern

TwinCAT 3
realtime C++ programming

Overview

This course focusses on the use of C++ as a development language for TwinCAT Realtime. Participants will learn how to create and use C++ driver projects to create the TcCOM objects executed in TwinCAT Realtime. They will learn how to adapt these objects to suit different scenarios and cover debugging and online change capabilities.

Goals

Understand the constituent parts of the C++ implementation:

- using the C++ Project Template and TMC wizards
- navigate the generated files and folders of the projects
- bringing IO and user types into a project
- fault-finding using the Realtime debugging facility
- perform code changes using the online change function
- cover 64-bit driver signing using Tc Sign

Training code	BAGB-TRUK-3042-1000
Duration	1 day, 9:15 am – 5:00 pm
Prerequisites	TwinCAT 3 PLC programming course, C++ programming experience

Agenda	
	– C++ Overview
	– Installation
	– TcCOM and Sample Project
	– Requirements and Limitations
	– Build vs Publish
	– Online Changes
	– Modifying TcCOM Objects
	– Debugging

TwinCAT 3 realtime MATLAB® and Simulink® programming

Overview
This course focusses on the use of MATLAB® and Simulink® as development languages for the TwinCAT Realtime. Participants will learn how to compile MATLAB® programs and Simulink® models into TcCOM objects and then execute them on a TwinCAT Runtime target. They will learn how to adapt these objects to suit different scenarios and cover debugging and online change capabilities.

Goals
Understand the constituent parts of the MATLAB® and Simulink® tool chains:
- using the project and TMC wizards
- navigate the generated files and folders
- creating MATLAB® and Simulink® TcCOM Objects
- bringing IO and user types into a project
- fault-finding using the Realtime debugging facility
- perform code changes using the online change function
- 64-bit driver signing using Tc Sign

Training code	BAGB-TRUK-3043-1000
Duration	1 day, 9:15 am – 5:00 pm
Prerequisites	TwinCAT 3 PLC programming course, MATLAB® and Simulink® experience

Agenda	
	– MATLAB®/Simulink® Overview
	– TE14xx Architecture
	– Toolchain Installation
	– Licensing and Signing
	– 1st Project – TE1400 (Simulink®)
	– TwinCAT Interface and Settings
	– Online Change and Versioning
	– Simulink Build Options
	– Calling the module from the PLC
	– 1st Project – TE1401 (MATLAB®)
	– Calling module as a TcCOM Object
	– Using the Automation Interface

TwinCAT 3 point-to-point motion control

Overview
This training focusses on the topic of TwinCAT NC PTP positioning. The target group consists of users who are familiar with programming with TwinCAT PLC and who now wish to familiarise themselves with the TwinCAT NC extension.

Goals
Understand the parts of TwinCAT 3 covered:
- navigate TwinCAT System Manager
- creation of TwinCAT NC axis
- navigate TwinCAT PLC Control
- navigate TwinCAT Software Scope
- identify Beckhoff IO components (hardware and software)
- be able to recreate the programs/systems studied after the completion of the course by applying the correct document to the fault
- be able to recreate the programs/systems studied after the completion of the course

Training code	BAGB-TRUK-3050-1000
Duration	1 day, 9:15 am – 5:00 pm
Prerequisites	TwinCAT 3 PLC programming course

Agenda	
	– NC commissioning interface
	– Commonly used parameters
	– PLC Control of the NC
	– Drive commissioning and tuning

TwinSAFE with TwinCAT 3

Overview

This course is designed to give you a firm foundation of knowledge on TwinSAFE hardware and software. TwinSAFE architecture concepts and practical examples of Boolean and Analogue safety projects are covered in the course to aid you in the design and completion of your first TwinSAFE project.

Goals

Understand the parts of TwinSAFE covered:
- identify Beckhoff TwinSAFE IO components (hardware and software)
- identify which architecture you require for your project
- navigate TwinCAT 3 and the TwinSAFE editor
- be able to create both digital based and analogue based safety logic diagrams

Training code	BAGB-TRUK-3068-1000
Duration	1 day, 9:15 am – 5:00 pm
Prerequisites	TwinCAT 3 PLC programming course, familiarity with Machine Safety requirements

Agenda	
	– Introduction to the TwinSAFE concept
	– Introduction to the TwinSAFE editor
	– Configuring a basic TwinSAFE project
	– How to diagnose your project
	– Configuring an extended TwinSAFE project with analogue safety

TwinCAT HMI (TE2000) programming

Overview

The focus of this training course is to provide fundamental knowledge of the web based TwinCAT HMI. Participants will be guided through building a simple, yet complete, HMI project. This will allow them to familiarise themselves with the engineering environment, learn key development concepts and get an overview of the tools and features included in the HMI product.

Goals

Understand the parts of TwinCAT HMI covered:
- navigate TwinCAT 3 HMI from within Visual Studio
- understand design principles using Beckhoff controls
- connect to a PLC program and interact with variables from the HMI
- understand HMI logic developed through a graphical interface
- design re-useable elements
- develop and deploy your own HMI project after the course

Training code	BAGB-TRUK-7050-1000
Duration	2 days, 9:15 am – 5:00 pm
Prerequisites	Basic knowledge of HMI design and PLC theory

Agenda	
Day one	– TwinCAT HMI Installation
	– Key concepts
	– HMI Project Builder
	– User Controls
	– Action Templates
	– EtherCAT Diagnostics
	– Themes
	– Publishing a project
Day two	– Alarms
	– User Management
	– Adding Videos and Documentation
	– Recipe Management
	– TwinCAT HMI Scope
	– Mobile clients

Vision with TwinCAT 3

Overview
In this course you will learn the basics of TwinCAT Vision, how to connect cameras and work with offline file sources, and to make use of the TwinCAT 3 Vision libraries. At the end of the course, you will know the structure and working method of TwinCAT Vision and will be able to solve your first image processing tasks independently.

Goals
Understand the parts of TwinCAT 3 Vision covered:
- Understand to the functionality of TwinCAT Vision
- System design using Beckhoff IPC and GIGE Vision Cameras
- create TwinCAT Vision configurations, using GIGE Cameras and File source
- use the TwinCAT Vision library
- create and execute sample code based the 3 core TwinCAT 3 Vision Libraries, Code reading, Measurement and matching.

Training code	BAGB-TRUK-3091-1000
Duration	1 day, 9:15 am – 5:00 pm
Prerequisites	TwinCAT 3 PLC programming course, general Machine Vision proficiency

Agenda	
	– Overview of TwinCAT 3 Vision architecture
	– Installation of required software
	– Configuration of project
	– Image sources
	– Base functions
	– Edge Detection example
	– TwinCAT HMI integration

XTS with TwinCAT 3

Overview
This course focusses on the XTS hardware, and configuring and programming an XTS system using TwinCAT 3.

Goals
Understand the parts of XTS system covered:
- the XTS modules, movers and position feedback technology
- track options
- architecture of the software components of the XTS system
- interaction between the hardware and software over EtherCAT
- programming of a multi-station machine with queuing performed with Collision Avoidance groups

Training code	BAGB-TRUK-3056-1000
Duration	2 days, 9:15 am – 5:00 pm
Prerequisites	TwinCAT 3 PLC programming course

Agenda	
Day one	– XTS Overview
	– Quick start
	– XTS Modules
	– XTS Movers
	– XTS Tracks
	– Electrical considerations
	– EtherCAT configuration for XTS
Day two	– XTS Soft drives
	– XTS PLC Library
	– Collision Avoidance
	– XTS Programming Examples

XPlanar with TwinCAT 3

Overview
This course focusses on configuring and programming an XPlanar system using TwinCAT 3.

Goals
Understand the parts of XTS system covered:
- the tiles and movers and how they work together
- layout of tiles and EtherCAT network planning
- configuring an XPlanar system in TwinCAT 3
- programming of an XPlanar machine
- diagnose errors using TwinCAT 3 and the available documentation

Training code	BAGB-TRUK-3156-1000
Duration	2 days, 9:15 am – 5:00 pm
Prerequisites	TwinCAT 3 PLC programming course

Agenda	
Day one	– XPlanar overview
	– Application suitability discussion
	– XPlanar and IPC hardware selection
	– Software installation
	– Software architecture
	– Project configuration
	– XPlanar library
	– Basic programming
Day two	– Track Theory and Design
	– Track Programming
	– Recovery strategies
	– Advanced Programming
	– Common errors
	– Diagnostics
	– EtherCAT G
	– TwinCAT HMI integration

TwinCAT 3 maintenance training

Overview
This course is aimed at Maintenance Engineers, and focusses on hardware diagnostics, tracing signals in and out of existing PLC code and making small changes to existing systems. It is somewhat flexible in its content, allowing for customer-relevant modules to be added to the core content. It can be presented on-site, allowing for a discussion of any specific considerations for the hardware that is in use. The course content to be presented is defined when booking.
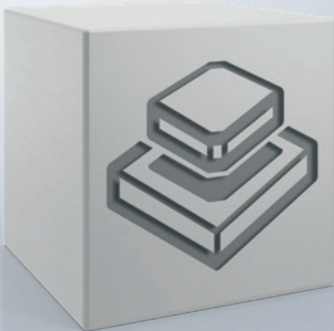
Goals
Understand the TwinCAT system with emphasis on maintenance tasks:
- navigate TwinCAT 3 Visual Studio shell
- navigate and configure TwinCAT Scope
- monitor and diagnose fieldbuses and hardware
- understand how to use the Beckhoff documentation
- fault-finding using Beckhoff documentation by applying the correct document to the fault
- replace hardware with awareness of where hardware settings are stored

Training code	BAGB-TRUK-3012-1000
Duration	1 day, 9:15 am – 5:00 pm
Prerequisites	Knowledge of programming and PC literacy

Agenda	
Core content	– Beckhoff Automation Concept
	– EtherCAT overview and diagnostics
	– IO hardware and power supply considerations
	– TwinCAT 3 Measurement Projects
	– TwinCAT 3 Licensing
	– Remote Manager
Optional Modules	– TwinCAT 3 NC (Motion Controller) diagnostics
	– Drive diagnostics
	– TwinSAFE diagnostics
	– Beckhoff Service Tool usage

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