

BECKHOFF New Automation Technology

TwinCAT/BSD: the proven TwinCAT real-time now in a non-Windows controls platform

TC/BSD



Powerful, flexible, secure: TwinCAT/BSD

At Beckhoff, we have built our reputation on manufacturing leading-edge, industrial-hardened control systems based on non-proprietary systems since our founding in 1980. The new non-Windows operating system – TwinCAT/BSD – continues this legacy and expands possibilities for proven Beckhoff hardware. As an alternative PLC target, TwinCAT/BSD charts a different path, but preserves all key features of the TwinCAT automation software and greatly enhances performance in many areas.

Ideal for applications across industries, TwinCAT/BSD combines the TwinCAT 3 runtime with a modern, non-Windows operating platform. The

result increases long-term availability for the underlying controls platform and reduces license costs.

The TwinCAT/BSD difference

Practically all modern PLC vendors no longer use custom “firmware” developed in-house. While this was true for the PLCs of the past, nearly all current platforms utilize a modified commercially available real-time operating system (RTOS). Generally, these are based on a UNIX or Linux kernel adapted for the individual vendor’s hardware designs.

These designs typically limit the potential functionality of both the underlying OS and the



hardware in multiple ways. For example, most third-party controllers with multiple processor cores greatly reduce flexibility by not allowing engineers to designate individual cores to handle specific functions. The Beckhoff platform, on the other hand, enables core isolation, so a quad-core controller could run one PLC program for machine control on Core 0, another for data analysis or machine learning on Core 1 and motion control on Core 2, while preserving the final core for future additions.

TwinCAT/BSD offers the best of both worlds, combining TwinCAT real-time execution of PLC code and a flexible, industrially proven OS.

This flexibility extends to hardware as well; the system supports 64-bit platforms for scalable systems with ARM® CPUs extending up to powerful Intel® Xeon® CPUs. If desired, the low footprint, industrial-hardened control system can be utilized in a more traditional stand-alone PLC application where the HMI resides on secondary hardware.

Through flexibility and simplicity, TwinCAT/BSD retains the system openness and performance that are hallmarks of New Automation Technology from Beckhoff.

► www.beckhoff.com/twincat-bsd



Core benefits of TwinCAT/BSD

With the improved accessibility to the base OS, TwinCAT/BSD gives controls engineers greater flexibility to build innovative solutions:

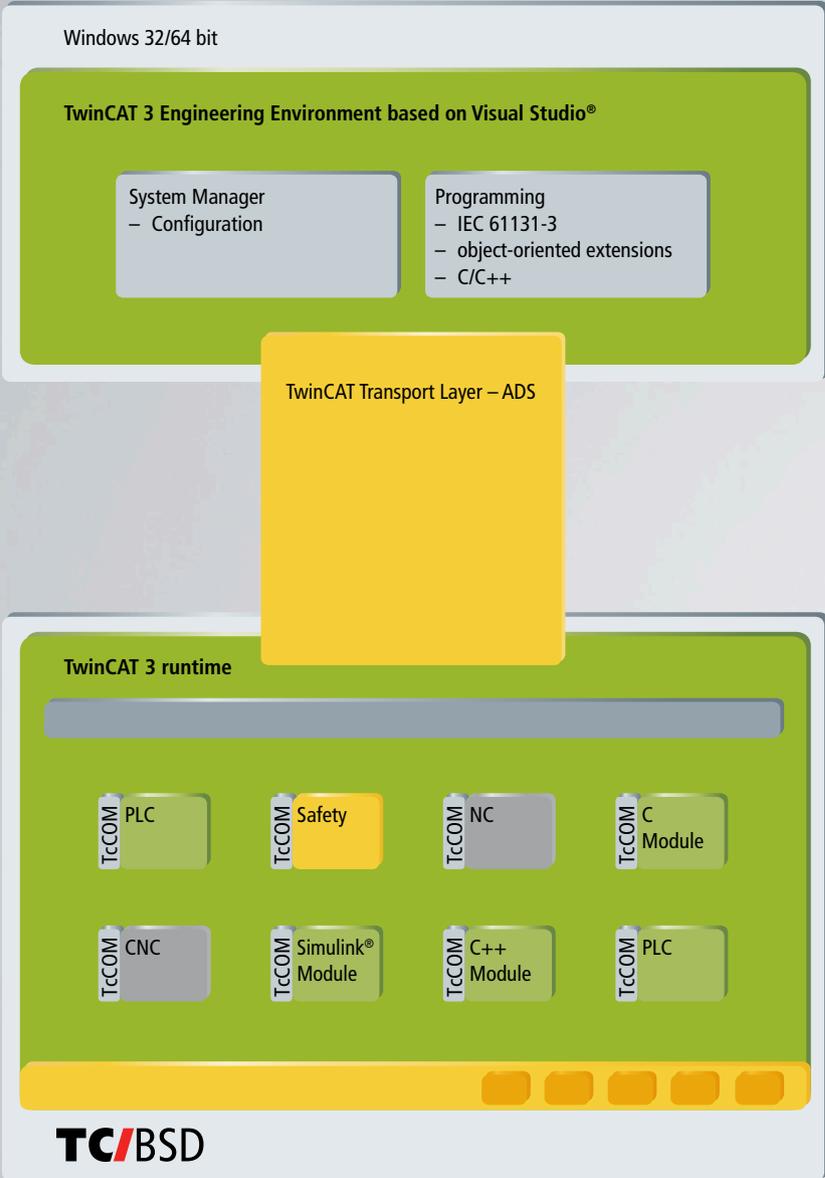
- implement all TwinCAT 3 runtime functions
- run machine control logic on scalable embedded controllers in electrical cabinets and controllers built into multi-touch HMI panels in the field
- program in the familiar TwinCAT 3 XAE (eXtended Automation Engineering) environment in Microsoft Visual Studio® from a development computer or a web browser using TwinCAT Cloud Engineering
- preserve multi-core and many-core support: individual cores can be reserved for exclusive use by TwinCAT real-time
- support TwinCAT HMI Server and an HTML5 web browser: modern HMI software runs on the machine controller
- allocate cores to controls tasks, making full use of hardware capabilities
- add functionality to the controller via one uniform software platform versus adding single-purpose “black box” hardware
- host PLC, HMI, analytics, machine learning, IoT, integration of additional fieldbus systems, high-level communications protocols, data logging and more locally on the same device
- utilize the local file system to log data to local files, as well as host databases, recipe files or help manuals/PDFs/videos

Extended platform for TwinCAT automation software: familiar programming

Accelerating time to market and reducing engineering efforts are key requirements to be competitive in today's industrial automation landscape. Controls code must be reusable from project to project, controller to controller, as each project's needs and scale change. TwinCAT/BSD helps distribution centers and machine builder OEMs meet these challenges by expanding possibilities for Beckhoff machine controllers. By retaining the familiar XAE environment, existing TwinCAT projects and code can simply redeploy to TwinCAT/BSD with minimal engineering effort. TwinCAT projects can also move to different hardware platforms

and scale depending on application requirements with no code rewriting.

Full customization remains possible with TwinCAT/BSD, along with an increased platform lifetime and availability for older devices. Simply put, the TwinCAT real-time kernel is combined with our modern BSD-based OS to provide an additional platform option when users and applications call for it. Of course, Beckhoff will continue to support Windows operating systems in new and already installed controller hardware. In both OS options, the TwinCAT real-time offers the same power, reliability, security and openness from the Beckhoff product portfolio.



TwinCAT/BSD and eXtended Automation Engineering

- program in the language fits your organization: traditional PLC code up to modern computer science standards
- move existing TwinCAT code between Windows and TwinCAT/BSD without rewriting
- easily scale TwinCAT projects from small to large complex applications
- harness the power, reliability and security of a modern BSD-based operating system



eXtended Automation Engineering (XAE)



eXtended Automation Runtime (XAR)

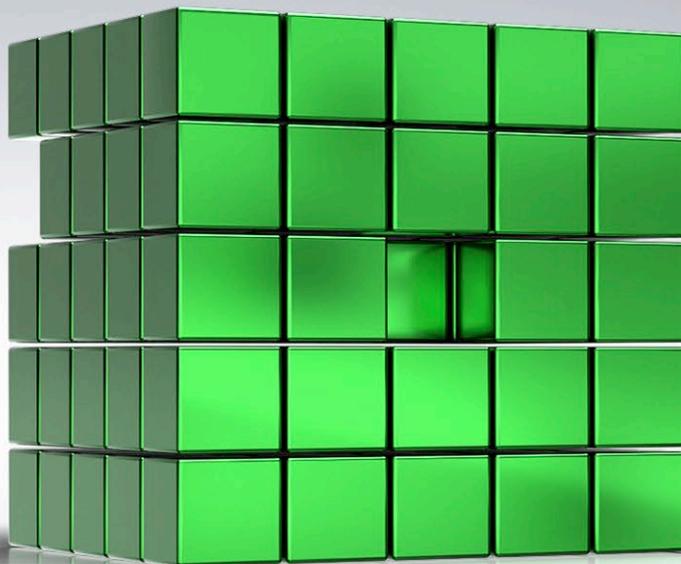
TwinCAT for engineering and runtime: the comprehensive automation platform

The TwinCAT automation suite forms the core of the Beckhoff machine control system. The TwinCAT software system provides a real-time control platform with multiple PLC, C++, Motion Control, CNC and/or robotics runtime packages. TwinCAT/BSD provides a non-Windows system target option with the same robust functionality.

Through the recent introduction of TwinCAT Cloud Engineering, programming can now take place on any computer or mobile device via a standard web browser. An ever-increasing list of leading edge capabilities – including integrated Vision and Machine Learning as well as

engineering tools for advanced data analytics and mechatronic systems – extend the platform's capabilities to enable the implementation of Industrie 4.0 and IoT concepts.

► www.beckhoff.com/TwinCAT3



MATLAB®/Simulink®
for virtual machine
development



Customer
intellectual property



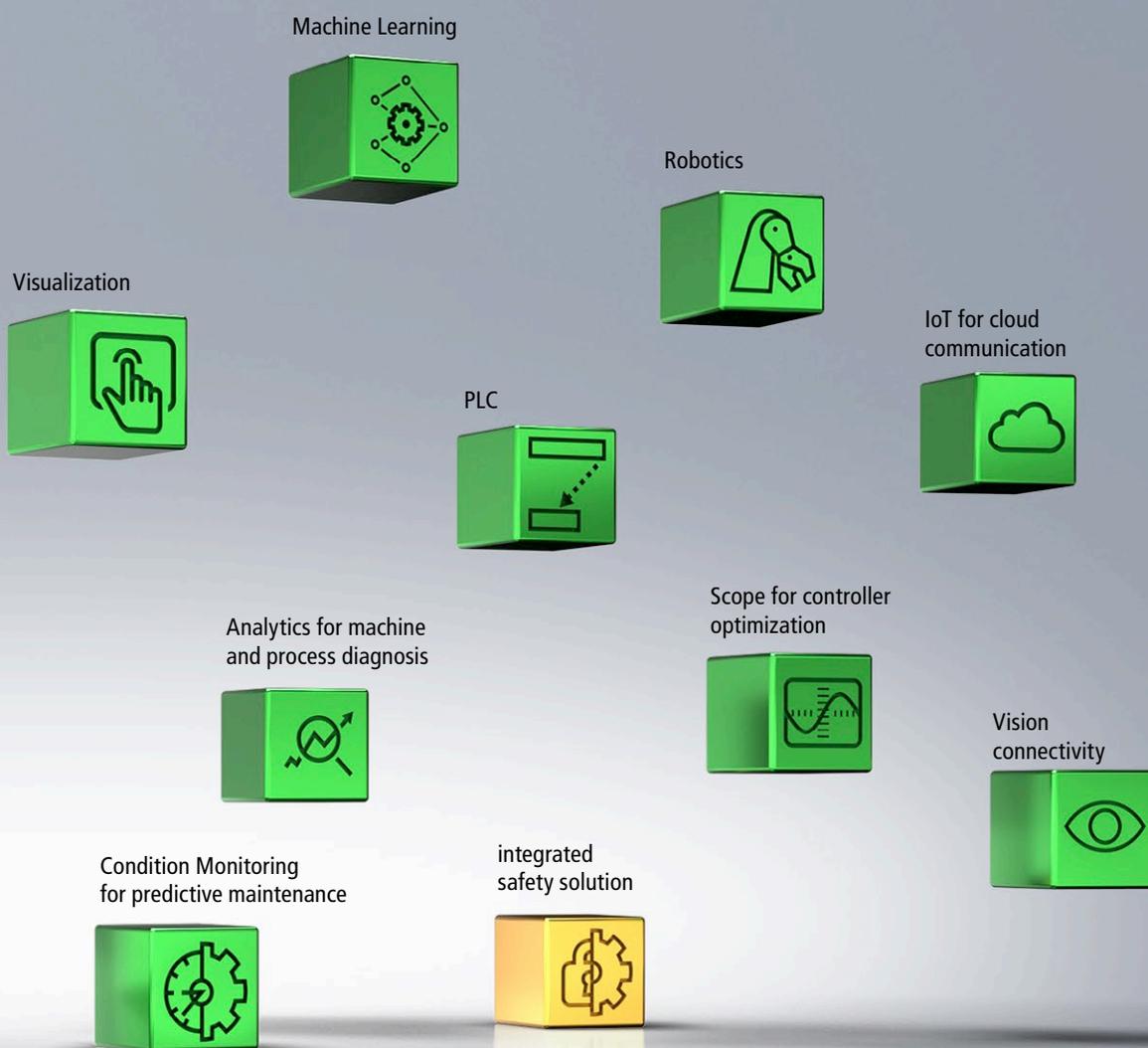
Motion control



TwinCAT® 3

TwinCAT 3 highlights

- one software platform for programming and configuration
- Visual Studio® integration
- integration of programmer collaboration tools such as Git
- total freedom in selecting programming languages
- support for the object-oriented extension of IEC 61131-3
- use of C/C++ as the programming language for real-time applications
- generate real-time code from MATLAB®/ Simulink®
- open interfaces for expandability and adaptation to the complete landscape of tools
- flexible runtime environment
- active support of multi-core and many-core hardware platforms



Maintaining proven performance: modern functionality in TwinCAT/BSD

In modern controls environments, every PLC requires periodic updates to ensure the highest possible performance and mitigate emerging security threats. TwinCAT/BSD preserves the well-known capabilities of the standard Beckhoff controls system while adding new functionality for a best-in-breed automation platform that is secure and easy to use.

► www.beckhoff.com/twincat-bsd

Advantages in material handling and intralogistics

- optimal platform for AS/RS, sorting, gapping, palletizing, AGV and other systems
- high security requirements for e-commerce and connected operations
- modularity and flexibility needed for constantly changing package types and processes
- enables onboard TwinCAT IoT, Analytics, Scope (digital oscilloscope) and Machine Learning for process optimization, predictive maintenance and more

Software and updates

1

TwinCAT/BSD combined with the Beckhoff Package Server offers a simple option for installing TwinCAT functions or updating the entire system. As with PLCs based on so-called "firmware," the Beckhoff platform can perform updates to the system and the TwinCAT runtime locally at the controller. Additionally, TwinCAT/BSD can easily perform updates securely from the web or internally via the end user facility's network. Updates completed via the end user's network can also be integrated into the IT infrastructure update processes. Updates to TwinCAT/BSD and TwinCAT programming software are free of charge and do not require a maintenance contract.

Additional software packages can also be installed on the system, such as additional TwinCAT functions. The software packages are first loaded to a development computer with a network connection and later installed directly on the Beckhoff machine controller. The hosting of the customer's own package server on their network is also possible or updates can be handled directly via a cloud accessible package server. Third-party functionality can be installed on the system via FreeBSD packages or as Linux-compatible binaries.

Security and protection

2

With powerful security measures designed in, TwinCAT/BSD provides a secure platform for the toughest, security-conscious applications, including critical infrastructure. TwinCAT/BSD applies the robust security of a modern UNIX system to industrial contexts. By leveraging the advantages

of this technology, TwinCAT/BSD promises simple configuration, extensions and customizations as desired by the individual programmer. The multiple update options keep the system secure from emerging external threats.

- the leading master controller for the world's fastest fieldbus: EtherCAT industrial Ethernet system
- integrated functional safety via TwinSAFE in the same controls architecture
- supports leading-edge mechatronics solutions, such as the eXtended Transport System (XTS) from Beckhoff



Backup and restore

3

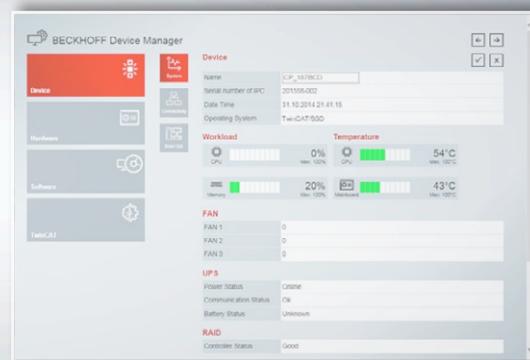
A TwinCAT/BSD system can be backed up and restored via network connection or by simple use of a USB stick. This is similar to functions offered with the Beckhoff Service Tool for Windows operating systems. A backup can also be created from the live system, which is handled locally or via

the network to a remote system. In addition, TwinCAT/BSD preserves a popular file "write filter" to protect the system against any unauthorized changes. With the write filter activated, the system will always start in a previously defined state.

Device Manager

4

The already well-known Device Manager for Beckhoff machine controllers is also used for the configuration and diagnostics of the system under TwinCAT/BSD. This can be done via the on-board Device Manager website, via PLC code, programming API or communication protocols such as ADS Secure or OPC UA.



Beckhoff at a glance

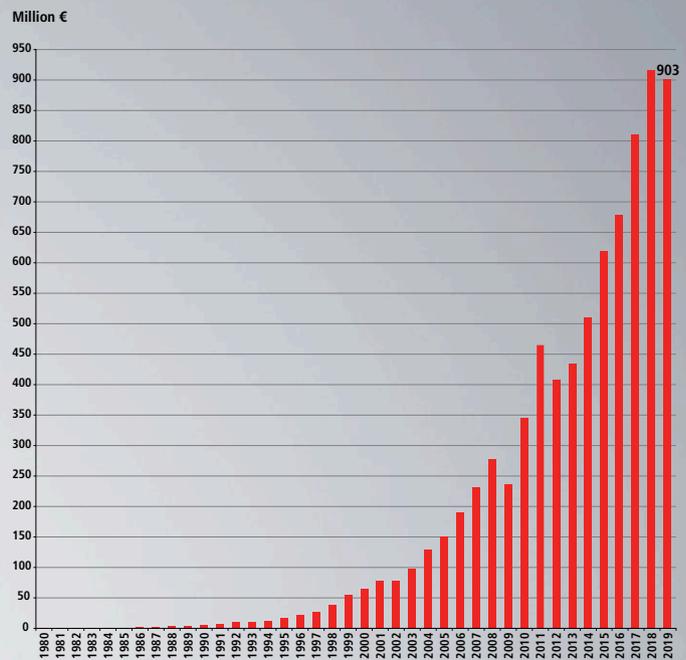
- headquarters: Verl, Germany
- 2019 sales: € 903 million (+1%)
- employees worldwide: 4,350
- offices in Germany: 23
- subsidiaries/representative offices worldwide: 39
- distributors worldwide: in 75 countries

(as of 04/2020)

Further information

The Beckhoff catalogs and flyers are available for download on our website.

► www.beckhoff.com/media



Sales development

■ Headquarters ■ Distributor
● Subsidiary

Learn more about TwinCAT/BSD, the new alternative operating system for Beckhoff machine controllers – visit us online!

► www.beckhoff.com/twincat-bsd

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