

IEC 61131-3

Extended range of functions and new features with TwinCAT 3.1

IEC 61131-3
Objectoriented extensions



Author: Dr. Josef Papenfort,
TwinCAT Product Manager, Beckhoff

More effective software engineering with TwinCAT 3.1

The integration of Visual Studio® into TwinCAT connects the standard development environment from Microsoft with the proven Beckhoff automation technology. It is evident that the product philosophies of TwinCAT and Visual Studio® are ideally suited to each other. The result of this integration is simplified software engineering for automation technology: the programming languages and platforms are freely selectable. Source code control tools can be simply integrated and the automatic generation of code will replace many manual steps in the future. The TwinCAT runtime system enables the distribution of the tasks to different cores and will thus increase the performance several times over. 64-bit operating systems are also supported from TwinCAT version 3.1, which will be presented for the first time at SPS IPC Drives 2012 trade show in Germany. The TwinCAT runtime can now also be used alongside the engineering environment on PCs with these 64-bit Windows versions.



The successful execution of large software projects in the IT world is based on a method that supports tools developed over many years. The question of whether one can also use this method and IT tools in automation technology can be answered with TwinCAT 3. Beckhoff has sought for and pushed the convergence of the worlds of IT and automation since the introduction of PC-based Control technology: first of all, Beckhoff made the "primary" IT tool – the PC – work for automation technology in 1986. This enabled users to make use of the great advantages of PC technology – price, performance and familiar "look and feel" – for machine automation too. With TwinCAT 2, Beckhoff opted as early as 1996 for the modern Windows operating system and for IEC 61131 as the programming standard. In the development of EtherCAT, the Ethernet world familiar from IT was mixed with experience from Beckhoff in numerous fieldbus systems; the result was the most successful Ethernet-based fieldbus. With TwinCAT 3 Beckhoff uses Microsoft Visual Studio® as the foundation and integrates the configurators and programming languages necessary for automation technology, such as IEC 61131 or Matlab®/Simulink®. The programming

languages native to Visual Studio® such as C/C++ or the .NET languages such as C# can still be used.

Freedom in the choice of programming languages

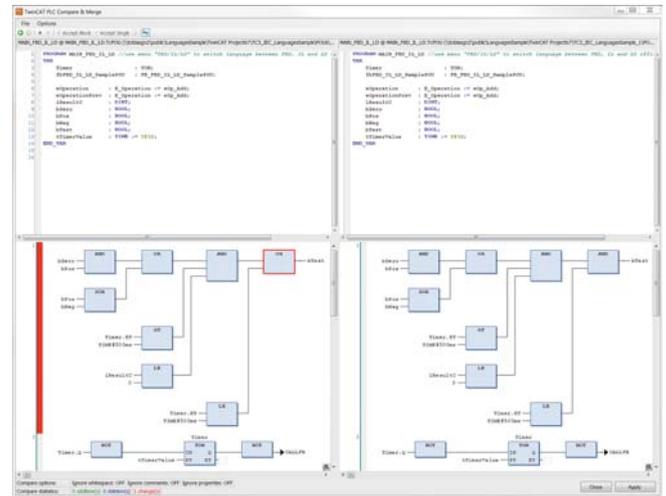
Visual Studio® from Microsoft is by far the world's most used tool for software production. With TwinCAT 3 this tool can now also be used to great effect for automation technology. Visual Studio® is a platform that encompasses several programming languages and provides programmers with the possibility to use the language with which they are most adept and which is most suitable for the solution to the problem or task at hand. TwinCAT 3 supplements the list of languages with IEC 61131, the language of PLC programmers for standard and safety PLCs. The integration of Matlab®/Simulink® can also be pointed to as a further language. Those who wish to create control tasks or a simulation can use the Matlab®/Simulink® package made available by Mathworks with TwinCAT 3. C or C++ code is then created via the coder and suitably compiled in Visual Studio®. The Visual Studio® philosophy of making various programming languages available is thus supplemented in TwinCAT 3 by the languages that are important for automation.

Support for different platforms

The paradigms of Visual Studio® additionally include the fact that different platforms are made available to the programmer in a single tool. In addition to the code generators for the .NET world, there are also further different platforms such as the 32-bit or 64-bit operating systems as well as the well-known Windows operating systems XP/Windows 7/Windows 8 or CE with C/C++. Naturally, ARM platforms are supported in addition to the x86 processors. The TwinCAT system is designed in exactly the same way: PLC and Motion Control are executable on different controller platforms with different processors and on different operating systems without the programmer having to adapt the software. The problem is solved by having different code generators. As a result, the TwinCAT components are once again well suited to the architecture of Microsoft Visual Studio®. The runtimes for the 64-bit operating system and the CE platforms are supported with TwinCAT version 3.1.

TwinCAT 3.1: new items at a glance

- TwinCAT 3.1 (pre-release)
 - Runtime also for 64-bit operating systems
 - PLC runtime for Windows CE (x86)
 - Improved integration of source code control databases (such as Team Foundation Server)
 - Automation interface (automatic code generation)
 - Open CNC interfaces (transformations)
 - Scope configuration in Visual Studio®
 - Integration in Visual Studio® 2012
- Condition Monitoring release
- TwinCAT Scope Professional
 - Long-term recording
 - Integration in the user HMI
 - Reporting/print functions
- OPC UA
 - PLCopen-compliant function blocks



Project comparison in TwinCAT 3

Integration of configurators

Apart from the programming, a configuration part is also always required. Visual Studio® has many configurators for different compiler and debugger options. TwinCAT 3 supplements Visual Studio® with the System Manager familiar from TwinCAT 2. The configuration of system properties, of axes for Motion Control applications, of PLC and safety PLC projects and of course the configuration of fieldbuses and fieldbus components, is integrated in a single project – the so-called solution.

Debuggers make life for programmers easier

Those who program naturally must also debug. Programmers rightly want a debugger here that they are as familiar with as possible and with which they can track down errors quickly and effectively. For C/C++ that is the proven debugger included in Visual Studio®. TwinCAT 3 uses it and extends its functions in order to enable the debugging of applications that run in the TwinCAT hard real-time. If an application is created in Matlab®/Simulink®, then the programmer values the possibility to debug in their tool – Matlab®/Simulink®. PLC programmers, conversely, want a PLC debugger: the monitoring of current values, sequence control in all languages and also the use of breakpoints are on the wish list here. All of this is possible with TwinCAT 3 and is completely integrated into Visual Studio®.

Use of existing know-how

In parallel to Visual Studio®, which encompasses a series of packages and libraries that facilitate programming, TwinCAT provides more than 70 different libraries and tools for the most diverse functions. This puts the programmer in the position of not always having to reinvent the proverbial wheel, but of being able to build on existing know-how.

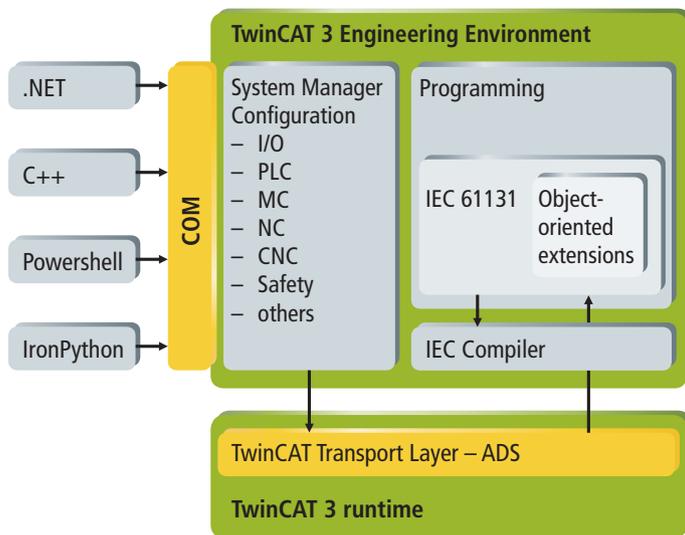
Modular programming

With the aid of software modules, re-usable functions can be simply encapsulated, tested and released. As a result, these modules can be used in further projects with no great effort. An elementary prerequisite for this is the definition of interfaces. In addition, a mechanism is required in order to use functions from different manufacturers in a skillful and safe way. Microsoft has developed the Component Object Model (COM) for this. The COM technology has been adapted for automation technology in TwinCAT 3. TwinCAT modules – regardless of the programming language in which they were written – can call and use methods of other modules at runtime under real-time conditions, so that re-use is simplified.

Source code databases for automation technology

Applications in IT and in automation technology have a tendency to become increasingly extensive. In order to cope with the extra software, a database for the management of the source code has long been used in IT – a solution that is also recommended for automation applications. So that users do not have to get accustomed to new, special tools, all known source code control tools that have a plugin for Visual Studio® are supported in TwinCAT 3.

Many new features are available in TwinCAT 3.1 for the source code control tools. In order to store source code sensibly, all source code for programming and configuration must first of all be stored as a text file, and that must of course be done for each object – e.g. for each function block – in a single file. TwinCAT uses XML files here for configurations; PLC modules are stored in the standardized PLCopen XML format. Apart from the pure storage of source code, versioning is a frequently desired property to enable the simple determination



TwinCAT 3 Automation Interface

of the differences between versions. TwinCAT 3.1 offers a comparison tool here that can display graphic differences between versions for the different programming languages and configurations. If two programmers work on the same object, the changes must be merged. This merging technique is fully supported for all configurations and languages with TwinCAT 3.1.

Automated code generation

Software is often generated automatically in complex applications or in series machine manufacturing. TwinCAT 3.1 now makes the familiar automation interfaces from TwinCAT 2 completely available. The automation interface conveniently supports the creation or modification of complete applications, including configuration and programming in different programming languages, as well as the distribution of the application in the network. Each node in the tree can be created, deleted or modified. As an XML file, the parameters of each node are readable and changeable. For the PLC modules these are then the files saved in PLCopen XML. In this way the automated creation of complete projects is possible – once again in keeping with the philosophy of Visual Studio®.

Further Information:

www.beckhoff.com/TwinCAT3



TwinCAT 3.1: New features for eXtended Automation

Beckhoff is presenting the pre-release of version 3.1 of the TwinCAT automation software at SPS IPC Drives 2012, Germany. Version 3.1 of TwinCAT provides the user with new and extended functions: Integration in Microsoft Visual Studio® 2012 means that the latest version of the world-famous software suite can now be used. The source code control databases such as Microsoft Team Foundation Server or Subversion are available in TwinCAT 3.1, including compare and merge function for all programming languages. Configuration and programming can be generated automatically with the extended automation interface, which is new for the PLC sector.

TwinCAT 3.1 also offers extended possibilities for Motion Control applications; for example, one can integrate one's own transformations conveniently in NC I and CNC. New Scope 2 functions facilitate the display and analysis of data even over a long period with many new trigger functions. Additional reporting and print functions are available. The user benefits from the co-operation with TwinCAT Scope 2 in particular in connection with the Condition Monitoring library. In addition, the TwinCAT OPC UA implementation has been extended by function blocks. A connection from the PLC to a further OPC UA server can be established directly via the OPC UA channel.

Product announcement

estimated market release

TwinCAT Version 3.1: 2nd quarter of 2013