CODESYS® in Factory Automation

Leading IEC 61131-3 development system in factory automation with powerful functions for fieldbus configuration, visualization, motion control and safety
CODESYS: Inspiring Automation Solutions

CODESYS in Factory Automation

The CODESYS Development System is the market-leading IEC 61131-3 software platform for the automation of serial and customized machines independent of the product category. No matter if it is for programming a low-end machine or a complete assembly line – CODESYS is used for all kinds of applications in factory automation. There are good arguments for choosing CODESYS. It is a powerful IEC 61131-3 development environment with numerous user-friendly functions for the programming and configuration of automation projects. Furthermore, it contains fully integrated backend functions, such as compilers, debuggers and variable trace. Thus, the application can be developed, tested and commissioned without any additional tools. The latest version of CODESYS can be downloaded free of charge from www.codesys.com, where end users also benefit from the latest CODESYS features.

Many tasks in factory automation can be performed in a single tool, as for the fieldbus configuration, the creation of modern visualization screens for machine operation, the planning and execution of complex motion control or CNC movements, and the programming of safety applications according to DIN IEC 61508 SIL3. Complete automation projects can be implemented without the user having to leave the familiar development interface. In addition, CODESYS includes multiple standard and proprietary interfaces for the integration with other tools and can easily be connected to existing system infrastructures. Today, CODESYS is used in about 500 different types of controllers around the world. Therefore, end users have a vast pool of automation devices to choose from in their automation projects.

Sample Application Configurations with CODESYS

A selection of CODESYS applications in the factory automation technology:

- Polymeric machines
- Glassshaping machines
- Rolling machines
- Machinetools
- Laser & Plasmacutting machines
- Assembly machines
- Textile machines
- Paper and Paperhandling machines
- Packaging machines
- Cigarette machines
- Printing machines
- Industrial handling machines
- Woodworking machines
- Coating machines
- Engraving machines
- Labeling machines
- Filling machines
- Tyre modelling machines

CODESYS: Worldwide in use in thousands of different industrial factory applications
What advantages does CODESYS offer in factory automation?

Everything integrated in one single user interface – the CODESYS Development System:

- Complete IEC 61131-3 development system for programming of PLCs, PACs or Motion Controllers: from combining of simple logic function blocks through to the complex object-oriented programming
- Remote application access directly from the CODESYS Development System: debugging and application update without additional software
- Development of user-friendly operating interfaces and operator displays with modern visualization elements: integrated visualization editor in the CODESYS Development System used for machine operation (HMI) as well as testing, commissioning, and diagnostics
- Extension for implementation of safety-related protection controllers in compliance with IEC 61508 SIL3 and EN13849PLe available as integrated product
- Device independent application development: CODESYS supports numerous exchangeable devices, fieldbus systems and standard protocols
- Fully integrated configurator for local inputs and outputs as well as classic fieldbus systems such as CANopen, DeviceNet, Modbus, PROFIBUS, ASI, IO-Link
- Support for Realtime-Ethernet-Systems such as PROFINET, EtherCAT, EtherNET/IP, Sercos with integrated configurator and protocol stacks
- Integrated planning and programming of movements for single and multi axis motion and CNC applications with the help of PLCopen certified motion FB libraries
- CODESYS is expandable through add-on software from the CODESYS Store with plug-in components, application libraries, sample programs and templates
- Highly sophisticated library functions for example for reading and writing CSV files or for sending, receiving and deleting emails
- Industrial and communication standards immediately available: data exchange via OPC / OPC UA without implementation and adaptation costs
- Power and usability for the effective realization of all kinds of automation projects:
  - Fast machine code for all controllers: industrially proven compilers for different CPU platforms on the target exploits the device performance to the optimum
  - Functional and object oriented programming within one project possible: software developers may encapsulate methods, interfaces and inheritance within easily reusable functions and function blocks
  - Finding application problems with powerful features: debugging using flow control, conditional and unconditional break points / execution points and core dump
  - Short turnaround times: online change during runtime of the application and incremental compile / download
  - Multiple security features: encrypting the application source / executable code for the protection of intellectual property as well as the controller communication, to protect against cyber attacks
  - Seamless integration into existing engineering platforms: Connection to third party tools like EPLAN, Apache Subversion® or Mawtlab / Simulink
  - Visualization for remote control, diagnostics or maintenance by any webbrowser with HTML5: function monitoring and supervision running on PCs, tablets and smartphones
  - Well-thought-through concept of libraries: high reusability of functions and function blocks with automatic generation of documentation out of source code comments
  - Systematic software development possible: with integrated add-on tools such as CODESYS UML, CODESYS Profiler, CODESYS Static analysis and CODESYS Test Manager

Power and usability for the effective realization of all kinds of automation projects:

- Complete IEC 61131-3 development system for programming of PLCs, PACs or Motion Controllers: from combining of simple logic function blocks through to the complex object-oriented programming
- Remote application access directly from the CODESYS Development System: debugging and application update without additional software
- Development of user-friendly operating interfaces and operator displays with modern visualization elements: integrated visualization editor in the CODESYS Development System used for machine operation (HMI) as well as testing, commissioning, and diagnostics
- Extension for implementation of safety-related protection controllers in compliance with IEC 61508 SIL3 and EN13849PLe available as integrated product
- Device independent application development: CODESYS supports numerous exchangeable devices, fieldbus systems and standard protocols
- Fully integrated configurator for local inputs and outputs as well as classic fieldbus systems such as CANopen, DeviceNet, Modbus, PROFIBUS, ASI, IO-Link
- Support for Realtime-Ethernet-Systems such as PROFINET, EtherCAT, EtherNET/IP, Sercos with integrated configurator and protocol stacks
- Integrated planning and programming of movements for single and multi axis motion and CNC applications with the help of PLCopen certified motion FB libraries
- CODESYS is expandable through add-on software from the CODESYS Store with plug-in components, application libraries, sample programs and templates
- Highly sophisticated library functions for example for reading and writing CSV files or for sending, receiving and deleting emails
- Industrial and communication standards immediately available: data exchange via OPC / OPC UA without implementation and adaptation costs

Ideal conditions for factory automation applications:

- CODESYS is a world wide proven system platform:
  - known by more than 10,000 application developers
  - in use in over 100,000 different applications
  - Programming interface for more than 500 different compatible controllers and running on over 700,000 sold controllers each year
- Today, CODESYS is used in applications with:
  - > 50,000 OPC items,
  - 25MB of application source code, 800MB of PLC data,
  - approximately 200 synchronised drives.
- Wide acceptance in educational institutions: CODESYS is used by schools and universities for training future technicians and engineers.
- A large know-how community world wide available: competent third party support for application development in form of programmers, engineering offices and system partners
- Driven by an innovation leader: 3S-Smart Software Solutions, the company behind CODESYS is one of the technological drivers for software in the automation industry. In cooperation with other companies and universities research projects lead to new products. Being part of standardizing committees the company is always successfully searching for beneficial approaches for the automation industry, for example for internet technologies in automation oriented towards modern front-end technologies

Large marketleading machine manufacturers strategically use CODESYS:

- ASYS Automatisierungssysteme GmbH
- Eisenmann Anlagenbau GmbH & Co.KG
- Homag Holzbearbeitungssysteme GmbH
- Koenig & Bauer AG
- Robert Bosch GmbH PA-ATMO
- SIG Combibloc Systems GmbH
- Voith Paper GmbH & Co. KG
Product components for factory automation applications

Integrated Fieldbus Support in CODESYS

- Extensive fieldbus support directly within the CODESYS Development System: including everything from communication POU's to configurators and portable protocol stacks:
  - Fully integrated configurators for most common classical fieldbus systems: PROFIBUS, CANopen, J1939, DeviceNet, AS-Interface, Modbus and IO-Link
  - Comprehensive real-time Ethernet support: for EtherCAT, EtherNet/IP, Sercos, and PROFINET including configurators and portable protocol stacks
  - Automatic insertion, compilation and loading of libraries for the used bus protocol
- Integrated diagnostics functionality: monitoring the system at runtime without additional tools directly in the CODESYS Development System as well as in the running IEC 61131-3 application
- Multiple benefits thanks to integration: just one single tool for programming and fieldbus configuration, reduced risk of errors, simplifies configuration and fast engineering

In Brief: CODESYS EtherCAT

- EtherCAT master integration in the CODESYS Development System
- Comprehensive integrated configurator with simplified or expert settings, supporting device scan, different bus topologies, EtherCAT redundancy etc.
- Portable protocol stack in form of a CODESYS library
- Support of CODESYS Motion + CNC
- Optional support of EtherCAT gateway modules to other fieldbus systems such as IO-Link, CANopen, PROFIBUS: for example PROFIBUS as child network of EtherCAT with full functionality

CODESYS Visualization for Factory Automation

- Integrated visualization in the IEC 61131-3 tool: Development of graphical visualization screens in parallel to the application code generation within one single tool
- Due to integration: ideal for testing, commissioning and operation of the PLC application
- Modern visualization elements and practical controls: for fast and easy creation of industrially applicable operating and diagnostics screens
- Standard visualization functions: integrated alarm and user management, user-friendly styles, language and image switch, import/animation of bitmaps and SVGs, data recording, flexible communication concept and multitouch support

- Extended functionality compared to conventional visualization systems:
  - real-time trace and trend recording
  - visualizations to instantiate for usage in library and application modules ("visualization FBs")
  - direct access to PLC functions
- Display variants for the most diverse platforms: one source file for
  - CODESYS HMI on remote terminals – for the operation of machines with HMI panels
  - CODESYS TargetVisu on panel controllers – operation and logic control with one single device
  - CODESYS WebVisu on web browsers – ideal for remote operation and diagnostics or unattended operation, for example on mobile devices

CODESYS SoftMotion + CNC

- Proven motion toolkit for processing coordinated motion or CNC programs: single-axis or multi-axis motions created in the CODESYS Development System
- Turns the device into a Motion Controller: execution of motions directly on the target controller
- Platform independent libraries included: for single and multi axis-control according to PLCopen, as well as for coordinated interpolation and kinematical transformations for programming CNC systems
- Comfortable motion planning: integrated cam and 3D-CNC editor with G-Code according to DIN66025 including import of CAD data
- Effortless motion communication with the drive: integrated fieldbus connection for example for CANopen, EtherCAT and Sercos with numerous supported drives
- Flexible application development through integration in the CODESYS Development System: adjusting the motion application within the graphical interface, dynamically during the machine runtime
- CODESYS SoftMotion Light: independent add-on product for commanding multi axis without coordination at a reduced load of the controller and Fieldbus
CODESYS Professional Developer Edition

- Seamlessly integrated add-on tools for the CODESYS Development System for the optimization of the development process:
  - CODESYS UML: UML class diagram and state chart for advanced application design and programming
  - CODESYS SVN: source code and version management of the application code based on Apache Subversion®
  - CODESYS Static Analysis: code analysis for detection of possible application errors, check of coding rules, software metrics etc.
  - CODESYS Profiler: measurement of the application execution times
  - CODESYS Test Manager: test automation for system and unit tests for increased quality
- All add-on tools can directly be downloaded and installed from the CODESYS Store into the CODESYS Development System.

CODESYS Application Composer

- Integrated add-on tool in the CODESYS Development System for the efficient creation of application variants
- Functional program units for mechatronic system components or pure software functions are combined into intelligent modules that can be used to configure a complete machine application
- Automated generation of application source code including visualization and device configuration through integrated generators
- End user benefit from improved re-usability and quality of application elements
- Perfect solution for series-produced machines that are customer-specifically equipped/set up as well as for special machines/plants that are constructed from recurring units

CODESYS Communication

- Fully integrated: multiple standard and lean proprietary communication protocols/services
- Communication between the CODESYS Development System and the target controller via portable gateway service: Remote debugging/editing/optimizing directly in the source code without additional software
- Data exchange between CODESYS compatible controllers: with proprietary UDP protocol (global network variables), for Safety controllers even with protected safety protocol (safety cross communication via Safety NetVars)
- Certified OPC 2.0 server (Data Access Specification): delivered with the CODESYS Development System for data exchange between target controller and any OPC client
- Platform independent communication: OPC UA Server available as additional runtime system component for device manufacturers
- Proprietary access to controller variables: data access from any external software or device, for example for specific diagnostic clients or commissioning devices via the CODESYS PLCHandler
CODESYS Safety for SIL3 Controller

Product for device manufacturers

- Realization of safety-related protection controllers (dual channel 1oo2) in mechanical engineering pursuant to the machine guideline in compliance with IEC 61508 SIL3 and EN13849 PLe as an add-on to standard controllers
- Additional functions for the protection of the safety function: change tracking, safe signal flow, safe versioning (pinning), separation of safe operation/debug mode, and more
- Safe cross-communication between safety controllers
- TÜV-approved and certified according to IEC 61508 SIL3: safety plug-ins for the CODESYS Development System, safety manual for users, safety runtime system and integration manual for device manufacturers
- Fieldbus support with separate certified implementations for FSoE (Failsafe over EtherCAT) and PROFiSafe/F-Host

End user benefits

- Integrated solution for functional and safety relevant applications within one single project
- Application-oriented function modules in accordance with PLCopen Safety: for typical safety devices in factory automation for example emergency off switch, two-handed operation, safety door etc.

CODESYS Security

- Know-how protection for the application source code through encryption by the CODESYS Security Key (USB dongle)
- Integrated user and access management for the application code and the target controller
- Interactive login (Level 1 security) to ensure connection with the right controller (device support required)
- Operation mode (Level 2 security) to prevent unwanted changes on a running application
- CODESYS Runtime Key to protect compiled boot applications against plagiarism of complete machines

Why do manufacturers of controllers for factory automation rely on CODESYS?

- Support for the commonly used CPUs/operating systems in PLCs, PACs, programmable drives and other industrial controllers:
  - CPUs for decentralized controllers such as Tricore, ARMx/Cortex Mx with or without proprietary operating system
  - High-performance CPUs for complex or motion control applications, such as Intel Atom or Cortex A for example with Windows, WinCE, QNX, VxWorks or Linux
- Simple porting and scaling of the runtime system on the basis of a runtime toolkit: with defined interfaces for device-specific functions and easy extensibility
- Development costs for the programmable controller can easily be precalculated due to defined interfaces, integration manual for the runtime system and qualified adaptation support
- Embedding of specific technology functions/visualization elements in CODESYS libraries – with licensing if necessary
- Proven interfaces for the connection to additional software or hardware systems
- Software components that are pre-certified to IEC 61508 SIL3 (development system, runtime system and FSoE/PROFiSafe F-Host master stack) simplify the realization and certification of SIL3 safety controllers.
- Expandability of the CODESYS Development System by adding device-specific or manufacturer-specific plug-in components and libraries
- Reliable software partner provides continuous well tested updates and improvements
- High market acceptance due to widespread use of CODESYS in Factory Automation

Original equipment manufacturers in the factory automation industry using CODESYS technology:

- ABB Automation Products GmbH
- Berghof Automation GmbH
- Bosch Rexroth AG
- Eaton Industries GmbH
- Festo AG & Co. KG
- Hitachi Industrial Equipment Systems Co., Ltd.
- KEBA AG
- Lenze Automation GmbH
- Parker Hannifin GmbH
- Schneider Electric Automation GmbH
- Hans Turck GmbH & Co. KG
- WAGO Kontakttechnik GmbH & Co.KG
CODESYS – the manufacturer-independent
IEC 61131-3 automation software.

CODESYS for further industries:

- Mobile Automation
- Energy Automation
- Embedded Automation
- Process Automation
- Building Automation

CODESYS® is a registered trademark
of 3S-Smart Software Solutions GmbH.
Technical specifications are subject to change. Errors
and omissions excepted. No reproduction or distri-
bution, in whole or in part, without prior permission.

Note: Not all CODESYS features are available in all
territories. For more information on geographic
restrictions, please contact support@codesys.com.