

CODESYS

Codesys (usually stylized as CODESYS, a portmanteau for **controller development system**, previously stylised **CoDeSys**) is a [development environment](#) for programming controller applications according to the international industrial standard [IEC 61131-3](#).



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Introduction

CODESYS is developed and marketed by the German software company 3S-Smart Software Solutions located in the Bavarian town of [Kempten](#). Version 1.0 was released in 1994. CODESYS licenses are free of charge and can be installed legally without copy protection on further workstations. The software tool covers different aspects of industrial automation technology with one surface.

Engineering

All five [programming languages](#) for application programming defined in the [IEC 61131-3](#) are available in the CODESYS development environment.

- IL ([instruction list](#)) is an assembler like programming language (Is now deprecated but available for backward compatibility)
- ST ([structured text](#)) is similar to programming in [Pascal](#) or [C](#)
- LD ([ladder diagram](#)) enables the programmer to virtually combine relay contacts and coils
- FBD ([function block diagram](#)) enables the user to rapidly program both Boolean and analogue expressions
- SFC ([sequential function chart](#)) is convenient for programming sequential processes and flows

Additional graphical editor available in CODESYS not defined in the IEC standard:

- CFC (Continuous Function Chart) is a sort of freehand FBD editor. Other than in the network-oriented FBD editor where the connections between inputs, operators and outputs are set automatically they have to be drawn by the programmer. All boxes can be placed freely which makes it possible to program feedback loops without interim variables.

Integrated compilers transform the [application code](#) created by CODESYS into native [machine code](#) (binary code) which is then downloaded onto the controller. The most important 16 and 32-bit [CPU](#) families are supported, such as [C166](#), [TriCore](#), [80x86](#), [ARM/Cortex](#), [PowerPC](#), [SH](#), [MIPS](#), [BlackFin](#) and more.

Once CODESYS is [online](#), it offers an extensive [debugging](#) functionality such as variable monitoring/writing/forcing by setting [breakpoints](#)/performing single steps or recording variable values online on the controller in a [ring buffer](#) (Sampling Trace).

CODESYS V3.x is based on the so-called CODESYS Automation Platform, an automation framework device manufacturers can extend by their own [plug-in](#) modules.

The CODESYS Professional Developer Edition offers the option to add components to the tool which are subject to licensing, e.g. integrated [UML](#) support, a connection to the [Apache Subversion](#) version control system, online runtime performance analysis, static code analysis of the application code or script based automated test execution.

The CODESYS Application Composer serves to create applications by using existing modules. The user composes, parameterizes, and connects the required modules to form a complete application. This configuration does not require knowledge of PLC programming and can therefore be done by technicians without programming experience. Internal generators create complete, well-structured IEC 61131-3 applications including the I/O mapping and visualizations. The Application Composer requires a license to develop and to compose modules. Furthermore, there are freely usable modules (i.e. Persistence Manager, Device Diagnosis), which can be used without a license.

Runtime

After implementing the CODESYS Control Runtime System, intelligent devices can be programmed with CODESYS. A charged-for toolkit provides this runtime system as a source and object code. It can be ported to different platforms.

Fieldbus technology

Different [field busses](#) can be used directly in the programming system CODESYS. For this purpose, the tool integrates configurators for the most common system such as [PROFIBUS](#), [CANopen](#), [EtherCAT](#), [PROFINET](#) and [EtherNet/IP](#). For some systems, additional [protocol](#)

[stacks](#) are available in the form of CODESYS libraries which can be loaded subsequently. By means of a software plugin in the FDT (Field Device Tool) Frame application, additional device-specific user interfaces from third-party suppliers can be integrated. Communication between these interfaces will be realised through a communication Device Type Manager (DTM)..

Visualization

An integrated editor helps the user create complex visualization masks directly in the programming system CODESYS and animate them based on application variables. To simplify the procedure, integrated visualization elements are available. An optional toolkit enables the user to create his own visualization elements. The masks created are, among others, used for application tests and commissioning during online operation of the programming system. In combination with optional visualization clients, the masks can also be used to operate machines or plants, e. g. on controllers with integrated display, in web browsers or a portable runtime under [Windows](#) or [Linux](#).

SoftMotion

An optional modular solution for controlling complex movements with an IEC 61131-3 programmed controller is also completely integrated in the programming system CODESYS. The modular solution includes:

- Editors for motion planning, e. g. with [CAMs](#) or DIN 66025 [CNC](#) descriptions
- Library modules for decoder, interpolator, for program execution, e. g. according to PLCopen MotionControl, for kinematical transformations and visualization templates

Safety

To reach the [safety integrity level](#) (SIL) required after a risk analysis, all system components have to comply to this level. Pre-certified software components within CODESYS make it much easier for device manufacturers to have their controllers SIL2 or SIL3 certified. Therefore, CODESYS Safety consists of components within the programming system and the runtime system, whereas the project planning is completely integrated in the IEC 61131-3 programming environment.

Industrial usage

Over 250 device manufacturers from different industrial sectors offer intelligent automation devices with a CODESYS programming interface. Consequently, thousands of end users such as machine or plant builders around the world employ CODESYS for all sorts of automation tasks.

The CODESYS Device Directory^[1] offers an overview on nearly 400 devices programmable with CODESYS from leading manufacturers from the sectors [control engineering](#), automation components and [embedded systems](#).

See also

- [Integrated development environment](#)
- [Process control](#)
- [Programmable logic controller \(PLC\)](#)
- [Software engineering](#)