



CODESYS® V3.5 SP18

Features and Improvements

Including presentation of component updates since the release of the last Service Pack

1

Engineering

2

Runtime

3

Visualization

4

Motion CNC Robotics

5

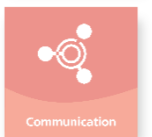
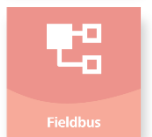
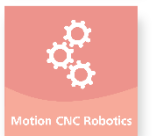
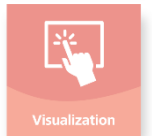
Fieldbus

6

Communication

Overview

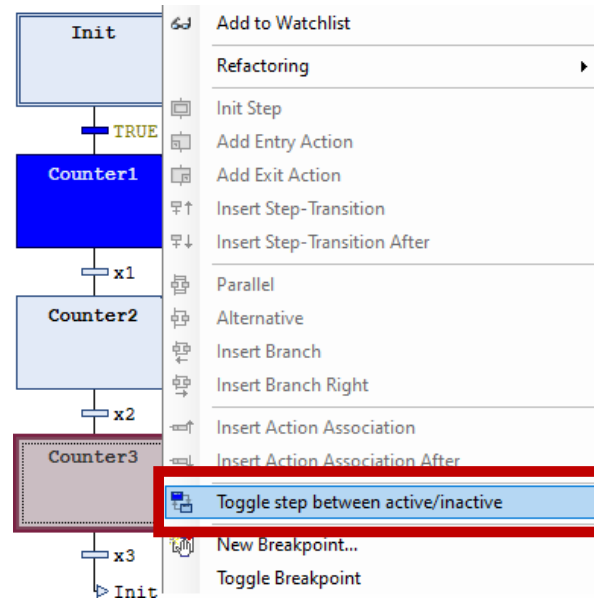
- IEC 61131-3 Editors
- Usability Features
- Security Features
- Package Manager
- Project Inspection
- Installer
- CODESYS Professional Developer Edition
- UTF-8 Encoding for Strings
- Constant Generics
- IIoT Libraries SL



IEC 61131-3 Editors

- **SFC**

- Toggling the active step in online mode



- **ST Editor Improvements**

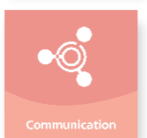
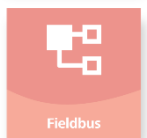
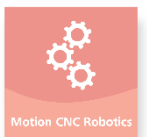
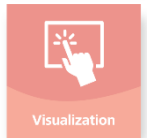
- Specific display of non-compiled code

```

1  {IF defined (variable :b)}
2  PLC_PRG_Nested();
3  PLC_PRG_Nested();
4  {END_IF}
5
6  {IF defined (variable: a)}
7  bValue := 1;
8  //Call();
9  a := 1;
10 {ELSE}
11 bValue := 2;
12 a := 2;
13 {END_IF}
14
15 {IF defined (variable: a)}

```

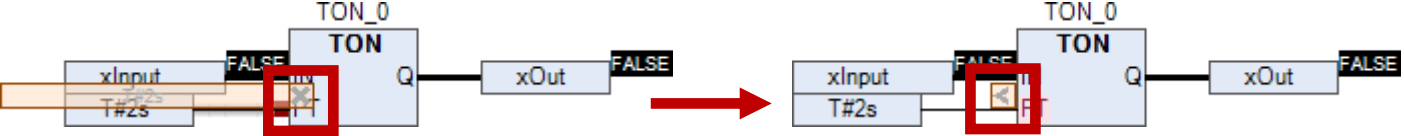
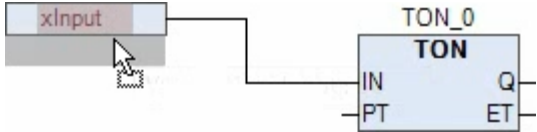
The code snippets are highlighted with red rectangular boxes. The first box covers lines 1-4, and the second box covers lines 10-13.



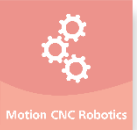
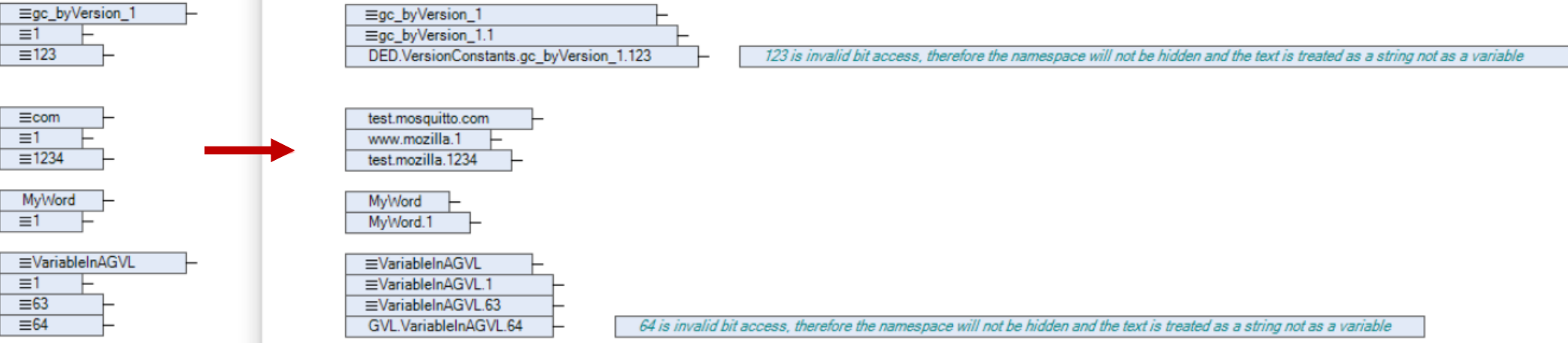
IEC 61131-3 Editors

CFC

- One-line elements (e.g. inputs, outputs, ...): Drag and Drop by clicking on their text
- Collapsing watch boxes



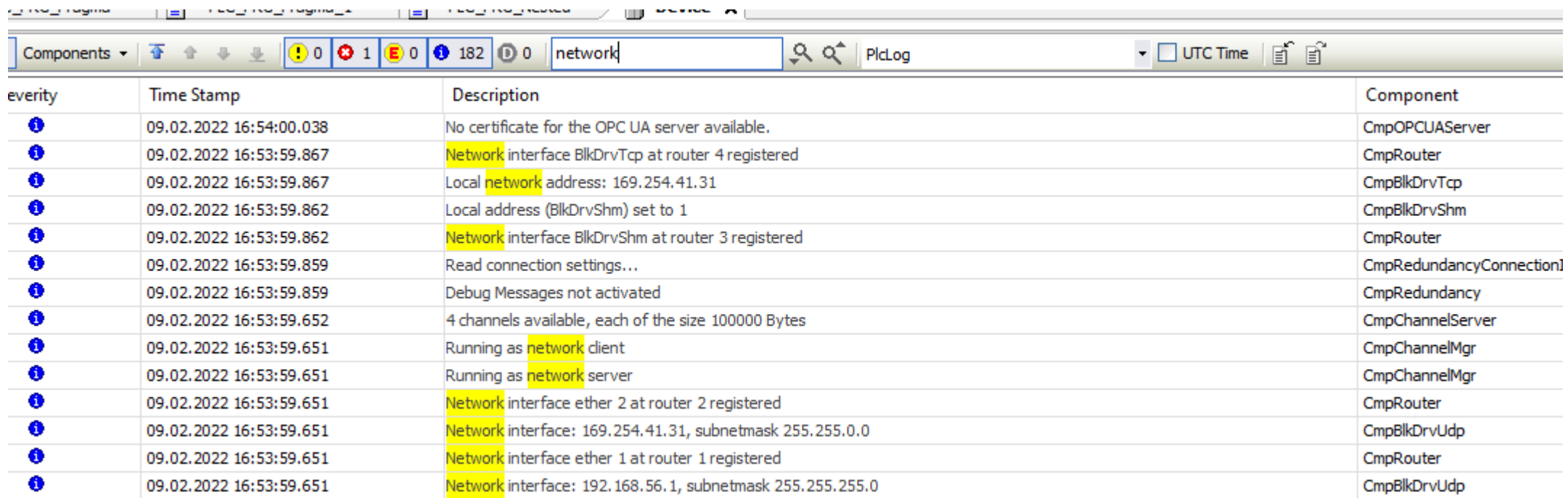
- Improved usability for shortened names



Usability Features

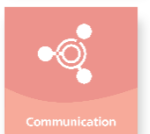
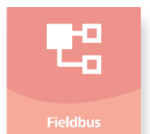
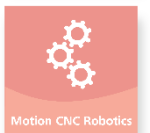
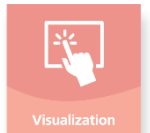
Searching in the device logger

- Search for matching message texts
- Navigation functions and highlighting



The screenshot shows the CODESYS device logger interface. The search bar at the top contains the text 'network'. The results table below shows several log entries with the word 'network' highlighted in yellow in the description column.

Severity	Time Stamp	Description	Component
	09.02.2022 16:54:00.038	No certificate for the OPC UA server available.	CmpOPCUAServer
	09.02.2022 16:53:59.867	Network interface BlkDrvTcp at router 4 registered	CmpRouter
	09.02.2022 16:53:59.867	Local network address: 169.254.41.31	CmpBlkDrvTcp
	09.02.2022 16:53:59.862	Local address (BlkDrvShm) set to 1	CmpBlkDrvShm
	09.02.2022 16:53:59.862	Network interface BlkDrvShm at router 3 registered	CmpRouter
	09.02.2022 16:53:59.859	Read connection settings...	CmpRedundancyConnectionI
	09.02.2022 16:53:59.859	Debug Messages not activated	CmpRedundancy
	09.02.2022 16:53:59.652	4 channels available, each of the size 100000 Bytes	CmpChannelServer
	09.02.2022 16:53:59.651	Running as network client	CmpChannelMgr
	09.02.2022 16:53:59.651	Running as network server	CmpChannelMgr
	09.02.2022 16:53:59.651	Network interface ether 2 at router 2 registered	CmpRouter
	09.02.2022 16:53:59.651	Network interface: 169.254.41.31, subnetmask 255.255.0.0	CmpBlkDrvUdp
	09.02.2022 16:53:59.651	Network interface ether 1 at router 1 registered	CmpRouter
	09.02.2022 16:53:59.651	Network interface: 192.168.56.1, subnetmask 255.255.255.0	CmpBlkDrvUdp



Usability improvements

Device Communication Editor

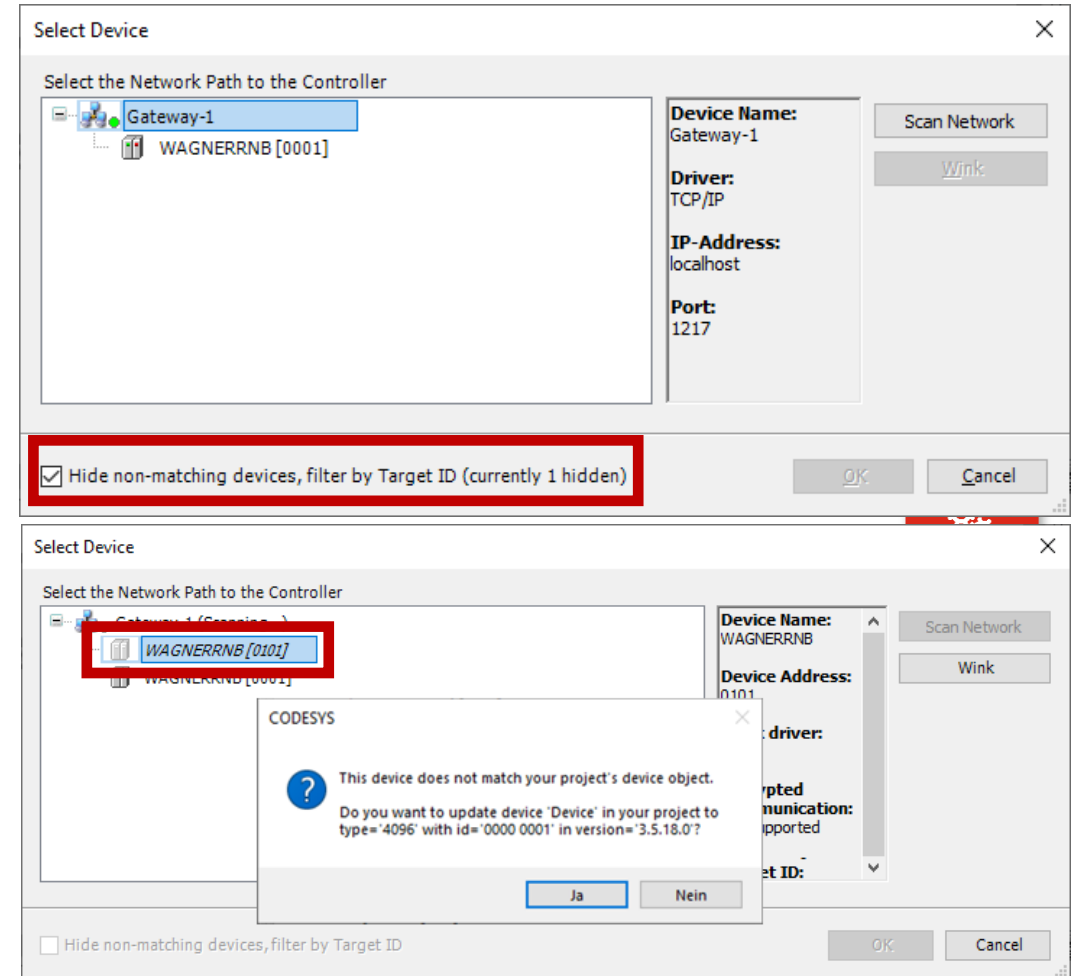
- New checkbox: show filtered devices directly from the scan dialog
- Update non-matching device description directly from the scan:

Doubleclick on grayed device:

→ Quick exchange e.g. from “CODESYS Control Win” to “CODESYS Control Winx64”

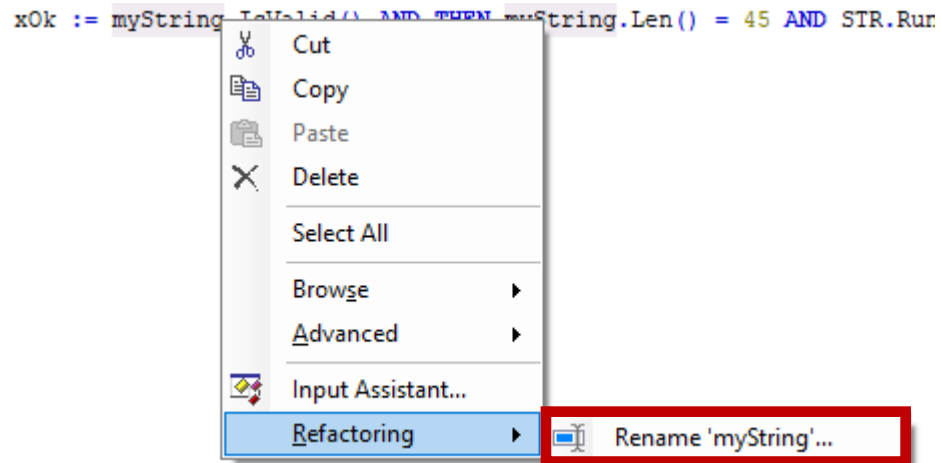
License subscriptions

Automatic renewal of license subscriptions for products without user interaction

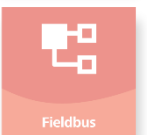
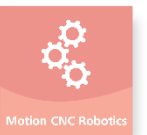
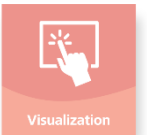
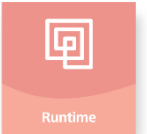
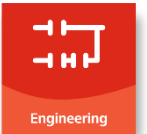
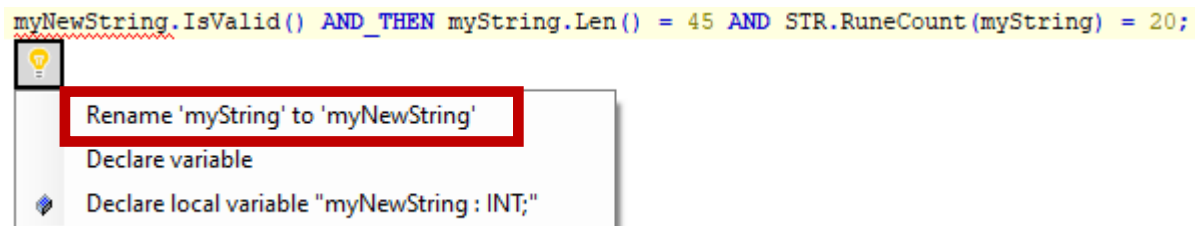


Usability improvements

- Refactoring option 1: Click and rename



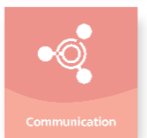
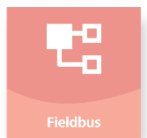
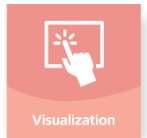
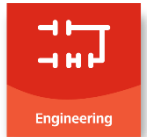
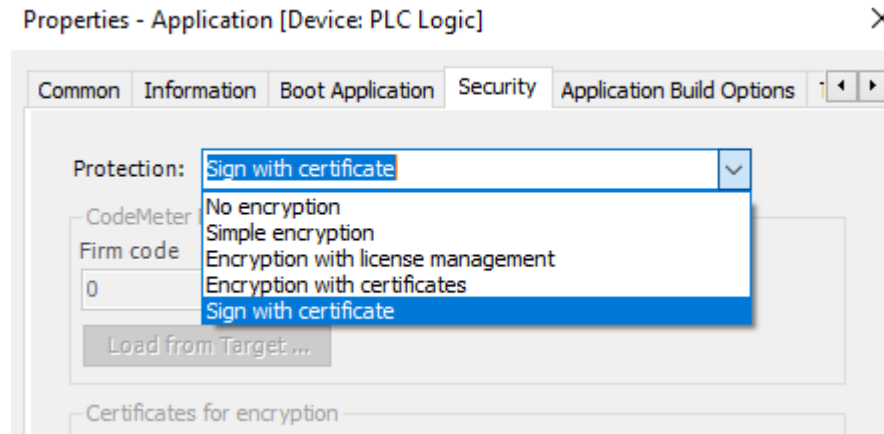
- Refactoring option 2: Rename and click



Security Features

Certificate Handling

- Support the runtime option „sign only“
- Improve encrypted download



Security Features

Enhanced security thanks to integrated web browser based on MS Edge

Start Page x

CODESYS V3.5 SP18

Basic operations

- New Project...
- Open Project...
- Open Project from PLC...

Recent projects

- Untitled4
- fridge_controller_timing_UA_SP18
- fridge_controller_timing_UA
- UC2016_Further_Features
- Untitled3
- Untitled2
- RS_Test
- Untitled1
- Robotics_Simple_RIV2020

Close page after project load

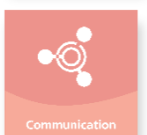
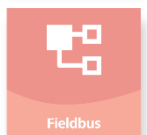
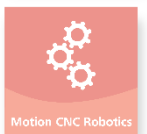
Show page on startup

Latest news

CODESYS TALK SPS FORUM CODESYS SUPPORT CODESYS DOWNLOAD

CODESYS DEVICE DIRECTORY

Information about the security vulnerabilities CVE-2021-44228 and CVE-2021-45046 in Log4j

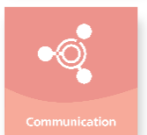
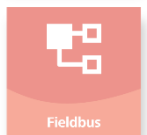
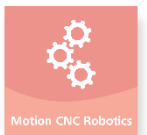
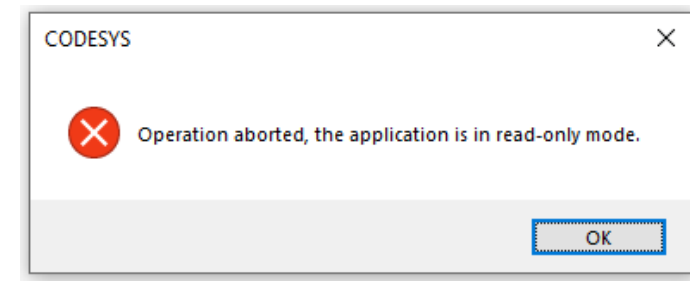
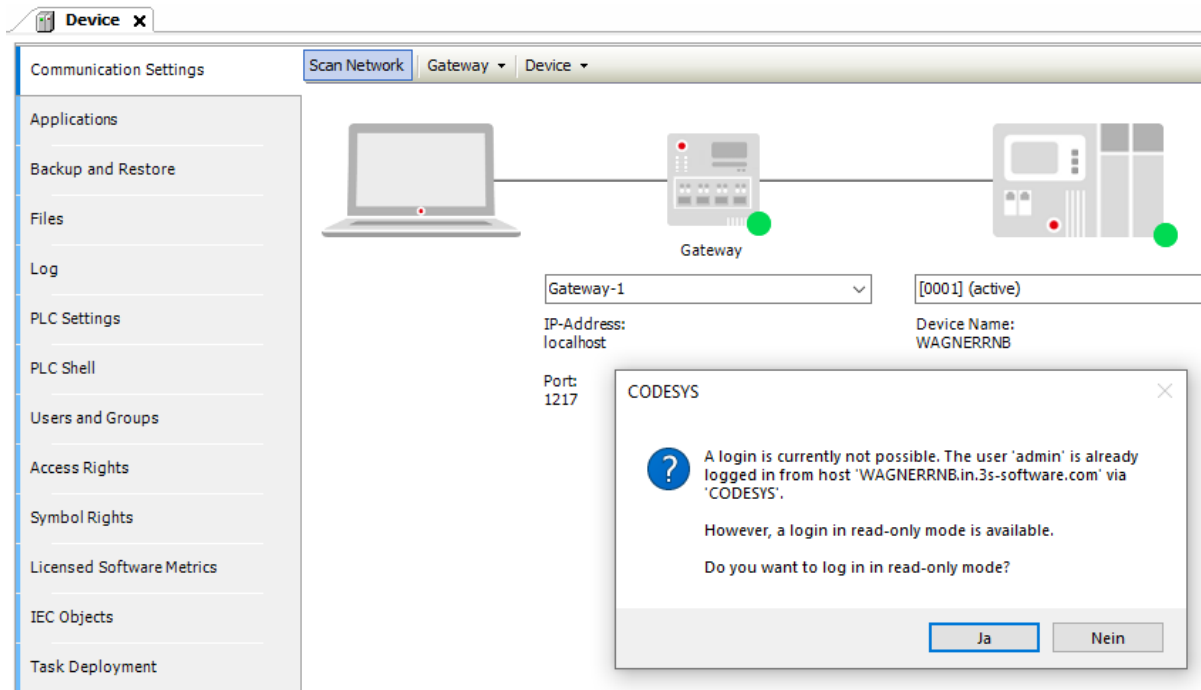


Security Features

Multi-Client (read-only mode):

Read-only access to already logged-in applications on one and the same controller

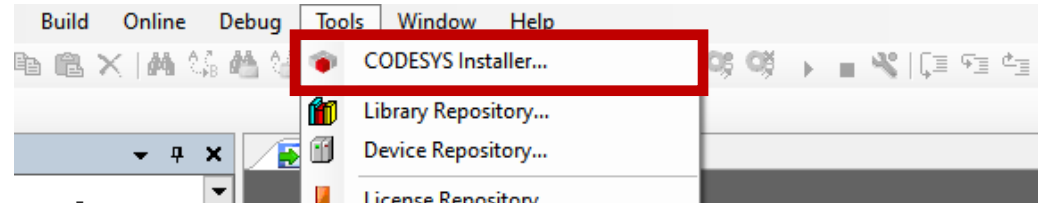
- Watch the application in online mode
- Write operation, start/stop not possible



Package Manager

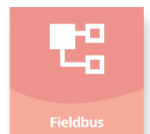
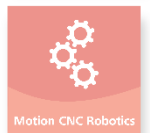
- **Replaced by CODESYS Installer in standard CODESYS installations as of SP18**

- Native Deployment Server connection
- Automatic reference resolution
- Requires CODESYS Installer 1.2.0 or higher
- **Package Manager still available and maintained for customer-specific CODESYS versions / derivatives**



- **Performance Improvements**

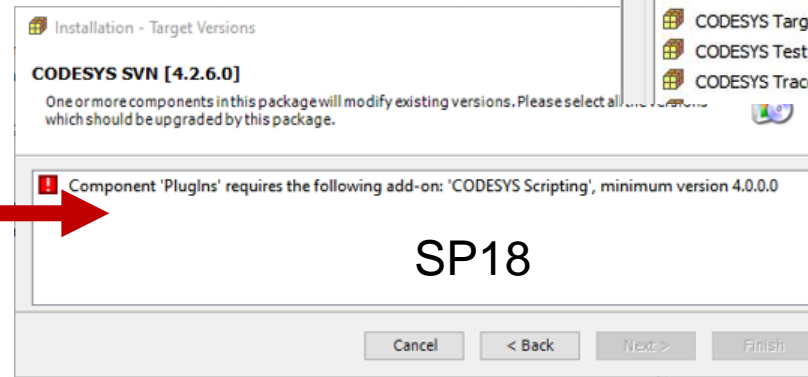
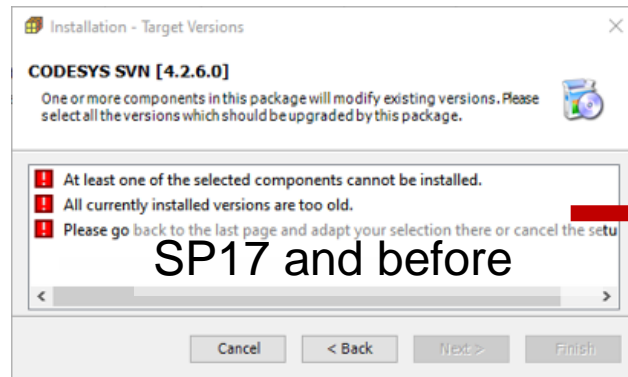
- Up to 30% faster package decompression
- Up to 40% faster library installation
- Pre-calculation of checksums
 - Up to 50% faster installation
 - Requires package optimization
 - Supported with SP18 and later
 - Compatible with SP17 and older



Package Manager

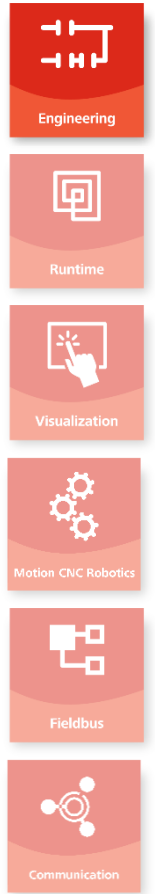
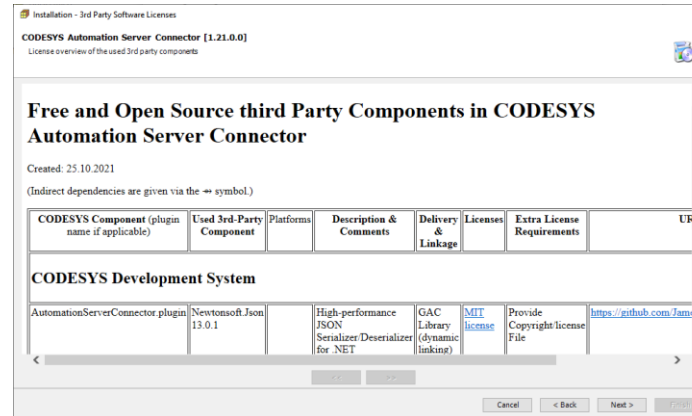
User interface improvements

- Improved presentation of modifications
- Detailed messages for unresolved dependencies



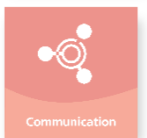
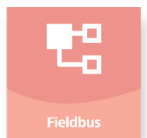
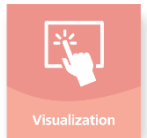
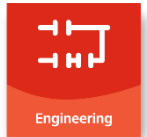
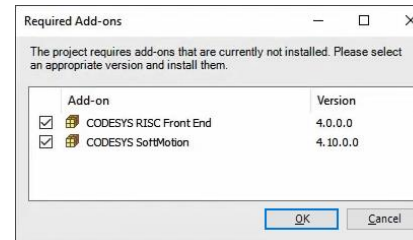
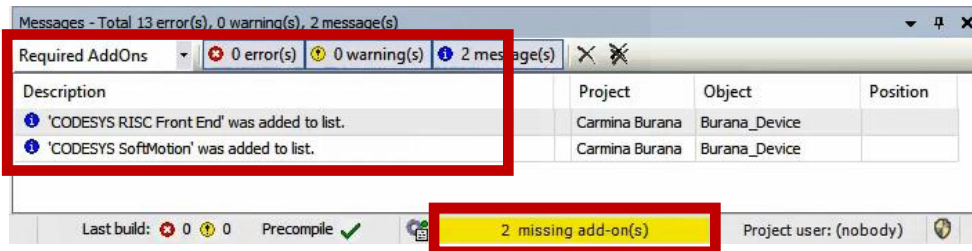
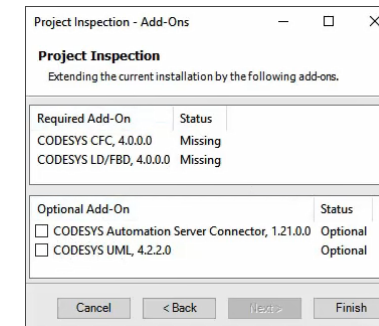
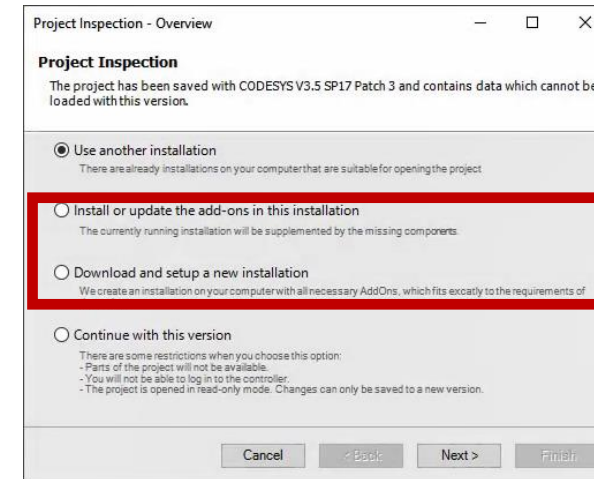
CODESYS Resurability	7.0.0.0	02.02.2022	No lice
CODESYS RISC Front End	4.0.0.0	02.02.2022	No lice
CODESYS SAE J1939	4.0.0.0	02.02.2022	No lice
CODESYS Safety Support	4.0.0.0	02.02.2022	No lice
CODESYS Scripting	4.0.0.0	02.02.2022	No lice
CODESYS Security Agent	1.2.1.0	02.02.2022	No lice
CODESYS Sercos III	4.0.0.0	02.02.2022	No lice
CODESYS SFC	4.1.0.0	02.02.2022	No lice
CODESYS SVN	4.3.0.0	03.02.2022	Licens
CODESYS Target Settings Export	4.0.0.0	02.02.2022	No lice
CODESYS Test Manager for Automation Platform	4.3.1.0	02.02.2022	Search
CODESYS Trace	4.0.0.0	02.02.2022	No lice

- Third-party licenses displayed
 - Package content
 - New wizard page
 - Release notes pending



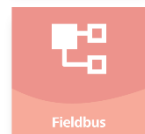
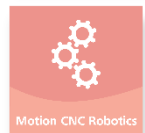
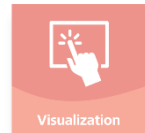
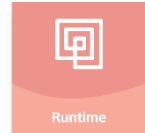
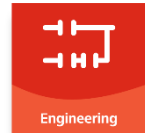
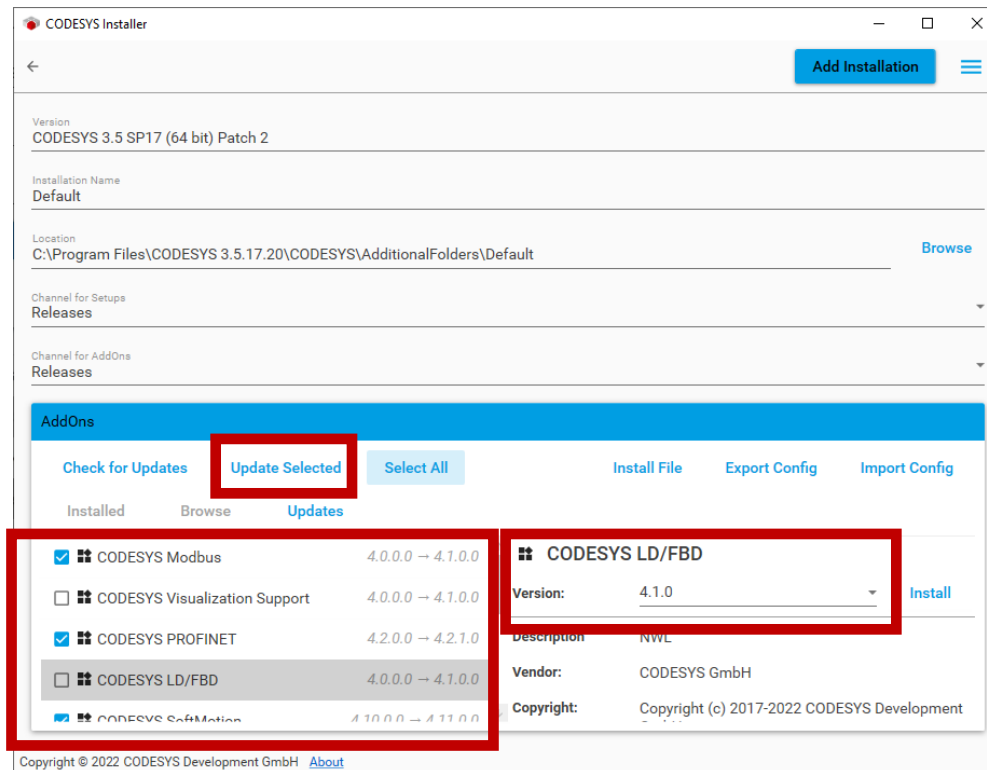
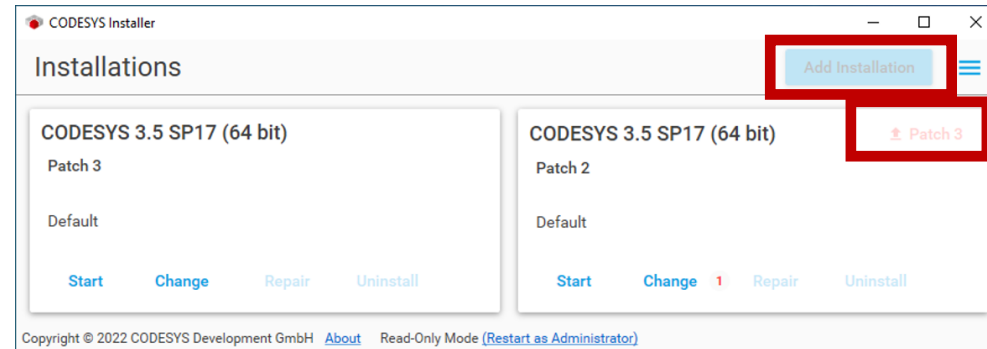
Project Inspection Improvements

- **New wizard concept**
 - Immediate hint if the project is not suitable for the installation
 - Wizard pages with detailed information
- **Only project-relevant content**
- **Optional add-on proposals**
- **Analysis while editing**
 - Required add-ons reported in the message view
 - Status bar indication
 - Automatic installation workflow



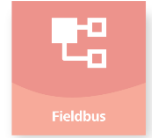
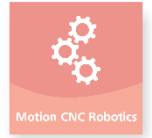
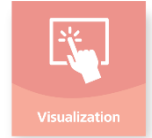
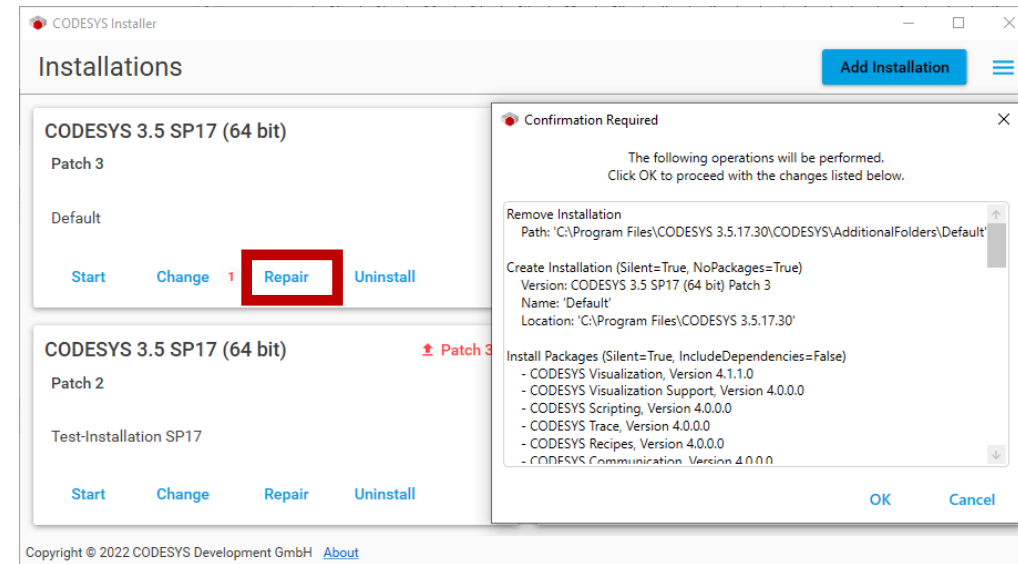
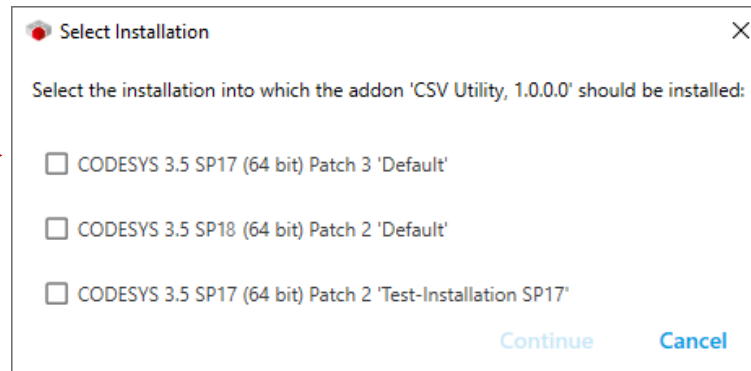
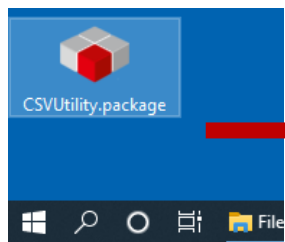
Installer Improvements

- **Viewer mode**
 - No admin rights required
 - No modifications possible
 - Elevation on demand
- **Bulk update for add-ons**
 - Multiple selection
 - Individual version selection
 - Bulk installation



Installer Improvements

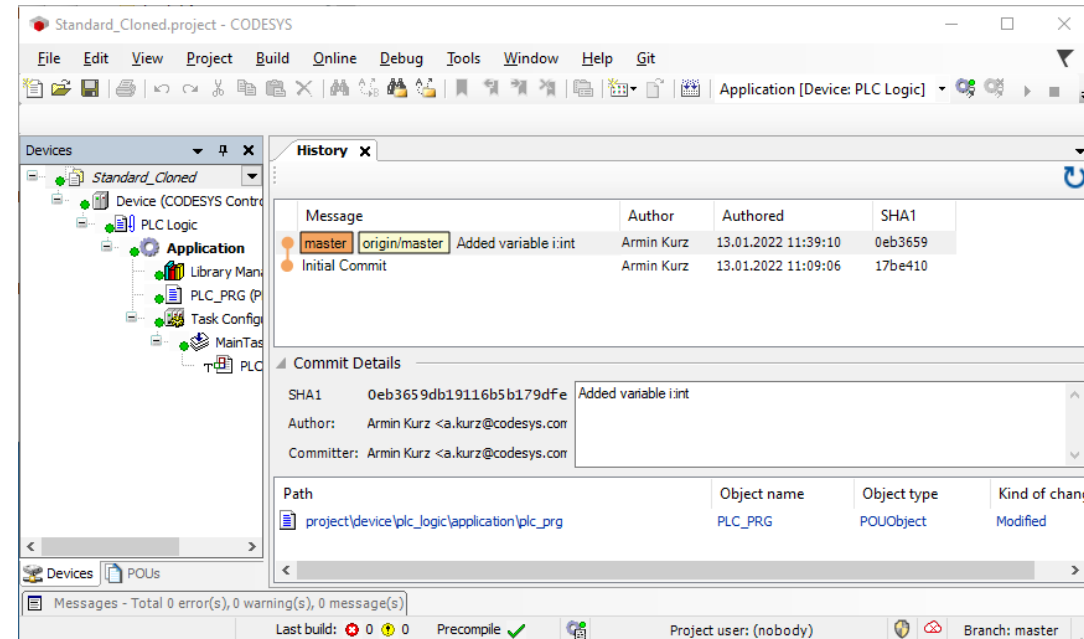
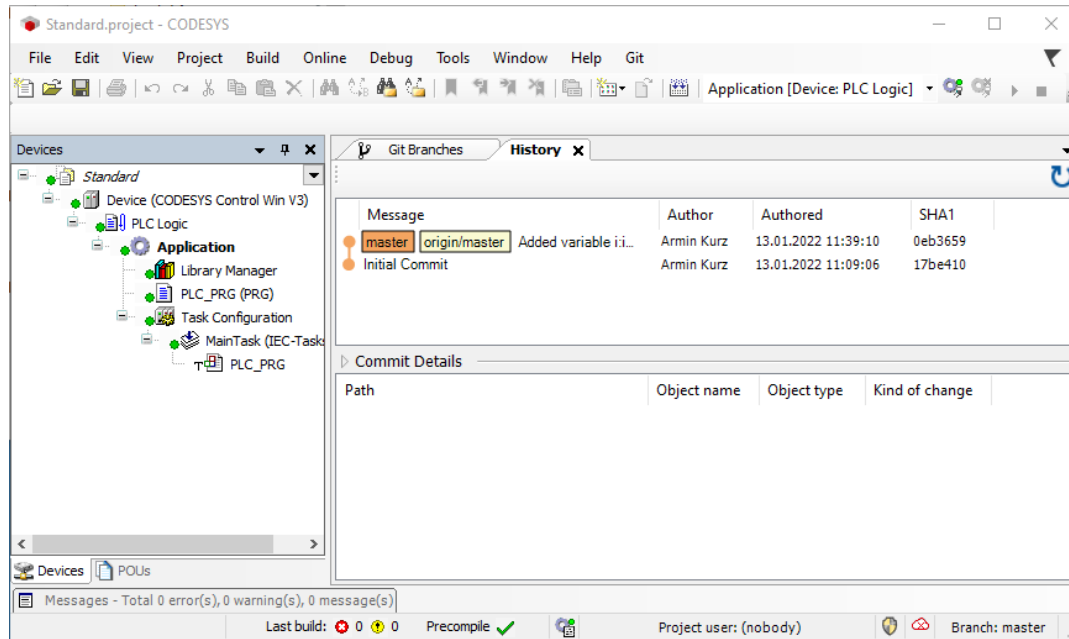
- **Installation repair function**
 - Complete uninstallation of the setup
 - Reinstallation with previously configured add-ons
- **Default handler for package files**
 - Starts CODESYS Installer with a double click
 - Selection of a target installation



CODESYS Professional Developer Edition: CODESYS Git

Allow fast forward and merge without commit in the Git pull command

- Pulling a branch without local changes on the branch → forward of the local branch
- Remote commits added to the local branch
- No merge commit necessary



Engineering



Runtime



Visualization



Motion CNC Robotics



Fieldbus

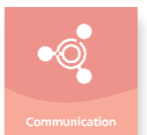
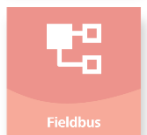
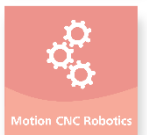
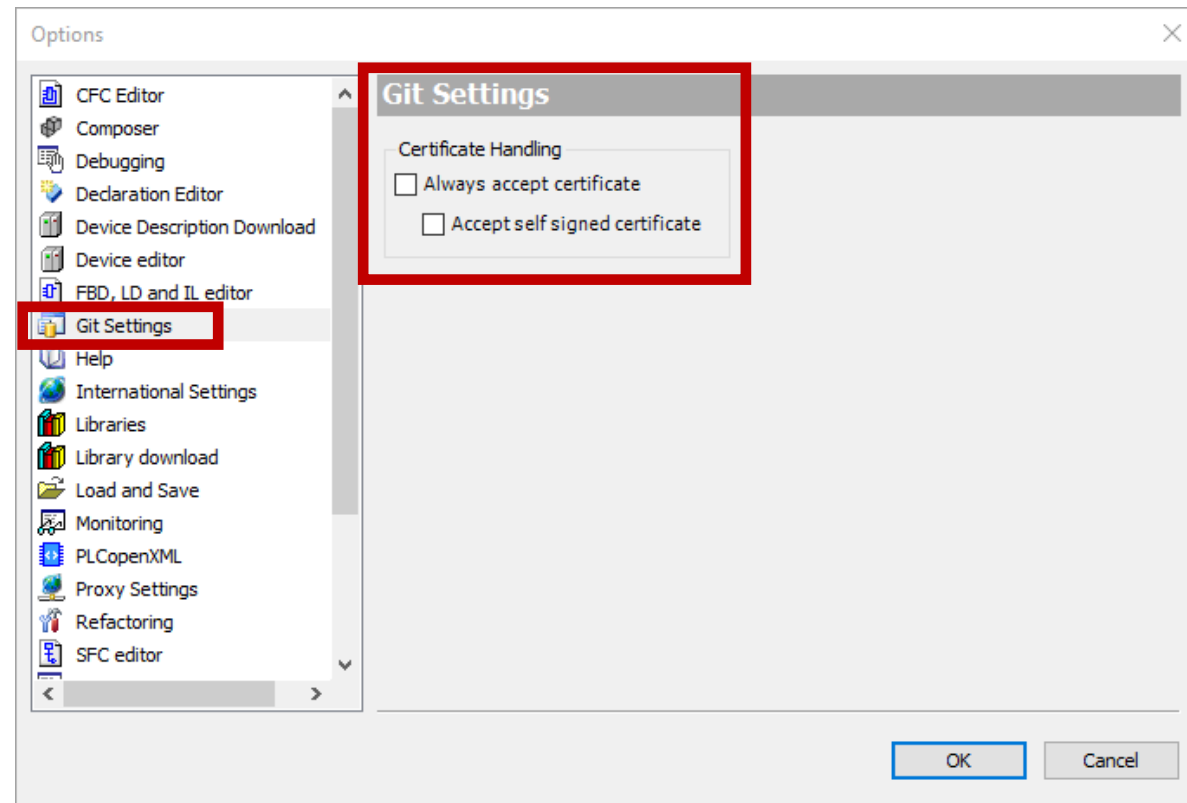


Communication

CODESYS Professional Developer Edition: CODESYS Git

Checking server certificates

- For remotely hosted repositories to Git servers (e.g. GitLab, GitHub): server certificates check recommended
- New default setting of CODESYS Git, may be deactivated
- Option for allowing self-signed certificates on Git servers

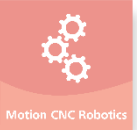
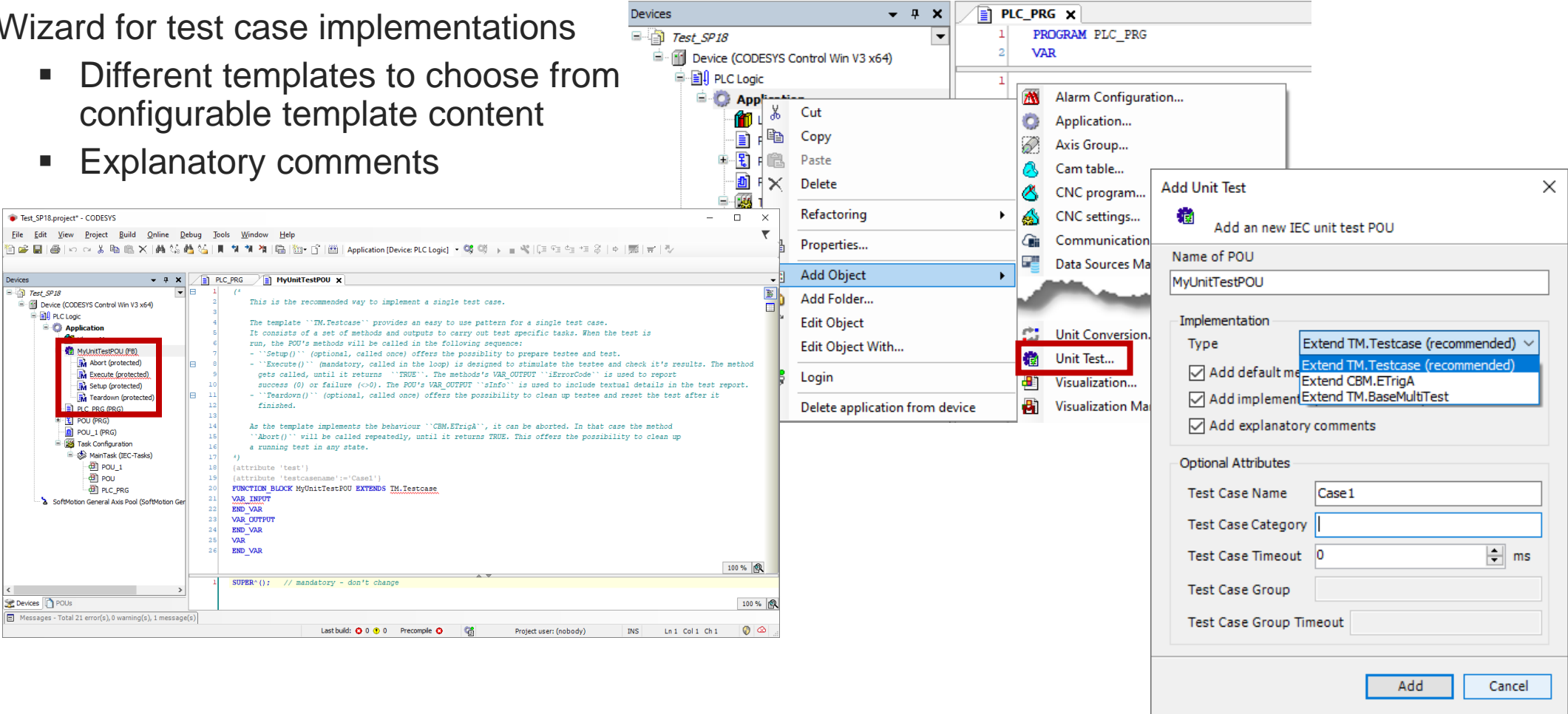


CODESYS Professional Developer Edition: CODESYS Test Manager

IEC Unit Test: Assisted authoring of test cases (Release July 2022)

Wizard for test case implementations

- Different templates to choose from
- Configurable template content
- Explanatory comments



CODESYS Professional Developer Edition: CODESYS Test Manager

IEC Unit Test: Assisted authoring of test cases

Simplified result check: Assertion methods

- TM.Testcase
- TM.BaseMultiTest

```
1 IF (sum=0) THEN // stimulate testee
2   a:=1;
3   b:=2;
4   sum:=a + b;
5   expected:= 4;
6   Execute:=FALSE;
7 ELSE
8   //
9
10  IF (expected<>sum ) THEN
11    iErrorCode:=1;
12    xError:=TRUE;
13    sInfo:=STRING_TO_WSTRING(CONCAT('Expected',
14      CONCAT(INT_TO_STRING(expected),
15        CONCAT(' got ', INT_TO_STRING(sum))));
16  ELSE
17    iErrorCode := 0; // test succeeded
18    xError:=FALSE;
19  END_IF
20
21  Execute := TRUE; // mandatory: signal test completed
22 END_IF
```

ELSE

Assert

- AssertEqual
- AssertGreater
- AssertGreaterEqual
- ASSERTION_ERROR TM
- AssertLess
- AssertLessEqual
- AssertNotEqual
- FAILURE_ASSERT_EQUAL TM.ASSERTION_ERROR
- FAILURE_ASSERT_GREATER TM.ASSERTION_ERROR
- FAILURE_ASSERT_GREATEREQUAL TM.ASSERTION_ERROR

(1/4) All items ==>



```
1 IF (sum=0) THEN // stimulate testee
2   a:=1;
3   b:=2;
4   sum:=a + b;
5   expected:= 4;
6   Execute:=FALSE; //Signal Test still running
7 ELSE
8   // check result
9   AssertEqual(expected, sum);
10
11   Execute := TRUE; // mandatory: signal test completed
12 END_IF
```

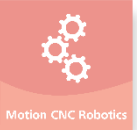


CODESYS Professional Developer Edition: CODESYS Test Manager

IEC Unit Test: Filter reports for functions of Test Tables

The screenshot displays the CODESYS Test Manager interface. On the left, a tree view shows test tables such as 'Reset' and 'Count up by 1 to limit 1'. The 'Reset' table is highlighted with a red box. The main area shows the configuration for an 'IEC Unit Test' with parameters like 'Title: ExampleUnitTests', 'Device read timeout (ms): 5000', and 'Login retries: 3'. A red box highlights the 'Selected functions (empty means all):' field, which contains the text 'Reset'. On the right, the 'Examples.CounterTestTable' report is shown. A red box highlights a specific test step: 'Run counter test (IEC Unit Test) - Succeeded', which includes a table of results for 'Configured selections', 'Configured exclusions', and 'Effectively scheduled tests'. The table shows 'Categories' as empty and 'Functions' as 'RESET'.

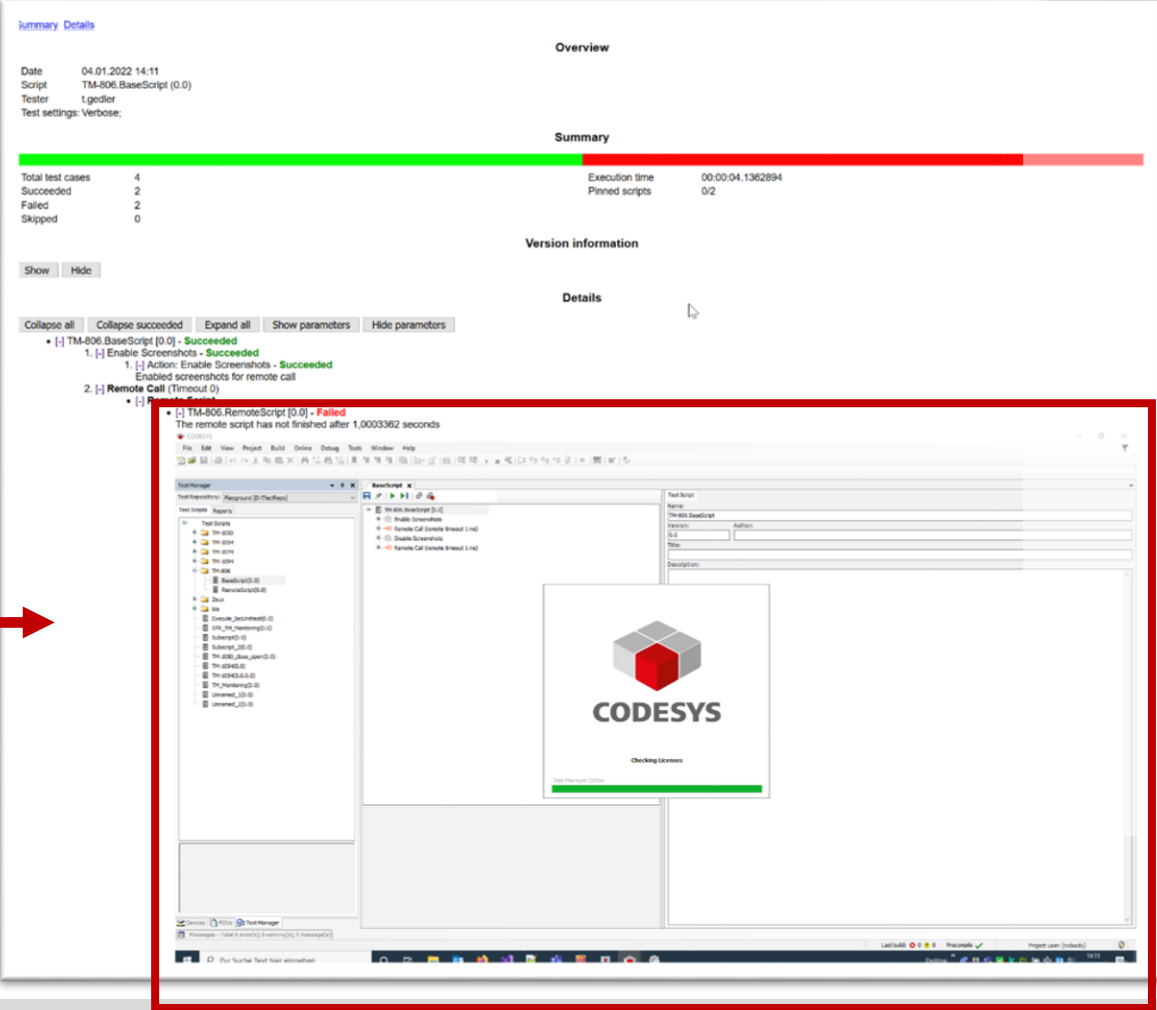
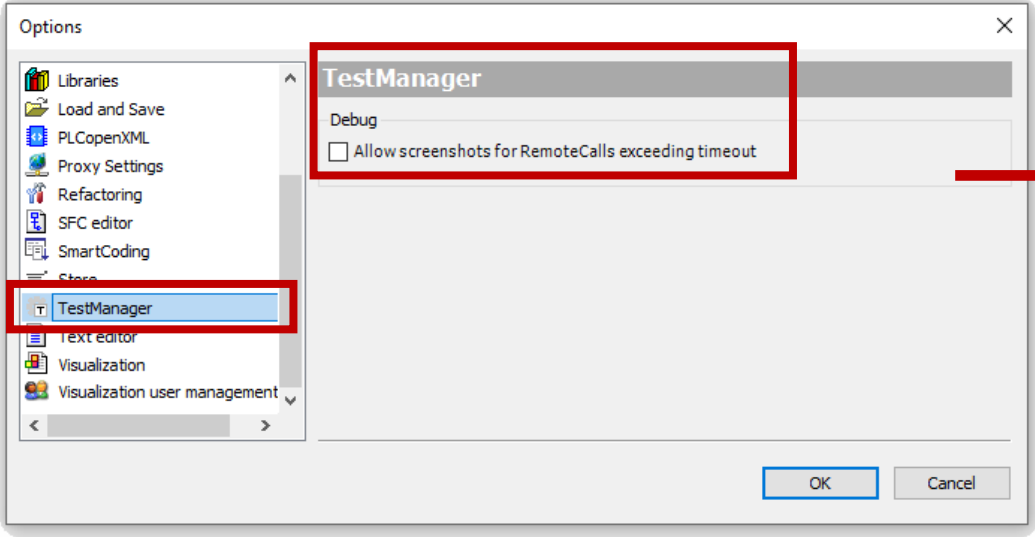
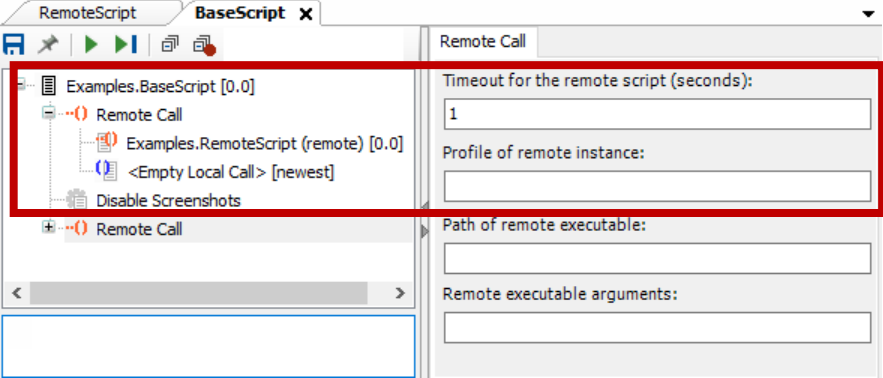
Configured selections	Configured exclusions	Effectively scheduled tests
Categories		
Functions		"RESET"



CODESYS Test Manager



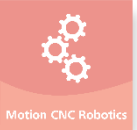
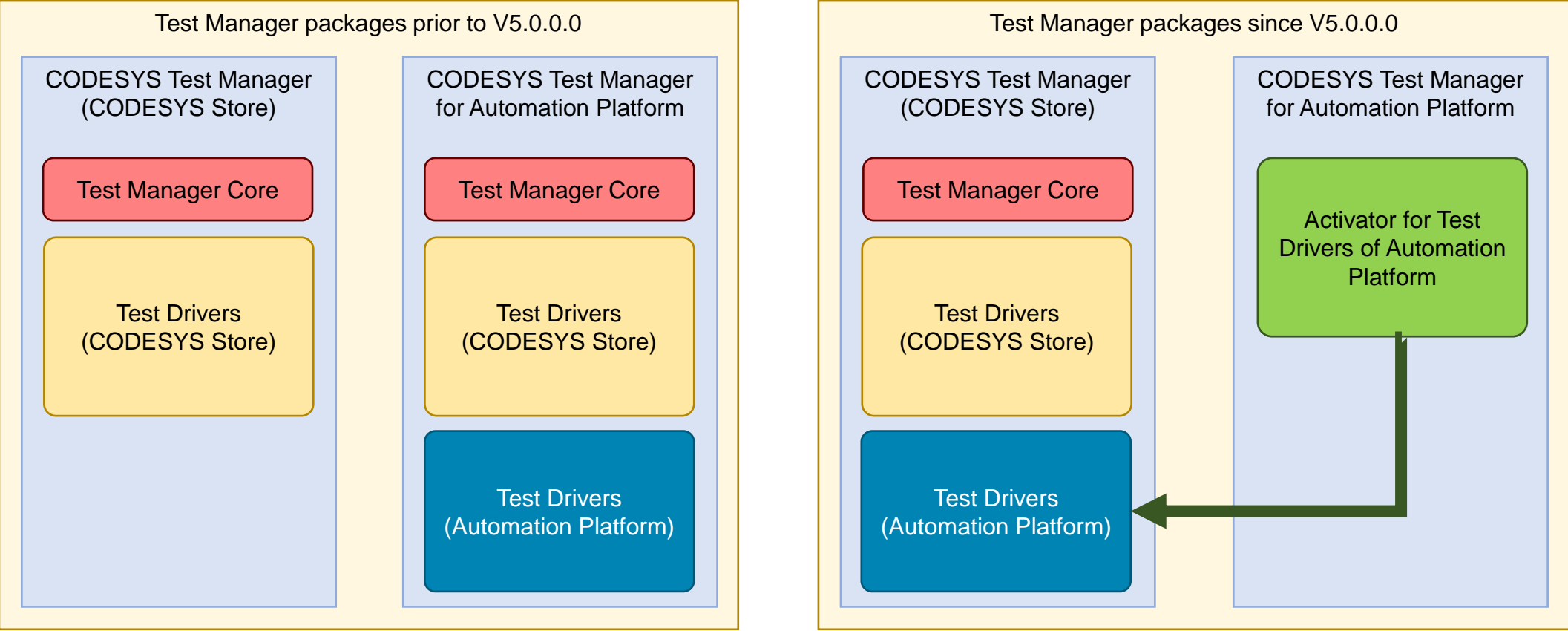
Test Script: Screenshot on timeout for 'Remote Calls'



CODESYS Professional Developer Edition: CODESYS Test Manager for Automation Platform

Refactored Add-on packages

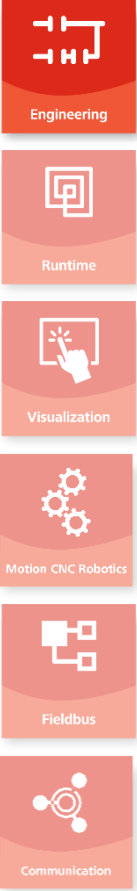
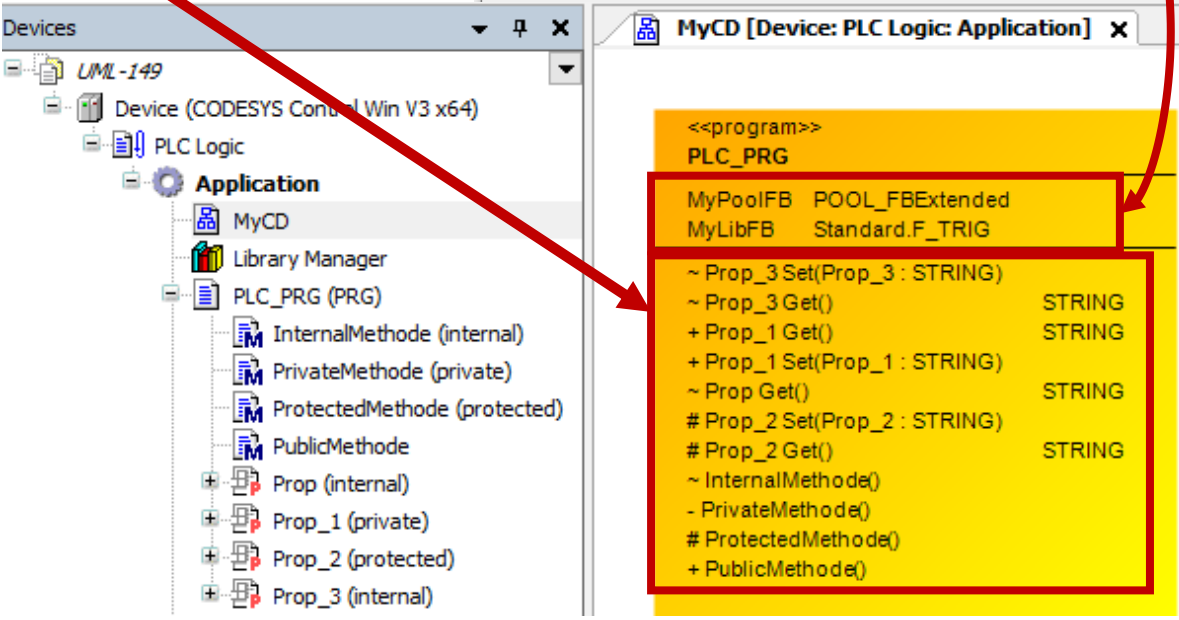
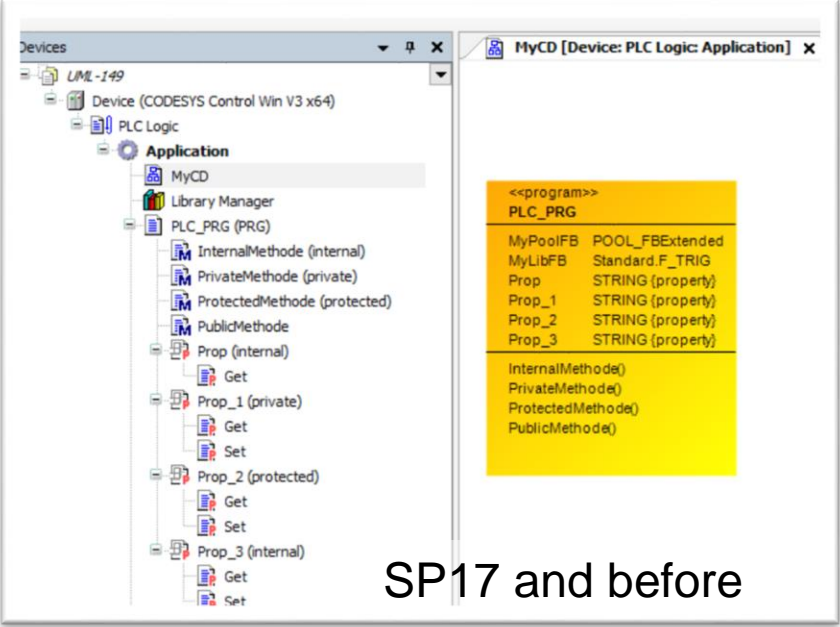
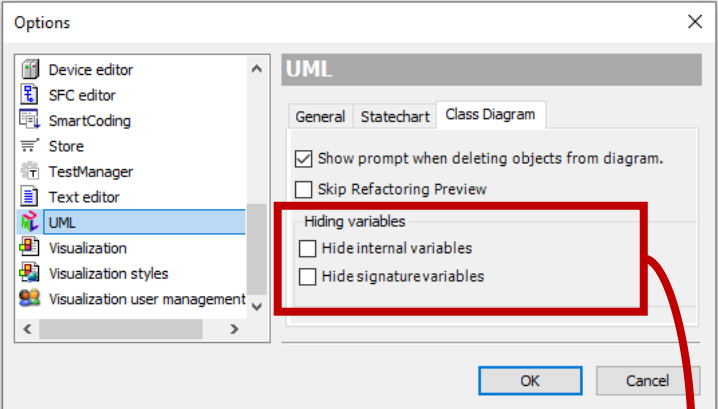
Pre-installation of CODESYS Test Manager now required



CODESYS Professional Developer Edition: CODESYS UML

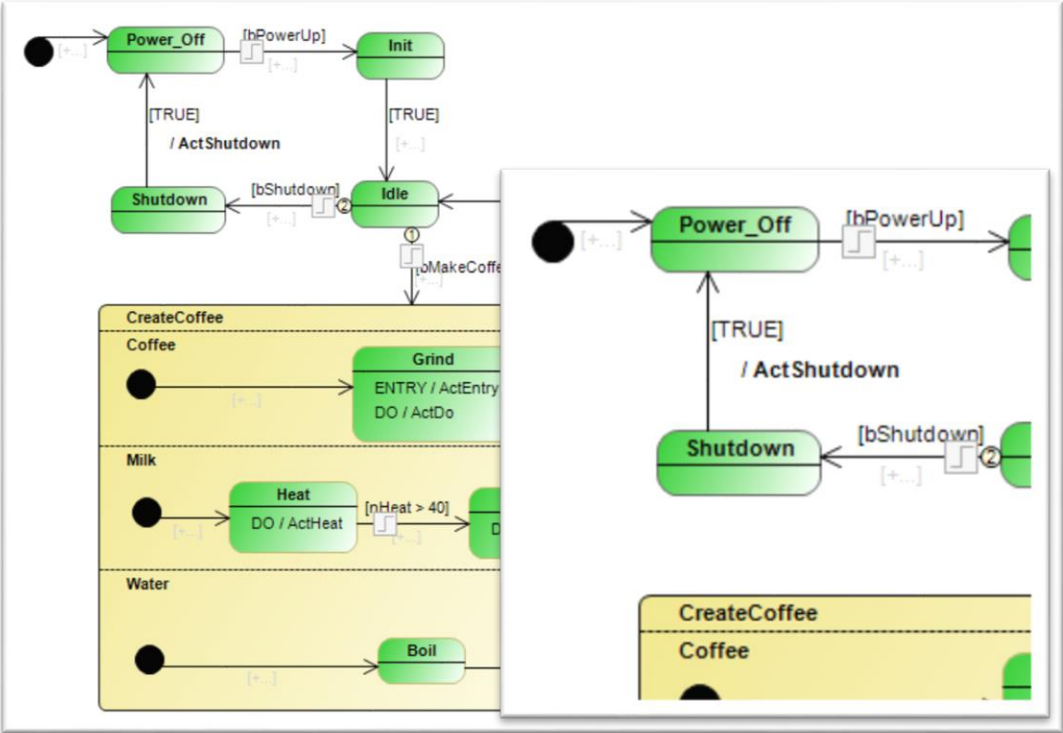
Class Diagram: Improved display of POU members

- Access methods of properties
- Access modifiers of methods
- Configurable display of variables

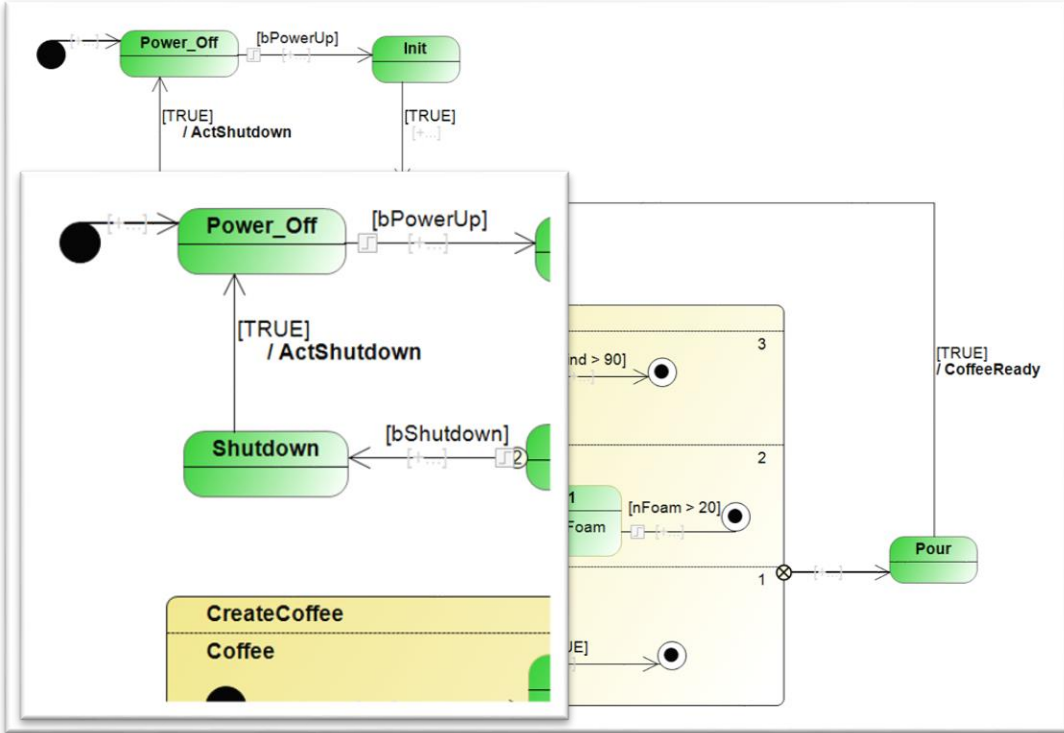


CODESYS Professional Developer Edition: CODESYS UML

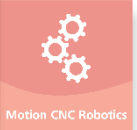
True High DPI support



Interpolated 96DPI to 175% display scaling (example 4K native resolution)



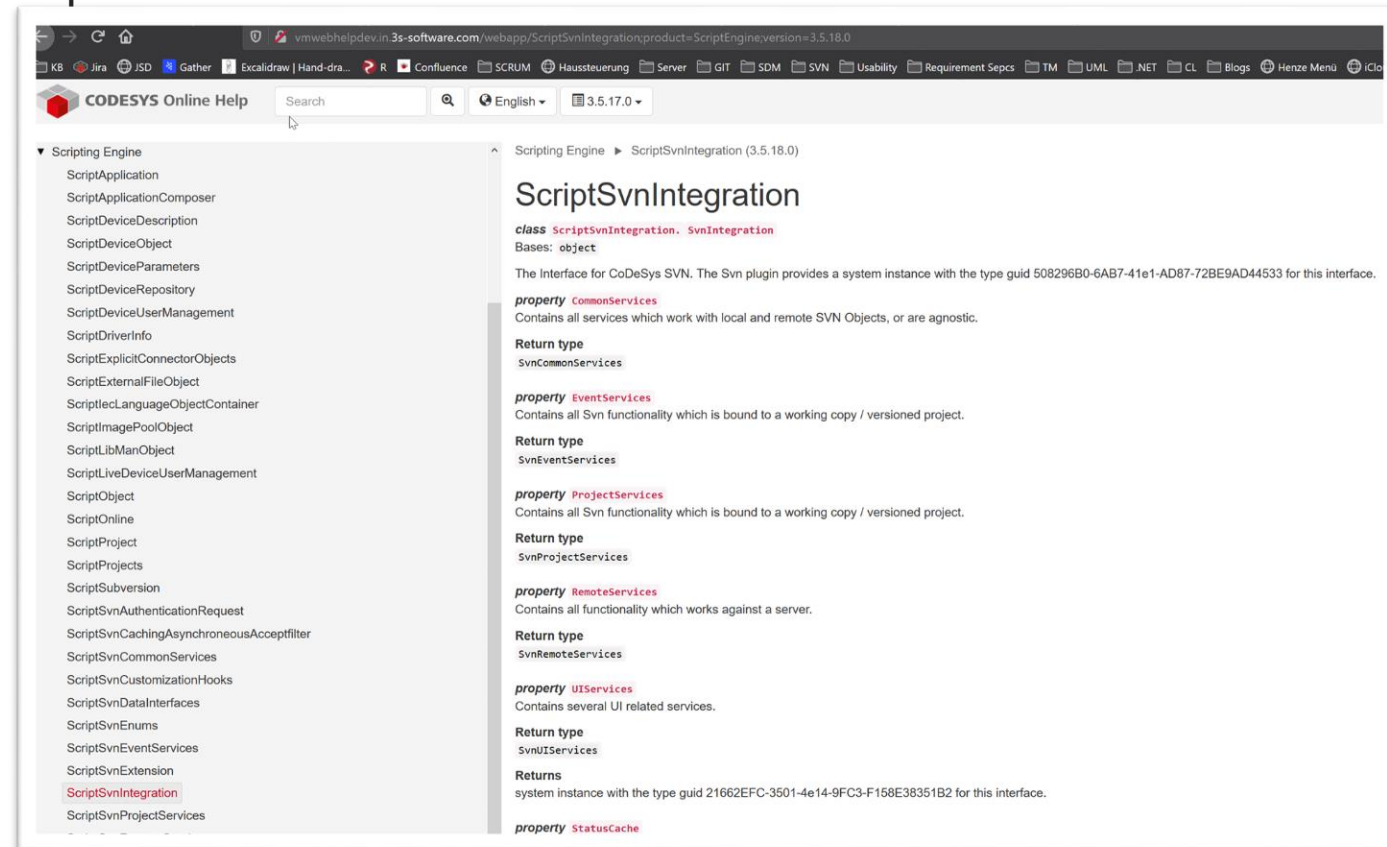
True 175% display scaling (example for 4K native resolution)



CODESYS Professional Developer Edition: CODESYS SVN

Online help for Python script driver

- API documentation for script driver SVN
- Available with new online help of CODESYS V3.5.18.0



The screenshot displays the CODESYS Online Help interface for the ScriptSvnIntegration class. The browser address bar shows the URL: `vmwebhelpdev.in:3s-software.com/webapp/ScriptSvnIntegration;product=ScriptEngine;version=3.5.18.0`. The page title is "ScriptSvnIntegration (3.5.18.0)".

ScriptSvnIntegration

class `ScriptSvnIntegration`. `SvnIntegration`
Bases: `object`

The Interface for CoDeSys SVN. The Svn plugin provides a system instance with the type guid 508296B0-6AB7-41e1-AD87-72BE9AD44533 for this interface.

property `CommonServices`
Contains all services which work with local and remote SVN Objects, or are agnostic.

Return type
`SvnCommonServices`

property `EventServices`
Contains all Svn functionality which is bound to a working copy / versioned project.

Return type
`SvnEventServices`

property `ProjectServices`
Contains all Svn functionality which is bound to a working copy / versioned project.

Return type
`SvnProjectServices`

property `RemoteServices`
Contains all functionality which works against a server.

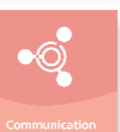
Return type
`SvnRemoteServices`

property `UIServices`
Contains several UI related services.

Return type
`SvnUIServices`

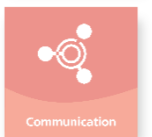
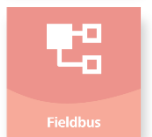
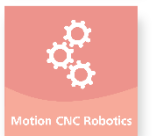
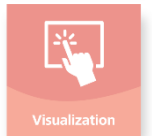
Returns
system instance with the type guid 21662EFC-3501-4e14-9FC3-F158E38351B2 for this interface.

property `StatusCache`



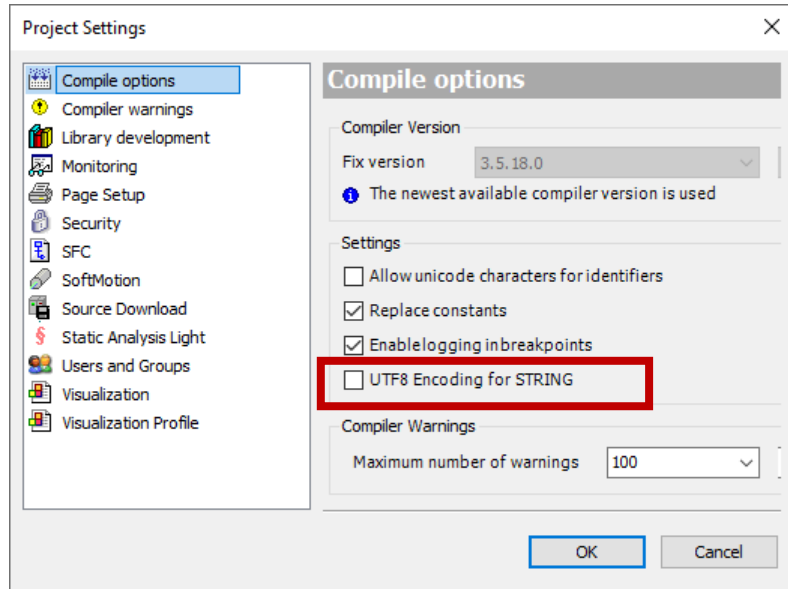
UTF-8 Support for Strings

- **UTF-8 basic information**
 - Encoding for Unicode
 - Characters: variable-length from 1 to 4 Bytes
 - ASCII-character set contained
 - Relatively compact
 - Very common
 - JSON
 - OPC UA
 - XML, HTML mostly encoded in UTF-8



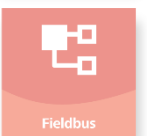
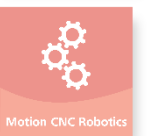
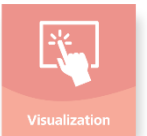
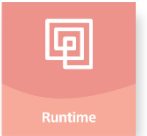
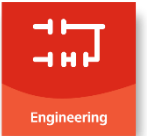
UTF-8 Support for Strings

■ Compiler setting



■ With activated setting:

- All STRING literals encoded as UTF-8
- Monitoring: all STRING-Variables decoded as UTF-8
- STRING-Conversion Functions: conversion from and to UTF-8



UTF-8 Support for Strings

- Independent from compile options:
 - UTF8 STRING literal
 - Monitoring attribute for STRING variables
 - Unicode character literal of type UDINT
 - Monitoring attribute for UDINT
 - New escape sequences for Unicode characters: '\$u00000045'

```
PROGRAM PLC_PRG
VAR
  {attribute 'monitoring_encoding' := 'UTF-8'}
  test: STRING;
  {attribute 'monitoring_encoding' := 'UnicodeCharacter'}
  char1: UDINT;
END_VAR
```

```
test := UTF8#'ÄçÄ';
char1 := UCHAR#'ᄀ';
```

PLC_PRG x			
Device.Application.PLC_PRG			
Expression	Type	Value	Prepar...
test	STRING	'ÄçÄ'	
char1	UDINT	ᄀ	


```
1 test: 'ÄçÄ' := UTF8#'ÄçÄ';
2 char1: ᄀ := UCHAR#'ᄀ';
3 RETURN
```



Engineering



Runtime



Visualization



Motion CNC Robotics



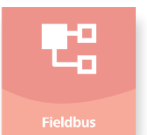
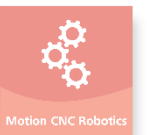
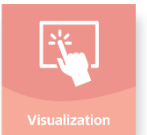
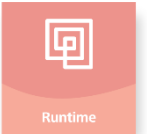
Fieldbus



Communication

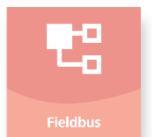
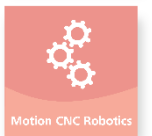
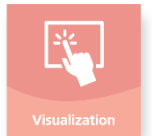
UTF-8 Support for Strings

- **UTF-8 encoding not activated:**
→ **New warning for non-ASCII strings**
- **New static analysis rule „suspicious operation on string“**
 - Index access `str[2]`
 - `ADR(str)`
 - Calls to STANDARD string functions with index accesses (all but CONCAT and LEN)
- **New STRING library to manipulate UTF-8 Strings**
 - Concatenation and parsing much faster than with the functions of the STANDARD lib
 - Fast iteration of characters („runes“)
 - Safe manipulation of UTF8 string
 - Release for users planned for Patch 1



Constant Generics

- **Problem:**
 - A function block treats arrays of different lengths.
 - **Possible solutions so far:**
 - Pass pointer to array and length
 - Problem: Consistency
 - Pass length and allocate with SysMemAlloc
 - Problem: When to free the memory?
 - Allocate a maximal array size
 - Problem: waste of resources
- ⇒ All solutions entail problems.
- **New solution: Constant Generic**



Constant Generics

▪ Definition / Syntax:

```
[attribute 'monitoring display' := 'Monitoring']  
{attribute 'no_explicit_call' := 'An explicit call makes no sense'}  
{attribute 'no_assign'}  
{attribute 'call_after_init'}  
FUNCTION_BLOCK UTF8String  
VAR_GENERIC CONSTANT  
    /// Capacity of the Stringbuffer in bytes  
    udiSize : UDINT := 10;  
END_VAR EXTENDS STR._UTF8String  
VAR_INPUT CONSTANT  
    /// Initial value of this instance  
    sValue : STRING(udiSize);  
END_VAR  
VAR  
    i : UDINT;  
END_VAR
```

Attribute to monitor the property string

Size of the handled string
→ Used for checking the FB
→ **Not** used during compilation



Engineering



Runtime



Visualization



Motion CNC Robotics



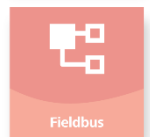
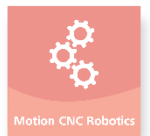
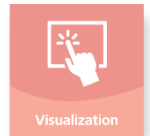
Fieldbus



Communication

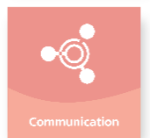
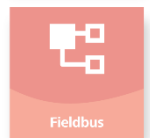
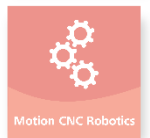
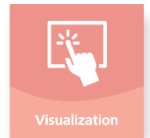
CODESYS IIoT Libraries

- **New library included: Web Socket Client SL**
- **Advantages of Web Socket connections**
 - Bi-directional connection to a webserver via the internet
 - No client polling necessary due to the bi-directional connection => Less data traffic, fast reaction time
 - Less data overhead
 - Communication via standard internet ports 80 and 443 (TLS)
- **Features of the Web Socket Client SL library**
 - Unencrypted connections (ws)
 - Encrypted connections (wss, configurable TLS settings)
 - Configurable ping interval
 - Communication via HTTP Proxy Server
 - Fragmented packages
- **Released with IIoT Libraries SL 1.4.0.0**



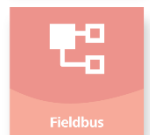
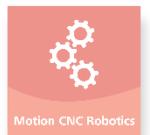
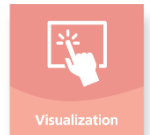
CODESYS IIoT Libraries

- **MQTT Client SL: Support of MQTT over Web Socket**
- **Advantages of Web Socket connections**
 - Communication via standard internet ports 80 and 443 (TLS)
 - Support of many internet MQTT brokers
 - Publish and subscribe messages over the internet
- **Features**
 - Unencrypted connections (ws)
 - Encrypted connections (wss, configurable TLS settings)
 - Communication via HTTP Proxy servers
- **Released with IIoT Libraries SL 1.5.0.0**



CODESYS IIoT Libraries

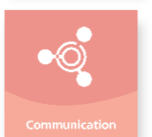
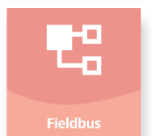
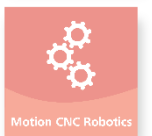
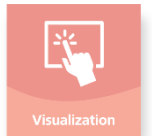
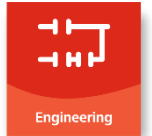
- **MQTT Client SL: Support of MQTT V5**
- **Advantages of Web Socket connections**
 - Improved error handling for more robust systems
 - Session and message expiry
 - Predefined restrictions (maximum QoS, maximum package size...)
 - Scalability
 - Load balancing via shared subscriptions
 - Topic aliases and subscription ids to reduce message size and CPU load
 - Greater flexibility
 - User properties
 - Payload format indicators
- **Features**
 - Support of all MQTT V5.0 features (see next slide for details)
 - MQTT V5.0 and V3.1.1 support (switchable via input)
- **Release with IIoT Libraries SL 1.6.0.0**



CODESYS IIoT Libraries

▪ MQTT Client SL: Supported MQTT V5 features

- Session expiry
- Message expiry
- Reason code on all ACKs
- Server disconnect
- Payload format and content type
- Request / response
- Shared subscriptions
- Subscription ID
- Topic alias
- Flow control
- User properties
- Maximum packet size
- Optional server feature availability
- Enhanced authentication
- Subscription options
- Will delay
- Server keep alive
- Assigned client ID
- Server reference



1

Engineering

2

Runtime

3

Visualization

4

Motion CNC Robotics

5

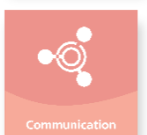
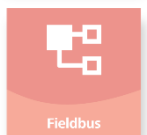
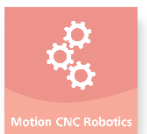
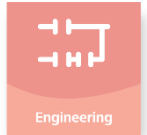
Fieldbus

6

Communication

Overview

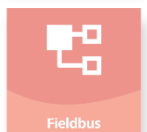
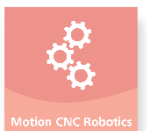
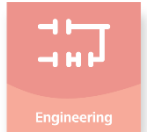
- **CODESYS Control Extension Package**
- **New Reference Implementation for Embedded Runtimes**
- **PLCopen Safety Library for SIL2**
- **Runtime Toolkit – Usage of CmRuntime and AxProtector**
- **CodeMeter® Support**
- **Online Communication**
- **Device User Management**



CODESYS Control Extension Package (1/7)

- **Extension of Linux-based SoftPLCs (“SL products”) without runtime toolkit**
- **Overview of main use cases**
 - Use existing C-Code from inside the IEC application
 - Use existing API from inside the IEC application (function call)
 - Support local/remote IOs from inside the IEC application
 - Support retain memory
 - Support run/stop switch
 - Trigger external event
 - Register to application events
 - Configure runtime/application (local PLC shell access)
- **Release based on SDK SP17 P3**

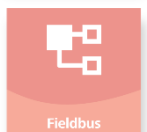
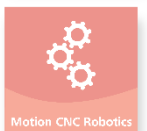
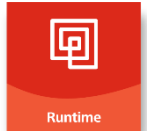
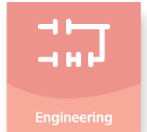
Included free of charge in Linux-based SoftPLC packages in the CODESYS Store



CODESYS Control Extension Package (2/7)

Use case: Use existing C-Code from inside the IEC application

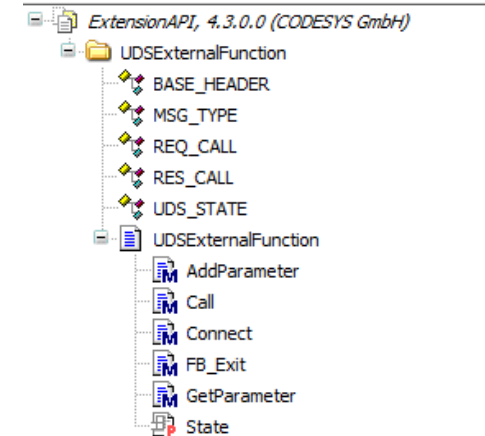
- Create own runtime component (shared object)
- Uses „standard“ mechanism for externally implemented function
- Can be created with Extension SDK (minimal subset from runtime SDK)
- Can be used with/without „C-Code Integration“ plug-in (transport via IEC library)
- Restrictions:
 - No access to runtime interfaces
 - No direct access to IEC application / variables
 - No debugging from CODESYS IDE
 - Only C code
 - Direct impact on runtime process (no process separation)



CODESYS Control Extension Package (3/7)

Use case: Use existing API/IO from inside the IEC application (function call)

- With process separation based on Unix domain sockets
- Client can be any technology (example available in Python / C).
- Extension IEC Library provides base FB to realize external function call (Extension API).
Performance: < 50us roundtrip per call
- Generic IO driver based on base FB for simple IOs (IoDrvSocketUnix)

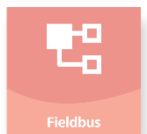
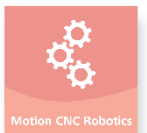
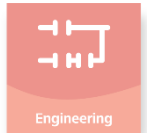


ExternalIoDrv

- DeviceUnderTest (CODESYS Control for Linux SL)
 - SPS-Logik
 - Application
 - Bibliotheksverwalter
 - PLC_PRG (PRG)
 - Taskkonfiguration
 - MainTask (IEC-Tasks)
 - PLC_PRG
 - SocketUnixIOModule (SocketUnixIOModule)
 - SoftMotion General Axis Pool

Suche

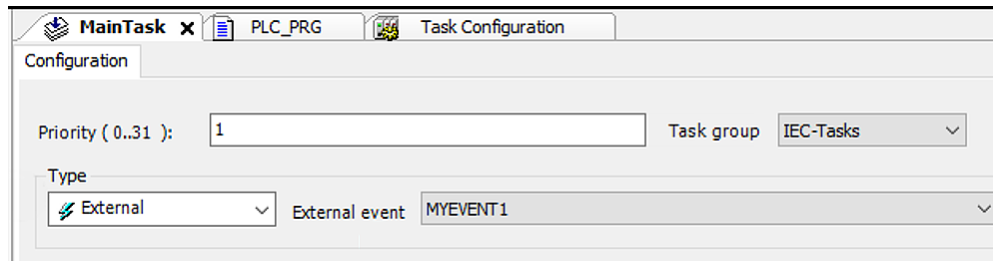
Variable	Mapping	Kanal	Adresse	Typ
Application.PLC_PRG.dwIn1		in1	%ID0	DWORD
Application.PLC_PRG.dwIn2		in2	%ID1	DWORD
Application.PLC_PRG.dwOut1		out1	%QD0	DWORD
Application.PLC_PRG.dwOut2		out2	%QD1	DWORD



CODESYS Control Extension Package (4/7)

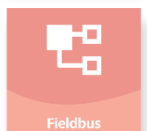
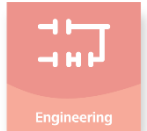
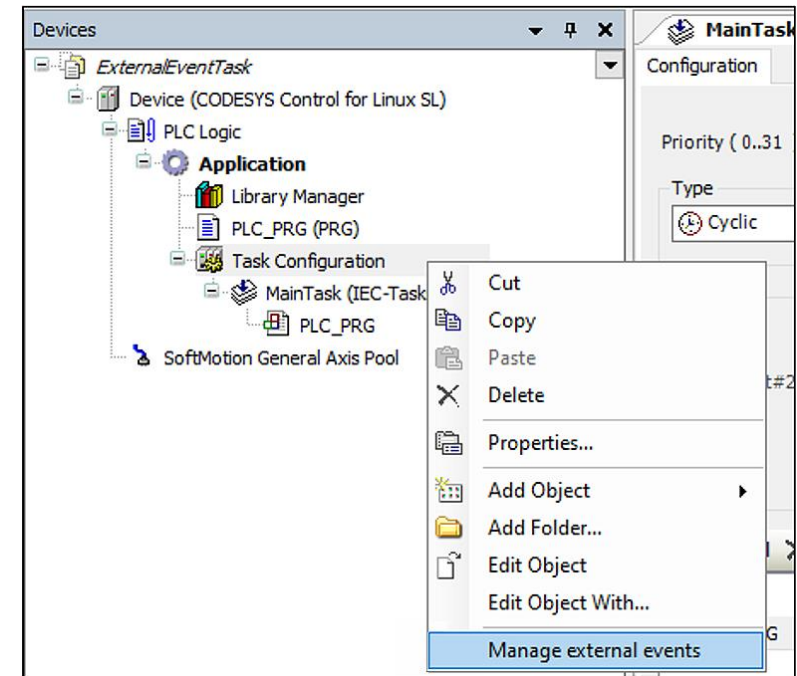
Use case: Trigger external event tasks / register to application events

- Runtime component providing Unix domain sockets triggering of external event tasks



```
socat - UNIX-CLIENT:/var/run/codesyscontrol/eventtasks/MYEVENT1.sock
```

- Register to and receive callback for IEC application events such as application start / stop / exception / reset / exit / bootappsloaded



CODESYS Control Extension Package (5/7)

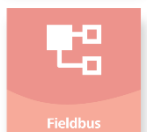
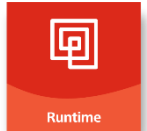
Use case: Support retain memory

- Standard CmpRetain mechanism (nothing SL specific)
 - Configuration „Retains in shared memory“

```
[CmpApp]  
RetainType.Applications=InSHM
```

```
[CmpRetain]  
Retain.SHM.Size=0x1FFFF  
Retain.SHM.Name=MyRetainMemory
```

➔ „Public“ shared memory is created and can be used or mounted to file-/devicedriver etc.

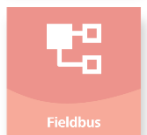
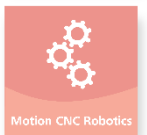
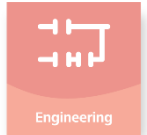


CODESYS Control Extension Package (6/7)

Use case: Support run/stop switch*

- Runtime component providing generic run/stop switch mechanism
 - Text file based
`/var/opt/codesysextension/runstop.switch`
- easy to use, e.g. from command line
- `echo „RUN“ > /var/opt/codesysextension/runstop.switch`
- `echo „STOP“ > /var/opt/codesysextension/runstop.switch`

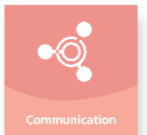
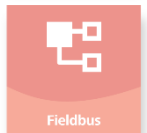
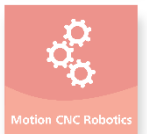
* Not supported on hardware that has „real“ run/stop switch (e.g. PLCnext / PFC etc.)



CODESYS Control Extension Package (7/7)

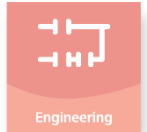
Use case: Support PLC Shell

- Runtime component providing access to runtime PLC Shell
 - Based on Unix domain sockets
 - Anonymous user must be activated in User Management settings
- Example command line:
`socat - UNIX-CLIENT:/var/run/codesyscontrol/plcshell.sock`



Reference Implementation for Embedded Runtimes

- **STM32H753I-EVAL (Cortex M7 480MHz)**
 - Reference implementation valid for the whole board family
- **Environment: STMCube IDE (free)**
 - Binary for demo purposes available
- **Implemented Features**
 - Timer Scheduler with FreeRTOS
 - Hardware breakpoints and exception handling
 - Flash driver for IEC application
 - Lightweight IP stack (LwIP) for CODESYS communication
 - COM / USB driver supported
- **Pending**
 - Target Visu Light / Embedded
 - SysEthernet implementation
 - CAN driver



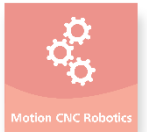
Engineering



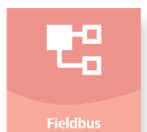
Runtime



Visualization



Motion CNC Robotics



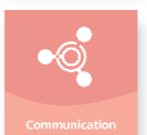
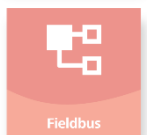
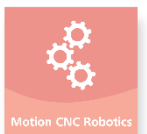
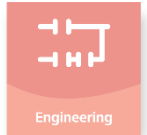
Fieldbus



Communication

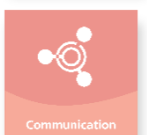
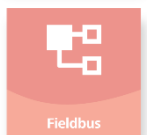
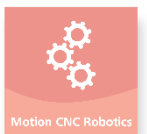
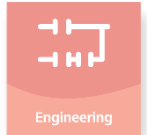
PLCopen Safety Library for SIL2

- **PLCopen specification version 2.01**
- **Usable in CODESYS Safety SIL2 applications**
- **Implemented function blocks**
 - SF_Equivalent
 - SF_Antivalent
 - SF_EmergencyStop
 - SF_EDM
 - SF_ResetButton



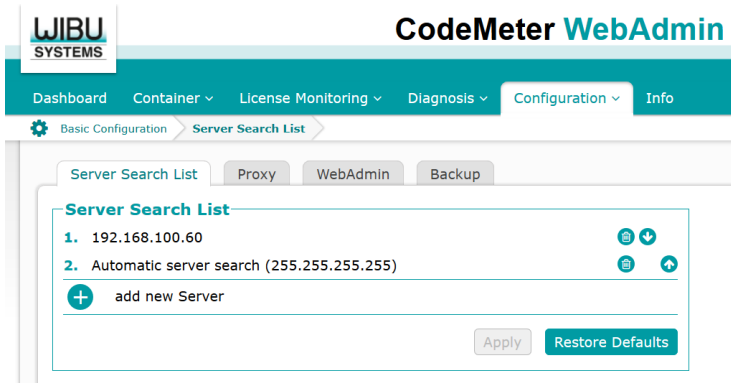
Runtime Toolkit – Usage of CmRuntime and AxProtector

- **Up to SP18**
 - Use of CmEmbedded very complex for device manufacturers
 - Providing a secure serial number on the target
 - FMEA to safeguard the runtime system (encryption/signing)
- **As of SP18:**
 - CmRuntime can be used under Windows and Linux (inclusive UFC support).
→ SmartBind mechanism provides the secure serial number.
 - Usage of the AxProtectors for Linux platforms!
 - Protection via AxProtector for runtime implementation of device manufacturers pending
 - Description of the usage of CmRuntime and AxProtector for device manufacturers available in the Runtime System Online Help (Access to Customer portal required)



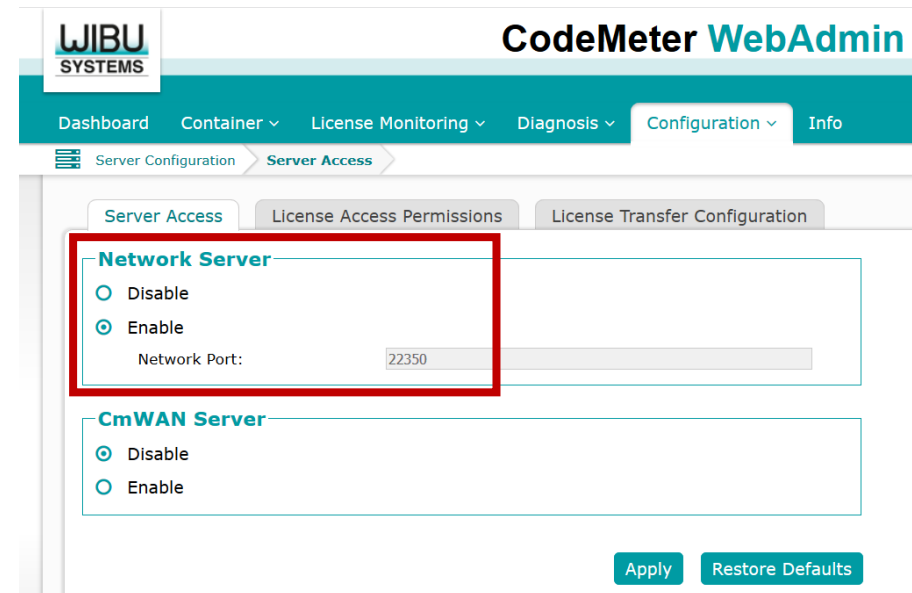
CodeMeter® Support – network licenses

- Configuration of CmRuntime as a license server
- Default IP Port 22350 must not be changed!
- Configuration of the license server in two different ways:
 - Additional entry in server search list:



- Entry in the cfg-File of the runtime system:

```
[CmpCodeMeter]
LicenseServer.1=192.168.100.60
```



Engineering



Runtime



Visualization



Motion CNC Robotics



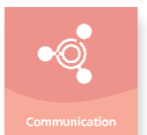
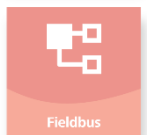
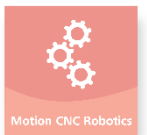
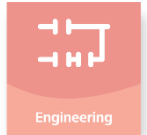
Fieldbus



Communication

CodeMeter® Support – Unit counter licenses

- **New license type: *UnitCount license***
- **Use case: *Pay per use***
- **Decrementing the license counter with every access to the license**
- **New interface functions to use UnitCount licenses:**
 - **Function to get the current value of the license unit counter:**
`RTS_RESULT CDECL CodeMGetUnitCounter(RTS_HANDLE hCodeMeter, RTS_UI32 *pulUnitCount)`
 - **Function to decrement unit count value with the specified decrement:**
`RTS_RESULT CDECL CodeMDecrementUnitCounter(RTS_HANDLE hCodeMeter, RTS_UI32 ulUnitCount)`

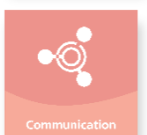
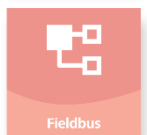
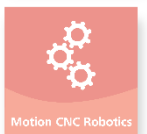
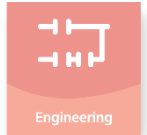


CodeMeter® Support – IEC-application performance licenses (pending)

- Licensing of SoftPLCs (“SL runtimes”) by so called „performance licenses“
- Limitation of the IEC application issues by performance licenses:
 - Number of IEC tasks
 - IEC code size
- License feature map provides performance licenses:
 - Number of IEC tasks: ProductCode=5000, Number of IEC tasks=*FeatureMap*
 - IEC code size: ProductCode=5001, Codesize=*FeatureMap* * 1MB

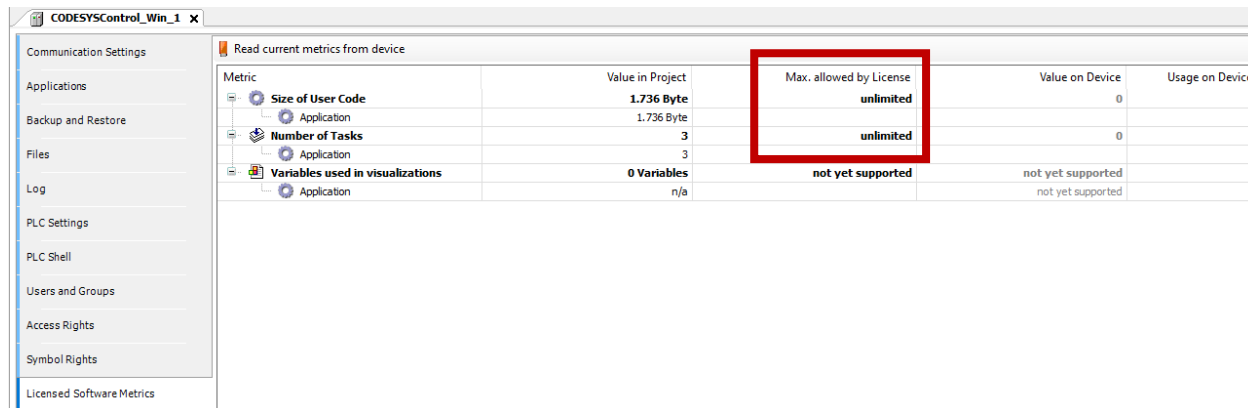
Notes:

- No implicitly generated tasks or code considered in these limits!
(Only application developer code considered)
- IEC code size / IEC tasks globally limited!
(Calculation over the complete IEC applications on the target)



CodeMeter® Support – IEC application performance licenses

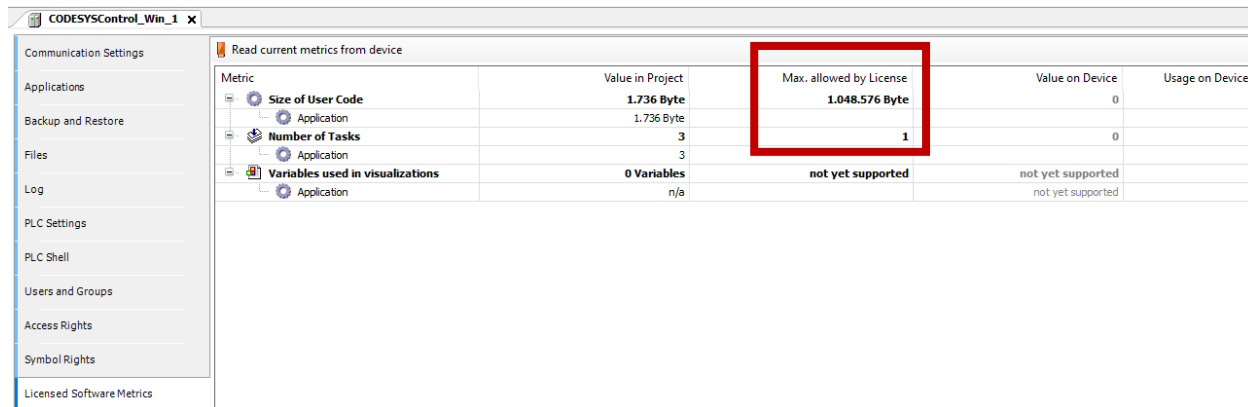
- CODESYS editor: Checking the license limits in the device dialog
 - Runtime full license available:



Read current metrics from device

Metric	Value in Project	Max. allowed by License	Value on Device	Usage on Device
Size of User Code	1.736 Byte	unlimited	0	
Application	1.736 Byte			
Number of Tasks	3	unlimited	0	
Application	3			
Variables used in visualizations	0 Variables	not yet supported	not yet supported	
Application	n/a		not yet supported	

- Performance license available:



Read current metrics from device

Metric	Value in Project	Max. allowed by License	Value on Device	Usage on Device
Size of User Code	1.736 Byte	1.048.576 Byte	0	
Application	1.736 Byte			
Number of Tasks	3	1	0	
Application	3			
Variables used in visualizations	0 Variables	not yet supported	not yet supported	
Application	n/a		not yet supported	



Engineering



Runtime



Visualization



Motion CNC Robotics



Fieldbus

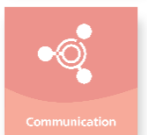
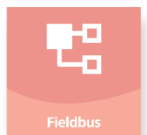
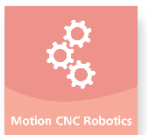
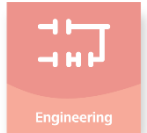


Communication

CodeMeter® Support – Generic SoftPLC license check

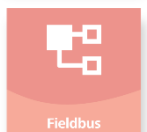
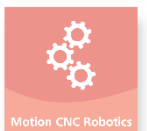
- Up to SP18:
Specific license check in every SoftPLC (“SL runtime”)
- As of SP18:
Generic checks by the component manager

➔ Cyclic license check / error handling now identical for all SoftPLCs



Online communication – asynchronous execution

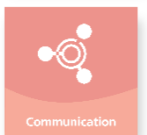
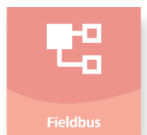
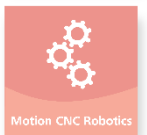
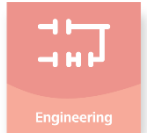
- **Asynchronous execution of all online service now activated by default**
- **Prerequisite:**
 - CmpAsyncMgr must be available on the runtime system!
- **Advantages:**
 - No time limitation for long running online services (reset, download, etc.)
→ No communication timeout limit
 - No blocking of the complete communication by unhandled exceptions in Layer 7 services



Device User Management – Access from IEC application

CmpUserMgr.library:

- New interface functions to edit the users, groups and rights
- New parameter hUser: first parameter at all interface functions!
→ Access to user management only after first login per UserMgrLogin() API
- Newly available interface functions:
 - UserMgrChangeMyPassword
 - UserMgrGetFirstUser, UserMgrGetNextUser
UserMgrGetFirstGroup, UserMgrGetNextGroup
UserMgrGetFristGroupMember, UserMgrGetNextGroupMember
 - UserMgrAddUser, UserMgrRemoveUser
UserMgrSetCredentials
UserMgrSetProperty
UserMgrAddGroup, UserMgrRemoveGroup
UserMgrAddUserToGroup, UserMgrRemoveUserFromGroup
 - UserMgrGetFirstObject, UserMgrGetNextObject
UserMgrObjectGetFirstChild, UserMgrObjectGetNextChild
UserMgrObjectGetFirstGroup, UserMgrObjectGetNextGroup
UserMgrObjectGetGroupRights
UserMgrObjectGetName
 - UserMgrObjectAddGroup, UserMgrObjectRemoveGroup
UserMgrObjectSetGroupRights, UserMgrObjectSetGroupDeniedRights, UserMgrObjectClearRights



1

Engineering

2

Runtime

3

Visualization

4

Motion CNC Robotics

5

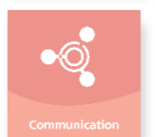
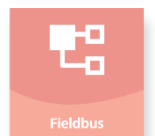
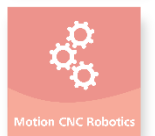
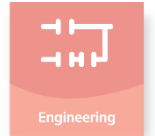
Fieldbus

6

Communication

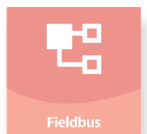
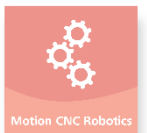
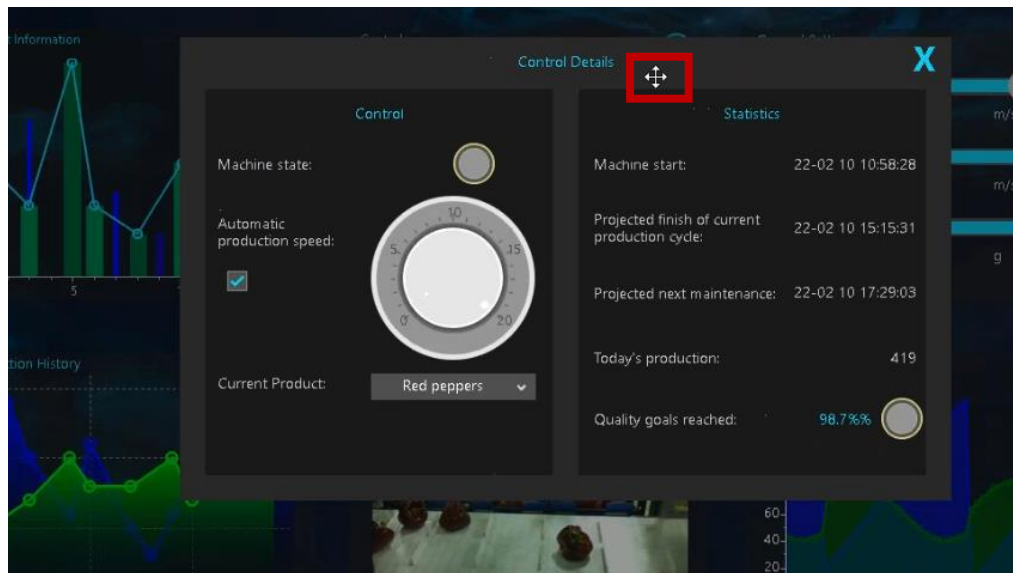
Overview

- **Moveable Dialogs**
- **XYChart**
- **Trend**
- **Further Features and Improvements**
- **CODESYS Web View (free Android App)**



Moveable Dialogs

- **With activated overlay mode: Visualization now movable**
- **Movable areas:**
 - Background areas
 - Element “Invisible Input” with set option “Used as pointing area”
- **Last opening position: Stored for each client and for each specific dialog**



XY Chart

- **Show localized texts instead of numbers for the axis labeling**

- Via variable
- Directly via test list

- **Example:**

- AxisX.wsTLNumberReplace := "Months";
- "Months" is the name of the text list

ID	Default	Misc	Eng
1	January	Januar	January
2	February	Februar	February
3	March	März	March
4	April	April	April
5	May	Mai	May
6	June	Juni	June
7	July	Juli	July
8	August	August	August
9	September	September	September
10	October	Oktober	October
11	November	November	November
12	December	Dezember	December

Extended variables

Axis variable:

Extended display parameters

Display ruler Display numbers

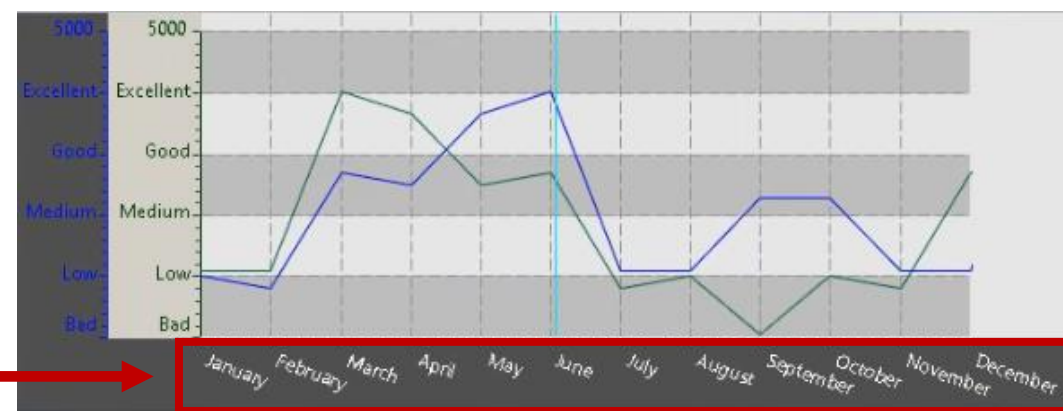
Extra space on x-axis Display of minimum number

Axes overlap in origin Display of maximum number

Rotation aligned to mark.

Number rotation angle:

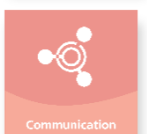
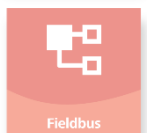
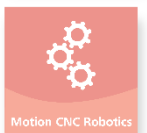
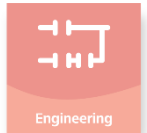
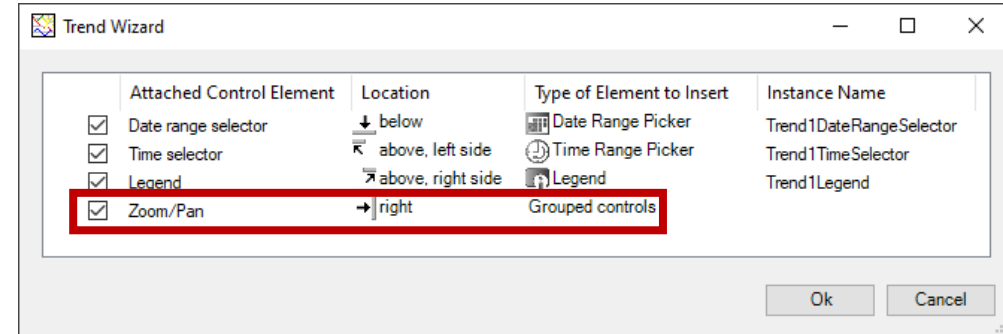
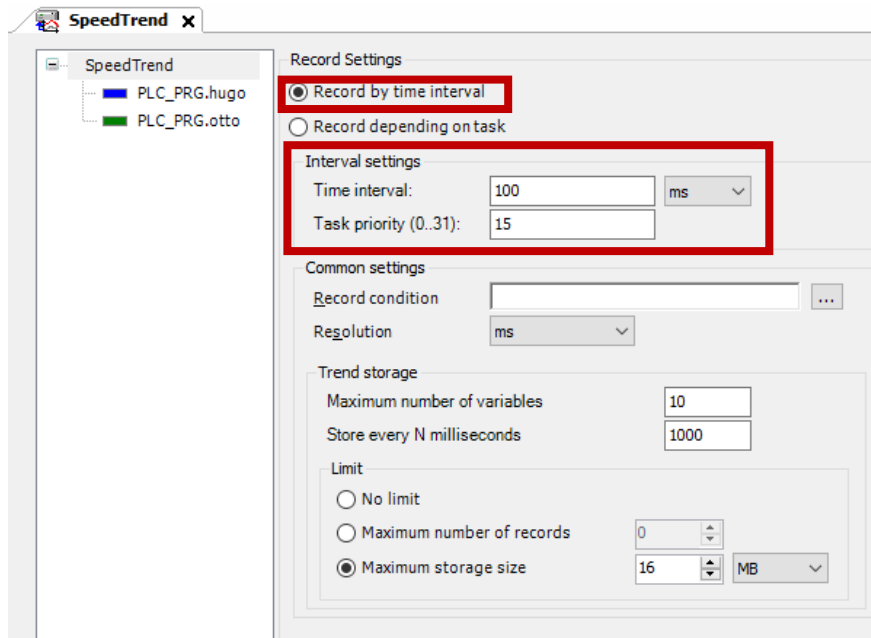
Texts for numbers replacing:



- Engineering
- Runtime
- Visualization
- Motion CNC Robotics
- Fieldbus
- Communication

Trend

- Scrolling/zooming by touch supported
- Trend recording: Simplified configuration



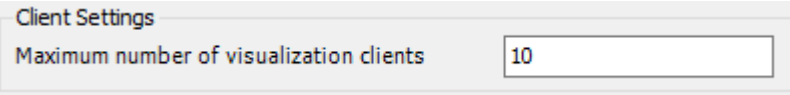
Further features and improvements

- **New OnValueChanged event in element properties**

- ➔ Reaction on changed values

- **Set maximum number of visualization clients**

- New message in the visualization manager (Advanced Settings)



Client Settings
Maximum number of visualization clients

- Target-specific device description, e.g.:

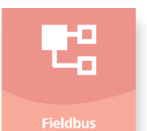
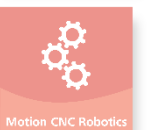
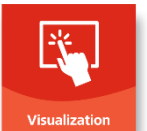
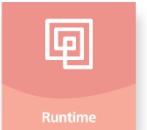
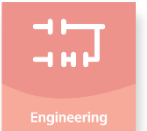
```
<ts:setting name="maximum_number_of_visualization_clients" type="integer" access="readonly">
  <ts:value>3</ts:value>
</ts:setting>
```

- **TabControl: Dynamic visibility for tabs by IEC variable**

- **Display of full date / time including time zone / offset in visualization or UTC**

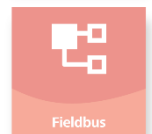
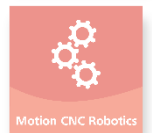
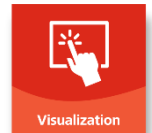
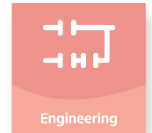
- New format specifier Z (f.e. +02:00 is displayed) or VisuElems.Visu_DateTime.DisplayUTC := TRUE;

- **WebVisu/Remote Target Visu: Automatic release of a tapped variable in case of lost connection to the client**



CODESYS Web View (free Android App)

- **General:**
 - Searches local wireless LAN network for web visualizations
 - Available in the Google Play Store
- **New: Support of CODESYS Automation Server**
 - Get and manage the URLs of web visualizations from the CODESYS Automation Server
 - Read device names from the CODESYS Automation Server



1

Engineering

2

Runtime

3

Visualization

4

Motion CNC Robotics

5

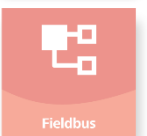
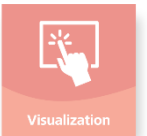
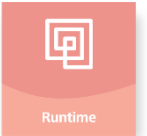
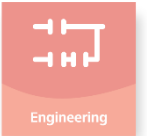
Fieldbus

6

Communication

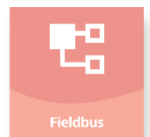
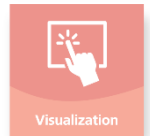
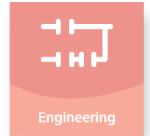
Overview

- **Improved CP-Tracking**
- **SMC_TrackSetValues**
- **Logical Axis: Improve filter**
- **SMC_GroupReadPathDynamics**
- **New drivers for servo drives**



Improved CP-Tracking

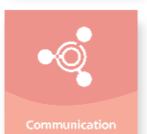
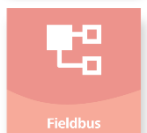
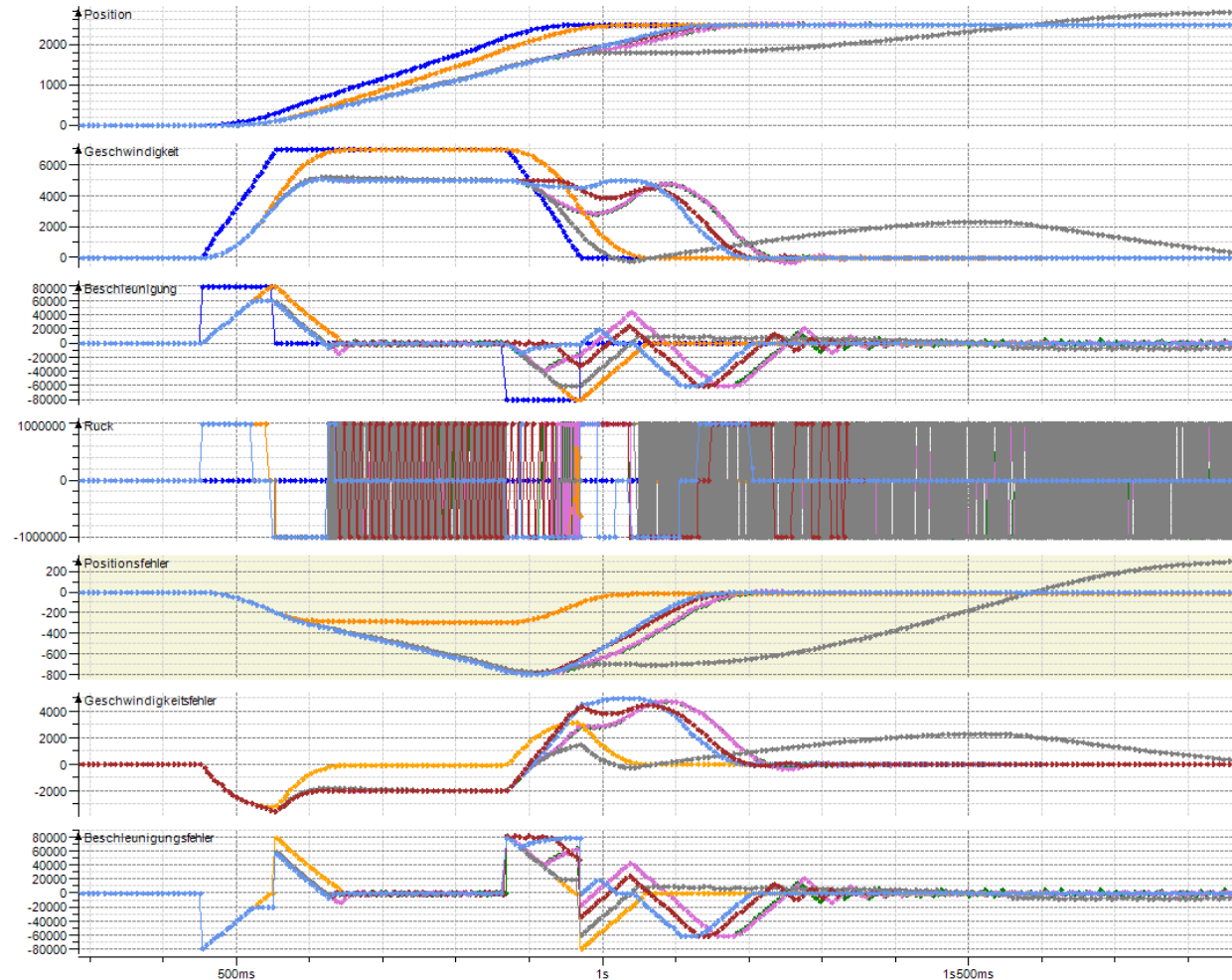
- Easier engineering of pick & place applications
- Improved robustness – usage without tuning
- Extended functionality
- More consistent behavior
- Improved maintainability



SMC_TrackSetValues

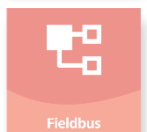
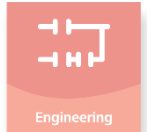
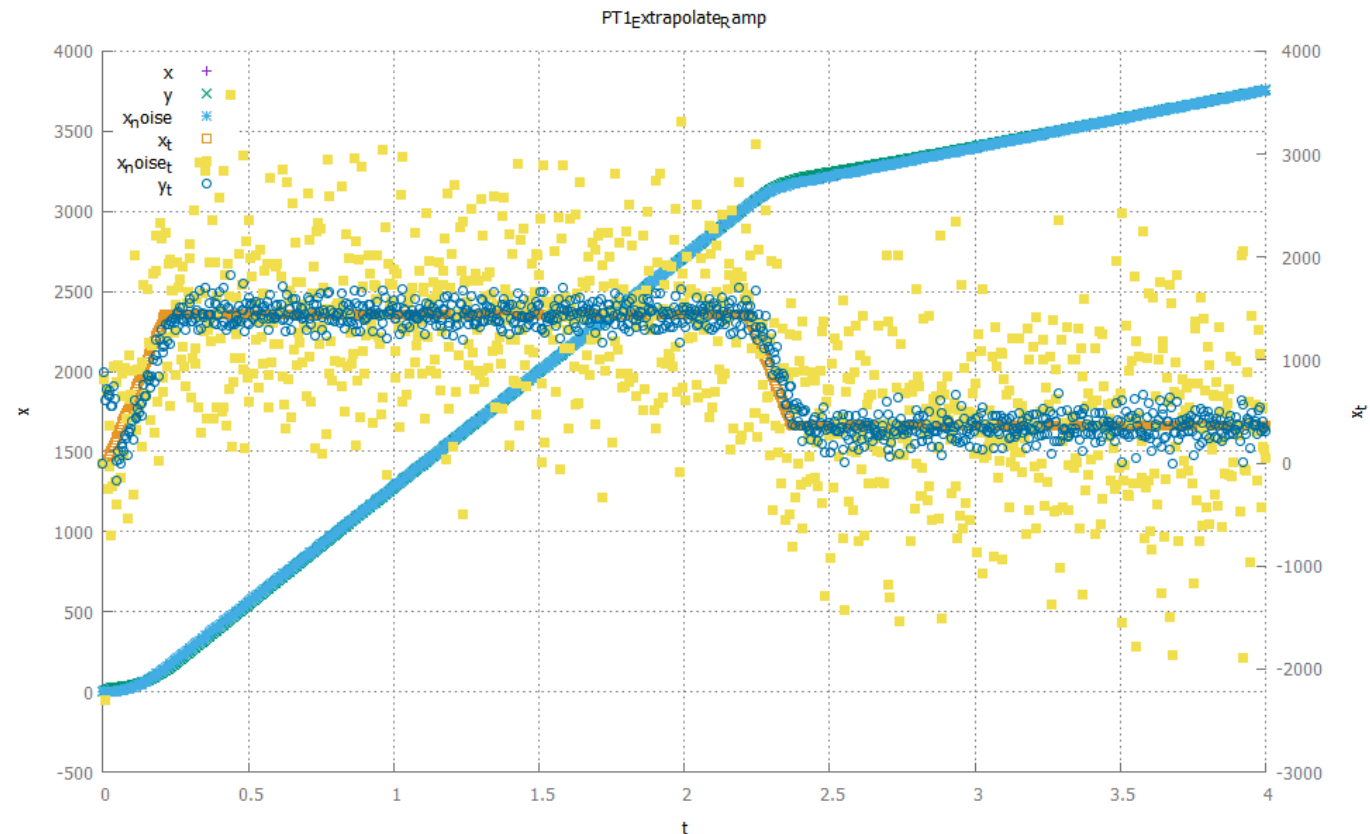
- Single Axis FB (PLCopen Part 1)
- Follows a given reference signal.
- Respects given limits for velocity, acceleration, jerk.

SMC_TrackSetValues	
Axis <i>AXIS_REF_SM3</i>	<i>BOOL</i> bBusy
bExecute <i>BOOL</i>	<i>BOOL</i> bCommandAborted
fSetPosition <i>LREAL</i>	<i>BOOL</i> bError
fSetVelocity <i>LREAL</i>	<i>SMC_ERROR</i> iErrorID
fSetAcceleration <i>LREAL</i>	<i>BOOL</i> bInSync
fSetJerk <i>LREAL</i>	
Velocity <i>LREAL</i>	
Acceleration <i>LREAL</i>	
Deceleration <i>LREAL</i>	
Jerk <i>LREAL</i>	
SignalModuloPeriod <i>LREAL</i>	



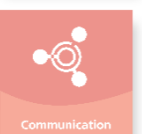
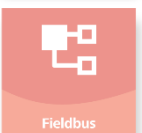
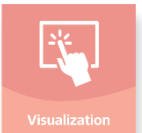
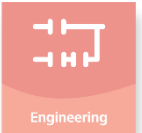
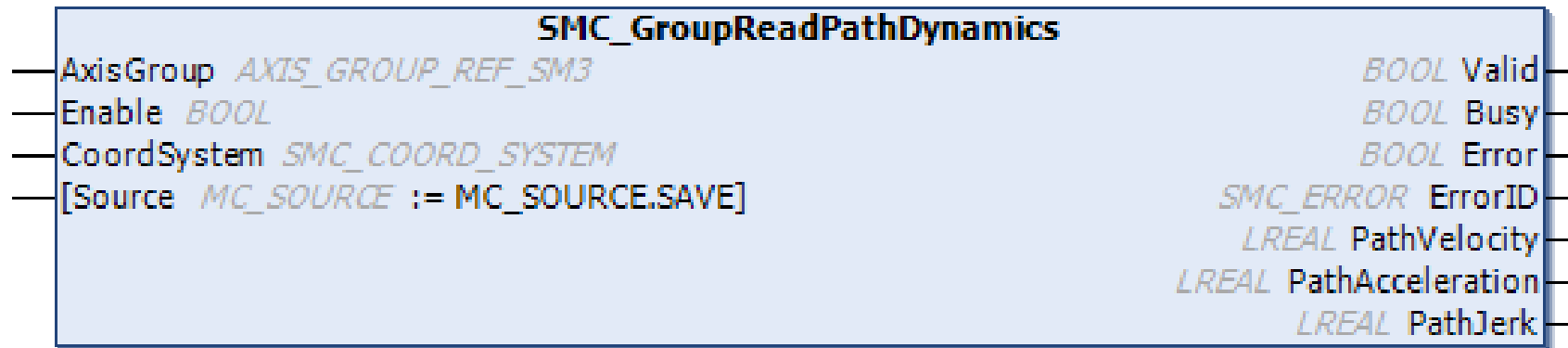
Logical Axis: Improved filter

- Logical axis: can be used to smooth noisy encoder signals
- Improved noise reduction of the position signal
- PT1 filter with extrapolation, instead of a moving average
- Maximum window length extended from 15 to 1000 cycles



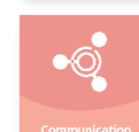
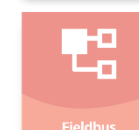
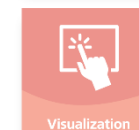
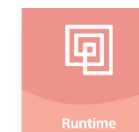
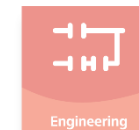
SMC_GroupReadPathDynamics

- Robotics function block to read path velocity, acceleration, and jerk



New drivers for servo drives

- Kollmorgen MKD-N/C, AKD-N/C, AKD2G
- Panasonic A6 MultiDrive
- Nidec Unidrive



1

Engineering

2

Runtime

3

Visualization

4

Motion CNC Robotics

5

Fieldbus

6

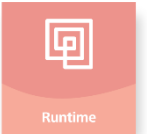
Communication

Overview

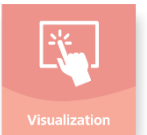
- **Symbolic access to IO channels**
- **EtherCAT Safety Module: New modules supported**
- **Building Automation Library**
- **Further improvements**



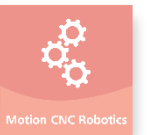
Engineering



Runtime



Visualization



Motion CNC Robotics



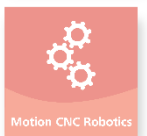
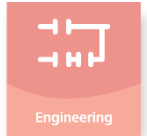
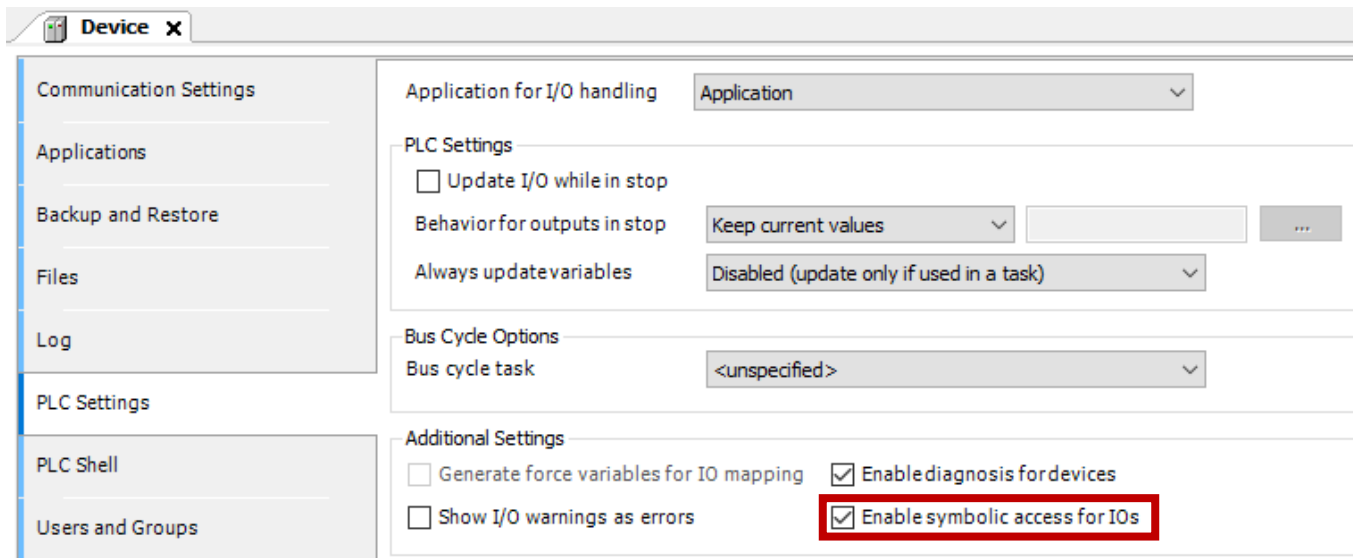
Fieldbus



Communication

Symbolic access to IO channels

- Direct access to all IO channels of a device through device name in the tree
- All datatypes (e.g. structures, enumerations) supported
- Working with all IO drivers without any change
- No more IO mapping in fieldbus editor required
→ Still supported, mixing possible
- Enabled by switch in PLC Settings or Device Description



Symbolic access to IO channels

Test_SP18.project [Read-only]* - CODESYS

File Edit View Project Build Online Debug Tools Window Help

Application [Device: PLC Logic]

Devices

- Test_SP18
 - Device (CODESYS Control Win V3 x64)
 - PLC Logic
 - Application
 - Library Manager
 - PLC_PRG (PRG)
 - POU (PRG)
 - POU_1 (PRG)
 - Task Configuration
 - EtherCAT_Master (EtherCAT Master)
 - FK1100 (FK1100 EtherCAT Coupler (2A F
 - EL1008 (EL1008 8Ch. Dig. Input 24V) **[Red Box]**
 - EL2008 (EL2008 8Ch. Dig. Output 24V
 - EL2008_1 (EL2008 8Ch. Dig. Output
 - SoftMotion General Axis Pool (SoftMotion Ger

PLC_PRG

```

1 PROGRAM PLC_PRG
2 VAR
3 END_VAR

1 EL2008.Output_0:=EL1008.Input_0;
2 EL2008_1.Output_0:=EL1008.Inp
    
```

EL1008

General

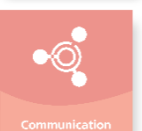
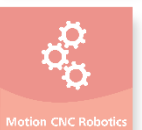
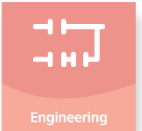
Process Data

Log

Find Filter Show all

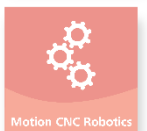
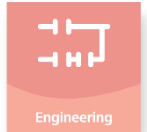
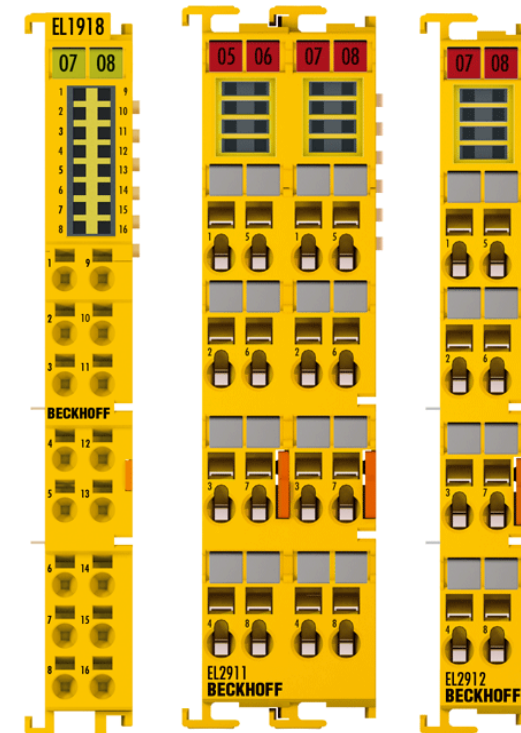
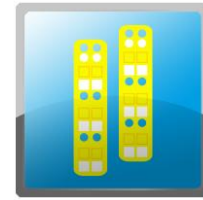
Variable	Mapping	Channel	Address	Type	Unit	Description
		Input	%IX0.0	BIT		Input
		Input	%IX0.1	BIT		Input
		Input	%IX0.2	BIT		Input
		Input	%IX0.3	BIT		Input
		Input	%IX0.4	BIT		Input
		Input	%IX0.5	BIT		Input
		Input	%IX0.6	BIT		Input
		Input	%IX0.7	BIT		Input

Input_0
Input_1
Input_2
Input_3
Input_4
Input_5
Input_6
Input_7
InputBitOffset
InputBitSize



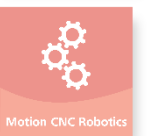
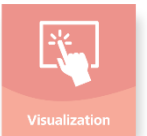
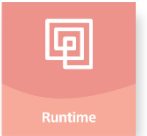
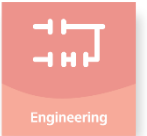
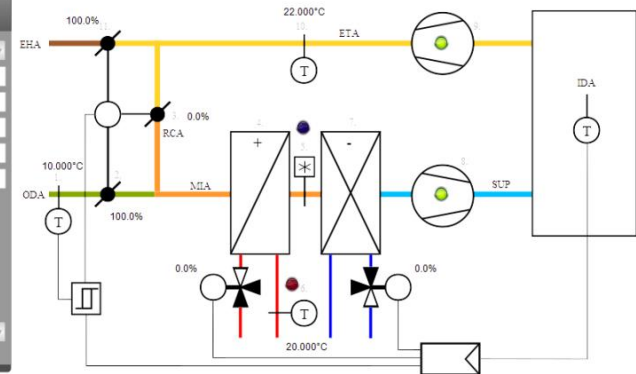
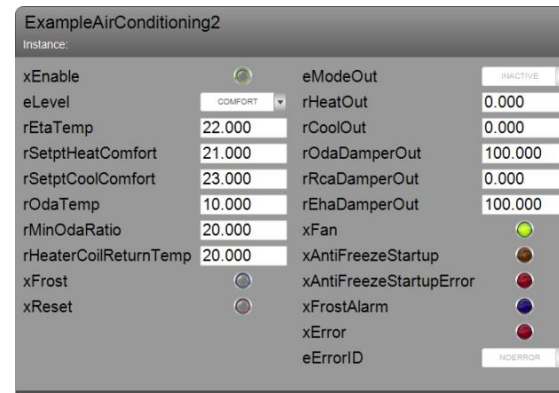
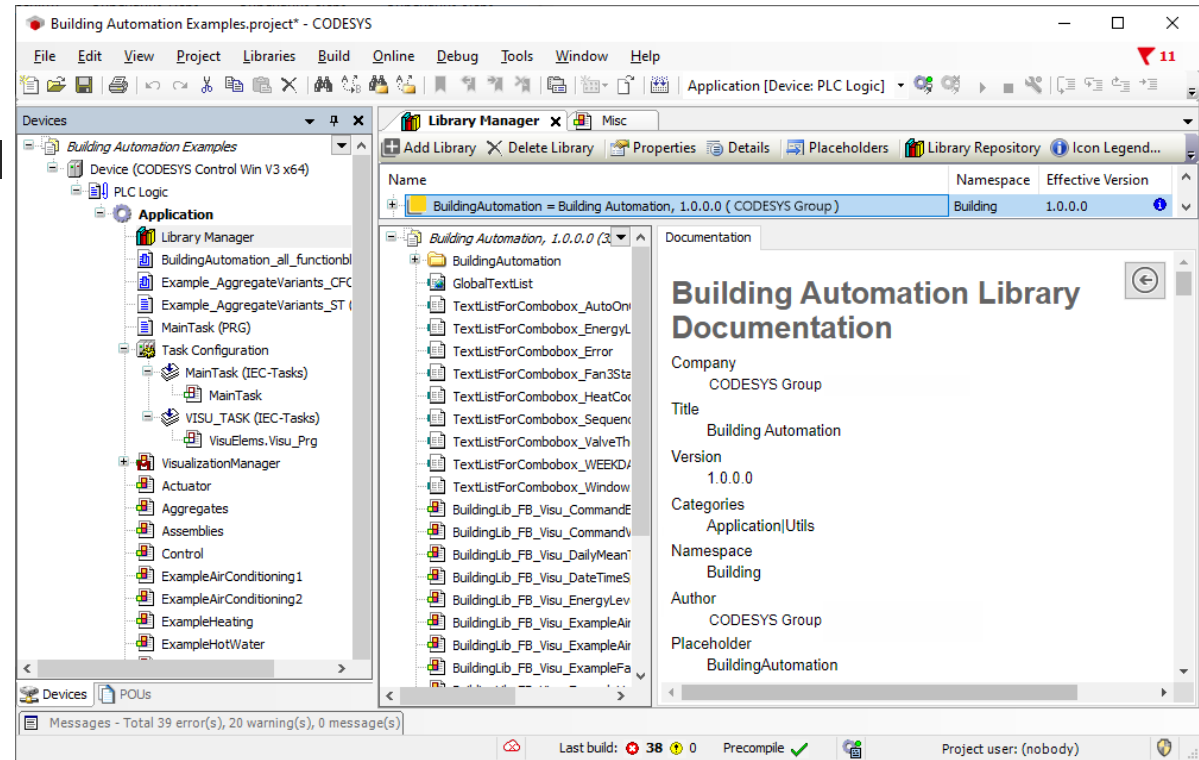
EtherCAT Safety Module: Support of further Safety Modules

- **New Beckhoff modules contain the Safety PLC logic together with I/O channels**
 - EL1918: 8 digital inputs
 - EL2911: 4 digital inputs
 - EL2912: 2 digital outputs
- **Programming similar to EL6910 or EK1960**
 - ➔ **Directly in the CODESYS Development System**
 - ➔ **Add-on component required**
- **Improved usability:**
Filter FBs in Toolbox / Intellisense® according to the definition in the Device Description



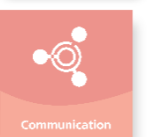
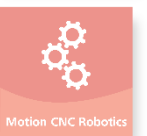
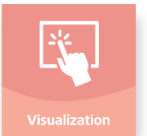
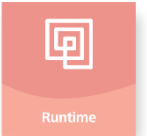
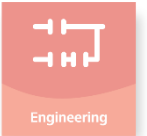
Building Automation Library

- Usage of Common Behaviour Model
- Time-related function blocks (“warp clock”) enabled to support non-real-time testing / simulation
- Project example available
- Oriented towards VDI 3814 Bl. 3.1
- Typical use cases:
 - Primary plants (e.g. boiler plants)
 - HVAC
 - Room automation
 - Lighting control in general
 - Building management
 - Assisted facility management
- Open source, free to use
First release pending (July 2022)



Further improvements

- **PROFINET:**
 - SNMP server added to support the conformance class B
- **Ethernet/IP:**
 - Optional QoS object now supported



1

Engineering

2

Runtime

3

Visualization

4

Motion CNC Robotics

5

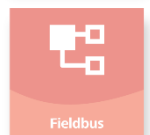
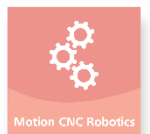
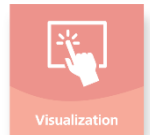
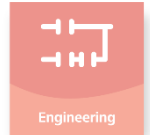
Fieldbus

6

Communication

Overview

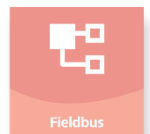
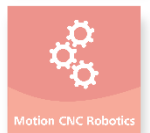
- **OPC UA Information Models**
- **New Symbol Configuration**



OPC UA Information Models

Further OPC UA features supported

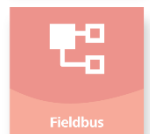
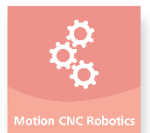
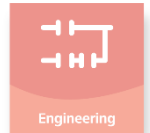
- Built-in OPC UA data types can be mapped to IEC types
 - ByteString, LocalizedText
- Translation of OPC UA state machines to IEC representation
- Declaration and usage of meta data for variables (Variable Types)
 - EURange, EngineeringUnits



OPC UA Information Models

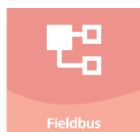
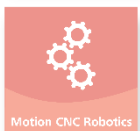
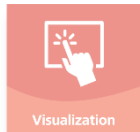
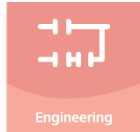
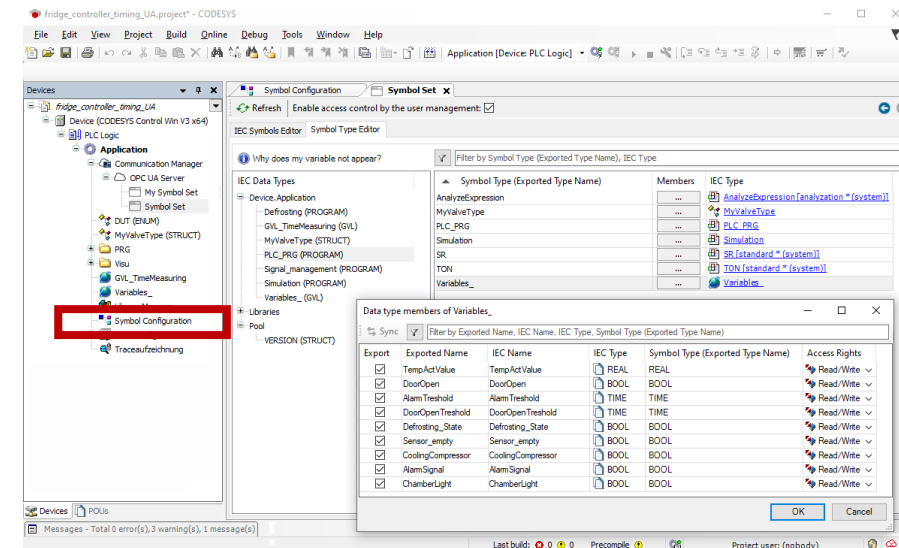
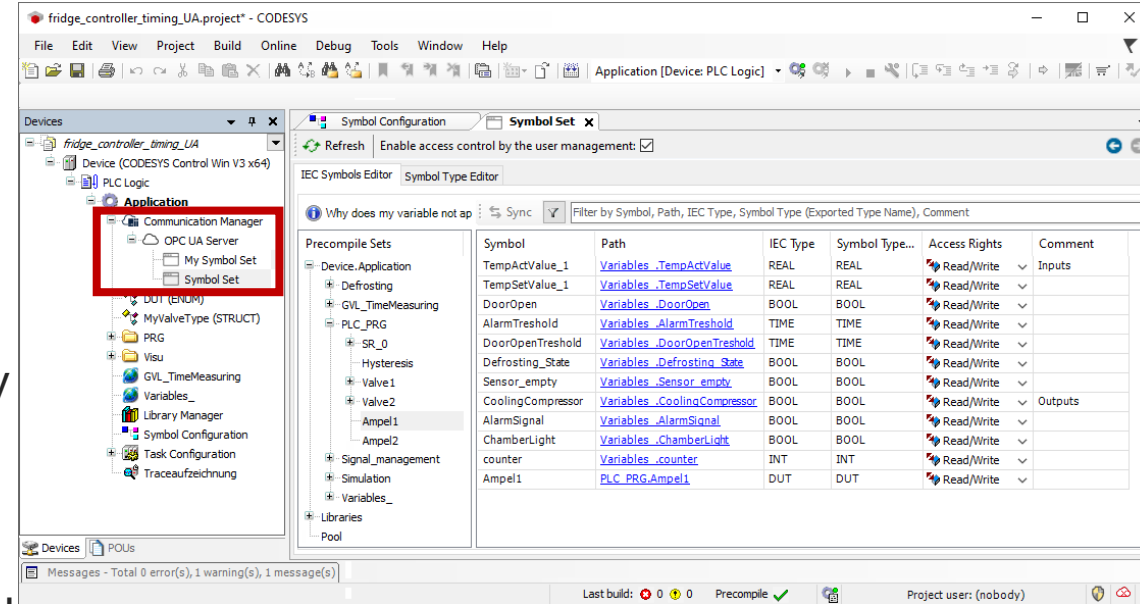
Current state of features for information models

- Key feature 'self describing data' now supported
→ Broader set of information models possible
- Still open: Unsupported features of complex models (e.g. for Injection Moulding Machines)
- Customer experience:
 - Successfully created prototype by means of information model with state machines and methods
 - Fast migration from open62541 server to CODESYS OPC UA
 - Very positive feedback



New Symbol Configuration

- **New editor for Symbol configuration**
 - Select „OPC UA Server“ Object below Communication Manager
 - New workflow
 - ➔ No compilation of application necessary
- **Support of independent Symbol Sets**
- **Legacy symbol configuration**
 - Usage in parallel to the latest editor possible
 - Exclusive support of PLCopen information model
 - Exclusive support of PLC Handler





Thank you for your attention.

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