

#### VAR IPO Buffer CODESYS V3.5 SP1 Task Configuration SMC CheckVelocities Features and Improvements eError := CBM.ERROR.TIME OUT Wis\_PickAndPlace 1+9 + > SoftMotion General Axis Pool EtherCAT\_Master (EtherCAT Master EK1100 (EK1100 EtherCAT Coupler (H) BasicLogic X EL 1008 (EL 1008 SCh. Dig. Input 24 EL2024\_0010 (EL2024-0010 4Ch. C TON MainSwitch CIFX\_PB (CIFX-PB) ET - timeEnableElapsed ET 2005 IM151 BASIC\_(ET 2005 (IN 1+9 GlobalTextList ast build: O 0 (\*) 0 Preco Library Manager · Project Settings

Device (CODESYS SoftMotion Win V3)

= O Application

Elle Edit View Project FBD/LD/IL, Build Online Rebug Iools Window Hele

FUNCTION BLOCK CALC VAR POS EXTEN

· VAR NCD

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Engineering

+ Boolean Operator

ADD (2 Input E ADD (3 Inputs 1 SU8

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Function blocks

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> Device + Device + DAppleLogic + DApple

Engineering

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## Runtime

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Visualization

4

**Motion CNC Robotics** 

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## Fieldbus

Communication

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#### **Overview**

- CFC improvements
- Security improvements
- Signed Libraries / Library Manager
- Further improvements
- Modularization of the CODESYS Development System

Engineering

#### **CFC** improvements

General space optimization



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#### Engineering

#### **CFC** improvements

Dark theme



Pin rearrangement by drag and drop









#### **CFC** improvements

- Increased drop area for connections
- Keyboard shortcuts
- Dropping objects and symbols into the canvas

Engineering









#### **Signed libraries**



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#### Supported since CODESYS V3.5 SP15

- Simplification of former signing process with public/private key files
- Now based on certificates

### • Unsigned libraries: now with restrictions in CODESYS

- No scripting in library documentation (since SP15)
- Embedded files from unsigned libraries cannot be opened (new in SP17)

### Signed CODESYS libraries

- In SP16: some
- In SP17: all (Exception: individual libraries with dependencies to libraries < SP17)

Ado	l Library 🔀 Delete Library 🛛 🚰 Properties 📷 Details 🗍 📰 Placeholders 🖉 🛗 Library Reposit	ory 🕕 Icon Legend 🗎	Summary
lame		Namespace	Effective Version
- 6	3SLicense = 3SLicense, 3.5.17.0 (3S - Smart Software Solutions GmbH)	_3S_LICENSE	3.5.17.0
🔒	Analyzation = Analyzation, 3.5.17.0 (System)	Analyzation	3.5.17.0
i - 6	BreakpointLogging = Breakpoint Logging Functions, 3.5.17.0 (3S - Smart Software Solutions GmbH)	BPLog	3.5.17.0
i 🔽	CAA Device Diagnosis = CAA Device Diagnosis, 3.5.17.0 (CAA Technical Workgroup)	DED	3.5.17.0
i 🔒	CAA Real Time Clock Extern, 3.5.17.0 (CAA Technical Workgroup)	RTCLK	3.5.17.0
i - 🔒	CmpTraceMgr = CmpTraceMgr, 3.5.17.0 (System)	CmpTraceMgr	3.5.17.0
i 🔒	IecSfc = IecSfc, 3.5.17.0 (System)	IecSfc	3.5.17.0
i - 🔒	IecVarAccess = IecVarAccess, 3.5.17.0 (System)	IecVarAccessLibrary	3.5.17.0
i 🔒	IoStandard = IoStandard, 3.5.17.0 (System)	IoStandard	3.5.17.0
🔒	Standard = Standard, 3.5.17.0 (System)	Standard	3.5.17.0
- <b>6</b>	System_VisuElem3DPath = VisuElem3DPath, 3.5.17.0 (System)	VisuElem3DPath	3.5.17.0
i - 🔒	System_VisuElemCamDisplayer = VisuElemCamDisplayer, 3.5.17.0 (System)	VisuElemCamDisplayer	3.5.17.0
i 🔒	System_VisuElemMeter = VisuElemMeter, 3.5.17.0 (System)	VisuElemMeter	3.5.17.0
i - 🔒	System_VisuElems = VisuElems, 3.5.17.0 (System)	VisuElems	3.5.17.0
- <b>6</b>	System_VisuElemsAlarm = VisuElemsAlarm, 3.5.17.0 (System)	VisuElemsAlarm	3.5.17.0
i - 🔒	System_VisuElemsDateTime = VisuElemsDateTime, 3.5.17.0 (System)	VisuElemsDateTime	3.5.17.0
i 🔒	System_VisuElemsSpecialControls = VisuElemsSpecialControls, 3.5.17.0 (System)	VisuElemsSpecialControls	3.5.17.0
) - <b>(</b>	System_VisuElemsWinControls = VisuElemsWinControls, 3.5.17.0 (System)	VisuElemsWinControls	3.5.17.0
i- 🔒	System_VisuElemTextEditor = VisuElemTextEditor, 3.5.17.0 (System)	VisuElemTextEditor	3.5.17.0
i- 🔒	System_VisuElemTrace = VisuElemTrace, 3.5.17.0 (System)	VisuElemTrace	3.5.17.0
i 🔒	System_VisuElemXYChart = VisuElemXYChart, 3.5.17.0 (System)	VisuElemXYChart	3.5.17.0
i - 🔒	system_visuinputs = visuinputs, 3.5.17.0 (system)	visuinputs	3.5.17.0
- <b>6</b>	System_VisuNativeControl = VisuNativeControl, 3.5.17.0 (System)	VisuNativeControl	3.5.17.0
) - <b>(</b>	TraceMgrUtils = Trace Mgr Utils, 3.5.17.0 (Intern)	TraceMgr_Utils	3.5.17.0
- <b>6</b>	Util = Util, 3.5.17.0 (System)	Util	3.5.17.0
) - <b>(</b>	VisuDialogs = VisuDialogs, 3.5.17.0 (System)	VisuDialogs	3.5.17.0

🚹 Library Manager 🗙

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#### **Library Manager**

New function in the Library Manager: **Display of all transitively referenced** libraries in the project

Managed Library



#### Further improvements

- Compare: Allow the comparison of two arbitrary objects
- Logger: Filter by component
   Improved usability

- Preparation for new language features
  - List of reserved keywords as of SP17 e.g. LDATE, CHAR, WCHAR
  - Usage → Compiler warnings
  - Compiler errors as soon as new language features are available

PROGRAM PLC_PRG	
VAR	
char : INT;	
END VAR	
Messages - lotal 2 error(s), 1 war	ning(s), 0 message(s)
P. d.d	- O gran(s) (0 1 warning(s) (0 grange(s)) 🗙
Build	
Description	
Build started: Application: I	Device. Application
Typify code	
• C0543: The name 'CHAR' is a re	served keyword in the IEC61131-3 standard. An error will be reported in future versions.





Engineering









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#### Further improvements

- Acceleration of project load
  - Language model stored as additional file (similar to compile information)
    - → 15% 35% faster loading of project files
- General acceleration
  - Blocking of certain operations avoided
    - ➔ Significantly faster reaction after project load / download

#### Re-work of the Build menu

- Easier usage
- Former commands still available (via Customize command)

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#### Further improvements

• Watch list:

Structured display of inherited variables of an FB

 Force list: Display of recent process value of a forced variable

Watch all Forces								
Jnforce 🗸								
Expression	Туре	Value	Prepar	Overwritten value at start of cycle	Overwritten value at end of cycle			
Device.Application.PLC_PRG;	DINT	<b>(</b> 55		55	1923			
Device.Application.PLC_PRG.instdi	DINT	<b>F</b> 78		78	1923			

EffBee2 X			Options		
Device.Application.PLC_PRG.instEffBee2			CFC Editor		Monitoring
Expression SUPER^ SUPER^ SUPER^ SUPER^ JiParOfForefather SUPER^ SUPER^ JiParOfForefather Prop0 JiBaseVar SaseVar Bran1	Type       BaseEffBee       BaseBaseEffBee       INT       INT       STRING       INT       INT       STRING       INT	Value 0 123 " 123 456 "	<ul> <li>Debugging</li> <li>Declaration Editor</li> <li>Device Description Download</li> <li>Device editor</li> <li>FBD, LD and IL editor</li> <li>Help</li> <li>International Settings</li> <li>Libraries</li> <li>Library download</li> <li>Load and Save</li> </ul>		Display Mode for Integer Variables O Binary O Decimal O Hexadecimal Floating Point Variables Number of displayed digits
W FIODI	INI	373	Monitoring PLCopenXML Proxy Settings		Structured display of inheritance hierarchy











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#### **Further improvements**

- Memory view: Search for specific values in the memory of the IEC application
  - Supported in Core Dump, too

#### Trace

- Simplified adding and editing of variables
- Improved work with multiple diagrams
- Improved usage of cursor

<u>Configuration</u> <u>Add Variable</u>			
Name	Cursor 1	Cursor 2	Delta
🗐 🗹 Diagram 1			
PLC_PRG.i	38693	38699	Δ6
🖹 🗸 Diagram 2			
PLC_PRG.j	38693	38699	Δ6

Memory Scan 🗙 📄 PLC\_PRG

Alignment Natural = 4

Offset: 0x000000000003D04

0x00000260ABDC3D00: D523 0000 EFBE ADDE 9851 DCAB 6002 0000 D523 0000 0000

Value 16#deadbeef

Memory Scan Options

Area 0 + 0x000000000003D04 Found 1 matching memory positions

Area: Area 0

Application: Application [Device: PLC Logic]

Area All Memory

Memory



Value Type DWORD

Scan

Columns: Auto

Q +9 + +

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## Engineering

#### Modularization of the CODESYS Development System

- CODESYS Development System
  - Unmodifiable core system: "CODESYS Essentials"
     Mandatory in order to work
    - → Mandatory in order to work
  - Various individual modules
    - ➔ Installed with the standard setup
    - ➔ Own versioning (4.x.x.x)
  - Update of individual modules possible without changing "CODESYS Essentials"
    - → Functional updates at any time
    - → Immediate benefit from improvements

3 3					×
rrently Installed Packages					
Refresh		S	ort by Name	$\sim$	Install
ame	Version	Installation date	Update info	^	Uninstall
CODESYS CANopen	4.0.0.0	28.04.2021			Details
CODESYS CFC	4.0.0.0	28.04.2021			Deconstru
CODESYS Code Generator 166	4.0.0.0	28.04.2021			
CODESYS Code Generator ARM	4.0.0.0	28.04.2021			
CODESYS Code Generator ARM64	4.0.0.0	28.04.2021			
CODESYS Code Generator Blackfin	4.0.0.0	28.04.2021			
CODESYS Code Generator ColdFire	4.0.0.0	28.04.2021			
CODESYS Code Generator Cortex M3	4.0.0.0	28.04.2021			
CODESYS Code Generator MIPS	4.0.0.0	28.04.2021			
CODESYS Code Generator PowerPC	4.0.0.0	28.04.2021			
CODESYS Code Generator RX	4.0.0.0	28.04.2021			
CODESYS Code Generator SH	4.0.0.0	28.04.2021			
CODESYS Code Generator TIC28x	4.0.0.0	28.04.2021			
CODESYS Code Generator TriCore	4.0.0.0	28.04.2021			
CODESYS Communication	4.0.0.0	28.04.2021			
CODESYS Compiler Versions Archive	4.0.0.0	28.04.2021			
CODESYS Core Dump	4.0.0.0	28.04.2021			
CODESYS Device Reader	4.0.0.0	28.04.2021			
CODESYS EDS Import	4.0.0.0	28.04.2021			
CODESYS Embedded Runtime Extension	4.0.0.0	28.04.2021			
CODESYS EtherCAT	4.0.0.0	28.04.2021			







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### Modularization of the CODESYS Development System

#### CODESYS Installer

- New executable delivered with the setup
- Grouping of required add-on components into so-called "installations"
- Creating customized versions with only desired components
- Simultaneous usage of versions for productive and experimental use
- Reload of missing components possible
  - → Deployment server

CODESYS Installer	– 🗆 X
nstallations	Add Installation
CODESYS 3.5 SP17 (64 bit)	CODESYS 3.5 SP17 (64 bit)
Default	SP17 Release
Start Change Uninstall	Start Change Uninstall
CODESYS 3.5 SP16 (32 bit)	
Start Change Uninstall	





#### **Modularization of the CODESYS Development System**

- Signed add-on Packages
  - All packages with native CODESYS add-ons are signed
     Packages can be trusted.
  - Check within the CODESYS Installer and the Package Manager
  - Result similar to signed libraries
    - Green: Certificate / time stamp certificate by a CA
      - → Both certificates are valid and not expired.
      - → Package can be installed without any concern.
    - Yellow: Certificate is self-signed, not signed or expired, timestamp is not trustworthy.
       Package can only be installed after user confirmation.
    - Red: Certificate does not match the content.
       Deckage connet be installed
      - → Package cannot be installed.

			- нн
Install packages		×	For solar a solar a
CODESYS KNX 4.0.1.0		CODESYS KNX 4.0.1.0	Engineering
	Signature		
	The signature of t	the package is verified.	
	Certificate -		四四
	Subject: Issuer:	CN=CODESYS Development GmbH, O=CODESYS Development GmbH, STREET=Tobias-Dannheimer-Straße CN=Sectigo RSA Code Signing CA, O=Sectigo Limited, L=Salford, S=Greater Manchester, C=GB	
	Thumbprint: Not Before:	AA7F1DDE0F87636B14C677DB79D5ACD952832233	Dunding
	Not After:	1/6/2024 12:59:59 AM	Kunume
	Certificate -		
	Subject: Issuer:	CN=Sectigo RSA Code Signing CA, O=Sectigo Limited, L=Salford, S=Greater Manchester, C=GB CN=USERTrust RSA Certification Authority. O=The USERTRUST Network. L=Jersev City. S=New Jersev. C=US	52
	Thumbprint:	94C95DA1E850BD85209A4A2AF3E1FB1604F9BB66	EN-
	Not After:	1/1/2031 12:59:59 AM	
	Certificate -		
	Subject:	CN=USERTrust RSA Certification Authority, O=The USERTRUST Network, L=Jersey City, S=New Jersey, C=US	Visualization
	Thumbprint:	D89E3BD43D5D909B47A18977AA9D5CE36CEE184C	
	Not Before:	3/12/2019 1:00:00 AM 1/1/2020 12:50:50 AM	- <b></b>
		1. Company and the second second	1994 - Sec.
	Subject:	CN=AAA Certificate Services. O=Comodo CA Limited. L=Salford. S=Greater Manchester. C=GB	10 M Co
I accept the license agreement(s)		Continue Cancel	
			Motion CNC Robo
			100 Aug. 1
	Check	nackage signatures X	



Engineering

Runtime

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#### **Visualization**

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Motion CNC Robotics

Communication



#### Fieldbus

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#### **Overview**

- OPC UA Server/Client
- Firmware update
- Modularization
- Update CODESYS Control RTE SL
- Further improvements



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#### Runtime

#### **OPC UA Server / Client**

- Support of OPC UA Methods
- Support of OPC UA Alarms & Conditions
- Support of user-defined information models / companion specifications
- Implementation of new security profiles defined in OPC UA 1.04

Find detailed information in the section **Communication** 



#### Firmware update

- Backup / restore / update of the complete runtime system
  - Main use cases
    - Update of the CODESYS runtime with backup of application, certificates, and licenses
    - Backup / restore of the CODESYS runtime including backup of application, certificates, and licenses
  - Introduction of a new "Device management service" running stand-alone or as component of a runtime with backend for access to local and remote PLCs
  - Introduction of a generic archive format (including manifest and packages)
    - Other firmware parts (OS parts, drivers, external software) could be included, but not scope of development so far
  - Client implementation in development





#### **Modularization**

- Independent releases of Linux-based single license runtimes
  - Release of new features / improvements independent from main version (CODESYS Essentials)
  - Version changed to V4.x.x.x
  - No compatibility break
  - Runtimes still based on V3.5.x.x Runtime Toolkit









#### **Update CODESYS Control RTE SL**

- **Multicore support** 
  - Distribution of the application on multiple CPU cores
  - Selection of cores during setup
  - Task group configuration and core assignment within IDE
- New drivers
  - Support of new Peak CAN PCI Express cards
  - Support of Innodisk CAN PCI Express cards









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## Runtime

### **Further improvements**

- CodeMeter®: Support of CodeMeter Universal Firm Code
  - New generic firm code introduced by WIBU for all container types (dongle, SoftContainer, cloud)
  - Necessary for CodeMeter Runtime Support for Linux ARM
  - Due to compatibility issues only released for Linux ARM runtime
- User Management
  - Enable online user management by default
- Integration of redundancy component in single-licensed runtimes
- Major update of CODESYS Control for PLCnext SL
  - Bug fixes within Axioline configuration
  - Support of retain memory
  - Support of Smart Elements modules
  - Bug fix for problems with thread priorities
- VxWorks
  - Support of 64-bit targets on VxWorks 7









#### **Further improvements**

- Logging of user actions
  - Login successful / failed / logout
  - Download / create / start / stop / reset / delete application

munication Settings	Compor	ients 🕶 🚹 🏦 🚇 📃	1 0 😳 0 😢 0 🚺 66 🔵 0 .Audit.log	C Time	
isations	Severity	Time Stamp	Description	Component	^
icacions	0	19.05.2021 17:15:20.423	User: 'admin', Login (1)	CmpUserMgr	
up and Restore	0	19.05.2021 17:15:20.054	User: 'admin', Logout (0)	CmpUserMgr	
	0	19.05.2021 17:15:19.994	User: 'admin', Login (1)	CmpUserMgr	
	0	19.05.2021 17:15:17.104	User: 'admin', Logout (0)	CmpUserMgr	
	0	19.05.2021 17:15:12.847	User: 'admin', Login (1)	CmpUserMgr	
	0	19.05.2021 17:14:48.084	User: 'admin', Logout (0)	CmpUserMgr	
	0	19.05.2021 17:14:47.988	User: 'admin', Login (1)	CmpUserMgr	
Settings	0	19.05.2021 17:14:46.841	User: 'admin', Logout (0)	CmpUserMgr	
C Shall	0	19.05.2021 17:14:46.804	User: 'admin', Login (1)	CmpUserMgr	
snen	0	19.05.2021 17:14:43.532	User: 'admin', Logout (0)	CmpUserMgr	
ers and Groups	0	19.05.2021 17:14:35.584	User: 'admin', Login (1)	CmpUserMgr	
	0	19.05.2021 17:14:34.448	User: 'admin', Logout (0)	CmpUserMgr	
ss Rights	0	19.05.2021 17:14:34.422	User: 'admin', Login (1)	CmpUserMgr	
	0	19.05.2021 17:14:26.186	System, Application [Application] started	CmpApp	
ool Rights	0	19.05.2021 17:14:26.167	System, App CodeGUID: 6d074fa4-0000-0000-0000-00000000000, DataGUID: 0	. CmpApp	
	0	19.05.2021 17:14:26.167	System, App Download successful [Application], create bootproject: 0	CmpApp	
ised Software Metrics	0	19.05.2021 17:14:24.858	System, App CodeGUID: 6d074fa4-0000-0000-0000-00000000000, DataGUID: 0	. CmpApp	
	0	19.05.2021 17:14:24.858	System, App Download successful [Application], create bootproject: 0	CmpApp	
bjects	0	19.05.2021 17:14:24.857	System, App CodeGUID: 6d074fa4-0000-0000-0000-00000000000, DataGUID: 0	. CmpApp	
Dealerson	0	19.05.2021 17:14:24.857	System, App Download successful [Application], create bootproject: 0	CmpApp	
Deproyment	0	19.05.2021 17:14:24.857	System, App CodeGUID: 6d074fa4-0000-0000-0000-00000000000, DataGUID: 0	. CmpApp	
e	0	19.05.2021 17:14:24.857	System, App Download successful [Application], create bootproject: 0	CmpApp	
-	0	19.05.2021 17:14:24.854	System, App CodeGUID: 6d074fa4-0000-0000-0000-00000000000, DataGUID: 0	. CmpApp	
mation	0	19.05.2021 17:14:24.854	System, App Download successful [Application], create bootproject: 0	СтрАрр	
	0	19.05.2021 17:14:24.829	System, App CodeGUID: 6d074fa4-0000-0000-0000-00000000000, DataGUID: 0	. CmpApp	~

**Runtime** 



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Engineering

Runtime

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#### Visualization

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#### **Overview**

- Overlay function in the CODESYS TargetVisu
- OPC UA Client support in CODESYS HMI SL
- HMI Redundancy
- Improvements of trend / alarm management
- Further improvements











### **Visualization**

#### **Overlay function in the CODESYS TargetVisu**

 Dynamic internal rotation for all elements (includes groups, frames, and native controls)

#### Time animations

- Smooth flying in of a menu independent of the visualization task
- Smooth transitions for dialog fade in/out
- Update of animated images such as GIFs/SVGs independently of the visualization task
- Free positioning of elements in all dimensions
  - Dialog opens over browser control
  - Crosshairs can be placed over camera image with visualization elements
- Hardware accelerated drawing of TargetVisu (using GPU)
- Enabled by default in new projects if supported by device
- Precondition: Qt installed on the target device
- For details, see video at <u>https://youtu.be/C-7RQW-jmDk</u>











Finish

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Туре

BOOL LINT

BOOL BOOL

BOOL

BOOL LINT BOOL

REAL

REAL

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## Visualization

#### **CODESYS HMI SL with OPC UA Client**

#### CODESYS HMI SL

Visualizations

Untitled59

HMI Features

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Visualization

🖮 🚟 Data Sources Manager

Datasource

Device (CODESYS HMI)

Visualization Manager

- Connecting to available OPC UA server
- Browsing the published data
- Read / write access to the data via visualization

		Choose the data items		
	Name Datasource Select data source type	Variables	Access right	Maximal access right
₽ × ▼	CODESYS Application/V3 CODESYS Application/V3 OPC UA Server Add Cancel	CODESYS_Control_Win_V3  CODESYS_Control_Win_V3  CODESYS_Control_Win_V3  CODESYS_Control_Win_V3  CODESYS_CONTROL  Application  Codesystem  Codesystem		
Initialize Date       Initialize the       Set the communication	ta Source Wizard - Provider settings - C X e Data Source unication parameters	GVL_TimeMeasuring     GVL_TimeMeasuring     Variables_     V    AlarmSignal     V    AlarmTreshold     V    ChamberLight	50 50 50	50 50 50
Server URI 0	pc.tcp://192.168.178.46:4840	<ul> <li>✓ Ø CoolingCompressor</li> <li>✓ Ø Defrosting_State</li> <li>✓ Ø DoorOpen</li> </ul>	54) 54)	59 59
Image: Approximation of the second	ittp://opcfoundation.org/UA/, 15.07.2020 (opcfound: $^{\sim}$	V      P DoorOpenTreshold     V      P Sensor_empty     V      P TempActValue     V      P TempSetValue	19 19 19	59 59 59
Security Message Secur Security Policy	rity Mode None ~ None ~	Server     Server     Server     Server     Server	•	
	Cancel <back next=""> Finish</back>	Can	cel < Bacl	k Next >

X

Initialize Data Source Wizard - Browse data items

Initialize the Data Source

Add Data Source

The data source object can be used to attach another

data source to the current PLC









#### **Visualization**

#### **HMI redundancy**

- Synchronization of WebVisu client information between HMI master and slave
- In case of failure of HMI master: All WebVisu clients are automatically switched to the other HMI
  - Clients remain on pages/frames as before.
  - Login remains
- Immediate start of data transfer from the new HMI master to the controllers
- Central display of alarms either in HMI1 or HMI2 using remote alarm configurations
- Remote trend recording possible
- First release: no synchronization of recipes



#### Visualization

#### **HMI redundancy - configuration**

- Visualization redundancy is not bound to CODESYS HMI SL.
- Enabled within the general redundancy configuration

□ VisuRedundancy = VisuRedundancy, 3.5.17.0 (System)

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 Automatic enabling via libraries and generated code possible

🖨 🕒 RedundancyDataTransfer = RedundancyDataTransfer, 3.5.17.0 (System)

NetBaseSrv = Net Base Services, 3.5.17.0 (3S - Smart Software Solutions GmbH)

gg Redundancy	y Configuration	×	
Redundancy State	1	Redundancy Link General Visualization	Engineering
Applications		Switchover references	몓
Files		Use redundancy link configuration	Runtime
Log		IP address:Port used by clients on PLC 1       0       .       0       .       0       .       0       .       Browse         IP address:Port used by clients on PLC 2       0       .       0       .       0       .       Browse	÷.
PLC Shell		Sec vity	
Redundancy Settir	ngs	Secure communication	Visualizatio
RegisteredAreas		Generate certificates View certificates	00
		Timeout	Motion CNC Robo
		Receiving timeout (ms)     5000       Transmission timeout (ms)     10000	10
suRedundancy	3.5.17.0	Options	Fieldburg
т	3.5.17.0	Seamless download	Pleidbus
			- A

#### **Improvements of Trend**

- Interruptions in the trend recording (PLC Start/Stop) visible as gaps
- Possibility to stop the recording of single variables
- Dynamic limits for minimum / maximum of Y axes via IEC variables
- Trend legend with optional checkboxes to hide / show individual variables
- Possibility to reset the trend recording in the database
- Search / replace within the trend recording now possible













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#### Improvements of alarm management

- Possibility to readout all information of a selected alarm Both active and historical alarms
- Complete alarm record can be reset via IEC application











#### **Further improvements**

- Support of the LDATE, LTOD, LDT, LTIME data types within visualization, alarm management, and recipe management
  - Support in the Date and Date / Time Picker elements as well as in the formatted output / input with %t
  - Support of alarm conditions and latch variables
  - Support of variables in recipe definitions
- Option to display scrollbars for scrollable elements like frame, table, combo box and alarm table when "Multitouch handling" is enabled.

WebVisu FileTransfer - dialogs for the file transfer can be customized in size and design.



Additional Settings Multitouch handling



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#### **Further improvements**

- Interface/callback: For tracking all inputs on elements
- New format string for TIME variables to enter REAL values Examples:
  - %t[hh4] or %t[HH4], hours with 4 decimal places
  - %t[mm2] or %t[m2], minutes with 2 decimal places, e.g. 40.25 minutes
  - %t[ss0], seconds without decimal places.
- Recipe management: new option
   Recipes are / are not overwritten during download.



#### Visualization





#### **Visualization**

#### **Further improvements**

 Output of the number of used variables within all visualizations



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#### **Visualization**

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**Motion CNC Robotics** 

#### **Overview**

- SoftMotion on Standard PLCs
- Robotics improvements
- New supported drives











#### **SoftMotion on Standard PLCs**

- Previously: SoftMotion only on devices with special target type = 0x1006
- New: SoftMotion can be run on all PLCs.
- Activation via new command "Enable SoftMotion"
   → SoftMotion objects (CAM editor, CNC editor, axis groups) can now also be inserted on standard PLCs.
- Advantage for users: easier upgrade
  - of CODESYS compatible devices
  - of SoftPLCs from the CODESYS Store ("SL Runtimes")



#### **Motion CNC Robotics**

#### **Robotics improvements**

- Improved jogging
  - Jogging = moving robot in manual mode
  - Improved orientation jogging: Robot rotation more predictable
  - Fixing of numerous bugs
  - Improvement of test coverage
  - Improved documentation and error messages
  - Note: SMC\_GroupJog2 replaces SMC\_GroupJog (will be discontinued)





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#### **Robotics improvements**

- SMC\_GroupInterruptAt
  - Stopping at a certain position on the path
  - Otherwise like SMC\_GroupInterrupt (pausing on the path)



#### **New supported drives**

- Bosch Rexroth Indradrive CS
- Delta Remote IO
- Delta ASDA A3/B3
- Beckhoff EL7041/7047



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#### **Overview**

- General improvements
- EtherNet/IP
- CAN / CANopen / J1939
- EtherCAT
- PROFINET
- MODBUS















#### **General improvements**

- Implicitly generated fieldbus task:
  - Warning when deleted
  - Easy way for restoring deleted task



**Fieldbus** 









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#### **EtherNet/IP**

#### Scanner

- LargeForwardOpen for Scanner and Adapter: Up to 65527 bytes per connection (before: 512 bytes)!
- EtherNet/IP Scanner: Possibility of enabling filling bytes in I/O mapping
- Stability improvements for multiple connections per slave
- GUI: Many bug fixes and performance improvements
   → Update recommended!

#### Adapter

- Possibility for sending outputs on start of bus cycle: Possible reason for doing so: less Jitter
- Extension of Ethernet Link Object: Conformance test with 1 GBit possible











#### CAN (CANopen/J1939)

#### General rework of online help with focus on diagnosis

- New structure: Configuration, Functions, Libraries, Diagnosis
- Diagnosis chapter added
  - Diagnosis in application
  - Diagnosis in user interface
  - Troubleshooting



CAN\_H

CAN\_L

CAN\_GND

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#### CAN (CANopen/J1939)

#### Troubleshooting

CANbus				Engineering
Problem	Possible Solution			
The CANbus is red in the device tree directly after the application download.	Check the status page and logger page of the CAN bus. You will find more information here. Possible causes: The driver could not be opened:	Diagnosis of Hardware Failures		Runtime
	<ul> <li>The network ID is set too large. In the CAN bus, a network ID was set for which there is no driver instance. If the interfaces, then valid values for the network ID are only 0 and 1.</li> <li>The driver component was not loaded in the runtime. Check whether the CAN driver component has been loaded correctly (see the Configuration").</li> <li>The memory is insufficient. Opening the CAN driver requires memory. Too little memory may be available.</li> <li>A bus error has occurred:</li> <li>The CAN chip signals a bus error. See the chapter "Diagnosis of Hardware Failed".</li> </ul>	Most CAN problems are traced back to incorrect wiring or faulty CAN of Missing or incorrectly dimensioned terminal resistors The bus has to be terminated exactly with a 120 Ω terminal is Different baud rates All subscribers have to use the same baud rate. Short circuit between CANLow, CANHigh, CANGround, V+ CANLow and CANHigh interchanged Different lengths of CANHigh and CANLow (CANHigh and CANLow) CANHigh and CANLow are not a twisted pair. As a result, sig Different grounding sources for CANGround Two-sided grounding of the CAN bus cable When both ends of the shielding of the CAN bus cable are g Bus cable too long The maximum bus length depends on the set baud rate (see	devices. Potential errors include the following: resistance at the beginning and at the end. gnals can be interrupted more easily. rounded, grounding loops can form which can cause interruptions.	Visualization
		Bit Rate	Cable Length	
		10 kbps	6.7 km	
		20 kbps	3.3 km	
		50 kbps	1.0 km	Fieldbus
		125 kbps	500 m	
		250 kbps	250 m	
		500 kbps	125 m	
		1 Mbps	25 m	Communication

Detecting hardware failures

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CAN\_H

CAN\_L CAN\_GND

# Fieldbus

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#### CAN (CANopen/J1939)

- Modularization
  - Stack library placeholders: Now part of the CANopenManager, CANopenSlave, and J1939Manager device
  - Using new protocol stack: Before: "Update device" for PLC necessary → New runtime required New: "Update device" on the corresponding stack device (e.g. CANopenManager) possible











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#### CANopen

- CANopen Manager
  - Improved COB-ID collision detection and intelligent suggestions
    - Additional check for EMCY, SYNC and TIME COB-ID
    - Check & Fix dialog suggests COB-ID formulas where possible.





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#### CANopen Slave

PDO/SRDO communication settings of I/O areas can be edited.



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#### Import function for DBC

- Proprietary file format from Vector Informatik for defining CAN messages and ECUs
- Widely used by Commercial Vehicle Manufacturers
- Different use cases (see following slides)







#### Untitled536.project\* - CODESYS TECU X × DBC content selection File Edit View Project Build Online Debug Tools Window 問意見(あ)のより感知(時間)(時間)(目前)()() General General Local ECU Import Name Description ACS Atemator/Charging System Devices TX Signals -**SAE J1939** Preferred address 3 🗏 🕑 Uhbbled536 CC. Climate Control 🖹 🗑 Device (CODESYS Control Win V3) Local device M EBS Electronic Brake System Log PLC Logic B O Application EMS Engine Management System # ECU NAME J1939 I/O Mapping Library Manager IC. Instrument Cluster PLC PRG (PRG) RD Retarder Driveline NAME (64 bit): 16# 800E8A93446 Task Configuration J1939 IEC Objects $\sim$ REX Retarder Exhaust Engine 🖹 🎲 MainTask (IEC-Tasks) Arbitrary Address Capable PLC\_PRG SSC Suspension System Controller #1 Status E CANbus (CANbus) Industry Group 0: Global, applies to all industries TCO Tachograph 1 319 X Cut TECU Transmission ECU Vehicle System Instance 0 + Information En Copy TPMS Tire Pressure Monitoring System 0 Vehicle System B Paste $\overline{\mathbf{v}}$ VGW Vehicle Gateway TECU X × Delete General Find Filter Show all - 🕂 Add FB for IO Channel... \* Go to instan Refactoring Enable Signal Conversion [SK Cancel Variable Mapping Channel Type Unit Description Address Properties. TX Signals 🖙 🏣 TOFG2\_TECU Add Object • 🏘 TransTorqueLimit 10 TransTorqueLimi Log %JW292 UINT Nim Add Folder... TO'G\_TEOU 1939 I/O Mapping WinberOfReverse. NumberOfReverseGearRatios Add Device... %18586 USIN \* NumberOfForward... NumberOfForwardGearRatios %JE587 USIN Insert Device... **Π** πευ x 11919 IEC Obserts \* TransGearRatio %ID147 REAL TransGearRatio **Disable Device** - Ca SOFT V General PGN Name General Enable PGN/SPN Name Length Status Update Device... Type \* NmbrOfSftwrIdenti... NmbrOfSftwrIdentificationFields USINT %18592 steps 8 Bytes Broadcast Edit Object SoftwareID1\_1 X Signals SoftwareID1 %IE593 USIN TransTorqueLi 16 Bits Information Description SoftwareID2\_1 SoftwareID2 %18594 USIN Edit Object With. 65250 TCFG\_TECU 8 Bytes Broadcas Length (By \* SoftwareID3\_1 SoftwareID3 %IB595 USIN 958 NumberOfRevers 8 Bits 8 Bits Edit IO mapping 957 J1939 UO Mapping NumberOfForwardGearRatios ETC7\_TECU Import mappings from CSV ... TransGearRate 16-815 \* TransRgedRangeDi.. TransRoedRangeDisplayBlankState USEN %18596 SOFT 65242 8 Bytes Broadcast \* TransReedRangeDL TransRoedRangeDisplayFlashState %18597 USIN 965 NebrOfSflwride 8 Bits \* TransReadyForBra. TransReadyForBrakeRelease %18598 USIN Import DBC file... 234 SoftwareID1 8 Bits \* ActiveShiftConsoleI. ActiveShiftConsoleIndicator USINT %IE599 234 SoftwareID2 8 Bits information 🐐 TransEngCrankEnab TransEngCrankEnable %IE600 USIN 234 SoftwareID3 8 Bits 1 65098 ETC7\_TECU 8 Bytes Broadcas \* TransShiftInhibitIn.. TransShiftInhibitIndicato %18601 USINT 1850 TransRgedRangeDisplay@lankState 2 Bits \* TransMode-Endicat TransMode Hindicato %JE602 USINT 1849 TransRgedRangeDisplayFlashState 2 Bits · \* TransModeSindicato TransMode3Endicato %IB603 USINT 3086 TransReadyForBrakeRelease 2 Bits \* TransMode Zindicato TransMode 20ndicat %IE604 USIN 2945 ActiveShiftConsoleEndicator 2 Bits \* TransMode Indicato TransMode Lindicator %IB605 USINT 2900 TransEngCrankEnable 2 Bits 1851 TransShiftInhibitIndicator 2 Bits - \* TransRgedGearFee. TransRoedGearFeedbad %IW303 INT 2539 TransMode4Indicator 2 Bits ETC2\_TECU 2538 TransMode3Indicator 2 Bits \* TransSelectedGear TransSelectedGear %JW304 INT 2 Bits 2537 TransMode2Indicator \* TransActualGearRati TransActualGearRate %ID153 REAL 2536 TransMode Lindicator 2 Bits 8 Bits \* TransCurrentGear TransCurrentGear %IW308 INT 3289 TransRoedGearFeedback V 61445 ETC2\_TECU 8 Bytes Broadcas \* TransRoedRange TransRoedRange %JW309 UINT 524 TransSelectedGear 8 Brts - \* TransCurrentRange TransCurrentRang %IW310 UINT 526 TransActualGearRatio 16 Bits \* Ca ETC1\_TECU 523 TransCurrentGear 8 Dits 🖲 🧰 ECUED TransRgedRange 16 Bits 16 Bits 🕸 🦾 DMS TransCurrentRand 61442 64965 65230 ETC1\_TECU 8 Bytes 8 Bytes 8 Bytes Broadcast 8 Bytes Broadcast 8 Bytes Broadcast 13 Bytes Broadcast 18 🧰 DM4 ECUID 1 DM25 98 18 DHS DH4 🕷 🧰 DM24 65229 64951 I Ca TRF1\_TECU DH25 13 Bytes Broadcast 12 Bytes Broadcast 8 Bytes Broadcast 64950 65272 DH24 Name Name of Param TRF1\_TECU Reset Mapping Always update variables Use parent device setting 🍫 = Create new variable 🍫 = Map to existing variable Add PG Add Signal Delete

#### Use case 1: Import a complete network











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#### Use case 2: Install as database















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#### Removal of standard database

- Tooltip and online help notice the user!
- User has to buy a DBC database e.g. from <u>https://www.csselectronics.com/</u>

Discount Code (5%): J1939DBC\_CODESYS



#### **EtherCAT**

- Online page shows Link-Status
- Routing of EoE
- Overview page for device status

General	Update Data Auto Update			
Sync Unit Assignment	Name	Address	State	CRC
o, ne o ne rissigninent	EK1100	1001	OP	0,0
Overview	EL2008	1002	OP	0,0
	EL 1008	1003	OP	0,0
Log	EL3142	1004	OP	0,0
	EL4132	1005	OP	0,0
EtherCAT Parameters	🖃 🌗 EK1122	1006	OP	0, 0, 0
	AXL_F_BK_EC	1007	OP	0
EtherCAT I/O Mapping	EK1122_1	1008	OP	0
Status				



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#### PROFINET

- Performance optimizations
   Up to 40% lower bus cycle times
- Support dual- / multi-port Ethernet interfaces
   → Build controllers and devices with up to 8 Ethernet ports, e.g. for "Daisy Chain" use case
- Create PROFINET Device \*.devdesc from GSDML
   No more manual steps for manufacturers of PROFINET Device



#### PROFINET

#### PROFINET Device: programmatic configuration

- No Device-objects in static device tree
- Completely programmatic, function block-based configuration (Library "ProfinetDeviceConfig")

```
12
     VAR
13
         pnDevice : ProfinetDeviceConfig.ProfinetDeviceInstance;
14
         deviceIdent : ProfinetDeviceConfig.DeviceIdentification;
1.5
     //Startup:
     IF (NOT pnDevice.xInit) THEN
         deviceIdent.deviceID := 16#1017;
                                                 // Device Config
         deviceIdent.vendorID := 16#02CC;
         11 ...
                                          //Plug Modules
         pnDevice.Plug(in32);
         pnDevice.Plug(out32x8);
         pnDevice.Plug(out32 param);
         11 ...
10
         pnDevice.ConfigureDevice(interfaceName, deviceIdent); //Configure
11
12
     ELSIF(NOT (pnDevice.xStartup OR pnDevice.xOnline)) THEN
13
         pnDevice.Start();
14
     END IF
15
16
     //Acylic services of device:
     pnDevice.ProcessServices();
17
```









#### PROFINET

- IO-Link integration
  - Editor for settings of IO-Link Device (IODD based)
  - Pre-processed IO data
  - Diagnosis with textual information from IODD
  - Scan / import of IO-Link sensors





**Fieldbus** 











#### **MODBUS**

#### MODBUS function block library

- Completely programmatic, function block-based configuration and communication
- Client + server
- TCP + serial
- Various examples in CODESYS Forge

ModbusFB = ModbusFB, 3.5.17.0 (3S - Smart Software Solutions	ModbusFB	3.5.17.0	0	
ModbusFB, 3.5.17.0 (3S - Smart Software Solutions Gmbl  ModbusFB  General Enums  General Client  Gient  Gient  GientRequest  ClientRequest  ClientRequestRead	<ul> <li>✓ Inputs/Outputs  Graphical</li> <li>xExecute BOOL udiTimeOut UDINT rClient Client</li> <li>[uiUnitId UINT := 0]</li> <li>[udiReplyTimeout UDINT := (5)</li> <li>[uiMaxRetries UINT := 0]</li> <li>[uiStartItem UINT := 0]</li> <li>[uiQuantity UINT := 1]</li> <li>[pData POINTER TO ARRAY [0]</li> </ul>	Documentation     ClientRequ 0 * 1000)]  0] OF BOOL := 0]	JestReadBits	BOOL xDone BOOL xBusy BOOL xError Error eErrorID ExceptionCodes eException UINT uiRetryCnt
ClientRequestReadBits ClientRequestReadCoils				











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#### **Visualization**

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#### **Overview**

- OPC UA Server/Client improvements
- OPC UA PubSub communication
- IIoT Library Bundle improvements











#### **OPC UA Server/Client improvements**

- Support of OPC UA methods
  - Use case: call functions and methods of IEC applications and start complex functional processes via OPC UA
- Support of OPC UA alarms & conditions
  - Use case: send and acknowledge alarms to and with a capable OPC UA client
  - Events signal a change of the alarm status to the client
  - The client uses methods to interact with a specific instance of an alarm or condition.
- Implementation of new security profiles defined in OPC UA 1.04 (CDS-62076)
  - Basic125Rsa15 and Basic256 message security policies have been deprecated.
  - Two new security profiles: Aes128Sha256RsaOaep (for medium security needs) and Aes256Sha256RsaPSS (for high security needs)







#### **OPC UA Server/Client Improvements**

Support of OPC UA Client configuration via Data Sources

PCUAClient_DataSources	Variables Type Mappings Communication Gen	eral and Diagnosis					
Device (CODESYS Control Win V3 x64)	😋 Update variables	-					
	Local variable	Access right	Update always	Create or Map	Type mapping	Remote variable	
Data Sources Manager		<b>54</b>		*	DeviceSet	DeviceSet	
Data Sources Manager	CODESVS Control Win V3	500		<b>v</b>	CODESYS Control Win V3	CODESYS Control Win V3	
		5			Resources	Resources	
Library Manager	Application	50	<b>V</b>		Application	Application	
DIC PRG (PRG)	GlobalVars	5	<b>V</b>		GlobalVars	GlobalVars	
Task Configuration	Variables	5	V		Variables	Variables	
DatasourcesTask (IEC-Tasks)	AlarmSignal	500	<b>V</b>		BOOL	AlarmSignal	
Datasources.Datasources PRG	AlarmTreshold	50	<b>V</b>		LINT	AlarmTreshold	
MainTask (IEC-Tasks)	ChamberLight	500			BOOL	ChamberLight	
PLC PRG	CoolingCompressor	5	<b>V</b>		BOOL	CoolingCompressor	
	Defrosting_State	5	<b>V</b>		BOOL	Defrosting_State	
	DoorOpen	5			BOOL	DoorOpen	
	DoorOpenTreshold	5			LINT	DoorOpenTreshold	
	Sensor_empty	5			BOOL	Sensor_empty	
	TempActValue	5			REAL	TempActValue	
	TempSetValue	50			REAL	TempSetValue	
	OPC UA Server  PLC_PRG  PLC_PRG  PROGRAM PLC_PRG VAR VAR VAR XTrigger: BOOL; NewSetTempValue: REAL	;			A V.	1	.00 % 👩



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#### **OPC UA information models / companion specifications**

Add OPC UA Information Model

Name

OPC\_UA\_Symbols

Information Model URI

Add

Alarm Configuration...

Application..

Axis Group...

Cam table...

CNC program...

🗘 DUT...

External File...

Global Variable List...

C Code Module..

Communication Manager...

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a.

Devices

■ initial fridge\_controller\_timing\_UA

B. PLC Logic

Device (CODESYS Control Win V3 x64)

Cut (ENL 👗 Cut

Avenue 🖻 Copy

🧭 GVL\_Time 🙉 🛛 Paste

Delete

Refactoring

Properties..

Add Object

Add Folder..

Edit Object

Edit Object With...

Delete application from device

🪳 Variables 🗙

DIC\_PRG

- Symbol C 🚞

📲 Task Con 🕤

- 🗄 P

🕀 s

🚭 Traceaufzeichnung Visualization Manager WebVisualization

OS I Login

VisuElems.Visu\_Prg

🖶 🍪 Mainī

🖻 🍪 VISU

🕘 Diagnosis

📲 Live Visu

Visualization

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Simulation

🗄 🕄 Defrostin

Application

Support of user-defined information models / companion specifications



OPC\_UA\_Symbols [https://codesys.com/UA/objecttest/] 🗙

Search for mapped instances 🌾 Create new instance Root node: Objects						•	•0
OPC UA Variable	OPC UA Type	Map or create	IEC Variable	IEC Туре	Access Rights	Maximal	
inst_1	TestRootObjectType	*ø	OPC_UA_Symbols.inst_1	TestRootObjectType	N	- <b>-</b>	Communica
inst_2	TestRootObjectType	**	OPC_UA_Symbols.inst_2	TestRootObjectType	<b>*</b>	<b>N</b>	
Inst2	TestRootObjectType	~⊘	PLC_PRG.Inst2	TestRootObjectType	<b>*</b>	<b>N</b>	

#### **CODESYS OPC UA PubSub SL**

- Add-on product for CODESYS-compatible controllers in the CODESYS Store
- Prerequisite: Licensing option on the controller, available Ethernet port
- Cyclic call of object-oriented function blocks from library
- Communication via UDP broadcast
- Interface prepared for time-synchronized communication protocols





#### **IIoT Library Bundle improvements**

- Extension of the functional scope
  - Now with function blocks for data exchange with Google Cloud IoT Core
  - License for Google Cloud IoT Core Client SL included in the IIoT Libraries SL







# Thank you for your attention!

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