



IEC 61850 Configuration of a Phoenix Contact IED

User manual

User manual

IEC 61850 Configuration of a Phoenix Contact IED

UM EN PHOENIX CONTACT IEDs – IEC 61850, revision 00

2017-06-29

This user manual is valid for:

Designation	As of version (HW)	As of version (FW)	Order No.
AXC 1050	03	3.00	2700988
AXC 1050 XC	03	3.00	2701295
AXL F BK SAS	03	1.30	2701457

Table of contents

1	For your safety	5
	1.1 Labeling of warning notes	5
	1.2 Qualification of users	5
2	About this document	6
	2.1 Aim of this document	6
	2.2 Hardware and software requirements	7
3	PC Worx or Config+	8
	3.1 Required settings	9
	3.1.1 Specifying designation for IEC 61850 variable group	9
	3.1.2 Creating global variable groups and variables	10
	3.1.3 Creating the program	12
	3.1.4 Assigning process data	12
	3.1.5 Compiling the project	12
	3.1.6 Creating a boot project	13
	3.1.7 Sending a project and performing a cold restart	14
	3.1.8 Parameterizing the AXL F BK SAS bus coupler	14
	3.2 Function blocks for the IEC 61850 communication	16
	3.2.1 GET.UTC.TIMESTAMP function block	16
	3.2.2 Function block GET.IEC61850.TIMEQUALITY	17
	3.2.3 Function block IEC61850.GOOSE.SUB.INFO	18
4	PC Worx IED Configurator	20
	4.1 Installing PC Worx IED Configurator	20
	4.2 Opening PC Worx IED Configurator	20
	4.3 User interface of the PC Worx IED Configurator	21
	4.4 Creating a new project	22
	4.5 Creating IEDs	24
	4.6 Configuring IEDs	26
	4.7 Creating logical devices	29
	4.8 Configuring the logical nodes of a logical device	30
	4.8.1 Viewing predefined logical nodes, data objects and functions in the library area	30
	4.8.2 Defining own logical nodes, data objects or functions	32
	4.8.3 Assigning a logical node to a logical device, changing or deleting it	41
	4.9 Specifying data attributes, data objects and/or functions of a logical node	43
	4.9.1 Specifying initial values for data attribute instances (DAI)	43
	4.9.2 Combining data attributes and/or objects into datasets	46
	4.9.3 Specifying communication methods for datasets	47

PLC – IEC 61850

4.9.4	Assigning IEC 61850 data attributes (mapping)	49
4.10	Validating IEC-61850 application.....	52
4.11	Transferring projects to an IED	53
5	Device-specific characteristics for IEDs of type AXC 1050 (XC)	56
5.1	Assignment of the IEC-61850 data types to the data types in PC Worx.....	56
5.2	Behavior of the IEC 61850 server depending on the operating state of the AXC 1050 (XC).....	58
A	Technical appendix.....	59
A 1	General data.....	59
A 2	Log files	60
B	Appendix for document lists.....	61
B 1	List of figures	61
B 2	List of tables	63
B 3	Explanation of terms	64
B 4	Configuration files of the IEC 61850	65
B 5	Index.....	66

1 For your safety

Read this user manual carefully and keep it for future reference.

1.1 Labeling of warning notes



This symbol indicates hazards that could lead to personal injury. There are three signal words that indicate the severity of a potential injury.

DANGER

Indicates a hazard with a high risk level. If this hazardous situation is not avoided, it will result in death or serious injury.

WARNING

Indicates a hazard with a medium risk level. If this hazardous situation is not avoided, it could result in death or serious injury.

CAUTION

Indicates a hazard with a low risk level. If this hazardous situation is not avoided, it could result in minor or moderate injury.



This symbol together with the **NOTE** signal word alerts the reader to a situation which may cause damage or malfunction to the device, hardware/software, or surrounding property.



Here you will find additional information or detailed sources of information.

1.2 Qualification of users

The product use described in this user manual is intended exclusively for:

- Electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.
- Qualified application programmers and software engineers. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

2 About this document

2.1 Aim of this document

This document provides you with information on how to create an IEC 61850 application and how to start up a Phoenix Contact, using the AXC 1050 as an example. The steps for an IEC 61850 configuration and startup is largely identical for all Phoenix Contact IEDs. Differences are explicitly pointed out by the document in the relevant sections.

An IEC 61850 application consists of an application project (PC Worx or Config+ project) and a PC Worx IED Configurator project.

In the application project, you can do the following:

- Program the logic of the IED.
- Operate the interface to the bus system used.

In the PC Worx IED Configurator project, you can do the following:

- Create the IEC 61850 data model, using the 2003 or 2007 namespace.
- Configure the datasets.
- Configure the control blocks for reporting (MMS) and GOOSE.
- Assign IEC 61850 data attributes to the IEC 61850 variables¹ of the application project or to the input/output channels² of the IED.



To model a communication relation (subscriber/client) between two IEDs, you need a system configuration tool.

Figure 2-1 shows a schematic diagram of the engineering workflow.

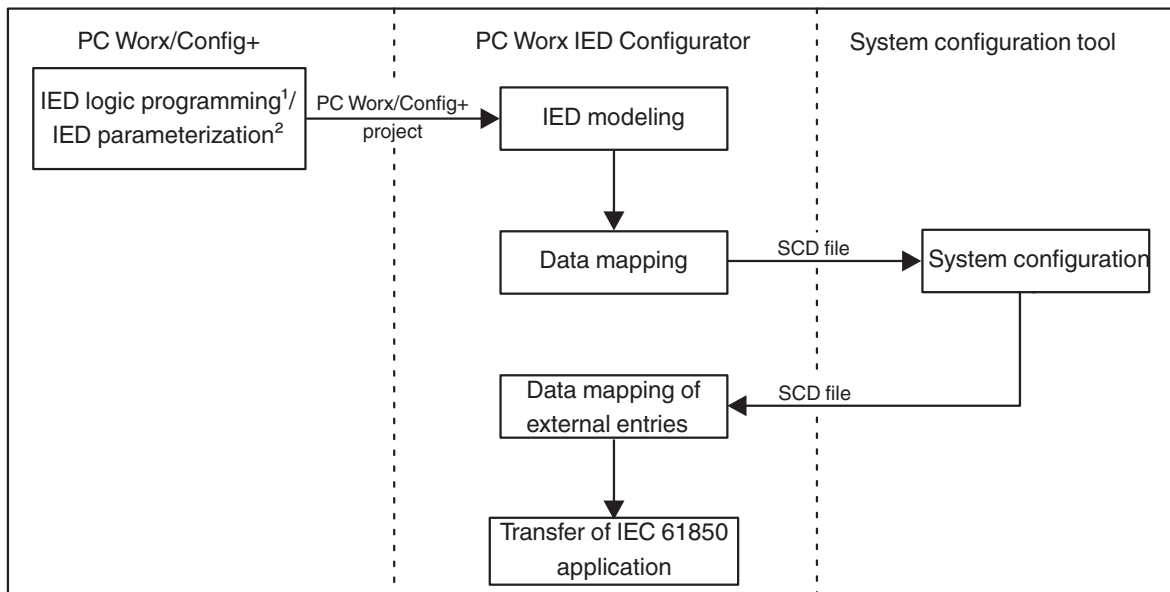


Figure 2-1 Schematic view of the engineering workflow

¹ IEDs of type AXC 1050 (XC)

² IEDs of type AXL F BK SAS

2.2 Hardware and software requirements

Hardware/software	Description	
IEDs	AXC 1050 (XC) with firm-ware version ≥ 3.00	AXL F BK SAS with firm-ware version ≥ 1.30
SD card ¹	SD card for AXC 1050 (XC) with license key for IEC 61850 communication (SD FLASH 2GB 61850 (order no. 2400435) or SD FLASH 2GB APPLIC A 61850 (order no. 2400436))	
Ethernet cable	Ethernet cable for connecting the IEDs with a PC	
PC Worx ¹	Version $\geq 6.30.1914$, component of the AUTOMATIONWORX Software Suite 2017 Version 1.84	
Config+ ²	Version $\geq 1.60.1914$, component of the AUTOMATIONWORX Software Suite 2017 Version 1.84	
PC Worx IED Configurator	Version ≥ 1.0	

¹ If the bus structure contains at least one AXC 1050 (XC) controller.

² If the bus structure contains an AXL F BK SAS bus coupler, but no AXC 1050 (XC) controller.

3 PC Worx or Config+

To use the AXC 1050 (XC) controller or AXL F BK SAS bus coupler as IEDs, you have to configure certain settings in the PC Worx or Config+ software. Which settings these are exactly, and in which software the settings have to be configured, depend on your bus structure and the devices that are to be used as IEDs. Table 3-1 shows which software you have to use.

Table 3-1 Software to be used depending on the IED(s) in the bus structure

IED(s) in the bus structure	Software
AXC 1050 (XC)	PC Worx ≥ 6.30.1914 ¹
AXC 1050 (XC) and AXL F BK SAS	PC Worx ≥ 6.30.1914 ¹
AXL F BK SAS without AXC 1050 (XC)	PC Worx ≥ 6.30.1914 ¹ or Config+ ≥ 1.60.1914 ¹

¹ Component of the AUTOMATIONWORX Software Suite 2017 Version 1.84

General requirements:

The following is assumed:

- The Axioline F station has been installed, connected and wired.
- There is an Ethernet connection between the IED(s) (AXC 1050 (XC) and/or AXL F BK SAS) and your PC.

Depending on your bus structure, the following requirements additionally apply:

Bus structure with AXC 1050 (XC)

If you use at least one AXC 1050 (XC) controller in your bus structure, it is assumed that you have already taken the following steps in PC Worx:

- Created a project.
- Assigned an IP address to all IEDs contained in the project.
- Imported the bus structure.
- Configured the AXL F BK SAS bus coupler(s), if one or more bus couplers of this type are present in the bus structure and are to be used as IEDs.



For additional information on creating projects in PC Worx, please refer to the user manual of the controller you are using. The user manual can be downloaded at phoenixcontact.net/products.

Bus structure AXL F BK SAS without AXC 1050 (XC)

If you use one or several AXL F BK SAS bus couplers **without** AXC 1050 (XC) controllers, it is assumed that you have done the following:

- Created a project in PC Worx or Config+.
- Assigned an IP address for all IEDs contained in the project.
- Imported the bus structure.
- Configured all AXL F BK SAS bus couplers that are to be used as IEDs.



The procedure for parameterization is identical in PC Worx and in Config+, and is described in Section 3.1.8.

3.1 Required settings



If you use one or several AXL F BK SAS bus couplers, but no AXC 1050 (XC) controller, only Section 3.1.8 is relevant to you. In this case, skip Section 3.1.1 ... 3.1.7 and Section 3.2.

This section uses the AXC 1050 as an example for describing the settings in PC Worx that are necessary for the IEC 61850 communication of a Phoenix Contact IED.

3.1.1 Specifying designation for IEC 61850 variable group

- Open the Bus Configuration workspace.
- In the “Bus Structure” window, select the “IED”.
- If necessary, enter a designation for the group of IEC 61850 variables in the “Device Details” window, or use the preset designation.



If you want to create several IEC 61850 variable groups, using a wildcard is recommended.

- Add the wildcard * at the end of the group designation (see example in Figure 3-1).

As designation for the individual variable groups, you respectively use the text that comes before the wildcard * and then replace the wildcard * with a text of your choice for each variable group (see example in Figure 3-3).

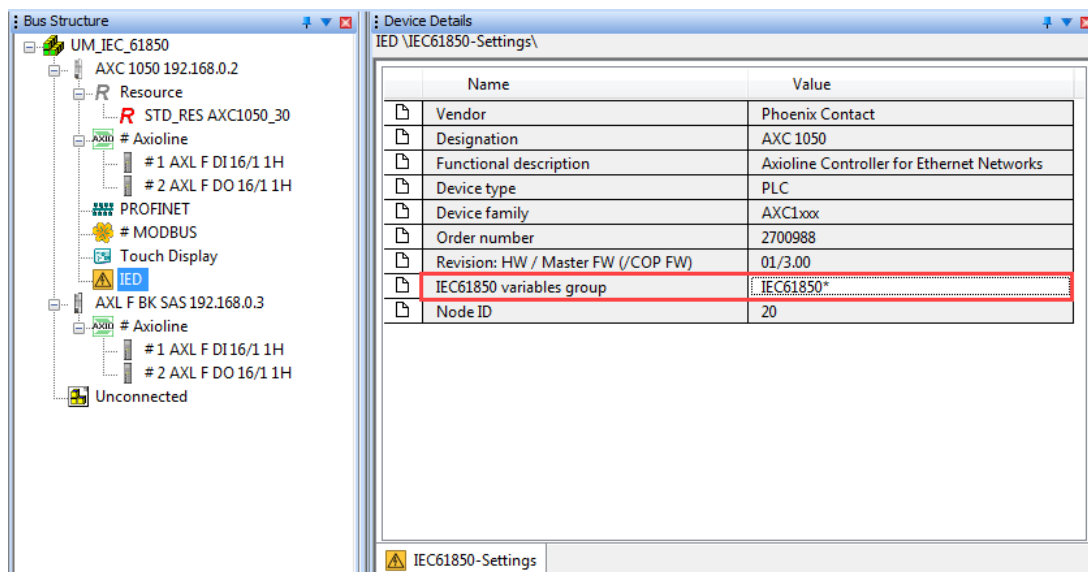


Figure 3-1 Defining designation for the IEC 61850 variable group

PHOENIX CONTACT IEDs – IEC 61850

3.1.2 Creating global variable groups and variables

Creating global variable groups

- Open the IEC programming workspace.
- Double-click “Global Variables”.
- Open the context menu of a variable group by right-clicking it (e.g. “Default”).
- Select “Insert group”.

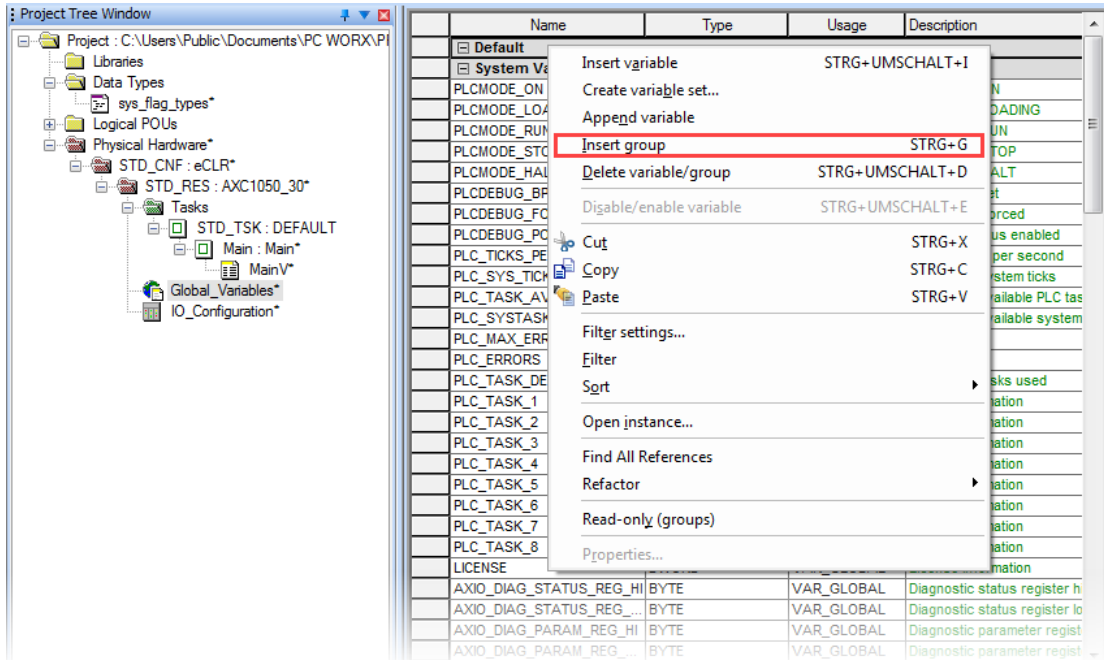


Figure 3-2 “Insert group” context menu

The “NewGroup” group is inserted.

- Double-click on “NewGroup”.
- Enter the designation for the IEC 61850 variable group that you have defined in the “Device Details” window for the IED, see Section 3.1.1. If you have used the wildcard * at the end of the group designation, as recommended in Section 3.1.1, you can enter a designation of your choice for the wildcard * (“_Group1” in Figure 3-3).

Name	Type	Usage	Description
IEC61850_Group1			
Default			
System Variables			
PLC_MODE_ON	BOOL	VAR_GLOBAL	PLC status ON
PLC_MODE_LOADING	BOOL	VAR_GLOBAL	PLC status LOADING
PLC_MODE_RUN	BOOL	VAR_GLOBAL	PLC status RUN
PLC_MODE_STOP	BOOL	VAR_GLOBAL	PLC status STOP
PLC_MODE_HALT	BOOL	VAR_GLOBAL	PLC status HALT
PLCDEBUG_BPSET	BOOL	VAR_GLOBAL	Breakpoint set
PLCDEBUG_FORCE	BOOL	VAR_GLOBAL	Variable(s) forced
PLCDEBUG_POWERFLOW	BOOL	VAR_GLOBAL	Address status enabled

Figure 3-3 Global variable group “IEC61850_Group1” created

Creating global variables

After you have created the global variable group, you can now create the variables that you want to use for the IEC 61850 communication.

- Open the context menu of the IEC 61850 variable group by right-clicking it (in this case “IEC61850_Group1”).
- Select “Insert variable”.

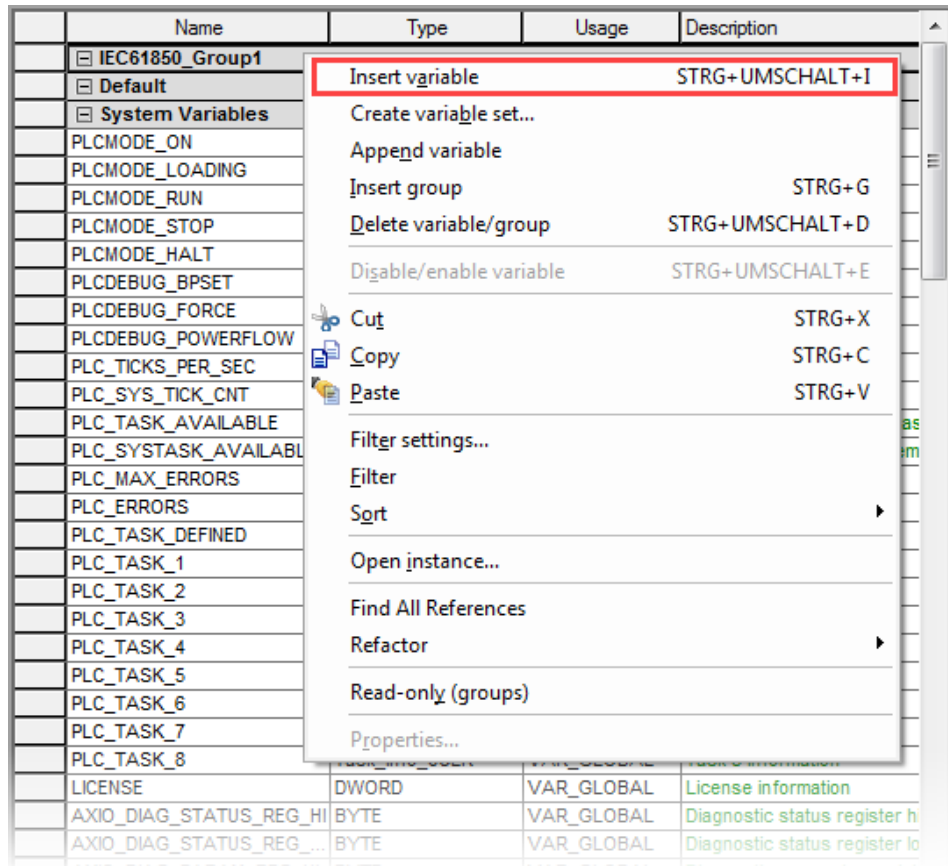


Figure 3-4 Inserting a variable

The new variable is displayed in the variable group.

- In the “Name” column, double-click on the automatically generated name of the new variable that has been created.
- Enter a name for the variable.
- Define the desired properties for the variable in the individual columns.



Please note:

Signals that go out of the application project and into the data model of the IEC 61850 server are defined as outputs in PC Worx.

Signals that the application project reads from the data model of the IEC 61850 server are defined as inputs in PC Worx.



When defining the data type of a variable, pay attention to the assignment of the IEC 61850 data types to the data types in PC Worx, see Section 5.1.

PHOENIX CONTACT IEDs – IEC 61850

Name	[I/Q]	Device	Signal
IEC61850_Group1			
Status_message_1	Q	AXC 1050 192.168.0.2	Status_message_1
Status_message_2	Q	AXC 1050 192.168.0.2	Status_message_2
Status_message_3	Q	AXC 1050 192.168.0.2	Status_message_3
Command_1	I	AXC 1050 192.168.0.2	Command_1
Command_2	I	AXC 1050 192.168.0.2	Command_2
Command_3	I	AXC 1050 192.168.0.2	Command_3
Default			
System Variables			
PLCMODE_ON			
PLCMODE_LOADING			
PLCMODE_RUN			

Figure 3-5 IEC-61850 variables of the “IEC61850_Group1” variable group

3.1.3 Creating the program

- Create the program.



For additional information on creating a program, refer to the PC Worx software online help or quick start guide.

For the IEC 61850 communication, PC Worx provides the function blocks GET_UTC_TIMESTAMP, GET_IEC61850_TIMEQUALITY and IEC61850_GOOSE_SUB_INFO. You can find information on the function blocks in Section 3.2.

3.1.4 Assigning process data

- Assign all variables that are **not** used for IEC 61850 communication to the corresponding appropriate process data.



Please note:

For variables that are to be used for IEC 61850 communication (see Section 3.1.2), configure the assignments to the desired IEC 61850 data attributes in the PC Worx IED Configurator software.

3.1.5 Compiling the project

- In the “Build” menu, select “Rebuild Project” (for the first time the project is compiled) or “Make” (if the project has already been compiled in the past).

3.1.6 Creating a boot project

- Open the IEC programming workspace.
- Open the context menu of the default resource by means of a right-click.
- Select the “Create Bootproject...” entry.

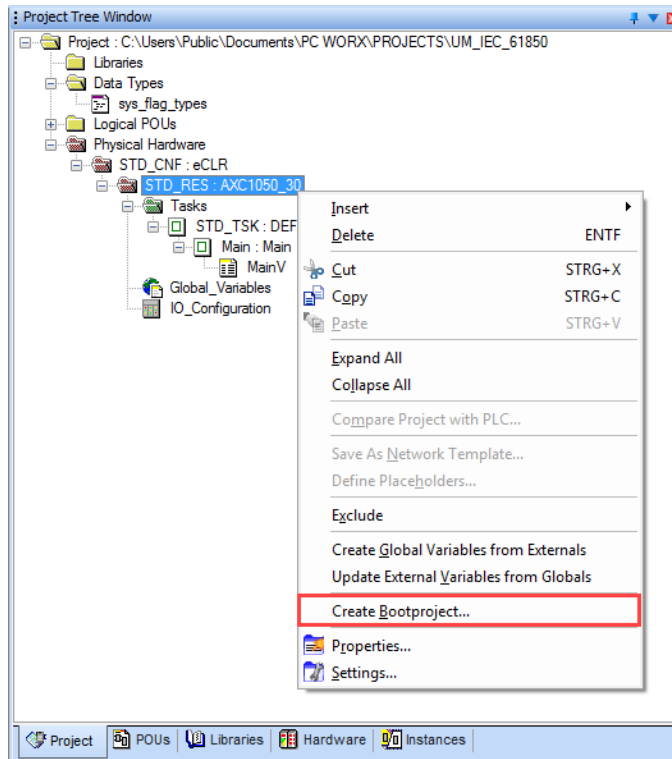


Figure 3-6 Creating a boot project

The “Bootproject Options” window opens.

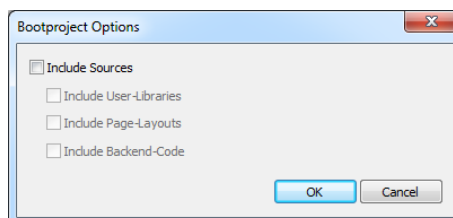


Figure 3-7 “Bootproject Options” window

No entries have to be made in the “Bootproject Options” window.

- To create the boot project, click “OK”.

The “Bootproject Options” window closes.

PHOENIX CONTACT IEDs – IEC 61850

3.1.7 Sending a project and performing a cold restart

The project is transferred to the IED(s) in the PC Worx IED Configurator software, see Section 4.11.

3.1.8 Parameterizing the AXL F BK SAS bus coupler

- Open the Bus Configuration workspace.
- In the “Bus Structure” window, select the “Axioline” node directly below the AXL F BK SAS bus coupler to be parameterized.
- Open the context menu and select “Parameterize...”.

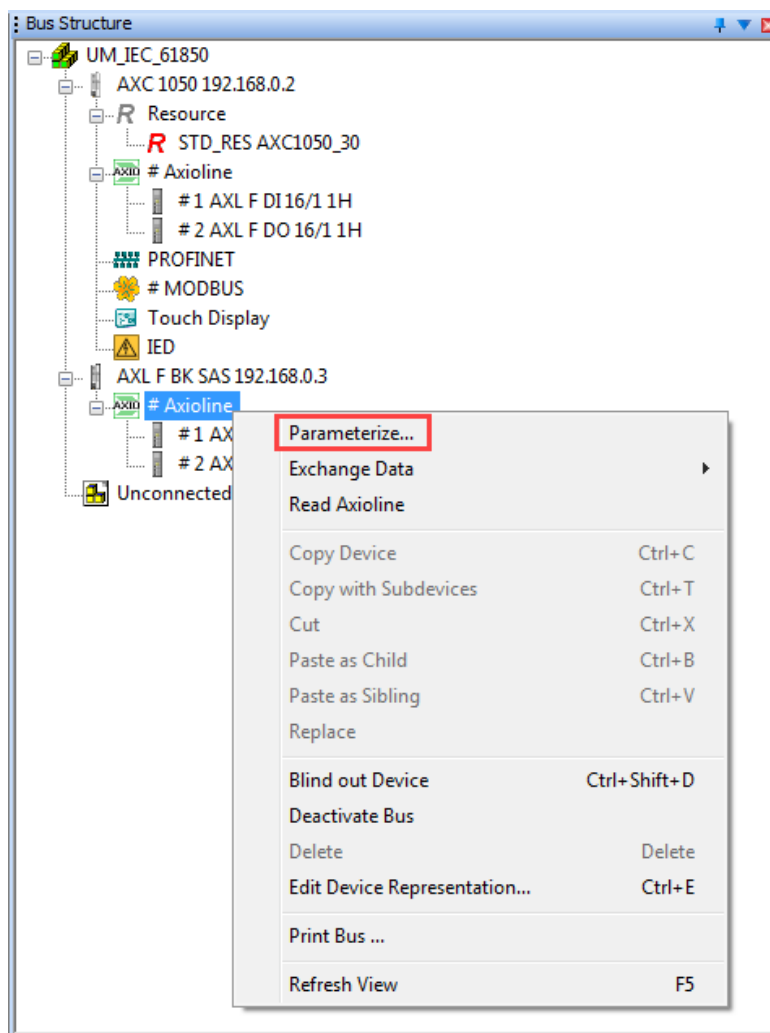


Figure 3-8 “Axioline, Parameterize...” context menu

The "Parameterize" window opens.

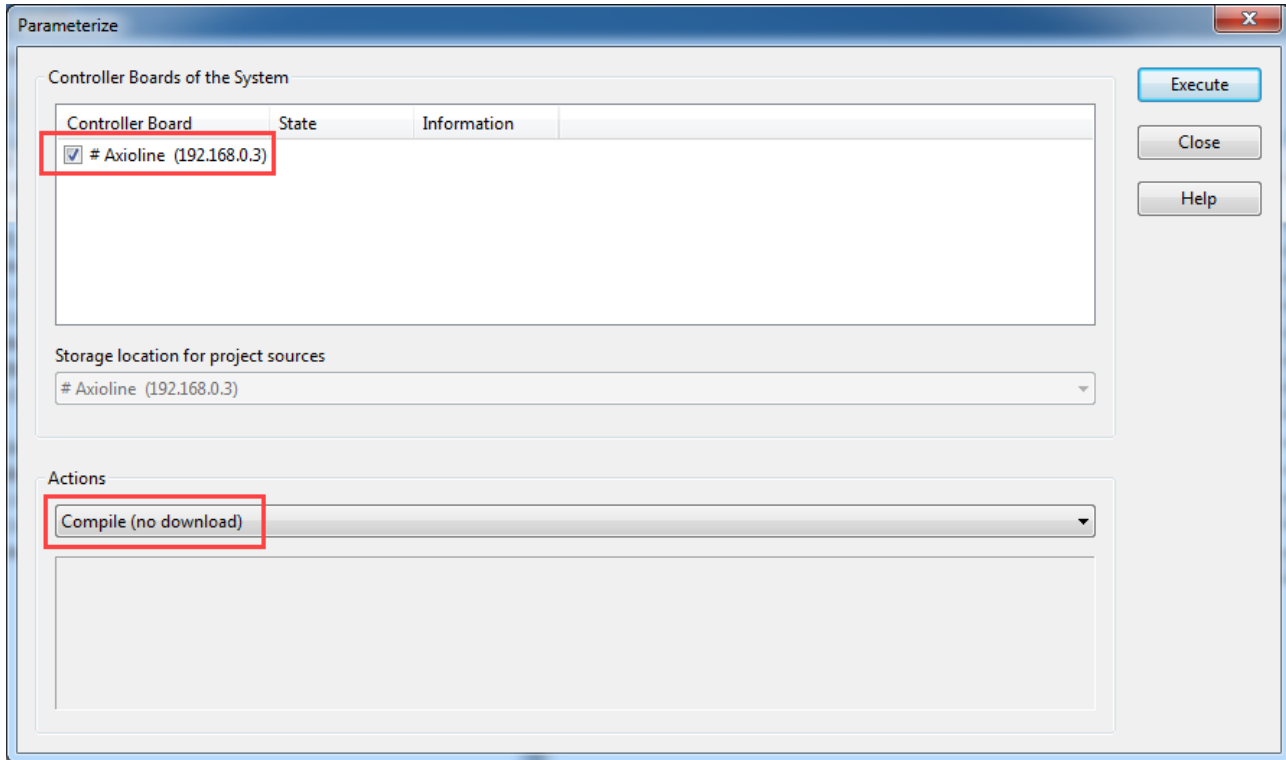


Figure 3-9 "Parameterize" window

- In the "Controller Boards of the System" area, activate the check box of the module(s) to be parameterized (here: AXL F BK SAS bus coupler with IP address 192.168.0.3).
- In the "Actions" area, select "Compile (no download)" in the drop-down list.
- Click "Execute" to parameterize the selected module(s).

The parameterization starts. Once the parameterization procedure is finished, the "State" column contains the entry "Completed". If errors occur during the parameterization procedure, the "Information" column displays the error details.

- After the parameterization has been completed successfully, click "Close" to close the "Parameterize" window.

3.2 Function blocks for the IEC 61850 communication

For the IEC 61850 communication, the function blocks GET_UTC_TIMESTAMP, GET_IEC61850_TIMEQUALITY and IEC61850_GOOSE_SUB_INFO are available in PC Worx.

3.2.1 GET_UTC_TIMESTAMP function block

The GET_UTC_TIMESTAMP function block enables you to query the coordinated universal time UTC. You can query information on the quality of the time supplied by means of function block GET_IEC61850_TIMEQUALITY (see Section 3.2.2).

Function block

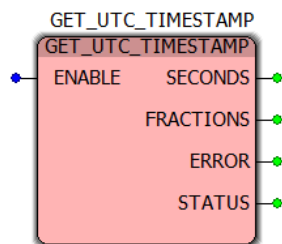


Figure 3-10 GET_UTC_TIMESTAMP function block

Input parameters

Table 3-2 ENABLE input of the GET_UTC_TIMESTAMP function block

Name	Data type	Description
ENABLE	BOOL	The function block is activated on a positive edge at this input. In every cycle, the function block provides the updated UTC. The function block remains active as long as the input has the TRUE status.

Output parameters

Table 3-3 Outputs of the GET_UTC_TIMESTAMP function block

Name	Data type	Description
SECONDS	DWORD	Seconds in the UTC
FRACTIONS	DWORD	Fractions of a second in the UTC
ERROR	BOOL	TRUE: An error occurred, the STATUS output provides details. FALSE: No error has occurred
STATUS	UDINT	Error code of the error that has occurred (ERROR output = TRUE)

Assignment to an IEC 61850 time stamp attribute

To assign the time stamp to an IEC 61850 time stamp attribute in PC Worx IED Configurator, you have to use a variable of the IEC61850_TIMESTAMP data structure.

3.2.2 Function block GET_IEC61850_TIMEQUALITY

The GET_IEC61850_TIMEQUALITY function block provides information on the quality of the UTC queried with the GET_UTC_TIMESTAMP function block. The information is displayed as DWORD.

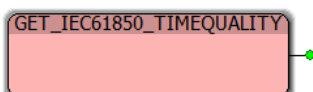


Figure 3-11 Function block GET_IEC61850_TIMEQUALITY

Table 3-4 shows the description of the individual bits of DWORD.

Table 3-4 Description of the bits at the output of the function block GET_IEC_TIMEQUALITY

Bit	Description
0 ... 4	Accuracy classes T0 ... T5
	32: Not specified
	7: T0 (10 ms)
	10: T1 (1 ms)
	14: T2 (0.1 ms)
	16: T3 (0.025 ms)
	18: T4 (0.004 ms)
	20: T5 (0.001 ms)
5	Set The time on the realtime clock of the controller is not in sync with the external time source.
6	Set The time of the realtime clock of the controller is not correct.
7	Set The seconds and second fractions of the UTC at the SECONDS and FRACTIONS outputs of the GET_UTC_TIMESTAMP function block include all leap seconds.

Assignment to an IEC 61850 time stamp attribute

To assign the time stamp to an IEC-61850 time stamp attribute in PC Worx IED Configurator, you have to use a variable of the IEC61850_TIMESTAMP data structure.

PHOENIX CONTACT IEDs – IEC 61850

3.2.3 Function block IEC61850_GOOSE_SUB_INFO

You can use the IEC61850_GOOSE_SUB_INFO function block for diagnosing subscriber errors in the GOOSE communication.

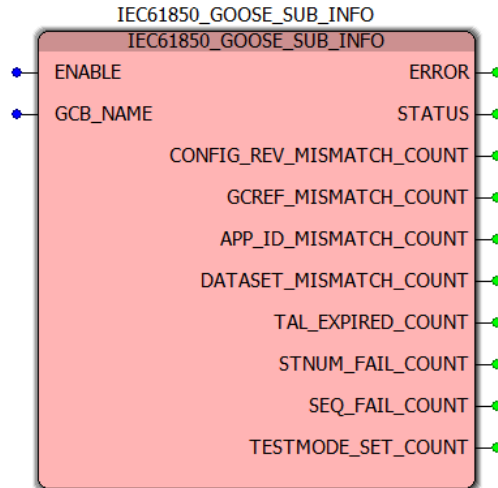


Figure 3-12 Function block IEC61850_GOOSE_SUB_INFO

For a certain GOOSE control block (GCB), the function block provides various counters (X_COUNT outputs, see Table 3-6) on the subscriber side. These counters are useful for the diagnosis.

You can find information on defining control blocks in Section 4.9.3.

Input parameters

Table 3-5 Inputs of the function block IEC61850_GOOSE_SUB_INFO

Name	Data type	Description
ENABLE	BOOL	The function block is activated on a positive edge at this input. In each cycle, the function block reads the counter value of the GOOSE control block at the GCB_NAME input. The function block remains active as long as the input has the TRUE status.
GCB_NAME	STRING	Name or part of name of GOOSE control block If part of a name is used, the diagnosis will flag the first control block whose name contains the partial name.

Output parameters

Table 3-6 Outputs of the function block IEC61850_GOOSE_SUB_INFO

Name	Data type	Description
ERROR	BOOL	TRUE: An error occurred, the STATUS output provides details. FALSE: No error has occurred
STATUS	UDINT	Error code of the error that has occurred 1: The control block has not been found.
CONFIG_REV_MISMATCH_COUNT	DWORD	Number of faulty configuration revisions ("confRev") of control blocks
GCREF_MISMATCH_COUNT	DWORD	Number of faulty GOOSE control block references
APP_ID_MISMATCH_COUNT	DWORD	Number of faulty APP IDs
DATASET_MISMATCH_COUNT	DWORD	Number of faulty datasets
TAL_EXPIRED_COUNT	DWORD	Number of expired time-allowed-to-live times
STNUM_FAIL_COUNT	DWORD	Number of packages lost due to gaps in the telegram received If the subscriber is started after the publisher, and the publisher has already published a number of data changes, the missed data changes are displayed at the start of the offset.
SEQ_FAIL_COUNT	DWORD	Number of telegram retries If the subscriber is started after the publisher, and the publisher has already published a number of retries, the missed retries are displayed at the start of the offset.
TESTMODE_SET_COUNT	DWORD	Number of received GOOSE messages with set test bits

4 PC Worx IED Configurator

With the PC Worx IED Configurator, you create your PC Worx IED Configurator project.

In the PC Worx IED Configurator project, you can do the following:

- Create the IEC 61850 data model, using the 2003 or 2007 namespace.
- Configure the datasets.
- Configure the control blocks for Reporting (MMS) and GOOSE.
- Assign IEC 61850 data attributes to the IEC 61850 variables¹ of the application project or to the input/output channels² of the IED.



To model a communication relationship (subscriber/client) between two IEDs, you need a system configuration tool.

4.1 Installing PC Worx IED Configurator

The software is available to download at phoenixcontact.net/products.

- Download the software onto your computer.
- Double-click on the *.exe file to start installation.
- Follow the instructions of the installation wizard.

4.2 Opening PC Worx IED Configurator

You can open the PC Worx IED Configurator from the Windows[®] start menu or from within the PC Worx software.

Opening software from the Windows[®] start menu

- Open the PC Worx IED Configurator software by going to “Start, All Programs, Phoenix Contact, AUTOMATIONWORX Software Suite <Version>, PC WORX IED Configurator x.x”.

Opening software from within PC Worx

- In PC Worx, open the menu “Extras, PC WORX IED Configurator”.

¹ IEDs of type AXC 1050 (XC)

² IEDs of type AXL F BK SAS

4.3 User interface of the PC Worx IED Configurator

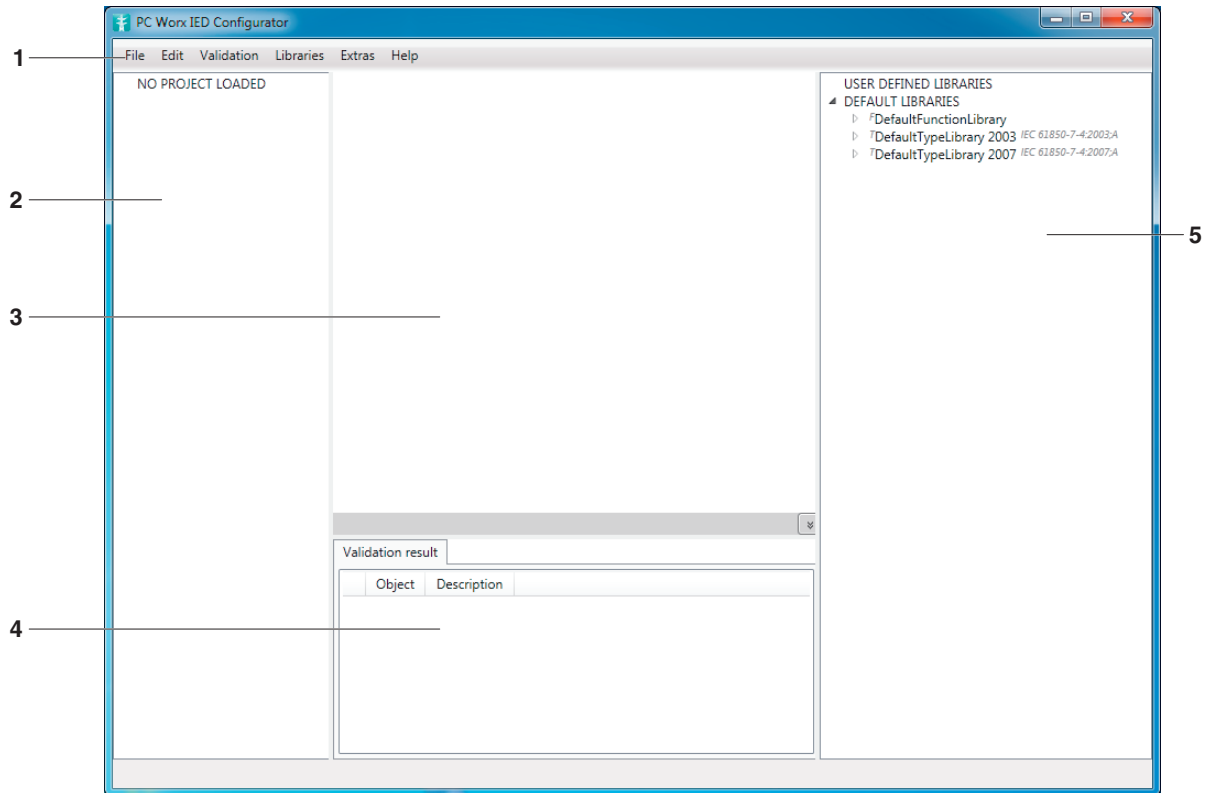


Figure 4-1 User interface of the PC Worx IED Configurator

- 1 Menu bar
- 2 Project tree
- 3 Editor area
- 4 "Validation result" area
- 5 Library area

Project tree

In the project tree, all IEDs of your IEC 61850 application, including access points, logical devices and logical nodes, are displayed as a hierarchical tree structure.

Editor area

If a node in the project tree or an element in the library area is clicked, the associated editor group opens in the editor area.

"Validation result" area

Once you have performed a validity check for your settings, the results of the check are shown in the "Validation result" area.

Library area

The library area displays all data types and functions that you can use for configuring an IED of Phoenix Contact, in acc. with IEC 61850-7-4:2003;A and IEC 61850-7-4:2007;A. Additionally you can add own data types and functions.

4.4 Creating a new project

Before you can configure the settings described in the coming sections, you have to create a new project.

- Open the “File, New” menu.
- In the “Create new project” dialog that opens, enter a name for your PC Worx IED Configurator project.

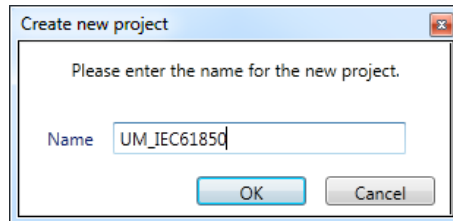


Figure 4-2 Create new project

- Click “OK” to save your entry.

The new project appears in the project tree.

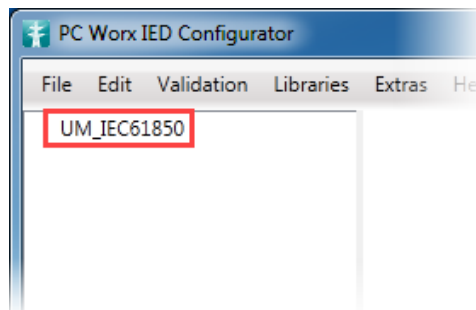


Figure 4-3 Project displayed in the project tree

Default path

The project is saved under the default path “\Libraries\Documents\PC Worx IED Configurator\Projects\” (default setting).

Alternative storage path

If you don't want to save the project under the default path, you can use an alternative path. To do this, proceed as follows:

- Open the menu “Extras, Settings...”.

The “Settings” window opens.

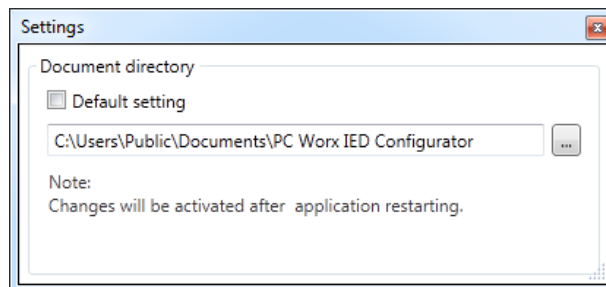


Figure 4-4 “Settings” window for entering an alternative path

- Deactivate the “Default setting” check box.
- Click on the “...” button.
- In the window that opens, enter the desired path for saving the project.
- Save the project by selecting the “File, Save” menu.

The alternative path will become active after PC Worx IED Configurator is restarted.

- Close PC Worx IED Configurator by selecting the menu “File, Close”.
- Open PC Worx IED Configurator again.



When changing the storage path at a later stage, keep the following in mind:

Under the storage path, a “Projects” directory is created for each project. This directory contains all project-specific folders and files.

If you change the memory path at a later stage, the “Projects” directory is created anew, under the modified storage path. The project-specific folders and files from the old storage path are not copied to the new “Projects” directory automatically.

- To copy all project-specific folders and files to the new storage path, copy the “<ProjectName>” directory from the old storage path to the “Projects” directory of the new storage path.

“Projects” directory

For each project, a separate “<ProjectName>” directory is created in the “Projects” directory. After the project has been created, the directory contains the IEC 61850 configuration file <ProjectName>.scd.

The <ProjectName>.scd file can be used for system configuration.

4.5 Creating IEDs

- Select the project in the project tree.
- In the editor area, open the “Project Editor” tab.
- Click the “IED type” input field. In the list box that opens, select the IED, incl. the IEC 61850 namespace to be used, and the device firmware (here: “AXC 1050 (2007/FW 3.00)”).



Please note: Consistent use of the selected namespace

- Use the namespace selected for the IED for the logical nodes of the IED as well (see Section 4.8.3).
 - Only assign logical nodes with namespace 2007 to an IED with namespace “(2007/FW X.XX)”.
 - Only assign logical nodes with namespace 2003 to an IED with namespace “(2003/FW X.XX)”.
- If necessary, change the automatically generated name of the IED. To do so, enter the desired name in the “Name” input field.

In the project tree, an access point (“AP1”), a logical device (“LDevice1”) as well as the logical nodes LLN0 and LPHD1 are instantiated for the IED automatically (see Figure 4-5).

- Create all other IEDs needed by repeating the steps above.



Please note:

You can create a maximum of 150 IEDs within a project.

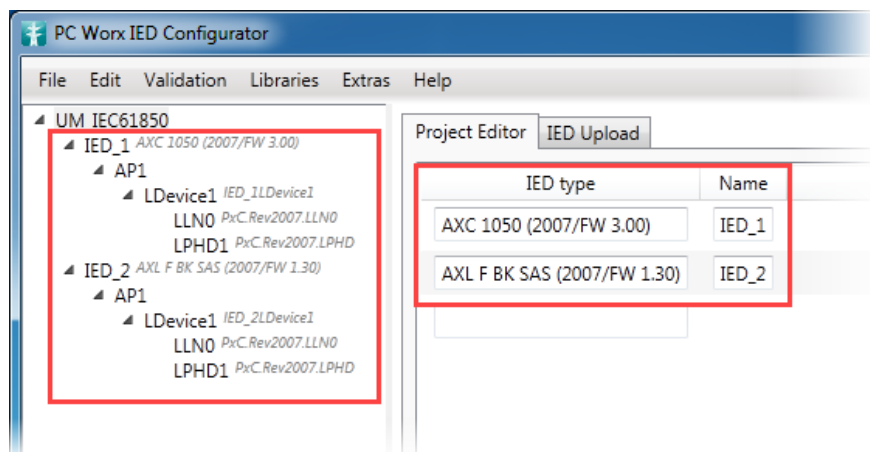


Figure 4-5 New IEDs in the project tree and on the “Project Editor” tab

- Save the project by selecting the “File, Save” menu.

When you save the project, a separate “<IED-Name>” directory is created under the path “\...\Projects\<ProjectName>” (default path: “\Libraries\Documents\PC Worx IED Configurator\Projects\<ProjectName>”). All files that are necessary for the IEC 61850 communication of the IED are stored in the “<IED-Name>” directory.

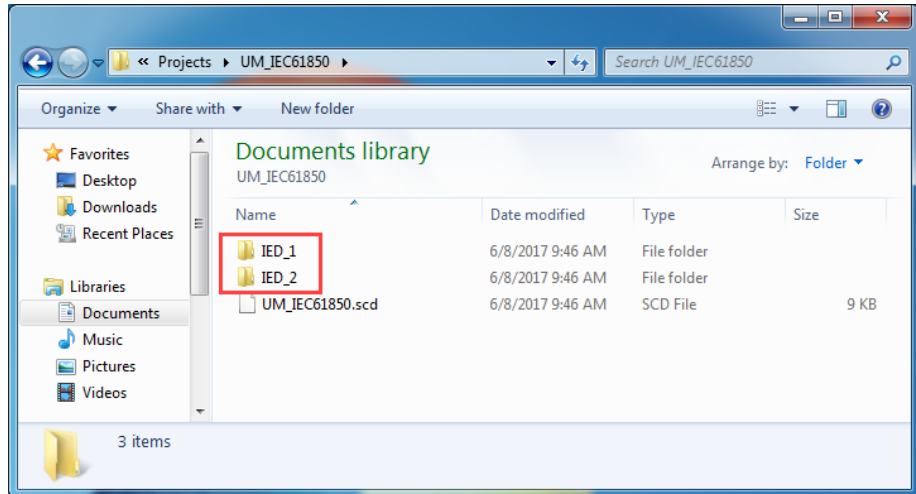


Figure 4-6 Directories created for two IEDs

PHOENIX CONTACT IEDs – IEC 61850

4.6 Configuring IEDs

Entering designation and IP settings of an access point

- In the project tree, select the IED to be configured.
- In the editor area, open the “IED Editor” tab.
- If necessary, change the automatically generated designation of the access point. To do so, enter the desired name in the “AccessPoint” input field.
- In the “IP,” “Subnet” and “Gateway” input fields, enter the IP address, subnet mask and gateway of the IED.

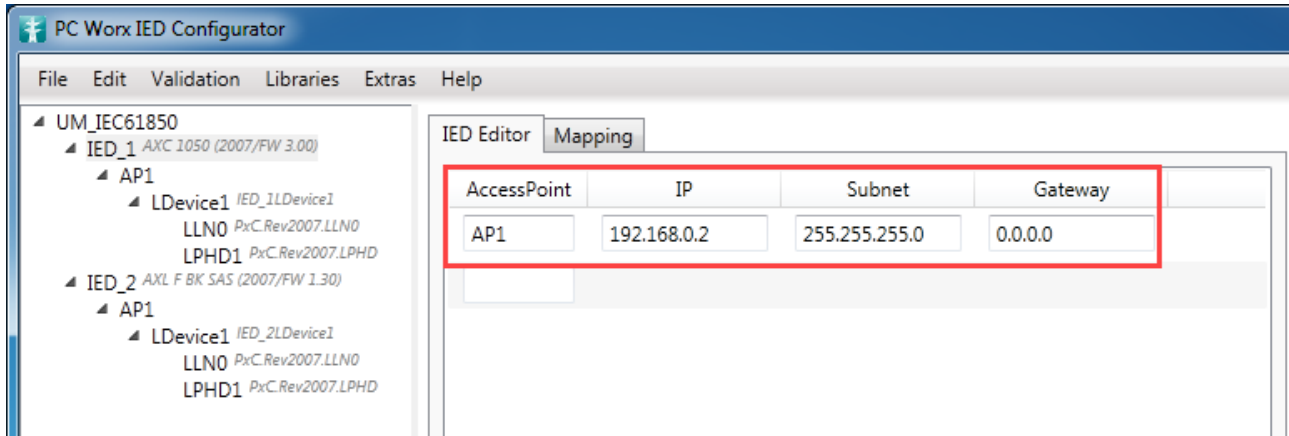


Figure 4-7 Designation and IP settings of an access point

Selecting application project

For **each created IED**, you have to select an appropriate application project that contains the necessary settings to use an AXC 1050 (XC) controller or an AXL F BK SAS bus coupler as IED, see Section 3. The settings are copied from the application project to the PC Worx IED Configurator project in the form of the files varList.csv and image.bin¹ or config.svc².



In the case of IEDs of type AXC 1050 (XC):

To transfer the required IED settings from the application project to the PC Worx IED Configurator project, you have to create a boot project in the respective PC Worx project, see Section 3.1.6.

If you haven't created a boot project in the PC Worx project, the image.bin file is not generated and can thus not be copied to the PC Worx IED Configurator project. In this case, PC Worx IED Configurator issues a corresponding error message.

To select the application project, proceed as follows:

- In the project tree, select the IED for which you want to select a PC Worx or Config+ project.
- In the editor area, open the “IED Editor” tab.
- In the “Application project” area, click the “...” button.
- In the window that opens, select the desired PC Worx or Config+ project.
- Click “Open”.

¹ IEDs of type AXC 1050 (XC)

² IEDs of type AXL F BK SAS

- In the “Select device” window that opens, enter the default resource of the device in PC Worx (for IEDs of type AXC 1050 (XC))
or
in the “Select device” window that opens, select the node ID of the device (for IEDs of type AXL F BK SAS).
- In the “Select device” window, click “OK” to save your entry.

The “updated...” window opens.

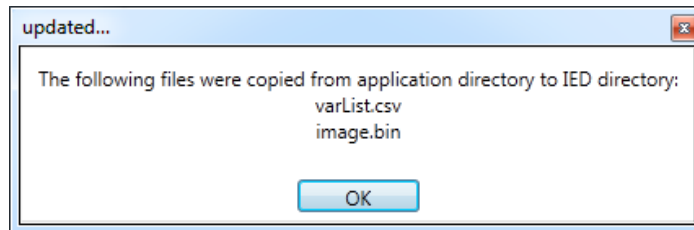


Figure 4-8 The “updated...” window

The “updated...” window displays the files that have been copied from the directory of the application project to the directory of the respective IED (default path: “\Libraries\Documents\PC Worx IED Configurator\Projects\<ProjectName>,<IED-Name>”).

- Click “OK” to close the “updated...” window.

The path to the selected application project is now displayed in the “Application project” area.

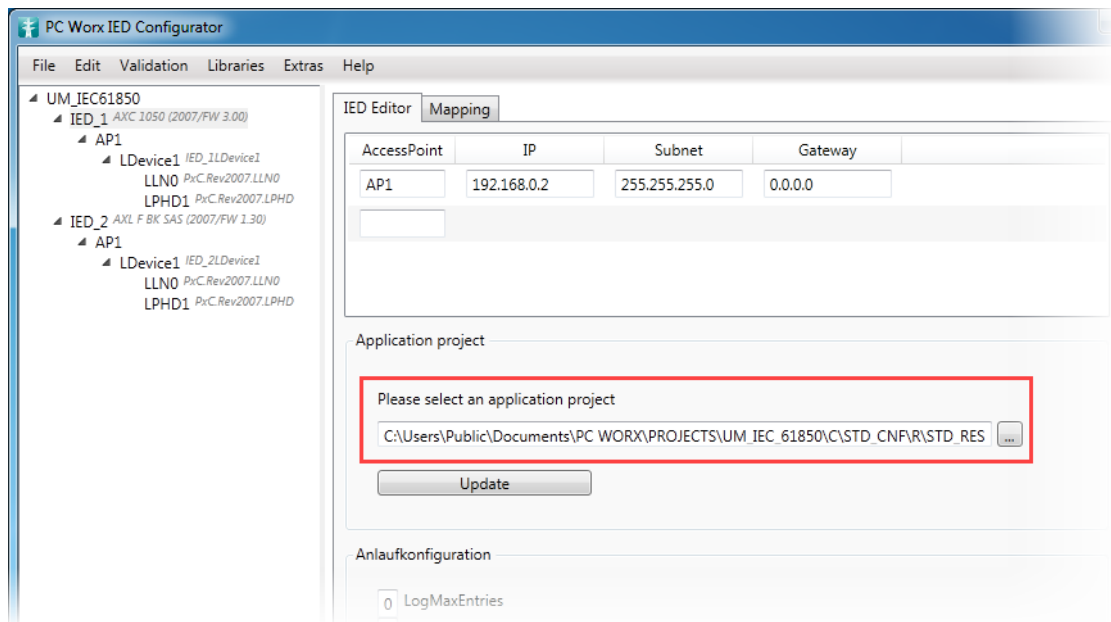


Figure 4-9 Path to application project of an IED (here: PC Worx project)

PHOENIX CONTACT IEDs – IEC 61850



Please note:

If you add, change or delete variables in the application project or change the bus structure after you have selected the path to the application project in PC Worx IED Configurator, the varList.csv file in the IED directory does not contain the current list of variables.

- In this case, if using IEDs of type AXC 1050 (XC), re-create the boot project in PC Worx, see Section 3.1.6.
- In PC Worx IED Configurator, go to the “Application project” area and click “Update” to update the variable list in the directory of the IED.

Editing the start-up configuration

If necessary, you can edit the start-up configuration of the IED.

- In the “LogMaxEntries” input field, enter the maximum number of entries that the mmsstacklog.log file should contain.

The mmsstacklog.log file is generated during the runtime, in the parameterization memory of the IED, in the “IEC61850” directory. The file contains messages that are generated from the base layer of the IEC 61850 stack (e.g. errors parsing the SCL files, etc.). You can access the file via FTP.

- In the “ReportScanRate” input field, enter the interval in ms within which report entries have to be recorded.
- Activate the “LocalBusErrorBehaviour” check box to ensure that, in the event of a module error, the local bus continues to run up to point where the error is located.

In the event of a module error, the Quality (q) attribute switches to the value “Invalid, Failure”.

IED Editor Mapping

AccessPoint	IP	Subnet	Gateway
AP1	192.168.0.2	255.255.255.0	0.0.0.0

Application project

Please select an application project

C:\Users\Public\Documents\PC WORX\PROJECTS\UM_IEC_61850\C\STD_CNFR\STD_RES ...

Update

Anlaufkonfiguration

- LogMaxEntries
- ReportScanRate
- LocalBusErrorBehaviour

Figure 4-10 “Anlaufkonfiguration” (start-up configuration) area

4.7 Creating logical devices

Logical devices are virtual devices. With the logical devices, you determine functional groups depending on the application, e.g. control functions, measurement recording, etc.

- In the project tree, select the access point for which you want to create a logical device.
- In the editor area, on the “AccessPoint Editor” tab, change the automatically generated designation of the first logical device, if necessary. To do so, enter the desired name in the “inst” input field.



Recommended:

- Use unique designations that have some relation to the connected hardware, e.g. KKS, EID, etc.
- In the “IdName” input field, enter a unique name for the logical device, if necessary.

The name of the “IdName” logical device is used as “LDName” in the *.scl file. If you have not entered an “IdName” for the logical device, the automatically generated designation “LDName” is used in the *.scl file.

You can create max. 35 logical devices. To create additional logical devices, proceed as follows:

- Below the line of the last logical device was created, click in the “inst” input field.
- In the “inst” input field, enter a designation for the new logical device.
- In the “IdName” input field, enter a unique name for the logical device, if necessary.
- Repeat this procedure for all required logical devices.

In the project tree, the logical nodes LLN0 and LPHD1 are instantiated for each new logical device that is created.

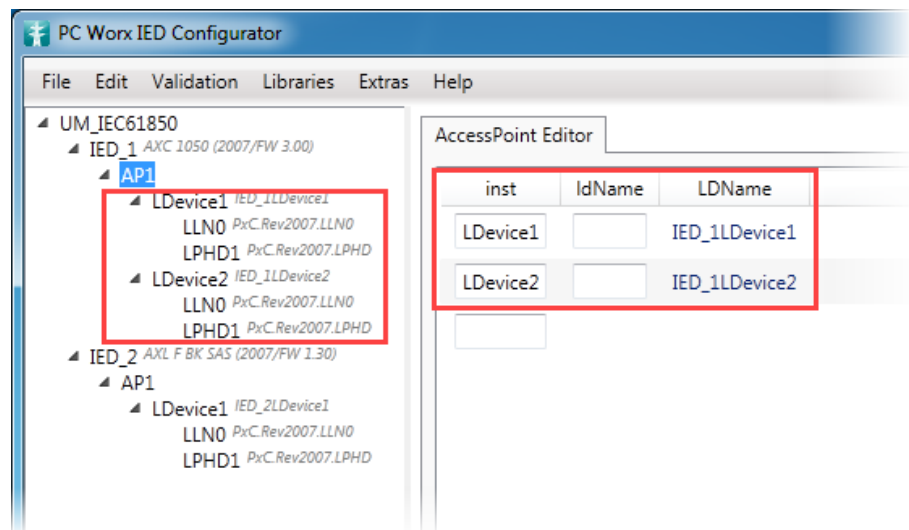


Figure 4-11 Logical devices in the project tree and on the “AccessPoint Editor” tab

Deleting logical device

To delete a logical device, proceed as follows:

- Click the line with the logical device to be deleted.
- Open the “Edit, Delete” menu or press the “Del” button to delete the logical device.

4.8 Configuring the logical nodes of a logical device

After you have created all required logical devices, you configure the desired logical nodes, data objects or functions **for each** logical device. You can use predefined logical nodes, data objects or functions, or define your own.

By default, the logical nodes LLN0 and LPHD1, in the namespace selected when you created the IEDs (see Section 4.5), have already been instantiated for each logical device.

4.8.1 Viewing predefined logical nodes, data objects and functions in the library area

Viewing logical nodes, data objects and functions in the library area

The library area displays all predefined logical nodes, data objects and functions that are available within the respective namespace. In the editor area, you can view the settings that have been saved for a predefined logical node, a data object or a function. To do this, proceed as follows:

- In the library area, open the library that contains the logical node, the data object or the function of which you want to view the settings (for the example in Figure 4-12, the “DefaultTypeLibrary 2007” was opened).
- In the open library, click on the logical node, data object or function (for example: logical node “PxC.Rev2007.GGIO.DI16”).

The “LNodeTypeEditor”¹ editor opens.

The respective editor displays the settings that have been predefined for the logical node, data object or function.

¹ For data objects: “DOType Editor”, for functions: “Function Editor”

LNodeType Editor

Type ID

Type

PxC.Rev2007.GGIO.DI16 : GGIO class

Generic Process I/O

Name	Type	Type template	Explanation	Transient
Beh	PxC.Rev2007.ENS.Beh	ENS		
Health	PxC.Rev2007.ENS.Health	ENS		
NamPlt	PxC.Rev2007.LPL	LPL		
EEHealth	PxC.Rev2007.ENS.Health	ENS	External equipment health (external sensor)	
EEName	PxC.Rev2007.DPL	DPL	External equipment name plate	
Ind1	PxC.Rev2007.SPS	SPS		
Ind2	PxC.Rev2007.SPS	SPS		
Ind3	PxC.Rev2007.SPS	SPS		
Ind4	PxC.Rev2007.SPS	SPS		

Template from namespace IEC 61850-7-4:2007;A

GGIO class

Generic Process I/O

Name	CDC	Explanation	Transient Conditions
Descriptions			
<input checked="" type="checkbox"/> EEName	DPL	External equipment name plate	<input type="radio"/>
Status			
<input checked="" type="checkbox"/> EEHealth	ENS	External equipment health	<input type="radio"/>
<input type="checkbox"/> LocKey	SPS	Local or remote key	<input type="radio"/>
<input type="checkbox"/> Loc	SPS	Local control behaviour	<input type="radio"/>
<input type="checkbox"/> IntIn1	INS	Integer status input	<input type="radio"/>
<input type="checkbox"/> Alm1	SPS	General single alarm	<input type="radio"/>
<input type="checkbox"/> Wrn1	SPS	General single warning	<input type="radio"/>
<input checked="" type="checkbox"/> Ind1	SPS	General indication (binary input)	<input type="radio"/>
Measurements			
<input type="checkbox"/> AnIn1	MV	Analogue input	<input type="radio"/>
<input type="checkbox"/> AnOut1	APC	Controllable analogue output	<input type="radio"/>

Figure 4-12 Predefined logical node "PxC.Rev2007.GGIO.DI16"

4.8.2 Defining own logical nodes, data objects or functions

If you do not want to use predefined logical nodes, data objects or functions, you can define your own logical nodes, data objects or functions. To do so, first create a user-defined library (see Section 4.8.2.1) and then define logical nodes, data objects or functions. You have two options for defining own logical nodes, data objects or functions:

- You can clone a predefined logical node, data object or function, and adapt the settings to match your needs (see Section 4.8.2.2).
- You can create an own logical node, data object or function, and define all required settings yourself (see Section 4.8.2.3).

When cloning or creating the user-defined logical nodes, data objects or functions, you then assign them to the user-defined library.



In the library area, the libraries, logical nodes, data objects and functions that you have created are then available to all PC Worx IED Configurator projects.

4.8.2.1 Creating a user-defined library

You can create two types of user-defined libraries: function libraries or type libraries. Functions are assigned to a function library, whereas logical nodes and data objects are assigned to a type library.

Proceed as follows to create a user-defined library:

- In the library area, right-click “USER DEFINED LIBRARIES” to open the context menu.
- Select “New Function Library...” to create a user-defined function library, or select “New Type Library” to create a user-defined type library.

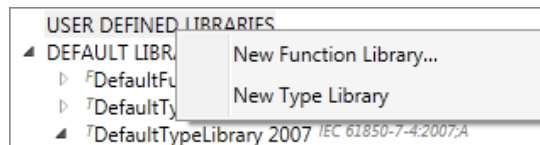


Figure 4-13 Context menu for creating user-defined libraries

The “Create new function library” or “Create new type library” window opens.

- In the “Name” input field, enter a name for the new (function or type) library.
- In the “Namespace” drop-down list, select the desired namespace (only in the case of type libraries).



Please note:

By defining the namespace (IEC 61850-7-4:2003;A or IEC 61850-7-4:2007;A) that is applicable to the type library, you define which versions of logical nodes and data objects the type library should contain. You can only assign logical nodes and data objects to a type library if they use the same namespace as the type library.

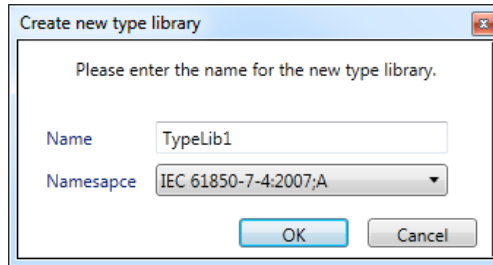


Figure 4-14 “Create new type library” window

- Click “OK” to create the new library.

The “Create new type library” window closes.

The new library appears in the library area.

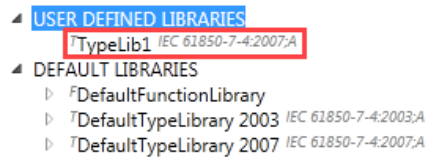


Figure 4-15 User-defined type library in the library area

PHOENIX CONTACT IEDs – IEC 61850

4.8.2.2 Duplicating predefined logical nodes, data objects and functions

To clone a predefined logical node, predefined data object or predefined function, proceed as follows:

- In the library area, open the library that contains the logical node, the data object or the function that you want to copy (for the example in Figure 4-16, the “DefaultTypeLibrary 2007” was opened).
- In the open library, click on the logical node, data object or function that is to be cloned (for example, in Figure 4-16: logical node “GGIO: PxC.Rev2007.GGIO.DI16”).
- Right-click to open the context menu and select “Clone...”.



Figure 4-16 “Clone” context menu of a logical node in the library area

The “Clone LNodeType ‘PxC.Rev200X...’”¹ window opens.

- In the “Name” input field, enter a name for the logical node, data object or function.
- In the “Paste in Type Library”² drop-down list, select the user-defined library that is to be assigned to the logical node, data object or function.



For type libraries, please note:

The namespace (IEC 61850-7-4:2003;A or IEC 61850-7-4:2007;A) of the user-defined type library has to match the namespace of the logical node or the data object.

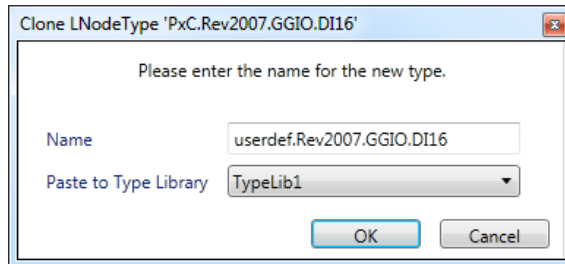


Figure 4-17 Window “Clone LNodeType ‘PxC.Rev200X...’”

- Click “OK” to insert the logical node, data object or function into the user-defined library.

The “Clone LNodeType ‘PxC.Rev200X...’” window closes.

The logical node, data object or function is displayed in the library area, below the user-defined library.

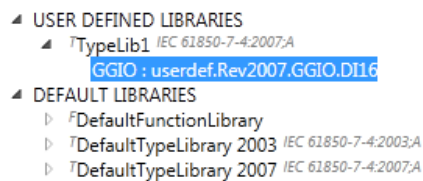


Figure 4-18 Cloned logical nodes in a user-defined library

- In the user-defined library, click the cloned logical node (in the example in Figure 4-18: “GGIO: userdef.Rev2007.GGIO.DI16”), cloned data object or cloned function.

The “LNodeType Editor”³ editor opens.

The respective editor displays the predefined settings of the logical node, data object or function that you have cloned. You can adapt these settings as needed.

¹ For data objects: “Clone DOType”, for functions: “Clone Function”

² For function libraries, use “Paste to Function Library”

³ For data objects: “DOType Editor”, for functions: “Function Editor”

PHOENIX CONTACT IEDs – IEC 61850

Settings for logical nodes in the “LNodeType Editor”

LNodeType Editor

Type ID

Type

userdef.Rev2007.GGIO.DI16 : GGIO class

Generic Process I/O

Name	Type	Type template	Explanation	Transient
EEName	<input type="text" value="PxC.Rev2007.DPL"/>	DPL	External equipment name plate	
EEHealth	<input type="text" value="PxC.Rev2007.ENS.Ht"/>	ENS	External equipment health (external sensor)	
Alm1	<input type="text" value="PxC.Rev2007.SPS"/>	SPS	General single alarm	Copy
Wrn1	<input type="text" value="PxC.Rev2007.SPS"/>	SPS	General single warning	Copy
Ind1	<input type="text" value="PxC.Rev2007.SPS"/>	SPS		Copy
Ind10	<input type="text" value="PxC.Rev2007.SPS"/>	SPS		Delete
Ind11	<input type="text" value="PxC.Rev2007.SPS"/>	SPS		Delete
Ind12	<input type="text" value="PxC.Rev2007.SPS"/>	SPS		Delete

Template from namespace IEC 61850-7-4:2007;A

GGIO class

Generic Process I/O

Name	CDC	Explanation	Transient Conditions
Descriptions			
<input checked="" type="checkbox"/> EEName	DPL	External equipment name plate	<input type="radio"/>
Status			
<input checked="" type="checkbox"/> EEHealth	ENS	External equipment health	<input type="radio"/>
<input type="checkbox"/> LockKey	SPS	Local or remote key	<input type="radio"/>
<input type="checkbox"/> Loc	SPS	Local control behaviour	<input type="radio"/>
<input type="checkbox"/> IntIn1	INS	Integer status input	<input type="radio"/>
<input checked="" type="checkbox"/> Alm1	SPS	General single alarm	<input type="radio"/>
<input checked="" type="checkbox"/> Wrn1	SPS	General single warning	<input type="radio"/>
<input checked="" type="checkbox"/> Ind1	SPS	General indication (binary input)	<input type="radio"/>
Measurements			
<input type="checkbox"/> AnIn1	MV	Analogue input	<input type="radio"/>

Figure 4-19 Two data objects for a self-defined logical node added to the “LNodeType Editor”

Adding data objects to a logical node

To add data objects to the predefined settings of a logical node, proceed as follows:

- In the “Template from namespace IEC 61850-7-4:XXXX;A” area, activate the check boxes for the data objects that are to be used in the logical node (in the example in Figure 4-19: “Alm1” and “Wrn1”).

The data objects are added in the “Type” area.

- In the drop-down list in the “Type” column of each added data object, select the common data class, in the desired namespace (in the example in Figure 4-19: “PxC.Rev2007.SPS”).

Some data objects are displayed across several lines in the “Type” area. If necessary, you can add another line to such a data object. To do this, proceed as follows:

- In a line of the multi-line data object, click “Copy” to copy the corresponding line.

The copy is inserted as last line of the data object.

- In the drop-down list in the “Type” column, select the common data class, in the desired namespace.

Changing predefined data objects

To change the predefined data objects of a logical node, proceed as follows:

- Go to the “Type” area and, in the drop-down list in the “Type” column of the data object to be changed, select a different common data class.

Deleting data objects from a logical node

Proceed as follows to delete data objects from a logical node:

- In the “Template from namespace IEC 61850-7-4:XXXX;A”, deactivate the check boxes of the data objects that you want to remove from the logical node.

The respective data objects are removed from the “Type” area.

Some data objects are displayed across several lines in the “Type” area. If necessary, you can delete one more such line(s) from such a data object. To do this, proceed as follows:

- In a line of the multi-line data object, click “Delete” to delete the corresponding line.

PHOENIX CONTACT IEDs – IEC 61850

Settings for data objects in the “DOType Editor”

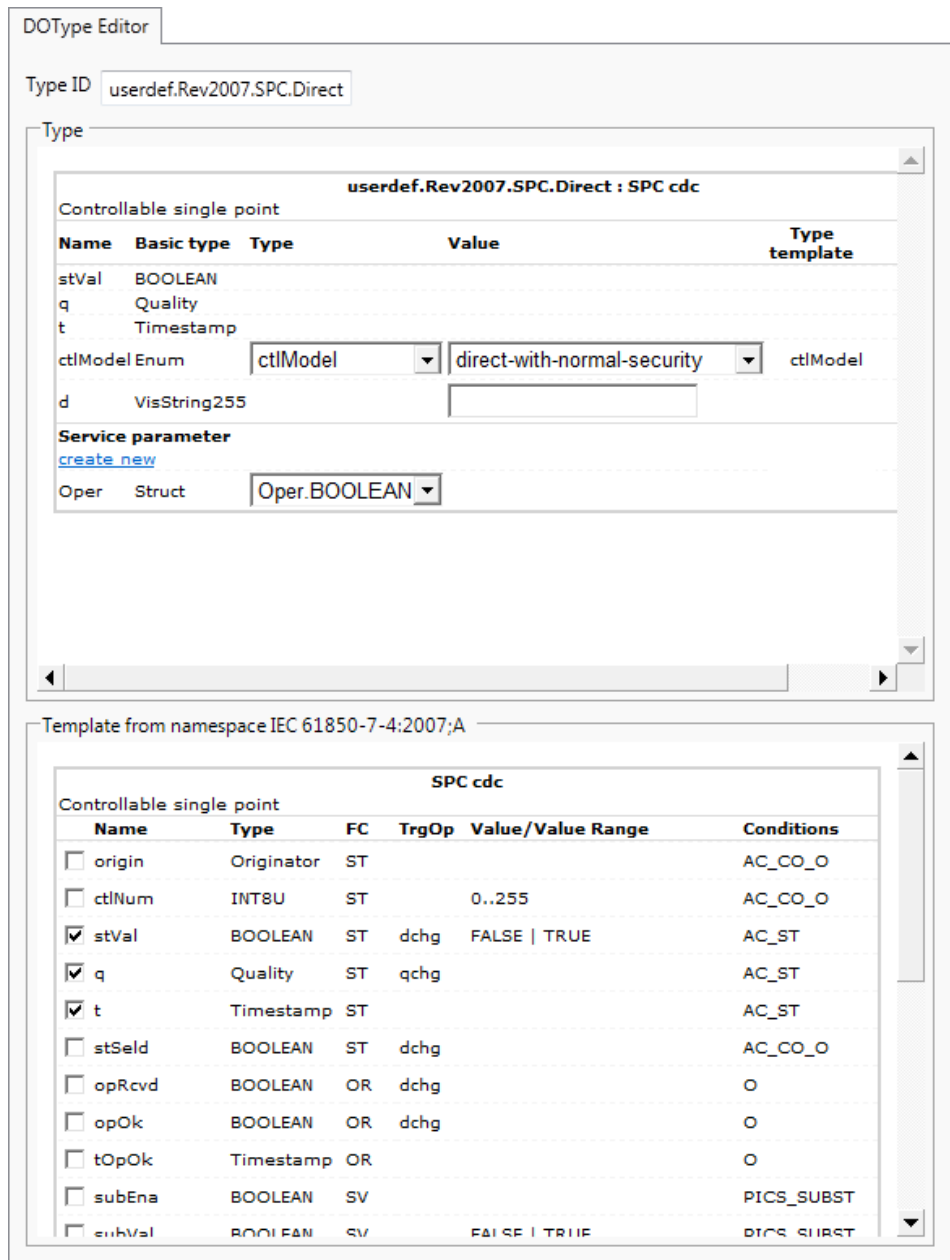


Figure 4-20 Possible settings for a cloned data object in “DOType Editor”

Adding data attributes to a data object

Proceed as follows to add data attributes to the predefined settings of a data object:

- In the “Template from namespace IEC 61850-7-4:XXXX;A”, activate the check boxes of the data attributes that are to be added to the data object.

The data attributes are added in the “Type” area.

- In the drop-down list(s) of each added data attribute, select the desired setting(s).

Changing predefined data attributes

To change the predefined data attributes of a data object, proceed as follows:

- In the “Type” area, in the drop-down list(s) of the data attribute to be modified, select the desired setting(s).

Deleting data objects from a logical node

Proceed as follows to delete data attributes from a data object:

- In the “Template from namespace IEC 61850-7-4:XXXX;A”, deactivate the check boxes of the data attributes that are to be removed from the data object.

The respective data attributes are removed from the “Type” area.

Settings for functions in the “Function Editor”

The screenshot shows the 'Function Editor' window. At the top, there is a 'Name' field containing 'userdef_Function Circuit Breaker' and a 'Type' dropdown menu set to 'TypeA'. Below this is a table with the following columns: LNName, InType, prefix, InClass, and InInst.

LNName	InType	prefix	InClass	InInst
QAxCBR1	PxC.Rev2007.XCBR	QAx	XCBR	1
QAxCSWI1	PxC.Rev2007.CSWI	QAx	CSWI	1
	<input type="text"/>	<input type="text"/>		<input type="text"/>

Figure 4-21 Possible settings for a cloned function in the “Function Editor”

Adding logical nodes to a function

Proceed as follows to add additional logical nodes to the predefined logical nodes of a function:

- In the last line, click in the empty input field in the “InType” column.
- In the list box that opens, select the desired logical node.
- If necessary, enter a prefix in the “prefix” input field.
- In the “InInst” input field, enter an instance number.

Deleting logical nodes from a function

Proceed as follows to delete a logical node from a function:

- Click the line with the logical node to be deleted.
- Open the “Edit, Delete” menu or press the “Del” button to delete the logical node.

The logical node is removed from the function.

PHOENIX CONTACT IEDs – IEC 61850

4.8.2.3 Creating own logical nodes, data objects and functions

To create an own logical node, a logical data object or a function, proceed as follows:

- Right-click a user-defined type or function library to open the context menu.
- Select “New LNodeType...” to create a new logical node
or
select “New DOType...” to create a new data object
or
select “New Function...” to create a new function.

The “Neuen LNodeType erstellen”¹ window (create new LNodeType) opens.

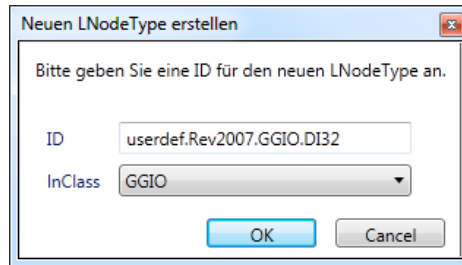


Figure 4-22 “Neuen LNodeType erstellen” window (create new LNodeType)

If you create a new logical node:

- In the “ID” input field, enter a unique designation for the logical node.
- In the drop-down list “InClass”, select the node type.
- Click “OK” to insert the logical node into the user-defined type library.

If you create a new data object:

- In the “Neuen DOType erstellen” window (create new DOType), enter a unique designation for the data object.
- In the “cdc” drop-down list, enter the common data class.
- Click “OK” to add the data object to the user-defined type library.

If you create a new function:

- In the “Create new function” window, enter a unique name for the function into the “Name” input field.
- Click “OK” to add the function to the user-defined function library.

After a logical node, a data object or a function has been added to the respective user-defined library, the associated editor automatically opens in the editor area. In the editor, you can change the settings of the logical node, the data data object or the function. Proceed as described in Section 4.8.2.2, in the “Settings for logical nodes in the “LNodeType Editor””, “Settings for data objects in the “DOType Editor”” and “Settings for functions in the “Function Editor”” sections.

¹ For data objects: “Neuen DOType erstellen” (create new DOType), for functions: “Create new function”

4.8.3 Assigning a logical node to a logical device, changing or deleting it

Assigning logical nodes



Please note: The selected namespace has to be used consistently throughout.

- Only assign logical nodes with namespace 2007 to an IED with namespace “(2007/FW X.XX)”.
- Only assign logical nodes with namespace 2003 to an IED with namespace “(2003/FW X.XX)”.

To assign a logical node to a logical device, proceed as follows:

- In the project tree, select the logical device.
- On the “LDevice Editor” tab, go to the last line and click the empty input field in the “In-Type” column.
- In the list box that opens, select the desired node type.
- If necessary, enter a prefix in the “prefix” input field.

The prefix is added in front of the designation of the logical node in the project tree.

- In the “InInst” input field, change the automatically generated instance number, if necessary.



Please note:

The “LNName” consists of “InClass” and “InInst”. The “LNName” is a unique designation of the logical nodes of a logical devices.

If you change the “InInst” instance number, it is possible that an “LNName” can occur multiple times and that unique identification of the logical node concerned cannot be guaranteed.

- Repeat this procedure for all required logical nodes of **each** logical device.

The assigned logical nodes for each logical device are displayed in the project tree underneath each logical device (see Figure 4-23 on page 42).

PHOENIX CONTACT IEDs – IEC 61850

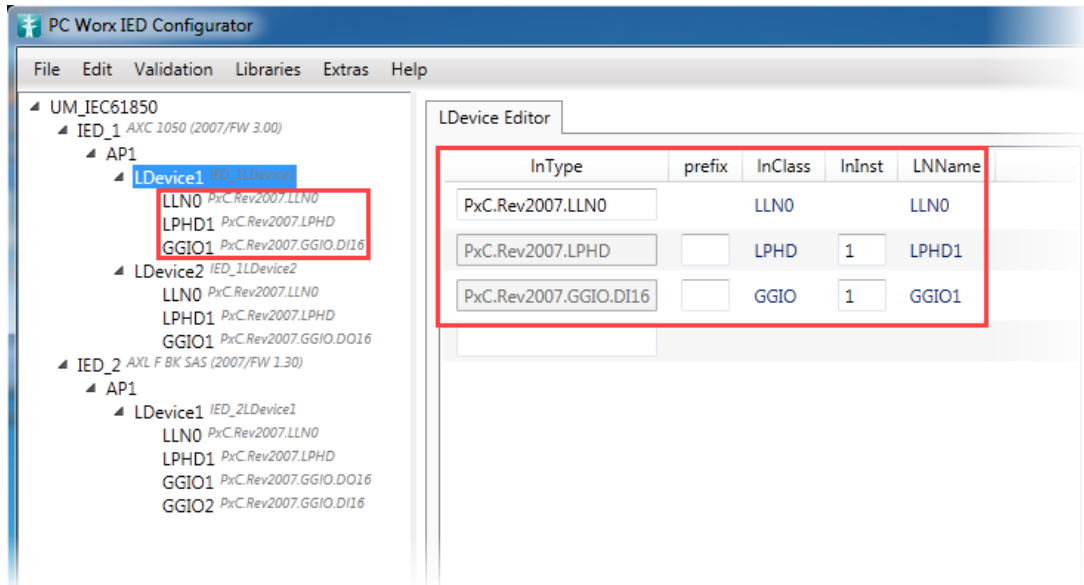


Figure 4-23 Logical nodes of logical devices in the project tree and on the “LDeviceEditor” tab

Changing logical nodes

To change an assigned logical node, proceed as follows:

- On the “LDevice Editor” tab, go to the input field in the “InType” column and delete the node type of the logical node to be changed.
- Subsequently click in the “InType” input field and, in the list box that opens, select a different node type.
- If necessary, enter a prefix in the “prefix” input field.

The prefix is added in front of the designation of the logical node in the project tree.

- In the “InInst” input field, change the automatically generated instance number, if necessary.



Please note:

The “LNName” consists of “InClass” and “InInst”. The “LNName” is a unique designation of the logical nodes of a logical devices.

If you change the “InInst” instance number, it is possible that an “LNName” can occur multiple times and that unique identification of the logical node concerned cannot be guaranteed.

Deleting logical nodes

To delete an assigned logical node, proceed as follows:

- In the “LDevice Editor”, click the line that contains the logical node to be deleted.
- Open the “Edit, Delete” menu or press the “Del” button to delete the logical node.

4.9 Specifying data attributes, data objects and/or functions of a logical node

After you have defined all necessary logical nodes, you specify the desired data attributes, data objects and/functions for each logical node, in acc. with IEC 61850. Several tabs are available for this purpose in the editor area of a logical node:

Table 4-1 Overview of the tabs of a logical node in the editor area

TAB	Description	See
DAI Editor	Specification of initial values for DAI references	Section 4.9.1
DataSets	Combination of data attributes and/or objects into datasets for GOOSE or Reporting (MMS)	Section 4.9.2
Control Blocks	Specification of the communication method (GOOSE ¹ or Reporting (MMS)) of a dataset	Section 4.9.3
Mapping	Assignment of the IEC 61850 data attributes to the variables of the IED (on IEDs of type AXC 1050 (XC)) or to the input and output channels (on IEDs of type AXL F BK SAS) of AxioLine F modules connected to the IED	Section 4.9.4

¹ The GOOSE communication method is only available for the LLN0 logical node.

4.9.1 Specifying initial values for data attribute instances (DAI)

On the “DAI Editor” tab, you can specify initial values for selected data attributes or objects, if necessary. To do this, proceed as follows:

- In the project tree, select the logical node.
- In the editor area, open the “DAI Editor” tab.
- Click in the empty “DAI Reference” input field.
- In the list box that opens, select the desired data attribute or data object.
- In the “Value” input field, enter the desired initial value.



The input method (plain text or selecting a value from a list box) for making entries in the “Value” input field depends on the selected data attribute or object.

- Repeat this procedure for all data attributes or objects for which you want to specify initial values.

Deleting a data attribute instance

To delete a data attribute instance, proceed as follows:

- Click in the line that contains the data attribute instance to be deleted.
- Open the “Edit, Delete” menu or press the “Del” button to delete the data attribute instance.

PHOENIX CONTACT IEDs – IEC 61850

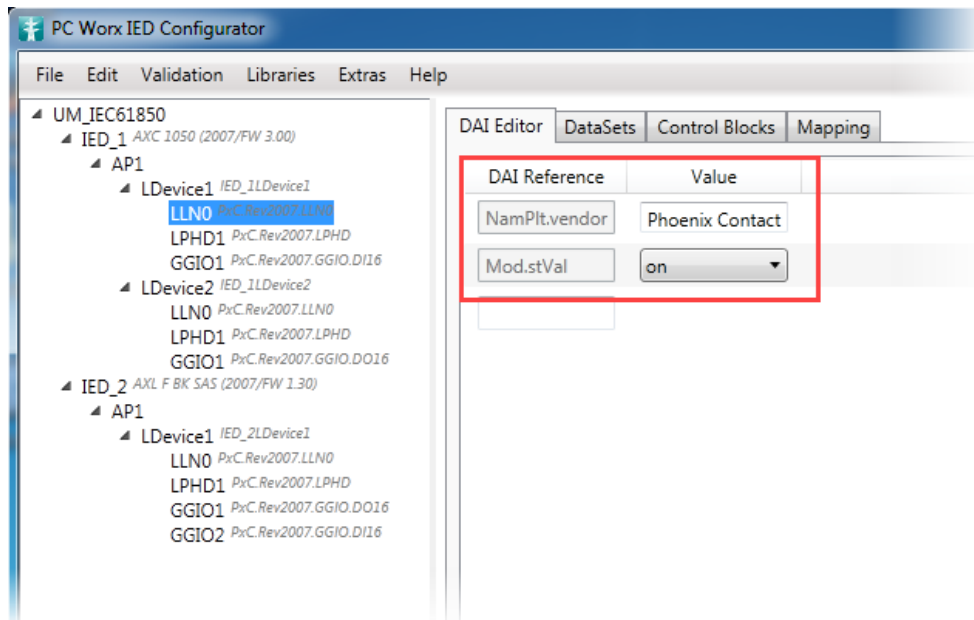


Figure 4-24 Example: Initial value for the “NamPlt.vendor” and “Mod.stVal” data attributes of the LLN0 logical node

Initial values at analog inputs and outputs

Analog inputs

To display analog input signals, you can use the instMag.f and mag.f data attributes.

Table 4-2 Data attributes for displaying analog input signals

Data attribute	Meaning
instMag.f	Instantaneous value of the measured dimension (FLOAT32)
mag.f	Deadband value of the measured dimension (FLOAT32)
rangeC.min.f	Minimum value of the value range (FLOAT32)
rangeC.max.f	Maximum value of the value range (FLOAT32)
db	Factor for determining the deadband (INTEGER)
DB	Deadband



Please note:

Using the instMag.f data attribute for Reporting or GOOSE can cause a significant data volume.

Recommended:

- Do not use the instMag.f data attribute for Reporting or GOOSE.

- Select the attributes rangeC.min.f and rangeC.max.f correspondingly to the minimum and maximum analog value of the connected Axioline F module.

Example: analog module configured for the range 4 mA to 20 mA

- rangeC.min.f = 4
- rangeC.max.f = 20

The width of the deadband is specified by the attributes rangeC.min.f, rangeC.max.f and db according to the following equation:

$$DB = \frac{\text{rangeC.max.f} - \text{rangeC.min.f}}{100\,000} * \text{db}$$

Example for db = 63:

$$DB = \frac{20\text{ mA} - 4\text{ mA}}{100\,000} * 63 \cong 0,01\text{ mA}$$

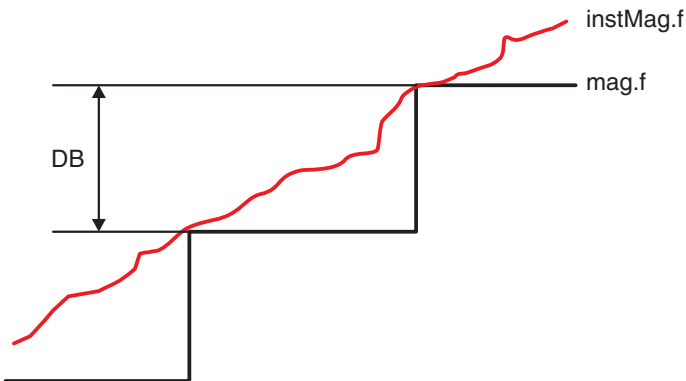


Figure 4-25 Curve of the analog values instMag.f and mag.f

If db = 0, then DB = 0 as well, and thus the values for instMag.f and mag.f are identical.

Analog outputs

The definitions of analog outputs differ depending on the IEC 61850 namespace that is used.

Namespace IEC 61850-7-4:2003;A:

In addition to the definition as per IEC 61850-7-4:2003;A, Phoenix Contact also supports analog outputs in logical nodes of type GGIO. The Common Data Class ASG (Analog Setting) is used for this. The attribute setMag.f is used to set the analog outputs.

Namespace IEC 61850-7-4:2007;A:

In the IEC 61850-7-4:2007;A namespace, the analog outputs are described in the common data class APC (Controllable Analog Process Value). The attribute Oper.ctlVal.f is used to set the analog outputs.

PHOENIX CONTACT IEDs – IEC 61850

4.9.2 Combining data attributes and/or objects into datasets

You can combine data attributes, and/or objects to be monitored or sent via GOOSE or Reporting functions, into datasets.



For GOOSE or Reporting, you can create up to four datasets. The individual datasets may each have max. 50 data attributes and/or data objects.

- Contact Phoenix Contact if you need a larger number of datasets or more data attributes/objects contained therein.

To create datasets and their associated data attributes and/or objects, proceed as follows:

- In the project tree, select the logical node.
- In the editor area, select the “DataSets” tab.
- Click in the empty input field in the “Name” column and enter a name for the dataset to be created.
- Click in the empty input field “Reference (FCDA)” (FCDA = Functionally Constrained Data Attribute).
- In the list box that opens, select the desired data attribute or data object.
- Repeat this procedure for all datasets you need and their associated data attributes and/or data objects.

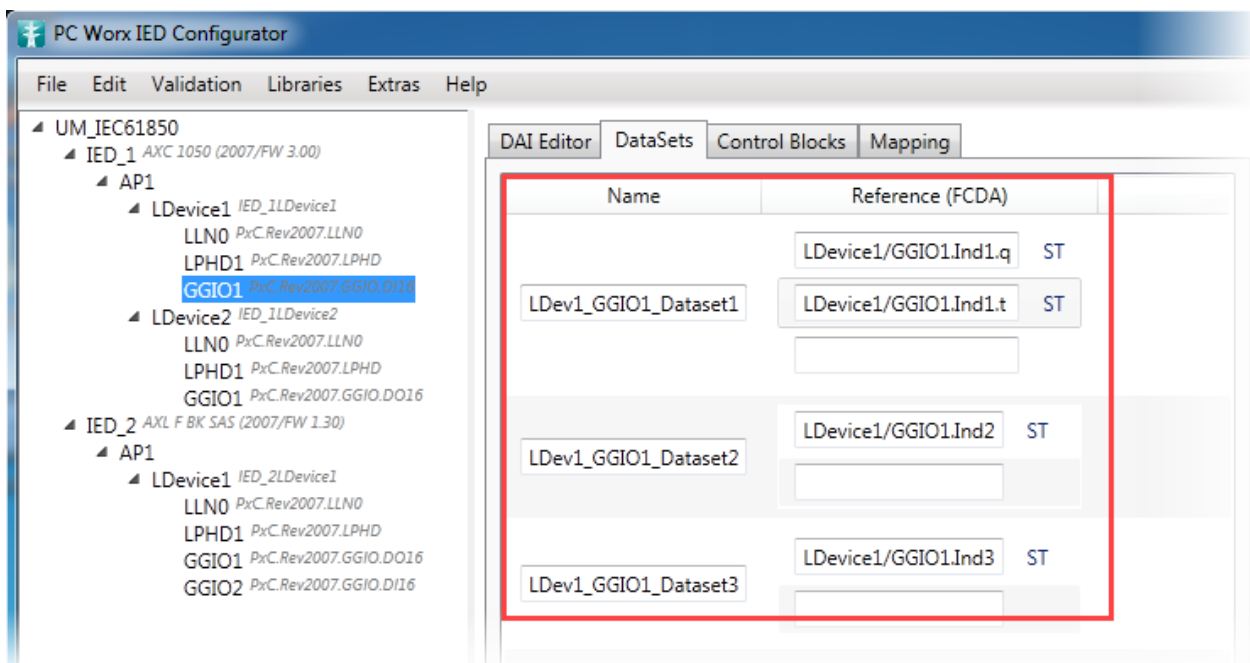


Figure 4-26 Datasets and the data attributes and objects contained therein

Deleting a data set

To delete a dataset, proceed as follows:

- Click the line that contains the dataset to be deleted.
- Open the “Edit, Delete” menu or press the “Del” button to delete the dataset.

4.9.3 Specifying communication methods for datasets

For each dataset, you can determine the communication method that is to be used for monitoring or sending the data attributes and/or data objects contained in the dataset.

**Please note:**

The GOOSE communication method is only available for the LLN0 logical node.

The communication method is specified by means of control blocks that you define for each dataset of a logical node.

**Please note:**

The number of GOOSE control blocks affects the performance of the IED. As the number of GOOSE control blocks increases, the performance of the IED decreases.



- Please note the maximum permissible number of GOOSE and Reporting (MMS) control blocks, see Section “Technical appendix” on page 59.

To specify the communication method, proceed as follows:

- In the project tree, select the logical node.
- In the editor area, open the “Control Blocks” tab.
- Click in the empty input field in the “Name” column and enter a name for the control block to be created.
- Click in the empty “DataSet” input field.
- In the list box that opens, select the desired dataset.
- If necessary, change the automatically generated ID in the input field “rptID” (for the Reporting (MMS) communication method) or “goID” (for the GOOSE communication method).
- Change the automatically generated configuration revision of the control block in the standard, if you made changes to the control block. To do so, enter the desired value into the “confRev” input field.
- Repeat this procedure for all required control blocks.

For the Reporting (MMS) communication method, you can configure the following settings:

PHOENIX CONTACT IEDs – IEC 61850

Table 4-3 Additional settings for the Reporting (MMS) communication method

Setting	Description
buffered	<p>Buffered or unbuffered reporting</p> <p>During buffered reporting, the report is not generated and transferred until the buffer time has elapsed. The fulfillment of a trigger option starts the recording of all events that occur due to the specified trigger options within the buffer time. Once the buffer time has elapsed, these events are summarized in a report and sent.</p> <p>During unbuffered reporting, the report is generated and transferred directly after the trigger option occurs.</p> <ul style="list-style-type: none"> • Activate the “buffered” check box if you want to use buffered reporting. • Deactivate the “buffered” check box if you want to use unbuffered reporting.
bufTime	Buffer time in ms for buffered reporting
TrgOps	<p>Trigger options for buffered and unbuffered reporting, see Table 4-4</p> <p>Which data attribute reacts to which trigger option depends on the data type used (see IEC 61850-7-3).</p>
OptFields	Values that are transferred as part of the Reporting
indexed	<ul style="list-style-type: none"> • Activate the check box if you want to specify a maximum number of clients that are allowed to request a report.
RptEnabled.max	<ul style="list-style-type: none"> • In this input field, enter the maximum number of clients that are allowed to request the report. <p>Please note: This input field is only active if the “indexed” check box is active.</p>

Table 4-4 Trigger options for buffered and unbuffered reporting

Operation	Meaning
dchg	Data Change
qchg	Quality Change
dupd	Data Update
gi	General Interrogation
period	–

Deleting a control block

To delete a control block, proceed as follows:

- Click the line that contains the control block to be deleted.
- Open the “Edit, Delete” menu or press the “Del” button to delete the control block.

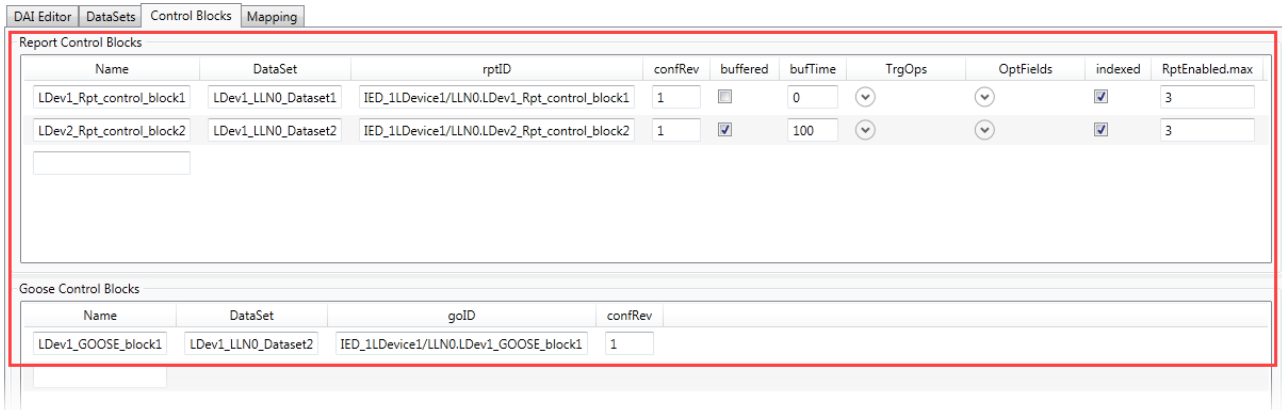


Figure 4-27 Control blocks of a dataset, for specifying the communication method

4.9.4 Assigning IEC 61850 data attributes (mapping)



To perform a mapping, the following prerequisites have to be met:

- For each IED, an application project has been selected, see Section 4.6.
- For IEDs of type AXC 1050 (XC):
 - Variables for the IEC-61850 communication have been saved in the application project, see Section 3.1.2-
 - A boot project has been created in the application project, see Section 3.1.6.
- On IEDs of type AXL F BK SAS: The bus coupler has been configured, see Section 3.1.8.

To enable the IED to start IEC 61850 communication, you have to assign the IEC 61850 data attributes to the variables of the IED (on IEDs of type AXC 1050 (XC)) or to the input and output channels (in IEDs of type AXL F BK SAS) of Axioline F modules connected to the IED.

To do this, proceed as follows:

- In the project tree, select the IED or a logical node of the IED.
- In the editor area, select the “Mapping” tab.
- Click in the empty input field in the “Variable [Type]” column (for IEDs of type AXC 1050 (XC)) or in the “Module-, Channelnumber” column (for IEDs of type AXL F BK SAS).
- In the list box that opens, select a variable (for IEDs of type AXC 1050 (XC)) that you have created in the PC Worx project for the IED, see Section 3.1.2 or in the list box that opens, select the module or chamber number (for IEDs of type AXL F BK SAS) of an input or output channel of a connected Axioline F module.
- Click in the empty input field in the “IEC 61850 Reference” column.
- In the list box that opens, select an IEC 61850 data attribute that is to be assigned to the variable or module/chamber number selected previously.

PHOENIX CONTACT IEDs – IEC 61850

- Activate the “Invert” check box if the signal should be inverted.



The “Invert” function is currently not available.

- Enter a substitution value in the “Substitution” input field.
The substitution value is set if GOOSE messages of the publisher fail to come in.



The “Substitution” function is currently only available for IEDs of type AXL F BK SAS. For IEDs of type AXC 1050 (XC), the substitution value behavior has to be defined in the application project.

Please note:

To use this function, you must have the subscriber configured in a system configuration tool.

- In the “Comment” input field, enter a descriptive comment regarding the assignment made.
- Repeat this procedure for all required variables or modules/channels of **each** IED.

In the “Direction” column, the data direction from the perspective of the IED is shown for each assignment.

Direction	Variable [Type]	IEC 61850 Reference	Invert	Substitution	Comment
Send	Status_message_1 [BOOL]	IED_1LDevice1/GGIO1.Ind1.stVal	<input type="checkbox"/>		
Send	Status_message_2 [BOOL]	IED_1LDevice1/GGIO1.Ind2.stVal	<input type="checkbox"/>		
Send	Status_message_3 [BOOL]	IED_1LDevice1/GGIO1.Ind3.stVal	<input type="checkbox"/>		
Receive	Command_1 [BOOL]	IED_1LDevice2/GGIO1.SPCSO1.Oper.ctlVal	<input type="checkbox"/>		
Receive	Command_2 [BOOL]	IED_1LDevice2/GGIO1.SPCSO2.Oper.ctlVal	<input type="checkbox"/>		
Receive	Command_3 [BOOL]	IED_1LDevice2/GGIO1.SPCSO4.Oper.ctlVal	<input type="checkbox"/>		

Figure 4-28 Assignment of IEC 61850 data attributes to variables of an IED of type AXC 1050 (XC)



When using the Quality (q) attribute, keep the following in mind:

The Quality (q) attribute is set in by the firmware of the AXC 1050 (XC) in certain cases, see Section 5.

Direction	Module-, Channelnumber	IEC 61850 Reference	Invert	Substitution	Comment
Receive	DO 2,1 [1]	IED_2LDevice1/GGIO1.SPCSO1.Oper.ctlVal	<input type="checkbox"/>		
Receive	DO 2,2 [1]	IED_2LDevice1/GGIO1.SPCSO2.Oper.ctlVal	<input type="checkbox"/>		
Receive	DO 2,3 [1]	IED_2LDevice1/GGIO1.SPCSO3.Oper.ctlVal	<input type="checkbox"/>		
Send	DI 1,1 [1]	IED_2LDevice1/GGIO2.Ind1.stVal	<input type="checkbox"/>		
Send	DI 1,2 [1]	IED_2LDevice1/GGIO2.Ind2.stVal	<input type="checkbox"/>		
Send	DI 1,3 [1]	IED_2LDevice1/GGIO2.Ind3.stVal	<input type="checkbox"/>		

Figure 4-29 IED of the type AXL F BK SAS: assignment of the IEC 61850 data attribute to the input and output channels of the Axioline F module connected to the IED

4.10 Validating IEC-61850 application

Before you transfer your IEC-61850 application to an IED, you have to validate all settings, i.e. check their validity. To do this, proceed as follows:

- Open the menu “Validation, Validate” or press the F5 button.

PC Worx IED Configurator performs a schema validation and an offline validation.

Schema validation

The schema validation checks whether all settings are compliant with the IEC 61850 namespace that you have selected for the respective IED (see Section 4.5).

Offline validation

The offline validation checks whether all settings of the respective IED can be imported and used for operation.

Result of the validity check

The result of the validity check is shown in the “Validation result” area.



Figure 4-30 “Validation result” area

If the validity check reveals no errors, the “Validation result” area stays empty.

Error during the schema validation

Errors that occurred during the schema validation are displayed in the “Validation result” area, with the heading “SCL schema version XXXX revision B”. The errors that occurred are shown in separate lines, with detailed information on the error.

Error during the offline validation

Errors that occurred during the offline validation are displayed in the “Validation result” area, with the heading “<IED Type> - Offline Validation”. The errors that occurred are combined and can be opened by means of a link. Additionally, the ModelChecker.log file is saved in the directory of the incorrectly configured IED. The ModelChecker.log contains additional information on the errors that occurred.

To get information on errors in the offline validation, proceed as follows:

- Open the “Details” link in the “Validation result” area
or
open the ModelChecker.log file in the directory of the IED concerned.

4.11 Transferring projects to an IED



You can transfer the PC Worx IED Configurator project and the associated application project to an IED or to several IEDs simultaneously.

Before an IED can start IEC 61850 communication, you have to transfer the PC Worx IED Configurator project and the application project (PC Worx or Config+ project) to the respective IED.

To do this, proceed as follows:

- In the project tree, select the PC Worx IED Configurator project.
- In the editor area, open the “IED Upload” tab.

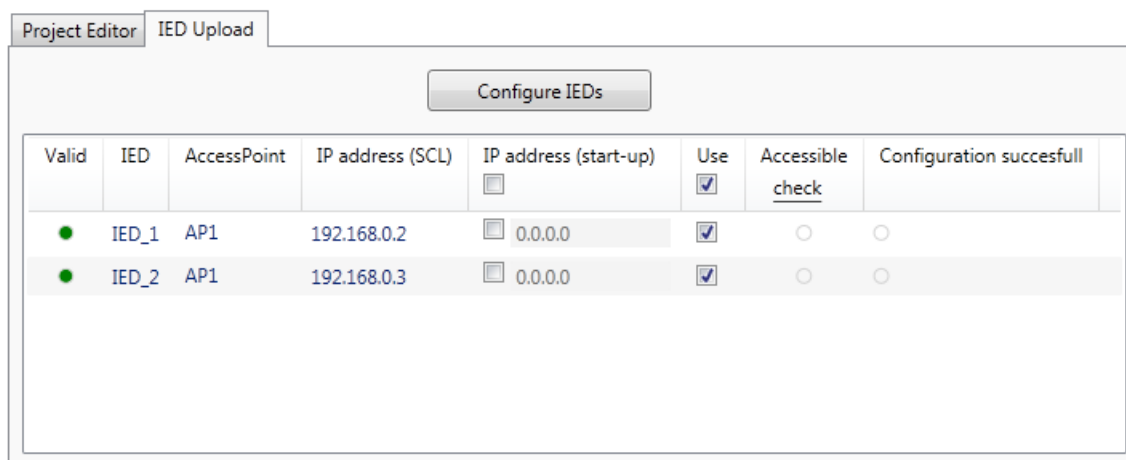


Figure 4-31 “IED Upload” tab

Validity of the IED

You check the validity of the IED by validating all settings, see Section 4.10. The “Valid” column shows whether the configuration of the IED is valid (green = valid, red = not valid).

Name and access point of the IED

The “IED” and “AccessPoint” columns display the name and the access point of the IED.

IP address of the access point

The “IP address (SCL)” column shows the IP address that you entered for the access point is s, see Section 4.6.



Please note:

When you transfer the PC Worx IED Configurator project to the IED, the existing IP address of the IED is overwritten. The IP address displayed at “IP address (SCL)” is then assigned to the IED.

You can only transfer the PC Worx IED Configurator project to the IED if **one** of the following two requirements are met:

- The IP address in the “IP address (SCL)” column corresponds to the actual IP address of the IED.
- If the IP address in the “IP address (SCL)” column doesn't match the actual IP address of the IED, the actual IP address of the IED is in the “IP address (start-up)” column.

PHOENIX CONTACT IEDs – IEC 61850

- IP address for the start-up** To enter the IP address for start-up, proceed as follows:
- In the line of an IED, activate the check box in the “IP address (start-up)” column, to activate the input field for entering an IP address for start-up for the IED, or activate the check box in the header of the “IP address (start-up)” column, to activate the input field for entering an IP address for start-up for all IEDs.
 - In the input field in the “IP address (start-up)” column, enter the IP address of the IED.

Selecting the IED configuration(s) to be transferred

If your PC Worx IED Configurator project contains several IEDs, you can select the IEDs for which the configuration should be transferred to the IED when the PC Worx IED Configurator project is transferred. To do this, proceed as follows:

- In the line of an IED, activate the check box in the “Use” column, to mark the selected IED, or activate the top check box, in the header of the “Use” column, to mark all IEDs.

Accessibility of an IED

- In the “Accessible” column, click the “check” link to verify whether the IED is accessible on the network.

The “Accessible” column shows whether an IED is accessible on the network (green = accessible, red= not accessible).

The result of the accessibility check is shown in the “Configuration successful” column. If the IED is not accessible on the network, the “Details” link is displayed in the “Configuration successful” column. Via this link you can call up information on the error if the accessibility check was not successful.

- If the IED is not accessible on the network, click the “Details” link in the “Configuration successful” column.

Transferring projects to IED(s)

You can only transfer the IED configuration to the actual IED if the following requirements are met:

- The IED configuration has to be valid, the validation check has to be successful (shown by a green indicator in the “Valid” column).
- The IED has to be selected for the transfer (the respective check box in the “Use” column is active).
- The accessibility check was successful (shown by a green indicator in the “Accessible” column).
- To transfer the PC Worx IED Configurator project and the application project (PC Worx or Config+ project) to an IED, click the “Configure IEDs” button.

The projects are transferred to the IED.



Please note:

After the projects have been successfully transferred, the IED is restarted automatically.

If the projects have been transferred to the IED successfully, but the IED is not starting up correctly, the “Details” link appears in the “Configuration successful” column of the respective IED. With this link, you can find information on the cause(s) for the incorrect start-up behavior.

Additionally mmsstacklog.log file is saved to parameter memory of the IED, to the “IEC61850” directory. This log file contains detailed information (e.g. errors during import or during processing of the SCL files, etc.). You can access the file via FTP.

Special case

If you want to debug your application program or perform a logic analysis, transfer only the application project (PC Worx project) to the IED. If you also transfer the IED configuration that you have set up in the PC Worx IED Configurator project to the IED, an error message will be issued during debugging or when performing the logic analysis in PC Worx.

To transfer only the application project to the IED, deactivate the “IED” node in the “Bus Structure” window of the PC Worx.

To do this, proceed as follows:

- In the “Bus Structure” window, select the “IED” node.
- Right-click to open the context menu and select “Deactivate bus”.

The deactivated nodes are displayed in red in the “Bus Structure” window (see Figure 4-32).

Now the IEC 61850 configuration is not included when the application project is transferred.

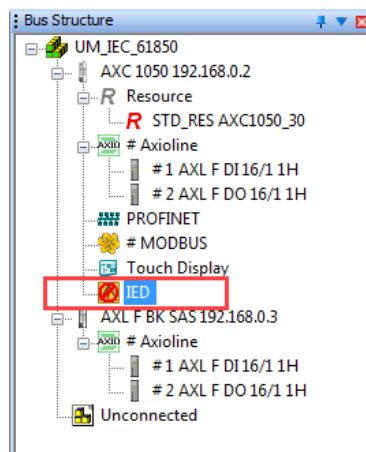


Figure 4-32 “IED” node in “Bus Structure” window deactivated

If you want to transfer the application project and the PC Worx IED Configurator project to the IED at a later stage, you have to reactivate the “IED” node in the “Bus Structure” window of PC Worx before the transfer. To do this, proceed as follows:

- In the “Bus Structure” window, select the “IED” node.
- Right-click to open the context menu and remove the check mark at “Deactivate bus”.

The “IED” node is now active again.

5 Device-specific characteristics for IEDs of type AXC 1050 (XC)

5.1 Assignment of the IEC-61850 data types to the data types in PC Worx

Supported BasicTypes in acc. with IEC 61850-7-2

Table 5-1 Assignment of the BasicTypes to the data types in PC Worx

BasicType in acc. with IEC 61850-7-2	Data type in PC Worx
BOOLEAN	BOOL
FLOAT32	REAL
INT8	SINT
INT8U	USINT, BYTE
INT16	INT
INT16U	UINT, WORD
INT32	DINT
INT32U	UDINT, DWORD
ENUMERATED	WORD
CODED ENUM	WORD
VISIBLE STRING	STRING

Supported constructed attribute classes in acc. with IEC 61850-7-2

Table 5-2 Assignment of the constructed attribute classes to the data types in PC Worx

Data types in acc. with IEC 61850-7-2	Data type in PC Worx
Dbpos	BYTE, WORD
Quality	WORD
TIMESTAMP	IEC61850_TIMESTAMP

ENUMERATED and CODED ENUM

The IEC 61850 data types ENUMERATED and CODED ENUM are treated as bitstring within the devices.

Contrary to all other data types, the bitstrings are written in a different bit order: the LSB and MSB have been switched. Bit 0 is assigned to bit 15, Bit 1 is assigned to Bit 14 etc.

The length of the bitstring determines the data type required in PC Worx.

The Dbpos data type is a 2-bit bitstring. The required data type in PC Worx is a BYTE. The 2-bit bitstring Dbpos is mapped to bits 6 ... 7.



Please note:

If, instead of BYTE, you use the data type WORD, the 2-bit bitstring Dbpos is also mapped to bits 6 ... 7 and **not** to bits 14 ... 15.

Device-specific characteristics for IEDs of type AXC 1050 (XC)
Quality (q)

The Quality (q) attribute is a 13-bit bitstring. The required data type in PC Worx is WORD. Table 5-3 shows the bit assignment of the WORD fdata type for the Quality (q) attribute.

Table 5-3 Bit assignment of the WORD data type for the Quality (q) attribute

Bit	Attribute name	Attribute value	Default setting
14 ... 15	validity	00: good	00
		01: invalid	
		10: reserved	
		11: questionable	
	detail quality		
13	overflow	TRUE	FALSE
12	outOfRange	TRUE	FALSE
11	badReference	TRUE	FALSE
10	oscillatory	TRUE	FALSE
9	failure	TRUE	FALSE
8	oldData	TRUE	FALSE
7	inconsistent	TRUE	FALSE
6	inaccurate	TRUE	FALSE
5	source	0: process	0
		1: substituted	
4	test	TRUE	FALSE
3	operatorBlocked	TRUE	FALSE

If the AXC 1050 (XC) is in the RUN operating state, the application program writes to the Quality (q) attribute. In the STOP operating state, the Quality (q) attribute is set by the firmware of the AXC 1050 (XC), see Section 5.2.

5.2 Behavior of the IEC 61850 server depending on the operating state of the AXC 1050 (XC)

Table 5-4 Behavior of the IEC 61850 server depending on the operating state of the AXC 1050 (XC)

State of the AXC 1050 (XC)	Behavior of the IEC 61850 server
STOP	<ul style="list-style-type: none"> – When a switch to this operating state occurs, the value of the Quality (q) attribute is set by the firmware of the AXC 1050 (XC). As a result, the time stamp also changes. Value of the Quality (q) attribute: <ul style="list-style-type: none"> – validity: invalid – detail quality: badReference – The IEC 61850 server is still accessible. – The last values of the data attributes/data objects of a dataset are retained.
STOP due to controller error	<ul style="list-style-type: none"> – When a switch to this operating state occurs, the value of the Quality (q) attribute is set by the firmware of the AXC 1050 (XC). As a result, the time stamp also changes. Value of the Quality (q) attribute: <ul style="list-style-type: none"> – validity: invalid – detail quality: failure – The IEC 61850 server is still accessible. – The last values of the data attributes/data objects of a dataset are retained.
RESET	<ul style="list-style-type: none"> – When a switch to this operating state occurs, the value of the Quality (q) attribute is set by the firmware of the AXC 1050 (XC). As a result, the time stamp also changes. Value of the Quality (q) attribute: <ul style="list-style-type: none"> – validity: invalid – detail quality: badReference – The IEC 61850 server is still accessible. – The last values of the data attributes/data objects of a dataset are retained.
RUN	<p>During the runtime, the application project sets the Quality (q) attribute to a value that makes sense. When a switch to this operating state occurs, the Quality (q) attribute is initially set to the following value by the firmware of the AXC 1050 (XC):</p> <ul style="list-style-type: none"> – validity: questionable – detail quality: oldData

A Technical appendix

A 1 General data



You can find the technical data of the respective IED in the device-specific user documentation. It can be downloaded at phoenixcontact.net/products.

General data	AXC 1050 (XC)	AXL F BK SAS
IEC 61850 server functionality	Yes	Yes
IEC 61850 client functionality	No	No
GOOSE publisher functionality	Yes	Yes
GOOSE subscriber functionality	Yes ¹	Yes
Clients that can establish a new connection concurrently	Max. 10	Max. 10
Elements per dataset	Max. 50	Max. 25 (depending on the configuration of the "ConfDataSet" service parameter)
Supported control model	Status-only, direct-with-normal-security	Status-only, direct-with-normal-security
Logical devices	Max. 35	Max. 35

¹ To model a communication relationship (subscriber/client) between two IEDs, you need a system configuration tool.

SNTP	AXC 1050 (XC)	AXL F BK SAS
Precision of the time synchronization	10 ms, Class T0 in accordance with IEC 61850-5	10 ms, Class T0 in accordance with IEC 61850-5
Interval of the synchronization	Adjustable	60 s

GOOSE	AXC 1050 (XC)	AXL F BK SAS
Subscriber	Max. 10	Max. 6
Publisher	Max. 10 ¹	Max. 6 ¹
Minimum repetition time	Min. 16 ms (can be configured with SCD file)	Min. 16 ms (can be configured with SCD file)
Maximum repetition time	Max. 32768 ms (can be configured with SCD file)	Max. 32768 ms (can be configured with SCD file)

¹ Please contact Phoenix Contact if you need a larger quantity.

PHOENIX CONTACT IEDs – IEC 61850

Reporting	AXC 1050 (XC)	AXL F BK SAS
Report scan rate	0.0 s ... 99.9 s	0.0 s ... 99.9 s
Control blocks	Max. 5 ¹	Max. 5
Memory size of control blocks for buffered reporting	2 kB ... 256 kB The memory size applies to the sum of all control blocks for buffered reporting.	2 kB ... 256 kB The memory size applies to the sum of all control blocks for buffered reporting.

¹ Please contact Phoenix Contact if you need a larger quantity.

A 2 Log files

During the runtime, the mmsuserlog.log and mmsstacklog.log files are generated. The files are generated in the parameterization memory of the IED, in the "IEC61850" directory. You can access the files per FTP.

During offline validation, the ModelChecker.log file is generated in the directory of the incorrectly configured IED (default path: "\Libraries\Documents\PC Worx IED Configurator\Projects\").

mmsuserlog.log	The file contains messages that are generated from the application layer of the IEC 61850 stack (e.g. errors in assignment of IEC 61850 data attribute, etc.).
mmsstacklog.log	The file contains messages that are generated from the base layer of the IEC 61850 stack (e.g. errors parsing the SCL files, etc.).
ModelChecker.log	The file contains details on the errors that occurred during the validation.

B Appendix for document lists

B 1 List of figures

Section 2

Figure 2-1:	Schematic view of the engineering workflow	6
-------------	--	---

Section 3

Figure 3-1:	Defining designation for the IEC 61850 variable group	9
Figure 3-2:	“Insert group” context menu	10
Figure 3-3:	Global variable group “IEC61850_Group1” created	10
Figure 3-4:	Inserting a variable	11
Figure 3-5:	IEC-61850 variables of the “IEC61850_Group1” variable group	12
Figure 3-6:	Creating a boot project	13
Figure 3-7:	“Bootproject Options” window	13
Figure 3-8:	“Axioline, Parameterize...” context menu	14
Figure 3-9:	“Parameterize” window	15
Figure 3-10:	GET.UTC.TIMESTAMP function block	16
Figure 3-11:	Function block GET_IEC61850_TIMEQUALITY	17
Figure 3-12:	Function block IEC61850_GOOSE_SUB_INFO	18

Section 4

Figure 4-1:	User interface of the PC Worx IED Configurator	21
Figure 4-2:	Create new project	22
Figure 4-3:	Project displayed in the project tree	22
Figure 4-4:	“Settings” window for entering an alternative path	22
Figure 4-5:	New IEDs in the project tree and on the “Project Editor” tab	24
Figure 4-6:	Directories created for two IEDs	25
Figure 4-7:	Designation and IP settings of an access point	26
Figure 4-8:	The “updated...” window	27
Figure 4-9:	Path to application project of an IED (here: PC Worx project)	27
Figure 4-10:	“Anlaufkonfiguration” (start-up configuration) area	28
Figure 4-11:	Logical devices in the project tree and on the “AccessPoint Editor” tab	29
Figure 4-12:	Predefined logical node “PxC.Rev2007.GGIO.DI16”	31
Figure 4-13:	Context menu for creating user-defined libraries	32

PHOENIX CONTACT IEDs – IEC 61850

Figure 4-14:	“Create new type library” window	33
Figure 4-15:	User-defined type library in the library area	33
Figure 4-16:	“Clone” context menu of a logical node in the library area	34
Figure 4-17:	Window “Clone LNodeType ‘PxC.Rev200X...’”	35
Figure 4-18:	Cloned logical nodes in a user-defined library	35
Figure 4-19:	Two data objects for a self-defined logical node added to the “LNodeType Editor”	36
Figure 4-20:	Possible settings for a cloned data object in “DOType Editor”	38
Figure 4-21:	Possible settings for a cloned function in the “Function Editor”	39
Figure 4-22:	“Neuen LNodeType erstellen” window (create new LNodeType)	40
Figure 4-23:	Logical nodes of logical devices in the project tree and on the “LDeviceEditor” tab	42
Figure 4-24:	Example: Initial value for the “NamPlt.vendor” and “Mod.stVal” data attributes of the LLN0 logical node	44
Figure 4-25:	Curve of the analog values instMag.f and mag.f	45
Figure 4-26:	Datasets and the data attributes and objects contained therein	46
Figure 4-27:	Control blocks of a dataset, for specifying the communication method	49
Figure 4-28:	Assignment of IEC 61850 data attributes to variables of an IED of type AXC 1050 (XC)	50
Figure 4-29:	IED of the type AXL F BK SAS: assignment of the IEC 61850 data attribute to the input and output channels of the Axioline F module connected to the IED	51
Figure 4-30:	“Validation result” area	52
Figure 4-31:	“IED Upload” tab	53
Figure 4-32:	“IED” node in “Bus Structure” window deactivated	55

B 2 List of tables

Section 3

Table 3-1:	Software to be used depending on the IED(s) in the bus structure.....	8
Table 3-2:	ENABLE input of the GET_UTC_TIMESTAMP function block.....	16
Table 3-3:	Outputs of the GET_UTC_TIMESTAMP function block.....	16
Table 3-4:	Description of the bits at the output of the function block GET_IEC_TIMEQUALITY.....	17
Table 3-5:	Inputs of the function block IEC61850_GOOSE_SUB_INFO.....	18
Table 3-6:	Outputs of the function block IEC61850_GOOSE_SUB_INFO.....	19

Section 4

Table 4-1:	Overview of the tabs of a logical node in the editor area	43
Table 4-2:	Data attributes for displaying analog input signals	44
Table 4-3:	Additional settings for the Reporting (MMS) communication method ..	48
Table 4-4:	Trigger options for buffered and unbuffered reporting.....	48

Section 5

Table 5-1:	Assignment of the BasicTypes to the data types in PC Worx.....	56
Table 5-2:	Assignment of the constructed attribute classes to the data types in PC Worx	56
Table 5-3:	Bit assignment of the WORD data type for the Quality (q) attribute.....	57
Table 5-4:	Behavior of the IEC 61850 server depending on the operating state of the AXC 1050 (XC).....	58

Appendix B

Table B-1:	Glossary	64
Table B-2:	Configuration files of the IEC 61850.....	65

PHOENIX CONTACT IEDs – IEC 61850

B 3 Explanation of terms

Table B-1 Glossary

Abbrevia- tion	Meaning	Description
IED	Intelligent Electronic Device	IED is the term for a secondary technical device that features at least one processor and is able to receive or send communication telegrams. The device has to be capable of executing a logical node.
PD	Physical Device	The physical device corresponds to an IED.
LD	Logical Device	The logical device is a virtual device. It allows for the combination of similar logical nodes.
LN	Logical Node	The logical node describes a function that exchanges the data. It is an object that is defined by its data and methods.
DO	Data Object	The data object is part of a logical node and represents specific information such as status or measurement.
DA	Data Attribute	The data attribute presents the current status of a data object as a property.
DAI	Data Attribute Instance	Instance of a data attribute
FCDA	Functionally Constrained Data Attribute	Functionally constrained data attribute
GOOSE	Generic Object Oriented System Event	GOOSE logs are generated and controlled by events and transfer the status of devices regularly and in fixed intervals. If the status of a signals changes, a new GOOSE log is promptly generated and transferred. The telegrams are broadcast as multicast via layer 2 in the entire network, i.e. several receivers can be informed simultaneously about the status of a device.
	Publisher	A publisher generates a GOOSE message and sends this as multicast.
	Subscriber	A subscriber receives a GOOSE message and evaluates it.
Reporting	Reporting	A report compiles multiple pieces of information and sends them in regular intervals or upon request to the client. A report is initiated by defined trigger events.
SAS	Substation Automation System	Station automation system
SCL	System Configuration Description Language	XML-based, object-oriented description language in acc. with IEC 61850.
XML	eXtensible Markup Language	XML is a meta language for displaying hierarchically structured data in the form of text files.
CSV	Comma Separated Values	CSV is a text file for saving or exchanging simply-structured data.

B 4 Configuration files of the IEC 61850

Table B-2 Configuration files of the IEC 61850

File	Meaning	Description
ICD	IED Capability Description	The ICD file describes the properties of an IED.
IID	Instantiated IED Description	The IID file describes the project-specific properties and configuration of an IED.
SSD	System specification description	The SSD file describes the primary technical elements within a system.
SCD	System configuration description	The SCD file describes all components of the whole system.
CID	Configured IED Description	The CID file describes the parts relevant for communication of an IED within a system. It is an SCD file that is reduced to the required information for an IED.

PHOENIX CONTACT IEDs – IEC 61850

B 5 Index**A**

AXC 1050 (XC)	
Behavior of the IEC 61850 server	58
Data types	
ENUMERATED and CODED ENUM	56
Supported BasicTypes	56
Supported constructed attribute classes.....	56
Quality attribute	57

H

Hardware requirements.....	7
----------------------------	---

L

Log files.....	60
mmsstacklog.log	60
mmsuserlog.log	60
ModelChecker.log	60

P

Parameterizing the bus coupler.....	14
PC Worx	
Assigning process data	12
Bootproject.....	13
Compiling project	12
Creating program	12
Function block	
GET_IEC61850_TIMEQUALITY.....	17
Function blocks	
GET_UTC_TIMESTAMP	16
IEC61850_GOOSE_SUB_INFO.....	18
PC Worx IED Configurator	
“Validation result” area	21
Analog inputs/outputs.....	44
Assigning IEC 61850 data attributes.....	49
Buffered/unbuffered reporting	48
Cloning	
Data objects.....	34
Functions	34

Logical nodes	34
Communication methods.....	47
Control block	47
Creating project	22
Data attribute instance.....	43
Datasets	46
Editor area.....	21
IEC 61850 variable group	
Creating	10
Designation.....	9
IEDs	
Access point	26
Configuring	26
Creating	24
Start-up configuration	28
Installing	20
Library area	30
Logical devices.....	29
Logical nodes	30
Changing	42
Defining	41
Deleting	42
Predefined	30
Mapping	49
Opening.....	20
Project tree	21
Selecting application project.....	26
Settings	
Data objects.....	38
Functions	39
Logical nodes	36
Transferring project to IED.....	53
User interface	21
User-defined library	32
Function library	32
Type library	32
Validating IEC 61850 application.....	52

S

Software requirements	7
Storage path	
Alternative storage path.....	22
Default path	22

V

Variables	10
-----------------	----

Please observe the following notes

General terms and conditions of use for technical documentation

Phoenix Contact reserves the right to alter, correct, and/or improve the technical documentation and the products described in the technical documentation at its own discretion and without giving prior notice, insofar as this is reasonable for the user. The same applies to any technical changes that serve the purpose of technical progress.

The receipt of technical documentation (in particular user documentation) does not constitute any further duty on the part of Phoenix Contact to furnish information on modifications to products and/or technical documentation. You are responsible to verify the suitability and intended use of the products in your specific application, in particular with regard to observing the applicable standards and regulations. All information made available in the technical data is supplied without any accompanying guarantee, whether expressly mentioned, implied or tacitly assumed.

In general, the provisions of the current standard Terms and Conditions of Phoenix Contact apply exclusively, in particular as concerns any warranty liability.

This manual, including all illustrations contained herein, is copyright protected. Any changes to the contents or the publication of extracts of this document is prohibited.

Phoenix Contact reserves the right to register its own intellectual property rights for the product identifications of Phoenix Contact products that are used here. Registration of such intellectual property rights by third parties is prohibited.

Other product identifications may be afforded legal protection, even where they may not be indicated as such.

How to contact us

Internet

Up-to-date information on Phoenix Contact products and our Terms and Conditions can be found on the Internet at:

phoenixcontact.com

Make sure you always use the latest documentation.

It can be downloaded at:

phoenixcontact.net/products

Subsidiaries

If there are any problems that cannot be solved using the documentation, please contact your Phoenix Contact subsidiary.

Subsidiary contact information is available at phoenixcontact.com.

Published by

PHOENIX CONTACT GmbH & Co. KG

Flachmarktstraße 8

32825 Blomberg

GERMANY

PHOENIX CONTACT Development and Manufacturing, Inc.

586 Fulling Mill Road

Middletown, PA 17057

USA

Should you have any suggestions or recommendations for improvement of the contents and layout of our manuals, please send your comments to:

tecdoc@phoenixcontact.com



SCATTERGOOD & JOHNSON LTD

ELECTRICAL ENGINEERING & FLUID CONTROL DISTRIBUTORS

Est.1899

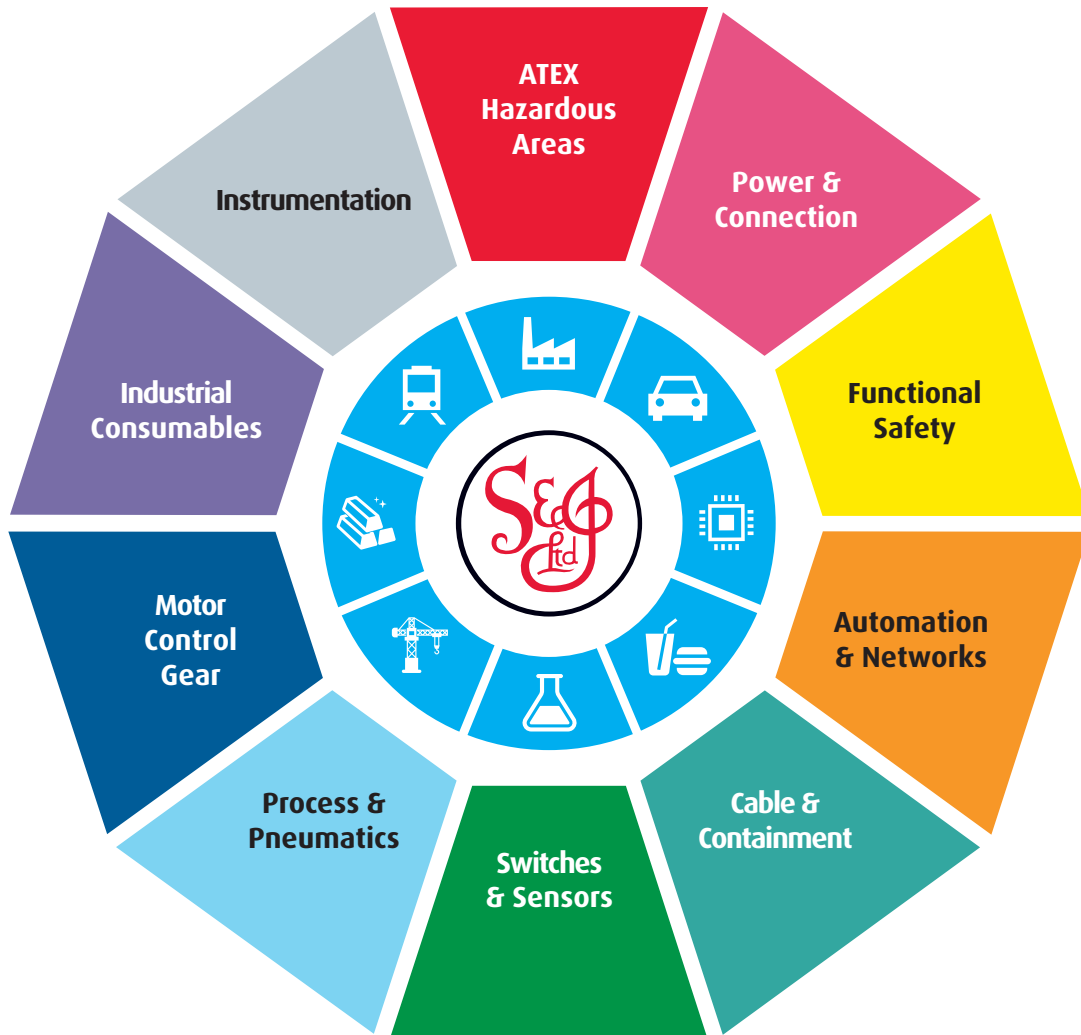
At Scattergood & Johnson Ltd, we pride ourselves on being a technical distributor to specialist industries.

Working with a range of quality product suppliers across a number of specialist markets, we are not your average 'box shifter' - we are your technical and supply chain partner.

We fully support every product we sell - for free! Our internal team and external sales engineers can answer any product or application question, no matter the complexity.

Backing up this technical ability is a range of 50,000+ products available from stock for nationwide next day delivery (same day if required!), or you can collect what you need from any of our trade counters around the UK.

Select your specialist interest below to learn more about how we can help.



Online, In Branch and On the Road - Scattergood & Johnson Ltd, there when you need us.

www.scatts.co.uk