

RELION® PROTECTION AND CONTROL

611 series

Engineering Manual





Document ID: 1MRS241255

Issued: 2019-04-10

Revision: B

Product version: 2.0

© Copyright 2019 ABB. All rights reserved

Copyright

This document and parts thereof must not be reproduced or copied without written permission from ABB, and the contents thereof must not be imparted to a third party, nor used for any unauthorized purpose.

The software or hardware described in this document is furnished under a license and may be used, copied, or disclosed only in accordance with the terms of such license.

Trademarks

ABB and Relion are registered trademarks of the ABB Group. All other brand or product names mentioned in this document may be trademarks or registered trademarks of their respective holders.

Warranty

Please inquire about the terms of warranty from your nearest ABB representative.

www.abb.com/relion

Disclaimer

The data, examples and diagrams in this manual are included solely for the concept or product description and are not to be deemed as a statement of guaranteed properties. All persons responsible for applying the equipment addressed in this manual must satisfy themselves that each intended application is suitable and acceptable, including that any applicable safety or other operational requirements are complied with. In particular, any risks in applications where a system failure and/or product failure would create a risk for harm to property or persons (including but not limited to personal injuries or death) shall be the sole responsibility of the person or entity applying the equipment, and those so responsible are hereby requested to ensure that all measures are taken to exclude or mitigate such risks.

This product has been designed to be connected and communicate data and information via a network interface which should be connected to a secure network. It is the sole responsibility of the person or entity responsible for network administration to ensure a secure connection to the network and to take the necessary measures (such as, but not limited to, installation of firewalls, application of authentication measures, encryption of data, installation of anti virus programs, etc.) to protect the product and the network, its system and interface included, against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB is not liable for any such damages and/or losses.

This document has been carefully checked by ABB but deviations cannot be completely ruled out. In case any errors are detected, the reader is kindly requested to notify the manufacturer. Other than under explicit contractual commitments, in no event shall ABB be responsible or liable for any loss or damage resulting from the use of this manual or the application of the equipment.

Conformity

This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 2014/35/EU). This conformity is the result of tests conducted by ABB in accordance with the product standard EN 60255-26 for the EMC directive, and with the product standards EN 60255-1 and EN 60255-27 for the low voltage directive. The product is designed in accordance with the international standards of the IEC 60255 series.

Safety information



Dangerous voltages can occur on the connectors, even though the auxiliary voltage has been disconnected.



Non-observance can result in death, personal injury or substantial property damage.



Only a competent electrician is allowed to carry out the electrical installation.



National and local electrical safety regulations must always be followed.



The frame of the protection relay has to be carefully earthed.



When the plug-in unit has been detached from the case, do not touch the inside of the case. The relay case internals may contain high voltage potential and touching these may cause personal injury.



The protection relay contains components which are sensitive to electrostatic discharge. Unnecessary touching of electronic components must therefore be avoided.



Whenever changes are made in the protection relay, measures should be taken to avoid inadvertent tripping.

Table of contents

Section 1	Introduction.....	5
	This manual.....	5
	Intended audience.....	5
	Product documentation.....	6
	Product documentation set.....	6
	Document revision history.....	6
	Related documentation.....	7
	Symbols and conventions.....	7
	Symbols.....	7
	Document conventions.....	7
	Functions, codes and symbols.....	8
Section 2	Relay engineering process.....	13
	Monitoring and control system structure.....	14
	Standard configuration concept.....	15
	Workflow.....	16
Section 3	PCM600 tool.....	19
	Connectivity packages.....	20
	PCM600 and relay connectivity package version.....	20
	Installing connectivity packages.....	21
	Installing connectivity packages by using the connectivity package installer.....	21
	Installing connectivity packages by using Update Manager...	21
	Activating connectivity packages.....	22
	PCM600 projects.....	22
	Technical key.....	23
	IEC 61850 naming conventions to identify an IED.....	24
	Setting the technical key.....	26
	Communication between PCM600 and the protection relay.....	28
	Setting up IP addresses.....	29
	IED Update.....	29
	Prerequisites for local and remote updates.....	30
	Updating firmware or language.....	30
Section 4	Setting up a project.....	33
	Creating a new project.....	33
	Building the plant structure.....	34
	Inserting an IED.....	35
	Inserting an IED in online mode.....	36

Inserting an IED in offline mode.....	44
Inserting an IED from the template directory.....	46
Inserting an IED by importing a .pcmi file.....	48
Setting the IED IP address in a project.....	49
COM600S project.....	51
Selecting communication port for configuration.....	51
Importing a 611 series protection relay in a COM600S project...	52
Using the Web HMI.....	55
Managing IED users.....	55
PCM600 project's IEC 61850 version identification.....	58
Section 5 Protection and control engineering.....	59
Parameter Setting tool.....	59
Configuration parameter.....	59
Setting parameter.....	59
Setting group.....	59
Parameter import and export.....	60
Parameter organization.....	60
Signal Matrix.....	60
Fault Record tool.....	61
Opening and closing Fault Record tool.....	61
Fault Record tool interface.....	63
IED Compare.....	64
Starting IED Compare.....	64
IED Compare tool interface.....	65
Protection and control blocking examples.....	66
Section 6 LHMI engineering.....	67
HMI event filtering.....	67
Starting HMI event filtering.....	68
Setting visibility of HMI events.....	68
Searching events.....	68
Saving event filter configuration.....	69
Section 7 IEC 61850 communication engineering.....	71
IEC 61850 protocol references and pre-conditions.....	71
IEC 61850 interface.....	71
IEC 61850 interface in the protection relay.....	74
GOOSE data exchange.....	74
Function view for IEC 61850 in PCM600.....	75
Station configuration description file types.....	76
IEC 61850 engineering process.....	76
Exporting SCL files from PCM600.....	77
Exporting SCD files.....	77

Exporting ICD or CID files.....	79
Engineering vertical and horizontal communication.....	80
Importing SCL files to PCM600.....	82
Importing SCD files.....	83
Importing ICD or CID files.....	84
Writing communication configuration to the IED.....	85
IEC 61850 version change while writing configuration to the IED.....	86
Section 8 Configuration migration.....	87
Configuration migration workflow.....	87
Preconditions for configuration migration.....	88
Backup creation.....	88
Migrating the IED configuration.....	88
Reengineering the migrated configuration.....	91
Reengineering in the Parameter Setting tool.....	91
Reengineering in the IEC 61850 Configuration tool.....	91
Reengineering in the Communication Management tool.....	91
Checking and updating Modbus points	91
Section 9 Glossary.....	93

Section 1 Introduction

1.1 This manual

1.2 Intended audience

This manual addresses system and project engineers involved in the engineering process of a project, and installation and commissioning personnel, who use technical data during engineering, installation and commissioning, and in normal service.

The system engineer must have a thorough knowledge of the application, protection and control equipment and the configured functional logic in the relays. The installation and commissioning personnel must have a basic knowledge of handling electronic equipment.

1.3 Product documentation

1.3.1 Product documentation set

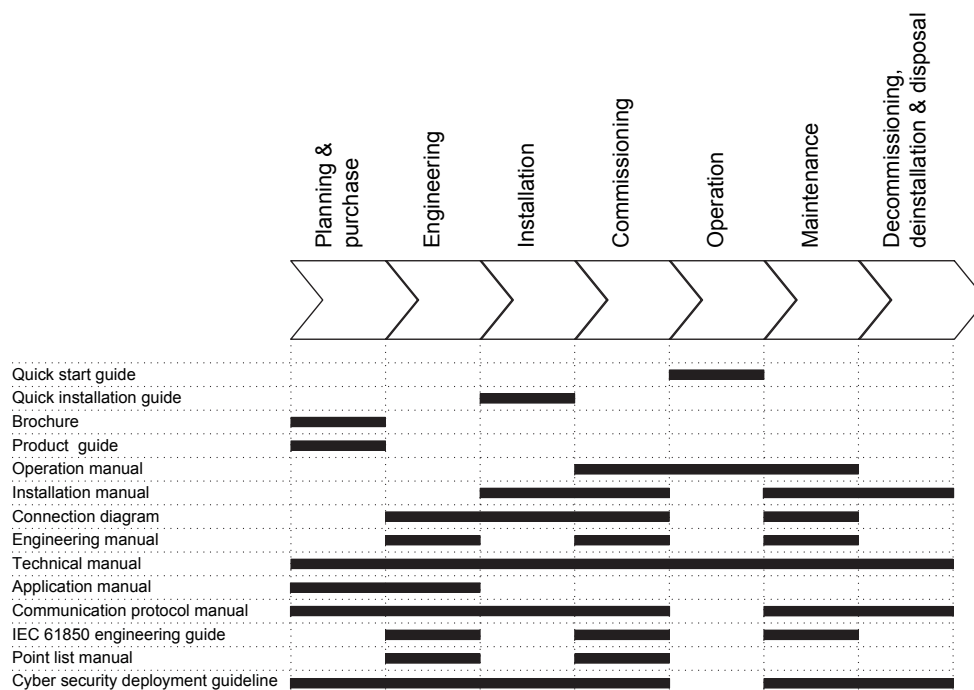


Figure 1: The intended use of manuals in different lifecycles



Product series- and product-specific manuals can be downloaded from the ABB Web site <http://www.abb.com/relion>.

1.3.2 Document revision history

Document revision/date	Product series version	History
A/2016-02-22	2.0	First release
B/2019-04-10	2.0	Content updated



Download the latest documents from the ABB Web site <http://www.abb.com/substationautomation>.

1.3.3 Related documentation

Product series- and product-specific manuals can be downloaded from the ABB Web site <http://www.abb.com/substationautomation>.

1.4 Symbols and conventions

1.4.1 Symbols



The caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.



The information icon alerts the reader of important facts and conditions.






The tip icon indicates advice on, for example, how to design your project or how to use a certain function.

Although warning hazards are related to personal injury, it is necessary to understand that under certain operational conditions, operation of damaged equipment may result in degraded process performance leading to personal injury or death. Therefore, comply fully with all warning and caution notices.

1.4.2 Document conventions

A particular convention may not be used in this manual.

- Abbreviations and acronyms are spelled out in the glossary. The glossary also contains definitions of important terms.
- Push button navigation in the LHMI menu structure is presented by using the push button icons.
To navigate between the options, use  and .
- Menu paths are presented in bold.
Select **Main menu/Settings**.
- LHMI messages are shown in Courier font.
To save the changes in nonvolatile memory, select Yes and press .
- Parameter names are shown in italics.
The function can be enabled and disabled with the *Operation* setting.
- Parameter values are indicated with quotation marks.
The corresponding parameter values are "On" and "Off".
- Input/output messages and monitored data names are shown in Courier font.

When the function starts, the `START` output is set to `TRUE`.

- This document assumes that the parameter setting visibility is "Advanced".

1.4.3

Functions, codes and symbols

All available functions are listed in the table. All of them may not be applicable to all products.

Table 1: *Functions included in the relays*

Function	IEC 61850	IEC 60617	IEC-ANSI
Protection			
Three-phase non-directional overcurrent protection, low stage, instance 1	PHLPTOC1	3I> (1)	51P-1 (1)
Three-phase non-directional overcurrent protection, high stage, instance 1	PHHPTOC1	3I>> (1)	51P-2 (1)
Three-phase non-directional overcurrent protection, high stage, instance 2	PHHPTOC2	3I>> (2)	51P-2 (2)
Three-phase non-directional overcurrent protection, instantaneous stage, instance 1	PHIPTOC1	3I>>> (1)	50P/51P (1)
Non-directional earth-fault protection, low stage, instance 1	EFLPTOC1	Io> (1)	51N-1 (1)
Non-directional earth-fault protection, low stage, instance 2	EFLPTOC2	Io> (2)	51N-1 (2)
Non-directional earth-fault protection, high stage, instance 1	EFHPTOC1	Io>> (1)	51N-2 (1)
Non-directional earth-fault protection, instantaneous stage	EFIPTOC1	Io>>>	50N/51N
Three-phase directional overcurrent protection, low stage, instance 1	DPHLPDOC1	3I> -> (1)	67-1(1)
Three-phase directional overcurrent protection, low stage, instance 2	DPHLPDOC2	3I> -> (2)	67-1(2)
Three-phase directional overcurrent protection, high stage, instance 1	DPHHPDOC1	3I>> -> (1)	67-2(1)
Directional earth-fault protection, low stage, instance 1	DEFLPDEF1	Io> -> (1)	67N-1 (1)
Directional earth-fault protection, low stage, instance 2	DEFLPDEF2	Io> -> (2)	67N-1 (2)
Directional earth-fault protection, high stage	DEFHPDEF1	Io>> ->	67N-2
Transient/intermittent earth-fault protection	INTRPTEF1	Io> -> IEF	67NIEF
Non-directional (cross-country) earth fault protection, using calculated Io	EFHPTOC1	Io>> (1)	51N-2 (1)
Negative-sequence overcurrent protection, instance 1	NSPTOC1	I2> (1)	46 (1)
Table continues on next page			

Function	IEC 61850	IEC 60617	IEC-ANSI
Negative-sequence overcurrent protection, instance 2	NSPTOC2	I2> (2)	46 (2)
Negative-sequence overcurrent protection for machines, instance 1	MNSPTOC1	I2>M (1)	46M (1)
Negative-sequence overcurrent protection for machines, instance 2	MNSPTOC2	I2>M (2)	46M (2)
Phase discontinuity protection	PDNSPTOC1	I2/I1>	46PD
Residual overvoltage protection, instance 1	ROVPTOV1	Uo> (1)	59G (1)
Residual overvoltage protection, instance 2	ROVPTOV2	Uo> (2)	59G (2)
Residual overvoltage protection, instance 3	ROVPTOV3	Uo> (3)	59G (3)
Three-phase undervoltage protection, instance 1	PHPTUV1	3U< (1)	27(1)
Three-phase undervoltage protection, instance 2	PHPTUV2	3U< (2)	27(2)
Three-phase undervoltage protection, instance 3	PHPTUV3	3U< (3)	27(3)
Three-phase overvoltage protection, instance 1	PHPTOV1	3U> (1)	59(1)
Three-phase overvoltage protection, instance 2	PHPTOV2	3U> (2)	59(2)
Three-phase overvoltage protection, instance 3	PHPTOV3	3U> (3)	59(3)
Positive-sequence undervoltage protection, instance 1	PSPTUV1	U1< (1)	47U+(1)
Positive-sequence undervoltage protection, instance 2	PSPTUV2	U1< (2)	47U+(2)
Negative-sequence overvoltage protection, instance 1	NSPTOV1	U2> (1)	47O-(1)
Negative-sequence overvoltage protection, instance 2	NSPTOV2	U2> (2)	47O-(2)
Frequency protection, instance 1	FRPFRQ1	f>/f<,df/dt (1)	81(1)
Frequency protection, instance 2	FRPFRQ2	f>/f<,df/dt (2)	81(2)
Three-phase thermal protection for feeders, cables and distribution transformers	T1PTTR1	3Ith>F	49F
Loss of load supervision	LOFLPTUC1	3I<	37
Motor load jam protection	JAMPTOC1	Ist>	51LR
Motor start-up supervision	STTPMSU1	Is2t n<	49,66,48,51LR
Phase reversal protection	PREVPTOC1	I2>>	46R
Thermal overload protection for motors	MPTTR1	3Ith>M	49M
Circuit breaker failure protection	CCBRBRF1	3I>/Io>BF	51BF/51NBF
Three-phase inrush detector	INRPHAR1	3I2f>	68
Master trip, instance 1	TRPPTRC1	Master Trip (1)	94/86 (1)
Table continues on next page			

Function	IEC 61850	IEC 60617	IEC-ANSI
Master trip, instance 2	TRPPTRC2	Master Trip (2)	94/86 (2)
High-impedance differential protection for phase A, instance 1	HIAPDIF1	dHi>(1)	87(1)
High-impedance differential protection for phase B, instance 2	HIBPDIF1	dHi>(2)	87(2)
High-impedance differential protection for phase C, instance 3	HICPDIF1	dHi>(3)	87(3)
Switch onto fault	CBPSOF1	SOTF	SOTF
Other			
Input switch group	ISWGAPC	ISWGAPC	ISWGAPC
Output switch group	OSWGAPC	OSWGAPC	OSWGAPC
Selector	SELGAPC	SELGAPC	SELGAPC
Minimum pulse timer (2 pcs)	TPGAPC	TP	TP
Minimum pulse timer (2 pcs, second resolution), instance 1	TPSGAPC	TPS (1)	TPS (1)
Move (8 pcs), instance 1	MVGAPC	MV (1)	MV (1)
Control			
Circuit-breaker control	CBXCBR1	I <-> O CB	I <-> O CB
Emergency start-up	ESMGAPC1	ESTART	ESTART
Autoreclosing	DARREC1	O -> I	79
Condition monitoring and supervision			
Trip circuit supervision, instance 1	TCSSCBR1	TCS (1)	TCM (1)
Trip circuit supervision, instance 2	TCSSCBR2	TCS (2)	TCM (2)
Runtime counter for machines and devices	MDSOPT1	OPTS	OPTM
Phase segregated CT supervision function for phase A, instance 1	HZCCASPVC1	MCS 1I(1)	MCS 1I(1)
Phase segregated CT supervision function for phase B, instance 2	HZCCBSPVC1	MCS 1I(2)	MCS 1I(2)
Phase segregated CT supervision function for phase C, instance 3	HZCCCSPVC1	MCS 1I(3)	MCS 1I(3)
Logging			
Disturbance recorder	RDRE1	DR (1)	DFR(1)
Fault recorder	FLTRFRC1	-	FR
Measurement			
Three-phase current measurement, instance 1 ¹⁾	CMMXU1	3I	3I
Sequence current measurement	CSMSQI1	I1, I2, I0	I1, I2, I0
Residual current measurement, instance 1	RESCMMXU1	I0	I0
Three-phase voltage measurement, instance 1	VMMXU1	3U	3U
Three-phase voltage measurement, instance 2	VMMXU2	3U(B)	3U(B)
Table continues on next page			

Function	IEC 61850	IEC 60617	IEC-ANSI
Sequence voltage measurement, instance 1	VSMSQ1	U1, U2, U0	U1, U2, U0
Residual voltage measurement	RESVMMXU1	Uo	Vn
Frequency measurement, instance 1	FMMXU1	f	f
Three-phase power and energy measurement, instance 1	PEMMXU1	P, E	P, E

1) In REB611, CMMXU is used for measuring differential phase currents

Section 2 Relay engineering process

PCM600 is used for various tasks in the protection relay engineering process.

- Relay engineering management
 - Organizing the bay protection relays in the structure of the substation by defining voltage levels and bays below the substation. PCM600 manages the project.
 - Configuring the parameters and setting values for the protection relay itself and for the process functions by using the Parameter Setting tool.
 - Configuring the events shown on the LHMI using the HMI Event Filtering tool.
 - Reusing configurations from older protection relay versions using the Configuration Migration tool.
- Communication management
 - IEC 61850 station communication engineering is done using the internal IEC 61850 Configuration tool or the separate IET600. PCM600 interacts with IET600 by importing and exporting SCL files.
 - Configuring the GOOSE receiving data connections to the protection relay's application configuration function blocks by using the Signal Matrix tool.
 - Configuring protocol data mapping for Modbus with the Communication Management tool.
- Record management
 - Generating overviews on the available (disturbance) recordings in all connected protection relays by using the Disturbance Handling tool.
 - Manually reading the recording files (in the COMTRADE format) from the protection relays by using the Disturbance Handling tool or automatically by using the PCM600 Scheduler.
 - Managing recording files with the Disturbance Handling tool.
 - Creating recording file content overview reports for fast evaluation with assistance of the Disturbance Handling tool.
 - Using the Fault Record tool to read fault records from the protection relay, save records to a PC and clear old records.
- Service management
 - Monitoring the selected signals of a protection relay for commissioning or service purposes by using the Signal Monitoring tool and Event Viewer tool (including audit trail).

There are also additional functions for managing projects and organizing user rights.

- PCM600 user management
 - Organizing users regarding their rights, profiles and passwords to use different tools and functions in the tools.
 - Defining allowed activities for user profiles to use tools in PCM600.

Once the engineering of the protection relay is finished, the results must be written to the protection relay.

The connection between the physical IED and PCM600 is established via an Ethernet link on the front or rear port on the protection relay.

2.1 Monitoring and control system structure

The monitoring and control system for electrical substations contains a number of devices for various purposes.



The maximum size of a project is 180 devices. However, in order to maintain good performance and usability of the tool, it is recommended to divide one big project into multiple smaller PCM600 projects.

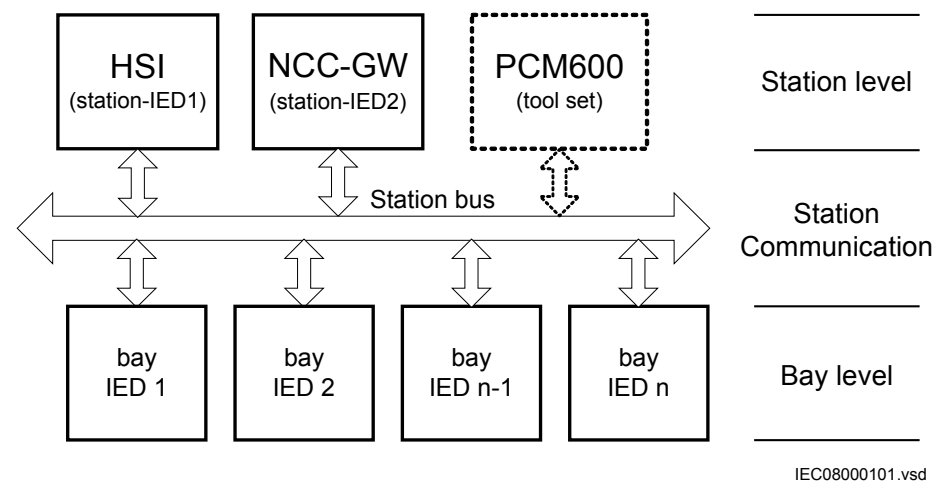


Figure 2: Principle structure of a monitoring and control system for a substation

The monitoring and control system can be divided into three main parts.

- Bay level devices
- Station communication
- Station level devices

All three parts require specific engineering and configuration.

A plant structure is used to identify each device in its location within the substation organization. The plant structure is a logical image of the substation and the bays within the substation. The organization structure for the devices may differ from the structure of the primary equipment in the substation.

In PCM600 it is possible to set up a hierarchical structure of five levels for the device identification.

- Project
- Substation = name of the substation
- Voltage level = identifies to which grid type or part the device belongs in the substation
- Bay = bay within the voltage level
- IED = the selection of the IED that is used in the bay; it is possible to insert several IEDs within a bay, for example, one control device and two protection relays

2.2 Standard configuration concept

The product series covers protection relays developed for the protection of medium voltage applications. Every product has predefined application-specific software called standard configuration that contains protection, control, supervision and measurement function blocks and default logical connections; for more information, see the application manuals. The product also includes the standard configuration specific default single-line diagram.

The standard configuration software consists of connections between an application's functions developed according to the needs of a particular functional application. The inputs and outputs are similarly assigned to a default set of connections such as position indication and Master trip. The alarm LEDs are assigned to default connections based on the order number.



Current and voltage channels for protection and measurement functions are fixed as a part of standard configuration and cannot be reassigned with Signal Matrix in PCM600.

The content of the standard configuration depends on the intended functional application. The standard configurations also have selectable software options, which are selected when ordering the protection relay. Some of the software options are related to the protection relay hardware.

All functions and application logic included in a standard configuration of the protection relay can be in use at the same time.

2.3 Workflow

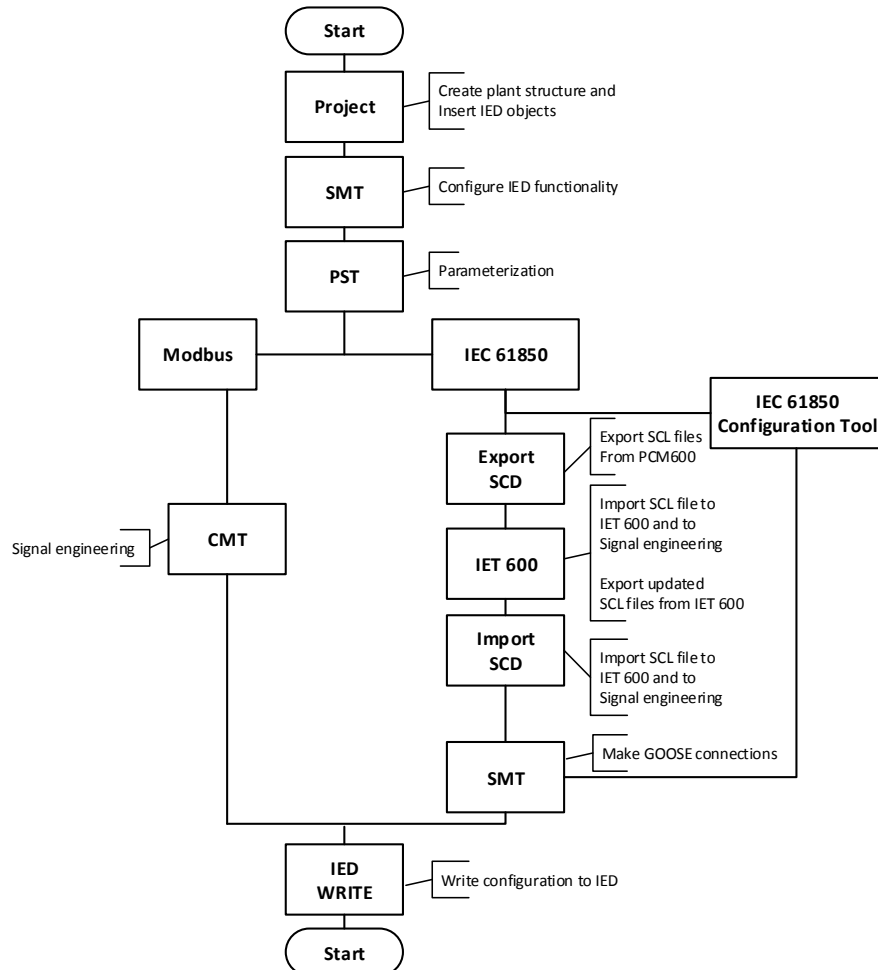


Figure 3: Protection relay engineering workflow proposal based on practical experience and dependencies of the steps

It is possible to follow a different sequence based on the information available at the time when the project is started. This means that several iterations may be needed to complete the project.

Setting up a PCM600 project

- The plant structure is built according to the substation structure.



The maximum size of a project is 180 IEDs. However, in order to maintain good performance and usability of the tool, it is

recommended to divide one big project into multiple smaller PCM600 projects.

- To add a protection relay to a project, a suitable Connectivity package is needed. Protection relays can be added either while connected or disconnected or through other means such as an IED template.
- IED objects are uniquely named within the PCM600 project.

Parameter setting and configuration in the Parameter Setting tool

- Configuration parameters such as CT and VT conversion values of the transformer module are checked by the tool.
- If needed, the setting values are checked and adjusted with the Parameter Setting tool.

LHMI engineering

- The LEDs are configured with Application Configuration.
- The LED behavior is defined with Parameter Setting.
- The HMI Event Filtering tool can be used to configure event visibility on the LHMI event list.

Communication protocol engineering

- The communication engineering details are protocol-dependent.
- The connectivity package creates the IEC 61850 configuration for vertical communication automatically and it is directly suitable, in most cases, for IEC 61850 client configuration. Either IEC 61850 Configuration tool or IET600 is needed for configuring horizontal and vertical communication.
- The Communication Management tool is used for other protocols; for example Modbus.



The protection relay restarts automatically when writing a relay configuration where changes have been made. It is not possible to communicate with the protection relay during restart.

Section 3 PCM600 tool

Protection and Control IED Manager PCM600 offers all the necessary functionality to work throughout all stages of the protection relay life cycle.

- Planning
- Engineering
- Commissioning
- Operation and disturbance handling
- Functional analysis

The whole substation configuration can be controlled and different tasks and functions can be performed with the individual tool components. PCM600 can operate with many different topologies, depending on the customer needs.

PCM600 is used to conduct complete engineering and configuration activities needed for the bay level protection relays.

Connectivity Packages are separate software packages that provide type and version information to PCM600. Further Connectivity Packages assist the tool with communications.

PCM600 uses IEC 61850 over Ethernet to communicate with bay devices. This communication allows PCM600 to configure and monitor the devices. In addition to IEC 61850 the devices have optional communications protocols and hardware to connect to station engineering tools. PCM600 provides the ability to export the configuration of the devices or an entire substation in a standard file format which enables station engineering in separate IEC 61850 System Configuration tools.

A PC with PCM600 can be connected to any 611 series IED within a station by using the Ethernet connection. The connection can also be used for service and maintenance purposes. In addition, the connection is used to handle disturbance records from the protection relays.

The modern-day protection relays are designed using the concept of the IEC 61850 standard. This is primarily in regards to how functions within the protection relay are modelled and how the protection relay is represented in the substation. See the IEC 61850 parameter list for the list of logical nodes available in the protection relay and observe how they follow the structure and rules as defined in part 7 of the standard.

The engineering of the used communication protocols is a separate task and an addition to the engineering of protection and control functions.

PCM600 can be used for different purposes throughout the protection relay life cycle. A set of special tools is available for different applications.

The applications can be organized into groups.

- Relay engineering
- Communication engineering
- Record management
- Device monitoring and diagnostic



For more information, see the PCM600 documentation.

3.1 Connectivity packages

A connectivity package is a software component that consists of executable code and data which enables system tools to communicate with a protection relay. Connectivity packages are used to create configuration structures in PCM600. The latest PCM600 and connectivity packages are backward compatible with older protection relay versions.

A connectivity package includes all the data which is used to describe the protection relay. For example, it contains a list of the existing parameters, data format used, units, setting range, access rights and visibility of the parameters. In addition, it contains code which allows software packages that use the connectivity package to properly communicate with the protection relay. It also supports localization of text even when it is read from the protection relay in a standard format such as COMTRADE.

Update Manager is a tool that helps in defining the right connectivity package versions for different system products and tools. Update Manager is included with the products that use connectivity packages.

3.2 PCM600 and relay connectivity package version

- Protection and Control IED Manager PCM600 Ver.2.7 or later
- REB611 Connectivity Package Ver.2.0 or later
- REF611 Connectivity Package Ver.2.0 or later
- REM611 Connectivity Package Ver.2.0 or later
- REU611 Connectivity Package Ver.2.0 or later



Download connectivity packages from the ABB Web site <http://www.abb.com/substationautomation> or directly with Update Manager in PCM600.

3.2.1 Installing connectivity packages

- Install connectivity packages either by running the installer which can be downloaded on the ABB Website or by using Update Manager when a network connection is available.



Download connectivity packages from the ABB Web site <http://www.abb.com/substationautomation> or directly with Update Manager in PCM600.

3.2.1.1 Installing connectivity packages by using the connectivity package installer

1. Close PCM600.
2. Run the **ABB IED Connectivity Package RE_6xx Ver. n.msi** installer. (n = version number)
3. To install the connectivity package, follow the steps in the connectivity package installation wizard.

3.2.1.2 Installing connectivity packages by using Update Manager

1. In PCM600, click **Help** and select **Update Manager**.
Run Update Manager with administrator rights.

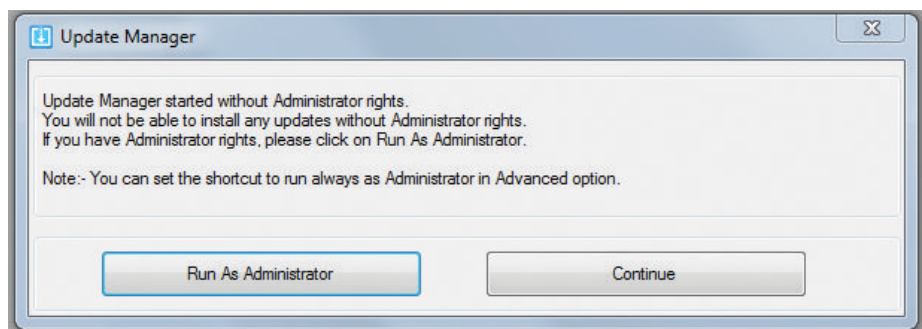


Figure 4: Running Update Manager as an administrator

2. Select **Get Connectivity Packages** from the menu on the left column.
3. Select all the required connectivity packages.
4. Click **Download and Install**.
The status bar shows the installation status.

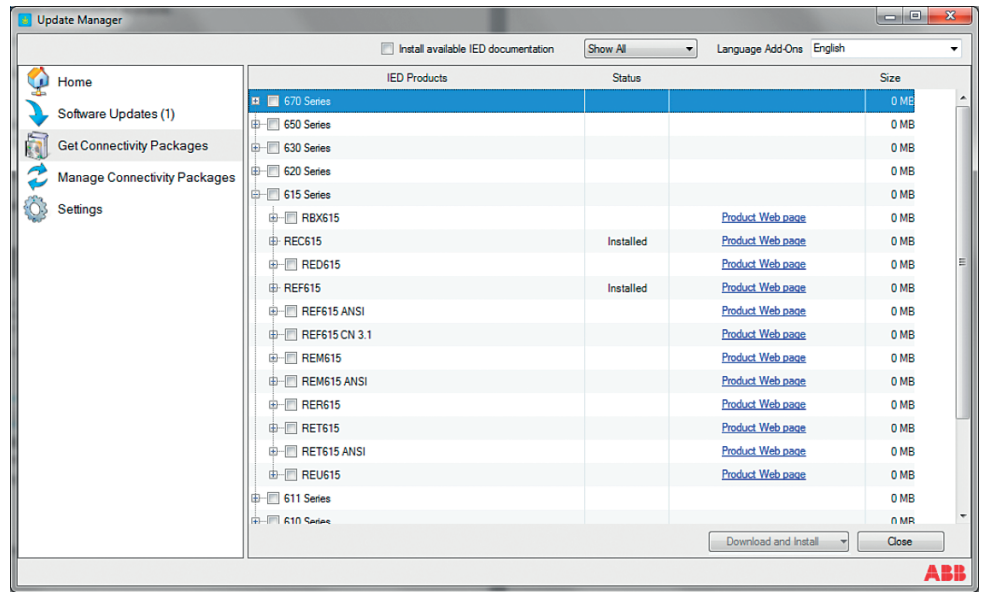


Figure 5: Selecting the connectivity packages

3.2.2

Activating connectivity packages

The relay connectivity package has to be installed before it can be activated in Update Manager.

1. Select **Manage Connectivity Packages** from the menu on the left column to access the installed connectivity packages.
2. Browse the tree structure to find the correct product.
3. Select the connectivity package version from the drop-down list beside the product name.



Always use the latest version of the connectivity package.

4. Click **Apply** to activate the connectivity package.
PCM600 recognizes the installed connectivity packages during start-up, and the corresponding IED types are available in PCM600 when starting a new project.

3.3

PCM600 projects

A typical project in PCM600 contains a plant structure including one or several IED objects, where each IED object contains the engineering data created or modified using the different PCM600 tools.

Several projects can be created and managed by PCM600, but only one project can be active at a time.

Regardless the protocol used in installation for each project, the IEC 61850 version must be selected when adding the first IED to plant structure. After the initial selection, all IEDs in plant structure use the selected version, either Edition 1 or Edition 2. In case the IEC 61850 is not used for station bus, the default version can be applied. By default, the IEC 61850 version of PCM600 is Edition 1. The protection relay's IEC 61850 version is by default Edition 2.

With PCM600, it is possible to do various tasks.

- Open existing projects
- Import projects
- Create new projects
- Export projects
- Delete projects
- Rename projects
- Copy and paste projects

The extension of the exported project file is .pcmp. The files are only used for exporting and importing projects between PCM600s.

3.4 Technical key

Both a physical IED and an IED object in PCM600 have a technical key. The technical key in the protection relay and PCM600 must be the same, otherwise it is not possible to download a configuration.

Each IED in a PCM600 project must have a unique technical key. Therefore, it is not possible to set the same technical key for several IEDs in the same PCM600 project.



The protection relay is delivered with a factory default technical key. The validation of the technical keys between PCM600 and the protection relay does not occur if the protection relay contains the factory default technical key.



The technical key property in PCM600 corresponds to the IED name attribute in SCL files. Avoid changing the IED name attribute outside PCM600, because data in PCM600 may get lost when importing the SCL files.

The technical key must be the same for the communication between the protection relay and PCM600. The technical key can be read from the protection relay and

updated to PCM600, or the PCM600 technical key can be written to the protection relay. Alternatively, a user-defined technical key can be defined.

When writing a configuration to the protection relay, PCM600 checks for a mismatch between the IED object and the physical IED technical key.

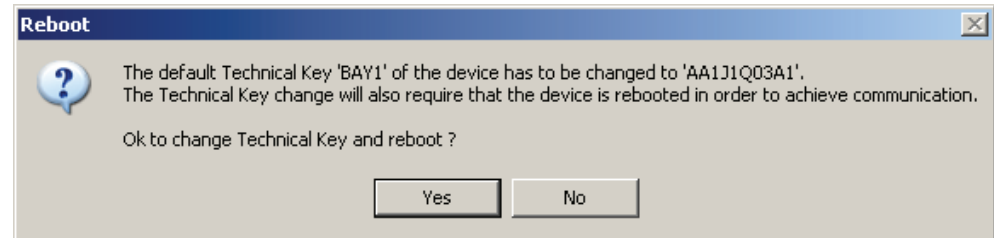


Figure 6: Reboot suggestion



Ensure that the IED object in PCM600 has the same IP address as the physical IED that is intended to be connected through the technical key concept.



Change the technical key for an IED object in the **Object Properties** dialog box in PCM600.

3.4.1

IEC 61850 naming conventions to identify an IED

This section is only valid when the IEC 61850 standard is used for station bus communication. The IEC 61850 naming conventions to identify an IED are only valid when the IEC 61850 standard is used for station bus communication. According to the IEC 61850-6, the SCL model allows two kinds of project designations in the object properties: a technical key and a user-oriented textual designation.

- Technical key is used in engineering drawings and for signal identifications. This is contained in the attribute name as an identification of each object. If the value is used as a reference to an object, it is contained in an attribute name starting with a string denoting the reference target object type and ending with the string *Name*. The technical key is used within SCL for referencing to other objects. The name is a relative identification within a hierarchy of objects. The maximum characters allowed for a technical key is 28 for IEC 61850 Edition 1 and 60 for Edition 2 projects.
- User-oriented textual designation is contained in the *desc* attribute. Attributes are not allowed to contain carriage return, line feed, tab, greater than, less than, double quotes or ampersand characters. The semantics of *desc* must also be relative within an object hierarchy. The maximum length is 100.

PCM600 takes care of these two possibilities. The two possible signal designations are available per object in the Object Properties for all the hierarchical levels beginning with the station as the highest level.

The technical key is automatically generated based on the rules and type specifications of IEC 61346 and the extended definitions assigned for substations by a technical committee. The technical key is shown in the Object Properties dialog box under SCL Technical Key or Technical Key.

- The station is predefined by "AA1" where 1 is the index. To get the real station name that is used, it is possible to rename the SCL Technical Key for the station as the name used by the project. To minimize the word length, a short form should be used, because this name is used also in the transmitted messages to identify the events, for example.
- The voltage level. In the example it is 20 kV and J1 is selected from the list below SCL Technical Key in the Object Properties dialog box.
- The bay and the IED are appended with the coding defined in the IEC 61346 standard and the substation definition lists. In the example, the Bay SCL Technical Key part is Q03 and IED is A1.

The user-oriented textual designation is visible in the Plant structure view for each object. It is the name given by default or changed by using the Rename function.

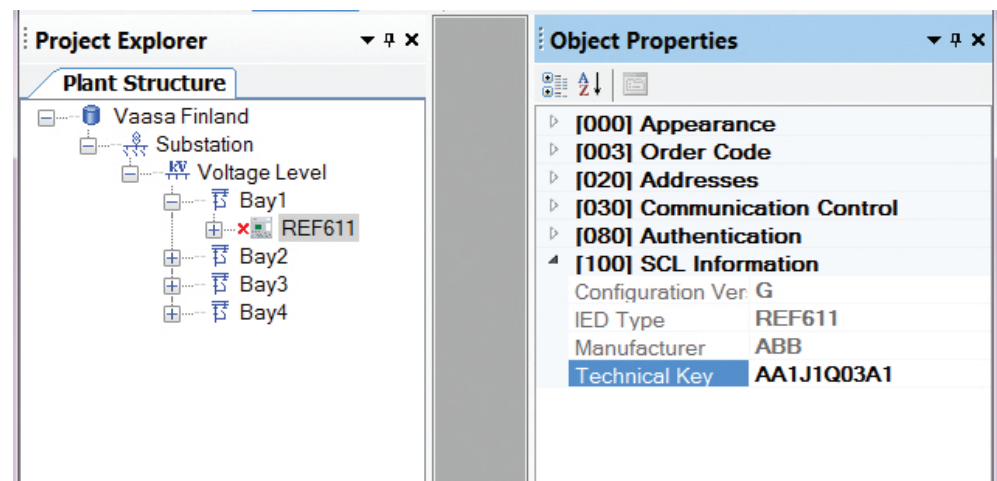


Figure 7: PCM600: IEC 61850 signal designation concept

The created technical key for the full path name of the IED would be: AA1J1Q03A1.

- AA1 = substation in the project
- J1 = voltage level from 20 to 30 kV
- Q03 = the third bay in the voltage level
- A1 = first IED in the bay Q03

3.4.2 Setting the technical key



The maximum length of technical key is 28 characters for Edition 1 and 60 characters for Edition 2.

1. In the **Plant Structure** view, right-click the IED and select **Set Technical Key in IED**.

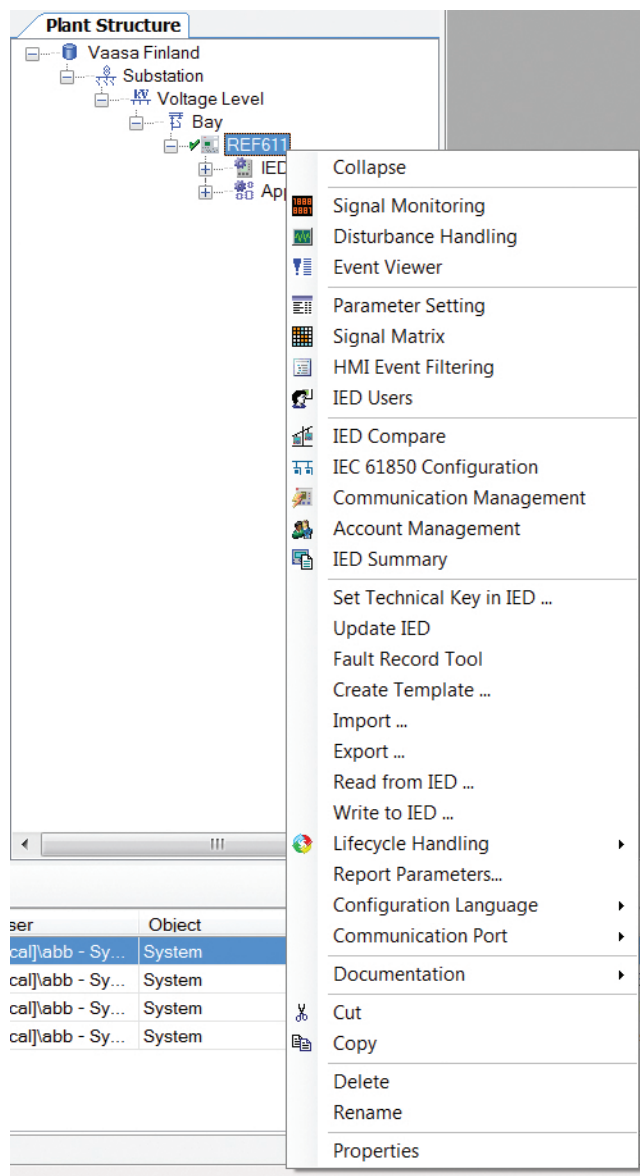


Figure 8: PCM600: Setting the technical key on the IED level

A dialog box opens to inform about the technical key concept.

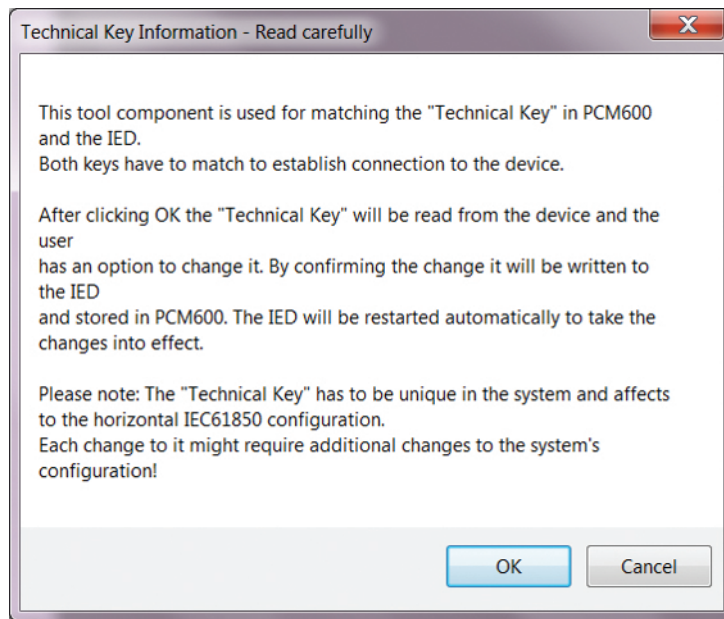


Figure 9: Technical key information

2. Click **OK**.
The technical key is read from the IED and the **Set Technical Key** dialog box opens.

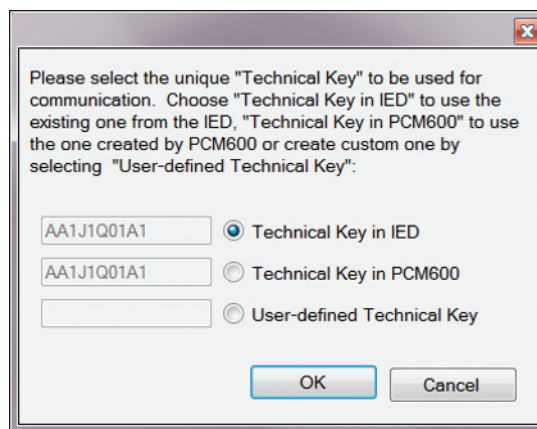


Figure 10: Setting the technical key

3. In **Set Technical Key** dialog box, select the technical key to be used. There are three alternatives.
 - Use the existing technical key in the IED
 - Use the existing technical key defined for the IED object in PCM600
 - Set a user-defined technical key, which changes the technical key for both the physical IED and IED object in PCM600
4. Click **OK** to confirm the selection.



It is not possible to set a user-defined name or select the **Technical key in IED** if the value is the same as already given to another IED object in the PCM600 project. An error message is displayed if this happens.

3.5

Communication between PCM600 and the protection relay

The communication between the protection relay and PCM600 is independent of the used communication protocol within the substation or to the NCC.

All communication is done over Ethernet using either IEC 61850 or FTP/FTPS protocol.

Each protection relay has an Ethernet interface connector on the front and optionally on the rear side as well. The Ethernet connector can be used for communication with PCM600.

When an Ethernet-based station protocol is used, the same Ethernet port and IP address can be used for PCM600 communication.

Two basic variants have to be considered for the connection between PCM600 and the protection relay.

- Direct point-to-point link between PCM600 and the protection relay's front port
 - Indirect link via station LAN or from remote via network
1. If needed, the IP address for the protection relay is set.
 2. A PC or workstation is set up for a direct link (point-to-point), or the PC or workstation is connected to the LAN/WAN network.
 3. The protection relays' IP addresses in the PCM600 project are configured for each protection relay to match the IP addresses of the physical IEDs.
 4. Technical keys of the IEDs in PCM600 project are configured for each protection relay to match the technical keys of the physical IEDs.

For successful protection relay engineering and usage, check the workstation firewall TCP and UDP port configurations, especially for IEC 61850 and FTP. Other protocols are not used for engineering and/or they are optional.

Table 2: *Ports that must be open in the firewall for different protocols*

Protocol	TCP port
File Transfer Protocol (FTP and FTPS)	20, 21
IEC 61850	102
Web Server HTTP	80
Table continues on next page	

Protocol	TCP port
Web server HTTPS	443
Simple Network Time Protocol (SNTP)	123
Modbus TCP	502

3.5.1 Setting up IP addresses

The IP address and the corresponding subnet mask can be set via LHMI for the rear Ethernet interface in the protection relay. Each Ethernet interface has a default factory IP address when the complete protection relay is delivered. The configured rear port IP address is preserved if a new communication card with Ethernet is installed or the communication card is replaced.



The protection relay's front port IP address is fixed to “192.168.0.254” and it cannot be modified.

1. Set the IP address for the protection relay's rear port and the corresponding subnet mask via the LHMI path **Configuration/Communication/Ethernet/Rear port**.

Table 3: *Default IP address for the rear port and the corresponding subnet mask*

IP address	Subnet mask
192.168.2.10	255.255.255.0



Communication fails if the IP addresses of the front and the rear port belong to the same subnet.



When using redundant Ethernet (HSR or PRP), configure all devices in the network before connecting cables to ports LAN A and LAN B. Avoid using the LAN A or LAN B ports on redundant communication modules while changing the *Switch mode* parameter.

3.6 IED Update

The firmware update tool is used for patching the IED firmware and for adding or replacing additional languages to the IED. Update packages are provided by Customer Support. The update tool can be used either locally or remotely.

It is recommended to take a backup of the IED configuration before starting the update. This can be done by using the Read from IED function from the IED context

menu in PCM600. The user needs to be authorized before using the tool. User credentials are asked if the default administrator password has been changed. Administrator or engineer credentials are needed for authorization.

3.6.1 Prerequisites for local and remote updates

Local update

- Use of the front port is recommended when updating locally. Remove the IED from the network especially with redundant network topologies (HSR/PRP).

Remote update

- Communication is recommended to be secured either by setting up a VPN connection or enabling secure communication in the IED via LHMI (**Configuration/Authorization/Remote Update**) while updating remotely.
- Remote update can be enabled in the IED either via the LHMI (**Configuration/Authorization/Security/Remote Update**) or by an administrator in the Parameter Setting tool in PCM600 (**IED Configuration/Configuration/Authorization/Remote Update**) to be able to update remotely. If the IED is in local control mode, remote update proceeds only after a confirmation is received from the user.
- Remote update has to be disabled manually after the update, if wanted.
- Remote update only works when the IED is connected from the rear port with a custom IP address.

3.6.2 Updating firmware or language

1. Select the update mode.
 - Firmware
 - Language
2. Select the update package and click **Next**.

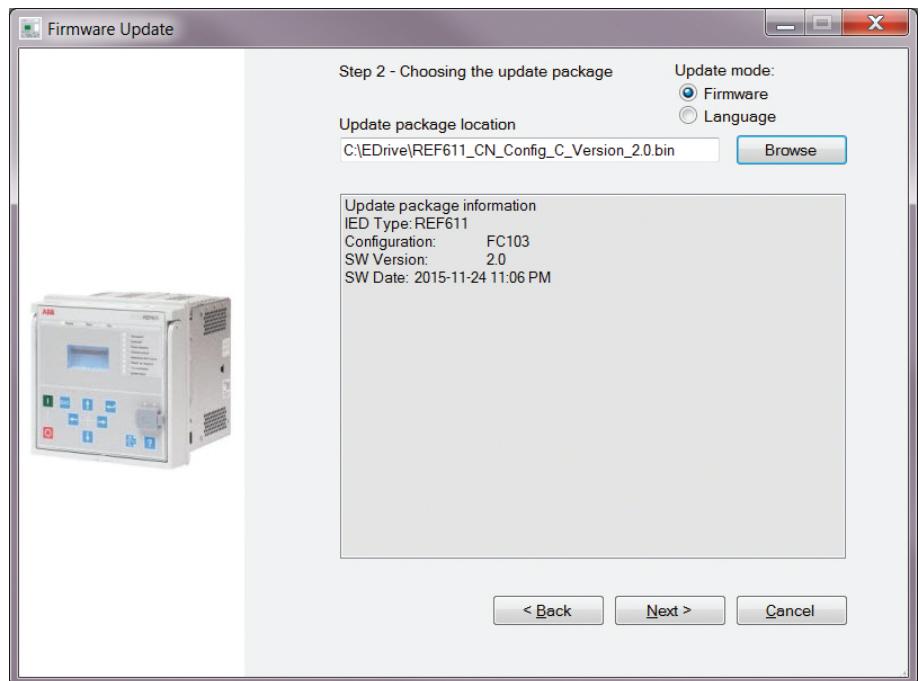


Figure 11: Choosing the update mode and package

3. Select the network interface controller, for example, the PC's integrated Ethernet communication card or an external Ethernet adapter, connected to the IED and click **OK**.

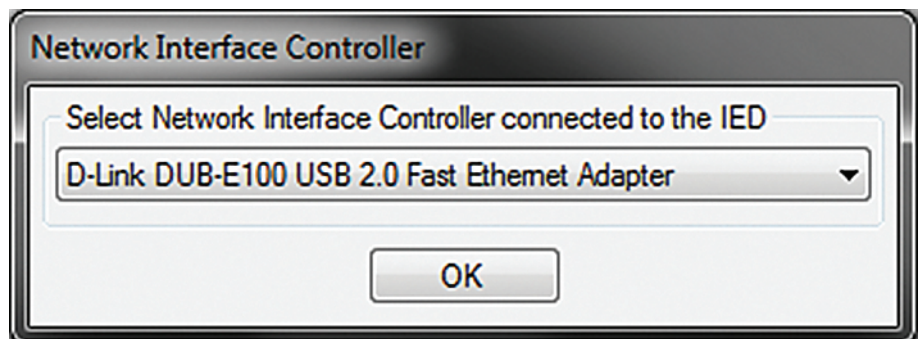


Figure 12: Selecting the network interface controller

4. When updating remotely, wait for 30 seconds for the local user confirmation before proceeding with the update.
 - The local user can cancel the update via the LHMI by pressing **ESC** during the 30 second window.
 - IED use is allowed after the update is completed successfully.

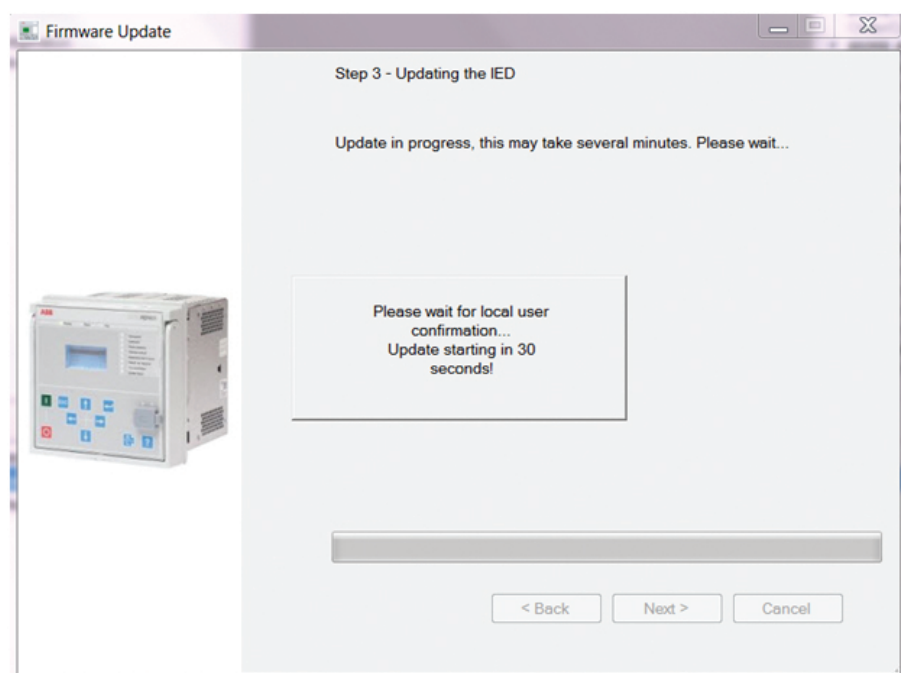


Figure 13: Waiting for local user confirmation with remote update

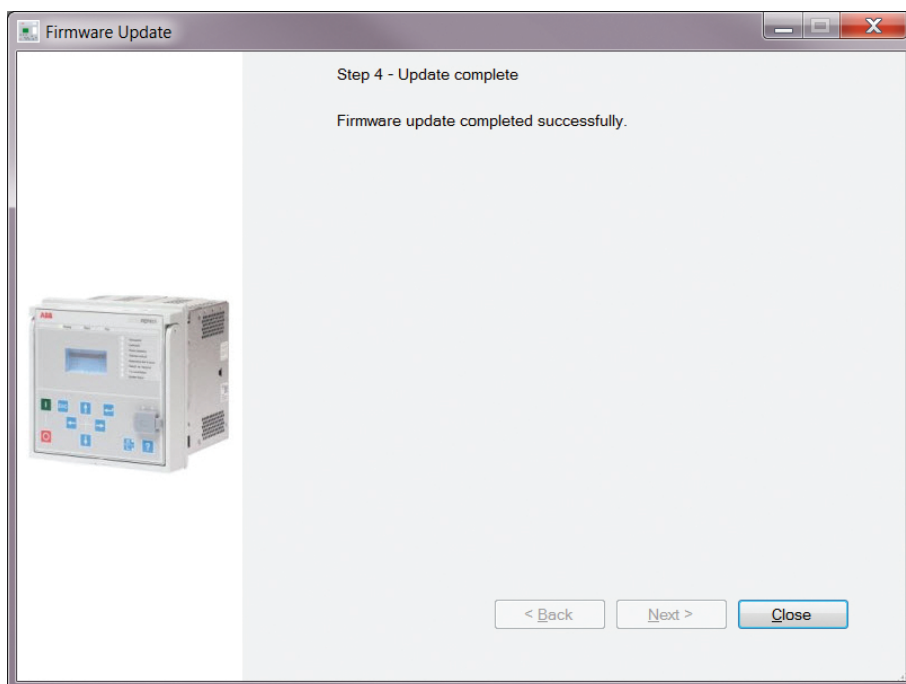


Figure 14: Completing the update

Section 4 Setting up a project

4.1 Creating a new project

1. Start PCM600.
2. To see the projects that are currently available in the PCM databases, select **File/Open/Manage Project** on the menu bar.
The **Open/Manage Project** window is displayed.
3. Click **Projects on my computer**.
4. Click **New Project**.
5. If there are currently projects or object tools open, a confirmation dialog box opens.
 - Click **Yes** to close the open projects. A **Create New Project** dialog box opens.

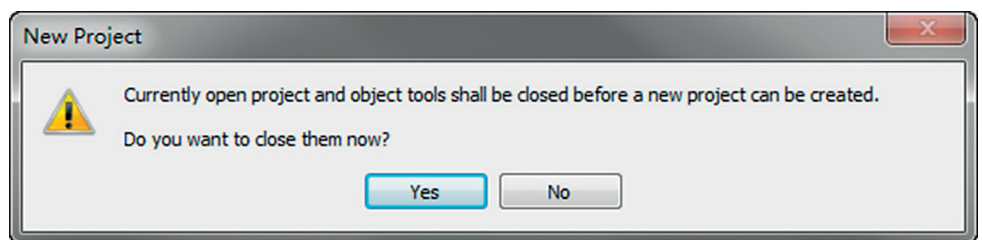


Figure 15: New Project dialog box

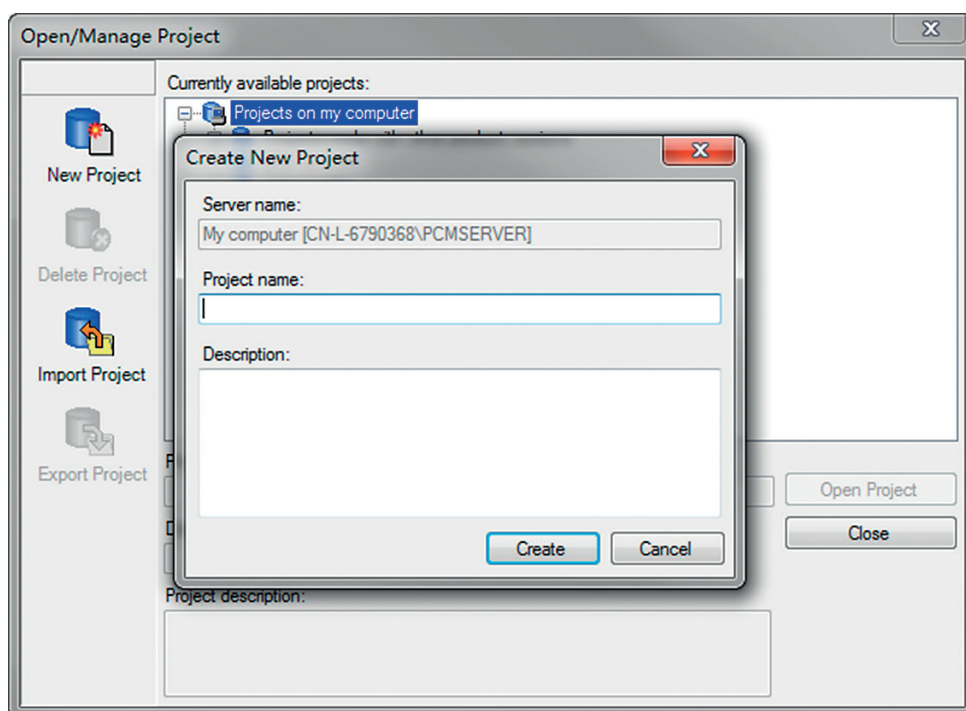


Figure 16: Creating a new project

6. In the **Project Name** box, give a name for the project.



The project name must be unique.

7. Optionally, write a description of the project in the **Description** box.
8. Click **Create**.

PCM600 sets up a new project that is listed under **Projects on my computer**.

4.2

Building the plant structure



Building a plant structure is useful when a complete grid with an essential number of IEDs has to be built.

1. Create a new plant structure in one of the alternative ways.

- Right-click the **Plant Structure** view, point to **New** and select **Create from Template**.
 - Right-click the **Plant Structure** view, point to **New** and select **General** and select the element either **IED Group** or **Substation**.
2. On the **View** menu, select **Object Types**.
 3. Select the needed elements and drag them into the plant structure.

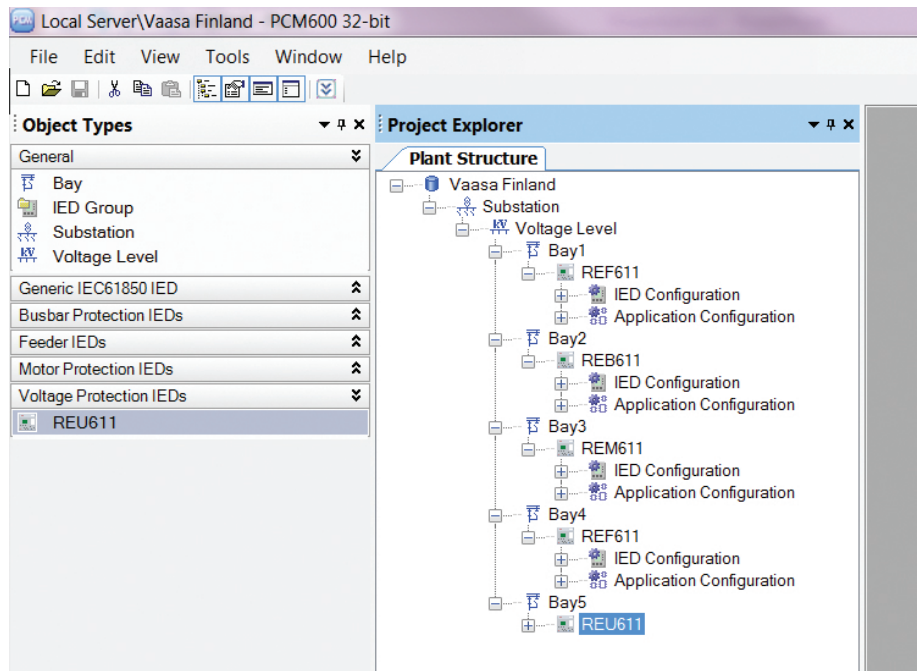


Figure 17: The start of a project with IEDs placed but not renamed

4. Rename each level in the structure by the names/identifications used in the grid.
 - Right-click the level and select **Rename**.
 - Rename the levels in the **Object Properties** view.

4.3 Inserting an IED

The context menu or the **Object Types** view shows the available IEDs that can be inserted, on the bay level, into the plant structure according to the installed connectivity package.

It is possible to do various tasks in the plant structure.

- Insert either offline or online IED
- Import a template IED that is available in the template library as a .pcmt file
- Import a preconfigured IED available as a .pcmi file



PCM600 uses two kinds of IED files: .pcmt and .pcmi. Both files include the complete IED configuration but their usage differs. The .pcmt files are always accessed through the PCM600 template manager while the .pcmi files are meant for sharing the IED instances between different PCM600 users enabling quick import/export directly from the plant structure context menu.



IEC 61850 Edition 1 and Edition 2 IEDs cannot be used simultaneously in the same PCM600 project. The first inserted IED determines the IEC 61850 version for the whole project.

4.3.1

Inserting an IED in online mode

To set up an IED online, the protection relay must be connected to PCM600.

When the protection relay is already connected to PCM600, PCM600 can read the order number directly from the relay. It is possible to read the full configuration from the relay by using the **Read from IED** function.

1. In the **Plant Structure** view, right-click the bay, point to **New**, point to the relay application area such as **Motor Protection IEDs** and select the protection relay type to be inserted.



Alternatively, drag an IED from the **Object Types** view to the bay level.

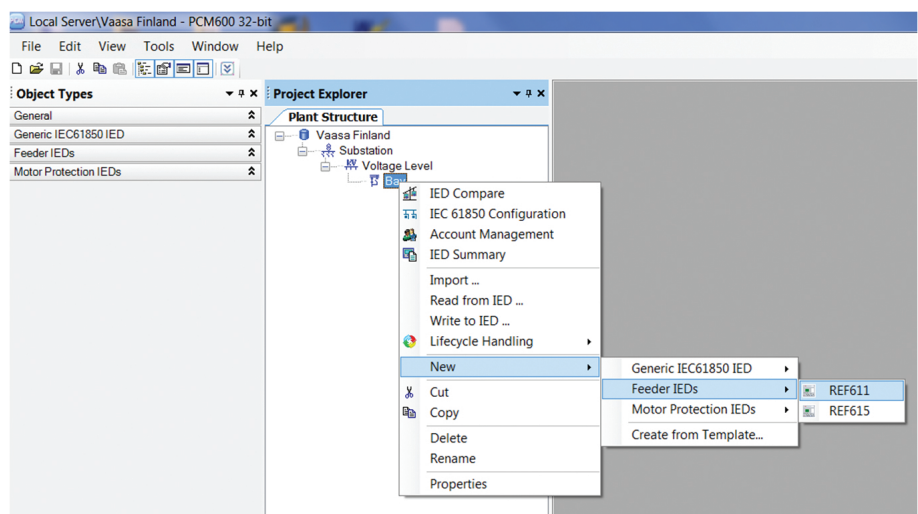


Figure 18: Selecting the protection relay type

2. On the **Configuration mode selection** page, select **Online Configuration** and click **Next**.

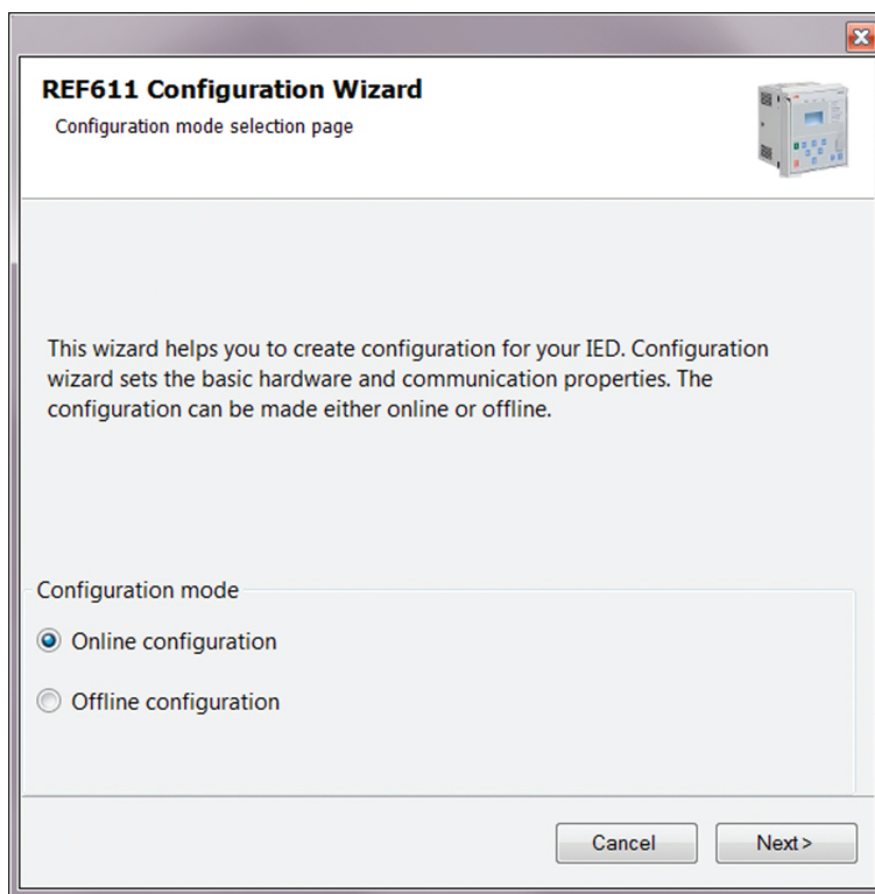


Figure 19: Configuration mode selection

3. On the **Communication protocol selection page**, select the communication protocol from the **IED protocol** list and click **Next**.

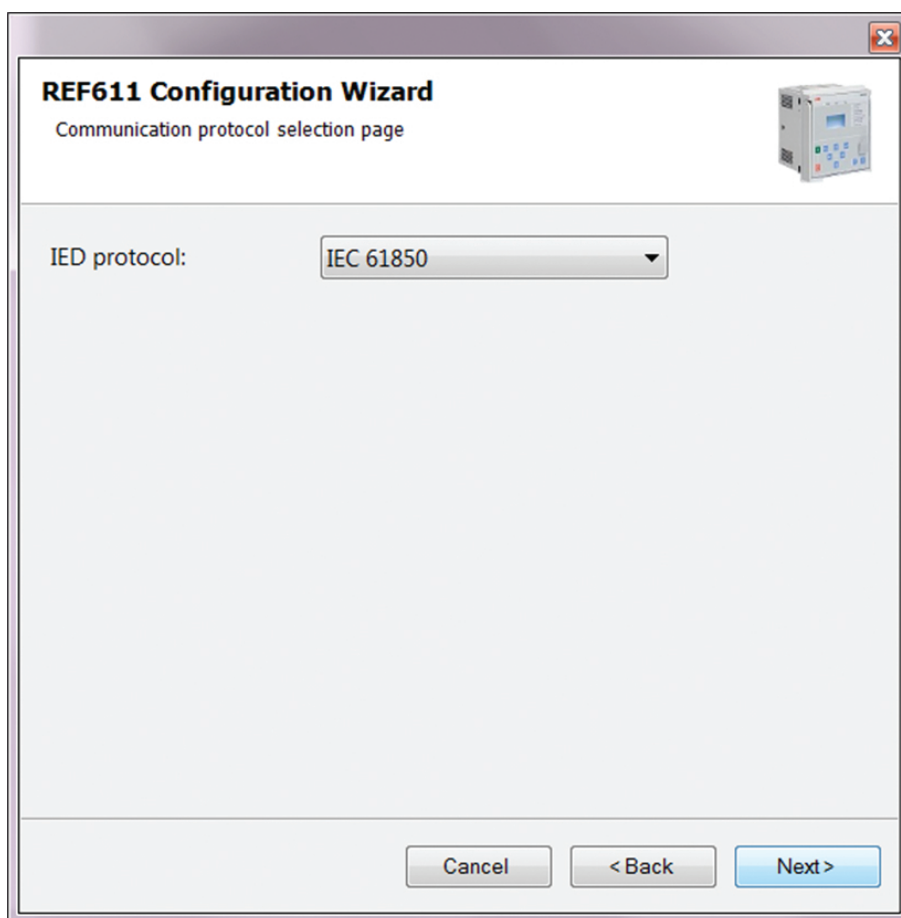
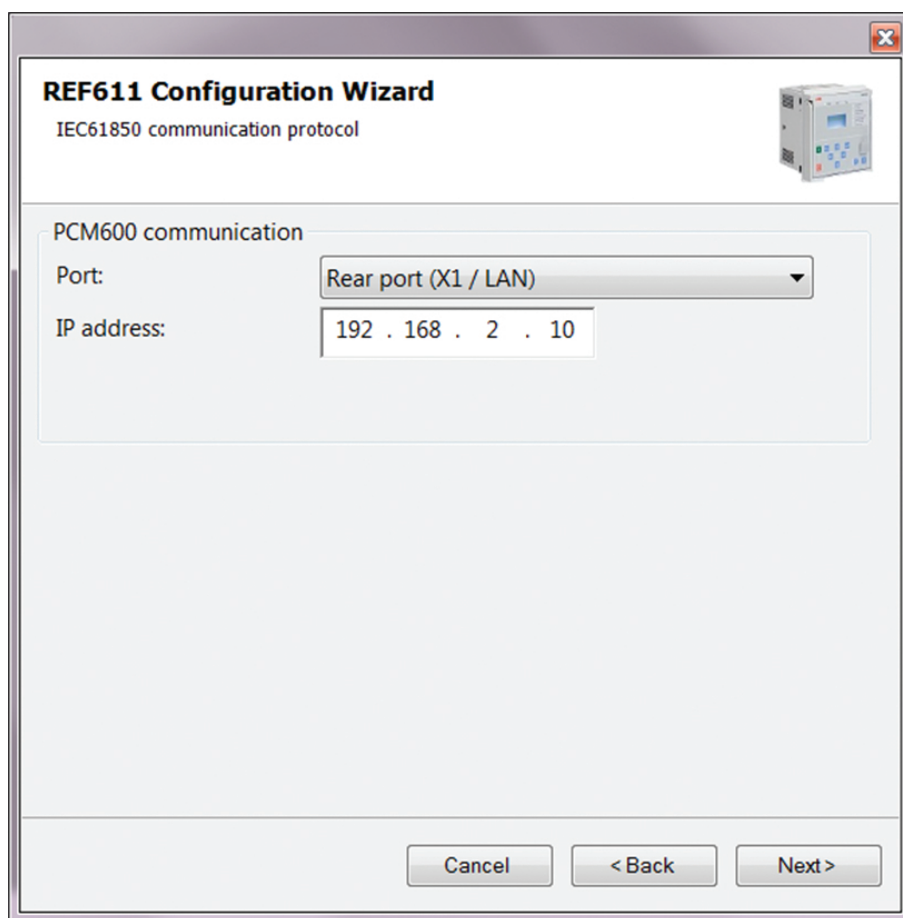


Figure 20: Communication protocol selection

4. On the **IEC61850 communication protocol** page, select the port from the **Port** list.
 - If the rear port is selected, type the correct IP address (of the physical protection relay to be configured) to the **IP address** box.



The image shows a software window titled "REF611 Configuration Wizard" with a subtitle "IEC61850 communication protocol". In the top right corner of the window is a small icon of a grey electrical device. The main area of the window is titled "PCM600 communication" and contains two configuration fields: "Port:" with a dropdown menu showing "Rear port (X1 / LAN)" and "IP address:" with a text box containing "192 . 168 . 2 . 10". At the bottom of the window are three buttons: "Cancel", "< Back", and "Next >".

Figure 21: Communication port and IP address

Communication configuration is now defined.

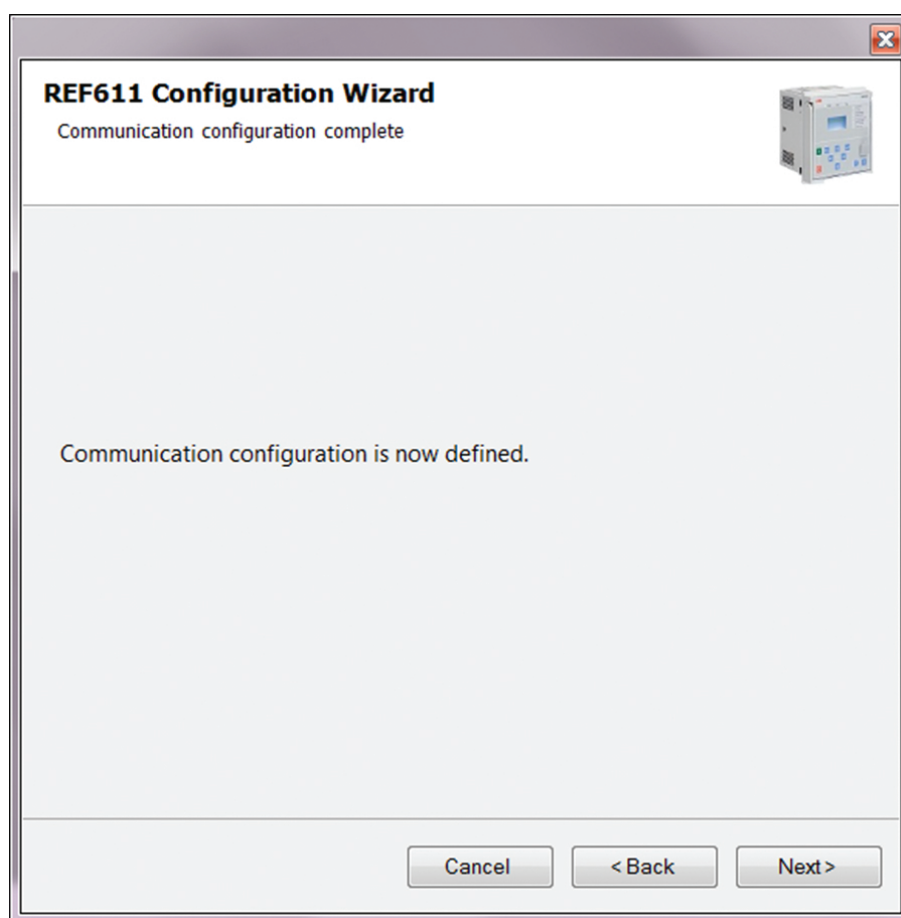


Figure 22: Communication configuration defined

5. Click **Next** to scan/read the order code of the protection relay.
6. On the **Order code detection** page, click **Next**.

Selection	Description
Product	REF611 611 series Feeder protection and control
Case	H Complete Relay
Standard	C CN
Configuration	CB Directional O/C and directional E/F [41 + 4U + 8 B] [Io 0.2/1A]
Communication module	D Ethernet 100Base TX (3xRJ45) with HSR/PRP
Communication protocol	C IEC 61850+Modbus
Language	2 English and Chinese
Option 1	A Reclosing
Option 2	N None
Power supply	2 24-60 Vdc
Product Version 2.0	1G Product Version 2.0

Figure 23: Order code detection

7. On the **Configuration selection** page, select the configuration type and click **Next**.
 - Select **Empty Configuration** to create an empty configuration.
 - Select **Example Configuration** to import any existing example configuration.
Click **Browse** to select the .pcmi/.pcmt file that has the example configuration.
 - Select **Standard Configuration** to generate a default configuration.
8. On the **Version selection** page, select the IEC 61850 version and click **Next**.

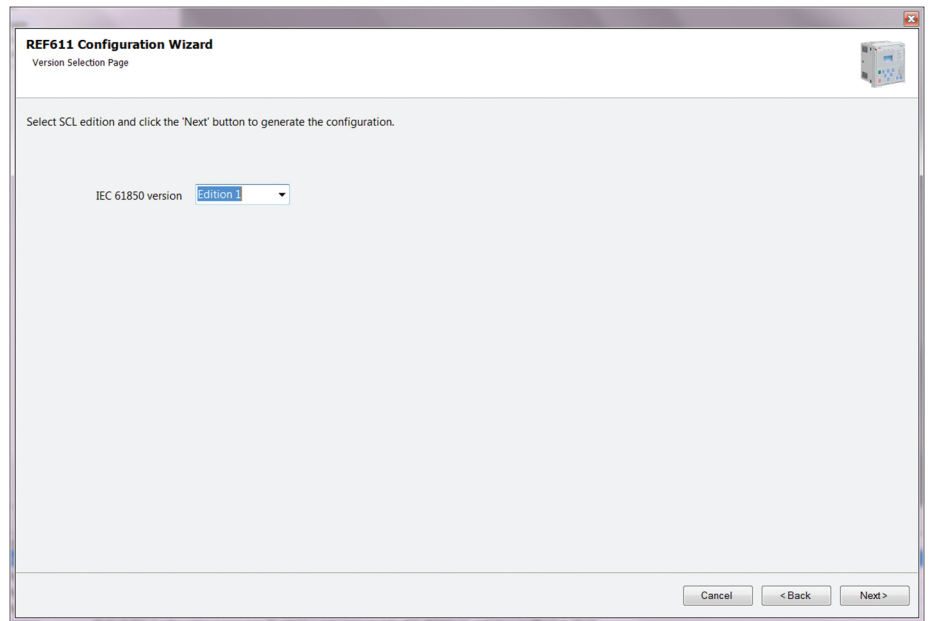


Figure 24: Version selection page



Regardless of the protocol used in the installation for each project, the IEC 61850 version must be selected when adding the first protection relay to the plant structure. After the initial selection all protection relays in the plant structure use the selected version, either Edition 1 or Edition 2.

9. The **Setup complete** page shows the summary of the protection relay's IED type, version, IP address and the selected order number. Click **Finish** to confirm the configuration and conduct the insertion.

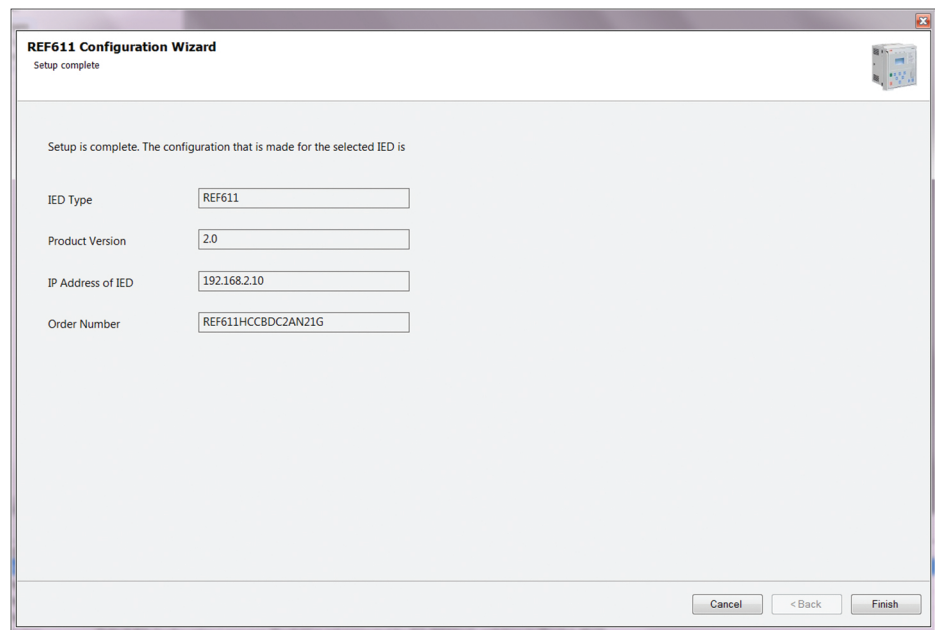


Figure 25: Setup complete



To cancel the insertion, click **Cancel**.



If an error is found on the **Setup Complete Page**, it is not possible to go back and make modifications. If an error is detected, cancel the insertion by clicking **Cancel** and insert the IED again.

10. From the **Plant structure** view, check that PCM600 has turned online the IED that was inserted to the bay level.



Data cannot be scanned from the protection relay and proceeding is prevented if the IED is not online or if the IP address is not correct.

4.3.2

Inserting an IED in offline mode

When the protection relay is not available or is not connected to PCM600, engineering can be done offline. The offline configuration in PCM600 can be written to the protection relay later when it is connected.

Working in the offline mode has an advantage compared to online mode in that the preparation for the configuration can be started even though the protection relay is not available.

1. In the **Plant Structure** view, right-click the bay, point to **New**, point to the relay application area such as **Feeder IEDs** and select the protection relay type to be inserted.



Alternatively, drag an IED from the **Object Types** view to the bay level.

2. On the **Configuration mode selection** page, select **Offline Configuration** and click **Next**.

Setting up an IED in the offline mode is similar as in the online mode; however, with the offline mode it is not necessary to type the correct IP address in the **Communication port and IP address** dialog box.

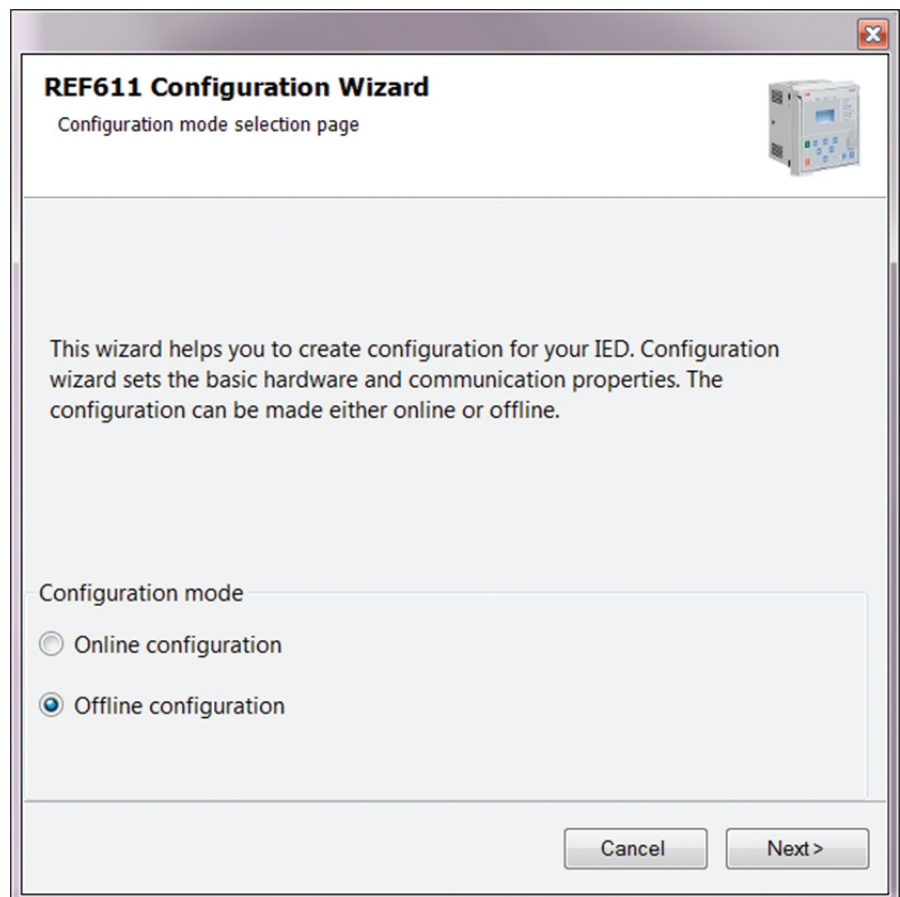


Figure 26: Configuration mode selection wizard

3. On the **Order Code selection** page, select the correct order codes and click **Next**.



Ensure that the order code is correct. PCM600 verifies later that the order code matches with the relay. If the order code digits related to the configuration, I/O or version do not match with the relay, PCM600 does not allow writing the configuration to the device. If other digits in the order code do not match, PCM600 informs about the mismatch with a dialog.

Figure 27: Order code selection

4. On the **Version Selection** page, select the IEC 61850 version and click **Next** to generate the functions.
5. The **Setup Complete Page** shows the summary of the IED type, version, IP address and the selected order number. Click **Finish** to confirm the configuration and conduct the insertion.

4.3.3

Inserting an IED from the template directory

IED templates can be used for replicating IEDs with same order code in PCM600 projects. Template includes IED configuration, communication protocol mappings and parameters. An IED in the plant structure can be exported as a template (.pcmt file). The template library can be built from all the exported IED templates.

It is also possible to insert an IED from the template library to create a new IED in the plant structure. After a template IED has been imported, the *IP address*, the *Caption* in IED's **Object Properties** and the *Technical Key* that corresponds to the physical IED have to be changed.



A template IED can be inserted only when the bay is selected in the plant structure.

1. In the **Plant structure** view, select the bay, right-click, point to **New** and select **Create from template**.

The **Create New Object from Template** dialog box opens.

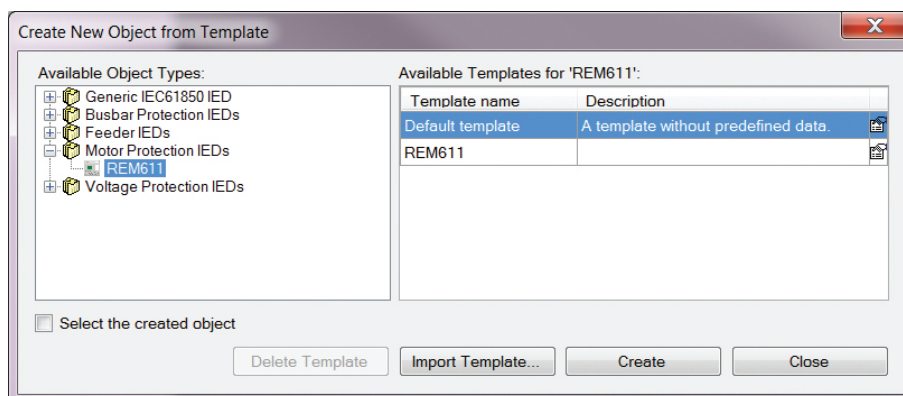


Figure 28: PCM600: Selecting an IED from the template library

2. Select the IED from the list of available IEDs.
 3. Click the icon on the right column in the list of available templates.
- The **Template Properties** dialog box opens.

Template Properties

Template info

Name: REM611

Type: User-Defined Template

Creation time: 12/1/2015 4:32:34 PM

Protocol: IEC61850

Path: C:\PCMDatabases\Templates\PCM600\REM611.ied.pcm

Description:

Created on

Product name: PCM600 2.7

Object type: REM611

Connectivity Package: REM611 2.0, RC 2.49 - Build 31

Close

Figure 29: PCM600: Template information

4. Check and verify the template information and click **Close** to close the dialog box.
The **Create New Object from Template** dialog box is displayed.
5. Delete, import or create a template by clicking the corresponding button.
 - To delete the selected template, click **Delete Template**.
 - To import a template from the selection window, click **Import Template**.
 - To insert the selected IED to the bay, click **Create**.



It is possible to insert more than one IED from the **Create New Object from Template** dialog box. The dialog box remains open until **Close** is clicked .

6. Click **Close** when finished.

4.3.4

Inserting an IED by importing a .pcmi file

It is possible to create a new IED object in the plant structure by importing a .pcmi file.

1. In the **Plant Structure** view, right-click the bay and select **Import**.



A .pcmi file can be imported only when the bay is selected in the plant structure.

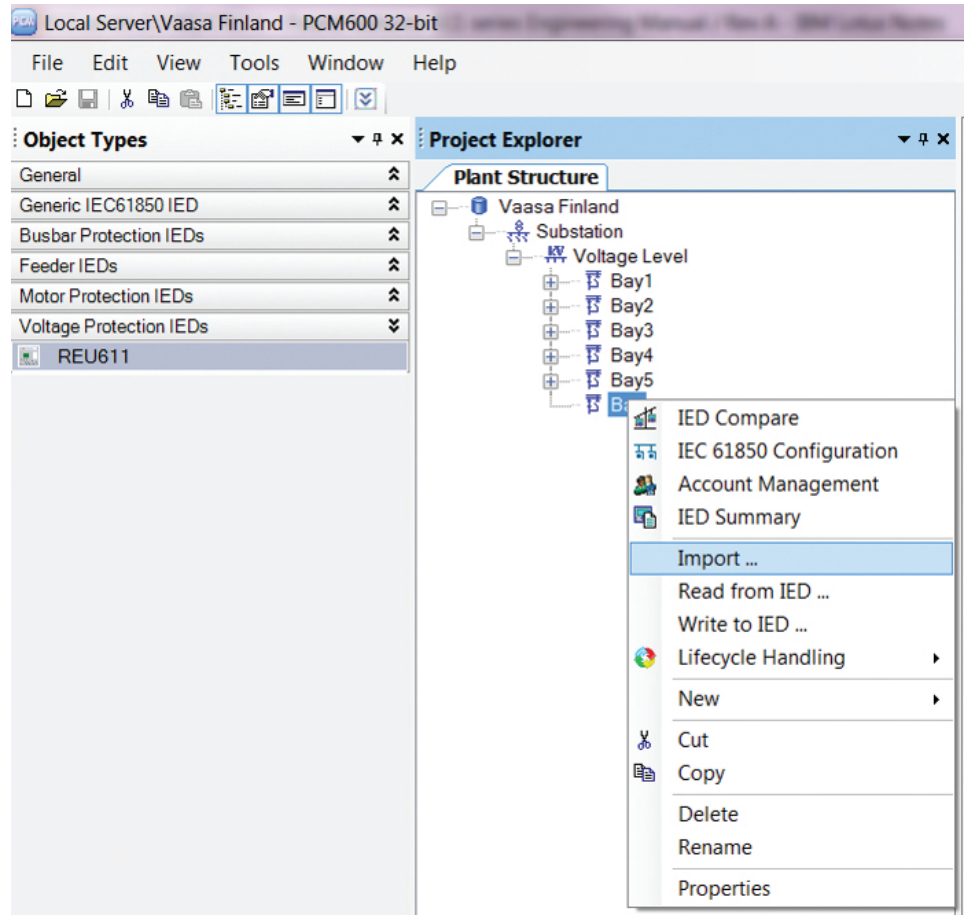


Figure 30: Importing IED configuration

2. In the **Import** dialog box, select the .pcmi file to be imported and click **Open**. After importing, the IED object is created in the plant structure.

After the .pcmi file has been imported, the IP address, the name and the technical key that correspond to the physical IED have to be changed.

4.4 Setting the IED IP address in a project

The IP address and subnet mask of the IED object in PCM600 must match the front and rear port of the protection relay (physical IED) to which the PC is connected. The IP address of the protection relay can only be set via the LHMI or Parameter Setting tool in PCM600. The PC and protection relay need to be on the same subnet.

There are two alternatives to set the IP address of an IED object in PCM600.

- On the first page of the wizard when including a new IED into a project.
- In the **IP address** box of the IED's **Object Properties** dialog box.

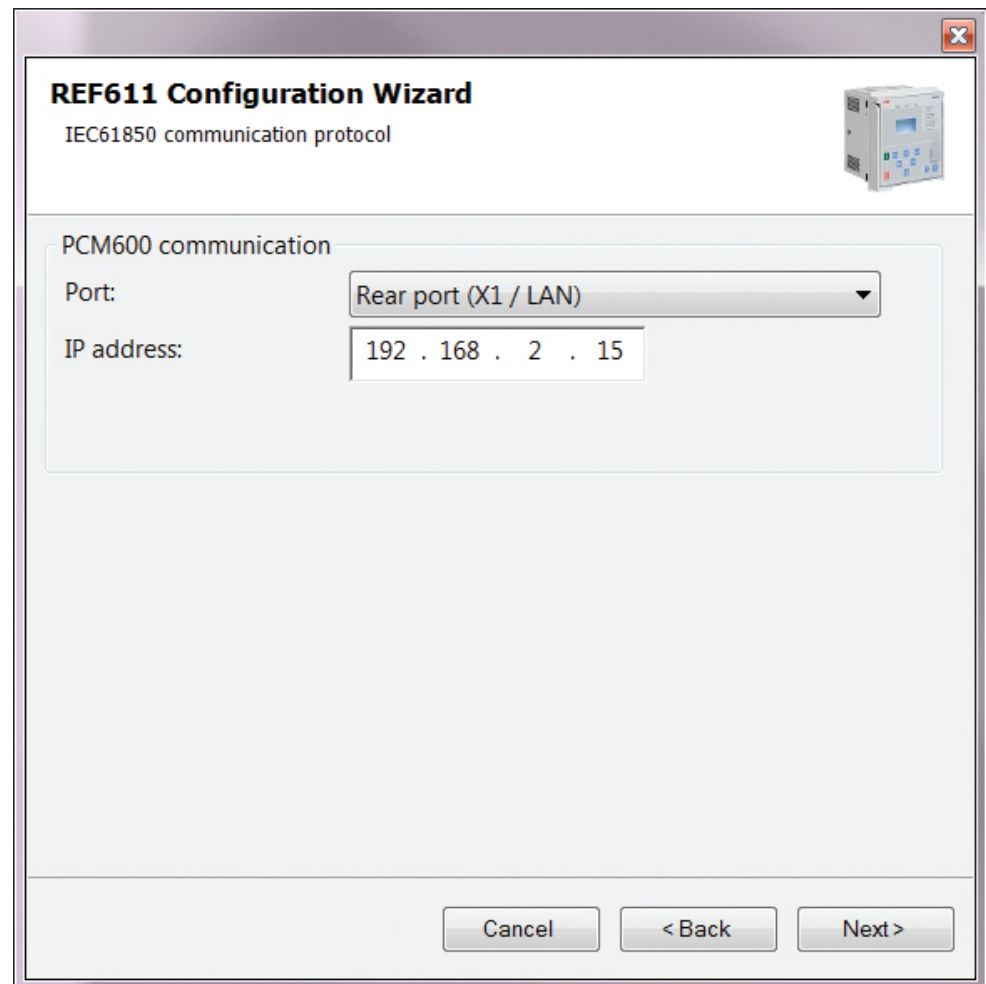


Figure 31: Alternative 1: Setting the IP address on the first wizard page

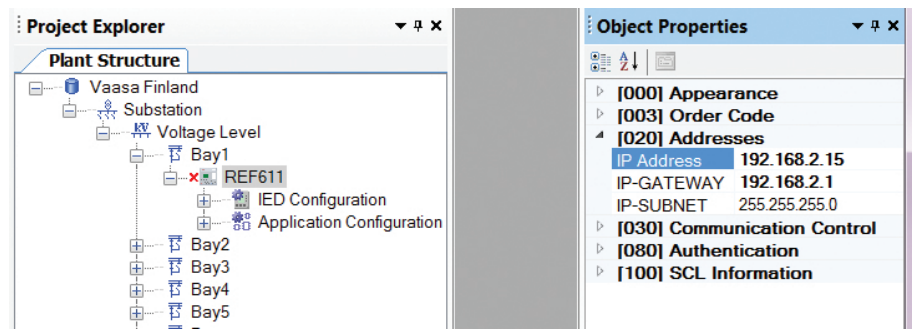


Figure 32: Alternative 2: Setting the IP address in IED's Object Properties dialog box

Choosing between the two ways depends on when the IP address is set. Typing the IP address via the IED's **Object Properties** dialog box is possible at any time while entering it via the configuration wizard can only be done when adding the IED object.

1. In the **Plant Structure** view, select the IED to which the IP address is to be entered.
2. On the **View** menu, select **Object Properties**.
Object Properties dialog box is opened.
3. Type in the IP address to the **IP Address** row.

4.5 COM600S project

The 611 series connectivity package supports SAB600. A 611 series protection relay is imported as a 611 series device. It is also possible to import a full PCM600 project including several 611 series devices to SAB600. In this case, PCM600 project information is imported to SAB600 using a SCD file.

The 611 series device supports several functions in COM600S.

- Controlling the switchgear
- Monitoring the measured values
- Reading disturbance recordings
- Setting parameters

4.5.1 Selecting communication port for configuration

When a relay is configured to a PCM600 project, the connection between the relay and the tool can be established using a point-to-point link between the relay front port and the computer or by connecting the computer to the relay rear port over an Ethernet station bus. In PCM600, the front or rear communication port can be selected from the project structure.

When using the front port, DHCP server functionality must be activated in the computer network adapter settings to get the IP address from the relay. Alternatively, the computer network adapter IP address can be set manually to the same subnet range as the front port.

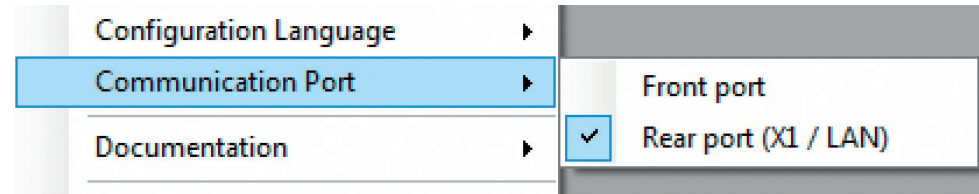


Figure 33: Communication port options

- Check that the settings are correct to ensure successful configuration access to the relay.
 - Computer port settings must match relay settings (IP address, subnet mask, DHCP).
 - Any firewall in the computer or in the network must pass required communication services.
 - When using the front port and switching the connection from the computer to another relay, it takes some time before the computer refreshes the relay's MAC address for front port IP address automatically. The MAC address can also be reset manually by clearing the computer ARP table.

4.5.2

Importing a 611 series protection relay in a COM600S project

1. Create a PCM600 project including several IEDs.

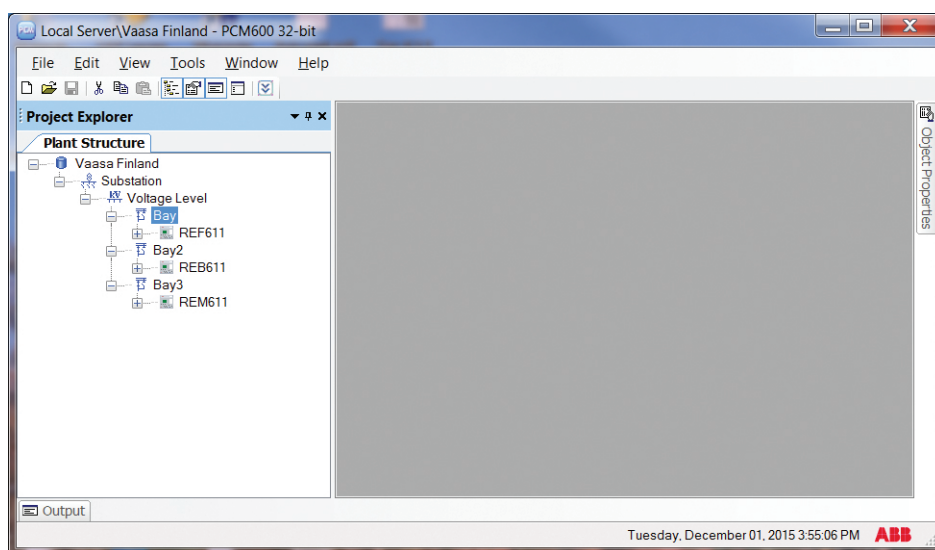


Figure 34: Creating a PCM600 project including several IEDs

- Export the SCD file from PCM600.
In the **Plant structure** view, select the substation, right-click and select **Export**.

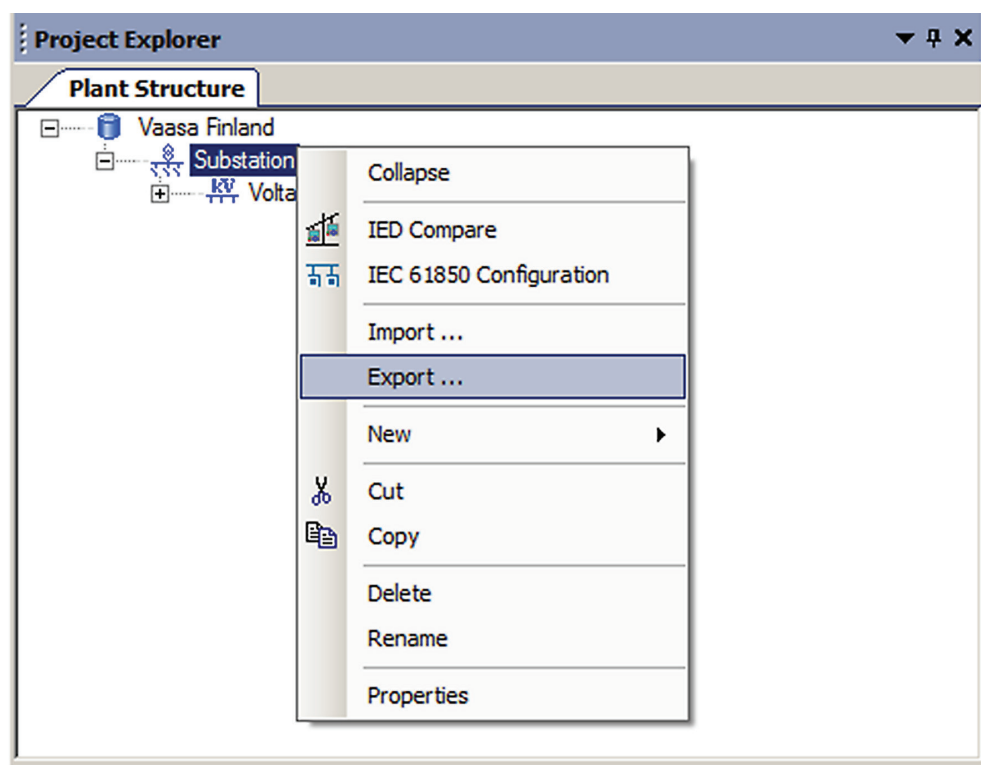


Figure 35: Exporting SCD file from PCM600 and importing it to SAB600

- Import the SCD configuration into the SAB600 project.
In the **Project Explorer** view, right-click the IEC61850 OPC Server object and select **SCL Import**.

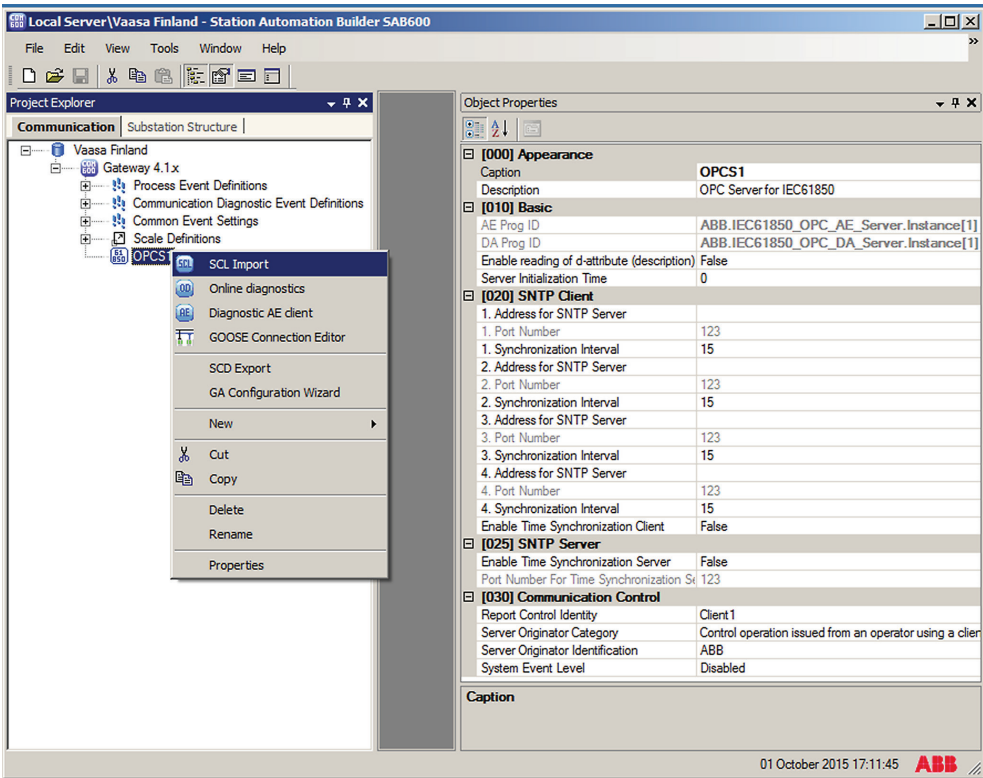


Figure 36: Importing the SCD configuration into the SAB600 project

4. In the **SCL Import** view, click **Select File** to select the SCD file exported from PCM600.

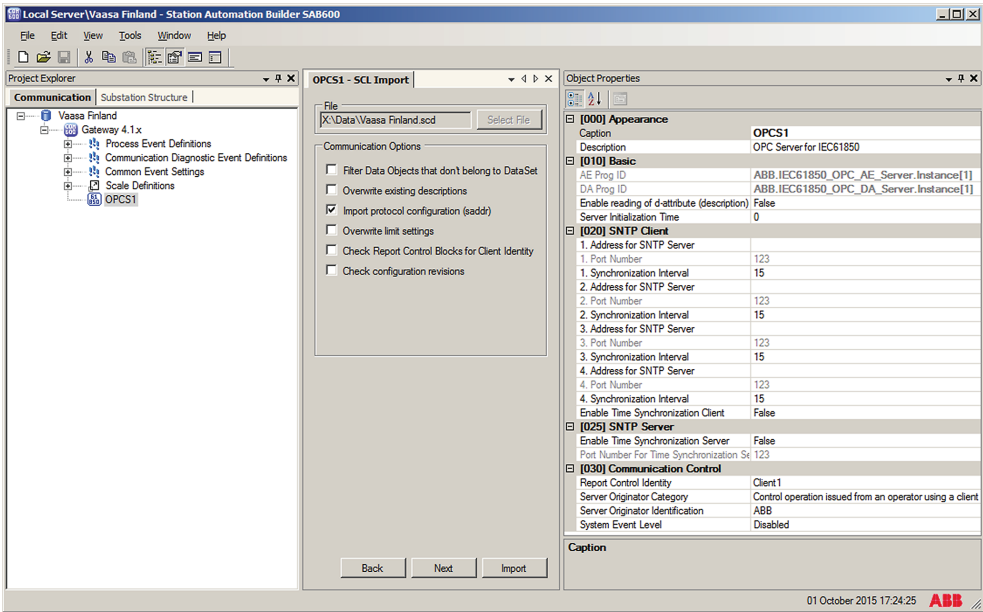


Figure 37: Creating a new IED into SAB600 project

5. Check the default settings in the **SCL Import** view and change the settings if they are not suitable.
The default settings in the **SCL Import** dialog should be correct in most cases.
6. Click **Import** to import the SCD file.
7. Check the IP address on the IEC 61850 subnetwork and change it if needed.
When the SCD file is directly exported from PCM600, it uses the IP address of the PCM600 computer, not the COM600S.

The communication towards the protection relays is now ready. For information on how to finalize the single-line diagram and enable parameter setting through COM600S HMI, see COM600S documentation.

4.6 Using the Web HMI

WHMI is enabled by default. As secure communication is enabled by default, the WHMI must be accessed from a Web browser using the HTTPS protocol.

If the WHMI was previously disabled, it can be enabled again via the LHMI.

1. To enable the WHMI, select **Main menu/Configuration/HMI/Web HMI mode** via the LHMI.
2. Reboot the relay for the change to take effect.
3. Log in with the proper user rights to use the WHMI.



To establish a remote WHMI connection to the protection relay, contact the network administrator to check the company rules for IP and remote connections.



Disable the Web browser proxy settings or make an exception to the proxy rules to allow the protection relay's WHMI connection, for example, by including the relay's IP address in **Internet Options/Connections/LAN Settings/Advanced/Exceptions**.

For more information on the WHMI, see the operation manual.

4.7 Managing IED users

IED user authorization is disabled by default. IED user passwords can be changed in LHMI, WHMI and using the IED Users tool in PCM600.



Local passwords can be changed only via the LHMI. Remote passwords can be changed via the LHMI or WHMI or with PCM600.

1. Enable IED user authorization at **Main Menu/Configuration/Authorization/Passwords** in LHMI or WHMI.
2. Use the IED Users tool in PCM600 to change the passwords. This tool cannot be used to add or change users.

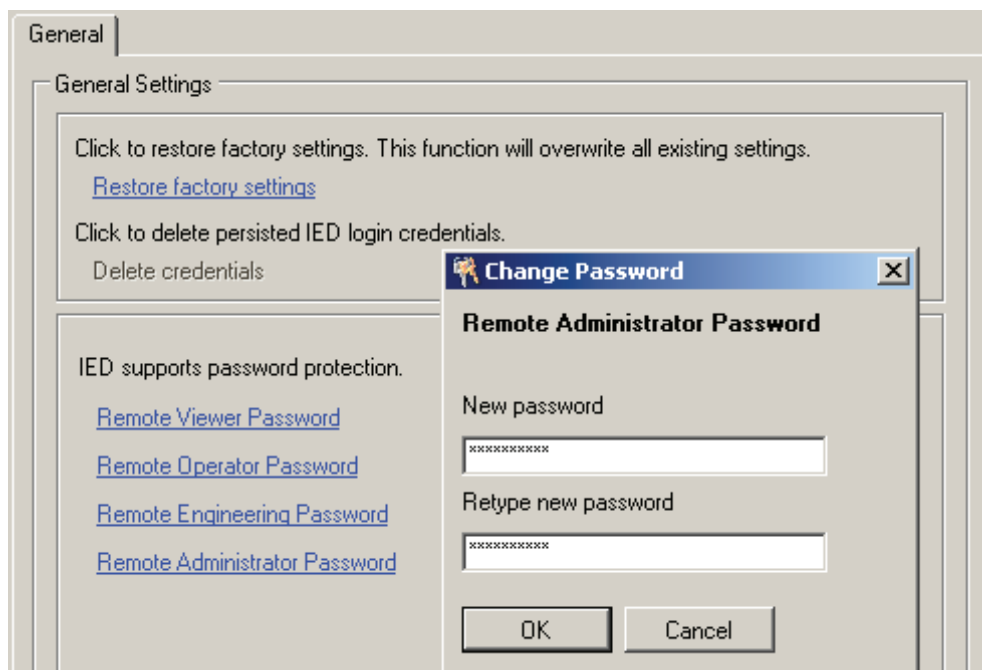


Figure 38: Changing the password using the IED User Management tool

3. Set the object property values in PCM600 to make the communication between the IED and PCM600 work, if the remote authentication has been enabled.

Table 4: Object properties to change

Object Properties field	Value
Is Authentication Disabled	False
Is Password used	True
Password	Write the correct password

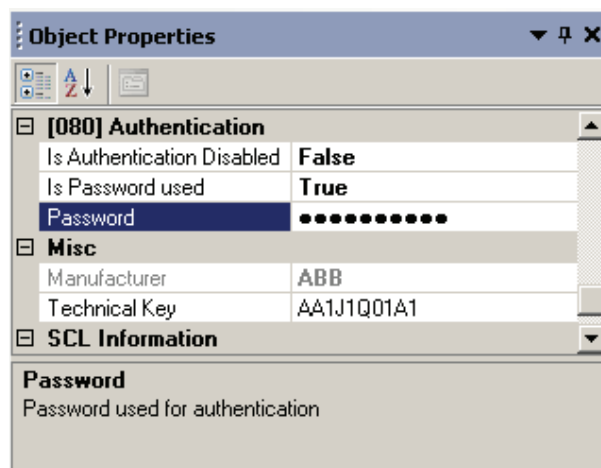


Figure 39: Object properties

When communicating with the protection relay with PCM600 tools and with the relay authentication enabled, the relay username and password must be given when prompted. When setting the technical key, the username and password must be given twice.

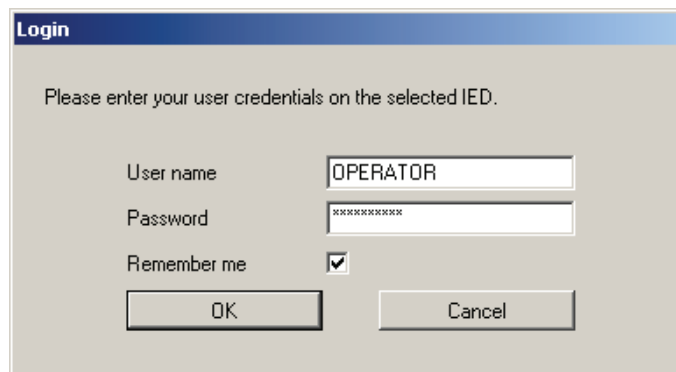


Figure 40: User login



If the PCM600 authentication has been enabled in PCM600 System Settings, a relay user can be linked to the current PCM600 user by selecting the Remember me check box in the Login dialog. After that, the user credentials are no longer asked at tool communication as logging in PCM600 also provides the authentication credentials to the protection relay.

4.8 PCM600 project's IEC 61850 version identification

The IEC 61850 version of a PCM600 project can be identified from the Object Properties pane of the project.

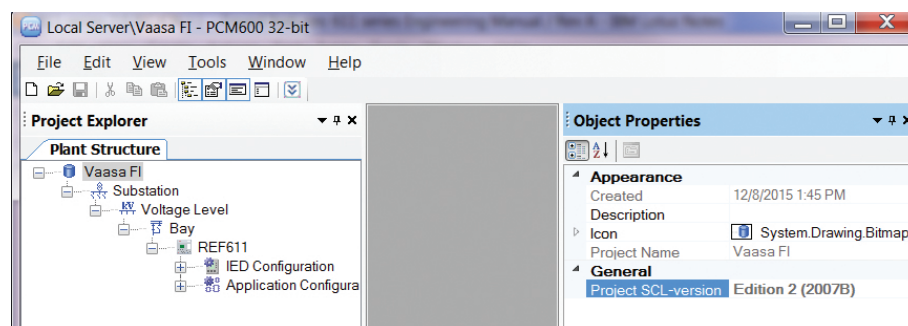


Figure 41: Project's IEC 61850 version

To change the IEC 61850 version Edition 1 of an IED to Edition 2, the configuration has to be written to the IED from a PCM600 project that has the IEC 61850 version Edition 2. A dialog box notifies on the difference of the versions.

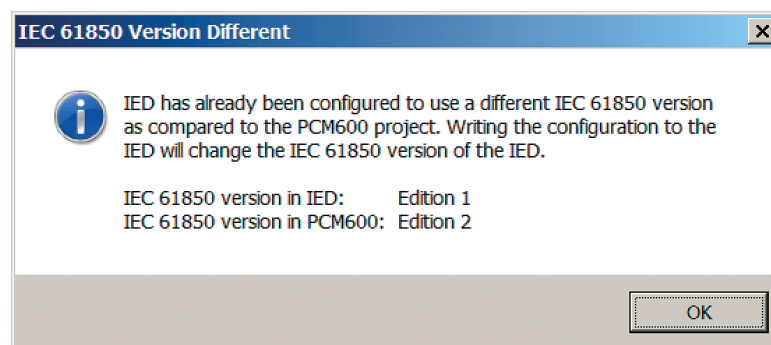


Figure 42: IEC 61850 version change

Section 5 Protection and control engineering

5.1 Parameter Setting tool

Configuration parameters and settings parameters can be changed with LHMI, WHMI or with the Parameter Setting tool in PCM600.



Some parameters are only visible in the Parameter Setting tool and some only in LHMI.



A common writing from PCM600 to the protection relay, where parameters are changed in the Parameter Setting tool, overwrites any parameter changes made locally with LHMI.

All parameters listed and displayed in the parameter list can be sorted into two groups.

- Configuration parameters
- Setting parameters

5.1.1 Configuration parameter

Configuration parameter specifies the operation mode of an application function or of the protection relay. These are basic configurations that are normally configured only once and then not modified again. The protection relay configures itself during start-up according to the given configuration parameter values.

5.1.2 Setting parameter

Setting parameter (short form: “setting”) is a parameter that can be changed in the protection relay at runtime.

5.1.3 Setting group

Nearly all settings used by the protection relay for protection application functions are organized into a group of settings. Up to six setting groups can be configured with different values.

The protection relay supports the selection of a setting group at runtime.

5.1.4 Parameter import and export

The parameter export and import function can be utilized, for example, when the protection relay's parameters are set using the WHMI instead of PCM600. The relay settings engineered with PCM600 can be exported to XRIO files and imported to the WHMI. The WHMI can be used to write the settings to the protection relays. The WHMI can also be used to read the relay setting parameters and to export those to files, which can be used by PCM600.



The exporting and importing of settings is sensitive to the protection relay's content. Settings are exported and imported for one protection relay at a time. The export files of a specific protection relay can be exchanged between PCM600, WHMI and the actual physical IED. To avoid errors and to efficiently manage the exporting and importing of settings, for example, in a substation with several protection relays, ensure that the names of the export files identify the protection relay to which the file should be imported.

The parameter import/export functionality is available via the File menu when the Parameter Setting tool is open.

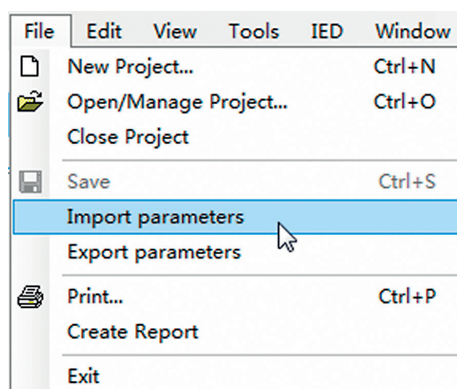


Figure 43: Parameter import/export

5.1.5 Parameter organization

The organization of parameters into a tree structure becomes visible in the **Plant Structure** by expanding the setting tree.

5.2 Signal Matrix

The Signal Matrix tool is used for the GOOSE signal input engineering.

There are 20 GOOSERCV_BINs in 611 series protection relays. For 611 series application, only GOOSE binary inputs can be connected. A maximum of 20 GOOSE binary inputs can be taken into use.

For details of GOOSERCV_BIN applications and related switch group functions, see the application manual.

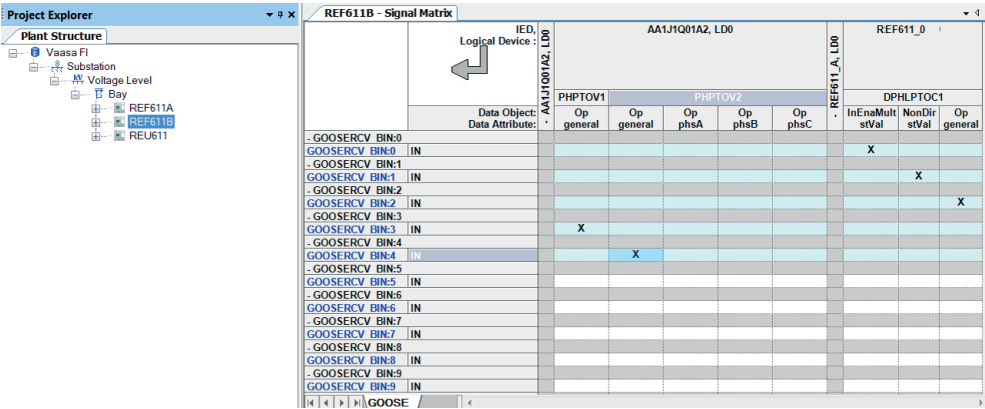


Figure 44: Signal Matrix

5.3 Fault Record tool

The Fault Record tool is used for reading the fault records from the protection relay and it is included in the connectivity packages. The tool makes analyzing the fault records easier by showing them separately in their own user control components. It also includes save, copy and clear functions where all the fault records are saved or copied in text format for later viewing or cleared from the protection relay or the tool.



The fault record is saved to a local PC with the default name `FaultRecords.txt`. Revise the file name before saving to avoid overriding the old record.

5.3.1 Opening and closing Fault Record tool

- To open the Fault Record tool, right-click an IED node in the PCM600 project tree and select **Fault Record Tool**.

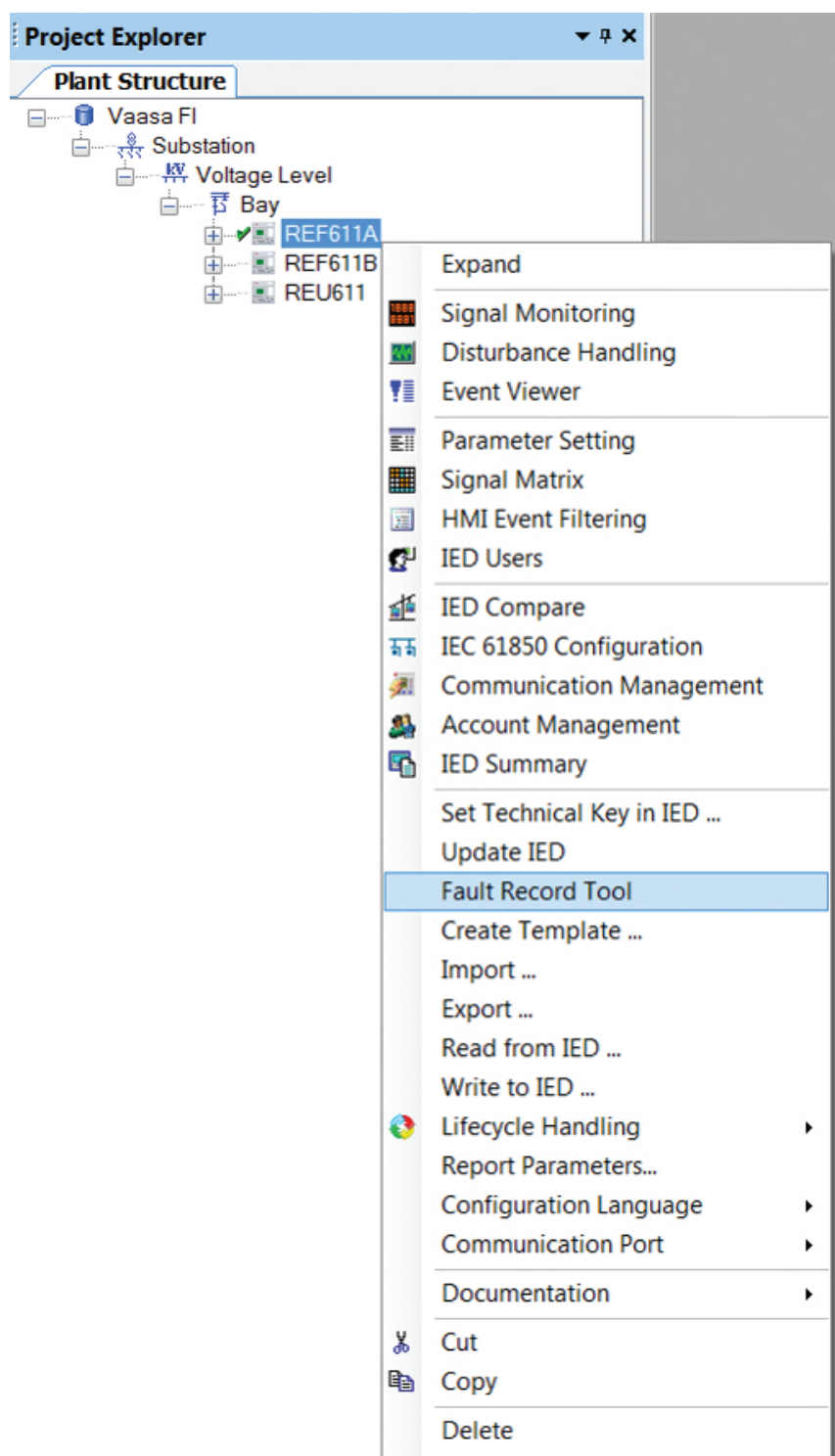


Figure 45: Opening the Fault Record tool

- To close the Fault Record tool, click the **Close** button in the tool.

The Fault Record tool runs in the same process as PCM600 but in a separate window. Multiple instances of the tool can be run at the same time. Any open tool instances are closed without confirmation when PCM600 is closed.

The Fault Record tool is a connectivity package tool. The main functionality is divided into three parts: reading the fault record parameters from the protection relay, displaying their names, values and units on the user interface and saving them to a text file. It is also possible to clear all the fault records from both the tool and the protection relay and copy the fault records either individually or all at once to a word processor.

5.3.2

Fault Record tool interface

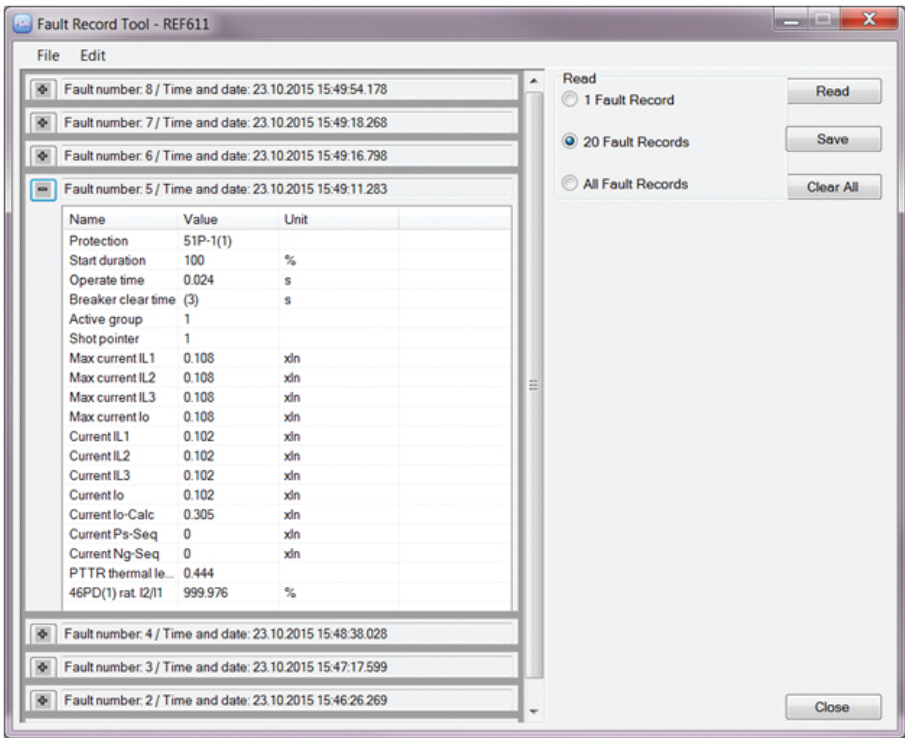


Figure 46: Fault record tool

Table 5: Available actions on the user interface

Action	Description
Read	Clicking the Read button reads all available fault records from the protection relay into the tool. User has the option to read 1 fault record, 20 fault records or all fault records. The Read button opens up a progress bar to indicate an ongoing read operation. Click the Cancel button on the Read progress bar to cancel the read operation. On operation completion, the available fault records are shown in the record grid. Click the + icon to expand and view record details.
Save	Click Save to save the fault records on the local machine as .txt file.
Clear	Record can be cleared from either the Fault record tool or the protection relay or both. Before deleting the records, a confirmation dialog box is shown.
Table continues on next page	

Action	Description
Close	Clicking the Close button closes this instance of the Fault Record tool. Any open instance is finally closed when the whole PCM600 is closed.
File	File menu for Save and Exit actions.
Edit	Copy All in the Edit menu allows to copy all the fault records which can then be pasted to a word processor and saved on the local machine without having to save the records as a .txt file. Additionally the user can select any particular fault record and right-click to copy the selected record.

5.4 IED Compare

IED Compare is used to compare the IED configurations of two IEDs of the same type. It generates a text report which lists the differences between the IED configurations. IED Compare provides an option to compare an IED configuration stored in PCM600, IED or .pcmi file. IED Compare can compare certain types of IED configurations and parameters.

- Display configuration
- GOOSE receive configuration
- Parameters



Display comparison compares two display pages with a delta of two pixels.



Detailed instructions are shown in PCM600 documentation.

5.4.1 Starting IED Compare

- Start **IED Compare** in the shortcut menu in plant structure.
 1. In the PCM600 plant structure, right-click **Substation**, **Voltage level**, **Bay** or **IED**.
 2. Select **IED Compare**.
- Start **IED Compare** from the PCM600 main menu.
 1. Select **Substation**, **Voltage level**, **Bay** or **IED** in the PCM600 plant structure.
 2. On the PCM600 menu bar, point to **Tools** and select **IED Compare**.

5.4.2 IED Compare tool interface

The comparison report shows differences in the configuration of two IEDs. Hardware, application, display, GOOSE and parameter configuration differences are grouped and listed under the corresponding headings.

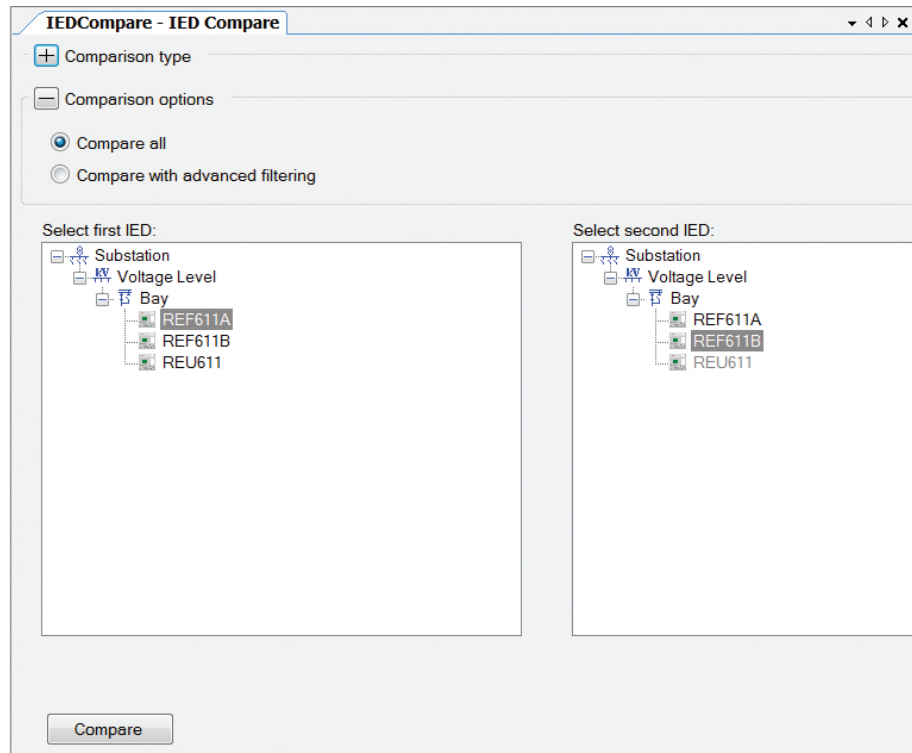


Figure 47: Compare options

Each configuration group can be expanded or collapsed by clicking the plus (+) or minus (-) button next to it in the result grid.

The reports must be read from left to right row-wise.

Table 6: Acronyms used in a report

Acronym	Description
DA	Data attribute
DO	Data object
IED	Intelligent electronic device
LN	Logical node
SIG	Signal

5.5 Protection and control blocking examples

All of the relay's logical nodes are set with *Test mode*. *Test mode* is selected through one common parameter via the HMI path **Tests/IED test**. By default, *Test mode* can only be set locally through LHMI. *Test mode* is also available via IEC 61850 communication (LD0.LLN0.Mod).

Table 7: *Test mode*

Test mode	Description
Normal mode	Normal operation
IED blocked	Protection working as in "Normal mode" but control function commands blocked.
IED test	Protection working as in "Normal mode" but protection functions are working in parallel with test parameters.
IED test and blocked	Protection working as in "Normal mode" but protection functions are working in parallel with test parameters. Control function commands blocked.

The physical outputs from control commands to process are blocked with *IED blocked* and *IED test and blocked* modes. The physical outputs from the protection functions are not blocked.

The mode of all logical nodes located under CTRL logical device are set with *Control mode*. *Control mode* is selected via the HMI or PCM600 path **Configuration/Control/General**. By default, *Control mode* can only be set locally through LHMI. *Control mode* inherits its value from *Test mode* but *Control mode* "On", "Blocked" and "Off" can also be independently set. *Control mode* is also available via IEC 61850 communication (CTRL.LLN0.Mod).

Table 8: *Control mode*

Control mode	Description
On	Normal operation.
Blocked	Control function commands blocked
Off	Control functions disabled

The physical outputs from commands to process are blocked with the *Blocked* mode.

Section 6 LHMI engineering



For information on LED operation modes supported by the protection relay, see the technical manual.

6.1 HMI event filtering

HMI Event Filtering is a tool that helps in configuring visibility of events shown on the LHMI and WHMI of the IED. This tool does not modify the actual events on the protocol level, it only modifies the event visibility on the LHMI and WHMI.

The event tree view is used to modify the visibility of the events shown on the LHMI and WHMI. Events in the tree view are structured in the same way as functions in the PCM600 plant structure.

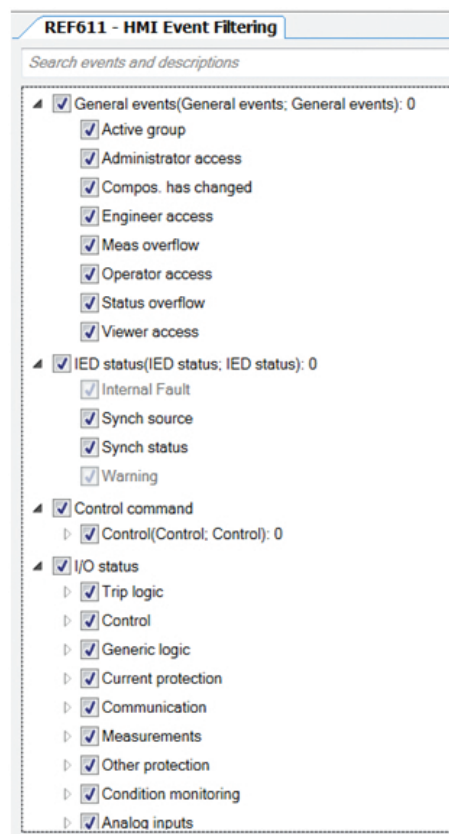


Figure 48: HMI event filtering interface

6.1.1 Starting HMI event filtering

Start HMI event filtering in one of the alternative ways.

- Right-click an IED and select **HMI Event Filtering**.
- On the **Tools** menu, click **HMI Event Filtering**.

6.1.2 Setting visibility of HMI events

1. Browse the event tree for the event.
Event nodes in the tree have more detailed description in the tool tip.
2. Select or clear the check box next to the event name to specify it's visibility.
 - When the check box is cleared, the event is not visible on either LHMI or WHMI.
 - When the check box is selected, the event is visible on both LHMI and WHMI.

The HMI visibility can also be modified for multiple events by selecting the check box of the parent node in the event tree view.

Some events in the event tree are read-only and cannot be modified. The read-only events appear dimmed in the user interface.

6.1.3 Searching events

HMI Event Filtering has search capabilities to quickly find wanted event from the event tree view. Use predefined search strings or type a search string manually. The event tree view is filtered using the search string.

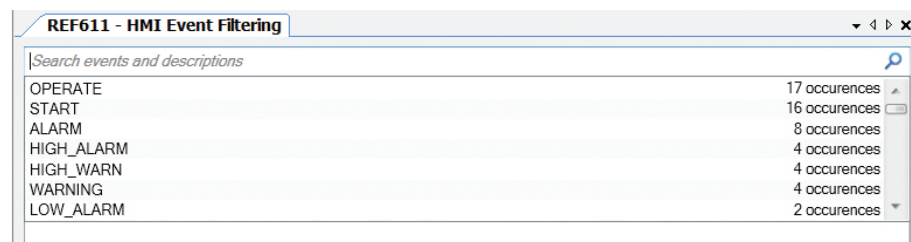


Figure 49: Searching events

- Search events using predefined search strings.
 1. Click the search text box shown on top of the event tree view.
A drop-down list is shown with predefined search strings.
 2. Select the event name to be shown in the event tree.
Event tree is filtered to show only events with the specified name.
- Search using custom search strings.

-
1. Click the search text box shown on top of the event tree view.
 2. Type a custom search string in the search text box.
The event tree is filtered to all matching events. Search functionality tries to match the given custom search string to the event name and description. Partial matches are also shown in the results view.
- To clear the search results, click the Clear button on the right side of the search text box or erase the search string.

6.1.4

Saving event filter configuration

Save the event filter configuration in one of the alternative ways.

- In the event tree view, select **File/Save**.
- Click the Save button on the toolbar.

Section 7 IEC 61850 communication engineering

7.1 IEC 61850 protocol references and pre-conditions

To engineer the IEC 61850 protocol interface for the protection relay, the following additional manuals or knowledge of their contents is required.

- Knowledge of the IEC 61850 engineering process as described in the IEC 61850 standard
- The technical manual describes the function blocks defined as logical nodes
- The IEC 61850 engineering guide
- The IEC 61850 conformance documents for the protection relay to be engineered
- The IEC 61850 parameter list

7.2 IEC 61850 interface



For more information on the implementation of IEC 61850 in protection relays, see IEC 61850 engineering guide and conformance documents.

Table 9: *Function blocks and IEC 61850 Edition 1 and Edition 2 Logical Nodes*

Function	IEC 61850	Logical device	Logical nodes in Ver.2.0	Logical nodes in Ver.1.0
Protection				
Three-phase non-directional overcurrent protection, low stage	PHLPTOC	LD0	PHLPTOC	PHLPTOC
Three-phase non-directional overcurrent protection, high stage	PHHPTOC	LD0	PHHPTOC	PHHPTOC
Three-phase non-directional overcurrent protection, instantaneous stage	PHIPTOC	LD0	PHIPTOC	PHIPTOC
Non-directional earth-fault protection, low stage	EFLPTOC	LD0	EFLPTOC	EFLPTOC
Non-directional earth-fault protection, high stage	EFHPTOC	LD0	EFHPTOC	EFHPTOC
Non-directional earth-fault protection, instantaneous stage	EFIPTOC	LD0	EFIPTOC	EFIPTOC
Three-phase directional overcurrent protection, low stage	DPHLPDOC	LD0	DPHLPTOC DPHLRDIR	DPHLPTOC DPHLRDIR
Three-phase directional overcurrent protection, high stage	DPHHPDOC	LD0	DPHHPTOC DPHHRDIR	DPHHPTOC DPHHRDIR
Directional earth-fault protection, low stage	DEFLPDEF	LD0	DEFLPTOC DEFLRDIR	DEFLPTOC DEFLRDIR
Table continues on next page				

Function	IEC 61850	Logical device	Logical nodes in Ver.2.0	Logical nodes in Ver.1.0
Directional earth-fault protection, high stage	DEFHPDEF	LD0	DEFHPTOC DEFHRDIR	DEFHPTOC DEFHRDIR
Transient/intermittent earth-fault protection	INTRPTEF	LD0	INTRPTEF	INTRPTEF
Non-directional (cross-country) earth-fault protection, using calculated Io	EFHPTOC	LD0	EFHPTOC	EFHPTOC
Negative-sequence overcurrent protection	NSPTOC	LD0	NSPTOC	NSPTOC
Negative-sequence overcurrent protection for machines	MNSPTOC	LD0	MNSPTOC	MNSPTOC
Phase discontinuity protection	PDNSPTOC	LD0	PDNSPTOC	PDNSPTOC
Residual overvoltage protection	ROVPTOV	LD0	ROVPTOV	ROVPTOV
Three-phase undervoltage protection	PHPTUV	LD0	PHPTUV	PHPTUV
Three-phase overvoltage protection	PHPTOV	LD0	PHPTOV	PHPTOV
Positive-sequence undervoltage protection	PSPTUV	LD0	PSPTUV	PSPTUV
Negative-sequence overvoltage protection	NSPTOV	LD0	NSPTOV	NSPTOV
Frequency protection	FRPFRQ	LD0	FRPTRC FRPTOF FRPTUF FRPFRC	FRPTRC FRPTOF FRPTUF FRPFRC
Three-phase thermal protection for feeders, cables and distribution transformers	T1PTTR	LD0	T1PTTR	T1PTTR
Loss of load supervision	LOFLPTUC	LD0	LOFLPTUC	LOFLPTUC
Motor load jam protection	JAMPTOC	LD0	JAMPTOC	JAMPTOC
Motor start-up supervision	STTPMSU	LD0	STTPMSS STTPMRI	STTPMSS STTPMRI
Phase reversal protection	PREVPTOC	LD0	PREVPTOC	PREVPTOC
Thermal overload protection for motors	MPTTR	LD0	MPTTR	MPTTR
Circuit breaker failure protection	CCBRBRF	LD0	CCBRBRF	CCBRBRF
Three-phase inrush detector	INRPHAR	LD0	INRPHAR	INRPHAR
Master trip	TRPPTRC	LD0	TRPPTRC	TRPPTRC
High-impedance differential protection for phase A	HIAPDIF	LD0	HIAPDIF	HIPDIF
High-impedance differential protection for phase B	HIBPDIF	LD0	HIBPDIF	HIPDIF
High-impedance differential protection for phase C	HICPDIF	LD0	HICPDIF	HIPDIF
Switch onto fault	CBPSOF	LD0	CBPSOF	CBRSOF
Other				
Input switch group	ISWGAPC	LD0	ISWGAPC	ISWGAPC
Output switch group	OSWGAPC	LD0	OSWGAPC	OSWGAPC
Selector	SELGAPC	LD0	SELGAPC	SELGAPC
Minimum pulse timer (2 pcs)	TPGAPC	LD0	TPGAPC	TPGAPC
Minimum pulse timer (2 pcs, second resolution)	TPSGAPC	LD0	TPSGAPC	TPSGAPC
Move (8 pcs)	MVGAPC	LD0	MVGAPC	MVGAPC
Control				
Table continues on next page				

Function	IEC 61850	Logical device	Logical nodes in Ver.2.0	Logical nodes in Ver.1.0
Circuit breaker control	CBXCBR	CTRL	CBCSWI CBCILO CBXCBR	CBCSWI CBCILO CBXCBR
Emergency start-up	ESMGAPC	LD0	ESMGAPC	ESMGAPC
Autoreclosing	DARREC	LD0	DARREC	DARREC
Condition monitoring				
Trip circuit supervision	TCSSCBR	LD0	TCSSCBR	TCSSCBR
Runtime counter for machines and devices	MDSOPT	LD0	MDSOPT	MDSOPT
Phase segregated CT supervision function for Phase A	HZCCASPCV	LD0	HZCCASPCV	HZCCRDIF
Phase segregated CT supervision function for Phase B	HZCCBSPVC	LD0	HZCCBSPVC	HZCCRDIF
Phase segregated CT supervision function for Phase C	HZCCCSPVC	LD0	HZCCCSPVC	HZCCRDIF
Logging				
Disturbance recorder	RDRE	DR	DR_LLNO RDRE_type RADR_type RBDR_type LPHD_M	DR_LLNO RDRE_type RADR_type RBDR_type LPHD_M
Fault recorder	FLTRFRC	LD0	FLTRFRC	FLTMSTA
Measurement				
Three-phase current measurement	CMMXU	LD0	CMMXU CAVMMXU CMAMMXU CMIMMXU	CMMXU CMSTA
Sequence current measurement	CSMSQI	LD0	CSMSQI	CSMSQI
Residual current measurement	RESCMMXU	LD0	RESCMMXU RCVMMXU RCMAMMXU RCMIMMXU	RESCMMXU RESCMSTA
Three-phase voltage measurement	VMMXU	LD0	VMMXU VAVMMXU	VMMXU VMSTA
Sequence voltage measurement	VSMSQI	LD0	VSMSQI	VSMSQI
Residual voltage measurement	RESVMMXU	LD0	RESVMMXU RVAVMMXU RVMAMMXU RVMIMMXU	RESVMMXU RESVMSTA
Frequency measurement	FMMXU	LD0	FMMXU	FMMXU
Three-phase power and energy measurement	PEMMXU	LD0	PEMMXU PEMMTR PEAVMMXU PEAMMMXU PEMIMMXU	PEMMXU PEMMTR PEMSTA

7.2.1

IEC 61850 interface in the protection relay

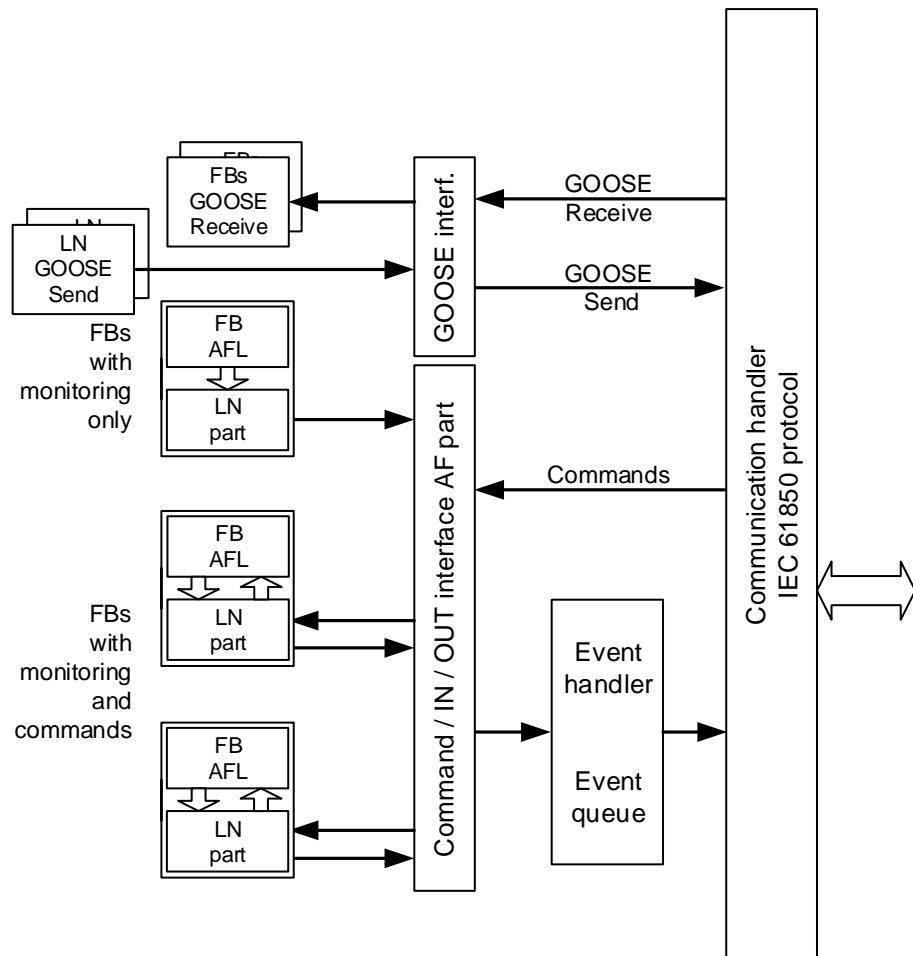


Figure 50: IEC 61850 communication interface principle

IEC 61850 provides a method for identifying all signals that belong to a function. These signals are identified through the logical nodes representing the functions. All signal information for commands and monitoring are available in logical nodes.

Whenever a function block is instantiated in the Application Configuration tool, PCM600 automatically generates the corresponding logical node data.

7.2.1.1

GOOSE data exchange

The IEC 61850 protocol supports a method to directly exchange data between two or more devices (IEDs). This method is described in the IEC 61850-7-2 clause 15.

The concept is based on sending a multicast over the Ethernet. Whoever needs the information, detects the telegram by its source address, reads the telegram and handles it. The telegrams are multicast sent and not acknowledged by the receiver.

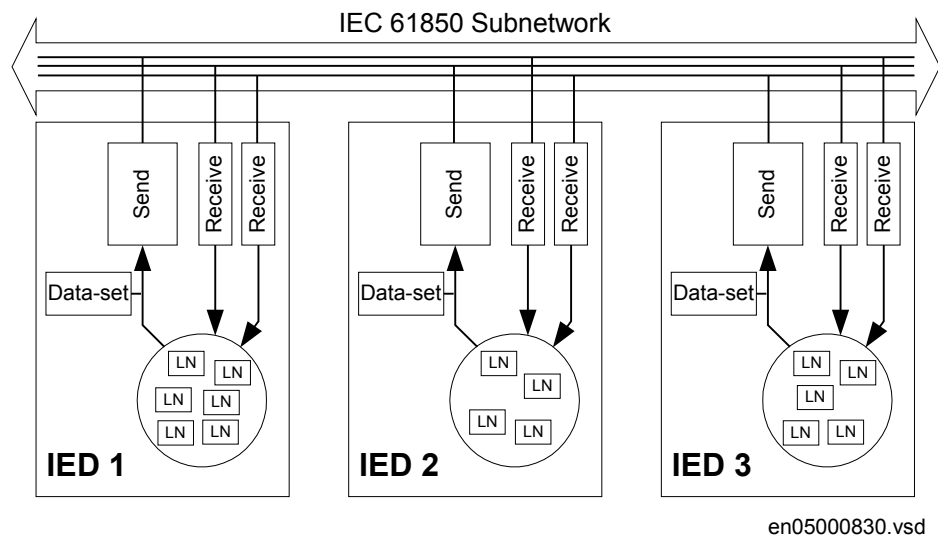


Figure 51: IEC 61850: Horizontal communication principle, an example of three IEDs where each IED communicates with all others

When a GOOSE message is to be sent, it is defined by configuring the data set with the defined trigger option and GoCB. This engineering process is done in a station configuration tool, for example, IEC 61850 Configuration tool or IET600. The task involves configuring lists with the signal, value and quality (data attributes or data objects) that belong to the GOOSE message data set.

In the opposite direction, the standard only defines the IED as a receiver of a GOOSE message. How the GOOSE input signals are handled must be defined in the device's application configuration. The SCL data generated by the IEC 61850 Configuration tool or IET600 (or any other station configuration tool) contains the GOOSE data sets as input data. The input data must be connected to a GOOSE receive function blocks in the Signal Matrix tool.

7.2.2

Function view for IEC 61850 in PCM600

The IED design is directly based on IEC 61850. Thus, the function blocks in PCM600 tool use IEC 61850 logical node naming for function blocks. This relation is automatically handled by the PCM600 tools.

The concept in the IED is such that the IEC 61850 data for each function instance is available in the data model, even when the function is not used in the application. This means that it is not necessary to handle any instance information for the functions regarding IEC 61850.

7.2.3

Station configuration description file types

The IEC 61850 standard defines SCL file types in the sequence of engineering. These files have a different definition, which is explained in IEC 61850-6. Three of the file types are used in the engineering process for an IED.

- ICD = IED capability description
 - Capability description of the IED in logical nodes and their data. No information about, for example, the communication configuration is included.
 - An IED is already extended by default data sets and report control blocks. They are predefined by ABB. Changes or additional data sets, for example, have to be done with IEC 61850 Configuration tool or IET600.
- SCD = Station configuration description
 - A complete configuration description of all IEDs in a station and the full engineering of process signals and communication structure is included. This includes all the needed data sets and control blocks.
- CID = Configured IED description
 - The CID file contains the information needed for configuring one specific IED. The CID file contains the complete configuration description of one specific IED. This includes the configured IED name, communication part, data sets and all control blocks.
- IID = Instantiated IED description
 - The IID file contains a complete IED configuration, like the CID file. The IID file can include references to other devices which are not present in the file. The IID file is meant for transferring configuration data from IED configuration tool to a system configuration tool.



The uploading of IEC 61850 communication configuration is not supported when reading a configuration from an online IED. The PCM600 project works as a repository for the IEC 61850 configuration.

7.3

IEC 61850 engineering process

The IEC 61850 standard defines how information is communicated in a substation. The information communication can be divided into different parts.

- Description of the substation part, including the used logical nodes
- Description of the IEDs with their logical nodes
- Description of the communication network
- Description of the engineering process

When exporting an SCL file from PCM600, the tool builds a default substation structure and creates default data sets and control blocks for vertical communication between the substation client and IEDs. For more information, see the IEC 61850 standards.

In the following example, it is assumed that PCM600 and IET600 are used as the system configuration tools. Another option is to use the IEC 61850 Configuration tool inside PCM600. In that case the SCL file export and import operations (steps 1 and 3) are not needed.

1. SCL files are exported from PCM600. In this case, a SCD file. It is also possible to export other SCL file types.
2. Horizontal and vertical communication is configured using the station configuration tool, for example, IEC 61850 Configuration tool or IET600.
3. SCL files are imported to a PCM600 project. In this case, it is the updated SCD file.

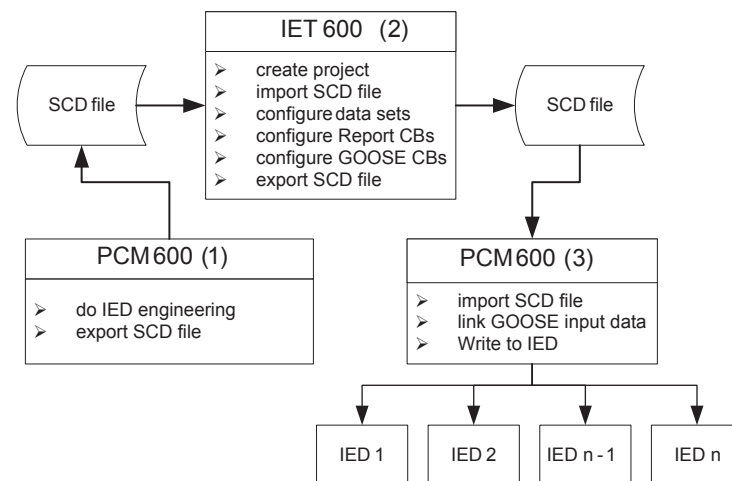


Figure 52: IEC 61850: signal engineering procedure flow when a complete station is exported as a SCD file

7.3.1

Exporting SCL files from PCM600

A pre-condition for exporting SCL files from PCM600 is that all IEDs in the project must be engineered in PCM600. The IEDs require unique name and IP addresses and they must be set according to the project definitions. IED configurations must be finalized as far as possible before starting the IEC 61850 configuration part.

7.3.1.1

Exporting SCD files

1. Select the station in the **Plant Structure** view.

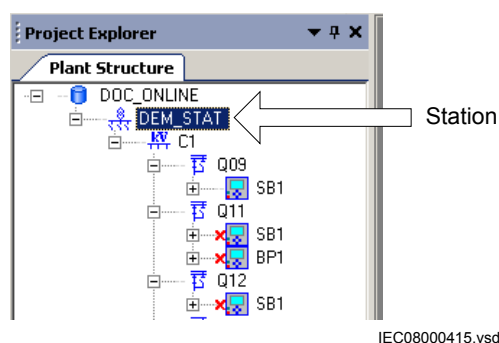


Figure 53: IEC 61850: selecting the station

2. Right-click the station and select **Export**.
3. From the open standard Windows dialog box, select the location to store the file and name it.
4. Click **Save**.
The **SCL Export Options** dialog box opens.

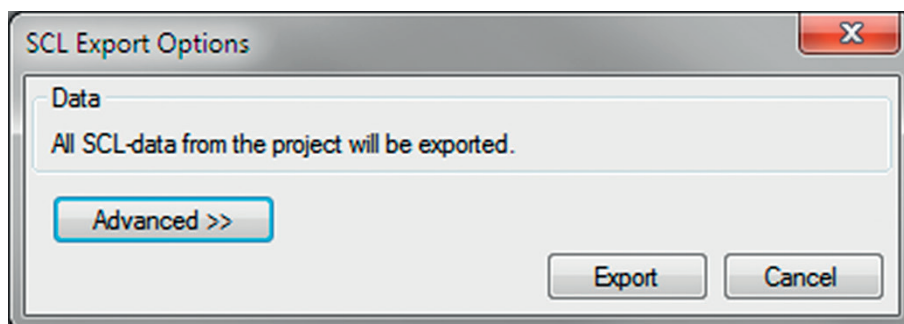


Figure 54: IEC 61850: selecting the SCL export option

5. Change the SCL file version by clicking the **Advanced** button, if required by the receiving configuration tool.

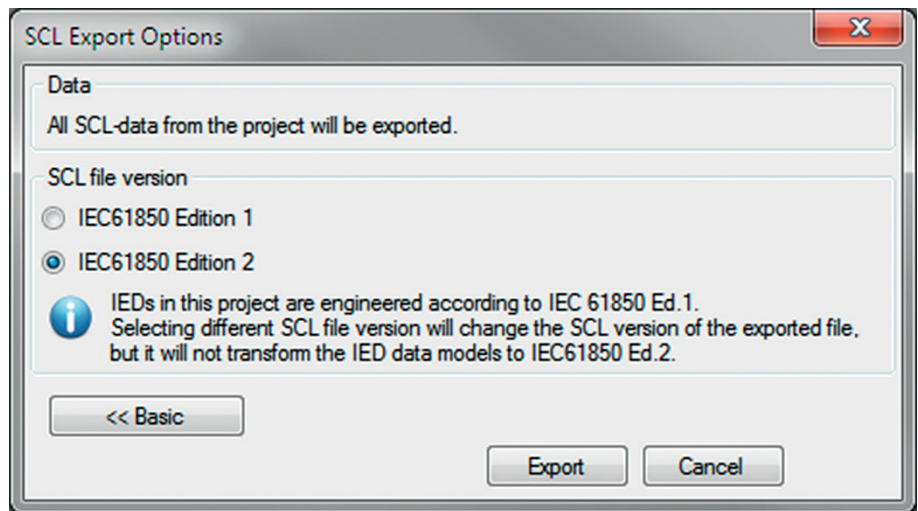


Figure 55: Export options of SCL

6. Click **Export** to generate the SCD file.
A progress window shows the ongoing export of the station.

7.3.1.2

Exporting ICD or CID files

1. Select the IED in the **Plant Structure** view.
2. Right-click the IED and select **Export...**
The **Export** dialog box opens.
3. From the **Save as type** list, select the type of file to export.
 - Configured IED description (.cid) for the IEC 61850 structure as needed for the IED at runtime
 - IED capability description (.icd) for the IEC 61850 structure

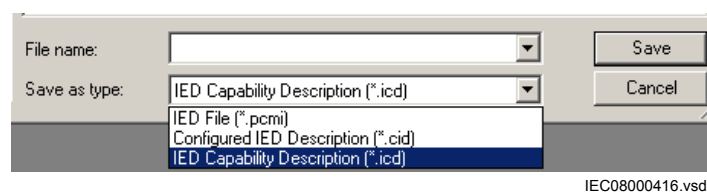


Figure 56: IEC 61850: export IED file type selection

4. Click **Save**.
The **SCL Export Options** dialog box opens.
5. Select the export options.

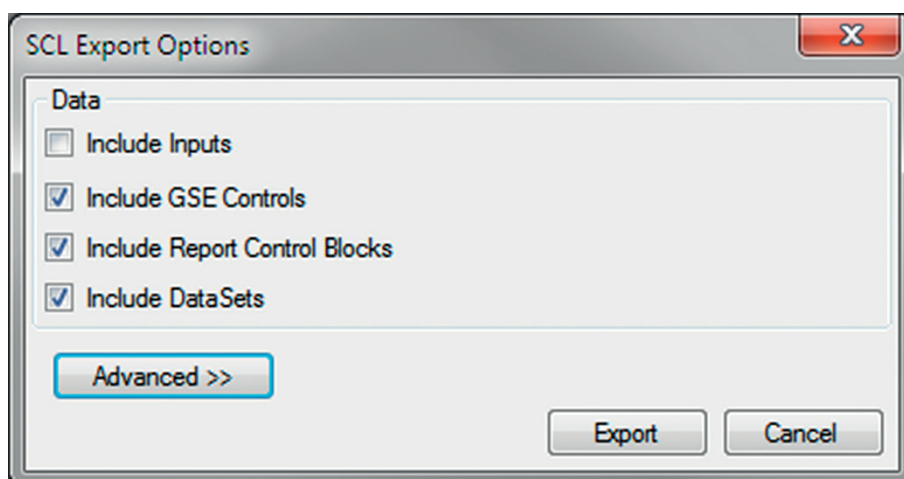


Figure 57: IEC 61850: export options for ICD files

6. Change the SCL file version by clicking the **Advanced** button, if required by the receiving configuration tool.

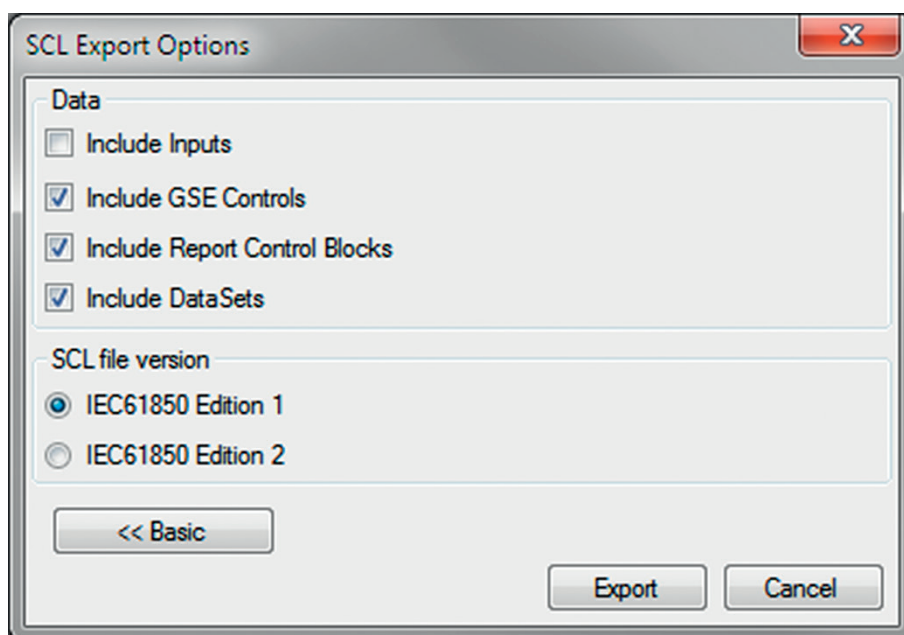


Figure 58: SCL export options

7. Click **Export**.

7.3.2

Engineering vertical and horizontal communication

For IEC 61850 engineering a separate system configuration tool is needed to be used with PCM600. In PCM600 Ver.2.4 the recommended tool is IET600, which is also included in the PCM600 Engineering Pro installation package. In PCM600 Ver.2.5 or

later the recommended tool for smaller projects is the IEC 61850 Configuration tool. For larger projects it is recommended to use IET600, which is available as a standalone tool.

1. Create a project in IET600. ^[1]
2. Import the SCD file created by PCM600. ^[1]
3. Conduct vertical communication engineering (monitoring direction).
 - 3.1. Check the default data sets.
 - 3.2. Configure and/or reconfigure the default data sets.



Data sets meant for vertical reporting can only contain data on the data object level, not on the data attribute level.



The data set for GOOSE can contain signals on the data attribute or data object level. Data object level GOOSE entries can only be received of the following CDC types: SPS, SPC, ACD, ACT, DPS, DPC, INC, INS, ENC and ENS.

- 3.3. Configure additional **Report Control Blocks** when needed for each data set used for vertical communication.
 - 3.4. Link the IED clients to the **Report Control Blocks**.



Up to five report clients can be configured.

4. Conduct horizontal communication engineering.
 - 4.1. Configure GOOSE control blocks for each data set configured for GOOSE messages.



One data can be included in the GOOSE data set only once.

- 4.2. Define the client IEDs for each GOOSE control block.
 - 4.3. Link the IEDs to the GOOSE control block that is to receive the GOOSE control block.
5. Export the updated SCD file. ^[1]



All data sets, **Report Control Blocks** and GOOSE control blocks must be located in LLN0.

[1] Applicable when using IET600

7.3.3 Importing SCL files to PCM600

The IED engineering tool must be able to receive an SCD file or an ICD file as an import to receive the engineered communication extensions, for example, for the different IEDs.

To be able to import an SCD file at station level, the option IED 61850 configuration engineering mode enabled has to be cleared in PCM600.

1. On the **Tools** menu, select **Options** and click **IEC 61850 Configuration**.
2. Clear the option **IED 61850 configuration engineering mode enabled** and click **OK**.

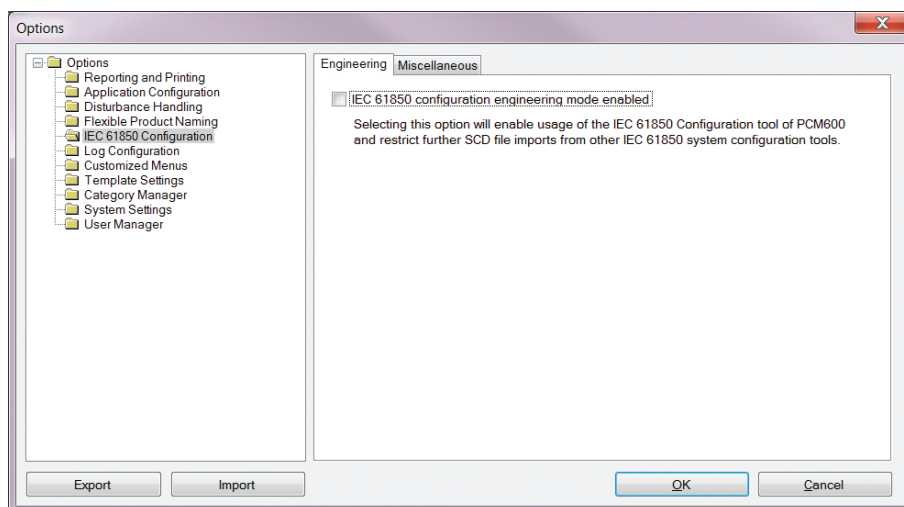


Figure 59: Enabling SCD file import at station level

If the IED 61850 configuration engineering mode is enabled, SCD files cannot be imported and an error message is shown.

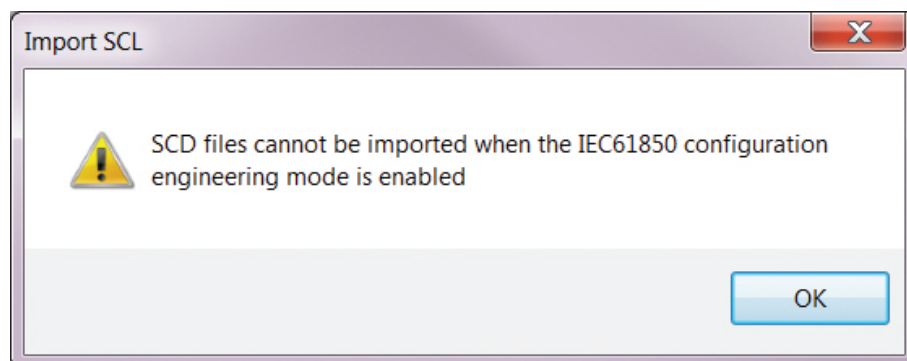


Figure 60: Error message when SCD files cannot be imported

7.3.3.1 Importing SCD files

To be able to import an SCD file at station level, the option IED 61850 configuration engineering mode enabled has to be cleared in PCM600.

1. Select the station in the **Plant Structure** view.
2. Right-click the station and select **Import**.
3. From the open standard Windows menu, select the file to be imported and start the reading.

The **SCL Import Options** dialog box opens, querying how the file should be handled during the import.

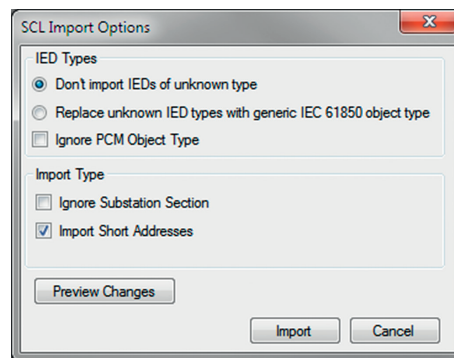


Figure 61: SCL Import Options

4. In the **SCL Import Options** dialog box, select how to handle the file during the import.
 - Click **Don't import IEDs of unknown type** to protect the existing IEDs in case the SCD file does not match the original configuration in PCM600.
 - Click **Replace unknown** if it is known that the file includes additional IEDs that are needed. The IED of type “Generic IEC 61850 IED” is used to integrate these kinds of IEDs into the plant structure, for example.
 - Click **Ignore PCM Object Type** to update the IED object(s) in PCM600 from the IED type(s) in the SCD file, whether or not the IED type(s) in the SCD file matches the IED object(s) in PCM600. This option can be used, for example, when third party IEDs are included in the system and the SCD file sends GOOSE messages to ABB IEDs included in the project.
 - Click **Ignore Substation Section** to not import the SSD file part of the SCD file.
5. Click **Import** when the file definition has been completed. A progress view displays the importing procedure.
6. Make connections from the sending IEDs to the receiving function blocks with the Signal Matrix tool.
Make connections between the signals that the server is sending and the function blocks on the receiver's side.
7. Write the configuration to the IED.
In the **Plant Structure** view, select the IED, right-click and select **Write to IED**.

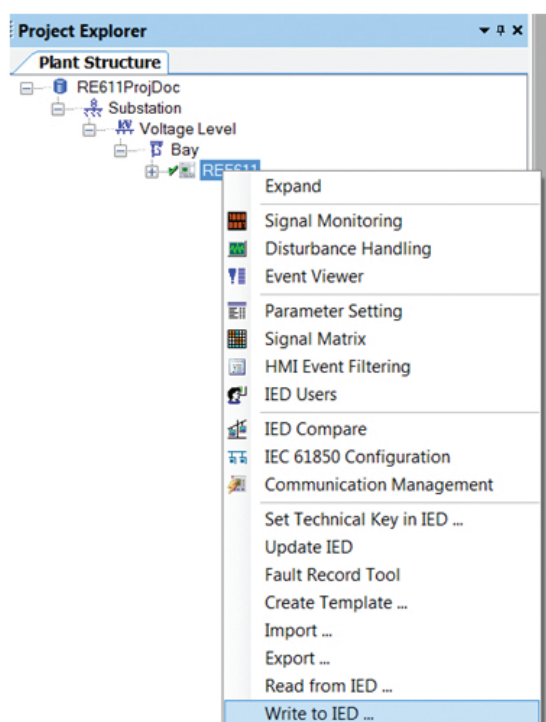


Figure 62: Common write menu



The engineered data is written to the IED when executing a common *Write to IED* operation.

7.3.3.2 Importing ICD or CID files

1. Select an existing IED to import IEC 61850 files.
2. From the **Files of type** list, select the file type of IEC 61850 to be imported (ICD or CID).
The **SCL Import Option** dialog box opens.
3. In the **SCL Import Option** dialog box, select how the file is to be handled during the import.

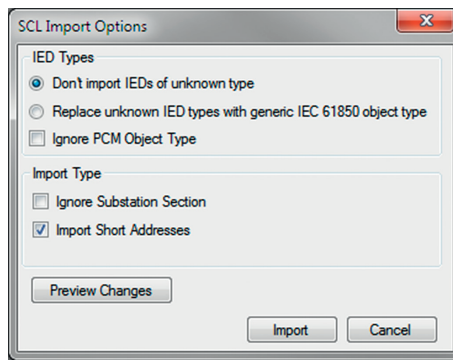


Figure 63: SCL Import Options

- **Don't import** protects the existing IEDs in case the SCD file does not match the original configuration in PCM600.
 - **Replace unknown** can be used when it is known that the file includes additional IEDs that are needed. The IED of type “Generic IEC 61850 IED” is used to integrate these kinds of IEDs into, for example, the plant structure.
 - **Ignore PCM Object Type** updates the IED object(s) in PCM600 from the IED type(s) in the SCD file, discarding whether or not the IED type(s) in the SCD file matches the IED object(s) in PM600.
 - **Ignore Substation Section** does not import the SSD file part of the SCD file.
4. Click **Import** when the definition has been completed.
A progress view displays the importing procedure.

7.3.4

Writing communication configuration to the IED

IEC 61850 communication depends on the proper communication configuration in all IEDs that communicate via IEC 61850.

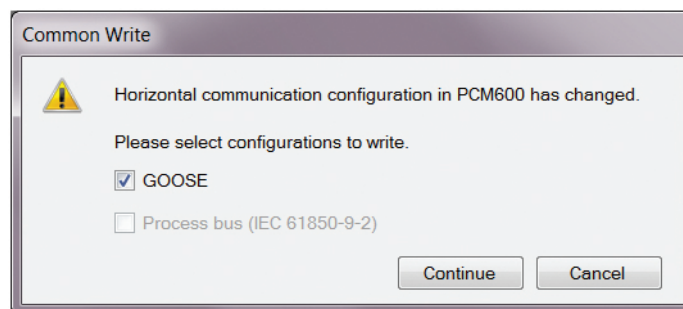


Figure 64: Updating the communication configuration in the IED with the configuration made in PCM600

It is possible to make a configuration change in one IED, without affecting the horizontal communication engineering between IEDs. When a changed configuration

is written to the protection relay, the horizontal communication configuration needs to be updated.

1. Select **GOOSE** to update the GOOSE configuration part in the IED.
2. Select whether or not to update the configuration.
 - Click **Continue** to update the selected communication configuration part(s) in the IED. The options can be left unselected. In this case, other parts of the configuration are updated.
 - Click **Cancel** to cancel the whole writing operation.

7.3.5

IEC 61850 version change while writing configuration to the IED

If there is a version mismatch of IEC 61850 edition 1 and 2 between the IED configuration and the PCM600 tool configuration while writing configuration to the IED, a dialog opens showing the version mismatch information.

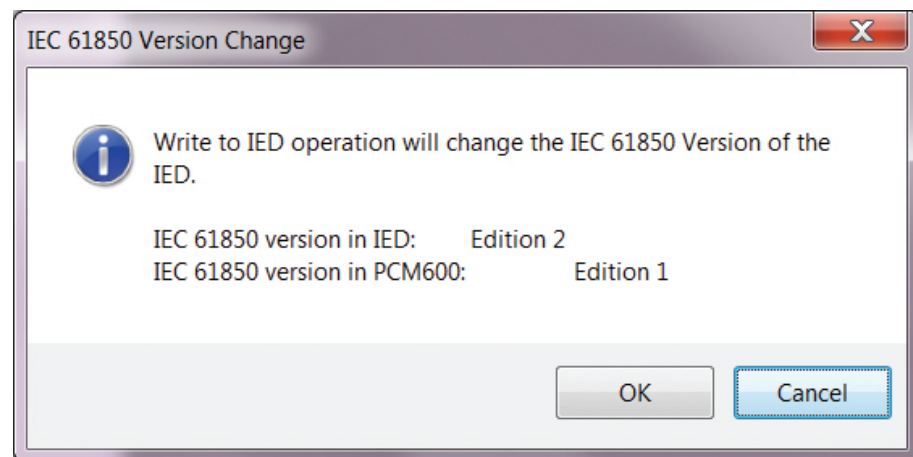


Figure 65: IEC 61850 version change

When making changes using PCM600 tools, for example Parameter Setting, the version mismatch information is only shown in the PCM600 output window.

Section 8 Configuration migration

8.1 Configuration migration workflow

IED Configuration Migration (ICM) migrates the configuration from an old relay product version into the latest product version with the corresponding functionality. The configuration migration is done by the Migrate Configuration functionality in PCM600. IED Configuration Migration retains the contents of an existing IED configuration and enables using it with the latest product version.

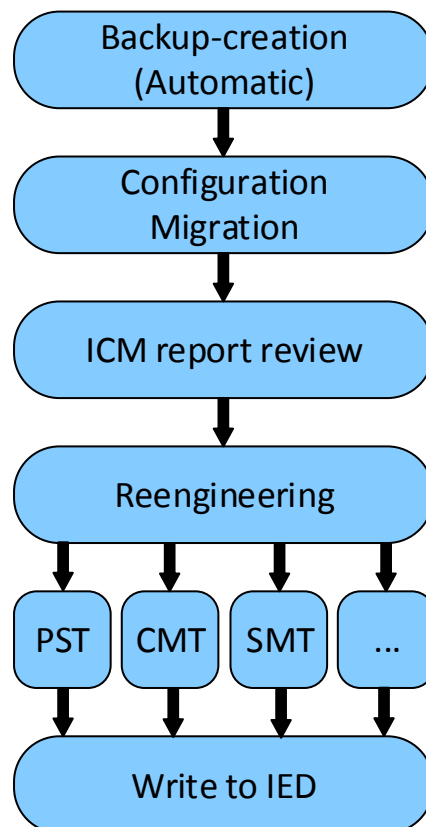


Figure 66: IED configuration migration workflow

The newer product versions and the function revisions have been designed to be backward compatible. No functionality is removed in newer function revisions apart from some exceptions.

8.2 Preconditions for configuration migration

The source IED configuration can be migrated to the target version using the latest versions of PCM600 and the connectivity package.

Manual reengineering may also be required as some interface changes can exist between the functions in different product versions.

The order code of the target IED must match the order code of the source IED. However, the language options and product version can differ.

Table 10: Versions supporting migration

PCM600 version	Connectivity package version	Source version	Target version
PCM600 2.7	Ver.2.0	Ver.1.0	Ver.2.0

8.3 Backup creation

While starting IED Configuration Migration, a backup is created automatically. The backup project is available in the PCMBBackup folder under PCMdatabases. The default location is C:\PCMdatabases\PCMBBackup.

8.4 Migrating the IED configuration

Ensure that the latest connectivity package is activated in PCM600 in **Help/Update Manager/Manage connectivity packages**. Restart PCM600 for the changes to take place in the active connectivity package.

1. Right-click the IED to be migrated and select **Migrate Configuration**.

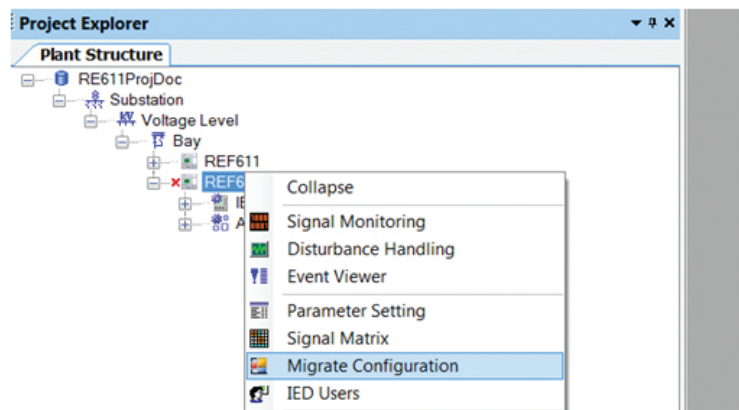


Figure 67: Selecting the IED to be migrated

2. Select the target version in the dialog box and click **Continue**.

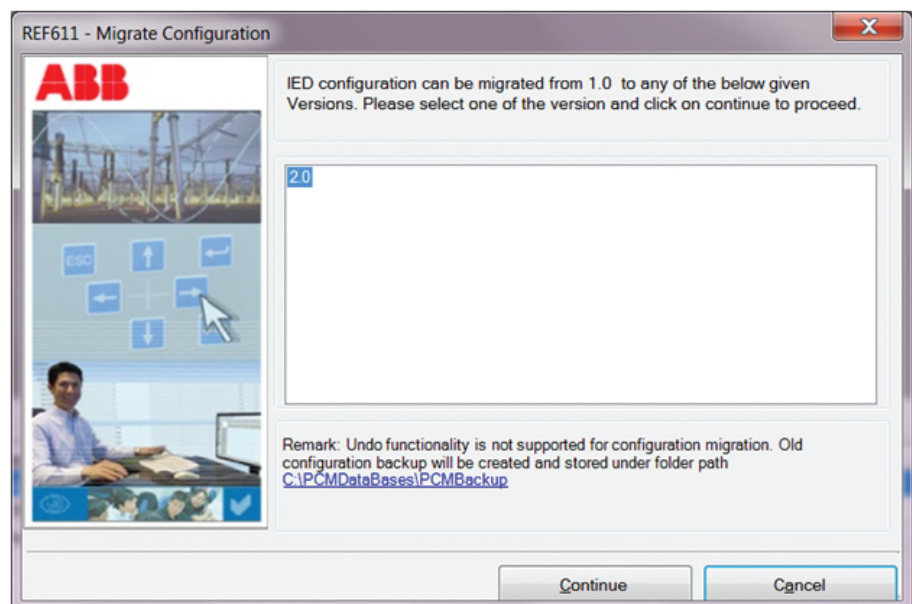


Figure 68: Target version selection

The Configuration Migration Details dialog box is displayed giving the summary of the migration process.

3. Click **Next** to start the migration process.
The migration takes a few minutes. The PCM600 output window contains valuable information from different parts of the migration, such as successfully imported parameter details and the location of the newly created template. The migration process also creates a report.
4. Wait until the migration process is completed.
5. Select the **Show IED Configuration Migration Report** check box to view, print or save the report and click **Finish**.
The report is useful later when updating the configuration.

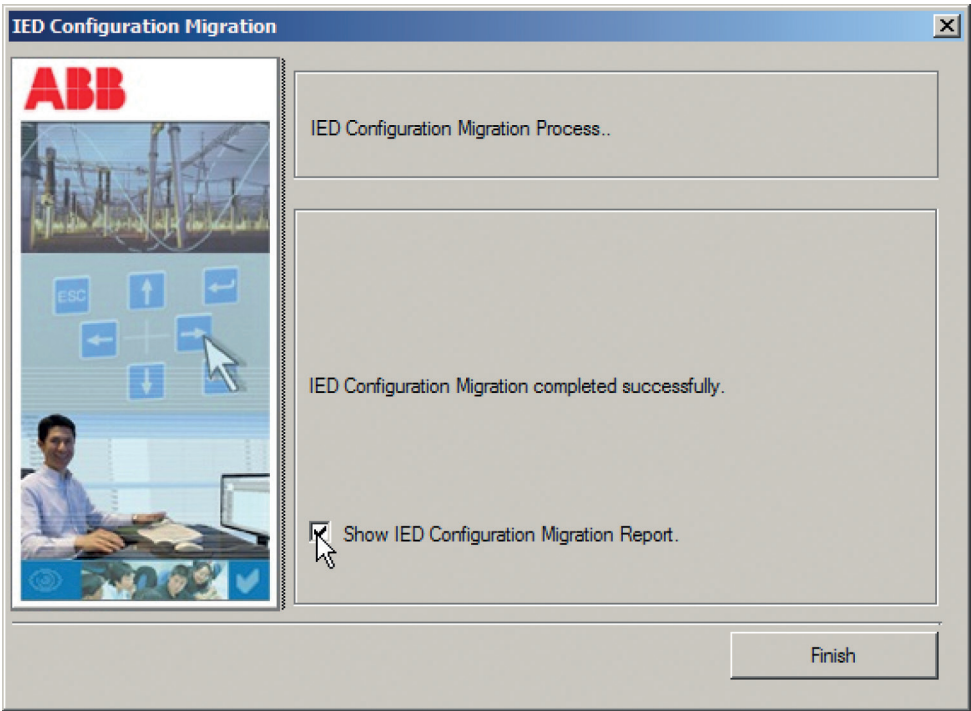


Figure 69: IED Configuration Migration window

REF611 - Reporting and Printing - Viewer

IED Configuration Migration Report

Worksheet Migration Summary for replaced/ recreated function blocks

Worksheet	Type	Name	What Happened?
MainApp	Function Blocks	CBXCBR1 (O: 707 T: 5 I: 1)	Function block is recreated as the Function block Version is updated.
		CCBRBRF1 (O: 627 T: 2.5 I: 1)	Function block is recreated as the Function block Version is updated.
		CMMXU1 (O: 85 T: 5 I: 1)	Function block is recreated as the Function block Version is updated.
		CSMSQI1 (O: 235 T: 5 I: 1)	Function block is recreated as the Function block Version is updated.
		DARREC1 (O: 431 T: 2.5 I: 1)	Function block is recreated as the Function block Version is updated.
		DEFHPDEF1 (O: 540 T: 5 I: 1)	Function block is recreated as the Function block Version is updated.

Figure 70: IED Configuration Migration Report pane in PCM600

While open, the migration report can be saved or printed from the PCM600 tool bar.

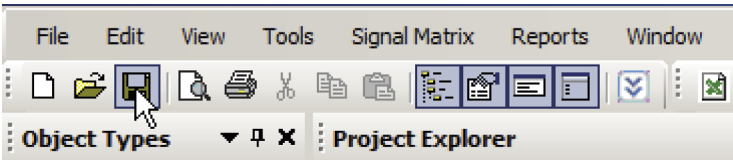


Figure 71: Saving and printing from the tool bar



Save the IED configuration migration report for later use as PCM600 does not save it automatically.

8.5 Reengineering the migrated configuration

8.5.1 Reengineering in the Parameter Setting tool

Review the configuration migration report and update the function parameters accordingly. Parameter values remain unchanged also for the functions not listed in the migration report, that is, the functions that have the same version in both the product versions.

- Set the parameter values again for all the needed functions.
 - All functions listed in **Obsolete Functions and Hardwares**.
 - All parameters for which the migration failed. See the migration report for failed parameters.



Note that some functions may have new settings.

8.5.2 Reengineering in the IEC 61850 Configuration tool

IEC 61850 data names have been changed in 2.0 compared to older product versions. ICM automatically updates the names according to the new version names. Migration report describes the details of the changes in dataset entries.



For the function block names in IEC 61850 Edition 1 and Edition 2, see [Table 9](#).

8.5.3 Reengineering in the Communication Management tool

8.5.3.1 Checking and updating Modbus points

If Modbus is used, the migrated Modbus point list should for most part correspond to the configuration made in the old IED.

1. Check the point list and verify that all the point types correspond to the old configuration and Modbus master.

- 0X – Readable coils
- 1X – Discrete inputs
- 3X – Input registers
- 4X - Readable holding registers
- Fault record data

If some points have different attributes, adjust them in the Communication Management tool.

2. Adjust possible missing points or changed point addresses in Modbus master configuration.

Section 9

Glossary

611 series	Series of numerical protection and control relays for low-end protection and supervision applications of utility substations, and industrial switchgear and equipment
ACT	1. Application Configuration tool in PCM600 2. Trip status in IEC 61850
ARP	Address Resolution Protocol
CID	Configured IED description
CMT	Communication Management tool in PCM600
COM600S	Substation Management Unit. An all-in-one communication gateway, automation platform and user interface solution for utility and industrial distribution substations.
COMTRADE	Common format for transient data exchange for power systems. Defined by the IEEE Standard.
Connectivity package	A collection of software and information related to a specific protection and control IED, providing system products and tools to connect and interact with the IED
CT	Current transformer
DA	Data attribute
DHCP	Dynamic Host Configuration Protocol
DHT	Disturbance Handling tool in PCM600
DO	Data object
EMC	Electromagnetic compatibility
Ethernet	A standard for connecting a family of frame-based computer networking technologies into a LAN
EVT	Event Viewer tool in PCM600
FTP	File transfer protocol
FTPS	FTP Secure
GDE	Graphical Display Editor in PCM600
GoCB	GOOSE control block
GOOSE	Generic Object-Oriented Substation Event
HMI	Human-machine interface
HSR	High-availability seamless redundancy

HTTPS	Hypertext Transfer Protocol Secure
ICD	IED capability description
ICM	IED configuration migration
IEC	International Electrotechnical Commission
IEC 61850	International standard for substation communication and modeling
IED	Intelligent electronic device
IET600	Integrated Engineering Toolbox
IID	Instantiated IED description
Instance	Identical protection function blocks available in a standard configuration. By setting the application-specific parameters of an instance, a protection function stage can be established.
IP	Internet protocol
IP address	A set of four numbers between 0 and 255, separated by periods. Each server connected to the Internet is assigned a unique IP address that specifies the location for the TCP/IP protocol.
LAN	Local area network
LED	Light-emitting diode
LHMI	Local human-machine interface
LN	Logical node
MAC	Media access control
Modbus	A serial communication protocol developed by the Modicon company in 1979. Originally used for communication in PLCs and RTU devices.
MON	Signal Monitoring tool in PCM600
NCC	Network control center
PC	1. Personal computer 2. Polycarbonate
PCM600	Protection and Control IED Manager
PRP	Parallel redundancy protocol
PST	Parameter Setting tool in PCM600
REB611	Busbar and multipurpose differential protection and control relay
REF611	Feeder protection and control relay
REM611	Motor protection and control relay

REU611	Voltage protection and control relay
SAB600	Substation automation builder tool
SCD	Substation configuration description
SCL	XML-based substation description configuration language defined by IEC 61850
SMT	Signal Matrix tool in PCM600
SNTP	Simple Network Time Protocol
Subnet mask	A set of four numbers used to create IP address numbers that are used only within a particular network, subnet
TCP	Transmission Control Protocol
UDP	User datagram protocol
VPN	Virtual Private Network
VT	Voltage transformer
WAN	Wide area network
WHMI	Web human-machine interface
XRIO	eXtended Relay Interface by OMICRON



ABB Distribution Solutions
Distribution Automation

P.O. Box 699

FI-65101 VAASA, Finland

Phone +358 10 22 11

www.abb.com/mediumvoltage

www.abb.com/relion