Protection and Control IED Manager PCM600

Operation Manual





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1 Introduction

This chapter introduces concepts and conventions used in this manual.

1.1 This manual

The operation manual contains instructions on how to use the software.

1.2 Intended audience

This manual addresses the operator, who operates the software on a daily basis.

1.3 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.

Operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to information or property loss. Therefore, comply fully with all notices.

1.4 Document conventions

The online help includes three different tabbed pages: **Contents**, **Index** and **Search**.

The **Contents** tab shows the structure of the online help. Expand or collapse the subentries, to find a certain topic.

The **Index** tab shows index words that help find information easily. Double-click an index word to display the topic related to the word. If there is more than one related topic, the online help shows the **Topics Found** dialog from which to select the right topic.

Use also the single word search on the **Search** tab to find information. Type the word or words in the search box and press ENTER or click **List Topics**. The online help lists the topics related to the search. Double-click the right topic to see the content.

The cross-references used in the text include links to other topics for related information.

2 Using the PCM600 tool

This chapter introduces the main functionalities of PCM600.

2.1 General PCM600 functions

This section describes general PCM600 functions.

2.1.1 Using PCM600 command line interface

PCM600 provides a command line interface (CLI) where certain operations can be performed without opening PCM600. Use the -- help option as below to see its full functionality:

1. In Windows, click **Start**, type **cmd** and select **Command Prompt**.
2. Navigate to a directory where PCM600 has been installed.
   For PCM600 Ver. 2.13, the path is `\Program Files (x86)\ABB\PCM600_213\bin`.
3. Type **PCM600Cmd --help**.

2.1.2 Starting PCM600

1. Select **Start** > **Programs** > **ABB** > **PCM600** > **PCM600**, to open the startup window.
2. Start a new or an existing project from the **File** menu. For creating new project, refer to *Chapter 2.3.3 Creating projects*.
3. Select **View** menu to choose the outlook, see *Chapter 2.1.7 Customizing desktop*.

When PCM600 is started for the first time, the default user categories and System Engineer account are created.

2.1.3 Logging in to PCM600

The **Login** dialog is displayed at the PCM600 startup if the PCM600 authentication is enabled and in use. If the Windows authentication is in use or the PCM600 authentication is disabled, the **Login** dialog is not displayed.

1. Type the user name and password to the **Login** dialog.

2. Click **Login** to proceed or **Exit** to cancel.

   After logging off, the **Login** dialog is shown again. Logging in again is possible by typing the user name and password in the **Login** dialog.

3. To log off, refer to *Chapter 2.1.4 Logging off PCM600*. If PCM600 is started for the first time, the **Login** dialog is not shown, because the user authentication is disabled by default.



When the user authentication is disabled, no login is performed and full user rights are given.

2.1.4 Logging off PCM600

The logoff function enables changing the user without closing PCM600.

1. Select **File** > **Logoff** to open the login dialog.
2. Type a new user name and password and click **Login** to log in again.

All the active tools are closed when logging off, but the project remains open. See also *Chapter 2.1.6 Exiting PCM600*.

2.1.5 Opening help

PCM600 contains online help to support normal use of the product.

Pressing F1 opens an instructive help on an active context, for example, to get information about activating the user authentication. Select **Tools** > **Options** > **System Settings** first and then select the **Use Authentication** check box and press F1 to open the help description of the selected parameter.

You can also open the online help by selecting **Help** > **Contents** to search helpful information when working with the tool. For the instruction on how to use the online help, refer to *Chapter 1.4 Document conventions*.

In some dialogs, there is a **Help** button. Click **Help** to see the context specific help.

2.1.6 Exiting PCM600

Exiting PCM600 closes the active project, all the opened tool components and logs the user off. Scheduling services may still keep running without visible PCM600. To exit PCM600 select **File** > **Exit**. If you only want to log off, see *Chapter 2.1.4 Logging off PCM600*.

2.1.7 Customizing desktop

- Select the appropriate command from the **View** menu.
  - **Project Explorer** opens the **Project Explorer** window.
  - **Object Properties** opens the **Object Properties** window.
  - **Output** opens the **Output** window.
  - **Object Types** opens the **Object Types** window.

2.1.8 Using Project Explorer

In Project Explorer, the Plant Structure tab can be used for navigating within the project structure. Plant Structure contains all the IEDs in the project. All the configuration work, such as application configuration, can be started via this structure by means of the respective tools.

2.1.9 Opening documentation

The available documentation for the devices shown in the object tree can be viewed, if the object type supports this feature.

1. Right-click the specific object in the **Project Explorer** window.
2. Select **Documentation** from the shortcut menu and select the appropriate manual to view.

2.1.10 Starting tool components

1. Select a specific object in the object tree of the **Project Explorer** window.
2. On the **Tools** menu, click the tool component.



A tool component can also be started from the shortcut menu of the object in the **Project Explorer** window.

Some tool components are also started during the startup. If the tool component has a visible user interface, it is displayed between the **Project Explorer** window and **Object Properties** window by default.

PCM600 contains many tool components depending on the installation. Some of the tool components are included in the basic installation and some of the tool components are available when ordered. The installed tool components are listed below.

- Scheduler
- SCL Import/Export
- Signal Matrix
- Graphical Display Editor
- Disturbance Handling
- Parameter Setting
- Signal Monitoring
- Event Viewer
- Reporting

2.1.11 Viewing installation information

1. On the **Help** menu, select **About PCM600**.
   The dialog shows the installed connectivity packages, language packages, hotfixes and their versions.
2. Click **Copy Info** to copy all the installation information of the computer.
   The information is copied on the clipboard. Paste the information, for example, to Notepad for viewing and analysing.

2.2 Update Manager

Update Manager notifies about all new available updates, provides updates based on the current machine configuration, installs and uninstalls updates based on user selection and also manages connectivity packages.

Update Manager operates in two modes, basic and advanced.

- In the **Basic** mode, the user selects the IED variants to download and installs the latest available IED connectivity packages.
- In the **Advanced** mode, the user selects the IED variants, the latest available IED connectivity packages and the IED versions to download, install and uninstall.



When opening Update Manager for the first time, a welcome screen is presented for customizing settings.

2.2.1 Starting Update Manager

Start Update Manager in one of the alternative ways.

- Double-click the **Update Manager** shortcut from desktop.
- Select **Start** > **All Programs** > **ABB** > **Update Manager** and click **Update Manager**.
- Open PCM600\SAB600\CET and, on the **Help** menu, select **Update Manager** from the list.

2.2.2 Home

The **Home** option shows information about the latest updates available in the update server and also the version of the installed Update Manager. Information about the latest releases is provided.

2.2.3 Downloading and installing software updates

The **Software Updates** option shows all the latest updates available in the update server based on the current machine configuration.

1. In Update Manager, select **Software Updates** in the tree view.

2. Select the check boxes provided under each node and click the **Download and Install** drop-down button or select **Download** from the drop-down list to only download the installation packages for later installation.

   This view also provides the count of the number of the installation packages to be installed in the machine.



- A user with no administrator rights only has the option **Download** available, which is provided as a button. The **Download and Install** option is not available.
- The current machine configuration is decided based on PCM600, connectivity package, and language add-ons installed in the machine.
- The displayed count includes language add-ons, documentation, connectivity packages and IED modules which may be hidden in **Basic view**.
- Downloading is not possible if the user has already installed updates. In this case, the path given in the **Setting** tab can be used to see the downloaded files.

2.2.4 Downloading and installing software package updates

The **Get Software Packages** option shows in a tree view all the IED series along with the latest connectivity packages and IED modules updates available at the update server based on the current machine configuration.

1. In Update Manager, select **Get Software Packages** in the tree view.
2. Select the check boxes under each node and click **Download and Install** or select **Download** in the drop-down list to only download the installation packages for later installation.

   This view also provides the count of the number of installation packages to be installed in the machine.



- A user with no administrator rights only has the option **Download** available, which is provided as a button. The **Download and Install** option is not available.
- The current machine configuration is decided based on PCM600, connectivity package and language add-ons installed in the machine.
- The displayed count includes language add-ons, documentation, connectivity package and IED modules which may be hidden in **Basic View**.
- Downloading is not possible if the user has already installed a package. In this case, the path given in the **Setting** tab can be used to see the downloaded files.

2.2.5 Exporting software packages

The **Export Software Packages** option shows all the available PCM600 and SAB600 add-ons and hot fixes and connectivity packages based on the current machine configuration.

1. In Update Manager, click **Export Software Packages** in the left navigation bar.
2. Select the check boxes provided under each node.
   - If Update manager is online, click **Download and Export**.
   - Otherwise click **Export**.

   This view shows the number of software packages to be exported.
3. Enter the export location in the **Export** dialog, and browse to or copy the desired location.
4. Click **Export** to export the selected packages to a specified location. If no packages are available in the machine, packages are first downloaded and then exported.

   A “Successfully Exported” message appears after a successful export.
5. Click **Close**.



If Update Manager is offline, then the already downloaded items are exported.

2.2.5.1 Installing software packages from exported location

1. In Update Manager, click **Settings** in the left navigation bar.
2. Select **Other source** and specify the location to import from.
3. Click **Software Updates** to install software updates, or click **Get Connectivity Packages** to install connectivity packages.



To install from a selected offline source on the **Settings** menu, click **Install**.

To import into this machine and then install, click **Import and Install**.

2.2.6 Managing connectivity packages

Manage Connectivity Packages shows all, for example PCM600 and SAB600, versions installed in the machine along with the installed connectivity packages for a particular IED and variant. If there are multiple connectivity packages installed for an IED series supported by a specific PCM600 version, the specific PCM600 versions are summarized. To view an individual connectivity package version, the tree node can be expanded.

The active connectivity package version can be changed to any available version.

1. Select the required version from the respective box.
2. Click **Restore To Previous** to reset the active version changes to the previous state.

Compatibility column shows whether the connectivity package is compatible with 64-bit or 32-bit version (PCM600 or SAB600).

By default, Update Manager sets the best suitable connectivity package version to work with PCM600, SAB600 and Communication Engineering.

Restart PCM600, SAB600 and Communication Engineering after enabling or disabling connectivity packages for the changes to take effect.

2.2.7 Uninstalling and deleting software packages

The **Remove software packages** option shows in a tree view all the installed IED series along with the connectivity package, IED modules and add-ons. This option provides the possibility to uninstall and delete software packages.

1. In Update Manager, select **Remove software packages** in the tree view.
2. Select the check boxes under each node and click **Uninstall and Delete** or select **Uninstall** in the drop-down list to only uninstall the installed packages.

   Only users with administrator rights have the option to uninstall software packages.

2.2.8 Changing Update Manager settings

The **Settings** option shows the existing Update Manager configuration which can be changed. Setting changes are saved when switching to a different page in the tree view or when Update Manager is closed.

1. On the **General** tab, under **View mode** select the **Basic** or **Advanced** mode. The advanced view displays the IED hardware version and IED modules of each IED variant. This view also allows to uninstall and delete software packages.
2. On the **Folder** tab, define data folders.
   a) Click **Browse** under **Store downloaded files** in to select the location for the installation packages.

      Select **Delete downloaded files after installation** to automatically delete the installer from the download file location after successful installation.

   b) Click **Browse** under **Store log files in** to select the location for the logs.

      Clicking **Browse** opens the folder browsing dialog and **Open folder** opens the folder contents in a new window. This option is available for the location of both the downloaded files and the log files.

3. On the **Add-ons** tab, define the settings for the add-ons installed with the connectivity packages.
   - From **Language add-ons**, select in which language the add-on packages are to be downloaded and installed from the update server.
   - From **IED documentation**, select the documentation variant to be installed.

- From **Preconfiguration**, select the variant of the preconfiguration files available for an IED to be downloaded.
- Select the option **MainApplication template** if the main application template files available for an IED are to be downloaded.

4. On the **Data source** tab, define the source of updates.
   - In the **Address** field, type the server address for downloading or installing updates from an online update server.
   - Click **Set To Default** to reset the address to default.
5. Define proxy settings.
   - Select **No proxy** if the connection to the online server does not require any proxy.
   - Click **Detect settings automatically** to automatically detect proxy settings.
   - Click **Specify settings manually** to set the proxy manually and enter the proxy address and port in the Address and Port fields.
6. Select **Other source** to install updates from offline sources in one of the alternative ways.
   - Type the source location in the **Directory path** field.
   - Click **Browse** and select an offline source location.



Clicking **Browse** opens the folder browsing dialog and **Open folder** opens the folder contents in a new window.



Click **Restore to Previous** to discard the changed settings.

2.2.9 Failure report

A failure report is shown in a grid view when the download or installation of a package fails. The report consists of installation package file name, status indicating the probable reason for failure and full path name to the installation package.

2.2.10 Troubleshooting update failures

Check the listed issues when updates from the update manager fail and the error message is shown: "`Content file download failed. Reason: The server does not support the necessary HTTP protocol. Background Intelligent Transfer Service (BITS) requires that the server support the Range protocol header.`"

- Check that the proxy server environment supports the HTTP 1.1 range request feature.
- Check that the **Enable HTTP Byte-Range request with Gateway AV** setting is enabled when a SonicWALL firewall device is used.

2.2.11 Prerequisites for installing updates offline

Update Manager can install updates from an offline source, such as local or removable disk or network, when certain prerequisites are met.

- Maintain the folder structure created by Update Manager in the **Location for download files** structure in offline source folder. The folder structure is self-explanatory. Updates can be copied selectively to the offline folder keeping the folder structure intact.
- The offline source folder should contain a certification file certificate.cer and the **Update Files** folder with all XML files at root level, for example, C:\ProgramData\ABB\UpdateManager\Downloads.
- It is recommended that clients use **Map Network Drive** to map the shared folder, if remote file sharing is used to share updates. When the map drive is created, enter it in the Update Manager settings under **Other source** > **Directory path**.

2.3 Project management functions

This section describes all the project management functions.

2.3.1 Starting project management

1. Start project management.
   - On the **File** menu, click **Open/Manage Projects**.
   - Click **Open/Manage Projects** on the toolbar.

   The **Open/Manage Projects** dialog box lists the available projects and provides the functionality to manage them. Projects can be opened, cloned, deleted, created, exported, imported and backed up.

   Project list can be sorted by clicking the column header and filtered by typing in the search field. Select **Show projects used with other product versions** to show also projects used with older and newer versions of PCM600.

   Mark projects as favorites by right-clicking and selecting **Add to favorites**. Favorite projects are marked with a star and are always kept on top of the project list. Remove projects from favorites by right-clicking and selecting **Remove from favorites**.
2. Right-click the project to see all actions available for the project.

2.3.2 Showing project information

1. Open the project management dialog.
2. Select the project from the project list.

3. Click **Show Project Information** to display information on the Connectivity Packages required by the selected project.

   Projects made with earlier product versions may not have complete version information available.

   The displayed information can be copied to the clipboard by clicking the **Copy Information to Clipboard** button.

2.3.3 Creating projects

1. Open the project management dialog.
2. Click **New** to create a new project.
3. Enter name of the project to be created.
4. Enter description for the new project (optional).

2.3.4 Opening projects

1. Open the project management dialog.
2. Select the project from the project list.
3. Click **Open** or select **Open** from the context menu.

   If any of the required Connectivity Packages is missing when the project is opened, PCM600 asks if the missing components should be installed. The project can be opened even if the connectivity package is missing, but then the related IED types are not available in PCM600.

2.3.5 Closing projects

To close an existing project select **File** > **Close Project** from the menu bar and all the running tool components close. PCM600 disconnects the project database and the project related windows.

2.3.6 Cloning projects

1. Open the project management dialog.
2. Select the project from project list.
3. Copy the project by using the keyboard shortcut **CTRL+C** or by selecting **Clone** from the context menu.

Cloning makes a full independent copy of the source project.



Transferring of projects between two computers must be done by importing and exporting projects. For more information on importing and exporting projects, see *Chapter 2.3.10 Importing projects* and *Chapter 2.3.9 Exporting projects*.

2.3.7 Renaming projects

1. Open the project management dialog.
2. Select the project from the project list.
3. Press **F2** or select **Rename** from the context menu.
4. Enter new name for the project.

2.3.8 Deleting projects

The deletion of a project deletes all project related data.

1. Open the project management dialog.
2. Select the project from the project list.
3. Click **Delete** or select **Delete** from the context menu.
4. Confirm the deleting by clicking **Yes**.

2.3.9 Exporting projects

Exporting a project enables you to transfer a project between different computers as a single file. The supported file formats are APCMP and APCMA.

APCMP is the default format suitable for common use. APCMA/PCMA is an archiving format which should be used if the export file is stored for a long time. It is an SQL Server version independent format which can always be imported directly to the latest PCM600 version. As exporting and importing an APCMA/ PCMA file takes longer, APCMP is a better format for normal use.

The project file will be signed so that integrity of the file can be verified when importing it. If the project file is imported by other user or to another computer, then the certificate used for exporting must be imported to the computer where project is imported to. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.



Old APCMP/PCMP files can be imported to the latest product version but in some cases the files must first be opened in an older product version to create an intermediate conversion. For example, a PCMP file created with PCM600 Ver.1.5 must be opened once in any PCM600 version between 2.0 and 2.7 before it can be opened in PCM600 Ver.2.8 or later.

1. Open the project management dialog.
2. Select the project from the project list.
3. Click **Export** or select **Export** from the context menu.
4. Choose the certificate to use for signing the file.
5. Choose file location, type and name.

2.3.10 Importing projects

Importing a project enables you to use a project file exported on the same or different computer.

Projects exported from previous product versions can be imported to a newer PCM600 version.

1. Open the project management dialog.
2. Click **Import**.
3. Choose the file to be imported (supported file types are APCMP/PCMP and APCMA/APCMA).
4. Choose name for the project to import.

If the project has been created with an earlier product version, it appears in project list only if **Show projects used with other product versions** has been selected, and it needs to be converted before it can be opened.



PCM600 checks the integrity of the project files during import. If the file was signed with a certificate that does not exist in the computer's certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the project file.

There can be several reasons why the integrity check fails:

- The file has been created with PCM600 version which does not sign the exported files
- The computer's certificate store does not contain the certificate needed to do the verification
- The verification itself fails

All the listed reasons above mean that integrity of the file could not be verified, and it is possible that someone has tampered with the file. If the integrity can't be checked or the verification fails, it is still possible to proceed with import.

For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

2.3.11 Converting projects

If a project has been created with a previous version of PCM600, the project conversion wizard opens when the project is opened. After the project has been converted, it can be used with the current version of PCM600.

1. Open the project management dialog.
2. Select **Show projects used with other product versions**.
3. Select the project to convert from the project list.
4. Click **Open** or select **Open** from the context menu.

When the project conversion wizard is open, follow the instructions and click **Next**. After reviewing the summary, click **Next** to proceed the conversion. During the conversion, the upper progress bar shows the total progress, and the lower progress bar shows the progress of the current phase. Finish the conversion and close the dialog by clicking **Finish**.

The project cannot be converted if any of the required connectivity packages is missing.

2.3.12 Backing up projects

1. Open the project management dialog.
2. Click **Backup** and select **Backup now**.
3. Click the check boxes in front of the project names to select the projects to be backed up.
4. Click **Backup Selected**.
5. Select folder where to store the backup files and click **OK**.

   Projects are backed up to the target folder as individual files named as [project name].apcmp.
6. Choose the certificate to use for signing the file.

The project files will be signed so that integrity of the projects can be verified when importing them. If the project files are imported by other user or to another computer, then the certificate used for exporting must be imported to the computer where projects are imported to. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

2.3.13 Scheduling project backups

1. Open the project management dialog.
2. Click **Backup** and select **Schedule backup**.
3. Click the check boxes in front of the project names to select them for creating scheduled backups.
4. Set **Settings**.
   - **Read project data**. The data is read from online IEDs while backing up project.

     If authentication is enabled in IEDs, the user name and password may need to be given several times for each IED while the backup is ongoing.
   - **Number of backup files retained**. Sets the maximum number of backup files retained for each project. If there are already as many backup files for the project as defined in this field, the oldest backup file is removed while creating a new one.
5. Set **Recurrence pattern**.
   - **Daily**. Define the time for backup start.
   - **Weekly**. Define the time and weekday for backup start.
   - **Monthly**. Define the time and day for backup start.

     Not every month has 31 days. In these cases the last day of month is the backup day, if day 31 has been selected as the monthly backup day.

6. Click **OK**.

   Selected projects are backed up at a specified time to location PCMDataBasesABB\Scheduled Project Backups\[project name] as individual files named as [project name]_[date]_[time].apcmp.

   If a project is open when scheduled backup starts, the backup is skipped. All open dialogs should be closed when the scheduled backup starts, otherwise the project backup may fail.

The project files will be signed so that integrity of the projects can be verified when importing them. If the project files are imported by other user or to another computer, then the certificate used for exporting must be imported to the computer where the projects are imported to. The backed-up project files are signed with the default certificate. For more information on integrity certificates, see *Chapter 2.3.13 Scheduling project backups*.

2.4 System configuration functions

This section describes the general system configuration functions and user rights.

After making changes to the user rights, restart the PCM600 for taking the new settings in to use.

2.4.1 Session management

Session management includes the following:

- Online/Offline mode
  - The Offline option terminates all currently open connections between PCM600 and any IEDs and prevents all new connections from being made.
  - The Online option allows PCM600 to communicate with IEDs.
- Communication security indication
  - After an IED has been selected in the Plant Structure, a lock icon in the bottom left corner of PCM600 indicates whether the communication between PCM600 and that IED is secure.
- Logged in user
  - After an IED has been selected in the Plant Structure, the logged in user's user name is displayed in the bottom left corner of PCM600.
- Credential storage
  - Any entered credentials are placed in storage for the remainder of the session time and automatically re-entered, if a login dialog should be shown. If the stored credentials do not work for some reason, the login dialog is shown and the credentials have to be entered manually. Stored credentials are disposed when the session ends.

Session timeout (default 20 minutes) can be set via **Tools** > **Options** > **Security Settings**. Session management can be completely disabled by editing `Config.xml`.

2.4.2 Security settings

The security settings cover authentication, security level, export file certificate management and the communication between PCM600 and the IED.

2.4.2.1 Activating user authentication

The system engineer can enable or disable the user authentication. When the user authentication is disabled, all the users get full rights to operate. The login function also works according to this function. For more information on the login functions, see *Chapter 2.1.3 Logging in to PCM600*.

1. On the menu bar, click **Tools** and select **Options**.
2. Click **Security Settings** and select the **General** tab.
3. Under **Authentication**, select the appropriate option.
   - **Disabled** means that user authentication is disabled.
   - **Windows** authentication compares the account name of the current Windows user to the Windows account names specified for users in PCM600 User Manager. If **Windows** authentication is enabled and the current Windows user account has not been linked to any PCM600 user account, the user name and password must be entered to log in to PCM600.



When entering Windows account names in PCM600 User Manager, the account name must contain both a domain and a user name. The account names are entered in the Windows Account field, for example, mydomain\john.

Multiple account names can be specified in the Windows Account field for a single PCM600 user, but they must be separated with semicolon, for example, mydomain\john;anotherdomain\john.



If the Administrator password has not been set before, it must be set when activating user authentication.

2.4.2.2 Selecting security level

PCM600 security mechanism assures that PCM600 uses only such software components that are published by a trustworthy source.

1. On the menu bar, click **Tools** and select **Options**.
2. Click **Security Settings** and select the **General** tab.
3. Under **Security Level**, select the appropriate option.
   - **High** means that PCM600 verifies every binary file before it is loaded. If PCM600 finds any file that is not signed with a valid ABB certificate, a security alert is displayed when trying to start PCM600. PCM600 can be used only after the reported security issue is fixed. Choose this option, if possible.
   - **Medium** performs the same validations as the High option, but connectivity packages that are not digitally signed can be temporarily accepted. However, the recommendation is to update them to the latest versions. If older

connectivity package versions have to be used, ensure that they are retrieved from a trustworthy location.

- **Low** means that PCM600 does not perform any security check for the binary files. If this option is chosen, ensure that the workstation is cyber secure.

2.4.2.3 Defining communication between PCM600 and IED

1. On the menu bar, click **Tools** and select **Options**.
2. Click **Security Settings** and select the **General** tab.
3. Under **Session timeout**, define the session timeout in minutes.

   The session timeout is 20 minutes by default.
4. Define whether PCM600 accepts certificates automatically.

   If **Always trust IED security certificates** is selected, PCM600 trusts all security certificates presented by IEDs. PCM600 also copies certificates to its session certificate store without displaying any security warning. This feature can be activated, for example, when using the Scheduler Service.

   This option should be enabled only when the connection to IEDs is secured.
5. Select **Export Authority Certification Key with APCMI/APCMT/ APCMP/APCMA file** if you want Authority Certification Keys to be included in exported APCMI/ APCMT/APCMP/APCMA files.

2.4.2.4 Defining login banner

If the authentication mode is enabled in PCM600 under Security Settings, a banner warning window can be defined to open before login to PCM600. The user must agree to the warning to be able to access PCM600. A user with admin rights can define the banner text.

1. On the menu bar, click **Tools** and select **Options**.
2. Click **Security Settings** and select the **Login Banner Settings** tab.

   The **Show login banner** check box and the **PCM600 login banner text** field are enabled if the authentication mode is enabled in PCM600.
3. To display a banner text before login to PCM600, select the **Show login banner** check box.
4. In the **PCM600 login banner text** field, define the banner warning message.

   The PCM600 banner text can be exported or imported by clicking **Options** and then selecting **Export** or **Import**.

2.4.2.5 Managing export file certificates

Certificates are used to verify the integrity of the exported project backup, IED and tool template files. Certificate private key is used to sign the file when it is exported. Certificate public key is used to verify the integrity of the file when it is being imported.

Certificates used for integrity and authenticity of exported files are managed in **Export file integrity certificates** tab in Security Settings of PCM600.

1. On the menu bar, click **Tools** and select **Options**.
2. Click **Security Settings** and select the **Export file integrity certificates** tab.

The list shows the certificates for current PCM600 user. A default certificate with Windows username and machine name is created when PCM600 is started for the first time. Certificates can be created, deleted, imported and exported.

The **Supports export** column indicates if the certificate can be used only when importing files, or both when importing and exporting. Certificate can be used for exporting if certificate contains the private key.

Default certificate can be set to specify which certificate is used by default when files are being exported. In most situations, the user is asked to choose the certificate to use for signing before export is done. The default certificate is used, for example, in command line export operations.

Certificate always supports also exporting when it is created in PCM600. When certificate is exported, it is possible to export only public key or also private key. As private key is the secret used to sign the exported file, share it only with such users who need to export files with same certificate. If the other user needs only to be able verify the file during import, then exporting only public key is enough.

When importing a certificate, the details of the certificate can be verified to ensure origin of it. Import certificates only from trusted sources. The certificates created in PCM600 are self-signed, which means that the certificate chain can't be verified.

The certificates are stored in user specific store in Windows certificate store. Certificates can be installed also manually using Windows (Manage user certificates). The backup file related certificates will be stored in `PCM600 Default Backup Certificate` and `PCM600 Backup CertificateStore\Certificates` folder. "Friendly Name" property of the certificate should contain the name which is shown in PCM600.

When importing a backup file (APCMP, APCMA, APCMI), or when creating IED from an IED template or importing tool template file, you need to have the respective certificate installed or available as file, to make integrity check possible. If the needed certificate is not found, or verification fails for other reasons, it is possible to proceed with the import when Security Level setting is Medium or Low. If the user chooses to proceed anyway, the integrity and origin of the file can't be guaranteed. If Security Setting is set to High, import is not possible.

2.4.3 Starting user management

You can view the current user management functions in the **Options** dialog by selecting **Tools** > **Options**.

With the user management options you can decide the permissions a certain user has. If the user does not have permission for certain operations, these operations will either be shown and disabled, or simply removed all together.

2.4.4 Creating user categories

The user management is based on the users and the user categories. The users have a user account for PCM600. Each user account is mapped to one user category, which defines the permission to access certain functions. There are three default user categories.

- System Engineer acts as an administrator for the system and has full rights to perform any function and can define the user accounts.
- Operator can perform certain simple tasks and has read-only access to certain functionality of PCM600.
- Application Engineer can access most of the functions and has read and write access to the IED engineering functionality.

The members of the System Engineer user category can create new user categories. The name of the user category must be unique.

1. On the menu bar, click **Tools** and select **Options** to start the user management.
2. Select the **Category Manager** folder.
3. Click **Add New Category** to open the **Add New Category** dialog.
4. Type the name for the new user category.
5. Specify the rights to perform different functions under the **Functions And Rights** field.
6. Select **OK** to save the definition.

2.4.5 Deleting user categories

A user with the System Engineer rights can delete the user categories. System Engineer and Security Administrator categories cannot be deleted. If there are members in the deleted category, a confirmation for removing the category appears. If the category is removed, the user accounts remain, but they are no longer mapped to any user category. The category changes are saved to the system configuration data.

1. On the menu bar, click **Tools** and select **Options** to start the user management.
2. Select the **Category Manager** folder.
3. Select the right user category from the drop-down list.
4. Click **Delete Category** to remove the user category.
5. Click **Yes** to confirm the delete operation.

2.4.6 Modifying existing user categories

Users belonging to a category with user management administration rights can change access rights of user categories. Access rights of System Engineer and Security Administrator user categories cannot be changed. The System Engineer user category has always full privileges.

1. On the menu bar, click **Tools** and select **Options** to start the user management.
2. Select **Category Manager** folder.
3. Select the right user category from the **User Category** drop-down list to activate the **Functions And Rights** field.
4. Change the user rights by selecting one of the user levels in the drop-down menu of the function.

The Functions And Rights field is divided into different sections for you to specify the user rights by a specific tool component or function.

2.4.7 Changing user settings

System Engineer rights are required for changing the settings related to user accounts.

1. On the main menu, point to **Tools** and select **Options** to start the user management.
2. Select the **User Manager** folder.
3. Select the user from the drop-down list.
4. Change **User Preferences**.
   - Length Unit
   - Temperature Unit

2.4.8 Creating users

Create a new user to PCM600 and define the user information.

- User name (mandatory)
- Real name of the user
- User category



The Windows account can be used to log in automatically. Single Windows account can be mapped to a single PCM600 account. These Windows account names are only used for login, if the administrator has enabled the Windows authentication.

1. On the menu bar, click **Tools** and select **Options** to start the user management.
2. Select the **User Manager** folder.
3. Click **Add New User** in the **User Profile** field.
   The **Add New User** dialog is displayed.
4. Type **User Name** and select **User Category** from the drop-down list.
   The user name must be at least three characters long.
5. Click **OK** to confirm.
   The new user is created.

2.4.9 Deleting users

1. On the menu bar, click **Tools** and select **Options** to start the user management.
2. Select **User Manager** folder.
3. Select the right user name from the **User Name** drop-down list.
4. Click **Delete User** under the User Profile field.

Users belonging to a category with user management administration rights can delete users.

The System Engineer account cannot be deleted.

2.4.10 Language settings

System engineering rights are required to modify language settings.

1. On the menu bar, click **Tools** and select **Options**.
2. Click **Language Settings** in the **Options** dialog box.
   - **PCM600 Language** defines which language is used in the user interface of the application. This setting also affects the formatting of the numbers and currencies. The drop-down list has all the currently installed languages.
   - **Default IED Configuration Language** determines the language of the function names of a new IED. The drop-down list contains all the languages supported by all the active connectivity packages. If the used connectivity package does not support the selected language, English is used. The IED's language can be later changed using the IED shortcut menu.
   - **Naming Style** defines how the function names are presented. When the setting is changed, the project is updated accordingly.

2.4.11 Customizing PCM600 menus

The **Tools** menu, the **Project Explorer** shortcut menu and the **Options** dialog box can be customized by defining which tools and tool functions are visible. Tools and functionality that are not needed can be hidden.

1. On the **Tools** menu, click **Options** and then click **Customized Menus**.
2. On the **Tools** tab, select the tools and functions to be shown in the menus.

   Plus (+) sign before the tool name indicates that the tool has functions for which the visibility can be separately defined. Clicking the plus sign shows the tool functions.
3. On the **Options** tab, select the items to be visible in the **Options** dialog box.
4. On the **Miscellaneous** tab, define the visibility of miscellaneous menu items.

Customized menus can be enabled or disabled either using the toolbar button or the **View** menu. When **Customized Menus** is disabled, all functionality is visible in the menus.

The customized menu settings can be exported and imported for reuse.

2.4.12 Export options

Exporting PCM600 Options

1. Click **Export**.
2. Select the destination file.
3. Choose the certificate to use for signing the file.

2.4.13 Import options

Importing PCM600 Options

1. Click **Import**.
2. Select the file to be imported.
3. Confirm import.

2.5 Object configuration functions

This section describes how to configure objects.

2.5.1 Adding objects

New objects can be added to the plant structure by dragging, by using a shortcut menu or by creating object from **Create from template** dialog.

- Add objects by dragging.
  1. Select the object type from the **Object Types** window.
  2. Drag the object to the structure with the mouse.
  3. Release the mouse in the appropriate place.
- Add objects using the shortcut menu.
  1. Select the object from the plant structure.
  2. Right-click the object to see the shortcut menu.
  3. Select the right object type from the shortcut menu to fit in the structure. The shortcut menu lists only the objects that can be added under the selected object.
- Create objects using the **Create from template** dialog.
  1. Right-click the object and select **New/Create from template** from the shortcut menu to open the **Create from template** dialog.
  2. Select the object you want to add.
  3. Click **Create** or double-click the object to add the selected object to the object tree.

The **Create from template** window shows such object types that can be added underneath the selected object. If the **Select the created object** is selected, created object is selected automatically.

If the **Create from the template** check box is selected, clicking **Create** an object based on the selected template is created. Alternatively, double-click a node in the **Object types** tree structure or a row on the templates table to create the object. The template table in the **Create from template** window shows the templates that are suitable for the object type selected in the **Object Types** tree structure. For more information regarding the template handling, see *Chapter 2.6 Template handling functions*.

2.5.2 Naming IEDs

The system assigns the SCLTechnicalKey property for each object in the plant structure.

SCLTechnicalKey is used as:

- an object identifier in communication
- an object name in an SCL file

SCLTechnicalKey follows:

- the substation object naming convention described in the IEC 61346 standard
- the naming convention when naming objects in the SCL files

You can change the default value of the SCLTechnicalKey property. Use the naming convention for the SCL objects, when changing the SCLTechnicalKey property.

2.5.3 Setting object properties

You can set object specific properties on the **Object Properties** window. To view the **Object Properties** window select **View/Object Properties**. Select the property to change its value. Changing the Caption property of an object can be done from the object tree as well.

Different property values can be presented several ways in the **Object Properties** window:

- Values of simple types, such as strings are changed by typing a new value to the field.
- Boolean types are typically presented as a drop-down list, where the value (True/False) can be selected.
- Expandable properties contain nested properties allowing more granular and logical level grouping than what is available for the simple types.

Property values are stored in project real time without user confirmation.

2.5.4 Deleting objects

To delete an object from the object tree, right-click the object to and select **Delete** from the shortcut menu.

2.5.5 Copying and moving objects

You can copy an object or move the object to another location in the object tree. These functions follow the typical Windows principles; you can cut, copy and paste method or drag the objects. You can use the shortcut menu or the appropriate keystrokes.

2.5.6 Importing files

1. Right-click an IED, substation or project object in the Plant Structure.
2. Select **Import** from the shortcut menu.
3. Select the file to be imported and click **Open**.
4. In the **SCL Import Options** dialog, select the import options.
   - **Import Generic IEDs only to project SCL data –** If PCM600 cannot recognize the IED type or the connectivity package is not activated, the IED object is not created in the Plant Structure during the import. The SCL IED is still imported to the project SCL data.
   - **Import Generic IEDs as Generic IEC 61850 IEDs into Plant Structure** - If PCM600 cannot recognize the IED type or the connectivity package is not activated, a generic IEC 61850 IED object is created in the Plant Structure during the import. The SCL IED is imported to the project SCL data.
   - **Ignore PCM Object Type** - If the IED type in the SCL file IED does not match the corresponding PCM600 project SCL IED, the IED is still imported from the file. This can be used, for example, when importing the IED from a CID/ICD/IID file to a generic IEC 61850 IED object.
   - **Ignore Substation Section –** Updates the SCL IEDs in the project, but the SCL substation section is not updated. This also means that the IED locations in the Plant Structure are not updated during the SCD import.
   - **Import Short Addresses –** Overwrites the existing logical nodes' short addresses in the project SCL with the short addresses from the imported SCL file.
   - **Include IED Name in Caption –** Adds the IED name in the imported file to the IED object's caption in the Plant Structure. Without this option, the caption contains the IED desc attribute value in the SCL file.
   - **Allow overwriting the ABB IED LN configuration –** The IED's logical node configuration in the SCL file is imported to the project SCL as it is for ABB IEDs. When using this option, the logical node configuration in the file must be consistent with the project.
   - **Import as Flexible Product Naming SCD –** Changes the project into an FPN project.
   - **Allow overwriting horizontal SMT configuration –** The IED's horizontal configuration in the SCL file is imported to the project SCL as it is for ABB IEDs. When using this option, the logical node configuration in the file must be consistent with the project.
5. If you want to allow overwriting of the logical nodes in ABB IEDs, select **Allow overwriting the ABB IED LN configuration**.
6. Click **Import**.

PCM600 checks the integrity of the PCMI and APCMI files during import. If the file was signed with a certificate that does not exist in the computer’s certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the file.

There can be several reasons why the integrity check fails:

- The file has been created with PCM600 version which does not sign the exported files
- The computer certificate store does not contain the certificate needed to do the verification
- Verification itself fails

All the listed reasons above mean that integrity of the file could not be verified, and it is possible that someone has tampered with the file. If the integrity can't be checked or the verification fails, it is still possible to proceed with import. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

Before importing SCL files (SCD, ICD, CID), it is possible to preview the changes. Changes can be previewed by clicking the **Preview** button in the SCL import options dialog appearing after the file has been selected. The preview window shows the changes which will be made to the SCL configuration if the file is imported.

The results are shown using two tree views: the view on the left shows the SCL configuration in its current state and the view on the right shows what the SCL configuration would be after the import operation. Both trees can be navigated to see what has changed. The **Options** dialog can be used to filter what data is shown in the results window. The comparison results can also be saved to a PDF file.



For more information, see *Chapter 2.5.8 Supported file types*.

2.5.7 Exporting files

1. Right-click an object in the plant structure.
2. Select **Export** from the shortcut menu.

   The **Information** dialog box is displayed with the supported file types and their descriptions.
3. Click **OK**.

   The **Export** dialog box is displayed.
4. Select the file type and the file to be exported and click **Save**.



Some file types are signed during export, and you can choose certificate which is used for signing. The files are signed so that integrity of the project can be verified when importing it. If the file is imported by other user or to another computer, then the certificate used for exporting must be imported to the computer where the file is imported to. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.



For more information, see *Chapter 2.5.8 Supported file types*.

2.5.8 Supported file types

CID (configured IED description)

CID files can be imported to or exported from the IED objects. The file contains the configured IED description as defined in the IEC 61850-6 standard. The possible private sections of the tool components are also included in the file.

ICD (IED capability description)

ICD files can be imported to or exported from the IED objects. The file defines the complete capability of an IED as defined in the IEC 61850-6 standard.

IID (instantiated IED description)

IID files can be exported from IED objects. The file contains project-specific configuration for the IED as specificed in the IEC 61850-6 standard.

APCMI/PCMI (PCM IED)

APCMI/PCMI files can be imported to or exported from bay objects. The file contains the IED's complete configuration as configured in PCM600.

SCD file (substation configuration description)

SCD files can be imported to or exported from the project and substation objects in Plant Structure. SCD files containing more than one substation can be imported or exported only from the project node. The file contains the PCM600 project configuration description as defined in the IEC 61850-6 standard. The imported file should contain the ABB-specific private extensions to get fully configured IEDs.

When importing an SCD file, the **SCD Import Settings** dialog opens. Handling the IED types and whether to ignore the substation section of the file or not can also be specified.

When exporting an SCD file, the **SCD Export Settings** dialog opens. It can be specified whether to export the private sections or not in the dialog box.

2.5.9 Setting IED communication

You can configure the objects in order for PCM600 to communicate with them either via the station bus or from the front panel of the IED.

The communication configuration is done as described in the *Chapter 2.5.3 Setting object properties*, or with the Configuration Wizard. The Configuration Wizard can be started by right-clicking the object in the plant structure and selecting **Configuration Wizard**.

Setting up the communication with the Configuration Wizard may differ with different types of objects the same way as the related properties may differ from each other.

2.6 Template handling functions

This section describes how to use ready made templates to create objects in the PCM600 structure or create your own templates with the help of PCM600 template handling.

A template of an object is a complete description of an IED including the full configuration as well as the parameter values of the tool components.

2.6.1 Creating new templates

A new template can be created only from an IED object.

1. Right-click the specific IED object.
2. Select **Create template** from the shortcut menu to open the **Create New Template** dialog.
3. Specify the name and the description of the template and click **OK**.

   The template is created to specified directory. The template contains a complete IED configuration. By default, the templates are stored in the directory `PCMDataBasesABB\Templates\PCM600`.
4. Choose the certificate to use for signing the template.
5. Change the template directory.
   a) Select **Tools** > **Options** to open the **Option** dialog.
   b) Select Template Settings folder from the navigation tree.
   c) Type the new path to the template directory and click **OK**.

2.6.2 Importing templates

Ready-made templates can be imported.

1. Right-click the specific IED object in the plant structure.
2. Select **New/Create from template** from the shortcut menu. The **Create New Object from Template** dialog is opened.
3. Click **Import Template**.

The template is saved in the template directory, which can be set from **Tools menu** > **Options** > **Template settings**.

PCM600 checks the integrity of the template during import. If the template was signed with a certificate that does not exist in the computer's certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the template.

There can be several reasons why the integrity check fails:

- The template has been created with PCM600 version which does not sign the template files

- The computer certificate store does not contain the certificate needed to do the verification
- Verification itself fails

All the listed reasons above mean that integrity of the template could not be verified, and it is possible that someone has tampered with the template. If the integrity can't be checked or the verification fails, it is still possible to proceed with import. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

2.6.3 Viewing template properties

- View the template properties using the **Template Properties** dialog.
  1. Right-click the template.
  2. Select **Properties** from the shortcut menu to open the **Template Properties** dialog.
- View the template properties using the shortcut menu.
  1. Right-click the object.
  2. Select **New/Create from template** from the shortcut menu.
  3. Double-click the properties icon of a specific template under the **Available templates** list.

2.6.4 Deleting templates

1. Right-click the object.
2. Select **New** > **Create from Template** from the shortcut menu. The **Create New Object from Template** dialog opens.
3. Select the specific template from the **Available Template** list.
4. Click **Delete Template** to delete the template.



The default template cannot be deleted. Only the user-defined templates can be deleted.

2.7 Troubleshooting communication problems

- When starting troubleshooting, keep the **PCM600 Output** window open for notifications.

Table 1: Remedies to communication problems

Problem	Action
Is the network cable connected?	• Check the cables.

Table continues on the next page

Problem	Action
	• Check that the cables are connected to correct communication ports.
Is the IED responding to any communication?	• Open the command prompt. • Type `ping <devices_IP_address>/-t` and wait for at least one minute to see if there are any communication breaks. • If the ping does not work, check the communication settings: IP gateway, IP addresses, subnet masks and firewalls.
Is the IP address unique in the subnetwork?	• Unplug the communication cable from the IED and ping the IP address. • If there is a response to the ping, find the device with the same IP address from the network and remove it.
Is the SCL technical key correct?	If the technical key is not correct, a message is displayed in the **PCM600 Output** window. • Select the IED from the PCM600 tree structure and run **Set Technical Key**.
Are the communicating devices in the same subnetwork?	• Verify the PC and IED communication addresses and subnet masks.
Is the communication port set correctly?	• Select the IED from the PCM600 tree structure and check the **Communication Port** setting from the shortcut menu. • Verify that the IP address in the **Object Properties** window is correct.
Was PCM600 first connected to one relay with a certain IP address, and the cable then switched to another relay with the same IP address, and the communication is not working any more?	Windows creates an ARP table containing MAC address and IP address pairs. Clearing this table helps to get communication working when the pairs no longer match. Every relay communication card has a unique MAC address. However, for example in 615 series, the front port IP address is fixed. This can create a mismatched ARP table when several relays are used. Windows also refreshes the ARP table automatically, but this can take several minutes. • Click the **Start** button, write `cmd` in the search box and press ENTER to open the command prompt. • Type `arp -d` and press ENTER to clear the ARP table. If this command is not recognized or allowed, open the command prompt as an administrator.
Are there several PCM600 processes running simultaneously on the same PC?	Only one PCM600 process can communicate at a time. • Stop other PCM600 instances while communicating with the IED.
Is the parameter communication working?	• Open the parameter settings and try to read parameters. If the parameter setting works and if there is no other communication, the problem can be in the firewall settings.
Is the IED communication reserved by other clients?	• Determine the maximum amount of simultaneous clients. In the IEC 61850 communication, this can be seen in the device's SCL file. In some IEDs, the used clients from the IED can be checked manually from the WHMI.

Table continues on the next page

Problem	Action
	• Isolate the IED from other communication devices to make sure that the clients are not reserving the communication. • Try to communicate with the IED directly from the front port when the rear port cable is disconnected.
Does the communication work with other software than PCM600?	• If the IED supports the IEC 61850 communication, try to communicate with the IED with a third-party client. If the communication fails, check the network configuration.
Does the communication work with the Windows Administrator rights?	Sometimes the communication configuration is updated wrongly with or without the administrator rights. • If UAC is enabled, run PCM600 using the administrator account.
Does rebooting the IED help resolve the communication issues?	It is possible that the communication is occasionally reserved in the IED. • Reboot the IED.
Can multiple tools be used simultaneously to configure the IED?	In some cases, when two users access the same IED at the same time, the communication fails.
Can data be read from the IED by using multiple tools at the same time?	Some IEDs do not support the reading of disturbance recording simultaneously from two clients.
Is the IED under heavy load?	Operations in the IED can have a high priority and consume most of the IED resources. This can break the communication with PCM600. An example of a resource-exhausting operation is the storing of a disturbance recording. • Ensure that there are no ongoing processes in the IED and try to communicate again.
Are there multiple devices with the same MAC in the same network?	• Try to communicate with a device directly from the front port when the rear port cable is disconnected.
Are the external network devices working properly?	Sometimes routers, switches and media converters can malfunction. • Try to communicate with a device directly from the front port when the rear port cable is disconnected.
Is the communication time-out too short?	• In the **Object Properties** window, select the value **Fixed with High Latency** for **Connection Type**. The **Time-out** property becomes visible. • Define the time-out for long-delay networks. - PCM communication uses the time-out value specified by the user. - When selecting **Fixed**, the default time-out is used.
Does Online Configuration Wizard or reading configuration fail?	• Make sure that your personal firewall allows inbound FTP connections. Reading configuration files from certain IEDs requires the possibility for inbound FTP connections.
Does secure communication sometimes fail with IEDs?	PCM600 opens an SSL connection to the device using the .NET SslStream implementation. In certain cases the SslStream.AuthenticateAsClient call

Table continues on the next page

Problem	Action
	takes a long time to authenticate, for example, if the latest root certificates are not updated on the computer. Disable the Automatic Root Certificates Update feature via GPO to block Internet access. • To turn off Automatic Root Certificates Update via Local Group Policy Editor, click **Start** and then click **Run**. • Type **gpedit.msc** and click **OK**. • If the **User Account Control** dialog box appears, confirm that the action it displays is correct and click **Continue**. • Under computer configuration, double-click **Administrative Templates**, double-click **System**, double-click **Internet Communication Management**, and then click **Internet Communication settings**. • Double-click **Turn off Automatic Root Certificates Update**, click **Enabled**, and then click **OK**.
Is PCM600 in offline mode?	If PCM600 is offline, enable communication from the menu in the bottom left corner.
Is Scheduler not able to connect to IED?	See section PCM600 Scheduler setup in the cyber security deployment guideline and *Chapter 2.4.2.3 Defining communication between PCM600 and IED*.

2.7.1 Certificates in PCM600

In cryptography, a public key certificate, also known as a digital certificate or identity certificate, is an electronic document used to prove the ownership of a public key. The certificate includes information about the key, about the identity of its owner, and the digital signature of an entity that has verified that the certificate contents are correct.

In PCM600, context certificates are used in client authentication and device identification. In client authentication, the certificates are used for authenticating the replication users between Centralized Account Management system and the IEDs. Device certificates are used for secure communication.

2.7.2 Secure communication

Due to increased cyber security awareness, PCM600 uses secure communication with the IEDs when possible. When PCM600 connects securely to the IED, a security warning may appear.

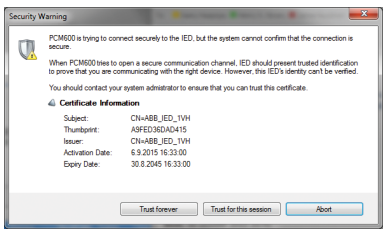


Figure 1: Security warning

Trust forever	Installs the IED certificate to PCM600's permanent certificate store. When this functionality is used for a certificate, PCM600 does not ask for confirmation when connecting to that IED. These certificates are not cleared when PCM600 is closed.
	Trust forever only applies to the certificate signature allowing self-signed certificates. If the certificate is expired or otherwise invalid, session trust can be used for ease of use within a PCM600 session until the issue can be corrected.
Trust for this session	Installs the IED certificate to PCM600's session certificate store. When this functionality is used for a certificate, PCM600 does not ask for confirmation when connecting to that IED during that session. When PCM600 is closed the session store is cleared.
Abort	Does not trust the IED and the connection attempt is cancelled.

If one of the following conditions is met, a security warning window opens.

- IED uses a self-signed certificate
- IED certificate has expired
- A wrong certificate has been deployed on the IED

3 Using the tool components

This chapter provides information about all the tool components and their usage in PCM600.

3.1 Account Management

Account Management is the central hub in PCM600 cyber security configuration. It contains several tools used for different aspects of IED security.

3.1.1 Password

The Password tool is used to change the password of a single IED or a group of IEDs.

3.1.1.1 Changing password

1. In the **Plant Structure**, click the appropriate node and select the devices for which the password should be changed.

   Unsupported devices cannot be selected.

2. Enter **User name**, **Old password**, **New password** and **Confirm new password**.

   The new password needs to be entered into two separate fields to ensure that it is typed correctly.

3. Click **Change Password**.

   As a result, the password change is attempted on all selected and supported devices using the credentials entered.

   An icon and a status text indicating whether the password was successfully changed appears in the list.

3.1.2 Centralized Account Management Configuration

Centralized Account Management Configuration is used for importing configuration bundles from SDM600 and configuring IEDs for Centralized Account Management (CAM) with SDM600. It is also possible to manually configure IEDs to be used with third party systems.



Details on how to configure SDM600 or a third party Centralized Account Management system are not described in this manual.

The tool consists of a main pane, a toolbar, and an editor. The main view shows IEDs in the open project. It shows all IEDs under the currently selected object in **Plant Structure**.

The toolbar on the **Centralized Account Management Configuration** page has six buttons.

- Read from IEDs
- Write to IEDs
- Import SDM600 configuration
- Hide incomplete configurations
- Edit the selected IED
- Clear the selected IED configuration

The options to edit and copy configuration to selected IEDs are available on the shortcut menu for each row in the main view.

3.1.2.1 Importing configurations

1. Click the **Import** button on the toolbar to import a configuration bundle from SDM600.
2. Browse to the bundle zip file to import.
3. Click **Open**.

   The import process asks for a password for the certificates if required.
4. Select the configuration to use.

   If one or several configured IEDs are configured in the bundle, a dialog box shows both configurations.

   The **Import Summary** dialog opens. It shows what was imported and if any of the configurations were skipped or were not applicable to the current project.

The IEDs that were imported are now ready to write.

3.1.2.2 Configuring IEDs manually

1. Open the editor in one of the alternative ways.
   - Select an IED and click the **Edit** button.
   - Right-click an IED and select **Edit**.
   - Double-click a row.

   The editor cannot be opened for IEDs that do not support Centralized Account Management.
2. Configure the IED.
   - In the **Local Configuration** tab, select **Configure IED for CAM use**. If **Device CAM Mode** is **Enabled**, fill in at least the **LDAP Server 1** and **Base DN** boxes.

     Load a certificate to activate the IED for CAM.

     Use the ABB specific **Replication** option only with SDM600. If **Replication** is set to **Enabled**, the **Replication Group** string needs to be set. Valid replication intervals are in the range of 10...1440 minutes.

     Enter **DNS Names**.

     Enter **Username** and **Password** if **Emergency User** is set to **Enabled**.

DNS Server Names and Emergency User are not be visible for IEDs that do not provide support for those.

- Use the **Remote Configuration** tab to read the configuration from an IED.

  The tab can be used only to copy remote configuration on the local tab, which overwrites the existing data.

  To check the IED's current configuration, read the configuration from the IED and check the contents of the Remote Configuration tab.

3. Click **Save & Close** to store the configuration and return to the main view, when the configuration is complete.

3.1.2.3 Copying configuration to selected IEDs

1. Configure an IED with the Centralized Account Management information.
2. Select the IEDs to which the configuration is copied.
3. Open the shortcut menu for the configured IED and click **Copy configuration to selected IEDs**.

   This option copies the current IED’s configuration to all selected IEDs.

3.1.2.4 Writing configurations

1. Select one or several IEDs and click the **Write** button. Write option is triggered for the selected IEDs. IEDs are processed in parallel, depending on how many system resources are available.

   IEDs that are not supported, not configured or offline are automatically skipped.

   If the IED has been configured to require login, click the **Use credentials** link on the main view to enter a default set of credentials that are tried before asking separately for credentials.

2. Click **Cancel** to cancel writing.

   The already started write processes are still completed.

3.1.3 Reset Emergency Account

Reset Emergency Account is used to change the Emergency user’s username, password or both for a single IED or a group of IEDs.

3.1.3.1 Changing Emergency user's credentials

1. Select the devices for which the Emergency user's credentials should be changed.

   Unsupported devices cannot be selected

2. Enter **New user name** and **New password**.

3. Click **Set**.

   As a result, an attempt is made to change the Emergency user's credentials on all selected and supported devices.

   An icon and a status text indicating whether the Emergency user's credentials were successfully changed appears in the list.

3.1.4 IED Key Management

The IED Key Management tool allows the configuration of a Public Key Infrastructure (PKI) for certificates as well as writing and reading these configurations to and from the device.



The number of PKI configuration pages seen depends on the IED capability.

3.1.4.1 Reading from the IED

1. Select the IEDs using the check boxes.
2. Click the **Read from IED** button on the toolbar.

3.1.4.2 Writing settings to the IEDs

1. Select the IEDs using the check boxes.
2. Click the **Write to IED** on the toolbar to write the displayed settings to the selected IEDs.

   If the settings are not modified, the default settings are written to the IED.

3.1.4.3 Editing the configuration

The IED Key Management tool allows the configuration of a Public Key Infrastructure for certificates as well as writing and reading these configurations to and from the IED.

1. Select the check boxes for the IEDs to be set up.
2. Click the **Edit** button on the toolbar to open the setup view.
3. Click **Enabled** and fill in the information needed to connect to the RA and CA servers.
4. Click the **Write to IED** button on the toolbar.

3.1.4.4 Copying and pasting PKI configuration

1. Open an IED’s PKI configuration.
2. Copy the PKI configuration in one of the alternative ways.
   - Click the **Copy PKI Configuration** button on the toolbar.
   - Right-click and select **Copy PKI Configuration**.

3. Open another IED's PKI configuration or a different PKI configuration page.
4. Paste the copied PKI configuration in one of the alternative ways.
   - Click the **Paste PKI Configuration** button on the toolbar.
   - Right-click and select **Paste PKI Configuration**.

3.1.4.5 Exporting and importing PKI configuration

1. Export a PKI configuration template.
   a) Open an IED's PKI configuration.
   b) Click the **Export PKI Configuration** button on the toolbar.
   c) Select the target folder and enter the file name.
   d) Click **Save**.
2. Import the PKI configuration template.
   a) Open an IED's PKI configuration.
   b) Click the **Import PKI Configuration** button on the toolbar.
   c) Browse for the PKI configuration template to be imported.
   d) Click **Open**.

3.1.5 Secure communication configuration

The Secure communication tool allows to set an authority certification key or generate a new authority certification key. This key is used for creating a secure communication between devices. Only the devices which support secure communication allow setting the certification key.

The authority certification key can be set or generated by specifying the key length. The IED needs to be enabled to apply the authority certification key.



The authority certification key can contain only hexadecimal values.



To export the authority certification key with the .apcmi or .apcmp file, select option Export Authority Certification Key with APCMI/APCMP file in **Tools** > **Options** > **Security Settings**.

3.1.5.1 Reading certification key

1. Select the devices using the check boxes.
2. On the toolbar, click **Read from IED**.



The read functionality is allowed only for a Secure Admin role. If the user does not have enough permissions, the read operation is cancelled.

3.1.5.2 Writing certification key

1. Select the devices using the check boxes.

2. On the toolbar, click **Write to IED**.



The write functionality is allowed only for a Secure Admin role. If the user does not have enough permissions, the write operation is cancelled.

3.1.6 IED login banner

An IED login banner text can be set for all supported IEDs configured in the project. The banner warning window is shown to the user before accessing an IED. The user must agree to the warning to be able to access the IED.

3.1.6.1 Enabling/disabling login banner

- Click **Enable login banner with following text** to set the banner text for all supported IEDs configured in the project.
- Click **Disable login banner** to disable the banner text for all supported IEDs configured in the project.

3.1.6.2 Saving banner text

The save option helps to save the banner text at project level.

- Save the banner text in one of the alternative ways.
  - Click the **Save** button on the toolbar.
  - From the PCM600 main menu, select **Save**.
  - Use the shortcut keys.

3.1.6.3 Writing banner text

- On the toolbar, click the **Write** button.

  On performing the write operation, the banner text is written to all supported IEDs configured in the project. The maximum text limit of the IED banner text is the shortest text limit of all supported IEDs.



The maximum text limit of the IED banner text depends on the IED capability. During the write operation, the text is truncated if the banner text length exceeds the text limit supported by the IED.

3.1.7 Rights to Role Mapping

In a Centralized Account system the roles are provided by the server but the IED specific rights need to be configured separately.

The Rights to Role Mapping toolbar has three buttons.

- Read from IEDs
- Write to IEDs
- Manage Templates

The content of the main view follows the selection in the plant structure. Only IEDs under the selected node are visible.

Each IED row has two buttons, **Edit configuration** and **Reset Factory Defaults**. They are used to modify the IED configuration. Each IED also shows the current setting.

3.1.7.1 Templates

A template is a configuration that can be quickly applied to compatible IEDs. When editing a configuration for an IED that uses a template, it is possible to either modify the existing template or create a new stand-alone configuration or configuration template. Modifying an existing template updates all IEDs that use that template.



Templates are generally compatible within an IED series. PCM600 ensures that incompatible templates are not selectable for an IED.

Templates are only stored as part of an IED configuration. A template that is not assigned to any IED does not remain when the tool is opened for the next time. To keep the templates that are not in active use, they can be saved to disk using the export function.

Templates are saved per project in the IED configuration. The export function can be used to move templates between projects.

3.1.7.2 Managing templates

Click the **Manage Templates** button to open the **Template Management** window.

- Double-click a template to rename it.
- Click **X** in the **Delete** column to delete a template.
- Click **Export to file** to export all templates to an XML file.
- Click **Import from file** to import a previously exported XML file.

  Templates with the same ID are not duplicated.

3.1.7.3 Editing role mappings

1. Right-click an IED and select **Edit** to open the editor view.

   Change the template being used or edit the configuration directly.
2. Click **Create Template** to create a new template based on the current configuration.

   This is also an option when saving the configuration.
3. Select the template to be used for the IED from the drop down list on the right.

   By default an IED has only “Factory Defaults” template. If the configuration has been changed, the active template changes to the current configuration.
4. Modify the IED Rights for each role.
   a) Select an IED Right row.
   b) Select the **Read** and **Write** check boxes.

   The view can be changed to be sorted based on **IED Right** instead. Selecting an IED right in the **IED Rights** list on the left shows what access the different **Roles** have. To change the view, click **View Rights** or **View Roles**.

3.1.7.4 Reading and writing

- Click the **Read** button to read mappings from IEDs.

  A new view opens that shows the progress of the operation. When the progress is complete, use the Back arrow in top left to return to previous view.
- Click the **Write** button to write mapping to the IEDs.

  A new view opens that shows the progress of the operation. When the progress is complete, use the Back arrow in top left to return to previous view.

3.1.8 Roles to Active Directory Group Mapping

In a Centralized Account Management system the mandatory roles are predefined by the IEC 62351-8 standard, but the IED-specific Active Directory group mappings need to be configured separately. Roles to Active Directory group mappings can be edited in the Account Management tool by selecting the Roles to Active Directory Group Mapping tile.

The Roles to Active Directory Group Mapping toolbar has three buttons.

- Read Roles to Active Directory Group mappings from selected IEDs
- Write Roles to Active Directory Group mappings to selected IEDs
- Import Active Directory groups

The content of the main view follows the selection in the Plant Structure. Only IEDs under the selected node are visible.

Each IED row has a check box and the Edit configuration button. The check box is used for selecting the IED and the Edit configuration button is used for modifying the IED's Roles to Active Directory group mappings.

3.1.8.1 Reading and writing mappings

1. Click the **Read** button to read the mappings from the selected IEDs or the **Write** button to write the mappings to the selected IEDs.

   A new view opens and shows the operation progress.
2. When the process is complete, click the **Back** arrow in the upper-left corner to return to the previous view.

3.1.8.2 Importing Active Directory groups



See the Active Directory documentation for information on how to export the Active Directory groups file.

1. Click **Import Active Directory groups** to import the Active Directory group names.

2. In the **Open file** dialog, select the LDIF, CSV or text file.

   The imported Active Directory group names are selectable when editing the IED's Active Directory group mappings.

3.1.8.3 Editing role to Active Directory group mappings

1. Click the **Edit configuration** button on the IED row.
2. Select the Active Directory group names for each role in the list box byselecting the check boxes in the mapping grid.
3. To save the configuration to the project, click the **Save** button on the PCM600 toolbar.

3.1.8.4 Using edited role to Active Directory group mappings in all selected IEDs

1. To select all the IEDs for which the same Role to Active Directory group mappings need to be configured, select the check boxes on the IED rows.
2. Click the **Edit configuration** button on some IED row.
3. Select the required Active Directory group names for each role in the list box by selecting the check boxes in the mapping grid.
4. Use the **Back** arrow in the upper-left corner to return to the main view of Roles to Active Directory Group Mapping.
5. Click **Yes** in the dialog to confirm that the edited Role to Active Directory group mapping data is used in all the selected IEDs.

3.1.9 Import and Write Certificates

Import and Write Certificates is used to import and deploy new certificates to an individual IED or to multiple IEDs using a certificate bundle.

3.1.9.1 Importing certificates to an individual IED

1. On the IED row, click **Import certificate**.
2. Browse for the certificate in a container supported by the selected IED and click **Open**.
3. Enter the password, if the container is password protected.
4. Select the certificate unit to deploy to and click **OK**.

Repeat the process for each IED to be configured.

3.1.9.2 Importing certificate bundle to selected IEDs

1. Select the IEDs for which certificates are imported using check boxes.
2. On the toolbar, click **Import certificate bundle**.
3. Browse for the certificate bundle zip file.

4. Click **Open**.
   The import process asks for a password if the certificate container is password protected.
5. Select the certificate unit to deploy to and click **OK**.
   After import, the **Import Summary** dialog opens. It shows which certificates were successfully imported and the reason for skipping any of the certificates.

3.1.9.3 Writing certificates

1. In the leftmost column, select the IEDs which are to be written.
2. Verify for each IED that the required Certificate Units are marked.
3. Click the **Write** button or right-click the IED and select **Write**.
   The tool switches to the write view, which shows detailed status information on the IEDs that are written. When the process is complete, click the left arrow to return.

3.1.10 Read and Delete Certificates

The Read and Delete Certificates tool allows reading certificates deployed on the IED, inspecting them locally or deleting them.



Private keys that have been written to the IED cannot be read, only the public part of the certificate is received from the IED.

3.1.10.1 Reading certificates

1. Select the check boxes for the IEDs to be read in the leftmost column.
2. Click the **Read** button or use the IED shortcut menu.
   Once read, the certificates are visible in the main pane.
3. Right-click or double-click to view the certificate properties.

3.1.10.2 Deleting certificates

1. Select the check boxes for the IEDs in the leftmost column.
2. Select the certificate units and click the **Delete** button on the toolbar. The removal operation on the selected IEDs is triggered.
   When the operation is complete, the resulting set of certificates from the IEDs can be read.

3.1.11 Trusted Certificates

Trusted Certificates is used to create a trusted certificate list for the substation and to write it to the IEDs associated with the substation.

The tool consists of a toolbar, a trusted certificate list, an IED list that displays all the substation IEDs and a status bar.

The tool supports the following functions

- *Chapter 3.1.11.1 Adding certificates*
- *Chapter 3.1.11.2 Removing certificates*
- *Chapter 3.1.11.3 Writing certificates*
- *Chapter 3.1.11.4 Checking certificate details*
- *Chapter 3.1.11.5 Saving certificates*

3.1.11.1 Adding certificates

1. Click the **Add** button on the toolbar to add a trusted certificate.
2. Browse to PEM certificate and click **Open**.

If the certificate is valid, it will be added to the trusted certificates list. The list can hold a maximum of 10 certificates.

3.1.11.2 Removing certificates

1. Select the certificate to be removed from the certificate list.
2. Click the **Remove** button on the toolbar.

3.1.11.3 Writing certificates

1. Select one or more IEDs from the IED list (using checkboxes) to which the certificate list will be written.

   By default, all the substation IEDs are checked.
2. Click the **Write** button on the toolbar.

The status of whether the write operation succeeded or failed for each individual IED is displayed in the status column of the IED list, along with a timestamp.

The overall write progress is shown in the status bar, where writing to the remaining IEDs can also be cancelled.

3.1.11.4 Checking certificate details

To see certificate details, Double-click the wanted certificate from the certificate list.

3.1.11.5 Saving certificates

Click the **Save** button on the toolbar to save changes made to certificates list.

3.2 Application Configuration

The application configuration tool is a generic tool used for configuring the IEDs.

3.2.1 Starting application configuration

The application configuration can be started using the shortcut menu in the plant structure or from the PCM600 main menu.

1. Select the IED from the plant structure.
2. To select application configuration:
   - Right-click any IED in the PCM600 object tree and select **Application Configuration** from the shortcut menu list.
   - Select **Tools** > **Application configuration** from the PCM600 main menu.

3.2.2 Configuration handling

The configuration option facilitates many operations which are possible only in the configuration mode of Application Configuration Tool.

3.2.2.1 Opening a configuration

The application configuration can be opened using the shortcut menu in the plant structure or from the PCM600 main menu.

Using the shortcut menu in the plant structure, configuration can be opened from various objects such as:

- IED object
- Application configuration object
- MainApp object (if the number of main applications are greater than 1)
- FunctionBlock object

1. Select any object from the plant structure.
2. To open the application configuration:
   - Right-click the selected object and select **Application Configuration** from the shortcut menu list.
   - Select **Tools** > **Application configuration** from the PCM600 main menu.

The last saved configuration will be opened in Application Configuration Tool. If the configuration is opened for the first time, either an empty configuration with the default main application opens or the basic configuration is loaded if it is configured using the configuration wizard. The basic configuration will not be displayed to the user.

If the user tries to open a configuration that is already open, there will not be any change. However, the user can opt to open the configuration of any IED, that is, multiple instances of Application Configuration Tool can be opened.

3.2.2.2 Navigating in a configuration

- Use the page navigator
- Navigate through the plant structure
- Choose the **MainApp** tabs available for the configuration

When a particular function block object or composite function block is selected in the plant structure, the corresponding object is selected in the Application Configuration tool.

3.2.2.3 Saving a configuration

The **Save** option helps to save the configuration data. The application configuration can be saved using the toolbar, from the PCM600 main menu or using shortcut keys.

- Click the **Save** button from the tool bar.
- Select **File** > **Save** from the PCM600 main menu.
- Press the CTRL+S keys.

The message box displays the effect of saving other tools. After the confirmation to proceed, the configuration is saved. A progress bar is displayed indicating the progress of saving. A message in the output window indicates the success or failure of the save operation.

Undo and redo operation is cleared after the save operation.

Any failure in saving results in a rollback and the changes are lost.

The save option is enabled only if there are any changes in the configuration. If the save option is disabled, there are no changes from the previous saving.

Upon successful save, the plant structure is updated. If the configuration has more than one main application, **MainApp** is visible in the plant structure, otherwise it does not appear. The function blocks which have parameters (controlled by the visibility) appear in the plant structure as well.

3.2.2.4 Writing a configuration

Refer Common read/write tool of PCM600.

The application configuration can be written even when Application Configuration Tool is not open. The user should have the appropriate rights to perform the write operation.

3.2.2.5 Reading a configuration

Refer Common read/write tool of PCM600.

The application configuration can be read only when Application Configuration Tool is not open. The user should have the appropriate rights to perform the read operation.

3.2.2.6 Closing a configuration

- Right-click the tool tab and select **Close** in the shortcut menu list.
- Click the **Close** button at the right-hand top corner of the window.

If there is unsaved data in the configuration, the user is prompted to either save or discard the changes. User is also provided with the option to cancel the close operation. A pop-up window opens.

1. If the user chooses **Yes**, the changes will be saved before closing the configuration.
2. If the user chooses **No**, the changes will be discarded and configuration will be closed.
3. If the user chooses **Cancel**, the close operation will be cancelled.



If the configuration has no unsaved data, the configuration closes without any message.

3.2.3 Validation handling

Validation helps the user to determine if there are any errors which can prevent the download of configuration to the IED. Configuration validation is done at different levels in the tool.

1. Design time validation
2. On-demand validation
3. Runtime validation

Design time validation

Design time validation is done when the user is creating/editing the configuration. The design time validation includes three basic checks.

- The connection is not made from input to input or from output to output.
- The connection is made between the allowed data types.
- Number of instances of the function blocks are within the allowed limit.

On-demand validation

Validation can be done at any time by clicking the Validate button on the toolbar.

The configuration is validated and the findings are classified as errors and warnings which are logged in the PCM600 output window under the Application Configuration tab. Errors and warnings are sorted in categories.

a. Error	: Errors in configuration
b. Cycle Time	: Cycle time violations
c. Execution Order	: Execution order violations
d. Cycle Time and Execution Order	: Cycle time and execution order violations
e. Others	: Other warnings not related to above violations
f. Accepted	: Accepted warnings by the user

Viewing can be disabled or enabled by clicking the category. Only the selected category messages are visible under the Application Configuration tab.

Any warning can be accepted via the shortcut menu. The warning is then moved to the accepted category and does not appear in the warnings even if the configuration is validated. This behavior stays the same when a project or IED is exported and then imported. On opening an imported project or IED file, the validation messages can be seen as they were before export. The messages can be accepted or restored after importing, too.

Accepted messages can be restored via the shortcut menu of each message.

By clicking the particular warning or error message, it is possible to navigate to the problem area in the configuration.

Runtime validation

This validation is automatically done by the Common Read/Write Tool tool while performing the Write operation to an IED. If the tool finds any errors, the write operation will not proceed.

3.2.4 MainApplication handling

A main application is the drawing area for creating or editing the application configuration. The main application can contain multiple pages. The configuration has always one default main application, that is, even an empty configuration has a default main application with a single page.

The main application-related operations are possible only in the configuration mode of the Application Configuration tool.

3.2.4.1 Adding MainApplication

The main application can be added from the PCM600 menu bar or using the button on the toolbar.

- On the menu bar, click **Insert** and select **MainApp**.
- Click the **Insert MainApp** button from the toolbar.

In both cases, a new main application is appended with the default name. The default name format is MainAppX, where X is the sequential number. For instance, MainApp2, MainApp3. The new main application has one page by default.

Upon successful save, the plant structure is updated. If the configuration has more than one main application, **MainApp** is visible in the plant structure, else it does not appear.

3.2.4.2 Renaming MainApplication

The main application can be renamed from the **Object Properties** window.

1. Select the **MainApp** tab in the **Object Properties** window.
2. Edit the value of the **Name** field to change the name of the main application.

   The name has a restriction of 50 characters. Only alphanumeric characters are allowed along with hyphens (-) and periods, no other special characters are allowed. The field cannot be left empty.

3.2.4.3 Locking MainApplication

The main application can be locked by changing the settings in the **Object Properties** window.

1. Select **MainApp** in the **Object Properties** window.
2. Set the value of the **Locked** field to **True**.

When the main application is locked, certain operations are not allowed.

- Creation or deletion of graphical symbols.
- Creation or deletion of connections.
- Movement of the graphical symbols.
- Deletion of the main application.

When the main application is locked, the configuration can still be downloaded to the IED.

The main application can be locked from the shortcut menu of the **MainApplication** node in the **Delete Option** dialog box. For more information, see Delete Option.

For an easy identification of the main application lock/unlock status, **MainApplication** with a lock image is added at the top left column of each page when the main application is locked.

3.2.4.4 Unlocking MainApplication

To unlock the main application, change the settings in the **Object Properties** window.

1. Open the **Object Properties** window.
2. Click the **MainApp** tab located at the bottom of the worksheet.
3. Check the **Locked** property status and set the value of the **Locked** property field from **False** to **True**.

   A Locked Worksheet icon is added at the top-left corner of every page in the application configuration.
4. Reset the value of the **Locked** property field to **False**.

   The main application prompts for a password.
5. Enter the main application password.

   The main application is unlocked and the Locked Worksheet icon is removed from the top-left corner of the application configuration pages.

Unlocking the main application overrides **Page Lock**, which means all the pages of the main application are unlocked even though they were locked previously.

A main application can also be unlocked from the shortcut menu of the **MainApplication** node in the **Delete Option** dialog box. For more information, see Delete Option.

3.2.4.5 Deleting MainApplication

Deleting the main application removes the main application and its contents from the configuration. The applications can be deleted only if they are unlocked. If there is only one main application, it cannot be deleted.

1. Right-click the main application and select **Delete**.
   A confirmation dialog box appears to confirm the delete operation.
2. Click **Yes** to delete the main application and its contents.
   If **No** is selected, the application is not deleted.

Deleting the main application results in deleting the application, its pages and the graphical symbols even if the pages or graphical symbols are locked.

A main application can be deleted using the **Delete Option** dialog box. For more information, see Delete Option.

A main application which cannot be deleted does not have the delete option available in the shortcut menu of the **MainApplication** tab.

3.2.4.6 Navigating among MainApplications

- Use the **Options** button in the lower-right corner of the **Application Configuration** window to navigate from the current main application to any main application in the main application list.
- Press **CTRL + TAB** to navigate to the next main application. Press **CTRL +SHIFT+TAB** to navigate to the previous main application.

If the **Application Configuration** window is not active, using the navigation keys results in navigating to the other tools that are open.

3.2.5 Page handling

The pages are a part of the main application. There will always be at least one page in the main application. The operations can be done only in the configuration mode of Application Configuration Tool.

3.2.5.1 Adding a page

A page can be added using the shortcut menu, from the PCM600 main menu or using the shortcut key. The page is inserted after the selected page in all the cases.

1. Select the main application.
2. Add a new page.
   - On the PCM600 menu bar, click **Insert** and then click **Page**.
   - Right-click on the main application, and then select **Insert page**.
   - Press Ctrl+Shift+P keys.

3.2.5.2 Setting up a page

Page layout can be set with the page setup.

- On the **File** menu, click **Page Setup**.

  The **Page Setup** dialog box opens.

The application configuration page supports A3 paper size and landscape orientation. This cannot be changed.

3.2.5.3 Locking a page

Using the lock option, operations like insertion, deletion and movement of graphical symbols on the page can be prevented.

A page can be locked with the shortcut menu, the **Object Properties** window or the shortcut keys.

- Right-click the page and select **Lock**.
- Set the value of the **Lock** field to **True** in the **Object Properties** window.
- Press CTRL+SHIFT+L.

A new page can be inserted from a locked page.

A page can be locked using the **Delete Option** dialog box.

3.2.5.4 Unlocking a page

The page-unlocking procedure is not protected by any password. A page can be unlocked using the shortcut menu, the **Object Properties** window or the shortcut keys.

- Right-click the page and select **Unlock**.
- Set the value of the **Lock** field to **False** in the **Object Properties** window.
- Press CTRL+SHIFT+UL.

A page can also be unlocked using the **Delete Option** dialog box.

3.2.5.5 Page navigation

The page navigator on the status bar of PCM600 enables the navigation to different pages.

- First page: Navigates to the first page of the main application
- Previous page: Navigates to the previous page from the current page
- Next page: Navigates to the next page from the current page

- Last page: Navigates to the last page of the main application
- Press PAGE UP to scroll up and PAGE DOWN to scroll down in the worksheet by the current view height.

The page navigator also displays the current page number, which is read-only. The coordinates of the mouse position within the drawing area are displayed on the status bar.

Press CTRL+G to navigate between the specific page numbers in the selected main application.

3.2.5.6 Page grid

The pages in the application configuration tool are divided equally into rows and columns of 50 mm width each. The parts are sequentially named as A, B, C and 1, 2, 3 and so on respectively to easily locate the graphical symbols. The width of the rows and columns can be 2.5 mm as well. This option can be enabled or disabled from the toolbar. When the grid is enabled, the instantiated function block will snap to grid automatically but the connections will not.

3.2.5.7 Deleting a page

The page is removed from the main application when it is deleted. The page can be deleted either from the shortcut menu or using the shortcut keys.

- Right-click the page and select **Delete page** from the shortcut menu.
- Press CTRL+Shift+D to delete the current page.

Both the page and its contents are deleted and the numbering of the page is automatically updated.

If the page is locked, the **Delete page** option is not available in the shortcut menu.

A page can be deleted using **Delete Option**. For more information, see Deleting pages.

3.2.6 Function block handling

The function blocks are the graphical representation of functions in Application Configuration Tool, which offer input and output data points.

3.2.6.1 Inserting a function block

A function block can be inserted only in the configuration mode of Application Configuration Tool. The function block can be inserted in the drawing area by dragging and dropping, using a shortcut menu, from the PCM600 main menu or using the shortcut keys. If the execution order is in automatic mode the cycle time, execution order and instance number are automatically assigned by application configuration tool. The function block instance popup window does not appear in this mode.

When inserting a function block, the execution order can be selected from the PCM600 toolbar. If the execution order is in automatic mode, the cycle time, execution order and instance number are automatically assigned by Application Configuration Tool. The popup window does not appear in this mode.

If the execution order is in fixed mode:

1. The **Function Block Instance** window opens.
2. The default name of the function block appears in the **Name** field, which can be modified depending on the IED's capability.
3. Select the appropriate **Exec order**, **Instance number** and **Cycle time** from the drop down list.
4. Click the **Assign** button to insert the function block in the drawing area. Click **Cancel** to cancel the operation. If there is collision with any other graphical symbol, also then the insertion of function block will be cancelled.

If the default name of the function block is modified, the modified name appears in blue on top of the function block in the function block instance window. If it is not renamed, the name is not displayed.

If the maximum number of function block instances are exhausted then function block will not be inserted.

Dragging and dropping

1. Drag a function block from the PCM600 object type window and drop it in the Application Configuration Tool drawing area. The function block is inserted, if the mode is automatic. If the execution order is in fixed mode, continue inserting the function block from the **Function Block Instance** window.

Using the shortcut menu

1. Right-click on the empty space in the Application Configuration Tool drawing area.
2. Select **Insert FunctionBlock** from the shortcut menu.
3. The function block is inserted, if the mode is automatic. If the execution order is in fixed mode, continue inserting the function block from the **Function Block Instance** window.

Using the PCM600 main menu

1. Select **Insert** from the PCM600 main menu.
2. Select **FunctionBlock**.

3. Click on the empty window space in the Application Configuration Tool drawing area where the function block has to be inserted.
4. The function block is inserted, if the mode is automatic. If the execution order is in fixed mode, continue inserting the function block from the **Function Block Instance** window.

Using the shortcut key

To insert function block using shortcut key:

1. Place the mouse pointer in the empty space in Application Configuration Tool drawing area where the function block has to be inserted.
2. Press CTRL+Shift+F from the keyboard, the **Function Block Instance** window opens.
3. Select the appropriate function block and click **Insert**.

The inserted function block is shown in grey color, indicating that the function block has no connections. The default signal user-defined name appears in blue above the default signal names.

3.2.6.2 Instance information

Application Configuration Tool provides two modes of instance information assignment:

- Fixed mode
- Automatic mode

Fixed mode

In the fixed mode, the user should select the **Execution order**, **Instance number** and **Cycle time** information from the available set of information during instantiation of the function block.

Automatic mode

In the automatic mode, the user need not select the **Cycle time**, **Instance number** and **Execution order** information. The **Function Block Instance** dialog box will not be displayed to the user. The tool calculates the required information based on the data flow. The calculation in the tool happens automatically on validation.

The user can also calculate the execution order on demand by clicking the **Calculate Execution order** button on the toolbar.

The user can also manually change the calculated information via **Change CycleTime ExecOrder** shortcut menu on the function block. Once changed by the user, this information is not considered in automatic calculation, it will remain as changed by user.

Automatic calculation will not recalculate the instance information for the function blocks present in the locked main applications. Hence, if a user wants to prevent other users from manipulating the execution order or cycle time information, the user can lock the main application.

Depending on the IED capability, the execution order cannot be manually set for certain function blocks in the automatic mode.

3.2.6.3 Toggling insertion on multiple clicks

Multiple instances of same function blocks can be inserted in the Application Configuration Tool drawing area by dragging and dropping or using the **Toggle Insertion** button on the toolbar.

- Drag and drop the function blocks on to the configuration drawing area.
- To enable toggle insertion mode using the tool bar:
  1. Click on the **Toggle Insertion** button on the toolbar.

     The button is highlighted indicating that the toggle insertion mode is enabled.
  2. Click on the Application Configuration Tool drawing area multiple times to insert multiple function blocks.

The toggle insertion mode can be disabled by clicking on the **Toggle Insertion** button on the tool bar. The button is not highlighted any more indicating that the toggle insertion mode is disabled.

3.2.6.4 Renaming a function block (Set user-defined name)

The function block instance can be renamed in the configuration mode with the **Object Properties** window, the **Find** feature, the shortcut keys or the shortcut menu.

- Change the name in the **User-defined Name** property in the **Object Properties** window and click the **Enter** button.
- Click **Find** from the toolbar and locate the function block. Change the name in the **Replace function block name** box and click **Replace**.
- Right-click the function block and select **Set User Defined Name**. Change the name of the function block in the **User Defined Name** field. Click **OK** to rename the function block, or **Cancel** to keep the previous name of the function block.

The changed name appears on the top of the function block in the Application Configuration tool if it is not the default name.

The font color of the renamed function block is blue.

Select the function block and press F2 to rename the function block.

Renaming of function blocks depends on the IED capability. Some IEDs do not support renaming.

The maximum length of the user-defined name depends on the IED capability.

3.2.6.5 Replacing a function block

The function block instance can be replaced by another block in the configuration mode using the shortcut menu or shortcut keys. The connections can be retained if required.

1. Right-click the function block.
2. Select **Replace function block** from the shortcut menu.

   The **Replace function block** window opens.
3. Select the same function block type to be replaced with a different cycle time, execution order and instance number.

   The connections are automatically made after the function block is replaced. In this case, selecting the **Retain connection** check box does not have any effect.
4. Select the function block to be replaced. If the connection has to be retained after replacing the function block, select the **Retain connection** check box and click the **Replace** button, else, clear the check box and click the **Replace** button.
5. Continue inserting a new function block.

The **Cancel** button cancels the replace operation. The function block can also be replaced by pressing Ctrl+R keys.

If an inverted function block is replaced with the same function block type, the inverted block is retained and connected automatically after the function block has been successfully replaced.

3.2.6.6 Locking a function block

A function block can be locked in the configuration mode using the shortcut menu, the **Object Properties** window or the shortcut keys.

1. Select the function block.
2. Lock the selected function block.

   - Right-click the function block and select **Lock**.
   - Set the value of the **Lock** field to **True** in the **Object Properties** window.
   - Press CTRL+SHIFT+L.

   The color of the lock symbol changes to red if the function block is locked.

A connection can be created even when a function block is locked. However, operations such as cut, copy, paste, move or delete cannot be performed.

Function block can be locked using the **Delete Option** dialog box.

3.2.6.7 Unlocking a function block

The function block can be unlocked in the configuration mode using the shortcut menu, the **Object Properties** window or the shortcut keys.

1. Select the function block.
2. Unlock the selected function block.
   - Right-click the function block and select **Unlock**.
   - Set the value of the **Locked** field to **False** in the **Object Properties** window.
   - Press CTRL+SHIFT+U.



The color of the lock symbol changes to black (default) if the function block is unlocked.



Function block can also be unlocked using the **Delete Option** dialog box. For more information, see Delete Option.

3.2.6.8 Moving a function block

- Drag a function block or a selected list of function blocks anywhere in the drawing area in the configuration mode
- Use the UP ARROW key and the DOWN ARROW key to move the function block
  - When a function block is moved across the page, the variables or channels connected to the function block are also moved.



Only unlocked function blocks in unlocked pages and in unlocked main applications can be moved.

3.2.6.9 Deleting a function block

An unlocked function block or a selected list of unlocked function blocks can be deleted in the configuration mode using the shortcut menu, PCM600 main menu or the DELETE key.

1. Select an unlocked function block or multiple function blocks.
2. Delete the selected function blocks.
   - Right-click the selection and select **Delete**.
   - On the **Edit** menu, select **Delete**.
   - Press DELETE.

   A confirmation dialog box appears if **Always confirm delete before any deletion** is selected in **Tools** > **Options** > **Application Configuration** > **Application Configuration Symbols**. If this is not selected, the confirmation dialog box does not appear.



If **Delete all connections on deletion of block** in **Tools** > **Options** > **Application Configuration** > **Application Configuration Symbols** is selected, the function block and the connections are deleted.

A function block can be deleted using the **Delete Option** dialog box.

3.2.6.10 Signals

The signals in the function blocks are connected using Application Configuration. The signals can be selected by clicking on the signals when the corresponding function block is selected. The navigation keys can be used to select different signals in the same function block.

Managing signals

The visibility of the function block signals in the Application Configuration tool and the Signal Matrix tool can be managed. The mandatory signals cannot be made invisible.

1. Right-click the function block and select **Manage Signals** or press the CTRL+SHIFT+M keys.

   The **Manage signals** window opens.
2. Double-click the signals in the **Show in Application Configuration** and **Show in Signal Matrix** columns to be made visible in the Application Configuration tool and the Signal Matrix tool respectively. To hide the signals, double-click the selected signals.
3. Double-click the signals in the **Invert Signal** column to invert the binary signals.
4. Click the signal in the **User Defined Name** column to change the user-defined name if it is supported.
5. Right-click the top left header row in the **Manage Signals** window to set further options.
   - Select **Clear All** to clear all the listed signals.
   - Select **Set to default** to set the signals to default state.
   - Select **Hide unconnected signals** to hide the unconnected signals.
6. Click **OK**.

   The cleared signals are made invisible within the function block.

The visibility of the connected signals cannot be changed.

Inverting signals

The signal should be connected to invert it.

1. Right-click the signal.
2. Select **Invert Signal** from the shortcut menu.

   The signal is inverted and its representation is changed.

The execution order of the function block in which a signal is inverted should be between the source function block and the target function block.

Application Configuration assigns the appropriate instance information to the inverter block that is created. If appropriate information is not available, inverting the signal is not allowed.

Uninverting signals

The signals can be uninverted in the configuration mode using the shortcut menu. It is used to negate the effect of inverting the signals.

1. Right-click the inverted signal.
2. Select **Uninvert** from the shortcut menu.
   The signal's representation is restored.

3.2.6.11 Managing the function block visibility

The default function block visibility can be overridden for the Parameter Setting tool in the configuration mode.

1. Right-click the function block and select **Manage function block visibility**.
   The **Manage function block visibility** dialog box appears with the Parameter Setting tool.
2. Select or clear the check box of the tool to define the function block visibility.
3. Click **OK**.

3.2.6.12 Specified function blocks

The OTI information of the function blocks whose instance information is changed is in square braces for easy visual identification.

The OTI information is presented only if the relevant option is selected in the Application Configuration tool preferences.

The blocks can be viewed for which the instance information (like execution order) is set specifically.

- Click **Specified Function Blocks** in the PCM600 toolbar to view the list of user-modified blocks (specified blocks).
- Click **Locate** in the list to navigate to a specified function block.

This list is updated during an addition or removal of the specified function blocks in the configuration.

The **Specified Function Blocks** menu item is available or unavailable based on the IED capability.

3.2.6.13 Detecting overlapping function blocks

The overlapping function blocks in any configuration can be detected using the **Detect overlapping function blocks** option. A message is logged in the output window for each page containing overlapping function blocks.

- On the menu bar, select **Format** > **Format Symbols** > **Align** > **Detecting overlapping function blocks** to detect overlapping function blocks.
- Double-click the message in the output window to navigate to the page containing the overlapping function blocks.

3.2.6.14 Aligning overlapping function blocks

- Select **Format** > **Format Symbols** > **Align** > **Align Overlapping Functionblocks** to align the overlapping function blocks in the entire configuration.
- Select the **Align Overlapping Functionblocks** option in the page to align the overlapping function blocks in that page.

If the Application Configuration tool does not have enough space to rearrange the overlapping blocks, a message is logged to the output window.

3.2.7 Connections

Connections represent the flow of signals from one function block to another or to/from a hardware channel.

The connected function block appears in green in certain cases.

- The function block is expecting a set of signals from another function block and all of them are connected.
- The function block has some mandatory connections and all of them are connected.
- The function block is connected to at least one signal but has no mandatory signals.



Connections cannot be made if data types of the source and target are different.

3.2.7.1 Making connections

Dragging and dropping

1. Select the graphical symbol of the signal, composite function block signal or the channel.
2. Drag the source signal, composite function block signal or channel to the target signal, composite function block signal or channel.

Using function block signal

1. Right-click the signal of the graphical symbol.
2. Select **Connect** > **FunctionBlock Signal** from the shortcut menu. The **Connect Function Block** window opens the lists of all the function blocks available in the configuration.
3. Select the signal that needs to be connected and click **Connect**.

The connection is created in the configuration using variables if the function blocks are on different pages or worksheets. The **Close** button closes the **Connect Function Block** window.

Using composite function block signal

1. Right-click the composite function block signal of the graphical symbol.
2. Select **Connect** > **Composite Function Block Signal** from the shortcut menu. The **Connect Composite Function Block** window opens the lists of all the composite function blocks available in the configuration.
3. Select the composite function block signal that needs to be connected and click **Connect**.

The connection is created in the configuration using variables if the composite function blocks are on different pages or worksheets. The **Close** button closes the **Connect Composite Function Block** window.

Using variables

1. Insert a variable using the shortcut menu or using the **Insert** menu in the toolbar.
2. Connect the inserted variable to the signal of the function block.
3. Insert a new or existing variable.
   - To insert a new variable, rename either the input or the output variable so that the input and output variable names are the same.
   - To insert an existing variable using the shortcut menu, choose **Connect** > **Variables** > **Existing**.



Input variables can be connected to an input signal and the output variables to an output signal.

Using connect to previous

1. Select an input or output signal.
2. Select and right-click the other appropriate signal.
3. Select **Connect to** and choose the first selected signal.

Using a split window

Graphical symbols can be connected using a split window. This is useful for creating connections across pages and worksheets.

1. Click **Split window** from the toolbar.

   This splits the diagram area of the configuration into two identical views. The connection can be made from the source graphical symbol in the view on the left to the destination graphical symbol in the view on the right and vice versa.
2. Drag the source signal to the target signal of another view.

   A connection is created between the source signal and the target signal using variables.

Linking to an existing connection

A connection from one source to multiple targets can be made through connection points. Drag the target signal port to a point on an existing connection from the same source.

In all the cases, a connection is created only if the validation is successful.

If a connection is made between the function blocks or composite function blocks with different cycle times, a warning is shown in the output window.

The signals or composite function block signals connected to the hardware channel are visible in Signal Matrix. When the connection is deleted, the visibility is not restored and the signal or composite function block signal is still visible in Signal Matrix. This is to provide flexibility to connect the signal to a different channel through Signal Matrix.

The signals or composite function block signals connected to the hardware channel automatically become visible to Signal Matrix. On deletion of this connection, the visibility is not restored and the signal or composite function block signal remains visible to Signal Matrix to provide flexibility to connect this signal to a different channel through Signal Matrix also.

Using GOOSE

1. Right-click the input function block/Composite function block signal/Hardware Channel of the graphical symbol.
2. Select **Connect** > **GOOSE** from the shortcut menu.
   The **Connect to GOOSE** window opens.

For information on making connections, see *Chapter 3.2.7.1 Making connections*.

3.2.7.2 Moving connections

1. Select the connections to be moved.
   The end points of the line segments forming the connection are highlighted.
2. Click on the highlighted endpoints and drag the connection segment.

Connections revert to their original positions if they are placed over an existing connection segment or graphical symbols.

3.2.7.3 Deleting connections

Connections can be deleted individually or as a group.

1. Select a connection or a group of connections to be deleted.
2. Right-click the selected connection and select **Delete** or press **Delete** on the keyboard.

To receive a confirmation on the deletion of a connection, the **Delete confirmation for Connection** option should be selected in the Application Configuration tool preferences.

3.2.7.4 Rerouting all connections

The connections in the configurations are rerouted by avoiding crossing or overlapping of the connection.

- On the **Format** menu, click **Re-Route all Connections**.

Rerouting routes all the connections in the configuration in such a way that it avoids crossing or overlapping of connections only if there is enough space available to reroute the respective configurations.

Re-Route all Connections supports undoing and redoing functionalities.

3.2.7.5 Connection validation

These parameters influence the runtime execution of the function block within the application configuration.

- *Execution Order*
- *Cycle Time*

Every time a new function block is selected, these parameters must be selected from the lists in Application Configuration. The parameters are either selectable or not selectable depending on the IED type. *Execution Order* and *Instance Number* are a predefined combination within a product. It is possible to select a pair from the list.

Possible warning or error messages are shown in the output window upon manual connection creation, configuration validation and execution order calculation. These messages are typically for cycle time, execution order or unconnected mandatory signals or symbols.

Error message appears when any of the mandatory signals of a function block is not connected or when a function block is expecting a set of signals from another function block and any of them is not connected.

Cycle time warnings appear when an output of a faster block is connected to an input of a slower block.

Execution order warnings appear when two directly connected blocks belong to same cycle time. The block, whose output is connected to the input of another block, should have a lower execution order.

Cycle time and execution order warnings appear in Application Configuration when two connected function blocks do not follow both the rules of *Cycle Time* and *Execution Order*.

Four message categories are provided in the output window. Visibility to the user can be changed by selecting or clearing the selection.

- Error. Error messages cannot be accepted.
- Cycle time warnings. Warnings related to connections violating cycle time rule; can be accepted.
- Execution order warnings. Warnings related to connections violating execution order rule; can be accepted.
- Cycle time and execution order warnings. Warnings related to connections violating cycle time and execution order rule; can be accepted.

- Others. Warnings that do not fall in above categories, for example, unconnected variables; can be accepted.
- Accepted. Warnings that are explicitly accepted. These warnings can be moved to the respective category by clicking Restore from the shortcut menu.

3.2.7.6 Creating feedback connections

Circular connections can be specified as feedback loops.

1. Right-click the feedback connection.
2. Select **Set Feedback indication**.
   This creates an arrow in the connection at the input side.

The Set Feedback indication option is available based on the IED capability.

Feedback connection indication helps PCM600 assign proper execution order to graphical blocks that are connected in loop.

Depending on the IED capability, warnings indicating the presence of feedback connections are shown in the output window during Application Configuration save or upon clicking the Validate button. These warnings are removed once the circular connection is indicated as a feedback connection or when the warnings are accepted.

3.2.7.7 Removing feedback connections

1. Right-click the feedback indication connection.
2. Select **Clear Feedback indication**.
   This removes the arrow in the connection from the input side.

The Clear Feedback indication option is available based on the IED capability.

3.2.8 Variables

A variable is a symbolic representation that is used to reference the connections in a configuration. The connection can be represented through variables in a page, across pages and/or worksheets.

Variables are of two types, input variables and output variables.

Input variable

The variable that can be connected to the input of any function block is called input variable. The input variable names may not be unique.

Output variable

The variable that can be connected to the output of any function block is called output variable. The output variable name is always unique.

3.2.8.1 Inserting variables

Variables can be inserted into a configuration using the page shortcut menu, PCM600 main menu, variable list dialog box or signal/channel shortcut menu.

- Insert variables using the page shortcut menu.
  1. Right-click the main application drawing area.
  2. Select **Insert Variable**.
  3. Select the **Input** variable or the **Output** variable. The variable appears with its default name.
- Insert variables using the PCM600 main menu.
  1. Click **Insert**.
  2. Select **Variable/Input** or **Output**.
  3. Click the main application drawing area to insert the variable.
- Insert variables using the **Variable list** dialog box.
  1. Click **Variable list** on the toolbar to open the **Variable list** dialog box.
  2. Drag the variable image to the drawing area to insert the variable.
- Insert variables using the signal/channel shortcut menu.
  1. Right-click any function block signal or a hardware channel port.
  2. Select **Connect/Variable**.
     - Click **New** to add a new variable with its default name in the format VAR_ followed by a running sequence number.
     - Click **Existing** to open the **Variable List** dialog box.
     - Select the variable to be connected to the signal or channel and click **Select**.

The color of the connected function block changes only if the variable has a partner.

The variable can be dragged from the variable list window to a function block signal to create an automatic connection.

In the variable list, the variables are filtered based on certain rules.

- If filtering is based on the input signal, all the input and output variables are filtered and displayed based on the data type of the signal.
- If filtering is based on the output signal, the unconnected output variables and input variables are displayed based on the signal data type filtering.

3.2.8.2 Renaming variables

Rename variables in one of the alternative ways.

- Select a variable, change the name in the **Name** field in the **Object Properties** window and press ENTER.
- Select a variable, press F2 and rename.
- Double-click a variable name in the configuration window and rename.
- Select **Edit** > **Find** to find the variable and rename.
- Open **Variable List** from the PCM600 toolbar and double-click a variable name in the list, rename the variable and press ENTER.

Renaming an output variable renames all the partner instances of the variable. Renaming an input variable renames only that instance. The partner variables of the input variable are not affected, it makes connection to the changed variable.

The maximum length of a variable name can be 35 characters and it should not be blank. The variable names are case-insensitive.

3.2.8.3 Variable naming conventions

When an input or output variable is inserted in the configuration, the default name is generated according to the variable naming conventions.

The variable property *AutoNameGeneration* defines automatic naming of the variables according to the user's choice. The default value of the property is **True**, when a variable is created through the shortcut menu of a function block/ composite function block signal or an input hardware channel. When the property is set to **False**, variable names are not created automatically.

When inserting a template containing variables, the *AutoNameGeneration* property value is **False** for all the variables.

After migration of configurations (created with previous versions of PCM600) containing variables, the property is set to **False** to ensure backward compatibility and to preserve the original configuration design.

Copying and pasting variables sets the property to **False** even though the original variable was created through the shortcut menu.

- When connecting to the new output variables through the **Connect** option in the shortcut menu of the function block output signals, the new output variable is created with the name in the format "FunctionBlockName[instance number]_SignalName[x]," where x is 1, 2, 3... depending on the number of new connections made from that signal.

  The names used are the user-defined (if set) for function block and function block signal, else type names are used. By default, the first variable does not contain any sequence number.
- When connecting to new output variables through the **Connect** option in the shortcut menu of composite function block output signals, the new output variable is created with the name in the format *CompositeFunctionBlockName_SignalName[x]* where x as 1, 2, 3...is the running sequence number.

  The names used are the user-defined (if set) for composite function block and composite function block signal, else type names are used. By default the first variable cannot have any running sequence.
- When connecting to new output or input variables through the **Connect** option in the shortcut menu of an allocated input or output hardware channel, the new

output variable is created with the same name as that of the allocated hardware channel. By default, the first output variable does not contain any sequence number. For the input channels with the user-defined names, the connected variable has the channel user-defined name as the default variable name.

- When connecting to new input variables through the **Connect** option in the shortcut menu of an unallocated input or output hardware channel, the new input variable is created with the name var_x, where x is 1, 2, 3 …, since an unallocated hardware channel does not have any name.
- When a user-defined name is given to the connected output variables, the names of the output variables with default names, that is, names provided by the Application Configuration tool are updated. Other variable names are unchanged, however, all the partner variables are also renamed. The functionality holds true for function block, composite function block, function block signals and composite function block signals.
- When a user-defined name is changed for function blocks or composite function blocks, the variables having default names are automatically renamed. Variables with a name already changed by the user are not updated.
- When the instance number of a function block is changed, for example, through **Replace function block with retain connection** option, the updated variable name reflects the updated instance number.



Manually entered variable names are not updated automatically.

- If a variable is disconnected from one output and connected to another output of same or different function block or composite function block, the variable names that are updated by the tool are updated accordingly.



The variable property *AutoNameGeneration* can be set to **False** to prevent generating variable names automatically.

3.2.8.4 Replacing variables

A variable connected to a signal can be replaced with another variable to change the connection.

1. Right-click the variable.
2. Select **Replace Variable**. The **Variable List** dialog box appears.
3. Select the variable to be replaced and click **Replace**.

3.2.8.5 Locking variables

The variables can be locked using the shortcut menu, using the object properties window or using the shortcut keys.

1. Select the variable.
2. To lock:
   - Right-click the variable and select **Lock** from the shortcut menu list.
   - Set the value of **Lock** field to **True** in the object properties window.
   - Press Ctrl+Shift+L.

A variable cannot be moved, deleted or renamed when it is locked.

3.2.8.6 Unlocking variables

Unlocking a locked variable allows it to return back to it's normal state. The variables can be unlocked using the shortcut menu, using the object properties window or using the shortcut keys.

1. Select the locked variable.
2. To unlock:
   - Right-click the variable and select **Unlock** from the shortcut menu list.
   - Set the value of **Lock** field to **False** in the object properties window.
   - Press Ctrl+Shift+U.

3.2.8.7 Locating partner variables

This feature allows the user to navigate to all the input variables connected to a particular output variable or vice versa in a configuration.

To locate partner variable using the context menu:

1. Right-click an input or an output variable.
2. Select **Go to partner** from the shortcut menu list. This lists all the partner variables of the selected variable in the submenu.
3. Click on anyone of the variable. The page navigates to the partner variable.

1. Right-click an input or an output variable.
2. Select **Go to partner** from the shortcut menu list.
   A list of all the partners of the selected variable opens.
3. Click any of the variables on the list, the partner variable is located.

3.2.8.8 Navigating forward and backward in variables

Application Configuration allows a quick and easy navigation between the browsed variables.

1. Open an application configuration and instantiate a function block.
2. Connect an input variable to the input signal of the function block.
3. Connect an output variable to the output signal of the function block.
4. Select the variable connected to the input signal of the function block.
5. Select the output variable connected to the output signal of the function block.
6. To navigate backward, press SHIFT+LEFT ARROW.
   The input variable is highlighted.

7. To navigate forward, press SHIFT+RIGHT ARROW.
   The output variable is highlighted.

When selecting multiple variables, only the primary selection variable is added to the history. This primary selection variable is highlighted during navigation. If a variable is part of a group, the whole group is highlighted with the particular variable as primary selection.

Navigation between variables is available only for a single session of Application Configuration. For a new session of Application Configuration, the selection history is updated and stored from the beginning of the session.

Saving the Application Configuration tool configuration or pressing CTRL+S disables the navigation of variables. The selection history is updated and stored once the Application Configuration tool configuration is saved.

3.2.8.9 Variable list

The names of all the existing variables in the configuration can be viewed in the **Variable List** window. The **Variable List** window opens when the **Variable List** icon is clicked.

The variables can be filtered using the filter option. It filters the variables based on the text entered in the text box.

Adding variables

Click the **Add** button in the **Variables List** window.

If the filter text box is empty, the new variable is named as **Var** followed by a unique running number by default. If there is text in the filter text box, the variable is created with the same name as the text in the filter followed by a unique running number.

Using variables

- Click and drag an input variable from the right pane on the **Variable List** window into the configuration diagram area to create an input variable.
- Click and drag an output variable from the left pane on the **Variable List** window into the configuration diagram area to create an output variable.

Deleting variables

1. Select the variable from the variable list.
2. Click the **Delete** button in the **Variable List** window.

   The variable and the connection are deleted. The selected variable is deleted from the variable list and also from the configuration.

Deleting an output variable also deletes its partner variables and the associated connections, whereas deleting an input variable deletes only the selected variable and the associated connection.

Locating variables

1. Select the variable from the variable list.
2. Click the **Locate** button to navigate to the variable in the configuration.

Closing Variable List window

- Click the **Cancel** button in the **Variable List** window.
- Press ESC.
- Click the **Close** button.

3.2.9 Edit features

There are many edit features available in the configuration mode.

3.2.9.1 Delete Option

In the configuration, multiple Application Configuration symbols, pages and main applications can be selected, deleted and locked/unlocked. Also, all the unconnected variables can be deleted.

Opening Delete Option dialog box

- On the main menu, point to **Edit** and select **Delete Option**.
- Click the **Delete** button on the toolbar.



Application Configuration symbol, page or MainApp can be locked and unlocked by selecting the **Lock/Unlock** option from the shortcut menu. Right-click the selected node to open the shortcut menu. If the selected node is locked, **Unlock** is available. If the selected node is unlocked, **Lock** is available.



When a node is selected in the **Delete Option** dialog box, it is located or focused in the configuration.



To suppress the confirmation message in the **Delete Option** dialog box, on the **Tools** menu, point to **Options** and select **Application Configuration Preferences**. Click the **Application Configuration Symbols** tab and clear the **Delete Option** confirmation check box.

Deleting Application Configuration symbols

1. On the **MainApp** tab, open the **Delete Option** dialog box.

   All the available Application Configuration symbols like function block, composite function block and variable, hardware channel and glue logic block are listed in the **Delete Option** dialog box.
2. Select the check box for the item to be deleted on the **MainApp** page and click **Delete**.

   In Application Configuration, if **MainApp** or page is locked, the **MainApp** or page and the Application Configuration symbols inside the page cannot be deleted. Hence, if **MainApp** or page is locked, the Application Configuration symbol selection is disabled in the **Delete Option** dialog box.

Deleting pages

- Select the pages to be deleted in the **MainApp** node.
- Select the pages to be deleted in the **Delete Option** dialog box and click **Delete**.
  - In the Application Configuration tool, if **MainApp** is locked, the **MainApp** and the page inside the application cannot be deleted. If **MainApp** is locked, the page selection is disabled in the **Delete Option** dialog box.
  - If the page is locked, the page selection is disabled in the **Delete Option** dialog box and the page cannot be deleted.



In the Application Configuration tool, the page cannot be deleted if **MainApp** has a single page. Hence, the page selection is disabled in the **Delete Option** dialog box.



If the configuration has one **MainApp** and only one page, the page and **MainApp** selections are disabled. However, if there are multiple pages in a single **MainApp**, there is an option to delete all the pages except one.

Deleting MainApps

1. In the **Delete Option** dialog box, select **MainApp** present in the IED.

   In the Application Configuration tool, **MainApp** cannot be deleted if it is locked. Therefore, if **MainApp** is locked, the **MainApp** selection is disabled in the **Delete Option** dialog box.
2. Select the **MainApp** node in the **Delete Option** dialog box and click **Delete**.

   The pages and the Application Configuration tool symbols in that **MainApp** are selected for deletion.



The **MainApp** selection is disabled in the **Delete Option** dialog box if there is only one or only the default **MainApp** available in the IED.

Deleting all unconnected variables from the configuration

Select the **Delete all unconnected variables from the configuration** check box in the **Delete Option** dialog box. If the check box is checked, all unconnected variables are deleted from the configuration. By default, the check box is cleared.

- Variables with partners in configuration
  - If an unconnected output variable has any of its partners connected, this output variable is not deleted.
  - If an unconnected input variable has its output partner variable connected, this input variable is not deleted.
- Variables without partners in configuration
  - Unconnected variables without partners are deleted from the configuration.

3.2.9.2 Symbol Selection

In the configuration mode, one or more symbols can be selected using the mouse or using both keyboard and mouse.

Symbol selection using mouse

One or more symbols can be selected using the mouse by clicking on the symbol or by clicking on the main application drawing area and dragging the mouse. A grey coloured rectangle appears and all the graphical symbols which fall under this rectangle get selected.

Symbol selection using Mouse and Keyboard

In configuration mode, to select multiple graphical symbols, click on a symbol, press and hold the **Ctrl** key and click the other symbols.

3.2.9.3 Symbol Movement

In configuration mode, one or more symbols can be moved using the mouse or the Arrow keys.

Moving symbols using mouse

In configuration mode, one or more symbols which are selected can be moved in the following ways:

- If there in only one symbol under selection, press and hold the mouse button over the symbol, move the symbol to the location where it has to be placed and then release the mouse button.
- If there are more than one symbol selected, press and hold the mouse button on any one of the selected symbols and move the mouse. Whole selection moves together and can now be placed at desired location by releasing the mouse button.

Moving symbols using arrow keys

In configuration mode, one or more symbols that are selected can be moved left, right, up or down by using the arrow keys in the keyboard.



Symbol movement is not allowed if it leads to collision with any existing symbol.

3.2.9.4 Copy-Paste

In configuration mode, any graphical symbol or a group of graphical symbols in the configuration can be copied and pasted to a different location in the same configuration or to a different configuration.

Copy-paste can be done in several alternative ways.

- Toolbar
- Shortcut menu
- PCM600 menu bar
- Shortcut key

The copy-paste option is supported for various entities.

- Function block
- Function block with parameters
- IED and across different IEDs

- Composite function block
- Hardware channel
- Variable
- Main application



Copy-paste of glue logic blocks is not supported. After pasting, glue logic blocks are removed from the configuration

Copy-Paste function block

A function block can be copied and pasted in different ways. It can be done using the toolbar, context menu, PCM600 main menu or using the shortcut keys.

Toolbar

To copy and paste a function block using toolbar:

1. Select the function block.
2. Click on **Copy** button in PCM600 Toolbar.
3. Click on **Paste** button in PCM600 Toolbar.
4. Click on the main application drawing area. **Paste** form will appear. This form will show a tree view which contains all the available instances for the copied function block with default selections. User has the provision to change the instance number, execution order and cycle time of the pasted block by changing the selection.
5. Click on **Paste** button. If there is no collision with existing graphical symbols, the function block will be pasted. Paste is not allowed if there is collision with existing graphical symbols.

Shortcut menu

To copy and paste a function block using shortcut menu:

1. Select the function block.
2. Right-click and select **Copy** from the shortcut menu.
3. Right-click on the main application drawing area.
4. Select **Paste** from the shortcut menu. **Paste** form will appear. This form will show a tree view which contains all the available instances for the copied function block with default selections. User has the provision to change the instance number, execution order and cycle time of the pasted block by changing the selection.
5. Click on **Paste** button. If there is no collision with existing graphical symbols, the function block will be pasted. Paste is not allowed if there is collision with existing graphical symbols.

PCM600 Main menu

To copy and paste a function block using PCM600 main menu:

1. Select the function block.
2. Select **Edit** from PCM600 main menu.
3. Select on **Copy** submenu.
4. Select **Edit** from PCM600 main menu.
5. Select **Paste** from submenu.

6. Click on the main application drawing area **Paste** form will appear. This form will show a tree view which contains all the available instances for the copied function block with default selections. User has the provision to change the instance number, execution order and cycle time of the pasted block by changing the selection.
7. Click on **Paste** button. If there is no collision with existing graphical symbols, the function block will be pasted. Paste is not allowed if there is collision with existing graphical symbols.

Shortcut key

To copy and paste a function block using shortcut keys:

1. Select the function block
2. Press Ctrl+C from the keyboard
3. Click on the main application drawing area.
4. Press Ctrl+V from the keyboard. **Paste** form will appear. This form will show a tree view which contains all the available instances for the copied function block with default selections. User has the provision to change the instance number, execution order and cycle time of the pasted block by changing the selection.
5. Click on **Paste** button. If there is no collision with existing graphical symbols, the function block will be pasted. Paste is not allowed if there is collision with existing graphical symbols.



In automatic mode user can not select the cycle time, instance number and execution order information and the **Paste** form will not appear.



In fixed mode, if the available instances of a copied function block exhausts **Instance Overflow** message appears and cancels the paste operation on click of **OK**.

Copy-Paste composite function block

A composite function block can be copied and pasted in different ways. This can be done using the toolbar, shortcut menu, PCM600 main menu or using the shortcut keys.

Toolbar

1. Select the composite function block.
2. Click on **Copy** button in PCM600 toolbar.
3. Click on **Paste** button in PCM600 toolbar.
4. Click on the main application drawing area. If there is no collision with existing graphical symbols, the composite function block will be pasted. Paste is not allowed if there is collision with existing graphical symbols.

Shortcut menu

1. Select the composite function block.
2. Right-click and select **Copy** from the shortcut menu.
3. Right-click on the main application drawing area.
4. Select **Paste** from the shortcut menu. If there is no collision with existing graphical symbols, the composite function block will be pasted. Paste is not allowed if there is collision with existing graphical symbols.

PCM main menu

1. Select the composite function block.
2. Select **Edit** from PCM600 main menu.
3. Select on **Copy** submenu.
4. Select **Edit** from PCM600 main menu.
5. Select **Paste** from submenu.
6. Click on the main application drawing area. If there is no collision with existing graphical symbols, the composite function block will be pasted. Paste is not allowed if there is collision with existing graphical symbols.

Shortcut key

1. Select the composite function block.
2. Press Ctrl+C keys from the keyboard.
3. Click on the main application drawing area.
4. Press Ctrl+V keys from the keyboard. If there is no collision with existing graphical symbols, the composite function block will be pasted. Paste is not allowed if there is collision with existing graphical symbols.

Copy-Paste hardware channel

A hardware channel can be copied and pasted in different ways. It can be done using the toolbar, shortcut menu, PCM600 main menu or using the shortcut keys.

Toolbar

To copy and paste a hardware channel using toolbar:

1. Select the hardware channel.
2. Click on **Copy** button in PCM600 Toolbar.
3. Click on **Paste** button in PCM600 Toolbar.
4. Click on the main application drawing area. **Paste** form will appear if the channel selected is binary output and it is already allocated. If the channel copied is input channel or unallocated, **Paste** form will not appear.
5. Click **Paste**. If there is no collision with the existing graphical symbols, the hardware channel is pasted. Paste is not allowed if there is collision with the existing graphical symbols.

Shortcut menu

To copy and paste a hardware channel using Shortcut menu:

1. Select the hardware channel.
2. Right-click and select **Copy** from the shortcut menu.
3. Right-click on the main application drawing area.
4. Select **Paste** from the shortcut menu. **Paste** form will appear if the channel selected is binary output and it is already allocated. If the channel copied is input channel or unallocated, **Paste** form will not appear.
5. Click **Paste**. If there is no collision with the existing graphical symbols, the hardware channel is pasted. Paste is not allowed if there is collision with the existing graphical symbols

PCM600 menu bar

To copy and paste a hardware channel using PCM menu bar:

1. Select the hardware channel.
2. Select **Edit** from PCM600 main menu.
3. Select on **Copy** submenu.
4. Select **Edit** from PCM600 main menu.
5. Select **Paste** from submenu.
6. Click on the main application drawing area. **Paste** form will appear if the channel selected is binary output and it is already allocated. If the channel copied is input channel or unallocated, **Paste** form will not appear.
7. Click **Paste**. If there is no collision with the existing graphical symbols, the hardware channel is pasted. Paste is not allowed if there is collision the with existing graphical symbols

Shortcut key

To copy and paste a hardware channel using shortcut key:

1. Select the hardware channel.
2. Press Ctrl+C from the keyboard.
3. Click on the main application drawing area.
4. Press Ctrl+V from the keyboard. **Paste** form will appear if the channel selected is binary output and it is already allocated. If the channel copied is input channel or unallocated, **Paste** form will not appear.
5. Click **Paste**. If there is no collision with the existing graphical symbols, the hardware channel is pasted. Paste is not allowed if there is collision with the existing graphical symbols



Copy-paste of unallocated hardware channels pastes the channels directly without showing the **Paste** form.



Copy-paste of input hardware channels will paste the same channels without showing **Paste** form since input channels can occur multiple times.

Copy-Paste variable

A variable can be copied and pasted in different ways. It can be done using the toolbar, shortcut menu, PCM600 main menu or using the shortcut keys.

Toolbar

To copy and paste a variable using toolbar:

1. Select the variable.
2. Click on **Copy** button in PCM600 Toolbar.
3. Click on **Paste** button in PCM600 Toolbar.
4. Click on the main application drawing area. If there is no collision with the existing graphical symbols, the variable is pasted. Paste is not allowed if there is collision with the existing graphical symbols.

Shortcut menu

To copy and paste a variable using Shortcut menu:

1. Select the variable.
2. Right-click and select **Copy** from the shortcut menu.

3. Right-click on the main application drawing area.
4. Select **Paste** from the shortcut menu. If there is no collision with the existing graphical symbols, the variable is pasted. Paste is not allowed if there is collision with the existing graphical symbols.

PCM600 menu bar

To copy and paste a variable using PCM menu bar:

1. Select the variable.
2. Select **Edit** from PCM600 menu bar.
3. Select **Copy** on the submenu.
4. Select **Edit** from PCM600 menu bar.
5. Select **Paste** on the submenu.
6. Click on the main application drawing area. If there is no collision with the existing graphical symbols, the variable is pasted. Paste is not allowed if there is collision the with existing graphical symbols.

Shortcut key

To copy and paste a variable using shortcut key:

1. Select the variable.
2. Press Ctrl+C from the keyboard.
3. Click on the main application drawing area.
4. Press Ctrl+V from the keyboard. If there is no collision with the existing graphical symbols, the variable is pasted. Paste is not allowed if there is collision with the existing graphical symbols.



Name of the pasted output variable changes on every paste. Name of the pasted input variable remains same as the copied input variable. However, the name of the pasted input variable also changes if its partner output variable is also copied and pasted together.



By default the pasted variable names (in case there is name change) will appear with a unique number appended to the copied variable name. The number is a sequential number. For example: if an output variable Var_1 is copied and pasted, the pasted variable name will be Var_1 [1].



If partner input and output variables are copied and pasted together to a different location in configuration, name of both input and output pasted variables will change and will be same to maintain the relation.

Copy-Paste main application

The main application can be copied and pasted in the same IED configuration or to a different IED configuration which has the same capabilities.

1. Right-click the **MainApp** tab and select **Copy** from the shortcut menu.
2. Place the cursor where the main application has to be pasted, right-click the **MainApp** tab again and select **Paste** from the shortcut menu. In case of function blocks and channels, the form appears in the tree view.
3. Click **Paste** to paste the function blocks, channels and other graphical symbols present in the main application. Click **Cancel** to cancel the copy-paste operation.

The rules applied for pasting the individual graphical symbols are applied for the main application contents during the paste operation.

Copy-Paste group

A group can be copied and pasted in different ways. It can be done using the toolbar, shortcut menu, PCM600 main menu or using the shortcut keys.

Form with tree view will appear while pasting a group, if there is any function block or hardware channel present in the copied group.

The rules applied for pasting the individual graphical symbols will be applied for the group contents during the paste.

3.2.9.5 Cut-Paste

In configuration mode, any graphical symbol or a group of graphical symbols in configuration can be cut and pasted to a different location in the same configuration. Cut-Paste can be done using various options.

- Toolbar
- Context menu
- PCM600 Main menu
- Shortcut key

The copy-paste option is supported for different entities.

- Function block
- Composite function block
- Hardware channel
- Variable
- Group

Toolbar

1. Select the graphical symbol.
2. Click on **Cut** button on the PCM600 toolbar.
3. Click on **Paste** button on the PCM600 Toolbar.
4. Click on the main application drawing area. If there is no collision with existing graphical symbols, the graphical symbol is pasted. Paste is not allowed if there is collision with existing graphical symbols.

Shortcut menu

1. Select the graphical symbol.
2. Right-click and select **Cut** from the shortcut menu.
3. Right-click on the main application drawing area.
4. Select **Paste** from the shortcut menu. If there is no collision with existing graphical symbols, the graphical symbol will be pasted. Paste is not allowed if there is collision with existing graphical symbols

PCM Main menu

1. Select the graphical symbol.
2. Select **Edit** from PCM600 main menu.
3. Select on **Cut** submenu.
4. Select **Edit** from PCM600 main menu.
5. Select **Paste** from submenu.
6. Click on the main application drawing area. If there is no collision with existing graphical symbols, the graphical symbol will be pasted. Paste is not allowed if there is collision with existing graphical symbols.

Shortcut key

1. Select the graphical symbol.
2. Press Ctrl+X from the keyboard.
3. Click on the main application drawing area.
4. Press Ctrl+V from the keyboard. If there is no collision with existing graphical symbols, the graphical symbol will be pasted. Paste is not allowed if there is collision with existing graphical symbols

Cut-Paste is possible only once. The paste menu disappears from shortcut menu or gets disabled from PCM edit menu, after a successful paste.

Cut-Paste is not allowed across different IED configurations.

Cut-paste behavior with connections

Cut-paste of graphical symbols retains/recreates the connections. Paste operation can be performed within same main application or different main application. Connections will be recreated as it is if both source and target symbols are in same page. The connections will be created using variables if the source and target symbols are in different pages.

If the source/target of any associated connection to the cut graphical symbol is hardware channel or variable then they are also moved along with the cut graphical symbol to the new page/MainApp after paste operation.

Cut operation is not allowed on connected hardware channels and variables.

Multiple representations of the variables/hardware channels are created for the variables/hardware channels which are having connections, connected to the graphical symbol other than the pasted objects.

- Only input channels/variables can have multiple representations.
- Output channels/variables will have single representation.

3.2.9.6 Undo-redo

Application Configuration tool allows the last action to be undone and redone. There are features that support undoing and redoing.

- Inserting Application Configuration Symbols like function block, composite function block, hardware channel, glue logic block, picture, text and new/existing variable (through the shortcut menu and toolbar menu).
- Inserting the worksheet, page.
- Deleting Application Configuration Symbols like function block, composite function block, hardware channel, glue logic block, picture, text and variable (through the shortcut menu and toolbar menu).
- Deleting worksheet, page.
- Deleting combination of multiple Application Configuration Symbols and connections.
- Copying and pasting the Application Configuration Symbols.
- Cutting and pasting the Application Configuration Symbols.
- Graphical symbols like function block, composite function block, hardware channel, glue logic block, text and new/existing variable movement.
- Creating and deleting the connection.
- Dragging a variable on the signal.
- Adding and deleting the User Defined Name (F2).
- Working on Manage Signals dialog box.
- Working on Delete Options dialog box.

Undoing and redoing can be done using the PCM600 main menu, toolbar and the shortcut keys.

- On the **Edit** menu, select **Undo** or **Redo**.
- Click the **Undo** or the **Redo** button on the toolbar.
- Press CTRL+Z to undo or CTRL+Y to redo an action.

If a configuration is saved, undoing and redoing become unavailable. The **Undo** and **Redo** buttons become unavailable on the toolbar and undoing and redoing become unavailable on the **Edit** menu.

If there are any changes in the Application Configuration tool through another tool like Signal Matrix tool, undoing and redoing actions are cleared.

Undoing and redoing are not supported for inserting the glue logic block, picture, text and new/existing variable through dragging.

If any insert operation is performed, redoing is cleared.

3.2.9.7 Grouping symbols

In the configuration mode, the group feature allows combining the selected symbols to a single object.

1. Select the desired symbols.
2. Right-click any of the selected symbols and select **Group**.

   The symbols are highlighted in blue, indicating that they are grouped.

To exclude an element from a group, right-click the element, and in the shortcut menu, select **Exclude from Group**.

To ungroup the grouped symbols, right-click the group and select **Ungroup**.

Locking a group

- Lock a group through the shortcut menu.
  - Right-click the group to be locked and select **Lock**.
- Lock a group with the shortcut keys.
  1. Select the group to be locked.
  2. Press CTRL+SHIFT+L.

Unlocking a group

- Unlock a group using the shortcut menu.
  - Right-click the group to be unlocked and select **Unlock**.
- Unlock a group with the shortcut keys.
  1. Select the locked group to be unlocked.
  2. Press CTRL+SHIFT+U.

3.2.9.8 Format

The format feature is useful in aligning the symbols in the configuration mode. It also enables moving channel names to the side of the channel icons and spacing the symbols vertically or horizontally.

Showing channel names beside the channel icons

The Show Channel Names to Side feature moves the hardware channel names to the side of the channel icons. This applies also to other operations performed on a hardware module, for example, copy and paste, cut and paste, grouping or ungrouping and setting the user-defined name.

- On the menu bar, click **Format** and then click **Show Channel Names to Side**. The hardware channel names are moved to the side of the channel icons.



Formatting of hardware channel names is not cancelled if the operation results in a collision of modules.

Aligning and spacing symbols

The symbols can be aligned and spaced in Application Configuration.

1. Use the mouse to select the symbols.

   To select several symbols, hold down the CTRL key while selecting.

   The primary selected symbol is outlined with red color, and the secondary selected symbols are outlined with blue color.
2. On the menu bar, select **Format** > **Format Symbols**, point and click the wanted option.
   - Point to **Align** and select **Left/Right/Horizontal/Top/Bottom/Vertical** to arrange the symbols in relation to the primary selected symbol.
   - Point to **Align** and select **Detect overlapping FunctionBlocks** to find the overlapping function blocks in the configuration. The pages containing

overlapping function blocks are listed on the **Output** window. To locate a page, double-click an item on the list.

- Point to **Align** and select **Align overlapping FunctionBlocks** to align the overlapping function blocks in the configuration.
- Point to **Horizontal Spacing** and select **Make Equal** to arrange the selected symbols horizontally with equal spaces between them.
- Point to **Vertical Spacing** and select **Make Equal** to arrange the selected symbols vertically with equal spaces between them.

Formatting of the symbols is cancelled if the operation results in collision.

3.2.9.9 Printing configurations

The configuration can be previewed and printed based on various worksheet selections.

- In the **Preview Setup** dialog box, select the values of the various options.
  - **Exposed Signals**
  - **Size** (A3, A4 or Letter)
  - **Orientation** (The default value is landscape and it cannot be changed.)
- Select the required printing options.
  - **Variable**
  - **Glue Logic Info**

Previewing configurations

- Click the **Print preview** button on the toolbar.
- Select **File** > **Print preview** on the PCM600 menu bar.

  Different type of pages can be selected in the **Preview** window.
  - Current page
  - Selected page
  - All type pages

The configuration parameters, variables and glue logic information can be printed after each page or after the configuration. An option is also provided not to print this information.

Printing

1. In the configuration mode, click the **Print** toolbar button or select **Print** on the **File** menu.
2. Select the configuration.
3. Click **OK**.

A configuration can also be printed by pressing CTRL+P.

3.2.9.10 Pan

In configuration mode, the Pan feature allows the user to move around within the current configuration window in any direction.

The Pan feature can be enabled by a single click on the **Enable Pan** button in the PCM600 toolbar. Once the Pan feature is enabled, hold down the mouse button and move around with in the configuration.

To disable Pan, release the mouse button and click the **Disable Pan** button.

3.2.9.11 Thumbnail

In Configuration mode, the thumbnail feature will allow the user to see the overview of the current main application in thumbnail view.

The Thumbnail feature can be enabled by a single click on the **Thumbnail** button in the PCM600 toolbar. A small window will pop up. In thumbnail view the active view of the configuration will be highlighted. Click in the thumbnail view and drag the mouse, a rectangle will be formed in the thumbnail view and the corresponding area will be shown in the main application.

Close the thumbnail view or click on the **Thumbnail** button in PCM600 toolbar to disable Thumbnail.

3.2.9.12 Zoom

There are various zoom options available in the configuration mode.

- Zoom in
- Zoom out
- Zoom by value

Zoom in

The zoom in feature gives an enlarged view of the configuration. Click the **Zoom in** button on the toolbar to enable zoom in.

Zoom out

The zoom out feature is used to see the configuration at reduced size. Click the **Zoom Out** button on the toolbar to enable zoom out.

Zoom by value

- Type the required zoom percentage in the zoom drop-down box to zoom in or zoom out.
- Select any required percentage value from the available values in the drop-down list.
- To fit the configuration view to width, height or page, use **Fit Width**, **Fit Height** or **Fit Page** options respectively from the drop-down list.



The maximum value for zooming is 250% and the minimum value is 40%.

3.2.9.13 Inserting text

1. Click the **Insert text** button on the toolbar or select **Insert/Text** from the main menu.
2. Click the main application drawing area to place the text.
3. Double-click the text box to open the text editor.

   The text editor has the options to set the font family selection, font size, font style, colour and alignment. The PCM600 predefined styles can also be set.
4. Enter the text and click outside the text editor in the main application to close the text editor.

The text box should not be left empty. A warning message appears if the text box is empty.

3.2.9.14 Delete text

Right-click on the text and select **Delete** from the shortcut menu or select the text box and press **Delete** key to delete the text.

3.2.9.15 Inserting pictures

1. Click on the **Insert Picture** toolbar button or select **Insert/Picture** from the main menu.
2. Click the main application drawing area to place the picture.

   A window opens to browse the image.
3. Click **Browse** and choose the location of the image.
4. Click **Open**.

   The picture is inserted as a background and the function blocks can be dragged and dropped over the picture. Connections can be made over the image.

The pictures that are larger than one page area are not inserted.

When the configuration is written to the IED, the pictures in the configuration is not written or saved in the IED.

3.2.9.16 Resizing pictures

1. Select the picture.
2. Click the window corner and drag to resize the picture.

3.2.9.17 Delete picture

Right click on the picture and select **Delete** from the shortcut menu or select the picture and press **Delete** key to delete the picture.

3.2.9.18 Find and replace

In the configuration mode, the find and replace feature can be used to search and locate the function blocks, composite function blocks, signals, variables, hardware channels, text comments, FeedBack Indication or all graphical symbols using simple or advanced search option.

- Find: There are two ways of finding, simple and advanced.
- Replace: Replaces the user-defined name of the graphic symbol or the graphic symbol of type Variable and the text name. There are two ways of replacing, simple and advanced.

The feature can be activated in different ways.

- Selecting **Find and Replace** on the **Edit** menu.
- Clicking the **Find and Replace Nodes** button on the toolbar.
- Pressing CTRL+F to find.
- Pressing CTRL+H for replace.



The **Find and Replace** dialog box can be closed by pressing ESC.

Simple Find

1. Activate the find feature in one of the alternative ways.
   - Select **Find and Replace** on the **Edit** menu.
   - Click the **Find and Replace Nodes** button on the toolbar.
   - Press CTRL+F.
2. Enter the graphical symbol name in the **Find what** text box.
3. Click **Find Next** to locate the next instance of the graphical symbol. After clicking **Find Next**, press Enter to move to the next instance.
4. Click **Close** to close the **Find and Replace** dialog box.



With the **Find What** text box empty, all graphical symbols can be located.

Advanced Find

1. Activate the find feature in one of the alternative ways.
   - Select **Find and Replace** on the **Edit** menu.
   - Click the **Find and Replace Nodes** button on the toolbar.
   - Press CTRL+F.
2. Enter the graphical symbol name in the **Find what** text box.
3. Click **Find Options** to perform advanced search.
4. Select a specific find option to filter the search.

- **Search Type** - In the **Search Type** drop-down list, **Function Block**, **Variable**, **Hardware Channel**, **Text**, **Signal**, **Composite Function Block**, **FeedBack Indication** or **All** can be selected. By default, the search type is **All**.
- **Search In** - The search can be filtered to search from **Current Main Application** or **All Main Applications**. By default, the **Search In** selection is **All Main Applications**.
- The search can be filtered to **Match Case**, **Match Whole Word** or **Search on UDN**.

5. Click **Find All** and the results are displayed in the **Search Results** list box.

   The search results list box contains generic column names.

   - **Name** - Name of the graphical symbol
   - **Type** - Type of the graphical symbol
   - **Details** - Information corresponding to the graphical symbol, that is, for the function block the **Details** column contains OTI information, for signal type the column tells to which function block the signal corresponds
   - **Location** - Details of location of the graphical symbol.

   Each column can be sorted by clicking the column header. The find result can be sorted based on each of the columns in ascending and descending order.

6. Click **Close** to close the **Find and Replace** dialog box.

Simple Replace

1. Activate the replace feature in one of the alternative ways.
   - Select **Find and Replace** on the **Edit** menu.
   - Click the **Find and Replace Nodes** button on the toolbar.
   - Press CTRL+H.
2. Enter the graphical symbol name in the **Find what** text box.
3. Click **Find Next** to locate the next instance of the graphical symbol. After clicking **Find Next**, press Enter to move to the next instance.
4. Click **Replace**.
5. Enter the string to be replaced in the **Replace with** text box.

   The user-defined name of the selected graphical symbol is replaced.

   With the **Find What** text box empty, all graphical symbols can be located.

Advanced Replace

1. Activate the replace feature in one of the alternative ways.
   - Select **Find and Replace** on the **Edit** menu.
   - Click the **Find and Replace Nodes** button on the toolbar.
   - Press CTRL+H.
2. Enter the graphical symbol name in the **Find what** text box.
3. Type the replacement string in the **Replace with** text box.
4. Click **Find Options** to perform advanced search.
5. Select a specific find option to filter the search.

- **Search Type** - In the **Search Type** drop-down list, **Function Block**, **Variable**, **Hardware Channel**, **Text**, **Signal**, **Composite Function Block**, **Composite Function Block Signal** or **All** can be selected. By default, the search type is **All**.
- **Search In** - The search can be filtered to search from **Current Main Application** or **All Main Applications**. By default, the **Search In** selection is **All Main Applications**.
- Search can be filtered to **Match Case**, **Match Whole Word**.

6. Click **Find ALL** and the results are displayed in the **Search Results** list box.

   The search results list box contains generic column names.

   - **Name** - Name of the graphical symbol
   - **Type** - Type of the graphical symbol
   - **Details** - Information corresponding to the graphical symbol, that is, for the function block the Details column contains OTI information, for signal type the column shows to which function block the signal corresponds.
   - **Location** - Details of location of the graphical symbol.

7. Click each column header to sort the column content. The find result can be sorted based on the columns in ascending and descending order.
8. Click **Replace** or **Replace All** to select and replace multiple items from the search results with the replacement string.

   - To replace the highlighted/selected occurrence of the search result, click **Replace**.
   - To replace all the occurrences of the find result, click **Replace All**.

9. Click **Close** to close the **Find and Replace** dialog box.



User-defined name (UDN) cannot be modified for objects that are locked in Application Configuration.

3.2.10 Composite function block editor

In configuration mode, the composite function block editor is used to create the composite function block types.

3.2.10.1 Opening the composite function block editor

- Click **Composite Function Block** on the menu bar and select **Show Editor**.

The composite function block editor opens within the Application Configuration drawing area with empty editor. New composite function block types can be created here.

3.2.10.2 Creating a composite function block type

1. Create a new composite function block in one of the alternative ways.

   - Select **Create New Type** from the **Composite Function Block** menu.
   - Click the **New Composite Function Block Type** icon in the composite function block editor.

- Click the **Create new Composite Function Block Type** link in the editor.
- Right-click any existing composite function block name in the **Available Composite Function Block Types** grid and select `Create New Type` from the menu.

  The **Composite Function Block Type Name** dialog box appears.

2. Enter the name and description.

   The name should be unique.
3. Drag the required function blocks from the **Object Types** window to the composite function block editor area.
4. Make the required connections.
5. To expose the signal, right-click **Manage Signal** and double-click the corresponding cell in the **Exposed** column.
6. Click **Save**.

An existing composite function block type can be duplicated from the **Available Composite Function Block Types** grid by right-clicking the name of the function block and selecting **Copy and Create New Type** option.

Composite Function Block Editor allows to add multiple instances of single function blocks from the **Object Types** window to the editor area. There is no limitation for adding any number of function blocks, same or different in the editor. Instance validation is performed while instantiating for using composite function blocks in the configuration.

3.2.10.3 Editing a composite function block

1. Open the composite function block editor.

   The existing composite function blocks are listed.
2. From the **Available Composite Function Block Types** grid, double-click the composite function block to be edited, or right-click the selected row and select **Edit**.
3. Make the required changes in the editor.
4. Click **Save** to save the updates.

3.2.10.4 Managing composite function blocks

1. Click **Composite function Block** on the menu bar and select **Manage**.
   The **Manage Composite Function Block Types** window opens.
2. Manage composite function blocks using the various options in the **Manage Composite Function Block Types** window.
   - To activate a composite function block, select the corresponding check box in the **Activated** column. The activated composite function block appears in the **Object Type** window.
   - To deactivate a composite function block, clear the corresponding check box in the **Activated** column. The deactivated composite function block is removed from the **Object Type** window.
   - To delete a composite function block, click the delete icon. If the composite function block is in active state, deactivate and then delete.

- To upgrade the composite function block, click **Upgrade**. The composite function block used in the configuration is upgraded with the changes. The **Upgrade** button appears in the **Composite Function Block Types** window, when any activated composite function block is edited in the editor and saved.
- To migrate the composite function block, click **Migrate**. The function block type(s) used in composite function block type will be migrated to current IED version. The **Migrate** button appears in the **Composite Function Block Types** window, when function block type(s) used in composite function block type has a newer version available.

3.2.10.5 Signal operations

Different operations can be performed on the signals in **Composite Function Block Editor**.

Exposing signals through function block signal context menu

1. Right-click the function block signal and select **Expose Signal**.
   The exposed input and output signals appear on the respective panels of **Composite Function Block Editor**.
2. Double-click the signal name in the **Input** or **Output** panel and update the name.



To expose the function block signal for a particular composite function block, the **Expose Signal** option is used.

Exposing signals through function block context menu

1. Right-click a function block in the **Composite Function Block Editor** and select **Manage signals**.
2. Select the **Exposed** check box to view the exposed signals.
   A warning message is displayed if the exposed signal's Custom Name is not unique.
3. Update the **Custom Name** and click **OK**.
4. Double-click the check boxes below the **Mandatory** column to make all the required signals mandatory.

Exposing signals by dragging

1. Select the signal to be exposed from the function block.
2. Drag the signal to the **Input** or **Output** panel.
   The signal dropped to the panel is exposed.



To change the order of exposed signals, right-click the panel of exposed signals and select **Sort Ascending** or **Sort Descending**.

Setting the name to exposed signals

- Expose a signal and double-click the signal name field to type the custom name.
- Click the exposed signal name in the input and output panels to change the custom name.
- Right-click the selected function block and select **Manage Signals**. In the **Manage Signals** dialog box, the name of the exposed signal can be updated.

  Custom names are always unique.

Exposing two or more input signals with the same name groups the signals, and these signals are exposed as a single signal in an instantiated composite function block.

Making signals mandatory

1. Right-click a function block and click **Manage Signals**.
2. Double-click the check boxes below the **Mandatory** column to make all the required signals mandatory.

Grouping signals

1. Select multiple exposed signals in the editor and right-click.

   The **Composite Signal Name** dialog box opens.
2. Enter the group signal name.
3. To ungroup signals, select multiple exposed signals in the editor, right-click and select **Un Group**.
4. To include a signal in an existing group, select the signal to be included in the group and any signal from the existing group, right-click and select **Group**.
5. To include an exposed signal to an existing group, select the signal and right-click, and then select **Group**.

A dialog box to enter group signal name appears. Enter an existing group name in which this exposed signal should be added.

Unexposing signals

Signals can be unexposed in several alternative ways.

- Right-click the exposed signal and select **Unexpose Signal**.
- Select the exposed signal port in the drawing area and press DELETE.
- Right-click the function block and select **Manage Signals**. Deselect the exposed signal to unexpose.

3.2.10.6 Copying editor items

- Shortcut menu

  1. Select the items to be copied.
  2. Right-click a selected item.
  3. Click **Copy**.

- Shortcut key

  1. Select the item to be copied.
  2. Press CTRL+C.

3.2.10.7 Cutting editor items

The **Cut** operation is used to cut items from the editor area and to paste them in some other part of the editor area.

- Shortcut menu

  1. Select the item to be cut.
  2. Right-click the selected item.
  3. Select **Cut**.

- Shortcut keys

  1. Select the item to be cut.
  2. Press CTRL+X to cut the item.

3.2.10.8 Pasting editor items

The **Paste** operation is used to copy the items from clipboard to the editor area.

- Shortcut menu

  1. Copy the items to activate the **Paste** function in the context menu.
  2. Right-click the editor area where to paste the items.
  3. Click **Paste** to paste the items.

- Shortcut key

  1. Copy an item.
  2. Click the editor area where to paste the item.
  3. Press CTRL+V to paste the item on the area.



The custom name of the exposed signal is changed automatically during the **Paste** operation to have a unique custom name.

3.2.10.9 Deleting editor items

- Pressing DELETE

  1. Select the item to be deleted.
  2. Press the DELETE key.

- Deleting with the menu button

1. Select the item to be deleted.

   The **Delete** button is activated on the menu bar.
2. On the **Edit** menu, select **Delete**.

3.2.10.10 Managing composite function block signals

1. Right-click a composite function block on the editor.
2. Click **Manage Composite Function Block Signals**.
3. Update the signals (custom name and visibility for signal matrix).
4. Click **OK**.

3.2.10.11 Closing the composite function block editor

- Click the **Close** button at the top corner of the editor window.
- Click the **Hide composite Function Block Editor** icon on the menu bar.

3.2.11 Creating composite function block types from function block instances

1. Select the required function block instances available in **MainApp**.
   a) Right-click the selected function block.
   b) Select **Create Composite Function Block Type**.

      The **Composite Function Block Type Creation** dialog box appears.
2. Type the name and description in the **Name** and **Description** text boxes.
3. Expose the desired signal by double-clicking the **Exposed** column.

   Exposing two or more signals of the same type on the input side of function blocks groups the signals when they are assigned with the same custom name.
4. Mark the exposed signals as mandatory by double-clicking the **Mandatory** column. Click the name of the signal that has to be set as mandatory in the composite function block definition.
5. Double-click the **Exposed Name** column to name the exposed signals. The custom names of the exposed signals are always unique.
6. Click **Create** to create a new composite function block type or **Cancel** to cancel the operation and close the dialog box.

7. Verify that the newly created composite function block type is added to the **PCM600 Object Types** window.



The double arrowhead symbol in the **Composite Function Block Editor** or the **Choose Instance** window represents the grouped signals.



Changing the custom name of an exposed group signal ungroups it from the current group.



The grouped signals are shown as a distinct single signal in the instantiated composite function block in Application Configuration.



Composite function blocks can be created only based on function blocks; nested composite function blocks are not supported.

3.2.12 Composite function block handling

Composite function block is an aggregation of the function blocks and connections. To protect proprietary configuration logic being exposed to the end user, to save the space in the configuration and to reduce the redundant mapping between function blocks and connection which follows same sequence they are grouped to form a composite function block.

3.2.12.1 Inserting a composite function block

1. Insert a composite function block in one of the alternative ways.
   - Drag the composite function block from the **Object Type** window to the drawing area of the configuration.
   - Press CTLR+SHIFT+C.
   - Use the shortcut menu.
     1. Right-click the main application drawing area and select **Insert Composite Function Block**.
     2. Select the composite function block from the list of all the available composite function blocks for a particular IED.

   After inserting the composite function block, the **Choose Instance** dialog box appears.



The top left corner of the **Choose Instance** dialog box displays the cycle time, execution order and instance number and the top right corner displays the constituents of the composite function block.

2. Select any cycle time, execution order and instance number or the constituents of the composite function block from the available list for the selected function block.

3. Click **Apply**.
   The selected cycle time, execution order and instance number are applied on the function blocks.



The **Choose Instance** dialog box appears only in the fixed mode.



When the function block is selected, the function block name is highlighted in the tree view. When the function block name is selected in the tree view, the respective function block is under focus in the dialog box.



A locked composite function block in the configuration can be upgraded to a newer version. The lock does not prevent upgrading.

3.2.12.2 Deleting a composite function block

The Delete option removes the selected composite function block from the configuration.

1. Delete a composite function block in one of the alternative ways.
   - Right-click a composite function block and select **Delete**.
   - Select a composite function block and press DEL.
   - On the **Available Composite Function Block Types** grid, right-click the name of the composite function block and select **Delete Type**.
2. In the confirmation dialog box, click **Yes** to confirm the deletion or **No** to cancel it.

3.2.12.3 Moving a composite function block

- Move the selected composite function block to a different location with the mouse or the arrow keys.

3.2.12.4 Viewing composite function block constituents

- Right-click a composite function block in Composite Function Block Editor and view the constituents.
  After selecting the composite function block, press CTRL+SHIFT+I to view the constituents.

3.2.12.5 Viewing cycle time execution order of composite function block constituents

- Place the pointer on a composite function block.

The constituents are displayed in Tool-Tip. Also execution order, cycle time and instance number information of the constituent block are displayed in the Tool-Tip.

3.2.12.6 Exporting a composite function block

1. Open the export form in one of the alternative ways.
   - Click **Composition Function Block** on the menu bar and select **Export**.
   - From the **Available Composite Function Block Types** grid, right-click the name of the composite function block and select **Export**.
   - Click the Export Composite Function Blocks button on the tool bar.

   The composite function block export form appears with a tree view of all the available composite function blocks on the left panel.
2. Select the target folder for exporting the composite function block on the right side of the panel.
3. Click **Export** to export the composite function block.
4. Specify the template file name.
5. Choose the certificate to use for signing.

3.2.12.7 Importing a composite function block

Only composite function blocks of the same IED type can be imported.

1. Open the import form in one of the following ways.
   - Click **Composition Function Block** on the menu bar and select **Import**.
   - From the **Available Composite Function Block Types** grid, right-click the name of the composite function block and select **Import**.
   - Click the Import Composite Function Blocks button on the tool bar.

   The composite function block import form appears with a tree view of all the available composite function blocks on the left panel.
2. Click **Browse** and browse the file to be imported.
3. Click the **Import** button to import the composite function block.
4. Click the **Include/Exclude Composite Function Block** button on the menu bar to include the imported composite function block.
5. Select the check box for the imported composite function block and click OK in the dialog box.
6. Verify that the newly created composite function block is added to the **PCM Object Type** window.



PCM600 checks the integrity of the template during import. If the template was signed with a certificate that does not exist in the computer's certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the template.

There can be several reasons why the integrity check fails:

- The template has been created with PCM600 version which does not sign the template files
- The computer certificate store does not contain the certificate needed to do the verification
- Verification itself fails

All the listed reasons above mean that integrity of the template could not be verified, and it is possible that someone has tampered with the template. If the integrity can't be checked or the verification fails, it is still possible to proceed with import. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

3.2.12.8 Viewing object properties

- Select a composite function block to view its properties.

  The properties are displayed in the **Object properties** section.
- Select a signal of a composite function block to view the signal properties.

  The properties are displayed in the **Object properties** section.



Proper execution order cycle time and instance number information for constituent blocks are assigned when user performs Save/Validate operation in the Application Configuration tool.

3.2.12.9 Renaming a composite function block (Set user-defined name)

Renaming of composite function blocks depends on the IED capability. Some IEDs do not support renaming.

- Rename the composite function block instance in the configuration mode in one of the alternative ways.
  - In the **Object Properties** window, change the name in the **User-defined Name** property and press ENTER.
  - Click **Find** on the toolbar and locate the composite function block.

    Change the name in the **Replace composite function block name** box and click **Replace**.
  - Select the composite function block and press F2 to rename the composite function block.
  - Right-click the composite function block and select **Set User Defined Name**.

    Change the name of the composite function block in the **User Defined Name** field. Click **OK** to rename the composite function block, or **Cancel** to keep the previous name of the composite function block.

The changed name appears on the top of the composite function block in Application Configuration if it is not the default name.



The font color of the renamed composite function block is blue.

The maximum length of the user-defined name for a composite function block is the same as the maximum length defined for the function block.

3.2.13 MainApplication template

The MainApplication template enables reusing MainApplication configurations. The configuration worksheets can be saved as a template and inserted later into any configuration. The templates can be exported to the selected location and imported to PCM600.

MainApplication templates are saved in the selected folder named by the IED type, for example REC615, in the default location **Tools** > **Option** > **Application Configuration** > **MainApplication (tab)** > **Path**.

If the MainApplication template path is empty or not available, the MainApplication templates are saved in the folder named by the IED type in **PCMDataBasesABB** > **ACT** > **Templates**.

Exporting of glue logic blocks is not supported. After importing the MainApplication template, glue logic blocks are removed from the configuration.

3.2.13.1 Exporting MainApplication templates

The application configuration worksheets created in MainApplication can be saved and exported as templates.

1. Create a configuration for one or more main applications.
2. On the **File** menu, select **MainApplication Template** > **Export**, click **Export** or press CTRL+E.
   The **MainApplication Export** dialog box opens.
3. Select the required MainApplication from the tree node to save as template.
4. Enter the description in the **Description** text box.
   The description is optional.
5. Click **Save As**.
   The **Save File** dialog opens with the default MainApplication template name in the default template path. To save the template in a custom location, select the location.
6. Click **Save** to save the template.
7. Choose the certificate to use for signing the file.
8. Click **Cancel** to close the **MainApplication Export** dialog box.

The templates have only application configuration-related information, not parameters or communication-related information.

3.2.13.2 Importing MainApplication templates

A template created for a specific IED type can be imported in a configuration in the configuration mode, provided that all object types of the template are supported by that IED configuration. If the selected execution order is **Fixed**, the instance information, such as instance number, execution order and cycle time, must be separately defined for function blocks. If the selected execution order mode is **Automatic**, the instance information is assigned by Application Configuration.

The instance information for other template constituents, such as hardware channels, must be assigned while importing.

1. Click **Insert** > **MainApplication Template** or on the **File** menu, select **MainApplication Template** > **Import** or press CTRL+I.
   The **Import MainApplication** dialog box opens listing the available templates for the IED type available in the default template path.
2. Set the template path.

   The **Template folder** text box contains the default template path. To browse to a custom location, click **Browse**. **The Browse to folder** dialog box opens. Select the destination folder to list the available templates for the IED type.
3. Select the IED type.

   The **IED Type** box displays the selected IED type, for example REC615.
4. Sort the template list.

   - Click the column header **Template Name** to sort the list by name.
   - Click the column header **Date Saved** to sort the list by date.

5. Select the template file in one of the alternative ways.

   - Click a template file to select it or use the arrow keys to navigate up and down the MainApplication Template list.
   - Double-click or click the left arrow key on the template file to select it and to expand the list of all selected worksheets.
   - Double-click or click the right arrow key on the template file to collapse the list of all selected worksheets.
   - Expand the tree view of any main application template file (.apcmm/.pcmm) and select or clear the worksheets to import into the configuration. By default, all the worksheets in the tree view are selected.
6. Click **Import** and then click **OK** to insert the template or **Cancel** to cancel the insertion.

   The default settings can be changed if required.

   Importing a template is based on the IED and the template version.

   - The IED supports the template to be inserted
     - If all the function blocks, hardware channels and composite function block instances are not used in the existing configuration, the template is inserted in the configuration and a message “Template inserted successfully” is displayed.
     - If any of the function blocks, hardware channels and composite function blocks in the template is not available, that is, is already used in the existing configuration, the available instances are shown in a tree-view report with default selection.
   - The IED does not support the template to be inserted

- Tree-view report containing a list of functions and hardware modules that are not supported is shown in red in the obsolete modules and hardware modules. The functions and hardware modules with changed version information are listed under the versioned function and hardware modules in blue.
- If all the instances of function blocks, hardware channels and composite function blocks in the template are available and not already used in the existing configuration, proceed with the importing.
- If any of the template's function block, hardware channel or composite function block instances is not available, that is, it is already used in the existing configuration, and the available instances are shown in a tree-view report, click Next to display all the available instances in a tree-view report. The instances are separated based on cycle time and the default instance is selected. The default instance can be modified by changing the instance number or the cycle time.
- All the connections in the template are retained in the configuration if it does not have any versioned function blocks. If a signal is removed from a new function block version, all the connections that are connected to the signal are removed. After importing a template in the configuration, it becomes part of the application configuration.

7. Click **Close** to close the dialog box.



PCM600 checks the integrity of the template during import. If the template was signed with a certificate that does not exist in the computer’s certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the template.

There can be several reasons why the integrity check fails:

- The template has been created with PCM600 version which does not sign the template files
- The computer certificate store does not contain the certificate needed to do the verification
- Verification itself fails

All the listed reasons above mean that integrity of the template could not be verified, and it is possible that someone has tampered with the template. If the integrity can't be checked or the verification fails, it is still possible to proceed with import. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

3.2.14 Hardware Channel

Hardware Channel is the graphical representation of the physical channels of the IED Hardware modules. Hardware Channels are of the following types:

- Binary Input
- Binary Output
- Analog Input
- Analog Output

The same input channel can be inserted multiple times in the configuration. However, the output channels can be inserted only once in the configuration.

3.2.14.1 Inserting hardware channel

The unallocated hardware channels can be inserted if the corresponding hardware modules are not created. The allocated and unallocated hardware channels are visibly distinct. The channels can be allocated or reallocated later.

Drag and drop

To insert a hardware channel by dragging and dropping:

1. Drag a Hardware Channel (Binary Input or Binary Output or Analog Input or Analog Output) from the Object Type window and drop it in the Configuration. The Hardware Channel allocation window will pop up.
2. Select **Hardware Module Name** and the required **Hardware Channel** to insert from the corresponding drop-down boxes.
3. Click **OK** to insert the required hardware channel.

Shortcut menu

To insert a hardware channel from the shortcut menu:

1. Right click on the empty space in configuration.
2. Select **Insert Hardware Channel** from shortcut menu.
3. Select the required hardware channel (Binary Input or Binary Output or Analog Input or Analog Output) and click **Insert**. The **Hardware Channel Allocation** window opens.
4. Select **Hardware Module Name** and the required **Hardware Channel** to insert from the corresponding list.
5. Click **OK** to insert the allocated hardware channel.

Menu bar

To insert a hardware channel from the menu bar:

1. Select **Insert** > **Hardware Channel** from the menu bar.
2. Select **Binary Input**, **Binary Output**, **Analog Input** or **Analog Output** from the list.
3. Click the configuration drawing area where channel should be inserted. The **Hardware Channel Allocation** window opens.
4. Select **Hardware Module Name** and the required **Hardware Channel** to insert from the corresponding list.
5. Click **OK** to insert the allocated hardware channel.

Shortcut key

To insert a hardware channel using the shortcut keys:

1. Press CTRL+SHIFT+H from the keyboard. A window will pop up.
2. Select the desired hardware channel (Binary Input or Binary Output or Analog Input).
3. Click **Insert** button. The hardware channel allocation window will pop up.

4. Select **Hardware Module Name** and the desired **Hardware Channel** to insert from the corresponding drop-down boxes.
5. Click the **OK** button to insert the allocated hardware channel.



Hardware modules cannot be created in Application Configuration. Only the channels of the created hardware modules (either through Configuration Wizard or Hardware Tool) can be used in the configuration.



Select **Create Unassigned Hardware channel** in the **Hardware Channel Allocation** to create unallocated hardware channels.



If both the module name and channel or either of them is empty before clicking the **OK** button, an unassigned channel is inserted even if the **Create Unassigned Hardware channel** check box is not selected.

3.2.14.2 Deleting hardware channel

- Right-click the hardware channel and select **Delete**.
- Select the hardware channel to be deleted and press DELETE.



If an assigned binary output channel is deleted, it is again available for insertion.



The hardware channel can be deleted with the **Delete Option** dialog box. For more information, see Delete Option.

3.2.14.3 Moving hardware channel

Select the hardware channel and move with the help of mouse and place it wherever required.

3.2.14.4 Allocating hardware channel

The unallocated hardware channels in the configuration can be allocated and allocated channels can also be reallocated. This is possible by the following steps:

1. Right-click the hardware channel.
2. Select **Allocate** from Shortcut menu.
   The **Hardware channel allocation** form pops up for that hardware module type.
3. Select **Hardware Module Name** and the desired **Hardware Channel** to insert from the corresponding drop-down boxes.
4. Click the **OK** button to insert the allocated hardware channel.

3.2.14.5 Setting hardware channel a user-defined name

The user-defined name for a hardware channel can be set in different ways.

- Right-click the hardware channel and select **Set user-defined Name**. Alternatively, press F2 or set the name from object properties.

Newline and comma (“,”) are not supported and cannot be used in user-defined names (UDN) for any channel.

When the Show Channel Names to Side option in the Format menu is enabled, the hardware channel names are moved to the side of the channel icon. When a user-defined name has been set to a hardware channel, this name is displayed in blue color next to the hardware channel name, and separated by space.

The maximum length of the user-defined name depends on the IED capability.

3.2.15 Comparing application configuration

The existing application configuration in PCM600 and the configuration in the IED can be compared. A report is given about the differences in function blocks and composite function blocks and their differences. Also the missing blocks and connections are listed. The function blocks can be compared based on their execution order and cycle time.

1. Click the **Compare configuration** button on the toolbar.
2. Select the comparison options and click **OK** to proceed with comparing or **Cancel** to cancel the comparison operation.
   - If the IED is connected, the tool reads the application configuration from the IED and compares it with the application configuration in PCM600.
   - If the configurations are identical, a message **The application configuration in PCM600 and IED are identical** is displayed.
   - If configurations are not identical, the differences are displayed in the comparison dialog box. The differences in connection are also displayed at the bottom of the comparison dialog box.

   Navigation from the comparison results dialog box to the corresponding function block or composite function block in the configuration can be done by right-clicking the function block or composite function block displayed in the comparison results dialog box and selecting **Show Function Block** or **Composite Function Block** in **Main Application**.

   If the IED is not connected, the **IED is not connected** message is displayed.

   Closing the application configuration closes the **Compare Configuration** dialog box.

3.2.16 Online Monitoring

This feature enables the user to continuously monitor the signal/channel values in the configuration. When in Online monitoring mode, the configuration in Application Configuration Tool cannot be edited. The following operations are possible:

3.2.16.1 Starting online monitoring

1. Click the **Work online** button on the toolbar.

   If the application configurations in the IED and PCM600 are the same, online monitoring starts.

   If the IED is offline, the message "IED is offline/communication error" is shown, the operation is cancelled and the **Work online** toolbar button is enabled.

2. Monitor the configuration of a connected IED.

   - The connections in the configuration change from solid line to animated railing line.
   - Online signal values are displayed near the hardware channels, function block signals and composite function block signals. These signal values are refreshed frequently.
   - Default signal values are displayed even though the output signals of a function block and a composite function block are not connected. These signals can be added to watch window.



If the focused page in the configuration does not have any signals to monitor, no values are displayed and the relevant information is displayed in the output window.



The color of the animated railing lines depends on the signal type and the signal values. Binary signals can have three colors.

- Blue for value "0"
- Red for value "1"
- Black indicating no status for any other values

Analog signals are set to the green color.

If the application configurations in the IED and PCM600 are not the same, online monitoring can be continued or cancelled.

- When clicking **Yes**, the monitoring starts but the mismatched signal has its default values.
- When clicking **No**, online monitoring does not proceed and the Application Configuration tool stays in the normal configuration mode.

When the Application Configuration tool is in online monitoring mode, the Work online button on the toolbar is disabled and the Work offline toolbar button is enabled.

The Work online button on the toolbar is disabled when there is no support from the IED for online monitoring.

A status message, "Trying to connect to IED . . . " is shown until the tool gets a response from the IED.

3.2.16.2 Watch Window

The function block signals can be added by the users to the watch window for selective monitoring. The following operations are possible:

Opening a watch window

The watch window button in the toolbar will be enabled only if configuration is in **Online Monitoring** mode. The window opens when the **Watch window** button in the toolbar is clicked.

Adding signals to watch window

1. Right click on the function block signal, a shortcut menu appears.
2. Click on **Add signal to watch window** in the shortcut menu. The selected signal will be added to the watch window and the values are displayed in the watch window.

Removing signals from watch window

To remove a signal from the watch window, select the signal in the watch window and click on the Remove button in the window.

Closing a watch window

The window can be closed by either clicking the **Close** button or by clicking the close button at the right hand top corner of the window.

3.2.16.3 Stop online monitoring

To stop online monitoring, click the **Work Offline** button in the toolbar. This stops the online monitoring and gets back to the configuration mode.

In configuration mode the **Work offline** button in the toolbar will be disabled and the **Work online** toolbar button is enabled again.

3.2.17 Glue Logics

Glue Logic Block (GLB) is an aggregation of multiple instances of cascaded logic functions into a single virtual logic function (or function groups). It is a set of basic logic functions that may be used to transform or combine logical signals. The current support is available for OR and AND function blocks only.

A glue logic block can have only one output.

3.2.17.1 Glue logic blocks with inverters

Inverters can be included in the expressions represented by glue logic blocks apart from the OR and AND blocks. The inverters included in the glue logic expressions are represented by a small circular symbol next to the glue logic blocks' signal that is similar to the representation of an inverted signals in the Application Configuration tool.

If the glue logic block consists of only an inverter block, it is represented in Application Configuration as a single input - single output function block with the inverter sign next to the glue logic block signal. The special block can be easily identified as this glue logic block does not have text inside it.

The OTI information of the functions part of the glue logic block is shown in the glue logic blocks' signal tooltip.

The glue logic blocks with inverter support are available when glue logic blocks are created with Signal Matrix. The inverted glue logic blocks cannot be created using Application Configuration.

3.2.17.2 Creating input glue logic blocks

Input glue logic blocks have inputs from hardware channels and output to function blocks.

Creation of input glue logic blocks is based on certain rules.

- At least one hardware channel should be connected to a function block and the output of this function block should be an input to another function block.
- The function blocks chosen for creating the input glue logic should be of the same logical type. That is, the logical set should contain either all OR logic types or all AND logic types.

1. Make a configuration.
2. Select the logical type function blocks based on the rules.
3. Right-click **Group Function Block for Glue Logic Block**. The glue logic block is automatically created and is also reflected in Signal Matrix.

The glue logic block that is now created in the configuration replaces the logical function blocks which were used to create this glue logic block.

Shortcut menu for creating glue logic blocks appears only if the selection of function blocks follows the rules of glue logic.

3.2.17.3 Creating output glue logic blocks

Output glue logic blocks have outputs to hardware channels and inputs from function blocks.

Creation of output glue logic blocks is based on the rules:

1. The function blocks chosen for creating output glue logic blocks should be of same logical type. That is, the logical set should contain either all the OR logic types or all the AND logic types.
2. The function block which has its output connected to the hardware channel should have inputs from any function blocks. It should also not be selected and not of the type logical OR or logical AND.
3. There should be only one hardware channel connected to the output of the function block group.

To create output glue logic blocks:

1. Make a configuration.
2. Select cascaded similar function blocks as mentioned in the rules above.
3. Right click **Group Function Block for Glue Logic Block** from the shortcut menu. The output glue logic block is then automatically created and is also reflected in Signal Matrix.

3.2.17.4 Editing connections in glue logic

1. Right-click the glue logic connection.
2. Click **Delete** from the shortcut menu to edit the selected connection and make connections to hardware channels or function blocks. These modifications in connections are also reflected in Signal Matrix.



The color of the glue logic changes to grey if all the signals are not connected.



The modifications in glue logic connections are merely the changes in the external logic of the glue logic block while the internal logic, which was used for creating the glue logic block, remains intact.

3.2.17.5 Deleting signals in glue logic

1. Right-click the signal.

2. Click **Delete** from the shortcut menu. The internal logic of the glue logic block, whose signal is deleted, is recalculated based on the left out internal configuration.



Only input signals can be removed.



Trying to delete the lone output signal or the last input signal removes the glue logic block.

3.2.17.6 Deleting glue logic blocks

1. Right-click the glue logic block.
2. Select **Delete** from the shortcut menu.

Deleting the glue logic blocks removes the hardware channels connected to it and these changes are also reflected in Signal Matrix.



Signal Matrix can also be used to create and delete glue logic blocks.

3.2.18 Constant signals

Constant value can be set for a signal in configuration mode. This depends upon the IED capability. The user can set the value of binary signal to **True** or **False**.

3.2.18.1 Set constant value

Constant values can be set for both analog and digital signals.

To set constant value for a binary signal:

1. Right click on the binary signal.
2. Select **Create Constant Signal** from shortcut menu (this appears depending on the IED's capability).
3. Select either **True** or **False** to set constant value accordingly.



Constant value of a signal can be seen in tool tip by placing the mouse cursor on that signal.

To set constant value for a analog signal:

1. Right click on the analog signal.
2. Select **Create Constant Signal** from shortcut menu (this appears depending on the IED's capability). A **Analog constant** window will popup
3. Enter the appropriate value for the signal and then click on **Assign** button to set the constant value.

The appearance of the signal changes on setting the constant value.

The Analog Signal Window shows default signal value (if not created already) for analog signal, if created then it shows previous value.

3.2.18.2 Remove constant value

Constant values that are set for a signal can be removed in the following ways:

1. Right click on the constant signal.
2. Select **Remove constant Signal** from the shortcut menu (this appears depending on the IED's capability). The constant value of the signal will be removed.

   Connection can be made to the constant signal. Constant signal will become normal signal once it is connected and value of the constant will disappear.

3.2.19 GOOSE Engineering

GOOSE Engineering enables to configure GOOSE communication between the sender and receiver IEDs. GOOSE receiver block of receiver IED can receive any available IEC 61850 attribute from any other IED in a project belonging to the same subnetwork.

3.2.19.1 Enabling/disabling GOOSE in Application Configuration

GOOSE configuration can be created between two IEDs after GOOSE has been enabled in Application Configuration.

1. On the **Tools** menu, point to **Options** and then select **Application Configuration** to enable GOOSE.
2. Under the **GOOSE Configuration** section, check **Allow configuring GOOSE in Application Configuration**. If the selection is cleared, all visual GOOSE representations are hidden in Application Configuration.

3.2.19.2 Making connections

1. Right-click the input signal of the function block, point to **Connect** and select **GOOSE** to make a single GOOSE connection.

   The Connect to GOOSE opens. Input signals can be connected to the sender IED’s IEC 61850 data attributes.
2. In the **Connect to GOOSE** dialog box, select the data attribute. The **Connect** button is enabled.

   After the input signal or channel has been connected to the data attribute, the GOOSE related configuration is created and the **Connect to GOOSE** dialog box is closed.

   The **Connect to GOOSE** dialog box contains several sections.

   - Recently Used IEDs
   - Select receiving access point

- Select sender IEDs
- Sender IEDs
- Extended Mode
- Receiver IED
- Search

GOOSE receiving is not possible if the sender IED and receiver IEDs do not belong to the same subnetworks. The sender IED must be within the same subnetwork as the subnetwork of the selected receiver access point.

When a connection is made to a data attribute, the connection is made to the first access point available in the sender IED.

Recently Used IEDs

The last three GOOSE subscribed IEDs are displayed under Recently Used IEDs.

Select receiving access point

The receiver access point can be selected from the Select receiving access point list.

Select sender IEDs

All IEDs are listed as per the project structure in PCM600. The receiver IED can receive attributes from the selected sender IEDs.

The IEDs listed under Select sender IEDs in the Connect to GOOSE dialog box may be unavailable in certain cases.

- The IED does not support Easy GOOSE.
- The IED is the receiver IED from which the Connect to GOOSE dialog box is launched.
- The IED is not part of the receiver IED’s subnetwork.

Sender IEDs

All the selected sender IEDs' attributes that can be received for the selected receiving signal are listed under Sender IEDs.

- Application Configuration
- SCL Configuration

Only the selected IEDs are listed in the Application Configuration section. Connection can be created after selecting the sender data attribute.

Only the selected IEDs are listed in the SCL Configuration section. Connection can be created after selecting the sender data attribute.

Extended Mode

Extended mode is used to make GOOSE connections directly without selecting an input signal in Application Configuration. In the Connect to GOOSE dialog box, “Extended Mode” is selected to create multiple GOOSE connections.

1. Select an input signal from the receiver IED. After the selection, only compatible signals are shown on sender IEDs.
2. Click or right-click the sender attribute and select Connect.

Receiver IED

The receiver IED is listed under the Receiver IED section. Connection can be made only at signal level and only for one signal.

After connecting input signal to data attribute, GOOSE related configuration changes are created and “Extended Mode” checkbox is disabled.

The attributes listed in Application Configuration and SCL Configuration tabs are the same. Same attributes can be received from the Application Configuration and SCL Configuration tabs.

GOOSE receive function block is created in the receiver IED along with the GOOSE variable. In the sender IED, the output signal is connected to the GOOSE variable. Right-click the GOOSE variable and select Go to Partner to navigate to the sender or receiver.

Search

In the Application Configuration tab, information can be searched, for example, based on MainAppilcation, function block, signal, data attribute and IED name.

In the SCL Configuration tab, logical device, logical node, data object and data attribute are considered in the filtering.

3.2.19.3 Deleting connections

1. Select a connection or a group of connections to be deleted.
2. Right-click and select **Delete**.

Certain connections cannot be deleted.

- GOOSE sending variable
- Link between the GOOSE sending variable and signal
- Function block to which the GOOSE sending variable is connected
- MainApp/Page containing the GOOSE sending variable

3.2.19.4 GOOSESenderApp MainApp

After input signals have been connected to data attributes, a GOOSE related configuration is created in the receiver IED. A separate MainApp called GOOSESenderApp is created in the sender IED. GOOSESenderApp contains the representation of SCL data attributes for signals that are not visible in Application Configuration.

After inputs signals have been connected to hardware channel data attributes, a GOOSE related configuration is created in the receiver IED. A separate MainApp called GOOSESenderApp is created in the sender IED. GOOSESenderApp contains the representation of new hardware channel data attributes connected to the GOOSE symbol.

3.2.19.5 GOOSE symbols

GOOSE symbol represents GOOSE communication between the sender and receiver IEDs.

The GOOSE symbol name is the full address of the data attribute that is being sent or received. After clicking “Connect” in the Connect to GOOSE dialog box, the GOOSE Symbol in the configuration is created. The naming convention for the GOOSE symbol is “Sender IED’s Technical key.LogicalDevice.LogicalNode.DataObject.Data Attribute (Functional Constraint)”



Click the Go to partner option in the receiver GOOSE symbol context menu to navigate to the sender IED’s GOOSE symbol and vice versa.

3.2.19.6 SCL blocks

SCL blocks represent the data attributes of signals/output hardware sender channels which are not visible in Application Configuration and are received by other IEDs.

SCL blocks are created in GOOSESenderApp in two ways.

- By receiving data attribute in SCL configuration tab in the Connect to GOOSE form.
- By receiving data attribute from output Hardware Channel in the Application Configuration tab in the Connect to GOOSE form.

The naming convention for SCL blocks is “Logical Data. Logical Node”. For SCL block’s output signals the naming convention is “Data Object.Data Attribute”.

3.2.19.7 Cut-Paste and Copy-Paste of ACT GOOSE variables

Cut-Paste

The GOOSE variables alone cannot be pasted. They can be cut or pasted only with the connected block.

Copy-Paste

Copying and pasting of GOOSE variables within the same IED is not allowed. If the GOOSE variable is copied along with the connected block, only the block is copied provided that the instance is available.

GOOSE variables and worksheets can be copied and pasted into other IEDs. However, the GOOSE sending variables are not copied. The receiving GOOSE variables are copied unless they are already present in the other IED.

3.2.19.8 GOOSE Online Monitoring

Perform Online Monitoring for the GOOSE sending signals and receiving signals with an online IED. The sending or receiving GOOSE variable shows the value being sent or received over GOOSE.

- Click **Work online** on toolbar.

The sending or receiving GOOSE variable shows the value being sent or received over GOOSE.

3.2.20 Signal user-defined name (Signal UDN)

In configuration mode, it is possible to set user-defined names for a signal depending upon the IED capability.

Signals, whose user-defined name can be set, appears in blue color.

3.2.20.1 Setting the signal user-defined name

1. Right-click the signal.
2. Select **Set user-defined Name**.
   The **Signal Instance** dialog box opens.
3. Edit the text in the **Signal user-defined Name** text box.
4. Click **OK**.
   The user-defined name and the default name of the signal appear inside the function block. The default signal name appears in black below the user-defined name of the signal, which is blue.

When the user-defined name is set for a signal, the function block height also increases automatically. If this function block collides with any other graphical symbol in the configuration or if the function block crosses the page boundary, a notification appears. In this case, the function block has to be placed manually in the appropriate place.

If the user-defined name set for the signal is similar to the default signal name, the user-defined name does not appear for the signal.

The maximum length of the user-defined name depends on the IED capability.

Newline and comma (“,”) are not supported and cannot be used in user-defined names (UDN) for any signal.

A user-defined name can also be set by selecting the signal and pressing F2 or with the **Manage Signal** dialog box. For more information, see Managing signals.

3.2.20.2 Reset signal user-defined name

To reset user-defined name of a signal:

1. Right-click the signal whose user-defined name has to be reset.

2. Select **Set user-defined Name** from the shortcut menu. A **Signal instance** window opens.
3. The user has to manually retype the default name of the signal in the **Signal user-defined Name** textbox and click **OK**. The user-defined name disappears from the function block and the function block height gets adjusted automatically. The default name appears in blue color. The user can also leave the textbox empty to reset the user-defined name.

3.2.21 Interaction with Signal Matrix Tool

The application configuration tool and signal matrix tool will always be in sync with each other. The various interactions between these tools are on the following features:

1. Visibility
2. Connections
3. Instance Name
4. Glue Logics

Visibility

User has the option to change the visibility of function blocks and signals. All the function blocks and signals will have default visibility depending on the IED. For more information refer to **Function Block Visibility** in **Function blocks** chapter.

According to the visibility options set in Application Configuration Tool, the function blocks and signals will be visible in Signal Matrix tool.



If the visibility of signal is set to Signal Matrix Tool, the corresponding function block's visibility is also set to Signal Matrix Tool.

Connections

Connections created/deleted in Application Configuration Tool between hardware channel and signal will be reflected in Signal Matrix Tool when it is saved. Connection created/deleted in Application configuration between signals are also reflected, where Signal Matrix supports connections between the Function Block signals. Similarly the changes made to connections in Signal Matrix tool will also be reflected in Application configuration tool when saved.



Signal visibility should be set to Signal Matrix Tool, for the connection made in Application Configuration Tool to appear in Signal Matrix Tool.

Instance Name

User can change the instance name of function block and signal depending on the IED capability. The changes made in Application Configuration Tool are reflected in Signal Matrix Tool and vice versa when it is saved.

Glue logic

See *Chapter 3.2.17 Glue Logics*

3.2.22 Interaction with Parameter Setting

Parameters can be set from Application Configuration.

1. Save the configuration before proceeding to change the parameters.
2. Right-click the function block for which the parameters have to be set.
3. Select **Configuration Parameters** from the shortcut menu.

   A **SimplePST** window opens. The parameters can be set for the selected function block.
4. Click **Save** to save the modified parameters. The user is prompted to save if the window is closed without saving the modified values.



Clicking Save when Application Configuration is in focus does not save the parameters modified in SimplePST.



When SimplePST is open, navigating in Application Configuration by selecting different function blocks shows automatically the parameters for that function block in SimplePST.

3.2.23 Setting Application Configuration preferences

1. On the **Tools** menu, point to **Options** and then click **Application Configuration**.
2. Set the **Configuration** preferences.
   - Project Name
   - Project ID
   - Customer Organization
   - Customer ID
3. In the **Main Application** preferences, set or change the password.

   The password is used to unlock the **MainApp** in application configuration.



The default password for the main application is blank. The password should be of eight characters and must contain at least one single alphanumeric and one special character.

   a) Enter the password in the **New Password** and **Confirm Password** fields.
   b) To set the password, click **Apply**.
   c) Click **OK** to close the dialog box.
4. Set the Application Configuration Symbols preferences.
   - Select **Always Confirm delete before any deletion** to prompt a message while deleting function blocks or hardware channels.
   - Select **Delete all connections on deletion of a block** to delete associated connections during deletion of a function block.
   - Select **Show Cycle Time, Execution Order, Instance Number** to display cycle time, execution order and instance number at the bottom of a function block.
   - Select **Include ANSI logic symbols** to use ANSI logic symbols.

- Select **Always confirm before delete from "Delete Option"** to prompt a message while deleting using **Delete option**.

3.2.24 Closing Application configuration

1. Right-click the application configuration tab at the top of the application configuration window.
2. Select **Close** from the shortcut menu or click the **Close** button in the right-hand corner of the window.

3.2.25 Licensing

The licensing feature helps in setting different options for the user. This is done in PCM600 using special **Order Option Flags** (OOF). These OOFs can be utilized during the configuration of the IED or by running the **License Update Tool** (LUT), once the IED is configured. The function block instances and hardware modules are made available or unavailable based on these OOFs.

3.3 Common read/write

Common read/write is used for both reading from IED and writing to IED. You can also maintain the jobs, modify user permissions and show reports.

3.3.1 Starting Read/Write for IED tool

1. Right-click Substation, Voltage Level, Bay or IED in the plant structure.
2. Select **Read from IED** or **Write to IED** from the shortcut menu.



If the Read/Write tool is already open, IEDs come last in the job list.

If the Read/Write tool is open and jobs are performed, start the read/write operation for certain IEDs by selecting IEDs from the job list.

1. Select the check box either in the Read or Write column.
2. Click **Start jobs** to start the read or write process.

While the operation is performed, the messages indicating the status of the operation are displayed in the Comment column. The operation progress is displayed in the progress bar of the Status column.



Only the modified parts of the IED configuration are read or written. IED User Management and Account Management configuration is not considered as part of the IED configuration.

3.3.2 Maintaining jobs

If the Read/Write tool is open and jobs are performed, you can perform the following operations:

- Schedule the read and write operations by selecting check boxes either in the Read or Write column.
- Delete IED from the job list by clicking **Delete**.
- Delete all IEDs from the job list by clicking **Delete all**.

3.3.3 Stopping Read/Write for IED tool

Stop jobs by clicking **Stop jobs**. If IED allows that the job can be stopped while it is ongoing, the job is stopped immediately. Otherwise, the current job is finished and other jobs on the job list are stopped.

3.3.4 Showing reports

After the selected jobs are finished, the detailed report is displayed. The report displays which data has been read from or written to each IED.

To display the different reports:

- Click **Report** to display the report of a specific IED.
- Click **Show total report** to display the report of all IEDs.

3.3.5 Modifying read/write permissions

A user with System Engineer rights can define the IED Read/Write permissions for user categories.

To define the IED Read/Write permissions:

1. Start the user management by selecting **Tools/Options**.
2. Select the **Category Manage** folder.
3. Specify the rights to perform different functions under the **Functions And Rights** field.
   a) Select **Read access** to enable the reading options.
   b) Select **Read/Write access** to enable both the writing and reading options.

3.4 Communication Connection

The communication connection tool is a generic tool used to create GOOSE connections between IEC 61850 GOOSE data attributes and GOOSE receive function block signals.

The tool can be launched from Substation/Voltage Level/Bay/IED in the project structure. It displays the overall GOOSE mappings configured at the selected project structure.

Within the tool, the GOOSE configurations are displayed in two split views:

- Top view: Connect to Logical Nodes
- Bottom view: Connect to Data Attributes

The top view is refreshed when the project structure selection changes. Any connection modification made in the previous view is retained in the updated view. However, these modified connections are lost when the tool is not saved.

If the selected project structure has no GOOSE senders/GOOSE receiving function blocks, the top view is empty, and a message is logged in the output window.

The communication connection tool is an exclusive tool and other tools cannot be opened unless this tool is closed.

Unassigned IEDs are not shown in Communication Connection for an FPN project.

3.4.1 Connect to Logical Nodes

The top view displays the GOOSE configuration between logical nodes and GOOSE receiver function instances in a tabular view. The grid columns display the GOOSE sending logical nodes and the grid rows display the GOOSE receiving function blocks configured at the selected project structure.

The top section tabular view is a read-only view. The view is updated when connections are made in the bottom view.

The cells in the top view are color-coded.

1. White cells indicate connectable cells. Double-clicking these cells loads the bottom view.
2. Blue cells indicate that there is at least one connection between the attributes of the corresponding logical node and the signals of the corresponding GOOSE receive function block. These cells have a '*' to indicate the presence of at least one connection. Double-clicking these cells loads the bottom view.
3. Pink cells indicate that the logical node's attributes cannot be received by the corresponding signals of the GOOSE receive function block due to data type mismatch. Connections cannot be created as the logical node is not supported by the GOOSE receive function block. These are read-only cells. Double-clicking these cells does not load the bottom view.
4. Grey cells indicate that the logical node is not configured in the data set for the corresponding receiving IED in the IEC 61850 Configuration tool. These are read-only cells. Double-clicking these cells does not load the bottom view. When selecting the row header, the bottom view populates all the logical nodes connected to the target GOOSE receiver block. If the function block is not connected to any logical node, clicking on the row header does not populate the bottom view.

3.4.2 Connect to Data Attributes

The bottom view displays the GOOSE configuration between data attributes and GOOSE receiving signals in a tabular view. The grid columns display the data

attributes of the selected logical node in the top view and the grid rows display the GOOSE receiving signals of the GOOSE receive function block selected in the top view.

The bottom view is populated based on the selected GOOSE receive function block in the top view. If the selected GOOSE receive function block changes in the top view, the bottom view is reloaded. However, if the selected logical node is changed for the currently selected GOOSE receive function block, the bottom view is updated with the attributes of the newly selected logical node.

The cells in the bottom view are color-coded.

1. White cells indicate connectable cells. Double-clicking these cells creates connection between the source data attribute and the target signal. An “X” in the cell indicates connection. After the connection is created , the cell color changes to blue and the top view is updated.
2. Blue cells indicate that the source data attribute / target signals are already connected. If the connection exists between the selected target signal and the source data attribute, an “X” is shown in the cell. If the cell is blue and there is no “X”, it means that the target signal / source attribute have an existing connection in the selected GOOSE receiving IED. Double-clicking a connected cell opens a dialog box where the user is asked to modify the connections.
3. Pink cells indicate that the attribute cannot be received by the corresponding target signal due to data type mismatch. These are read-only cells.

3.4.3 Connection copying and pasting

Connections can be copied and pasted from the top view. Copy-paste can be done in several alternative ways.

1. Edit menu
2. Toolbar
3. Shortcut menu when a top-view cell is right-clicked
4. Shortcut keys: CTRL+C for Copy and CTRL+V for Paste

The Copy option is enabled when there is at least one connection between the selected logical node and the GOOSE receive function block.

The tool validates the connections when pasting. The undo-redo options are enabled after pasting.



Connection patterns are not copy-pasted. Connection details are copied. Connections are pasted when there are compatible data attributes and GOOSE receiving signals in the selected top view cell.



Copy-paste options are not available for the bottom view.



The top view is refreshed when the plant structure selection changes. Any connection modification made in the previous view is retained in the updated view.

3.4.4 Undo-redo

Undo-redo operations are available across the tool and are enabled when connections are modified in the tool. With undo-redo, the tool view is updated to the previously modified view. Connections can be modified using undo-redo even when the plant structure selection is changed.

Undo-redo operations enable the Save button. Any connection modification during undo-redo in the previous view is retained in the updated view when the plant structure selection changes. The modified connections are lost when the tool is not saved.

3.4.5 Saving configuration

- Save the communication configuration in one of the alternative ways.
  - Click the **Save** button on the toolbar.
  - On the **File** menu, select **Save**.
  - Press the CTRL+S keys.

3.4.6 Finding

The find feature can be used to search for and locate, for example, GOOSE receiver function blocks or signals, logical devices, logical nodes, data objects, and data attributes in the Communication Connection tool.

1. Select the **Find** option in one of the alternative ways.
   - On the toolbar, click the **Find** button.
   - On the **Edit** menu, select **Find**.
   - Press CTRL+F.
2. Enter the search string and choose the required options by selecting the **Match Case** or **Match Whole Word** check boxes.
3. Click **Find Next** to find the next matching text.
4. Click **Close** to close the **Find** dialog box.

3.5 Communication Management

The Communication Management tool is used to configure communication protocols for the IED. It is also a generic tool used for mapping IED signals and outputs.

3.5.1 Starting Communication Management

- Right-click an IED and select **Communication Management**.
- On the **Tools** menu, click **Communication Management**.

3.5.2 Saving communication data

- Select **File/Save** from the PCM600 main menu.
- Click the **Save** toolbar button.

The save function is enabled only if data has been modified.

3.5.3 Writing communication data to IED

- Select **CMT/Write to IED** in the PCM600 main menu.
- Click the **Write to IED** toolbar button.

The data is saved when the writing process starts.

3.5.4 Reading communication data from IED

- Select **CMT/Read from IED** in the PCM600 main menu.
- Click the **Read from IED** toolbar button.

3.5.5 Exporting protocol mappings

1. On the **File** menu, click **Export Protocol Mappings**.
2. Select the target folder and enter the file name.
3. Click **Save**.

3.5.6 Importing protocol mappings

1. On the **File** menu, click **Import Protocol Mappings**.
2. Select the file to be imported.
3. Click **Open**.

3.5.7 Color coding

Every state of the signal is indicated by a color code.

- A signal in the default state is displayed in black, non-bold font.
- A signal in the deleted state is displayed in gray, strike-through font. The deleted state means that the function block of the signal is removed from the PCM600 configuration.

- A signal in the new-in-configuration state is displayed in dark blue, bold font. The new-in-configuration state means that the function block of the signal is added to the PCM600 configuration.
- A signal in the new-in-master state is displayed in green, bold font. The new-in-master state means that the signal is added to the protocol master.
- A signal in the imported state is displayed in black, bold font. The imported state means that the protocol mapping of the signal is imported into the PCM600 configuration from a file.

3.5.8 Creating or printing reports

- Create the report in one of the alternative ways.
  - On the toolbar, click **Create Report**.
  - On the **File** menu, click **Create Report**.
- On the **File** menu, click **Print** to print a report.

3.5.9 Closing communication management

Click the **Close** button.

If there is any unsaved data in the **Communication Management** window, a notification window pops up to save the changes.

3.5.10 Configuring DNP3 protocol

The configuration of DNP3 is done based on the configuration made in the Application Configuration tool. The Communication Management window for DNP3 has the signal selection view on the left and the signal configuration view on the right.

These views are used to set up the DNP3 protocol and the protocol-specific attributes. The views can be selected using the toolbar buttons.

3.5.10.1 Signal selection view

The signal selection view is displayed when Communication Management is started. The required signals for the system can be selected in the signal selection view. A list of all the available signals in the IED based on the current configuration is displayed on the signal selection view. The signal type can be selected from the list on the toolbar.



The lists contain only the signals that are selected in the list on the toolbar.

Assigning to different masters

- Select the signal to be assigned to a master by right-clicking it.
  - Select **Insert At...** and enter an index number.
  - Select Insert **Before**.

- Select Insert **After**.

- Select the signal and click .
- Click to assign all the available signals.

Hold down CTRL and select the required signals to select multiple signals at a time.

Changing signal index number

- Right-click the signal and select **Set Address**.
- Click to decrease the index number by one and click to increase the index number by one.
- Select the signal and enter the address in the **Index** field.

Hold the CTRL key and select the required signals to select multiple signals.

Removing signals from master

- Right-click the signal and select **Remove**.
  This moves the signal from the master list to the list of the available signals.
- Select the signal and click .
- Click to remove all the signals from the master.
- Click to clear all the mappings of the signals to the masters.

Hold the CTRL key and select the required signals to select multiple signals.

Changing point class

- Right-click the signal and select **Set Class**.
  The **Class Selection** window is displayed.
- Click the Class field of a signal.
  The **Class Selection** window is displayed.

Hold the CTRL key and select the required signals to select multiple signals.

3.5.10.2 Copying signals between masters

1. Right-click the signal and select **Copy to**.
   A list of all the masters are displayed in the shortcut menu.
2. Click on the master to paste the signal.

Hold the CTRL key and select the required signals to select multiple signals.

3.5.10.3 Signal configuration view

The protocol-specific parameters can be set for different signals in the signal configuration view. The signals list of different masters is displayed.

Add the signals from the signal selection view to be able to see it in the signal configuration view.

For more information on signals and the attributes, see the IED/protocol manuals.

3.5.10.4 Displaying row numbers

- Click .
- Select **CMT/Display Row Numbers** in the PCM600 main menu.

3.5.11 Configuring Modbus protocol

The Communication Management window for Modbus has a signal configuration view and UDR mapping view.

These views are used to set up the Modbus protocol and the protocol specific attributes. The views can be selected using the toolbar buttons.

3.5.11.1 Signal configuration view

The protocol-specific parameters can be set for different signals in the signal configuration view. The signals list of different masters is displayed.

For more information on signals and the attributes, see the IED/protocol manuals.

3.5.11.2 UDR mapping view

The signals can be added to the user defined registers. The protocol-specific parameters for the signals can be edited in the UDR mapping view.

For more information on signals and the attributes, see the IED/protocol manuals.

Mapping analog signals

1. Select a signal or multiple signals in the **Measurands And Counters signal** list.
2. Select an empty register in the UDR mapping table.
3. Click .
   If multiple signals are selected, the first selected signal is mapped to the selected empty register. The next signal is mapped to the consecutive empty register and so on.

   Hold the CTRL key and select the required signals to select multiple signals.

Mapping binary signals

1. Select a signal or multiple signals in the **Indications** signal list.
2. Click the **Plus** button next to the register to view the bit addresses of the register.
3. Select an empty bit address and click .
   If multiple signals are selected, the first selected signal is mapped to the selected empty bit address. The next signal is mapped to the consecutive empty bit address and so on.

   Hold the CTRL key and select the required signals to select multiple signals.

Removing UDR mapping

Select the mappings in the UDR mapping list and click .

Hold the CTRL key and select the required signals to select multiple signals.

3.5.12 Configuring IEC 60870-5-103 protocol

The **Communication management** window for IEC 60870-5-103 has a signal configuration view and user definable class 2 frame view. These views are used to

set up the IEC 60870-5-103 protocol and the protocol-specific attributes. The views can be selected using the toolbar buttons.

3.5.12.1 Signal configuration view

The protocol-specific parameters for indications and measurand signals can be set in the signal configuration view. The signal type can be selected from the Signal type list in the PCM600 toolbar or from CMT in the PCM600 shortcut menu.

For more information on signals and the attributes, see the IED/protocol manuals.

Setting protocol-specific values

1. Select a signal or multiple signals.
2. Right-click the value property field to set the value.
3. Enter or set the values and click **OK** or press **Enter**.

Hold the CTRL key and select the required signals to select multiple signals.

3.5.12.2 User-definable class 2 frame view

The user-definable class 2 frame view can be accessed from the toolbar button or from **CMT** in the PCM600 main menu.

The user-definable class 2 frame view consists of user-definable frame in the lower grid and the measurand signals that are not yet added to the user definable frame in the upper grid.

There are two buttons to move the signals from one grid to another. When a signal is moved from the upper grid to the lower one, it is appended to the next available frame position. The position of the selected signals in the grid can be changed using buttons next to the user-definable frame grid.

3.5.13 Configuring IEC 60870-5-101/104 protocol

The **Communication Management** window for IEC 60870-5-101/104 has the signal selection view on the left and the signal configuration view on the right.

These views are used to set up the IEC 60870-5-101/104 protocol and the protocol-specific attributes. The views can be selected using the toolbar buttons.

3.5.13.1 Signal selection view

The signal selection view is displayed when Communication Management is started. The required signals for the system can be selected in the signal selection view. A list of all the available signals in the IED based on the current configuration is displayed on the signal selection view. The signal type can be selected from the list on the toolbar.

The lists contain only the signals that are selected in the list on the toolbar.

Taking signals into use

- Select the signal to be assigned to a master by right-clicking it.
  - Select **Insert At...** and enter an index number.
  - Select **Insert Before**.
  - Select **Insert After**.
- Select the signal and click .
- Click  to take all the available signals.
- Click  to take all the available signals at default addresses.

Hold down CTRL and select the required signals to select multiple signals at a time.

Changing signal address

- Right-click the signal and select **Set Address**.
- Click  to decrease the value of the address by one and click  increase the value of the address by one.
- Select the signal and enter the address in the **Point Address** field.

Hold the CTRL key and select the required signals to select multiple signals.

Removing signals from master

- Right-click the signal and select **Remove**.
  This moves the signal from the master list to the list of the available signals.
- Select the signal and click .
- Click  to remove all the signals from the master.
- Click  to clear all the mappings of the signals to the masters.

Hold the CTRL key and select the required signals to select multiple signals.

3.5.13.2 Signal configuration view

The protocol-specific parameters can be set for different signals in the signal configuration view. The signals list of different masters is displayed.

Add the signals from the signal selection view to be able to see it in the signal configuration view.

For more information on signals and the attributes, see the IED/protocol manuals.

Setting protocol-specific values

1. Select a signal or multiple signals.
2. Right-click the value property field to set the value.
3. Enter or set the values and click **OK** or press **Enter**.

Hold the CTRL key and select the required signals to select multiple signals.

3.5.14 Editing object properties

Edit the object properties in one of the alternative ways.

- Edit properties in the main window.
  1. Select an object property.
  2. Edit the property value.
- Edit properties in the **Object Properties** pane.
  1. Select the object or objects in the main window.
  2. Edit the property value in the **Object Properties** pane.

It is possible to edit the properties of multiple objects at the same time in the Object Properties pane. If multiple objects are selected in the main window, only the properties that do not need to have a unique value are displayed in the Object Properties pane.

3.6 Configuration Wizard

Configuration Wizard helps the user to configure the IEDs, the supported hardware modules and software modules for the IEDs. The hardware modules are required in Signal Matrix Tool for connecting the signals in physical channels.

3.6.1 Starting Configuration Wizard

1. In the **Project Explorer** frame:
   - Right-click **Bay** in the plant structure.
   - Right-click **IED group** in the plant structure.
2. Select **New** and choose the required IED.

3.6.2 Selecting configuration mode

The **Online** configuration mode can be chosen when the IED is physically available for configuration. The software and the hardware information of the IED can be read using PCM600. The IED can be configured in **Offline** configuration mode, when the IED has to be configured but not available. In offline configuration, the user should enter the details manually.

1. In the **Configuration Mode Selection Page**:
   - Select **Online Configuration**.
   - Select **Offline Configuration**.
2. Click **Next** to select the communication protocol.

3.6.3 Selecting communication protocol

IEC 61850 is the default communication protocol. All the IEDs support this communication protocol.

1. In **Communication protocol selection page**, click the **IED protocol** drop down list. and choose the right communication protocol and click **Next**.
2. Select the other communication protocols like **SPA** and **LON** if required.



The **Communication provider** field cannot be modified. It is **PCM600** by default.

3.6.4 Configuring the communication protocol

The communication protocol configuration differs based on the chosen protocol.

IEC61850 communication protocol:

1. Select either **the Front Port** or **LAN** from the **Port** field.
2. Enter the IP address of the specified port in the **IP address** field.
3. Click **Next** to proceed to the version selection page.

SPA communication protocol:

1. Select the right port from the **Serial port** field. It is **COM1** by default.
2. Select the correct bit rate from the **Bit rate** field. It is **9600 Bits** / s by default.

3. Select the connection type from the **Connection type** field and click **Next**. It is **Direct connection** by default.
4. Select the SPA address from the **SPA address** field and click **Next** to proceed to the version selection page. It is **1** by default.

LON communication protocol:

1. Select the device name from the **Device name** field in **Line setting** frame.
2. Select the LON node number from the **LON node number field** in **Line setting** frame. It is **1** by default.
3. Select the LON subnet number from the **LON subnet number** field in **Line setting** frame. It is **1** by default.
4. Select the LON node number from the **LON node number** field in **IED setting** frame. It is **1** by default.
5. Select the LON subnet number from the **LON subnet number** field in **IED setting** frame. It is **1** by default.
6. Select the SPA unit number from the **SPA unit number** field in **IED setting** frame and click **Next** to proceed to the version selection page. It is **1** by default.

3.6.5 Defining version information

If the IED is configured in the online mode, click Scan to scan the IED name and version number from the IED database.

If the IED is configured in the offline mode:

1. In **Version Selection Page**, select the version number from the **Select the IED version** drop-down list.
2. Click **Next** to progress to the **Order Option Browse Page**.

3.6.6 Defining order code

IED identification is done by defining order options of the IED in Configuration Wizard. There are different ways to enter the ordering information depending on the IED product. An example of defining ordering options for RELION IEDs:

In the **Order Code Page**:

- If the IED is configured online, click **Scan** to read the order code from the IED.
- If the IED is configured offline, enter the order code available from the order certificate e-mail or choose the details of the IED from the selection boxes.

In the **Order Option Page**:

- If the IED is configured online, click Scan to read the order specific file from the IED.
- If the IED is configured offline, enter the path where the Order specific file is stored or browse to the location by clicking on the Browse button.



If **Order specific file** is not available, select **No Order Specific File** checkbox and click **Next**.

3.6.7 Completing IED configuration

- Click the **Finish** button if the listed configuration is correct.
  Click **Cancel** if some data is incorrect and re-configure the IED.

The user can cancel the configuration at any point by clicking the **Cancel** button.

Once the **Finish** button is clicked, all the necessary functions and hardware modules are created and listed in the plant structure.

3.7 Disturbance Handling

The Disturbance Handling tool is used for uploading and processing the disturbance files located in the specific IED. It is also used to view and process the disturbance recording data and create reports. The reports can be distributed among the chosen clients. An alternative COMTRADE analysing tool can be used for a detailed analysis of the disturbance recording data.

3.7.1 Starting Disturbance Handling

1. Select an IED from the plant structure.
2. To start Disturbance Handling:
   - Right-click the IED in the plant structure and select **Disturbance Handling** from the shortcut menu.
   - Click **Tools** > **Disturbance Handling** from the main menu.

Use the uploaded recordings or the recordings that are manually copied to the IED folder to work offline.

The access to the tool operations are based on the access rights or privileges assigned. For more information on user rights, see *Chapter 2.4 System configuration functions*

For more information on connecting the IED to PCM600, see *Chapter 2.5.9 Setting IED communication*

3.7.2 Setting preferences

1. Select **Tools** > **Options** > **Disturbance Handling**.
2. In the **General** tab, use one of the browsing options.

- Click **Browse** in the **Recordings folder** field to browse and change the folder path where the recordings are saved.

  The folder structure is similar to the plant structure used in the project.

  Include or exclude the project name in the folder structure by selecting or clearing the **Include project name** check box.

  The recordings folder cannot be deleted from the PCM600 tool but this has to be performed manually in the Windows folder structure. The COMTRADE recordings can be imported from or exported to the folder with **Windows Explorer**.
- Click **Browse** in the **Open Recordings With** field to set an external tool for analyzing the COMTRADE recording data. When a recording is selected for opening, the assigned tool opens the recording for analysis.

  Include or exclude the disturbance records when importing and exporting the IED or project by selecting or clearing the **Import/ Export disturbance records with APCMI/PCMI/APCMP/PCMP file** check box.

3. In the **Column Settings** tab, set the **Disturbance Handling** window appearance.
   - Select the **Visible** check box to show or hide the columns in the **Disturbance Handling** window.
   - Select **Width** of any item and type a value to change the width. The width of any item can also be adjusted by expanding or contracting the header row in the **Disturbance Handling** window.
   - Select an item in the list and drag the first column of the item to rearrange the order of appearance in the **Disturbance Handling** window. The order of appearance can also be changed by dragging the header row to the required position.

     The **Reset** button resets all the values to default.

4. In the **SMTP and Email settings** tab, define the corresponding settings.
   a) In the **Simple Mail Transfer Protocol (SMTP) settings** group, enter the values in the available options.
      - Type in the **SMTP Server** field the name or IP address of the SMTP server field through which the emails are sent.
      - Type in the **Port No** field the port number of the SMTP server through which the mails are routed. The port number should be the same as the port number configured in the network SMTP server port. By default, the port number is 25.
      - Select one of the options under **Server Settings**.
        - Select **Use local host as SMTP server** to use the local host as an SMTP server. This is used when the SMTP server is running on the user's system.
        - Select **Use Secure Sockets Layer (SSL)** to authenticate the client using SSL. This option is selected when the SMTP server requires that the client sending requests is SSL-enabled.
      - Select one of the options under **SMTP Authentication**.

- Click **Not required** if the SMTP server requires no authentication for sending emails.
- Click **Windows** if SMTP server requires user to be windows authenticated.
- Click **Specify credentials** and type the user name and password in the **User Name** and **Password** fields if the SMTP server requires the user to be authenticated with server credentials to send emails.

The **SMTP Server** and **Port No** fields are mandatory.

The port may be blocked by a firewall or antivirus software installed in the computer to prevent sending anonymous emails. Verify that the firewall or the antivirus software does not block the port.

b) In the **Email Settings** group, type the values in the available fields.

- Type the email address of the sender in the **Sender** field.
- Type the email address of the recipients in the **To** field. To send the email to multiple recipients, use commas to separate the email addresses.
- Type the email address of the recipients to whom a carbon copy of the report should be sent in the **Cc** field.
- Type the subject relevant to the report in the **Subject** field.
- Type any additional information that needs to be conveyed along with the report in the **Text** field.

The report is added as a PDF attachment to the email.

All the fields are mandatory except **Cc** and **Text**.

All the fields of **SMTP and Email settings** tab are user-specific.

3.7.3 Recordings filter

The recordings can be filtered using the three filtering options provided in the recordings selection box in the toolbar.

Table 2: Filtering options

Filtering option	Description
All Recordings	Both the IED recordings and the local recordings are displayed
IED Recordings	The recordings available in the IED are displayed
Local Recordings	The recordings available in the local computer are displayed

The delete operation deletes the recordings based on the current filter. All the other operations are the same irrespective of the filtering option.

3.7.4 Customizing recordings view

The columns in the **Disturbance Handling** window can be rearranged by dragging the column header to the required position. Any item in the window can be shown or hidden by right-clicking it and selecting it on the menu. The width of the columns can be adjusted by expanding or contracting the header row when the pointer becomes a double-headed arrow.

The first column which displays the icon in the recordings window cannot be customized.

3.7.5 Reading recordings information

The **Read Recordings Information** operation retrieves information about the recordings that are available to be uploaded from the IED. This operation provides a list of available recording identities with useful pre-information about each of them before the user decides to upload the actual COMTRADE recording files for further detailed analysis.

- Select **IED/IED Recordings/Read Recordings Information** from the PCM600 main menu.
- Click the **Read Recordings Information** toolbar button.
- Right-click the **Disturbance Handling** window and select **Read Recordings Information** from the shortcut menu.

The first column which has two icons is visible only after the first **Read Recordings Information** or **Execute Manual Trig** operation is performed. The first icon represents the IED and the second icon represents the local computer. If the IED icon of a recording is enabled, the recording is available in the IED. Similarly, if the computer icon of a recording is enabled, the recording is available in the local computer. If both the icons are enabled, the recording is available in the IED and the local computer.

Some operations operate differently based on the availability of the recordings in the IED and the local computer. For example, if a recording is available only in the IED, a report cannot be created. The recording has to be downloaded to the local computer. Similarly, if a recording is available only in the local computer, the read operation cannot be performed on that recording.

3.7.6 Selecting recordings

- To select a single recording, click the recording in the **Disturbance Handling** window.
- To select all the recordings, right-click the **Disturbance Handling** window and select **Select All Rows**.
- To select multiple rows manually, click the left border of the row and drag the mouse up or down.
- To make a contiguous selection, select a row, hold the SHIFT key and select the last row.
- To make a random selection, select a row, hold the CTRL key and select the other rows.

3.7.7 Reading recordings

The Read Recordings from IED operation uploads the selected COMTRADE recordings to the recordings folder in the local computer. On a successful read operation, the computer icon in the first column is enabled indicating that the recording is available locally in the computer for analysis.

The read operation is performed based on the IED's capability. If the IED is not capable of reading the subset of recordings, all the recordings are read. If no recordings are selected, all the recordings are read.

- On the PCM600 menu bar, select **IED** > **IED Recordings** > **Read Recordings from IED**.
- Click the **Read Recordings from IED** toolbar button.
- Right-click the **Disturbance Handling** window and select **Read Recordings from IED** in the shortcut menu.
- Double-click the IED recording.



The recordings with the IED icon enabled in the first column can only be read.



If a recording is already read in the local computer, a warning appears asking if the recording should be overwritten.

3.7.8 Exporting recordings

The record export operation is performed only for uploaded (local) recordings that are present in the view. The recordings which are present only in the IED are not exported.

1. Select the recordings in the view.
2. Export the recordings in one of the alternative ways.
   - Select **IED** > **Local Recordings** > **Export Recordings** from the PCM600 main menu.
   - Right-click the **Disturbance Handling** window and select **Export Recordings**.
   - On the toolbar, click the **Export Recordings** icon.

3. On the **Export Recordings** dialog box, select in what format the recordings should be exported and click **Export**.
4. Select the destination folder to export the recordings.



If no recording is selected, all the uploaded recordings are exported.

3.7.9 Deleting recordings

- Select **IED** > **Delete Recordings** from the PCM600 main menu.
- Click the **Delete Recordings** toolbar button.
- Right-click the **Disturbance Handling** window and select **Delete Recordings** in the shortcut menu.

The delete operation is performed based on the IED's capability, filter settings, selected recordings and recordings in view.

IED capability

The subset of recordings cannot be deleted from some IEDs depending on its capability, in such cases all the recordings must be deleted.

Filter settings

When the filter is set to **All Recordings**, the recordings in the local computer and the IED recordings can be deleted based on the selection made in the check box. When the filter is set to **IED Recordings**, only the IED recordings are deleted. When the filter is set to **Local Recordings**, only the recordings from the local computer are deleted.

Selected recording

To delete only the selected recordings, select the recordings in the **Disturbance Handling** window and delete. If no recordings are selected, all the recordings are deleted.

Recordings in view

The recordings in the view are also considered when deleting the recordings. If the recordings listed in the **Disturbance Handling** window are only local recordings and if the filter is set to **All recordings**, performing the delete operation deletes all the local machine recordings without a warning.



If the selected recording is available in both the IED and the local computer, a delete confirmation window appears to choose the source from which the recording has to be deleted.



When the selected recording is available in both the IED and the local computer, it appears in the list even after deleting the recording from one source. Only the respective icon is disabled.

3.7.10 Executing manual trigger

The **Execute Manual Trigger operation** is used to activate a specified IED to trigger the true recordings. The generated recordings are then available for upload. This test feature can be useful during system verification to ensure correct IED communication.

- Select **IED** > **IED Recordings** > **Execute Manual Trigger** from the PCM600 main menu.
- Click the **Execute Manual Trigger** toolbar button.
- Right-click the **Disturbance Handling** window and select **Execute Manual Trigger** in the shortcut menu.



The **Read Recordings Information** operation is performed automatically to refresh the recordings view after the manual trigger is executed successfully.

3.7.11 Clearing LEDs

Clear LEDs switches off the LEDs for a specified IED. This is used to reset the status LEDs.

To clear LEDs, select **IED** > **Clear LEDs**.

3.7.12 Refreshing local recordings

The **Disturbance Handling** window can be refreshed any time to update the list of the local recordings. This operation is helpful when the recordings are moved, copied or deleted manually from the recordings folder in the local computer.

- Select **IED** > **Local Recordings** > **Refresh Local Recordings** from the PCM600 main menu.
- Click the **Refresh Local Recordings** toolbar button.
- Right-click the **Disturbance Handling** window and select **Refresh Local Recordings** in the shortcut menu.



To refresh the IED recordings, the **Read Recordings Information** operation has to be performed.

3.7.13 Analyzing recordings with alternative tool

The recordings that are available in the local computer can be viewed and opened with an alternative tool for a detailed analysis.

1. Right-click a recording.
2. Select **Open With** from the shortcut menu.

The path of the analysis tool can be set in Disturbance Handling Preferences. For more information, see *Chapter 3.7.2 Setting preferences*

Open With is available only for the recordings in the local computer. If multiple local recordings are selected, or if one or more IED recordings are selected, **Open With** is unavailable.

In the shortcut menu, **Open With** is followed by the name of the tool set in **Disturbance Handling Preferences**. If no tool is set, the user is prompted to choose the tool.

3.7.14 Using short reports

3.7.14.1 Opening short reports

1. Open Disturbance Handling, select **Read Recordings Information** to read the information and then select **Read Recordings from IED**.
2. Select the recording for which the report has to be created in one of the alternative ways.
   - On the **IED** menu, select **Local Recordings** and then select **Create Report**.
   - Click **Create Report** on the toolbar.
   - Right-click the selected recording and then select **Create Report**.
3. Double-click a recording to open the short report.

If the RMS value for a channel is zero but some amplitude is shown in the vector diagram, the value shown in the table is the truncated value, whereas the value shown in the vector diagram is the actual value without truncation.

The COMTRADE standard is displayed under device information only for the recordings in the COMTRADE 2013 standard.

3.7.14.2 Defining report preferences

Short report features, such as report layout and analog and binary time diagram layout, can be defined in the **Report Preferences** window.

1. Open **Report Preferences** in one of the alternative ways.
   - On the **File** menu, select **Report Preferences**.
   - Click **Report Preferences** on the toolbar.
   - Press CTRL+R.
2. Define the report settings.

Setting the report layout

1. Select **Show in Report** to view the required section, subsection and the related data.

2. Rearrange the order of the report sections with the arrow buttons on the right side of the **Preferences** section.

   The report sections are shown in the layout settings. The view of the report is automatically updated according to the options in the layout settings. The **Time Diagrams Information** has two subsections, **Analog Information** and **Binary Information**. **Analog Information** has two subsections, **Voltage channels** and **Current channels**.

3. Change the channel name by using the **User-Defined Name** option in the **Time Diagram** subsection.

   The maximum length of name is 20 characters. After clicking **Apply and Save**, the new channel names are shown in the report.

4. Select the time diagram line color and click **Apply and Save** to confirm the changes.
5. Select the line style in the **Analog Information** subsection.
6. Select the vector in which the given analog can be drawn. Click **Apply and Save** to confirm the changes.
7. Click the **Show in Vector** check box to view the corresponding analog channel in the vector diagram, and then click **Apply and Save** to confirm the changes.
8. Go to the **Channel Status** column to check whether the **Binary channel** is active or inactive.

The position of the **Disturbance Recording Information** section cannot be modified.

When there is no section information for a particular recording, the sections are not displayed in **Layout Settings**.

By default, the inactive binary channels are not shown in **Time Diagram**.

Defining advanced settings

The options such as **Amplitude Scale**, **Trigger Time Scale** and **Additional Footer Information** can be defined in the **Advanced Settings** section.

1. Modify the amplitude scale of the analog and binary channels by entering the wanted amplitude scale in the text boxes **Analog Channel** and **Binary Channel**.
2. Click **Apply and Save** to plot the graph based on the given values.
3. Modify the text boxes **PreTrigTime** and **PostTrigTime** to view the time diagram for the selected time range.

4. Click **Apply and Save** to plot the time diagram based on the values. Modifying the entries does not modify the actual pretrig and posttrig times, but only sets the scale in the graph.



Additional footer information is optional, and a maximum of 150 characters are allowed in this field.



Validation for ranges in text boxes under **Amplitude Scale** and **Trigger Time Scale** is provided as a tool tip. The **Apply and Save** button is unavailable if the entered value is not valid.



Report preferences are stored for that IED instance and they reflect to all the recordings which are opened for that IED.



The amplitude scale of **Binary Channel** cannot be modified.

3.7.14.3 Exporting to PDF

1. Export the short report to PDF.
   - On the **File** menu, select **Export to PDF**.
   - Click the Export to PDF button on the toolbar.
   - Press the shortcut keys Ctrl+E.
2. Select the location to export the PDF.

The currently displayed report is exported to PDF format, containing the header and footer information.

- Header section contains the company logo and the total number of pages.
- Footer section contains the recording file path, page number and the user-defined additional information. Additional information can be set in the report preferences.

3.7.14.4 Previewing short reports

- Preview the short report before printing.
  - On the **File** menu, select **Print preview**.
  - Click **Print Preview** on the toolbar.
  - Press the shortcut keys CTRL+W.

The report preview contains the header and footer sections.

- Header section contains the company logo and the total number of pages.
- Footer section contains the recording file path, page number and the user-defined additional information. The additional information can be set in the report preferences.

The `No printers installed` message is displayed if there is no printer installed on the system.

3.7.14.5 Printing short reports

- On the **File** menu, select **Print**.
- Click **Print** on the toolbar.
- Press the shortcut keys CTRL+P.

The currently displayed report is printed containing the header and footer information.

- Header section contains the company logo and the total number of pages.
- Footer section contains the recording file path, page number and the user-defined additional information. Additional information can be set in the report preferences.

The default print size is A4 in a portrait orientation.

The `No printers installed` message is displayed if there is no printer installed on the system.

3.7.14.6 Zooming short reports

The zooming options in the short report are zooming in and zooming out.

- Click the **Zoom In** button on the toolbar or click the **Zoom** menu and select **Zoom In** to zoom in.
- Click the **Zoom Out** button on the toolbar or click the **Zoom** menu and select **Zoom Ou**t to zoom out.

The maximum allowed zoom in is 200% and zoom out is 80%.

3.7.14.7 Closing short reports

- On the **File** menu, click **Close**.
- Click **Close** at the top corner of the window.
- Press the shortcut keys CTRL+X.

When PCM600 is closed, all the report instances opened from PCM600 are closed. However, the reports opened independently of PCM600 remain open.

3.7.15 Scheduler operations

The **Read recordings** and **Read recordings and send report** operations can be invoked by the scheduler for disturbance recordings at defined time intervals. The e-mail settings, scheduler settings and report settings should be configured for the Read recordings and send report operation to perform correctly.

For more information on setting **E-mail settings**, see *Chapter 3.7.2 Setting preferences*

3.7.15.1 Configuring scheduler settings

1. Select **Tools** > **Scheduler**.
2. Right-click **Task Manager** and select **Add task**.
3. Define all the schedule timing settings.
4. Right-click **Task** and select **Add Object Job**.
5. Choose the **Tool** and **Job** from the drop-down list.
6. Save the changes.
7. Right-click **Task** and enable it.

For more information, see *Chapter 3.24 Scheduler*

3.8 Ethernet Configuration

Ethernet Configuration is used to configure Ethernet ports both online and offline.

Ethernet configuration can be used to configure access points, merging unit and routers in the respective tabs of Ethernet configuration.

Access points

This tab is used to configure access points. The access point tab shows the access points based on the supported hardware. For example, if the 100FX-ST/100FX-LC hardware modules are selected in hardware configuration, the corresponding access points will be available.

Merging unit

This tab is used to configure the merging unit. Merging unit's availability is based on the 9-2 order options and the hardware module selection. For example, if OEM02 is selected, the corresponding 9-12 merging units will be available.

Routers

This tab is used to configure routers.



After the SCD import, the physical port name in the SCD file must match the IED physical port name to make the subnetwork appear in the Ethernet configuration.



After communication port changes, close and reopen Ethernet Configuration to get the updated IP address.

3.8.1 Starting Ethernet Configuration

The Ethernet configuration can be started using the shortcut menu in the plant structure or from the PCM600 main menu.

1. Select the IED from the plant structure.
2. Select Ethernet Configuration in one of the alternative ways.
   - Right-click any IED in the PCM600 object tree and select Ethernet Configuration from the shortcut menu list.
   - On the Tools menu, select Ethernet Configuration.

3.8.2 Saving configuration

The Save option helps save the configuration data. The Ethernet Configuration can be saved using the toolbar, from the PCM600 main menu or using shortcut keys.

- Click the **Save** button on the toolbar.
- On the **File** menu, select **Save**.
- Press CTRL+S.

3.8.3 Reading Ethernet configuration from IEDs

- On the IED menu, click **Read from IED**.
- Click the **Read Ethernet Configuration from IED** button on the toolbar. The columns that can be read from the IED are highlighted when the mouse pointer is moved over the **Read Ethernet Configuration from IED** button.

3.8.4 Writing Ethernet configuration to IEDs

- On the IED menu, click **Write to IED**.
- Click the **Write Ethernet Configuration to IED** button on the toolbar.

  The columns that can be written to the IED are highlighted when the mouse pointer is moved over the **Write Ethernet Configuration to IED** button.
- If there is a mismatch between the PCM600 Ethernet configuration and the IED SCL related parameters when **Write Ethernet Configuration to IED** is selected, a confirmation dialog appears.
  - Click **Yes** to proceed with the writing.
  - Click **No** to cancel the writing.



In case of an SCL related parameter mismatch, it is recommended to perform Common Read/Write.

Only the highlighted columns are written to the IED when Write Ethernet Configuration to IED is selected.

3.8.5 Undoing and redoing

Ethernet Configuration allows the last action to be undone or redone.

- Undo the last action in one of the alternative ways.
  - On the **Edit** menu, select **Undo**.
  - Click the **Undo** button on the toolbar.
  - Press CTRL+Z.
- Redo the last action in one of the alternative ways.
  - On the **Edit** menu, select **Redo**.
  - Click the **Redo** button on the toolbar.
  - Press CTRL+Y.

3.8.6 Comparing Ethernet configuration

The existing Ethernet configurations in PCM600 and the configuration in the IED can be compared to show the differences between the configurations.

- On the **Ethernet Configuration** menu, select **Online Compare**.
- Click the **Compare parameters** button on the toolbar.

3.8.7 Find and replace

The find and replace feature can be used to search Ethernet parameters using simple or advanced search option.

- Find: There are two ways of finding, simple and advanced.
- Replace: Replaces the Ethernet parameters.

3.8.7.1 Simple find

1. Activate the find feature in one of the alternative ways.
   - Click the **Find** button on the toolbar.
   - Press CTRL+F.
2. Enter the search string in the **Search** box.
3. Click **Find Next** to locate the next parameter. After clicking **Find Next**, press ENTER to move to the next parameter.
4. Click **Close** to close the **Find and Replace** dialog box.

3.8.7.2 Advanced find

1. Activate the find feature in one of the alternative ways.
   - Click the **Find** button on the toolbar.
   - Press CTRL+F.
2. On the **Find** window, click **Advanced Find** and select the **Find** tab.
3. Enter the search string in the **Find what** box.
4. Click **Find Options** to perform advanced search.
5. Check **Match case** for case sensitive search.
6. Check **Match whole word** for a particular word search.
7. 7. Use **Look In** - to define of the search should be done in All Tabs or in a specific tab. By default, All is selected.

3.8.7.3 Replace

1. Activate the replace feature in one of the alternative ways.
   - Click the **Find** button on the toolbar.
   - Press CTRL+F.
2. On the **Find** window, click **Advanced Find** and select the **Replace** tab.
3. Enter the search string in the **Find what** box.
4. Enter the string to be replaced in the **Replace with** box.
   - Click the **Replace** button to replace one matched parameter value.
   - Click the **Replace All** button to replace all the matched parameter values.

3.8.8 Flipping columns

The column header orientation can be changed horizontally and vertically according to readability. By default the orientation is vertical.

- On the **Ethernet Configuration** menu, select **Flip Columns**.
- Click the **Flip Columns** button on the toolbar.



Flipping is applicable to the active tab page.

3.8.9 Locking and unlocking parameters

All parameters can be locked and unlocked in Ethernet configuration.

- Click the **Lock/Unlock all parameters** button on the toolbar.

Locking and unlocking of parameters is applicable to the active tab page.

3.8.10 Exporting Ethernet configurations

Ethernet configuration parameters can be exported to a file.

1. Click the **Export parameters** button on the toolbar.
2. In the **Export** dialog box, define the export options.
   - File name
   - Path or location
   - File type (.xrio, .csv, .xlsx)
3. Click **Save**.

   By default the exported file is saved on the drive where PCM600 is installed `<Drive:>ProgramData\ABB\PCMDataBasesABB\ECT`.
4. Choose the certificate to use for signing the file.

3.8.11 Importing Ethernet configurations

Exported Ethernet configuration parameters can be imported to the Ethernet configuration.

1. Click the **Import parameters** button on the toolbar.
2. Select the file to be imported. The import file must be in .xrio or .csv format.
3. Click **Open** and select the functions in the **Open** dialog box. All the functions are selected by default.
4. Click **OK**.

PCM600 checks the integrity of the template during import. If the template was signed with a certificate that does not exist in the computer's certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the template.

There can be several reasons why the integrity check fails:

- The template has been created with PCM600 version which does not sign the template files
- The computer certificate store does not contain the certificate needed to do the verification
- Verification itself fails

All the listed reasons above mean that integrity of the template could not be verified, and it is possible that someone has tampered with the template. If the integrity can't be checked or the verification fails, it is

still possible to proceed with import. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

3.8.12 Printing Ethernet configurations

1. Preview the generated document before printing it in one of the alternative ways.
   - On the **File** menu, select **Create Report**.
   - Click the **Create Report** button on the toolbar.
   - Press CTRL+SHIFT+P.
2. Open the Print dialog box in one of the alternative ways.
   - SOn the **File** menu, select **Print**.
   - Click the **Print** button on the toolbar.
   - Press CTRL+P.

   A Print dialog appears.
3. Select the required print options and click **OK**.

3.9 Event Viewer

Event Viewer displays the actual events stored in the IED. These events can be sorted and filtered for easier examination or they can be printed or exported to a file. All uploaded events from the IED are stored in a dedicated database called Events datastore.

3.9.1 Starting Event Viewer

1. Right-click an IED in the object tree.
2. Select **Event Viewer** from the shortcut menu.

   Alternatively, on the **Tools** menu, click **Event Viewer** to start Event Viewer. The Event Viewer window is displayed in the center of the program window.

Event Viewer shows two tabs.

- The **IED events** tab lists all IED events in a table. See *Chapter 3.9.3 Event Viewer data columns*.
- The **Security events** tab lists all security events in a table. Security events is shown only if the IED is online, and it is read only. See *Chapter 3.9.3 Event Viewer data columns*.

The default order is by descending date and time, that is, the newest events are displayed at top of the list. The order of the list can be changed by sorting, see *Chapter 3.9.4 Sorting event data*.

When Event Viewer is started, it first tries to read and display the actual events stored in the IED. Depending on the capabilities of the IED and the corresponding Connectivity Package, new events are either automatically added to the tabular

display or collected and displayed by Event Viewer on a regular basis. Event Viewer opens showing the last selected tab. The date and time shown on the IED events tab are in the time zone of the events provided by the IED.

To synchronize the listed events with the IED, Time zone must be the same in the system and the IED.

The **Security event** tab is shown based on the user rights and the IED capability.

3.9.2 Closing Event Viewer

To close Event Viewer:

1. Right-click the **Event Viewer** tab at the top of the **Event Viewer** window.
2. Select **Close** from the shortcut menu.

Alternatively, close the Event Viewer by clicking the close button at the upper right side of the window.

3.9.3 Event Viewer data columns

Table 3: IED events tab (default) columns

Column	Meaning
Flag	One (optional) character showing the status of the event [empty] Valid event (default) ? Event status is unknown T Event is not time-synchronized M Event value has been manually altered (for example by manual data entry)
Type	One (optional) character showing the status of the event [empty] Event type is unknown P Process event S System event T Test event
Date&Time	The date and time (including milliseconds) of the event The format can be selected in Regional Options of the Windows Control Panel.
Signal name	The name of the signal that generated the event
Value	The actual value of the signal at the time the event was generated. The value displayed in this column is usually empty for the binary signals. Their current value is dis-

Column	Meaning
	played only in the **Status** column. For analog signals, a numeric value (integer or floating point) is usually displayed together with the unit text. It can also be an empty value.
Status	The text representation of the signal's status at the time the event was generated.
Additional info	An optional IED-specific (signal) information text (for example function block name). It can be empty for some IED types.



Some of the columns can be hidden if all their values are empty.

Table 4: Security events tab columns

Column	Meaning
Event Log ID	Sequence number generated when a new incoming security event in the persistency is saved.
Sequence Of Event	Sequence number of the security events in the current transmission session from sender to receiver.
Event Date Time	Occurrence date and time at UTC of the security event in the originator.
Event Severity	Severity of the security event Unknown — Severity not set or unknown. Alarm — Represents alarm. Event — Represents security event.
User Name	User name of the user who caused the security events to occur.
Event ID	The unique identifier for the security events
Event Text	Description of the security event
Extra Information	Additional information associated with the security events if any.
Source	Security event source, name or identifier of the device or tool
Product Name	Product name, type of the device or tool
IP Address	IP address of the originating device or machine
Log Date Time	Date and time in UTC when the event is stored in the persistency (central log server or device).

Column	Meaning
Hierarchy	Hierarchy to uniquely identify the device which produced the event.
Substation	Substation name in which the source device is configured.
Voltage Level	Voltage level name in which the source device is configured.
Bay	Bay name in which the source device is configured.

3.9.4 Sorting event data

The default order of the events is by descending date and time, that is, the newest events are shown at the top of the list.

To sort the event data differently, click the column header of the column to be sorted. The data is sorted in ascending order of the column values which is indicated by an upwards triangle on the right side of the column name. To sort in descending order, click the same column header again. The descending order is indicated by a downwards triangle on the right side of the column name. Clicking the same column header a third time the sort order changes back to ascending.

The Date & Time column can also be sorted by selecting **Event Viewer** > **Show newest events on top/on bottom** or by clicking the **Show newest events on top/on bottom** toolbar button. If the event list is already sorted by date and time, the order is reversed by the command.

The actual sort order is stored when closing Event Viewer and the same sort order is held when Event Viewer is opened the next time.

3.9.5 Filtering event data

Filtering allows reducing the amount of the displayed event data to a wanted subset.

To filter event data:

- Select **Event Viewer** > **Filter On** > **Off** or
- Click the **Filter On/Off** toolbar button.

A filter bar is displayed below the column headers consisting of a drop-down list box for each column with the column values as menu items.

Select a value from the drop-down list box of the wanted column, to display only those events, which have that specific value. To specify more detailed filter conditions, select **Custom filter**. The **Custom Filter for Event List Column** dialog is displayed where detailed conditions for example showing values inside a certain range; or combining two conditions with an or-condition or an and- condition, can be specified. Click **OK** to apply the filtering conditions.

Filters can be used on more than one column which causes the filter conditions to be combined over these columns.

To turn off a filter condition on a specific column select No filter from the column's drop-down list box.

To turn off all filters:

- Select Event **Viewer** > **Filter On/Off** again or
- Click the **Filter On/Off** toolbar button again.

The filter bar below the column headers disappears.

The actual filter settings are stored when closing Event Viewer and the same filter settings are held when opening Event Viewer next time.

3.9.6 Reading newest events from IED

To update the event data with the newest events from the IED:

- Select **IED** > **Read newest events from IED** or
- Click the **Read newest events from IED toolbar** button.

Note that depending on the capabilities of the IED and the corresponding Connectivity Package new events are either automatically added to the tabular display or collected and displayed by Event Viewer on a regular basis. The Read newest events from IED command is therefore only useful if the waiting time until the next automatic update seems to be too long. New events (if any) are only added to the display if the actual time period is displayed, that is, the user has not moved to a different time period (Refer to *Chapter 3.9.8 Moving to another period*), and if the new events match the actual filter settings (Refer to *Chapter 3.9.5 Filtering event data*).

3.9.7 Selecting period type

Event Viewer displays event data only for a selected time period to reduce the amount of displayed data which also improves performance, and to allow easier retrieval of needed events. The default time period is one day. The event periods of defined hours work as evenly distributed portions of a day. For example, periods for type 6 hours are from 00:00 to 06:00, 06:00 to 12:00, 12:00 to 18:00 and 18:00 to 24:00.

To select a period type:

- Select **Event Viewer** > **Select period type** and select the period type from the submenu or
- Select the period type directly from the **Select period type** drop-down combo box.

Period type Unlimited allows displaying of all events for the IED irrespective of period length boundaries. For all other period types, the period boundaries are lengthened by 5 minutes at the beginning and at the end of the period to have the possibility to easily detect also the events near the period boundaries. For example, if the actual selected period type is one day, the events that happened shortly before or after midnight are displayed as well.

When selecting period types with a long period length, for example Unlimited, Month or Week, loading events takes a considerable amount of time depending on the number of events generated by the IED. In case an IED generates a lot of events, it can be true also for period type Day or even shorter period types.

The actual period type is stored when closing Event Viewer and the same period type is held when Event Viewer is opened the next time.

3.9.8 Moving to another period

To move to the event data of another time period, select one of the following commands in the Event Viewer menu or click one of the corresponding toolbar buttons:

- **Go to first period**

  Moves to the oldest available event data of the IED.
- **Go to previous period**
- **Go to next period**
- **Go to last period**

  Moves to the newest available event data of the IED.
- **Go to specific period**

  Specify the date for which the events of the IED are to be displayed. In case the selected period type is less than one day, the wanted hour can be selected as well. Exit the dialog by clicking **OK**.

After selecting one of the commands, Event Viewer displays the events of the selected period.

These menu commands and toolbar buttons are enabled only if there is at least one event whose date and time are outside the boundaries of the selected period. Furthermore, all these commands and toolbar buttons are always disabled if period type Unlimited has been selected.



When selecting period types with a long period length, for example Unlimited, Month or Week, loading events takes a considerable amount of time depending on the number of events generated by the IED. In case an IED generates a lot of events, it can be true also for period type Day or even shorter period types.

3.9.9 Clearing event buffers in IED

1. Clear all the internal event buffers of an IED.
   - On the main menu, point to **IED** and then click **Clear IED event buffer(s)**.
   - On the toolbar, click the **Clear IED event buffer(s)** button.
2. To confirm the clearing, click **Yes**.

This command is enabled only if the IED and its corresponding connectivity package support this feature, and the current user has access rights to clear the IED event buffers. To modify the user management settings, see *Chapter 2.4.6 Modifying existing user categories*.



The command deletes all the events in the IED except for the already uploaded events stored in the events datastore. To delete the events in the datastore, see *Chapter 3.9.10 Deleting events in datastore*.

Read the events before clearing the IED event buffer.

3.9.10 Deleting events in datastore

- Deleting the uploaded events from the IED that are stored in the Events datastore
  - Select **Event Viewer** > **Delete events in datastore** or
  - Click the **Delete events in datastore** toolbar button.

1. Confirm the deleting by clicking the **Yes** button.
2. Depending on the number of already uploaded events from the IED including the events from earlier times using Event Viewer, deleting can take a considerable amount of time. This command is only enabled if the current user has access rights to delete events from Events Datastore. Refer to the user management settings *Chapter 2.4.6 Modifying existing user categories*.

The command does not delete the events that are currently stored in the internal event buffer(s) of the IED. Use *Chapter 3.9.9 Clearing event buffers in IED* for this purpose.

3.9.11 Deleting all events before last read from IED

Deleting all events before last read from IED deletes all events which are already read from the IED.

This feature is supported based on the IED capability.

3.9.12 Stopping reading events from the IED

- In the **Reading Events Status** window, click **Cancel**.
  Event viewer shows the events read before cancellation.

Stopping reading events from the IED is supported based on the IED capability.

3.9.13 Printing events

- Print the events that are currently displayed in Event Viewer in one of the alternative ways.
  - On the **File** menu, click **Print**.
  - On the toolbar, click the **Print** button.
  - Press CTRL+P.

In the **Print** dialog, select the wanted options and click **OK**.

- Before printing, examine the generated print document in one of the alternative ways.
  - On the **File** menu, click **Print Preview**.
  - On the toolbar, click the Print Preview button.
  - Press CTRL+SHIFT+P
- Use the Zoom function to check how many pages there are and how the pages are printed. Click **OK** to print.
- In the **Print Options** window, select the columns to print or print preview by clicking **Print** or **Print Preview**.

  The **Print Options** window appears when **Event Viewer** contains both the **IED events** and the **Security events** tab.

  The **Print** and **Print Preview** functions are disabled if no events are currently shown in the Event Viewer display or if the default printer is not defined.

3.9.14 Exporting events to other programs

1. Copy the currently displayed events in Event Viewer to the clipboard in one of the alternative ways.
   - On the **Edit** menu, click **Copy**.
   - On the toolbar, click the Copy button.
   - Press CTRL+C.
2. Add the events to another program, for example to Microsoft Excel or Microsoft Word.
   a) Start the program.
   b) Open an existing document by selecting **File** > **Open** to add the events to it, or create a new document by selecting **File** > **New**.
   c) Select **Edit** > **Paste** or click the Paste button on the toolbar.

Alternatively, export the currently displayed events in Event Viewer directly to Microsoft Excel.

1. Select **Reports** > **Export To Excel File**.
2. On the toolbar, click the Export To Excel File button.
3. Save the Excel file that contains the exported events. The exported file is automatically opened, if the computer can open Excel files.

All exporting functions are disabled, if no events are currently displayed in the Event Viewer tabular display.

3.9.15 Viewing Event Viewer options

- Start **Event Viewer** and, on the menu bar, click **Options**, or on the toolbar, click **Opt**.

  There are various options available in the **Event Viewer - Options** dialog box.

- Select **Show actual IED events** only or **Show historic and actual IED events** to see the default value. The historic events are read from the IED and they are not stored in the IED event buffers.
- Set the time for reading from the IED with the drop-down list in the **Interval used for reading new events from IED** field. The number of seconds is relevant only for the IEDs which have the type of IED Connectivity Package that does not support a spontaneous notification about new events in the IED. This can be set to **None** if it is not required to read from the IED.
- Set the current setting of sort options, column filter settings, period type and reading interval to **differently per substation**, **differently per voltage level**, **differently per bay**, **differently per IED type** or **differently for each IED**. The setting is **identically for all IEDs** by default.

Two polling interval sections are shown to set the interval for the IED events and security events if the IED supports security events. The security events date time stamps are shown based on the selection between **Coordinated Universal Time (UTC)** or **Local time**.



The default value for the **Interval used for reading new events from IED** field is 30 seconds. The setting depends on the IED capability and can be changed and saved.

3.10 Graphical Display Editor

Graphical Display Editor is a tool for configuring the graphical display of an IED, also called Local Human-Machine Interface (LHMI).

The graphical display consists of one or more display pages. A display page contains the drawing area where the actual graphical configuration is made.

A display is configured by dragging preconfigured symbols from a library onto the drawing area.

Object Types pane

The Object Types pane contains all the symbols supported by Graphical Display Editor.

The two symbol palettes supported are the IEC symbol palette and the ANSI symbol palette. The ANSI symbol palette is mainly intended to be used in the U.S. market.

Every symbol type has a corresponding representation in both the ANSI and the IEC symbol palettes.

Switch symbols

The status and the position of all the switch symbols are dynamically updated on the LHMI. The indication only switches, however, are not controllable.

Dynamic text

The dynamic texts have two parts, label text and state text. The label text is static and the state text is the dynamic value of a connected signal. The label text can be edited by double clicking the symbol or by modifying the **Name** field in the **Object properties** window. The starting point of the state text is represented using the

symbol. The LHMI in the IED shows the value of the connected signal from the starting point of the state text location in Graphical Display Editor. The location of the state text can be changed in the **Alignment value** field in the **Object properties** window. The alignment value is the distance from the starting point of the label text to the starting point of the state text in LHMI pixels.

If a value less than the sum of label text width and minimum gap is entered, the alignment value changes to the sum of the label text width and minimum gap by default. The minimum gap is 10 pixels.

3.10.1 Starting Graphical Display Editor

1. Right-click IED in the object tree.
2. Select **Graphical Display Editor** from the shortcut menu.

Alternatively, start Graphical Display Editor by selecting **Tools** > **Graphical Display Editor**.

3.10.2 Closing Graphical Display Editor

- Close Graphical Display Editor in one of the alternative ways.
  - Right-click the Graphical Display Editor tab and select Close from the shortcut menu.
  - Click the Close button in the upper-right corner of the window.

When closing the tool, the options are to save the changes or quit without saving.

3.10.3 Graphical Display Editor toolbar

Toolbar button	Function
	Read display configuration from the IED.
	Write the display configuration from the Graphical Display Editor to the IED.
	Zoom in the current display page.
	Zoom out of the current display page.
	Place the selected symbols left aligned with the leftmost symbol.
	Place the selected symbols right aligned with the rightmost symbol.
	Place the selected symbols top aligned with the topmost symbol.
	Place the selected symbols bottom aligned with the bottommost symbol.

Table continues on the next page

Toolbar button	Function
	Center the selected symbols horizontally.
	Center the selected symbols vertically.
	Create an equal horizontal space between the selected symbols.
	Create an equal vertical space between the selected symbols.
	Set the connection line width.
	Set the selected text font.
	Set the selected symbol size.
	Rotate a symbol 90 degrees to the left.
	Rotate a symbol 90 degrees to the right.
	Add display page.
	Remove display page.
	With Snap to Grid function enabled, position a symbol with its top left corner at the intersection of the nearest grid lines.
	Display or hide the grid in the display page.

3.10.4 Reading display information from IEDs

- On the **IED** menu, click **Read from IED**.
- Click the **Read Display Configuration from IED** toolbar button.

This action must be confirmed before it is carried out because the action overwrites the existing display configuration of Graphical Display Editor. The reading operation can take a few seconds or minutes to complete.

If the user belongs to a user category which is authorized to access the IED online, the read function can be used.



Configuration is automatically saved after reading a display configuration from the IED.

3.10.5 Creating display pages

Start Graphical Display Editor as described in *Chapter 3.10.1 Starting Graphical Display Editor*.

If the user belongs to a user category, which has the read/write access to the Graphical Display Editor configuration, the graphical display configuration can be modified. See *Chapter 2.4.6 Modifying existing user categories*.

If a display configuration is already available in the IED, it is possible to read the configuration from the IED. See *Chapter 3.10.4 Reading display information from IEDs*.

If the user belongs to a user category, which is authorized to access the IED online, the read function can be used.

3.10.5.1 Adding display pages

Add display pages in one of the alternative ways.

- Select **Graphical Display Editor** > **Add Display Page**.
- Click the **Add Display Page** toolbar button.

A new thumbnail with the name of the new display page is visible in Graphical Display Editor. The maximum number of display pages is 12.

3.10.5.2 Removing display pages

Remove display pages in one of the alternative ways.

- Select **Graphical Display Editor** > **Remove Display Page**.
- Click the **Remove Display Page** toolbar button.
- Click the **Remove Display Page** from context menu.

When removing a display page, the content is also removed. It is not possible to undo a display page removal. Therefore, the action needs to be confirmed before it is carried out.

3.10.5.3 Creating single-line diagrams

1. Optionally add more display pages as described in *Chapter 3.10.5.1 Adding display pages*.
2. Select the wanted symbol library (IEC or ANSI) from the combo box at the top of the Graphical Display Editor.
3. Ensure that the **Snap to grid** and **Show grid** functions are available.
   This is the default and recommended setting when designing a single-line diagram.
4. Place the primary equipment on the single-line diagram approximately in the wanted position.
   If required, rotate the symbols using the **Rotate Left** or **Rotate Right** functions.
5. Consider the necessary symbol connections (links).

   Wherever a connection needs to be made at a right angle, a junction symbol should be placed on the diagram.

   a) Click on the source port and press SHIFT. Click on the desired position to add a junction point.
   b) Draw a perpendicular line by moving the mouse and clicking on the target port.

For example, a junction symbol (from the Connections category in the **Object Types** pane) should be placed at the "T" intersection between the two busbar isolators and the circuit breaker in a typical double busbar feeder diagram.

6. Connect the symbols where necessary.
   a) Move the mouse pointer over the symbol's connection ports.
   The connection ports of all symbols are activated.
   b) Drag the connection from the source connection port and drop it in the target connection port.

   A connection line between the source and target connection ports is drawn.

   Alternatively, click on the source port and then click once at the target port to create the connection. Move the mouse on the nearest connection port to ensure the target port. A “+” sign appears.
   c) Right-click or press ESC to cancel the connection creation.

   Once a link has been used to connect the symbols, the link follows the symbol when it is moved to a new position or when it is rotated. See *Chapter 3.10.5.6 Moving symbols*.
7. After creating the connections, move the mouse pointer away from the symbol's port for all the connection ports of the symbols to become deactivated.
8. Select a symbol and modify its properties in the **Object Properties** pane. See *Chapter 3.10.5.8 Modifying symbol properties*.
   The symbol name can also be changed by double-clicking the symbol.
9. Relate dynamic symbols to their source data as described in *Chapter 3.10.5.4 Selecting input signals for dynamic symbols*.
10. Configure the tab order of controllable objects. The tab order defines the order in which the controllable objects are selected when the **Select** button is pressed on the IED.

    The tab order is set using the **Tab order** property. The first symbol to be selected should be set with a Tab order of 1 in the **Object Properties** window.

    The **Sort Tab Order** function from the **Graphical Display Editor** menu can also be used.

    In general, all the lines pass through the middle of a grid square and the symbols fill the entire grid square.

    A straight line or a link can be drawn to connect the different diagrams by pressing SHIFT on the display page.

3.10.5.4 Selecting input signals for dynamic symbols

1. To relate the dynamic symbols to their input signals, right-click the symbol and choose **Select input signal** from the shortcut menu.
   - Alternatively, select the input signal directly in the drop-down menu on the right to the **Input Signal** property.

   A drop-down menu containing a list of appropriate signals for this symbol is displayed. The **Input Signal** property in the **Object properties** pane is updated to reflect the new configuration.

A maximum of five signals appear in the drop down list.

2. Click More in the signals menu to disply the remaining signals. An input signal can be chosen for several symbols. If the same input signal is also related to other symbols, the input signal name is marked by an asterisk in the drop-down menu. The signal names are shown only if there is more than one connectable signal for a function block, else, only the function block name is shown.

If a dynamic symbol is not connected with any signal then the respective dynamic symbol is unavailable.

3.10.5.5 Selecting symbols and links

- Click a symbol or a link. The selection turns grey.
- Select all symbols and links on the actual display page in one of the alternative ways.
  - Select **Edit** > **Select All**.
  - Press CTRL + A.
  - Right-click on a page and, in the shortcut menu, choose **Select All**.

To select multiple symbols and links, press CTRL while selecting symbols or links.

To select multiple neighboring symbols and links, draw a rectangle by pressing the mouse button and moving the mouse. All the symbols and links are selected that are located in the rectangular area.

3.10.5.6 Moving symbols

1. Select a symbol to be moved. See *Chapter 3.10.5.5 Selecting symbols and links*
2. Drag the symbol to the wanted position.

The symbols must remain completely within the boundaries of the display page. If a symbol is dragged to a position beyond the boundaries of the display page, it is automatically returned to the last allowed position in the diagram when the mouse button is released. The existing links are also moved with their connected symbols. The symbols are auto aligned, so if a symbol is placed on another symbol, it is placed to the nearest available location.

The junction symbol can be placed on other symbols.

3.10.5.7 Aligning symbols

The symbols can be aligned and spaced in Graphical Display Editor.

1. Select the symbols with the mouse.

   To select several symbols, hold down CTRL while selecting. The selected symbol is outlined in grey.

2. On the toolbar, select **Align** and click the wanted option.

   - **Align Left**. Align the selected symbols left with the leftmost symbol.
   - **Align Right**. Align the selected symbols right with the rightmost symbol.
   - **Align Top**. Align the selected symbols top with the topmost symbol.
   - **Align Bottom**. Align the selected symbols bottom with the bottommost symbol.
   - **Align Horizontal Center**. Center the selected symbols horizontally.
   - **Align Vertical Center**. Center the selected symbols vertically.
   - **Align Horizontal Distribute**. Create an equal horizontal space between the selected symbols.
   - **Align Vertical Distribute**. Create an equal vertical space between the selected symbols.

3.10.5.8 Modifying symbol properties

The **Object Properties** window opens when the Graphical Display Editor is started.

When clicking a symbol on the display page, its properties are shown in the **Object Properties** window. The symbol properties can vary depending on the selected object. The **Name** property can be changed by double-clicking the symbol and entering a new name. The text font can also be chosen from the drop-down menu above the diagram.

When clicking on an empty location on the diagram, or when multiple symbols or links are selected, the properties of the display page are shown in the **Object Properties** window. The name of the display page can be changed here.

3.10.5.9 Deleting, cutting, copying and pasting

- Delete the selected symbols and links in one of the alternative ways.
  - Select **Edit** > **Delete**.
  - Press DELETE.
  - Right-click and choose **Delete**.
- Delete the selected symbols and links and move them to the clipboard in one of the alternative ways.
  - Select **Edit** > **Cut**.
  - Click the **Cut** toolbar button.
  - Press CTRL+X.
  - Right-click and choose **Cut**.
- Copy the selected symbols and links to the clipboard in one of the alternative ways.
  - Select **Edit** > **Copy**.

- Click the **Copy** toolbar button.
- Press CTRL+C.
- Right-click and choose **Copy**.

- Paste the earlier cut or copied symbols and links from the clipboard in one of the alternative ways.
  - Select **Edit** > **Paste**.
  - Click the Paste toolbar button.
  - Press CTRL+V.
  - Right-click and choose **Paste**. Different display pages can be pasted across same type of IEDs.

3.10.5.10 Undoing and redoing

- Undo the last action in one of the alternative ways.
  - Select **Edit** > **Undo**.
  - Click the **Undo** button on the toolbar.
  - Press CTRL+Z.
- Redo the last action in one of the alternative ways.
  - Select **Edit** > **Redo**.
  - Click the **Redo** button on the toolbar.
  - Press CTRL+Y.

3.10.5.11 Zooming

Zoom in and out the current display page in one of the alternative ways.

- Select **Graphical Display Editor** > **Zoom**.
- Click the **Zoom** toolbar button.
- Press CTRL and rotate the wheel of the mouse.

3.10.6 Printing display pages

1. Preview the generated document before printing it in one of the alternative ways.
   - Select **File** > **Create Report**.
   - Click the **Create Report** toolbar button.
   - Press CTRL+SHIFT+P.
2. Open the **Print** dialog box in one of the alternative ways.
   - Select **File** > **Print**.
   - Click the **Print** toolbar button.
   - Press CTRL+P.

   A **Print** dialog appears.

3. Select the required print options and click **OK**.

3.10.7 Saving the display configuration

Save the display configuration in one of the alternative ways.

- Select **File** > **Save**.
- Click the **Save** button on the toolbar.
- Press CTRL+S.

3.10.8 Writing display information to the IED

Write display information to the IED in one of the alternative ways.

- Select **IED** > **Write Display Configuration to IED**.
- Click the **Write Display Configuration to IED** button on the toolbar.

This action must be confirmed before it is carried out, because it overwrites the existing display configuration of the IED. The writing operation can take a few seconds or minutes to complete.

3.10.9 Template export and import

The single-line diagram templates enable the reuse of the single-line diagram created in the Graphical Display Editor tool. The single-line diagram can be exported as a template and the same template can be imported to another IED. The file extension of the single-line diagram template file is .apsld.

3.10.9.1 Exporting display configuration as a template

1. Export display pages as a template in one of the alternative ways.
   - On the **File** menu, point to **Display Editor Template** and select **Export**.
   - On the menu bar, point to **Graphical Display Editor** and select **Export Display Page as Template**.
2. In the GDE export window, select the pages, SLD pages, custom symbols and translations to be exported.
3. Click **Export**.
4. Select the location to save the template and click **Save**.
5. Choose the certificate to use for signing the file.

3.10.9.2 Importing display configuration from template

1. Import display pages from the template in one of the alternative ways.
   - On the **File** menu, point to **Display Editor Template** and select **Import**.

- On the menu bar, point to **Graphical Display Editor** and select **Import Display Page from Template**.

2. Click **Browse** to select any previously exported template file (*.apgdep/.pgdep) and click **Open**.
3. In the GDE export window, select the pages, SLD pages, custom symbols and translations to be imported.
   - Items present in the current configuration have a green border.
   - Items present in the current configuration with differences have a red border.
   - Items not present in the current configuration (new items) have a blue border.
4. Click **Import**.

PCM600 checks the integrity of the template during import. If the template was signed with a certificate that does not exist in the computer's certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the template.

There can be several reasons why the integrity check fails:

- The template has been created with PCM600 version which does not sign the template files
- The computer certificate store does not contain the certificate needed to do the verification
- Verification itself fails

All the listed reasons above mean that integrity of the template could not be verified, and it is possible that someone has tampered with the template. If the integrity can't be checked or the verification fails, it is still possible to proceed with import. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

3.11 Graphical Display Editor (touch screen LHMI)

Graphical Display Editor is a tool for configuring the touch screen graphical display of an IED, also called the local human-machine interface (LHMI).

Graphical Display Editor can be used to create new pages, configure pages by adding Widgets, set page visibility to different user categories, create single-line diagrams and symbols and to provide language translations.

3.11.1 Starting Graphical Display Editor

- Start Graphical Display Editor in one of the alternative ways.
  - Right-click an IED in the object tree and select **Graphical Display Editor** from the shortcut menu.
  - On the **Tools** menu, select **Graphical Display Editor**.

3.11.2 Closing Graphical Display Editor

- Close Graphical Display Editor in one of the alternative ways.
  - Right-click the **Graphical Display Editor** tab and select **Close** from the shortcut menu.
  - Click the **Close** button in the upper-right corner of the window.

  When closing the tool, the options are to save the changes or quit without saving.

3.11.3 Graphical Display Editor toolbar

Table 5: Graphical Display Editor toolbar buttons

Toolbar button	Function
	Reads display configuration from the IED
	Writes the display configuration from the Graphical Display Editor to the IED
	Displays the Page Map
	Displays the preview of the LHMI
	Finds any search text inside Graphical Display Editor
	Zooms in the current display page
	Zooms out of the current display page
	Moves the selected items to the back
	Moves the selected items to the front
	Places the selected items right aligned with the rightmost item
	Places the selected items left aligned with the leftmost item
	Places the selected items top aligned with the topmost item
	Places the selected items to the bottom aligned with the bottommost item
	Centers the selected items horizontally
	Centers the selected items vertically

Table continues on the next page

Toolbar button	Function
	Distributes the selected items horizontally
	Distributes the selected items vertically
	Makes the width of all items selected equal to that of the first item selected
	Makes the height of all items selected equal to that of the first item selected
	Makes the size of all items selected equal to that of the first item selected
	Rotates an item 90 degrees to the left
	Rotates an item 90 degrees to the right
	Groups the selected items
	Ungroups the selected items
	Locks the selected items
	With Snap to Grid function enabled, positions a symbol with its top left corner at the intersection of the nearest grid lines
	Displays or hides the grid in the display page

3.11.4 Page Organizer

Page Organizer is used for configuring pages of LHMI by creating Main Pages and Linked Pages. Pages can be added, removed or reordered in Page Organizer and, for example, their visibility can be changed. Page Organizer also enables saving a page as a Template which can be selected as a Main Page or Linked page later on.

Pages available under the Switchgear HMI Pages section are displayed as bay overviews in Switchgear HMI Configuration.



Pages which have a padlock symbol are ABB Built-in Pages. These pages cannot be modified.



The first page in the Main Pages is always the Home Page and it is denoted by a Home symbol.



The Switchgear HMI Pages section is available in Page Organizer based on the IED capability. It is not possible to paste or reorder pages across Switchgear HMI Pages and Main Page/Linked Pages.

3.11.4.1 Adding pages

1. Under **Main Pages**, select **Linked Pages** and click **Add Page**.
2. In the **Add Page** dialog, select any page from ABB Built-in Pages or Templates and click **Add**.

3.11.4.2 Removing pages

Remove pages in one of the alternative ways.

- Click **Options** in the upper-right corner of the page and click **Remove Page**.
- Right-click on the page and click **Remove Page**.

3.11.4.3 Editing pages

- Edit pages in one of the alternative ways.
  - Click **Options** in the upper-right corner of the page and click **Edit Page**.
  - Right-click on the page and click **Edit Page**.
  - Double-click on the page.

  This opens the page in Page Editor Tab which can be used to edit the page.

3.11.4.4 Renaming pages

- Rename pages in one of the alternative ways.
  - Click **Options** in the upper-right corner of the page and click **Rename Page**.
  - Right-click on the page and click **Rename Page**.
  - Double-click on the **Page Caption**.
  - Select the page and change the **name** in object property window.



The page name has to be unique across Main Pages and Linked Pages.

3.11.4.5 Reordering pages

- Reorder pages by dragging a page and dropping it in the required place.

  Pages from Main Pages can also be dragged and dropped to Linked Pages and vice versa.

3.11.4.6 Cutting, copying and pasting

- Cut the selected Page in one of the alternative ways.
  - Click the **Options** button in the upper-right corner of the page and select **Cut** from the shortcut menu.

- Right-click on the page and select **Cut**.

- Copy the selected Page in one of the alternative ways.
  - Click the **Options** button in the upper-right corner of the page and select **Copy** from the shortcut menu.
  - Right-click on the page and select **Copy**.

- Paste the earlier Cut or Copied Page in one of the alternative ways.
  - Click the **Options** button in the upper-right corner of the page and select **Paste** from the shortcut menu.
  - Right-click on the page and select **Paste**.

3.11.4.7 Saving as template

- Save pages as templates in one of the alternative ways.
  - Click **Options** in the upper-right corner of the page and select **Save as Template** from the shortcut menu.
  - Right-click on the page and click **Save as Template**.

When a template is created out of an existing page, it is available under the Templates section in the Add Page dialog. Templates allow replicating the same configuration with less effort.

3.11.4.8 Setting page visibility

- Set page visibility by selecting the **Basic** and **Advanced** toggle buttons at the bottom of the page.

  Pages are filtered based on the mapped rights in LHMI.

3.11.5 Page Editor

Page Editor is used to configure pages. Pages can be configured by adding widgets that are the building blocks of LHMI configuration. Any graphical objects drawn in LHMI page is a widget.

Object Types Pane

The Object Types Pane contains all the supported widgets and supported function blocks.

Page Browser is shown at the bottom of the Page Editor where all pages are available. When a page is clicked, it is opened in Page Editor.



Page templates are not shown in Page Browser.

3.11.5.1 Adding and deleting widgets

- A widget can be added to the page in one of the alternative ways.
  - Drag the widget from the Object Types pane to the page.
  - Drag the **Function Block** from the **Object Types** pane. When the **Function Block** is dragged, the widget group associated with the function block is created.
- A selected widget can be deleted from the page in one of the alternative ways.
  - Right-click and select **Delete**.
  - Press DELETE.
  - Select **Edit** and then **Delete**.

3.11.5.2 Resizing widgets

- Resize selected widgets in one of the alternative ways.
  - Click and hold the any resize point in the edge or corner of the widget. Drag the mouse to resize.
  - Change the width and height properties of the widget in the **Object Properties** window.

3.11.5.3 Setting widget properties

- Change the properties of the selected widget by modifying the values in the **Object properties** window.

  The properties of the widget can vary depending on the selected widget.



See the technical manual for further help on setting State Values of the Valuemap property.



For widgets that contain a collection of child items which support order property (for example MeasurementList, Saco), the child items can be sorted according to the order value.

3.11.5.4 Cutting, copying and pasting

- Cut the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Cut**.
  - Click the **Cut** button on the toolbar.
  - Press CTRL+X
  - Right-click and select **Cut**.
- Copy the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Copy**.
  - Click the **Copy** button on the toolbar.

- Press CTRL+C
- Right-click and select **Copy**.
- Select the widget, press and hold CTRL and drag.

- Paste the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Paste**.
  - Click the **Paste** button on the toolbar.
  - Press CTRL+V
  - Right-click and select **Paste**.

3.11.5.5 Grouping and ungrouping widgets

- Group multiple widgets in one of the alternative ways.
  - Press CTRL+G.
  - Right-click and select **Group Selected**.
  - Click the **Group Selected** button on the toolbar.

- Ungroup multiple widgets in one of the alternative ways.
  - Press CTRL+U.
  - Right-click and select **Ungroup**.
  - Click the **Ungroup** button on the toolbar.

3.11.5.6 Managing group properties

1. Right-click and select **Manage Group Properties**.
2. In the **Widget group** window, provide the **Widget Group Name** and **Alias Names**.
3. Click **OK**.

3.11.5.7 Property data binding

Widget property values can be bound to the same or other widget property values or signal values from Application configuration function.

1. Select any widget or group, right-click it and select **Property Data Binding**.
2. In the **Logic** window, expand any property to set the binding.
3. Click + to add **IF** and **ELSE** conditions.
4. Click … to add another **And** condition inline.
5. Click **And** to change or remove the condition.
6. Click x to remove the **IF** condition.
7. Click **Value Button**, select any signal value or widget property value and press ENTER.
8. Click **Apply** to save the property data binding.

3.11.5.8 Managing Editor settings

1. Right-click on the page and select **Editor Settings**.
2. Adjust the size in one of the alternative ways.
   - Adjust the **Grid size** and **Margin size** slider.
   - Click **Default** to set the values to the default.
3. Click **x** to close the window.

Editor settings are common to both Page Editor and SLD Editor. Any change in settings is reflected in both places.

3.11.5.9 Undoing and redoing

- Undo the last action in one of the alternative ways.
  - On the **Edit** menu, select **Undo**.
  - Click the **Undo** button on the toolbar.
  - Press CTRL+Z.
- Redo the last action in one of the alternative ways.
  - On the **Edit** menu, select **Redo**.
  - Click the **Redo** button on the toolbar.
  - Press CTRL+Y.

3.11.5.10 Zooming

- Zoom the current display in or out in one of the alternative ways.
  - Click the **Zoom** button on the toolbar.
  - Select a value from the **Zoom** drop-down list.
  - Press CTRL and rotate the mouse wheel.

3.11.5.11 Locking widgets

Locking widgets can be useful in preventing accidental changes to the widgets. Locked widgets cannot be moved or resized and all the properties inside Object Properties cannot be modified till the widget is unlocked.

- Select the widget and click the **Lock** or **Unlock** button on the toolbar.

3.11.5.12 Creating ViewPort widgets

The ViewPort widget displays the content of a page.

1. Drag the ViewPort widget from the **Object Types** pane to the page.
2. Select **Page** in **Object Properties** to the required page.

3.11.5.13 Creating SLDViewPort widgets

The SLDViewPort widget displays the single-line diagram configured from the SLD Editor.

1. Drag the **SLDViewPort widget** from the **Object Types** pane to the page.
2. Select **Page** in **Object Properties** to the required SLD page.

3.11.6 Single Line Diagram Editor

Single Line Diagram (SLD) Editor is used to create single-line diagrams. In SLD Editor, standard and custom symbols can be added from the object type window and links can be created between symbols.

Single-line diagrams support both ANSI and IEC standards. Single-line diagrams created in ANSI can be changed to IEC and vice versa by changing the symbol standard from the drop-down list on PCM600 toolbar. Custom symbols can be used in both ANSI and IEC standards.

Object Types pane

The Object Types pane contains all the supported standard symbols and custom symbols. Based on the symbol standard selection, standard symbols are populated with either IEC or ANSI.

Single-line diagrams created in SLD Editor can be used in the main pages using a special widget called SLDViewPort which is available under the Container group in the object type window.

3.11.6.1 Adding, renaming and removing SLD pages

- To add a single-line diagram page, click **Add Page** below the SLD Editor.
- Rename a single-line diagram page in one of the alternative ways.
  - Right-click on the page and select **Rename Page**.
  - Double-click on the page caption.
  - Change the name in the **Object type** window.
- Remove a single-line diagram page.
  1. Right-click on the page.
  2. Select **Remove Page**.

All single-line diagram pages are shown at the bottom of the SLD editor. When a page is clicked, it opens in SLD Editor.

3.11.6.2 Creating single-line diagrams

1. On the Graphical Display Editor toolbar, select the symbol standard from the combo box.
   - IEC
   - ANSI

2. Ensure that the **Snap to grid** and **Show grid** functions are available.
   This is the default and recommended setting when designing a single-line diagram.
3. Place the primary equipment on the single-line diagram approximately in the wanted position.
   If required, rotate the symbols using the **Rotate Left** or **Rotate Right** functions.
4. Consider the necessary symbol connections, that is, links.
   a) Click on the source port and click on the desired position to add a connection point.
   b) Draw a perpendicular line by moving the mouse while pressing SHIFT and clicking on the target port.
5. Connect the symbols where necessary.
   a) Move the mouse pointer over the symbol's connection ports.
   The connection ports of all symbols are activated.
   b) Drag the connection from the source connection port and drop it in the target connection port.

   A connection line between the source and target connection ports is drawn.

   Alternatively, click on the source port and then click once at the target port to create the connection. Move the mouse on the nearest connection port to ensure the target port. A “+” sign appears.
   c) Right-click or press ESC to cancel the connection creation.

   Once a link has been used to connect the symbols, the link follows the symbol when it is moved to a new position or when it is rotated. See *Chapter 3.11.6.5 Moving symbols*.
6. After creating the connections, move the mouse pointer away from the symbol's port for all the connection ports of the symbols to become deactivated.
7. Select a symbol and modify its properties in the **Object Properties** pane. See *Chapter 3.11.6.7 Modifying symbol properties*.
   The symbol name can also be changed by double-clicking the symbol.
8. Relate dynamic symbols to their source data as described in *Chapter 3.11.6.3 Selecting input signals for dynamic symbols*.
   A straight line or a link can be drawn to connect the different diagrams by pressing SHIFT on the page.

3.11.6.3 Selecting input signals for dynamic symbols

1. To relate the dynamic symbols to their input signal, select the input signal in the drop-down menu on the **control** property in the **Object Properties** pane.
   A maximum of five signals appear in the drop-down list.
2. Click … to select the signal.

3.11.6.4 Selecting symbols and links

- Click a symbol or a link.
- Select all the symbols on the page in one of the alternative ways.
  - Press CTRL + A.
  - Right-click on the page and select **Select All**.

To select multiple symbols, press CTRL while selecting symbols.

To select multiple neighboring symbols, draw a rectangle by pressing the mouse button and moving the mouse. All the symbols in the rectangular area are selected.

3.11.6.5 Moving symbols

1. Select the symbol to be moved.
2. Move the symbol in one of the alternative ways.
   - Drag the symbol to the wanted position.
   - Use the arrow keys to move the symbol to the wanted position.

   The existing links are also moved with their connected symbols.

Symbols can be moved outside the page with arrow keys.

3.11.6.6 Aligning symbols

1. Select multiple symbols.
2. On the toolbar, select **Align** and click the wanted option.
   - **Align Left** aligns the selected symbols left with the leftmost symbol.
   - **Align Right** aligns the selected symbols right with the rightmost symbol.
   - **Align Top** aligns the selected symbols top with the topmost symbol.
   - **Align Bottom** aligns the selected symbols bottom with the bottommost symbol.
   - **Align Horizontal Center** centers the selected symbols horizontally.
   - **Align Vertical Center** centers the selected symbols vertically.
   - **Distribute Horizontally** creates an equal horizontal space between the selected symbols.
   - **Distribute Vertically** creates an equal vertical space between the selected symbols.

3.11.6.7 Modifying symbol properties

The Object Properties pane opens when Graphical Display Editor is started.

1. Click a symbol on the page to show its properties in the **Object Properties** pane.

   The symbol properties can vary depending on the selected object.

2. Change the **Caption Text** property by double-clicking the symbol and entering a new name.



Click on an empty location to show the properties of the page.

3.11.6.8 Deleting, cutting, copying and pasting

- Delete the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Delete**.
  - Press DELETE.
  - Right-click and select **Delete**.
- Cut the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Cut**.
  - Click the **Cut** button on the toolbar.
  - Press CTRL+X.
  - Right-click and select **Cut**.
- Copy the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Copy**.
  - Click the **Copy** button on the toolbar.
  - Press CTRL+C.
  - Right-click and select **Copy**.
- Paste the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Paste**.
  - Click the **Paste** button on the toolbar.
  - Press CTRL+V.
  - Right-click and select **Paste**.



A copy of the selected symbol can be created by pressing CTRL and dragging the symbol.

3.11.6.9 Undoing and redoing

- Undo the last action in one of the alternative ways.
  - On the **Edit** menu, select **Undo**.
  - Click the **Undo** button on the toolbar.
  - Press CTRL+Z.
- Redo the last action in one of the alternative ways.
  - On the **Edit** menu, select **Redo**.
  - Click the **Redo** button on the toolbar.

- Press CTRL+Y.

3.11.6.10 Zooming

- Zoom the current display in or out in one of the alternative ways.
  - Click the **Zoom** button on the toolbar.
  - Press CTRL and rotate the mouse wheel.

3.11.6.11 Managing Editor settings

1. Right-click on the page and select **Editor Settings**.
2. Adjust the size in one of the alternative ways.
   - Adjust the **Grid size** and **Margin size** slider.
   - Click **Default** to set the values to the default.
3. Click **x** to close the window.

Editor settings are common to both Page Editor and SLD Editor. Any change in settings is reflected in both places.

3.11.6.12 Managing bus bar coloring

Bus bar coloring is used to assign a color to a bus bar or links. New bus bar color groups can be created and each color group can have one or more logic conditions; each logic condition is associated with one color.

1. Apply the busbar coloring.
   a) Right-click anywhere on the page and select **Show Bus Bar Coloring**.
   b) In the **SLD Logic** window, click + to add a new color group and x to remove and existing color group.
   c) Expand any color group and click + to add **IF** and **ELSE** conditions and x to remove them.
   d) Click … to add another **And** condition inline. Click **And** to change or remove the condition.
   e) To add a value for a condition, click **Value Button**, select any signal value or widget property value and press ENTER.
   f) Select any color from the drop-down list.
   g) Select the **Color Group** and click on any bus bar to apply the coloring.
2. Remove the busbar coloring.
   a) Right-click anywhere on the page and select **Show Bus Bar Coloring**.
   b) Select any color group and click the busbar to remove the busbar coloring.

Right-click anywhere on the page and select **Highlight Conditional Bus Bar** to show bus bars that have the coloring applied.

3.11.6.13 Managing symbol state coloring

The color of a symbol is based on its state and it can be changed using the stateColorMap property. Based on the active state, the assigned color is displayed on the LHMI.

1. Select any symbol and edit the **statecolormap** property in the **Object Property** panel.
2. In the **Valuemap Editor** window, double-click any state value and select a color.
3. Click **OK**.

3.11.6.14 Setting connector visibility

- To make connectors or ports always visible, right-click anywhere on the page and select **Show Connector Always**.

3.11.7 Symbol Editor

Symbol Editor is used to create symbols for a single-line diagram. It has different drawing tools available like line, rectangle and ellipse to draw the symbols. These symbols can be saved as in SVG format and written to the IED. This gets displayed on the LHMI.

Symbol standards

Symbol Editor supports three types of symbol standards.

1. ANSI
2. IEC
3. Custom

ANSI and IEC symbols are provided by default. Only custom symbols can be created or edited.

Categories

Categories can be created to group symbols in Symbol Editor.

States

A state represents the graphics of a symbol at different positions. Each symbol has at least one state.

3.11.7.1 Symbol Editor toolbar

Table 6: Symbol Editor toolbar buttons

Toolbar button	Function
	Creates a new category
	Deletes the selected category
	Creates a new symbol
	Deletes the selected symbol
	Opens the Create State dialog
	Opens the Delete State dialog
	Selects/moves/resizes a shape
	Draws a line
	Draws a rectangle
	Draws an ellipse/circle
	Draws a curve
	Draws a polyline. Right-click or double-click to end the drawing.
	Draws a polygon. Right-click or double-click to end the drawing.
	Draws any shape
	Adds text
	Shows or hides the guide lines. When the guide lines are enabled, new lines can be added or removed by right-clicking and selecting Guides from the context menu.

3.11.7.2 Creating categories

1. Create a new category in one of the alternative ways.
   - On the menu bar, point to **Graphical Display Editor**, point to **Symbol Editor** and select **Create Category**.
   - Right-click the symbol library and click **Create Category**.

2. Specify a name in the **Create Category** dialog and click **Create**.



New categories can only be created under the custom symbol standard.

3.11.7.3 Deleting categories

1. On the menu bar, point to **Graphical Display Editor**, point to **Symbol Editor** and select **Delete Category**.
2. In the **Delete Category** dialog, select the categories to be deleted and click **Delete**.



Categories created by ABB cannot be deleted.



A created category can only be deleted under the custom symbol standard. Deleting categories also deletes the contained symbols.

3.11.7.4 Creating symbols

1. Create a new symbol in one of the alternative ways.
   - On the menu bar, point to **Graphical Display Editor**, point to **Symbol Editor** and select **Create Symbol**.
   - Right-click the symbol library and click **Create symbol**.
2. Specify the name, category, size and states in the **Create Symbol** dialog and click **Create**.



New symbols can only be created under the custom symbol Standard.



Select states with unique values.

3.11.7.5 Deleting symbols

- Delete a symbol in one of the alternative ways.
  - On the menu bar, point to **Graphical Display Editor**, point to **Symbol Editor** and select **Delete Symbol**.
  - Right-click the symbol library and click **Delete**.

Only symbols available under the custom symbol standard can be deleted.

3.11.7.6 Creating states

1. On the menu bar, point to **Graphical Display Editor**, point to **Symbol Editor** and select **Create State**.
2. In the **Create State** dialog, select **Create New State**.
3. Specify a name, a numeric value and click **Create**.

Alternately, click the **Add states** button from the states panel.

3.11.7.7 Deleting states

1. On the menu bar, point to **Graphical Display Editor**, point to **Symbol Editor** and select **Delete State**.
2. In the **Delete State** dialog, select states to be deleted.
3. Click **Delete**.

States that are created under the custom symbol standard but not used by any symbol are available for selection.

3.11.7.8 Selecting signal type

1. On the menu bar, point to **Graphical Display Editor**, point to **Symbol Editor**, point to **Symbol** and select **Object Properties**.
2. Select **Signals property** and click **....**
3. To add signals, select a signal or a function block and click .
4. To remove signals select one or more signals and click .

3.11.7.9 Exporting custom symbols

1. On the menu bar, point to **Graphical Display Editor**, point to **Symbol Editor** and select **Export Symbol**.
2. In the **Export custom symbols** dialog, select the symbols to be exported.
3. Click **Export**.
4. Type the file name and click **Save**.

3.11.7.10 Importing custom symbols

1. On the menu bar, point to **Graphical Display Editor**, point to **Symbol Editor** and select **Import Symbol**.
2. Browse for a custom symbol template file (.psbl) and click **Open**.
3. Select the symbols to be imported.
4. Click **Import**.

3.11.7.11 Deleting, cutting, copying and pasting

- Delete the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Delete**.
  - Press DELETE.
  - Right-click and select **Delete**.
- Cut the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Cut**.
  - Click the **Cut** button on the toolbar.
  - Press CTRL+X.
  - Right-click and select **Cut**.
- Copy the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Copy**.
  - Click the **Copy** button on the toolbar.
  - Press CTRL+C.
  - Right-click and select **Copy**.
- Paste the selected widgets in one of the alternative ways.
  - On the **Edit** menu, select **Paste**.
  - Click the **Paste** button on the toolbar.
  - Press CTRL+V.
  - Right-click and select **Paste**.

3.11.7.12 Undoing and redoing

- Undo the last action in one of the alternative ways.
  - On the **Edit** menu, select **Undo**.
  - Click the **Undo** button on the toolbar.
  - Press CTRL+Z.
- Redo the last action in one of the alternative ways.
  - On the **Edit** menu, select **Redo**.
  - Click the **Redo** button on the toolbar.
  - Press CTRL+Y.

3.11.7.13 Zooming

- Zoom the current display in or out in one of the alternative ways.
  - Click the **Zoom** button on the toolbar.
  - Press CTRL and rotate the mouse wheel.

3.11.8 Language Translation

Language Translation is used to translate configuration data text into different languages. Configuration data includes widget properties, page properties and symbol captions. All the translatable properties, that is, text properties, are displayed on the language translation tab.

With Language Translation the users can add a new language from the list of languages supported by the IED and set the translated text for the language. Once the translations are written to the IED they can be displayed on the LHMI based on the language selected.



Changing any text in the configuration only updates the Default Text in Language Translation. Update all the corresponding texts in Languages manually.

3.11.8.1 Adding and deleting languages

- Add a new language.
  1. Click **Add Language**.
  2. Select a language from the drop-down list.
  3. Press **OK**.
- Delete a language.
  1. Right-click any added language.
  2. Select **Delete**.

3.11.8.2 Undoing and redoing

- Undo the last action in one of the alternative ways.
  - On the **Edit** menu, select **Undo**.
  - Click the **Undo** button on the toolbar.
  - Press CTRL+Z.
- Redo the last action in one of the alternative ways.
  - On the **Edit** menu, select **Redo**.
  - Click the **Redo** button on the toolbar.
  - Press CTRL+Y.

3.11.8.3 Copying and pasting

- To copy any text, select the cell and press CTRL+C.
- To paste the copied text, select any cell and press CTRL+V.

3.11.9 Switchgear HMI Page Editor

Switchgear HMI Page Editor is used to configure Switchgear HMI bay overview pages. Pages can be configured by adding widgets that are the building blocks of an LHMI configuration. Any graphical object drawn in the LHMI page is a widget.

Configuring Switchgear HMI Pages is the same as configuring Pages in Page Editor. See *Chapter 3.11.5 Page Editor* for more information.

Switchgear HMI Page Editor is available based on the IED capability.

The widgets available in the Object Types pane might differ from Page Editor. This depends on IED capability.

3.11.10 Switchgear HMI SLD Editor

Switchgear HMI SLD Editor is used to create single-line diagrams to be displayed in Switchgear HMI Pages. In Switchgear HMI SLD Editor, standard and custom symbols can be added from the Object Types pane and links can be created between symbols.

Configuring Switchgear HMI SLD Pages is the same as configuring SLD Pages in Single Line Diagram Editor. See *Chapter 3.11.6 Single Line Diagram Editor* for more information.

Single-line diagrams created in Switchgear HMI SLD Editor can be used in the Switchgear HMI pages using a special widget called SLDViewPort which is available under the Container group in the Object Types pane.

Switchgear HMI SLD Editor is available based on the IED capability.

The symbols available in the Object Types pane might differ from Page Editor. This depends on IED capability.

3.11.11 Simple find

1. Activate the find feature in one of the alternative ways.
   - Click the **Find** button on the toolbar.
   - Press CTRL+F.
2. Enter the search string in the **Search** box.

3. Click **Find Next** to locate the next parameter. After clicking **Find Next**, press ENTER to move to the next parameter.
4. Click **Close** to close the **Find** dialog box.

3.11.12 Advanced find

1. Activate the find feature in one of the alternative ways.
   - Click the **Find** button on the toolbar.
   - Press CTRL+F.
2. On the **Find** window, click **Advanced Find** and select the **Find** tab.
3. Enter the search string in the **Find what** box.
4. Check **Match case** for case sensitive search.
5. Check **Match whole word** for a particular word search.
6. 7. Use **Look In** - to define if the search should be done in All Tabs or in a specific tab. By default, All is selected.

3.11.13 Printing display configuration

1. Preview the generated document before printing it in one of the alternative ways.
   - On the **File** menu, select **Create Report**.
   - Click the **Create Report** button on the toolbar.
   - Press CTRL+SHIFT+P.
2. Open the **Print** dialog box in one of the alternative ways.
   - On the **File** menu, select **Print**.
   - Click the **Print** button on the toolbar.
   - Press CTRL+P.

   A Print dialog appears.
3. Select the required print options and click **OK**.

3.11.14 Saving display configuration

Save the display configuration in one of the alternative ways.

- On the **File** menu, select **Save**.
- Click the **Save** button on the toolbar.
- Press CTRL+S.

3.11.15 Reading display configuration from the IED

- To read the configuration from the IED, click the Read from IED button on the toolbar.

Configuration is automatically saved after reading a display configuration from the IED.

3.11.16 Writing display configuration to the IED

- To write the configuration to the IED, click the Write to IED button on the toolbar.

  This action must be confirmed before it is carried out, because it overwrites the IED's existing display configuration. The writing operation can take a few seconds or minutes to complete.

3.11.17 Importing display configuration from template

1. Import display pages from the template in one of the alternative ways.
   - On the **File** menu, point to **Display Editor Template** and select **Import**.
   - On the menu bar, point to **Graphical Display Editor** and select **Import Display Page from Template**.
2. Click **Browse** to select any previously exported template file (*.apgdep/.pgdep) and click **Open**.
3. In the GDE export window, select the pages, SLD pages, custom symbols and translations to be imported.
   - Items present in the current configuration have a green border.
   - Items present in the current configuration with differences have a red border.
   - Items not present in the current configuration (new items) have a blue border.
4. Click **Import**.

PCM600 checks the integrity of the template during import. If the template was signed with a certificate that does not exist in the computer’s certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the template.

There can be several reasons why the integrity check fails:

- The template has been created with PCM600 version which does not sign the template files
- The computer certificate store does not contain the certificate needed to do the verification
- Verification itself fails

All the listed reasons above mean that integrity of the template could not be verified, and it is possible that someone has tampered with the template. If the integrity can't be checked or the verification fails, it is still possible to proceed with import. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

3.11.18 Exporting display configuration as a template

1. Export display pages as a template in one of the alternative ways.
   - On the **File** menu, point to **Display Editor Template** and select **Export**.
   - On the menu bar, point to **Graphical Display Editor** and select **Export Display Page as Template**.
2. In the GDE export window, select the pages, SLD pages, custom symbols and translations to be exported.
3. Click **Export**.
4. Select the location to save the template and click **Save**.
5. Choose the certificate to use for signing the file.

3.11.19 Viewing page map

The page map provides the link page information between the pages.

- To view the page map, click the **Page Map** button on the toolbar.

3.11.20 Previewing configuration

After the pages have been configured, the configuration can be previewed with a soft LHMI before it is written to the IED. The soft LHMI is a Windows version of the actual LHMI.

- To launch the soft LHMI and to preview the configuration, click the **Show Preview** button.

3.12 Switchgear HMI Configuration

Switchgear HMI Configuration is a tool for creating and configuring the navigation pages displayed on the switchgear HMI (SHMI).

Switchgear HMI Configuration can be used to allocate and reorder bays in the navigation page configuration, to modify Substation Name, Switchgear Name and Voltage Level, and to write the configuration.

3.12.1 Starting Switchgear HMI Configuration

- Start Switchgear HMI Configuration in one of the alternative ways.
  - Right-click an SHMI in the object tree and select **Switchgear HMI Configuration** from the shortcut menu.
  - On the **Tools** menu, select **Switchgear HMI Configuration**.

SHMI is available in the Object Types pane when the supported connectivity packages are installed.

3.12.2 Closing Switchgear HMI Configuration

- Close Switchgear HMI Configuration in one of the alternative ways.
  - Right-click the **Switchgear HMI Configuration** tab and select **Close** from the shortcut menu.
  - Click the **Close** button in the upper-right corner of the window.

3.12.3 Configuring switchgear HMI navigation pages

Switchgear HMI Configuration displays the bay overviews of all the supported IEDs in the plant structure providing that they are not a part of another SHMI's navigation page configuration.

The Switchgear HMI Navigation Page Configuration section contains the pages to be displayed in the SHMI. The order of the pages displayed in the SHMI is the same as the order configured in the Switchgear HMI Navigation Page Configuration section.

The Unallocated bays overview section displays the bay overviews of all the supported IEDs in the plant structure providing that they are not allocated to any SHMI's navigation page configuration.

- Configure the SHMI navigation pages in one of the alternative ways.
- Drag a page from the **Unallocated bays overview** section to the **Switchgear HMI Navigation Page Configuration** section to allocate a page.
- Drag a page from the **Switchgear HMI Navigation Page Configuration** section to the **Unallocated bays overview** section to remove a page.
- Drag pages within the **Navigation Page Configuration** section to reorder them.



Bay overviews of IEDs that support SHMI page configuration are automatically added to the Switchgear HMI Navigation Page Configuration section when Switchgear HMI Configuration is opened for the first time.



Bay overviews are shown based on the SHMI pages configured in the Graphical Display Editor of the respective IEDs.

3.12.4 Editing switchgear HMI page configuration

SHMI pages are configured in the Graphical Display Editor of the IED in the Switchgear HMI Page Editor tab.

- To edit the SHMI page configuration, launch Graphical Display Editor from Switchgear HMI Configuration in one of alternative ways.
  - Right-click a page in the **Switchgear HMI Page Configuration** section or in the **Unallocated bays overview** section and select **Edit Configuration** from the shortcut menu.

- Double-click a page.

3.12.5 Saving switchgear HMI configuration

- Save the SHMI configuration in one of the alternative ways.
  - On the **File** menu, select **Save**.
  - Click the **Save** button on the toolbar.

3.12.6 Writing switchgear HMI configuration

- To write the SHMI configuration, click the **Write** button on the toolbar.

Writing of the configuration is cancelled with an error message if any IED included in the Switchgear HMI Navigation Page Configuration section cannot be reached through the network.

3.12.7 Previewing configuration

After the SHMI navigation pages have been configured, the configuration can be previewed with a soft SHMI before it is written.

- To launch the soft SHMI and to preview the configuration, click the **Show Preview** button.

The ability to preview a configuration depends on the IED capability.

3.13 Hardware Configuration

The Hardware Configuration tool is used to configure the IED's hardware modules and to troubleshoot the IED's hardware configuration.

3.13.1 Starting hardware configuration

To start the Hardware Configuration tool:

1. Right-click an IED in the object tree
2. Select
   - **Hardware Configuration** from the shortcut menu or
   - **Tools** > **Hardware Configuration**.

You can start the tool on different levels in the object tree:

1. Expand an IED node.
2. Right-click
   - IED configuration node or
   - hardware configuration node.

3.13.2 Closing hardware configuration

To close the Hardware Configuration tool:

1. Right-click the **Hardware Configuration** tab at the top of the **Hardware Configuration** window.
2. Select **Close** from the shortcut menu.

Alternatively, close the **Hardware Configuration** by clicking the close button at the upper right side of the window.

If you try to close the tool before saving the changes, the program asks whether you want to save the changes.

3.13.3 Changing hardware modules

The optional hardware modules can be replaced with other supported hardware modules in the slot. A new hardware module can also be created using the supported hardware modules.

If the slot type is fixed or mandatory for some hardware modules, the slot cannot be empty. The hardware modules should be created contiguously if the device variant does not support empty slots between them.

The fixed or mandatory slots are highlighted in turquoise color. The optional slots are shown as normal rows.

For hardware configuration information, the below features are only applicable to connectivity packages supporting dynamic rear- view images.

1. On the **Hardware Configuratio**n, click the **Card Type** drop-down list.
2. Select a hardware module.
   - The respective hardware card module image is updated in the rear view.
   - Changing the hardware modules of the grid changes the hardware module card images in the rear view.
   - Each card is updated with its respective hardware module card image in the rear view.
   - A blank hardware module card image is shown only if the slot is empty or if there is no card in the hardware configuration grid.

3.13.4 Changing display type

To change the display type, select **Display type** from the drop-down menu and choose the required type.

The display type is disabled, if it is not allowed to change the LHMI display to a particular IED.

3.13.5 Changing housing type

1. Select the required housing type from the **Housing** drop-down list. The rear view image is changed and the supporting hardware modules are updated in the grid based on the housing type.
2. Save the changes to the housing type.

   If the changes are not saved, the previous housing and hardware configuration are restored.

   If the slots are not compatible between the old and the new housing type, the modules in these slots are highlighted with wheat color in the hardware configuration grid, and a message is displayed asking to select a supported hardware module for the replacement in the grid.

   Save the hardware module changes before changing the housing type.

   - If any hardware modules are added or removed after changing the **Housing**, those modules are respectively added or deleted from the hardware configuration grid.

If multiple housing types are not supported for an IED, the **Housing** drop-down list is disabled.

3.13.6 Changing hardware parameters

To change hardware module parameters:

1. Right-click on a card space row on the hardware configuration grid view.
2. Select **Parameter Settings** from the shortcut menu to open the Parameter Settings tool.

   The tool shows the parameters of the selected hardware module.
3. Make the changes and save.
4. Close the Parameter Setting tool.

An alternative way to change the hardware module parameters:

1. Select **IED** > **Parameter Settings**.
2. Right-click on a hardware module under HW Configuration in the plant structure.
3. Select **Parameter Settings** from the shortcut menu.

3.13.7 Saving hardware configuration

- To save the hardware configuration:
  - **Select File** > **Save** or
  - Click the **Save** button in the toolbar.

3.13.8 Parent-child cards

Only the selection of valid cards and slots are filtered and shown in Hardware Configuration. The number of visible sub slots changes dynamically based on the parent card selections.

For example, if the OEM card is selected, P30:5:1 and P30:5:2 will be visible for P30:5. Otherwise these slots are hidden.



This functionality is based on the IED's capability.

3.13.9 Reading hardware configuration from IED

The hardware configuration can be read from the connected IED. The PCM600 configuration is replaced with the IED configuration if the reading is completed successfully.

1. Right-click the specific IED object in the plant structure.
2. Select **Read from IED**. A confirmation message is displayed.
3. Select **Yes** to confirm.

It is required to confirm an action before it is carried out, because the action overwrites the existing PCM600 configuration. A message is shown if a invalid configuration is found.

3.13.10 Writing hardware configuration to IED

A PCM600 configuration can be written to the IED if the connected IED supports the writing process.

1. Right-click the specific IED object in the plant structure and select **Write to IED**. A confirmation message is displayed.
2. Select **Yes** to confirm.

It is required to confirm an action before it is carried out, because the action overwrites the entire IED configuration.

3.13.11 Comparing hardware configuration

The hardware configurations created using PCM600 and the IED can be compared. After comparison, the differences between the configurations are shown.

To compare hardware configuration:

- Click the **Compare Configuration** button in the toolbar.
- Select **IED** > **Compare Configuration** from the PCM600 main menu.



The report is shown if PCM600 and the IED housing variants match.

3.13.12 Printing hardware configuration

1. Start the Hardware Configuration tool.
2. Click the **Print preview** button on the tool bar, or on the **File** menu, select **Print Configuration**.
3. Click the **Save** button on the toolbar.

The hardware configuration is stored as a PDF file by default.

3.14 IEC 61850 Configuration

The IEC 61850 Configuration tool is used for GOOSE, client-server and process bus data flow engineering between IEDs in a substation or substations (R-GOOSE and R-SV). It is also used for configuring subnetworks.

- The GOOSE mode is used for configuring data sets, GOOSE control blocks and inputs of IEDs.
- The client server mode is used for configuring data sets and report control blocks of IEDs.
- The process bus mode is used for configuring data sets, sampled value control blocks and inputs of IEDs.
- The subnetwork mode is used for configuring how communication access points of IEDs are connected to subnetworks.

The data displayed in the IEC 61850 Configuration tool is context-sensitive with the current selection in PCM600 Plant Structure. That is, only the data of the IEDs residing under the selected Plant Structure tree node is displayed.

The IEC 61850 Configuration tool window consists of a matrix which has the receiver access points as columns on the top and data available for receiving as rows on the left. The grey arrow on the upper-left corner of the tool window depicts the data flow direction. Each data row in the matrix contains a check box for each receiver access point to know that the data is sent to or received by the access point in the corresponding column.

On top of the tool window is a drop-down list for selecting the configuration mode, that is, which part of the IEC 61850 configuration to configure.

Next to the drop-down list are buttons for selecting the tool mode, IED naming convention and two context-sensitive buttons for creating new objects or viewing or editing details of the currently selected object.

At the bottom of the tool window are tab pages for selecting the type of data to configure. The available type of data depends on the selected configuration mode.

The properties of the data currently selected in the matrix are displayed on the right in the Object Properties pane. In this pane, it is possible to edit the object's properties.

3.14.1 Data Sets tab

Several functions are possible in the Data Sets tab.

- Configuring, sending and receiving data sets
- Editing data set entries
- Editing data set properties
- Copying, cutting, pasting and deleting data sets

3.14.2 GOOSE Controls tab

Several functions are possible in the GOOSE Controls tab.

- Configuring, sending and receiving of GOOSE control blocks
- Editing GOOSE control block properties
- Changing the connected data set
- Copying, cutting, pasting and deleting GOOSE control blocks



The GOOSE Controls tab page is available only in the GOOSE communication mode.

3.14.3 Inputs tab

Two functions are possible in the Inputs tab.

- Editing input properties
- Deleting inputs



The Inputs tab is available only in the GOOSE and process bus communication modes.

3.14.4 Report Controls tab

Several functions are possible in the Report Controls tab.

- Configuring, sending and receiving of report control blocks
- Editing the report control block properties

- Changing the connected data set
- Changing the order of report clients
- Copying, cutting, pasting and deleting report control blocks



The Report Controls tab page is available only in the client-server communication mode.

3.14.5 Sampled Value Controls tab

Several functions are possible in the Sampled Value Controls tab.

- Configuring, sending and receiving sampled value control blocks
- Editing sampled value control block properties
- Changing connected data set
- Copying, cutting, pasting and deleting sampled value control blocks



The Sampled Value Controls tab page is available only in the process bus communication mode.

3.14.6 Access Points tab

Several functions are possible in the Access Points tab.

- Connecting the communication access points of an IED to subnetworks
- Editing the address properties of the IED's communication access points



The Access Points tab is available only in the subnetwork configuration mode.

3.14.7 Subnetworks tab

Several functions are possible in the Subnetworks tab.

- Creating new subnetworks
- Editing properties of subnetworks
- Copying, pasting and deleting subnetworks



The Subnetworks tab is available only in the subnetwork configuration mode.

3.14.8 Data Set Templates tab

Several functions are possible on the Data Set Templates tab.

- Creating new data set templates
- Editing data set templates
- Deleting data set templates

The Data Set Templates tab is available only in the Template Management mode.

3.14.9 GOOSE Control Templates tab

Several functions are possible in the GOOSE Control Templates tab.

- Creating new GOOSE control templates
- Editing GOOSE control templates
- Deleting GOOSE control templates

The GOOSE Control Templates tab is available only in the Template Management mode.

3.14.10 Report Control Templates tab

Several functions are possible in the Report Control Templates tab.

- Creating new report control templates
- Editing report control templates
- Deleting report control templates

The Report Control Templates tab is available only in the Template Management mode.

3.14.11 Sampled Value Control Templates tab

Several functions are possible on the Sampled Value Control Templates tab.

- Creating new sampled value control templates
- Editing sampled value control templates
- Deleting sampled value control templates

The Sampled Value Control Templates tab is available only in the Template Management mode.

3.14.12 Starting IEC 61850 Configuration

- Start **IEC 61850 Configuration** from the context menu in the PCM600 plant structure.
  1. In the PCM600 plant structure, right-click **Substation**, **Voltage Level**, **Bay**, **IED Group** or **IED**.
  2. Select **IEC 61850 Configuration**.
- Start **IEC 61850 Configuration** from the PCM600 main menu.
  1. Select **Substation**, **Voltage Level**, **Bay**, **IED Group** or **IED** in the PCM600 plant structure.
  2. On the PCM600 menu bar, point to **Tools** and select **IEC 61850 Configuration**.

3.14.13 Changing the configuration mode

Different parts of the IEC 61850 configuration can be edited and templates can be managed by selecting the configuration mode from the drop-down list on the PCM600 toolbar.

- Select **GOOSE Communication** from the drop-down list to edit the GOOSE configuration.
- Select **Client-Server Communication** from the drop-down list to edit the client-server configuration.
- Select **Process Bus Communication** from the drop-down list to edit the process bus configuration.
- Select **Subnetwork Configuration** from the drop-down list to edit the subnetwork configuration.
- Select **Template Management** from the drop-down list to manage templates.

3.14.14 Changing configuration data type

Different kind of data can be edited by selecting a tab page from the bottom of the tool window. The type of the data available depends on the current configuration mode.

- Change the data type in the GOOSE Communication mode.
  1. Select the **Data Sets** tab to edit the data sets.
  2. Select the **GOOSE Controls** tab to edit the GOOSE control blocks.
  3. Select the **Inputs** tab page to edit the GOOSE inputs.
- Change the data type in the Client-Server Communication mode.
  1. Select the **Data Sets** tab to edit the data sets.
  2. Select the **Report Controls** tab to edit the report control blocks.
- Change the data type in the Process Bus Communication mode.

1. Select the **Data Sets** tab to edit the data sets.
2. Select the **Sampled Value Controls** tab to edit the sampled value control blocks.
3. Select the **Inputs** tab to edit the sampled value inputs.

- Change the data type in the Subnetwork Configuration mode.

  1. Select the **Access Points** tab to edit access points.
  2. Select the **Subnetworks** tab to edit subnetworks.

- Change the data type in the Template Management mode.

  1. Select the **Data Set Templates** tab to manage data set templates.
  2. Select the **GOOSE Control Templates** tab to manage GOOSE control templates.
  3. Select the **Report Control Templates** tab to manage report control templates.
  4. Select the **Sampled Value Control Template**s tab to manage sampled value control templates.

3.14.15 Switching IEC 61850 IED naming on and off

The IED naming convention used in the IEC 61850 Configuration tool can be changed. When IEC 61850 IED naming is on, all IED names displayed in the tool are SCL technical keys. When IEC 61850 IED naming is off, all IED names displayed in the tool are the same as displayed in the PCM600 Plant Structure.

- On the **Edit** menu, click **IEC 61850 IED Naming**.
- Click the IEC 61850 IED Naming button on the PCM600 toolbar.
- Press CTRL+ALT+I.

3.14.16 Switching engineering mode on and off

The engineering mode can be switched on and off in the IEC 61850 Configuration tool. When the engineering mode is on, the IEC 61850 configuration can be edited. When the engineering mode is off, the IEC 61850 configuration can only be viewed.

- Switch the engineering mode on and off in the tool window in one of the alternative ways.

  - On the **Edit** menu, select **Engineering Mode**.
  - Click the Engineering Mode button on the PCM600 tool bar.
  - Press CTRL+ALT+E.

- Switch the engineering mode on and off in the PCM600 **Options** window.

  1. On the **Tools**, click **Options** and then click **IEC 61850 Configuration**
  2. Select or clear the **IEC 61850 configuration engineering mode enabled** check box.
  3. Click **OK** or press ENTER to apply the changes.

3.14.17 Sending and receiving data

In the Data Sets, GOOSE Controls, Report Controls and Sampled Value Controls tabs, it is possible to configure the sending or receiving of data. A check mark in the matrix means that the data on the row is sent to or received by the client in the column.

- To send or receive data, select a check box in the mapping matrix.
- To send data to all receivers, right-click the data to be sent and select **Send to All**.
- To receive all data, right-click a receiver and select **Receive All**.
- To receive the same data as another IED, right-click a receiver, select **Receive Same Data As** and select an access point from the pop-up menu.



When sending or receiving a data set, the corresponding control block is created automatically on the sending IED if it does not exist yet. When sending or receiving GOOSE or sampled value data, the inputs corresponding to the sent or received data set are created automatically on the receiving IED.

3.14.18 Creating new objects

New objects can be created on the Data Sets, GOOSE Controls, Report Controls, Sampled Value Controls, Subnetworks, Data Set Templates, GOOSE Control Templates, Report Control Templates and Sampled Value Control Templates tabs.

- Create new objects on the **Data Sets**, **GOOSE Controls**, **Report Controls** or **Sampled Value Controls** tab.
  1. Open the dialog box for creating a new object in one of the alternative ways.
     - On the **Edit** menu, click **New**.
     - Click the New button on the PCM600 toolbar.
     - Press CTRL+ALT+N.
  2. Create a new object.
     a. In the tree on the left, select the logical node where to create the new object.
     b. If available, select a template as a basis for the new object (optional).
     c. Type or select the required information in the fields on the right.
     d. Click **OK** or press ENTER to create the object.
- Create new objects on the **Subnetworks** tab.
  1. Open the dialog box for creating a new object in one of the alternative ways.
     - On the **Edit** menu, click **New**.
     - Click the New button on the PCM600 toolbar.
     - Press CTRL+ALT+N.
  2. Create a new subnetwork.
     a. Enter a unique subnetwork name in the **Name** box (mandatory).
     b. Type a description in the **Description** box (optional).
     c. Click **OK** or press ENTER to create the object.
- Create new objects on the **Data Set Templates**, **GOOSE Control Templates**, **Report Control Templates** and **Sampled Value Control Templates** tabs.

1. Open the dialog box for creating a new object in one of the alternative ways.
   - On the **Edit** menu, click **New**.
   - Click the New button on the PCM600 toolbar.
   - Press CTRL+ALT+N.
2. Create a new template.
   a. Enter a unique template name in the **Name** box (mandatory).
   b. Enter a template description in the **Description** box (optional).
   c. Enter a default name in the **Default name** box (optional).
   d. Enter a default description in the **Default description** box (optional).
   e. Enter or select the required information in the rest of the fields.
   f. Click **Save** to create the template.

3.14.19 Creating data set templates

The data set templates are created in the Data Set Template Editor dialog box.

1. Under **Template parameters**, give the template a name and a description.
2. Under **Data set parameters**, give default name and description for the data sets that are created based on the template.
3. Under **Data set entries**, define the entries to be added in the data sets that are created based on the template.

   It is possible to define exact data names or use wildcard characters. When using wildcard characters, one data set entry definition may add more than one entry in the data sets that are created based on the template.

Table 7: Supported wildcard characters

Character	Description
*	Matches any number of any characters, including none Can occur only in the beginning or in the end of the value, for example: '*', '*ABC', 'ABC*' Cannot occur consecutively in the value, for example: '**', '**ABC', 'AB**C', 'ABC**'
?	Matches any single character Can occur everywhere and also consecutively in the value, for example: '??', '?BC', 'A?C', 'AB?'
|	Matches one of the literal character sequences separated with this character Can occur everywhere in the value, for example: 'ABC|' 'ABC|DEF' Cannot occur with other wildcard characters in the same value, for example: '*|?', '*A|B', 'A|B?'



A data set entry can be moved up and down in the list. To do this, click the row header section on the left and drag the row up or down while holding the left mouse button and the SHIFT key down.

4. Click **Save**.

   All parameter values are validated after entering them. It is not possible to save the changes made to the template if any parameter value is invalid. An invalid value is indicated with a red icon next to the field containing the invalid value. An explanation is shown when the mouse pointer is moved over the icon.

3.14.20 Creating GOOSE control templates

The templates are created in the GOOSE Control Template Editor dialog box.

1. Under **Template parameters**, give the template a name and a description.
2. Under **GOOSE control parameters**, give default name, description and other parameter values for the GOOSE controls that are created based on the template.
3. Click **Save**.

   All parameter values are validated after entering them. It is not possible to save the changes made to the template if any parameter value is invalid. An invalid value is indicated with a red icon next to the field containing the invalid value. An explanation is shown when the mouse pointer is moved over the icon.

3.14.21 Creating report control templates

The templates are created in the Report Control Template Editor dialog box.

1. Under **Template parameters**, give the template a name and a description.
2. Under **Report control parameters**, give default name, description and other parameter values for the report controls that are created based on the template.
3. Under **Optional fields** and **Trigger options**, define what report options are set for the report controls that are created based on the template.
4. Click **Save**.

   All parameter values are validated after entering them. It is not possible to save the changes made to the template if any parameter value is invalid. An invalid value is indicated with a red icon next to the field containing the invalid value. An explanation is shown when the mouse pointer is moved over the icon.

3.14.22 Creating sampled value control templates

The templates are created in the Sampled Value Control Template Editor dialog box.

1. Under **Template parameters**, give the template a name and a description.
2. Under **Sampled value control parameters**, give default name, description and other parameter values for the sampled value controls that are created based on the template.
3. Under **Sampled value options**, define what options are set for the sampled value controls that are created based on the template.

4. Click **Save**.

   All parameter values are validated after entering them. It is not possible to save the changes made to the template if any parameter value is invalid. An invalid value is indicated with a red icon next to the field containing the invalid value. An explanation is shown when the mouse pointer is moved over the icon.

3.14.23 Copying objects

Objects can be copied in the Data Sets, GOOSE Controls, Report Controls, Sampled Value Controls and Subnetworks tabs in several ways.

- Select the object, and on the **Edit** menu, click **Copy**.
- Click the Copy button on the PCM600 toolbar.
- Right-click the object and select **Copy**.
- Select the object and press CTRL+C.

3.14.24 Copying IEDs in Plant Structure

1. In the Plant Structure, select the IED and copy it in one of the alternative ways.
   - On the **Edit** menu, click **Copy**.
   - Select **Copy** from the context menu.
2. Select the target parent and paste the IED in one of the alternative ways.
   - On the **Edit** menu, click **Paste**.
   - Select **Paste** from the context menu.

   A copy of the corresponding IED in the project's IEC 61850 model is also created. The new IEC 61850 IED contains the same configuration as the source IED except for the GOOSE and Sampled Value control blocks that do not send any data.

3.14.25 Cutting objects

Objects can be cut in the Data Sets, GOOSE Controls, Report Controls and Sampled Value Controls tabs in several ways.

- Select the object, and on the **Edit** menu, click **Cut**.
- Click the Cut button on the PCM600 toolbar.
- Right-click the object and select **Cut**.
- Select the object and press CTRL+x.



A data set cannot be cut if it is mapped with a receiver in the matrix or if a control block is attached to it. A control block cannot be cut if it is mapped with a receiver in the matrix.

3.14.26 Pasting objects

Objects can be pasted on the Data Sets, GOOSE Controls, Report Controls, Sampled Value Controls and Subnetworks tabs.

- Paste objects on the **Data Sets**, **GOOSE Controls**, **Report Controls** and **Sampled Value Controls** tabs.
  1. Open the window for pasting an object in one of the alternative ways.
     - On the **Edit** menu, click **Paste**.
     - Click the Paste button on the PCM600 toolbar.
     - Press CTRL+V.
  2. In the tree on the left, select the logical node to paste the object.
  3. Give the object a name.
  4. Click **OK** or press ENTER to paste the object.
- Paste objects on the **Subnetworks** tab in one of the alternative ways.
  - On the **Edit** menu, click **Paste**.
  - Click the Paste button on the PCM600 toolbar.
  - Press CTRL+V.



On the Data Sets tab, it is possible to paste data set entries of copied data sets to an existing data set. The data set entries can be pasted by right-clicking the target data set and selecting the Paste entries option from the shortcut menu. The data set entries that are compatible with the target IED are appended to the target data set

3.14.27 Deleting objects

Objects can be deleted on the Data Sets, GOOSE Controls, Report Controls, Sampled Value Controls, Inputs, Subnetworks, Data Set Templates, GOOSE Control Templates, Report Control Templates and Sampled Value Control Templates tabs in several ways.

- On the **Edit** menu, click **Delete**.
- Right-click the object and select **Delete**.
- Press DELETE.

3.14.28 Editing data set entries

- Open the data set editor window in the **Data Sets** tab in one of the alternative ways.
  - Select the data set, and on the **Edit** menu, click **Details**.
  - Click the Details button on the PCM600 toolbar.
  - Right-click the data set and select **Details**.
  - Select the data set and click the Browse button of the **Entries** property in the **Object Properties** window.
  - Double-click the data set.
- Right-click a control block and select **Data Set Details** to open the data set editor window in the **GOOSE Controls**, **Report Controls** or **Sampled Value Controls** tab.
- Select the data.
  1. Select a logical device in the LD list.
  2. Select a logical node in the LN list.

     Logical nodes can be searched by entering the logical node name or part of it into the text field above the logical node list.
  3. Select a data object in the DO list.
  4. Select one or more functional constraints in the FC list or select one or more data attributes in the DA list.
- Append the selected data at the end of the **Data Set Entries** list by clicking the **Append** button or by pressing CTRL+ALT+A.
- Insert the selected data into the **Data Set Entries** list.
  1. Select the location to insert the data.
  2. Click **Insert** or press CTRL+ALT+I.
- Remove the entries from the **Data Set Entries** list.
  1. Select the entries to be removed.
  2. Click **Remove** or press DELETE.
- Move the entries up or down in the **Data Set Entries** list.
  1. Select the entry to be moved.
  2. Click **Up** or **Down** or press CTRL+ALT+UP ARROW or CTRL+ALT+DOWN ARROW.
- Click **OK** or press ENTER to apply the changes.



The current number and the maximum number of entries allowed in data set are displayed on top of the Data Set Entries list. How the current number of entries is calculated depends on the IEC 61850 edition of the IED. On IEC 61850 Edition 1 IEDs, one row in the Data Set Entries list can mean more than one entry depending on what kind of data it is. On IEC 61850 Edition 2 IEDs, one row in the Data Set Entries list means always one entry regardless of what kind of data it is.

Example: DR.RDRE1.RcdMade (ST) data is added to the Data Set Entries list. On Edition 1 IEDs this data means three entries because data object RcdMade contains three data attributes of ST type and the current number of entries is increased by three. On Edition 2 IEDs this data means only one entry and the current number of entries is increased by one.

3.14.29 Changing the order of report clients

1. Open the client editor in the **Report Controls** tab page in one of the alternative ways.
   - Select the report control block, and on the **Edit** menu, click **Details**.
   - Select the report control block and click the Details button on the PCM600 toolbar.
   - Right-click the report control block and select **Details**.
   - Select the report control block and click the Browse button of the **Client IEDs** property in the **Object Properties** window.
   - Double-click the report control block.
2. Move a client up or down in the list.
   a) Select the client.
   b) Click the Up or Down button or press CTRL+ALT+UP or CTRL+ALT +DOWN.
3. Click **OK** or press ENTER to apply the changes.

3.14.30 Changing control block data sets

1. Select the control block.
2. In the **Object Properties window**, select a data set from the **Data Set** drop-down list.

3.14.31 Editing object properties

1. Select the object or objects.
2. Edit the properties in the **Object Properties** pane.

If multiple objects are selected, only the properties that can have the same value in the selected objects are displayed in the Object Properties pane.

3.14.32 Printing

- Preview the report.
  1. On the **File** menu, click **Print Preview**.
  2. In the **Report Options** dialog, select what to include in the report and click **OK** or press ENTER to open the report viewer.
  3. To save the report as a PDF file in the report viewer, select **File** > **Save**, or click the Save button on the PCM600 toolbar, or press CTRL+S.
- In the **Report Options** dialog, select what to include in the report and click **OK** or press ENTER to print the report.
- Open the **Report Options** dialog for printing the report in one of the alternative ways.
  - On the **File** menu, click **Print**.

- Click the Print button on the toolbar.
- Press CTRL+ALT+P.

3.14.33 Saving changes

- Save changes in one of the alternative ways.
  - On the File menu, click Save.
  - Click the Save button on the PCM600 toolbar.
  - Press CTRL+S.



All control blocks not connected to any data sets and empty data sets are automatically deleted during the save.

3.14.34 Importing client ICD files

IED SCL files can contain default client definitions such as Client1...Client5 which can already be in use by some of the predefined RCBs. PCM600 does not show these clients in the plant structure, but the IEC 61850 Configuration tool shows the clients in the Client-Server Communication mode.

COM600 clients can use these client definitions directly. If other clients need to be added to the project, the ICD file describing the client data model can be imported to PCM600.

1. Right-click a **Bay** or **IED Group** node in the PCM600 plant structure, point to **New**, then point to **Generic IEC61850 IED** and select **IEC61850 IED**.
2. Right-click the created IED and select **Import**.
3. Select an ICD file describing the client data model.
4. Click **Open** in the file selection dialog box.
5. Select **Ignore PCM Object Type**.
6. Click **Import** in the **SCL Import Options** window.



If the imported client ICD file contains more than one access point, only the first access point defined in the imported file is available as client in the IEC 61850 Configuration tool. The other access point can be made available by connecting it to a subnetwork in the Access Points tab of the subnetwork configuration mode in the IEC 61850 Configuration tool, or by using System Configuration Tool.

3.14.35 Changing SCL edition of one or more IEDs

The SCL edition of certain IEDs can be changed from IEC 61850 Edition 1 to IEC 61850 Edition 2 and vice versa.

1. Enable changing of SCL version in PCM600.

a) On the **Tools** menu, click **Options**.
b) Select **IEC 61850 Configuration** and click the **Miscellaneous** tab.
c) Select **Allow changing SCL version of an IED configuration** and click **OK**.

2. In **Plant Structure**, select the IED or parent object containing the IEDs whose SCL edition should be changed.
3. Right-click the selected object and select **Change SCL edition**.
4. In the **Change SCL edition** dialog box, make the necessary selections.
   a) In the **Migrate to** list, select the target SCL edition. The list is disabled if there is only one possible SCL edition for the selected IEDs.
   b) Under **Select IEDs to migrate**, select the IEDs for SCL edition change. IEDs not supporting edition change are not shown.
   c) Click **Migrate** to start the operation.



When the operation is completed, a change report is shown for each IED.

3.14.36 Resetting IEC 61850 configuration

- In the plant structure, right-click the IED and then click **Reset IEC 61850 configuration of IED**.

  Resetting the IEC 61850 configuration regenerates the IED SCL configuration based on the current Application Configuration. During the process, all existing communication configurations, such as MMS, GOOSE, RCB and SMV, are cleared for the IED.

3.14.37 Enabling automatic LNode creation

Some tools and systems can utilize LNode information from the Substation section of the SCD files. When this option is enabled, PCM600 automatically adds an LNode representing the function, when a new function block is created in PCM600. Added LNodes cannot be seen in PCM600, but they will appear in the SCD file when the file is exported.

The automatic LNode creation can be enabled in the PCM600 Options window.

1. On the **Tools** menu, click **Options** and then click **IEC 61850 Configuration**.
2. Select the **Automatic LNode creation enabled** check box.
3. Click **OK** or press ENTER to apply the change.

3.14.38 Enabling automatic RCB creation

The IEC 61850 data sets created when generating the application configuration are automatically connected to report control blocks. The application configuration generation happens, for example, when the configuration is saved in Application Configuration tool or the IED configuration wizard is run.

The Automatic RCB creation can be changed in the PCM600 options window.

1. On the **Tools** menu, point to **Options** and select **IEC 61850 Configuration**.
2. Select or clear the **Automatic RCB creation enabled** check box.
3. Click **OK** or press ENTER to apply the change.

3.14.39 Changing the subnetwork assigned for the client IED

Certain Relion devices support multiple access points and thus also the mapping of those access points to different subnetworks. By default, PCM600 contains client-server communication clients for one subnetwork. If necessary, some of the client IEDs can be moved to a different subnetwork.

1. Select the **Client-Server Communication** configuration mode and remove all connections to the client IED access point.
2. Select the **Subnetwork** configuration mode.
3. If needed, create additional subnetworks on the **Subnetworks** tab.
4. On the **Access Points** tab, select the client IED's access point to be moved. If it is not shown, select the root node of PCM600 Plant Structure to show all the access points.
5. Change the subnetwork assigned in the **Object Properties**.
6. Save the configuration.

3.14.40 Enabling automatic GOOSE or SMV supervision configuration

PCM600 can automatically create logical nodes for supervising GOOSE and sampled value data in the subscriber IEDs. These logical nodes are updated if the respective IEC 61850 Configuration option is selected and the GOOSE or SMV configuration is stored in IEC 61850 Configuration, Application Configuration or Signal Matrix.

- In the **PCM600 Options** window, enable automatic GOOSE supervision configuration.
  1. On the **Tools** menu, click **Options** and then click **IEC 61850 Configuration**.
  2. Select **Automatic GOOSE supervision configuration enabled**.
  3. Click **OK** or press ENTER to apply the change.
- In the PCM600 Options window, enable automatic SMV supervision configuration.
  1. On the **Tools** menu, click **Options** and then click **IEC 61850 Configuration**.
  2. Select Automatic SMV supervision configuration enabled.
  3. Click **OK** or press ENTER to apply the change.

3.15 IEC 61850 Structure Mapping

IEC 61850 Structure Mapping is used to engineer flexible product naming (FPN) of the IEDs. In flexible product naming, the IEC 61850 data model can be freely defined and IEDs adapt to this customer specific data model. IEC 61850 Structure Mapping helps to map all the available data in the IED to the customer specific IEC 61850 modelling to the data attributes of the customer specific SCL. IEC 61850 Structure Mapping also includes engineering efficiency functionalities like templates and comprehensive filtering.

3.15.1 FPN projects in PCM600

The IEC 61850 structure mapping tool is available only in FPN projects in PCM600. A PCM600 project can be converted into an FPN project by importing an FPN SCD file into it. When a project is once converted into an FPN project, all subsequent SCD file imports made to the project are FPN SCD imports.

A FPN project contains IED objects of some or all of the listed types.

Table 8: IED object types contained in FPN projects

IED object	Description
Customer IED	An IED created in Bay or IED group in PCM600 Plant Structure as a result of FPN SCD file import. This IED type represents a customer-specified IED data model.
Internal IED	An IED created in the Unassigned IEDs group in PCM600 Plant Structure. This IED type represents a real device in a substation and can be mapped with a customer IED if the IED type supports FPN. The internal IED data model version must be equal to the FPN projects' declared SCL version.
Non-FPN IED	An IED created in Bay or IED group in PCM600 Plant Structure. This IED type represents a real device in a substation but cannot be mapped with a customer IED. The non-FPN IED data model version must be equal to the FPN project's declared SCL version.
Mapped IED	An IED in Bay or IED group in PCM600 Plant Structure after an internal IED is mapped with a customer IED. A mapped IED is indicated by a mapping status icon on the top left corner of the IED’s own icon.

3.15.1.1 Importing FPN SCD files into PCM600 project

1. Right-click the substation or project node in PCM600 plant structure, and then click **Import**.
2. Select the SCD file and click **Open**.
3. Select **Import as Flexible Product Naming SCD** and click **Import**.

3.15.1.2 Enabling FPN SCD import option

The FPN SCD import option is not enabled by default in PCM600.

1. On the PCM600 menu bar, click **Tools** and then click **Options**.
2. Click **Flexible Product Naming**.
3. Select **Import as Flexible Product Naming SCD enabled**.

FPN projects can be imported into and opened in PCM600 even if the FPN SCD import option is not enabled.

To import SCD files into projects, IEC 61850 configuration engineering mode must be disabled in PCM600.

1. On the PCM600 menu bar, click **Tools** and then click **Options**.
2. Click **IEC 61850 Configuration**.
3. Clear the **IEC 61850 configuration engineering mode enabled** check box.

3.15.2 Starting IEC 61850 Structure Mapping

Start IEC 61850 Structure Mapping in one of the alternative ways.

- Start IEC 61850 Structure Mapping from the shortcut menu in the PCM600 plant structure.
  1. In the plant structure, right-click **Substation, Voltage Level, Bay, IED Group** or **IED**.
  2. Point to **Flexible Product Naming** and click **IEC 61850 Structure Mapping**.
- Start **IEC 61850 Structure Mapping** from the PCM600 menu bar.
  1. Click **Substation, Voltage Level, Bay, IED Group** or **IED** in the PCM600 plant structure.
  2. On the menu bar, click **Tools** and then click **IEC 61850 Structure Mapping**.

The IEC 61850 Structure Mapping tool is available only in FPN projects in PCM600.

3.15.3 IED mapping

IED mapping is done in the IED Mapping tab. IED mapping means configuring which IED in the FPN SCD file (customer IED) corresponds to a real IED in the substation (internal IED).

It depends on the selection in the PCM600 plant structure which IED mappings are shown. For example, if a bay is selected, the mappings of IEDs residing under the selected bay are shown.

The **IED Mapping** tab consists of the following elements.

- Mapping list on the left
  - Mapping status icon

  - IED icon
  - Customer IED name
  - Name of the internal IED mapped with the customer IED

- Internal IED list on the right
  - IED icon
  - Internal IED name

- Text field on top of both lists for searching the IEDs

3.15.3.1 Using the IED mapping functions

The **IED Mapping** tab can be used for several functions.

- Create IED mapping in one of the alternative ways.
  - Drag an IED in the mapping list on an IED in the internal IED list.
  - Drag an IED in the internal IED list on an IED in the mapping list.
  - Click an IED in the mapping list and double-click an IED in the **Internal IED** list.
  - Click an IED in the Internal IED list and double-click an IED in the mapping list.
  - Click an IED in the Internal IED list, right-click an IED in the mapping list and click **Create Mapping**.

- Remove IED mapping in one of the alternative ways.
  - Right-click an IED in the mapping list and click **Remove Mappings**.
  - Click an IED in the mapping list and press DELETE.

- Validate all mappings in one of the alternative ways.
  - On the **Edit** menu, click **Validate All**.
  - Click the **Validate** button on the PCM600 toolbar.
  - Click the down arrow next to the **Validate** button on the PCM600 toolbar and click **Validate All**.
  - Press CTRL+ALT+A.

- Validate the mappings currently shown in the mapping list in one of the alternative ways.
  - On the **Edit** menu, click **Validate Current**.
  - Click the down arrow next to the **Validate** button on the PCM600 toolbar and click **Validate Current**.
  - Press CTRL+ALT+C.

- Validate the mappings currently selected in the mapping list in one of the alternative ways.
  - On the **Edit** menu, click **Validate Selected**.
  - Click the down arrow next to the **Validate** button on the PCM600 toolbar and click **Validate Selected**.
  - Press CTRL+ALT+S.

- Enter the IED name or a part of it to the text field above the mapping list to search customer IEDs.
- Enter the IED name or a part of it to the text field above the **Internal IED** list to search Internal IEDs.

- Select or unselect one or more of the four status buttons on the PCM600 toolbar to show and hide items based on their mapping status.
- Right-click a mapping in the mapping list and click **Create Mapping Template** to create a mapping template.
- Right-click a mapping in the mapping list and click **Apply Mapping Template** to apply a mapping template.
- Right-click a mapping in the mapping list and click Accept Mapping to accept IED mapping.

  The **Accept Mapping** function excludes all unmapped data attributes of the customer IED.
- View the properties of currently selected IEDs in the PCM600 **Object Properties** pane.

3.15.3.2 Using the IED mapping functions in PCM600 Plant Structure

- Create IED mapping.
  - Drag an IED from **Unassigned IEDs** to an unmapped IED in **Bay** or **IED Group**.
- Remove IED mapping.
  - Drag a mapped IED from **Bay** or **IED group** to **Unassigned IEDs**.
- Create an internal IED in one of the alternative ways.
  - Right-click **Unassigned IEDs**, click **New** and select the IED type.
  - Copy an existing internal IED in **Unassigned IEDs** and paste it in **Unassigned IEDs**.
  - Drag a non-FPN IED from Bay or IED group to Unassigned IEDs.
  - Copy a non-FPN IED in **Bay** or **IED group** and paste it in **Unassigned IEDs**.
- Create a non-FPN IED in one of the alternative ways.
  - Right-click **Bay** or **IED group**, click **New** and select the IED type.
  - Copy an existing non-FPN IED in **Bay** or **IED group** and paste it in **Bay** or **IED Group**.
  - Drag an internal IED from **Unassigned IEDs** to **Bay** or **IED group**.
  - Copy an internal IED in **Unassigned IEDs** and paste it in **Unassigned IEDs**.



The IED mapping functions in PCM600 Plant Structure are not available if IEC 61850 Structure Mapping is started.

3.15.4 Access point mapping

Access point mapping is done in the Access Point Mapping tab. Access point mapping means configuring which access point in the FPN SCD file (customer access point) corresponds to an access point of the real IED in the substation (internal access point).

The shown access point mapping depends on the selection in the PCM600 plant structure. Only the access point mappings of the selected mapped IED are shown.

The Access Point Mapping tab consists of the following elements.

- Mapping list on the left
  - Mapping status icon
  - Customer access point name
  - Name of the internal access point mapped with the customer access point
- Internal access point list on the right
  - Internal access point name
- Text field on top of both lists for searching access points



The Access Point Mapping tab does not show any access points, if access point mapping is not needed for the selected IED.

3.15.4.1 Creating access point mappings

Access point mappings can be created in the Access Point Mapping tab.

- Create access point mappings in one of the alternative ways.
  1. Drag an access point in the mapping list on an access point in the internal access point list.
  2. Drag an access point in the internal access point list on an access point in the mapping list.
  3. Click an access point in the mapping list and double-click an access point in the internal access point list.
  4. Click an access point in the internal access point list and double-click an access point in the mapping list.
  5. Click an access point in the internal access point list, right-click an access point in the mapping list and click **Create Mappings**.

3.15.4.2 Removing access point mappings

Access point mappings can be removed in the Access Point Mapping tab.

- Remove access point mappings in one of the alternative ways.
  1. Right-click an access point in the mapping list and click **Remove Mappings**.
  2. Click an access point in the mapping list and press DELETE.

3.15.4.3 Excluding and including access points

Access points can be excluded or included in the Access Point Mapping tab.

Excluded access points cannot be mapped and they are ignored in determining the status of the IED mapping. For example, if an access point cannot or does not need to be mapped, it can be excluded to make the IED mapping complete.

- Right-click an access point in the mapping list and click Exclude Items to exclude access points.
- Right-click an excluded access point in the mapping list and click Include Items to include access points.

The Exclude Items option is not available, if the IED does not support excluding of access points.

3.15.4.4 Validating mappings

Mappings can be validated in the Access Point Mapping tab.

- Validate all mappings in one of the alternative ways.
  1. On the **Edit** menu, click **Validate All**.
  2. Click the **Validate** button on the PCM600 toolbar.
  3. Click the down arrow next to the **Validate** button on the PCM600 toolbar and select **Validate All**.
  4. Press CTRL+ALT+A.
- Validate the mappings currently shown in the mapping list in one of the alternative ways.
  1. On the **Edit** menu, click **Validate Current**.
  2. Click the down arrow next to the **Validate** button on the PCM600 toolbar and select **Validate Current**.
  3. Press CTRL+ALT+C.
- Validate the mappings currently selected in the mapping list in one of the alternative ways.
  1. On the **Edit** menu, click **Validate Selected**.
  2. Click the down arrow next to the **Validate** button on the PCM600 toolbar and select **Validate Selected**.
  3. Press CTRL+ALT+S.

3.15.4.5 Filtering the shown access point mapping content

The shown access point content can be filtered in the Access Point Mapping tab.

1. Select or cancel the selection of one or more of the five status buttons on the PCM600 toolbar to show or hide items based on mapping status.
2. View the properties of currently selected access points in the PCM600 **Object Properties** pane.

3.15.5 Data attribute mapping

Data attribute mapping of an IED is done in the Data Attribute Mapping tab. This means configuring which data attribute in the FPNSCD file (customer data attribute) corresponds to a data attribute of the real IED in the substation (internal data attribute).

It depends on the selection in the PCM600 plant structure which data attribute mappings are shown. Only the data attribute mappings of the selected mapped IED are shown.

The Data Attribute Mapping tab has the following elements.

- Customer IED data structure on top left
- Internal IED data structure on top right
- Text field on top of both data structures for searching logical nodes
- Mapping list on bottom left
  - Mapping status icon
  - Customer data attribute path
  - Path of the internal data attribute mapped with the customer data attribute
- Internal data attribute list on bottom right
  - Internal data attribute path
  - The number of mappings for the internal data attribute
- Text field on top of both lists for searching data attributes

3.15.5.1 Creating data attribute mappings

Data attribute mappings can be created in the Data Attribute Mapping tab.

- Create data attribute mappings in one of the alternative ways.
  - Drag a data attribute in the mapping list on a data attribute in the internal data attribute list.
  - Drag a data attribute in the internal data attribute list on a data attribute in the mapping list.
  - Click a data attribute in the mapping list and double-click a data attribute in the internal data attribute list.
  - Click a data attribute in the internal data attribute list and double-click a data attribute in the mapping list.
  - Click a data attribute in the internal data attribute list, right-click a data attribute in the mapping list and click **Create Mappings**.
- Create data attribute mappings on the data object level in one of the alternative ways.
  - Drag a data object from the customer data structure on a data object in the internal data structure.
  - Drag a data object from the internal data structure on a data object in the customer data structure.
- Create data attribute mappings on the logical node level in one of the alternative ways.
  - Drag a logical node from the customer data structure on a logical node in the internal data structure.
  - Drag a logical node from the internal data structure on a logical node in the customer data structure.

3.15.5.2 Removing data attribute mappings

Data attribute mappings can be removed in the Data Attribute Mapping tab.

- Remove data attribute mappings in one of the alternative ways.
  - Right-click a data attribute in the mapping list and click **Remove Mappings**.
  - Click a data attribute in the mapping list and press DELETE.

- To remove data attribute mappings on the data object level, right-click a data object in the customer data structure and click **Remove Mappings**.
- To remove data attribute mappings on the logical node level, right-click a logical node in the customer data structure and click **Remove Mappings**.

3.15.5.3 Excluding and including data attributes

Data attributes can be excluded or included in the Data Attribute Mapping tab.

Excluded data attributes cannot be mapped and they are ignored in determining the status of the IED mapping. For example, if a data attribute cannot or need not to be mapped, it can be excluded to make the IED mapping complete.

- Right-click a data attribute in the mapping list and click **Exclude Items** to exclude data attributes.
- Right-click a data object in the customer data structure and click **Exclude Items** to exclude data attributes on the data object level.
- Right-click a logical node in the customer data structure and click **Exclude Items** to exclude data attributes on the logical node level.
- Right-click an excluded data attribute in the mapping list and click **Exclude Items** to include data attributes.
- Right-click a data object in the customer data structure and click **Exclude Items** to include data attributes on the data object level.
- Right-click a logical node in the customer data structure and click **Exclude Items** to include data attributes on the logical node level.

3.15.5.4 Validating mappings

Mappings can be validated in the Data Attribute Mapping tab.

- Validate all mappings in one of the alternative ways.
  - On the **Edit** menu, click **Validate All**.
  - Click the **Validate** button on the PCM600 toolbar.
  - Click the down arrow next to the **Validate** button on the PCM600 toolbar and select **Validate All**.
  - Press CTRL+ALT+A.
- Validate the mappings currently shown in the mapping list in one of the alternative ways.
  - On the **Edit** menu, click **Validate Current**.
  - Click the down arrow next to the **Validate** button on the PCM600 toolbar and select **Validate Current**.
  - Press CTRL+ALT+C.
- Validate the mappings currently selected in the mapping list in one of the alternative ways.
  - On the **Edit** menu, click **Validate Selected**.
  - Click the down arrow next to the **Validate** button on the PCM600 toolbar and select **Validate Selected**.
  - Press CTRL+ALT+S.

3.15.5.5 Searching logical nodes and data attributes

Data attributes and logical nodes can be searched in the Data Attribute Mapping tab.

- Enter the logical node name or a part of it to the text field above the customer data structure to search the logical nodes from the customer data structure.
- Enter the logical node name or a part of it to the text field above the internal data structure to search logical nodes from the internal data structure.
- Enter the data attribute path or a part of it to the text field above the mapping list to search customer data attributes.
- Enter the data attribute path or a part of it to the text field above the internal data attribute list to search internal data attributes.

3.15.5.6 Filtering the shown data attribute mapping content

The shown data attribute content can be filtered in the Data Attribute Mapping tab.

- Click a node in the customer data structure to show customer data attributes of a specific parent object.

  For example, if a data object is selected, only the data attributes of the selected data object are shown in the mapping list.
- Click a node in the internal data structure to show internal data attributes of a specific parent object.

  For example, if a data object is selected, only data attributes of the selected data object are shown in the internal data attribute list.
- Right-click a data attribute in the internal data attribute list and click **Show Mappings** to show mappings of an internal data attribute. The function automatically enters the selected internal data attribute path as search text to the search text field above the mapping list. The search text field needs to be cleared manually to show all mappings in the mapping list again.
- Select or cancel the selection of one or more of the five status buttons on the PCM600 toolbar to show or hide items based on mapping status.
- Select or cancel the selection of one or more of the ten data attribute filter buttons on the PCM600 toolbar to filter internal data attributes.

  For example, if the data attribute name filter is selected, that is the DA button, the internal data attribute list shows only data attributes whose name, that is, DAName property, matches with the customer data attribute currently selected in the mapping list.
- View the properties of currently selected data attributes in the PCM600 **Object Properties** pane.

3.15.5.7 Setting the value of excluded data attributes

Data attribute values can be edited in the Data Attribute Mapping tab.

1. Click an excluded data attribute in the mapping list.
2. Edit the **Value** property in the PCM600 **Object Properties** pane.



Some data attribute values cannot be edited, for example, quality and time stamp.

3.15.6 Managing mapping templates

The **Mapping Template Manager** pane consist of three elements.

- IED type selection
- Template list
- Action buttons

1. Open the **Mapping Template Manager** pane.
   a) In **Plant Structure**, right-click **Substation**, **Voltage Level**, **Bay**, **IED Group** or **IED**.
   b) Point to **Flexible Product Naming** and then click **Manage Mapping Templates**.
2. Manage mapping templates using the available functions.

   - Select **All** from the **IED type** drop-down list to show all templates.
   - Select the IED type from the **IED type** drop-down list to show templates of a specific IED type.
   - Click a column header in the template list to sort the templates on that column. First click sorts in ascending order, second click sorts in descending order.
   - Select a template and click **Apply** to apply a mapping template.
   - To delete mapping templates, select the templates to delete and either click the **Delete** button or press DELETE.
   - Export mapping templates.

     a) Select the templates to export and click **Export**.
     b) Click the folder where to export and click **OK**.
   - Import mapping templates.

     a) Click **Import**.
     b) Select the template files (.afpnt/.fpnt) to import and click **Open**.



Not all the functions listed above are available at the same time.

3.15.7 Creating mapping templates

New templates are created in the **Create Mapping Template** pane.

1. Open the Create Mapping Template pane in one of the alternative ways.

   - Right-click a mapped IED in the IED Mapping tab and then click Create Mapping Template.
   - Right-click a mapped IED in the PCM600 plant structure, point to Flexible Product Naming and click Create Mapping Template.
2. Fill in any of the optional fields and click OK.

   The first three fields are mandatory. They are automatically filled and cannot be changed.

- IED type
- IED version
- Template version
- Template type
- Customer name
- Customer ID
- Customer ID
- Description

3.15.8 Defining report options

IED mappings to be included in the report and the type of the report are selected in the **Report Options** dialog box.

1. Define the IED mappings to include.
   - Select **All** to include all mappings.
   - Select **Current** to include the currently shown mappings.
   - Select **Selected** to include the currently selected mappings.

   The Selected option is not available if the Data Attribute Mapping tab is active while creating or printing a report.

2. Define the report type.
   - Select **PDF** to create a PDF report.
   - Select **Excel** to create a Microsoft Excel report.

   Report type options are not available when printing a report or if Microsoft Excel is not installed on the computer.

3.15.9 Defining flexible product naming options

- On the **Tools** menu, click **Options** and then select **Flexible Product Naming** to show the flexible product naming options.
- In the **General** tab, select Import as **Flexible Product Naming SCD option enabled** to import FPNSCD files into PCM600 projects.
- Define the options in the **IEC 61850 Structure Mapping** tab.
  - Select **Confirm removing of IED mapping** to show a dialog on attempt to remove IED mapping.
  - Select **Confirm accepting of IED mapping** to show a dialog on attempt to accept IED mapping.
  - Select **Confirm creating a mapping template from an incomplete mapping** to show a dialog on attempt to create template from an incomplete mapping.
  - Select **Confirm modifying the mapping if a mapping template is defined** to show a dialog on attempt to modify an IED mapping having a mapping template defined.

- Select **Automatic access point mapping** to make PCM600 attempt automatic access point mapping during the creation of IED mapping.
- Under **Apply mapping template automatically**, select the wanted alternative.
- Select **Confirm** to show a confirmation dialog on attempt to apply template automatically.
- Select **Yes, use customer template** to apply customer template automatically.
- Select **Yes, use internal template** to apply internal template automatically.
- Select **No** to never apply template automatically.

- Under **Create mapping template on IED export**, select the wanted alternative.
  - Select **Confirm** to show a confirmation dialog on IED export.
  - Select **Yes** to create a mapping template on IED export.
  - Select **No** to never create a mapping template on IED export.

- Select **PCM600 naming style in use** to make the **IEC 61850 Structure Mapping** show IED caption instead of the SCL Technical Key as the IED name.

3.15.10 Undoing and redoing

Changes can be undone and redone until they are saved.

- Undo changes in one of the alternative ways.
  - Click **Undo** on the PCM600 toolbar.
  - On the **Edit** menu, click **Undo**.
  - Press CTRL+Z.

- Redo changes in one of the alternative ways.
  - Click **Redo** on the PCM600 toolbar.
  - On the **Edit** menu, click **Redo**.
  - Press CTRL+Y.

3.15.11 Creating or printing reports

- On the File menu, click Create Report to create a report.
- Print the report in one of the alternative ways.
  - Click **Print** on the PCM600 toolbar.
  - On the **File** menu, click **Print**.
  - Press CTRL+P.

3.15.12 Reading and writing mapping information

The mapping information can be written to and read from the IED by using the common read/write tool of PCM600.

- Right-click the mapped IED in the PCM600 plant structure and click **Write to IED** to write mappings to the IED.

- Right-click the mapped IED in the PCM600 plant structure and click **Read from IED** to read mappings from the IED.

  Mapping information is not written to the IED if the data attribute mapping of the IED is not complete or the write IEC 61850 communication configuration option of the common read/write tool is not enabled.

3.16 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 .apcmi/.pcmi file.

3.16.1 Starting IED Compare

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

3.16.2 IED Compare options

IED Compare can compare certain types of IED configurations and parameters.

- Application configuration
- Hardware configuration
- Display configuration
- Communication configuration
- Parameters

Two comparison options are available.

- Compare all
- Compare with advanced filtering

The compare option is available only for the Relion IEDs. Comparison of the configuration types depends on the IED capability.

The last selected compare option is remembered.

Application comparison also compares the system function blocks.

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

3.16.2.1 Comparing PCM600 configuration online with IED

1. Select the option **Compare PCM600 configuration with configuration in IED** under **Online** in **Compare Options**.
2. Select the configuration types to be compared from the check box list.
3. Select the IED from the **Select IED** tree view and click **Compare**.

The online comparison depends on the Connectivity Package and the IED's capability to read the selected configuration and parameters.

3.16.2.2 Comparing PCM600 configuration offline with another IED of the same type

This option can be used to compare the IED configuration of two same types of IEDs stored in same PCM600 projects.

1. Select the option **Compare PCM600 configuration with another IED of same IED type**.
2. Select the configuration type to be compared from the check box list.
3. Select the two IEDs to be compared from the respective tree structure view.
4. Click **Compare**.

3.16.2.3 Comparing PCM600 configuration offline with apcmi/pcmi file

1. Select the option **Compare PCM600 configuration with IED file(*.apcmi/pcmi) of same IED type**.
2. Select the configuration types to be compared from the check box list.
3. Select the IED to be compared from the tree view.
4. Click **Browse** to browse for a apcmi/pcmi file or type the file name in the text box.
5. Click **Compare**.

3.16.2.4 Comparing two IED files (*.apcmi/.pcmi) of same IED type

1. Select the option **Compare two IED files (*.apcmi/.pcmi) of same IED type**.
2. Select the configuration types to be compared from the check box list.
3. Select the two pcmi files to compare.
   a) Click **Browse** to browse for a apcmi/.pcmi file to compare.
   b) Type the file name in the text box.

4. Click **Compare**.

3.16.3 Reading comparison report

The comparison report shows differences in the configuration of any two IEDs. The hardware, application, display, communication and parameter configuration differences are grouped, subgrouped and isolated from each other.

The comparison of IEC 61850 data from an online IED depends on the IED capability.

- Read the reports from left to right row-wise.

3.16.3.1 Application Configuration

Table 9: Sample report for Application Configuration

Configuration group		IED1 (Technical ID)	IED2 (Technical ID)
Application Configuration			
Function Block	AND:0	Execution Order 11	Execution Order 13
	AND:2	Execution Order 16	Execution Order 26
Signal Connection	SIG:B1 of AND O:16| T2.5|I2	Missing	Connected to source SIG:O of OR O:11| T2.5|I0
	SIG:B2 of AND O:16| T2.5|I2	Connected to target SIG:O of OR O:12| T2.5|I1	Missing
	SIG:O of AND O:16| T2.5|I2	Missing	Connected to target SIG:B1 of OR O:15| T2.5|I2

- The Function Block AND: 0 has an Execution Order of 11 in IED1 and an Execution Order of 13 in IED2.
- The Function Block AND: 2 has an Execution Order of 16 in IED1 and an Execution Order of 26 in IED2.
- The Signal Connection Signal B1 of AND: 2 is missing in IED1 and it is connected to source signal O of OR: 0 in IED2.
- The Signal Connection Signal B2 of AND:2 is connected to target signal O of OR:1 in IED1 and missing in IED2.
- The Signal Connection Signal O of AND:2 is missing in IED1 and it is connected to target signal B1 of OR:2 in IED2.

3.16.3.2 Hardware Configuration

Table 10: Sample report for Hardware Configuration

Configuration Group		IED1(Technical ID)	IED2(Technical ID)
Hardware Configuration			
Card Space	p4	BOM : BOM_4	BIM : BIM_4
	P5	Missing	BOM : BOM_5

- Card Space p4: IED1 has a BOM card with card identifier BOM_4 and IED2 has a BIM card with the card identifier BIM_4.
- Card Space P5: IED1 has no card whereas IED2 has a BOM with the card identifier BOM_5.

3.16.3.3 Display Configuration

Table 11: Sample report for Display Configuration

Configuration Group		IED1 (Technical ID)	IED2 (Technical ID)
Display Configuration			
Display Node	Motor_operated_isolator at X Pos 96 Y Pos 96 in display page 1	Present	Missing
Display Node Link	Breaker at X Pos 96 Y Pos 48 connected to Node Isolator_Indication_Only at X Pos 107 Y Pos 120 in display page 1	Missing	Present
Display Node Function Connection	Breaker at X Pos 96 Y Pos 48 in display page 1 connected to	SIG POSITION of SCSWI O:4800| T100|I1	Missing

- Display Node “Motor_operated_isolator” at starting position X 96 and Y 96 in display page 1 is present in IED1 and is missing in IED2.
- Display Node Link connecting display node “Breaker” at starting position X 96 and Y 48 to display node “Isolator_Indication_Only” at starting position X 107 and Y 120 in display page 1 is missing in IED1 and present in IED2.
- Display Node “Breaker” at starting position X 96 and Y 48 in display page 1 is connected to function block signal “POSITION” of SCWI:1 in IED1 and missing in IED2.

3.16.3.4 Communication Configuration

Table 12: Sample report for Communication Configuration

Configuration Group		IED1 (Technical ID)	IED2 (Technical ID)
Communication Configuration			
Protocol: DNP 3.0 | Master: Serial RS485			
Signal	DRPRDRE: 1.FaultNumber	Missing	Present
	DRPRDRE: 1.RECMADE	Missing	Present
Protocol: DNP 3.0 | Master: TCP/IP 1			
	DRPRDRE: 1.FaultNumber	Missing	Present
Protocol: DNP 3.0 | Master: TCP/IP 2			
	DRPRDRE: 1.FaultNumber	Missing	Present
	DRPRDRE: 1.RECMADE	Missing	Present
IEC61850 Configuration			
GOOSE Control Blocks			
gcbStatUrg	App ID	4	5
	MAC Address	01-0C-CD-01-00-03	01-0C-CD-01-00-04
	Application Id	AA1J1Q01A3LD0/LLN0.gcbStatUrg	AA1J1Q01A4LD0/LLN0.gcbStatUrg
	Client List	AA1J1Q01A4, AA1J1Q01A5	AA1J1Q01A3, AA1J1Q01A7
GOOSE Receive Configuration			
GOOSE Receive Data Attribute	IED: AA1J1Q01A90, Logical Device:	Connected to target SIG:IN of GOOSERCV_BIN	Missing
	LD0, LN: LPHD1, DO: SrcSt, DA: stValB	O:193|T2.5|I0	
GOOSE Receive IED	IED: AA1J1Q03A2	Present	Missing

- Protocol: DNP 3.0 | Master: Serial RS485-Signal “DRPRDRE: 1.FaultNumber”,” DRPRDRE: 1.RECMADE” are missing in IED1 and present in IED2.

- Protocol: DNP 3.0 | Master: TCP/IP 1: “DRPRDRE: 1.FaultNumber”,” DRPRDRE: 1.RECMADE” is missing in IED1 and present in IED2.
- GOOSE Control Blocks Protocol: DNP 3.0 | Master: TCP/IP 2: Signal “DRPRDRE: 1.FaultNumber”,” DRPRDRE: 1.RECMADE” are missing in IED1 and present in IED2.
- GOOSE Control Blocks gcbStatUrg: App ID of IED1 is 4 and IED2 is 5. MAC Address of IED1 is 01-0C-CD-01-00-03 and IED2 is 01-0C-CD-01-00-04. Application Id of IED1 is AA1J1Q01A3LD0/LLN0.gcbStatUrgand IED2 is AA1J1Q01A4LD0/LLN0.gcbStatUrg. Client List of IED1 is AA1J1Q01A4, AA1J1Q01A5 and IED2 is AA1J1Q01A3, AA1J1Q01A7.
- GOOSE Receive Data Attribute “IED: AA1J1Q01A90, Logical Device: LD0, LN: LPHD1, DO: SrcSt, DA: stValB” is connected to signal “IN” of “GOOSERCV_BIN O: 193|T2.5|I0” in IED1 and is missing in IED2.
- GOOSE Receive “IED AA1J1Q03A2” is sending data to IED1 but not to IED2.

3.16.3.5 Parameters

Table 13: Sample report for Parameters

Configuration Group		IED1 (Technical ID)	IED2 (Technical ID)
Parameter(s)			
Parameter	LDCMBinary_312;CommSync	Master	Slave
	SMAI1:1;TYPE	Present	Missing

- Parameter “CommSync” of the LDCMBinary_312 hardware module has the value “Master” in IED1 and “Slave” in IED2.
- Parameter “TYPE” of SMAI1:1 function block is present in IED1 and missing in IED2.

3.16.3.6 Acronyms used in report

Table 14: Acronyms used in a report

Acronym	General Description
SIG	Signal
IED	Intelligent Electronic Device
LN	Logical Node
DO	Data Object
DA	Data Attribute

3.16.4 Saving comparison results

IED Compare provides an option to save the comparison result. The result can be saved as PDF or Excel.

1. Click **Save Report** in the result window.
2. Select the storage format from the drop-down list.
3. Name the file.

3.16.5 Using the find feature in comparison report

Use the **Find** feature to search and locate strings in the comparison report.

1. Select the **Find** option in the result view.
   - Click **Find** at bottom of the form.
   - Press **CTRL+F**.
2. Enter the search string and select the required option if necessary by selecting the **Match Whole Word** check box.
3. Click **Find Next** to find the next matching text.
4. Click **Cancel** or the **Close** button or press **Esc** to stop the search.

3.17 IED Configuration Migration

IED Configuration Migration is used to migrate an existing configuration of an IED. The user can migrate multiple IEDs configuration together without user interaction.

3.17.1 Starting IED Configuration Migration

1. Launch the **Migrate Configuration** from **Substation** > **Voltage Level** > **Bay** > **IED Group** > **IED** in the project structure.

   The **Migrate Configuration** tool populates all IEDs available under the current project, like plant structure.

   Current version column indicates the existing configuration version. Supported upgradable configuration versions are shown in a drop-down menu under the target version column.

2. Select the target version to migrate the configuration.

   Target version has three options:

   - Version to Migrate (Version to migate the configuration)
   - None (IED configuration will not migrate)
   - Not available (IED doesnot support configuration migration)

3.17.2 Continuing migration to a different IED version

1. Select the required target version of the IEDs to migrate.
2. Click **Migrate**.
   - The functions and hardware modules which have no items to be replaced in the new IED version are deleted from the existing configuration.
   - The functions and hardware modules which have compatible items in the new IED version are replaced by the latest versions.
   - The functions which have not changed but whose instance and execution information is changed are assigned with new instance and execution information according to the new IED version. The user-defined name of the signals, all the properties that can be set, for example, cycle time, instance number and visibility, and all the Graphical Display Editor-related connections to the signals are transferred to the replaced function block.
3. Click **Finish**.

The tool creates an IED configuration template (APCMI file) and stores it in a backup directory before the migration.

During the migration, the parameters and settings are backed up and they are restored after the function migration.

After the migration, the migration report is stored under `...\PCMDataBasesABB\Migration-Reports` folder.

If the migration failed for any IED, the next IED migration continues without terminating the operation. The summary status of all IEDs is shown after migration is completed. Any errors or exceptions that occurred during migration are displayed in the output window.

3.17.3 Canceling migration

- The migration stops after migrating the current IED by clicking **Stop**.

3.17.4 Migration report

A migration report is generated after the migration process is completed. The report contains the migration summary of all IEDs and an individual report information available of the changes in the function blocks, hardware channels and the glue logic blocks due to migration of IEDs. The details of the connections deleted during the migration and a summary of the changes in each worksheet are also provided.

The migration report is not displayed if the **Show migration report** checkbox is not selected in the migration summary window.

3.18 IED Summary

IED Summary displays IED details for all IEDs in a PCM600 project. The summary can be used for documenting IED related information in a project, on substation, voltage, bay and IED level.

IED Summary display lists details based on IED capability.

- Bay name
- Order code
- Technical key
- IP address and sub-network mask
- IED serial number
- IED firmware version

IED Summary displays IED related information based on the IED capability.

3.18.1 Starting IED Summary

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

When IED Summary is open, navigating in the plant structure to for example Voltage level, Bay or IED, refreshes the IED summary list details accordingly and the selected plant structure item's summary is displayed.

3.18.2 Finding

The find feature can be used to search and locate any text in the summary details of IED Summary, for example, a bay name or any configuration detail in PCM600 or IED in the IED Summary grid.

1. Select the **Find** option in one of the alternative ways.
   - Click the **Find** button on the toolbar.
   - On the PCM600 menu bar, click **Edit** and then click **Find**.
   - Press CTRL+F.

2. Enter the search string and choose the required options by selecting the **Match Whole Word** check boxes.
3. Click **Find Next** to find the next matching text or click **Find Previous** to find the previous matching text.
4. Click **Close** to stop the search and close the window.

3.18.3 Reading online

- Read the IED summary from IED in one of the alternative ways.
  - Click the **Read online** button on the toolbar.
  - On the **IED Summary** menu, select **Read online**.

3.18.4 Exporting to Excel

1. Export the IED summary details currently displayed in the **IED Summary** pane to Microsoft Excel in one of the alternative ways.
   - Click the **Export to Excel** button on the toolbar.
   - Click **Export to Excel** on the **Report** menu.
2. Select the path and name the XLS file.

   By default the file name is IEDSummary.xlsx and the path is Libraries\Documents.

The exported file is automatically opened in Microsoft Excel.

3.18.5 Exporting to PDF

1. Export the IED summary to PDF in one of the alternative ways.
   - Click the **Export to pdf** button on the toolbar.
   - Click **Export to pdf** on the **Report** menu.
2. Select the location to export the PDF.

The currently displayed IED summary is exported to PDF format, containing the header and footer information.

3.18.6 Comparing configuration

- Compare the IED configuration with PCM600 configuration in one of the alternative ways.
  - Click the **Compare Configuration** button on the toolbar.
  - On the **IED Summary** menu, select **Compare Configuration**.

3.18.7 Collapsing/Expanding all

- Collapse or expand all in one of the alternative ways.
  - Click the **Collapse All/Expand All** button on the toolbar.
  - On the **IED Summary** menu, select **Collapse All/Expand All**.
  - In the **IED Summary** pane, click the plus (+) sign to expand or the minus (-) sign to collapse the detail list.

3.19 IED Users

IED Users is used for editing user profiles, user password policies, user roles and role access rights for the IED functions and operations. This tool can also be used to import and export user account data. Some functionalities of the tool might not be available based on the level of support for these operations, that is, whether the IED has a full user management control built in or not. If the IED does not support the full user management control, the user-specific passwords cannot be set and the roles are not supported.

A full user management control means that a user always has at least one role and that role can be assigned to specific IED rights. Also, it is possible to set the access rights to perform certain operations (read and write) for a role. When the full user management control is not supported, the user profiles and roles cannot be edited. In that case, it is possible to define more generic passwords, for example, HMI setting and HMI communication passwords. For more information on IED-specific functions, see the corresponding IED documentation.

In the IED Users toolbar, the data can be retrieved from an IED or the data can be written to an IED if permitted. The data from an IED can be saved to the project database.

3.19.1 Starting IED Users

- Select **Tools** > **IED Users**.
- Right-click an IED in the object tree and select **IED Users** from the shortcut menu.

The window for managing IED users opens.

3.19.2 General settings

In the **General** tab, the factory settings can be restored if the target IED supports the feature and the existing user credentials can be deleted.

If the IED supports only the password protection feature, the password can be edited in the **General** tab.

If the IED has full user management, the **Password Policies** option and the options for individual users to change their passwords without administrative rights are shown.

3.19.2.1 Password policies

The policy for validating the IED passwords can be defined in the **Password Policies** dialog box. It is possible to set a number of criteria depending on the level of support from the IED.

If the password policies are not enabled, the only criterion for passwords is the minimum length of one character. The minimum required length of password can be set within a range defined by the IED. The maximum age of passwords in days sets the time how long the password is valid.

A password is valid if the conditions are true.

- The password must have one or more lowercase characters (range a-z).
- The password must have one or more uppercase characters (range A-Z).
- The password must have one or more numeric characters (range 0-9).
- The password must have one or more special characters (!, @, #, +, ", *, %,&, /, = or ?).

The availability of options depends on the IED. All of the options may not appear.

Policy changes only apply to passwords created after the policy was set.

Password policies set the minimum level of security, but it is always possible to create passwords more secure than the policy requires.

3.19.2.2 Changing own password

In the **Change own Password** dialog box, the password can be changed without the administrative rights in the IED using the present username and the old password.

1. In the **General** tab, click **Change own password**.
2. Type the username and old password.
3. Type the new password twice.
   The password is updated online to the IED.

Administrator should use the full user management feature to change user passwords.

3.19.3 Importing and exporting

Use the import and export methods to copy the user account data between IEDs. The exported data can be imported into an IED in the same project or different project or even transferred to another computer.

3.19.3.1 Importing IED user account data

1. Click **Import**.
2. Select the file to be imported.

3. When prompted, confirm the importing of the data found in the file.

Importing overwrites the data in PCM600, but not the data in the IED or the data stored in a PCM600 project unless the data is saved.

Additionally PCM600 checks the integrity of the template during import. If the template was signed with a certificate that does not exist in the computer's certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the template.

There can be several reasons why the integrity check fails:

- The template has been created with PCM600 version which does not sign the template files
- The computer certificate store does not contain the certificate needed to do the verification
- Verification itself fails

All the listed reasons above mean that integrity of the template could not be verified, and it is possible that someone has tampered with the template. If the integrity can't be checked or the verification fails, it is still possible to proceed with import. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

3.19.3.2 Exporting IED user account data

1. Click **Export**.
2. Select the destination file and click **Save**.
3. Choose the certificate to use for signing the file.

3.19.4 User profiles

In the Users tab, the user profiles of the selected IED can be edited. New users can be created, existing users can be deleted and different roles can be edited.

A user profile must always belong to at least one role.

3.19.4.1 Adding new users

1. Click the Create New User button in the **Users** tab to open the wizard.
2. Follow the instructions in the wizard to define a user name, password and role. Select at least one role to assign the user. The user profile can be seen in the **User details** field.

The hidden roles cannot be selected in the Select roles page in the wizard. The hidden role names are displayed in parentheses. The user administrator roles are indicated by the letter A in parentheses at the end of the role name.

3. Select the user from the user list and type a new name or description in the **Description/full name** field to change the name or description of the user.

3.19.4.2 Adding roles to users

1. Select the user from the **Users** list.
2. Select the new role from the **Select a role** list.
3. Click to assign role to the selected user.
   The information about the roles the user belongs to can be seen in the **Roles** area.

3.19.4.3 Deleting existing users

1. Select the user from the **Users** list.
2. Click .

3.19.4.4 Changing passwords

1. Select the user from the **Users** list.
2. Click .
3. Enter the old password once and the new password twice in the required fields.
   The passwords can be saved in the project database or sent directly to the IED.

3.19.4.5 Unlocking users

1. Select the locked user from the Users list.
2. Click .

icon will be enabled if logged in user has access rights and IED supports the feature.

3.19.5 Editing user roles

1. Click the **Roles** tab to modify the user roles.
2. Select the role from the **Roles** list and type a new description in the **Role description** dialog box.

Some of the features are only available if the target supports the feature.

3.19.5.1 Adding new users to roles

1. Select the required role from the **Roles** list.
   The role profile can be seen under the **Role details** field.
2. Select the new user from the **Select a user** list.
3. Click to assign a user this role.
   The new user is shown in the **Users assigned** list.

3.19.5.2 Removing existing users from roles

1. Right-click the user in the **Users assigned** list.
2. Select **Remove This Role from Selected Member** from the shortcut menu.

3.19.5.3 Creating new roles

- Click the Create New User button in the **Roles** list and type the name of the group.
- Right-click the list, select the Create New Role and type the name.

3.19.5.4 Deleting existing roles

- Select a role in the list and click the Remove Selected User button.
- Right-click a role from the list and select **Remove Selected Role** from the shortcut menu.

3.19.6 IED rights

The role rights for the IED functions and operations of the selected IED can be edited in the **Rights** tab. These actions are limited depending on the level of IED support. Different access rights for a specific IED function can be given to a role and the users assigned to that role.

3.19.6.1 Adding new role to IED Rights

1. Select the IED function in the **IED Rights** field.
2. Select the new role from the **Select a role** list.
3. Click .
   The new role is shown in the **Selected Roles** list.

3.19.6.2 Adding permissions for roles

1. Select the IED function under the **IED Rights** field.
2. Select the role from the **Selected Roles** list.

3. Define the permissions in the **Permissions** field by selecting the corresponding rights (Read/Write).

3.19.7 Verifying IED user authentication

Some of the IEDs or the protocols require a password to transmit the data between an IED and PCM600. Depending on whether the full user management control is supported or not, the software requests for either a user name and password or only a password.

If PCM600 authentication is used, the user name and password should be specified in the **User Management** window. The software can remember the password if the **Remember Me** check box is selected. Otherwise, the **Login** window appears every time when data transmission is needed.

3.19.8 Writing user management settings to the IED

- Click the **Write to IED** button on the toolbar.

The data is automatically saved when writing to the IED starts.

3.19.9 Reading user management settings from the IED

- Click the **Read from the IED** button on the toolbar.

The Save button is enabled after performing read user management settings from the IED.

3.19.10 Saving user management settings

- Select **File** > **Save** from the menu.
- Click the **Save** toolbar button.

The save function is enabled only if the data has changed.

3.20 Injection Commissioning

The injection principle is a protection method which can detect earth fault in the generator stator and rotor winding when a machine is in operation or at standstill. In the IED applications, a voltage to ground is applied from an injection box to the

stator and rotor winding at a suitable frequency. The resulting voltage and current signals are measured by the IED. The relevant protection functions within the IED process the current and voltage signals and issue a trip signal if the measured resistance to ground falls below the preset value.

Injection Commissioning helps perform the installation, calibration and commission of 100% stator earth-fault protection and rotor earth-fault protection functions based on the injection principle in the IED.

It is not intended to be used for any other generator protection function.

3.20.1 Starting Injection Commissioning

- Right-click an IED and select **Injection Commissioning**.
- Select an IED and choose **Tools** > **Injection Commissioning** from the main menu.



User rights are required to launch ICT.



Injection Commissioning is a product-specific tool that is not available for all IEDs.



The IED should be configured with at least one protection function out of the 100% stator earth-fault protection or rotor earth-fault protection functions to launch Injection Commissioning.



Only one instance of this tool is allowed for an IED.

3.20.2 Selecting protection function

- Select a protection function from the drop-down list in the function selection box.

  After selecting a function, the function status box displays errors if any occur. It is recommended to correct the errors before continuing to get correct results. It is not necessary to correct the errors if only auditing is required. Auditing can be done for calibration, installing and commissioning process to view report and generate log files. If there are no errors, the tool displays **OK** in the function status box.
- Disable tripping using the function tripping toggle button in the toolbar.

  If the IED is connected to trip the system, tripping should be disabled to avoid unwanted operation during installation, calibration and commissioning. If function tripping is enabled, a trip signal may be issued during calibration or commissioning which leads to a breaker action. When calibration or commissioning is completed, tripping should be re-enabled to protect the generator.

The Parameter Setting tool is used to edit parameters.

The IED must be online.

If the IED offline message is shown, the IED must be connected online and the protection function should be re-selected. Performing auditing does not require the IED to be online.

See *Chapter 3.20.9 Interaction with Parameter Setting* for more information about interaction with Parameter setting after a function is selected.

3.20.3 Installing

The voltage and current signals from the injection box must be adjusted so that all the values are permitted. If the values are within the permissible range, the bars are displayed in green. Otherwise they are red. When all bars are green, the reading of live values can be frozen and adjusting the signal amplitudes is stopped.

When selecting voltage and current signal amplitudes for injection:

1. Start reading values
2. Stop reading values

A protection function must be selected in the function selection box during the operation.

The progress of measurement is shown using an indicator on the right-hand top corner in the tool.

3.20.3.1 Starting reading of values

1. Select a protection function.
2. Select the **Installation** tab.
3. To read the value from the IED:
   - Click the **Start** toolbar button.
   - Select **Measurement** > **Start reading values from IED** from the PCM600 main menu.

   Clicking **Submit and save in Report** saves the installation data into a report that can be seen in the auditing tab.

   The installation bars are updated with the latest values.

   The voltage and current amplitudes can be adjusted with the injection box buttons. If voltage and current signal amplitudes are acceptable, the installation bars are green. Otherwise, they are red. The green area is only the recommended range.

IED must be online.

User rights are required to read the values from the IED.

3.20.3.2 Stopping reading of values

1. To stop reading of values:
   - Click **Stop** in the toolbar when the installation bars are green.
   - Select **Measurement** > **Stop reading values from IED** from the PCM600 main menu.
2. Click **OK** to stop the installation when the tool displays a message when in another tab than auditing.

Injection commissioning stops reading values from the IED and the voltage and current amplitudes are suitable for injection.

3.20.4 Calibrating

Calibration is done to determine the new calibration factors. The three measurements that are performed are normal operation of circuit without any additional impedance connected, normal operation of circuit with a known impedance connected, and the short circuit condition.

Injection Commissioning determines a multiplication factor (K1), an addition factor (K2) and reference impedance 1, which can be posted to the Parameter Setting tool.

The required steps for calibration are:

1. Measure normal operation of circuit without any additional impedance connected
2. Measure with a known impedance connected
3. Measure with a short circuit
4. Submit calibration factors

The operations are possible only if a protection function is selected in the function selection box.

If any setting is changed in REX060 after or during the calibration, a new calibration is required. It is also recommended to repeat the installation process.

The progress of measurement is shown using an indicator on the right-hand top corner in the tool.

IED must be online.

User rights are required for reading the values from the IED to perform calibration.

The steps, one, two and three can be performed in any order.

See the installation and commissioning manual of the IED for more information.

3.20.4.1 Measuring normal operation circuit without impedance

1. To start plotting live values:
   a) Remove all attached know impedances connected in the injection circuit.
   b) Select the **Step 1: Measurement 1** tab under the **Calibration** tab.
   c) Click the **Start** toolbar button or select **Measurement** > **Start reading values from IED** from the PCM600 main menu to read the values from the IED.

   The system updates the plot when receiving the latest values from the IED. The system calculates the stability of the readings. Depending on the stability, the scale can grow or shrink.

2. Click the Stop toolbar button or select **Measurement** > **Stop reading values from IED** from the PCM600 main menu at any time to stop plotting values on a graph.
3. Click **Submit** after a few readings when the stability scale shows green.
   If the readings are unstable and the stability scale is red, the value can be forced by clicking **Force**.

   Submit or **Force** can be performed even without stopping plotting the values.

3.20.4.2 Measuring with connected known impedance

1. To start plotting live values:
   a) Connect a known impedance. A 10 kΩ resistor is recommended.
   b) Select the **Step 2: Measurement 2** tab under the **Calibration** tab.
   c) Enter the known impedance value which is connected to the circuit in text boxes.
   d) Click the **Start** toolbar button or select **Measurement** > **Start reading values from IED** from the PCM600 main menu to read the values from the IED.

   The system updates the plot when receiving the latest values from the IED. The system calculates the stability of the readings. Depending on the stability, the scale can grow or shrink.

2. Click the **Stop** toolbar button or select **Measurement** > **Stop reading values from IED** from the PCM600 main menu at any time to stop plotting values on a graph.

3. Click **Submit** after a few readings when the stability scale shows green.
   If the readings are unstable and the stability scale is red, the value can be forced by clicking **Force**.

   Submit or **Force** can be performed even without stopping plotting the values.

3.20.4.3 Measuring with applied short circuit

1. To start plotting live values:
   a) Apply a short circuit.
   b) Select the **Step 3: Measurement 3** tab under the **Calibration** tab.
   c) Click the **Start** toolbar button or select **Measurement** > **Start reading values from IED** from the PCM600 main menu to read the values from the IED.

      The system updates the plot when receiving the latest values from the IED. The system calculates the stability of the readings. Depending on the stability, the scale can grow or shrink.

2. Click the **Stop** toolbar button or select **Measurement** > **Stop reading values from IED** from the PCM600 main menu at any time to stop plotting values on a graph.
3. Click **Submit** after a few readings when the stability scale shows green.
   If the readings are unstable and the stability scale is red, the value can be forced by clicking **Force**.

   Submit or **Force** can be performed even without stopping plotting the values.

3.20.4.4 Saving calibration factors

After completing three successful impedance measurement processes, the system calculates new calibration factors K1, K2 and Reference Impedance 1.

1. Select the **Step 4: Save Calibration Factors** tab under the **Calibration** tab.
   The tab shows result of three impedance measurement processes along with suggestions to correct the problem in a text box if the previous steps have failed and it also shows the calculated calibration factors and the reference impedance.
2. Click **Submit to Parameter Setting**.
   The system launches the Parameter Setting tool with the parameters for the function that is being calibrated.
3. Save the suggested calibration factors K1, K2 and Reference Impedance 1 to PCM.
4. Download the displayed K1, K2 and Reference Impedance 1 values to the IED from Parameter Setting.

Clicking **Submit to Parameter Setting** creates a new report record for the calibration process. The Auditing tab shows the record.

The calibration factors can be edited before clicking **Submit to Parameter Setting**.

3.20.5 Commissioning

Five reference impedances for stator and two for rotor can be set on the basis of generator operating condition. The injection principle functions detect faults in the generator stator or rotor based on the reference values.

With a properly set reference impedance, a trip signal is issued when the calculated fault resistance is lower than the preset value. The fault resistance is calculated using the measured and reference impedances.

Finding the reference impedance and submitting it to Parameter setting are required in commissioning.

IED must be online.

User rights are required for reading the values from the IED to perform commissioning.

Selected function must be calibrated for better results.

The progress of measurement is shown using an indicator on the right-hand top corner in the tool.

See the installation and commissioning manual of the IED for more information.

3.20.5.1 Finding reference impedance values

1. To start plotting live values:
   a) Select the **Step 1: Find Reference Impedance** tab under the **Commissioning** tab.
   b) Click the Start toolbar button or select **Measurement** > **Start reading values from IED** from the PCM600 main menu to read the values from the IED.
   c) Select the viewed quantity in the selection box to view various plots. The available quantities are **Absolute Impedance**, **Real Impedance**, **Imaginary Impedance**, **Resistance** and **Capacitance**.

      The system updates the plot when receiving the latest values from the IED. Besides plotting, the measured impedance and measured average impedance values are shown below the graph in the text boxes.

2. Click the Stop toolbar button or select **Measurement** > **Stop reading values from IED** from the PCM600 main menu at any time to stop plotting values on a graph.
3. To select reference impedance:
   a) Choose which reference impedance to modify from the reference impedance selection box.
   b) Click **Select** when the measured average impedance reading is suitable as reference impedance value.

The reference impedance can be selected from the reference impedance selection box at any time before clicking **Select**.

Clicking **Select** is acceptable without first clicking **Stop**.

Real part of reference impedance negative

Due to the finite measurement accuracy and quality of calibration, a slightly negative value may appear. The reference impedance is set as the parameters of a parallel coupling of a capacitance refCx with a resistance refRx in the Parameter Setting tool. This model cannot describe impedances with a negative real part.

- Correct the measured reference impedance manually in the **Step 2: Save Reference Impedance** tab under the **Commissioning** tab by entering a suggested small positive value for the real part as 0.01 KOhm. This results in a very large value for refRx in Parameter setting.

3.20.5.2 Saving reference impedance values

1. Select the **Step 2: Save Reference Impedance** tab under the **Commissioning** tab.
2. Click **Submit to Parameter Setting**.
   The system launches the Parameter Setting tool with the parameters for the selected function.
3. Save the reference impedance value from Parameter Setting to PCM.
4. Download the reference impedance value to the IED.

Clicking **Submit to Parameter Setting** creates a new report record for the commissioning process. The **Auditing** tab shows this record.

The reference impedance value can be edited before clicking **Submit to Parameter Setting**.

3.20.6 Monitoring

Monitoring helps verify the calibration factors and the reference impedances. During monitoring, online plotting can be viewed and online values can be logged to a text file. The progress of the measurement is indicated using an indicator on the

right-hand top corner of the tool while the values are read from the IED for plotting and/or logging.

The IED must be online.

The installation, calibration and commissioning have to be successfully completed.

User rights are required to read the values from the IED to perform monitoring.

Both the 100% stator earth-fault protection and rotor earth-fault protection functions can be monitored simultaneously.

3.20.6.1 Viewing online plotting

1. To start plotting live values:
   a) Select the **4. Monitoring** tab.
   b) Specify the graph update rate in seconds in the text box.
   c) Click the **Start** toolbar button or select **Measurement** > **Start reading values from IED** from the PCM600 main menu to read the values from the IED.
   d) Select the viewed quantity in the selection box to view various plots. The available quantities are **Absolute Impedance**, **Abs(Z-Zref)**, **Real Impedance**, **Imaginary Impedance**, **Resistance**, **Capacitance**, **Fault Resistance** and **Fault conductance**.

      The system updates the plot every time when it gets the latest values from the IED. The system stops updating after three hours.

      The measured values are updated with new values when a new reading is obtained from the IED.

2. Click the **Stop** toolbar button or select **Measurement** > **Stop reading values from IED** from the PCM600 main menu at any time to stop plotting values on a graph.

3.20.6.2 Logging online values

The log file is a tabbed text file, meaning that it can be opened in notepad or excel.

1. To start logging online values:
   a) Enter the graph update rate in seconds in the text box after selecting a protection function.
   b) Click **Browse** to browse a text file.

c) Specify the log period in hours in the text box.

The log period is the length of the logging process. The logging process stops after this period.

d) Click **Start** to initiate the logging of values into the browsed text file.

2. Click **Stop** in the toolbar at any time to stop logging the values.

A message is displayed after the logging stops. The system stops logging into the file automatically after three hours.

3.20.7 Auditing

Auditing provides the option of viewing a report, deleting a report and generating log.



User rights are required to launch the tool.



User comments can be inserted for each record.

3.20.7.1 Viewing report

- Right-click a record and select **View Report**.
  The tool opens the report in the PCM600 tools space.
- Click **View Report** on the upper right-corner of the auditing screen.
- Double-click a row to view the report.

3.20.7.2 Deleting report

- Right-click a record and click **Delete**. Click **Yes** in the confirmation window.
- Click **Delete** on the upper right-corner of the auditing screen.
- Select a row on a data grid and press DELETE.

3.20.7.3 Generating log file

A log file can be generated with the same information that is available for a report. The log file is a tabbed text file, meaning that it can be opened in notepad or excel.

- Right-click the data grid and select **Generate Log**. Select a text file in the dialog that appears.
- Click **Generate** on the upper right-corner of the auditing screen.
  The system confirms the successful generation of a log with a message with the path of the log file.

3.20.8 Graph editing features

Zooming in, zooming out, canceling zooming, enabling X zooming and enabling Y zooming can de done on the graph during calibration, commissioning and monitoring but not during auditing.

3.20.8.1 Zooming in

- Right-click a graph and then click **Zoom In**.
- Select an area of a graph by using mouse to zoom in.
- Press PAGE UP to zoom in.

3.20.8.2 Zooming out

- Right-click a graph and click **Zoom Out**.
- Press PAGE DOWN to zoom out.

3.20.8.3 Canceling zooming

- Right-click a graph and click **Cancel Zoom**.
  The graph area is shrunk to its original size.
- Press ESC.

3.20.8.4 Enabling X zooming

The X zooming can be enabled and disabled from the shortcut menu when right-clicking over a graph.

3.20.8.5 Enabling Y zooming

The Y zooming can be enabled and disabled from the shortcut menu when right-clicking over a graph.

3.20.9 Interaction with Parameter Setting

Injection Commissioning helps determine parameter values, and they are then posted to Parameter Setting. To open Parameter Setting to view and edit parameters of the selected function:

1. Select the function block for which the parameters have to be set.
2. Click **PST** to launch Parameter Setting.
   The **Parameter Setting** tool window opens and parameters can be set for the selected function block.
3. Click **Save** in the PCM600 toolbar to save the modified parameter values.

3.20.10 User management

1. Select **Tools** > **Options** > **Category Manager**.
2. Select a user type from the **User category** field.
3. Assign permission for the user to access Injection Commissioning in the **Functions and Rights** field.

The **Functions and Rights** field includes the **Launch ICT from plant structure**, **Read from IED** and **Write into IED** permissions.

The **Allow** or **Deny** rights can be set under each category.



The default permission for the functions for the administrator is **Allow**.

3.20.11 Closing Injection Commissioning

- Right-click the **Injection Commissioning** tab in the Injection **Commissioning** window and select **Close**.
- Click the **Close** button of the tool window.

3.21 License Update tool

License Update tool is used to update the license information in PCM600. On selecting the License Update tool, the user is prompted to backup the IED.

- Select **Yes** to backup the IED.
- Select **No** to continue to the mode selection page.



Updating the license may affect the hardware modules, function blocks or configuration that exists in PCM600, so it is recommended to backup the IED object in PCM600 before starting License Update Tool.

3.21.1 Selecting license update mode

When the IED is physically available for license update, the license can be updated online. In the online mode, the software and hardware license information are read directly from the IED.

Updating the license can be done offline if the configurations have to be modified based on the new license information but when the IED is not available. In the offline mode, the license information has to be entered manually.

1. In **License Update Mode Selection Page**:
   - Select **Online Update**.
   - Select **Offline Update**.
2. Click **Next** to provide the license information.

3.21.2 Providing license information

If the IED is configured online, click Scan to read the order code from the IED.

If the IED is configured offline:

- Enter the 18– characters long order code available from the order certificate e-mail or choose the details of the IED from the selection boxes.
- Set, paste or import the composition code.

3.21.3 Completing license updating

Once the required license information is entered:

- Click **Cancel** to make changes if some data is found incorrect.
- Click **Finish** if the license information is correct.

License Update Tool opens Application Configuration Tool.

License Update Tool opens Application Configuration Tool and scans through the existing configuration. License Update Tool checks if any function blocks or channels that are used in the configuration are not supported in the new license information. If there are any, the function blocks or channels are displayed in a tree view in the License Change Details window and deallocated in Application Configuration Tool. The new supported function blocks or channels are available in the PCM600 after the license updating.

In the tree view, all the function blocks, composite function blocks and hardware modules that are no longer available with the existing license appear in red. In Application Configuration Tool, all the function blocks and composite function blocks that are no longer available with the existing license appear in blue, and the hardware modules that are no longer available appear in red and their statuses are changed to unallocated.



While writing using the common read/write utility, the function blocks or channels that are supported by the IED are written to the IED. Otherwise, a notification appears about the mismatch in the order option message.

Operations that can be performed on unavailable function blocks and composite function blocks:

- Press DELETE or right-click a function block or a composite function block and select Delete to delete the function block.
- Right-click a function block and select Replace function block to replace a function block with a similar one.

A notification appears if such function block is unavailable. After replacing the function block, the connections have to be made manually. However, the connections can be retained during replacement.



Unavailable function blocks are removed after saving. However, a popup window appears to notify about this during the operation.



Unavailable function blocks are removed when quitting PCM600 or Application Configuration Tool regardless of whether the changes made in the configuration are saved or discarded. A popup window appears to notify about this during the operation.

Operations that can be performed on unavailable hardware modules:

- Press DELETE or right-click a hardware module and select Delete.
- Right-click a hardware module and select Allocate to allocate an unallocated hardware module to any available hardware module.



The unavailable hardware modules used in the configuration are not removed, so they can still be allocated to an available hardware module.

3.22 Parameter Setting

Parameter Setting is used for the parameterization of IED units. The parameters can be set offline in a PC, and sent to the IED or received from the IED over a communication line. Once started, Parameter Setting will display parameter data for the selected node.

3.22.1 Starting Parameter Setting

1. Select the IED from the plant structure.
2. Select **Tools** > **Parameter Setting** to start the Parameter Setting.

You can also start the Parameter Setting by right-clicking an IED node or one of the nodes subsequent to IED, in the object tree of the plant structure selecting Parameter Setting.

3.22.2 Setting parameters

The parameters can be set using the parameter setting sheet of the Parameter Setting tool. The tool supports various parameter types.

- Numerical
- SingleChoice
- String
- Date/Time
- MultiChoice

The parameter values can be defined in the **PC Value** column of the setting sheet.

1. Select the right cell for the new value.
2. Type the new value.

The Parameter Setting tool checks whether the given value is valid and within the setting range. If the new value is valid and within the range, the value is accepted. Otherwise, an error message appears. The message describes the error and the correct format for the parameter, if needed.

If the given value is different from the initial value, that is, the value in the Parameter Setting start, the value appears in bold. The values appearing in bold type are called changed parameters. A parameter is a changed parameter until the value is set back to the initial value, read from the IED or written to the IED or the Parameter Setting tool is restarted.

Once the value is changed and indicated in bold, the initial value is shown as a tool tip.



Select **Changed parameters** from the **Parameters option** group to write only the changed parameters to the IED.



The value of string-type parameters cannot be empty, contain a comma (“,”) or a newline character. This can cause corrupted disturbance recordings. The parameter value can be set to a dummy string if the value is empty so that the parameter can be saved.

3.22.3 Saving parameters

- On the **File** menu, click Save to save the changed parameter values.
  The operation saves the changed PC values (displayed in bold) to the database.

3.22.4 Copying parameter values

To copy a parameter value:

1. Select a parameter (PC Value) from the setting sheet. The selection becomes highlighted.
2. Select **Edit** > **Copy** to copy the parameter value to the clipboard.

To copy multiple parameter values:

1. Select a parameter group header (parameter group headers are indicated with a blue color) from the setting sheet. All parameters belonging to the selected group are marked as check marks.
2. Select **Edit** > **Copy** to copy the parameter values to the clipboard.

To copy setting groups:

1. Select **Edit** > **Copy** > **Paste setting group**.

   A dialog for copying setting groups opens.
2. Select source group and the target group and click **OK** to copy the setting group.

   All parameters currently visible in the setting sheet are copied from source group to the target group.

3.22.5 Pasting parameter values

To paste a parameter value:

1. Select a parameter from the setting sheet. The selection becomes highlighted.
2. Select **Edit** > **Paste** to paste the parameter value from the clipboard to the setting sheet.

To paste multiple parameter values:

1. Select a parameter group header (parameter group headers are indicated with a blue color) from the setting sheet.
2. Select **Edit** > **Paste** to paste the parameter values from the clipboard to the setting sheet.

3.22.6 Restoring saved values

To restore a saved value:

1. Right-click a parameter row in the setting sheet.
2. Select **Restore saved value** from the shortcut menu.

The saved value from the database is restored.

To restore all saved values, select **Edit** > **Restore all saved values**. All changed values are replaced with saved values from the database.

3.22.7 Restoring all default values

To restore all default values, select **Edit** > **Restore all default values**. All values are restored back to default values (factory values).

3.22.8 Undoing

It is possible to undo parameter changes and parameter functions like multi paste, restore all saved values and replace all tool values with IED values.

To undo the last action:

1. Right-click the object.
2. Select Undo from the shortcut menu to restore the old value from the database.

3.22.9 Printing

To print the parameters of current setting sheet:

1. Select **File** > **Print** to open the Print dialog.
2. Define the print options.
3. Click **OK** to print or **Cancel** to end the printing.

3.22.10 Reading parameters from IED

To read parameters from the IED:

1. Click the **Read parameters from IED** toolbar button or select **IED** > **Read parameters from IED** to open the **Read parameters from IED** dialog.
2. Select one of the options under the **Parameter range** field to read from the IED: whole setting sheet, selected group or single parameter.
3. Select under **Parameter rangeCopy IED values to PC values** field.

4. Click **OK** to read the parameters or **Cancel** to end the operation.

In case the reading of a single parameter fails, an error dialog is displayed. Continue by clicking one of the buttons in the dialog:

- Click **Retry** to read the parameter again.
- Click **Skip** to skip the parameter.
- Click **Skip all** to continue the reading of parameters and automatically skip the possible parameters that fail.
- Click **Cancel** to end the reading procedure.

3.22.11 Writing parameters to IED

1. Click the **Write parameters to IED** toolbar button or select **IED** > **Write parameters to IED** to send the parameters to the selected IED. The **Write Parameters to IED** window opens.
2. Select one of the options **Whole Setting Sheet**, **Selected Group** or **Single Parameter** under the **Parameter range** field.
3. Select the parameter to be written to the IED under the **Parameter options** field. The **All Parameters** option writes all the parameters and **Changed Parameters** writes only the changed parameters to the IED.
4. Define whether to read the parameters back after writing or not by selecting the **Read back** check box.
5. Click **OK** to write the parameters or **Cancel** to end the operation.

If the writing of a single parameter fails, an error message is displayed. The operation can be continued by choosing one of the options below.

- Click **Retry** to write the parameter again.
- Click **Skip** to skip the parameter.
- Click **Skip all** to continue the writing of parameters and skip automatically the possible parameters that fail.
- Click **Cancel** to end the reading procedure.



The locked parameters are written to IED using the **Parameter Setting** tool. The locked parameters are not written to IED during **Common Write**. The locked parameters must be initially unlocked to be able to write them to the IED. The parameter can be locked or unlocked by right-clicking the **PC value** field and selecting **Lock/ Unlock parameter**.

3.22.12 Modifying setting sheet

Modify the setting sheet to display only the specified parameters.

3.22.12.1 Hiding or showing parameters

1. On the setting sheet, right-click the parameter.
2. In the shortcut menu, select **Hide parameter** or **Unhide parameter**.

If the parameter filter is set to **Visible parameters**, the hidden parameter is not shown on the setting sheet.

If the parameter filter is set to **All parameters**, the hidden parameter is shown and can be turned **On**. The hidden parameter shows in grey font.



Some parameters are hidden by default. Parameters hidden by the user are indicated by a small user icon.

3.22.12.2 Selecting parameter filters

- Select **All parameters** to display a full set of parameters defined in the current parameter layer.
- Select **Changed parameters** to display parameters that have been changed during the current parameter setting session. The values of these parameters are displayed in bold.
- Select **Default parameters** to display parameters having the factory value.
- Select **Visible parameters** to display parameters that are not hidden by the user or the function.
- Select **Hidden parameters** to display parameters hidden by the user or the function.
- Select **Invalid parameters** to display parameters having wrong format or parameters that are out of range.
- Select **IED value < > PC value** to display parameters having different IED and PC values.

3.22.12.3 Hiding or showing parameter groups

1. On the setting sheet, right-click the parameter group header.
2. In the shortcut menu, select **Hide group parameters** or **Unhide group parameters**.

3.22.12.4 Hiding or showing columns

1. On the setting sheet, right-click the column header.
   A shortcut menu opens, containing the column names.
2. Click a column name to hide or to show the columns on the setting sheet.

3.22.12.5 Collapsing and expanding parameter groups

- To collapse or expand a single group, double-click the parameter group header in the setting sheet.
- Collapse or expand the selected group and it's child groups.
  - On the menu, select **View** > **Group options** > **Expand selected group + child groups** to expand the groups.
  - On the menu, select **View** > **Group options** > **Collapse selected group + child groups** to collapse the groups.

- On the toolbar, click the corresponding toolbar buttons.

3.22.13 Autosizing columns

1. Click **Set column autosize on/off** and set to **ON** to view more information on the parameters in the parameter setting sheet.

   This feature is useful when the setting group presentation is set horizontally.

2. Click **Set column autosize on/off** to enable the autosize mode on the toolbar.

   - Click **Set column autosize on/off** again to disable the mode.

     When the mode is enabled, columns are collapsed to minimum size. The column width can be increased manually based on the requirement.

3.22.14 Finding parameters

1. On the **Edit** menu, click **Find parameter**.
2. In the **Find Parameter** dialog box, enter the find string and column where to find from.
3. Click **Find Next** to find the parameter.

3.22.15 Selecting parameter filter

It is easy to find parameters, which are changed, invalid or hidden with the parameter filters.

You can select the following filters:

- All parameters
- Changed parameters
- Default parameters
- Visible (default), shows all the parameters
- Hidden parameters
- Invalid parameters
- IED value different than PC value

To filter parameters:

1. Select **View** > **Parameter filter**.
2. Select the specific filter or click the corresponding toolbar button. You can see the filtered parameters in the setting sheet.

After the selection of the filter, the setting sheet is updated according to the selected filter.

3.22.16 Selecting parameter layer

Select either Advanced or Basic parameter layer by selecting View/Parameter layer. The default layer for the user categories is defined in Category Manager, refer to *Chapter 2.4.6 Modifying existing user categories*.

- Advanced parameters: contains all the IED parameters.
- Basic parameters: subset of the Advanced parameters, usually contains the most used parameters.

When the layer is selected the setting sheet is updated according the to selected layer. If you belong to a user category which is authorized to set only the basic parameters, you can only see the advanced parameters but not modify them.

3.22.17 Replacing values

To replace a PC value with an IED value:

1. Right-click a parameter row in the setting sheet.
2. Select **Replace PC value with IED value** from the shortcut menu.

The IED value is copied to the PC value field.

To replace all PC values with IED values, select **Edit** > **Replace PC value with IED value**. The PC values are replaced with IED values.

3.22.18 Displaying parameters

You can define whether to see only the parameters of the selected node or all the parameters of the selected node and its child nodes. Especially, if the number of parameters is high, selecting **View** > **Browse options** > **Display only selected node** is recommended.

Browse options:

- Display only selected node
- Display selected node + child nodes

When this is done, the selection setting sheet is updated according to the selected browse option.

3.22.19 Selecting setting group presentation

Setting groups can be presented as a vertical view or horizontal view.

To select setting group presentation, select **View** > **Setting group presentation**.

3.22.20 Exporting parameters

Parameters can be exported from an IED in any level of the Plant Structure.

1. Click the Export parameters toolbar button or on the **File** menu, select **Export parameters**.
2. In the **Export** dialog box, define the export options.

- File name
- Path or location
- File type (xrio, csv, txt)

3. Click **Save**.
4. Choose the certificate to use for signing the file.

3.22.21 Importing parameters

An exported parameter file contains all the IED functions which have parameters. In the import phase, the functions to be imported from the file can be defined.

By default, both parameter values and visibilities are imported. If either parameter values or visibilities should not be imported, the check box under Import options must be cleared.

Parameters can be imported in an IED in any level of the Plant Structure as a whole or partially.

1. Select the node from the tree structure in Plant Structure to import the parameters.

   To import all the parameters, select the IED node. To import the parameters related to a subnode, select the subnode by expanding the IED node.
2. Click the Import parameters toolbar button, or on the File menu select Import parameters.
3. Define the location of the import file.

   The import file must be in .xrio or .csv format.
4. Click Open, and in the Open dialog box, select the functions containing the parameters required for importing.

   All the functions are selected by default.
5. Click OK.



If a revision mismatch occurs between the source function in the import file and the target function in the PCM600 tool, the function is displayed in red font and it is not selected. The function can be selected and imported but all parameters may not be updated in the target function.

Additionally PCM600 checks the integrity of the template during import. If the template was signed with a certificate that does not exist in the computer’s certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the template.

There can be several reasons why the integrity check fails:

- The template has been created with PCM600 version which does not sign the template files
- The computer certificate store does not contain the certificate needed to do the verification
- Verification itself fails

All the listed reasons above mean that integrity of the template could not be verified, and it is possible that someone has tampered with the template. If the integrity can't be checked or the verification fails, it is still possible to proceed with

import. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

3.22.22 Graphical parameter presentation for distance protection

When the Parameter Setting tool is started for an IED which is capable of showing parameters graphically, the **Graphical presentation** drop-down list becomes available in the **Parameter Setting** toolbar. From the list, select a protection function to display graphically.

3.22.22.1 Starting graphical presentation

1. Click the **Graphical presentation** drop-down list from the **Parameter Setting** toolbar.
2. Select **Protection function** from the list.
   The **Graphical presentation** dialog box opens.

The **Graphical presentation** dialog box is a floating window which is always on top when the Parameter Setting tool is active. This enables setting a parameter and viewing the effect of the parameter change on the protection characteristic immediately.

3.22.22.2 Graphical parameter filter

When the graphical presentation is started, Parameter Setting starts using the graphical parameter filter and only parameters that have effect on the protection characteristic are visible in Parameter Setting. The graphical parameter filter is available only during a graphical presentation session. All other filters in Parameter Setting are available normally.

3.22.22.3 Selecting setting group

1. Click the **Select setting group** box on the **Graphical presentation** toolbar.
2. From the list, select the setting group to be used in calculation of characteristics.

3.22.22.4 Selecting characteristic visibility

From the characteristic visibility list, the measuring zones can be hidden quickly without disabling the zones from the parameter.

1. On the **Graphical presentation** toolbar, click **Set characteristic visibility**.

2. Define visibility for the characteristics.

The visibility list is IED-specific. For some IEDs, it is the only place where certain function characteristics can be hidden or unhidden if the function does not have the parameter to disable it. If the function has two instances for the same characteristic, the function name and instance number is displayed in the legend text. For example, “Phase sel. - FDPSPDIS: 2” means that the characteristic is drawn by using the FDPSPDIS function instance 2.

3.22.22.5 Setting grid

- Click the **Grid ON/OFF** button on the **Graphical presentation** toolbar to set the grid on or off.

3.22.22.6 Zooming

This feature is not available for all protection functions.

- To zoom in, click the **Zoom In** button on the **Graphical presentation** toolbar.
- To zoom out, click the **Zoom Out** button on the **Graphical presentation** toolbar.

3.22.22.7 Panning

Panning allows moving a characteristic by mouse in any direction.

This feature is not available for all protection functions.

1. In the **Graphical presentation** toolbar, click **Pan on/off** to enable the Pan tool.
2. Drag to move the characteristic.
3. Click **Pan on/off** to disable the **Pan** tool.

3.23 Reporting

Reporting is used by tools for viewing, saving, and printing of the reports. Reports are opened in the report viewer, which normally provides zooming and navigating functions.

3.23.1 Setting the report header/footer values

In the reports, the header/footer values which are not generated automatically can be filled in manually.

To set the report values using the **Tools** menu:

1. Select **Tools** > **Options**.
2. Select **Reporting and Printing** in the navigation bar.
3. In the **General** tab, enter the organization specific values such as the organization name, approver and creator names, technical reference and owner's organization name.
4. Select the paper size in the **Margins** tab and click **OK**.

The margins for the selected page are prefixed values and it cannot be modified.

To set the report values using the shortcut menu:

1. Right-click the IED in the plant structure.
2. Select **Report Parameters** from the list.
3. Enter the responsible department, approver and creator names, document id, revision and release date.

The header/footer report values can be set for different tools in the **Report Parameters** window. Different tabs are available for the tools but the fields in the tabs are the same. The values entered in the **Report Parameters** window overwrites the values entered in **Tools** > **Options** > **Reporting and Printing** > **General tab**.

- Application tab: Application Configuration, Hardware Configuration and Signal Matrix
- Local Display tab: Graphical Display Editor
- Communication tab: Communication Management
- Parameter tab: Parameter Setting

The greyed out fields cannot be modified.

The document revision history is stored in the IED and can be set individually for each IED.

3.23.2 Modifying header

The reporting and printing system makes it possible to change the company logo in the header of the page and the company name in the footer of the page of the printed report. The height and width of the image should be relatively small not to interfere with the layout of the report. The height of the image should be less than 2.5 cm or one inch.

To change the logo:

1. Copy the company logo image file, which must be a JPG file, to `[PCM600 installation path]\bin\Tools` directory and rename it `COMPANY.jpg`.
2. Create a new text file, called `COMPANY.txt`, with the Notepad text editor and save it in the same directory.
3. Open `COMPANY.txt` and add the company name to the first line of the document.
4. Save the file with Unicode encoding.
5. Restart PCM600.

3.24 Scheduler

The Scheduler is a system tool under PCM600. With the Scheduler you can create and configure scheduled tasks and jobs. You can use the Scheduler to define scheduled tasks performing different functions at the defined times. A task and job set up a scheduled event, you cannot have one without the other. This will be explained more clearly later in this chapter.

The Scheduler provides:

- Graphical User Interface (GUI) for creating and configuring scheduled tasks and jobs
- Control over Task Manager
- Information on task and job status

The upper pane of Scheduler contains an object tree which includes the following nodes:

- Task Manager: Root node of the structure
- Task: Each node represents a task
- Job: Each node represents a job under a task. The object and system jobs have slightly different symbols.

A task configuration contains information on when the task should be run, project name, owner (that is, a user who created the task), purpose of the task and the jobs the task contains.

The jobs are schedulable functions provided by the Scheduler client tools. The Client tools are tools which host one or more schedulable functions. The job functions are designed for a specific purpose (like getting disturbance recording from IED). A job consists of several attributes of which the most important are name, client tool name and job function name. A task contains one or several jobs. If there are several jobs under a task, the running order is the order in which the jobs reside under the task node in Scheduler. The task and job information defined in Scheduler are stored in the system database. The system database is also used for exchanging task and job information between the Task Manager and Scheduler.

The jobs are run by Task Manager according to the schedule defined in the task configuration. Several tasks can be active at the same time. The number of simultaneous tasks depend on system resources (CPU speed, memory, and so on).



First update the connectivity packages to the latest versions. In case of connectivity packages that do not contain digitally signed files, select Security settings in the Options menu and set the Security Level to "Low". Ensure that the connectivity packages are retrieved from a secure location. Reboot the computer after this change.

3.24.1 Opening Scheduler

To open Scheduler and to see the task data (tasks, jobs and their status) select **Tools** > **Scheduler**.

3.24.2 Closing Scheduler

1. Save the modified task or job data before closing.
2. Click close in the upper right corner to close Scheduler. If you have any unsaved data, the program asks whether it should be saved before closing.

3.24.3 Starting Task Manager

- Select **Task Manager** > **Start Task Manager** or right-click the **Task Manager** node and select **Start Task Manager**.
  Task Manager starts and the tasks are activated according to the data read from the permanent task storage.

  If some unexpected errors occur while starting the service, they are displayed in the Windows Event Viewer.

  Task Manager requires connection to the Scheduler service. See section PCM600 Scheduler setup in the cyber security deployment guideline.

3.24.4 Adding task

To create a new task select Task / Jobs/Add Task or right-click the Task Manager node in Scheduler and select Add Task. The new task is added under the Task Manager node. You can name the task by clicking the selected task and typing the name. For creating new job, see *Chapter 3.24.8 Creating job*.

To set up the Task settings:

1. Click the Task node and select the Configuration tab.
2. Set Schedule to Once under the Scheduling field.
3. Set Start Date/Time option under the Start Condition field to a specific time for the Scheduler to start the task.
4. Click the Task Manager node and click Yes to accept the settings.

For more information on configuring the tasks, refer to *Chapter 3.24.6 Configuring task*.

3.24.5 Viewing task configuration

To view the task configuration, click the Task node from Scheduler and select the **Configuration** tab.



Save any unsaved task and job data before viewing the task configuration.

For more information on configuring the tasks, refer to *Chapter 3.24.6 Configuring task*.

3.24.6 Configuring task

A Scheduler task can be started only a certain amount of times. After the limit has been exceeded, Scheduler stops working. Before exceeding the limit, the PC or Windows service (ABBPCMSchedulerService) needs to be restarted.

Table 15: Continuous Scheduler operation times with different task intervals

Task interval	Maximum operation time
1 minute	10 days
10 minutes	100 days
30 minutes	300 days
1 hour	More than a year

1. Select the task. The task configuration is shown on the **Configuration** tab. If the task status is not Disabled select **Task** > **Jobs** > **Disable task**.
2. Define the attributes.
   - Schedule:

     Defines the schedule in which the task is activated. If no schedule is required choose None.
   - Interval Days hh:mm:ss:

     If the schedule is Fixed Interval, the interval in days, hours, minutes and seconds can be defined here.
   - Start Date/Time:

     Defines the point of time the task is activated for the first time.
   - End Date/Time:

     Defines the point of time when the task is not activated any more. Note! Overrides the possible value of Number of Activations.
   - Number of Activations:

     Defines how many times the task is activated. Note! Overrides the possible value of End Date/Time.
   - Description:

Optional user description of the task.

3. Click the green button to save the task configuration into database.

3.24.7 Deleting task

To delete a task from the system database right-click the task and select **Delete Task**. The task and the jobs under it are deleted from the database.

3.24.8 Creating job

To create a System Job under an existing task, right-click the task and select **Add Object Job**.

- Create an Object Job under an existing task.
  1. Select the task.
  2. Select an object from the plant structure (the object must have schedulable functions).
  3. Drag the object on the selected task node or right-click the task and select **Add Object Job**.

- Set up the job settings.
  - Click the Job node.
  - Select **Configuration** tab.
  - Select **Disturbance Handling** from the **Tool** drop-down menu.
  - Select **Read New Recordings** from the **job** drop-down menu.
  - Click the Task Manager node and click Yes to accept the settings.

If user credentials for the IED have not been stored, a dialog box opens and the credentials are requested when a job is added. If the credentials are not entered, Scheduler may not be able to communicate with the IED, depending on how the security settings on the IED have been configured. Setting the IED credentials affects all jobs related to that IED.

If PCM600 and SQL Server are not installed on same machine (“distributed setup”), the IED credentials must be entered on the machine where the Scheduler service is running.

For more information on setting the job configuration, refer to *Chapter 3.24.11 Configuring job*.

3.24.9 Saving job

To save a changed job configuration click the green check button on the top of the Configuration tab. The job configuration is saved into database.

3.24.10 Viewing job configuration

To view job configuration click the Job node from Scheduler and select the **Configuration** tab. For more information on configuring the jobs, refer to *Chapter 3.24.11 Configuring job*.

3.24.11 Configuring job

1. Select the job. The job configuration is shown on the **Configuration** tab. If status of the task containing the job is not Disabled, select **Task** > **Jobs** > **Disable task**.
2. Select the specific tool component from the **Tool** drop-down menu.
3. Select a job type from the **Job** drop-down menu.
4. Type the purpose of the job to the **Description** box.
5. Click the green button on the **Configuration** tab to save the job configuration in the database.



Some of the job types may contain job type specific properties shown in the Job Properties field. Give these properties the values as required.

Setting up a task for single operation for reading recordings and sending a report:

1. Click the **Task** node and set a new time for starting the task, see the previous example.
2. Click the **Job** node.
3. Select **Read Recordings and Send Report** from the **Job** drop-down menu.
4. Right-click the **Task** node and select **Enable Task**.

When the task and the jobs are performed successfully, the status of the task and jobs becomes Completed.

The recipients can be configured by selecting **Tools** > **Options** > **Disturbance Handling**.

Setting up a task for single operation for reading recordings and sending a report after shutting down PCM600:

1. Click the **Task** node and set a new time for starting the task, see the previous example.
2. Click the **Job** node.
3. Select **Read Recordings and Send Report** from the **Job** drop-down menu.
4. Right-click the **Task** node and select **Enable Task**.
5. Shut down PCM600.

Although PCM600 is shut down, the job should be completed as scheduled. The recipients can be configured by selecting **Tools** > **Options** > **Disturbance Handling**.

Scheduler can be set up to run multiple tasks for a repeatable number of jobs.

Setting up a task for multiple task operation for reading recordings and sending a report:

1. Click the **Task** node.
2. Select one of the menu items in the **Schedule** drop-down menu.
3. Save the setting by clicking some other node and accepting the settings or clicking the green button in the upper left corner of the **Configuration** tab.
4. Right-click the **Task** node and select **Enable Task**.

Setting up user credentials for the IED:

1. Right-click the **Job** node.
2. Select **Set IED credentials** from the shortcut menu.
3. Enter the user name and password used to log in to the IED.

Setting the IED credentials affects all jobs related to the IED. If the credentials have not been entered or they are incorrect, Scheduler may not be able to communicate with the IED, depending on how the security settings on the IED have been configured.

If PCM600 and SQL Server are not installed on the same machine (“distributed setup”), the IED credentials must be entered on the machine where the Scheduler service is running.

3.24.12 Deleting job

To delete a job from the system database right-click the job and select **Delete Job**. The job is deleted from the database.

3.24.13 Activating task

A task is activated in order to run the jobs under it. Task Manager activates tasks according to the schedule defined in the task configuration. Alternatively, you can activate a task outside the defined schedule. A task may contain one or several jobs. If there are several jobs under a task, the running order is the order the jobs reside under the task node.

To activate a task manually outside the schedule:

1. Make sure the task is enabled.
2. Right-click the task and select **Activate Task**. The task is now activated and the jobs under it are running.

3.24.14 Interrupting task

An active task can be interrupted manually. This means that the currently running job is stopped and task is set to wait for the next scheduled activation (if any).

1. Select the active task you want to interrupt.
2. Right-click the Task node and select **Interrupt Task**. The jobs running under the task are stopped and the task is set into Waiting state, if it has scheduled activations in the future. The task is deactivated and dynamic task data is updated.

3.24.15 Using task filters

The task nodes shown in the object tree of the Scheduler are defined by the task filter selected. To show the appropriate tasks select one of the task filters in the Scheduler toolbar or select **Task Manager** > **Filter**.

The available filters are:

1. All Tasks:
   Shows all tasks within the PCM600 system.
2. Project Tasks:
   Shows tasks created under currently open project.
3. User Tasks:
   Shows all tasks created by the current user.

After selecting the filter the tasks are shown in the Scheduler's object tree.

3.24.16 Viewing event log

The events related to the tasks and jobs are stored into a log database. The log information contains the date and time of the event, event type, user name that initiated the event and an optional message.

A log information is created when:

- Task Manager is started.
- Task is enabled, disabled, activated, interrupted or an error occurs.
- Job is started, stopped, progressing or an error occurs.

You can view the logged events of a certain Scheduler element, that is, Task Manager, Task or Job. The events are displayed according to the event filter settings. The event filters are:

- Time period
- Display method

To view event log:

1. Select **Event Log** tab of the Scheduler.
2. Select the specific node from the Scheduler's object tree to view the events.
3. Define the following attributes:
   - Show history for:

     Defines if the history is shown only for the currently selected element or recursively also for its sub elements.
   - from:

     Defines whether the log entries are shown from the last hour, from the whole history or from the defined period of time (see below).
   - Time Period:

     Start and end date of the log entries to be shown.

3.24.17 Enabling task

Enabling a task includes it in the scheduling. This means that the task is activated according to the schedule defined in the task configuration.

1. Select a task from the Scheduler's object tree.
2. Select **Tasks** > **Jobs** > **Enable Task** or right-click the task and select **Enable Task**. The task status changes and the Task Manager starts to activate the tasks according to the schedule.

3.24.18 Disabling task

Disabling a task takes it out of the scheduling. This means that the task is not activated according to the schedule defined in the task configuration.

1. Select a task from the Scheduler's object tree.
2. Select **Tasks** > **Jobs** > **Disable Task** or right-click the task and select **Disable Task**. The task status is changed in the Scheduler's object tree.

3.25 Signal Matrix

The Signal Matrix tool is used to create connections between source and target objects in an IED configuration. A target object can be connected with only one source object; however one source object can be connected to several different target objects.

The exception to this rule is provided by glue logic function. Glue logic enables several source objects to be combined via a simple boolean logic function (AND or OR), the output of which is then connected to a target object.

The IED configuration is displayed in a tabular grid or grids, where the source and target objects are represented as rows or columns, and the connections are represented by a particular character in the cell that intersects a source and target object (row/column intersection).

Source objects:

- Optocoupler inputs to an IED
- Current or voltage transformer (CT/VT) inputs to an IED
- Transducer inputs (4-20 mA or 0-10V) to an IED
- Function block's output signals
- IEC 61850 GOOSE input signals received by the IED

Target objects:

- IED's output relay contacts
- IED's transducer (4-20 mA or 0-10V) output
- Function block's input signals
- IED's indication LEDs

Signal Matrix contains the following predefined matrices:

- Analog input grid
- Analog output grid
- Binary input grid
- Binary output grid
- GOOSE receive grid



The predefined matrices will only be visible if the IED configuration contains data for that particular grid.

In order for Signal Matrix to show any of the individual matrices, there must be functions and signals that are defined as visible to the Signal Matrix tool. If there is no visible data available for a particular grid, the grid will be unavailable. If there is no visible data available for any of the matrices, a warning message will be displayed.

In the event of no visible data being available for Signal Matrix, the Application Configuration Tool tool must be opened and some functions should be set for signals to be visible in Signal Matrix.

A picture showing the selected type of IED is displayed in the top left corner of the Signal Matrix. The columns are grouped according to their parent container. For example, in the binary inputs grid, the parent containers of the optocoupler input channels are the hardware modules.

The labels of the column headers identify the source or target item group and the items themselves as source or target. For example, a hardware module label displays the card identifier text as shown in the hardware tool and a function block label displays the function block name.

The columns and rows are resizable in each matrix grid.

A grid consist of cells with different colors:

- White cells are available for configuration
- Cells shaded in light red are not available for configuration, which indicates that this source and target combination may not be connected
- Light blue cells are available for configuration, but the corresponding target object already has a connection with some other source object in the Grid. In this case, the behaviour of the connection depends on whether or not glue logic is enabled in the Grid.
  - If glue logic is not enabled, the existing connection will be removed
  - If glue logic is enabled, Signal Matrix Tool will attempt to combine the new source object with the existing source object using glue logic and connect the output to the target object.

3.25.1 Creating and deleting connections

Connections can be created by double-clicking an empty, white cell in the grid. The X symbol indicates that the connection has been created successfully.

The corresponding target object in the row or column will be highlighted in light blue color to indicate that a source object is connected to it.

The connection can be disconnected by double-clicking on the cell with X symbol.

3.25.2 Starting Signal Matrix

To start Signal Matrix:

1. Right-click an IED in the PCM600 object tree
2. Select
   - **Signal Matrix** from the shortcut menu or
   - **Tools** > **Signal Matrix**

The Signal Matrix window opens in the centre of the PCM600 program window.

3.25.3 Analog input grid

The analog inputs grid allows the creation and deletion of connections between the source objects and target objects. The current and voltage channels are the source objects. The input signals of current and voltage function block are the target objects.

There are three requirements that must be fulfilled for the analog inputs grid to be displayed:

- There must be hardware modules with current or voltage transformer input channels, that is, current or voltage must exist in the source channels with quantity.
- There must be some functions with analog input signals that accept current or voltage connections, that is, current or voltage must exist in the target signals with quantity.
- The analog input signals and their parent function block(s) must be visible to the Signal Matrix tool. The visibility property of signals and functions can be set using the Application Configuration tool.

The columns in the analog inputs grid display current or voltage transformer analog input channels which are the input source channels with current or voltage quantity.

The rows in the analog inputs grid display current or voltage analog input signals which are the input target signals with current or voltage quantity.



Several analog input signals can be connected to the same physical analog input channel. But once an analog input signal is connected to a physical analog input channel, it cannot be connected to another physical analog input channel.



The appearance of the grid is based on the IED's capability.

Each analog input channel refers to a certain transformer type:

- Current transformer for protection (CT)
- Voltage transformer type (VT)

The Signal Matrix connection rules are used to prevent invalid connections. Invalid connection cells are disabled and colored red. For example, Signal Matrix prevents the connection of a source voltage channel with a target analog current input signal whose quantities are voltage and current respectively.

3.25.4 Analog output grid

The analog output grid allows the creation and deletion of connections between the source objects and target objects. The analog output signals are the source objects and the current and voltage channels are the target objects.

There are three requirements that must be fulfilled for the analog output grid to be displayed:

- There must be hardware modules with current or voltage transformer input channels, that is, current or voltage must exist in the target channels with quantity.
- There must be some functions with analog output signals, that is, current or voltage must exist in the source signals with quantity.
- The analog output signals and their parent function block(s) must be visible to the Signal Matrix tool. The visibility property of signals and functions can be set using the Application Configuration tool.

The columns in the analog output grid display the current or voltage transformer analog output channels which are the output target channels with current or voltage quantity.

The rows in the analog output grid display the current or voltage analog output signals which are the output source signals with current or voltage quantity.



Several analog output signals can be connected to the same physical analog output channel. But once an analog output signal is connected to a physical analog output channel, it cannot be connected to another physical analog output channel.



The appearance of the grid is based on the IED's capability.

The Signal Matrix connection rules are used to prevent invalid connections. The invalid connection cells are disabled and colored red. For example, the Signal Matrix tool prevents the connection of a source voltage channel with a target analog current output signal whose quantities are voltage and current respectively.

3.25.5 Binary input grid

The Binary Inputs grid allows the creation and deletion of connections between binary input signals, which are the targets objects and physical optocoupler input channels, which are the source objects in the IED configuration.

There are three requirements that must be fulfilled for the binary inputs grid to be displayed:

- There must be hardware modules with optocoupler input channels, that is, the binary values must exist in source channels with quantity.
- There must be some functions with binary input signals that accept binary values must as target signals with quantity.
- The binary input signals and their parent function block(s) must be visible to Signal Matrix. The visibility property of signals and functions can be set using the Application Configuration Tool.

The columns in the binary inputs grid display optocoupler inputs, which are the binary values of source channels with quantity. The rows in the binary inputs grid display binary input signals of function blocks, which are binary values of target input signals with quantity.

The binary inputs grid supports glue logic. This means that several optocoupler input channels may be connected to the same binary input signal. A glue logic connection is represented by more than one connection (X) in a row and the logic type is shown in the combo-box next to the target binary input signal.

When several optocoupler input channels are connected to the same target signal, the optocoupler channels are grouped together by a simple boolean function (AND or OR) and the output of the logic function is connected to the target binary input signal.

3.25.6 Binary output grid

The Binary outputs grid allows the creation and deletion of connections between physical output relay contact channels, which are the targets objects and binary output signals, which are the source objects in the IED configuration.

There are three requirements that must be fulfilled for the binary outputs grid to be displayed:

- There must be hardware modules with relay output contact channels, that is, binary values must exist in target channels with quantity.
- There must be some functions with binary output signals that accept binary values as source signals with quantity.
- The binary output signals and their parent function block(s) must be visible to Signal Matrix. The visibility property of signals and functions can be set using the Application Configuration Tool.

The columns in the binary outputs grid display output relay contact channels, which are the binary values of target channels with quantity. The rows in the binary outputs grid display binary output signals, which are the binary values of source signals with quantity.

The binary outputs grid supports glue logic. This means that several binary output signals may be connected to the same output relay contact channel. A glue logic connection is represented by more than one connection (X) in a column, and the logic type is shown in the combo-box below the target output relay contact channel.

When several binary output signals are connected to the same target output relay contact channel, the output signals are grouped together by a simple boolean function (AND or OR) and the output of the logic function is connected to the target output relay contact channel.

3.25.7 GOOSE receive grid

The GOOSE receive grid allows the creation and deletion of connections between GOOSE receive signals, which are the source objects and binary input signals, which are the target objects in the IED configuration.

There are three requirements that must be fulfilled for the GOOSE grid to be displayed:

- The IEC 61850 SCL description for the IED must contain an input section under one or more logical nodes that contain valid external references, that is, the IED must be configured to receive GOOSE information from other IEDs in the PCM600 project.
- There must be functions with binary input signals that accept binary values as target signals with quantity.
- The binary input signals and their parent function block(s) must be visible to the Signal Matrix tool. The visibility property of signals and functions can be set using the Application Configuration tool.

The columns in the GOOSE receive grid display all the GOOSE receive signals.



The GOOSE receive input signals are those signals that are communicated to one IED from another IED using the IEC 61850 GOOSE communication mechanism. The signals are generally defined in IEC 61850 engineering process. They have to be defined using a system level engineering tool.

The rows in the GOOSE receive grid display binary input signals, which are the binary values of target signals with quantity.

The Signal Matrix connection rules are used to prevent invalid connections. Invalid connection cells are disabled and are colored red. For example, if the IEC 61850 data type of the GOOSE receive input is not compatible with the binary input signal, Signal Matrix would prevent the connection of GOOSE receive signals with the target binary input signal.

The header of the GOOSE Receive sheet consists of two rows:

- The first row shows the GOOSE Receive logical device (IEDName + LDInst).
- The second row shows the GOOSE Receive input (Prefix + LnClass + LnInst + DO + DA).

The GOOSE receive grid does not support glue logic.



Several binary input signals can be connected to the same GOOSE receive input, but once a binary input signal is connected to a GOOSE receive input, it cannot be connected to another GOOSE receive input.



The appearance of the grid is based on the IED's capability

3.25.8 SMV receive grid

The SMV grid allows the creation and deletion of connections between SMV Streams, that is, the source objects and SMV receive block inputs, which are the target objects in the IED configuration.

There are three requirements that must be fulfilled for the SMV grid to be displayed:

- In the IEC 61850 Configuration tool, under the Process Bus Communication section, the IEC 61850 SCL description for the IED must contain an input section with valid external references, that is, the IED must be configured to receive Sampled Value Streams from other IEDs in the PCM600 project.
- The SMVRCV function must be added in Application Configuration to accept the Sampled Value Streams sent by the Sender IED.

- The receiver input signals and their parent function blocks must be visible to Signal Matrix. The visibility property of signals and functions can be set using Application Configuration.

The columns in the SMV grid display all the Sampled Value Streams coming in from the configured Sender IEDs in the subnetwork.

The Sampled Value Streams that are communicated between two IEDs using the IEC 61850 Process Bus Communication mechanism are generally defined in the IEC 61850 engineering process.

The rows displayed in the SMV grid are the SMV receiver inputs that can receive the complete streams of Sampled Value data.

The Signal Matrix connection rules are used to prevent invalid connections. Invalid connection cells are disabled and are colored red. For example, if SMV Stream is not compatible with the SMV Receiver input signal, Signal Matrix prevents the connection.

The header of the SMV grid consists of two rows:

- The first row shows the SMV Sender (IEDName, Ex. AA1J1Q02A1)
- The second row shows the SMV Stream Name (Ex. AA1J1Q02A1MU01)

The SMV grid does not support glue logic.

Several SMV streams can be connected to the same SMV receive input, but an SMV stream cannot be connected to several SMV receive inputs.

The appearance of the grid depends on the IED's capability.

3.25.9 Functions grid

The functions grid allows the creation and deletion of connections between binary output signals, which are the source objects and binary input signals, which are the target objects in the IED configuration.

There are three requirements that must be fulfilled for the functions grid to be displayed:

- There must be functions with binary input signals that accepts binary values as target signals with quantity.
- There must be functions with binary output signals that accepts binary values as source signals with quantity.
- The binary input and binary output signals and their parent function block(s) must be visible to Signal Matrix. The visibility property of signals and functions can be set using the Application Configuration tool.

The columns in the functions grid display binary input signals, which are the binary values of target signals with quantity. The rows in the functions grid display binary output signals, which are the binary values of source signals with quantity.

The functions grid supports glue logic. This means that several binary output signals can be connected to the same binary input signal. A glue logic connection is represented by more than one connection (X) in one column, and the logic type is shown in the combo-box below the target binary input signal.

When several binary output signals are connected to the same target binary input signal, the output signals are grouped together by a simple boolean function (AND or OR) and the output of the logic function is connected to the target binary input signal.

The appearance of the grid is based on the IED's capability.

3.25.10 Connection rules

The connection rules helps in preventing invalid connections. The Signal Matrix tool verifies whether the source and target combination is compatible with the connection rules or not.

General connection rules

A connection can be made only if:

- The connection pair consists of a source and a target (source-source and target-target connections are not allowed)
- An output signal of a function is not connected with the input signal of the same function.
- The source quantity is compatible with the target quantity, for example, binary values of source with quantity cannot be connected with the current values of target with quantity.

  A target object may have any value as quantity, which indicates that it can be compatible with any source Quantity.

- The source data type must be compatible with the target data type, for example, a source with data type string is most likely not compatible with a target with data type int32.

  The data type compatibility is defined by the IED connectivity package. It is specific to a particular IED.

GOOSE grid connection rules

GOOSE inputs may only be connected with compatible target input signals. The compatibility is defined by the target signal that is, the target signal defines with which IEC 61850 data types it is compatible.

The GOOSE input has a defined IEC 61850 data type, that is, Signal Matrix tool examines the IEC 61850 data type of the GOOSE input, and ensures that it is compatible with the target signal.

3.25.11 Glue logic

Some of the Signal Matrix grids support glue logic like the binary inputs, binary outputs and functions grids

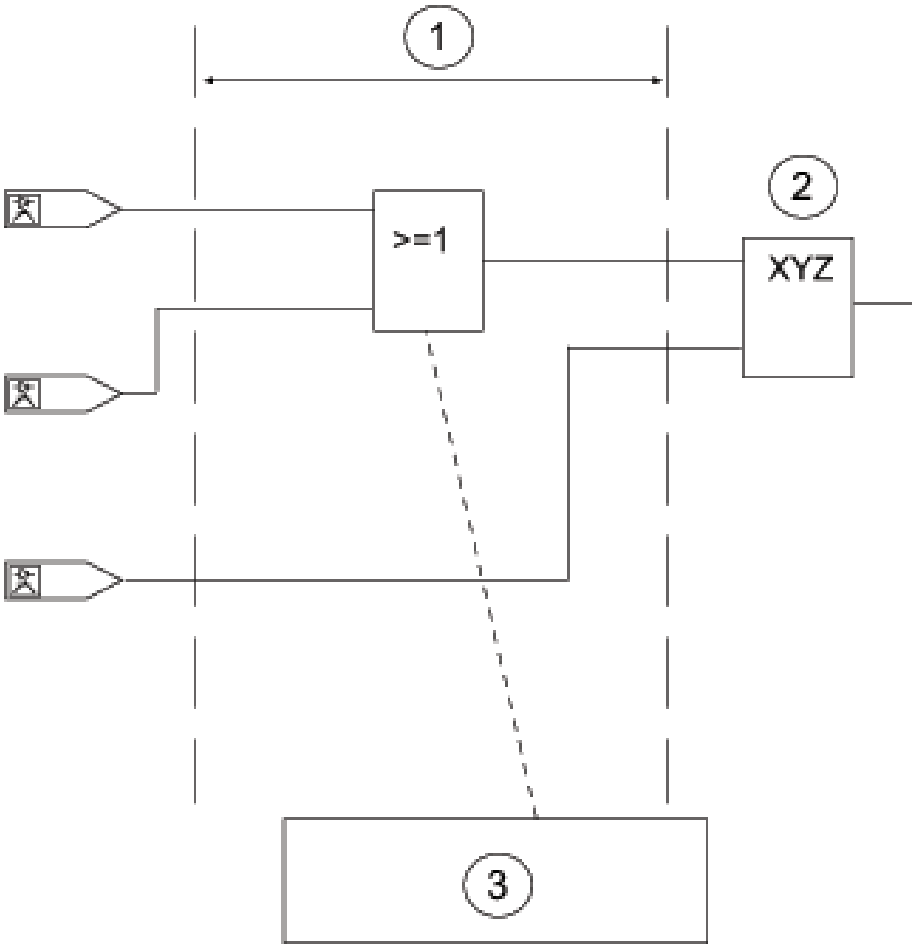


Figure 2: Input Glue logic

1. Signal Matrix Tool input glue logic boundaries
2. Application logic
3. Possible logic types are AND & OR

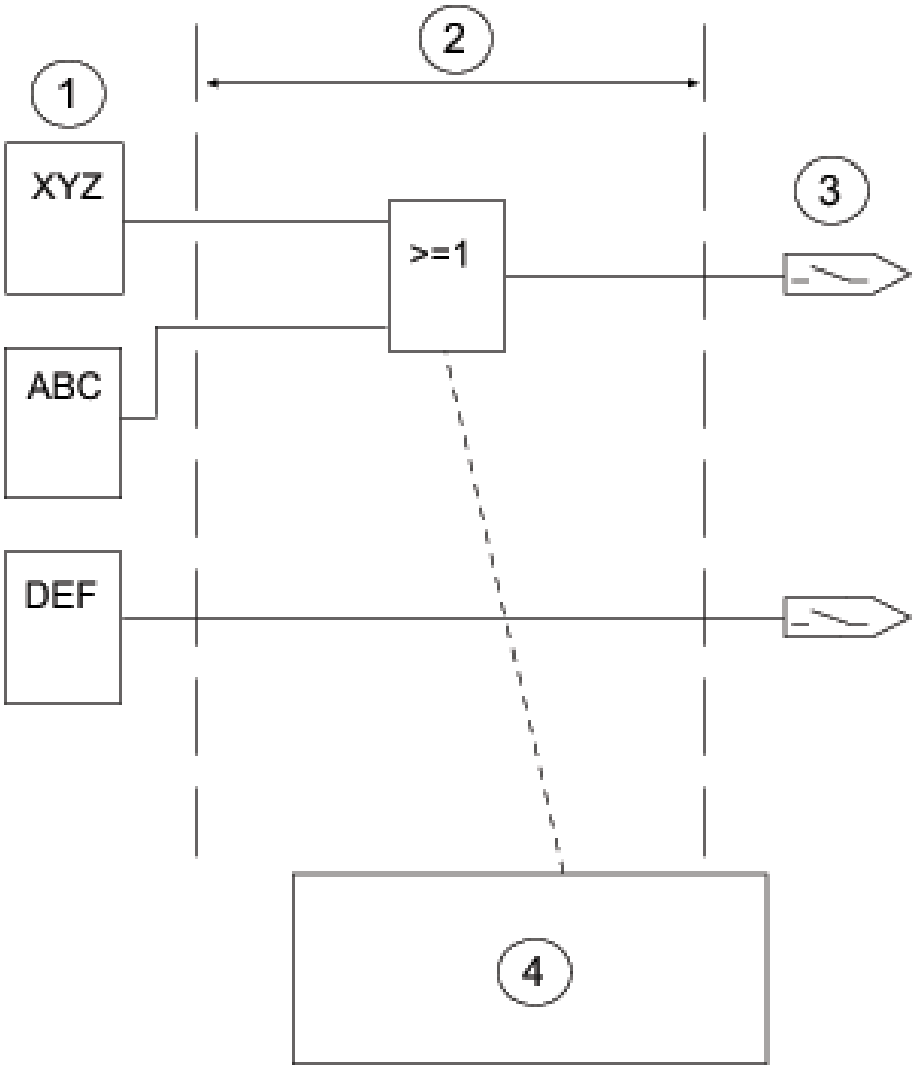


Figure 3: Output glue logic

1. Application logic
2. Signal Matrix Tool input glue logic boundaries
3. Physical outputs
4. Function output signals may be grouped. Possible logic types are AND & OR

Glue logic allows the user to connect several sources to the same target, which is normally not possible. A target can normally have only one source connected to it. In practice, the outputs of multiple source objects are connected to the inputs of a simple boolean logic function and the output of the boolean function is connected to the target object.

The two boolean logic functions that are possible are:

- AND
- OR

The selected boolean logic function is displayed by a combo-box cell adjacent to the target object.

The boolean logic function can be changed by selecting a different logic type from the combo-box after creating some connections.

The logic type can be changed only if there is possibility to create instances of the new logic type. The footprint of the new logic type should match the footprint of the existing logic type, for example, if the existing logic type is OR with four inputs, then the new logic type must be AND with four inputs.

The glue logic type by default is OR. To create glue logic connections with AND logic, the user must first select the AND logic type from the glue logic combo-box. If the number of source objects to be connected exceeds the number of available inputs on the boolean logic function, the Signal Matrix tool will instantiate a new boolean logic function and connect it in a cascaded fashion.

In this manner the number of glue logic connections with one target object is limited by the number of function block instances that can be created from a particular logic type.

If the number of source objects to be connected exceeds the number of available inputs on the boolean logic function, Signal Matrix creates a new boolean logic function and connects it to cascaded glue logic. The only limitation for the cascaded glue logic is the number of function block instances that can be created from a particular logic type.

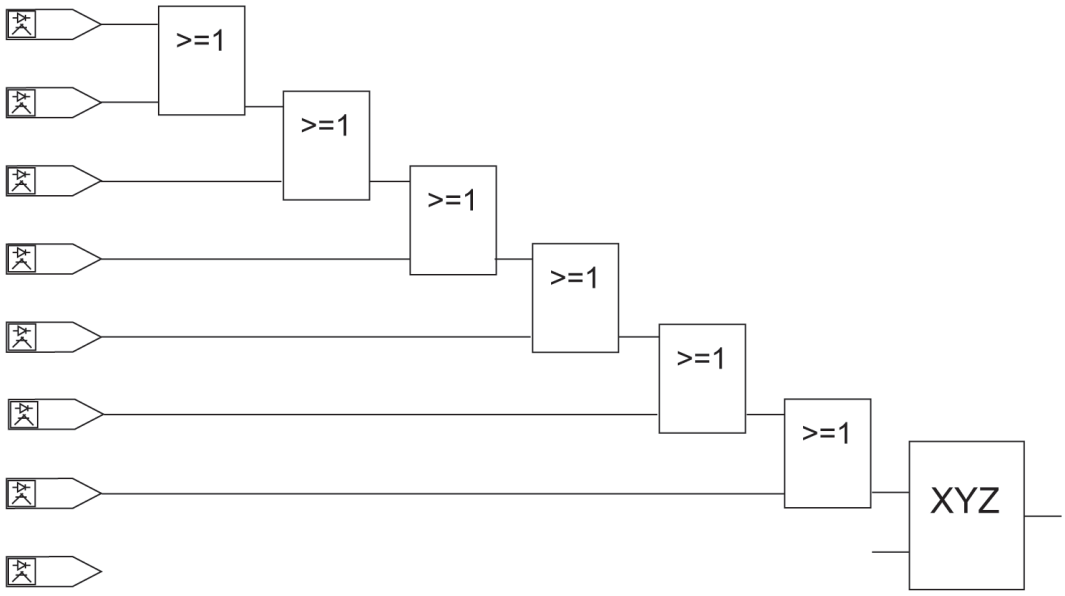


Figure 4: Cascaded glue logic

If there are several different types of the same basic logic type available, the Signal Matrix tool will use the type with the largest number of inputs. This will reduce the overall number of instances of functions. For example, if an OR function is available with two inputs and another OR function with six inputs, the Signal Matrix tool will use the six input OR function for glue logic.

3.25.12 Inverted connections

Some of the Signal Matrix grids like the binary inputs, binary outputs, functions and GOOSE grids support inverted connections.

An inverted connection means that the source is connected to an inverter function and its output is connected to the target.

An inverted connection is created by double clicking a connection cell using the right mouse button. Disconnect by double clicking an inverted connection with either of the mouse buttons.

Inverted connections can be combined with glue logic. In this case, the source is connected to an inverter function, its output is connected to a glue logic function input signal, and the output of the glue logic is connected to the target.

3.25.13 Previewing the grid

- Select **File** > **Print Preview**.
- Click the **Print Preview** button in the toolbar.
- Press CTRL+SHIFT+P.

3.25.14 Printing

1. Select the print option.
   - Selecting **File** > **Print**.
   - Click the **Print** toolbar button.
   - Press CTRL+P.

   The reports can be printed with information about the connected signals, unconnected signals or both connected and unconnected signals.
2. Choose the required print options.
3. Click **OK**.

3.25.15 Exporting to Microsoft Excel

To export the configuration from Signal Matrix to Microsoft Excel:

- Select **Reports** > **Export To Excel File** or
- Click the **Export To Excel File** button in the toolbar.

Save the Microsoft Excel file that contains the exported events. The exported XLS file will open in the application that is associated with XLS files.

3.25.16 Signal Matrix template

Connection configurations created in signal matrix grids can be exported as templates. They can also be imported from templates provided that the template object types are supported by the IED configuration.

3.25.16.1 Exporting Signal Matrix template

Connection configurations created in signal matrix grids can be exported as templates.

1. Create connection mappings in Signal Matrix.
2. On the **File** menu, point to **Signal Matrix Template** and select **Export**.
3. On the **Signal Matrix menu**, select **Export To Template**.
   The **Export save file** dialog opens with the default template path.
4. Click **Save**.
5. Choose the certificate to use for signing the file.

The empty cell information in the signal matrix grid is not exported during template export.

3.25.16.2 Importing Signal Matrix template

Connection configurations created in signal matrix grids can be imported from templates provided that the template object types are supported by the IED configuration.

1. On the **File** menu, point to **Signal Matrix Template** and select **Import**.
2. On the **Signal Matrix menu**, select **Import To Template**.
3. In the **Signal Matrix Template Import** dialog, select the grid type such as binary inputs, analog outputs or GOOSE.
4. Click **Import** and select the template file (.asmtct/.smtct) from the template folder.
5. Click **Open file** and the connection is imported.

Imported connections appear in blue color to differentiate between existing and imported connections.

Empty cell information is not updated during template import. An existing cell connection in Signal Matrix is updated only in two cases.

- An inverter connection has been replaced with a direct connection or vice versa in the imported IED.
- There is a change in the GOOSE/SMV mappings made in the GOOSE grid of the imported IED.

PCM600 checks the integrity of the template during import. If the template was signed with a certificate that does not exist in the computer's certificate store, a dialog will be shown for choosing a certificate file to use in checking the integrity of the template.

There can be several reasons why the integrity check fails:

- The template has been created with PCM600 version which does not sign the template files
- The computer certificate store does not contain the certificate needed to do the verification
- Verification itself fails

All the listed reasons above mean that integrity of the template could not be verified, and it is possible that someone has tampered with the template. If the integrity can't be checked or the verification fails, it is still possible to proceed with import. For more information on integrity certificates, see *Chapter 2.4.2.5 Managing export file certificates*.

3.25.17 Reading and writing an application from or to an IED

These tasks are accomplished using the Common Read/Write Tool. For more information about reading or writing to an IED, refer **Common Read** > **Write tool**.

3.25.18 Expanding and collapsing modules

The expand functionality shows the channels of a hardware module, signals of a function block and GOOSE attributes of the logical nodes. They can be collapsed using the collapse option.

To expand or collapse a source or target module:

- Double-click on the summary rows or columns.
- Double-click on the source or target modules.
- Click on the **Collapse** > **Expand button in the toolbar**.
- Select **Signal matrix** > **Collapse** > **Expand** for the grid names of the rows and columns to appear.

3.25.19 Automatic execution order

The Signal Matrix tool can calculate the execution order and cycle time for the 615 series IEDs.

The calculation can be done either by clicking the **Calculate EO and CT** toolbar button or by using the saving tool. Using the tool assigns the proper execution order for all the function blocks present in the configuration data server including the glue logic function.

If any errors occur during the calculation or assignment of the execution order and cycle time, they are logged in the PCM600 output window.



The appearance of the grid is based on the IED's capability.

3.25.20 Filtering rows and columns

The filtering functionality is used for filtering the rows and columns of the grid in the Signal Matrix tool. The X, I, Connected, Disconnected and No Filter are the filtering options available. The grids can be filtered using General Filter or Column/Row Filter. The General Filter option filters the entire grid of rows and columns. The Column/Row Filter option filters a specific row or column.

- To activate the filtering option using the toolbar:

- Click **On/Off General filter for (grid name)** for general filtering.
- Click **On/Off Column/Row filter for (grid name)** for column/row specific filtering.

An extra row and column appears in the header rows and header columns displaying the drop down cells.

- To activate the filtering option using the main menu:

1. To activate the filtering option using the main menu:
2. Select:
   - **On/Off General filter for (grid name)** for general filtering.
   - **On/Off Column/Row filter for (grid name)** for column/row specific filtering.

3.25.21 Flipping signal column text orientation

The appearance of the signal column text can be vertical or horizontal.

1. Select the **Flip Columns** option.
   - Click the **Flip Signal Column Text** button on the toolbar.
   - On the main menu, point to **Signal Matrix** and select **Flip Signal Column Text**.
2. Select **Horizontal** or **Vertical** for a grid name and click **Apply** to change the text orientation of respective grid.
3. Click **Apply All Horizontal** to change the text orientation to horizontal in all the grids.
4. Click **Apply All Vertical** to change the text orientation to vertical in all the grids.
5. Click **Cancel** or press ESC to close the **Flip Columns** window.

3.25.22 Finding

The find feature can be used to search and locate, for example, function blocks or composite function blocks, signals and channels in the Signal Matrix grid.

1. Select the **Find** option in one of the alternative ways.
   - Click the **Find** toolbar button.
   - Select **Edit** > **Find** from the main menu.
   - Press CTRL+F.
2. Enter the search string and choose the required options by selecting the **Match Case** or **Match Whole Word** check boxes.
3. Click **Find Next** to find the next matching text.
4. Click **Cancel** to stop the search.

3.26 Signal Monitoring

Signal Monitoring is a tool for visualizing all configured signals of an IED.

The Signal Monitoring tool consists of:

- **List View** which is an overview of all the signals
- One or more tabbed pages where each tabbed page contains a set of signals displayed with a seven segment graphical LED and/or binary LED display.

3.26.1 Starting Signal Monitoring

To start Signal Monitoring:

1. Right-click an IED in the object tree.
2. Select **Signal Monitoring** from the shortcut menu.

Alternatively, start Signal Monitoring by selecting **Tools** > **Signal Monitoring**.

3.26.2 Closing Signal Monitoring

To close Signal Monitoring:

1. Right-click the **Signal Monitoring** tab at the top of the Signal Monitoring window.
2. Select **Close** from the shortcut menu.

Alternatively, close **Signal Monitoring** by clicking the close button at the upper right side of the window.

3.26.3 Online monitoring

To start continuous online monitoring:

- Click the **Continuous Reading** button on the toolbar or
- Select **IED** > **Toggle Continuous Reading** .



The menus are available only if the corresponding IED is connected to PCM600 with the proper IED communication properties configured.

The values displayed are refreshed automatically when new values are received. Meanwhile, it is possible to freely switch to other tools without having to stop the monitoring process.

To stop continuous online monitoring:

- Release the **Continuous Reading** button on the toolbar or
- Select **IED**, deselect **Toggle Continuous Reading**.

The last received values remains displayed when online monitoring stops.

3.26.4 Manual refresh

To force a synchronous value refresh of signal monitoring:

- Click the **Read Latest Values from IED** button on the toolbar or
- Select **IED** > **Read Latest Values from IED**.

The menus are available only if the corresponding IED is connected to PCM600 with the proper IED communication properties configured.

PCM600 freezes until the values or time-out events are received. Meanwhile, it is not possible to switch to other processes in PCM600.

3.26.5 Switching views

Switch to another view in the Signal Monitoring tool by clicking the tab at the top of the **Signal Monitoring** view.

The number of tabbed pages available and their contents depend on the configuration of IED.

3.26.6 Filtering signals

Filtering enables reducing the amount of data events that are displayed to a certain number of wanted subsets.

To filter the monitored signals:

- Switch to a specific graphical tab view or
- Apply a filter to the **List View** tabbed page.

To filter monitoring data:

1. Select the **List View** tab.
2. Click the **Filter On/Off** toolbar button or select **Signal Monitoring** > **Filter On/Off** to enable filtering.
3. The columns and the column values are displayed as menu items in a drop-down list in the filter bar, which is found below the column headers. Select a value from the drop-down list to display the specific events of the value of a column.

To specify more detailed filter conditions:

1. Select **Custom Filter**.

   A dialog box called **Custom Filter for Monitoring List View Column** will be displayed, where the values are displayed by combining two conditions with an OR condition or an AND which can be specified.
2. Click **OK** to apply the filtering conditions.

The filters can be used on more than one column.

To turn off the filter condition on a specific column:

1. Select **No filter** from the column's drop-down list.

To turn off all filters:

1. Select the **List view** tab.
2. Select **Signal Monitoring Filter On/Off** or
   - Click the filter on/off button on the toolbar.

3.26.7 Printing

1. Preview the document before printing it.
   - Select **File** > **Print Preview**.
   - Click the **Print Preview** button in the toolbar.
   - Use the shortcut keys CTRL+SHIFT+P.
2. Open the print dialog box to print the last retrieved values.
   - Select **File** > **Print** .
   - Click the **Print** button in the toolbar.
   - Press CTRL+P.
3. In the **Print** dialog, select the wanted options and click **OK**.



The print layout is shown in the List View format.

3.26.8 Exporting to Microsoft Excel

To export the configuration that is currently displayed in Signal Monitoring to Microsoft Excel:

- Select **Reports** > **Export To Excel File** or
- Click the **Export To Excel File** button in the toolbar.

The user should then select the path and name of the XLS file, which has the events. The exported file will be automatically launched in Microsoft Excel.

3.26.9 Forcing

Forcing Mode is accessible in frame menu depending on the access rights and IED capabilities.

- To open a forcing session.
  1. Select **IED** > **Forcing Session** on the List View tab.
  2. If IED successfully enters in forcing mode, the **Start editing signal value for forcing** button is displayed on the toolbar. Click the **Start editing signal value for forcing** button on the toolbar.
- Every signal that can be forced is displayed with a special background color in the List View. Each of the following actions can be repeated several times.
  - Edit an analog signal by double-clicking the signal cell, type a new value and press ENTER.

  - Edit a digital signal by selecting a different signal state from the available drop-down menu.
  - If both analog and digital signals are already in the state that should be forced, right-click and select **Force Signal Value** from the shortcut menu.
  - Remove a forcing flag by right-clicking an edited value and select **Unforce Signal Value** from the shortcut menu.
  - Assign the same command for several signals by holding down the left mouse button while moving the mouse in the grid.
- Depending on the selection, it is possible to,
  - Force all selected signals into their current state
  - Force all selected digital signals into true or false state
  - Force all analog signals to 0
  - Unforce all selected forced signals
- Every re-edited value is highlighted once the editing phase is complete.
  - Force or unforce the selected and edited values by clicking the **Acknowledge and Send** button on the toolbar.
  - Ignore the changes made for forcing by clicking the **Cancel** button on the toolbar.
  - After the last action, the **Start editing signal value for forcing** button is released. Monitoring tool automatically refreshes all its values and all signals forced in the IED remain highlighted.

    If it is not required to force/unforce a signal, select **IED** and deselect **Forcing Session**.

3.27 Security Policy Settings

Security Policy Settings is used to configure the parameters related to IED security. User can configure one or more IEDs configuration together from **Substation** > **Voltage Level** > **Bay** > **IED Group** > **IED** in the plant structure.

- *Chapter 3.27.1 Starting Security Policy Settings*
- *Chapter 3.27.2 Security Policy Settings*
- *Chapter 3.27.3 Saving Security Policy Settings*
- *Chapter 3.27.4 Partial Read from IED*
- *Chapter 3.27.5 Partial Write to IED*
- *Chapter 3.27.6 Collapsing and expanding parameter groups*

3.27.1 Starting Security Policy Settings

1. Launch the **Security Policy Settings** from **Substation** > **Voltage Level** > **Bay** > **IED Group** > **IED** in the project structure.
2. Select **Tools** > **Security Policy Settings** to start the Security Policy Settings.



Security Policy Settings can be launched by Security Administrator only.

Configurations cannot be exported.

Reporting option is not supported.

IED Compare tool is not supported.

Common Read/Write operations not supported

3.27.2 Security Policy Settings

The policy settings can be set using the Security Policy Settings tool. If tool is opened from **Substation** > **Voltage Level** > **IED Group** > **Bay** level, settings that are common across IED's under the plant structure selection are grouped under "Common Parameters" section. When these settings are set with a value, it applies to all corresponding IED's under the selected plant structure. Settings which are device specific will be shown respectively under that IED and any change done is applicable to those IED only.

The tool checks whether the entered value is valid and within the setting range. If the new value is not valid, an error message appears in the output window.

Once the tool is launched and if any value is modified, value will be shown in highlighted.

IED's which do not support Security Policy Settings tool will be shown as "not supported".

Once the tool is opened, if the plant structure selection is changed, the tool's view will update accordingly.

3.27.3 Saving Security Policy Settings

On the **File** menu, click **Save** to save the changed setting values.

The operation saves the changed values to the database. This applies to all IED's if save is happening from **Substation** > **Voltage Level** > **IED Group** > **Bay** > **IED** level.

3.27.4 Partial Read from IED

Partial Read operation can be done from **Substation** > **Voltage Level** > **IED Group** > **Bay** > **IED** level

To read settings from the IED:

- Click the **Read settings from IED** toolbar button.
- Progress bar indicates the process completion.
- If there are multiple IEDs that support Security Policy Settings tool, partial read happens sequentially one after another.

3.27.5 Partial Write to IED

To write settings to the IED:

- Click the **Write settings to IED** toolbar button.
- Progress bar indicates the process completion.
- If there are multiple IEDs that support Security Policy Settings tool, partial write happens sequentially one after another.

3.27.6 Collapsing and expanding parameter groups

To expand or collapse a single group, you can use the “⊞” or “⊟” icons which expand or collapse the groups.

4 Glossary

ACT	1. Application Configuration tool in PCM600 2. Trip status in IEC 61850
APCMI	PCM IED
ARP	Address Resolution Protocol
BITS	Background intelligent transfer service
CAM	Centralized account management
CET	Communication Engineering tool
CID	Configured IED description
CMT	Communication Management tool in PCM600
CRW	Configuration read/write
DA	Data attribute
DHT	Disturbance Handling tool in PCM600
DO	Data object
EVT	Event Viewer tool in PCM600
FC	Functional constraint
FPN	Flexible product naming
FTP	File transfer protocol
GDE	Graphical Display Editor in PCM600
GOOSE	Generic Object-Oriented Substation Event
HMI	Human-machine interface
HWT	Hardware Configuration tool in PCM600
ICD	IED capability description
ICM	IED configuration migration
IEC 61850	International standard for substation communication and modeling
IED	Intelligent electronic device
IID	Instantiated IED description
LD	Logical device
LHMI	Local human-machine interface
LN	Logical node

MAC	Media access control
MMS	1. Manufacturing message specification 2. Metering management system
MON	Signal Monitoring tool in PCM600
OOF	Order option flag
PC	1. Personal computer 2. Polycarbonate
PCM600	Protection and Control IED Manager
PST	1. Parameter Setting tool in PCM600 2. Product Selection Tool
R-GOOSE	Routable GOOSE. Enables GOOSE communication over a wide area network.
RCB	Report control block
R-SV	Routable SV. Enables SV communication over a wide area network.
SAB600	Substation automation builder tool
SCD	Substation configuration description
SCL	XML-based system configuration description language defined by IEC 61850
SDM600	A software solution for automatic management of service and cyber security relevant data across substations
SLD	Single-line diagram
SMT	Signal Matrix tool in PCM600
SMV	Sampled measured values
SV	Sampled Values
SVG	Scalable vector graphics
UAC	User account control
UDN	User-defined name
UMT	User Management tool in PCM600
Update Manager	Software that helps the user define right connectivity package versions for different applications and tools
WHMI	Web human-machine interface

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