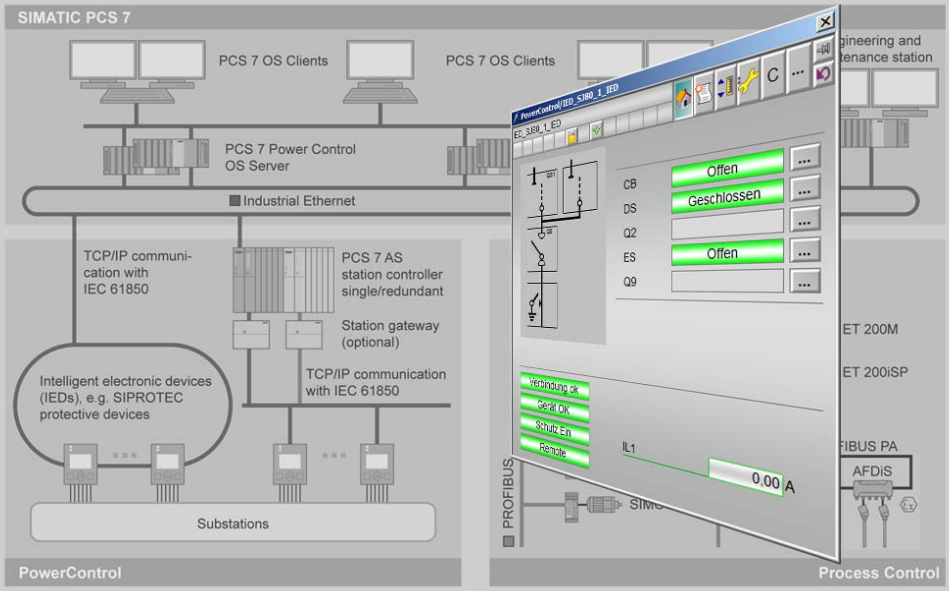
SIMATIC PCS 7 PowerControl – Integration of Medium Voltage Switchgear according to IEC 61850

SIMATIC PCS 7 PowerControl

Application Description • February 2013



Applications & Tools

Answers for industry.

SIEMENS

Siemens Industry Online Support

This entry is taken from Siemens Industry Online Support. The following link takes you directly to the download page of this document:

http://support.automation.siemens.com/WW/view/en/67688155

SIEMENS

SIMATIC PCS 7

SIMATIC PCS 7 PowerControl

Application Description

Warranty and Liability

Note

The application examples are not binding and do not claim to be complete regarding configuration, equipment and any eventuality. The application examples do not represent customer-specific solutions. You are responsible for ensuring that the described products are used correctly. These application examples do not relieve you of your responsibility to use sound practices in application, installation, operation and maintenance. When using these application examples, you recognize that we will not be liable for any damage/claims beyond the liability clause described. We reserve the right to make changes to these application examples at any time and without prior notice. If there are any deviations between the recommendations provided in this application example and other Siemens publications (e.g. catalogs), the contents of the other documents shall have priority.

We do not accept any liability for the information contained in this document.

Any claims against us – based on whatever legal reason – resulting from the use of the examples, information, programs, engineering and performance data etc., described in this application example shall be excluded. Such an exclusion shall not apply in the case of mandatory liability, e.g. under the German Product Liability Act (“Produkthaftungsgesetz”), in case of intent, gross negligence, or injury of life, body or health, guarantee for the quality of a product, fraudulent concealment of a deficiency or violation of fundamental contractual obligations (“wesentliche Vertragspflichten”). The damages for a breach of a substantial contractual obligation are, however, limited to the foreseeable damage, typical for the type of contract, except in the event of intent or gross negligence or injury to life, body or health. The above provisions do not imply a change in the burden of proof to your disadvantage.

Table of Contents

1 Automation Task

1.1 Overview

Background

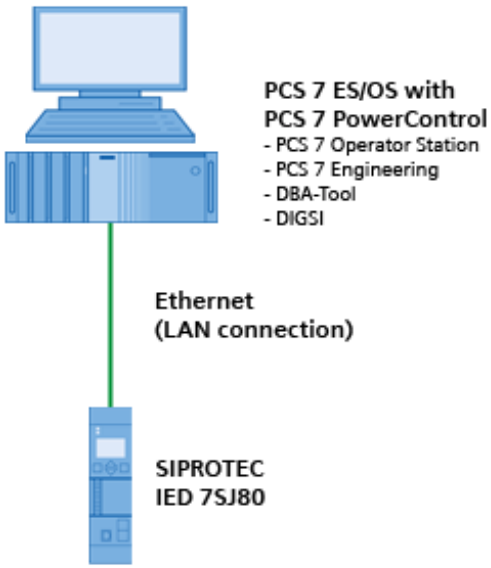
Users of station control systems (SAS, Station Automation System) increasingly demand the application of standardized communication protocols to enable combining various devices and systems independent of the manufacturer.
In power generation and supply in particular, but also in many process automation applications of medium voltage switchgear, standard IEC 61850 has established itself. Standardized communication and engineering is the key to interoperability here.

The technology component SIMATIC PCS 7 PowerControl supports precisely this standard - IEC 61850 (Using the IEC 61850 protocol).

Integration of protective gear

Protective gear is used for controlling, switching, measuring and automating of electrical installations and networks. This refers to intelligent devices, so-called "Intelligent Electronic Devices" (IED), which record abnormal operating states and errors and automatically react accordingly.
In the case of an error, only the affected plant sections are switched off. This is achieved by safe, fast and selective switching-off, diagnosing and reporting of failed plant sections.

Figure 1-1: Configuration



This protection technology is generally used in supply networks > 1 kV. The relevant variables are recorded indirectly with current and voltage transformers. The active elements used are circuit-breakers and protective gear.

In low voltage networks, the plant protection is generally realized by means of fuses and circuit-breakers.

Task of the protective gear

The task of protective gear is to allow operational over-current yet prevent undue loads on lines and devices. Due to hazardous effects in the case of a short-circuit, the affected equipment must be switched off within the shortest of time.

Otherwise, an error should only disrupt the supply for as few consumers as possible. Therefore, the protective devices within the network must detect the error, switch off by themselves or send trigger commands to the respective switches. The protective devices should be set in such a way as to allow for selective switch-off.

1.2 Requirements

Apart from the high requirements for local automation, many SIMATIC PCS 7 projects also have the option to integrate and monitor the medium voltage switchgear, which supplies the power, into a total automation solution. In order to fulfill this requirement, the new technology component SIMATIC PCS 7 PowerControl was developed. It enables integrating switchgear for the power supply using the IEC 61850 communication protocol in the familiar look&feel of SIMATIC PCS 7.

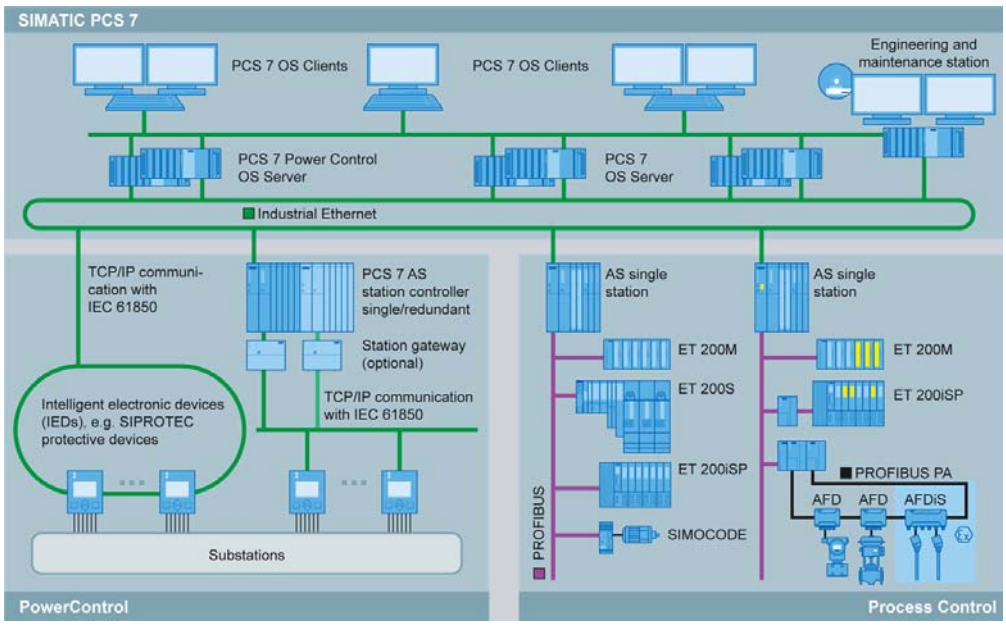
In an electrical switchgear, the electrical power is distributed or transformed. Loads/consumers are bundled in load groups. The network nodes designed as busbars use switchgear to connect incoming and outgoing lines, the so-called branches. When designing such a switchgear, the change of the network topology for failures, such as enabling and grounding of operating tools for maintenance works must also be considered.

2 Solution

2.1 Automation of electrical switchgear with PowerControl

Systems for automating electrical switchgear for the power supply of the process were in the past strictly separated from systems for process automation. SIMATIC PCS 7 PowerControl now enables combining the process automation and the automation of electronic switchgear for medium voltage in the range of 4 to 30 kV in a control system.

Figure 2-1: Combination of control system and power management



For switchgear automation, i.e. for protection, control measuring and monitoring tasks in the electronic power transmission and distribution, “Intelligent Electronic Devices” (IEDs) are used, e.g. SIPROTEC switchgear or interoperable “third-party” devices. These can also be integrated homogenously into the SIMATIC PCS 7 process control system via the Ethernet TCP/IP communication protocol IEC 61850.

2.1.1 Application of the SIPORTEC 7SJ80 protective device

The SIPROTEC Compact 7SJ80 can, for the line protection of high and medium voltage networks, be used with grounded, low-resistance grounded, isolated or compensated starpoint design. As a supplement for transformer differential protection, the IED fulfils all tasks of a reserve protection.

SIPROTEC Compact 7SJ80 offers flexible protection functions. For fulfilling individual requirements, up to 20 additional protection functions can be added to the already existing protection functions. This enables realizing, for example, a frequency change protection or a reverse power protection.

Figure 2-2: SIPROTEC protection device 7SJ80

The protection device supports the control of the circuit-breaker as well as further switchgear and automation functions. The integrated programmable logic (CFC) enables the user to add own functions for automating his switchgear (interlocking). Users can furthermore create user-definable messages.

LEDs to be assigned by the user and a six-line display provide for a unique and clear display of the process states. The up to 9 function keys enable quickly and safely reacting in each situation which guarantees high operational safety.

Note

Further information is available via the Siemens internet page:

Protection device SIPROTEC 7SJ80

2.1.2 Using the IEC 61850 protocol

The **IEC 61850** standard of the International Electrotechnical Commission (IEC) describes an Ethernet-based substation automation protocol (transmission protocol) for the protection and process control of electrical switchgear of medium and high voltage technology (station automation).

The IEC 61850 protocol contains more comprehensive definitions than other protocols and is aimed at:

- interoperability between devices from different manufacturers
- long-term investment security
- efficient exchange of object-oriented data models between engineering systems

The standard has been defined in collaboration with manufacturers and users to provide a uniform, future-proof basis for protection technology, communication and control of switchgear. IEC 61850 has established itself as the worldwide communication standard on the automation of switchgear marked.

Note More information is available via the IEC 61850 website.

2.2 Advantages of PCS 7 PowerControl

The automation based on SIMATIC PCS 7 PowerControl has decisive advantages compared with previous automation solutions.

The homogenous user interface for process automation and station automation simplifies the operation and at the same time reduces the risk of operating errors in the overall system.

Cost reduction

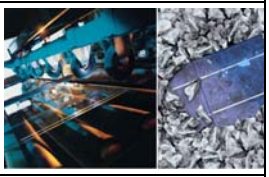
- Only one system for automation and switchgear
- No cabling between automation and switchgear necessary
- Investment security through standardization

Reduction of operational costs

- Fewer operating staff due to one system for the process and energy sections of the plant
- Simplified maintenance through a uniform General view
- Higher availability due to fewer components – Lower life cycle costs

2.3 Typical fields of application

Table 2-1

Industry		Task
Chemical industry		• Reliable and operationally safe power supply • Load shedding at power cuts • Preventing peak loads • High energy consumption → Energy saving • Electrical energy = Raw material, management of energy • Optimizing the production
Food & Beverages		
Water		
Glass / Solar		
Pharmaceutical industry		
Oil & Gas		
Cement		

2.4 Hardware and software components used

The document on hand was generated using the following components:

Hardware components

Table 2-2

Component	MLFB/order number
IPC 547D	6ES7660-3AC11-2CA0
SIPROTEC 7SJ80x	7SJ8031-1EA96-3FB3
Power supply	

Software components

Table 2-3

Component	MLFB/order number	Note
SIMATIC PCS 7 V8.0 SP1	6ES7658-5AX08-0YA5	
SIMATIC PCS 7 PowerControl OS Engineering V8.0 SP1	6ES7658-7LX08-0YA5	Engineering expansion
SIMATIC PCS 7 PowerControl OS Runtime V8.0 SP1	6ES7658-7MX08-0YA0	OS expansion

Note For configuring the SIPROTEC 7SJ80 protection device the DIGSI software is used in addition. In our text example, DIGSI is operated on one computer together with SIMATIC PCS 7.

Generally, however, we recommend installing both software components on a separate PC each.

2.5 Objective of this documentation

This document describes the simple application of PCS 7 PowerControl and the integration of the SIPROTEC 7SJ80 protection device in the SIMATIC PCS 7 process control system.

Furthermore, changes in the application are explained to you using the PC_FEEDER example project.

Main contents of this document

This document deals with the following main points on the topic of PCS 7 PowerControl:

- Configuration and settings
- Commissioning
- Changes in the application

Validity

SIMATIC PCS 7 V8.0 Upd1 or higher and SIMATIC PCS 7 PowerControl V8.0 SP1

Assumed knowledge

Basic knowledge of SIMATIC PCS 7 and DBA engineering is assumed.

3 Installation

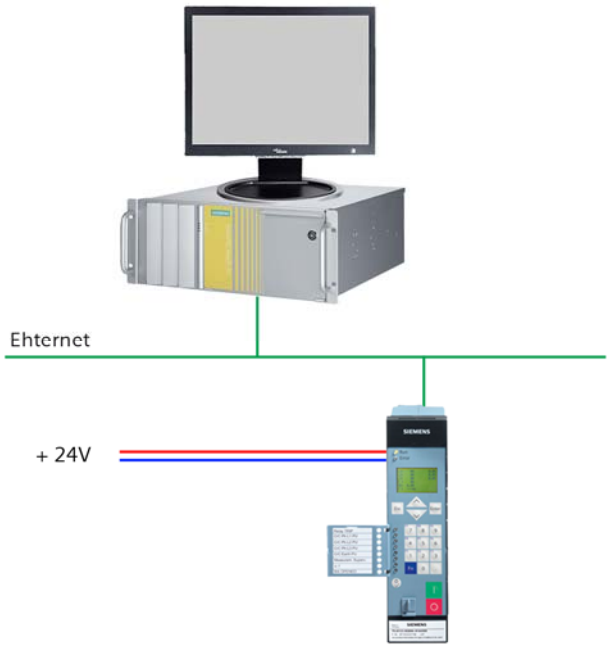
This chapter describes which hardware and software components have to be installed. It is also important to read the descriptions, manuals and any delivery information supplied with the products.

3.1 Hardware installation

Hardware installation

The figure below shows the hardware setup of the application.

Figure 3-1: IPC 547D and SIPROTEC 7SJ80 protection device



NOTICE	The setup guidelines for SIPROTEC protection devices must generally be followed. For respective information see manual: 7SJ80xx Manual V4.6 A4

3.2 Installation of the PCS 7 PowerControl software

Hardware requirements

The PowerControl software is a technology component for the SIMATIC PCS 7 process control system and can therefore only be operated on devices which meet the hardware requirements of PCS 7.

The requirements are described in the readme file of the PCS 7 software. In contrast to the PCS 7 readme file, however, a storage capacity of 4 GB is required for large projects with more than 7500 process objects for the ES station. The virtual main memory should at least have 4GB.

Software requirements

A SIMATIC PCS 7 V8.0 Upd.1 installed and licensed according to the respective station type is required.

Runtime environment

Running PCS 7 PowerControl V8.0 SP1 requires, apart from PCS 7 V8.0 Upd.1, one of the following operating systems:

- Microsoft Windows XP Professional SP3 (32Bit)
- Microsoft Windows Server 2003 SP 2 Standard Edition (32Bit)
- Mircosoft Windows Server 2003 R2 SP2 Standard Edition (32Bit)
- Microsoft Windows 7 Ultimate SP1 (32Bit)
- Microsoft Windows 7 Ultimate SP1 (64Bit)
- Microsoft Windows Server 2008 SP2 Standard Edition (32Bit)
- Microsoft Windows Server 2008 R2 SP1 Standard Edition (64 Bit)

Communication

For the communication, the object oriented IEC 61850 protocol is used. "TCP/IP" is used as basic transmission protocol and the client - server communication is based on the "MMS" standard (Manufacturing Messaging Specification).
Furthermore, two "Peer-to-Peer" services are used for the real-time communication, which are based on the Ethernet protocol.

Installation

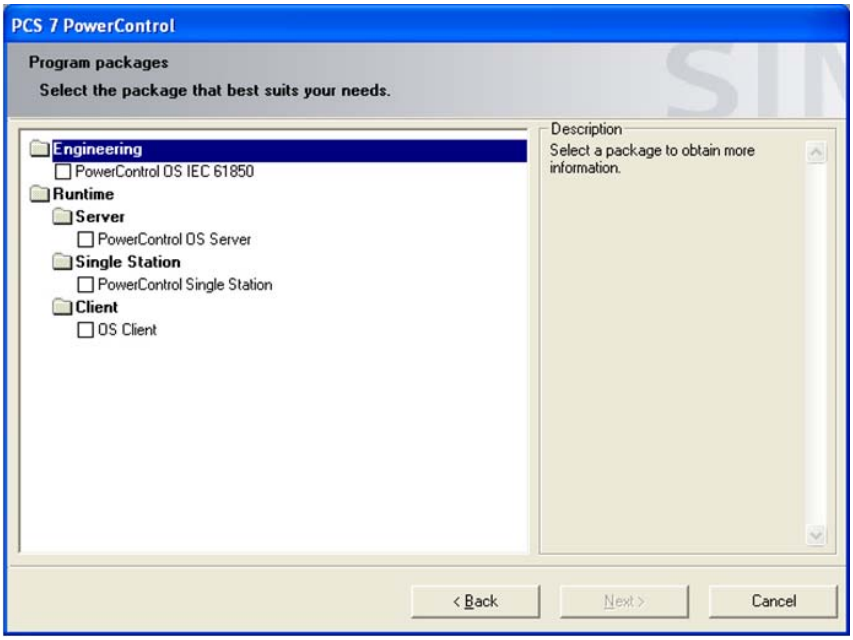
The following table shows the installation steps to be performed.

Table 3-1: PCS 7 TeleControl installation steps

Step	Action
1.	Installation of the operating system
2.	Installation of “third party” software
3.	Installation of SIMATIC PCS 7
4.	Installation of SIMATIC PCS 7 PowerControl
5.	Installation of the authorizations and licenses

The following figure shows the package selection of the PCS 7 PowerControl setup.

Figure 3-2: PCS 7 PowerControl installation dialog



Note The “PowerControl Setup Guide” documentation is referred to for a detailed description.

3.3 Functional expansion through PowerControl

SIMATIC PCS 7 PowerControl expands the familiar engineering and the process management functions of the control system.

Specific function and performance characteristics of PCS 7 PowerControl are:

Engineering

- Object library with function blocks, symbols and faceplates
- Object-oriented type/instances concept
- Automatic generation of the objects for the operator station
- Integration of new IEDs through the import of the IEC 61850 device description (ICD)

Process management

- Faceplates for SIPROTEC protection devices in SIMATIC PCS 7 APL style
- Uniform behavior for alarms, messages, operator control and monitoring
- Diagnostics functionality for each IED

4 Configuration and Settings

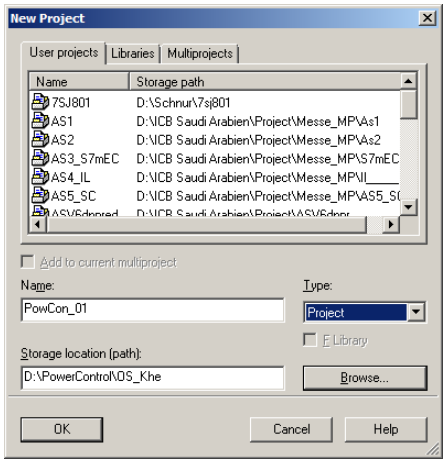
4.1 Configuring the ES/OS station

4.1.1 Creating a SIMATIC PCS 7 project

A new project is created in the SIMATIC Manager. A PC station is configured in this project.

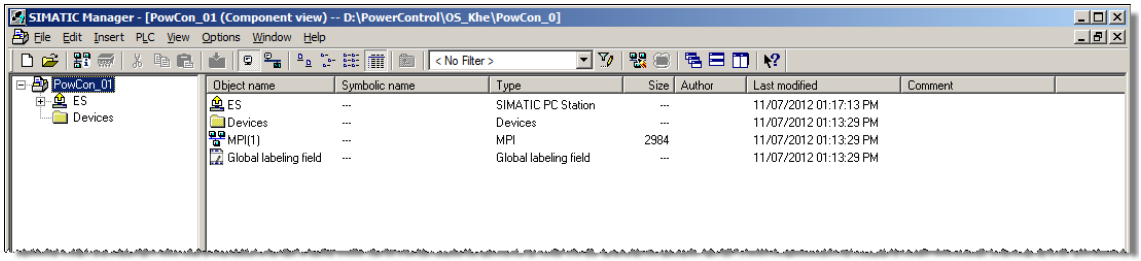
SIMATIC Manager

1. Create a new project in the SIMATIC Manager via "File > New…".
2. Assign a project name and specify the storage path for the project.

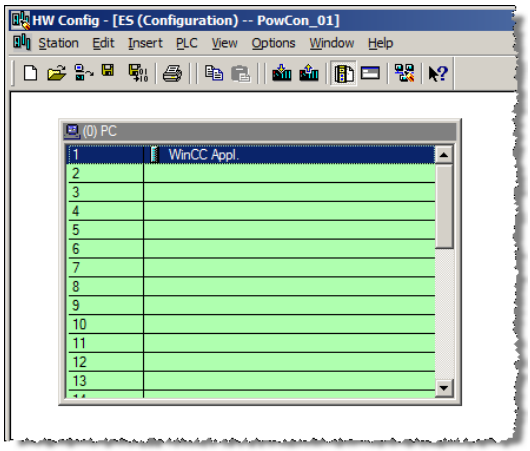


3. Configure a SIMATIC PC station in the project via context menu command "Insert New Object > SIMATIC PC Station".

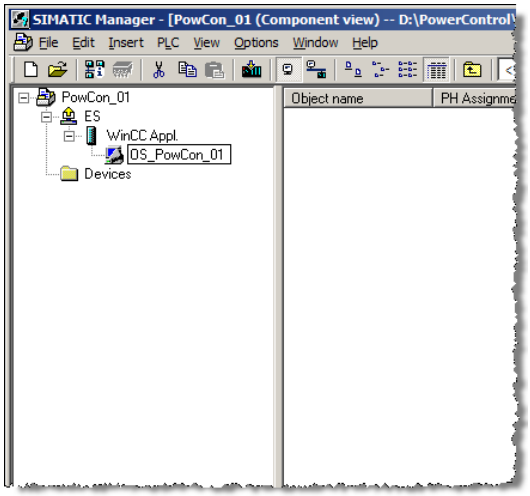
Figure 4-1: SIMATIC PCS 7 project with PC station



4. Configure the SIMATIC PC station via HW Config, as familiar with PCS 7, using a WinCC application.

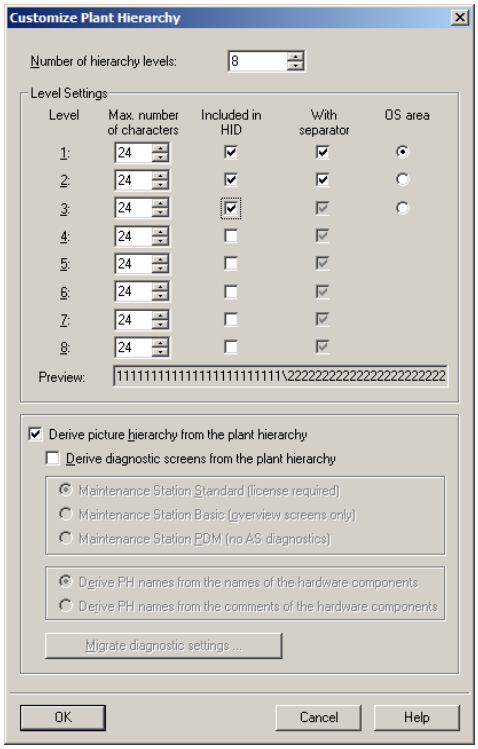


5. Assign meaningful names for the OS application, for example, “OS_PowCon_01”.



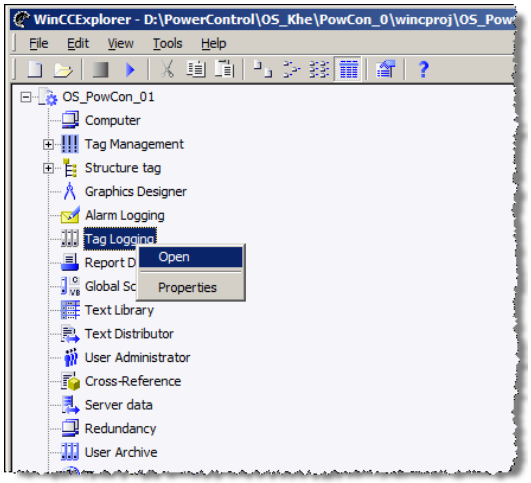
6. In the Component view of the project you go to the Plant View. Here you call the Plant Hierarchy of the folder structure via "Options > Plant Hierarchy > Settings".

7. Make your selections regarding the representation of the Plant Hierarchy. The checkbox "Derive picture hierarchy from the plant hierarchy" must remain active in order to display the picture of the PH on the OS.

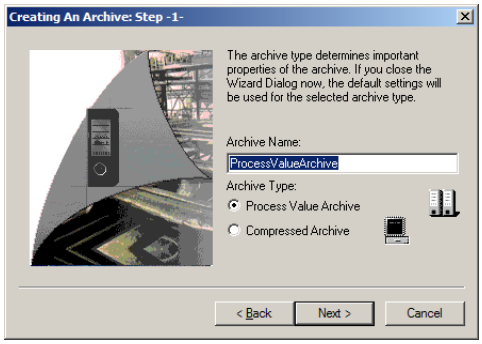


WinCC Explorer

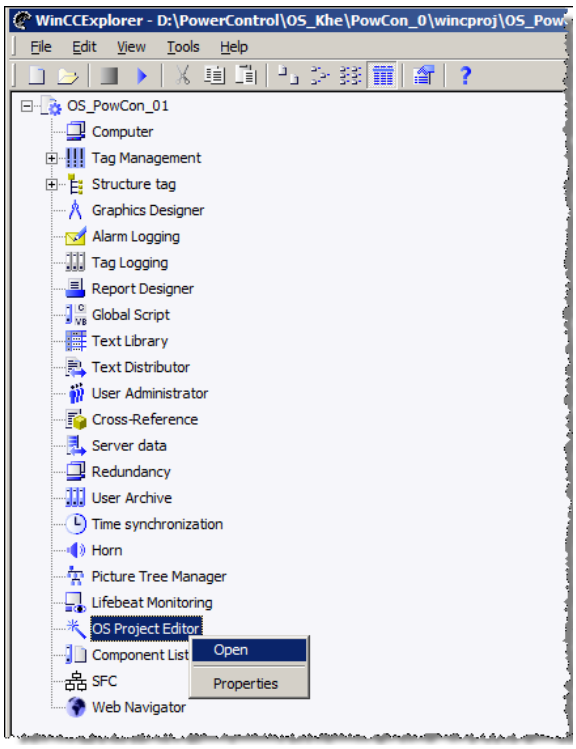
8. For a more consistent later configuration, it is recommended to open the OS application and creating at least one process archive value in the Tag Logging configuration.



9. The process value archive can be simply and quickly created with the "Archive wizard".



10. Subsequently, you open the OS project editor in the WinCC Project Editor. It is used to make the basic configuration of the OS. Simply confirm the basic settings by pressing the "OK" button.



This completes the configuration of the SIMATIC PCS 7 project.

4.2 Configuration of the SIPROTEC protection device

The individual configuration and settings of the SIPROTEC devices are performed with the DISGI 4 software. The configuration is performed **offline**. The created data are subsequently loaded via the respective **interfaces of the** SIPROTEC protection device.

4.2.1 Creating a project

An individual project must be created in the SIMATIC Manager for the SIPROTEC protection device.

Note The protection device cannot be integrated into the already created PCS 7 project.

1. Create a new project in the SIMATIC Manager via "File > New…".
2. Assign a project name and specify the storage path for the project.

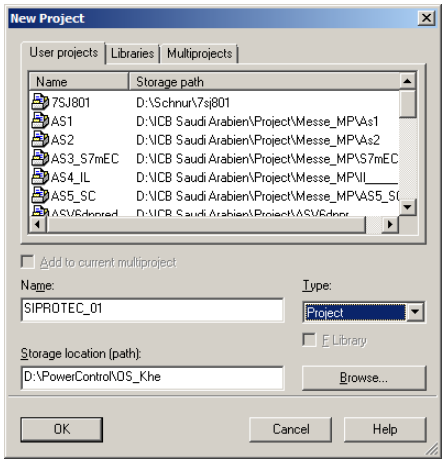
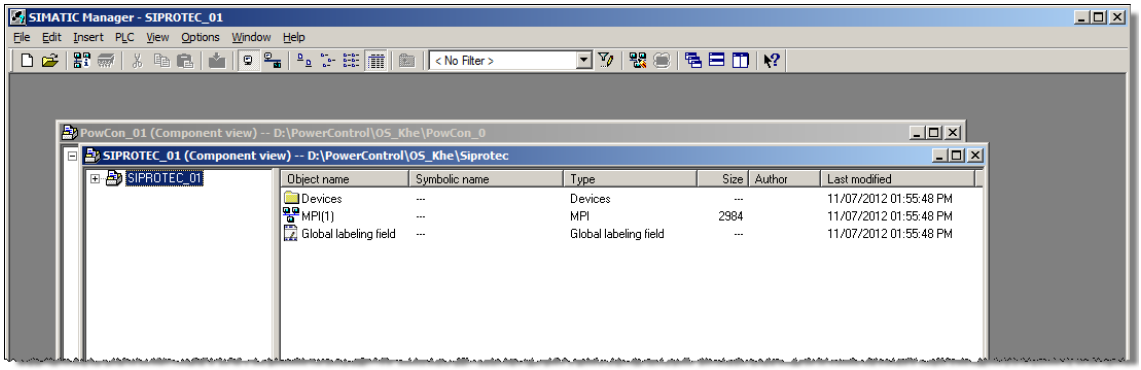


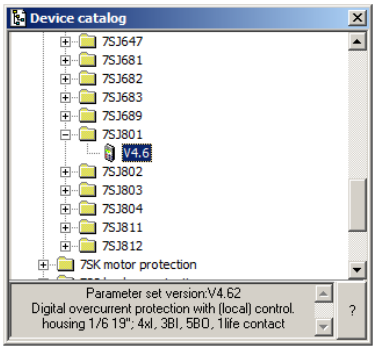
Figure 4-2: PCS 7 project for the protection device



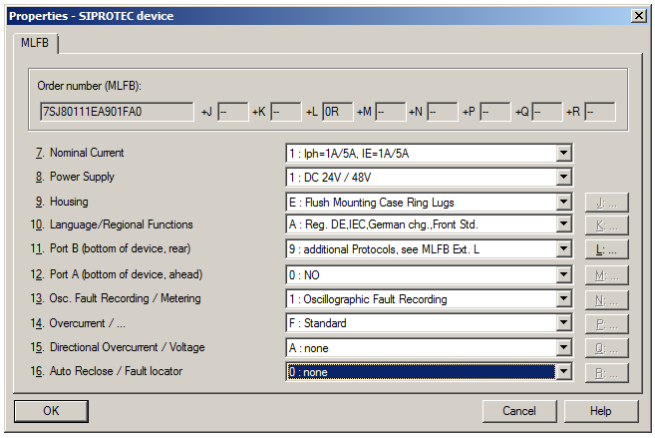
4.2.2 Creating and managing the protection device

SIPROTEC protection devices are added to the project structure from the device catalog.

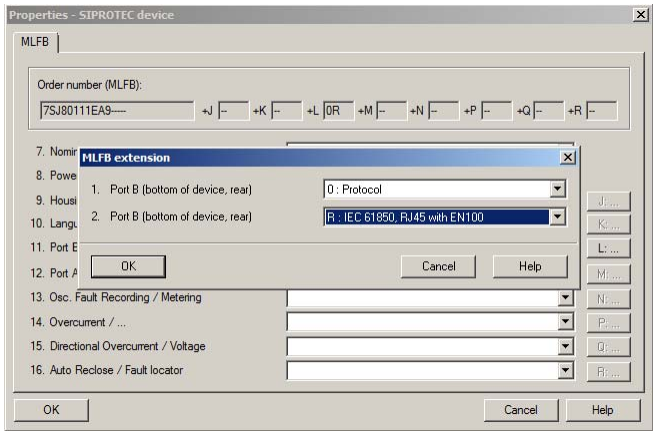
1. In the project structure you select the "Devices" folder.
2. The device catalog is called up via the context menu "Add new project > SIPROTEC device".
3. Select protection device "7SJ801" from the catalog.



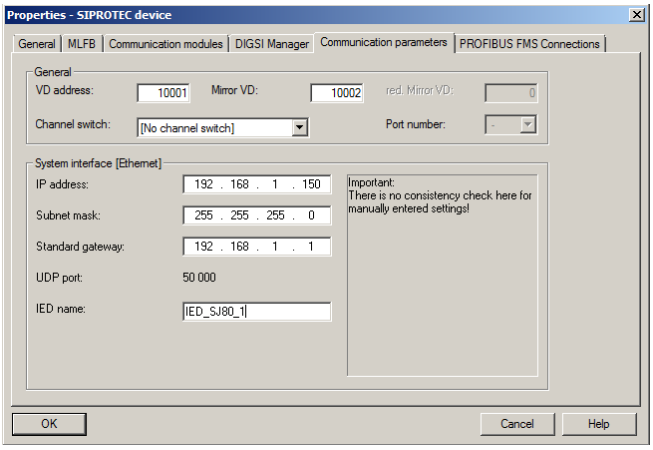
4. Drag the IED to the "Devices" folder in the project tree via drag&drop.
5. In the following dialog you need to set the device parameters according to the MLFB ordering number.



6. For the "Port B" parameter settings you press the "L…" button on the right. For "Port B" you need to select the IEC61850 protocol.

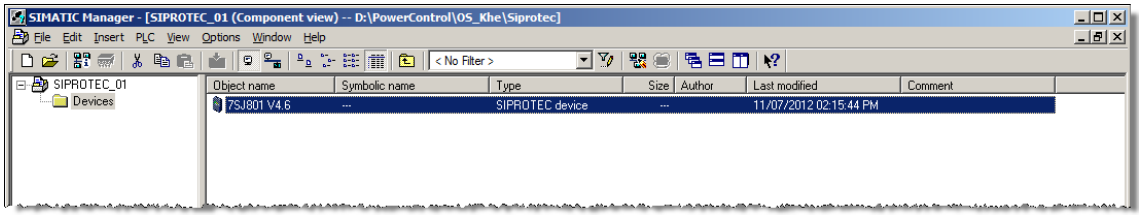


7. Within the IEC 61850 network each station requires a unique name. This name is assigned by you in the properties dialog of the SIPROTEC device.



In the SIMATIC Manager, the created SIPROTEC device is now shown in the Component view.

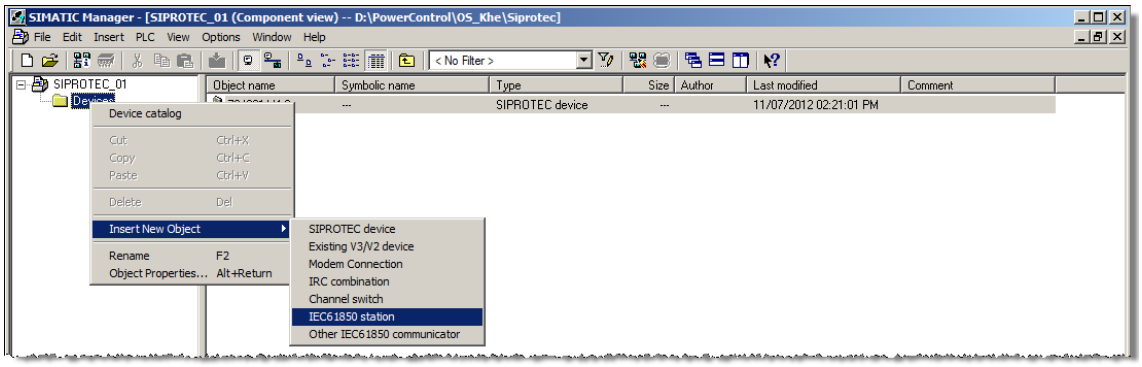
Figure 4-3: Configured protection device in the Component View



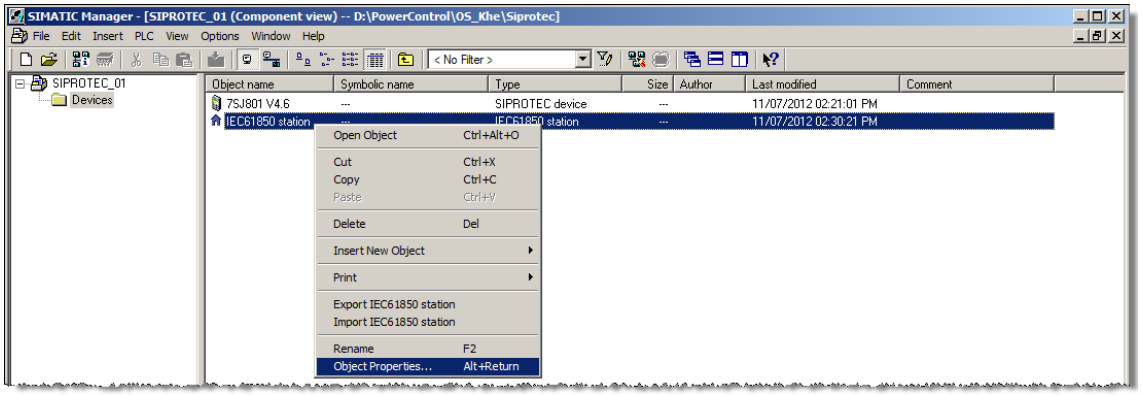
4.2.3 Create IEC station

All SIPROTEC devices created in a project are combined in a so-called IEC61850 station.

1. In the SIMATIC Manager you create a IEC61850 station:

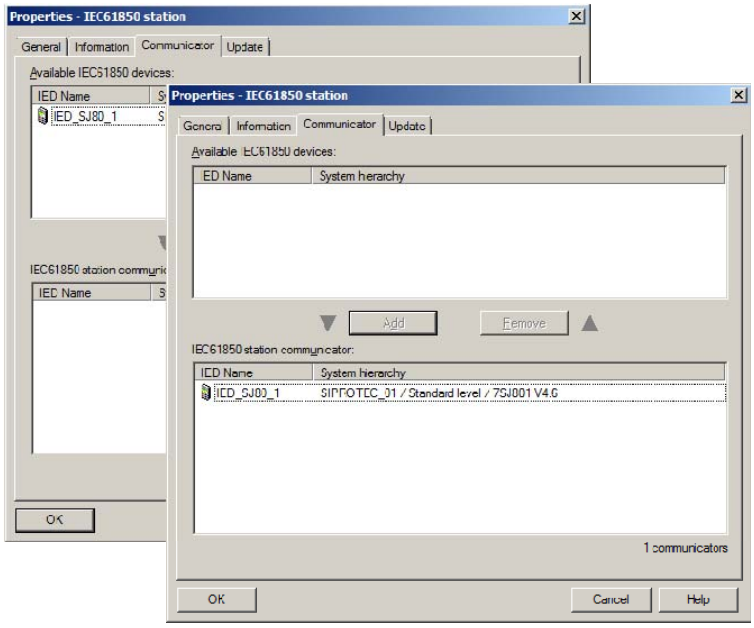


2. The protection device must now be assigned to the IEC61850 station. To do this, open the Properties dialog of the station.

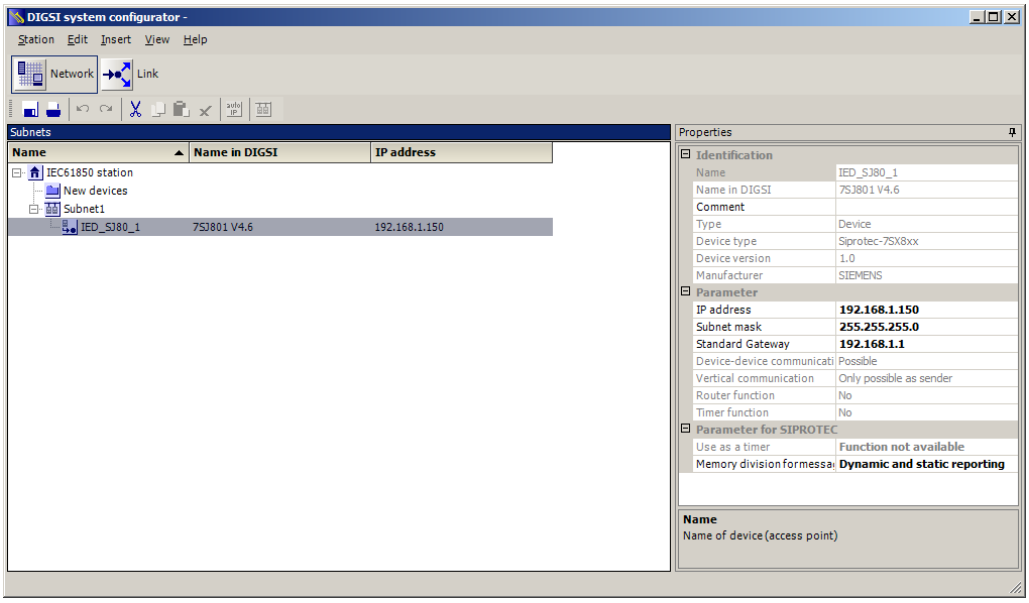


3. In the upper part, all pending stations are displayed. These must now be adopted in the list of actual stations. Mark the protection device 7SJ801 and press the “Add” button.

4. Acknowledge your selection with the "OK" button.

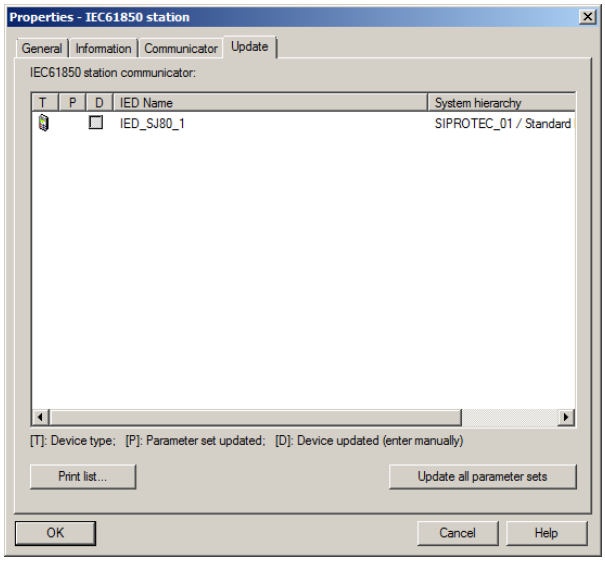


5. In the next step the network address for the protection device must be assigned. Open the IEC61850 station. Double-clicking the station opens the "DIGSI system configurator".
6. The network is established here and the IP address for the SIPROTEC protection device is set.

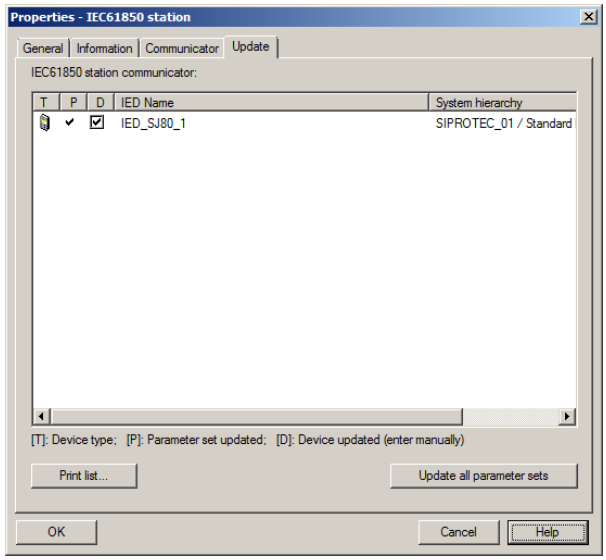


7. Close the configuration.

8. Open the Properties dialog of the IEC61850 station again. Select the "Update" tab.



9. Press the "Update all parameter sets" button to map data to the IEC object.

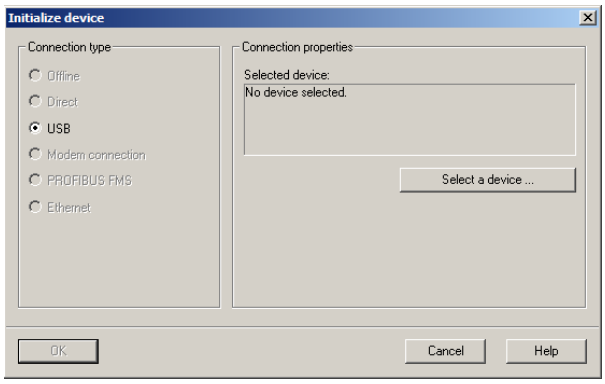


4.2.4 Loading the configuration to the protection device

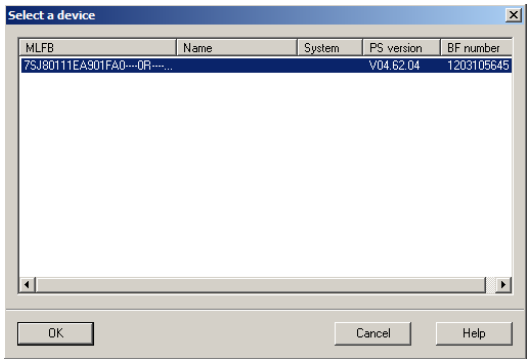
The configured settings are now transferred to the protection device. SIPROTEC 7SJ80 must be initialized for this.

The initialization gives the protection device its own identity. This transfers the parameter settings and assigns the TCP/IP a unique address. The initialization is performed via the appropriate USB interface of the protection device.

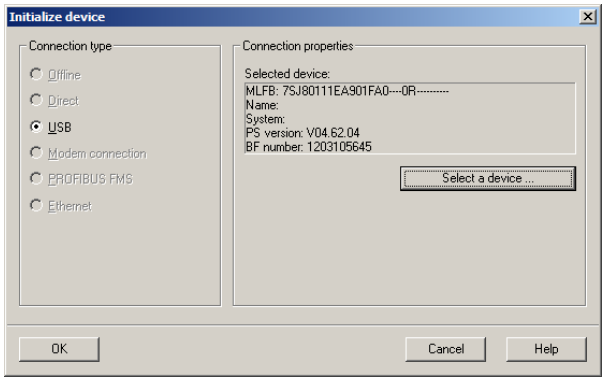
1. Select the protection device in the SIMATIC Manager.
2. Call the "Initialize device…" command via the context menu.



3. A new protection device is not automatically detected. Therefore, you need to select the IED via the "Select a device…" button.
4. Select your respective protection device by means of the MLFB number.



5. Press the “OK” button to initialize the SIPROTEC 7SJ80.



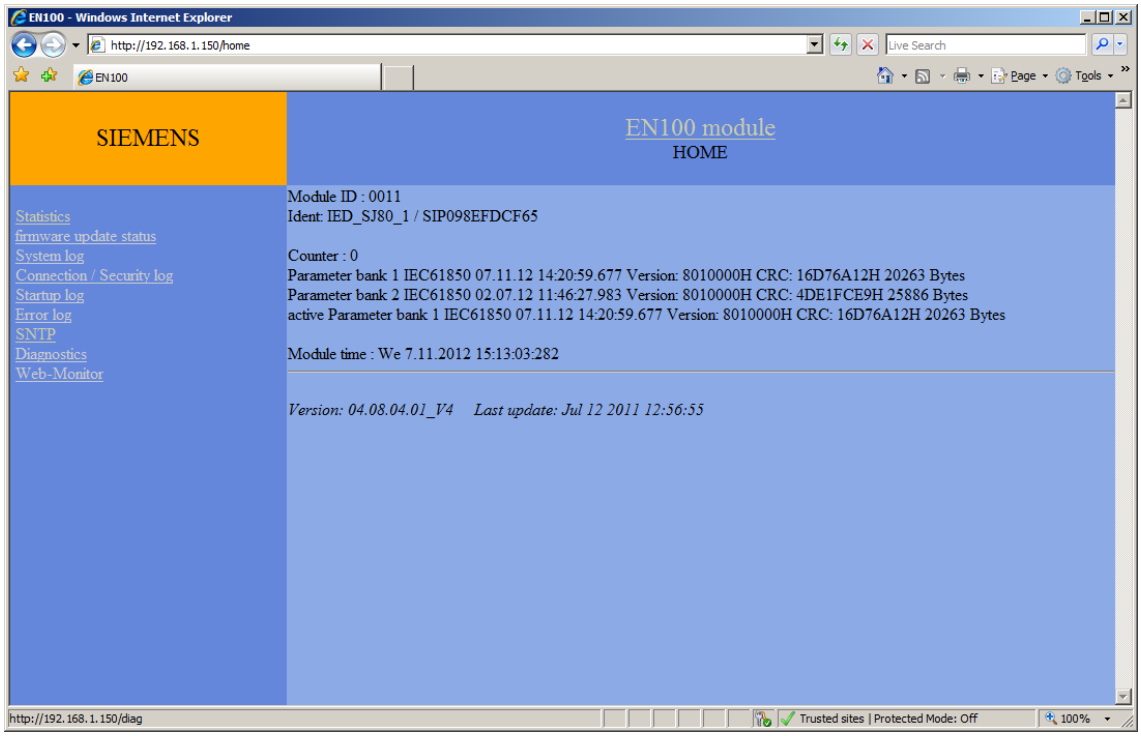
4.2.5 Testing the operability

After transferring the parameters, the protection device is accessible via the set IP address in the network.

The diagnostic functions can be used during commissioning via the website which provides the Ethernet EN100 module.

1. For calling the website, you enter the IP address into the address line of the Internet Explorer. At the end of the IP address you enter the suffix "/home". In this example, the entry reads: "http:192.168.1.150/home"
2. Confirm your input with "Enter" key.

Figure 4-4: Website of SIPROTEC 7SJ80



A wide range of information on protective devices can be called up via the left hand navigation.

4.2.6 Exporting the protection device description

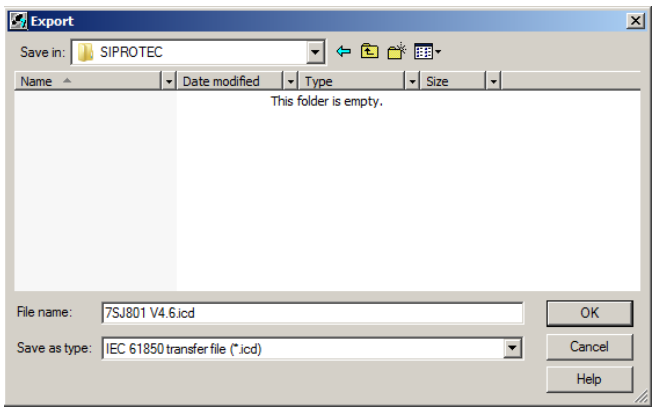
For the OS configuration described in the following chapter, the so-called device description ICD (IED Configuration Description) of the SIPROTEC device is required.

It is created with DIGSI and stored in an XML file. The basis is the “Substation Configuration Description Language” (SCL).

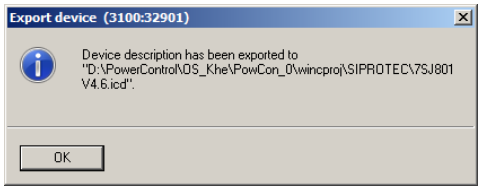
Note

It is recommended to save the device description file in a sub-directory of the SIMATIC PCS 7 project (e.g. SIPROTEC). DBA in particular always requires access to the data (next chapter). Furthermore, this archives the data consistently.

1. Select the protection device in the SIMATIC Manager.
2. Select the "Export device…" command via the context menu.
3. Create the storage location and assign a meaningful file name. Select "*.icd" as the file name.



4. Click "OK" to generate the device description.
5. The following query once more points out the storage path of the device description.



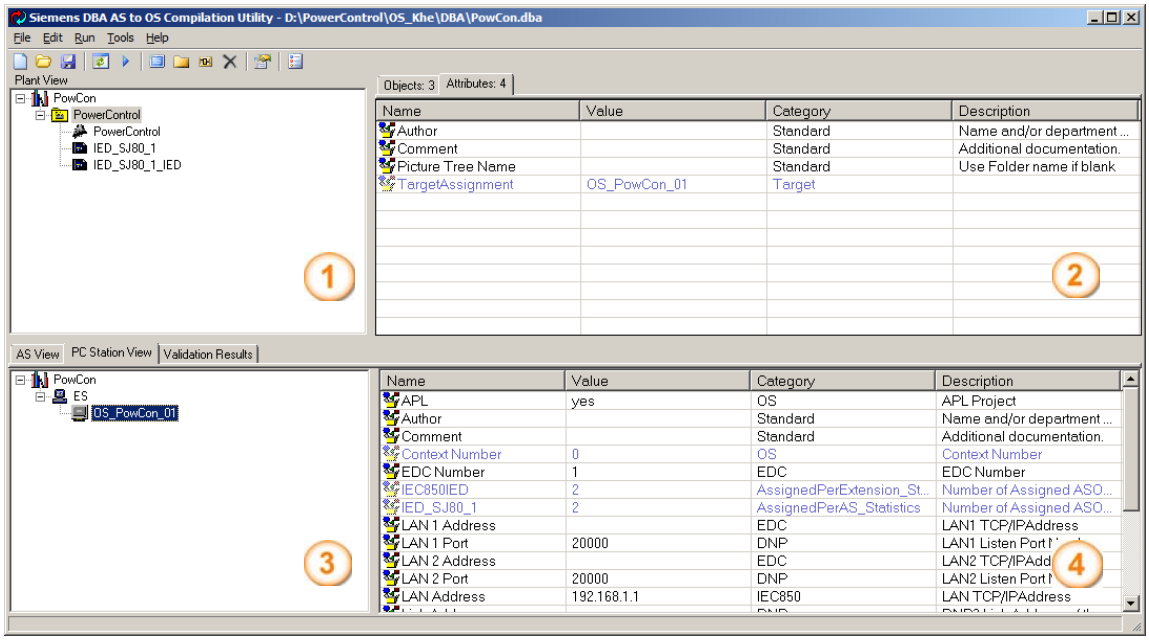
4.3 Configuring the PCS 7 PowerControl functions via the DBA tool

The Data Base Automation (DBA) engineering software generates, in conjunction with a library (OS symbols, OS faceplates, OS diagnostic view), the OS database with picture hierarchy, tags, alarms, alarm messages as well as the specific faceplates and block symbols.

The desktop of the DBA tool is divided into 4 areas:

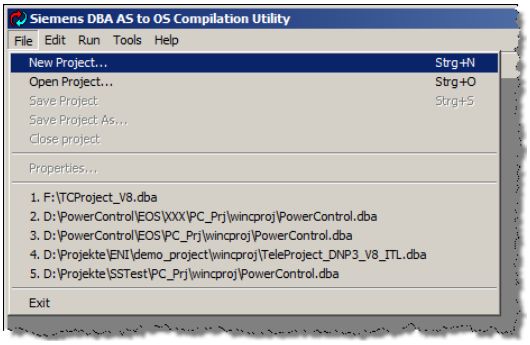
- Plant View – Generating the Plant Hierarchy (PH) and assigning the AS instances
- Object Editor: configuring the OS instances
- Physical objects (IED)
- AS Object Editor: configuring the IED instances

Figure 4-5: DBA tool



4.3.1 Creating the DBA project

1. Start DBA configuration tool via "START > Programs > Siemens Automation > SIMATIC > DBA > PCS 7 DBA".
2. Select "File > New Project…".

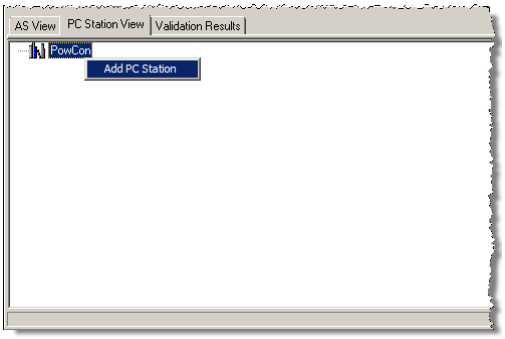


3. Save your newly created DBA project via "File > Save Project As…".

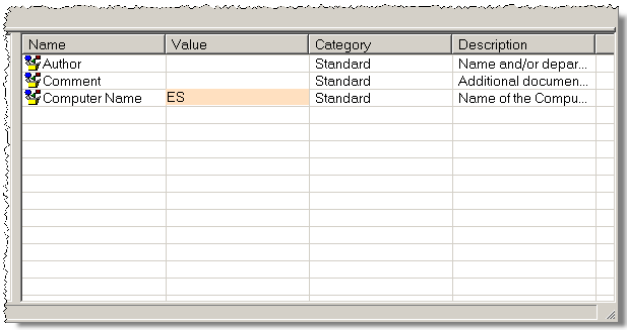
Note Saving should be repeated from time to time, since the DBA changes in the project are not saved automatically.

Add PC station

4. Go to the "PC Station View" tab.
5. There you enter a PC station into the project. Call the context menu of the project and select "Add PC Station".

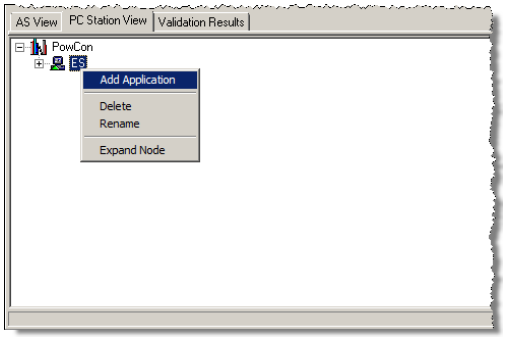


6. Assign a computer name for the PC station.

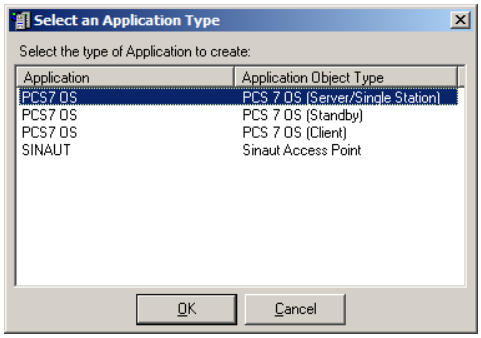


Add OS application

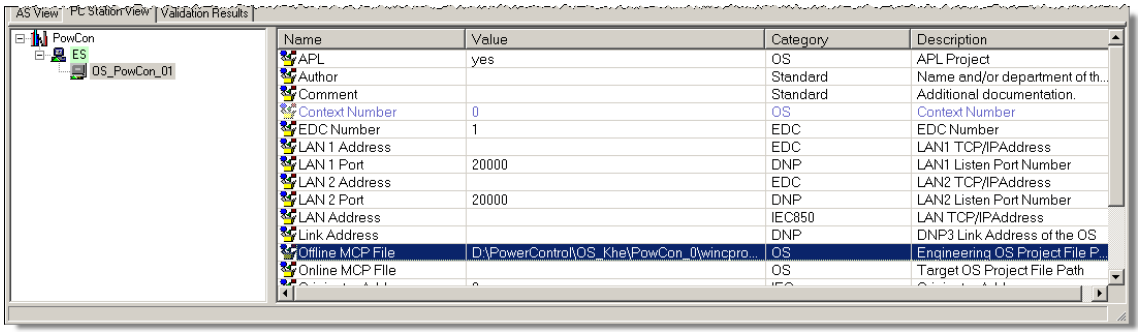
7. Add a PCS 7 OS application to the PC station. Call the context menu of the station and select "Add Application".



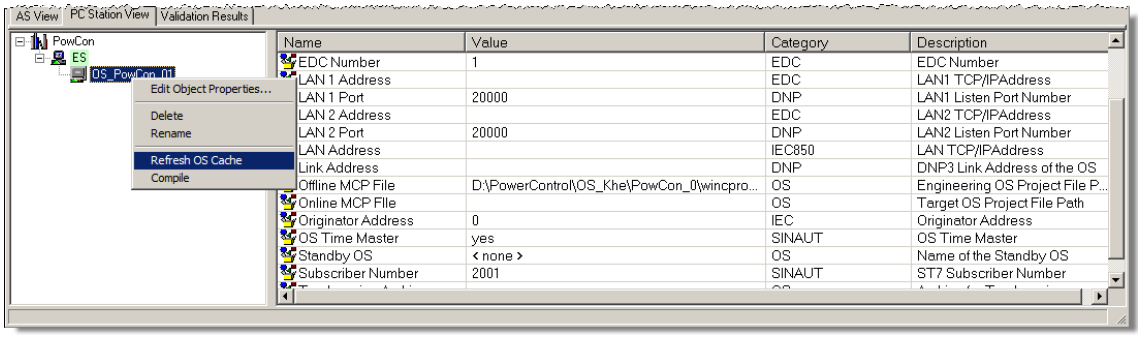
8. In the dialog window which opens, you select the "PCS 7 OS" application of type Server/Single Station.



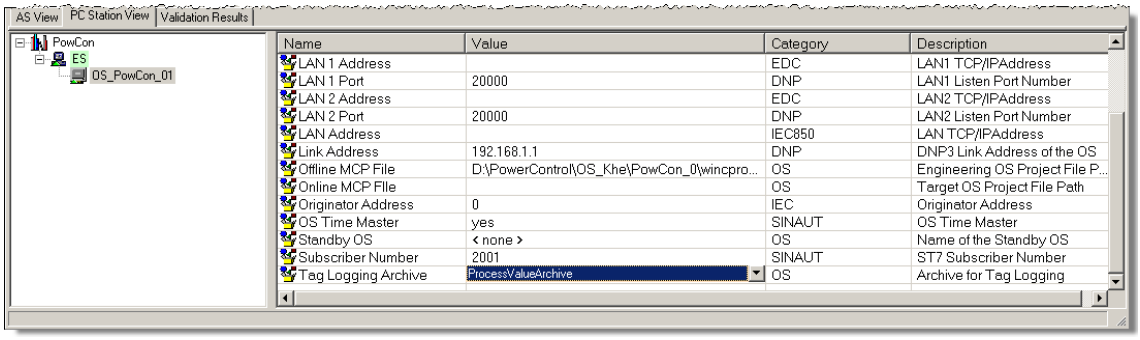
9. Acknowledge your selection with the "OK" button.
10. The OS application can also be renamed.
11. In the Value field of the “Offline MCP File“ you enter the mcp-project file including the path (connection with the configured OS project) of the respective project.



12. In the next step you trigger reading the OS project. Select the OS application in the DBA tool and select the “Refresh OS Cache” command from the context menu.

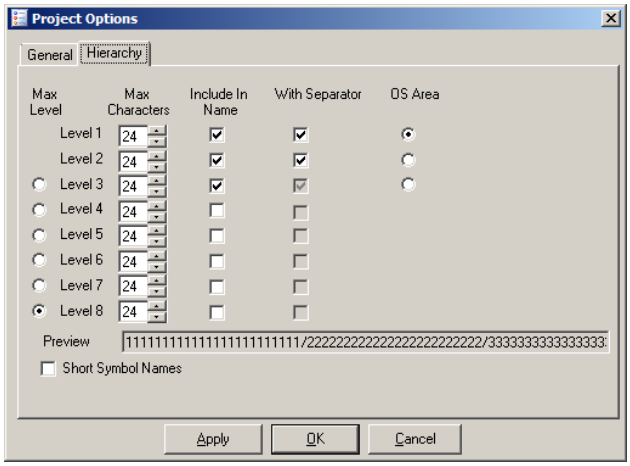


13. Confirm the following dialog box with “Yes”.
14. After reading the OS project, the process value archive created in the PCS 7 project must be selected in the Value field of the “Tag Logging Archive”. To do so, open the drop-down menu:



Set PH

15. The project-specific settings of the Plant Hierarchy are made via the Properties of the DBA project. Select “File > Properties...”.
16. In the “Properties” dialog box you select the “Hierarchy” tab.



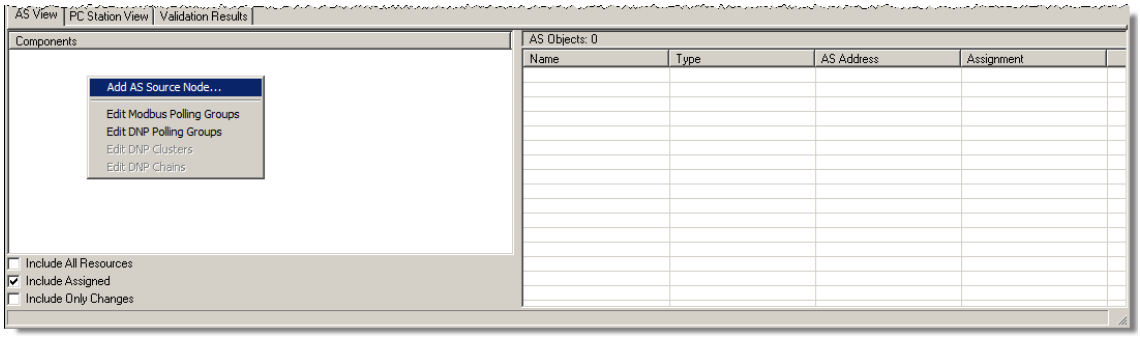
Note The settings for the PH must match those of the configuration in the Plant Hierarchy view of the SIMATIC Manager (see page 20).

4.3.2 Creating a technology object

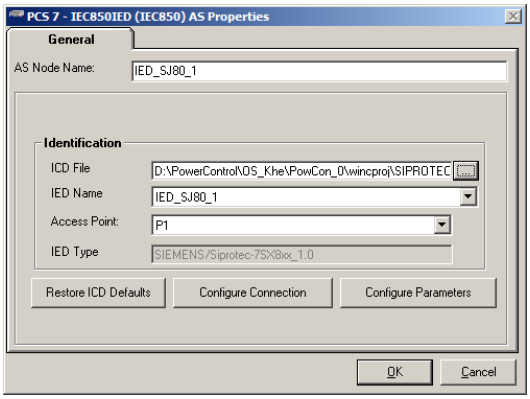
Creating IED in DBA

To create a new protection device, the "AS View" tab must be selected.

1. In the window for physical objects you call up the context menu.
2. Select the "Add AS Source Node…" command.

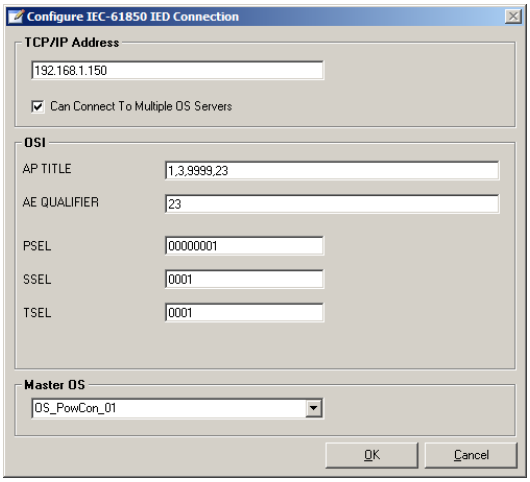


3. In the "AS Node Name" field you enter the name of the protection device 7SJ80. The fields for identification are filled by the .icd file, which you select via the "…" button, and must not be changed.



Note Select the .icd file, which you have created at 4.2.6 Exporting the protection device description.

4. Acknowledge the "Configure Connection" button to enter the TCP/IP address of the SIPROTEC 7SJ80.



5. Confirm you entry with the "OK" button.

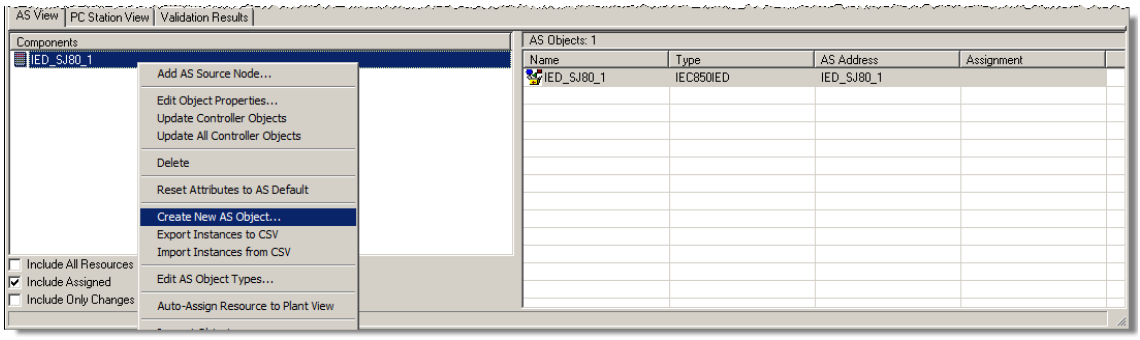
Note The parameter settings (via the "Configure Parameters" button) can be retained without changes.

6. The ICD files are read after pressing the "OK" button. This may take some time depending on scope and size.

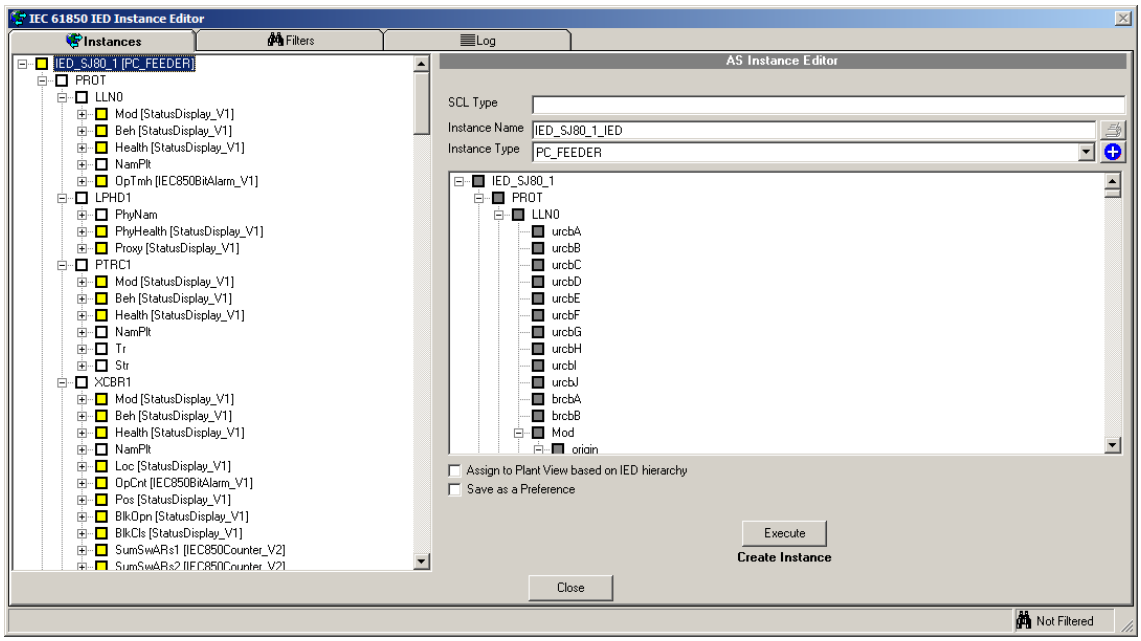
Creating a technology object (instance)

The technology object is created in the DBA using the "Create New AS Object". When reading the .icd file, the DBA checks which technology objects can be applied to the IED and offers them in a selection.

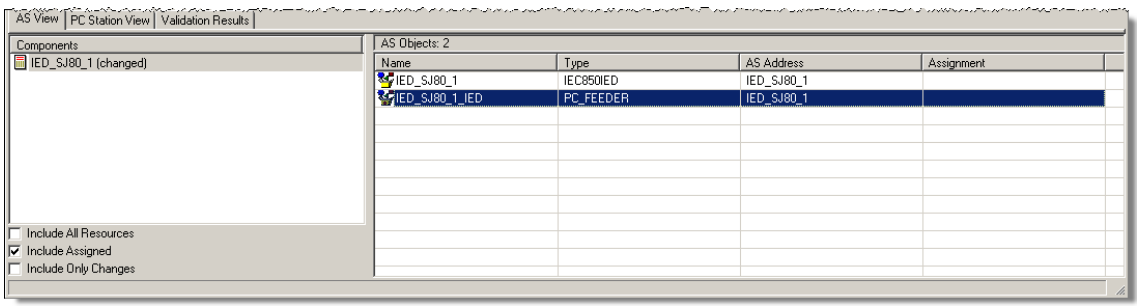
7. Mark the protection device (AS View) and select the "Create New AS Object…" command via the context menu.



8. Select instance editor of the protection device from the tree structure. This maps the whole IED in an object. As instance type you select "PC_FEEDER" from the selection list. Then complete with the "Execute" button.



9. The created IED instance has now been created in the AS Object Editor.



4.3.3 Creating a Plant Hierarchy

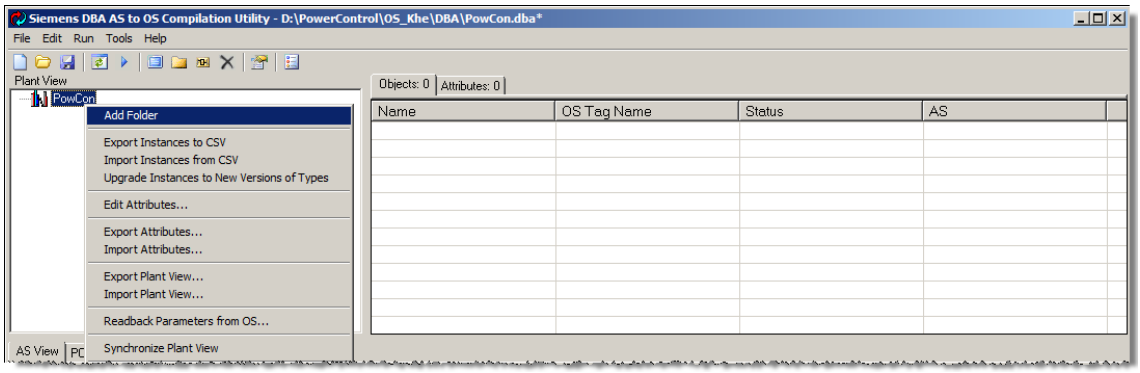
For the PCS 7 OS the picture hierarchies are automatically created on the basis of the Plant Hierarchy created in DBA.

The folders of the hierarchy are assigned to an existing OS. DBA creates a picture for each folder.

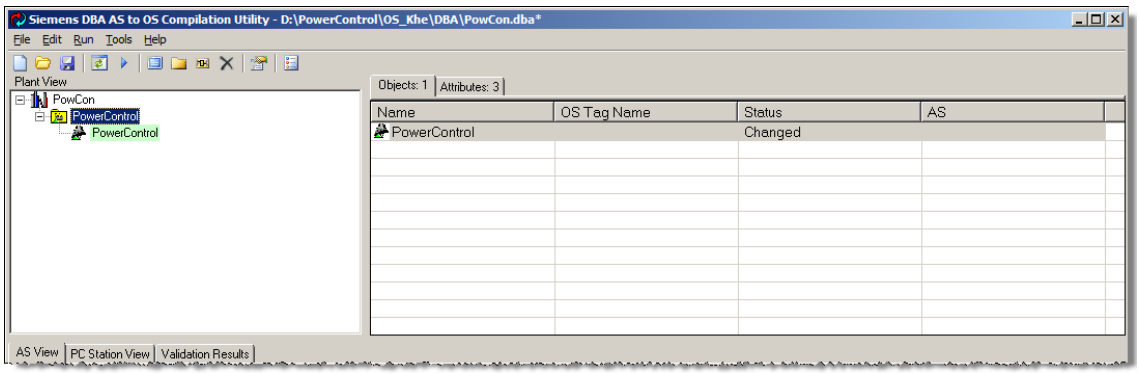
Plant area

Below, the plant area to be output later in the OS is created first.

1. Mark the DBA project in the "Plant View".
2. Call up the "Add Folder" command via the context menu to create an appropriate folder structure for the plant areas.



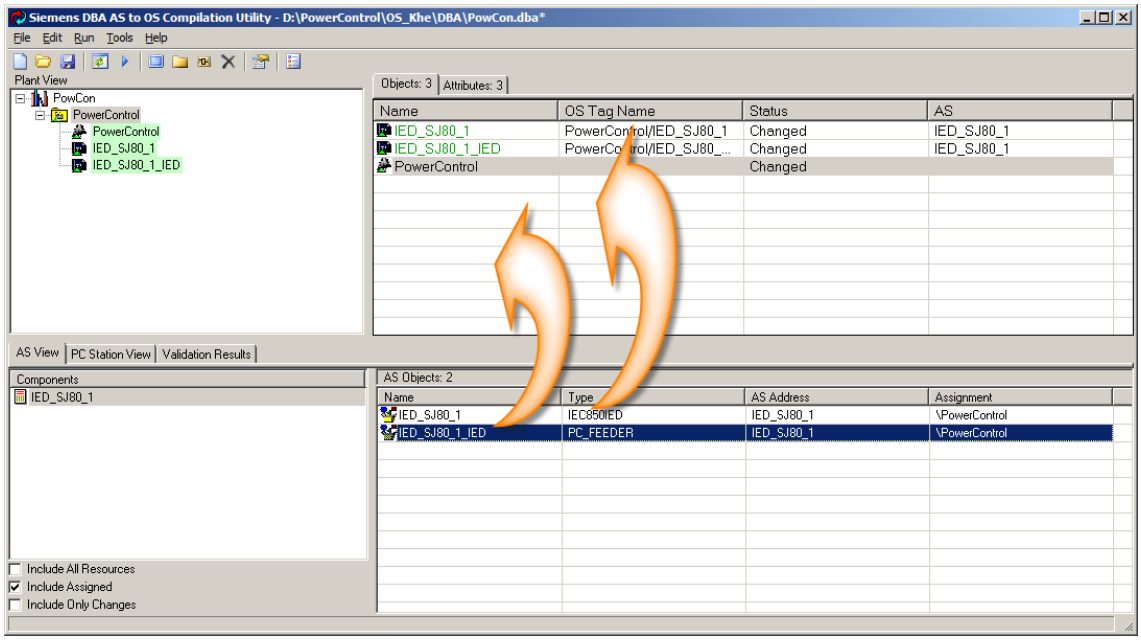
3. The system automatically generates the respective area picture.



Object assignment

The AS objects from the AS Objects view are assigned to the plant area in the OS area object view.

4. Drag the AS objects to the respective folder in the PH via drag&drop.

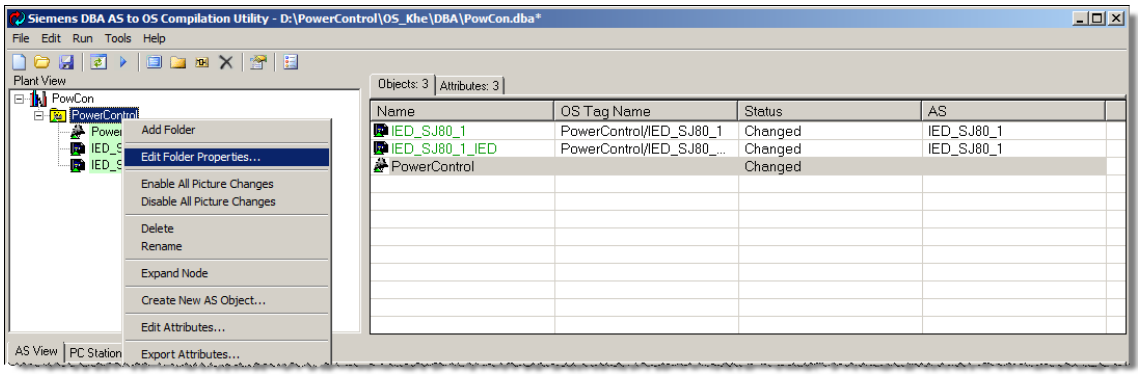


Note Objects marked green and areas point to changes in the project. These must still be compiled and adopted in the OS project.

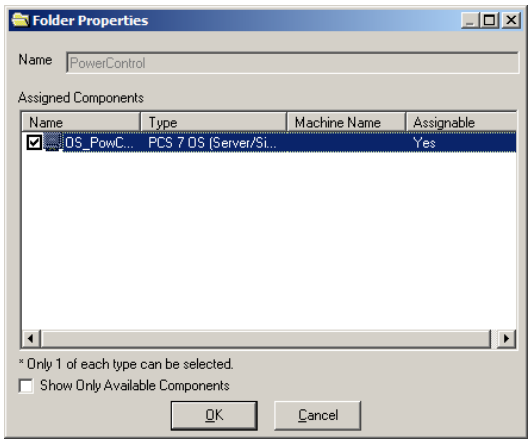
OS assignment

The created plant areas of the PH must be assigned to the OS.

5. Select the new plant area in the "Plant View".
6. Select the "Edit Folder Properties…" command from the context menu.



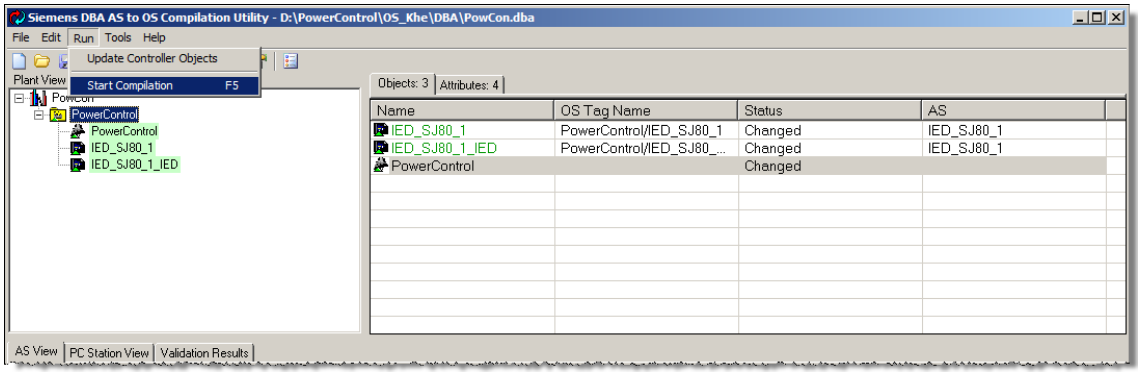
7. Select the OS in the subsequent dialog.



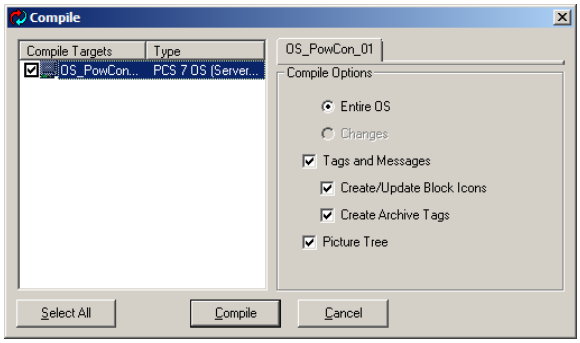
Compiling the DBA project

Now, the project can be compiled and be used for a preliminary test in Runtime. This writes the DBA configuration to the OS.

8. Select "Run > Start Compilation" via the menu.



9. In the compilation dialog, the options can be adopted without changes. Press the "Compile" button.



Note The protocol of the compilation can be saved after completion. Click the button “Save” button.

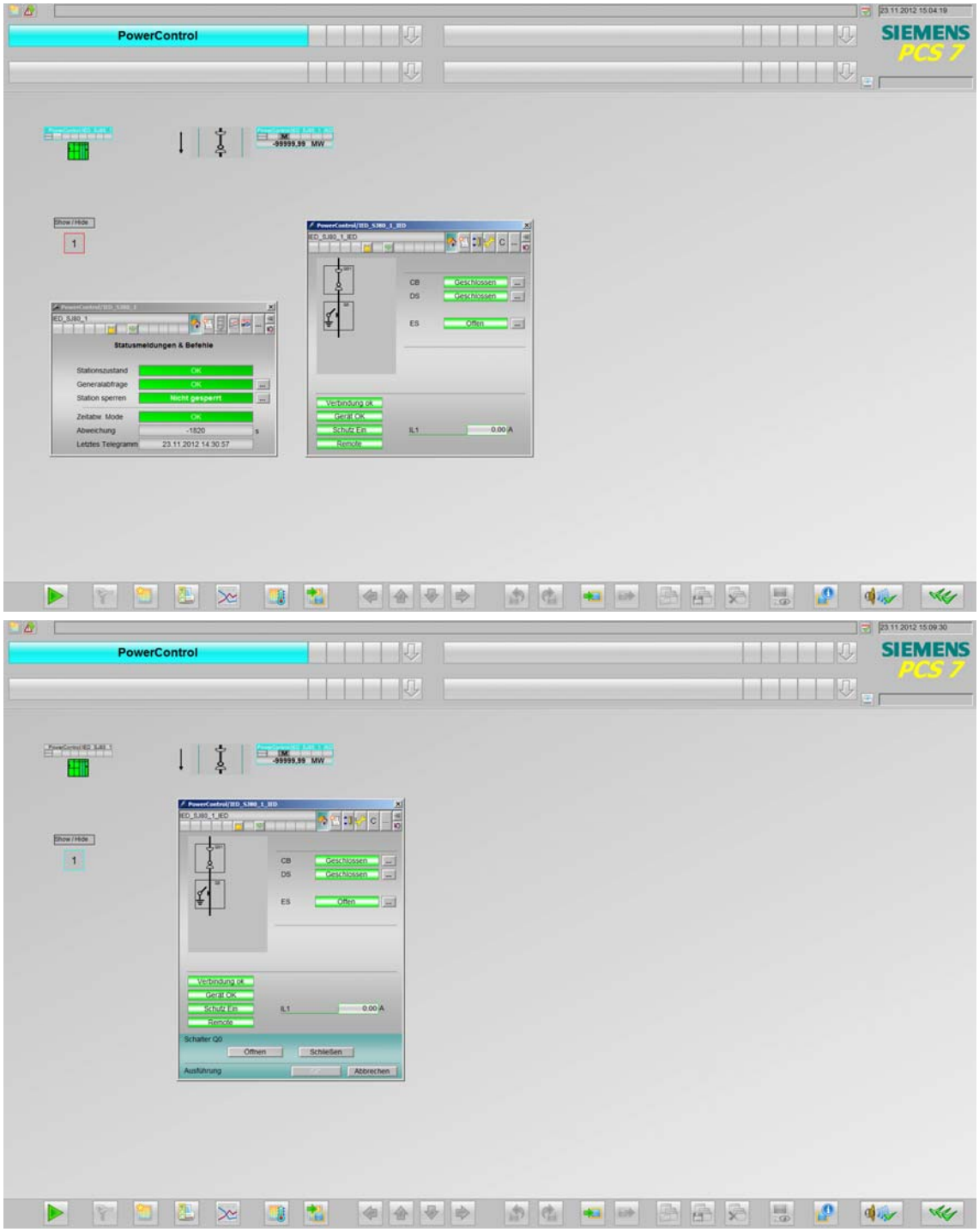
10. If the compilation was completed without errors, the OS can be adopted to Runtime.

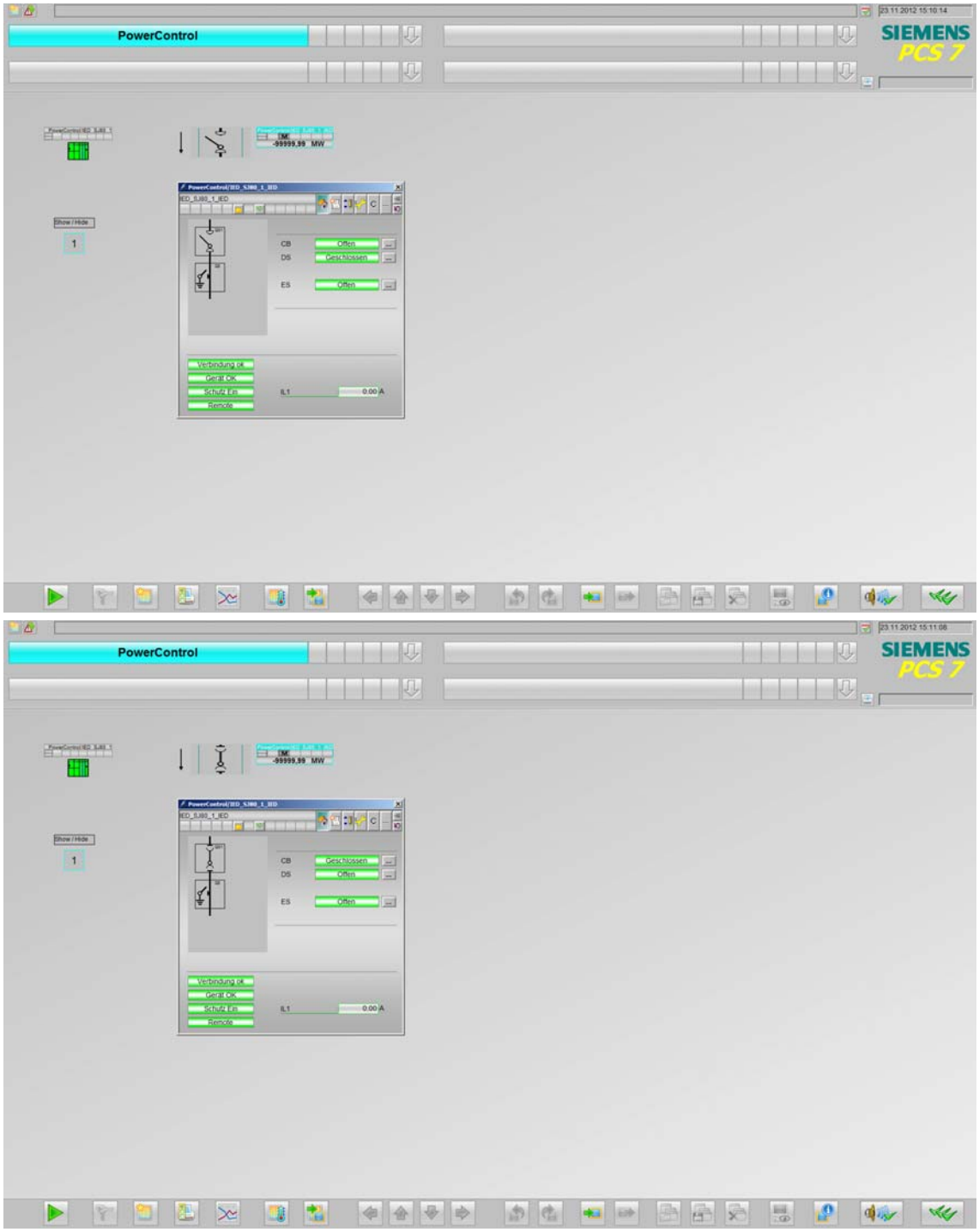
5 Starting the Application

After the project was compiled in the DBA, the configured symbols are available in the respective process image and are generally functional.

1. Open the OS in the SIMATIC Manager.
2. Press the "Run" button in the WinCC Editor.
3. Open the existing faceplates.

Figure 5-1: OS Runtime





The PC_FEEDER object is used for all inputs or outputs of a busbar. It can also be configured as individual circuit-breaker, ground electrode or isolator. Furthermore, it is used for switchable machine contactors.

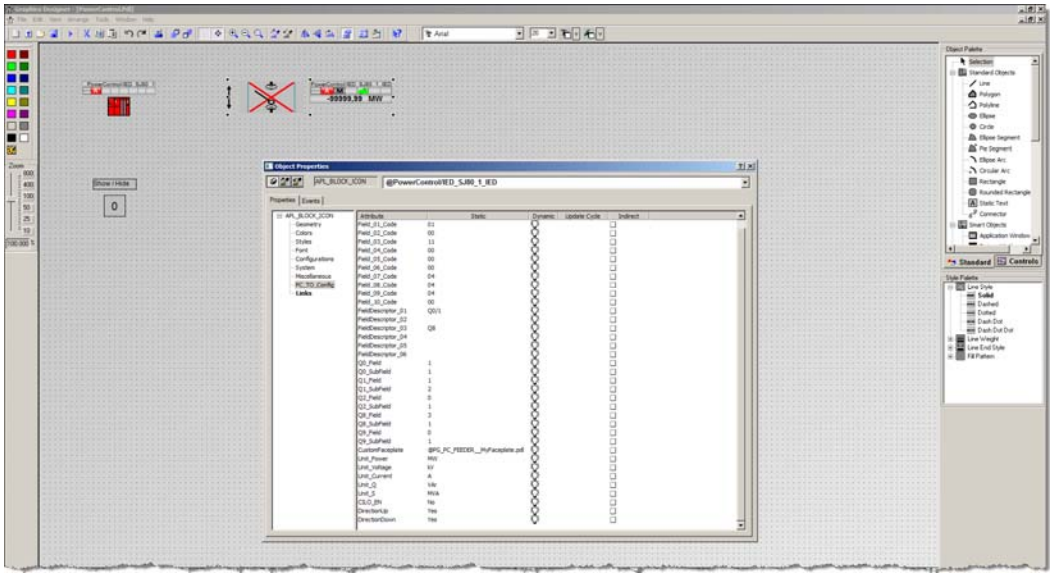
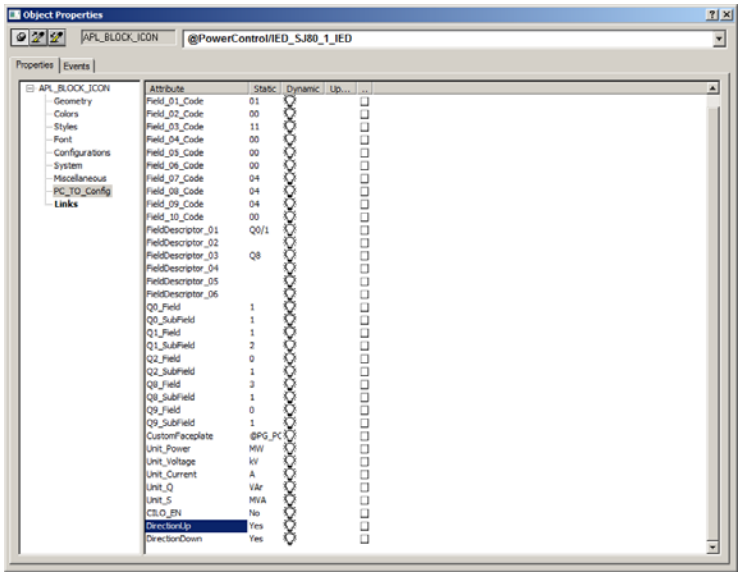
6 Changes in the Application

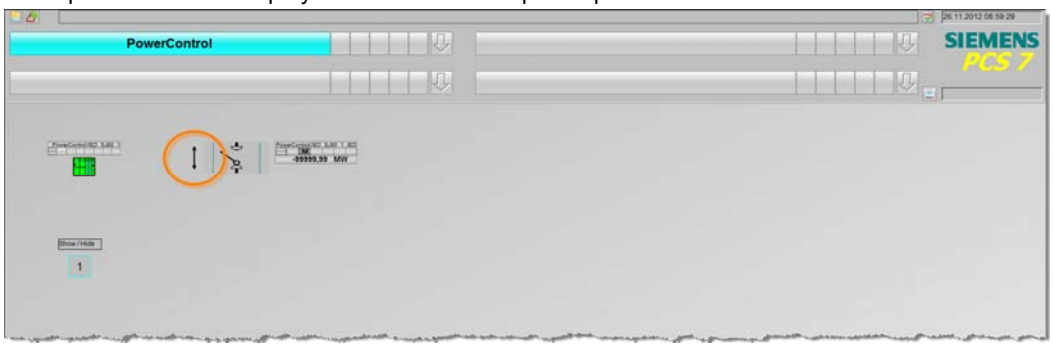
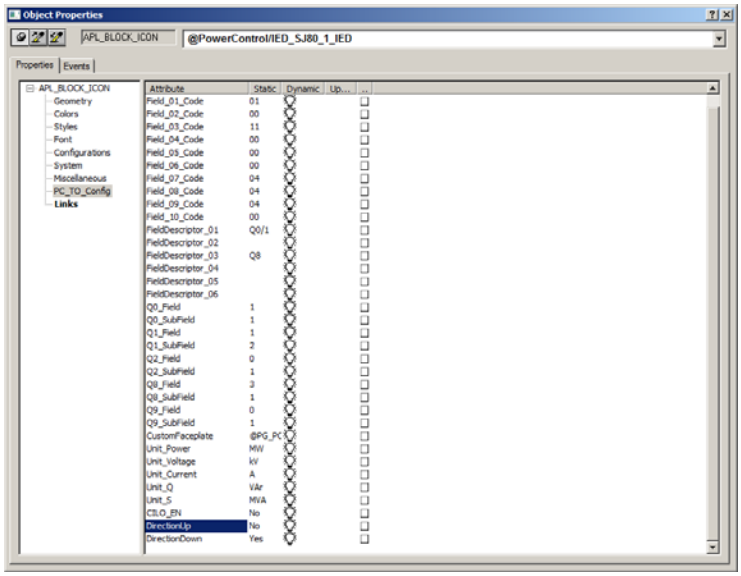
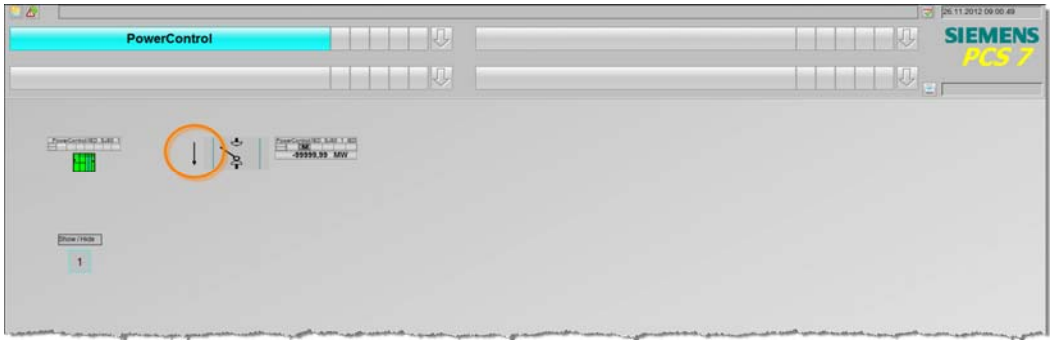
For project-specific adjustment of symbols and faceplates, there are some attributes which should be checked and, if necessary, be adjusted. The process picture must be opened in "WinCC Graphics Designer" and the properties of the respective symbols be displayed.

6.1 Power direction display

There is the option of displaying the power direction in the switchgear by means of a direction arrow. It is configured with the attributes “DirectionUp” (power direction up) and “DirectionDown” (power direction down).

Table 6-1

No	Action
1	Open the project screen in the "WinCC Graphic Designer". 
2	If the attributes for "DirectionUp" and "DirectionDown" each have been set to "Yes" in the Object Properties… 

No	Action
3	…the power direction display in OS Runtime will point up as well as down. 
4	For a downward current flow display, the "DirectionDown" attribute is assigned with "Yes" and "DirectionUp" with "No". 
5	

Note If both attributes are configured to “No”, the power direction arrow is hidden.

6.2 Hiding non-existent values

All technology objects have the option of hiding certain values. This functionality is controlled via the internal WinCC tag “Status5”, whose start value can be configured in the DBA.

Each hidden value in the faceplate is assigned a bit in the “Status5 tag”. If the respective bit is set to 0, the value is hidden in the faceplate.

The default value of “Status5” is 0xFFFFFFFF. This means, that all values assigned to "Status5", are shown in the faceplate.

The assignment of the values to the bits of the “Status5 tags” is available in the Appendix (7.2 Assigning the "Status5" tag).

Note In the DBA tool, an input of the hexadecimal values is not possible. These must be converted into the appropriate decimal value and be entered as such.

Figure 6-1: Status5 in the DBA Project Editor

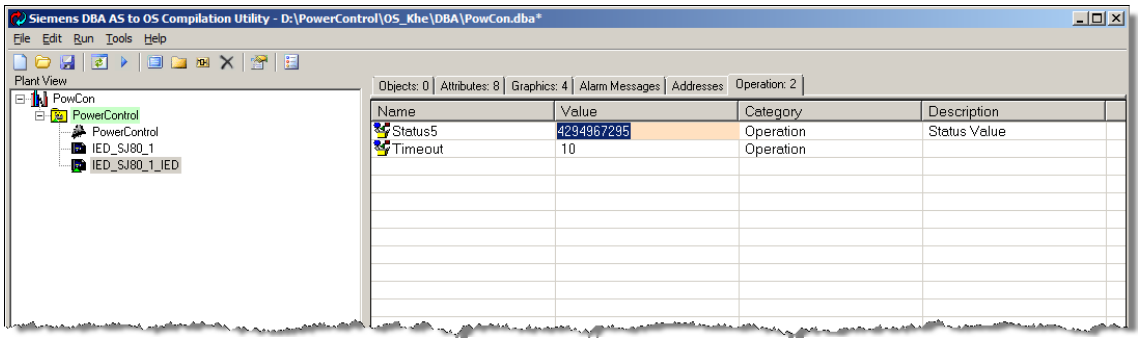
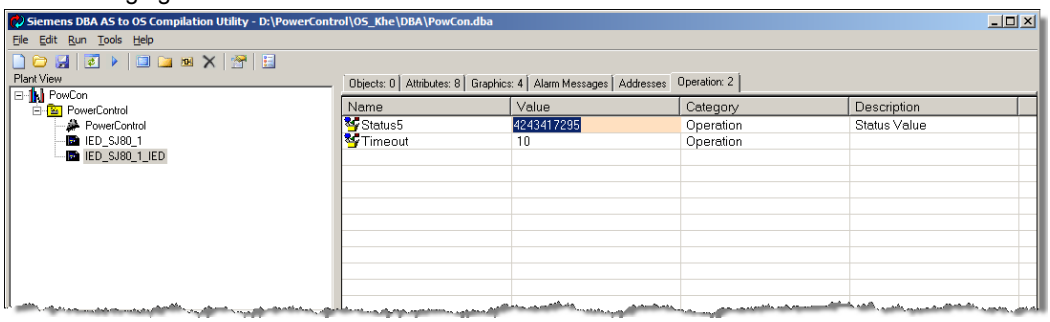
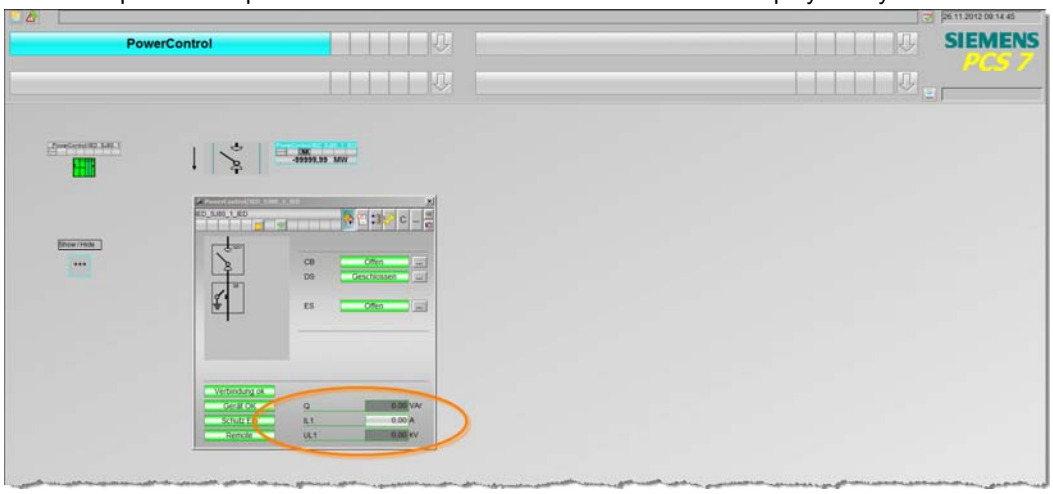
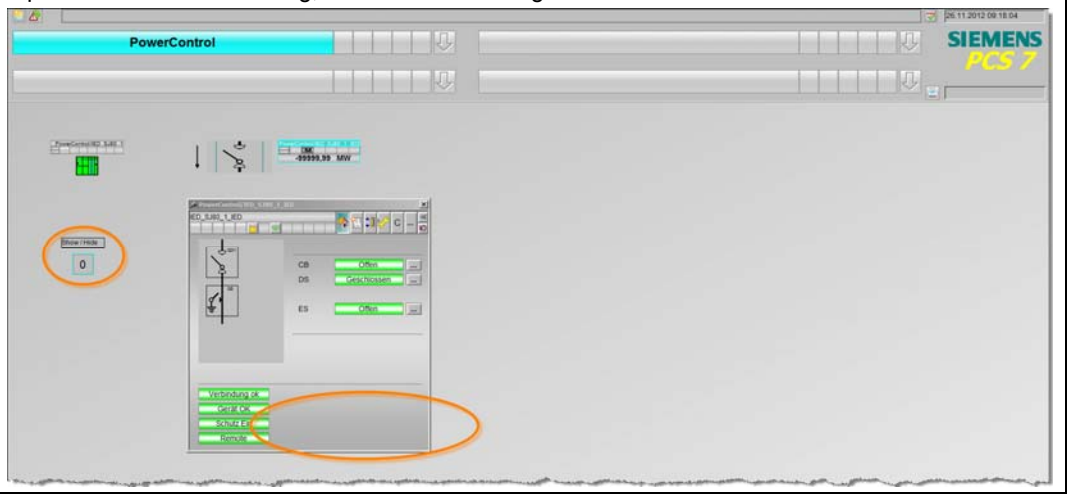


Table 6-2

No	Action
1	In the faceplate, various power, current and voltage value fields are displayed. These connected with the “Status5” tag. 

No	Action
2	When changing the default value in the DBA tool… 
3	… the faceplate of the protection device shows that not all values are displayed anymore. 
4	In the following example, a simple input/output field was configured in the Graphic Designer. This I/O field is connected with the "Status5 tag". Input "0" forces a total hiding, "1" leads to unhiding the values. 

Note Each change in the DBA tool must be transferred to the OS via a "Compile".

6.3 PC_FEEDER switch representation

The PC_FEEDER faceplate offers a flexible representation of the switches (e.g. circuit-breaker, ground electrode, isolator). Up to 5 switches can be represented dynamically in 6 fields.

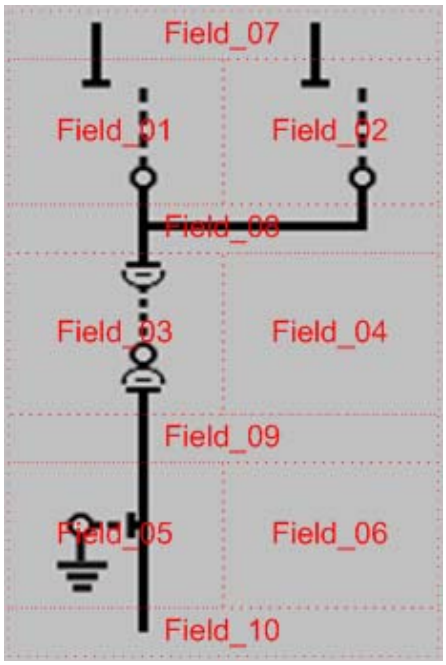
The representation occurs using randomly combinable symbols (see Appendix), which are aligned in 6 fields (field 1-6).

Additionally, there are 4 fields (field 7-10), which form the connection between fields 1-6.

Configuration fields

The figure below shows the arrangement of the fields in relation to the switch representation.

Figure 6-2: Configurations fields for PC_FEEDER



The “Field_XX_Code” symbol attributes are used for configuring the fields in which the symbols are displayed. Only the two-digit symbol codes are entered (7.1 Symbols/Codes).

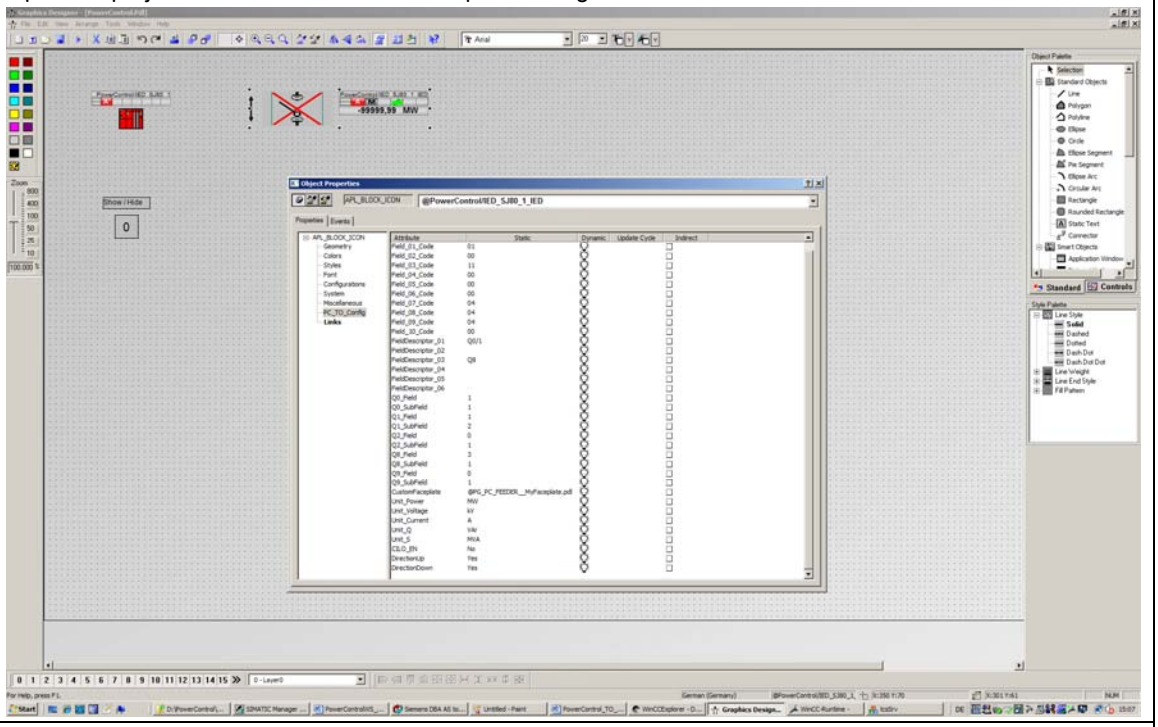
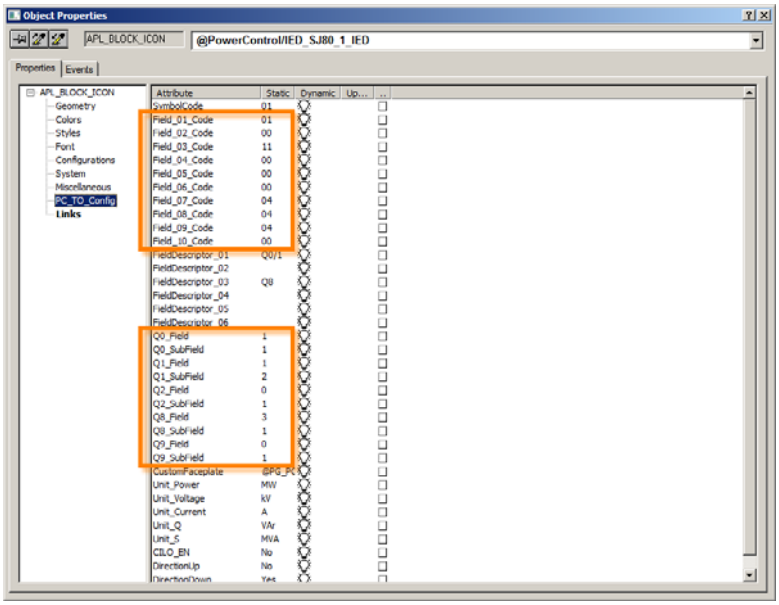
Configuration of the switches

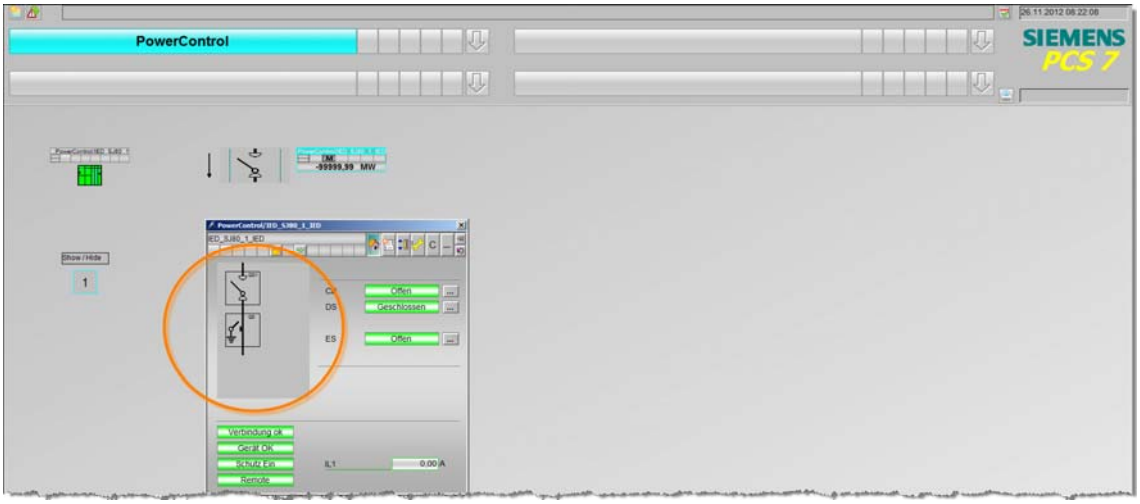
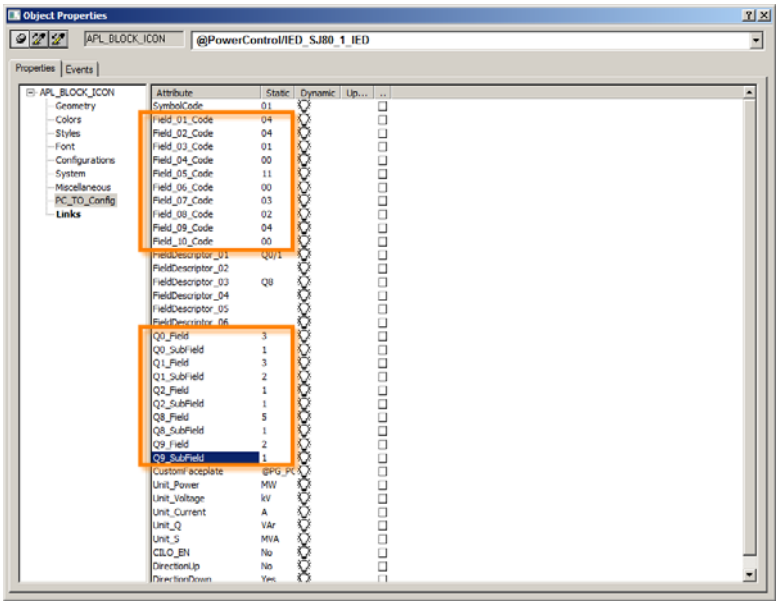
The following switches can be configured in PC_FEEDER:

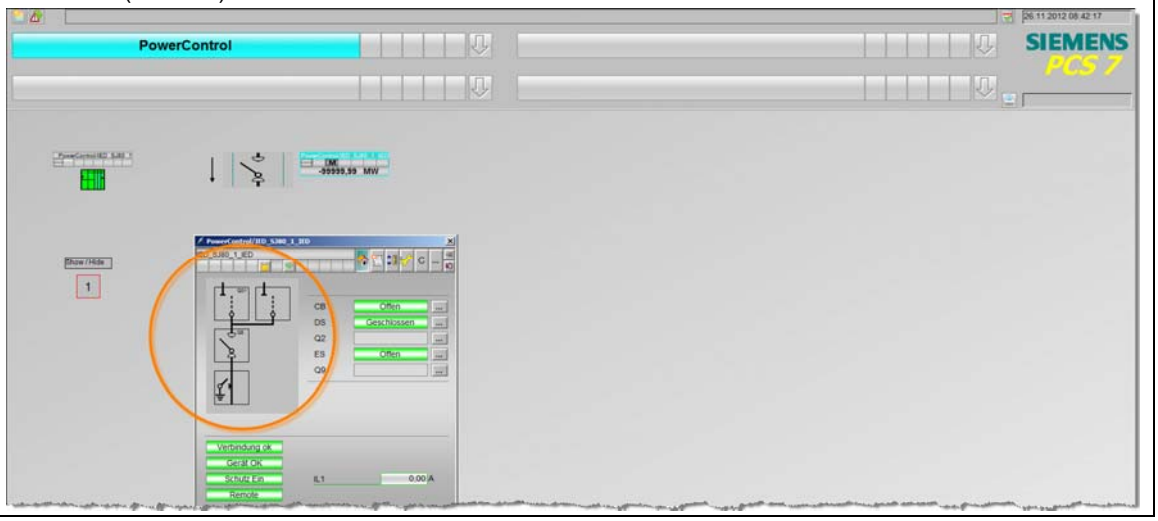
- Q0 (e.g. circuit breaker)
- Q1 (e.g. isolator)
- Q2 (e.g. additional isolator)
- Q8 (e.g. ground electrode)
- Q9 (e.g. additional ground electrode)

Switches can only be represented in the fields 1-6. In the fields it is possible to display and configure up to two switches (Figure 6-2: Configurations fields for PC_FEEDER: Feld_03 – Circuit-breaker/isolator combination).

Table 6-3

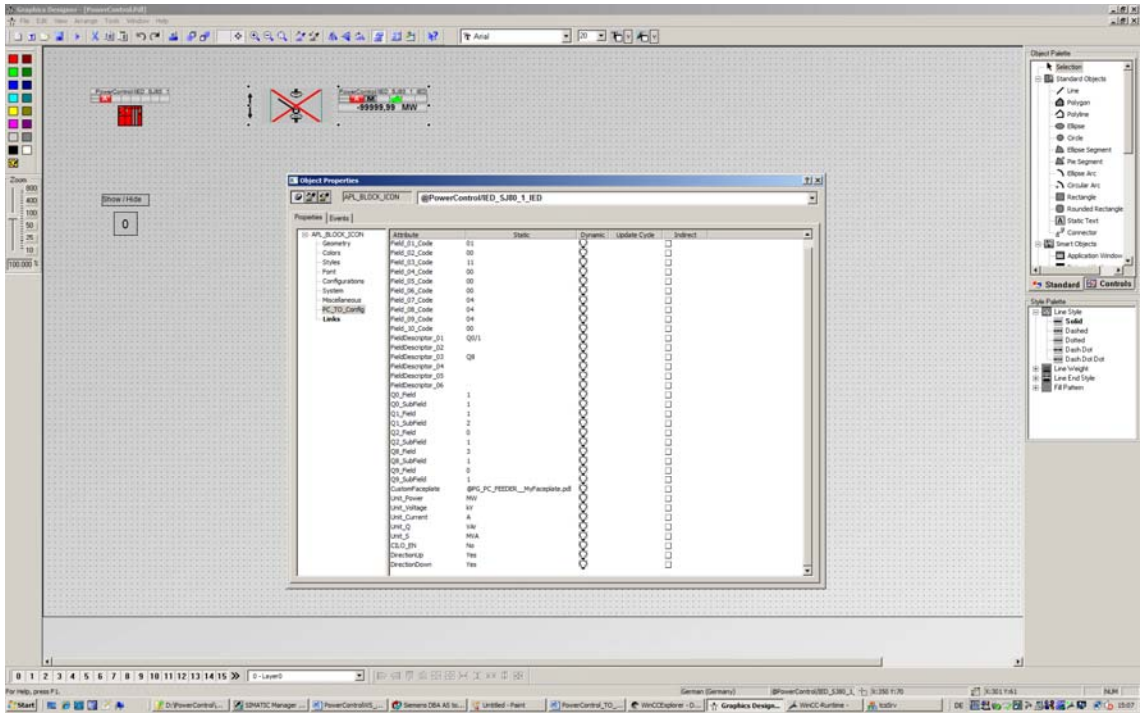
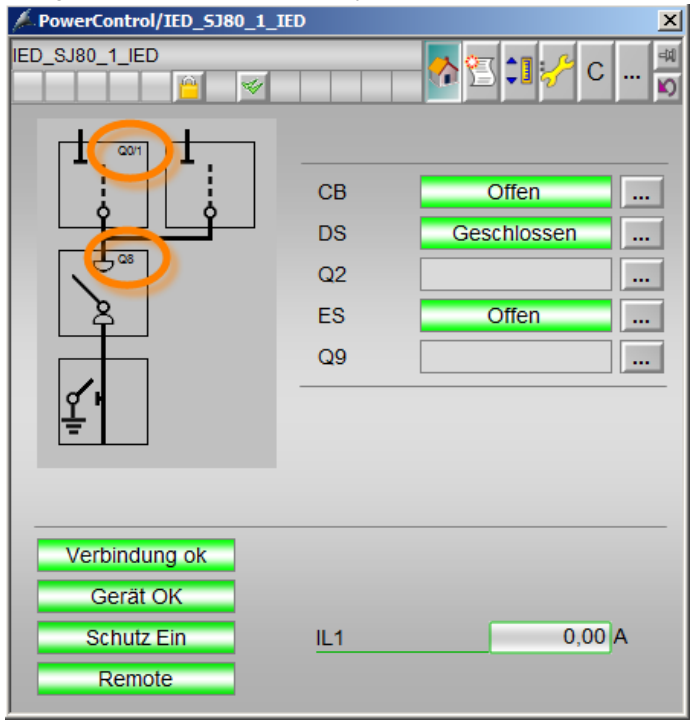
No	Action
1	Open the project screen in the "WinCC Graphics Designer". 
2	Select the properties dialog of “PC_FEEDER”. The assignment of the switches to the fields is configured with the symbol attributes “QX_Field” and “QX_SubField”, which exist for each of the 5 switches. “QX_Field” describes the number of the field in which the switch is located (possible values: 1-6). 

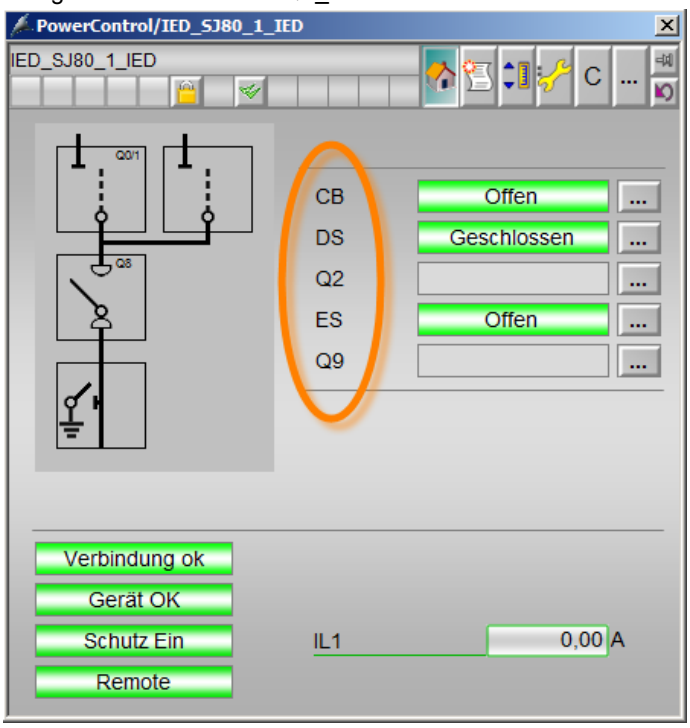
No	Action
3	If attribute “QX_Field” is configured to 0, this switch is not displayed in the faceplate (no display of the position and no control). 
4	“QX_SubField” represents one of both “sub-fields” of “QX_Fields”. This is required in order to represent two switches in one field. “QX_SubField“ can ONLY take on value 1 or 2. If, for example, the circuit-breaker (Q0) and the isolator (Q1) are displayed in field 3, the configuration must be as follows: • Q0_Field 3 • Q0_SubField 1 • Q1_Field 3 • Q1_SubField 2 

No	Action
5	This means, that both switches are represented in field 3. Q0 is assigned the sub-field 1 (switch 1), Q1 the sub-field 2 (switch 2). 

6.4 Labeling the fields and switches of PC_FEEDER

Table 6-4

No	Action
1	Open the project screen in the "WinCC Graphics Designer". Select the Properties dialog of PC_FEEDER. 
2	Using the “FieldDescriptor_XX” symbol attributes, the label of fields 1-6 can be configured. 

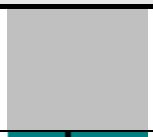
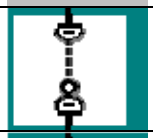
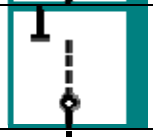
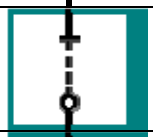
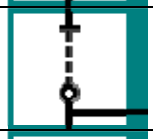
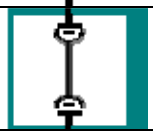
No	Action
3	Using the DBA attributes “QX_DESC” the names of the individual switches are configured in the faceplate. 

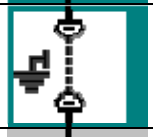
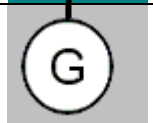
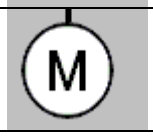
7 Appendix

7.1 Symbols/Codes

Symbol codes for PC_FEEDER

Table 7-1

Symbol	Code	Remark
	00	Empty field
	01	Circuit-breaker with isolator and carriage (2 switches)
	02	Circuit-breaker
	03	Isolator and ground electrode (2 switches)
	04	Isolator
	05	Simple connection
	06	Isolator
	07	Isolator
	08	Ground
	09	
	10	Isolator (with carriage)

Symbol	Code	Remark
	11	Ground
	12	Isolator with carriage and ground (2 switches!)
	13	Generator
	14	Motor

Symbol codes for connections

Table 7-2

Symbol	Code	Remark
	00	Empty field
	01	1 connection under field 5 (for field 10)
	02	Connection between 2 rows (for field 8,9,10)
	03	Connection via field 1 and 2 (for field 7)
	04	Connection between 2 rows (for field 8,9)
	05	Connection via field 1 (for field 7)
	06	Connection via field 1 (for field 7)
	07	Connection (for field 8,9,10)
	08	Connection between 2 rows (for field 8,9)
	09	Connection between 2 rows (for field 8,9)
	10	Connection via field 1 and 2 (for field 7)

7.2 Assigning the "Status5" tag

PC_FEEDER

Table 7-3

Bit…	Feature	Remark
0	I_A	Current phase 1
1	I_B	Current phase 2
2	I_C	Current phase 3
3	U_A	Voltage phase 1 – Ground
4	U_B	Voltage phase 2 – Ground
5	U_C	Voltage phase 3 – Ground
6	U_AB	Voltage phase 1 – Phase 2
7	U_BC	Voltage phase 2 – Phase 3
8	U_CA	Voltage phase 3 – Phase 1
9	U	Voltage
10	P	Power
11	Q	Wattless power
12	S	Apparent power
13	F	Frequency
14	PF	Cosinus Phi
15	WpForw	Power counter P Forward

8 Glossary

DBA

DataBase Automation – Engineering Tool for integrating different protocols in PCS 7

ICD

IEC 61850 Device Description – Standardized device descriptions which are integrated for the engineering of switchgear automation in the system.

IEC

International Electrotechnical Commission – Commission based in Geneva for standards in the field of electrical engineering and electronics.

IED

Intelligent Electronic Device – For switchgear automation, i.e. for protection, control, measuring and monitoring tasks in electronic power transmission and distribution, Intelligent Electronic Devices (IEDs) are used.

WinCC

Windows Control Center – PC-based process visualization system of Siemens. WinCC is used as Human Machine Interface (HMI) in the process control system SIMATIC PCS 7.

9 Related Literature

The following list is by no means complete and only provides a selection of appropriate information.

Table 9-1

	Topic	Title
\1\	Link to this document	http://support.automation.siemens.com/WW/view/en/67688155
\2\	Industry Online Support	http://support.automation.siemens.com
\3\	IEC 61850	http://www.tissues.iec61850.com/default.mspx
\4\	SIMATIC PCS 7 PowerControl	www.siemens.com/simatic-pcs7/powercontrol
\5\	Protection technology	http://www.energy.siemens.com/hq/en/automation/power-transmission-distribution/protection/siprotec-compact/overcurrent-protection/7sj80.htm

10 History

Table 10-1

Version:	Date:	Revisions
V1.0	02/2013	First release