SIEMENS

WinCC

Communication Manual

Manual 2

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(We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvements are welcomed.)

Technical data subject to change

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Preface

Purpose of this Manual

This manual contains various sample projects pertaining to the topic communication between WinCC and a PLC. It emphasizes the different communication options to the SIMATIC S5 and SIMATIC S7.
This manual is available in printed form as well as an electronic online document.
The table of contents or the index will quickly point you to the information required. The online document also provides an expanded search function.

Additional Support

For technical questions, please contact your Siemens representative at your local Siemens branch.
In addition, you can contact our Hotline at the following number:
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Information about SIMATIC Products

Constantly updated information about SIMATIC products can be found in the CA01 catalog. This catalog can be accessed at the following Internet address:
http://www.ad.siemens.de/ca01online/
In addition, the SIEMENS Customer Support provides you with current information and downloads. A collection of frequently asked questions is listed at the following Internet address:
http://www.ad.siemens.de/support/html_00/index.shtml

1 Sample Projects

This chapter illustrates the configuration of the communication between a WinCC station and a PLC by means of sample projects. Each of the sample projects is based on the application of a certain communication option and hardware combination.

Content of the Examples

The sample projects described below can be copied directly from the online document to your hard drive.
The functionality of the sample projects is limited to the application and display of a few tag values. The emphasis is placed on the configuration of the communication.

Structure of the Samples

The steps necessary to successfully start up the communication connection are described in detail. In general, the individual descriptions are structured into the following sections:

- Overview of the sample project
- Installation of the necessary components in the PC
- Creation of the project for the PLC
- Creation of the WinCC project
- Diagnosis of the communication connection

Software

The samples have been created with the following software versions:

- WinCC Version 5.0
- STEP5 Version 4.6
- STEP7 Version 5.0
- SIMATIC NET 05/99

2 Communication to the SIMATIC S7 via Industrial Ethernet (Hardnet)

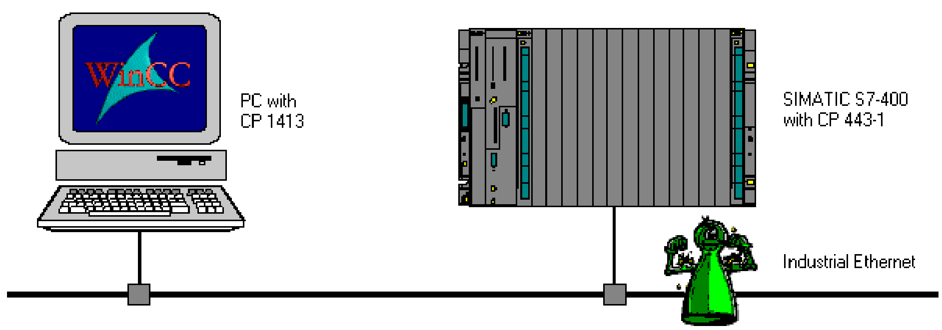
The projects created in this chapter can also be copied directly from the online document to your hard drive. By default, they will be copied to the folder *C:\Communication_Manual*. You have the option to copy the following components to the hard drive:

S7_IEH
The STEP7 project we will create.

WinCC_S7_IEH

The WinCC project we will create.
This chapter describes in detail the startup of a communication connection between a SIMATIC S7 and WinCC. The communication connection is realized via the Industrial Ethernet. The communication card CP 1413 used in the computer has its own CPU onboard. This will free the CPU of the computer from communication tasks. Such a configuration is generally referred to as Hardnet.

Overview of the Structure of the Sample



On the computer side, the connection to the *Industrial Ethernet* network is established via the communication processor *CP 1413*. To install this communication processor in the computer, the driver *IE S7 1413*, located on the *SIMATIC NET* CD-ROM, is needed.
In the WinCC project, the communication driver *SIMATIC S7 Protocol Suite* must be installed. Via its channel unit *Industrial Ethernet*, the connection to the *SIMATIC S7* is configured.
The PLC is equipped with a *CPU 416-1* module. The connection to the network is established via the communication processor *CP 443-1*. For the configuration of this communication processor with the STEP7 software, the option package *NCM S7 Industrial Ethernet* is required.

Overview of the Configuration Steps

The following lists all configuration steps necessary for the creation of the communication connection:

- Startup of the Communication Processor CP 1413
- Creation of the STEP7 Project S7_IEH
- Creation of the WinCC Project WinCC_S7_IEH
- Diagnosis of the Communication Connection

Required Software

Name	Description
SIMATIC NET	Driver *IE S7-1413* from the *SIMATIC NET* CD-ROM for the installation of the communication processor *CP 1413*.
STEP7	STEP7 software with option package *NCM for Industrial Ethernet* for the creation of the STEP7 project.
WinCC	WinCC with the communication driver *SIMATIC S7 Protocol Suite* for the creation of the WinCC project.

Required Computer Hardware

Name	Description
Communication Processor	Communication processor *CP 1413* to establish the connection to the PLC's communication processor.

Required PLC Hardware

Name	Description
Rack	Rack *UR1*
Power Supply	Power supply *PS 407 10A* in slot 1 and 2.
CPU Module	CPU module *CPU 416-1* in slot 3.
Communication Processor	Communication processor *CP 443-1* in slot 4.

2.1 Startup of the Communication Processor CP 1413

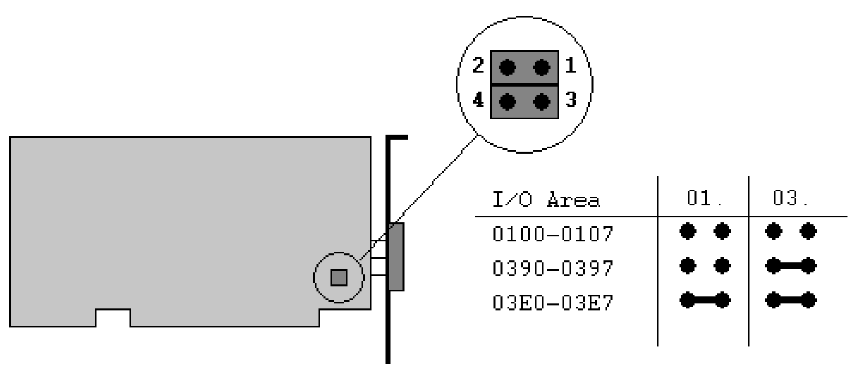
The following description details the configuration steps necessary to successfully start up the communication processor CP 1413.

Overview of the Configuration Steps

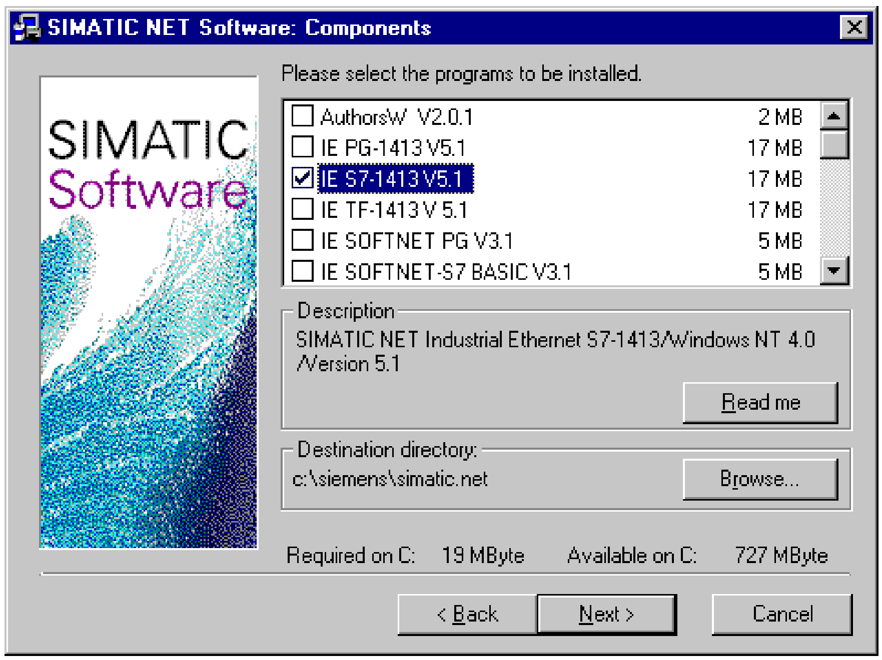
The following lists the configuration steps necessary to start up the communication processor *CP 1413*:

- A: Mounting the Communication Processor in the Computer
- B: Installing the Communication Driver
- C: Installing the Communication Processor
- D: Assigning the Communication Processor
- E: Testing the Communication Processor

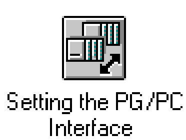
A: Mounting the Communication Processor in the Computer

Step	A: Mounting the Communication Processor in the Computer
1	Check the selected jumper settings at the CP 1413. During the installation of the *CP 1413*, the *I/O Range* must be specified. The I/O Range is set via *jumpers*. By default, the *I/O Range* is set to *03E0-03E7*. The settings *0100-0117* and *0390-0397* are also possible. The following graphic illustrates the jumper settings necessary for the various *I/O Ranges*. 
2	Mount the module according to the installation instructions. Among other things, follow the steps for handling electrostatic sensitive devices (ESD). The module must only be installed while the computer is off. For the communication card *CP 1413*, a free ISA slot in the computer is required. After the installation of the *CP 1413*, close the computer's case and start the computer.

B: Installing the Communication Driver

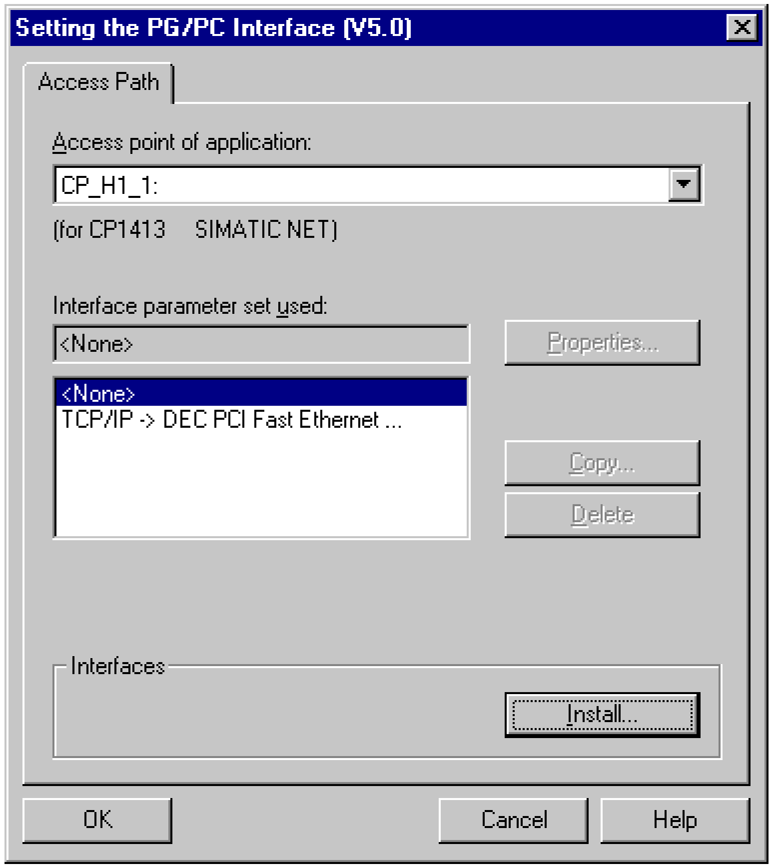
Step	B: Installing the Communication Driver
1	Install the communication driver *IE S7-1413* from the *SIMATIC NET* CD-ROM. After inserting the *SIMATIC NET* CD-ROM, the installation program is automatically started. If this is not the case, open the *Windows NT Explorer* and start the *setup.exe* program located on the CD-ROM. The installation of the software is started via the button displayed below.  Follow the instructions of the installation program. On the *Components* page, the check-box of the driver *IE S7-1413* to be installed must be selected. Finish the installation. 

C: Installing the Communication Processor

Step	C: Installing the Communication Processor
1	Install the communication processor CP 1413 via the program Setting the PG/PC Interface. This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*. 

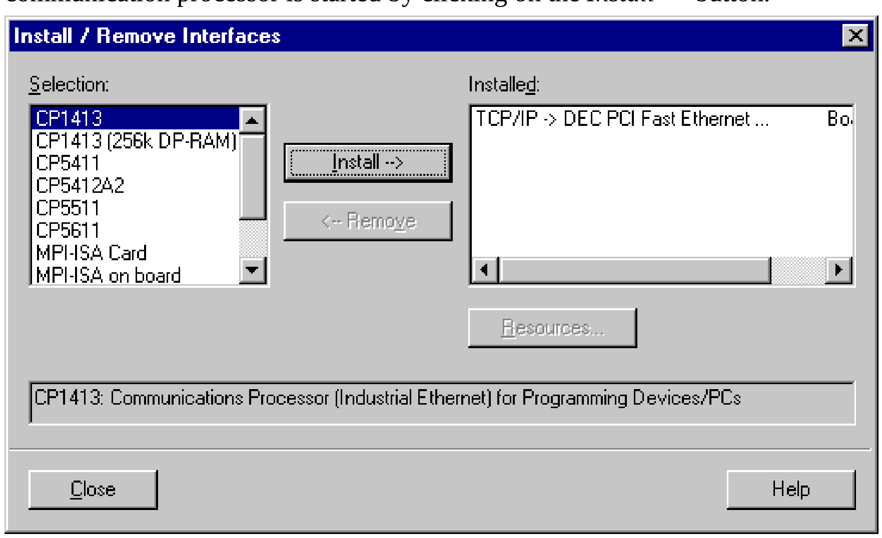
The program *Setting the PG/PC Interface* will be displayed.

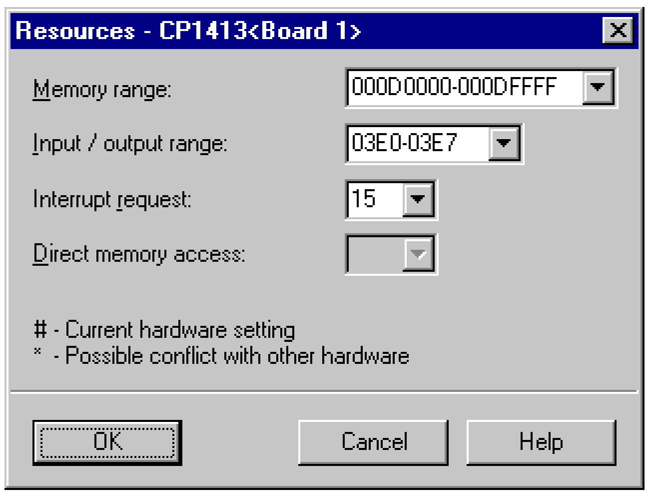
The dialog box for installing a new interface is opened via the *Install* button.

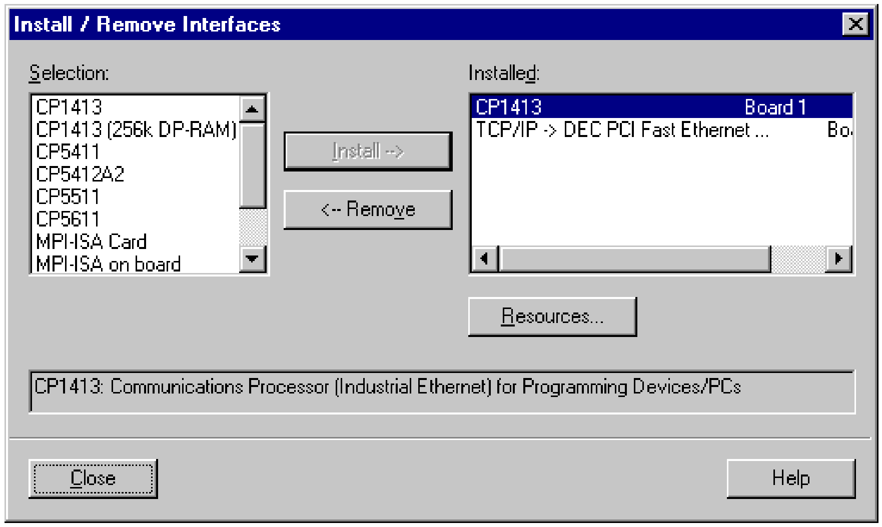


3 The dialog box *Install/Remove Modules* will be displayed. The *Selection* field lists all interfaces that can be installed. Among them will be the entry *CP 1413*, if the communication driver has been installed previously as outlined in step B.

From the *Selection* field, select the entry *CP 1413*. The installation of the communication processor is started by clicking on the *Install ->* button.

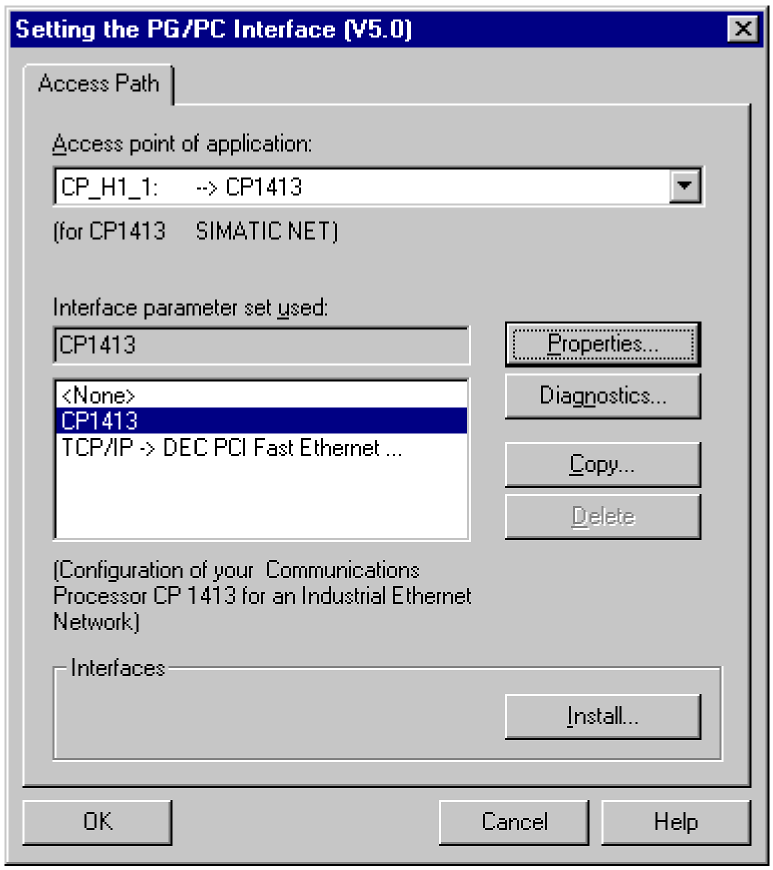


Step	C: Installing the Communication Processor
4	The dialog box *Resources - CP 1413* will be displayed. The settings for the *Memory Range*, *I/O Range* and *Interrupt* have to be specified. The *I/O Range* has already been determined via the Jumper Settings at the *CP 1413*. Make sure that the assigned resources have not already been taken by other modules in the computer. Information about already taken system resources can be obtained from the *Resources* tab accessed via *Start* → *Programs* → *Administrative Tools (Common)* → *Windows NT Diagnostics*. Close the *Resources* tab by clicking on *OK*. 

Step	C: Installing the Communication Processor
5	In the dialog box *Install/Remove Modules*, the *Installed* field will now contain the entry for the *CP 1413*. Exit the dialog box *Install/Remove Modules* via the *Close* button. 

D: Assigning the Communication Processor

Step	D: Assigning the Communication Processor
1	In the program *Setting the PG/PC Interface*, assign the access point *CP_H1_1:* to the just installed interface. The access point CP_H1_1: is the default access point used by WinCC for the communication via the Industrial Ethernet. It has been created automatically during the installation of the communication driver IE S7-1413. In the field *Access Point of the Application*, set the entry *CP_H1_1:*. In the field below, select the entry *CP1413*. This completes the assignment between the access point and the communication processor.



<table>
<tr><th>Step</th><th>D: Assigning the Communication Processor</th></tr>
<tr><td>2</td><td>
Setting the properties of the communication processor CP 1413.

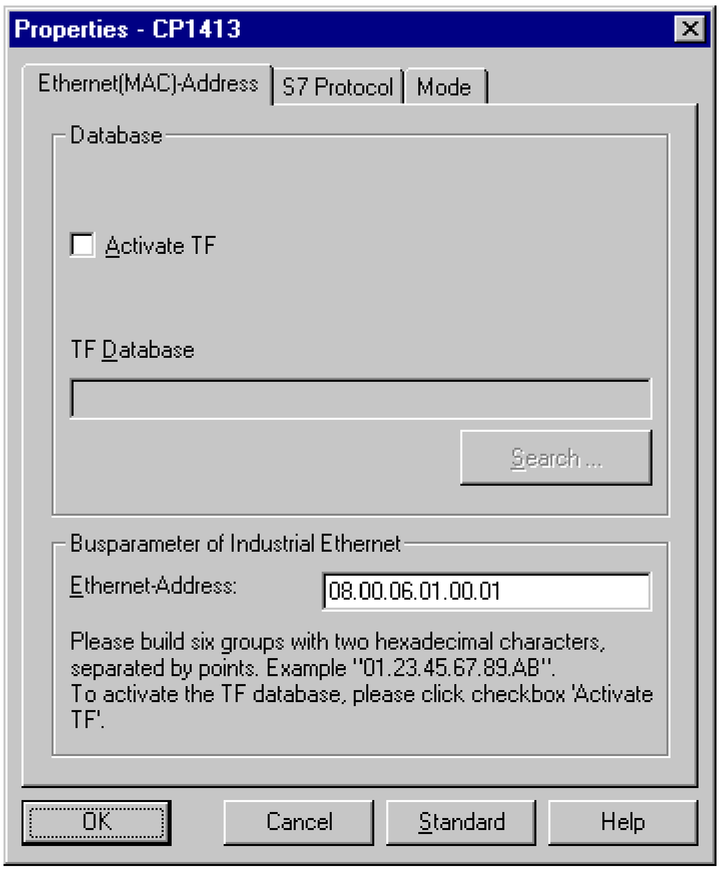
The dialog box for setting the properties is opened via the *Properties* button of the *Setting the PG/PC Interface* program.

The dialog box *Properties - CP 1413* will be displayed.

In the *Ethernet (MAC) Address* tab, enter the *Ethernet Address* of the *CP 1413*. In our sample, this is *08.00.06.01.00.01*.

The *Ethernet Address* is six Bytes long and structured as follows for SIEMENS devices:

- *08.00.06*: The first six digits of the hexadecimal value correspond to the number for SIEMENS.
- *01*: The next two digits specify the range for SIEMENS.
- *0*: The next digit signifies the SIMATIC system.
- *0.01*: The last three digits correspond to the significant station address of a SIEMENS device.



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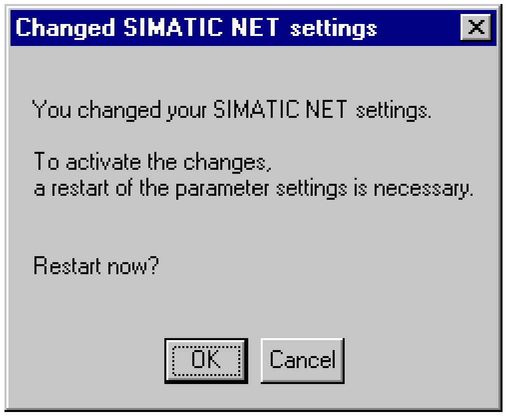
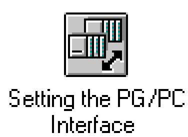
</table>

Step	**D: Assigning the Communication Processor**
3	Exit the program Setting the PG/PC Interface via the OK button. A dialog box will be displayed requesting the restart of the *CP 1413*. Acknowledge this dialog box by clicking on *OK*, which will result in the restart of the communication processor *CP 1413*. This completes the installation of the communication processor. 

E: Testing the Communication Processor

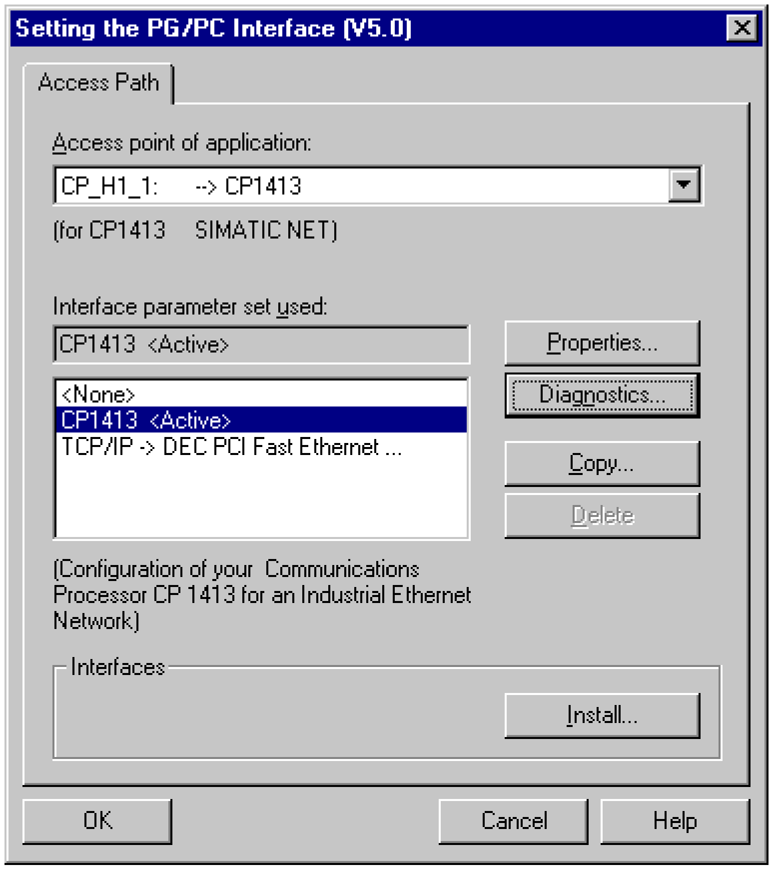
Step	**E: Testing the Communication Processor**
1	Check the proper installation of the communication processor *CP 1413* via the program *Setting the PG/PC Interface*. This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*. 

<table>
<tr><th>Step</th><th>E: Testing the Communication Processor</th></tr>
<tr><td>2</td><td>

The program *Setting the PG/PC Interface* will be displayed.

Select the interface to be checked. In this case, select the entry *CP 1413*. Make sure that the assignments between access points and the interfaces are not changed.

The check for a proper installation is activated by clicking on the *Diagnostics* button.



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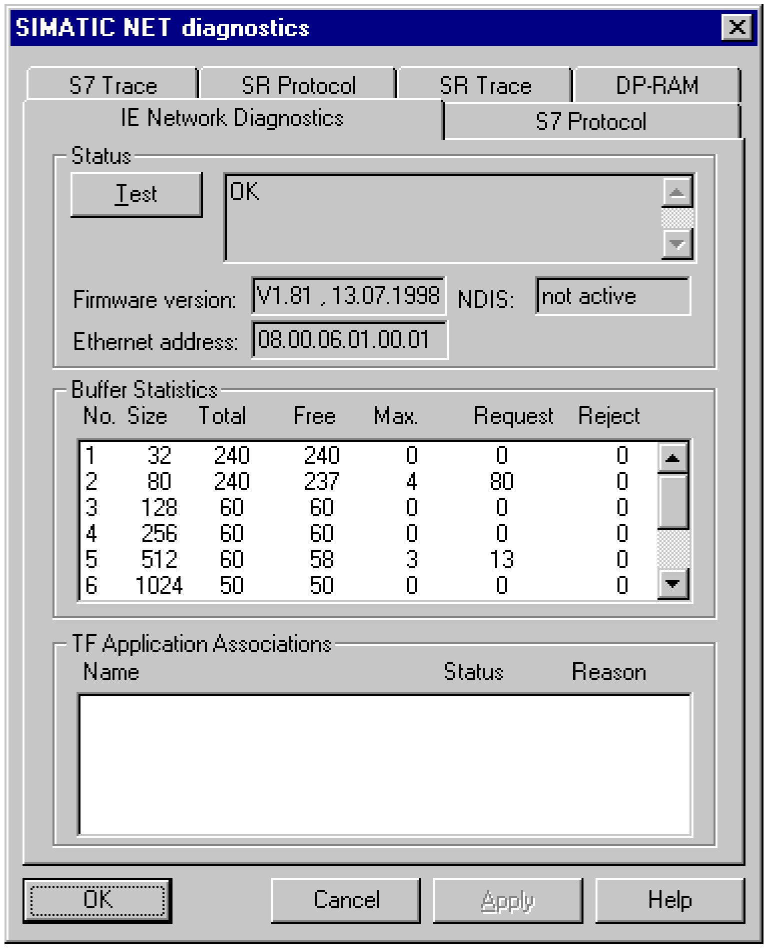
</table>

Step	**E: Testing the Communication Processor**
3	The dialog box Simatic NET Diagnostics will be displayed. In the *IE Network Diagnostics* tab, the diagnosis is started via the *Test* button. The result of the diagnosis will be displayed after that. If the result of the diagnosis is positive (correct installation), the dialog box can be exited with *OK*. In this case, the program *Setting the PG/PC Interface* can also be closed by clicking on *OK*. The configuration of the communication to the S7 via the *Industrial Ethernet* is continued in the following section. However, if the result of the diagnosis is negative (incorrect installation), the error must be localized and corrected. Troubleshooting procedures are described in the section Is the Communication Module in the Computer operational?. 

2.3 Creation of the STEP7 Project S7_IEH

The following description details the configuration steps necessary to create and start up the STEP7 project *S7_IEH*.

Overview of the Configuration Steps

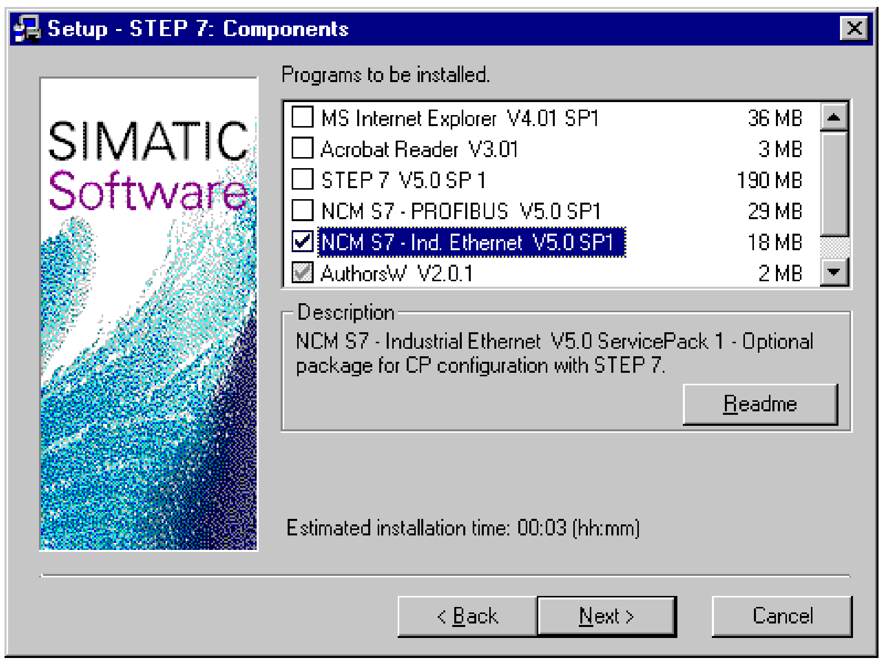
The following lists the configuration steps necessary to create the STEP7 project *S7_IEH*:

- A: Installing the Hardware
- B: Installing the Option Package
- C: Creating the STEP7 Project
- D: Configuring the Hardware
- E: Loading the Hardware Configuration
- F: Testing the Hardware Configuration
- G: Creating the STEP7 Program
- H: Testing the STEP7 Program

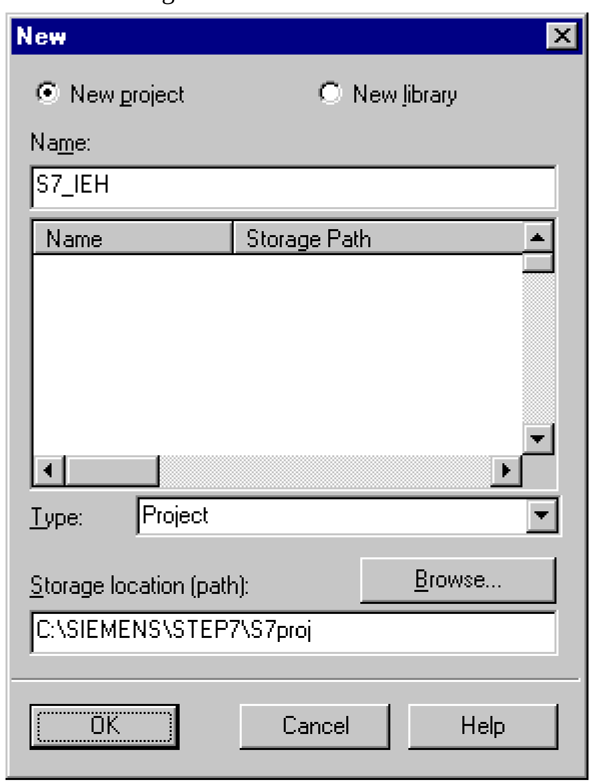
A: Installing the Hardware

Step	A: Installing the Hardware
1	Rack-mounting of the modules used. In this sample, the modules to be installed are the power supply *PS 407 10A*, the CPU module *CPU 416-1* and the communication processor *CP 443-1*. Establishing the connection from the programming device to the programming interface of the CPU module. Establishing the connection from the communication processor *CP 1413* in the computer to the communication processor *CP 443-1* in the PLC.

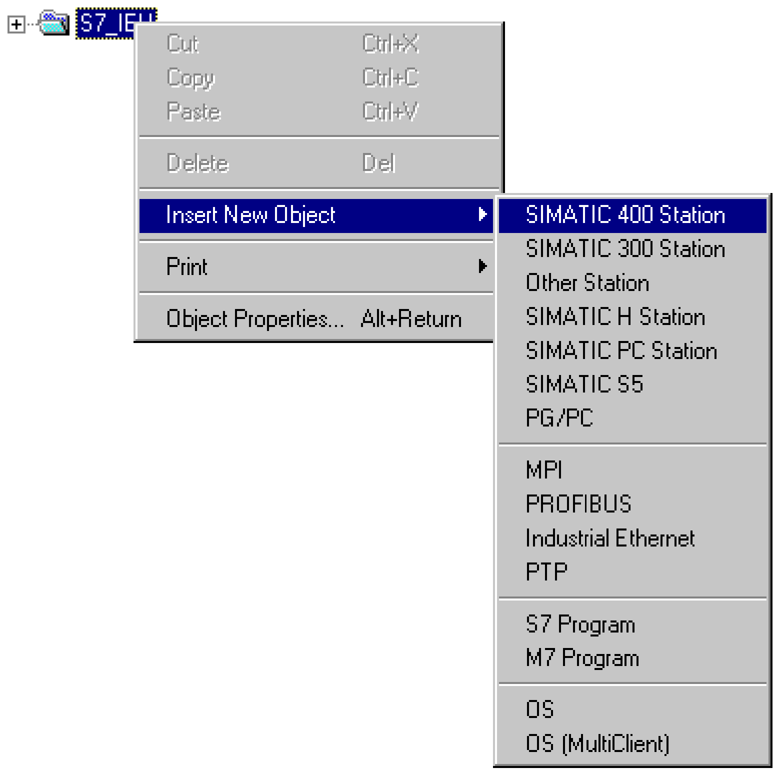
B: Installing the Option Package

Step	**B: Installing the Option Package**
1	If the option package NCM S7 Industrial Ethernet has not been installed during the installation of STEP7, install it now from the STEP7 CD-ROM. This option package is required for the configuration of the communication processor CP 443-1 via the STEP7 software. After inserting the *STEP7* CD-ROM, the installation program is automatically started. If this is not the case, open the *Windows NT Explorer* and start the *setup.exe* program located on the CD-ROM. 
2	This starts the installation program. Follow the instructions of the installation program. On the *Components* page, select the check-box *NCM S7 Ind. Ethernet*. Finish the installation. 

C: Creating the STEP7 Project

Step	C: Creating the STEP7 Project
1	Create a new STEP7 project in the *SIMATIC Manager*. It is started via *Start* → *Simatic* → *SIMATIC Manager*. 
2	This displays the *SIMATIC Manager*. Via the menus *File* → *New*, the dialog box for specifying the parameters of a new STEP7 project will be opened. The *New* dialog box will be displayed. The radio-button *New Project* must be selected. In the *Name* field, the name of the new project to be created is entered. The names of the STEP7 projects created within the framework of this manual all start with *S7*. They also include a reference to the communication type used. The project of this sample has the name *S7_IEH*. By default, projects are stored in the *C:\SIEMENS\STEP7\S7proj* folder. This can be changed at any time via the *Browse* button. The *New* dialog box is closed via the *OK* button. 

D: Configuring the Hardware

<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td>1</td><td>
The new project will be displayed in the SIMATIC Manager.
The hardware for this project must be configured. Two components are needed: One SIMATIC 400-Station and for its networking an Industrial Ethernet.These components are added to the SIMATIC Manager via a R on the project name S7_IEH and then selecting Insert New Object → SIMATIC 400-Station and Insert New Object → Industrial Ethernet from the pop-up menu.


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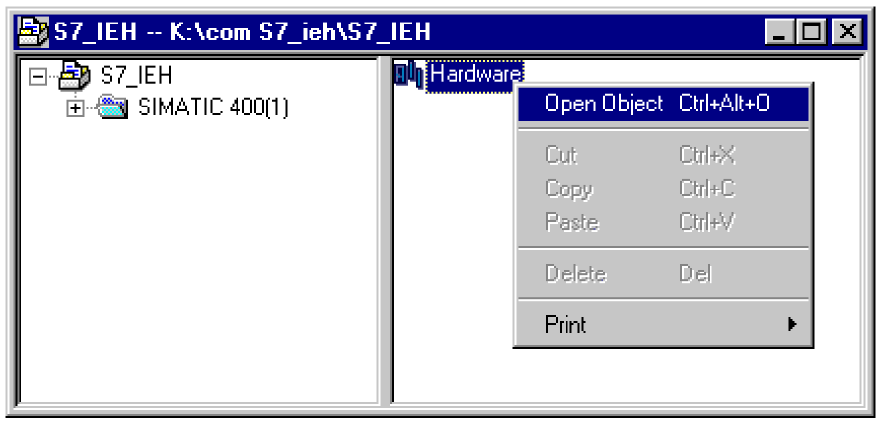
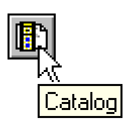
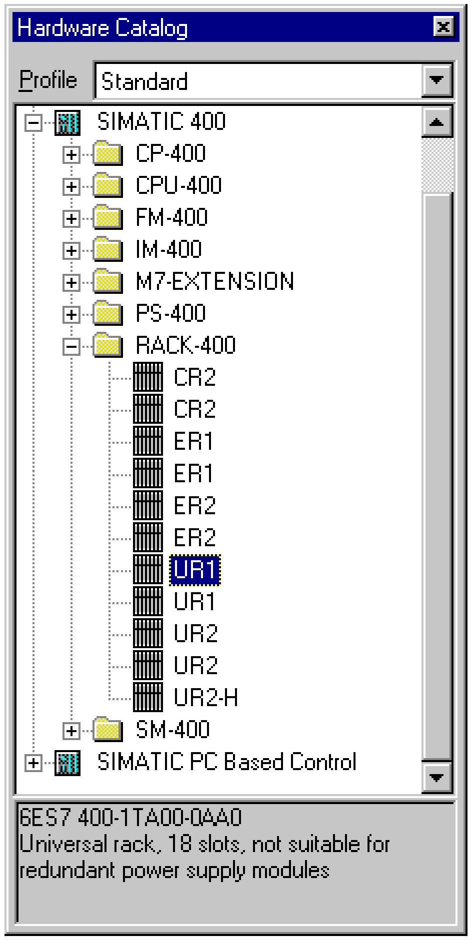
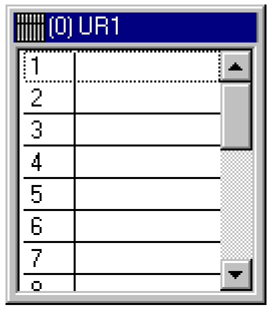
</table>

Step	D: Configuring the Hardware
2	The just added components will be displayed in the right window of the *SIMATIC Manager*.  By D on the component *SIMATIC 400(1)* in the right window, the point *Hardware* will be displayed. By D on the point *Hardware* or R on it and then selecting *Open Object* from the pop-up menu, the program *HW Config* will be started. 
3	The program HW Config is displayed. This program is used to exactly define the hardware used in the PLC and to configure their properties. 
4	By clicking on the toolbar button of the program *HW Config* displayed below, the *Hardware Catalog* is opened. This catalog is used to select the required hardware components. 

Step	D: Configuring the Hardware
5	The Hardware Catalog is displayed. The first component selected is the rack. On this rack, all other components will be installed. The rack is inserted into the project via a D or by Dragging Dropping. In this sample, the rack type *UR1* is used.



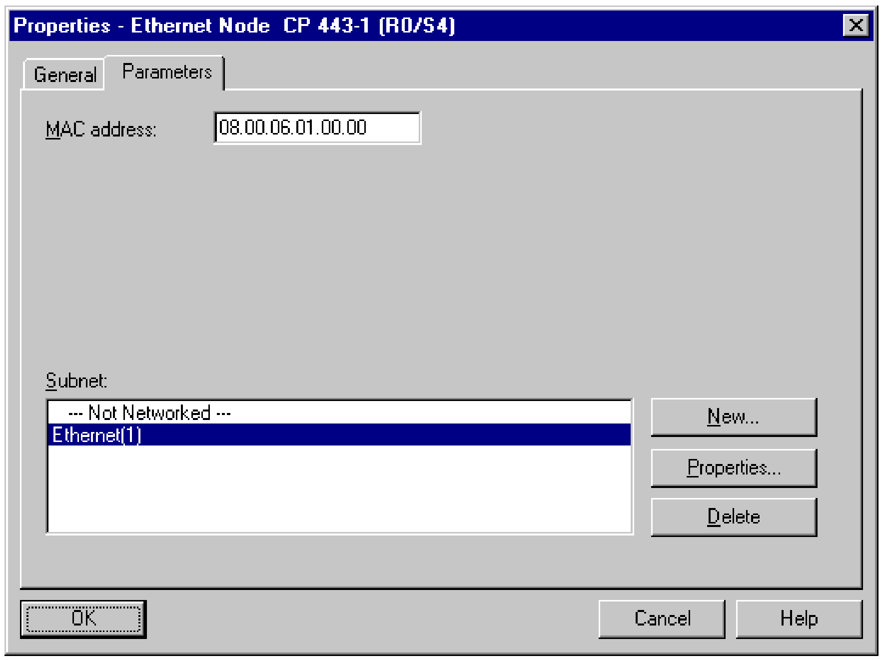
Step	**D: Configuring the Hardware**
6	The program HW Config displays the currently still empty rack. It received the Rack Number 0. During the configuration of the connection in the WinCC project, the Rack Number is one of the parameters that must be set. 
7	Arrange the other hardware components in the rack. This is done by Dragging Dropping the desired components from the Hardware Catalog to the corresponding slot in the rack. This sample uses the power supply *PS 407 10A*. It is inserted into slot *1*. A power supply of this type occupies two slots. As the CPU module, this sample uses a *CPU 416-1*. This module is inserted into slot *3*. Another parameter to be set during the configuration of the connection in the WinCC project is the slot number of the CPU module. We also require the communication processor *CP 443-1*. This CP is only available from the *Hardware Catalog* if the option package *NCM S7 Industrial Ethernet* has been installed. After the communication processor *CP 443-1* has been inserted in the rack, its properties dialog box will open.

<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td>8</td><td>

The Ethernet Interface properties dialog box of the CP 443-1 will be displayed.

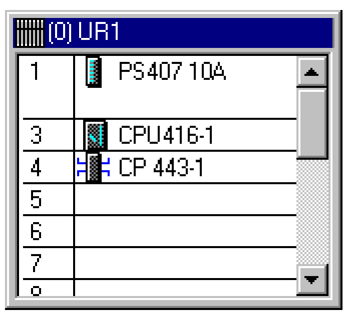
In the *MAC Address* field of the *Parameters* tab, enter the desired Ethernet address of the communication processor. In this sample, the address *08.00.06.01.00.00* is specified. Another parameter to be set during the configuration of the connection in the WinCC project is this Ethernet address.

In the *Subnet* field below, assign the entry *Ethernet(1)* to the communication processor. Close the dialog box by clicking on *OK*.



</td></tr>
<tr><td>9</td><td>

The following graphic shows the completed hardware arrangement of the sample.



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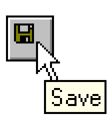
<tr><td>10</td><td>

Save the settings made in the program *HW Config*. This is done via the toolbar button displayed below.



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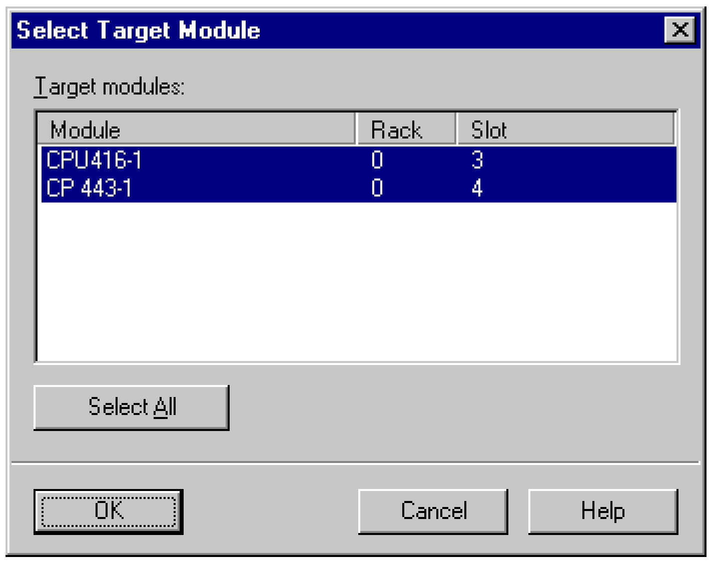
</table>

E: Loading the Hardware Configuration

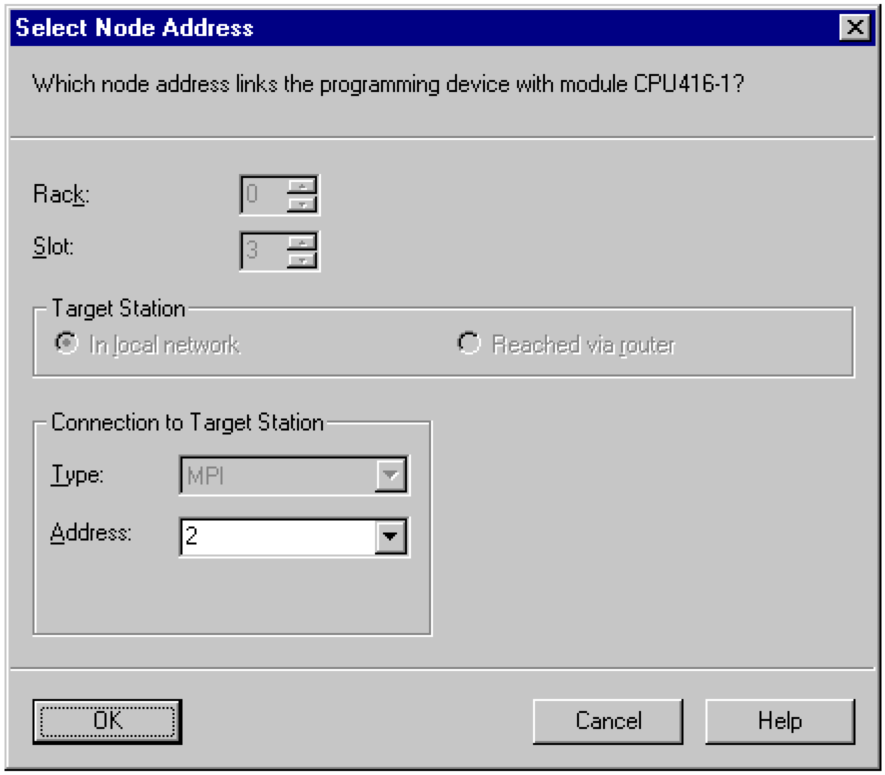
Step	E: Loading the Hardware Configuration
1	The hardware configuration created in the program *HW Config* must be transferred to the PLC. This is done via the toolbar button displayed below. 
2	A dialog box will be displayed from which the components to be loaded can be selected. For this sample, all displayed components will be selected. Note that loading to the CPU module is only possible while the operating mode switch is set to *STOP* or *RUN-P*. Close the dialog box by clicking on *OK*. 

<table>
<tr><th>Step</th><th>E: Loading the Hardware Configuration</th></tr>
<tr><td>3</td><td>

Now the dialog box *Select Station Address* will be displayed.

In this dialog box, specify which station address is used by the STEP7 software to communicate with the CPU module. In this sample, the communication is carried out via the MPI interface. The *Address* of the CPU module is *2*.

Close the dialog box by clicking on *OK*.

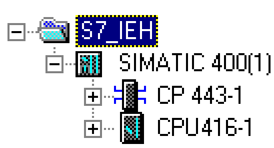


</td></tr>
<tr><td>4</td><td>

The configuration data will now be transferred to the PLC. If necessary, the individual modules will be set to the STOP status.

The program *HW Config* can be exited.

The newly added components will be displayed by the *SIMATIC Manager* for the station *SIMATIC 400(1)*.



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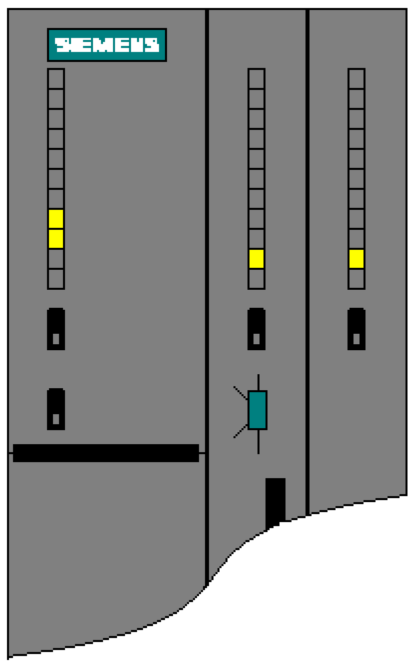
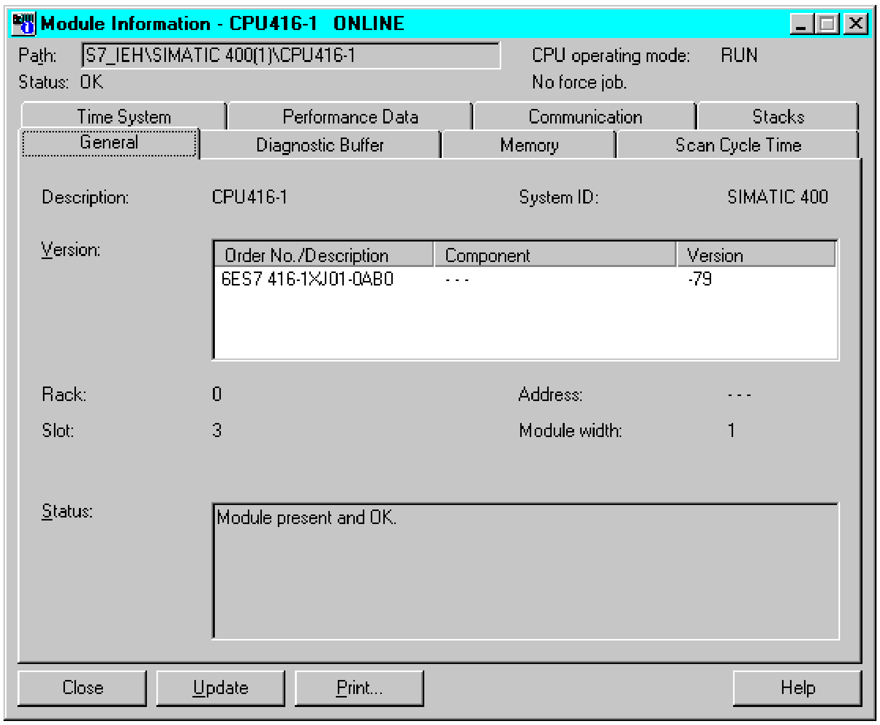
</table>

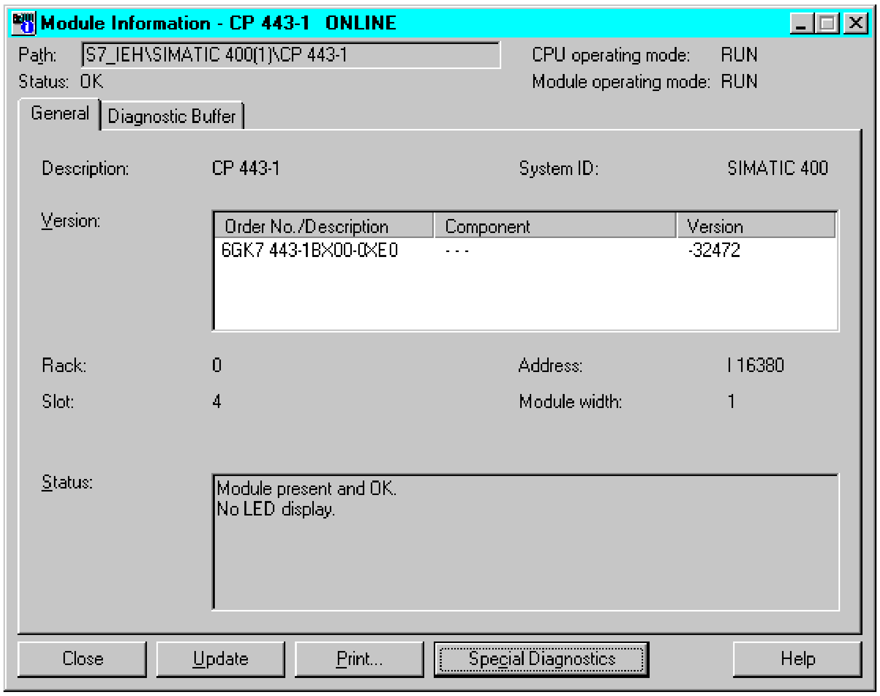
F: Testing the Hardware Configuration

Step	F: Testing the Hardware Configuration
1	Testing of the hardware configuration made. If the key switch of the CPU module is set to *RUN* or *RUN-P* and the operating mode switch of the communication processor is set to *RUN*, only the status LEDs signifying the *RUN* operating mode should be displayed. If this is not the case, there is an error. The following steps help you localize this error. However, these steps should still be performed even if the status LEDs show no error. This allows you to recognize uncritical errors and faulty configurations. 

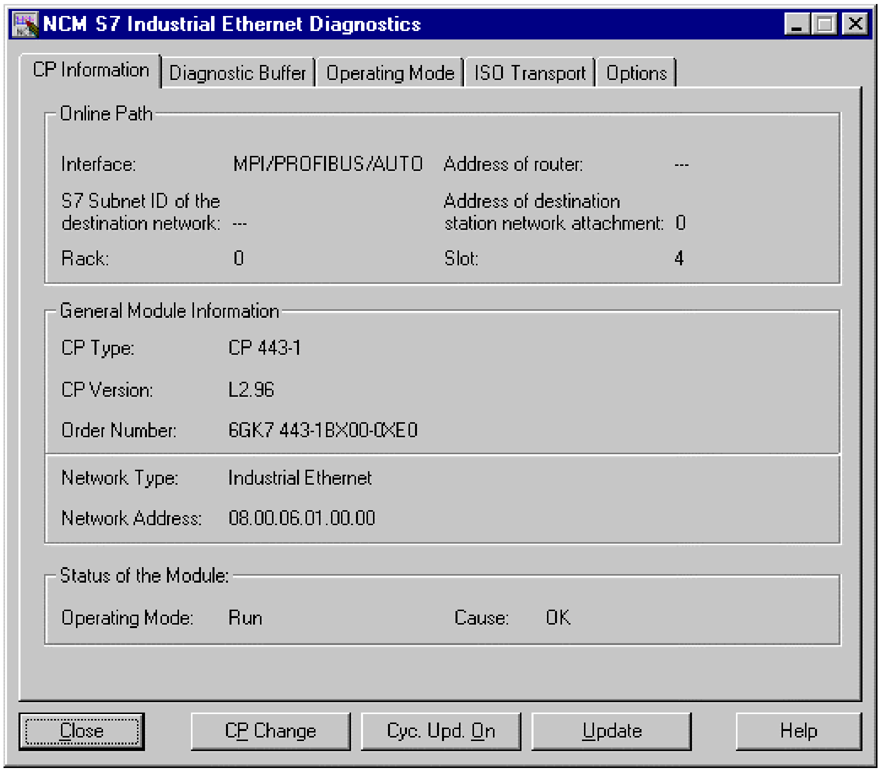
<table>
<tr><th>Step</th><th>F: Testing the Hardware Configuration</th></tr>
<tr><td>2</td><td>
Testing the configuration of the CPU module.
This is done via the dialog box Module Status in the SIMATIC Manager. It is opened by a R on the entry of the CPU module in the left window and then selecting Target System → Module Status from the pop-up menu.
The dialog box Module Status of the CPU module will be displayed.
The General tab displays various general data of the CPU module. In the Status field, the current module status and any existing errors are displayed.
The Diagnosis Buffer tab contains more detailed information about existing errors and how to correct them.
The dialog box can be exited via the Close button.



</td></tr>
</table>

<table>
<tr><th>Step</th><th>F: Testing the Hardware Configuration</th></tr>
<tr><td>3</td><td>
Testing the configuration of the communication processor.
This is done via the dialog box Module Status in the SIMATIC Manager. It is opened by a R on the entry of the communication processor in the left window and then selecting Target System → Module Status from the pop-up menu.
The dialog box Module Status of the communication processor will be displayed.
The General tab displays various general data of the module.
A dialog box for a more detailed diagnosis of the communication processor can be accessed via the Special Diagnosis button.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>F: Testing the Hardware Configuration</th></tr>
<tr><td>4</td><td>
The dialog box NCM S7 Industrial Ethernet Diagnosis will be displayed.
The *CP Information* tab displays general information about the module. Among other things, the network address set can be checked.
The dialog box can be exited via the *Close* button. The Module Status dialog box can also be exited via the *Close* button.


</td></tr>
</table>

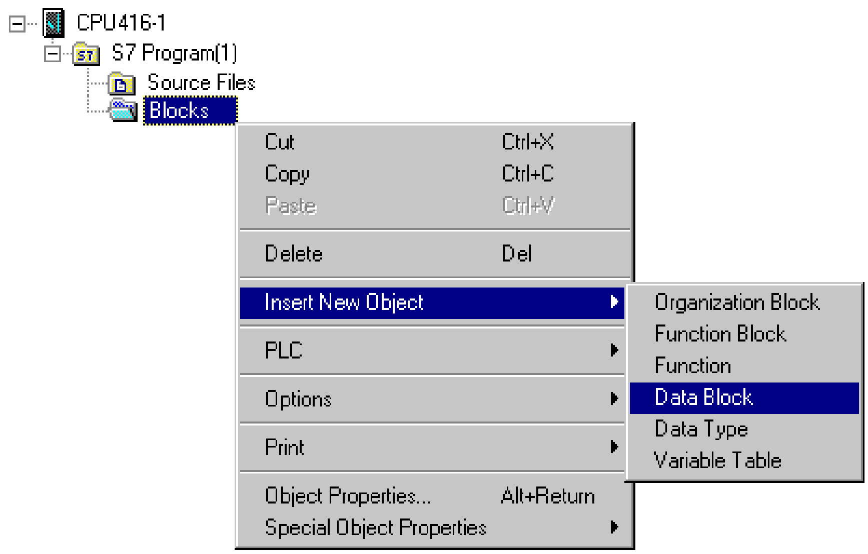
G: Creating the STEP7 Program

<table>
<tr><th>Step</th><th>G: Creating the STEP7 Program</th></tr>
<tr><td>1</td><td>

Creation of the *S7 Program*.

This sample project requires the operation block OB1 and a data block. OB1 is available by default, the required data block must be created. This is done in the SIMATIC Manager via a R on the sub-entry Modules of the entry S7 Program(1) of the configured CPU module and then selecting *Insert New Object* → *Data Block* from the pop-up menu.

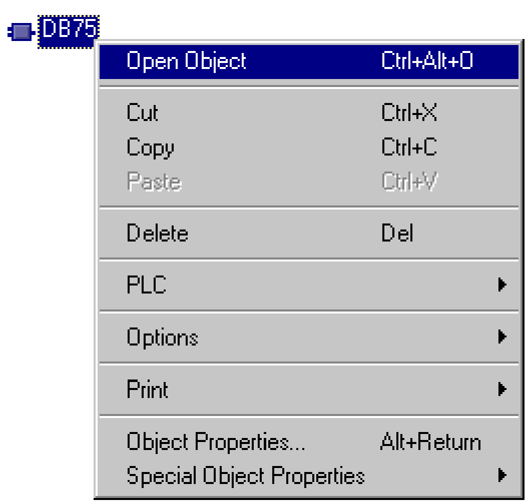
The properties dialog box of the data block will be opened. As the block's *Name* enter *DB75* and close the dialog box with *OK*.



</td></tr>
<tr><td>2</td><td>

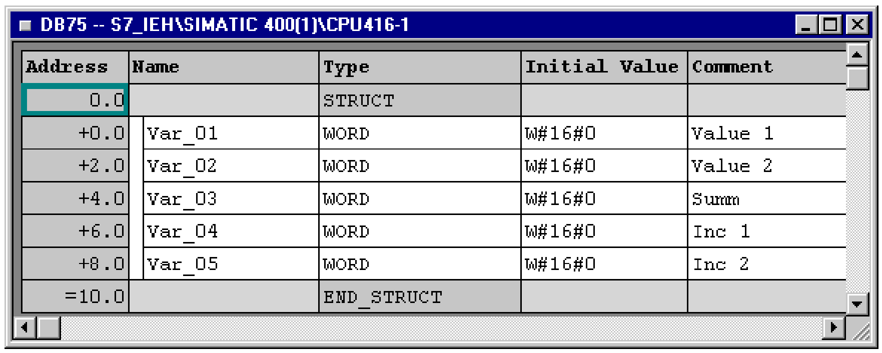
The newly created data block *DB75* will be displayed in the right window of the project.

Via a D on this data block or a R and then selecting Open Object from the pop-up menu, the content of the block can be programmed. This starts the program LAD/STL/SCF.



</td></tr>
</table>

<table>
<tr><th>Step</th><th>G: Creating the STEP7 Program</th></tr>
<tr><td>3</td><td>The program LAD/STL/SCF is displayed.
Acknowledge the dialog box New Data Block by clicking on OK.

</td></tr>
<tr><td>4</td><td>Programming the DB75.
In this data block, two tags with a length of 16 Bits are created. Their sum is to be determined in OB1 and then be written to another tag with a length of 16 Bits.
Two additional tags with a length of 16 Bits are created, whose values are cyclically incremented in OB1.
The tags created in the data block DB75 are visualized in the WinCC project. To do so, WinCC tags with corresponding addressing are created there.
The following graphic displays the programmed data block DB75.

DB75 -- S7_IEH\SIMATIC 400(1)\CPU416-1
<table>
<tr><th>Address</th><th>Name</th><th>Type</th><th>Initial Value</th><th>Comment</th></tr>
<tr><td>0.0</td><td></td><td>STRUCT</td><td></td><td></td></tr>
<tr><td>+0.0</td><td>Var_01</td><td>WORD</td><td>W#16#0</td><td>Value 1</td></tr>
<tr><td>+2.0</td><td>Var_02</td><td>WORD</td><td>W#16#0</td><td>Value 2</td></tr>
<tr><td>+4.0</td><td>Var_03</td><td>WORD</td><td>W#16#0</td><td>Summ</td></tr>
<tr><td>+6.0</td><td>Var_04</td><td>WORD</td><td>W#16#0</td><td>Inc 1</td></tr>
<tr><td>+8.0</td><td>Var_05</td><td>WORD</td><td>W#16#0</td><td>Inc 2</td></tr>
<tr><td>=10.0</td><td></td><td>END_STRUCT</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>5</td><td>Save the block and load it into the PLC. This is done via the toolbar button displayed below. Note that loading to the CPU module is only possible while the operating mode switch is set to STOP or RUN-P.

</td></tr>
<tr><td>6</td><td>Programming the OB1.
Open the block in the program LAD/STL/SCF.
First, two values in the DB75 are added and then stored again in DB75.
Netzwerk 1: Addition
Adding two 16-Bit Values
The result is stored in another
16-Bit Value
OPN DB 75
L DBW 0
L DBW 2
+I
T DBW 4
Next, a value in the DB75 is incremented every second.</td></tr>
</table>

<table>
<tr><th>Step</th><th>G: Creating the STEP7 Program</th></tr>
<tr><td></td><td>

Network 2: Second Cycle

```
Generation of a second cycle at M 0.0
```

```
      AN    M      0.0
      L     S5T#1S
      SD    T      1
      A     T      1
      =     M      0.0
```

Network 3: Counting in a second cycle

```
Counting a value in a second cycle
At 10000, reset to 0
```

```
      AN    M      0.0
      JC    M001
      L     DBW    6
      L     1
      +I
      T     DBW    6
      L     10000
      <I
      JC    M001
      L     0
      T     DBW    6
M001: NOP   0
```

Finally, a value in the *DB75* is incremented every time the *OB1* run.

Network 4: Counting in the cycle time

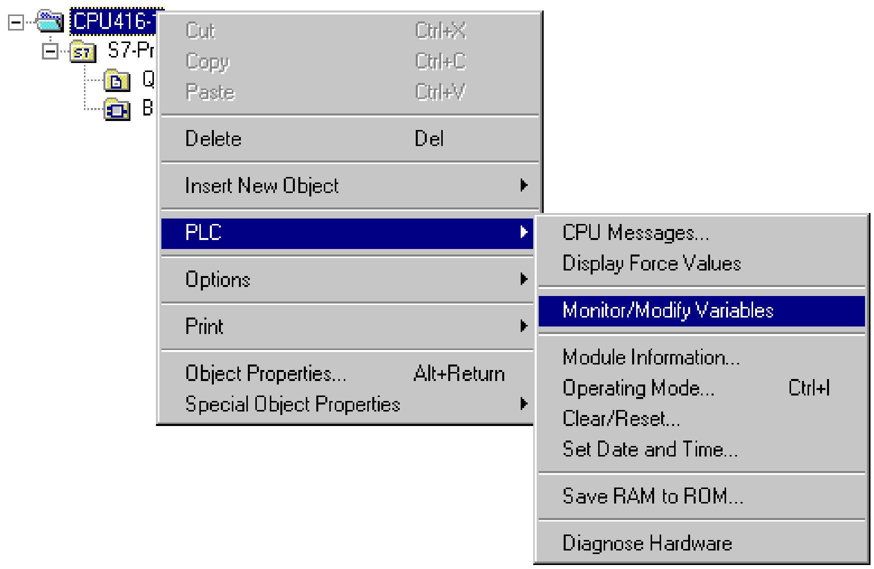
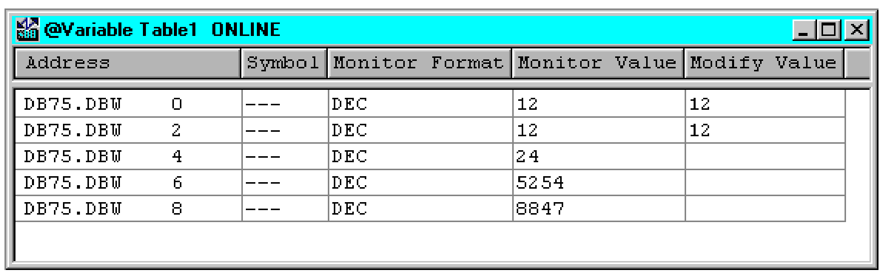
```
Counting a value each time the OB is executed
At 10000, reset to 0
```

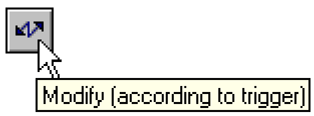
```
      L     DBW    8
      L     1
      +I
      T     DBW    8
      L     10000
      <I
      JC    M002
      L     0
      T     DBW    8
M002: NOP   0
```

</td></tr>
<tr><td>7</td><td>Save the block OB1 and load it into the PLC. This is done via the corresponding buttons on the toolbar.

This completes the creation of the STEP7 project and it can now be run. Exit the program LAD/STL/SCF.</td></tr>
</table>

H: Testing the STEP7 Program

<table>
<tr><th>Step</th><th>H: Testing the STEP7 Program</th></tr>
<tr><td>1</td><td>Testing the program with the STEP7 software.
For this purpose, a tag table is created. This is done in the SIMATIC Manager via a R on the entry of the configured CPU module and then selecting Target System R Monitor/Control Tag from the pop-up menu.

</td></tr>
<tr><td>2</td><td>An editor for creating and using a tag table will be displayed.
The following shows a completed tag table. In this table, enter all tags created in the DB75.

@Variable Table1 ONLINE<table><tr><th>Address</th><th></th><th>Symbol</th><th>Monitor Format</th><th>Monitor Value</th><th>Modify Value</th></tr><tr><td>DB75.DBW</td><td>0</td><td>---</td><td>DEC</td><td>12</td><td>12</td></tr><tr><td>DB75.DBW</td><td>2</td><td>---</td><td>DEC</td><td>12</td><td>12</td></tr><tr><td>DB75.DBW</td><td>4</td><td>---</td><td>DEC</td><td>24</td><td></td></tr><tr><td>DB75.DBW</td><td>6</td><td>---</td><td>DEC</td><td>5254</td><td></td></tr><tr><td>DB75.DBW</td><td>8</td><td>---</td><td>DEC</td><td>8847</td><td></td></tr></table></td></tr>
</table>

Step	H: Testing the STEP7 Program
3	Monitoring the current tag values. By clicking on the toolbar button displayed below, the current values of the corresponding tags in the PLC are displayed in the column Status Value.  Controlling the tag values. Values can be entered in the column Control Value. By clicking on the toolbar button displayed below, these values will be written to the corresponding tags in the PLC. Note that tags can only be controlled while the operating mode switch of the CPU module is set to *RUN-P*. 
4	The created tag table can now be saved. In this sample, the table is saved under the name *VAT1*. After checking the program in the PLC, the tag table can be closed. This concludes the configuration of the STEP7 project and the *SIMATIC Manager* can be exited. 

2.4 Creation of the WinCC Project WinCC_S7_IEH

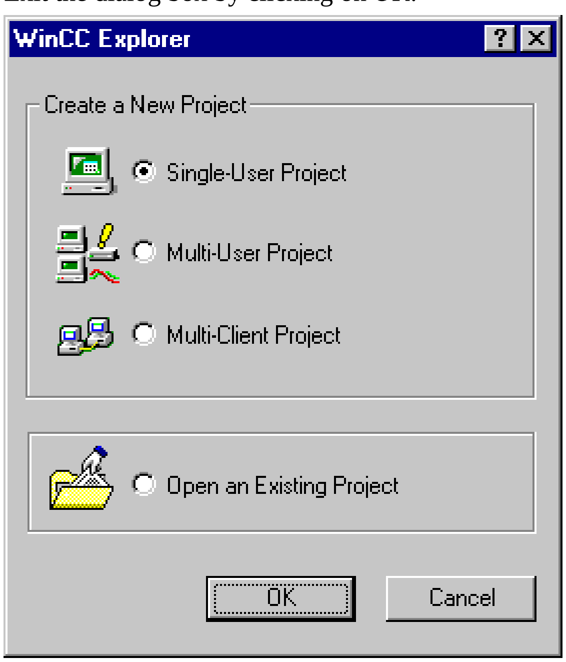
The following description details the configuration steps necessary to create and start up the WinCC project *WinCC_S7_IEH*.

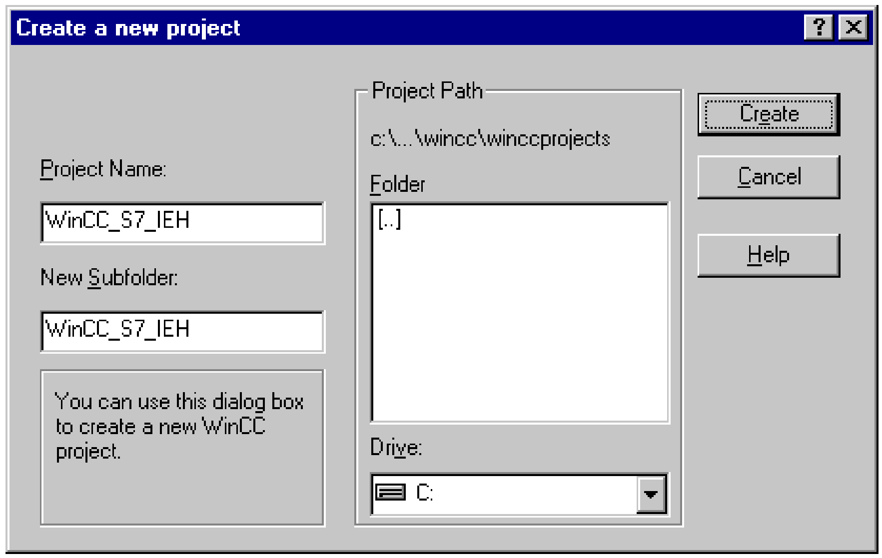
Overview of the Configuration Steps

The following lists the configuration steps necessary to create the WinCC project *WinCC_S7_IEH*:

- A: Creating the WinCC Project
- B: Creating the Connection
- C: Creating the WinCC Tags
- D: Creating the WinCC Screen

A: Creating the WinCC Project

Step	A: Creating the WinCC Project
1	Creation of a new WinCC project in the WinCC Explorer. The WinCC Explorer is started via *Start* → *Simatic* → *WinCC* → *Windows Control Center*. 
2	The WinCC Explorer will be displayed. Via the menus *File* → *New*, the dialog box for specifying the properties of a new WinCC project will be opened. For this sample project, a *Single-User Project* is created. Exit the dialog box by clicking on *OK*. 

Step	A: Creating the WinCC Project
3	The dialog box *Create a new Project* will be displayed. Specify a *Project Name* for the new project. The names of the WinCC projects created within the framework of this manual all start with *WinCC* and also include a reference to the communication partner and communication type used. The project of this sample has the name *WinCC_S7_IEH*. In the *Project Path* field, set the storage location of the new project. The dialog box *Create a new Project* is concluded by clicking on the *Create* button. 

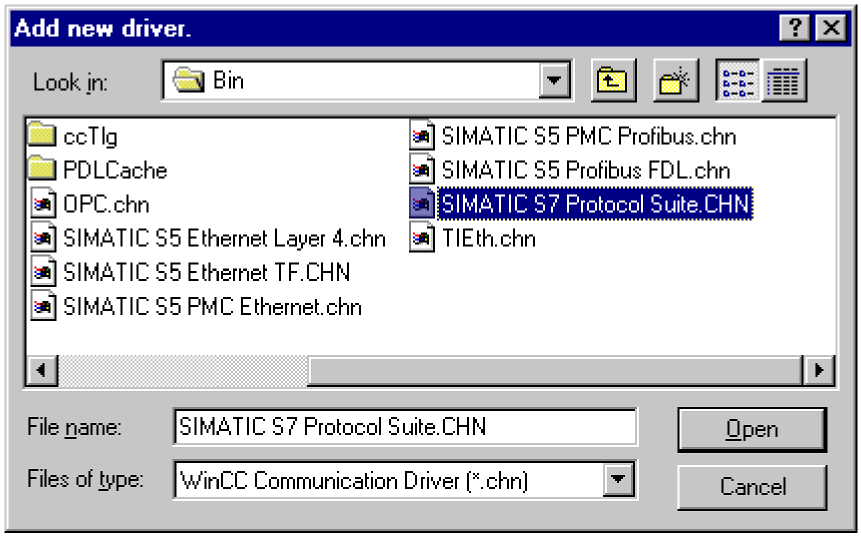
B: Creating the Connection

Step	B: Creating the Connection
1	The new project will be displayed in the *WinCC Explorer*. Installation of the required communication driver. This is performed via a R on *Tag Management* and selecting *Add New Driver* from the pop-up menu. 

<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>2</td><td>

The dialog box *Add New Driver* will be displayed.

This dialog box lists all communication drivers that can be installed. For the communication to the *SIMATIC S7*, the driver *SIMATIC S7 Protocol Suite* is required. Select this driver from the dialog box. Exit the dialog box by clicking on *Open*.

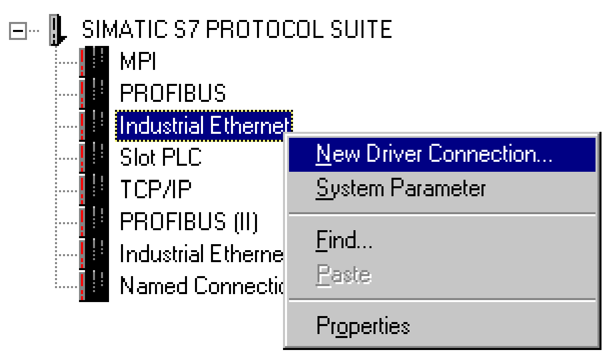


</td></tr>
<tr><td>3</td><td>

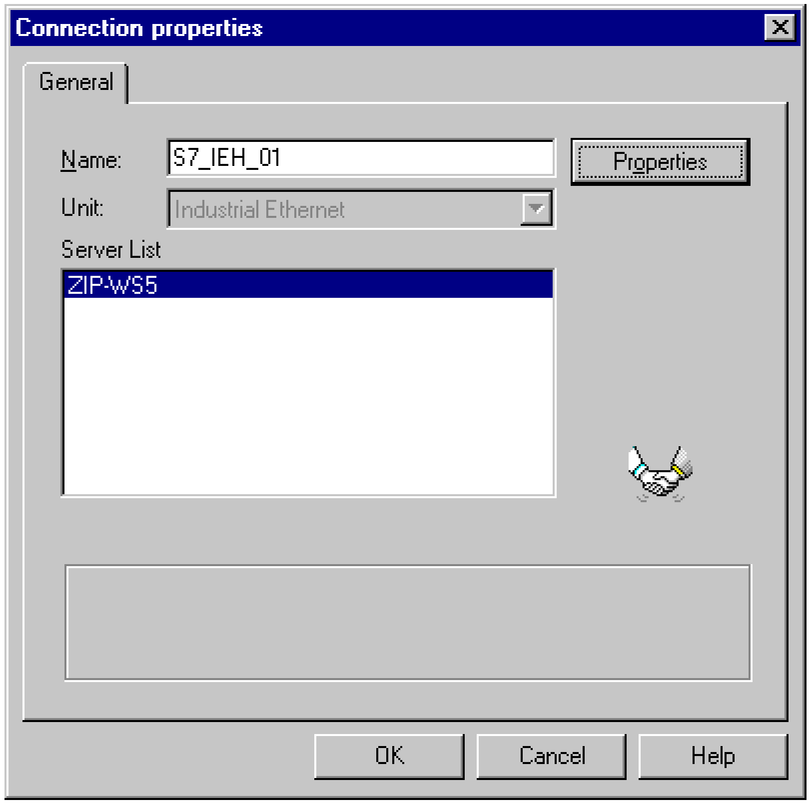
The newly added driver *SIMATIC S7 Protocol Suite* will be displayed as a sub-entry to *Tag Management*.

The driver contains eight different channel units. To operate a computer with two *CP 1413* communication processors, two *Industrial Ethernet* channel units are available.

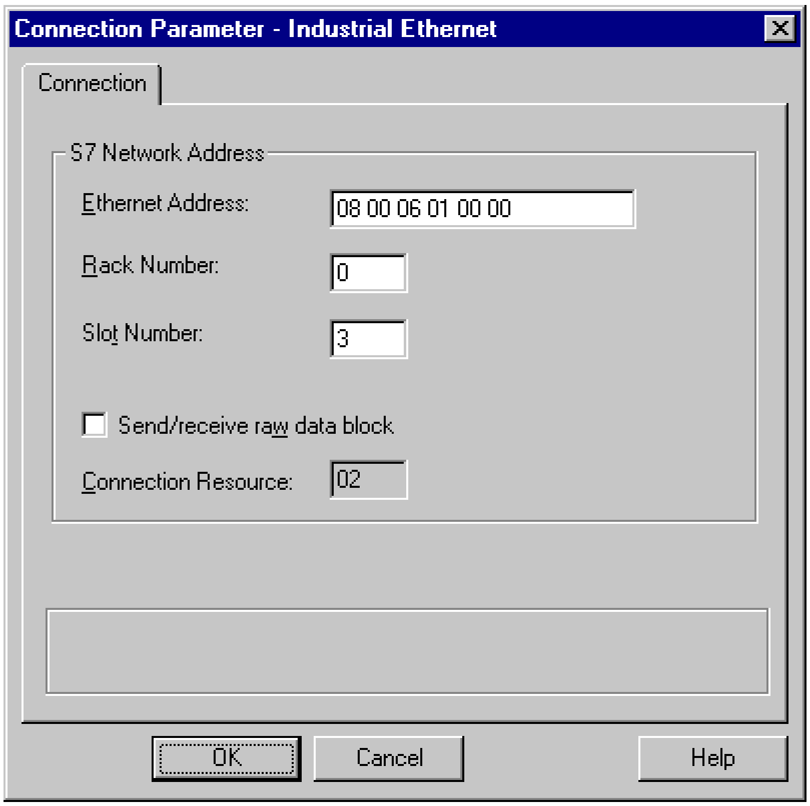
In this sample, the channel unit *Industrial Ethernet* is used. Create a new connection for this channel unit by R on *Industrial Ethernet* and then selecting *New Driver Connection* from the pop-up menu.

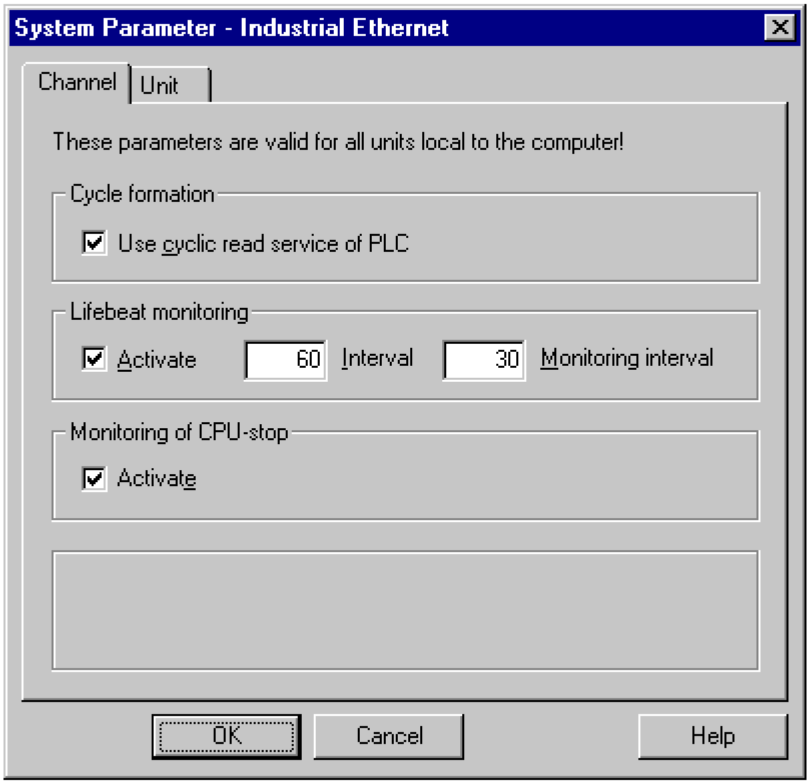


</td></tr>
</table>

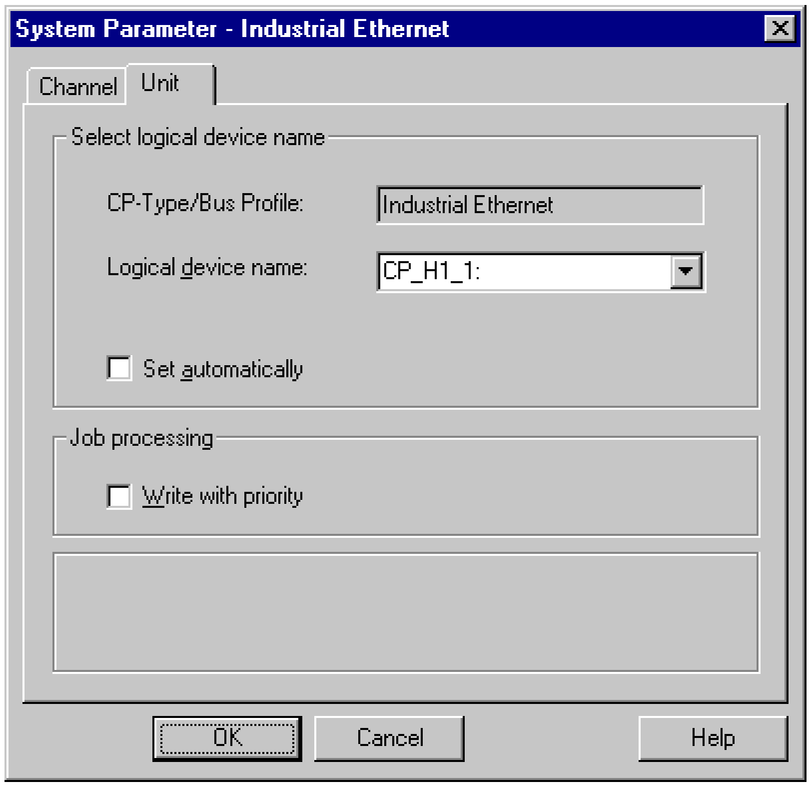
Step	B: Creating the Connection
4	The properties dialog box of the connection will be displayed. In the *General* tab, the *Name* of the new connection is entered. In this sample, this is *S7_IEH_01*. Click on the *Properties* button to define the connection properties. 

Step	B: Creating the Connection
5	The dialog box Connection Properties will be displayed. In the *Ethernet Address* field, enter the address that has been set for the communication processor *CP 443-1*. In this sample, this is the Ethernet Address *08.00.06.01.00.00*. Additionally, the Rack Number and Slot Number of the CPU module to be accessed must be entered. Make sure that the values of the CPU module are entered here and not the values of the communication processor. Close the dialog box by clicking on *OK*. Also close the *Connection Properties* dialog box by clicking on *OK*.

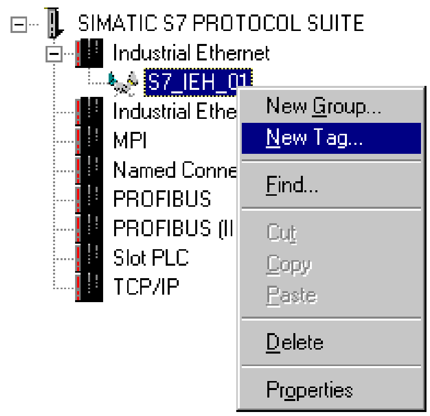
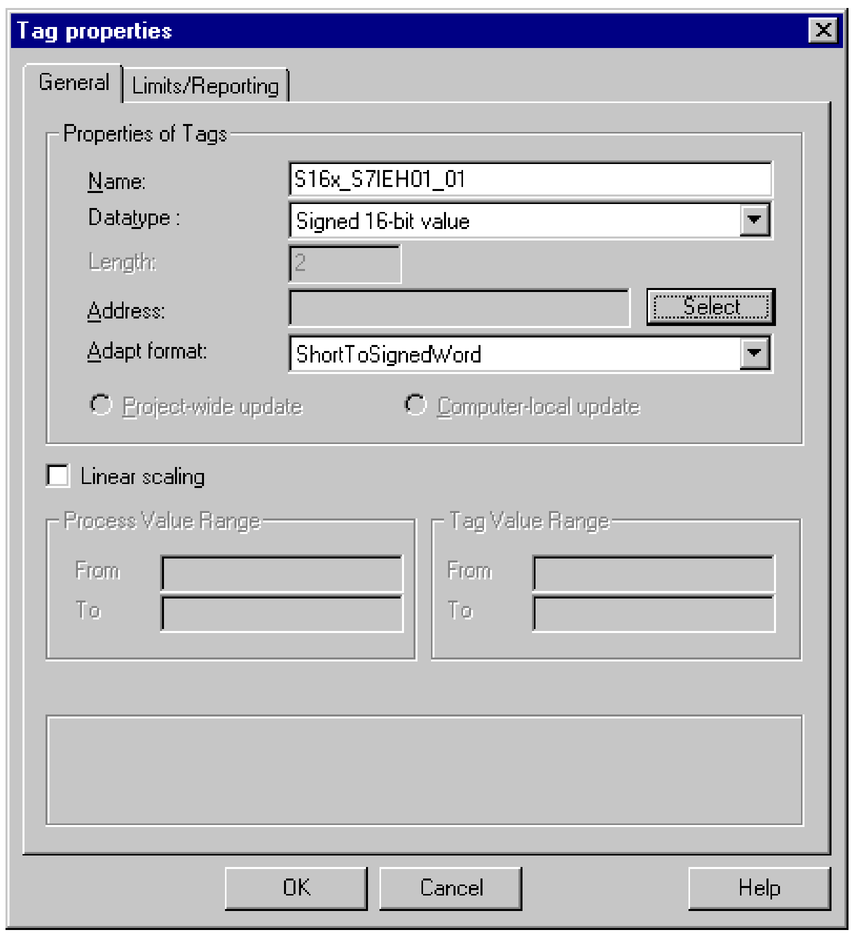


<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>6</td><td>
Setting the system parameters of the Industrial Ethernet channel unit.
These settings are made in the System Parameters dialog box, which is accessed via a R on the Industrial Ethernet entry and then selecting System Parameters from the pop-up menu.
In the Channel tab, various settings pertaining to the communication and monitoring a communication can be made. These settings will apply to all channel units of the communication driver.


</td></tr>
</table>

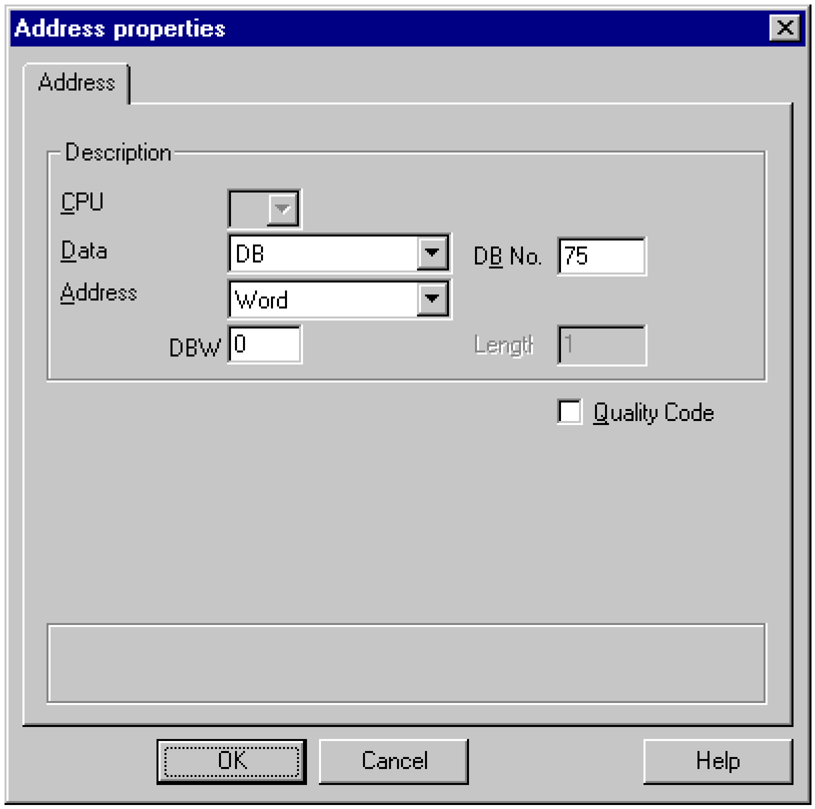
Step	B: Creating the Connection
7	In the Device tab, the access point used by the connection to access the PLC is specified. By default, the access point *CP_H1_1:* is set. Previously, the communication processor *CP 1413* has been assigned to the access point CP_H1_1: in the program *Setting the PG/PC Interface*. If you want the access point to be set automatically, make sure that the correct one is being used, especially if multiple communication processors are used. Close the dialog box by clicking on *OK*. 

C: Creating the WinCC Tags

Step	C: Creating the WinCC Tags
1	Creation of the WinCC tags required for the sample.This is done via a R on the newly created connection *S7_IEH_01* and then selecting *New Tag* from the pop-up menu. 
2	The properties dialog box of the tag will be displayed. In the sample, the *Name* of the first tag is *S16x_S7IEH01_01*. The tag is of the *Signed 16-Bit Value* data type. Click on the *Select* button to set the *Address* of the new tag. 

<table>
<tr><th>Step</th><th>C: Creating the WinCC Tags</th></tr>
<tr><td>3</td><td>
The dialog box Address Properties will be displayed.

Set DB as the Data Range and the value 75 as the DB No.. Set Word in the Address field and the value 0 in the DBW field. Close the dialog box by clicking on OK. The properties dialog box of the tag is also closed by clicking on OK.

The just created WinCC tag is addressed in the range of the DB75, where the first of the two values to be added is located.


</td></tr>
<tr><td>4</td><td>
Creation of the remaining WinCC tags required.

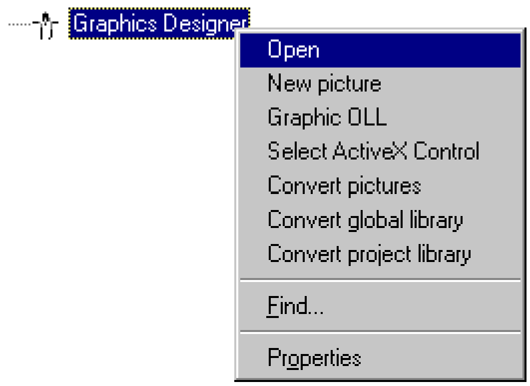
Follow steps 1 to 3 for the creation of the remaining tags. The names, data types and addresses of the tags used in this sample are listed in the following graphic.
<table>
<tr><th>Name</th><th>Type</th><th>Parameters</th></tr>
<tr><td>S16x_S7IEH01_01</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
<tr><td>S16x_S7IEH01_02</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
<tr><td>S16x_S7IEH01_03</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
<tr><td>S16x_S7IEH01_04</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
<tr><td>S16x_S7IEH01_05</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
</table>
</td></tr>
</table>

D: Creating the WinCC Screen

<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>1</td><td>

Creation of a WinCC screen in which the previously created tags are visualized.

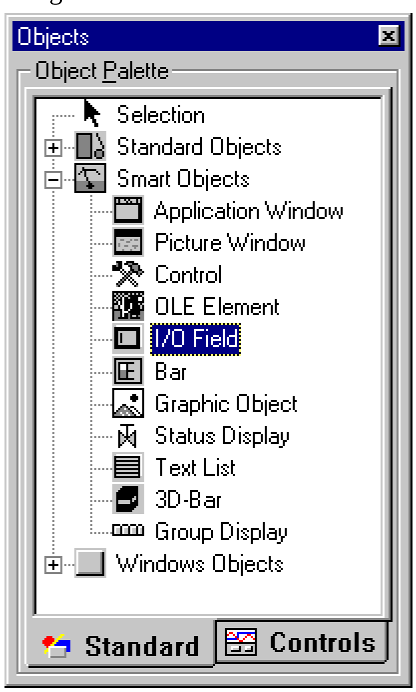
Open the *Graphics Designer* editor via a R and then selecting *Open* from the pop-up menu.



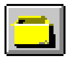
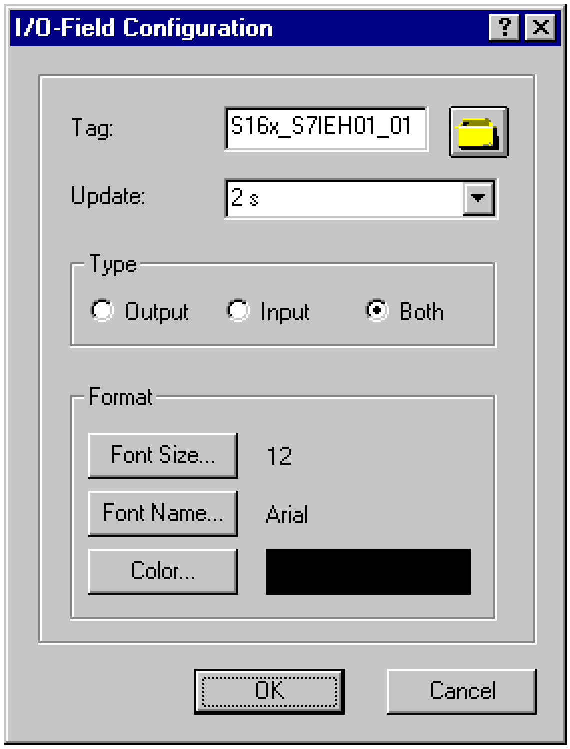
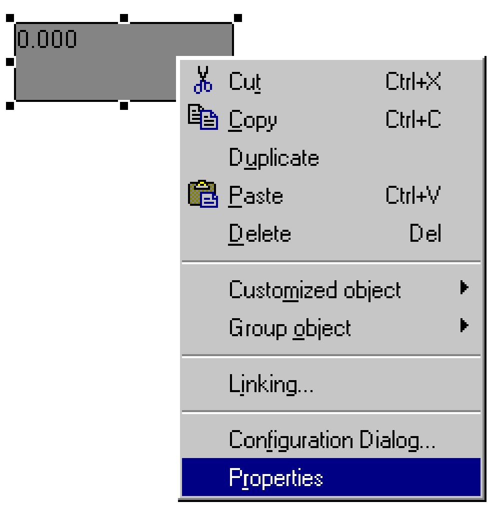
</td></tr>
<tr><td>2</td><td>

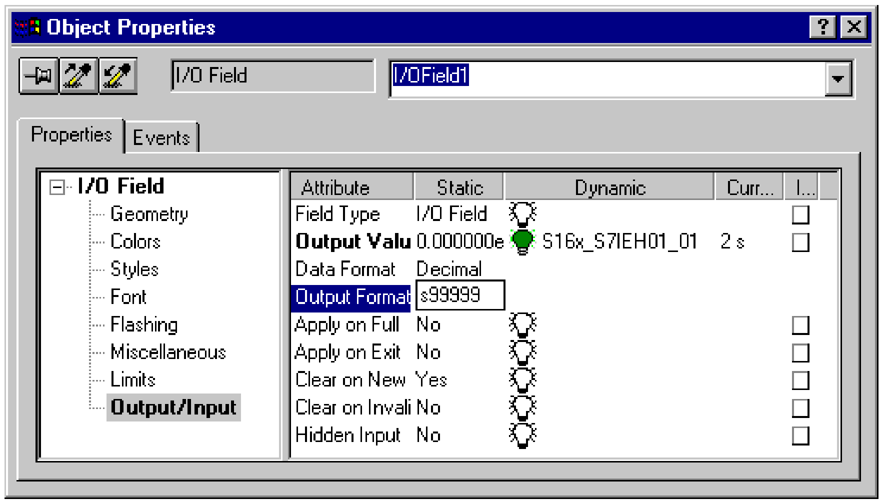
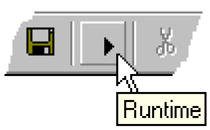
This will open the Graphics Designer editor with a new (blank) screen.

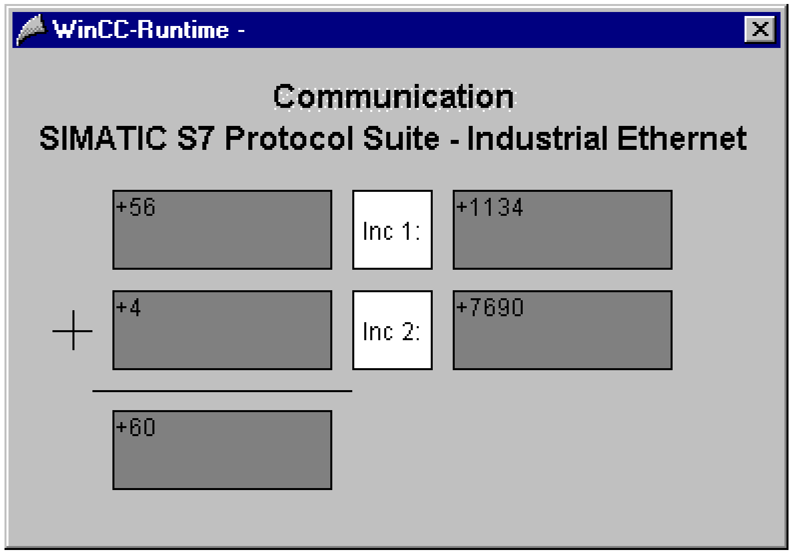
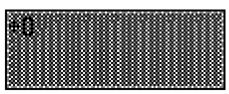
To display the first tag, configure a *Smart Object* → *I/O Field*. To do so, select the *I/O Field* object from the *Object Palette* and place it on the screen using the mouse.



</td></tr>
</table>

Step	D: Creating the WinCC Screen
3	After placing the I/O Field on the screen, its Configuration dialog box will be displayed. In the *Tag* field, set the tag *S16x_S7IEH01_01* via the button displayed below.  Leave the Update of the tag at 2 s. Keep the default settings for the remaining options. Close the dialog box by clicking on OK. 
4	Changing the output format of the *I/O Field*. For this, open its properties dialog box via a R on the *I/O Field* and then select *Properties* from the pop-up menu. 

Step	D: Creating the WinCC Screen
5	The dialog box *Object Properties* will be displayed. On the left side of the *Properties* tab, select the entry *Output/Input*. Via a D on the output format set, the field can be edited. Select the new format *s99999*. This format enables the *I/O Field* to display signed values with a maximum of 5 digits. 
6	Creation of four additional *I/O Fields* for the display of the remaining tags. Follow steps 2 to 5 to create the remaining I/O fields.
7	Save the screen. In the sample project, the screen is saved under the name com_S7IEH_01.pdl. The screen can be switched directly to runtime from the Graphics Designer via the button displayed below. 

Step	**D: Creating the WinCC Screen**
	If the screen is in runtime, the PLC started and the network connection established, the current values of the PLC will be displayed in the I/O fields. They can be changed by entering values in the individual *I/O Fields*.  If there is no connection to the PLC, the *I/O Fields* will be displayed grayed out. In this case an error is present at some point of the communication connection. 

2.5 Diagnosis of the Communication Connection

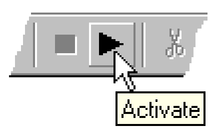
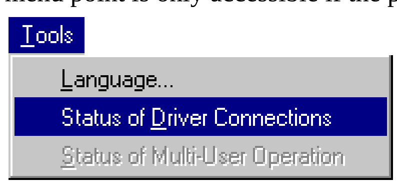
The following describes the options available for diagnosing the communication connection between the WinCC project *WinCC_S7_IEH* and the SIMATIC S7 station.
A diagnosis of the sample according to the following description makes only sense, if the checks listed below have been completed successfully.
Startup of the Communication Processor CP 1413

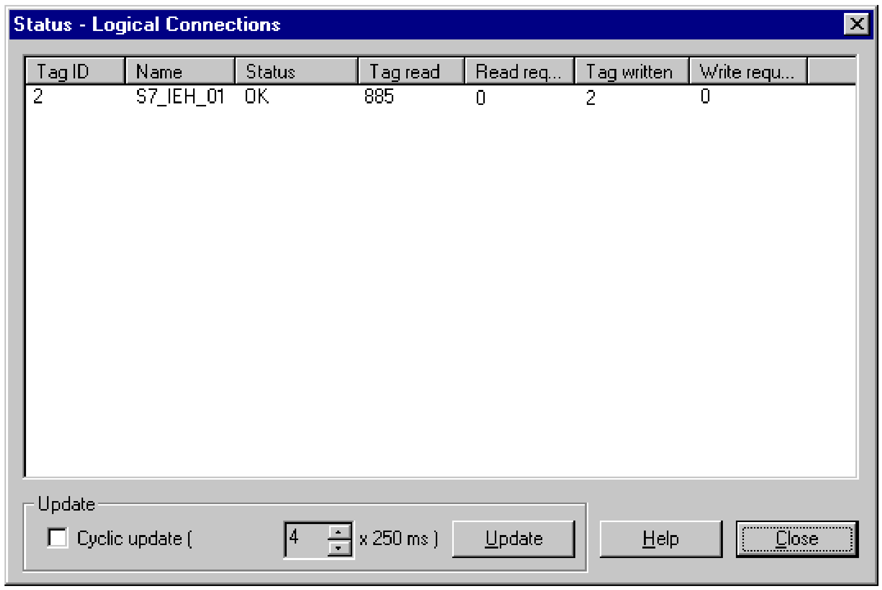
- E: Testing the Communication Processor

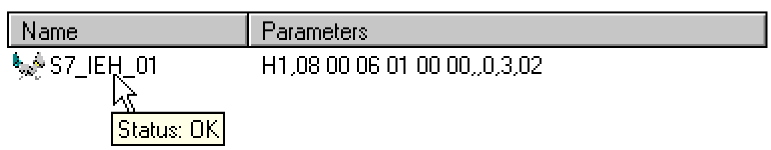
Creation of the STEP7 Project S7_IEH

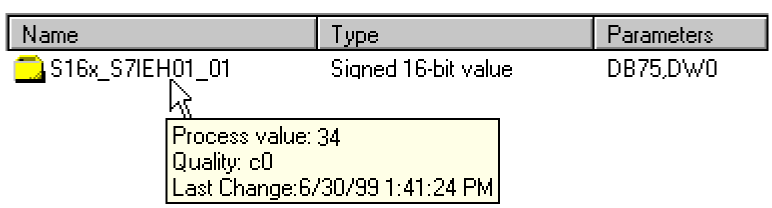
- F: Testing the Hardware Configuration
- I: Testing the STEP7 Program

WinCC Explorer

Step	WinCC Explorer
1	Diagnosis of the communication connection in the *WinCC Explorer*. Switch the project *WinCC_S7_IEH* into runtime. This is done from the *WinCC Explorer* via the toolbar button displayed below.  The created WinCC screen *com_3_S7IEH_01.pdl* can also be switched directly from the *Graphics Designer* into runtime.
2	In the *WinCC Explorer*, a dialog box for monitoring all configured connections can be accessed via the *Tools* → *Status of Driver Connections* menu. This menu point is only accessible if the project is in runtime. 

<table>
<tr><th>Step</th><th>WinCC Explorer</th></tr>
<tr><td>3</td><td>
The dialog box Status - Logical Connections will be displayed.
This dialog box lists all configured connections. For this sample, only the connection S7_IEH_01 will be displayed.
The displayed values correspond to the status at the moment the dialog box was opened. By selecting the appropriate check-box, a Cyclic Update of the display can be achieved.


</td></tr>
<tr><td>4</td><td>
Another way to obtain information about the connection status in general and about the connection status of individual tags is provided by Tag Management.
The status of a configured connection can be displayed as a tooltip by simply pointing the mouse on the connection in question.


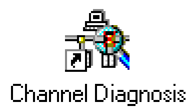
The current process value of a certain tag as well as its status can be displayed as a tooltip by pointing the mouse on it. This allows you to detect errors concerning an individual tag and not the entire connection.


</td></tr>
</table>

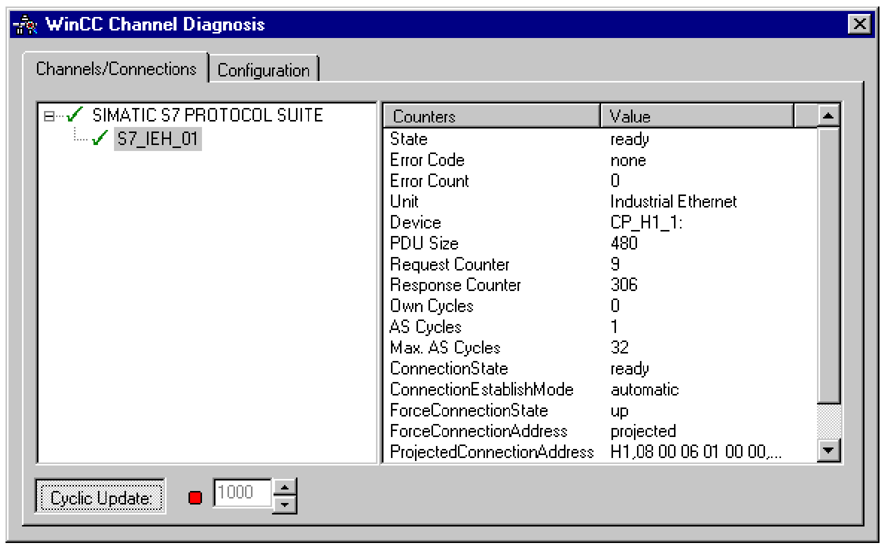
Channel Diagnosis

<table>
<tr><th>Step</th><th>Channel Diagnosis</th></tr>
<tr><td>1</td><td>Diagnosis of the communication connection via the program WinCC Channel Diagnosis.

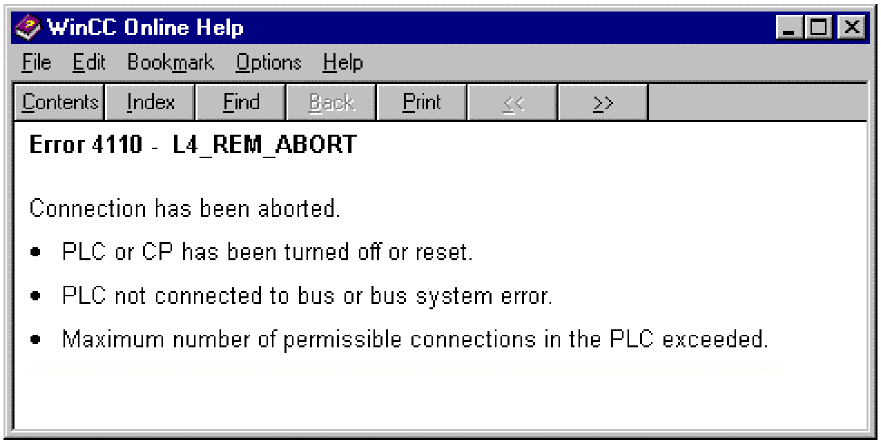
Start this program via Start → Simatic → WinCC → Channel Diagnosis.


</td></tr>
<tr><td>2</td><td>The program WinCC Channel Diagnosis will be displayed.

The Channels/Connections tab displays detailed information about the status of each configured connection. By default, the display is updated every second. The update cycle can be changed in the input field located at the bottom.


</td></tr>
<tr><td>3</td><td>If a connection error is detected, the Error Code line in the right window half will display a value specifying the error cause. Detailed information about this error code is displayed by R on the Error Code entry and then selecting Help from the pop-up menu.


</td></tr>
</table>

Step	Channel Diagnosis
4	This opens the Online Help to WinCC containing a description of the corresponding error code. Additionally, possible error causes are also listed. 

3 Communication to the SIMATIC S7 via Industrial Ethernet (Softnet)

The projects created in this chapter can also be copied directly from the online document to your hard drive. By default, they will be copied to the folder *C:\Communication_Manual*. You have the option to copy the following components to the hard drive:

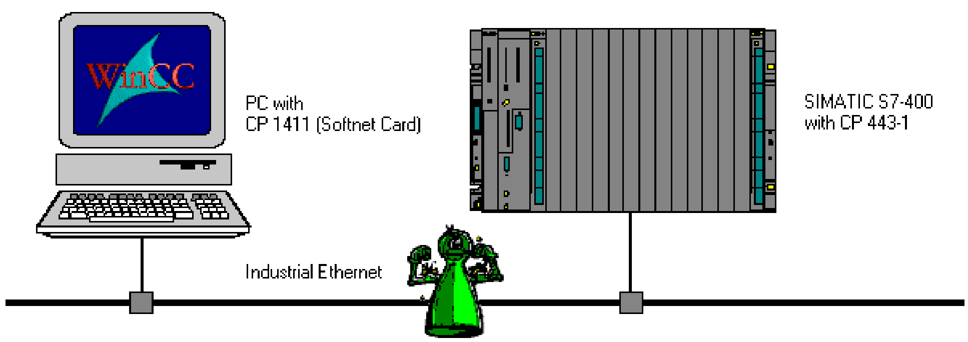
S7_IES

The STEP7 project we will create.

WinCC_S7_IES

The WinCC project we will create.
This chapter describes in detail the startup of a communication connection between a SIMATIC S7 and WinCC. The communication connection is realized via the Industrial Ethernet. The CP 1411 communication processor used in the computer has no separate CPU, the computer's CPU handles all communication tasks. Such a configuration is generally referred to as Softnet.

Overview of the Structure of the Sample



On the computer side, the connection to the *Industrial Ethernet* network is established via the communication processor *CP 1411*. To install this communication processor in the computer, the driver *IE SOFTNET-S7 BASIC*, located on the *SIMATIC NET* CD-ROM, is needed.
In the WinCC project, the communication driver *SIMATIC S7 Protocol Suite* must be installed. Via its channel unit *Industrial Ethernet*, the connection to the *SIMATIC S7* is configured.
The PLC is equipped with a *CPU 416-1* module. The connection to the network is established via the communication processor *CP 443-1*. For the configuration of this communication processor with the STEP7 software, the option package *NCM S7 Industrial Ethernet* is required.

Overview of the Configuration Steps

The following lists all configuration steps necessary for the creation of the communication connection:

- Startup of the Communication Processor CP 1411
- Creation of the STEP7 Project S7_IES
- Creation of the WinCC Project WinCC_S7_IES
- Diagnosis of the Communication Connection

Required Software

Name	Description
SIMATIC NET	Driver *IE SOFTNET S7 BASIC* from the *SIMATIC NET* CD-ROM for the installation of the communication processor *CP 1411*.
Windows NT	Windows NT installation software for the installation of the communication processor *CP 1411*.
STEP7	STEP7 software with option package *NCM for Industrial Ethernet* for the creation of the STEP7 project.
WinCC	WinCC with the communication driver *SIMATIC S7 Protocol Suite* for the creation of the WinCC project.

Required Computer Hardware

Name	Description
Communication Processor	Communication processor *CP 1411* to establish the connection to the PLC's communication processor.

Required PLC Hardware

Name	Description
Rack	Rack *UR1*
Power Supply	Power supply *PS 407 10A* in slot 1 and 2.
CPU Module	CPU module *CPU 416-1* in slot 3.
Communication Processor	Communication processor *CP 443-1* in slot 4.

3.1 Startup of the Communication Processor CP 1411

The following description details the configuration steps necessary to successfully start up the communication processor CP 1411. The communication is handled by the SIEMENS Industrial Ethernet protocol.

Overview of the Configuration Steps

The following lists the configuration steps necessary to start up the communication processor *CP 1411*:

- A: Mounting the Communication Processor in the Computer
- B: Installing the Communication Driver
- C: Installing the Communication Processor
- D: Installing the Communication Protocol
- E: Configuring the Bindings
- F: Creating an Access Point
- G: Testing the Communication Processor

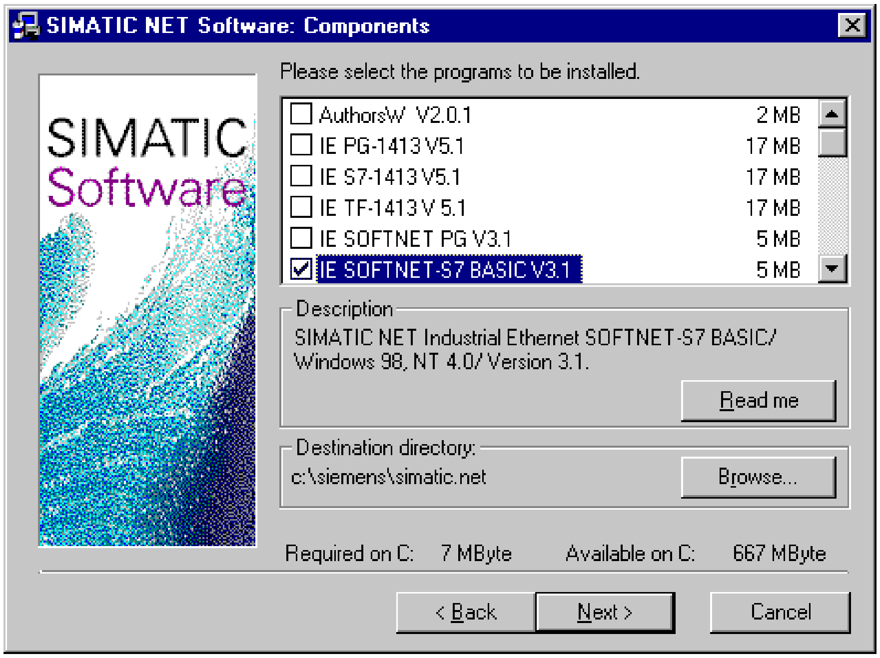
A: Mounting the Communication Processor in the Computer

Step	A: Mounting the Communication Processor in the Computer
1	Mount the module according to the installation instructions. Among other things, follow the steps for handling electrostatic sensitive devices (ESD). The module must only be installed while the computer is off. The communication card *CP 1411* requires a free ISA slot in the computer. After the installation of the *CP 1411*, close the computer's case and start the computer.

B: Installing the Communication Driver

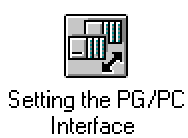
Step	B: Installing the Communication Driver
1	Install the communication driver *IE SOFTNET S7 BASIC* from the *SIMATIC NET* CD-ROM. After inserting the *SIMATIC NET* CD-ROM, the installation program is automatically started. If this is not the case, open the *Windows NT Explorer* and start the *setup.exe* program located on the CD-ROM. The installation of the software is started via the button displayed below. 

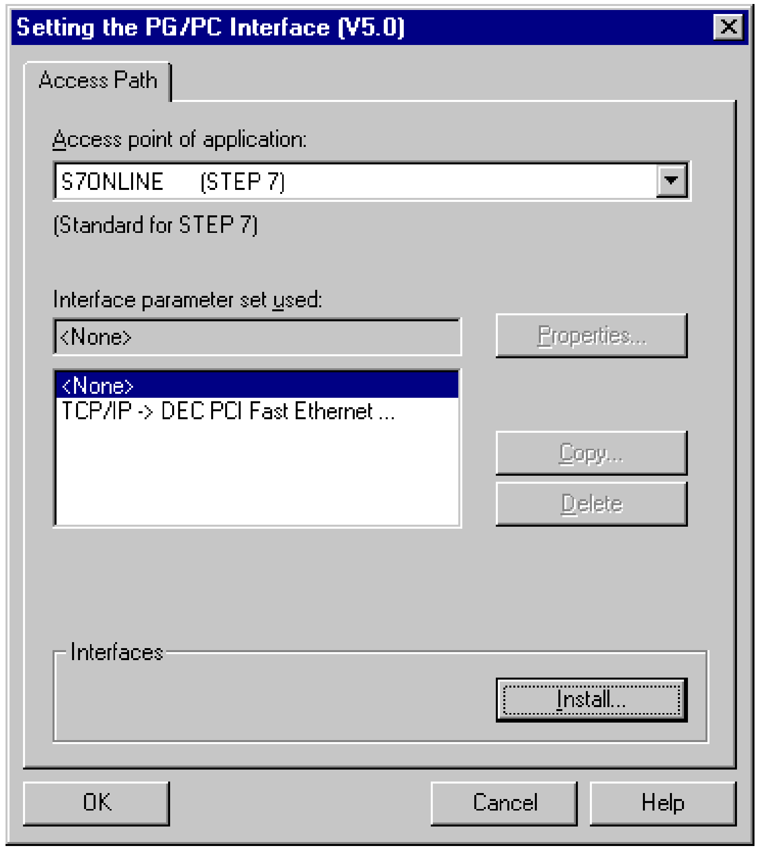
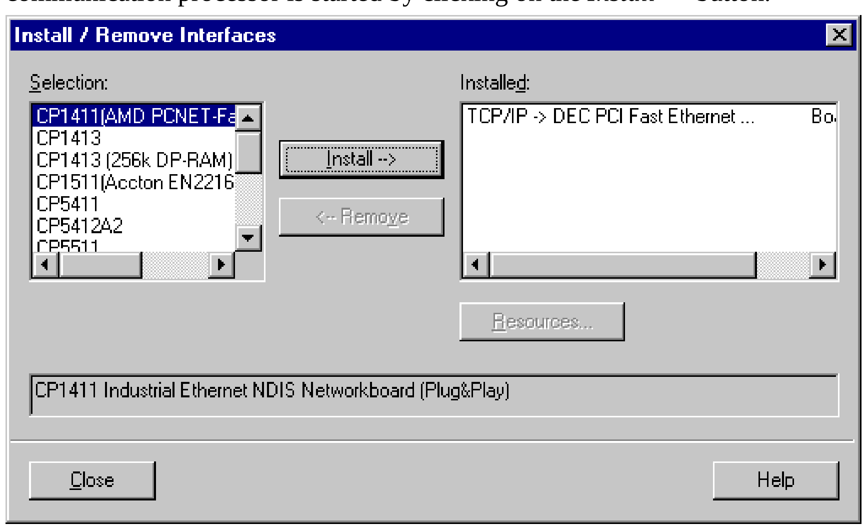
Step	B: Installing the Communication Driver
	Follow the instructions of the installation program. On the *Components* page, the check-box of the driver *IE SOFTNET-S7 BASIC* to be installed must be selected. Finish the installation.



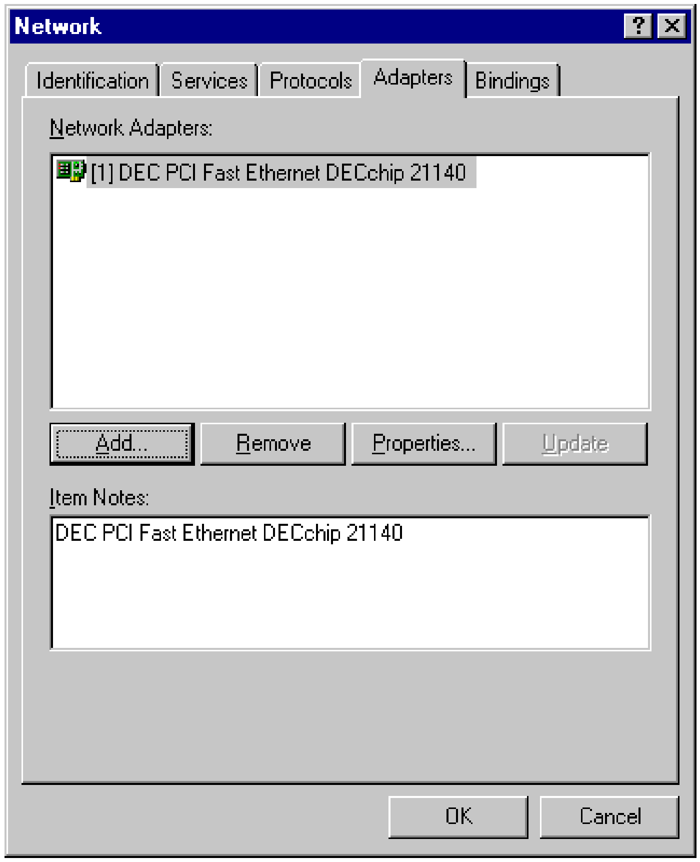
C: Installing the Communication Processor

Step	C: Installing the Communication Processor
1	Install the communication processor *CP 1411* via the program *Setting the PG/PC Interface*. This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*.



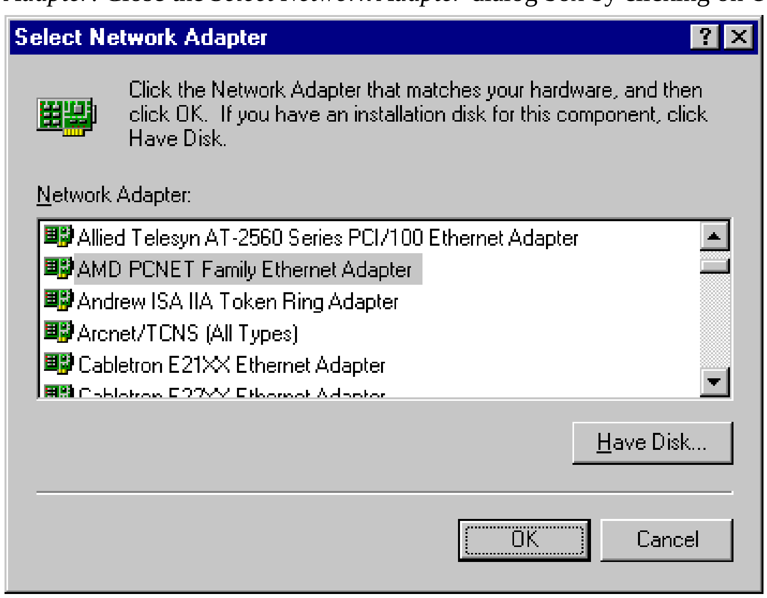
Step	C: Installing the Communication Processor
2	The program *Setting the PG/PC Interface* will be displayed. The dialog box for installing a new interface is opened via the *Install* button. 
3	The dialog box *Install/Remove Modules* will be displayed. The *Selection* field lists all interfaces that can be installed. Among them will be the entry *CP 1411*, if the communication driver has been installed previously as outlined in step B. Select the entry *CP 1411 (AMD PCNET-Family)*. The installation of the communication processor is started by clicking on the *Install ->* button. 

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>4</td><td>This opens the Network dialog box.In the Adapters tab, install the communication card CP 1411 by clicking on the Add button.



</td></tr>
<tr><td>5</td><td>The Select Network Adapter dialog box will be displayed.

From the Network Adapter list, select the entry AMD PCNET-Family Ethernet-Adapter. Close the Select Network Adapter dialog box by clicking on OK.



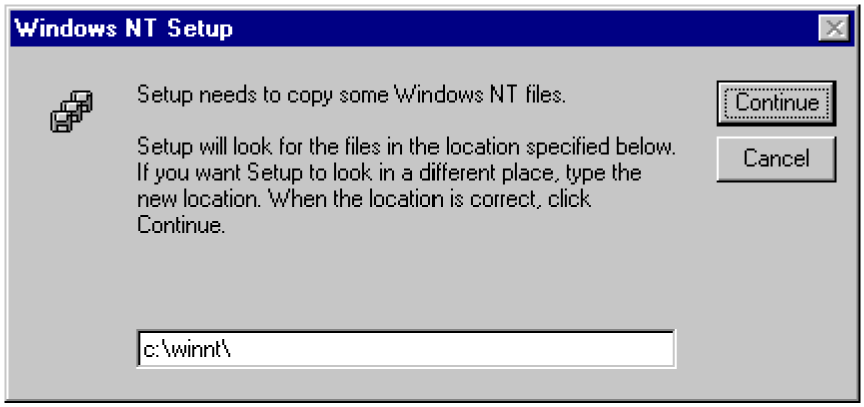
</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>6</td><td>

The *Windows NT Setup* dialog box will be displayed. This dialog box informs you that some Windows NT files must be copied for the installation of the *CP 1411*.

In the input field at the bottom, specify the path in which the appropriate files can be found. Normally, this is the path to the CD-ROM drive (if the files are copied from a Windows NT Installation CD-ROM).

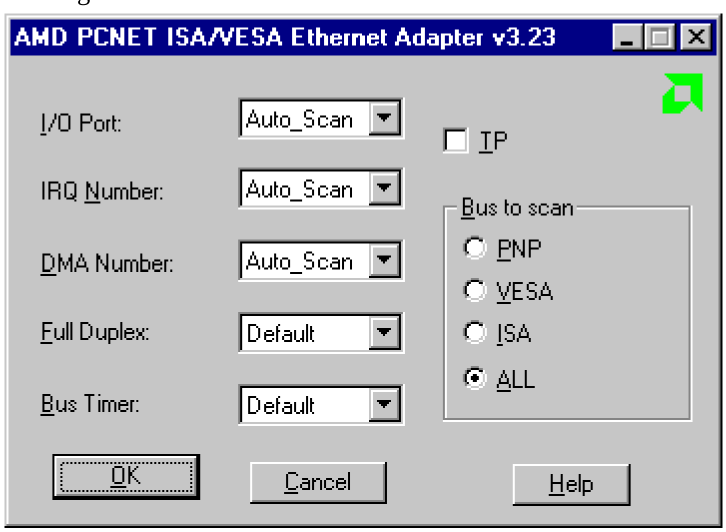
Conclude the *Windows NT Setup* by clicking on the *Continue* button.



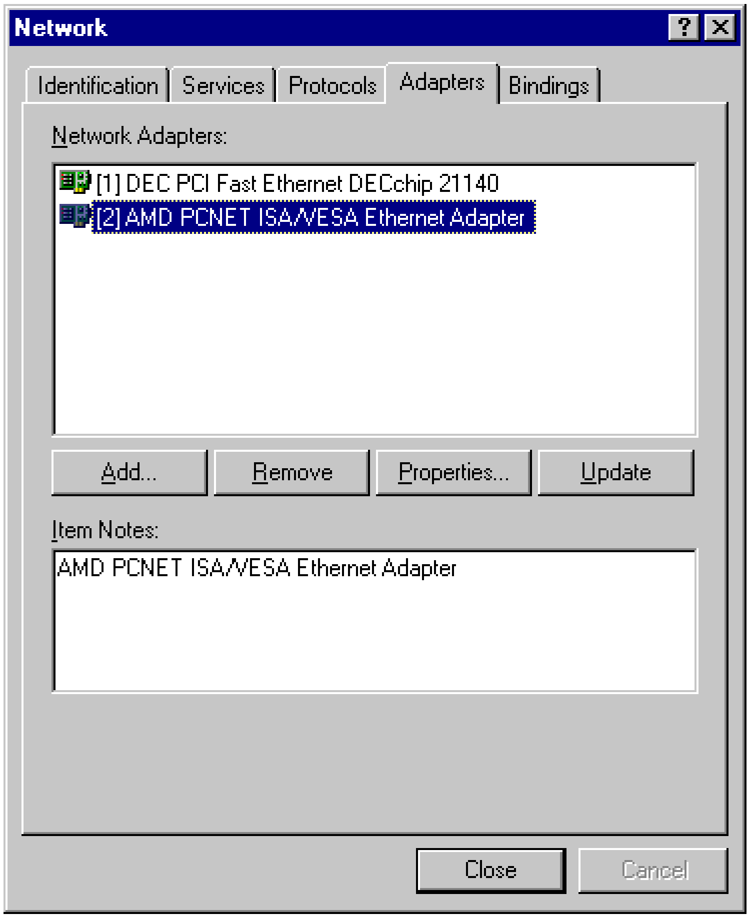
</td></tr>
<tr><td>7</td><td>

The setup dialog box for the *CP 1411* will be displayed.

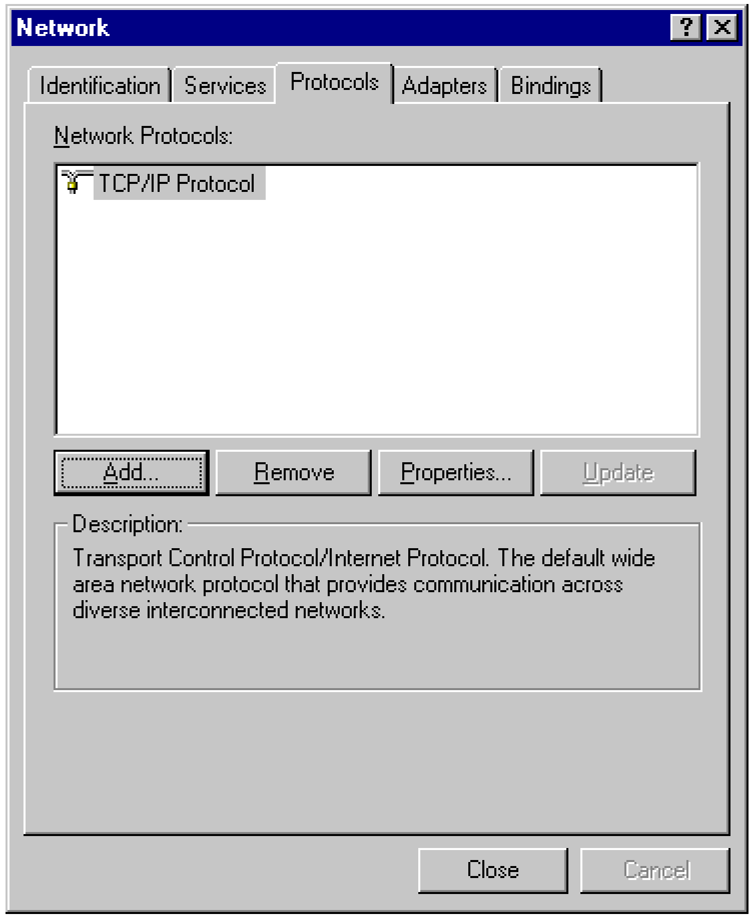
Keep the default settings for the various options. Close the setup dialog box by clicking on *OK*.

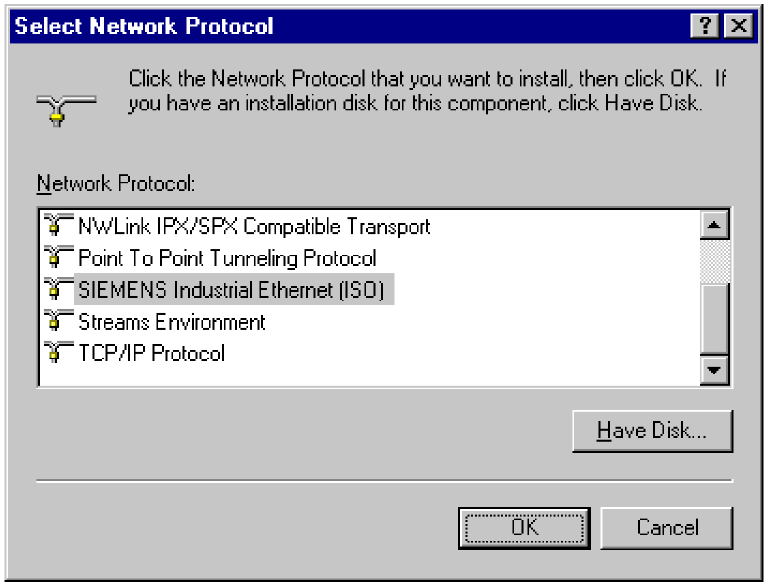
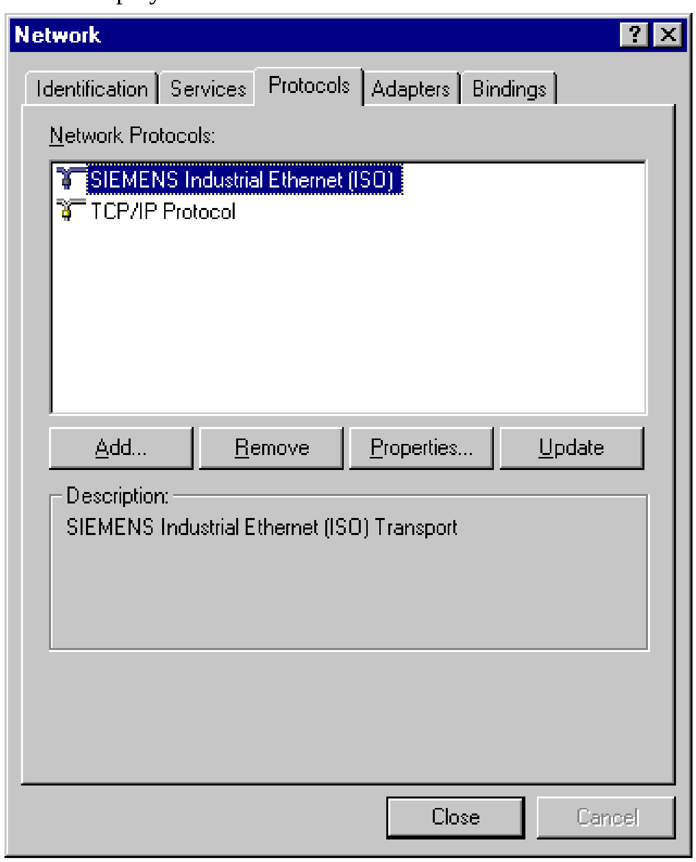


</td></tr>
</table>

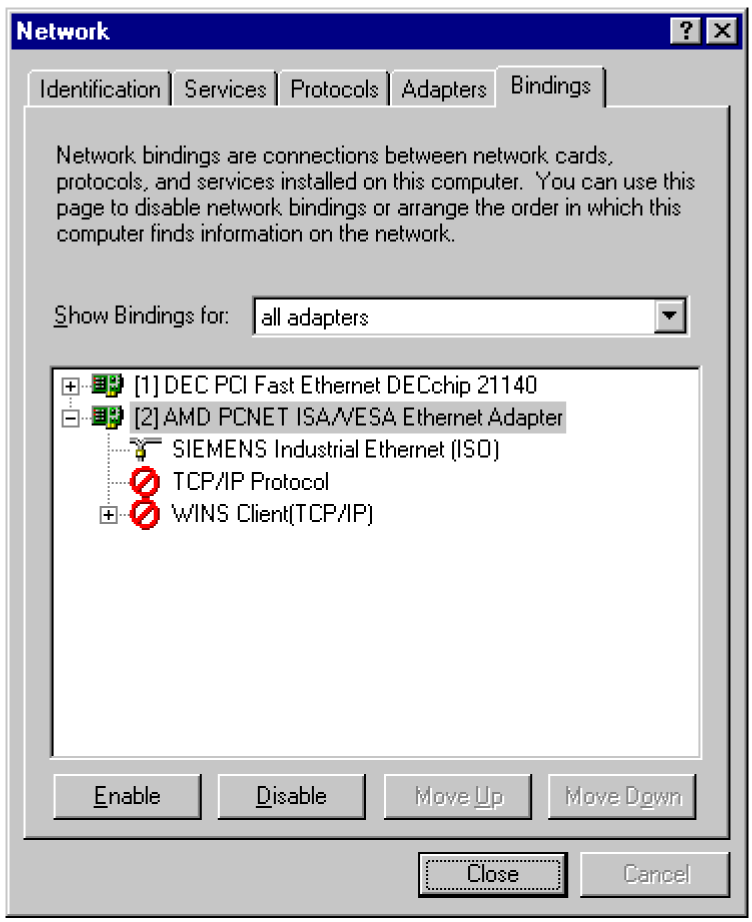
Step	C: Installing the Communication Processor
8	After the installation of the *CP 1411* is complete, the entry *AMD PCNET ISA/VESA Ethernet-Adapter* will be displayed in the *Network Adapters* list of the *Adapters* tab. 

D: Installing the Communication Protocol

Step	D: Installing the Communication Protocol
1	Installation of the SIEMENS Industrial Ethernet protocol. This is done in the *Protocols* tab of the *Network* dialog box via the *Add* button. 

Step	D: Installing the Communication Protocol
2	This opens the *Select Network Protocol* dialog box. From the *Network Protocol* list, select the entry *SIEMENS Industrial Ethernet (ISO)*. Close the *Select Network Protocol* dialog box by clicking on *OK*. 
3	After the installation of the *SIEMENS Industrial Ethernet* protocol is complete, it will be displayed in the *Network Protocols* field of the *Protocols* tab. 

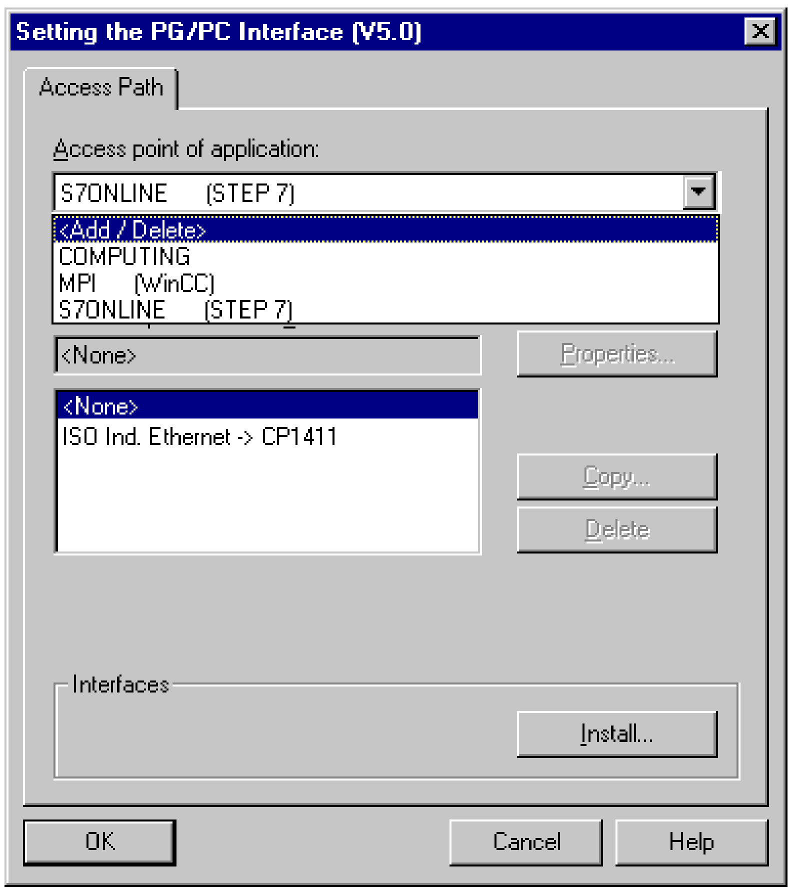
E: Configuring the Bindings

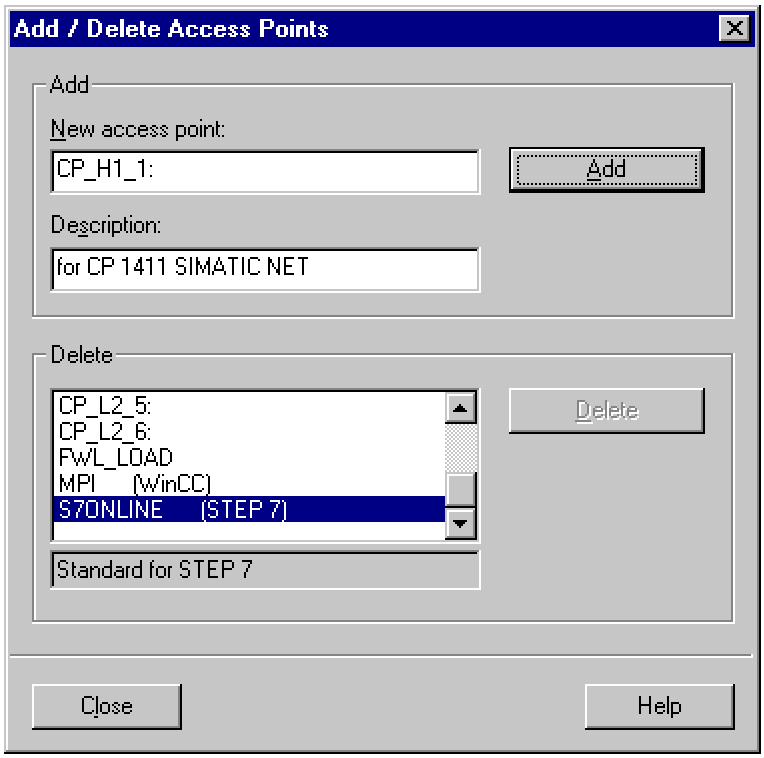
Step	E: Configuring the Bindings
1	The bindings of the communication processor CP 1411 must be configured. This is done in the Bindings tab of the Network dialog box. In the *Show Bindings for:* field, select the entry *all adapters*. Select all protocols to be used by the communication processor *CP 1411*. In this sample, the communication processor only communicates via the *SIEMENS Industrial Ethernet (ISO)* protocol. For this purpose, all available protocols except for the *SIEMENS Industrial Ethernet (ISO)* must be disabled for the *AMD PCNET-Family Ethernet-Adapter* entry. A protocol is disabled via the *Disable* button. Disabled protocols are marked as follows:  Close the *Network* dialog box by clicking on the *OK* button. 

<table>
<tr><th>Step</th><th>E: Configuring the Bindings</th></tr>
<tr><td>2</td><td>The installation and settings made require a restart of the computer.
Acknowledge the dialog box displayed by clicking on Yes.

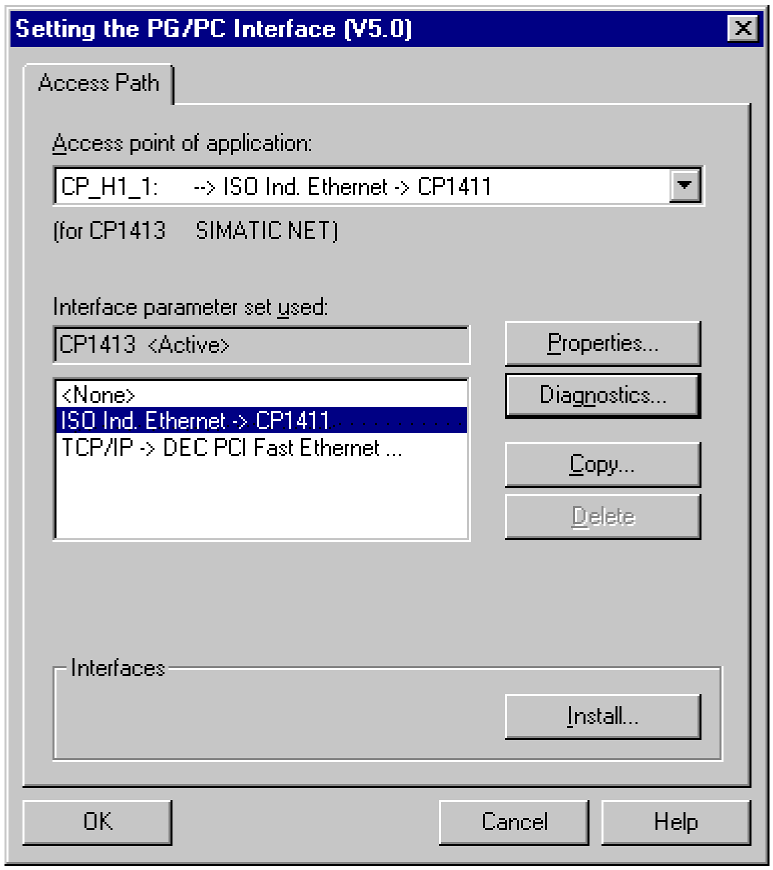
</td></tr>
</table>

F: Creating an Access Point

<table>
<tr><th>Step</th><th>F: Creating an Access Point</th></tr>
<tr><td>1</td><td>Creation of an access point for the communication processor CP 1411 via the program Setting the PG/PC Interface.
This program is accessed via Start → Settings → Control Panel → Setting the PG/PC Interface.</td></tr>
<tr><td>2</td><td>The program Setting the PG/PC Interface will be displayed.
The dialog box for adding a new access point is opened via the Add/Delete entry from the Access Point of the Application list-box.

</td></tr>
</table>

Step	F: Creating an Access Point
3	The dialog box *Add/Delete Access Points* will be displayed. In the *New Access Point* field, enter the name of the new access point. For this sample, the name *CP_H1_1:* is entered. The access point CP_H1_1: is the default access point used by WinCC for the communication via the *Industrial Ethernet*. In the *Description* field, additional information about the access point can be entered. The access point is created via the *Add* button. The access point will then be displayed in the list of available access points. Exit the dialog box *Add/Delete Access Points* by clicking on the *Close* button. 

Step	F: Creating an Access Point
4	In the program *Setting the PG/PC Interface*, assign the communication processor *CP 1411* to the new access point. To do so, set the *CP-H1_1:* entry in the *Access Point of the Application* field. In the field below, select the entry *ISO Ind. Ethernet -> CP1411*. This completes the assignment between the access point and the communication processor. Close the program *Setting the PG/PC Interface* by clicking on the *OK* button. This concludes the installations and settings required for the operation of the *CP 1411*.

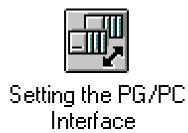


G: Testing the Communication Processor

<table>
<tr><th>Step</th><th>G: Testing the Communication Processor</th></tr>
<tr><td>1</td><td>

Check the proper installation of the communication processor *CP 1411* via the program *Setting the PG/PC Interface*.

This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*.

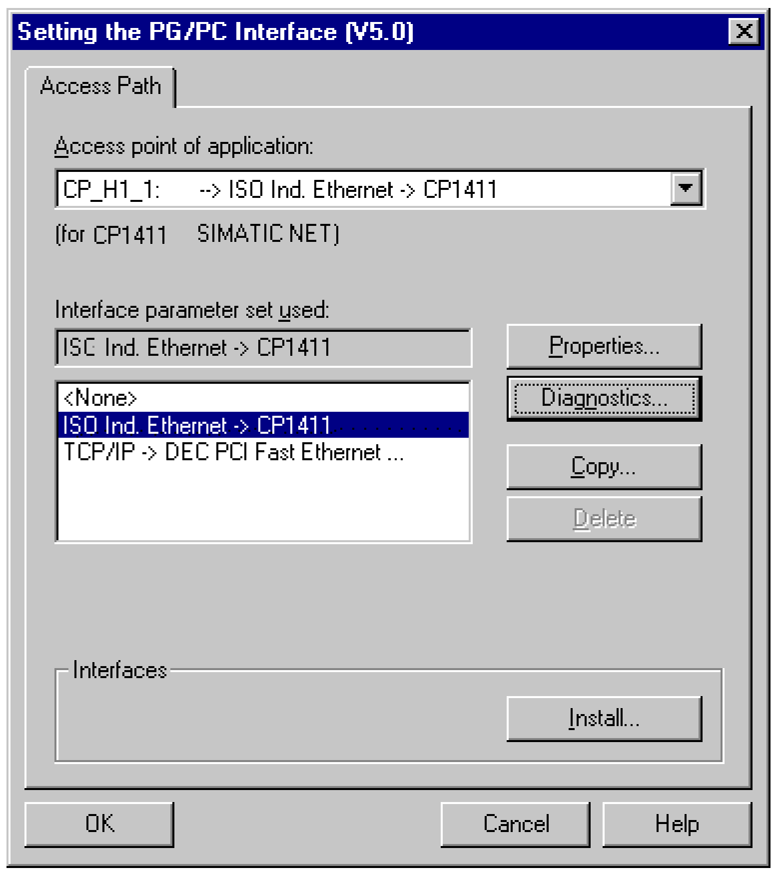


</td></tr>
<tr><td>2</td><td>

The program *Setting the PG/PC Interface* will be displayed.

Select the interface to be checked. In this case, select the entry *ISO Ind. Ethernet -> CP 1411*. Make sure that the assignments between access points and the interfaces are not changed.

The check for a proper installation is activated by clicking on the *Diagnostics* button.



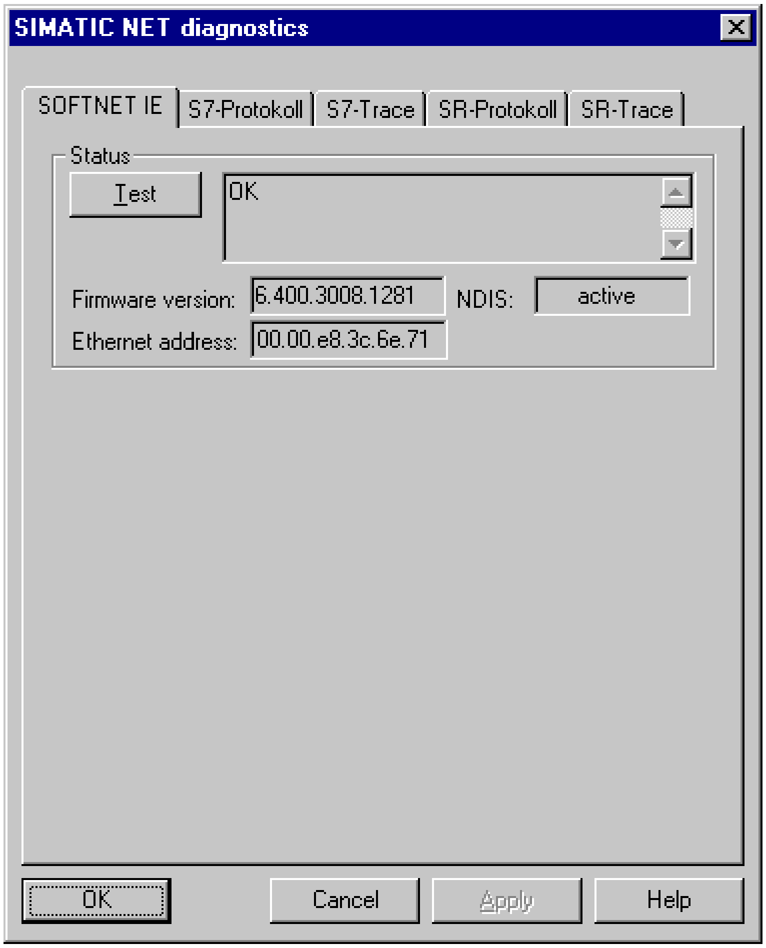
</td></tr>
<tr><td>3</td><td>

The dialog box *Simatic NET Diagnostics* will be displayed.

In the *SOFTNET IE* tab, the diagnosis is started via the *Test* button. The result of the diagnosis will be displayed immediately following.

If the result of the diagnosis is positive (correct installation), the dialog box can be exited with *OK*.

</td></tr>
</table>

Step	G: Testing the Communication Processor
	In this case, the program *Setting the PG/PC Interface* can also be closed by clicking on *OK*. The configuration of the communication to the S7 via the *Industrial Ethernet* is continued in the following section. However, if the result of the diagnosis is negative (incorrect installation), the error must be localized and corrected. Troubleshooting procedures are described in the section Is the Communication Module in the Computer operational?. 

3.2 Creation of the STEP7 Project S7_IES

The following description details the configuration steps necessary to create and start up the STEP7 project *S7_IES*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to create the STEP7 project *S7_IES*:

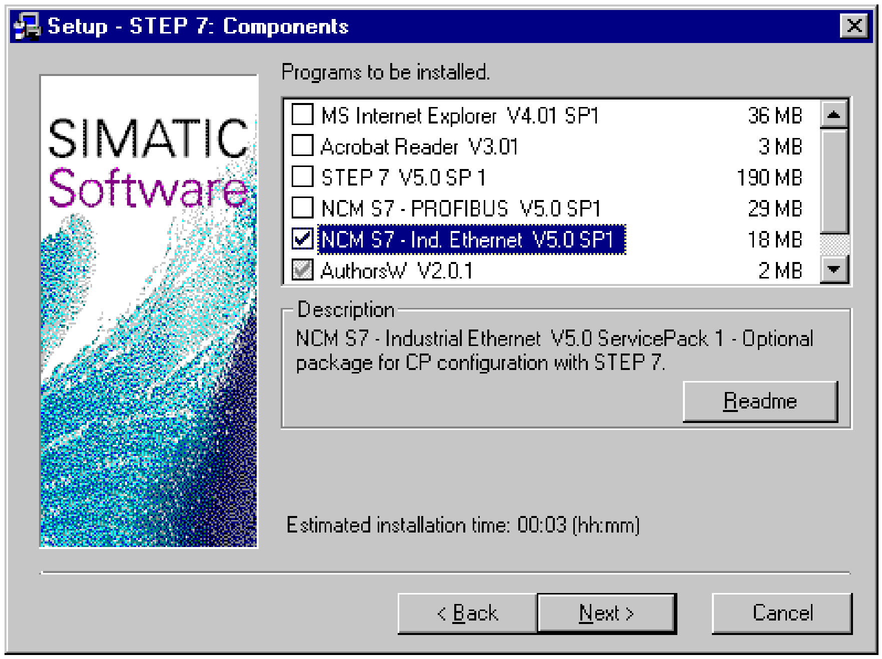
- A: Installing the Hardware
- B: Installing the Option Package
- C: Creating the STEP7 Project
- D: Configuring the Hardware
- E: Loading the Hardware Configuration
- F: Testing the Hardware Configuration
- G: Creating the STEP7 Program
- H: Testing the STEP7 Program

A: Installing the Hardware

Step	A: Installing the Hardware
1	Rack-mounting of the modules used. In this sample, the modules to be installed are the power supply *PS 407 10A*, the CPU module *CPU 416-1* and the communication processor *CP 443-1*. Establishing the connection from the computer to the programming interface of the CPU module. Establishing the connection from the communication processor *CP 1411* in the computer to the communication processor *CP 443-1* in the PLC.

B: Installing the Option Package

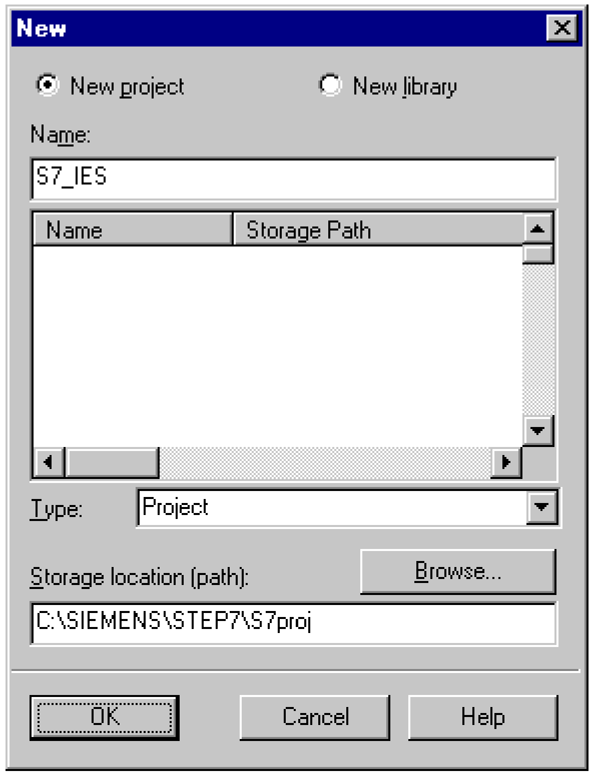
Step	B: Installing the Option Package
1	If the option package *NCM S7 Industrial Ethernet* has not been installed during the installation of *STEP7*, install it now from the *STEP7* CD-ROM. This option package is required for the configuration of the communication processor *CP 443-1* via the *STEP7* software. After inserting the *STEP7* CD-ROM, the installation program is automatically started. If this is not the case, open the *Windows NT Explorer* and start the *setup.exe* program located on the CD-ROM. 

Step	B: Installing the Option Package
2	This starts the installation program. Follow the instructions of the installation program. On the *Components* page, select the check-box *NCM S7 Ind. Ethernet*. Finish the installation. 

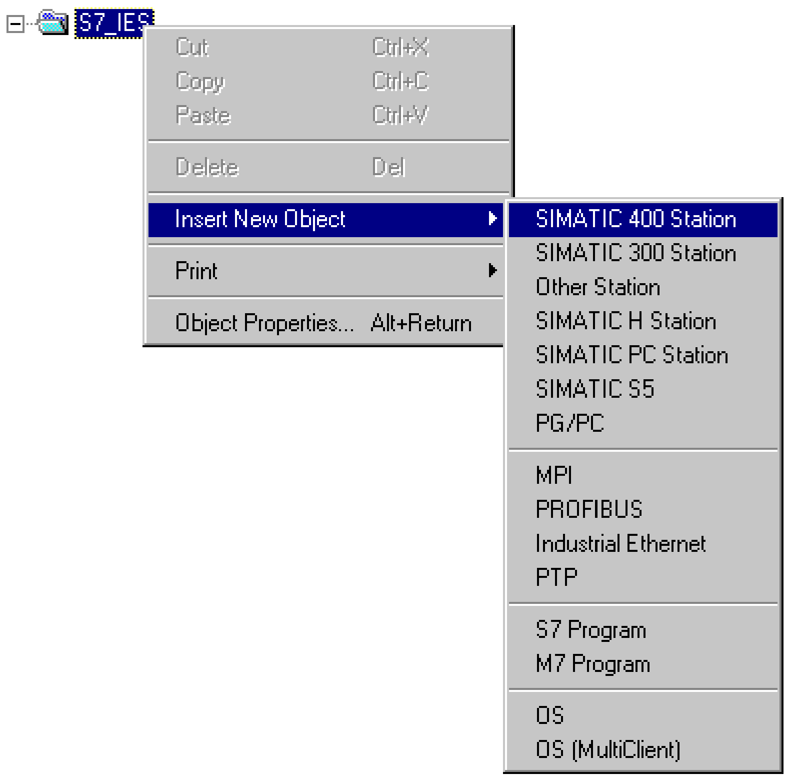
C: Creating the STEP7 Project

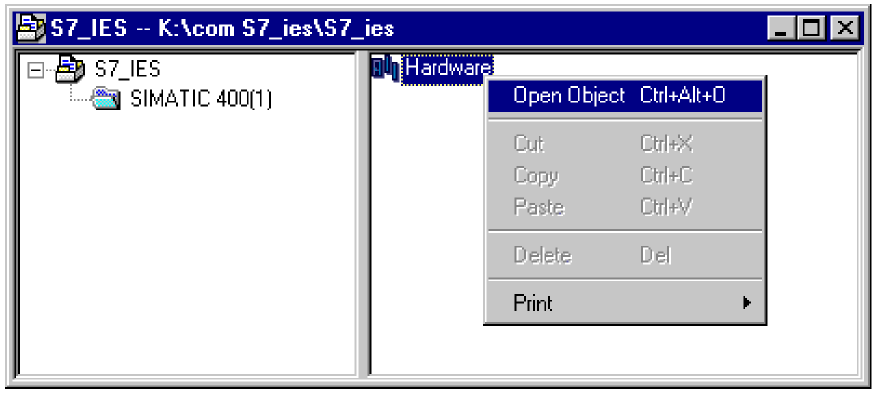
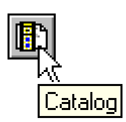
Step	C: Creating the STEP7 Project
1	Create a new STEP7 project in the SIMATIC Manager. It is started via *Start* → *Simatic* → *SIMATIC Manager*. 
2	This displays the *SIMATIC Manager*. Via the menus *File* → *New*, the dialog box for specifying the parameters of a new STEP7 project will be opened. The *New* dialog box will be displayed. The radio-button *New Project* must be selected. In the *Name* field, the name of the new project to be created is entered. The names of the STEP7 projects created within the framework of this manual all start with *S7*. They also include a reference to the communication type used. The project of this sample has the name *S7_IES*.

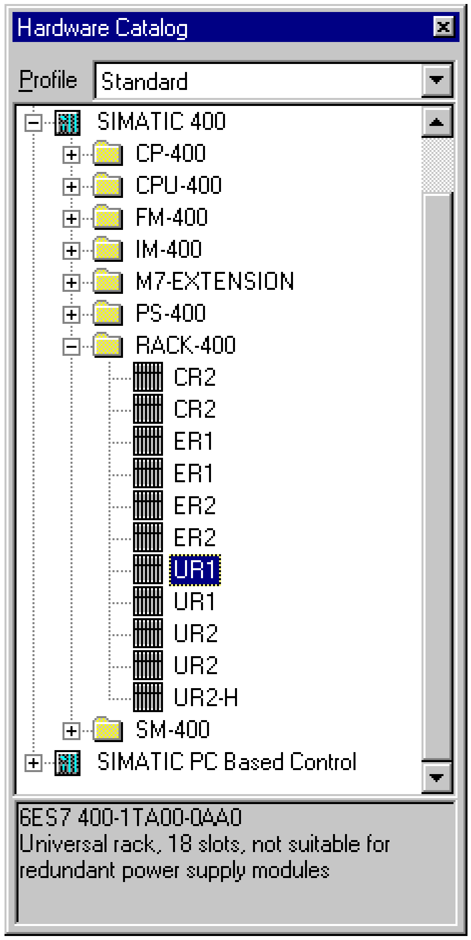
Step	**C: Creating the STEP7 Project**
	By default, projects are stored in the *C:\SIEMENS\STEP7\S7proj* folder. This can be changed at any time via the *Browse* button. The *New* dialog box is closed via the *OK* button.

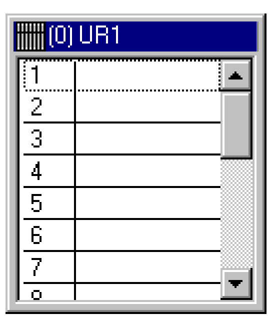


D: Configuring the Hardware

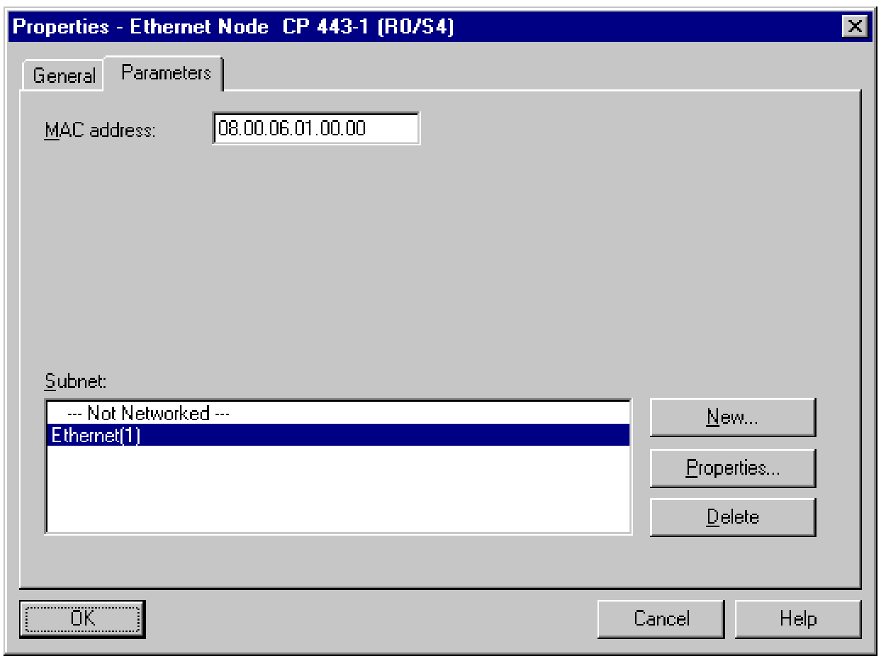
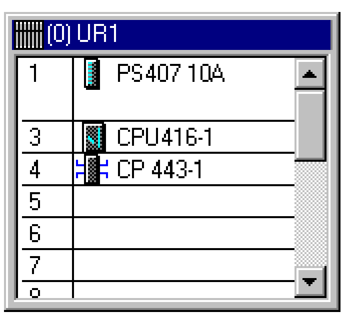
Step	D: Configuring the Hardware
1	The new project will be displayed in the *SIMATIC Manager*. The hardware for this project must be configured. Two components are needed: One *SIMATIC 400-Station* and for its networking an *Industrial Ethernet*. These components are added to the *SIMATIC Manager* via a **R** on the project name *S7_IES* and then selecting *Insert New Object* → *SIMATIC 400-Station* and *Insert New Object* → *Industrial Ethernet* from the pop-up menu. 
2	The just added components will be displayed in the right window of the *SIMATIC Manager*. 

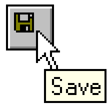
Step	D: Configuring the Hardware
	By **D** on the component *SIMATIC 400(1)* in the right window, the point *Hardware* will be displayed. By **D** on the point *Hardware* or **D** on it and then selecting *Open Object* from the pop-up menu, the program *HW Config* will be started. 
3	The program *HW Config* will be displayed. This program is used to exactly define the hardware used in the PLC and to configure their properties. 
4	By clicking on the toolbar button of the program *HW Config* displayed below, the *Hardware Catalog* is opened. This catalog is used to select the required hardware components. 

<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td>5</td><td>The Hardware Catalog will be displayed.
The first component selected is the rack. On this rack, all other components will be installed. The rack is inserted into the project via a D or by Dragging Dropping. In this sample, the rack type UR1 is used.


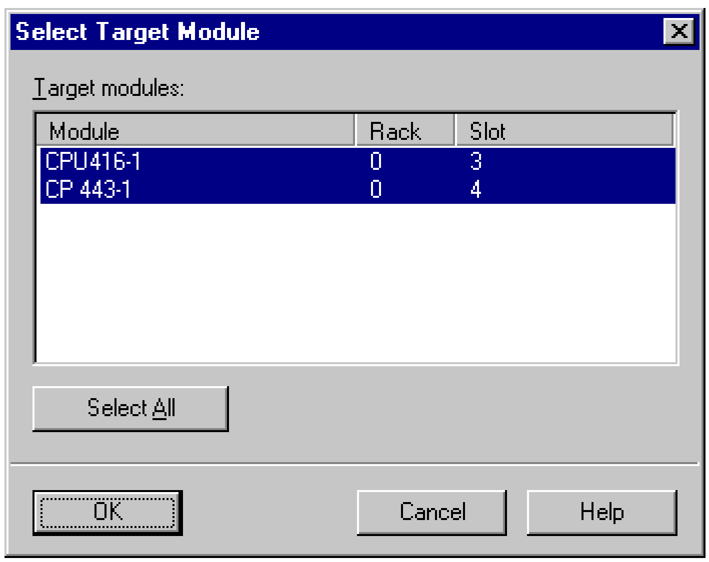
</td></tr>
<tr><td>6</td><td>The program HW Config will display the currently still empty rack. It received the Rack Number 0. During the configuration of the connection in the WinCC project, the Rack Number is one of the parameters that must be set.


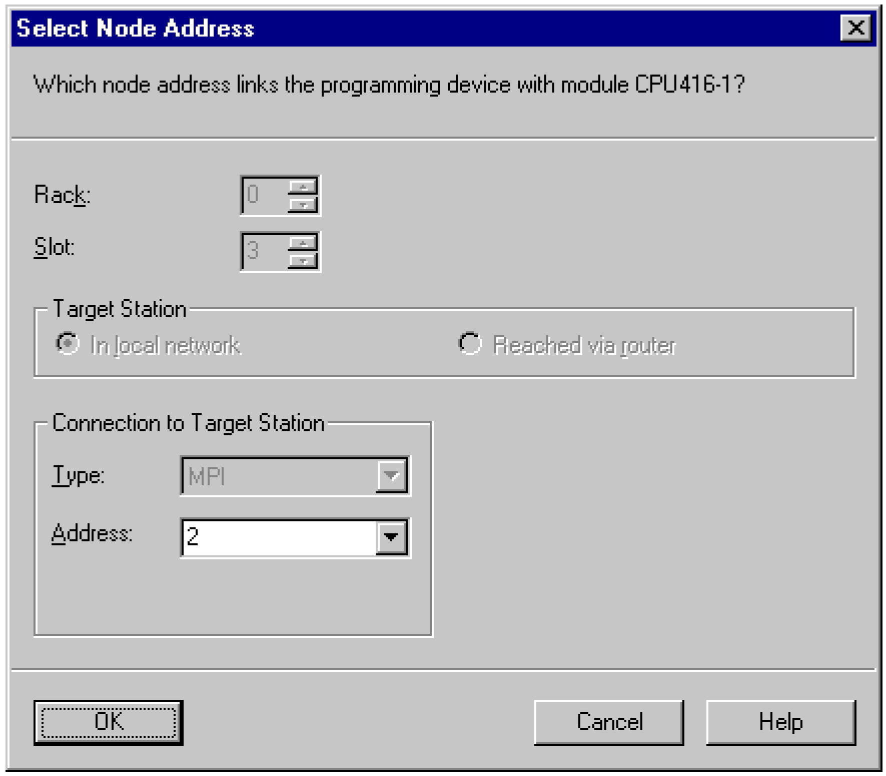
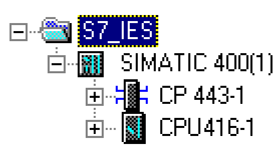
</td></tr>
<tr><td>7</td><td>Arrange the other hardware components in the rack. This is done by Dragging Dropping the desired components from the Hardware Catalog to the corresponding slot in the rack.</td></tr>
</table>

Step	D: Configuring the Hardware
	This sample uses the power supply PS 407 10A. It is inserted into slot 1. A power supply of this type occupies two slots. As the CPU module, this sample uses a CPU 416-1. This module is inserted into slot 3. Another parameter to be set during the configuration of the connection in the WinCC project is the slot number of the CPU module. We also require the communication processor *CP 443-1*. This CP is only available from the *Hardware Catalog* if the option package *NCM S7 Industrial Ethernet* has been installed. After the communication processor *CP 443-1* has been inserted in the rack, its properties dialog box will open.
8	The properties dialog box of the communication processor *CP 443-1* will be displayed. In the *MAC Address* field of the *Parameters* tab, enter the desired Ethernet address of the communication processor. In this sample, the address *08.00.06.01.00.00* is specified. Another parameter to be set during the configuration of the connection in the WinCC project is this Ethernet address. In the Subnet field below, assign the entry Ethernet(1) to the communication processor. Close the dialog box by clicking on OK. 
9	The following graphic shows the completed hardware arrangement of the sample. 

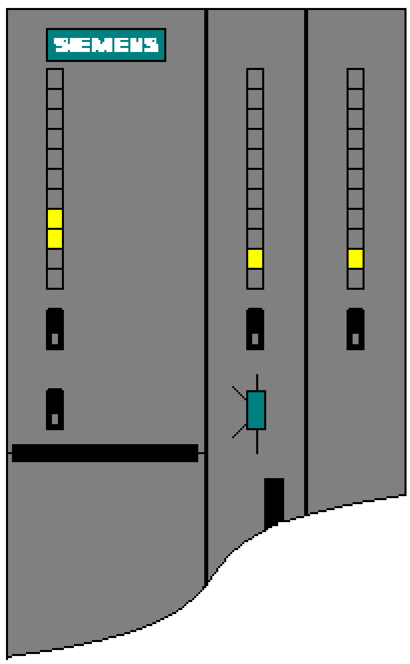
Step	D: Configuring the Hardware
10	Save the settings made in the program *HW Config*. This is done via the toolbar button displayed below. 

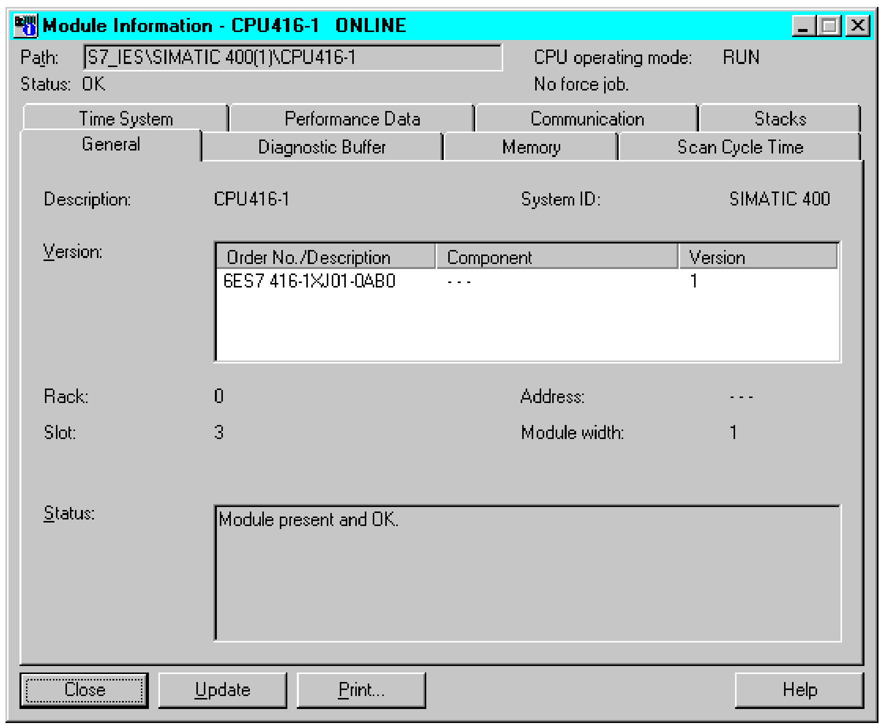
E: Loading the Hardware Configuration

Step	E: Loading the Hardware Configuration
1	The hardware configuration created in the program *HW Config* must be transferred to the PLC. This is done via the toolbar button displayed below. 
2	A dialog box will be displayed from which the components to be loaded can be selected. For this sample, all displayed components will be selected. Note that loading to the CPU module is only possible while the operating mode switch is set to *STOP* or *RUN-P*. Close the dialog box by clicking on *OK*. 

Step	E: Loading the Hardware Configuration
3	Now the dialog box *Select Station Address* will be displayed. In this dialog box, specify which station address is used by the STEP7 software to communicate with the CPU module. In this sample, the communication is carried out via the MPI interface. The *Address* of the CPU module is *2*. Close the dialog box by clicking on *OK*. 
4	The configuration data will now be transferred to the PLC. If necessary, the individual modules will be set to the STOP status. The program *HW Config* can be exited. The newly added components will be displayed by the *SIMATIC Manager* for the station *SIMATIC 400(1)*. 

F: Testing the Hardware Configuration

Step	F: Testing the Hardware Configuration
1	Testing of the hardware configuration made. If the key switch of the CPU module is set to *RUN* or *RUN-P* and the operating mode switch of the communication processor is set to *RUN*, only the status LEDs signifying the *RUN* operating mode should be displayed. If this is not the case, there is an error. The following steps help you localize this error. However, these steps should still be performed even if the status LEDs show no error. This allows you to recognize uncritical errors and faulty configurations. 

Step	**F: Testing the Hardware Configuration**
2	Testing the configuration of the CPU module. This is done via the dialog box *Module Status* in the *SIMATIC Manager*. It is opened by a R on the entry of the CPU module in the left window and then selecting *Target System* → *Module Status* from the pop-up menu. The dialog box *Module Status* of the CPU module will be displayed. The *General* tab displays various general data of the CPU module. In the *Status* field, the current module status and any existing errors are displayed. The *Diagnosis Buffer* tab contains more detailed information about existing errors and how to correct them. The dialog box can be exited via the *Close* button. 

<table>
<tr><th>Step</th><th>F: Testing the Hardware Configuration</th></tr>
<tr><td>3</td><td>

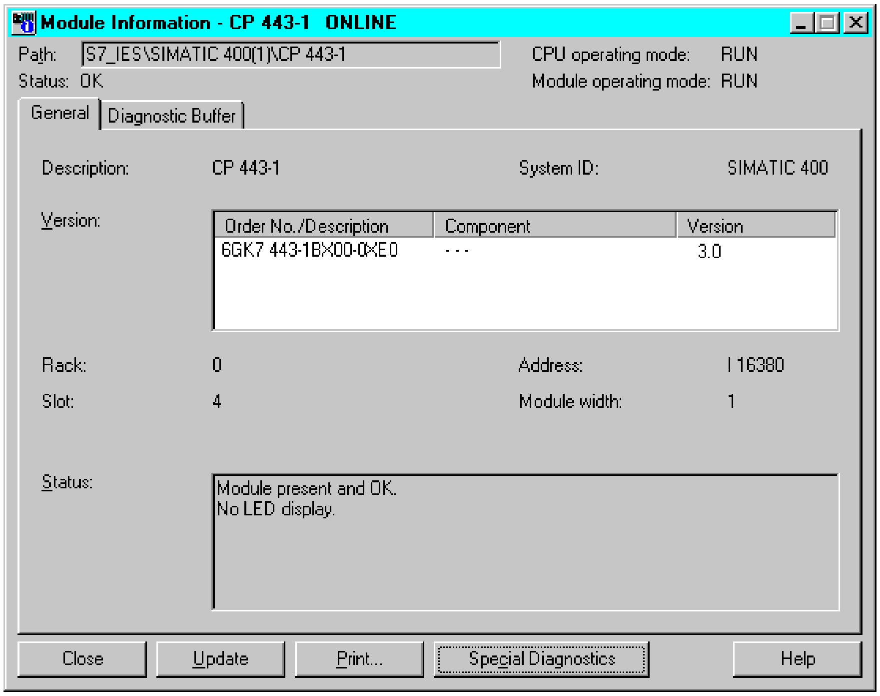
Testing the configuration of the communication processor.

This is done via the dialog box *Module Status* in the *SIMATIC Manager*. It is opened by a R on the entry of the communication processor in the left window and then selecting *Target System* → *Module Status* from the pop-up menu.

The dialog box *Module Status* of the communication processor will be displayed.

The *General* tab displays various general data of the module.

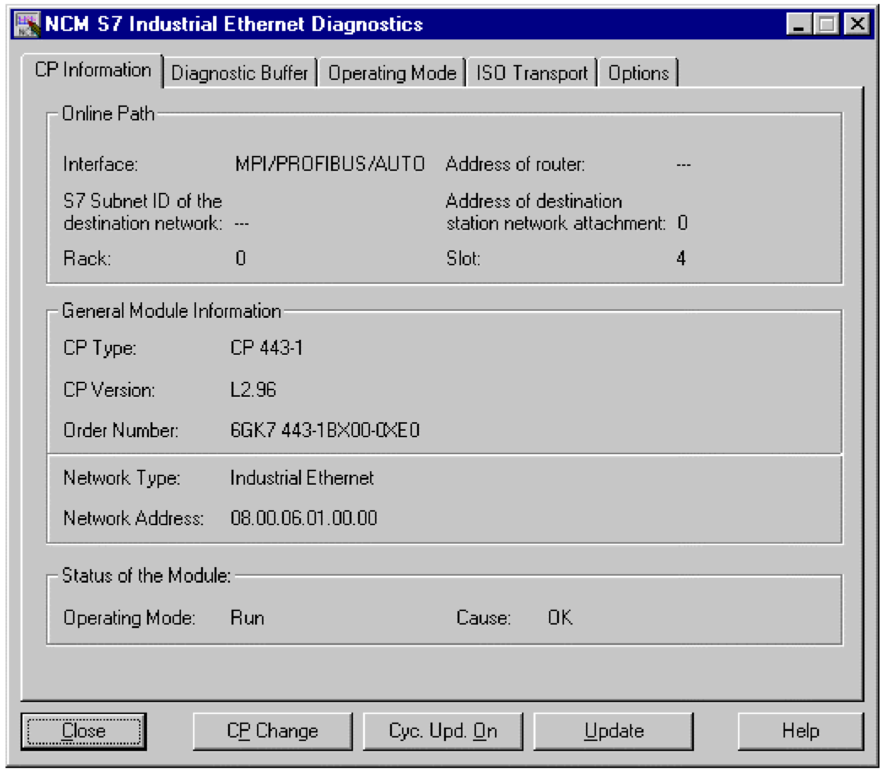
A dialog box for a more detailed diagnosis of the communication processor can be accessed via the *Special Diagnosis* button.



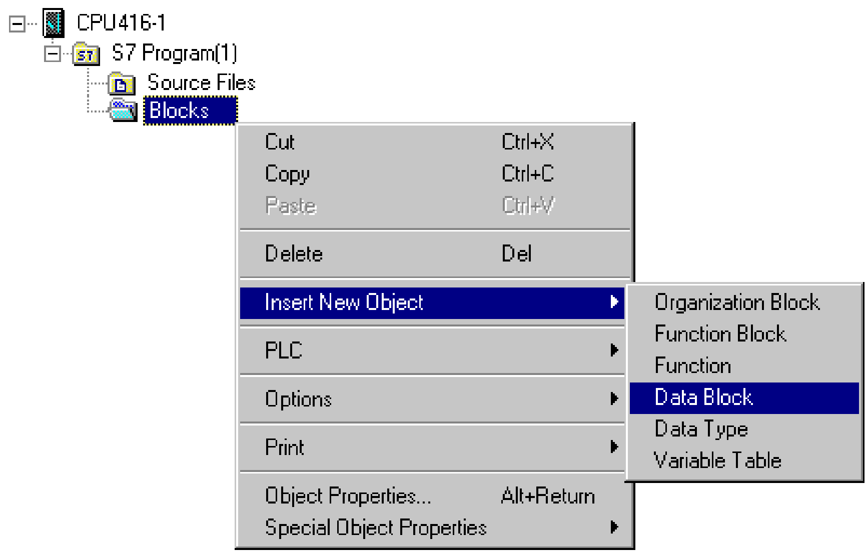
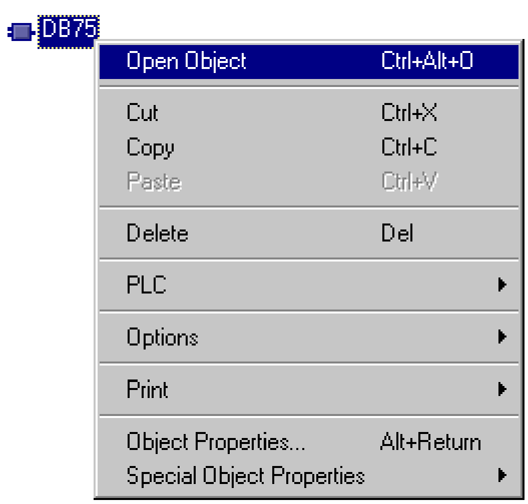
</td></tr>
</table>

<table>
<tr><th>Step</th><th>F: Testing the Hardware Configuration</th></tr>
<tr><td>4</td><td>The dialog box NCM S7 Industrial Ethernet Diagnosis will be displayed.

The CP Information tab displays general information about the module. Among other things, the network address set can be checked.

The dialog box can be exited via the Close button. The Module Status dialog box can also be exited via the Close button.
</td></tr>
</table>

G: Creating the STEP7 Program

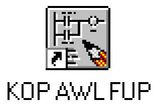
Step	G: Creating the STEP7 Program
1	Creation of the *S7 Program*. This sample project requires the operation block *OB1* and a data block. *OB1* is available by default, the required data block must be created. This is done in the *SIMATIC Manager* via a R on the sub-entry *Modules* of the entry *S7 Program(1)* of the configured CPU module and then selecting *Insert New Object* → *Data Block* from the pop-up menu. The properties dialog box of the data block will be opened. As the block's *Name* enter *DB75* and close the dialog box with *OK*. 
2	The newly created data block *DB75* will be displayed in the right window of the project. Via a D on this data block or a R and then selecting *Open Object* from the pop-up menu, the content of the block can be programmed. This starts the program *LAD/STL/SCF*. 

Step	G: Creating the STEP7 Program

3

The program *LAD/STL/SCF* is displayed.

Acknowledge the dialog box *New Data Block* by clicking on *OK*.



4

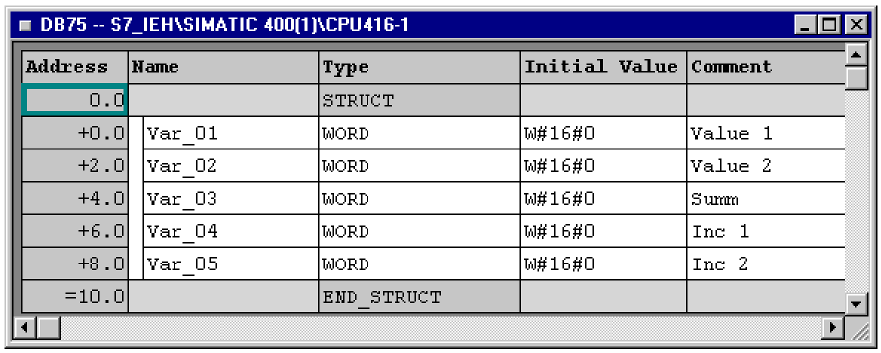
Programming the *DB75*.

In this data block, two tags with a length of 16 Bits are created. Their sum is to be determined in *OB1* and then be written to another tag with a length of 16 Bits.

Two additional tags with a length of 16 Bits are created, whose values are cyclically incremented in *OB1*.

The tags created in the data block *DB75* are visualized in the WinCC project. To do so, WinCC tags with corresponding addresses are created there.

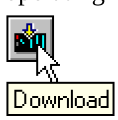
The following graphic displays the programmed data block *DB75*.


DB75 -- S7_IEH\SIMATIC 400(1)\CPU416-1

Address	Name	Type	Initial Value	Comment
0.0		STRUCT		
+0.0	Var_01	WORD	W#16#0	Value 1
+2.0	Var_02	WORD	W#16#0	Value 2
+4.0	Var_03	WORD	W#16#0	Summ
+6.0	Var_04	WORD	W#16#0	Inc 1
+8.0	Var_05	WORD	W#16#0	Inc 2
=10.0		END_STRUCT		

5

Save the block and load it into the PLC. This is done via the toolbar button displayed below. Note that loading to the CPU module is only possible while the operating mode switch is set to *STOP* or *RUN-P*.



6

Programming the *OB1*.

Open the block in the program *LAD/STL/SCF*.

First, two values in the *DB75* are added and then stored again in *DB75*.

Netzwerk 1: Addition

```
Adding two 16-Bit Values
The result is stored in another
16-Bit Value
```

```
      OPN   DB    75
      L     DBW    0
      L     DBW    2
      +I
      T     DBW    4
```

Next, a value in the *DB75* is incremented every second.

Step	G: Creating the STEP7 Program

	Network 2: Second Cycle
	
	Generation of a second cycle at M 0.0
	
	`AN M 0.0`
	`L S5T#1S`
	`SD T 1`
	`A T 1`
	`= M 0.0`
	
	Network 3: Counting in a second cycle
	
	Counting a value in a second cycle
	At 10000, reset to 0
	
	`AN M 0.0`
	`JC M001`
	`L DBW 6`
	`L 1`
	`+I`
	`T DBW 6`
	`L 10000`
	`<I`
	`JC M001`
	`L 0`
	`T DBW 6`
	`M001: NOP 0`
	
	Finally, a value in the *DB75* is incremented every time the *OB1* run.
	
	Network 4: Counting in the cycle time
	
	Counting a value each time the OB is executed
	At 10000, reset to 0
	
	`L DBW 8`
	`L 1`
	`+I`
	`T DBW 8`
	`L 10000`
	`<I`
	`JC M002`
	`L 0`
	`T DBW 8`
	`M002: NOP 0`

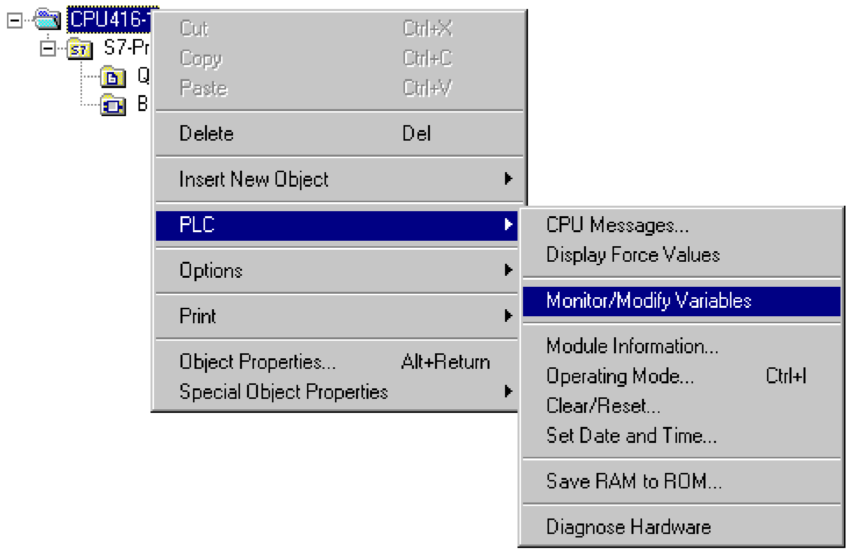
7	Save the block *OB1* and load it into the PLC. This is done via the corresponding buttons on the toolbar. This completes the creation of the STEP7 project and it can now be run. Exit the program *LAD/STL/SCF*.

H: Testing the STEP7 Program

<table>
<tr><th>Step</th><th>H: Testing the STEP7 Program</th></tr>
<tr><td>1</td><td>

Testing the program with the STEP7 software.

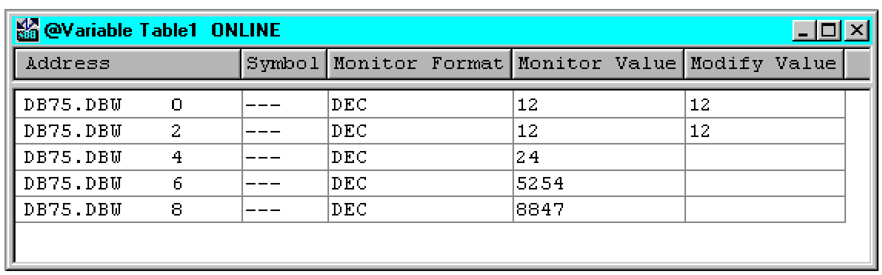
For this purpose, a tag table is created. This is done in the *SIMATIC Manager* via a R on the entry of the configured CPU module and then selecting *Target System* → *Monitor/Control Tag* from the pop-up menu.



</td></tr>
<tr><td>2</td><td>

An editor for creating and using a tag table will be displayed.

The following shows a completed tag table. In this table, enter all tags created in the *DB75*.



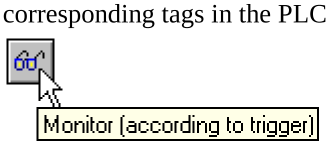
@Variable Table1 ONLINE

Address	Symbol	Monitor Format	Monitor Value	Modify Value
DB75.DBW 0	---	DEC	12	12
DB75.DBW 2	---	DEC	12	12
DB75.DBW 4	---	DEC	24	
DB75.DBW 6	---	DEC	5254	
DB75.DBW 8	---	DEC	8847	

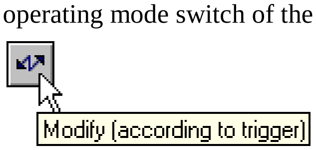
</td></tr>
<tr><td>3</td><td>

Monitoring the current tag values.

By clicking on the toolbar button displayed below, the current values of the corresponding tags in the PLC are displayed in the column *Status Value*.



Controlling the tag values.Values can be entered in the column *Control Value*. By clicking on the toolbar button displayed below, these values will be written to the corresponding tags in the PLC.Note that tags can only be controlled while the operating mode switch of the CPU module is set to *RUN-P*.



</td></tr>
</table>

Step	H: Testing the STEP7 Program
4	The created tag table can now be saved. In this sample, the table is saved under the name *VAT1*. After checking the program in the PLC, the tag table can be closed. This concludes the configuration of the STEP7 project and the *SIMATIC Manager* can be exited. 

3.3 Creation of the WinCC Project WinCC_S7_IES

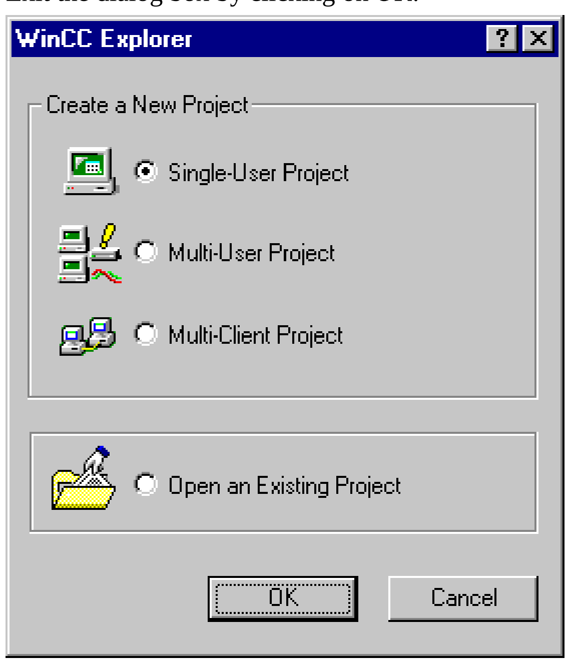
The following description details the configuration steps necessary to create and start up the WinCC project *WinCC_S7_IES*.

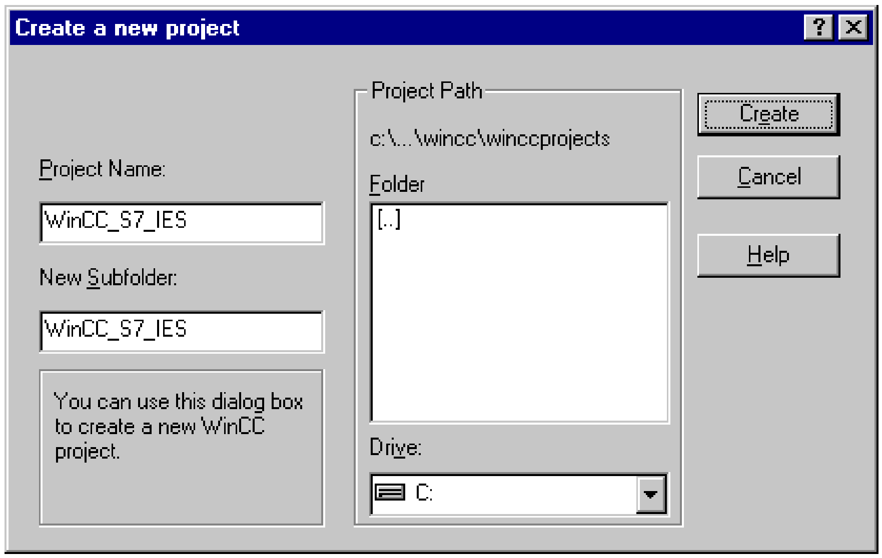
Overview of the Configuration Steps

The following lists the configuration steps necessary to create the WinCC project *WinCC_S7_IES*:

- A: Creating the WinCC Project
- B: Creating the Connection
- C: Creating the WinCC Tags
- D: Creating the WinCC Screen

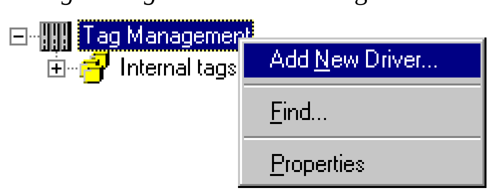
A: Creating the WinCC Project

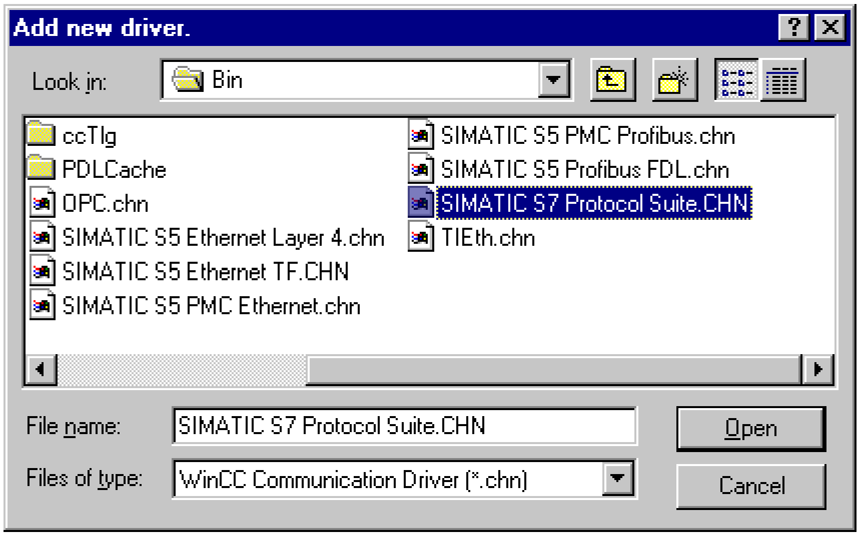
Step	A: Creating the WinCC Project
1	Creation of a new WinCC project in the *WinCC Explorer*. The WinCC Explorer is started via *Start* → *Simatic* → *WinCC* → *Windows Control Center*. 
2	This will display the *WinCC Explorer*. Via the menus *File* → *New*, the dialog box for specifying the properties of a new WinCC project will be opened. For this sample project, a *Single-User Project* is created. Exit the dialog box by clicking on *OK*. 

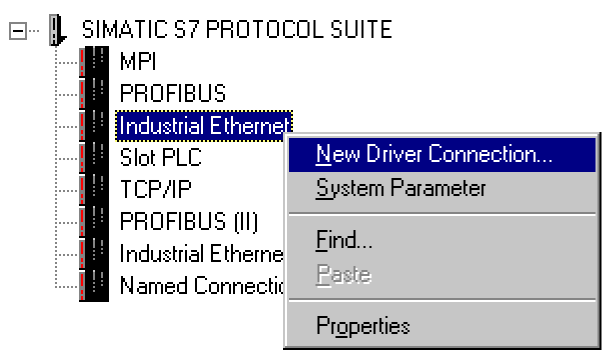
<table>
<tr><th>Step</th><th>A: Creating the WinCC Project</th></tr>
<tr><td>3</td><td>The dialog box Create a new Project will be displayed.
Specify a Project Name for the new project. The names of the WinCC projects created within the framework of this manual all start with WinCC and also include a reference to the communication partner and communication type used. The project of this sample has the name WinCC_S7_IES.
In the Project Path field, set the storage location of the new project.
The dialog box Create a new Project is concluded by clicking on the Create button.

</td></tr>
</table>

B: Creating the Connection

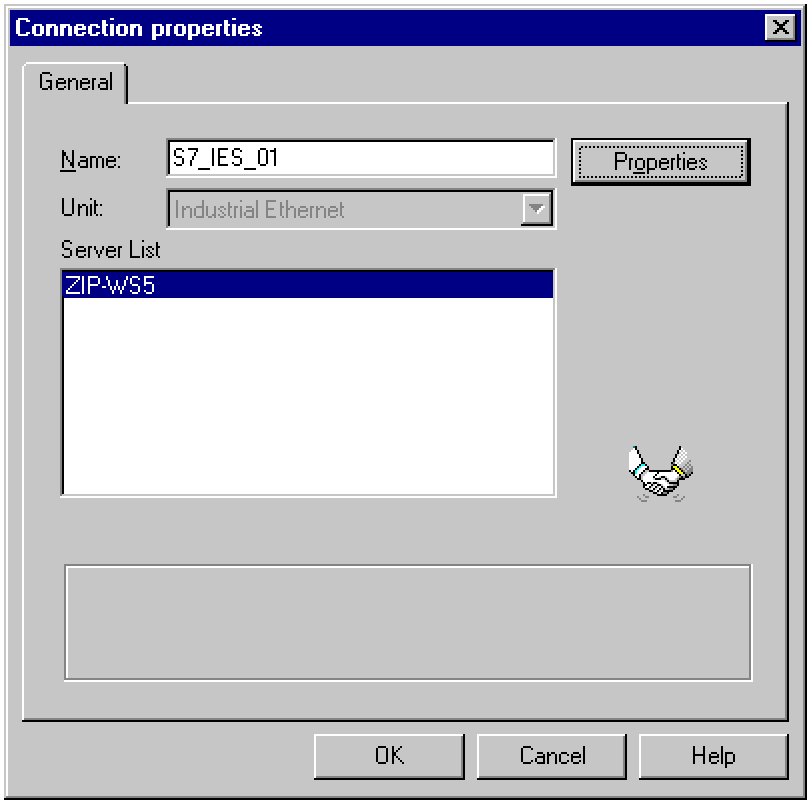
<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>1</td><td>The new project will be displayed in the WinCC Explorer.

Installation of the required communication driver. This is performed via a R on Tag Management and selecting Add New Driver from the pop-up menu.

</td></tr>
</table>

<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>2</td><td>
The dialog box Add New Driver will be displayed.
This dialog box lists all communication drivers that can be installed. For the communication to the SIMATIC S7, the driver SIMATIC S7 Protocol Suite is required. Select this driver from the dialog box. Exit the dialog box by clicking on Open.


</td></tr>
<tr><td>3</td><td>
The newly added driver SIMATIC S7 Protocol Suite will be displayed as a sub-entry to Tag Management.
The driver contains eight different channel units. To operate a computer with two CP 1413 communication processors, two Industrial Ethernet channel units are available.
In this sample, the channel unit Industrial Ethernet is used. Create a new connection for this channel unit by R on Industrial Ethernet and then selecting New Driver Connection from the pop-up menu.


</td></tr>
</table>

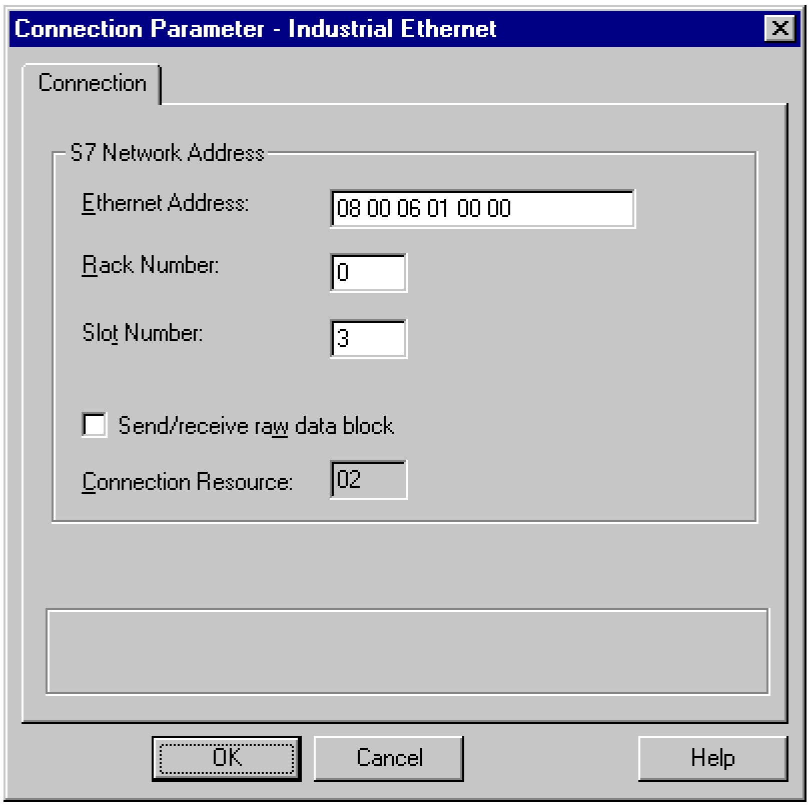
<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>4</td><td>The properties dialog box of the connection will be displayed.
In the General tab, the Name of the new connection is entered. In this sample, this is S7_IES_01.
Click on the Properties button to define the connection properties.

</td></tr>
</table>

<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>5</td><td>
The dialog box Connection Properties will be displayed.

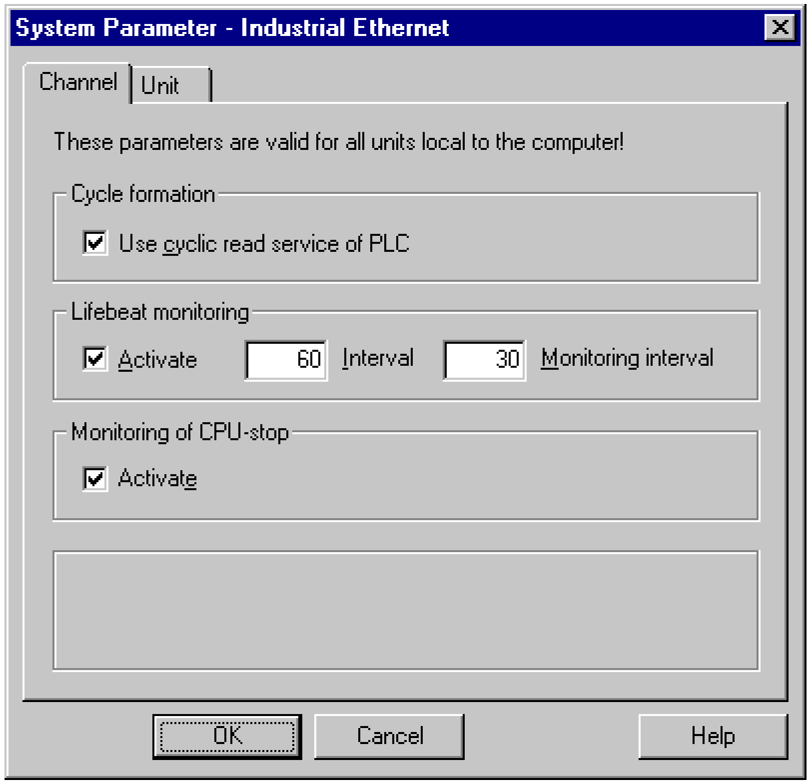
In the Ethernet Address field, enter the address that has been set for the communication processor CP 443-1. In this sample, this is the Ethernet Address 08.00.06.01.00.00.

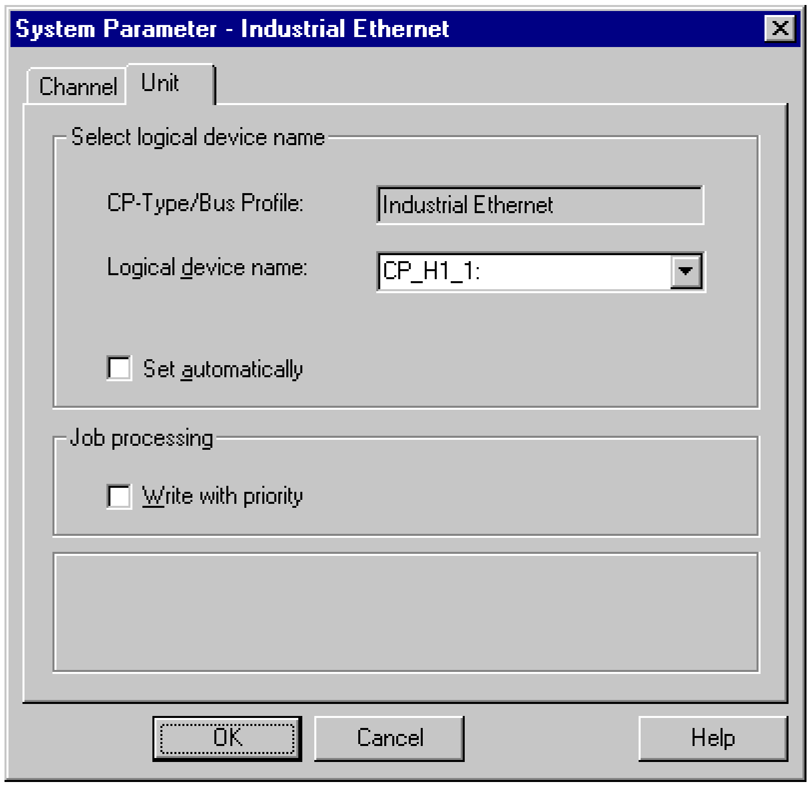
Additionally, the Rack Number and Slot Number of the CPU module to be accessed must be entered. Make sure that the values of the CPU module are entered here and not the values of the communication processor.

Close the dialog box by clicking on OK. Also close the Connection Properties dialog box by clicking on OK.

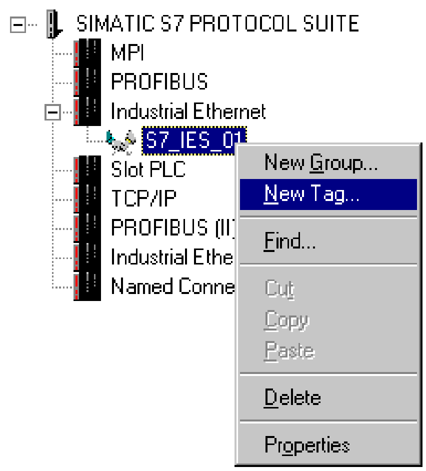
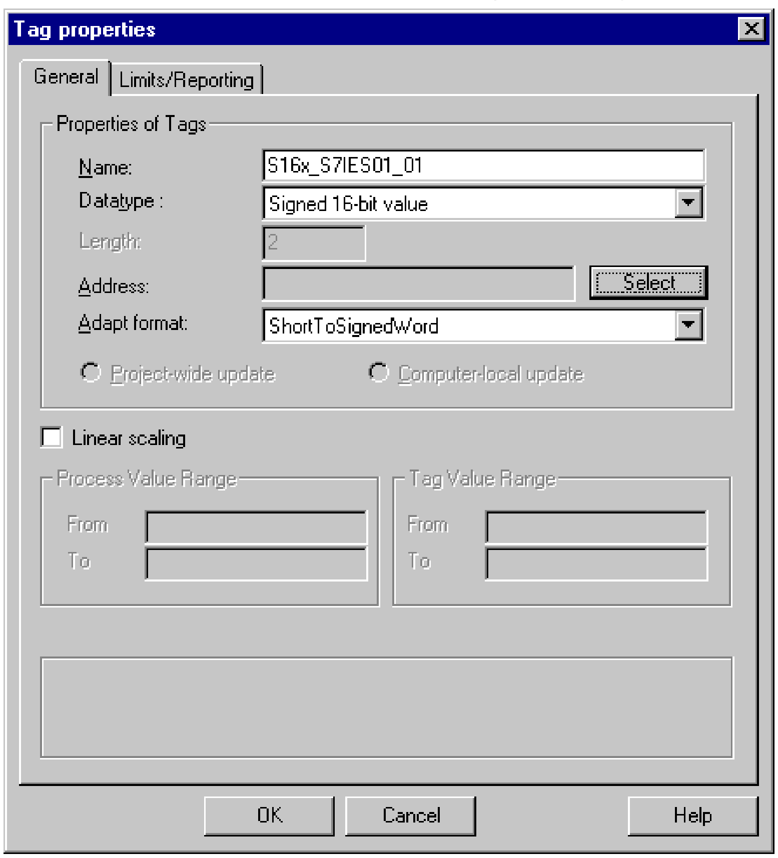


</td></tr>
</table>

Step	B: Creating the Connection
6	Setting the system parameters of the *Industrial Ethernet* channel unit. These settings are made in the *System Parameters* dialog box, which is accessed via a R on the *Industrial Ethernet* entry and then selecting *System Parameters* from the pop-up menu. In the *Channel* tab, various settings pertaining to the communication and monitoring a communication can be made. These settings will apply to all channel units of the communication driver. 

Step	B: Creating the Connection
7	In the *Device* tab, the access point used by the connection to access the PLC is specified. By default, the access point *CP_H1_1:* is set. Previously, the communication processor *CP 1411* has been assigned to the access point CP_H1_1: in the program *Setting the PG/PC Interface*. If you want the access point to be set automatically, make sure that the correct one is being used, especially if multiple communication processors are used. Close the dialog box by clicking on *OK*. 

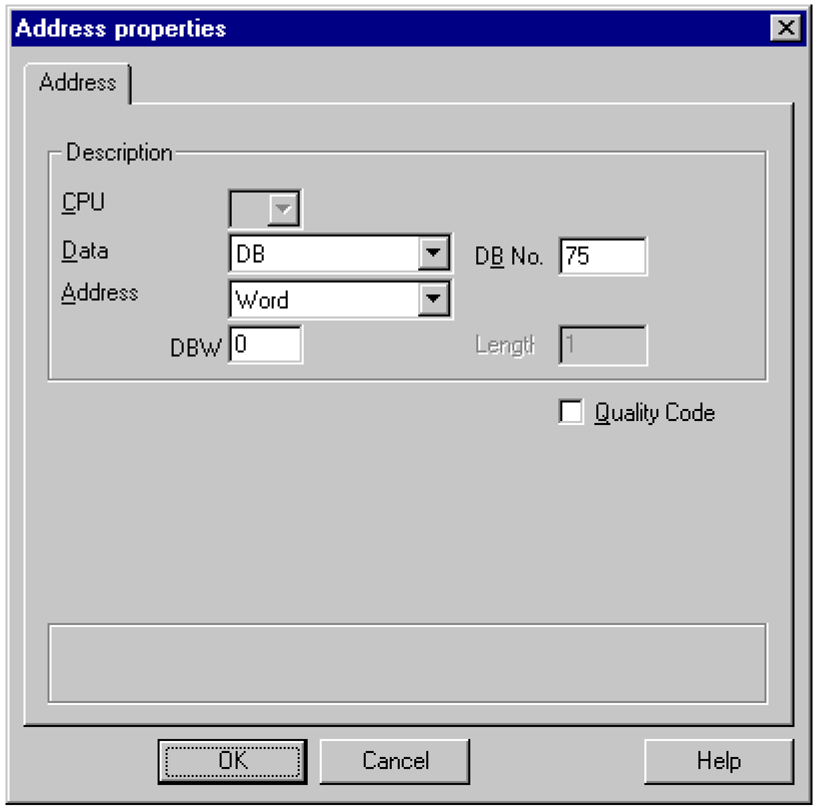
C: Creating the WinCC Tags

Step	C: Creating the WinCC Tags
1	Creation of the WinCC tags required for the sample. This is done via a R on the newly created connection *S7_IES_01* and then selecting *New Tag* from the pop-up menu. 
2	The properties dialog box of the tag will be displayed. In the sample, the *Name* of the first tag is *S16x_S7IES01_01*. The tag is of the *Signed 16-Bit Value* data type. *Click on the Select button to set the Address of the new tag.* 

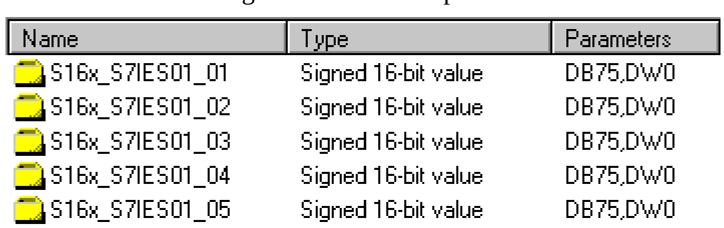
<table>
<tr><th>Step</th><th>C: Creating the WinCC Tags</th></tr>
<tr><td>3</td><td>The dialog box Address Properties will be displayed.

Set DB as the Data Range and the value 75 as the DB No.. Set Word in the Address field and the value 0 in the DBW field. Close the dialog box by clicking on OK. The properties dialog box of the tag is also closed by clicking on OK.

The just created WinCC tag is addressed in the range of the DB75, where the first of the two values to be added is located.


</td></tr>
<tr><td>4</td><td>Creation of the remaining WinCC tags required.

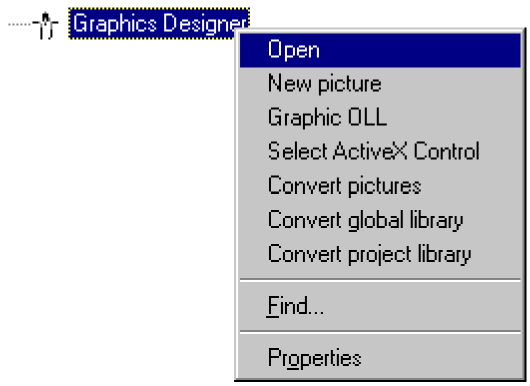
Follow steps 1 to 3 for the creation of the remaining tags. The names, data types and addresses of the tags used in this sample are listed in the following graphic.


<table>
<tr><th>Name</th><th>Type</th><th>Parameters</th></tr>
<tr><td>S16x_S7IES01_01</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
<tr><td>S16x_S7IES01_02</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
<tr><td>S16x_S7IES01_03</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
<tr><td>S16x_S7IES01_04</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
<tr><td>S16x_S7IES01_05</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
</table></td></tr>
</table>

D: Creating the WinCC Screen

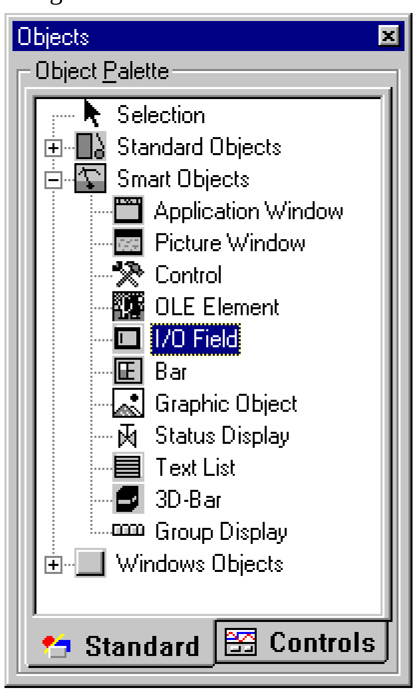
<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>1</td><td>
Creation of a WinCC screen in which the previously created tags are visualized.

Open the *Graphics Designer* editor via a R and then selecting *Open* from the pop-up menu.



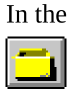
</td></tr>
<tr><td>2</td><td>
This will open the *Graphics Designer* editor with a new (blank) screen.

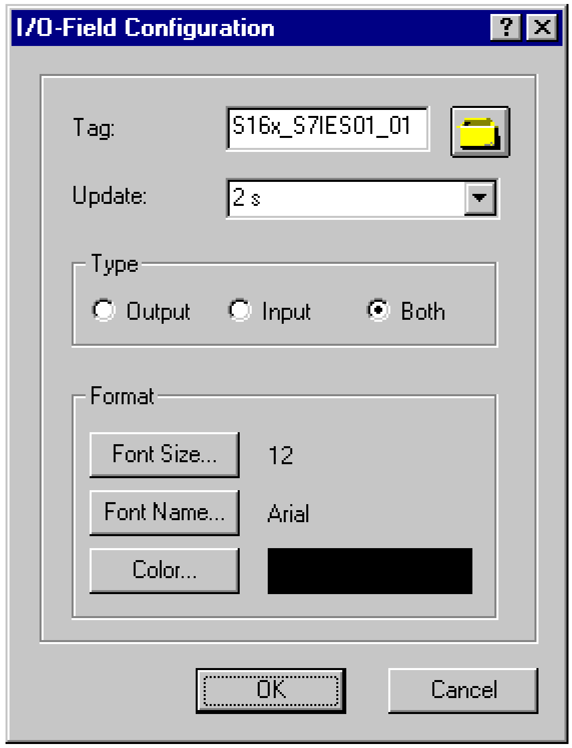
To display the first tag, configure a *Smart Object* → *I/O Field*. To do so, select the *I/O Field* object from the *Object Palette* and place it on the screen using the mouse.

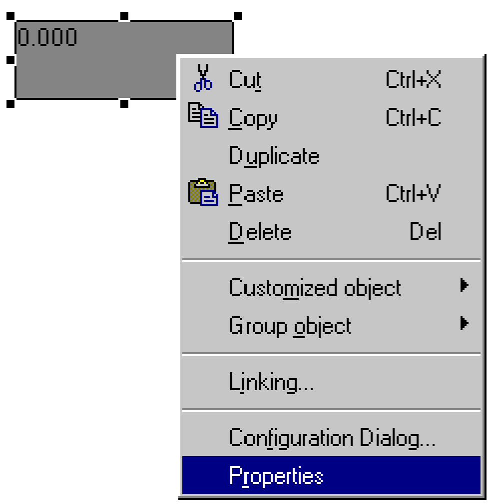


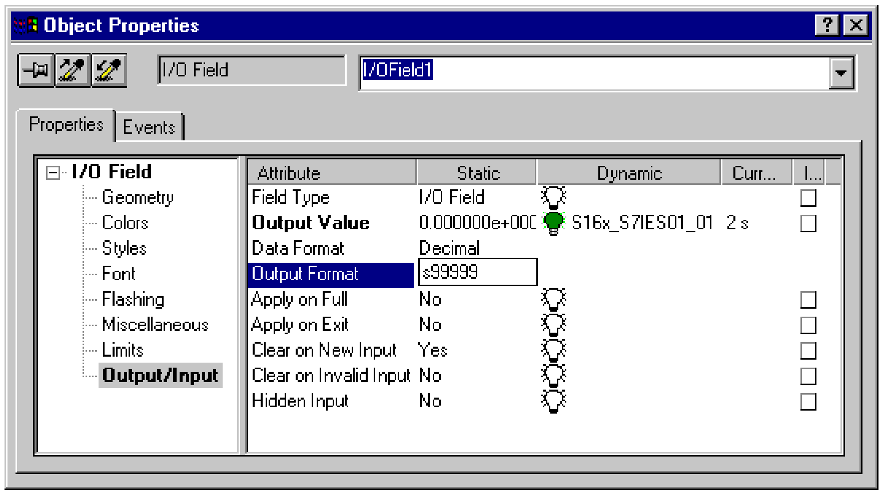
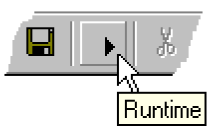
</td></tr>
<tr><td>3</td><td>
After placing the *I/O Field* on the screen, its *Configuration* dialog box will be displayed.

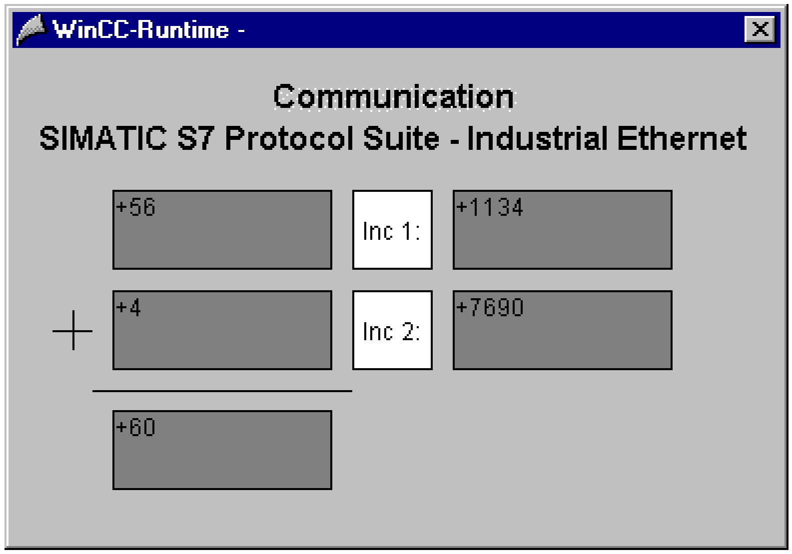
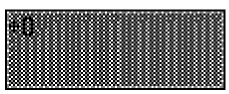
In the *Tag* field, set the tag *S16x_S7IES01_01* via the button displayed below.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td></td><td>The Update of the tag is set to Upon Change. Keep the default settings for the remaining options. Close the dialog box by clicking on OK.

</td></tr>
<tr><td>4</td><td>Changing the output format of the I/O Field.

For this, open its properties dialog box via a R on the I/O Field and then select Properties from the pop-up menu.

</td></tr>
</table>

Step	D: Creating the WinCC Screen
5	The dialog box *Object Properties* will be displayed. On the left side of the *Properties* tab, select the entry *Output/Input*. Via a D on the output format set, the field can be edited. Select the new format *s99999*. This format enables the *I/O Field* to display signed values with a maximum of 5 digits. 
6	Creation of four additional *I/O Fields* for the display of the remaining tags. Follow steps 2 to 5 to create the remaining I/O fields.
7	Save the screen. In the sample project, the screen is saved under the name *com_3_S7IES_01.pdl*. The screen can be switched directly to runtime from the *Graphics Designer* via the button displayed below. 

Step	D: Creating the WinCC Screen
	If the screen is in runtime, the PLC started and the network connection established, the current values of the PLC will be displayed in the I/O fields. They can be changed by entering values in the individual *I/O Fields*.  If there is no connection to the PLC, the *I/O Fields* will be displayed grayed out. In this case an error is present at some point of the communication connection. 

3.4 Diagnosis of the Communication Connection

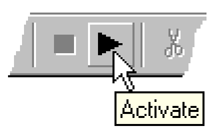
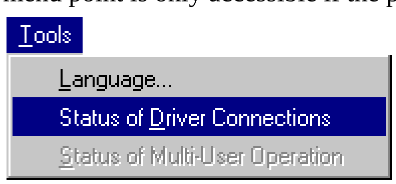
The following describes the options available for diagnosing the communication connection between the WinCC project *WinCC_S7_IES* and the SIMATIC S7 station.
A diagnosis of the sample according to this description makes only sense, if the checks listed below have been completed successfully.
Startup of the Communication Processor CP 1411

- G: Testing the Communication Processor

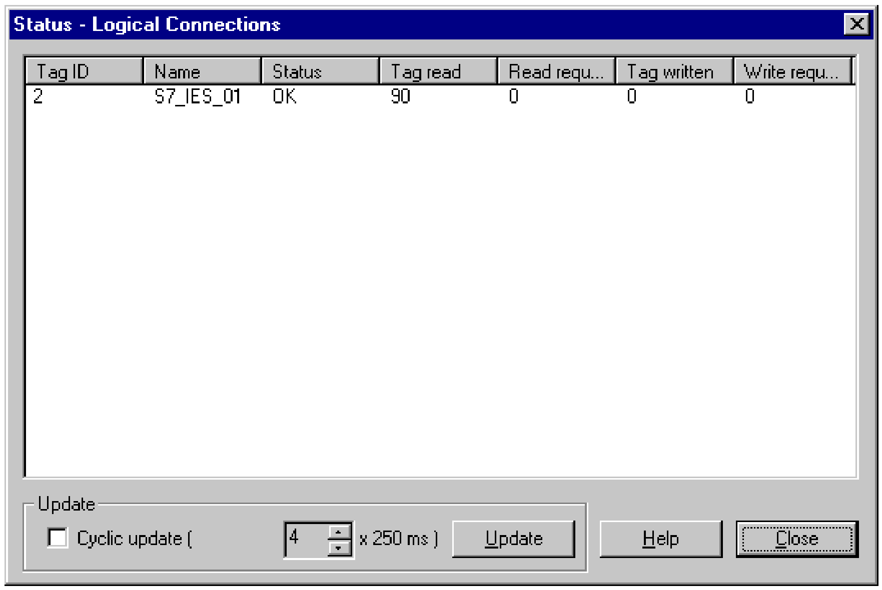
Creation of the STEP7 Project S7_IES

- F: Testing the Hardware Configuration
- I: Testing the STEP7 Program

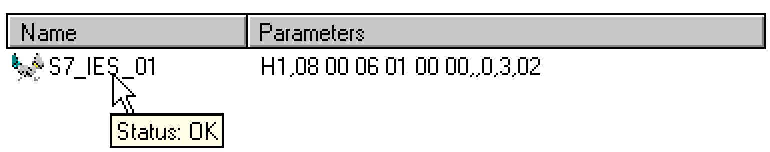
WinCC Explorer

Step	WinCC Explorer
1	Diagnosis of the communication connection in the *WinCC Explorer*. Switch the project *WinCC_S7_IES* into runtime. This is done from the *WinCC Explorer* via the toolbar button displayed below.  The created WinCC screen *com_3_S7IES_01.pdl* can also be switched directly from the *Graphics Designer* into runtime.
2	In the *WinCC Explorer*, a dialog box for monitoring all configured connections can be accessed via the *Tools* → *Status of Driver Connections* menu. This menu point is only accessible if the project is in runtime. 

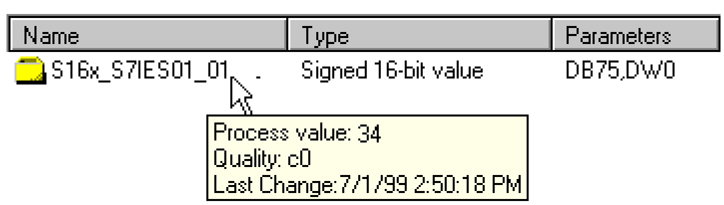
<table>
<tr><th>Step</th><th>WinCC Explorer</th></tr>
<tr><td>3</td><td>
The dialog box Status - Logical Connections will be displayed.
This dialog box lists all configured connections. For this sample, only the connection S7_IES_01 will be displayed.
The displayed values correspond to the status at the moment the dialog box was opened. By selecting the appropriate check-box, a Cyclic Update of the display can be achieved.



</td></tr>
<tr><td>4</td><td>
Another way to obtain information about the connection status in general and about the connection status of individual tags is provided by Tag Management.
The status of a configured connection can be displayed as a tooltip by simply pointing the mouse on the connection in question.



The current process value of a certain tag as well as its status can be displayed as a tooltip by pointing the mouse on it. This allows you to detect errors concerning an individual tag and not the entire connection.



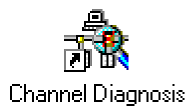
</td></tr>
</table>

Channel Diagnosis

<table>
<tr><th>Step</th><th>Channel Diagnosis</th></tr>
<tr><td>1</td><td>

Diagnosis of the communication connection via the program *WinCC Channel Diagnosis*.

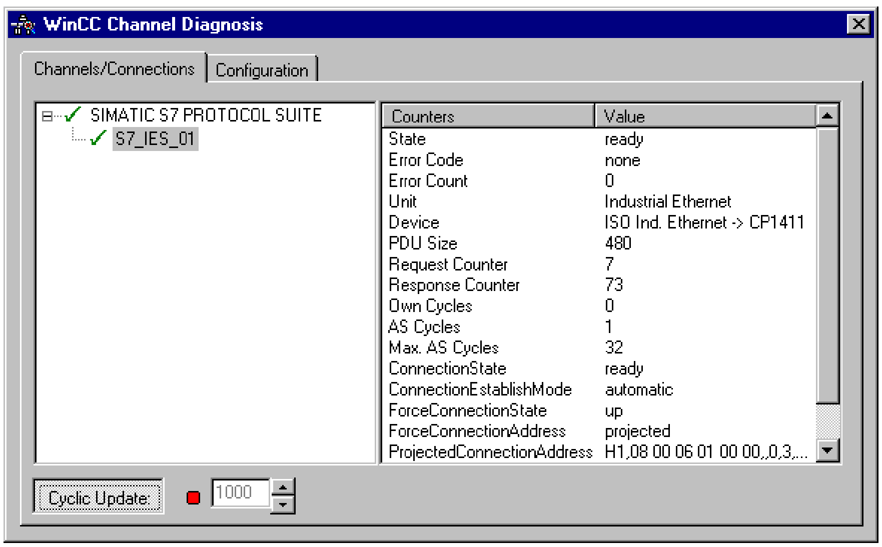
Start this program via *Start* → *Simatic* → *WinCC* → *Channel Diagnosis*.



</td></tr>
<tr><td>2</td><td>

The program *WinCC Channel Diagnosis* will be displayed.

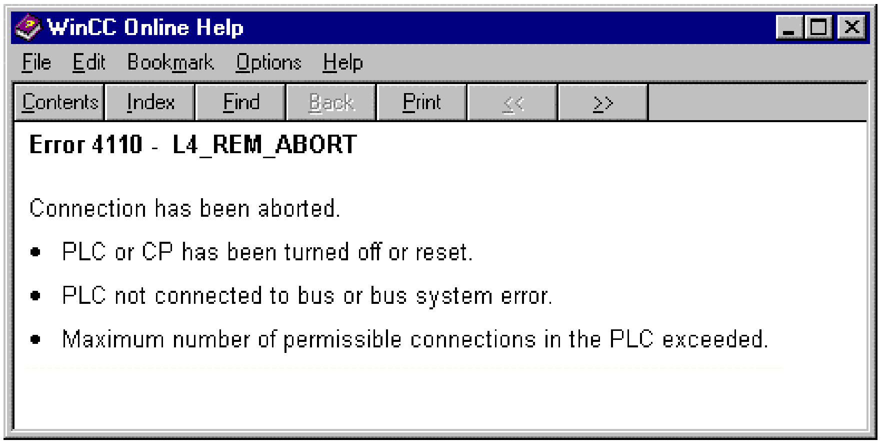
The *Channels/Connections* tab displays detailed information about the status of each configured connection. By default, the display is updated every second. The update cycle can be changed in the input field located at the bottom.



</td></tr>
<tr><td>3</td><td>

If a connection error is detected, the *Error Code* line in the right window half will display a value specifying the error cause. Detailed information about this error code is displayed by R on the *Error Code* entry and then selecting *Help* from the pop-up menu.

</td></tr>
</table>

Step	Channel Diagnosis
4	This opens the Online Help to WinCC containing a description of the corresponding error code. Additionally, possible error causes are also listed. 

4 Communication to the SIMATIC S7 via TCP/IP

The projects created in this chapter can also be copied directly from the online document to your hard drive. By default, they will be copied to the folder *C:\Communication_Manual*. You have the option to copy the following components to the hard drive:

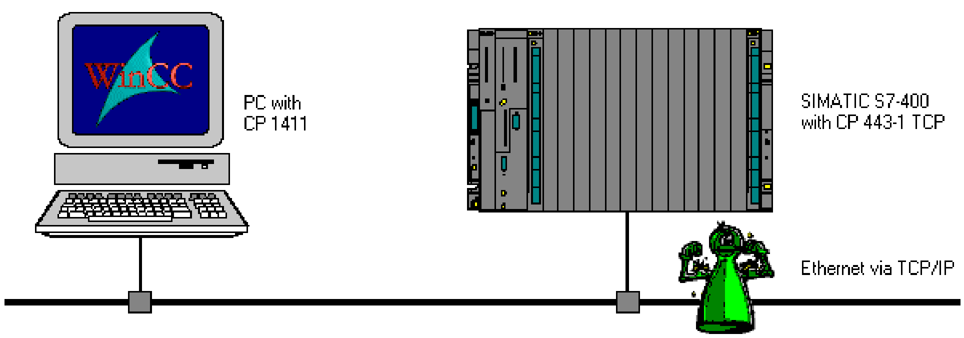
S7_IETCP

The STEP7 project we will create.

WinCC_S7_IETCP

The WinCC project we will create.
This chapter describes in detail the startup of a communication connection between a SIMATIC S7 and WinCC. The communication connection is realized via the Industrial Ethernet. As the transport protocol, the TCP/IP Protocol will be used.

Overview of the Structure of the Sample



On the computer side, the connection to the *Industrial Ethernet* network is established via the communication processor *CP 1411*. To install this communication processor in the computer, the driver *IE SOFTNET-S7 BASIC*, located on the *SIMATIC NET* CD-ROM, is needed.
In the WinCC project, the communication driver *SIMATIC S7 Protocol Suite* must be installed. Via its channel unit *TCP/IP*, the connection to the *SIMATIC S7* is configured.
The PLC is equipped with a *CPU 416-1* module. The connection to the network is established via the communication processor *CP 443-1 TCP*. For the configuration of this communication processor with the STEP7 software, the option package *NCM S7 Industrial Ethernet* is required.

Overview of the Configuration Steps

The following lists all configuration steps necessary for the creation of the communication connection:

- Startup of the Communication Processor CP 1411
- Creation of the STEP7 Project S7_IETCP
- Creation of the WinCC Project WinCC_S7_IETCP
- Diagnosis of the Communication Connection

Required Software

Name	Description
SIMATIC NET	Driver *IE SOFTNET S7 BASIC* from the *SIMATIC NET* CD-ROM for the installation of the communication processor *CP 1411*.
Windows NT	Windows NT installation software for the installation of the communication processor *CP 1411* and the *TCP/IP Protocol*.
STEP7	STEP7 software with option package *NCM for Industrial Ethernet* for the creation of the STEP7 project.
WinCC	WinCC with the communication driver *SIMATIC S7 Protocol Suite* for the creation of the WinCC project.

Required Computer Hardware

Name	Description
Communication Processor	Communication processor *CP 1411* to establish the connection to the PLC's communication processor.

Required PLC Hardware

Name	Description
Rack	Rack *UR1*
Power Supply	Power supply *PS 407 10A* in slot 1 and 2.
CPU Module	CPU module *CPU 416-1* in slot 3.
Communication Processor	Communication processor *CP 443-1 TCP* in slot 4.

4.1 Startup of the Communication Processor CP 1411

The following description details the configuration steps necessary to successfully start up the communication processor *CP 1411*. The communication is handled by the *TCP/IP Protocol*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to start up the communication processor *CP 1411*:

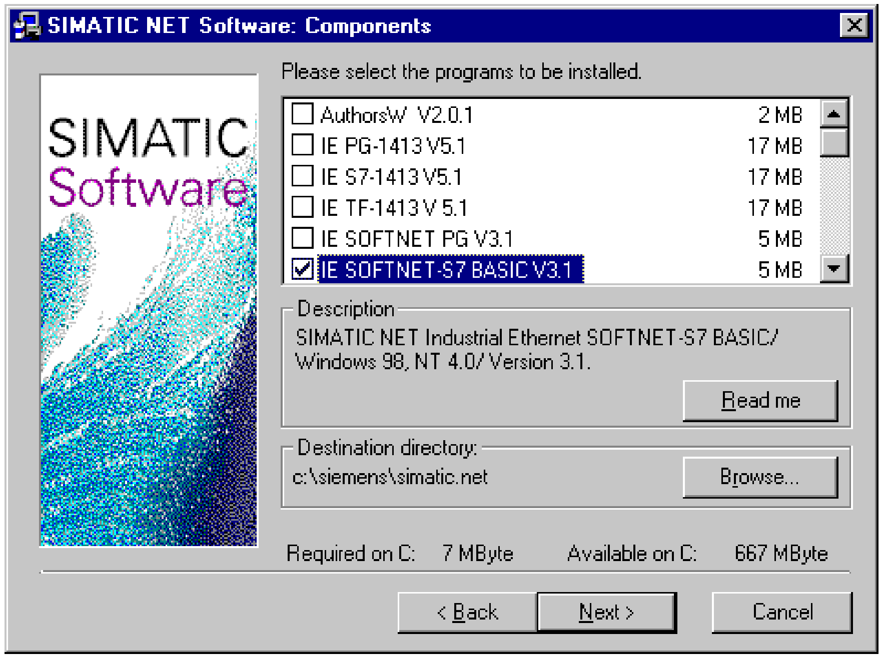
- A: Mounting the Communication Processor in the Computer
- B: Installing the Communication Driver
- C: Installing the Communication Processor
- D: Installing the Communication Protocol
- E: Configuring the Bindings
- F: Creating an Access Point

A: Mounting the Communication Processor in the Computer

Step	A: Mounting the Communication Processor in the Computer
1	Mount the module according to the installation instructions. Among other things, follow the steps for handling electrostatic sensitive devices (ESD). The module must only be installed while the computer is off. The communication card *CP 1411* requires a free ISA slot in the computer. After the installation of the *CP 1411*, close the computer’s case and start the computer.

B: Installing the Communication Driver

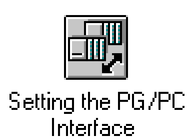
Step	B: Installing the Communication Driver
1	Install the communication driver *IE SOFTNET S7 BASIC* from the *SIMATIC NET* CD-ROM. After inserting the *SIMATIC NET* CD-ROM, the installation program is automatically started. If this is not the case, open the *Windows NT Explorer* and start the *setup.exe* program located on the CD-ROM. The installation of the software is started via the button displayed below. 

<table>
<tr><th>Step</th><th>B: Installing the Communication Driver</th></tr>
<tr><td></td><td>Follow the instructions of the installation program. On the Components page, the check-box of the driver IE SOFTNET-S7 BASIC to be installed must be selected. Finish the installation.


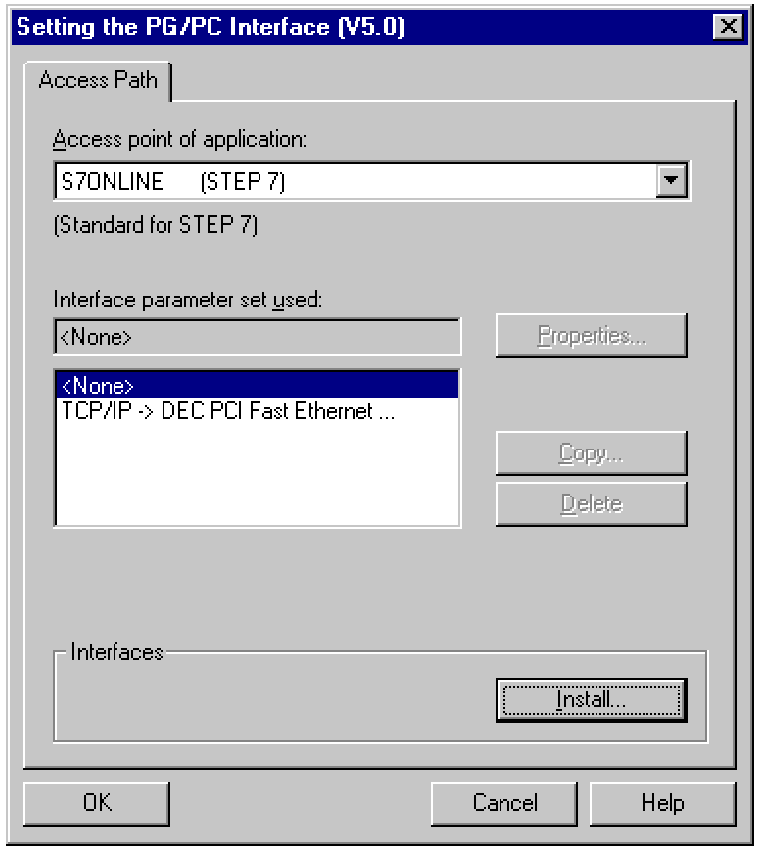
</td></tr>
</table>

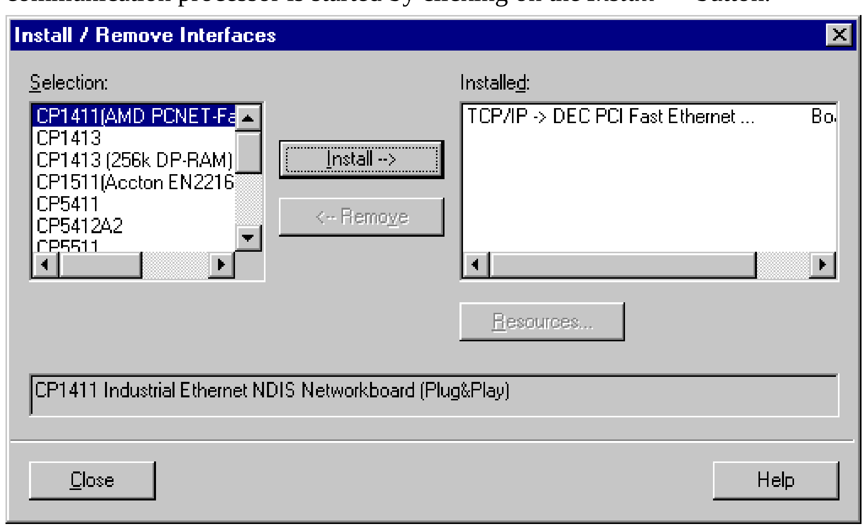
C: Installing the Communication Processor

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>1</td><td>Install the communication processor CP 1411 via the program Setting the PG/PC Interface.

This program is accessed via Start → Settings → Control Panel → Setting the PG/PC Interface.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>2</td><td>The program Setting the PG/PC Interface will be displayed.
The dialog box for installing a new interface is opened via the Install button.


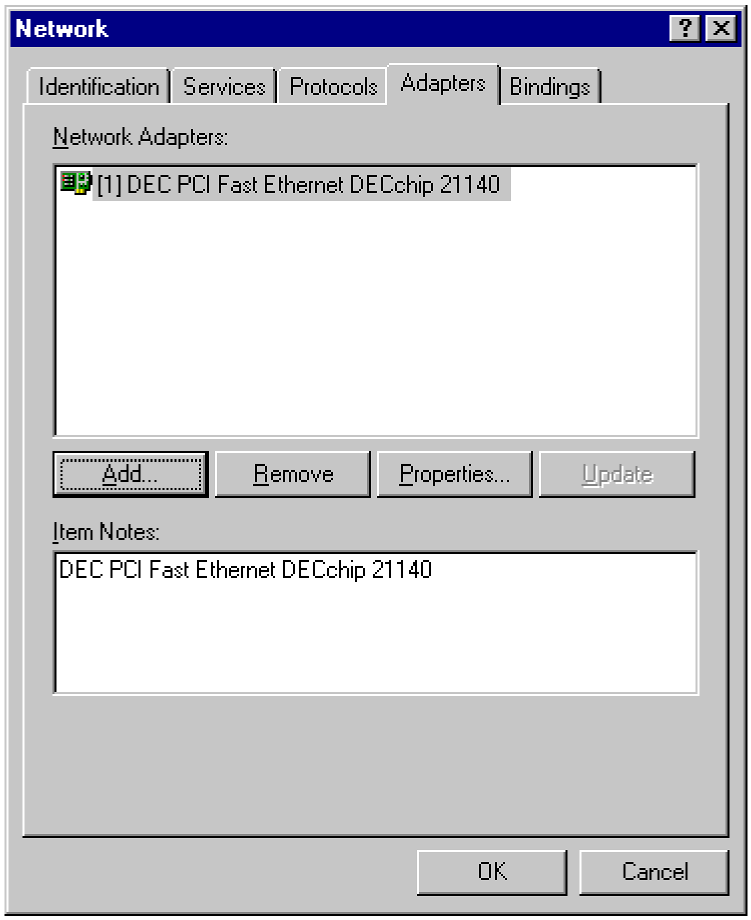
</td></tr>
<tr><td>3</td><td>The dialog box Install/Remove Modules will be displayed. The Selection field lists all interfaces that can be installed. Among them will be the entry CP 1411, if the communication driver has been installed previously as outlined in step B.
Select the entry CP 1411 (AMD PCNET-Family). The installation of the communication processor is started by clicking on the Install -> button.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>4</td><td>

This opens the *Network* dialog box.

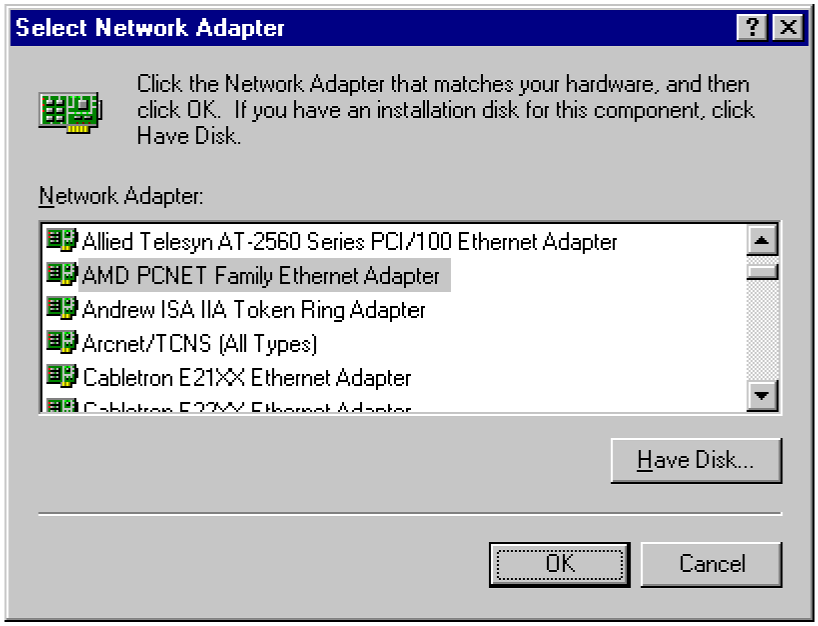
In the *Adapters* tab, install the communication card *CP 1411* by clicking on the *Add* button.



</td></tr>
</table>

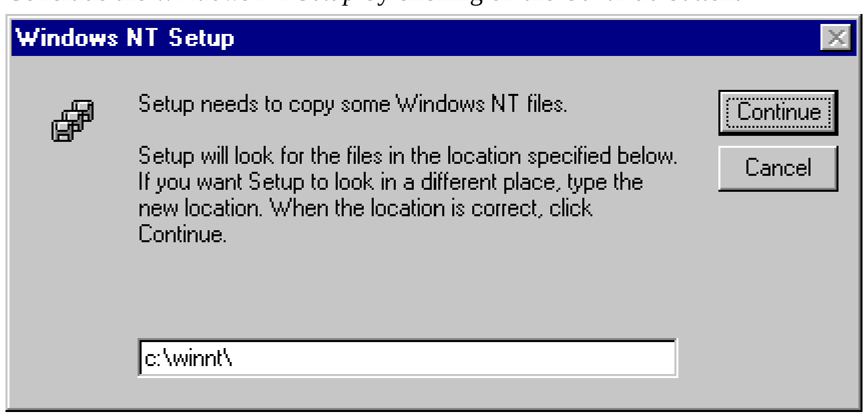
<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>5</td><td>The Select Network Adapter dialog box will be displayed.

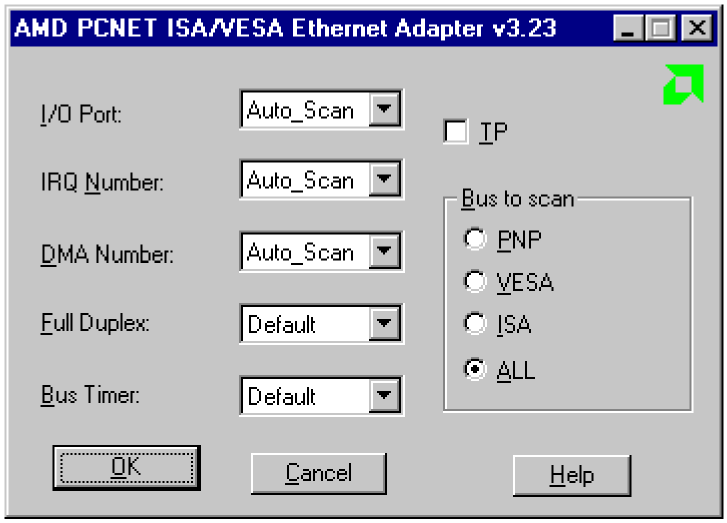
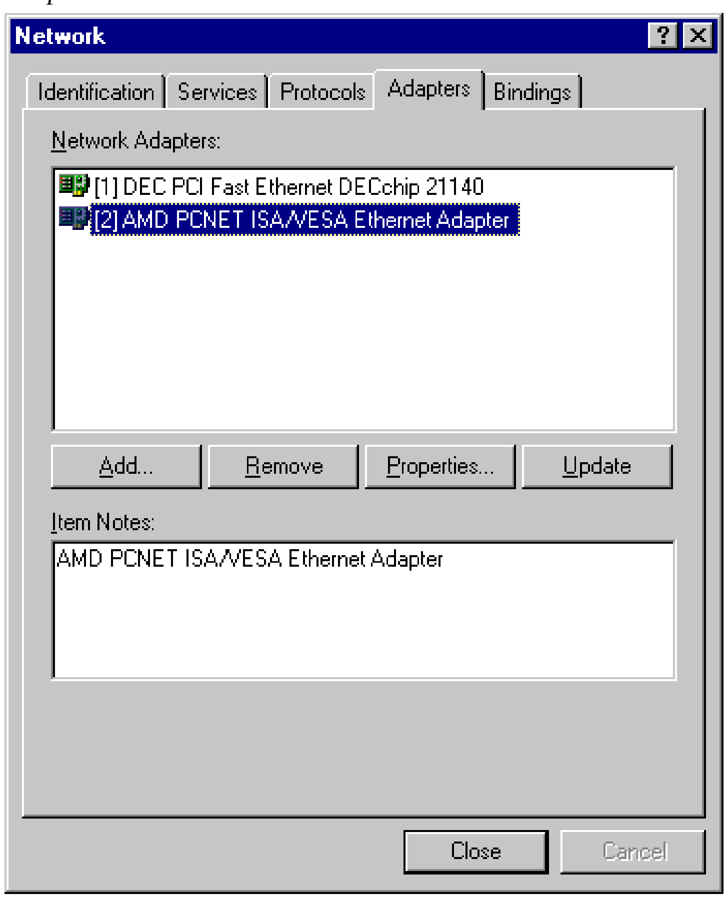
From the Network Adapter list, select the entry AMD PCNET-Family Ethernet-Adapter. Close the Select Network Adapter dialog box by clicking on OK.


</td></tr>
<tr><td>6</td><td>The Windows NT Setup dialog box will be displayed. This dialog box informs you that some Windows NT files must be copied for the installation of the CP 1411.

In the input field at the bottom, specify the path in which the appropriate files can be found. Normally, this is the path to the CD-ROM drive (if the files are copied from a Windows NT Installation CD-ROM).

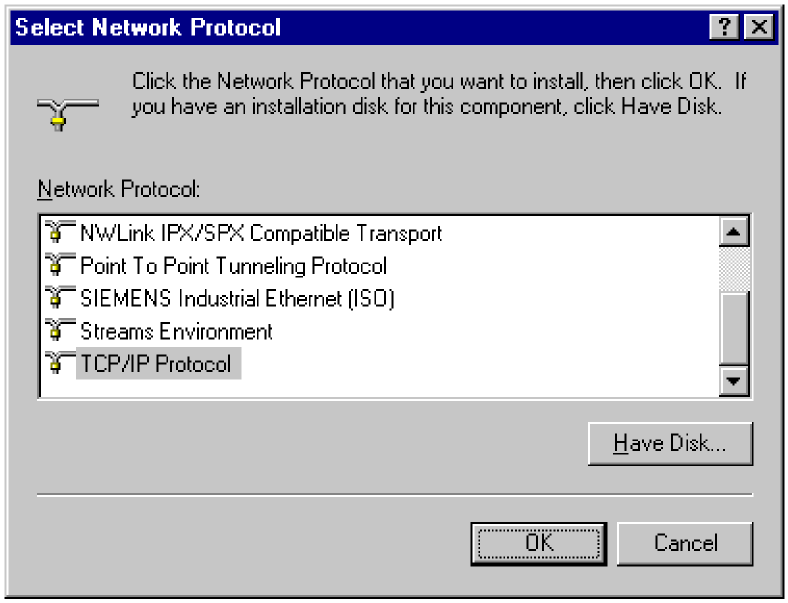
Conclude the Windows NT Setup by clicking on the Continue button.

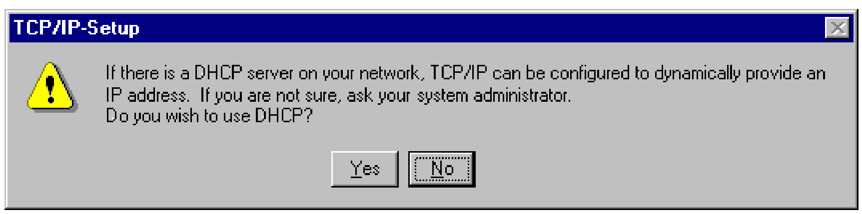

</td></tr>
</table>

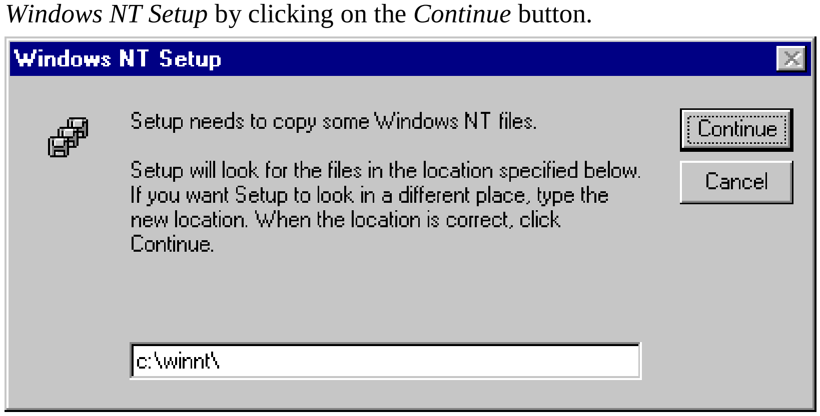
<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>7</td><td>The setup dialog box for the CP 1411 will be displayed.
Keep the default settings for the various options. Close the setup dialog box by clicking on OK.

</td></tr>
<tr><td>8</td><td>After the installation of the CP 1411 is complete, the entry AMD PCNET ISA/VESA Ethernet-Adapter will be displayed in the Network Adapters list of the Adapters tab.

</td></tr>
</table>

D: Installing the Communication Protocol

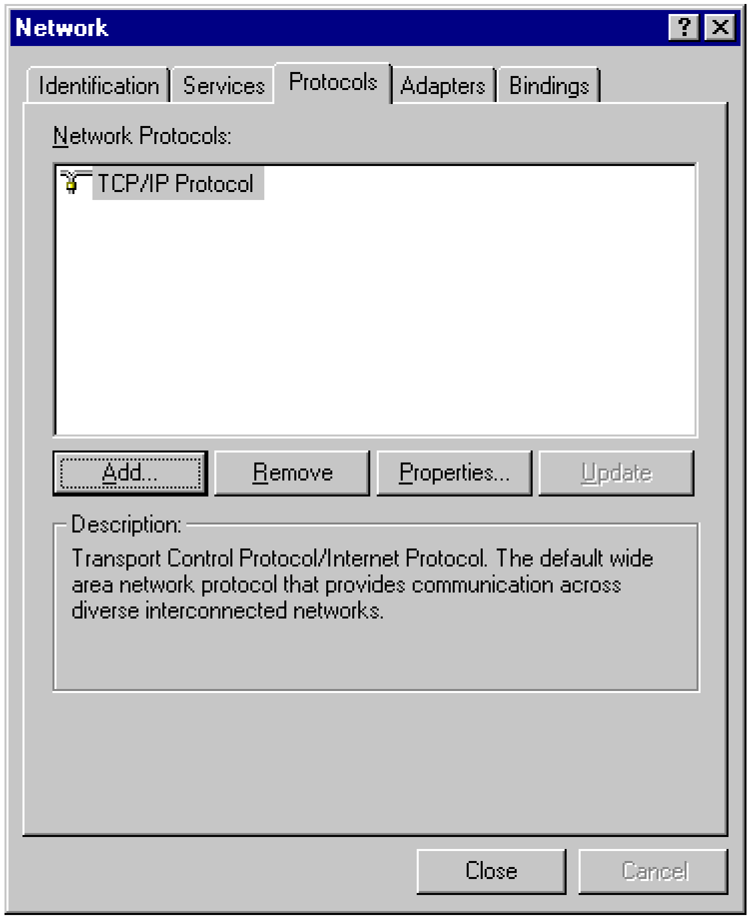
Step	D: Installing the Communication Protocol
1	The *TCP/IP Protocol* must be installed. All protocols already installed are displayed in the *Protocols* tab of the *Network* dialog box. If the *TCP/IP Protocol* entry is not available, install it via the *Add* button. 

<table>
<tr><th>Step</th><th>D: Installing the Communication Protocol</th></tr>
<tr><td>2</td><td>
This opens the Select Network Protocol dialog box.
From the Network Protocol list, select the entry TCP/IP Protocol. Close the Select Network Protocol dialog box by clicking on OK.


</td></tr>
<tr><td>3</td><td>
The TCP/IP Setup dialog box will be displayed.
Answer the question if the configuration data for the TCP/IP Protocol are to be retrieved from a DHCP server with No.


</td></tr>
<tr><td>4</td><td>
The Windows NT Setup dialog box will be displayed. This dialog box informs you that some Windows NT files must be copied for the installation of the TCP/IP Protocol.In the input field at the bottom, specify the path in which the appropriate files can be found. Normally, this is the path to the CD-ROM drive (if the files are copied from a Windows NT Installation CD-ROM).Conclude the Windows NT Setup by clicking on the Continue button.


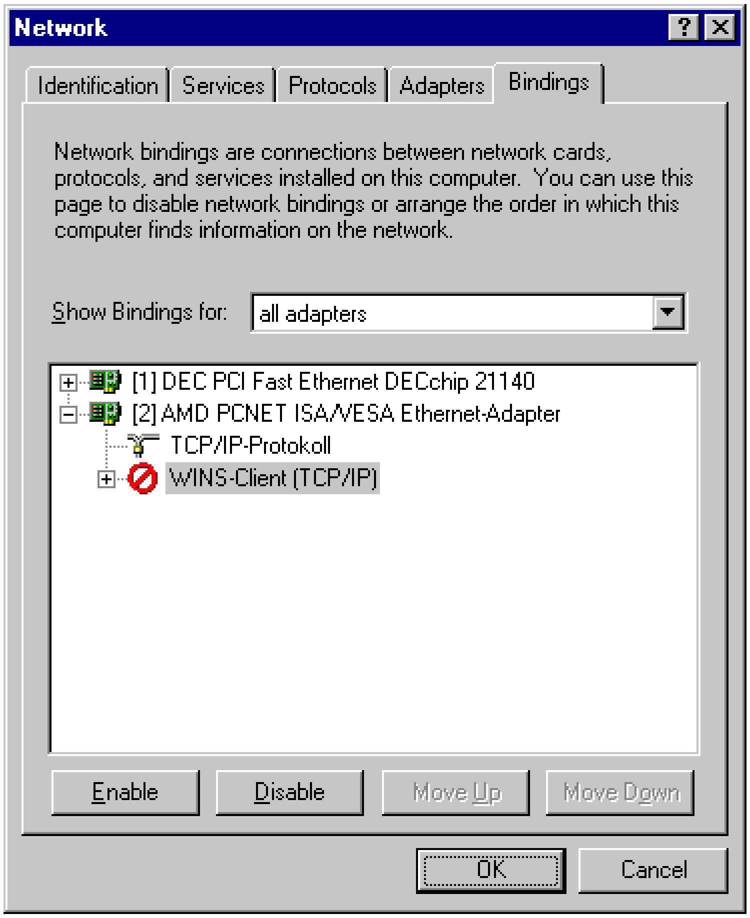
</td></tr>
</table>

Step	D: Installing the Communication Protocol
5	After the installation of the *TCP/IP Protocol* is complete, it will be displayed in the *Network Protocols* field of the *Protocols* tab. 

E: Configuring the Bindings

Step	E: Configuring the Bindings
1	The bindings of the communication processor *CP 1411* must be configured. This is done in the *Bindings* tab of the *Network* dialog box. In the *Show Bindings for:* field, select the entry *all adapters*. Select all protocols to be used by the communication processor *CP 1411*. In this sample, the communication processor only communicates via the *TCP/IP Protocol*. For this purpose, all available protocols except for the *TCP/IP Protocol* must be disabled for the *AMD PCNET ISA/VESA Ethernet-Adapter* entry. A protocol is disabled via the *Disable* button. Disabled protocols are marked as follows: 

Step	E: Configuring the Bindings
	Close the Network dialog box by clicking on the *OK* button.

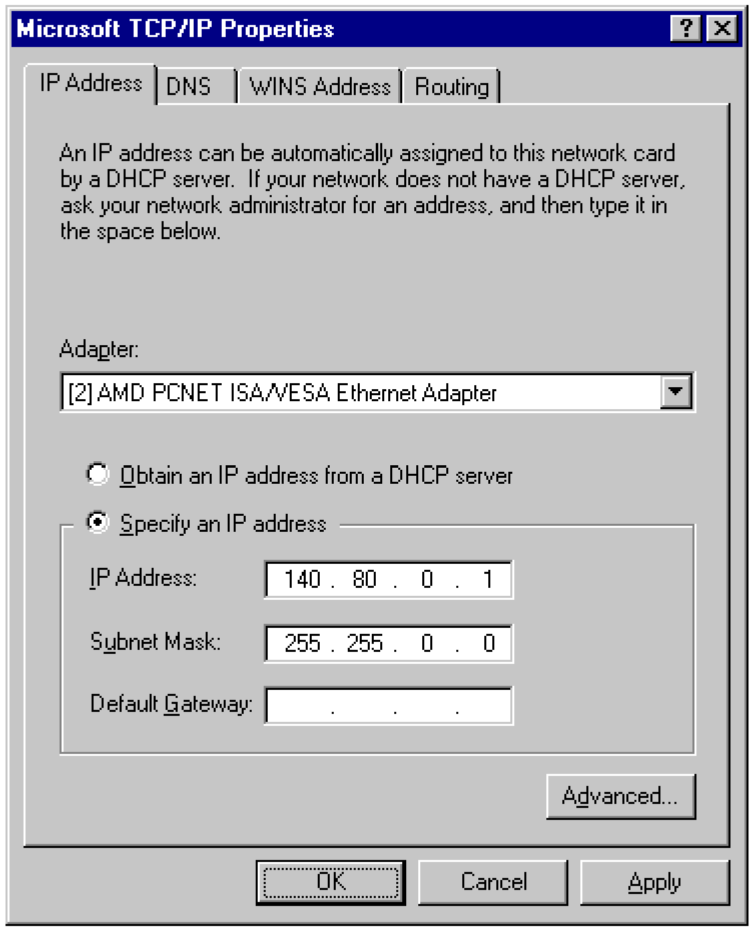


<table>
<tr><th>Step</th><th>E: Configuring the Bindings</th></tr>
<tr><td>2</td><td>
The properties dialog box of the TCP/IP Protocol will be displayed.

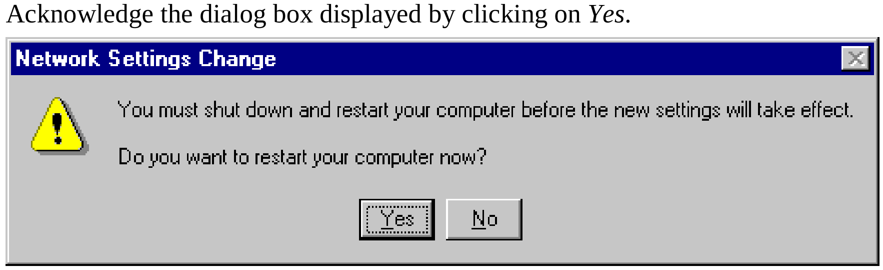
In the *Adapter* field of the *IP Address* tab, set the entry *AMD PCNET ISA/VESA Ethernet-Adapter* for the communication processor *CP 1411*.

The radio-button *Specify an IP address* is selected to specify an *IP Address* and *Subnet Mask*. The same Subnet Mask must also be specified in the configuration of the PLC's *CP 443-1 TCP* communication processor.

Close the properties dialog box of the *TCP/IP Protocol* by clicking on *OK*.



</td></tr>
<tr><td>3</td><td>
The installation and settings made require a restart of the computer. Acknowledge the dialog box displayed by clicking on *Yes*.



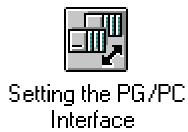
</td></tr>
</table>

F: Creating an Access Point

<table>
<tr><th>Step</th><th>F: Creating an Access Point</th></tr>
<tr><td>1</td><td>

Creation of an access point for the communication processor *CP 1411* via the program *Setting the PG/PC Interface*.

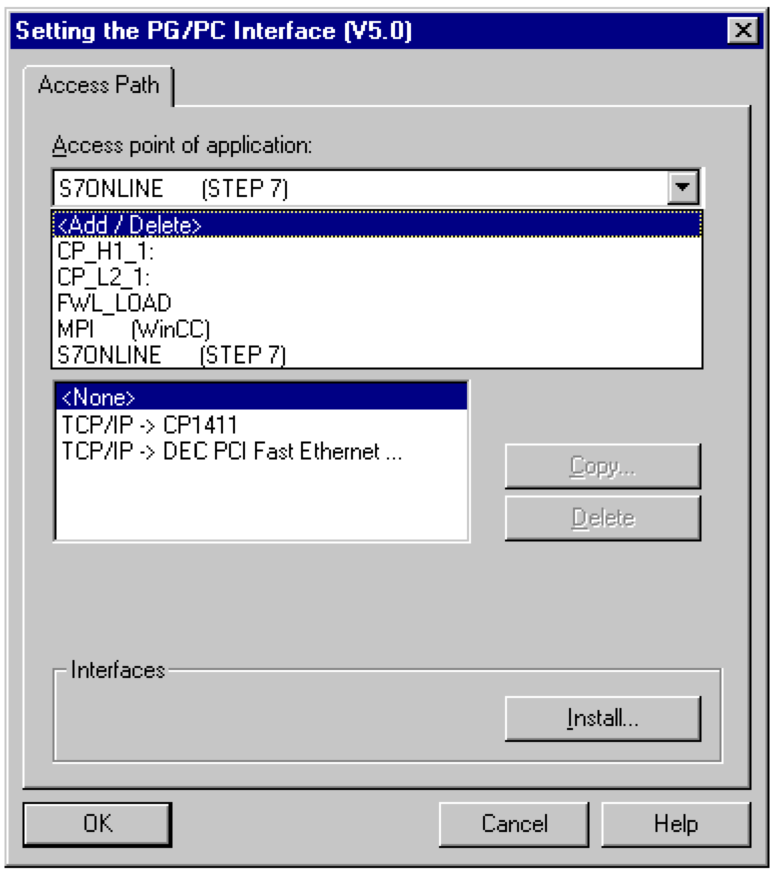
This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*.



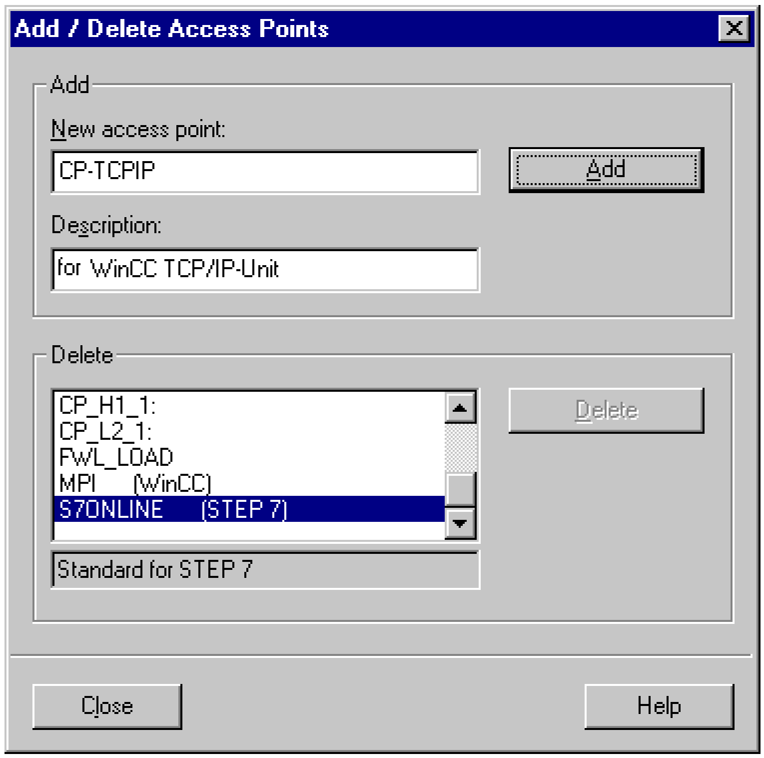
</td></tr>
<tr><td>2</td><td>

The program *Setting the PG/PC Interface* will be displayed.

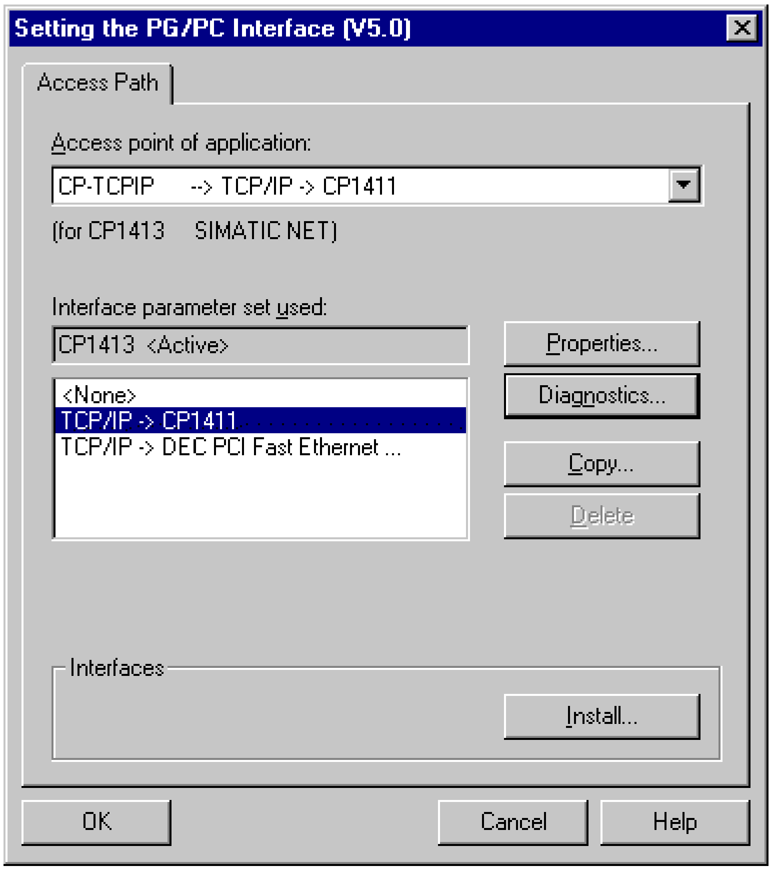
The dialog box for adding a new access point is opened via the *Add/Delete* entry from the *Access Point of the Application* list-box.



</td></tr>
</table>

Step	F: Creating an Access Point
3	The dialog box *Add/Delete Access Points* will be displayed. In the *New Access Point* field, enter the name of the new access point. For this sample, the name *CP-TCPIP* is entered. The access point CP-TCPIP is the default access point used by WinCC for the communication via the *TCP/IP Protocol*. In the *Description* field, additional information about the access point can be entered. The access point is created via the *Add* button. The access point will then be displayed in the list of available access points. Exit the dialog box *Add/Delete Access Points* by clicking on the *Close* button. 

Step	**F: Creating an Access Point**
4	In the program *Setting the PG/PC Interface*, assign the communication processor *CP 1411* to the new access point. To do so, set the *CP-TCPIP* entry in the *Access Point of the Application* field. In the field below, select the entry *TCP/IP -> CP1411*. This completes the assignment between the access point and the communication processor. Exit the program *Setting the PG/PC Interface* via the *OK* button. This concludes the installations and settings required for the operation of the *CP 1411*.



4.2 Creation of the STEP7 Project S7_IETCP

The following description details the configuration steps necessary to create and start up the STEP7 project *S7_IETCP*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to create the STEP7 project *S7_IETCP*:

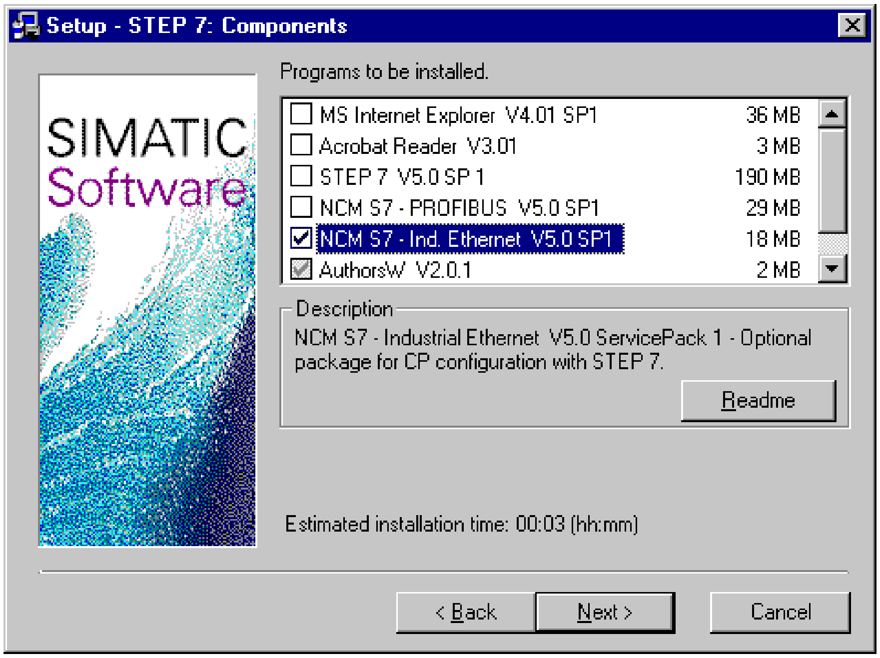
- A: Installing the Hardware
- B: Installing the Option Package
- C: Creating the STEP7 Project
- D: Configuring the Hardware
- E: Loading the Hardware Configuration
- F: Testing the Hardware Configuration
- G: Creating the STEP7 Program
- H: Testing the STEP7 Program

A: Installing the Hardware

Step	A: Installing the Hardware
1	Rack-mounting of the modules used. In this sample, the modules to be installed are the power supply *PS 407 10A*, the CPU module *CPU 416-1* and the communication processor *CP 443-1 TCP*. Establishing the connection from the computer to the programming interface of the CPU module. Establishing the connection from the communication processor *CP 1411* in the computer to the communication processor *CP 443-1 TCP* in the PLC.

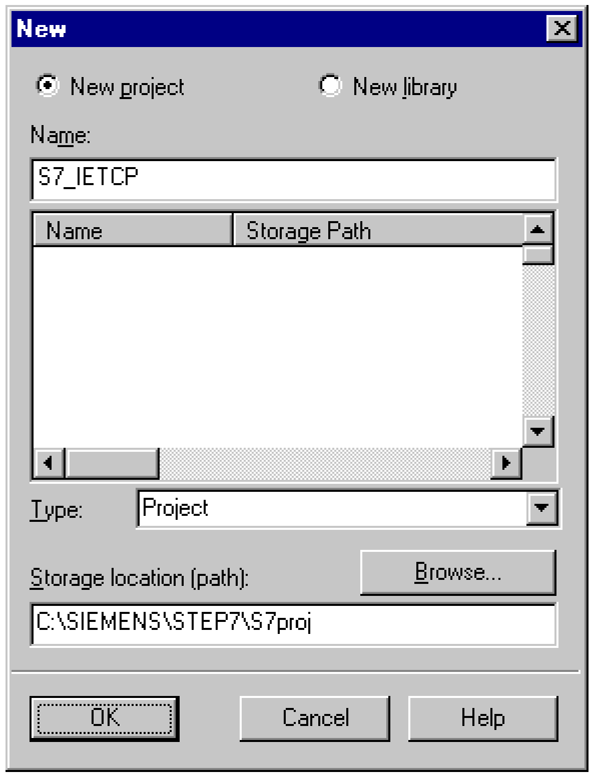
B: Installing the Option Package

Step	B: Installing the Option Package
1	If the option package *NCM S7 Industrial Ethernet* has not been installed during the installation of *STEP7*, install it now from the *STEP7* CD-ROM. This option package is required for the configuration of the communication processor *CP 443-1 TCP* via the *STEP7* software. After inserting the *STEP7* CD-ROM, the installation program is automatically started. If this is not the case, open the *Windows NT Explorer* and start the *setup.exe* program located on the CD-ROM.  setup.exe

Step	B: Installing the Option Package
2	This starts the installation program. Follow the instructions of the installation program. On the *Components* page, select the check-box *NCM S7 Ind. Ethernet*. Finish the installation. 

C: Creating the STEP7 Project

Step	C: Creating the STEP7 Project
1	Create a new STEP7 project in the *SIMATIC Manager*. It is started via *Start* → *Simatic* → *SIMATIC Manager*. 

Step	C: Creating the STEP7 Project
2	This displays the *SIMATIC Manager*. Via the menus *File* → *New*, the dialog box for specifying the parameters of a new STEP7 project will be opened. The *New* dialog box will be displayed. The radio-button *New Project* must be selected. In the *Name* field, the name of the new project to be created is entered. The names of the STEP7 projects created within the framework of this manual all start with *S7*. They also include a reference to the communication type used. The project of this sample has the name *S7_IETCP*. By default, projects are stored in the *C:\SIEMENS\STEP7\S7proj* folder. This can be changed at any time via the *Browse* button. The *New* dialog box is closed via the *OK* button. 

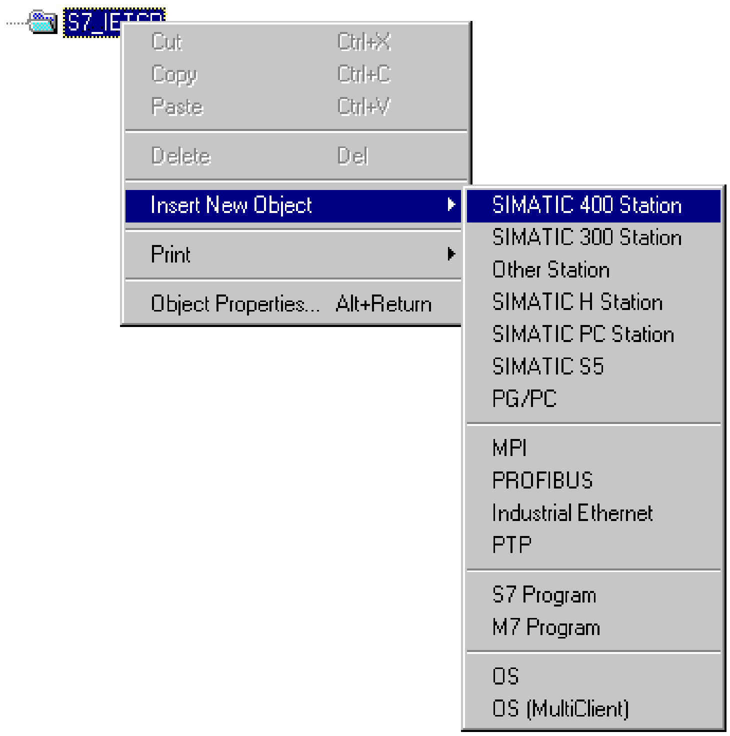
D: Configuring the Hardware

<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td>1</td><td>

The new project will be displayed in the *SIMATIC Manager*.

The hardware for this project must be configured. Two components are needed: One *SIMATIC 400-Station* and for its networking an *Industrial Ethernet*.

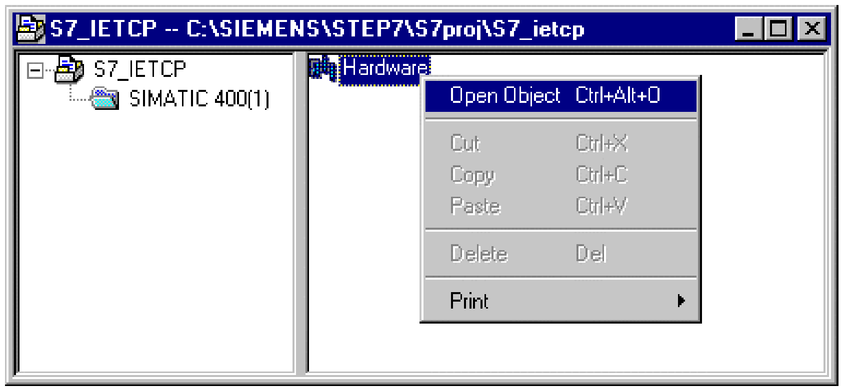
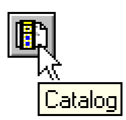
These components are added to the *SIMATIC Manager* via a R on the project name *S7_IETCP* and then selecting *Insert New Object* → *SIMATIC 400-Station* and *Insert New Object* → *Industrial Ethernet* from the pop-up menu.

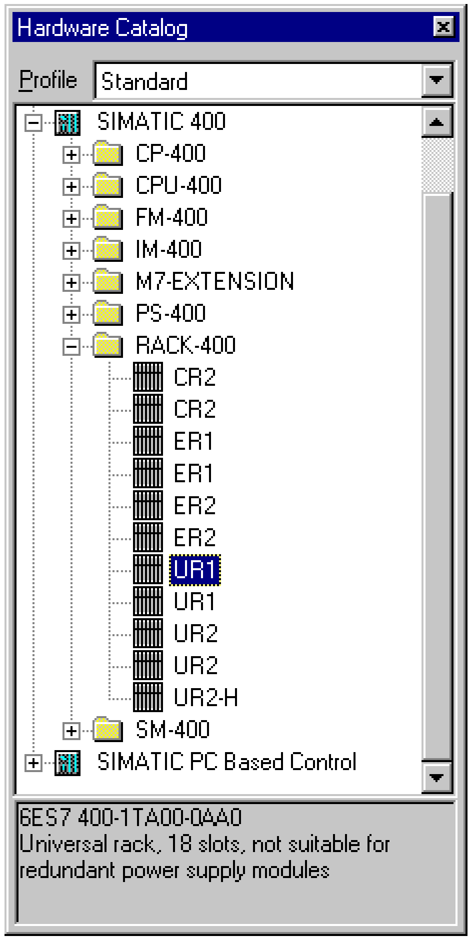


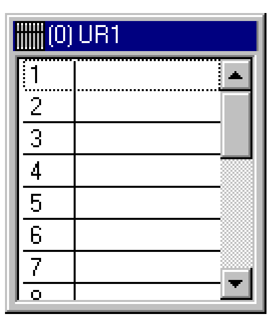
</td></tr>
<tr><td>2</td><td>

The just added components will be displayed in the right window of the *SIMATIC Manager*.

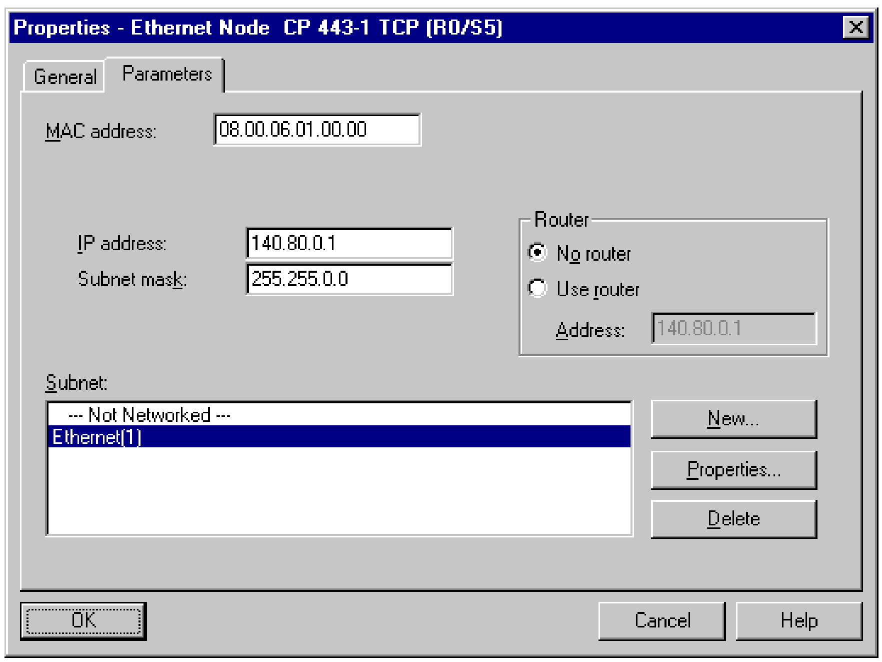
</td></tr>
</table>

Step	D: Configuring the Hardware
	By D on the component *SIMATIC 400(1)* in the right window, the point *Hardware* will be displayed. By D on the point *Hardware* or R on it and then selecting *Open Object* from the pop-up menu, the program *HW Config* will be started. 
3	The program *HW Config* will be displayed. This program is used to exactly define the hardware used in the PLC and to configure their properties. 
4	By clicking on the toolbar button of the program *HW Config* displayed below, the *Hardware Catalog* is opened. This catalog is used to select the required hardware components. 

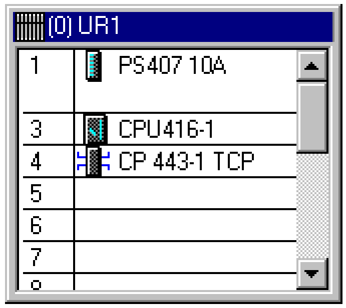
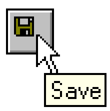
<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td>5</td><td>The Hardware Catalog will be displayed.
The first component selected is the rack. On this rack, all other components will be installed. The rack is inserted into the project via a D or by Dragging Dropping. In this sample, the rack type UR1 is used.


</td></tr>
<tr><td>6</td><td>The program HW Config will display the currently still empty rack. It received the Rack Number 0. During the configuration of the connection in the WinCC project, the Rack Number is one of the parameters that must be set.


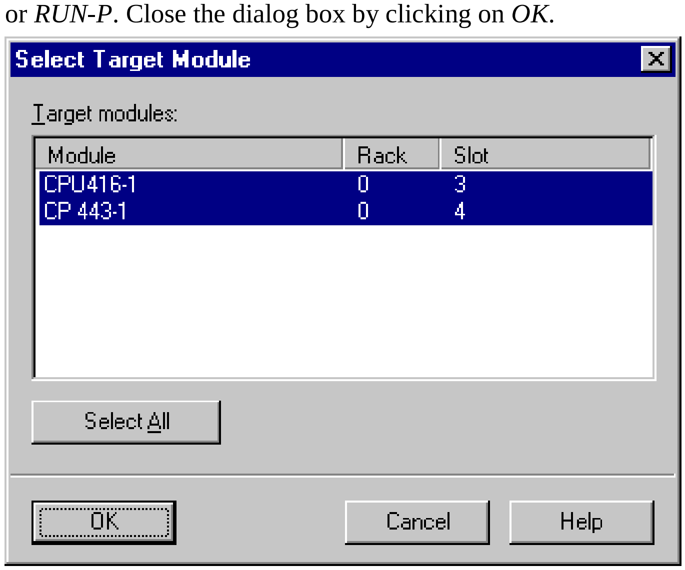
</td></tr>
<tr><td>7</td><td>Arrange the other hardware components in the rack. This is done by Dragging Dropping the desired components from the Hardware Catalog to the corresponding slot in the rack.</td></tr>
</table>

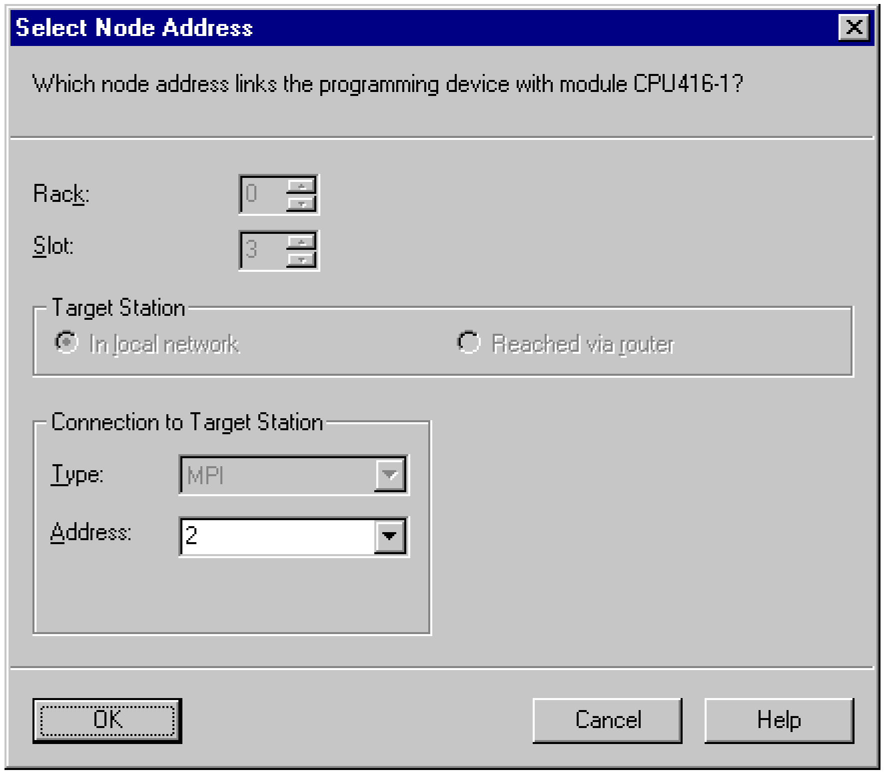
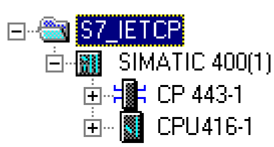
<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td></td><td>
This sample uses the power supply PS 407 10A. It is inserted into slot 1. A power supply of this type occupies two slots.
As the CPU module, this sample uses a CPU 416-1. This module is inserted into slot 3. Another parameter to be set during the configuration of the connection in the WinCC project is the slot number of the CPU module.
We also require the communication processor CP 443-1 TCP. This CP is only available from the Hardware Catalog if the option package NCM S7 Industrial Ethernet has been installed. After the communication processor CP 443-1 TCP has been inserted in the rack, its properties dialog box will open.
</td></tr>
<tr><td>8</td><td>
The properties dialog box of the communication processor CP 443-1 TCP will be displayed.
In the MAC Address field of the Parameters tab, enter the desired Ethernet address of the communication processor. However, the settings relevant for the communication via the TCP/IP Protocol are the IP Address and the Subnet Mask.
During the configuration of the connection in the WinCC project, the IP Address of the communication processor CP 443-1 TCP is another parameter that has to be set. The value set for the Subnet Mask must be the same value that has been set for the Subnet Mask during the installation of the communication processor CP 1411.
In the Subnet field below, assign the entry Ethernet(1) to the communication processor. Close the dialog box by clicking on OK.


</td></tr>
</table>

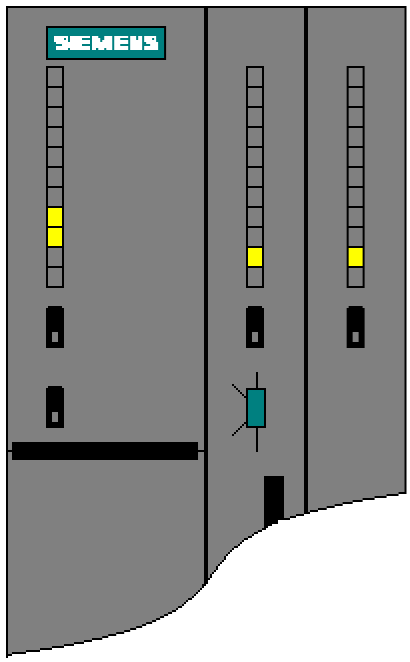
Step	D: Configuring the Hardware
9	The following graphic shows the completed hardware arrangement of the sample. 
10	Save the settings made in the program *HW Config*. This is done via the toolbar button displayed below. 

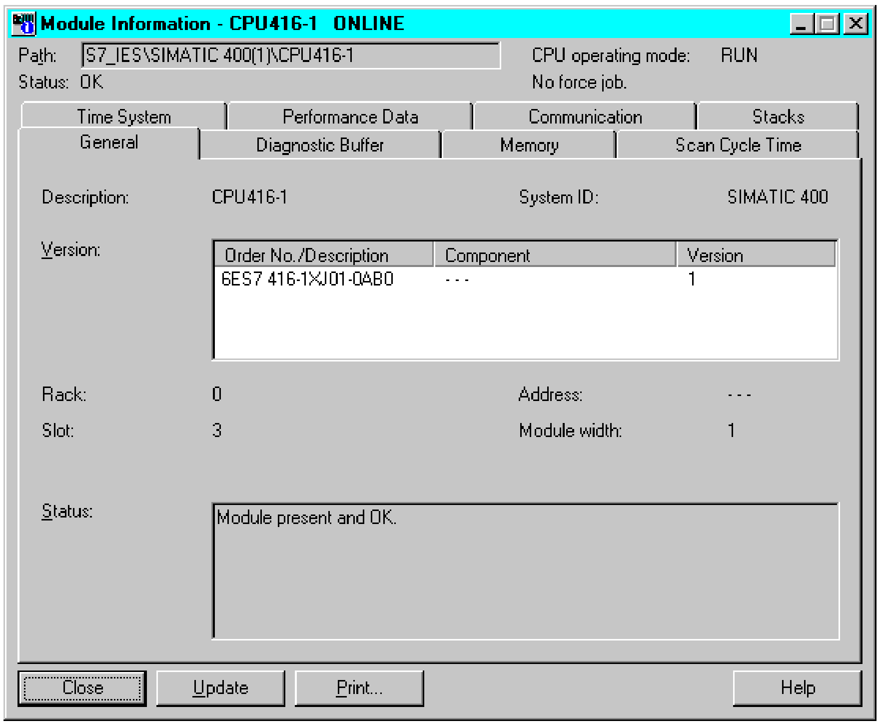
E: Loading the Hardware Configuration

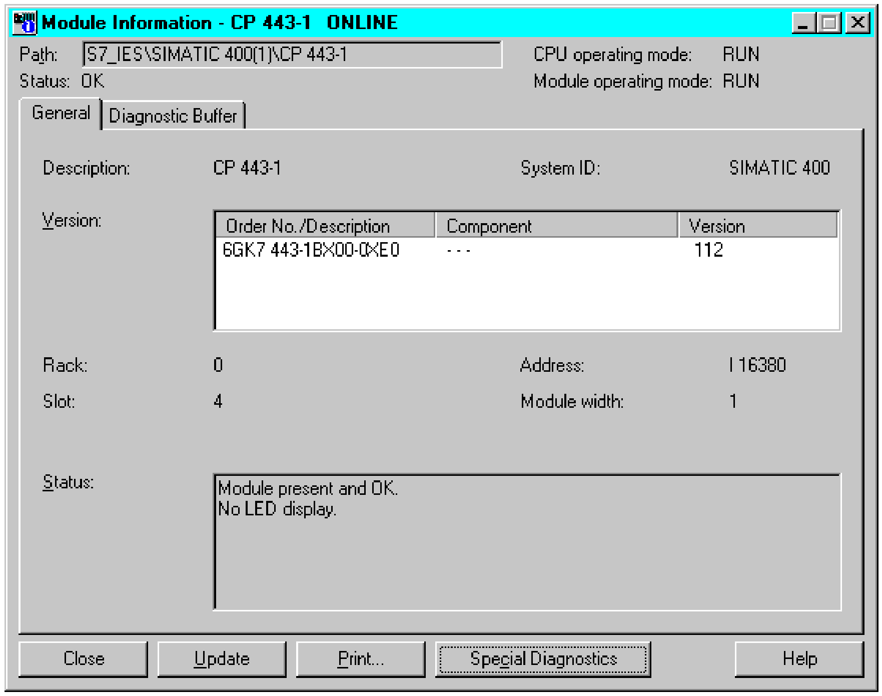
Step	E: Loading the Hardware Configuration
1	The hardware configuration created in the program *HW Config* must be transferred to the PLC. This is done via the toolbar button displayed below. 
2	A dialog box will be displayed from which the components to be loaded can be selected. For this sample, all displayed components will be selected. Note that loading to the CPU module is only possible while the operating mode switch is set to *STOP* or *RUN-P*. Close the dialog box by clicking on *OK*. 

Step	E: Loading the Hardware Configuration
3	Now the dialog box *Select Station Address* will be displayed. In this dialog box, specify which station address is used by the STEP7 software to communicate with the CPU module. In this sample, the communication is carried out via the MPI interface. The *Address* of the CPU module is *2*. Close the dialog box by clicking on *OK*. 
4	The configuration data will now be transferred to the PLC. If necessary, the individual modules will be set to the STOP status. The program *HW Config* can be exited. The newly added components will be displayed by the *SIMATIC Manager* for the station *SIMATIC 400(1)*. 

F: Testing the Hardware Configuration

Step	F: Testing the Hardware Configuration
1	Testing of the hardware configuration made. If the key switch of the CPU module is set to *RUN* or *RUN-P* and the operating mode switch of the communication processor is set to *RUN*, only the status LEDs signifying the *RUN* operating mode should be displayed. If this is not the case, there is an error. The following steps help you localize this error. However, these steps should still be performed even if the status LEDs show no error. This allows you to recognize uncritical errors and faulty configurations. 

Step	F: Testing the Hardware Configuration
2	Testing the configuration of the CPU module. This is done via the dialog box *Module Status* in the *SIMATIC Manager*. It is opened by a R on the entry of the CPU module in the left window and then selecting *Target System* → *Module Status* from the pop-up menu. The dialog box *Module Status* of the CPU module will be displayed. The *General* tab displays various general data of the CPU module. In the *Status* field, the current module status and any existing errors are displayed. The *Diagnosis Buffer* tab contains more detailed information about existing errors and how to correct them. The dialog box can be exited via the *Close* button. 

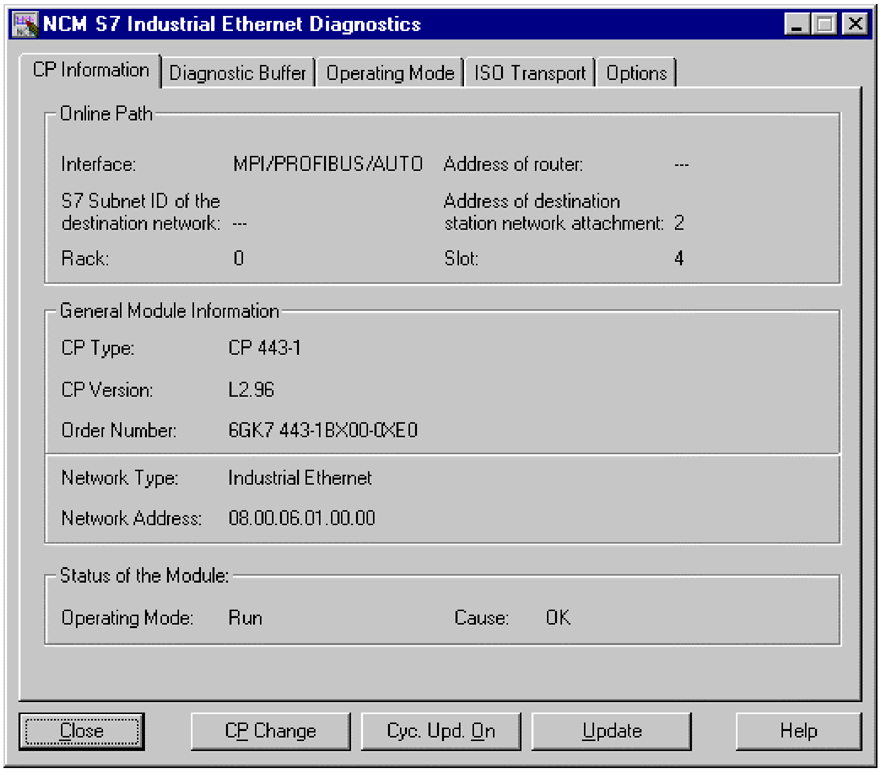
<table>
<tr><th>Step</th><th>F: Testing the Hardware Configuration</th></tr>
<tr><td>3</td><td>Testing the configuration of the communication processor.
This is done via the dialog box *Module Status* in the *SIMATIC Manager*. It is opened by a R on the entry of the communication processor in the left window and then selecting *Target System* → *Module Status* from the pop-up menu.
The dialog box *Module Status* of the communication processor will be displayed.
The *General* tab displays various general data of the module.
A dialog box for a more detailed diagnosis of the communication processor can be accessed via the *Special Diagnosis* button.

</td></tr>
</table>

<table>
<tr><th>Step</th><th>F: Testing the Hardware Configuration</th></tr>
<tr><td>4</td><td>

The dialog box *NCM S7 Industrial Ethernet Diagnosis* will be displayed.

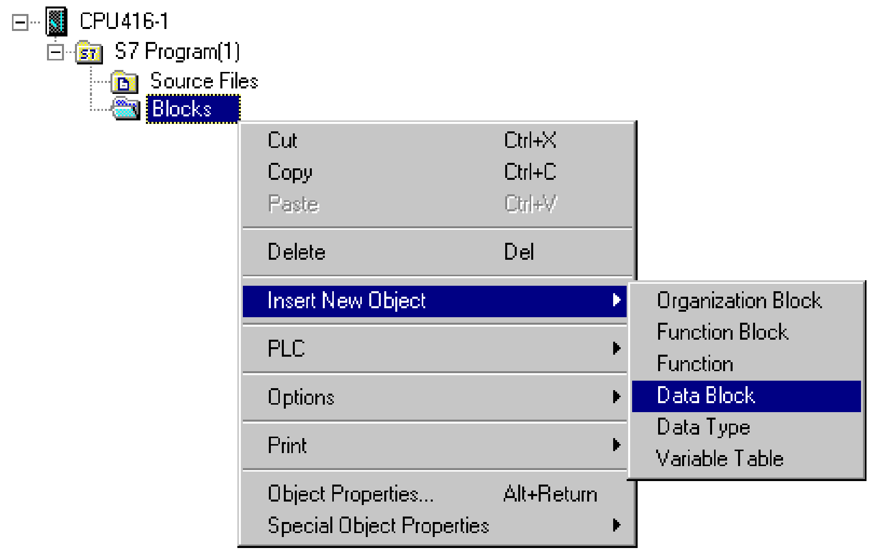
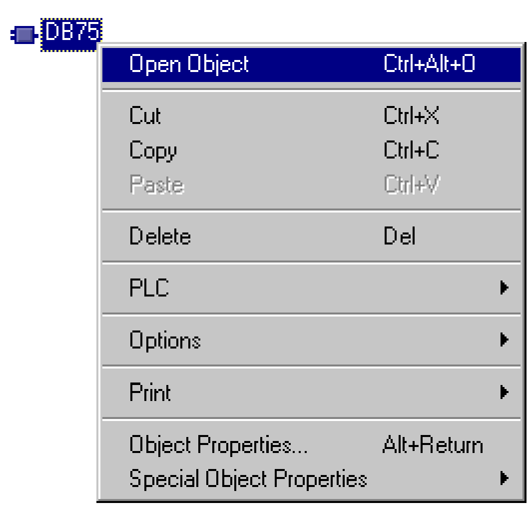
The *CP Information* tab displays general information about the module.

The dialog box can be exited via the *Close* button. The Module Status dialog box can also be exited via the *Close* button.



</td></tr>
</table>

G: Creating the STEP7 Program

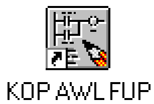
Step	G: Creating the STEP7 Program
1	Creation of the *S7 Program*. This sample project requires the operation block *OB1* and a data block. *OB1* is available by default, the required data block must be created. This is done in the *SIMATIC Manager* via a R on the sub-entry *Modules* of the entry *S7 Program(1)* of the configured CPU module and then selecting *Insert New Object* → *Data Block* from the pop-up menu. The properties dialog box of the data block will be opened. As the block's Name enter DB75 and close the dialog box with OK. 
2	The newly created data block *DB75* will be displayed in the right window of the project. Via a D on this data block or a R and then selecting *Open Object* from the pop-up menu, the content of the block can be programmed. This starts the program *LAD/STL/SCF*. 

Step	G: Creating the STEP7 Program

3

The program *LAD/STL/SCF* is displayed.

Acknowledge the dialog box *New Data Block* by clicking on *OK*.



4

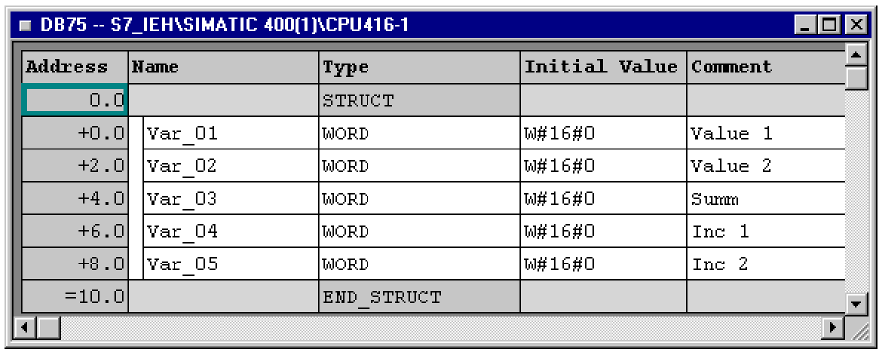
Programming the *DB75*.

In this data block, two tags with a length of 16 Bits are created. Their sum is to be determined in *OB1* and then be written to another tag with a length of 16 Bits.

Two additional tags with a length of 16 Bits are created, whose values are cyclically incremented in *OB1*.

The tags created in the data block *DB75* are visualized in the WinCC project. To do so, WinCC tags with corresponding addresses are created there.

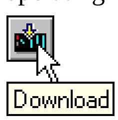
The following graphic displays the programmed data block *DB75*.


DB75 -- S7_IEH\SIMATIC 400(1)\CPU416-1

Address	Name	Type	Initial Value	Comment
0.0		STRUCT		
+0.0	Var_01	WORD	W#16#0	Value 1
+2.0	Var_02	WORD	W#16#0	Value 2
+4.0	Var_03	WORD	W#16#0	Summ
+6.0	Var_04	WORD	W#16#0	Inc 1
+8.0	Var_05	WORD	W#16#0	Inc 2
=10.0		END_STRUCT		

5

Save the block and load it into the PLC. This is done via the toolbar button displayed below. Note that loading to the CPU module is only possible while the operating mode switch is set to *STOP* or *RUN-P*.



6

Programming the *OB1*.

Open the block in the program *LAD/STL/SCF*.

First, two values in the *DB75* are added and then stored again in *DB75*.

Netzwerk 1: Addition

```
Adding two 16-Bit Values
The result is stored in another
16-Bit Value
```

```
      OPN   DB    75
      L     DBW    0
      L     DBW    2
      +I
      T     DBW    4
```

Next, a value in the *DB75* is incremented every second.

<table>
<tr><th>Step</th><th>G: Creating the STEP7 Program</th></tr>
<tr><td></td><td>

Network 2 : Second Cycle

```
Generation of a second cycle at M 0.0
```

```
      AN     M       0.0
      L      S5T#1S
      SD     T       1
      A      T       1
      =      M       0.0
```

Network 3 : Counting in a second cycle

```
Counting a value in a second cycle
At 10000, reset to 0
```

```
      AN     M       0.0
      JC     M001
      L      DBW     6
      L      1
      +I
      T      DBW     6
      L      10000
      <I
      JC     M001
      L      0
      T      DBW     6
M001: NOP    0
```

Finally, a value in the *DB75* is incremented every time the *OB1* run.

Network 4 : Counting in the cycle time

```
Counting a value each time the OB is executed
At 10000, reset to 0
```

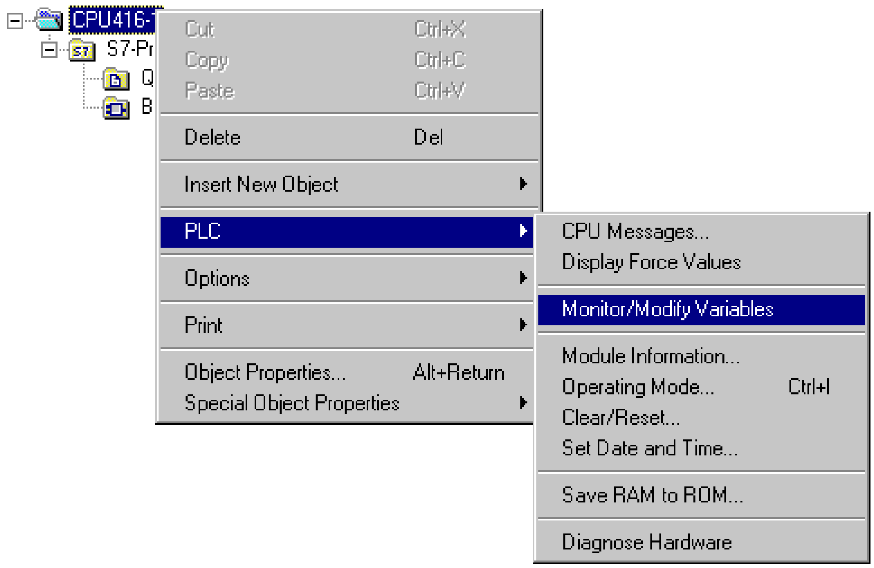
```
      L      DBW     8
      L      1
      +I
      T      DBW     8
      L      10000
      <I
      JC     M002
      L      0
      T      DBW     8
M002: NOP    0
```

</td></tr>
<tr><td>7</td><td>Save the block OB1 and load it into the PLC. This is done via the corresponding buttons on the toolbar.
This completes the creation of the STEP7 project and it can now be run. Exit the program LAD/STL/SCF.</td></tr>
</table>

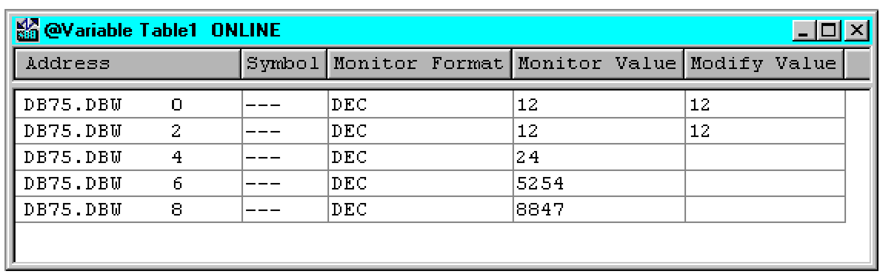
H: Testing the STEP7 Program

<table>
<tr><th>Step</th><th>H: Testing the STEP7 Program</th></tr>
<tr><td>1</td><td>Testing the program with the STEP7 software.

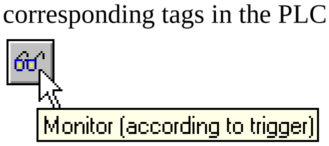
For this purpose, a tag table is created. This is done in the SIMATIC Manager via a R on the entry of the configured CPU module and then selecting Target System → Monitor/Control Tag from the pop-up menu.


</td></tr>
<tr><td>2</td><td>An editor for creating and using a tag table will be displayed.

The following shows a completed tag table. In this table, enter all tags created in the DB75.


@Variable Table1 ONLINE
<table>
<tr><th>Address</th><th></th><th>Symbol</th><th>Monitor Format</th><th>Monitor Value</th><th>Modify Value</th></tr>
<tr><td>DB75.DBW</td><td>0</td><td>---</td><td>DEC</td><td>12</td><td>12</td></tr>
<tr><td>DB75.DBW</td><td>2</td><td>---</td><td>DEC</td><td>12</td><td>12</td></tr>
<tr><td>DB75.DBW</td><td>4</td><td>---</td><td>DEC</td><td>24</td><td></td></tr>
<tr><td>DB75.DBW</td><td>6</td><td>---</td><td>DEC</td><td>5254</td><td></td></tr>
<tr><td>DB75.DBW</td><td>8</td><td>---</td><td>DEC</td><td>8847</td><td></td></tr>
</table></td></tr>
<tr><td>3</td><td>Monitoring the current tag values.

By clicking on the toolbar button displayed below, the current values of the corresponding tags in the PLC are displayed in the column Status Value.



Controlling the tag values.

Values can be entered in the column Control Value. By clicking on the toolbar button displayed below, these values will be written to the corresponding tags in the PLC.</td></tr>
</table>

Step	H: Testing the STEP7 Program
	Note that tags can only be controlled while the operating mode switch of the CPU module is set to *RUN-P*. 
4	The created tag table can now be saved. In this sample, the table is saved under the name *VAT1*. After checking the program in the PLC, the tag table can be closed. This concludes the configuration of the STEP7 project and the *SIMATIC Manager* can be exited. 

4.3 Creation of the WinCC Project WinCC_S7_IETCP

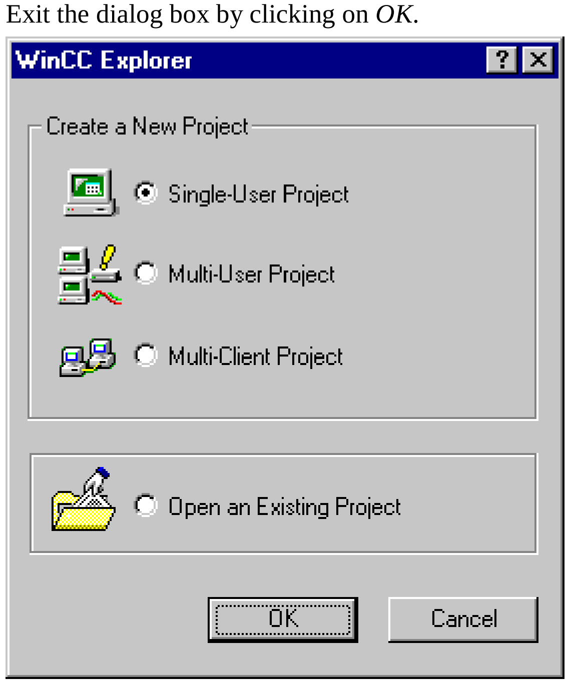
The following description details the configuration steps necessary to create and start up the WinCC project *WinCC_S7_IETCP*.

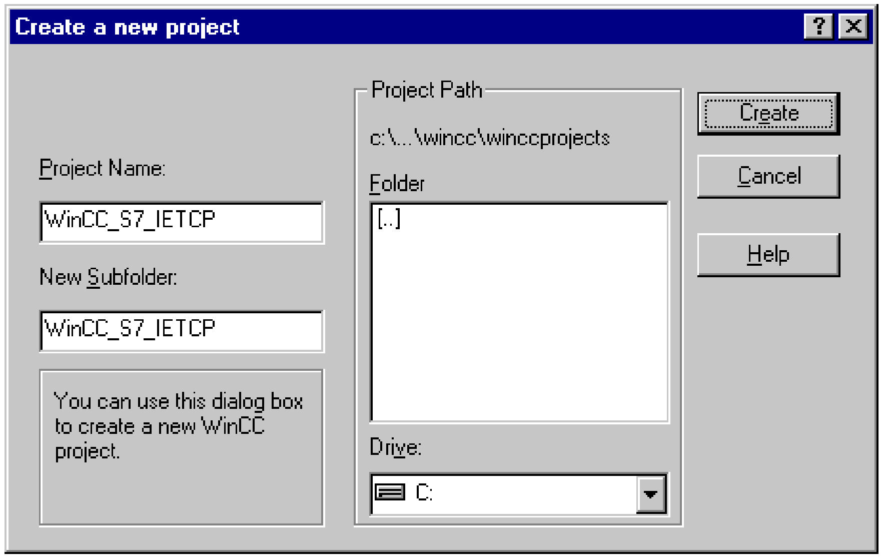
Overview of the Configuration Steps

The following lists the configuration steps necessary to create the WinCC project *WinCC_S7_IETCP*:

- A: Creating the WinCC Project
- B: Creating the Connection
- C: Creating the WinCC Tags
- D: Creating the WinCC Screen

A: Creating the WinCC Project

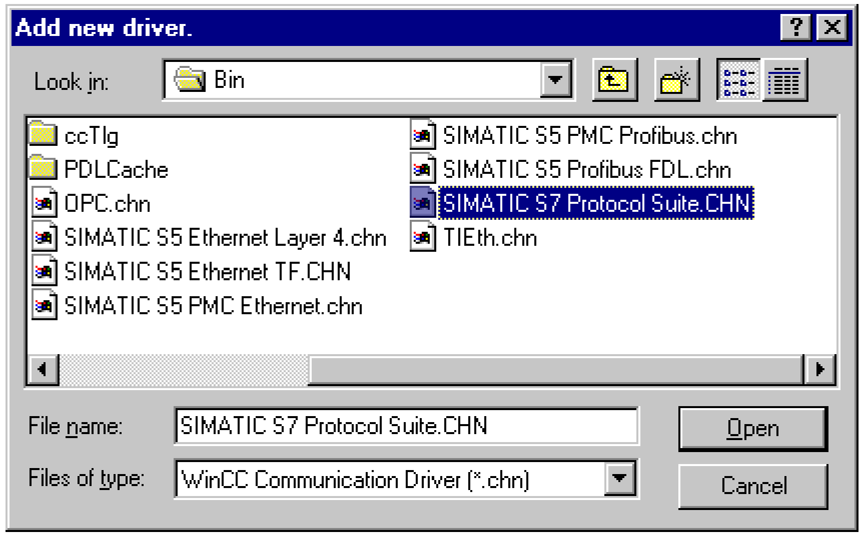
Step	A: Creating the WinCC Project
1	Creation of a new WinCC project in the *WinCC Explorer*. The WinCC Explorer is started via *Start* → *Simatic* → *WinCC* → *Windows Control Center*. 
2	This will display the *WinCC Explorer*. Via the menus *File* → *New*, the dialog box for specifying the properties of a new WinCC project will be opened. For this sample project, a *Single-User Project* is created. Exit the dialog box by clicking on *OK*. 

Step	A: Creating the WinCC Project
3	The dialog box *Create a new Project* will be displayed. Specify a *Project Name* for the new project. The names of the WinCC projects created within the framework of this manual all start with *WinCC* and also include a reference to the communication partner and communication type used. The project of this sample has the name *WinCC_S7_IETCP*. In the *Project Path* field, set the storage location of the new project. The dialog box *Create a new Project* is concluded by clicking on the *Create* button. 

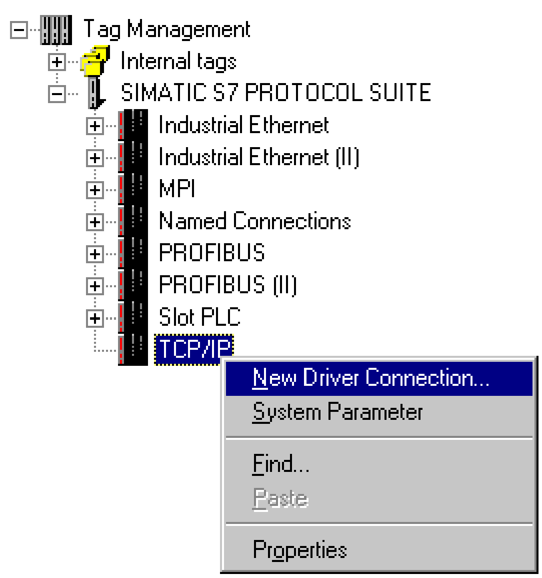
B: Creating the Connection

Step	B: Creating the Connection
1	The new project will be displayed in the *WinCC Explorer*. Installation of the required communication driver. This is performed via a R on *Tag Management* and selecting *Add New Driver* from the pop-up menu. 

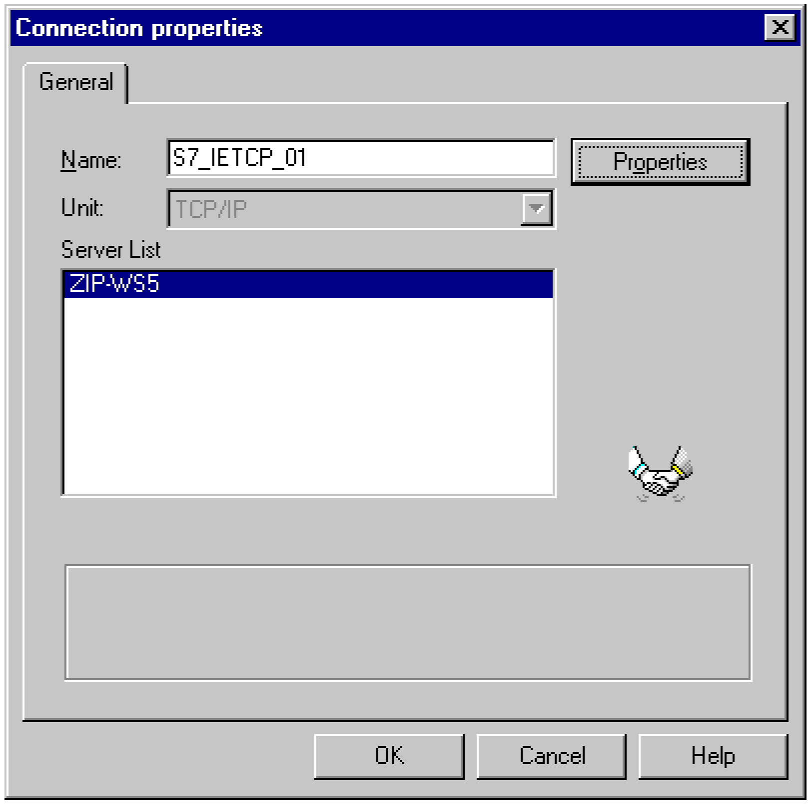
<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>2</td><td>
The dialog box Add New Driver will be displayed.
This dialog box lists all communication drivers that can be installed. For the communication to the SIMATIC S7, the driver SIMATIC S7 Protocol Suite is required. Select this driver from the dialog box. Exit the dialog box by clicking on Open.

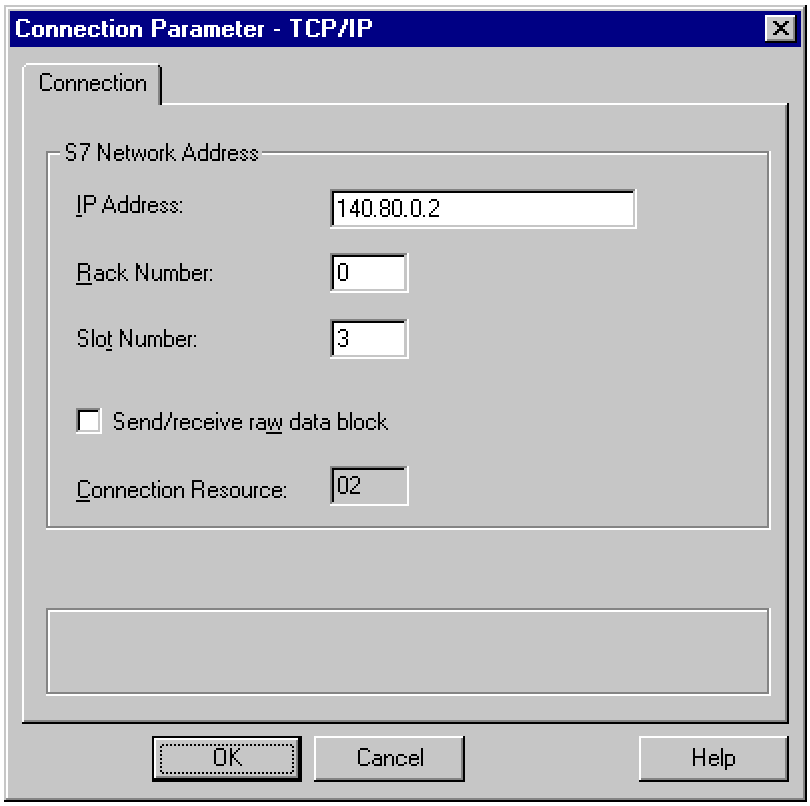


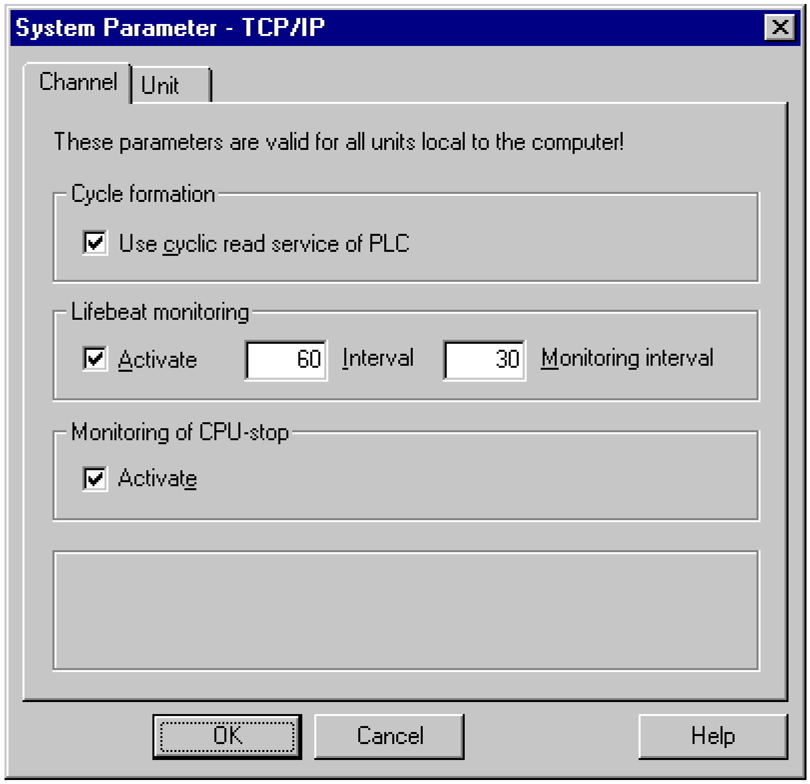
</td></tr>
<tr><td>3</td><td>
The newly added driver SIMATIC S7 Protocol Suite will be displayed as a sub-entry to Tag Management.
The driver contains eight different channel units. In this sample, the channel unit TCP/IP is used. Create a new connection for this channel unit by R on TCP/IP and then selecting New Driver Connection from the pop-up menu.

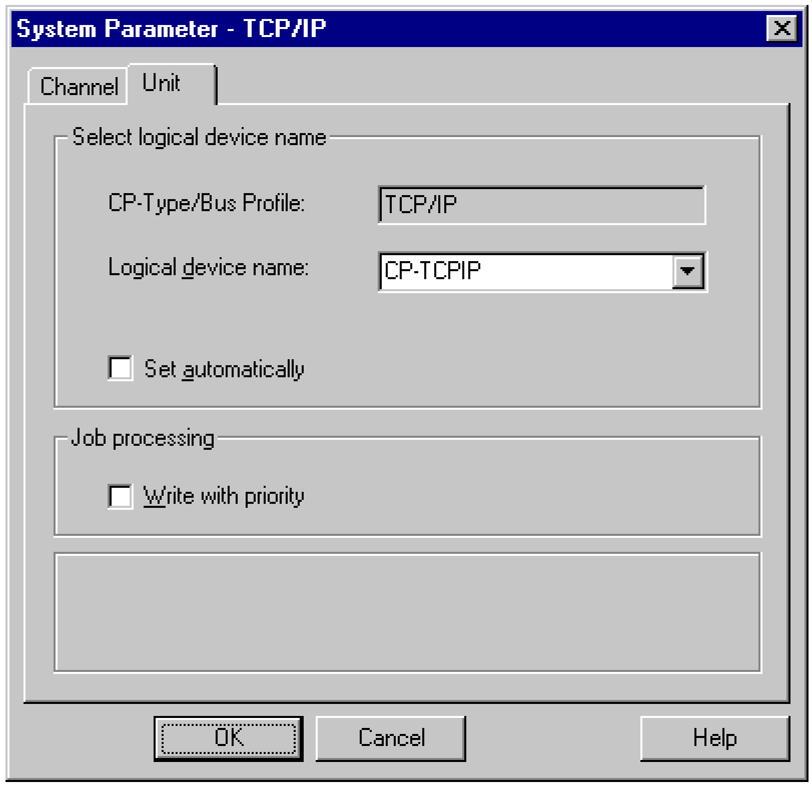


</td></tr>
</table>

Step	B: Creating the Connection
4	The properties dialog box of the connection will be displayed. In the *General* tab, the *Name* of the new connection is entered. In this sample, this is *S7_IETCP_01*. Click on the *Properties* button to define the connection properties. 

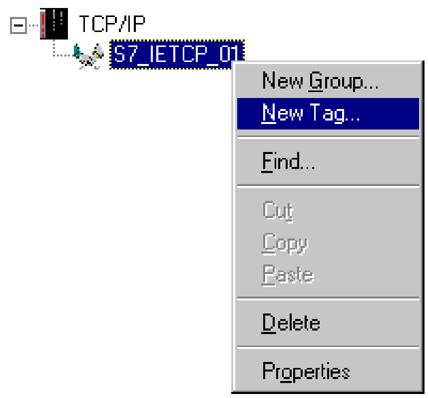
Step	B: Creating the Connection
5	The dialog box Connection Properties will be displayed. In the IP Address field, enter the address that has been set for the communication processor *CP 443-1 TCP*. For this sample, this is the address *140.80.0.2*. Additionally, the Rack Number and Slot Number of the CPU module to be accessed must be entered. Make sure that the values of the CPU module are entered here and not the values of the communication processor. Close the dialog box by clicking on *OK*. Also close the *Connection Properties* dialog box by clicking on *OK*. 

Step	B: Creating the Connection
6	Setting the system parameters of the *TCP/IP* channel unit. These settings are made in the *System Parameters* dialog box accessed via a R on the *TCP/IP* entry and then selecting *System Parameters* from the pop-up menu. In the *Channel* tab, various settings pertaining to the communication and monitoring a communication can be made. These settings will apply to all channel units of the communication driver. 

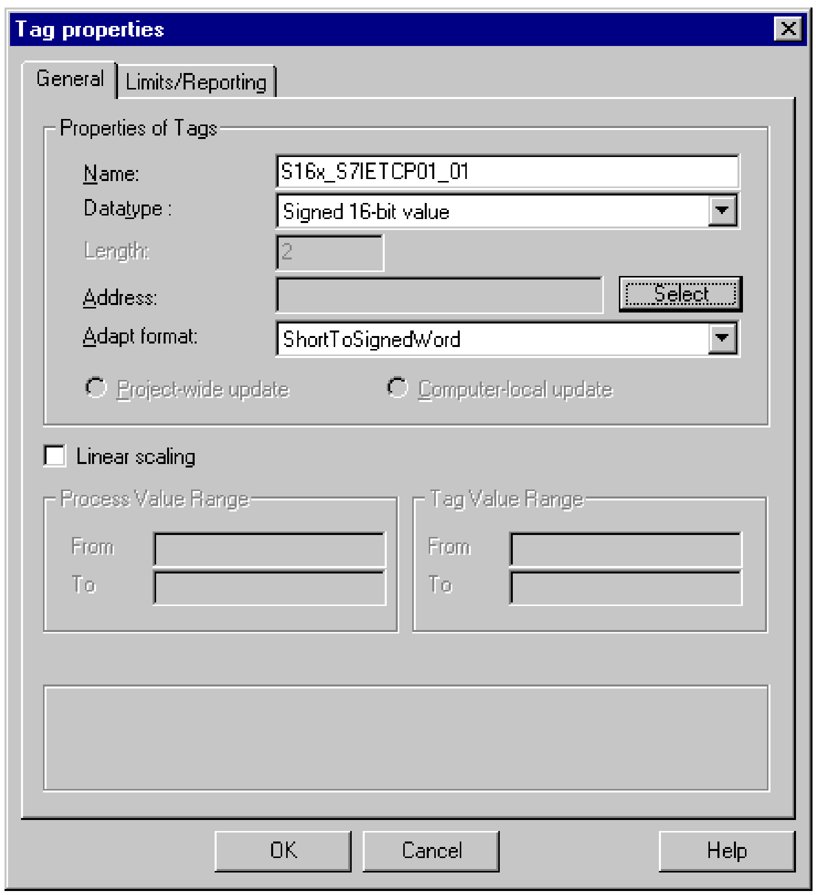
Step	B: Creating the Connection
7	In the *Device* tab, the access point used by the connection to access the PLC is specified. By default, the access point *CP-TCPIP* is set. Previously, the communication processor *CP 1411* has been assigned to the access point CP-TCPIP in the program *Setting the PG/PC Interface*. If you want the access point to be set automatically, make sure that the correct one is being used, especially if multiple communication processors are used. Close the dialog box by clicking on *OK*. 

C: Creating the WinCC Tags

<table>
<tr><th>Step</th><th>C: Creating the WinCC Tags</th></tr>
<tr><td>1</td><td>
Creation of the WinCC tags required for the sample.

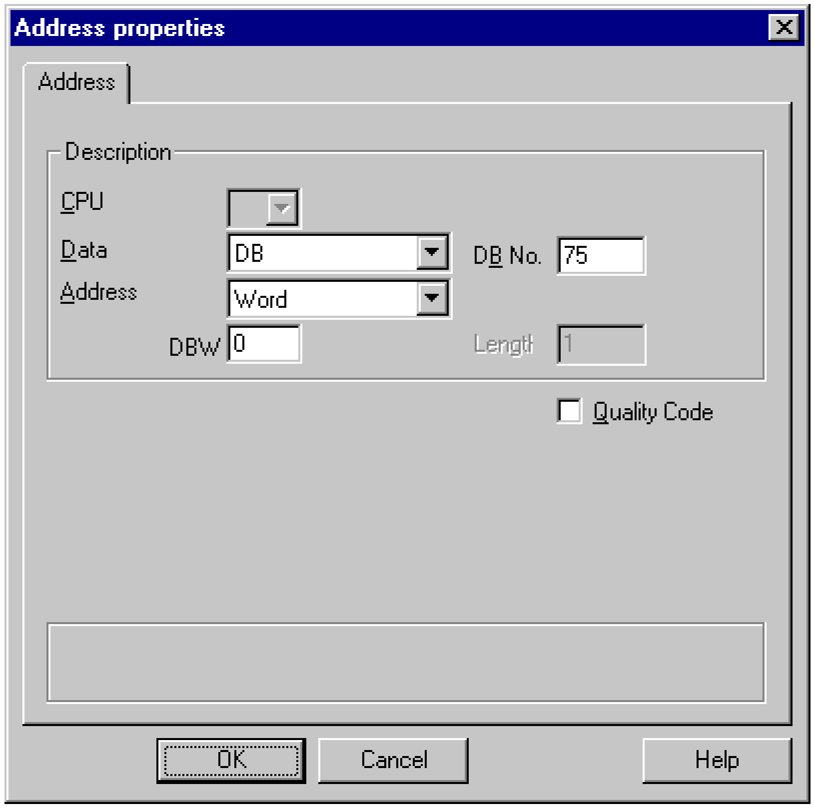
This is done via a R on the newly created connection S7_IETCP_01 and then selecting New Tag from the pop-up menu.


</td></tr>
<tr><td>2</td><td>
The properties dialog box of the tag will be displayed.

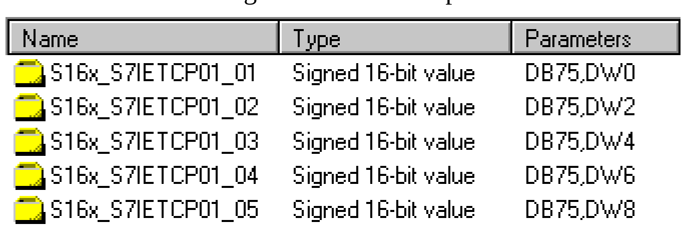
In the sample, the Name of the first tag is S16x_S7IETCP01_01. The tag is of the Signed 16-Bit Value data type. Click on the Select button to set the Address of the new tag.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Creating the WinCC Tags</th></tr>
<tr><td>3</td><td>
The dialog box Address Properties will be displayed.
Set DB as the Data Range and the value 75 as the DB No.. Set Word in the Address field and the value 0 in the DBW field. Close the dialog box by clicking on OK. The properties dialog box of the tag is also closed by clicking on OK.
The just created WinCC tag is addressed in the range of the DB75, where the first of the two values to be added is located.



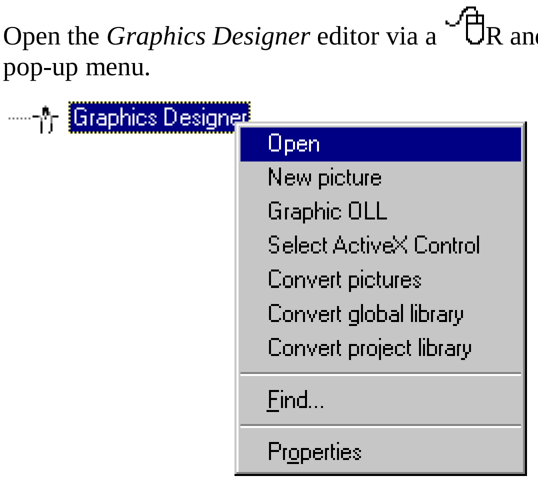
</td></tr>
<tr><td>4</td><td>
Creation of the remaining WinCC tags required.
Follow steps 1 to 3 for the creation of the remaining tags. The names, data types and addresses of the tags used in this sample are listed in the following graphic.


<table>
<tr><th>Name</th><th>Type</th><th>Parameters</th></tr>
<tr><td>S16x_S7IETCP01_01</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
<tr><td>S16x_S7IETCP01_02</td><td>Signed 16-bit value</td><td>DB75,DW2</td></tr>
<tr><td>S16x_S7IETCP01_03</td><td>Signed 16-bit value</td><td>DB75,DW4</td></tr>
<tr><td>S16x_S7IETCP01_04</td><td>Signed 16-bit value</td><td>DB75,DW6</td></tr>
<tr><td>S16x_S7IETCP01_05</td><td>Signed 16-bit value</td><td>DB75,DW8</td></tr>
</table>
</td></tr>
</table>

D: Creating the WinCC Screen

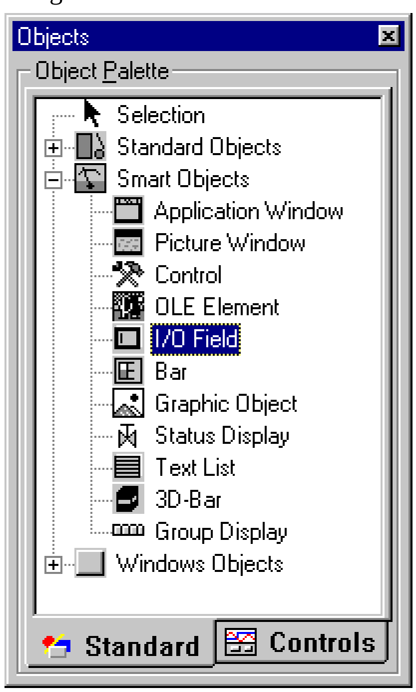
<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>1</td><td>
Creation of a WinCC screen in which the previously created tags are visualized.

Open the Graphics Designer editor via a R and then selecting Open from the pop-up menu.

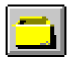
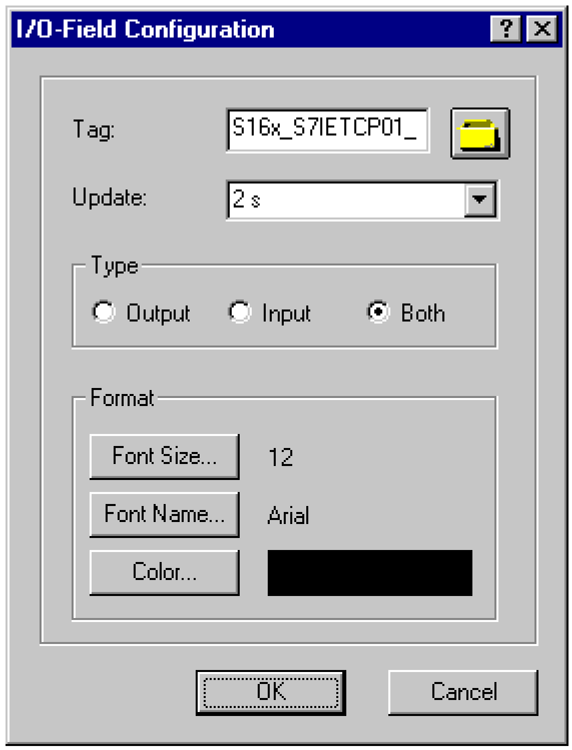


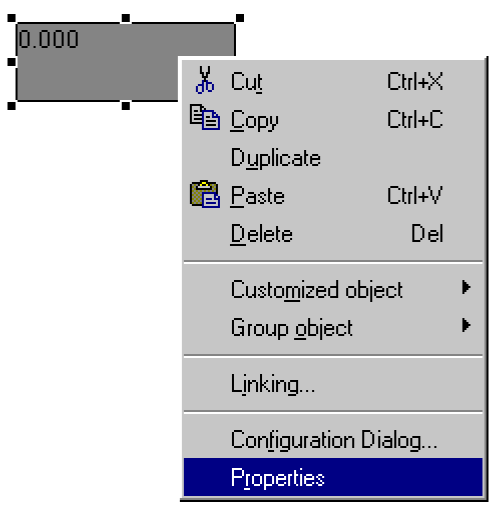
</td></tr>
<tr><td>2</td><td>
This will open the Graphics Designer editor with a new (blank) screen.

To display the first tag, configure a Smart Object → I/O Field. To do so, select the I/O Field object from the Object Palette and place it on the screen using the mouse.



</td></tr>
</table>

<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>3</td><td>
After placing the I/O Field on the screen, its Configuration dialog box will be displayed.
In the Tag field, set the tag S16x_S7IETCP01_01 via the button displayed below.

Leave the Update of the tag at 2 s. Keep the default settings for the remaining options. Close the dialog box by clicking on OK.


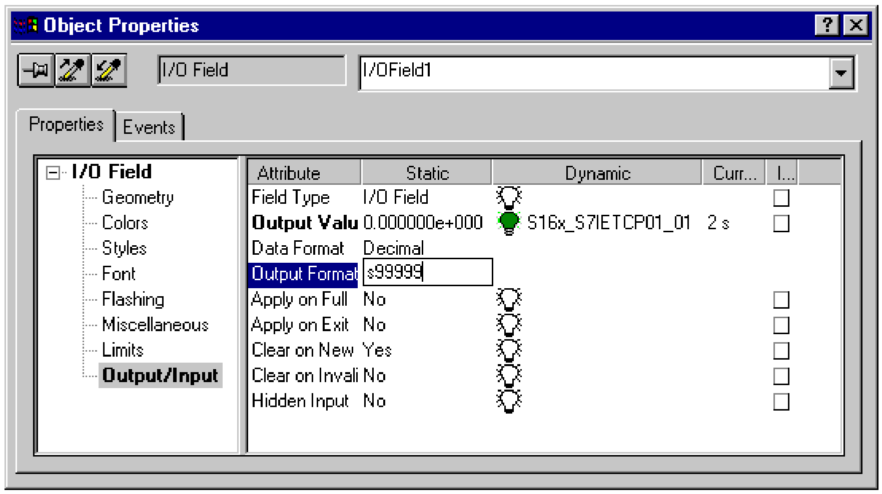
</td></tr>
<tr><td>4</td><td>
Changing the output format of the I/O Field.
For this, open its properties dialog box via a R on the I/O Field and then select Properties from the pop-up menu.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>5</td><td>

The dialog box *Object Properties* will be displayed.

On the left side of the *Properties* tab, select the entry *Output/Input*. Via a D on the output format set, the field can be edited. Select the new format *s99999*. This format enables the *I/O Field* to display signed values with a maximum of 5 digits.



</td></tr>
<tr><td>6</td><td>

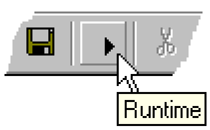
Creation of four additional *I/O Fields* for the display of the remaining tags.

Follow steps 2 to 5 to create the remaining I/O fields.

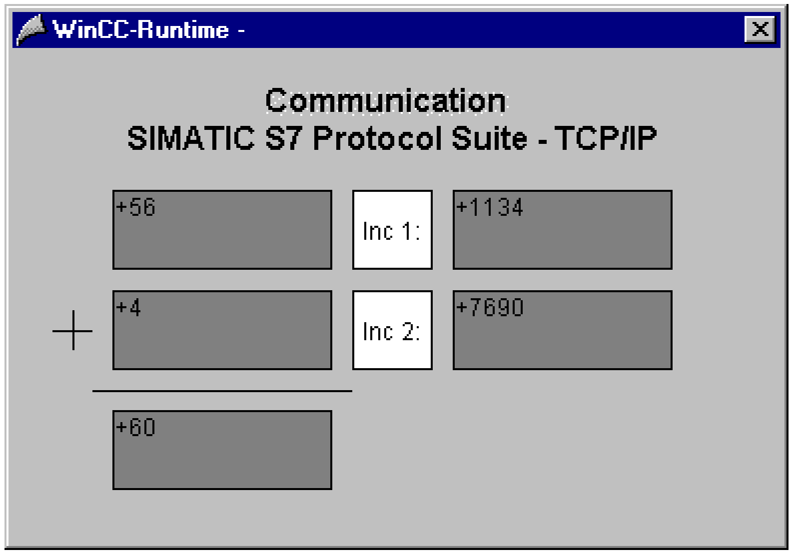
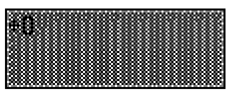
</td></tr>
<tr><td>7</td><td>

Save the screen.

In the sample project, the screen is saved under the name *com_3_S7IETCP_01.pdl*. The screen can be switched directly to runtime from the *Graphics Designer* via the button displayed below.



</td></tr>
</table>

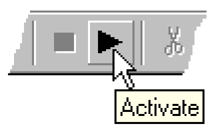
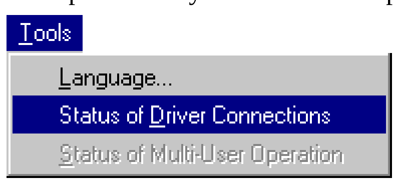
Step	D: Creating the WinCC Screen
	If the screen is in runtime, the PLC started and the network connection established, the current values of the PLC will be displayed in the I/O fields. They can be changed by entering values in the individual *I/O Fields*.  If there is no connection to the PLC, the *I/O Fields* will be displayed grayed out. In this case an error is present at some point of the communication connection. 

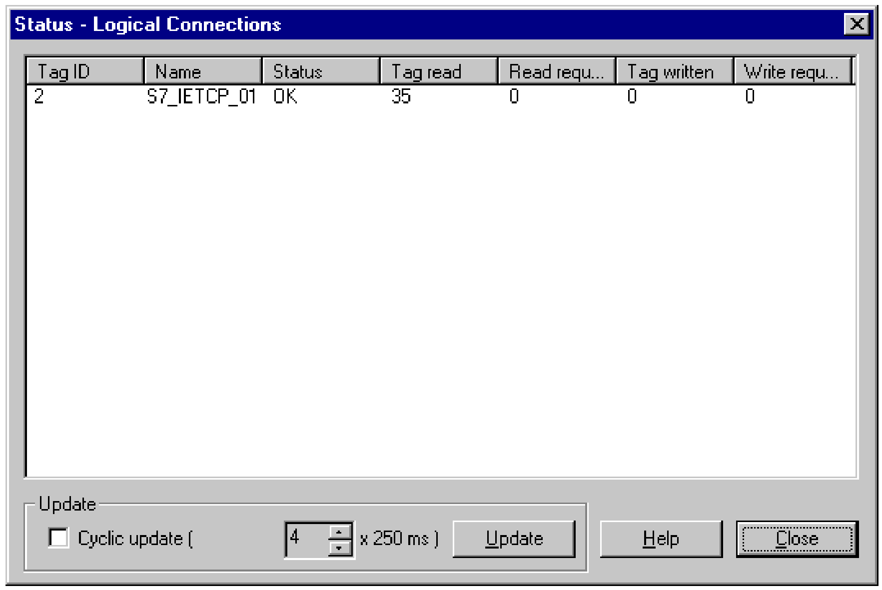
4.4 Diagnosis of the Communication Connection

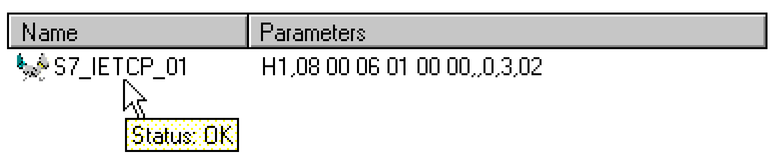
The following describes the options available for diagnosing the communication connection between the WinCC project *WinCC_S7_IETCP* and the SIMATIC S7 station.
A diagnosis of the sample according to this description makes only sense, if the checks listed below have been completed successfully.
Creation of the STEP7 Project S7_IETCP

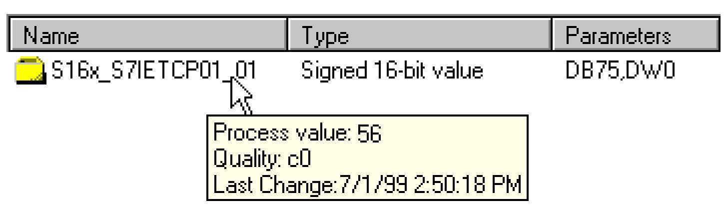
- F: Testing the Hardware Configuration
- H: Testing the STEP7 Program

WinCC Explorer

Step	WinCC Explorer
1	Diagnosis of the communication connection from the *WinCC Explorer*. Switch the project *WinCC_S7_IETCP* into runtime. This is done from the *WinCC Explorer* via the toolbar button displayed below.  The created WinCC screen *com_3_S7IETCP_01.pdl* can also be switched directly from the *Graphics Designer* into runtime.
2	In the *WinCC Explorer*, a dialog box for monitoring all configured connections can be accessed via the *Tools* → *Status of Driver Connections* menu. This menu point is only accessible if the project is in runtime. 

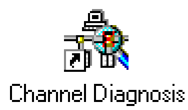
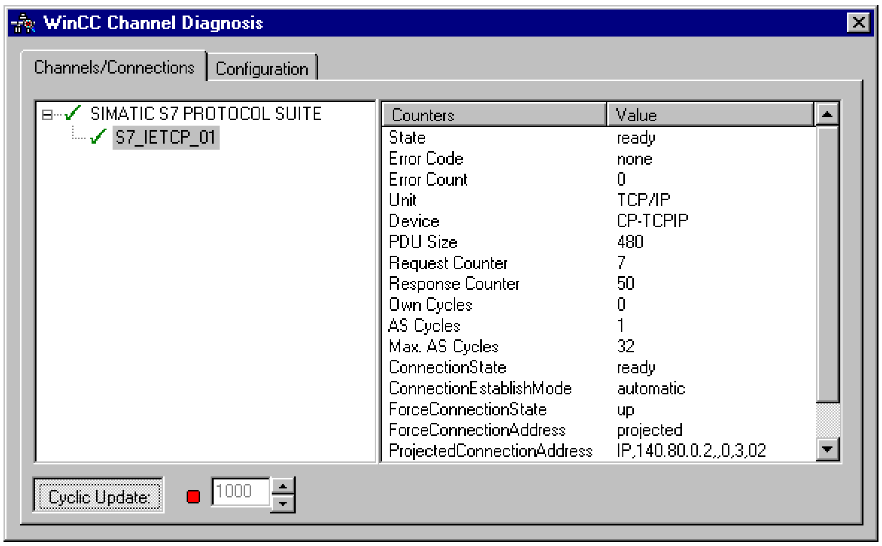
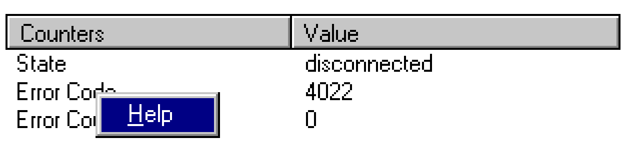
<table>
<tr><th>Step</th><th>WinCC Explorer</th></tr>
<tr><td>3</td><td>
The dialog box Status - Logical Connections will be displayed.
This dialog box lists all configured connections. For this sample, only the connection S7_IETCP_01 will be displayed.
The displayed values correspond to the status at the moment the dialog box was opened. By selecting the appropriate check-box, a Cyclic Update of the display can be achieved.


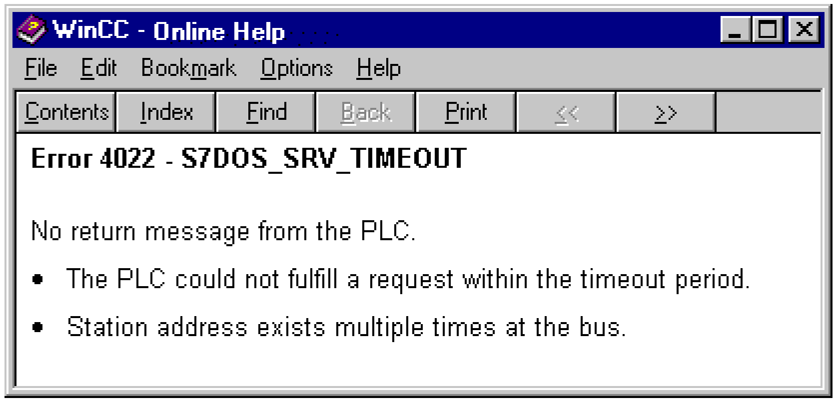
</td></tr>
<tr><td>4</td><td>
Another way to obtain information about the connection status in general and about the connection status of individual tags is provided by Tag Management.
The status of a configured connection can be displayed as a tooltip by simply pointing the mouse on the connection in question.


The current process value of a certain tag as well as its status can be displayed as a tooltip by pointing the mouse on it. This allows you to detect errors concerning an individual tag and not the entire connection.


</td></tr>
</table>

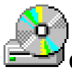
Channel Diagnosis

Step	Channel Diagnosis
1	Diagnosis of the communication connection via the program *WinCC Channel Diagnosis*. Start this program via *Start* → *Simatic* → *WinCC* → *Channel Diagnosis*. 
2	The program *WinCC Channel Diagnosis* will be displayed. The *Channels/Connections* tab displays detailed information about the status of each configured connection. By default, the display is updated every second. The update cycle can be changed in the input field located at the bottom. 
3	If a connection error is detected, the *Error Code* line in the right window half will display a value specifying the error cause. Detailed information about this error code is displayed by R on the *Error Code* entry and then selecting *Help* from the pop-up menu. 

<table>
<tr><th>Step</th><th>Channel Diagnosis</th></tr>
<tr><td>4</td><td>This opens the Online Help to WinCC containing a description of the corresponding error code. Additionally, possible error causes are also listed.

</td></tr>
</table>

5 Communication to the SIMATIC S7 via OPC

The projects created in this chapter can also be copied directly from the online document to your hard drive. By default, they will be copied to the folder C:\Communication_Manual. You have the option to copy the following components to the hard drive:

comls7_S7OPC

The database file of the communication processor CP 1413.

S7_OPC

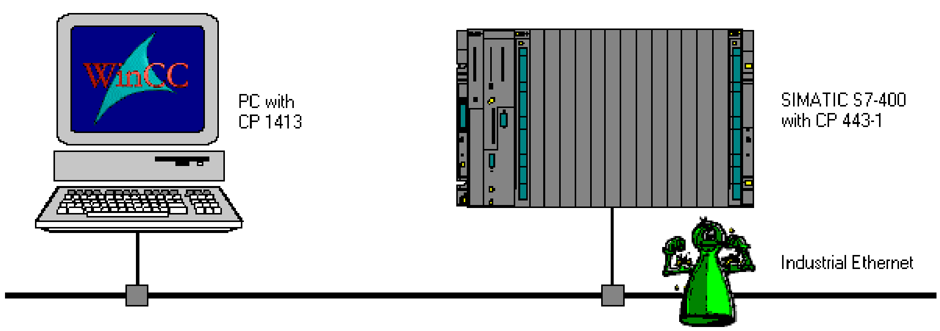
The STEP7 project we will create.

WinCC_S7_OPC

The WinCC project we will create.
This chapter describes in detail the startup of a communication connection between a *SIMATIC S7* and *WinCC*. In this sample, the communication connection is realized via the *Industrial Ethernet*. By making only slight changes, the communication via the *PROFIBUS* is also possible.

The S7 OPC Server running on the computer makes the data of the PLC available to other applications running on the same computer and to applications running on the network. The S7 OPC Server communicates with the PLC via the communication processor CP 1413.

Overview of the Structure of the Sample



On the computer side, the connection to the *Industrial Ethernet* network is established via the communication processor *CP 1413*. To install this communication processor in the computer, the driver *IE S7 1413*, located on the *SIMATIC NET* CD-ROM, is needed. In addition, the *S7 OPC Server*, also located on the *SIMATIC NET* CD-ROM, is needed.
In the WinCC project, the communication driver *OPC* must be installed. Using this *OPC Client*, the connection to the *S7 OPC Server* is configured.
The PLC is equipped with a *CPU 416-1* module. The connection to the network is established via the communication processor *CP 443-1*. For the configuration of this communication processor with the STEP7 software, the option package *NCM S7 Industrial Ethernet* is required.

Overview of the Configuration Steps

The following lists all configuration steps necessary for the creation of the communication connection:

- Startup of the Communication Processor CP 1413
- Creation of the STEP7 Project S7_OPC
- Configuration of the S7 OPC Server
- Creation of the WinCC Project WinCC_S7_OPC
- Diagnosis of the Communication Connection

Required Software

Name	**Description**
SIMATIC NET	Driver *IE S7-1413* from the *SIMATIC NET* CD-ROM for the installation of the communication processor *CP 1413*. *S7 OPC Server* for the communication to the *OPC Client* from WinCC.
STEP7	STEP7 software with option package *NCM for Industrial Ethernet* for the creation of the STEP7 project.
WinCC	WinCC with the communication driver *OPC* for the creation of the WinCC project.

Required Computer Hardware

Name	**Description**
Communication Processor	Communication processor *CP 1413* to establish the connection to the PLC's communication processor.

Required PLC Hardware

Name	**Description**
Rack	Rack *UR1*
Power Supply	Power supply *PS 407 10A* in slot 1 and 2.
CPU Module	CPU module *CPU 416-1* in slot 3.
Communication Processor	Communication processor *CP 443-1* in slot 4.

5.1 Startup of the Communication Processor CP 1413

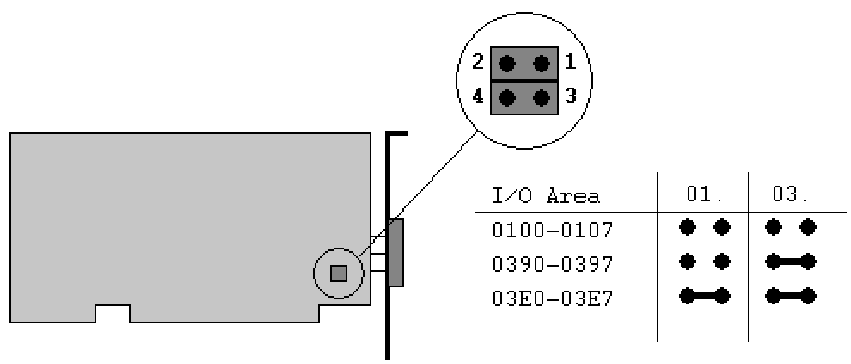
The following description details the configuration steps necessary to successfully start up the communication processor *CP 1413*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to start up the communication processor *CP 1413*:

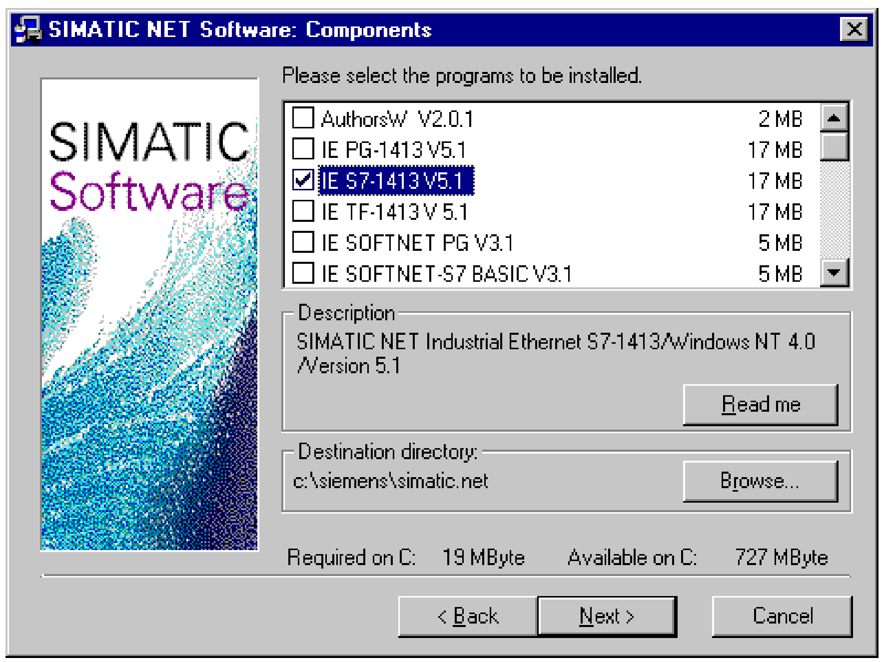
- A: Mounting the Communication Processor in the Computer
- B: Installing the Communication Driver
- C: Installing the Communication Processor
- D: Assigning the Communication Processor
- E: Testing the Communication Processor

A: Mounting the Communication Processor in the Computer

Step	A: Mounting the Communication Processor in the Computer
1	Check the selected jumper settings at the *CP 1413*. During the installation of the *CP 1413*, the *I/O Range* must be specified. The *I/O Range* is set via *jumpers*. By default, the *I/O Range* is set to *03E0-03E7*. The settings *0100-0117* and *0390-0397* are also possible. The following graphic illustrates the jumper settings necessary for the various *I/O Ranges*. 
2	Mount the module according to the installation instructions. Among other things, follow the steps for handling electrostatic sensitive devices (ESD). The module must only be installed while the computer is off. For the communication card *CP 1413*, a free ISA slot in the computer is required. After the installation of the *CP 1413*, close the computer's case and start the computer.

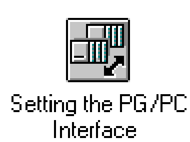
B: Installing the Communication Driver

<table>
<tr><th>Step</th><th>B: Installing the Communication Driver</th></tr>
<tr><td>1</td><td>
Install the communication driver IE S7-1413 from the SIMATIC NET CD-ROM.
After inserting the SIMATIC NET CD-ROM, the installation program is automatically started. If this is not the case, open the Windows NT Explorer and start the setup.exe program located on the CD-ROM.
The installation of the software is started via the button displayed below.

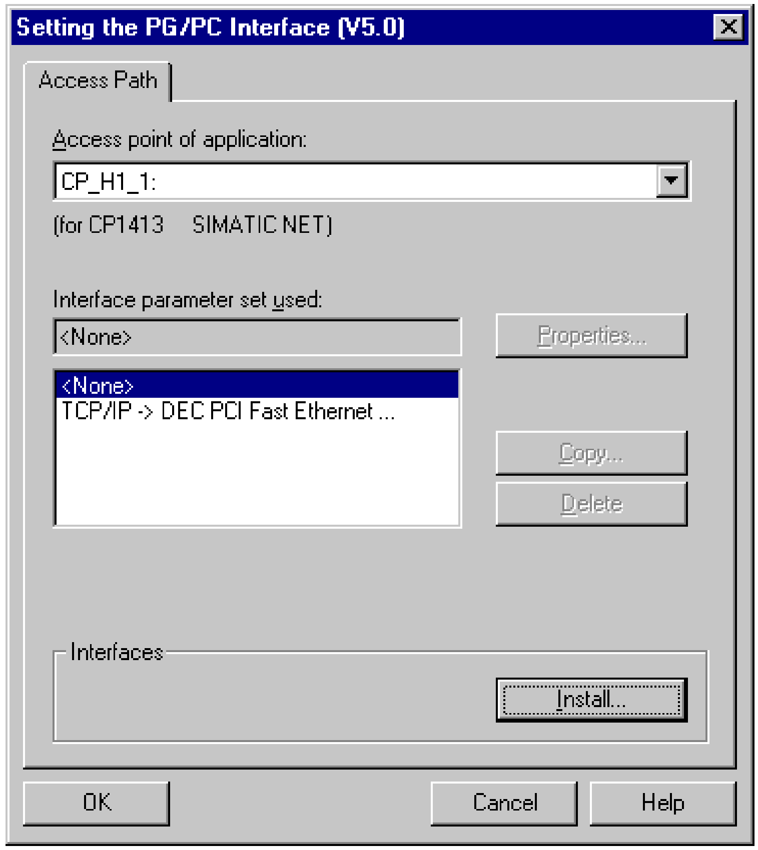
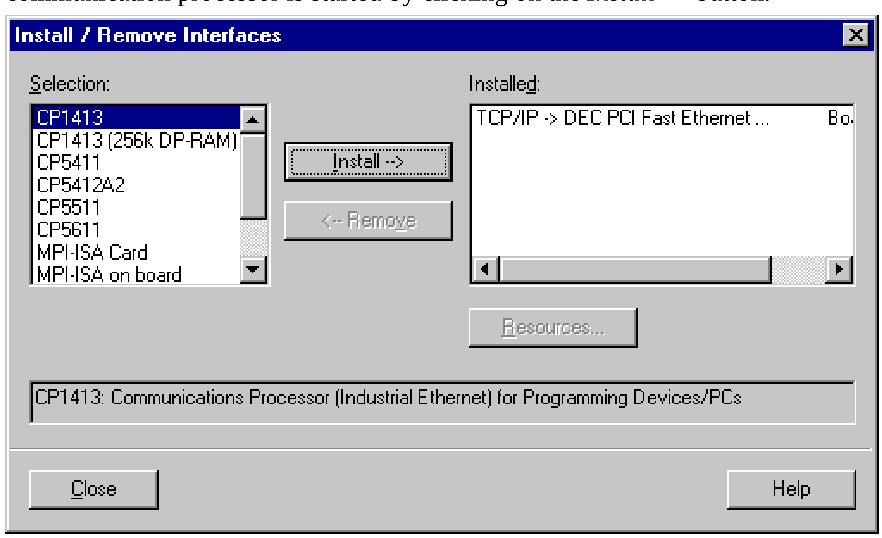

Follow the instructions of the installation program. On the Components page, the check-box of the driver IE S7-1413 to be installed must be selected. Finish the installation.


</td></tr>
</table>

C: Installing the Communication Processor

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>1</td><td>
Install the communication processor CP 1413 via the program Setting the PG/PC Interface.
This program is accessed via Start → Settings → Control Panel → Setting the PG/PC Interface.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>2</td><td>The program Setting the PG/PC Interface will be displayed.
The dialog box for installing a new interface is opened via the Install button.

</td></tr>
<tr><td>3</td><td>The dialog box Install/Remove Modules will be displayed. The Selection field lists all interfaces that can be installed. Among them will be the entry CP 1413, if the communication driver has been installed previously as outlined in step B.
From the Selection field, select the entry CP 1413. The installation of the communication processor is started by clicking on the Install -> button.

</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>4</td><td>

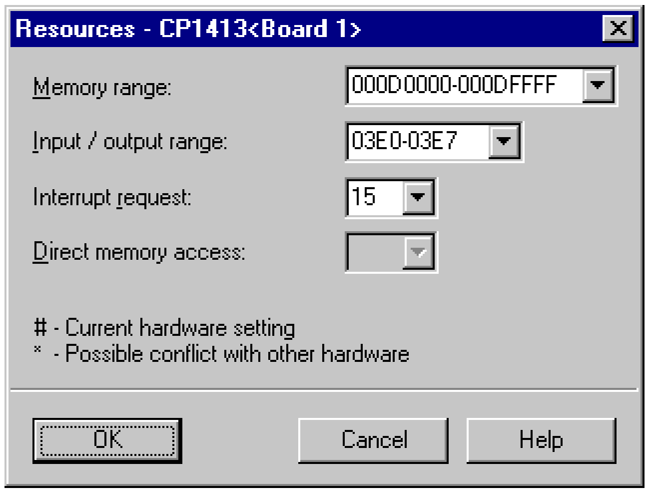
The dialog box *Resources - CP 1413* will be displayed.

The settings for the *Memory Range*, *I/O Range* and *Interrupt* have to be specified.

The *I/O Range* has already been determined via the *Jumper Settings* at the *CP 1413*.

Make sure that the assigned resources have not already been taken by other modules in the computer. Information about already taken system resources can be obtained from the *Resources* tab accessed via *Start* → *Programs* → *Administrative Tools (Common)* → *Windows NT Diagnostics*.

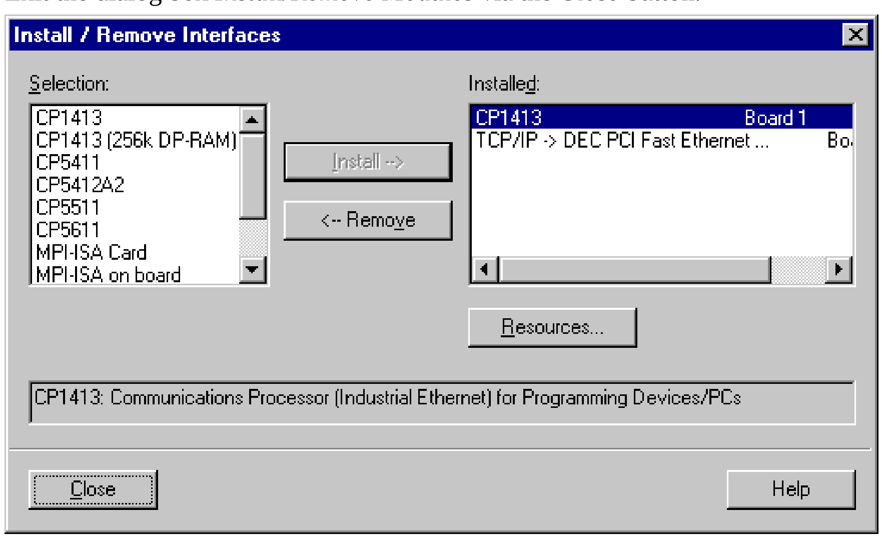
Close the *Resources* tab by clicking on *OK*.



</td></tr>
<tr><td>5</td><td>

In the dialog box *Install/Remove Modules*, the *Installed* field will now contain the entry for the *CP 1413*.

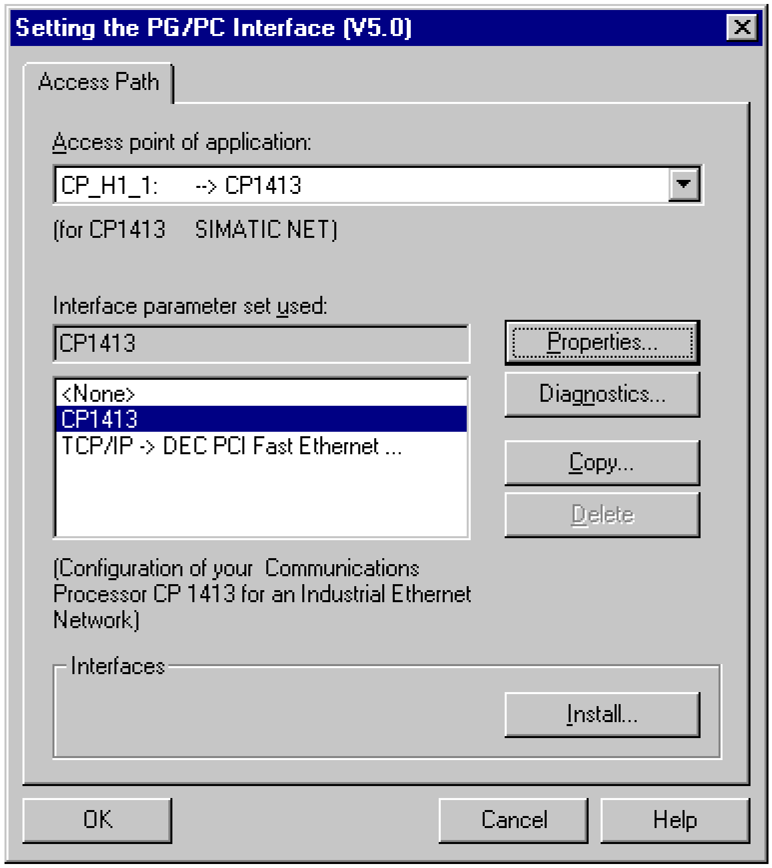
Exit the dialog box *Install/Remove Modules* via the *Close* button.



</td></tr>
</table>

D: Assigning the Communication Processor

Step	D: Assigning the Communication Processor
1	In the program *Setting the PG/PC Interface*, assign the access point *CP_H1_1:* to the just installed interface. It has been created automatically during the installation of the communication driver *IE S7-1413*. In the field *Access Point of the Application*, set the entry *CP_H1_1:*. In the field below, select the entry *CP1413*. This completes the assignment between the access point and the communication processor.



<table>
<tr><th>Step</th><th>D: Assigning the Communication Processor</th></tr>
<tr><td>2</td><td>

Setting the properties of the communication processor *CP 1413*.

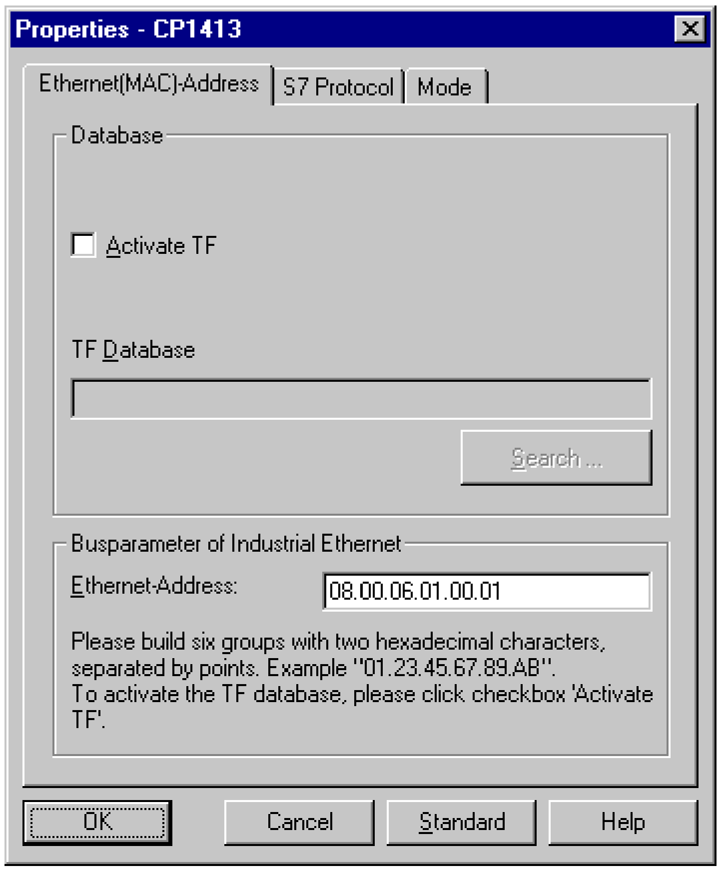
The dialog box for setting the properties is opened via the *Properties* button of the *Setting the PG/PC Interface* program.

The dialog box *Properties - CP 1413* will be displayed.

In the *Ethernet (MAC) Address* tab, enter the *Ethernet Address* of the *CP 1413*. In our sample, this is *08.00.06.01.00.01*.

The *Ethernet Address* is six Bytes long and structured as follows for SIEMENS devices:

- *08.00.06*: The first six digits of the hexadecimal value correspond to the number for SIEMENS.
- *01*: The next two digits specify the range for SIEMENS.
- *0*: The next digit signifies the SIMATIC system.
- *0.01*: The last three digits correspond to the significant station address of a SIEMENS device.



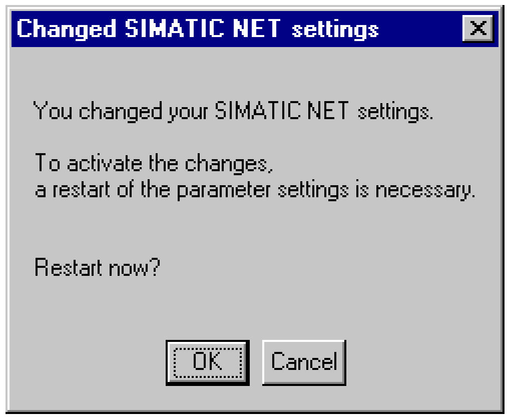
</td></tr>
</table>

<table>
<tr><th>Step</th><th>D: Assigning the Communication Processor</th></tr>
<tr><td>3</td><td>

Exit the program *Setting the PG/PC Interface* via the *OK* button.

A dialog box will be displayed requesting the restart of the *CP 1413*. Acknowledge this dialog box by clicking on *OK*, which will result in the restart of the communication processor *CP 1413*.

This completes the installation of the communication processor.



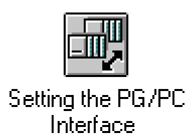
</td></tr>
</table>

E: Testing the Communication Processor

<table>
<tr><th>Step</th><th>E: Testing the Communication Processor</th></tr>
<tr><td>1</td><td>

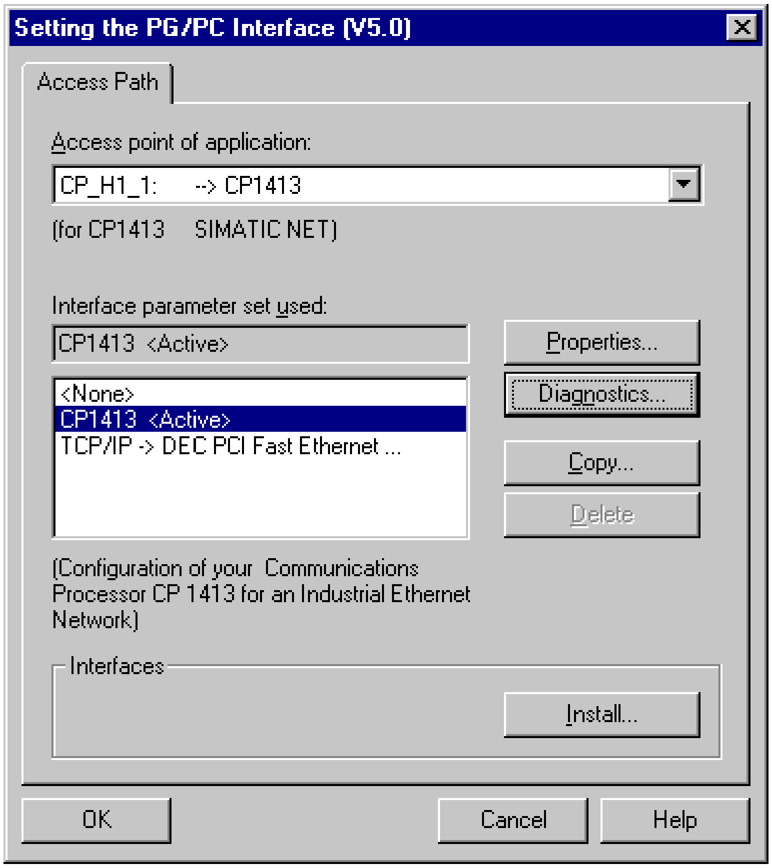
Check the proper installation of the communication processor *CP 1413* via the program *Setting the PG/PC Interface*.

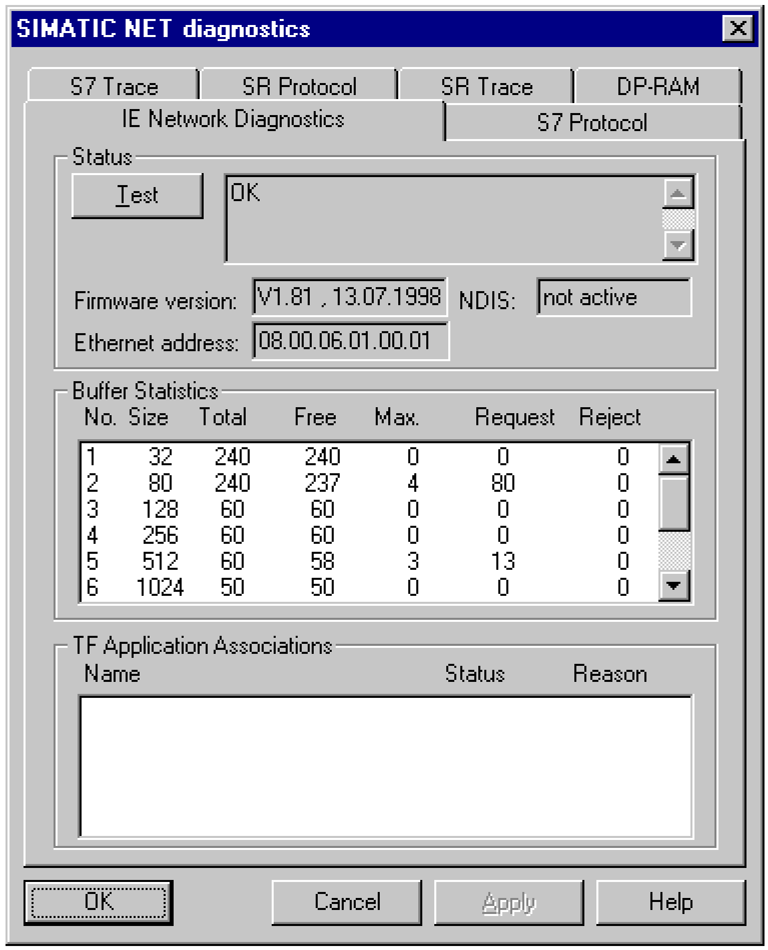
This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*.



</td></tr>
</table>

Step	E: Testing the Communication Processor
2	The program *Setting the PG/PC Interface* will be displayed. Select the interface to be checked. In this case, select the entry *CP 1413*. Make sure that the assignments between access points and the interfaces are not changed. The check for a proper installation is activated by clicking on the *Diagnostics* button.



Step	E: Testing the Communication Processor
3	The dialog box *Simatic NET Diagnostics* will be displayed. In the *IE Network Diagnostics* tab, the diagnosis is started via the *Test* button. The result of the diagnosis will be displayed immediately following. If the result of the diagnosis is positive (correct installation), the dialog box can be exited with *OK*. In this case, the program *Setting the PG/PC Interface* can also be closed by clicking on *OK*. The configuration of the communication to the S7 is continued in the following section. However, if the result of the diagnosis is negative (incorrect installation), the error must be localized and corrected. Troubleshooting procedures are described in the section Is the Communication Module in the Computer operational?. 

5.2 Creation of the STEP7 Project S7_OPC

The following description details the configuration steps necessary to create and start up the STEP7 project *S7_OPC*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to create the STEP7 project *S7_OPC*:

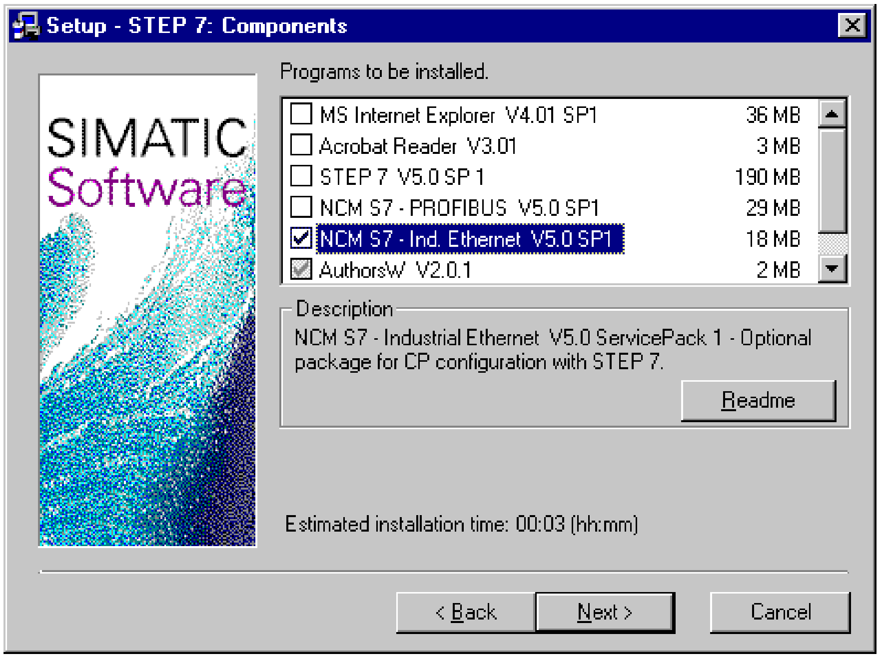
- A: Installing the Hardware
- B: Installing the Option Package
- C: Creating the STEP7 Project
- D: Configuring the Hardware
- E: Loading the Hardware Configuration
- F: Testing the Hardware Configuration
- G: Creating the STEP7 Program
- H: Testing the STEP7 Program

A: Installing the Hardware

Step	A: Installing the Hardware
1	Rack-mounting of the modules used. In this sample, the modules to be installed are the power supply *PS 407 10A*, the CPU module *CPU 416-1* and the communication processor *CP 443-1*. Establishing the connection from the programming device to the programming interface of the CPU module. Establishing the connection from the communication processor *CP 1413* in the computer to the communication processor *CP 443-1* in the PLC.

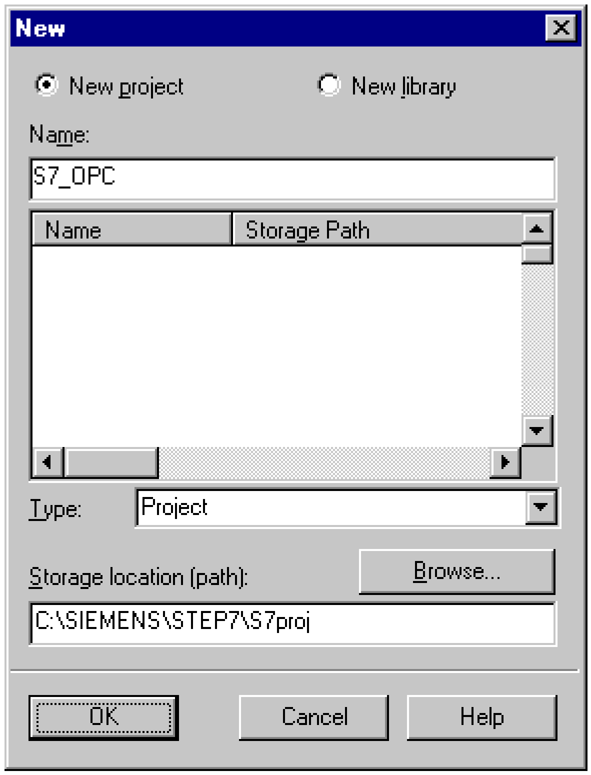
B: Installing the Option Package

Step	B: Installing the Option Package
1	If the option package *NCM S7 Industrial Ethernet* has not been installed during the installation of *STEP7*, install it now from the *STEP7* CD-ROM. This option package is required for the configuration of the communication processor *CP 443-1* via the *STEP7* software. After inserting the *STEP7* CD-ROM, the installation program is automatically started. If this is not the case, open the *Windows NT Explorer* and start the *setup.exe* program located on the CD-ROM.  setup.exe

Step	B: Installing the Option Package
2	This starts the installation program. Follow the instructions of the installation program. On the *Components* page, select the check-box *NCM S7 Ind. Ethernet*. Finish the installation. 

C: Creating the STEP7 Project

Step	C: Creating the STEP7 Project
1	Create a new STEP7 project in the *SIMATIC Manager*. It is started via *Start* → *Simatic* → *SIMATIC Manager*. 
2	This displays the *SIMATIC Manager*. Via the menus *File* → *New*, the dialog box for specifying the parameters of a new STEP7 project will be opened. The *New* dialog box will be displayed. The radio-button *New Project* must be selected. In the *Name* field, the name of the new project to be created is entered. The names of the STEP7 projects created within the framework of this manual all start with *S7*. They also include a reference to the communication type used. The project of this sample has the name *S7_OPC*.

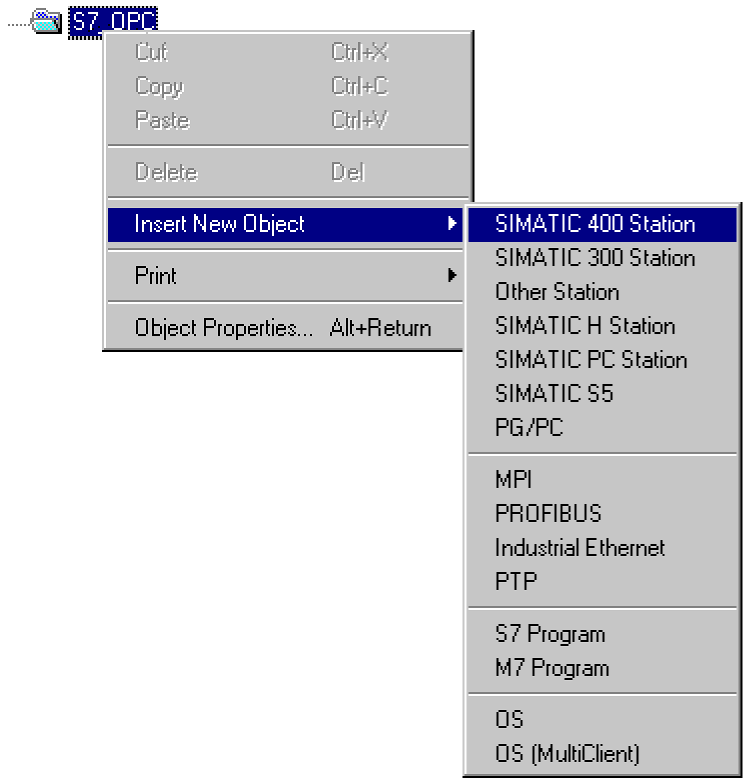
Step	**C: Creating the STEP7 Project**
	By default, projects are stored in the *C:\SIEMENS\STEP7\S7proj* folder. This can be changed at any time via the *Browse* button. The *New* dialog box is closed via the *OK* button. 

D: Configuring the Hardware

Step	**D: Configuring the Hardware**
1	The new project will be displayed in the *SIMATIC Manager*. The hardware for this project must be configured. Three components are needed: A *SIMATIC 400-Station*, a *PG/PC* and for their networking an *Industrial Ethernet*.

<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td></td><td>

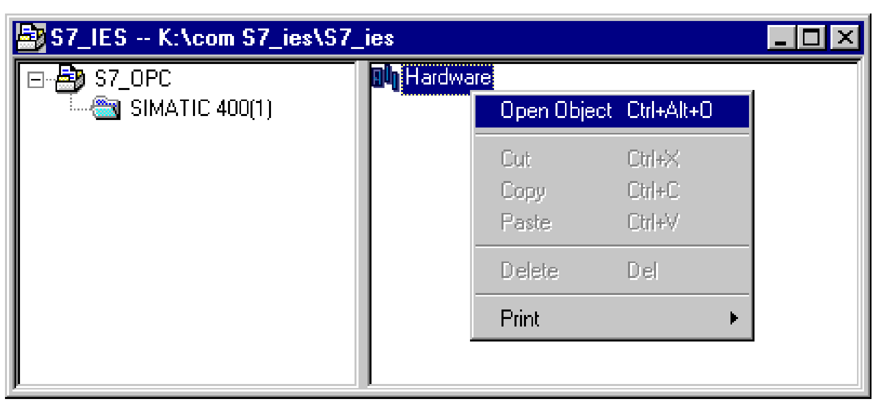
These components are added to the *SIMATIC Manager* via a R on the project name *S7_IEH* and then selecting *Insert New Object* → *SIMATIC 400-Station* and *Insert New Object* → *Industrial Ethernet* from the pop-up menu.



</td></tr>
<tr><td>2</td><td>

The just added components will be displayed in the right window of the *SIMATIC Manager*.

By D on the component *SIMATIC 400(1)* in the right window, the point *Hardware* will be displayed. By D on the point *Hardware* or R on it and then selecting *Open Object* from the pop-up menu, the program *HW Config* will be started.

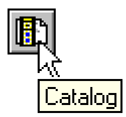


</td></tr>
</table>

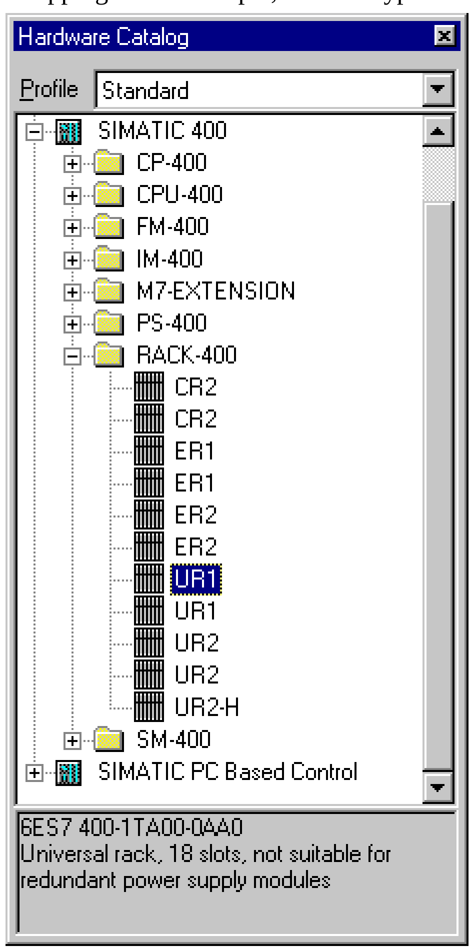
<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td>3</td><td>The program HW Config will be displayed.

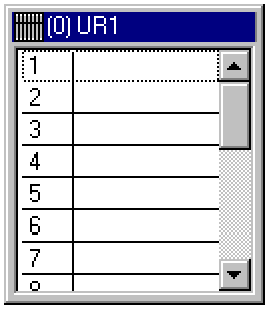
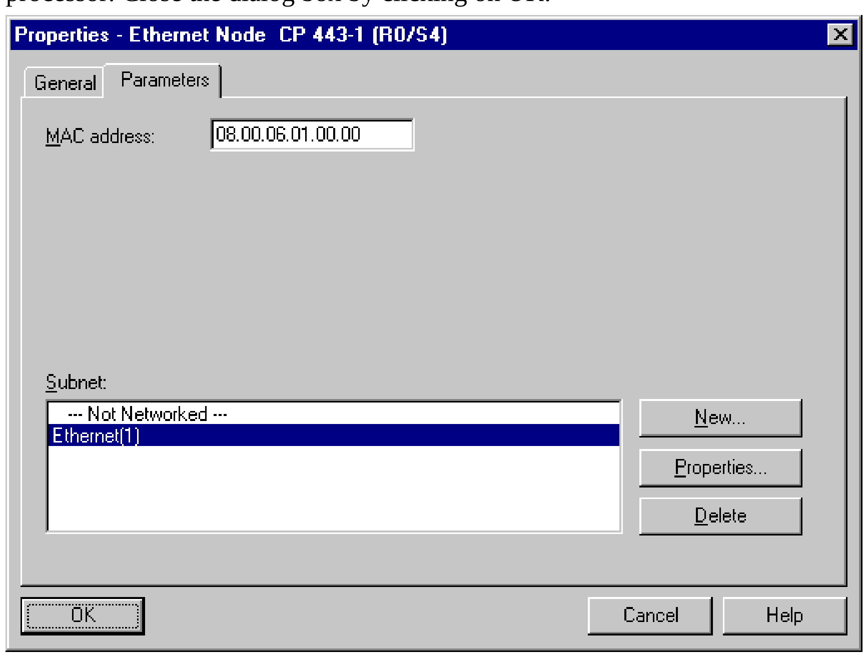
This program is used to exactly define the hardware used in the PLC and to configure their properties.

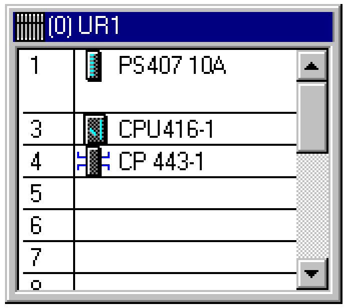
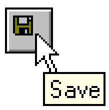
</td></tr>
<tr><td>4</td><td>By clicking on the toolbar button of the program HW Config displayed below, the Hardware Catalog is opened. This catalog is used to select the required hardware components.

</td></tr>
<tr><td>5</td><td>The Hardware Catalog will be displayed.

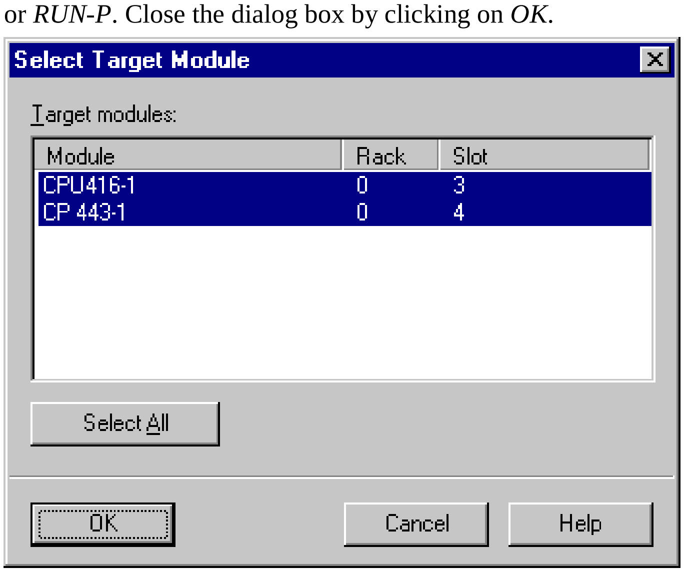
The first component selected is the rack. On this rack, all other components will be installed. The rack is inserted into the project via a D or by Dragging Dropping. In this sample, the rack type UR1 is used.

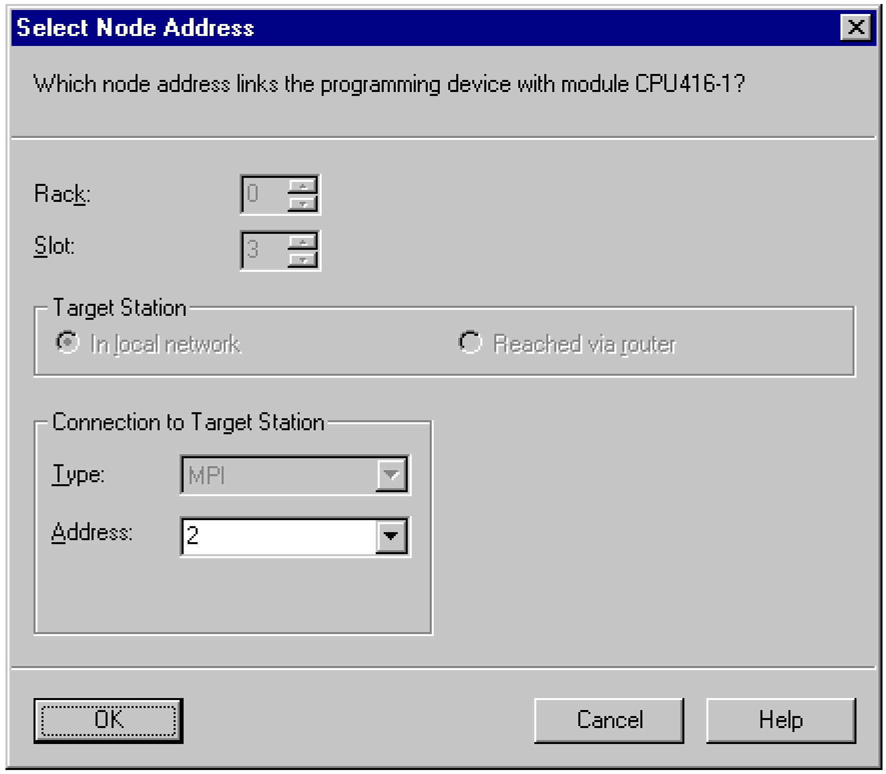
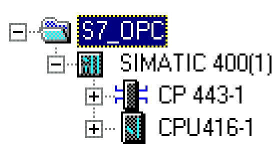
</td></tr>
</table>

Step	D: Configuring the Hardware
6	The program *HW Config* will display the currently still empty rack. 
7	Arrange the other hardware components in the rack. This is done by Dragging Dropping the desired components from the *Hardware Catalog* to the corresponding slot in the rack. This sample uses the power supply *PS 407 10A*. It is inserted into slot *1*. A power supply of this type occupies two slots. As the CPU module, this sample uses a *CPU 416-1*. This module is inserted into slot *3*. We also require the communication processor *CP 443-1*. This CP is only available from the *Hardware Catalog* if the option package *NCM S7 Industrial Ethernet* has been installed. After the communication processor *CP 443-1* has been inserted in the rack, its properties dialog box will open.
8	The *Ethernet Interface* properties dialog box of the *CP 443-1* will be displayed. In the *MAC Address* field of the *Parameters* tab, enter the desired Ethernet address of the communication processor. During the creation of the database file for the communication processor *CP 1413* in the computer, this address is one of the parameters that must be set. In the *Subnet* field below, assign the entry *Ethernet(1)* to the communication processor. Close the dialog box by clicking on *OK*. 

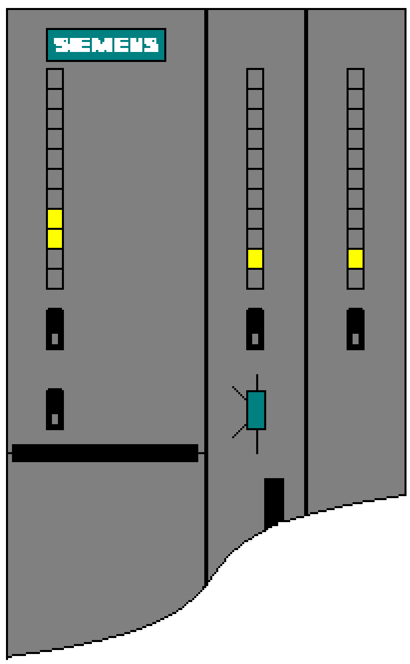
Step	D: Configuring the Hardware
9	The following graphic shows the completed hardware arrangement of the sample. 
10	Save the settings made in the program *HW Config*. This is done via the toolbar button displayed below. 

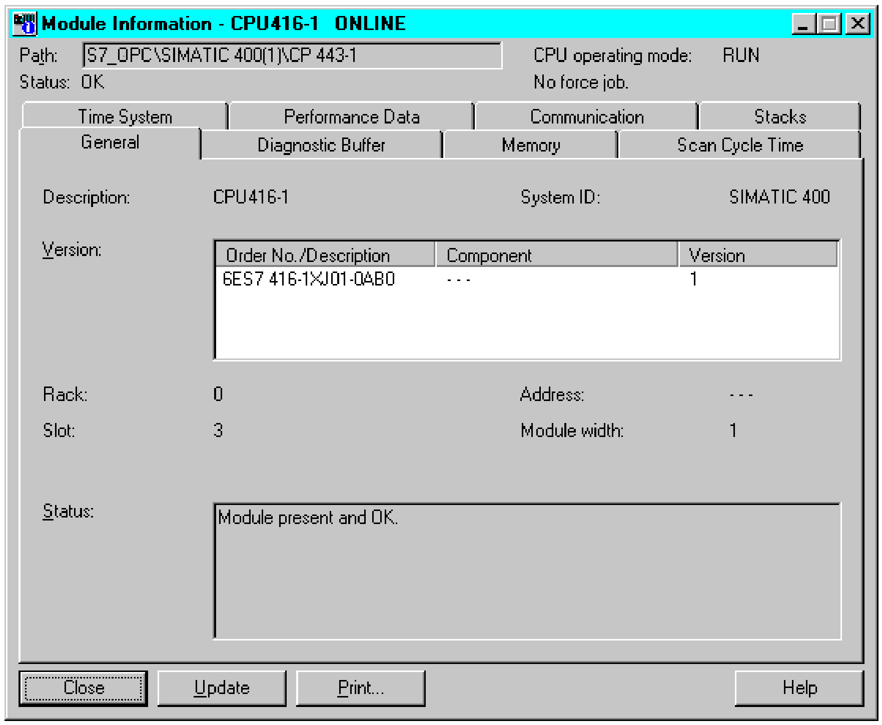
E: Loading the Hardware Configuration

Step	E: Loading the Hardware Configuration
1	The hardware configuration created in the program *HW Config* must be transferred to the PLC. This is done via the toolbar button displayed below. 
2	A dialog box will be displayed from which the components to be loaded can be selected. For this sample, all displayed components will be selected. Note that loading to the CPU module is only possible while the operating mode switch is set to *STOP* or *RUN-P*. Close the dialog box by clicking on *OK*. 

Step	E: Loading the Hardware Configuration
3	Now the dialog box *Select Station Address* will be displayed. In this dialog box, specify which station address is used by the STEP7 software to communicate with the CPU module. In this sample, the communication is carried out via the MPI interface. The *Address* of the CPU module is *2*. Close the dialog box by clicking on *OK*. 
4	The configuration data will now be transferred to the PLC. If necessary, the individual modules will be set to the STOP status. The program *HW Config* can be exited. The newly added components will be displayed by the *SIMATIC Manager* for the station *SIMATIC 400(1)*. 

F: Testing the Hardware Configuration

Step	F: Testing the Hardware Configuration
1	Testing of the hardware configuration made. If the key switch of the CPU module is set to *RUN* or*RUN-P* and the operating mode switch of the communication processor is set to *RUN*, only the status LEDs signifying the *RUN* operating mode should be displayed. If this is not the case, there is an error. The following steps help you localize this error. However, these steps should still be performed even if the status LEDs show no error. This allows you to recognize uncritical errors and faulty configurations. 

Step	F: Testing the Hardware Configuration
2	Testing the configuration of the CPU module. This is done via the dialog box *Module Status* in the *SIMATIC Manager*. It is opened by a R on the entry of the CPU module in the left window and then selecting *Target System* → *Module Status* from the pop-up menu. The dialog box *Module Status* of the CPU module will be displayed. The *General* tab displays various general data of the CPU module. In the *Status* field, the current module status and any existing errors are displayed. The *Diagnosis Buffer* tab contains more detailed information about existing errors and how to correct them. The dialog box can be exited via the *Close* button. 

<table>
<tr><th>Step</th><th>F: Testing the Hardware Configuration</th></tr>
<tr><td>3</td><td>

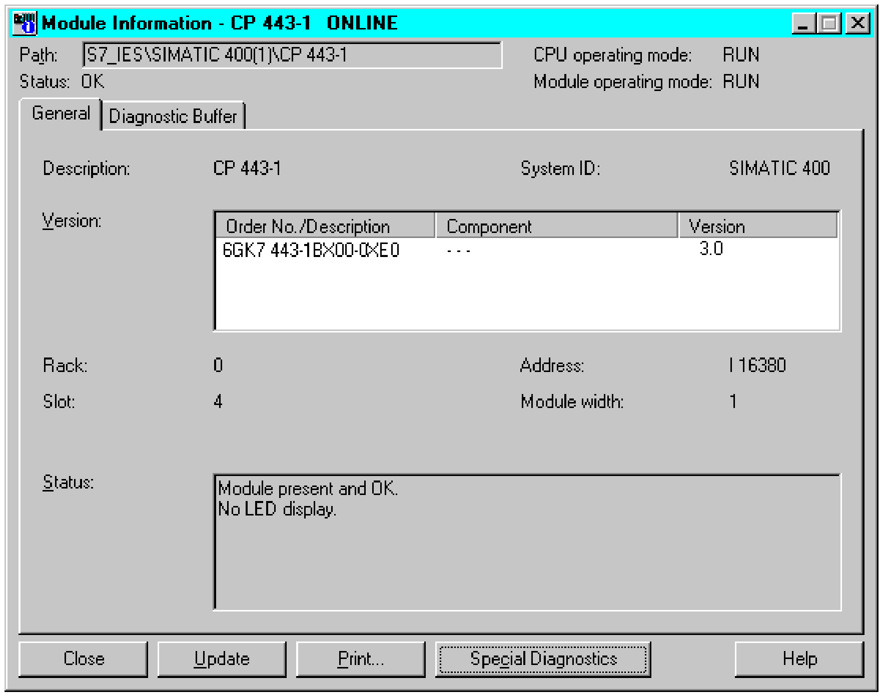
Testing the configuration of the communication processor.

This is done via the dialog box *Module Status* in the *SIMATIC Manager*. It is opened by a R on the entry of the communication processor in the left window and then selecting *Target System* → *Module Status* from the pop-up menu.

The dialog box *Module Status* of the communication processor will be displayed.

The *General* tab displays various general data of the module.

A dialog box for a more detailed diagnosis of the communication processor can be accessed via the *Special Diagnosis* button.



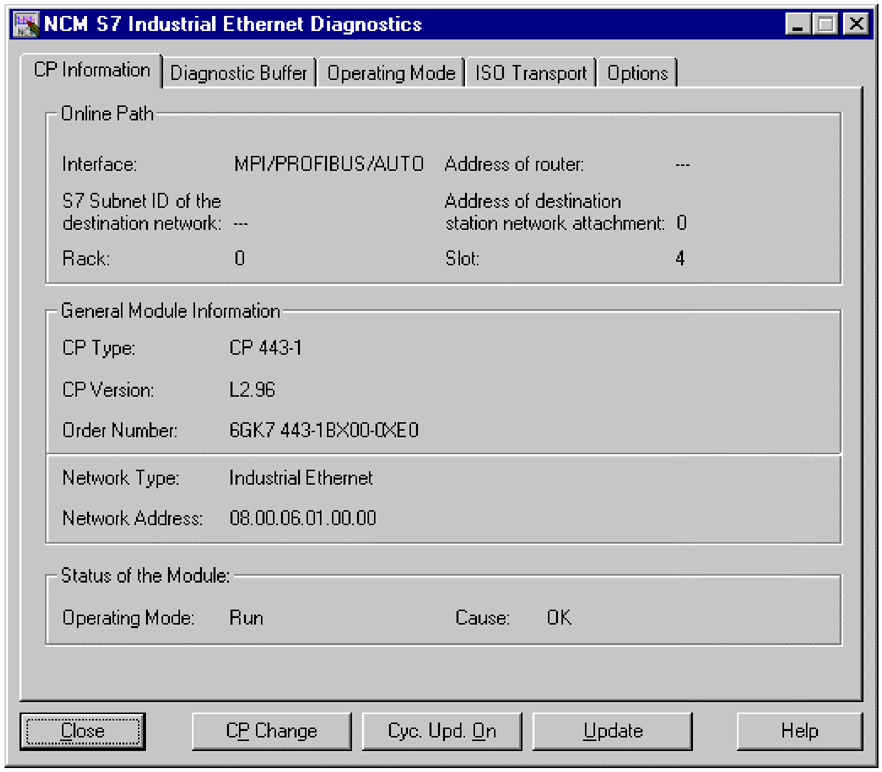
</td></tr>
</table>

<table>
<tr><th>Step</th><th>F: Testing the Hardware Configuration</th></tr>
<tr><td>4</td><td>

The dialog box *NCM S7 Industrial Ethernet Diagnosis* will be displayed.

The *CP Information* tab displays general information about the module. Among other things, the network address set can be checked.

The dialog box can be exited via the *Close* button. The Module Status dialog box can also be exited via the *Close* button.



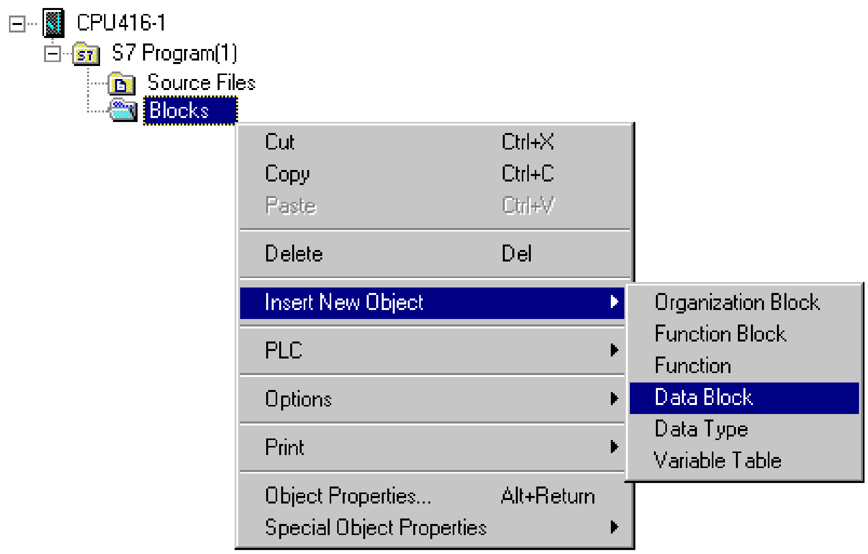
</td></tr>
</table>

G: Creating the STEP7 Program

<table>
<tr><th>Step</th><th>G: Creating the STEP7 Program</th></tr>
<tr><td>1</td><td>
Creation of the S7 Program.

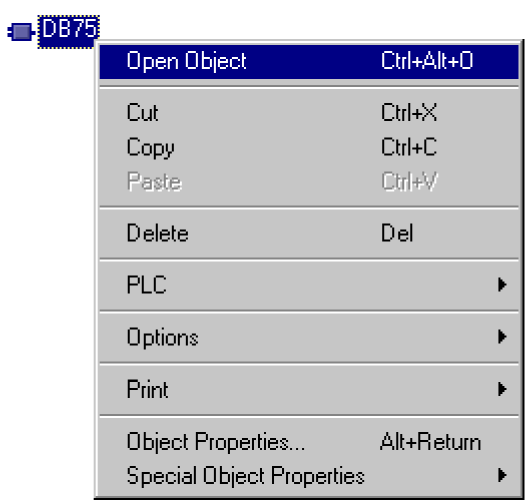
This sample project requires the operation block OB1 and a data block. OB1 is available by default, the required data block must be created. This is done in the SIMATIC Manager via a R on the sub-entry Modules of the entry S7 Program(1) of the configured CPU module and then selecting Insert New Object → Data Block from the pop-up menu.

The properties dialog box of the data block will be opened. As the block’s Name enter DB75 and close the dialog box with OK.

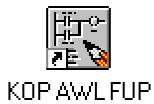
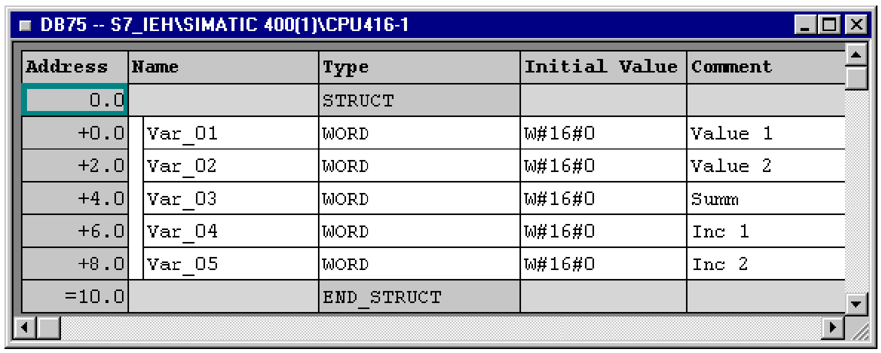
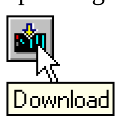


</td></tr>
<tr><td>2</td><td>
The newly created data block DB75 will be displayed in the right window of the project.

Via a D on this data block or a R and then selecting Open Object from the pop-up menu, the content of the block can be programmed. This starts the program LAD/STL/SCF.



</td></tr>
</table>

<table>
<tr><th>Step</th><th>G: Creating the STEP7 Program</th></tr>
<tr><td>3</td><td>The program LAD/STL/SCF is displayed.
Acknowledge the dialog box New Data Block by clicking on OK.

</td></tr>
<tr><td>4</td><td>Programming the DB75.
In this data block, two tags with a length of 16 Bits are created. Their sum is to be determined in OB1 and then be written to another tag with a length of 16 Bits.
Two additional tags with a length of 16 Bits are created, whose values are cyclically incremented in OB1.
The following graphic displays the programmed data block DB75.

DB75 -- S7_IEH\SIMATIC 400(1)\CPU416-1
<table>
<tr><th>Address</th><th>Name</th><th>Type</th><th>Initial Value</th><th>Comment</th></tr>
<tr><td>0.0</td><td></td><td>STRUCT</td><td></td><td></td></tr>
<tr><td>+0.0</td><td>Var_01</td><td>WORD</td><td>W#16#0</td><td>Value 1</td></tr>
<tr><td>+2.0</td><td>Var_02</td><td>WORD</td><td>W#16#0</td><td>Value 2</td></tr>
<tr><td>+4.0</td><td>Var_03</td><td>WORD</td><td>W#16#0</td><td>Summ</td></tr>
<tr><td>+6.0</td><td>Var_04</td><td>WORD</td><td>W#16#0</td><td>Inc 1</td></tr>
<tr><td>+8.0</td><td>Var_05</td><td>WORD</td><td>W#16#0</td><td>Inc 2</td></tr>
<tr><td>=10.0</td><td></td><td>END_STRUCT</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>5</td><td>Save the block and load it into the PLC. This is done via the toolbar button displayed below. Note that loading to the CPU module is only possible while the operating mode switch is set to STOP or RUN-P.

</td></tr>
<tr><td>6</td><td>Programming the OB1.
Open the block in the program LAD/STL/SCF.
First, two values in the DB75 are added and then stored again in DB75.
Netzwerk 1: Addition
Adding two 16-Bit Values
The result is stored in another
16-Bit Value
OPN DB 75
L DBW 0
L DBW 2
+I
T DBW 4
Next, a value in the DB75 is incremented every second.</td></tr>
</table>

<table>
<tr><th>Step</th><th>G: Creating the STEP7 Program</th></tr>
<tr><td></td><td>

Network 2 : Second Cycle

```
Generation of a second cycle at M 0.0
```

```
      AN     M       0.0
      L      S5T#1S
      SD     T       1
      A      T       1
      =      M       0.0
```

Network 3: Counting in a second cycle

```
Counting a value in a second cycle
At 10000, reset to 0
```

```
      AN     M       0.0
      JC     M001
      L      DBW     6
      L      1
      +I
      T      DBW     6
      L      10000
      <I
      JC     M001
      L      0
      T      DBW     6
M001: NOP    0
```

Finally, a value in the *DB75* is incremented every time the *OB1* run.

Network 4 : Counting in the cycle time

```
Counting a value each time the OB is executed
At 10000, reset to 0
```

```
      L      DBW     8
      L      1
      +I
      T      DBW     8
      L      10000
      <I
      JC     M002
      L      0
      T      DBW     8
M002: NOP    0
```

</td></tr>
<tr><td>7</td><td>

Save the block *OB1* and load it into the PLC. This is done via the corresponding buttons on the toolbar.

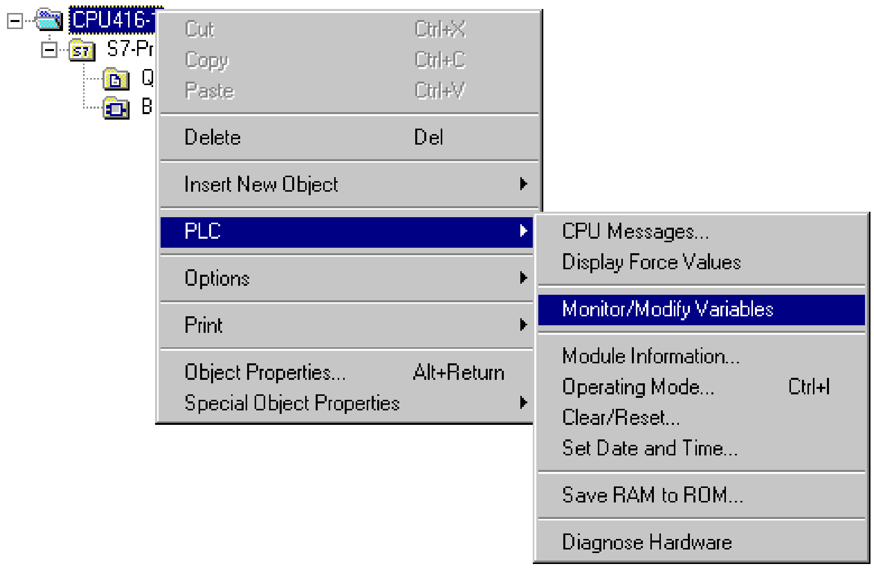
This completes the creation of the STEP7 project and it can now be run. Exit the program *LAD/STL/SCF*.

</td></tr>
</table>

H: Testing the STEP7 Program

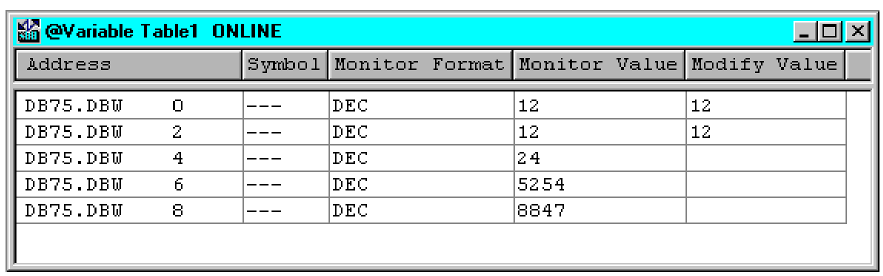
<table>
<tr><th>Step</th><th>H: Testing the STEP7 Program</th></tr>
<tr><td>1</td><td>
Testing the program with the STEP7 software.

For this purpose, a tag table is created. This is done in the SIMATIC Manager via a R on the entry of the configured CPU module and then selecting Target System → Monitor/Control Tag from the pop-up menu.



</td></tr>
<tr><td>2</td><td>
An editor for creating and using a tag table will be displayed.

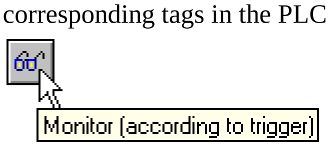
The following shows a completed tag table. In this table, enter all tags created in the DB75.



@Variable Table1 ONLINE

<table>
<tr><th>Address</th><th></th><th>Symbol</th><th>Monitor Format</th><th>Monitor Value</th><th>Modify Value</th></tr>
<tr><td>DB75.DBW</td><td>0</td><td>---</td><td>DEC</td><td>12</td><td>12</td></tr>
<tr><td>DB75.DBW</td><td>2</td><td>---</td><td>DEC</td><td>12</td><td>12</td></tr>
<tr><td>DB75.DBW</td><td>4</td><td>---</td><td>DEC</td><td>24</td><td></td></tr>
<tr><td>DB75.DBW</td><td>6</td><td>---</td><td>DEC</td><td>5254</td><td></td></tr>
<tr><td>DB75.DBW</td><td>8</td><td>---</td><td>DEC</td><td>8847</td><td></td></tr>
</table>
</td></tr>
<tr><td>3</td><td>
Monitoring the current tag values.

By clicking on the toolbar button displayed below, the current values of the corresponding tags in the PLC are displayed in the column Status Value.



Controlling the tag values.

Values can be entered in the column Control Value. By clicking on the toolbar button displayed below, these values will be written to the corresponding tags in the PLC.
</td></tr>
</table>

Step	H: Testing the STEP7 Program
	Note that tags can only be controlled while the operating mode switch of the CPU module is set to *RUN-P*. 
4	The created tag table can now be saved. In this sample, the table is saved under the name *VAT1*. After checking the program in the PLC, the tag table can be closed. This concludes the configuration of the STEP7 project and the *SIMATIC Manager* can be exited. 

5.3 Configuration of the S7 OPC Server

The following description details the steps necessary to configure the *S7 OPC Server*.

Overview of the Configuration Steps

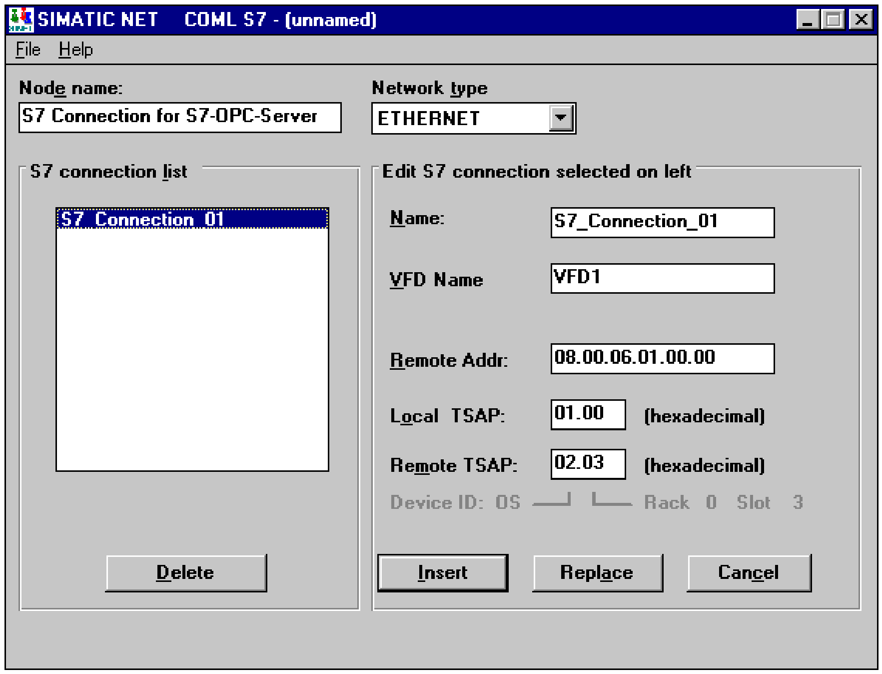
The following lists the steps necessary to configure the *S7 OPC Server*:

- A: Activating the S7 Protocol
- B: Installing the S7 OPC Server
- C: Setting the DCOM Configuration
- D: Configuring the S7 OPC Server
- E: Testing the S7 OPC Server

A: Activating the S7 Protocol

Step	**A: Activating the S7 Protocol**
1	Creation of the database file for the S7 Protocol using the program COML S7. This program is started via *Start* → *Simatic* → *SIMATIC NET* → *COML S7*. 
2	The program *COML S7* will be displayed. In the database file, define the *S7 Connection* which is going to be used by the *S7 OPC Server* to access the PLC. As the *Network Type*, select the entry *ETHERNET*. In the right area of the program's dialog box, the S7 connection properties can be defined. As the *Name* of the connection, enter *S7_Connection_01*, as the *VFD Name*, enter the name *VFD1*. The *Remote Address*, that is the Ethernet address of the communication processor in the PLC, this sample uses *08.00.06.01.00.00*.

<table>
<tr><th>Step</th><th>A: Activating the S7 Protocol</th></tr>
<tr><td></td><td>
As the Local TSAP, this sample uses 01.00. The first two digits represent a device identifier, the second two digits must always be 0. As the Remote TSAP, this sample uses 02.03. The first two digits represent the ID of the resource reserved for an operator station in the S7. The second two digits indicate the rack and slot number of the CPU module to be accessed.

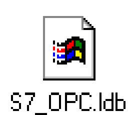
Clicking on the Add button adds the new S7 connection to the database file list of existing connections.


</td></tr>
<tr><td>3</td><td>
Save the settings made as a text file.

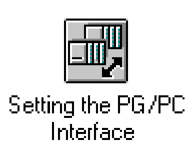
This is done via the File → Save Text DB menu. In this sample, the file is saved under the name S7_OPC.txt.

Generation of the binary database file.

This is done via the File → Generate Binary DB under menu. In this sample, the file is named S7_OPC.ldb.

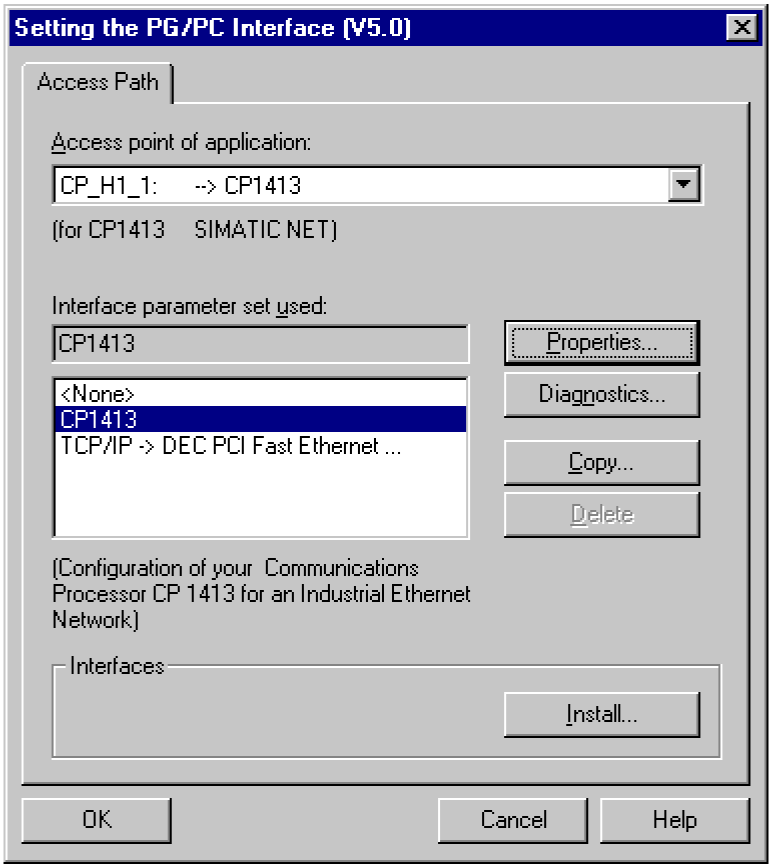
The program COML S7 can now be exited.


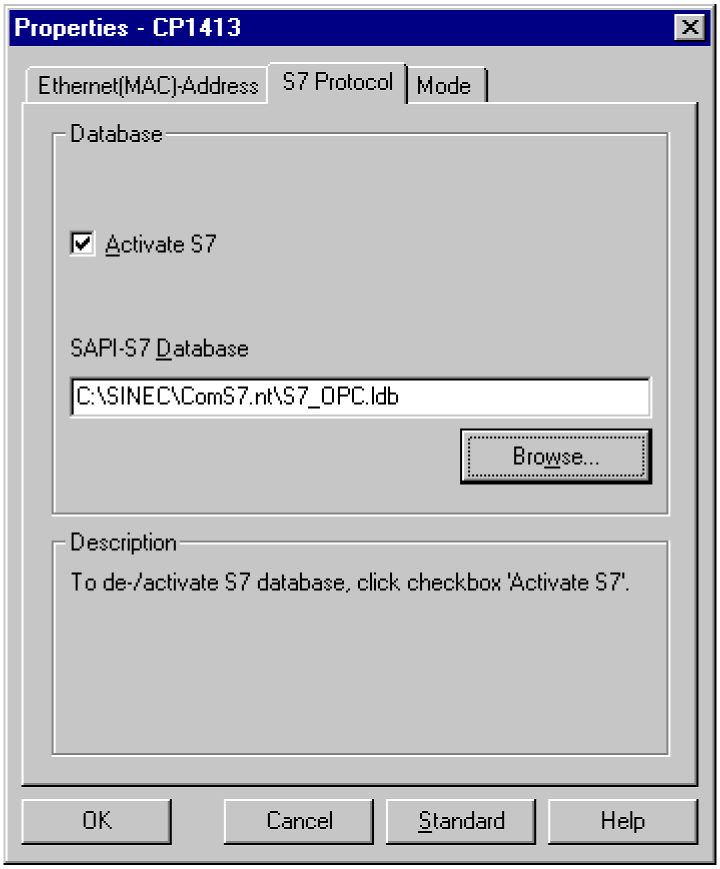
</td></tr>
<tr><td>4</td><td>
Activation of the S7 Protocol for the communication processor CP 1413 using the program Setting the PG/PC Interface.

This program is accessed via Start → Settings → Control Panel → Setting the PG/PC Interface.


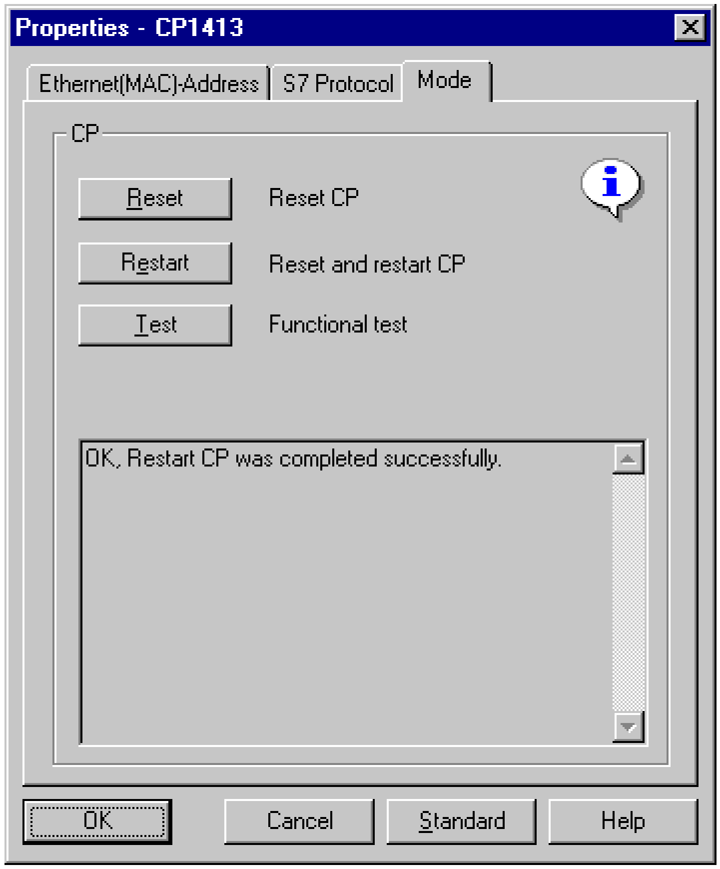
</td></tr>
</table>

Step	A: Activating the S7 Protocol
5	The program *Setting the PG/PC Interface* will be displayed. In this program, select the entry of the communication processor *CP 1413*. Make sure that the assignments between access points and the interfaces are not changed. Via the *Properties* button, the properties dialog box of the communication processor *CP 1413* is opened.



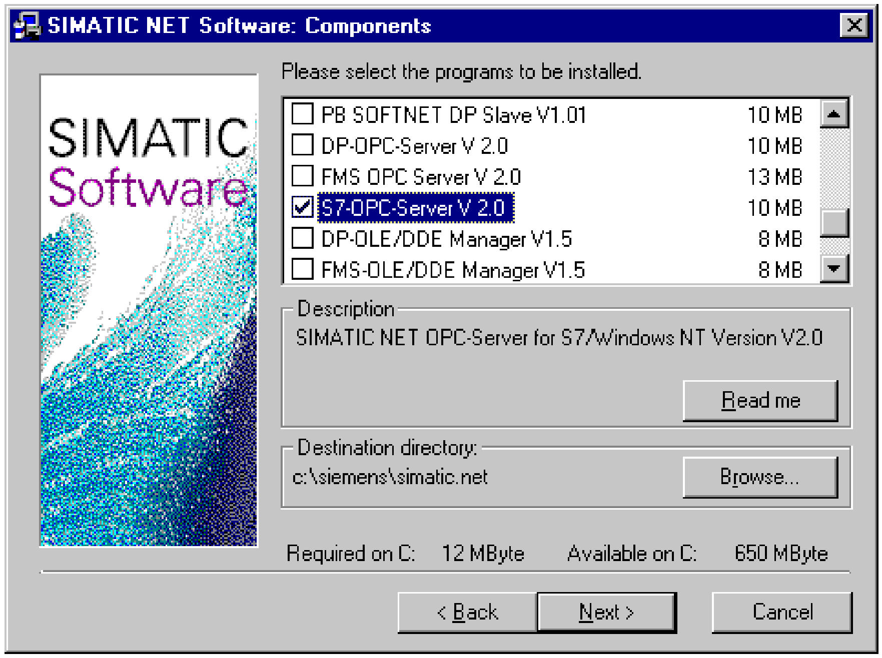
Step	**A: Activating the S7 Protocol**
6	The properties dialog box of the communication processor *CP 1413* will be displayed. In the S7 Protocol tab, select the check-box Activate S7. This enables the input field SAPI S7 Database below. In this field, specify the path to the previously created database file S7_OPC.ldb. You can use the Browse button to do this. 

Step	A: Activating the S7 Protocol
7	In the *Operating Status* tab, click on the *Restart* button to restart the communication processor. The settings made will become effective. Close the properties dialog box of the communication processor *CP 1413* by clicking on *OK*. The program *Setting the PG/PC Interface* can also be closed by clicking on *OK*.



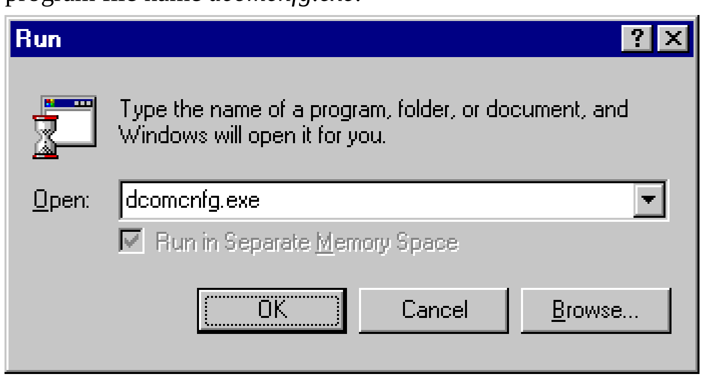
B: Installing the S7 OPC Server

Step	B: Installing the S7 OPC Server
1	Install the *S7 OPC Server* from the *SIMATIC NET* CD-ROM. After inserting the *SIMATIC NET* CD-ROM, the installation program is automatically started. If this is not the case, open the *Windows NT Explorer* and start the *setup.exe* program located on the CD-ROM. The installation of the software is started via the button displayed below.

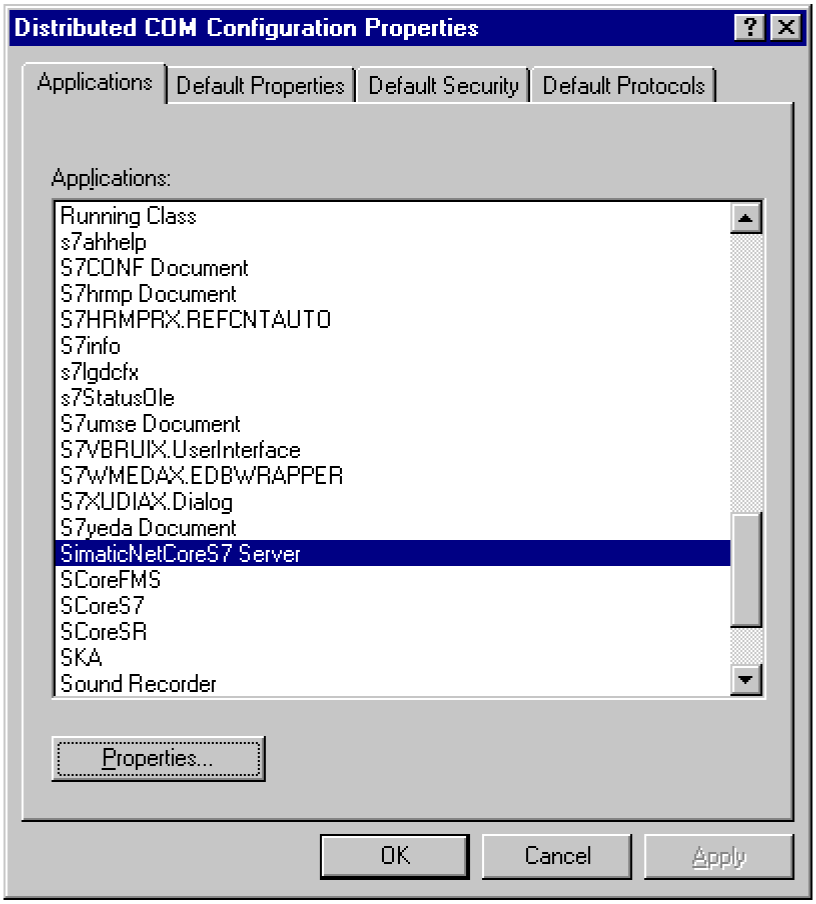
<table>
<tr><th>Step</th><th>B: Installing the S7 OPC Server</th></tr>
<tr><td></td><td>Follow the instructions of the installation program. On the Components page, select the check-box S7 OPC Server. Finish the installation. After the installation, a restart of the computer is required.


</td></tr>
</table>

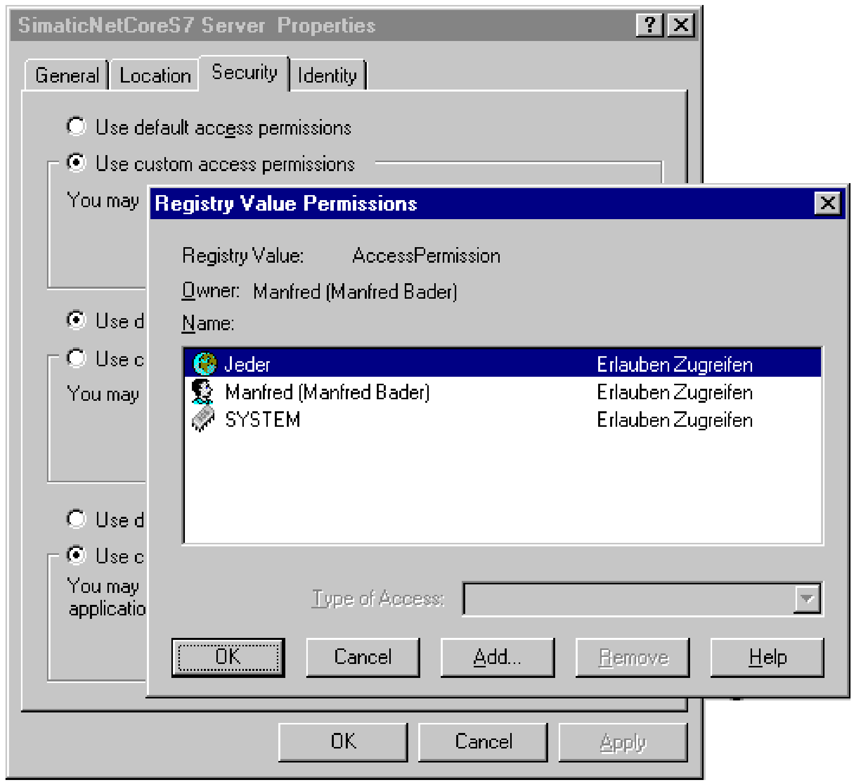
C: Setting the DCOM Configuration

<table>
<tr><th>Step</th><th>C: Setting the DCOM Configuration</th></tr>
<tr><td>1</td><td>Setting the DCOM configuration for the S7 OPC Server.
The DCOM configuration is set via the program DCOM Configuration Properties. This program is started via Start → Run and then entering the program file name dcomcnfg.exe.


</td></tr>
</table>

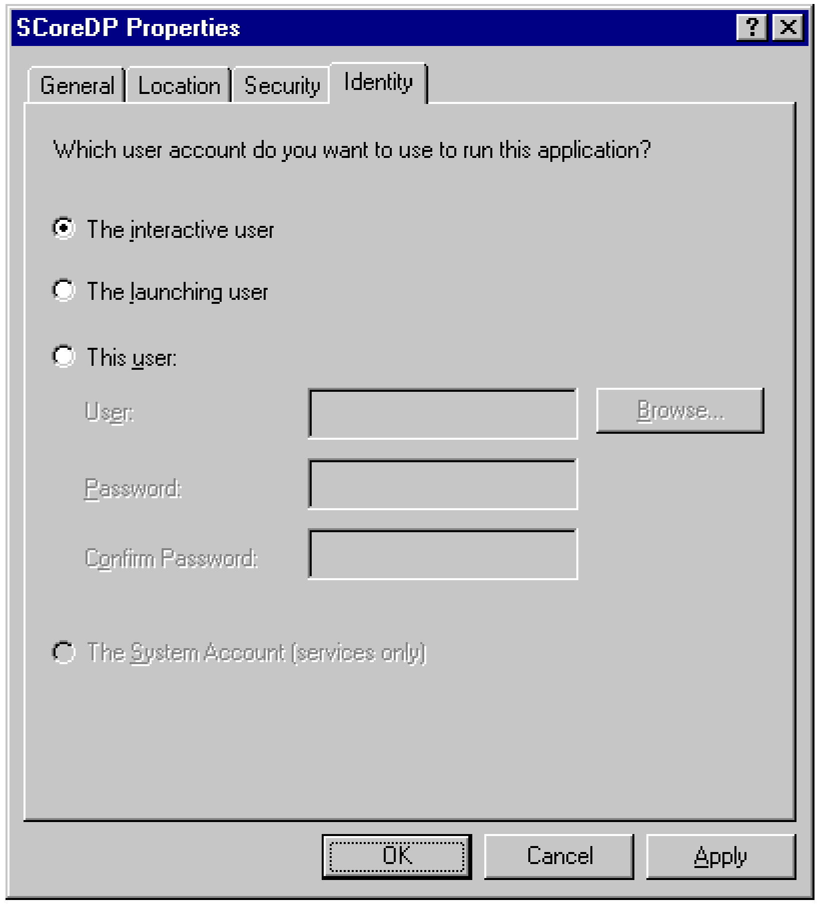
<table>
<tr><th>Step</th><th>C: Setting the DCOM Configuration</th></tr>
<tr><td>2</td><td>The program DCOM Configuration Properties will be displayed.
In the Applications tab, select the entry of the S7 OPC Server. This is the entry SimaticNetCoreS7 Server.
Clicking on the Properties button will open its properties dialog box.


</td></tr>
</table>

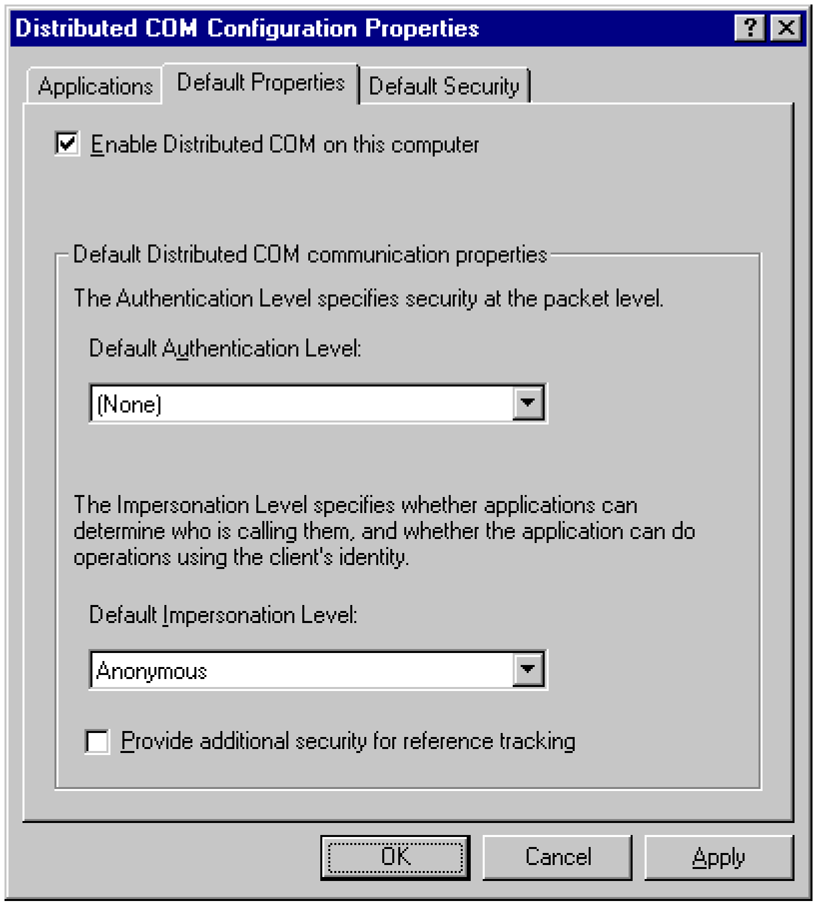
<table>
<tr><th>Step</th><th>C: Setting the DCOM Configuration</th></tr>
<tr><td>3</td><td>
The dialog box SimaticNetCoreS7 Server Properties will be displayed.
In the Securitytab, specify who has access to the S7 OPC Server. To do so, click on the radio-button Use custom access permissions. By clicking on the now enabled Edit button, set the access permissions. Among other things, the System must be accessible.
During the configuration phase it makes sense to give access permissions to everybody to rule out problems due to insufficient access rights. After the successful commissioning of the communication, you can still limit the access rights of certain users if necessary.


</td></tr>
</table>

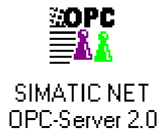
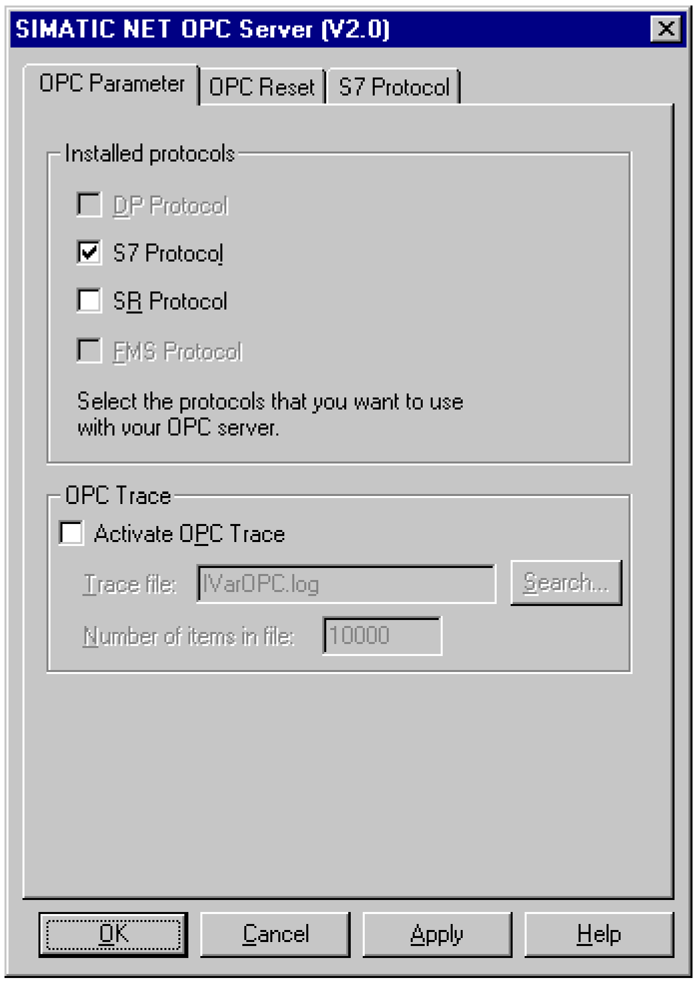
Step	C: Setting the DCOM Configuration
4	In the Identity tab, the radio-button The interactive user is selected. The dialog box *SimaticNetCoreS7 Server Properties* can be closed by clicking on *OK*. The program *DCOM Configuration Properties* can also be closed by clicking on *OK*.

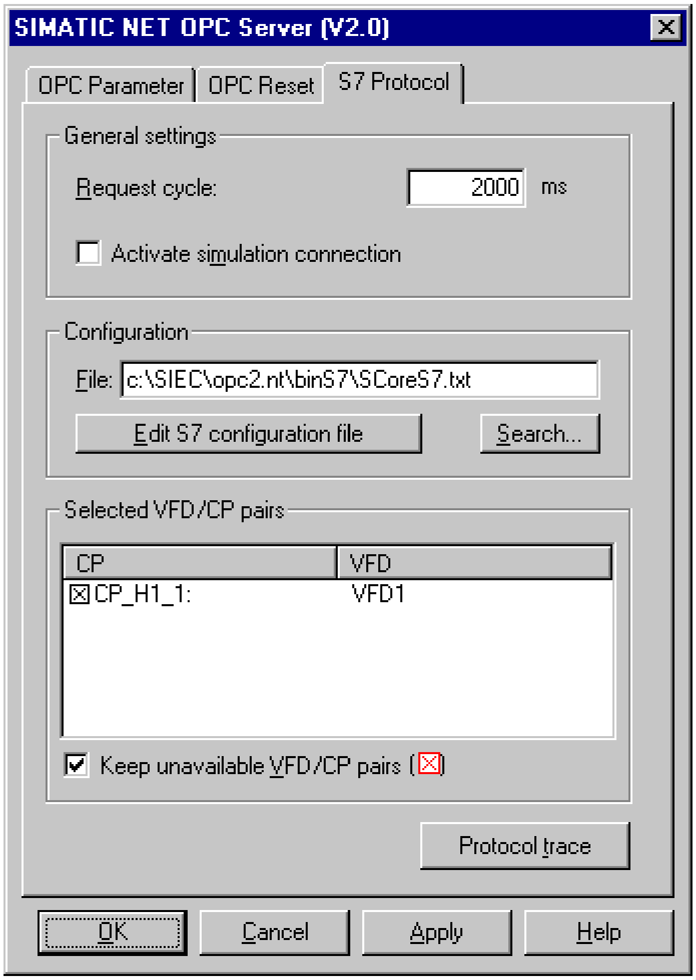


Step	C: Setting the DCOM Configuration
5	In the *Default Properties* tab, the general properties of the DCOM communication are defined. DCOM must be activated on the computer. Via the *Default Authentication Level* list box, the desired security at the packet level can be defined. Via the *Default Impersonation Level* list box, you can specify if accessing clients can be identified. During the configuration phase it makes sense to choose the lowest security level for both settings. This rules out problems caused by these settings from the beginning. The program *DCOM Configuration Properties* can also be exited by clicking on *OK*.

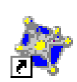


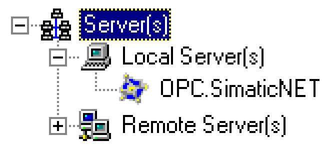
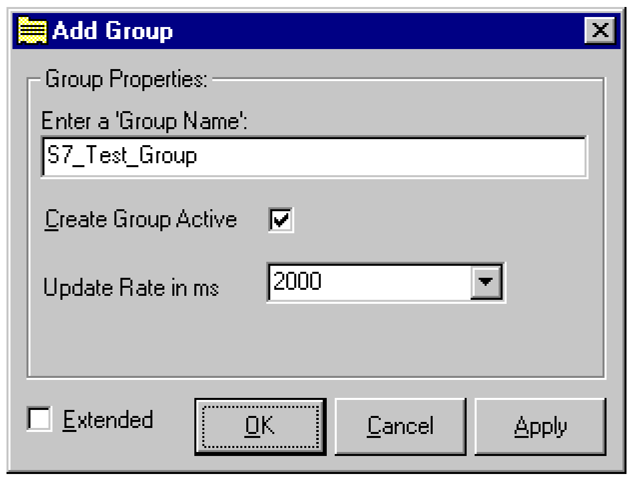
D: Configuring the S7 OPC Server

Step	D: Configuring the S7 OPC Server
1	Configuration of the *S7 OPC Server* via the program *SIMATIC NET OPC Server*. This program is started via *Start* → *Simatic* → *SIMATIC NET* → *OPC Server* → *OPC Settings*. 
2	The program *SIMATIC NET OPC Server* will be displayed. In the *OPC Parameters* tab, specify which protocols are to be supported by the *OPC Server*. In this sample, only the support for the *S7 Protocol* is needed. The check-box *SR Protocol* can be deselected. 

Step	D: Configuring the S7 OPC Server
3	In the *S7 Protocol* tab, additional settings for the communication with the *SIMATIC S7* can be made. As the scan cycle, this sample uses *2000 ms*. In the *Select CP/VFD Pairs* area, define which access points are to be used by the *S7 OPC Server* for the communication. In this sample, the access point *CP_H1_1:* is selected. The program *SIMATIC NET OPC Server* can be exited by clicking on *OK*. 

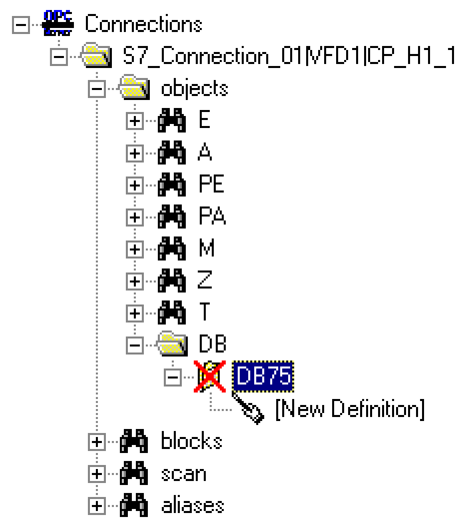
E: Testing the S7 OPC Server

Step	E: Testing the S7 OPC Server
1	Testing of the S7 OPC Server with the program OPC Scout. This program is started via *Start* → *Simatic* → *SIMATIC NET* → *OPC Server* → *OPC Scout*. 

<table>
<tr><th>Step</th><th>E: Testing the S7 OPC Server</th></tr>
<tr><td>2</td><td>The program OPC Scout will be displayed.
The left window lists all available OPC servers. The Local Server(s) list includes the entry of the S7 OPC Server. This is the entry OPC.SimaticNET. Via a D on the entry OPC.SimaticNET, a connection to the S7 OPC Server will be established.

</td></tr>
<tr><td>3</td><td>The dialog box Add Group will be displayed.
Via this dialog box, a new group can be created in the S7 OPC Server. Such a group is used to carry out the exchange of data between an OPC server and an OPC client. The group to be created must be given a name. The update cycle of this group is set to 2000 ms. Clicking on OK creates the group in the OPC Server.

</td></tr>
<tr><td>4</td><td>The new group will be listed as a sub-entry to the S7 OPC Server entry in the left window. At this time, the group is still empty. Now, the data to be requested from the OPC server is defined. The data provided by an OPC server is called an Item.
Via a D on the group in the left window, the required items can be specified.</td></tr>
<tr><td>5</td><td>The dialog box OPC Navigator will be displayed.
From this dialog box, all items provided by the server are accessible. Via a D on the entry of the connection S7_Connection_01 and then a D on the displayed entry objects, all object types available in the PLC will be displayed.</td></tr>
</table>

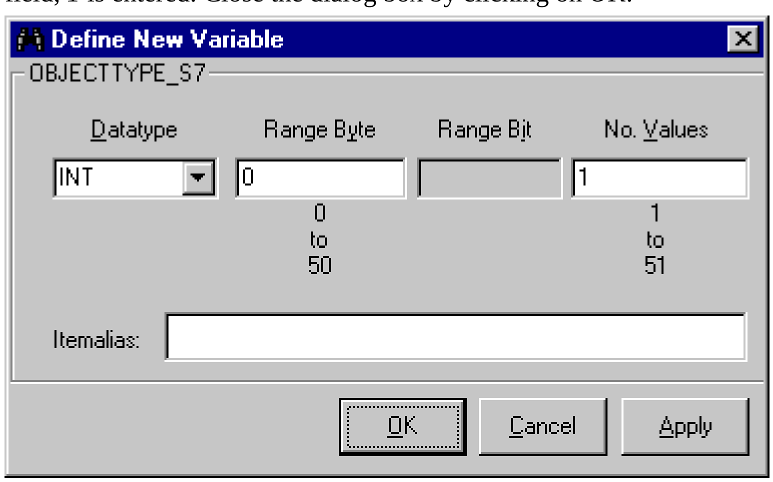
<table>
<tr><th>Step</th><th>E: Testing the S7 OPC Server</th></tr>
<tr><td></td><td>These object types also include data blocks. Via a D on the entry *DB*, the accessible data blocks are displayed. In this sample, only *DB75* is accessible.

Via a D on the entry *(New Definition)*, the required items can be defined.


</td></tr>
<tr><td>6</td><td>The dialog box *Define New Tag* will be displayed.

From this dialog box, a new item can be created. In this sample, the first item to be created corresponds to the first of the five tags created for the STEP7 program in the *DB75*.

In the *Data Type* field, the type of this item is set to *INT*. This corresponds to a Signed 16-Bit value. In the *Range Byte* field, the Byte number *0* is entered. This corresponds to the Byte number of the tag in the data block. In the *No. Values* field, *1* is entered. Close the dialog box by clicking on *OK*.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>E: Testing the S7 OPC Server</th></tr>
<tr><td>7</td><td>The column in the middle will now display the newly defined item.

For the remaining four tags of the DB75, define the corresponding items as described above. However, use the corresponding Byte number of the respective tag.

To insert the just defined items into the group, select them and move them to the right via the arrow button. By clicking on the OK button, they will be inserted into the group.

Name
DB75,INT000,1
DB75,INT002,1
DB75,INT004,1
DB75,INT006,1
DB75,INT008,1</td></tr>
<tr><td>8</td><td>The items inserted will be displayed in the right window of the program OPC Scout.

In the Value column, the current tag values will be displayed.

The program OPC Scout can be exited. You also have the option to save the just created project.

<table>
<tr><th></th><th>Item Names</th><th>Value</th><th>Format</th><th>Type</th></tr>
<tr><td>1</td><td>[S7:S7_Connection_01|VFD1|CP_H1_1:]DB75,INT000,1</td><td>0</td><td>Original</td><td>integer 16</td></tr>
<tr><td>2</td><td>[S7:S7_Connection_01|VFD1|CP_H1_1:]DB75,INT002,1</td><td>12</td><td>Original</td><td>integer 16</td></tr>
<tr><td>3</td><td>[S7:S7_Connection_01|VFD1|CP_H1_1:]DB75,INT004,1</td><td>12</td><td>Original</td><td>integer 16</td></tr>
<tr><td>4</td><td>[S7:S7_Connection_01|VFD1|CP_H1_1:]DB75,INT006,1</td><td>7230</td><td>Original</td><td>integer 16</td></tr>
<tr><td>5</td><td>[S7:S7_Connection_01|VFD1|CP_H1_1:]DB75,INT008,1</td><td>7978</td><td>Original</td><td>integer 16</td></tr>
</table></td></tr>
</table>

5.4 Creation of the WinCC Project WinCC_S7_OPC

The following description details the configuration steps necessary to create and start up the WinCC project *WinCC_S7_OPC*.

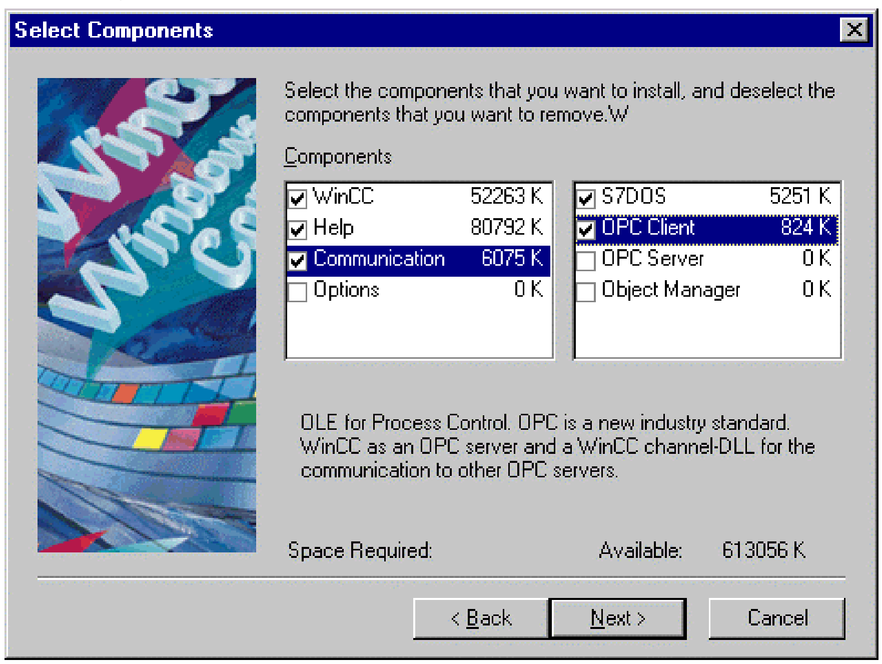
Overview of the Configuration Steps

The following lists the configuration steps necessary to create the WinCC project *WinCC_S7_OPC*:

- A: Installing the OPC Client
- B: Creating the WinCC Project
- C: Creating the Connection
- D: Conventional Configuration
- E: Creating the WinCC Screen

A: Installing the OPC Client

Step	A: Installing the OPC Client
1	During the installation of WinCC, the *OPC Client* can be installed as an option. If the OPC client has not been installed yet, it can also be installed afterwards without any problems.



B: Creating the WinCC Project

<table>
<tr><th>Step</th><th>B: Creating the WinCC Project</th></tr>
<tr><td>1</td><td>Creation of a new WinCC project in the WinCC Explorer.

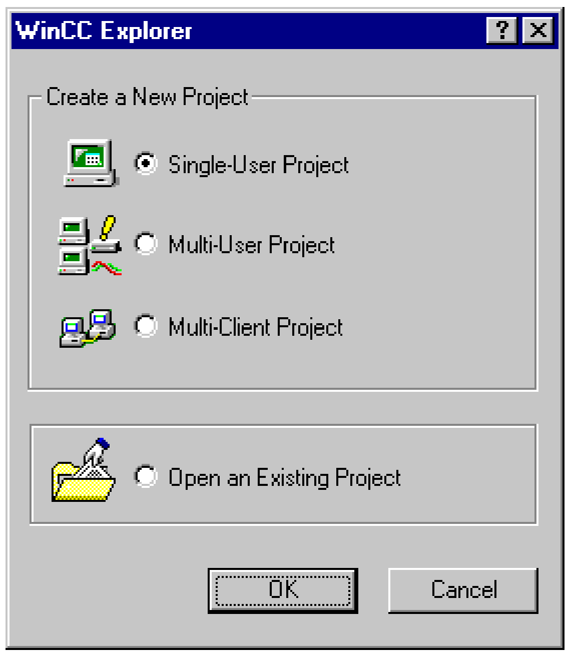
The WinCC Explorer is started via Start → Simatic → WinCC → Windows Control Center.

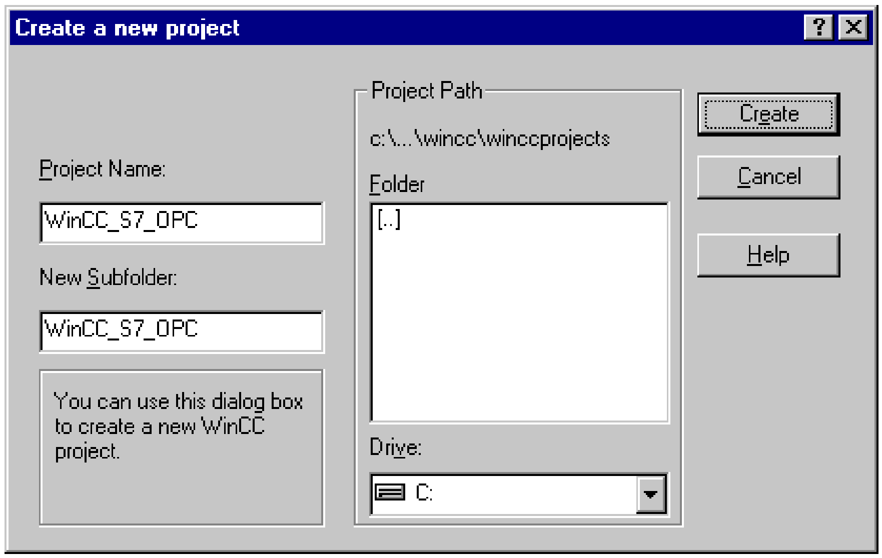

</td></tr>
<tr><td>2</td><td>The WinCC Explorer will be displayed.

Via the menus File → New, the dialog box for specifying the properties of a new WinCC project will be opened.

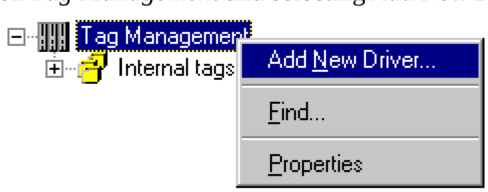
For this sample project, a Single-User Project is created.

Exit the dialog box by clicking on OK.


</td></tr>
</table>

Step	B: Creating the WinCC Project
3	The dialog box *Create a new Project* will be displayed. Specify a *Project Name* for the new project. The names of the WinCC projects created within the framework of this manual all start with *WinCC* and also include a reference to the communication partner and communication type used. The project of this sample has the name *WinCC_S7_OPC*. In the *Project Path* field, set the storage location of the new project. The dialog box *Create a new Project* is concluded by clicking on the *Create* button. 

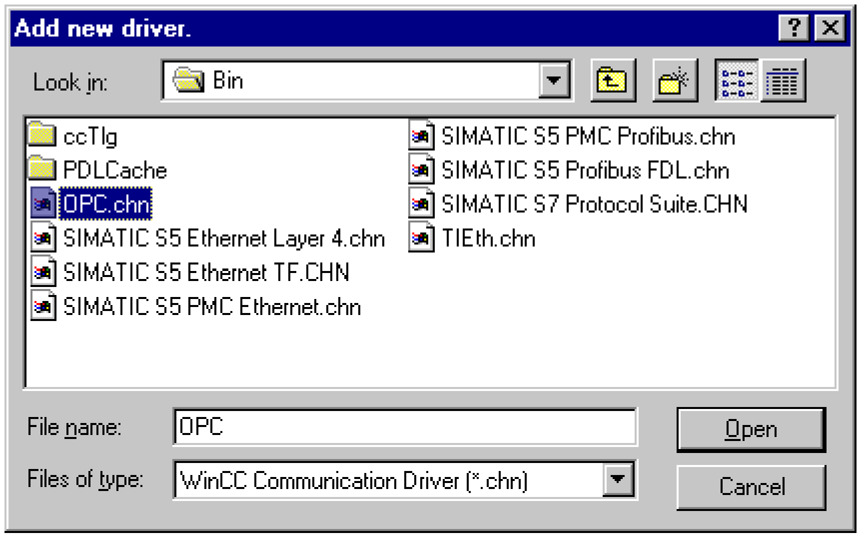
C: Creating the Connection

Step	C: Creating the Connection
1	The new project will be displayed in the *WinCC Explorer*. Installation of the required communication driver. This is performed via a R on *Tag Management* and selecting *Add New Driver* from the pop-up menu. 

<table>
<tr><th>Step</th><th>C: Creating the Connection</th></tr>
<tr><td>2</td><td>

The dialog box *Add New Driver* will be displayed.

This dialog box lists all communication drivers that can be installed. This sample requires the communication driver *OPC*. Select this driver from the dialog box. Exit the dialog box by clicking on *Open*.



</td></tr>
<tr><td>3</td><td>

The newly added communication driver *OPC* will be displayed as a sub-entry to *Tag Management*.

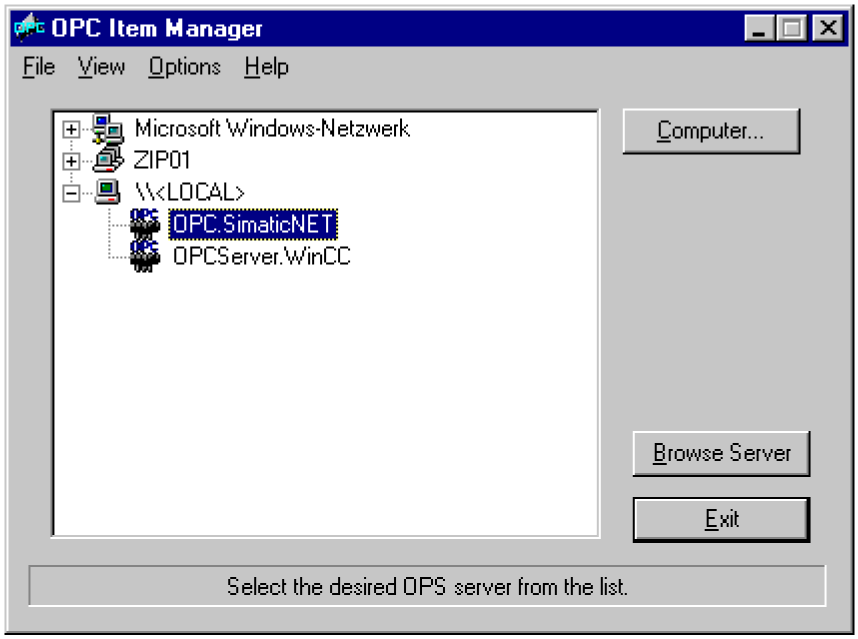
The communication driver *OPC* contains one channel unit.

The creation of a connection to a certain OPC server and the selection of the items required by this server can be carried out via the OPC Item Manager. The OPC Item Manager is started via ´ R on the channel unit OPC Groups (OPCHN Unit #1) and then selecting System Parameters from the pop-up menu.

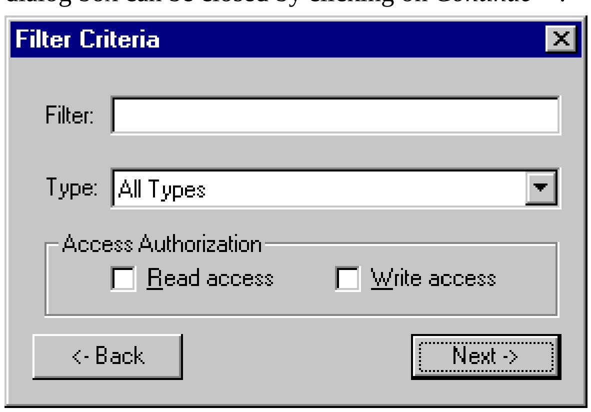
</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Creating the Connection</th></tr>
<tr><td>4</td><td>
The OPC Item Manager will be displayed.

The desired OPC server can be selected from here. This server can be located on the local computer or on another computer accessible by the network. In this sample, the selected OPC server is located on the local computer.

Via a D on the LOCAL entry, all OPC servers available on the local computer will be listed. Select the entry OPC.SimaticNET of the S7 OPC Server. Clicking on the button Browse Server displays a selection dialog box for selecting the items available from the S7 OPC Server.


</td></tr>
<tr><td>5</td><td>
The dialog box Filter Criteria will be displayed.

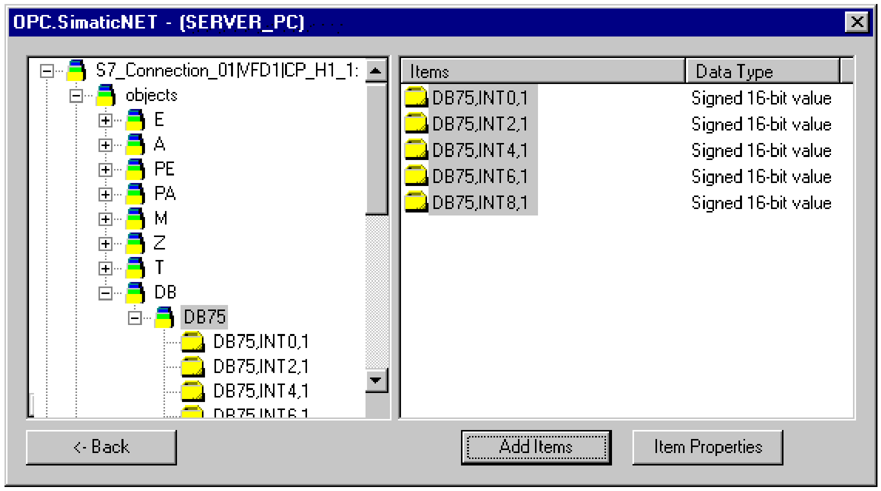
Using this dialog box, the type of the desired items can be specified more exactly. If you want to display all available items, no settings are required. The dialog box can be closed by clicking on Continue->.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Creating the Connection</th></tr>
<tr><td>6</td><td>
A dialog box for selecting the desired items will be displayed.

As a sub-entry to the group *DB*, this sample only contains *DB75*. The group *DB75* contains the five items defined in the previous section with the *OPC Scout*. These items represent the five tags in the PLC.

These five items of the *DB75* must be selected in the right window. By clicking on the button *Add Items*, they will be inserted into the WinCC project.



</td></tr>
<tr><td>7</td><td>
This requires the creation of a new connection into which these items can be inserted as WinCC tags.

This connection can be created automatically by the *OPC Item Manager*. The dialog box *New Connection* will be displayed. In this dialog box, only the name of the new connection must be entered. In this sample, the name *S7_OPC_01* is used. Close the dialog box by clicking on *OK*.

</td></tr>
</table>

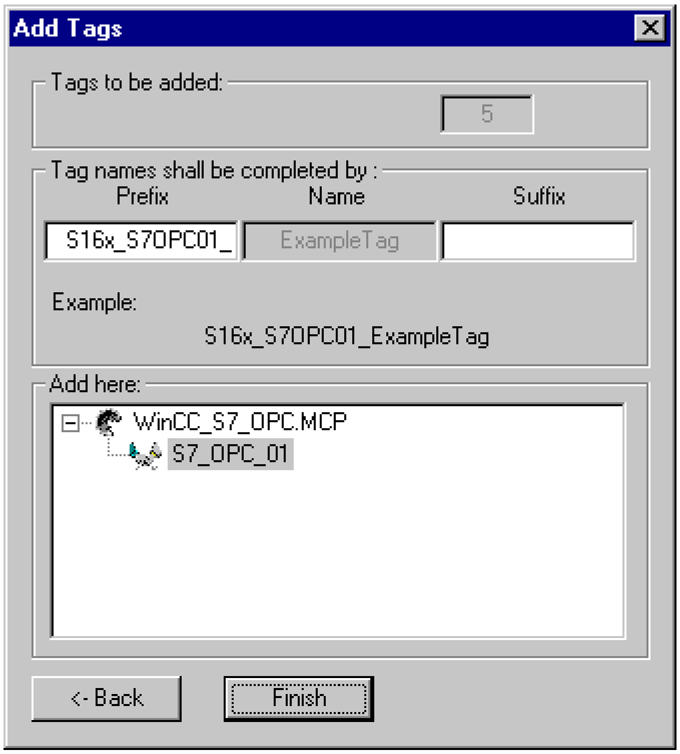
<table>
<tr><th>Step</th><th>C: Creating the Connection</th></tr>
<tr><td>8</td><td>The dialog box <i>Add Tags</i> will be displayed.

In this dialog box, the connection is defined to which the tags are added. In this sample, the tags are added to the connection <i>S7_OPC_01</i> created previously. This connection is selected from the field <i>Add Here</i> at the bottom.

Optionally, a <i>Prefix</i> and a <i>Suffix</i> can be added to the tag names used by the <i>OPC Item Manager</i>. In this sample, the <i>prefix S16x_S7OPC01_</i> is placed in front of the tag names.

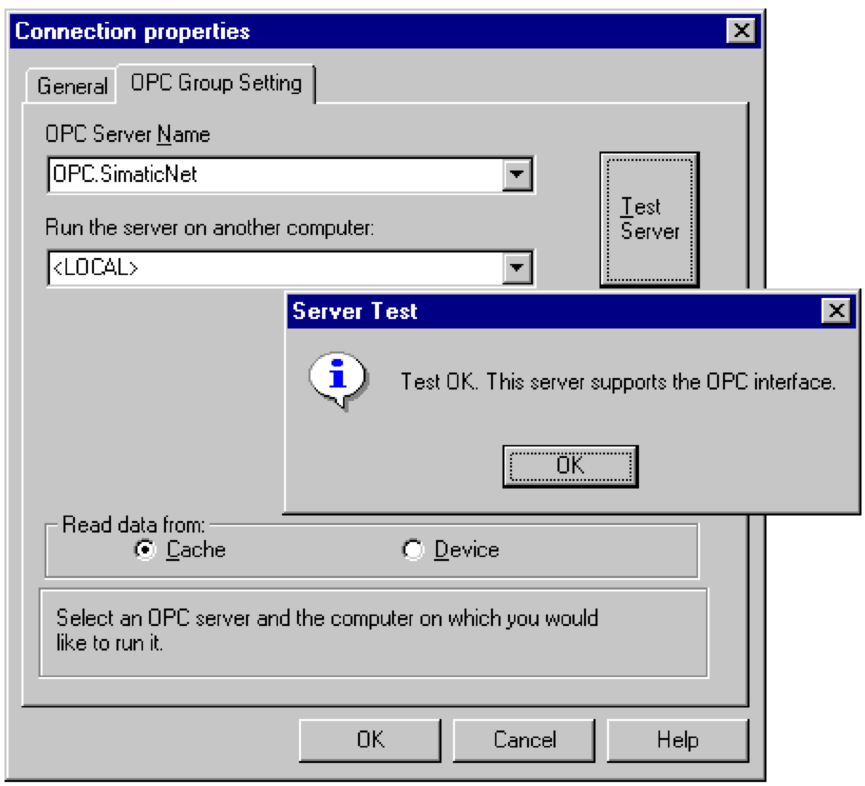
Clicking on the <i>Finish</i> button creates the WinCC tags.

The dialog box for the selection of the desired items can be exited via the <-<i>Back</i> button. The <i>OPC Item Manager</i> can be exited via the <i>Close</i> button.


</td></tr>
<tr><td>9</td><td>The following graphic lists the WinCC tags created by the OPC Item Manager.

<table>
<tr><th>Name</th><th>Type</th><th>Parameters</th></tr>
<tr><td>S16x_S7OPC01_DB75_INT0_1</td><td>Sig...</td><td>"S7:[S7_Connection_01|VFD1|CP_H1_1:]DB75,INT0,1", "", 2</td></tr>
<tr><td>S16x_S7OPC01_DB75_INT2_1</td><td>Sig...</td><td>"S7:[S7_Connection_01|VFD1|CP_H1_1:]DB75,INT2,1", "", 2</td></tr>
<tr><td>S16x_S7OPC01_DB75_INT4_1</td><td>Sig...</td><td>"S7:[S7_Connection_01|VFD1|CP_H1_1:]DB75,INT4,1", "", 2</td></tr>
<tr><td>S16x_S7OPC01_DB75_INT6_1</td><td>Sig...</td><td>"S7:[S7_Connection_01|VFD1|CP_H1_1:]DB75,INT6,1", "", 2</td></tr>
<tr><td>S16x_S7OPC01_DB75_INT8_1</td><td>Sig...</td><td>"S7:[S7_Connection_01|VFD1|CP_H1_1:]DB75,INT8,1", "", 2</td></tr>
</table></td></tr>
</table>

D: Conventional Configuration

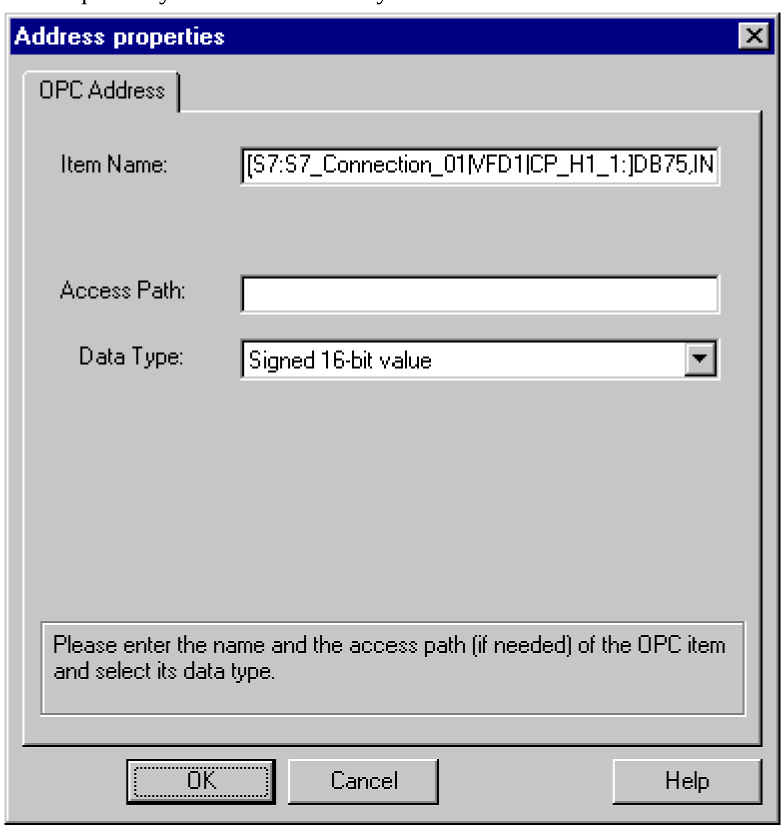
Step	D: Conventional Configuration
1	In addition to the procedure described above for the automatic creation of a connection for the *OPC* communication driver, there is also the option to create the connection using the conventional method. The actions required are described in this step. A new connection is created via a R on the channel unit of the communication driver *OPC* and then selecting *New Driver Connection* from the pop-up menu. The dialog box *Connection Properties* will be displayed. In the *General* tab, the *Name* of the new connection is entered. In the *OPC Connection* tab, specify the OPC server to be used. In the *OPC Server Name* field, enter the name of the OPC server to be used and in the field below, enter the name of the computer on which the OPC server is located. Clicking on the *Test Server* button allows you to check, if a connection to the desired OPC server can be established. Clicking on the *OK* button creates the new connection. 
2	In addition to the procedure described above for the automatic creation of the tags, there is also the option to create the tags using the conventional method. The actions required are described in this step. A new tag is created via a R on the entry of the appropriate connection (in this sample, this is the connection *S7_OPC_01*) and then selecting *New Tag* from the pop-up menu. The dialog box *Tag Properties* will be displayed.

<table>
<tr><th>Step</th><th>D: Conventional Configuration</th></tr>
<tr><td></td><td>
In this dialog box, the name of the tag and its data type is defined. The address of the tag is set via the Select button.

The dialog box Address Properties will be displayed.

In the Item Name field, specify the name of the desired item from the OPC server. This name contains the address information. The syntax of this address information is explained by means of the first tag to be created within the framework of this sample. Its Item Name is
[S7:S7_Connection_01|VFD1|CP_H1_1:]DB75,INT0,1
.

• S7 specifies the OPC server type used (FMS and DP are other examples of available OPC servers from SIMATIC NET).
• S7_Connection_01 is the name of the S7 connection.
• VFD1 is the VFD name (Virtual Field Device).
• CP_H1_1: is the access point used.
• DB75 indicates the data block number.
• INT0 indicates that it is a Signed 16-Bit Value with a start address of 0.
• 1 indicates that it is a single tag as opposed to an array consisting of multiple tags.

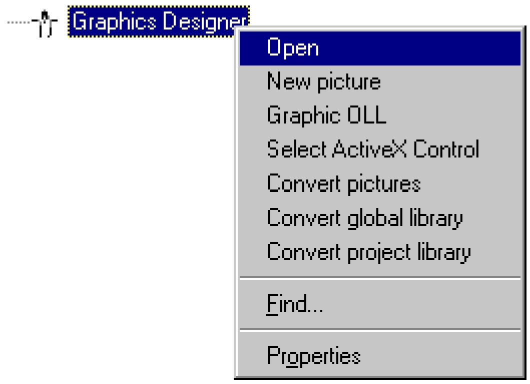
The required syntax must be strictly adhered to.


</td></tr>
</table>

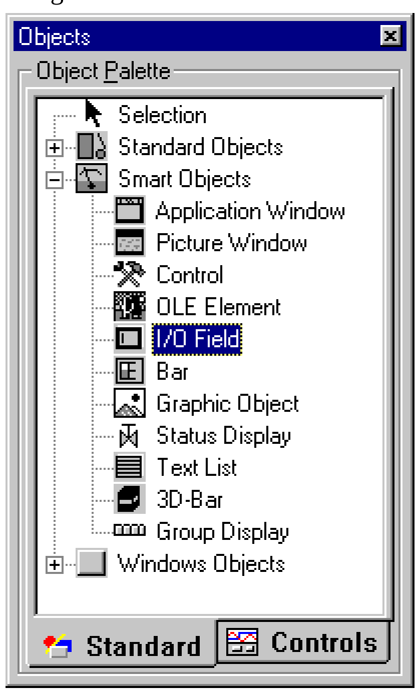
E: Creating the WinCC Screen

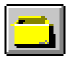
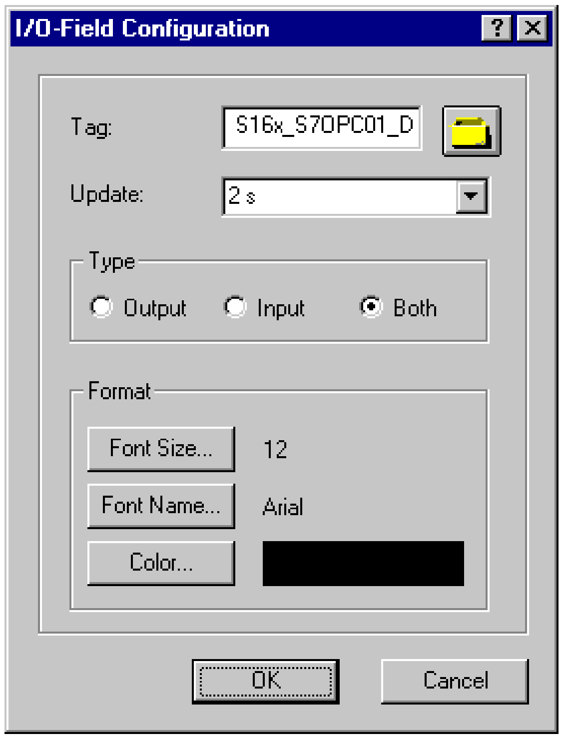
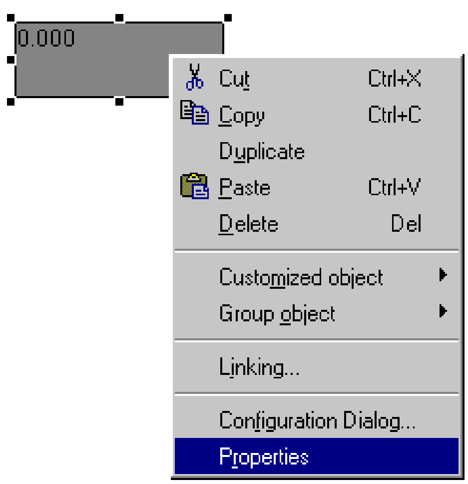
<table>
<tr><th>Step</th><th>E: Creating the WinCC Screen</th></tr>
<tr><td>1</td><td>Creation of a WinCC screen in which the previously created tags are visualized.

Open the Graphics Designer editor via a R and then selecting Open from the pop-up menu.

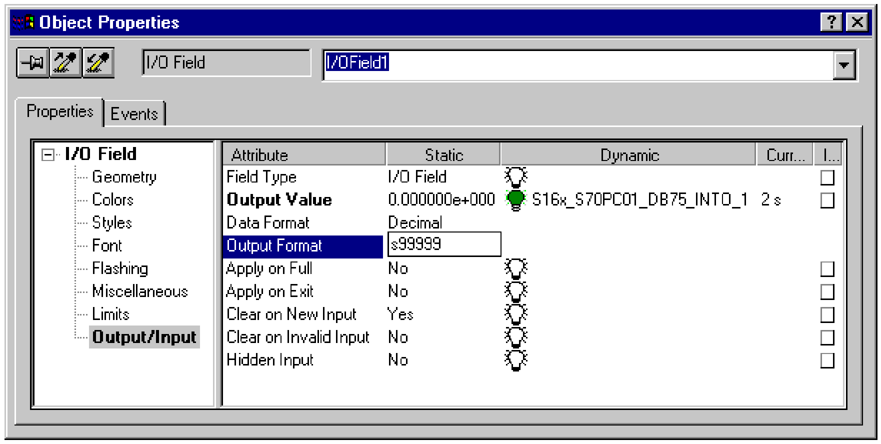
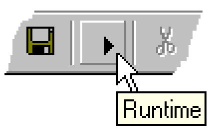

</td></tr>
<tr><td>2</td><td>This will open the Graphics Designer editor with a new (blank) screen.

To display the first tag, configure a Smart Object → I/O Field. To do so, select the I/O Field object from the Object Palette and place it on the screen using the mouse.

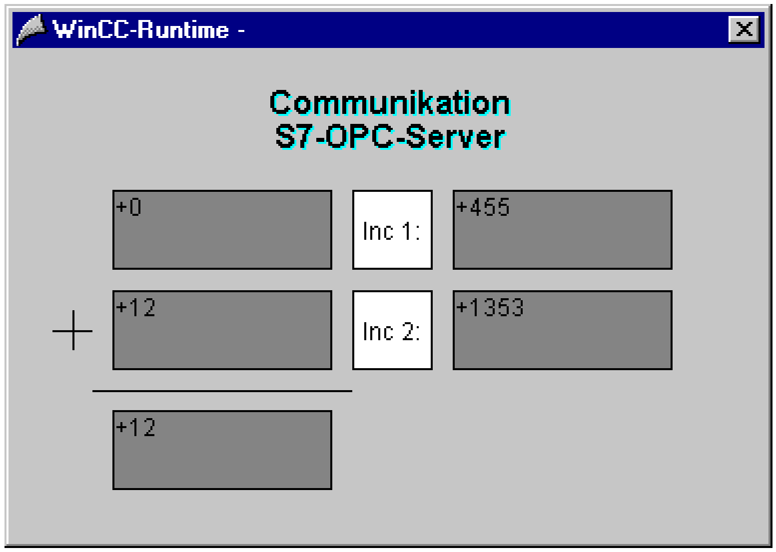

</td></tr>
</table>

Step	E: Creating the WinCC Screen
3	After placing the *I/O Field* on the screen, its *Configuration* dialog box will be displayed. In the *Tag* field, set the tag *S16x_S7OPC01_DB75_INT0_1* via the button displayed below.  Leave the *Update* of the tag at *2 s*. Keep the default settings for the remaining options. Close the dialog box by clicking on *OK*. 
4	Changing the output format of the *I/O Field*. For this, open its properties dialog box via a R on the *I/O Field* and then select *Properties* from the pop-up menu. 

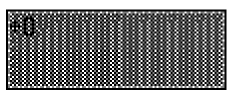
<table>
<tr><th>Step</th><th>E: Creating the WinCC Screen</th></tr>
<tr><td>5</td><td>The dialog box Object Properties will be displayed.

On the left side of the Properties tab, select the entry Output/Input. Via a D on the output format set, the field can be edited. Select the new format s99999. This format enables the I/O Field to display signed values with a maximum of 5 digits.

</td></tr>
<tr><td>6</td><td>Creation of four additional I/O Fields for the display of the remaining tags.
Follow steps 2 to 5 to create the remaining I/O fields.</td></tr>
<tr><td>7</td><td>Save the screen.
In the sample project, the screen is saved under the name com_3_S7OPC_01.pdl. The screen can be switched directly to runtime from the Graphics Designer via the button displayed below.

</td></tr>
</table>

<table>
<tr><th>Step</th><th>E: Creating the WinCC Screen</th></tr>
<tr><td></td><td>
If the screen is in runtime, the PLC started and the network connection established, the current values of the PLC will be displayed in the I/O fields. They can be changed by entering values in the individual I/O Fields.



If there is no connection to the PLC, the I/O Fields will be displayed grayed out. In this case an error is present at some point of the communication connection.



</td></tr>
</table>

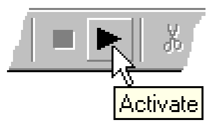
5.5 Diagnosis of the Communication Connection

The following describes the options available for diagnosing the communication connection between the WinCC project *WinCC_S7_OPC* and the SIMATIC S7 station.

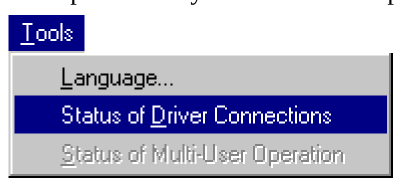
WinCC Explorer

<table>
<tr><th>Step</th><th>WinCC Explorer</th></tr>
<tr><td>1</td><td>
Diagnosis of the communication connection from the WinCC Explorer.

Switch the project WinCC_S7_OPC into runtime. This is done from the WinCC Explorer via the toolbar button displayed below.



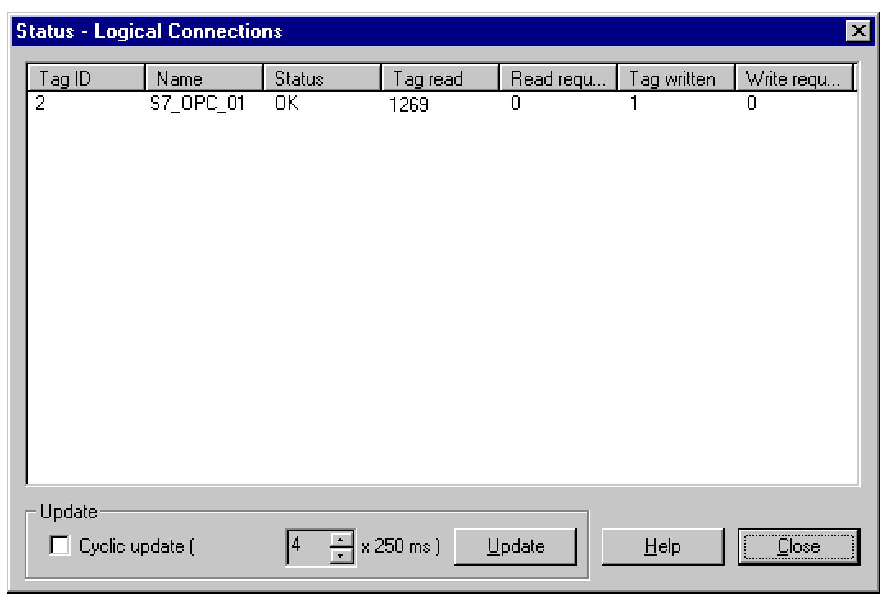
The created WinCC screen com_3_S7OPC_01.pdl can also be switched directly from the Graphics Designer into runtime.
</td></tr>
<tr><td>2</td><td>
In the WinCC Explorer, a dialog box for monitoring all configured connections can be accessed via the Tools → Status of Driver Connections menu. This menu point is only accessible if the project is in runtime.



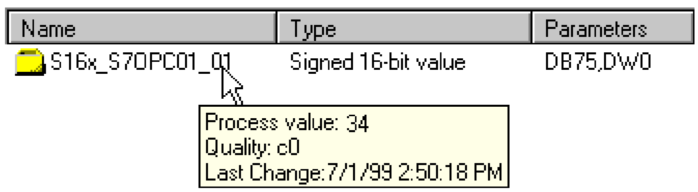
</td></tr>
<tr><td>3</td><td>
The dialog box Status - Logical Connections will be displayed.

This dialog box lists all configured connections. For this sample, only the connection S7_OPC_01 will be displayed.

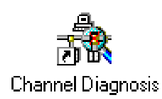
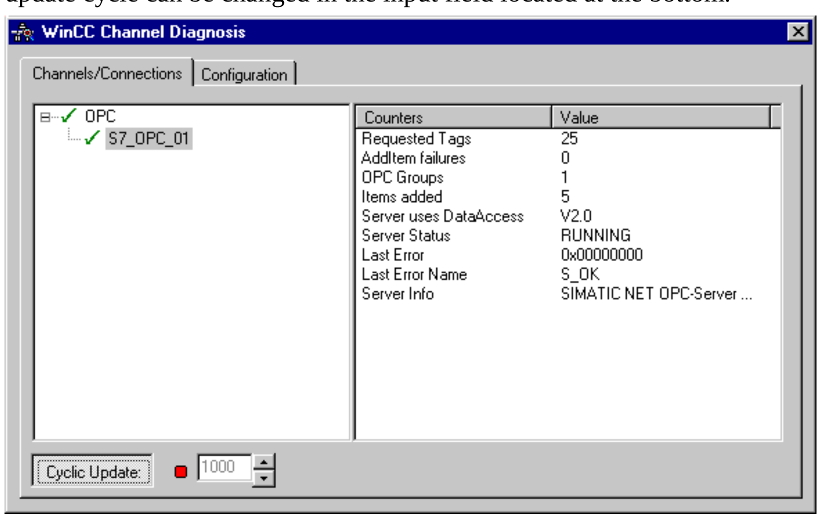
The displayed values correspond to the status at the moment the dialog box was opened. By selecting the appropriate check-box, a Cyclic Update of the display can be achieved.



</td></tr>
</table>

Step	WinCC Explorer
4	Another way to obtain information about the connection status in general and about the connection status of individual tags is provided by *Tag Management*. The status of a configured connection can be displayed as a tooltip by simply pointing the mouse on the connection in question.  The current process value of a certain tag as well as its status can be displayed as a tooltip by pointing the mouse on it. This allows you to detect errors concerning an individual tag and not the entire connection. 

Channel Diagnosis

Step	Channel Diagnosis
1	Diagnosis of the communication connection via the program *WinCC Channel Diagnosis*. Start this program via *Start* → *Simatic* → *WinCC* → *Channel Diagnosis*. 
2	The program *WinCC Channel Diagnosis* will be displayed. The *Channels/Connections* tab displays detailed information about the status of each configured connection. By default, the display is updated every second. The update cycle can be changed in the input field located at the bottom. 

6 Communication to the SIMATIC S7 via PROFIBUS

The projects created in this chapter can also be copied directly from the online document to your hard drive. By default, they will be copied to the folder C:\Communication_Manual. You have the option to copy the following components to the hard drive:

S7_PB

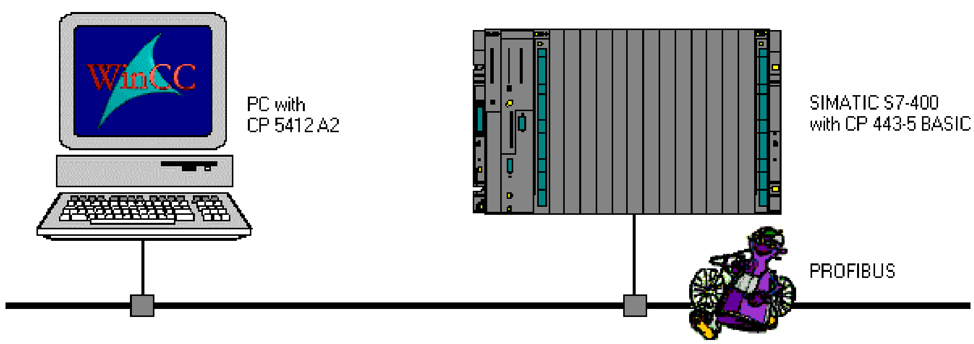
The STEP7 project we will create.

WinCC_S7_PB

The WinCC project we will create.

This chapter describes in detail the startup of a communication connection between a SIMATIC S7 and WinCC. The communication connection will be realized via PROFIBUS. The communication card CP 5412 A2 used in the computer has its own CPU onboard. This will free the CPU of the computer from communication tasks.

Overview of the Structure of the Sample



On the computer side, the connection to the *Industrial Ethernet* network is established via the communication processor *CP 5412 A2*. To install this communication processor in the computer, the driver *PB S7-5412*, located on the *SIMATIC NET* CD-ROM, is needed.
In the WinCC project, the communication driver *SIMATIC S7 Protocol Suite* must be installed. Via its channel unit *PROFIBUS*, the connection to the *SIMATIC S7* is configured.
The PLC is equipped with a *CPU 416-1* module. The connection to the network is established via the communication processor *CP 443-5 BASIC*. For the configuration of this communication processor with the STEP7 software, the option package *NCM S7 PROFIBUS* is required.

Overview of the Configuration Steps

The following lists all configuration steps necessary for the creation of the communication connection:

- Startup of the Communication Processor CP 5412 A2
- Creation of the STEP7 Project S7_PB
- Creation of the WinCC Project WinCC_S7_PB
- Diagnosis of the Communication Connection

Required Software

Name	**Description**
SIMATIC NET	Driver *PB S7-5412* from the *SIMATIC NET* CD-ROM for the installation of the communication processor *CP 5412 A2*.
STEP7	STEP7 software with option package *NCM S7 PROFIBUS* for the creation of the STEP7 project.
WinCC	WinCC with the communication driver *SIMATIC S7 Protocol Suite* for the creation of the WinCC project.

Required Computer Hardware

Name	**Description**
Communication Processor	Communication processor *CP 5412 A2* to establish the connection to the PLC's communication processor.

Required PLC Hardware

Name	**Description**
Rack	Rack *UR1*
Power Supply	Power supply *PS 407 10A* in slot 1 and 2.
CPU Module	CPU module *CPU 416-1* in slot 3.
Communication Processor	Communication processor *CP 443-5 BASIC* in slot 4.

6.1 Startup of the Communication Processor CP 5412 A2

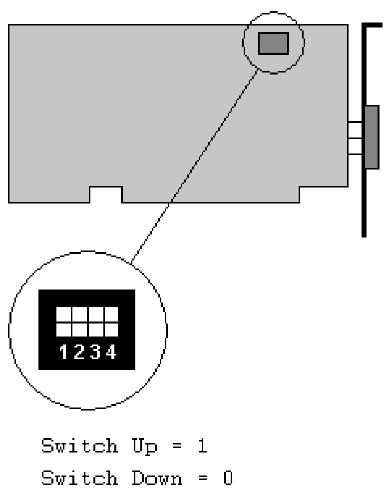
The following description details the configuration steps necessary to successfully start up the communication processor *CP 5412 A2*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to start up the communication processor *CP 5412 A2*:

- A: Mounting the Communication Processor in the Computer
- B: Installing the Communication Driver
- C: Installing the Communication Processor
- D: Assigning the Communication Processor
- E: Testing the Communication Processor

A: Mounting the Communication Processor in the Computer

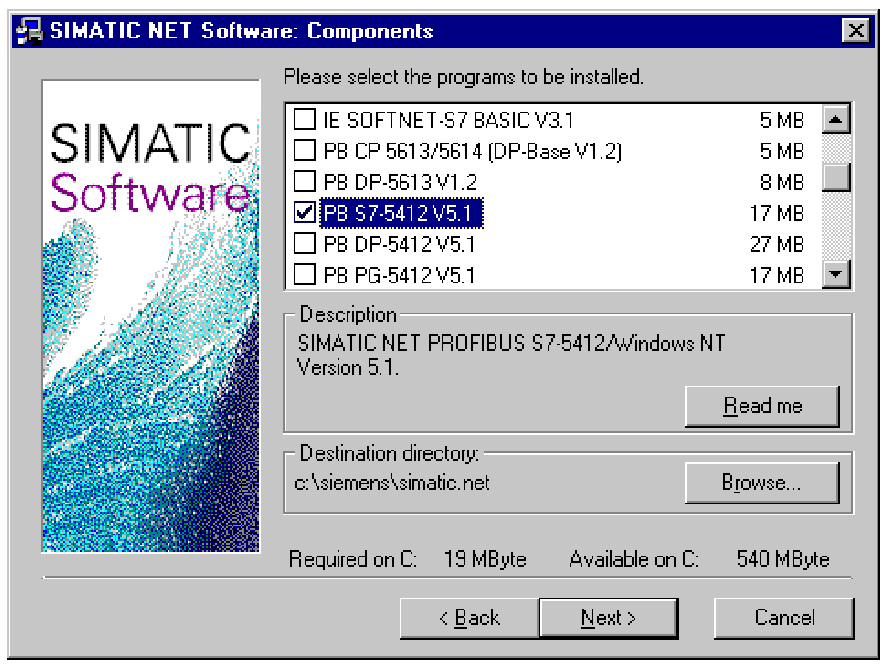
<table>
<tr><th>Step</th><th>A: Mounting the Communication Processor in the Computer</th></tr>
<tr><td>1</td><td>
Check the selected jumper settings at the CP 5412 A2.
During the installation of the CP 5412 A2, the I/O Range must be specified. The I/O Range is set via jumpers.
By default, the I/O Range is set to 0240-0243. However, other settings are also possible. The following graphic illustrates the jumper settings necessary for the various I/O Ranges.


<table>
<tr><th>I/O Area</th><th>1-2-3-4</th></tr>
<tr><td>0240-0243</td><td>0 0 0 0</td></tr>
<tr><td>0244-0247</td><td>0 0 0 1</td></tr>
<tr><td>0248-024B</td><td>0 0 1 0</td></tr>
<tr><td>024C-024F</td><td>0 0 1 1</td></tr>
<tr><td>0280-0283</td><td>0 1 0 0</td></tr>
<tr><td>0284-0287</td><td>0 1 0 1</td></tr>
<tr><td>0288-028B</td><td>0 1 1 0</td></tr>
<tr><td>028C-028F</td><td>0 1 1 1</td></tr>
<tr><td>0300-0303</td><td>1 0 0 0</td></tr>
<tr><td>0304-0307</td><td>1 0 0 1</td></tr>
<tr><td>0308-030B</td><td>1 0 1 0</td></tr>
<tr><td>030C-030F</td><td>1 0 1 1</td></tr>
<tr><td>0390-0393</td><td>1 1 0 0</td></tr>
<tr><td>0394-0397</td><td>1 1 0 1</td></tr>
<tr><td>0398-039B</td><td>1 1 1 0</td></tr>
<tr><td>039C-039F</td><td>1 1 1 1</td></tr>
</table>
</td></tr>
<tr><td>2</td><td>
Mount the module according to the installation instructions. Among other things, follow the steps for handling electrostatic sensitive devices (ESD). The module must only be installed while the computer is off.
For the communication card CP 5412 A2, a free ISA slot in the computer is required. After the installation of the CP 5412 A2, close the computer’s case and start the computer.
</td></tr>
</table>

B: Installing the Communication Driver

<table>
<tr><th>Step</th><th>B: Installing the Communication Driver</th></tr>
<tr><td>1</td><td>
Install the communication driver PB S7-5412 from the SIMATIC NET CD-ROM.
After inserting the SIMATIC NET CD-ROM, the installation program is automatically started. If this is not the case, open the Windows NT Explorer and start the setup.exe program located on the CD-ROM.
The installation of the software is started via the button displayed below.

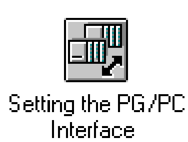
Follow the instructions of the installation program. On the Components page, the check-box of the driver PB S7-5412 to be installed must be selected. Finish the installation.



</td></tr>
</table>

C: Installing the Communication Processor

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>1</td><td>
Install the communication processor CP 5412 A2 via the program Setting the PG/PC Interface.
This program is accessed via Start → Settings → Control Panel → Setting the PG/PC Interface.

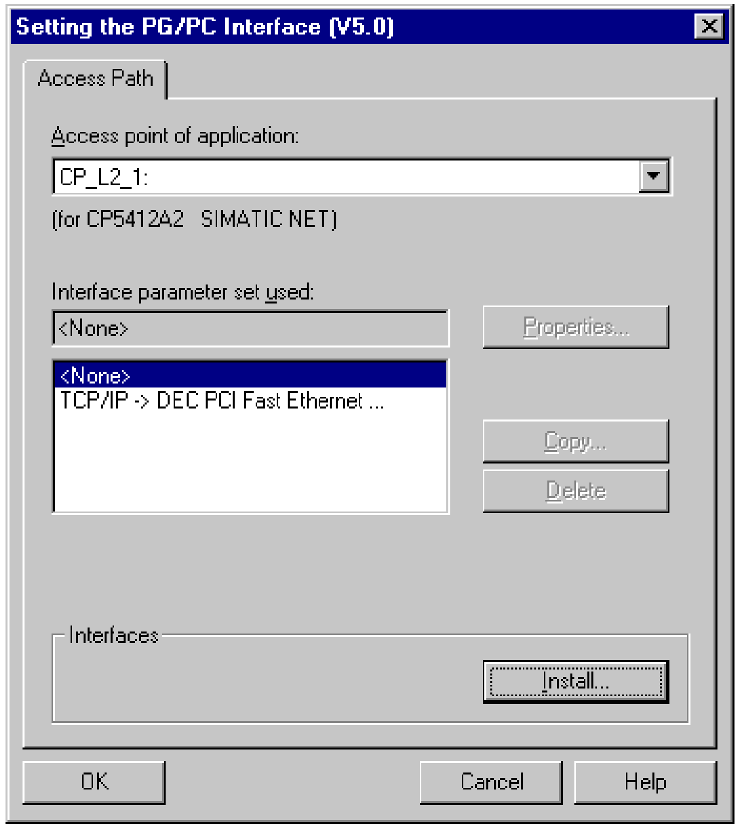


</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>2</td><td>

The program *Setting the PG/PC Interface* will be displayed.

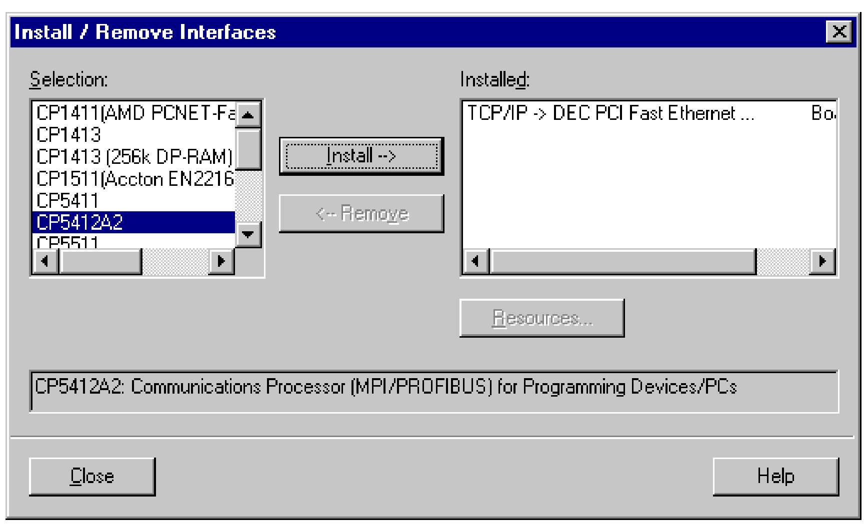
The dialog box for installing a new interface is opened via the *Install* button.



</td></tr>
<tr><td>3</td><td>

The dialog box *Install/Remove Modules* will be displayed.

The *Selection* field lists all interfaces that can be installed. Among them will be the entry for the *CP 5412 A2*, if the communication driver has been installed previously as outlined in step B. From the *Selection* field, select the entry *CP 5412 A2*. The installation of the communication processor is started by clicking on the *Install* -> button.



</td></tr>
</table>

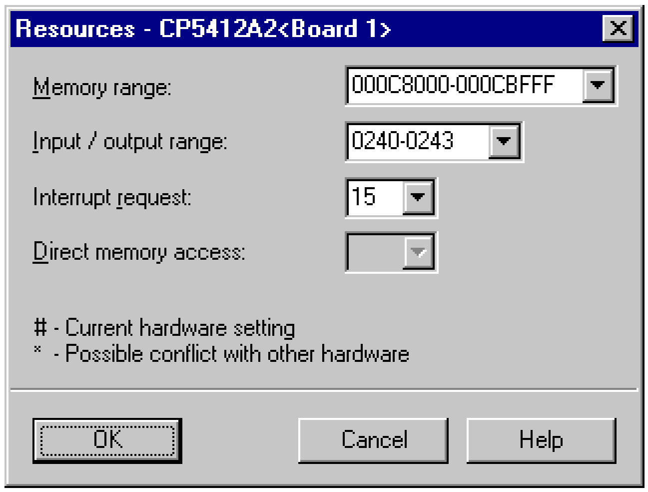
<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>4</td><td>
The dialog box *Resources - CP 5412 A2* will be displayed.

The settings for the *Memory Range*, *I/O Range* and *Interrupt* have to be specified.

The *I/O Range* has already been determined via the Jumper Settings at the *CP 5412 A2*.

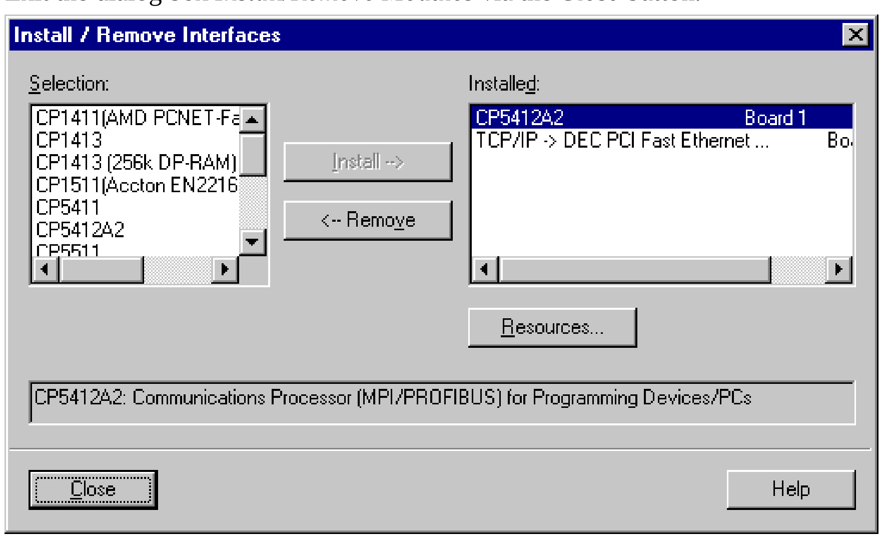
Make sure that the assigned resources have not already been taken by other modules in the computer. Information about already taken system resources can be obtained from the *Resources* tab accessed via *Start* → *Programs* → *Administrative Tools (Common)* → *Windows NT Diagnostics*.

Close the *Resources* tab by clicking on *OK*.



</td></tr>
<tr><td>5</td><td>
In the dialog box *Install/Remove Modules*, the *Installed* field will now contain the entry for the *CP 5412 A2*.

Exit the dialog box *Install/Remove Modules* via the *Close* button.



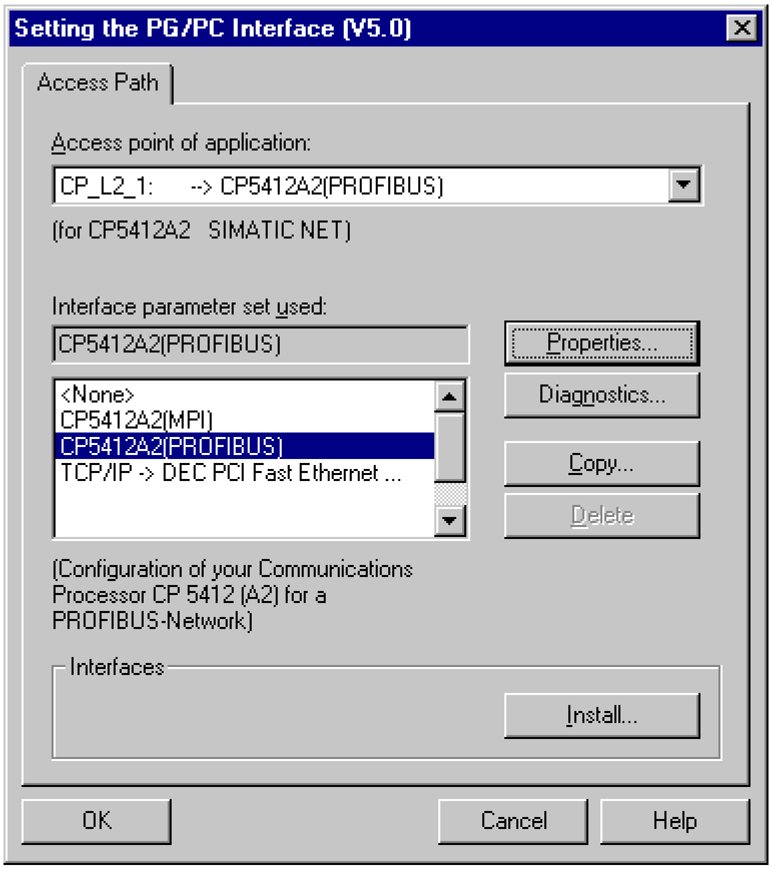
</td></tr>
</table>

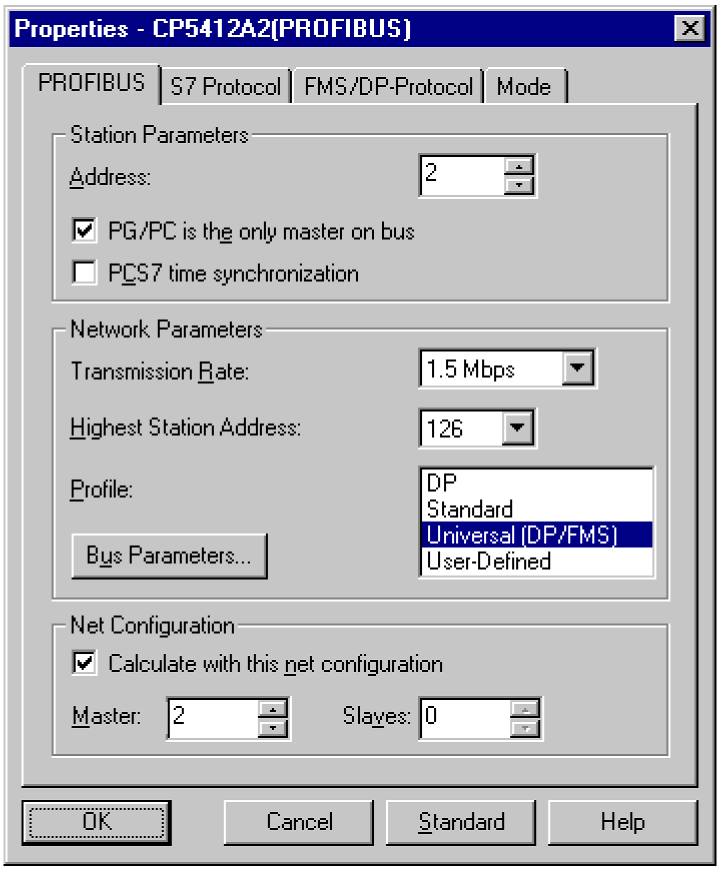
D: Assigning the Communication Processor

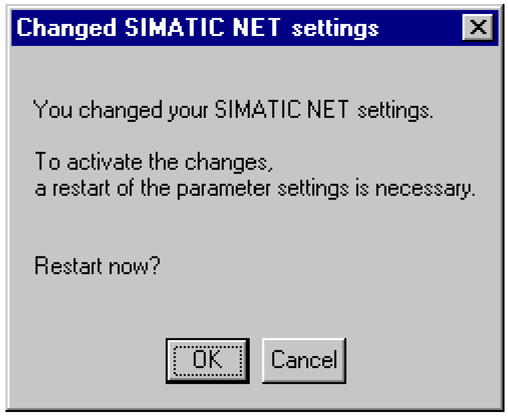
<table>
<tr><th>Step</th><th>D: Assigning the Communication Processor</th></tr>
<tr><td>1</td><td>In the program Setting the PG/PC Interface, assign the access point CP_L2_1: to the just installed interface.

The access point CP_L2_1: is the default access point used by WinCC for the communication via the PROFIBUS. It has been created automatically during the installation of the communication driver PB S7-5412.

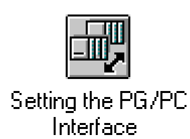
In the field Access Point of the Application, set the entry CP_L2_1:. In the field below, select the entry CP 5412 A2 (PROFIBUS). This completes the assignment between the access point and the communication processor.


</td></tr>
</table>

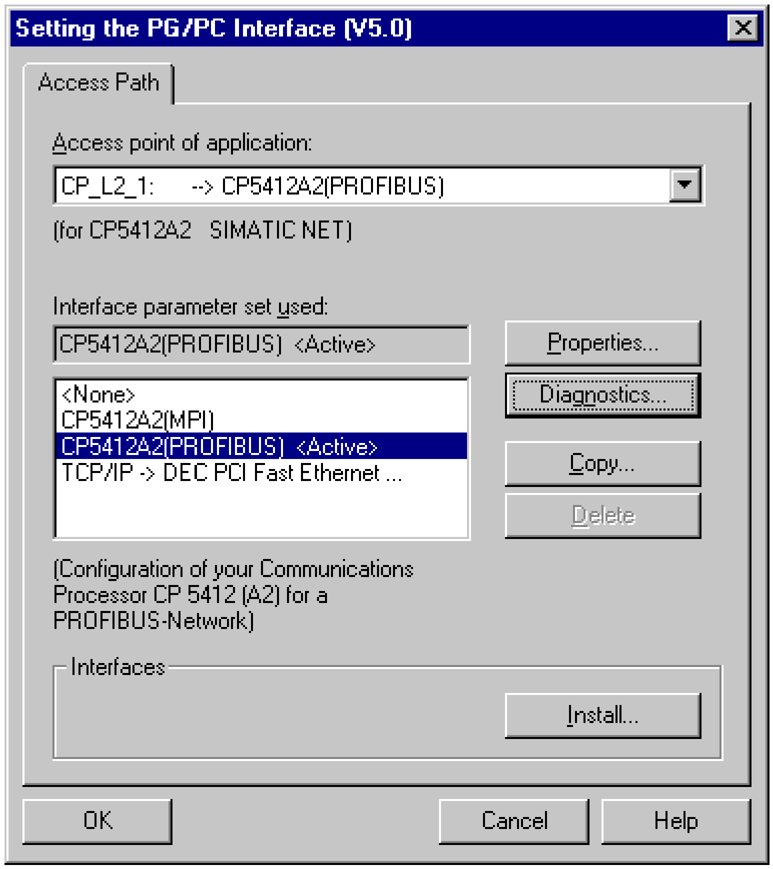
Step	**D: Assigning the Communication Processor**
2	Setting the properties of the communication processor *CP 5412 A2*. The dialog box for setting the properties is opened via the *Properties* button of the *Setting the PG/PC Interface* program. The dialog box *Properties - CP 5412 (PROFIBUS)* will be displayed. In the *PROFIBUS* tab, station and network related parameters are set. In this sample, the *Local Station Address* of the communication processor is set to *2*. For the *PROFIBUS Network*, a *Baud Rate* of *1.5 MBit/s* is selected. The *Highest Station Address* is set to the maximum value of *126*. As the *Profile*, *Universal (DP/FMS)* is selected. The network settings just made must be uniform for all stations in the *PROFIBUS network*. Close the properties dialog box of the *CP 5412 A2* by clicking on *OK*. 

Step	D: Assigning the Communication Processor
3	Exit the program *Setting the PG/PC Interface* via the *OK* button. A dialog box will be displayed requesting the restart of the *CP 5412 A2*. Acknowledge this dialog box by clicking on *OK*, which will result in the restart of the communication processor *CP 5412 A2*. This completes the installation of the communication processor. 

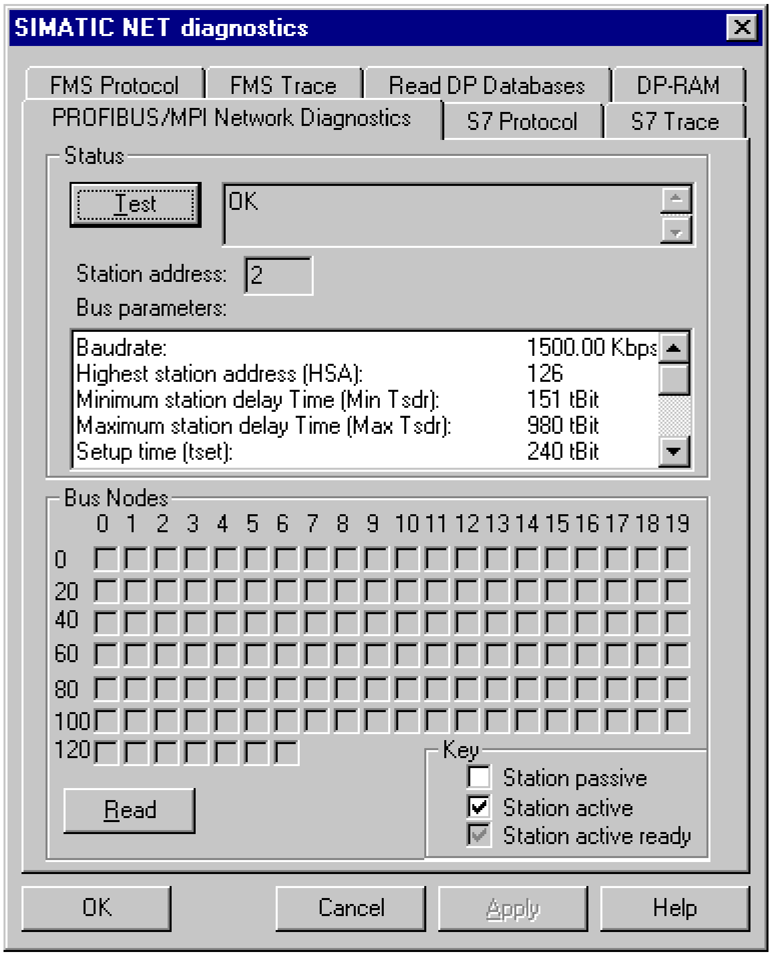
E: Testing the Communication Processor

Step	E: Testing the Communication Processor
1	Test the communication processor *CP 5412 A2* via the program *Setting the PG/PC Interface*. This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*. 

Step	E: Testing the Communication Processor
2	The program *Setting the PG/PC Interface* will be displayed. Select the interface to be checked. In this case, select the entry *CP 5412 A2 (PROFIBUS)*. Make sure that the assignments between access points and the interfaces are not changed. The check for a proper installation is activated by clicking on the *Diagnostics* button.



Step	E: Testing the Communication Processor
3	The dialog box *Simatic NET Diagnostics* will be displayed. In the *PROFIBUS/MPI Network Diagnostics* tab, the diagnosis is started via the *Test* button. The result of the diagnosis will be displayed immediately following. If the result of the diagnosis is positive (correct installation), the dialog box can be exited with *OK*. In this case, the program *Setting the PG/PC Interface* can also be closed by clicking on *OK*. The configuration of the communication to the S7 via *PROFIBUS* is continued in the following section. However, if the result of the diagnosis is negative (incorrect installation), the error must be localized and corrected. Troubleshooting procedures are described in the section Is the Communication Module in the Computer operational?.



6.2 Creation of the STEP7 Project S7_PB

The following description details the configuration steps necessary to create and start up the STEP7 project *S7_PB*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to create the STEP7 project *S7_PB*:

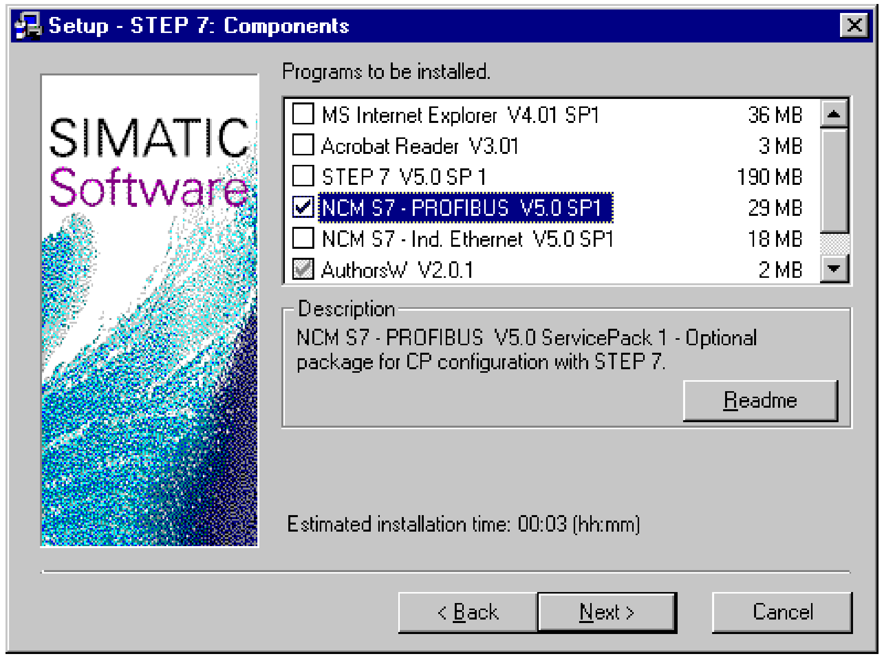
- A: Installing the Hardware
- B: Installing the Option Package
- C: Creating the STEP7 Project
- D: Configuring the Hardware
- E: Loading the Hardware Configuration
- F: Testing the Hardware Configuration
- G: Creating the STEP7 Program
- H: Testing the STEP7 Program

A: Installing the Hardware

Step	A: Installing the Hardware
1	Rack-mounting of the modules used. In this sample, the modules to be installed are the power supply *PS 407 10A*, the CPU module *CPU 416-1* and the communication processor *CP 443-5 BASIC*. Establishing the connection from the programming device to the programming interface of the CPU module. Establishing the connection from the communication processor *CP 5412 A2* in the computer to the communication processor *CP 443-5 BASIC* in the PLC.

B: Installing the Option Package

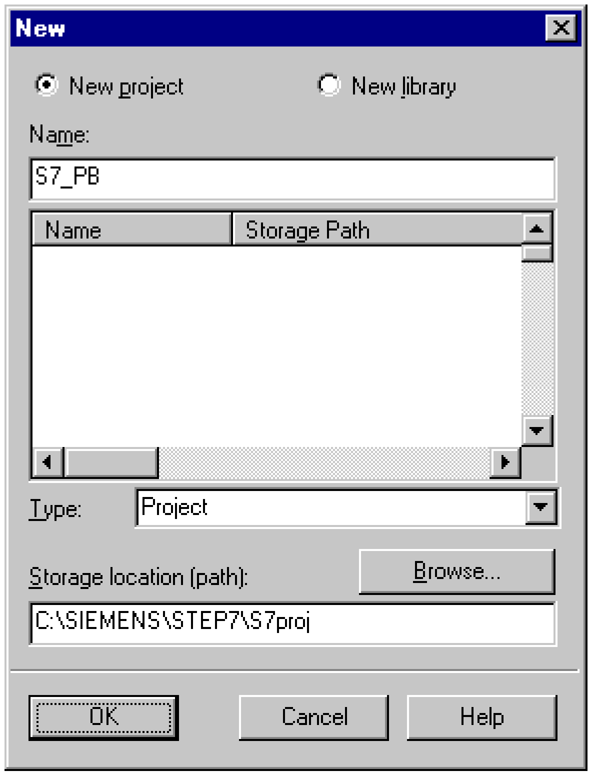
Step	B: Installing the Option Package
1	If the option package NCM S7 PROFIBUS has not been installed during the installation of STEP7, install it now from the STEP7 CD-ROM. This option package is required for the configuration of the communication processor CP 443-5 BASIC via the STEP7 software. After inserting the *STEP7* CD-ROM, the installation program is automatically started. If this is not the case, open the *Windows NT Explorer* and start the *setup.exe* program located on the CD-ROM.  setup.exe

Step	B: Installing the Option Package
2	This starts the installation program. Follow the instructions of the installation program. On the *Components* page, select the check-box *NCM S7-PROFIBUS*. Finish the installation. 

C: Creating the STEP7 Project

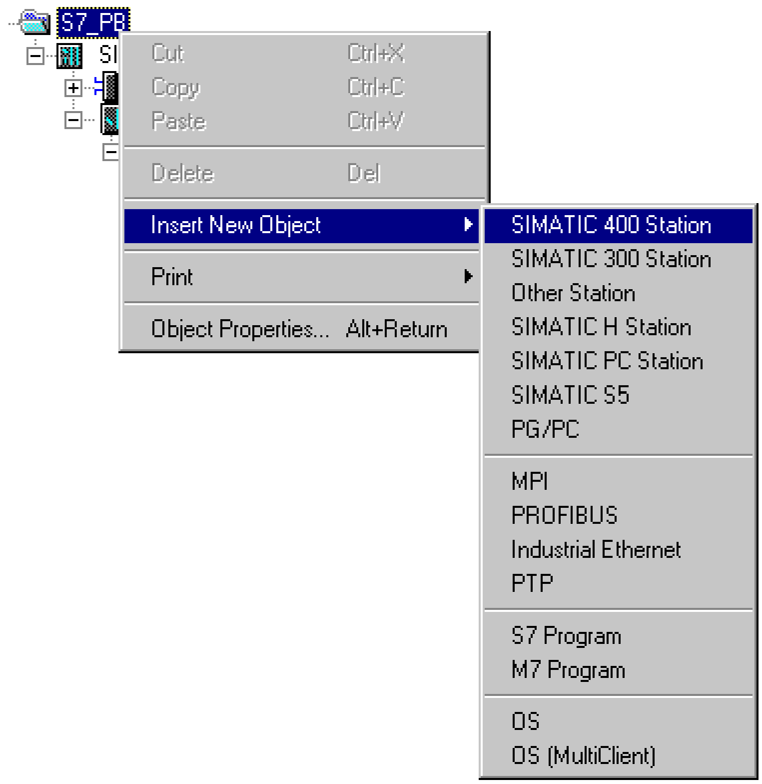
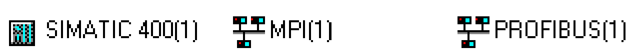
Step	C: Creating the STEP7 Project
1	Create a new STEP7 project in the *SIMATIC Manager*. It is started via *Start* → *Simatic* → *SIMATIC Manager*. 
2	This displays the *SIMATIC Manager*. Via the menus *File* → *New*, the dialog box for specifying the parameters of a new STEP7 project will be opened. The *New* dialog box will be displayed. The radio-button *New Project* must be selected. In the *Name* field, the name of the new project to be created is entered. The names of the STEP7 projects created within the framework of this manual all start with *S7*. They also include a reference to the communication type used. The project of this sample has the name *S7_PB*.

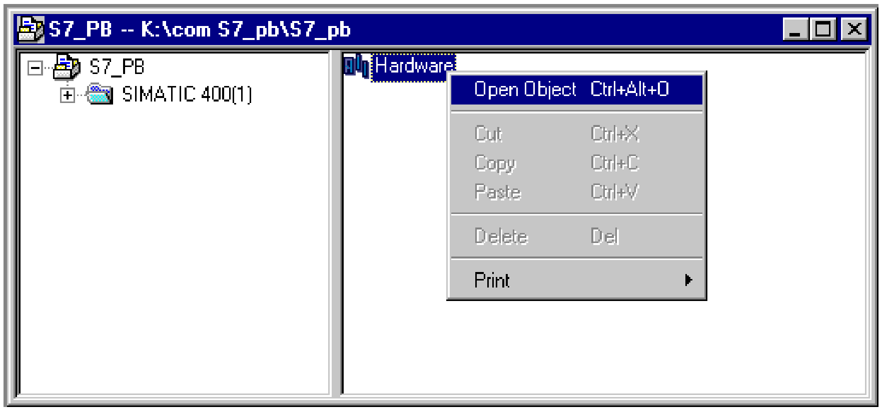
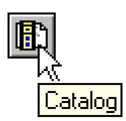
Step	C: Creating the STEP7 Project
	By default, projects are stored in the *C:\SIEMENS\STEP7\S7proj* folder. This can be changed at any time via the *Browse* button. The *New* dialog box is closed via the *OK* button.

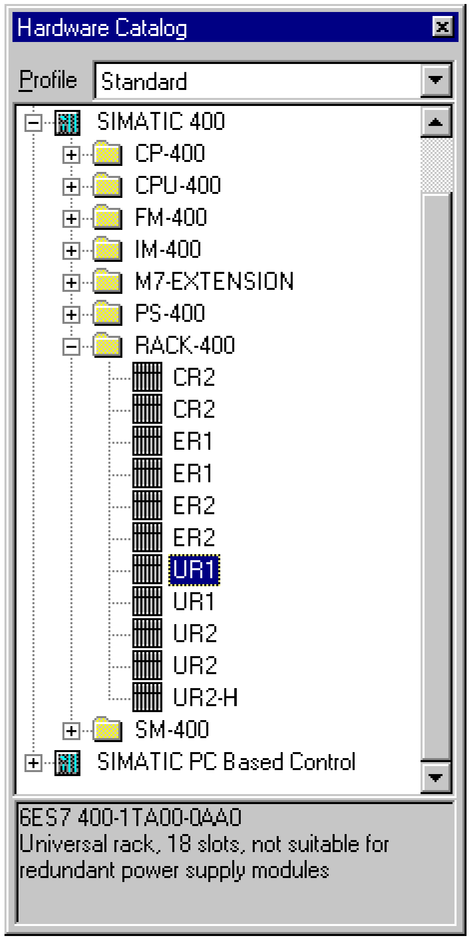


D: Configuring the Hardware

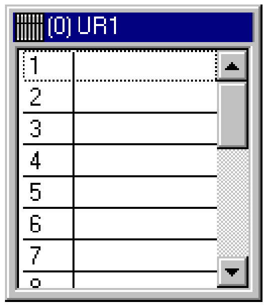
Step	D: Configuring the Hardware
1	The new project will be displayed in the *SIMATIC Manager*. The hardware for this project must be configured. Two components are needed: One *SIMATIC 400-Station* and for its networking a *PROFIBUS*.

<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td></td><td>These components are added to the SIMATIC Manager via a R on the project name S7_PB and then selecting Insert New Object → SIMATIC 400-Station and Insert New Object → PROFIBUS from the pop-up menu.

</td></tr>
<tr><td>2</td><td>The just added components will be displayed in the right window of the SIMATIC Manager.

</td></tr>
</table>

Step	**D: Configuring the Hardware**
	By D on the component *SIMATIC 400(1)* in the right window, the point *Hardware* will be displayed. By D on the point *Hardware* or R on it and then selecting *Open Object* from the pop-up menu, the program *HW Config* will be started. 
3	The program *HW Config* will be displayed. This program is used to exactly define the hardware used in the PLC and to configure their properties. 
4	By clicking on the toolbar button of the program *HW Config* displayed below, the *Hardware Catalog* is opened. This catalog is used to select the required hardware components. 

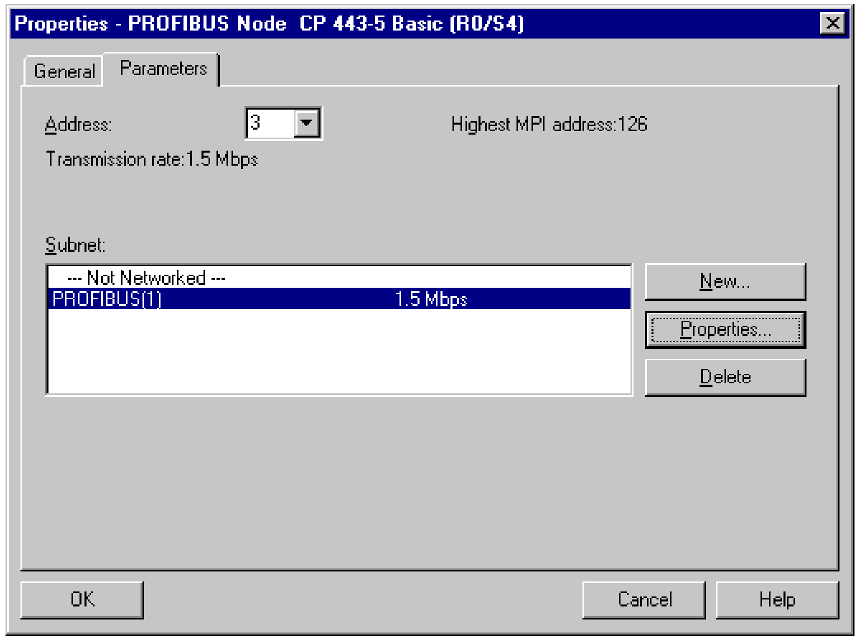
<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td>5</td><td>The Hardware Catalog will be displayed.
The first component selected is the rack. On this rack, all other components will be installed. The rack is inserted into the project via a D or by Dragging Dropping. In this sample, the rack type UR1 is used.


</td></tr>
</table>

Step	**D: Configuring the Hardware**
6	The program *HW Config* will display the currently still empty rack. It received the Rack Number *0*. During the configuration of the connection in the WinCC project, the rack number is one of the parameters that must be set. 
7	Arrange the other hardware components in the rack. This is done by Dragging Dropping the desired components from the *Hardware Catalog* to the corresponding slot in the rack. This sample uses the power supply *PS 407 10A*. It is inserted into slot *1*. A power supply of this type occupies two slots. As the CPU module, this sample uses a *CPU 416-1*. This module is inserted into slot *3*. Another parameter to be set during the configuration of the connection in the WinCC project is the slot number of the CPU module. We also require the communication processor *CP 443-5 BASIC*. This CP is only available from the *Hardware Catalog* if the option package *NCM S7 PROFIBUS* has been installed. After the communication processor *CP 443-5 BASIC* has been inserted in the rack, its properties dialog box will open.
8	The *PROFIBUS Interface* properties dialog box of the *CP 443-5 BASIC* will be displayed. In the *Address* field of the *Parameters* tab, enter the desired address of the communication processor. In this sample, the address *3* is specified. Another parameter to be set during the configuration of the connection in the WinCC project is this Station Address. In the *Subnet* field below, assign the entry *PROFIBUS(1)* to the communication processor.

<table>
<tr><th>Step</th><th>D: Configuring the Hardware</th></tr>
<tr><td></td><td>

The properties of *PROFIBUS(1)* must be defined. Its properties dialog box is opened via the *Properties* button.

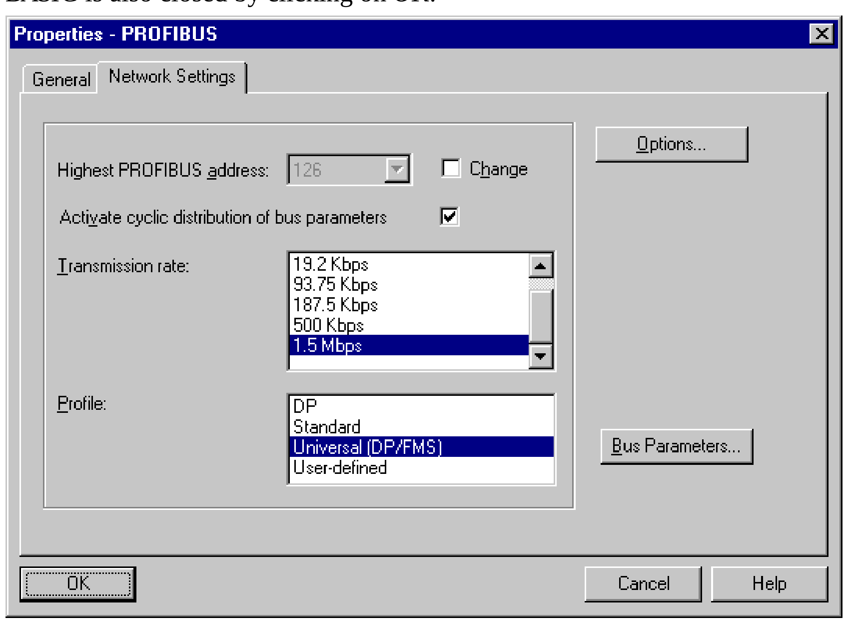


</td></tr>
<tr><td>9</td><td>

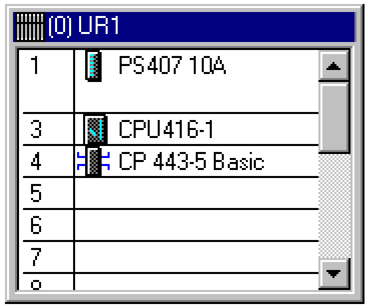
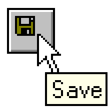
The dialog box *Properties - PROFIBUS* will be displayed.

In the *Network Settings* tab, the properties of the *PROFIBUS Network* are defined. The same Network Settings that have used for the installation of the communication processor *CP 5412 A2* must be used.

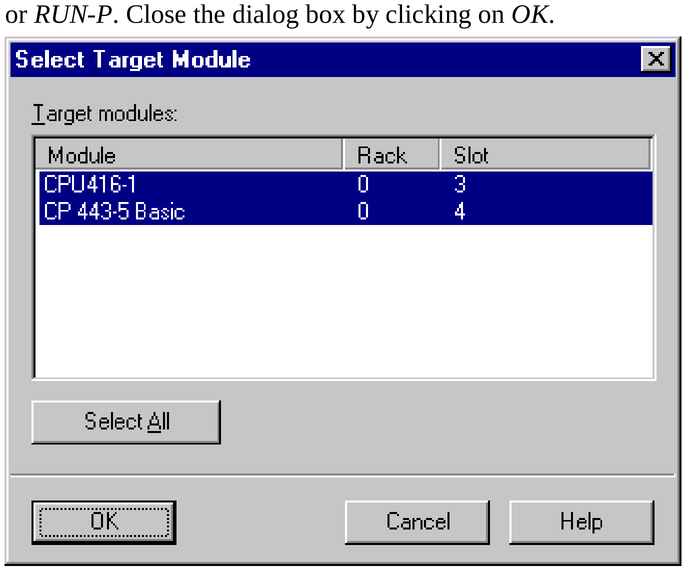
For the *PROFIBUS Network*, this sample uses a *Baud Rate* of *1.5 MBit/s*. The *Highest PROFIBUS Address* is set to the maximum value of *126*. As the *Profile*, *Universal (DP/FMS)* is selected. Exit the dialog box by clicking on the *OK* button. The properties dialog box of the *PROFIBUS Interface* of the *CP 443-5 BASIC* is also closed by clicking on *OK*.



</td></tr>
</table>

Step	D: Configuring the Hardware
10	The following graphic shows the completed hardware arrangement of the sample. 
11	Save the settings made in the program *HW Config*. This is done via the toolbar button displayed below. 

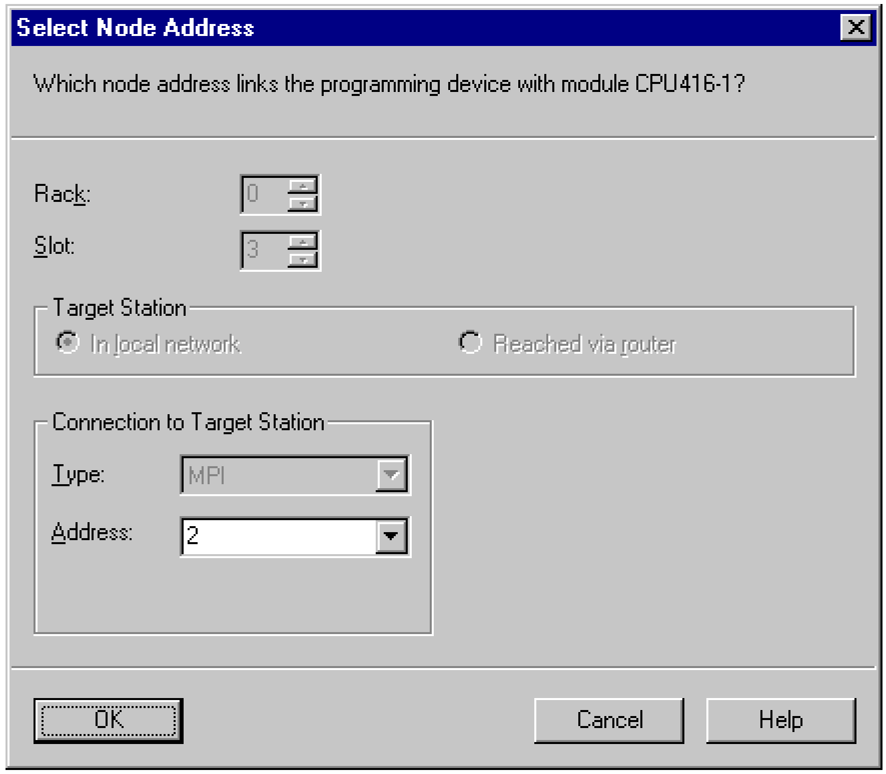
E: Loading the Hardware Configuration

Step	E: Loading the Hardware Configuration
1	The hardware configuration created in the program *HW Config* must be transferred to the PLC. This is done via the toolbar button displayed below. 
2	A dialog box will be displayed from which the components to be loaded can be selected. For this sample, all displayed components will be selected. Note that loading to the CPU module is ony possible while the operating mode switch is set to *STOP* or *RUN-P*. Close the dialog box by clicking on *OK*. 

<table>
<tr><th>Step</th><th>E: Loading the Hardware Configuration</th></tr>
<tr><td>3</td><td>
Now the dialog box *Select Station Address* will be displayed.

In this dialog box, specify which station address is used by the STEP7 software to communicate with the CPU module. In this sample, the communication is carried out via the MPI interface. The *Address* of the CPU module is *2*.

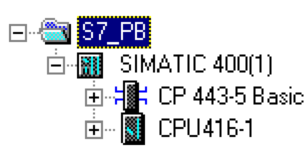
Close the dialog box by clicking on *OK*.



</td></tr>
<tr><td>4</td><td>
The configuration data will now be transferred to the PLC. If necessary, the individual modules are set to the STOP status.

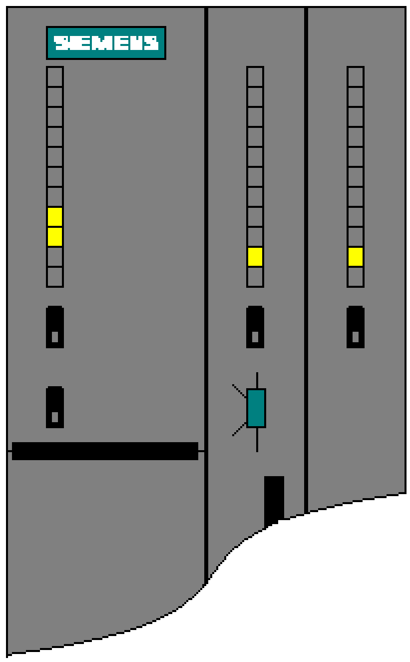
The program *HW Config* can be exited.

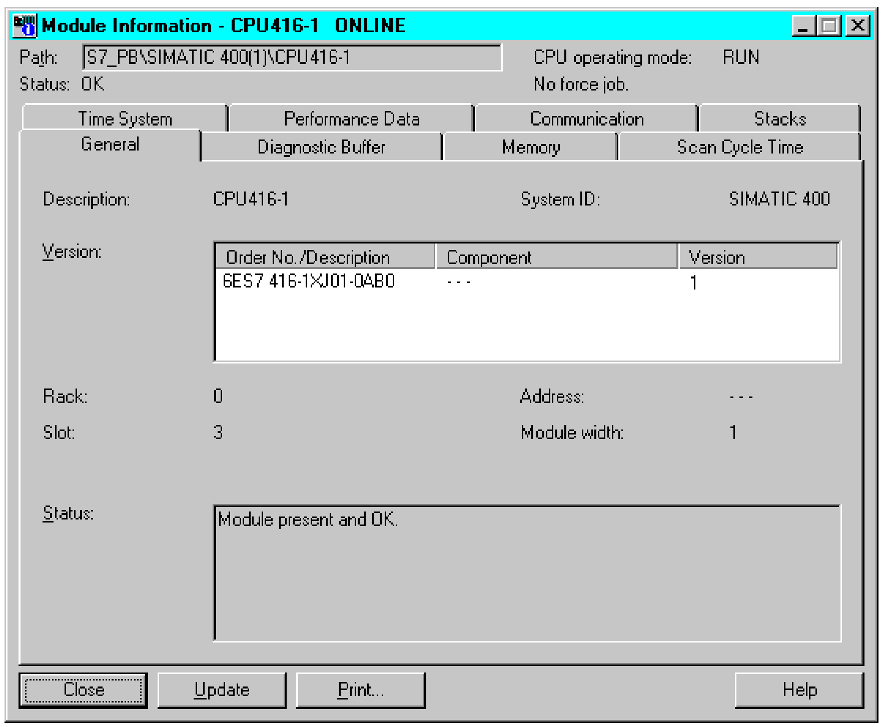
The newly added components will be displayed by the *SIMATIC Manager* for the station *SIMATIC 400(1)*.



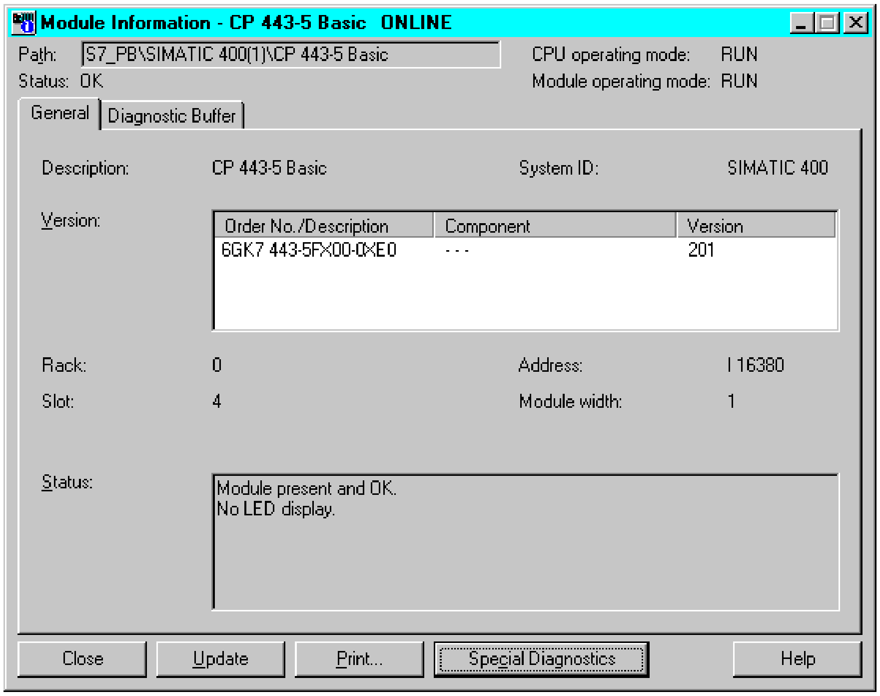
</td></tr>
</table>

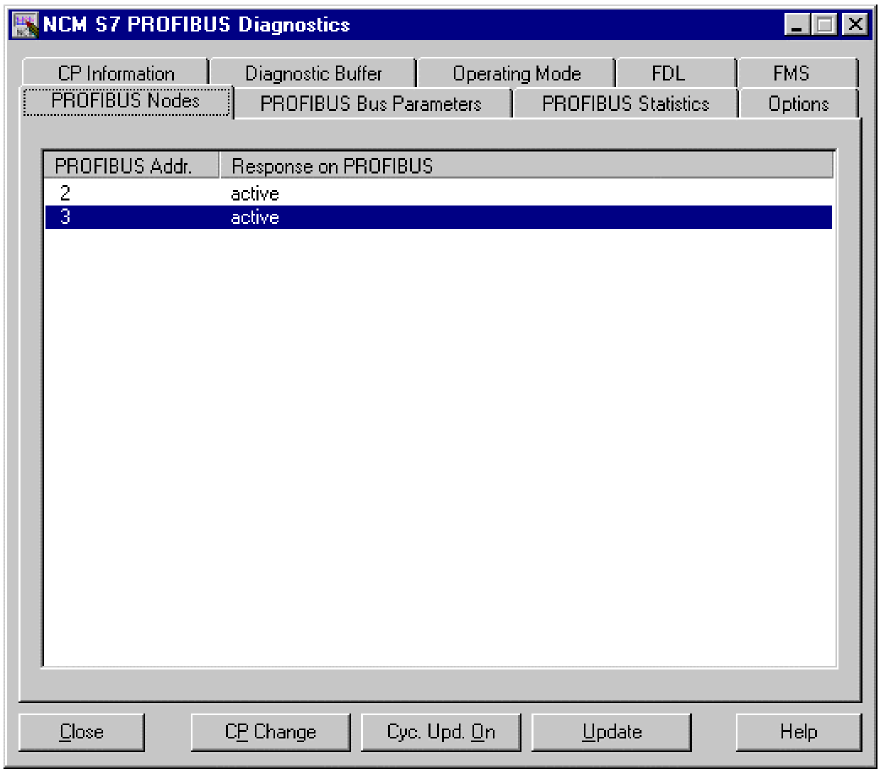
F: Testing the Hardware Configuration

Step	F: Testing the Hardware Configuration
1	Testing of the hardware configuration made. If the key switch of the CPU module is set to RUN or RUN-P and the operating mode switch of the communication processor is set to RUN, only the status LEDs signifying the *RUN* operating mode should light up. If this is not the case, there is an error. The following steps help you localize this error. However, these steps should still be performed even if the status LEDs show no error. This allows you to recognize uncritical errors and faulty configurations. 

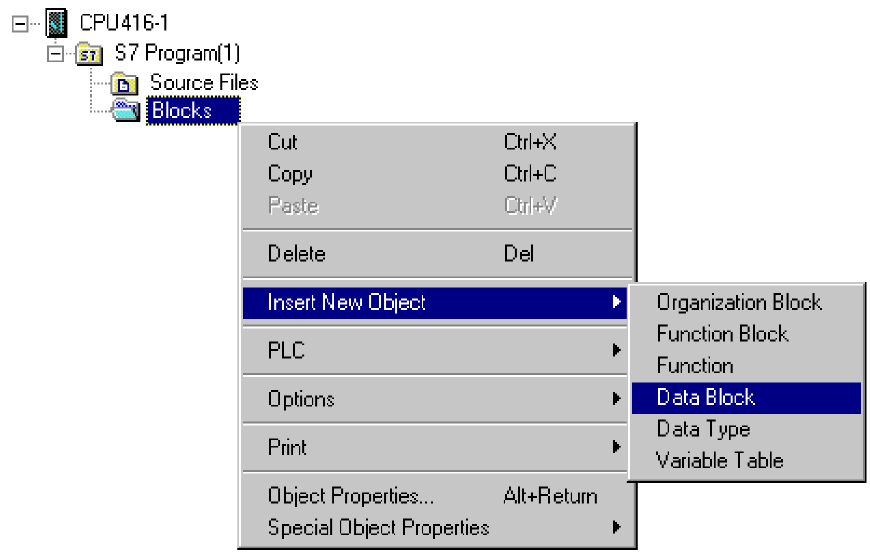
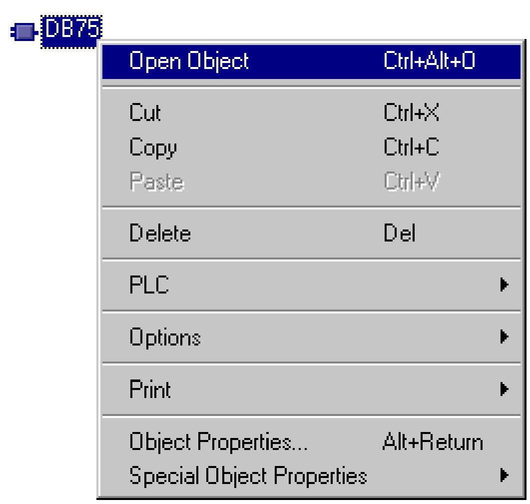
Step	F: Testing the Hardware Configuration
2	Testing the configuration of the CPU module. This is done via the dialog box *Module Status* in the *SIMATIC Manager*. It is opened by a R on the entry of the CPU module in the left window and then selecting *Target System* → *Module Status* from the pop-up menu. The dialog box *Module Status* of the CPU module will be displayed. The *General* tab displays various general data of the CPU module. In the *Status* field, the current module status and any existing errors are displayed. The *Diagnosis Buffer* tab contains more detailed information about existing errors and how to correct them. The dialog box can be exited via the *Close* button. 

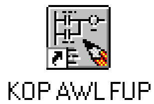
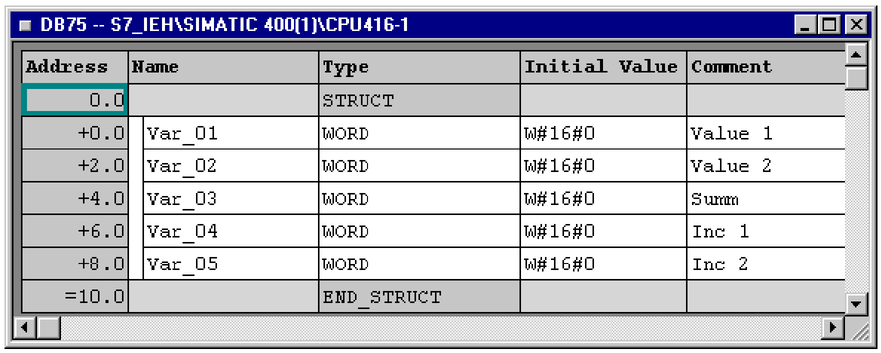
Step	F: Testing the Hardware Configuration
3	Testing the configuration of the communication processor. This is done via the dialog box *Module Status* in the *SIMATIC Manager*. It is opened by a R on the entry of the communication processor in the left window and then selecting *Target System* → *Module Status* from the pop-up menu. The dialog box *Module Status* of the communication processor will be displayed. The *General* tab displays various general data of the module. A dialog box for a more detailed diagnosis of the communication processor can be accessed via the *Special Diagnosis* button.

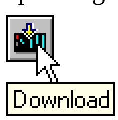


Step	F: Testing the Hardware Configuration
4	The dialog box *NCM S7 PROFIBUS Diagnosis* will be displayed. From the *PROFIBUS Station* tab, a diagnosis of the *PROFIBUS Network* can be performed. If the physical connection to the communication processor *CP 5412 A2* has already been established, the list should contain two entries for this example. One entry for the communication processor *CP 5412 A2* with the address *2* and one entry for the communication processor *CP 443-5 BASIC* with the address *3*. If the physical connection to the communication processor *CP 5412 A2* has not been established yet, at least the entry for the communication processor *CP 443-5 BASIC* with the address *3* should be displayed. The dialog box can be exited via the *Close* button. The Module Status dialog box can also be exited via the *Close* button. 

G: Creating the STEP7 Program

Step	G: Creating the STEP7 Program
1	Creation of the *S7 Program*. This sample project requires the operation block *OB1* and a data block. *OB1* is available by default, the required data block must be created. This is done in the *SIMATIC Manager* via a R on the sub-entry *Modules* of the entry *S7 Program(1)* of the configured CPU module and then selecting *Insert New Object* → *Data Block from the pop-up menu.* *The properties dialog box of the data block will be opened. As the block's Name enter DB75 and close the dialog box with OK.* 
2	The newly created data block *DB75* will be displayed in the right window of the project. Via a D on this data block or a R and then selecting *Open Object* from the pop-up menu, the content of the block can be programmed. This starts the program *LAD/STL/SCF*. 

<table>
<tr><th>Step</th><th>G: Creating the STEP7 Program</th></tr>
<tr><td>3</td><td>The program LAD/STL/SCF is displayed.
Acknowledge the dialog box New Data Block by clicking on OK.

</td></tr>
<tr><td>4</td><td>Programming the DB75.
In this data block, two tags with a length of 16 Bits are created. Their sum is to be determined in OB1 and then be written to another tag with a length of 16 Bits.
Two additional tags with a length of 16 Bits are created, whose values are cyclically incremented in OB1.
The following graphic displays the programmed data block DB75.


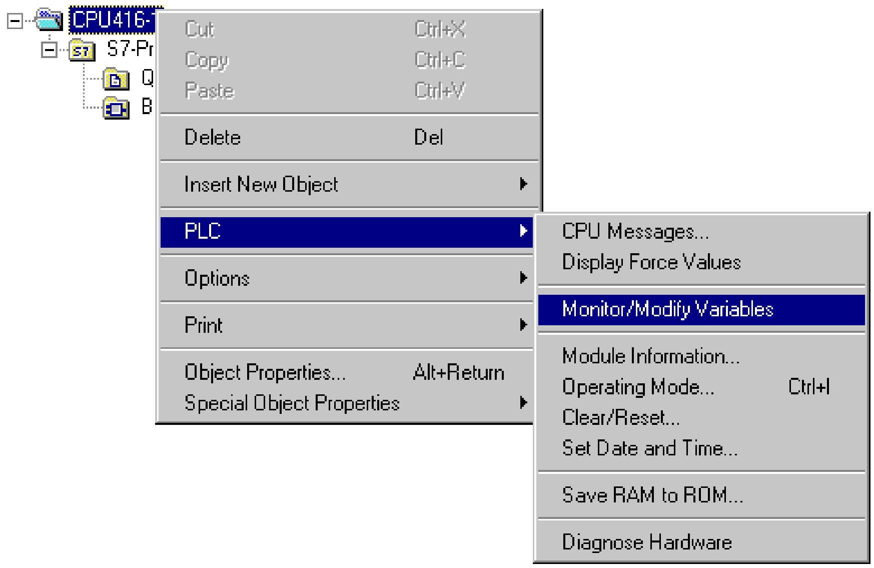
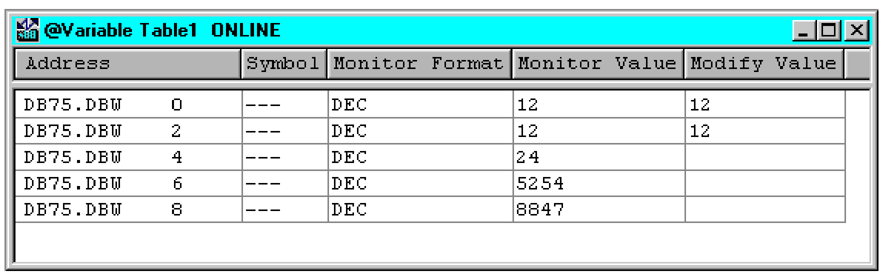
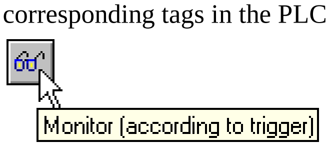
<table>
<tr><th>Address</th><th>Name</th><th>Type</th><th>Initial Value</th><th>Comment</th></tr>
<tr><td>0.0</td><td></td><td>STRUCT</td><td></td><td></td></tr>
<tr><td>+0.0</td><td>Var_01</td><td>WORD</td><td>W#16#0</td><td>Value 1</td></tr>
<tr><td>+2.0</td><td>Var_02</td><td>WORD</td><td>W#16#0</td><td>Value 2</td></tr>
<tr><td>+4.0</td><td>Var_03</td><td>WORD</td><td>W#16#0</td><td>Summ</td></tr>
<tr><td>+6.0</td><td>Var_04</td><td>WORD</td><td>W#16#0</td><td>Inc 1</td></tr>
<tr><td>+8.0</td><td>Var_05</td><td>WORD</td><td>W#16#0</td><td>Inc 2</td></tr>
<tr><td>=10.0</td><td></td><td>END_STRUCT</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>5</td><td>Save the block and load it into the PLC. This is done via the toolbar button displayed below. Note that loading to the CPU module is only possible while the operating mode switch is set to STOP or RUN-P.

</td></tr>
<tr><td>6</td><td>Programming the OB1.
Open the block in the program LAD/STL/SCF.
First, two values in the DB75 are added and then stored again in DB75.
Netzwerk 1: Addition
Adding two 16-Bit Values
The result is stored in another
16-Bit Value
<pre>
      OPN   DB   75
      L   DBW   0
      L   DBW   2
      +I
      T   DBW   4
</pre>
Next, a value in the DB75 is incremented every second.</td></tr>
</table>

Step	G: Creating the STEP7 Program

	Network 2 : Second Cycle
	Generation of a second cycle at M 0.0
	```AN M 0.0``` / ```L S5T#1S``` / ```SD T 1``` / ```A T 1``` / ```= M 0.0```
	Network 3 : Counting in a second cycle
	Counting a value in a second cycle
	At 10000, reset to 0
	```AN M 0.0``` / ```JC M001``` / ```L DBW 6``` / ```L 1``` / ```+I``` / ```T DBW 6``` / ```L 10000``` / ```<I``` / ```JC M001``` / ```L 0``` / ```T DBW 6``` / ```M001: NOP 0```
	Finally, a value in the *DB75* is incremented every time the *OB1* run.
	Network 4 : Counting in the cycle time
	Counting a value each time the OB is executed
	At 10000, reset to 0
	```L DBW 8``` / ```L 1``` / ```+I``` / ```T DBW 8``` / ```L 10000``` / ```<I``` / ```JC M002``` / ```L 0``` / ```T DBW 8``` / ```M002: NOP 0```

7	Save the block *OB1* and load it into the PLC. This is done via the corresponding buttons on the toolbar. This completes the creation of the STEP7 project and it can now be run. Exit the program *LAD/STL/SCF*.

H: Testing the STEP7 Program

<table>
<tr><th>Step</th><th>H: Testing the STEP7 Program</th></tr>
<tr><td>1</td><td>Testing the program with the STEP7 software.
For this purpose, a tag table is created. This is done in the SIMATIC Manager via a R on the entry of the configured CPU module and then selecting Target System → Monitor/Control Tag from the pop-up menu.

</td></tr>
<tr><td>2</td><td>An editor for creating and using a tag table will be displayed.
The following shows a completed tag table. In this table, enter all tags created in the DB75.

@Variable Table1 ONLINE
<table>
<tr><th>Address</th><th></th><th>Symbol</th><th>Monitor Format</th><th>Monitor Value</th><th>Modify Value</th></tr>
<tr><td>DB75.DBW</td><td>0</td><td>---</td><td>DEC</td><td>12</td><td>12</td></tr>
<tr><td>DB75.DBW</td><td>2</td><td>---</td><td>DEC</td><td>12</td><td>12</td></tr>
<tr><td>DB75.DBW</td><td>4</td><td>---</td><td>DEC</td><td>24</td><td></td></tr>
<tr><td>DB75.DBW</td><td>6</td><td>---</td><td>DEC</td><td>5254</td><td></td></tr>
<tr><td>DB75.DBW</td><td>8</td><td>---</td><td>DEC</td><td>8847</td><td></td></tr>
</table></td></tr>
<tr><td>3</td><td>Monitoring the current tag values.
By clicking on the toolbar button displayed below, the current values of the corresponding tags in the PLC are displayed in the column Status Value.


Controlling the tag values.
Values can be entered in the column Control Value. By clicking on the toolbar button displayed below, these values will be written to the corresponding tags in the PLC.</td></tr>
</table>

Step	**H: Testing the STEP7 Program**
	Note that tags can only be controlled while the operating mode switch of the CPU module is set to *RUN-P*. 
4	The created tag table can now be saved. In this sample, the table is saved under the name *VAT1*. After checking the program in the PLC, the tag table can be closed. This concludes the configuration of the STEP7 project and the *SIMATIC Manager* can be exited. 

6.3 Creation of the WinCC Project WinCC_S7_PB

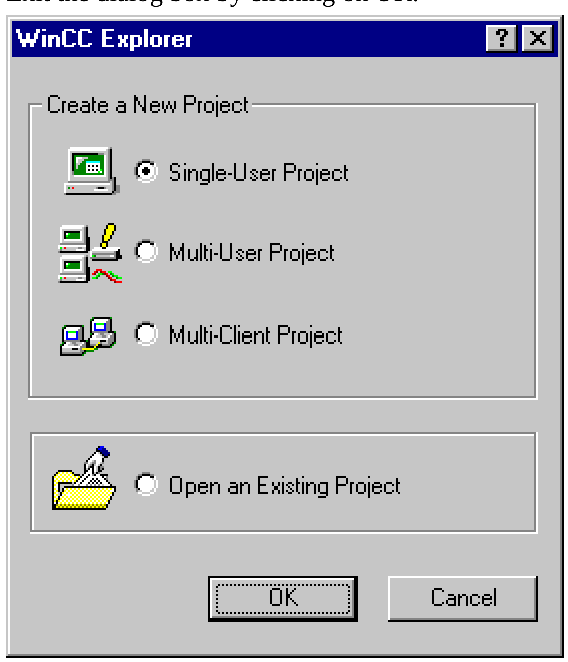
The following description details the configuration steps necessary to create and start up the WinCC project *WinCC_S7_PB*.

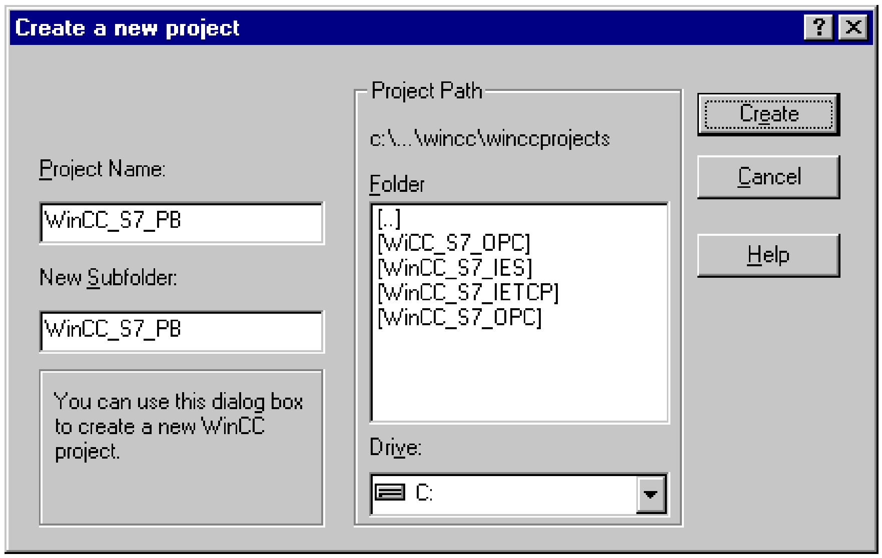
Overview of the Configuration Steps

The following lists the configuration steps necessary to create the WinCC project *WinCC_S7_PB*:

- A: Creating the WinCC Project
- B: Creating the Connection
- C: Creating the WinCC Tags
- D: Creating the WinCC Screen

A: Creating the WinCC Project

Step	A: Creating the WinCC Project
1	Creation of a new WinCC project in the *WinCC Explorer*. The WinCC Explorer is started via *Start* → *Simatic* → *WinCC* → *Windows Control Center*. 
2	This will display the *WinCC Explorer*. Via the menus *File* → *New*, the dialog box for specifying the properties of a new WinCC project will be opened. For this sample project, a *Single-User Project* is created. Exit the dialog box by clicking on *OK*. 

Step	**A: Creating the WinCC Project**
3	The dialog box *Create a new Project* will be displayed. Specify a *Project Name* for the new project. The names of the WinCC projects created within the framework of this manual all start with *WinCC* and also include a reference to the communication partner and communication type used. The project of this sample has the name *WinCC_S7_PB*. In the *Project Path* field, set the storage location of the new project. The dialog box *Create a new Project* is concluded by clicking on the *Create* button. 

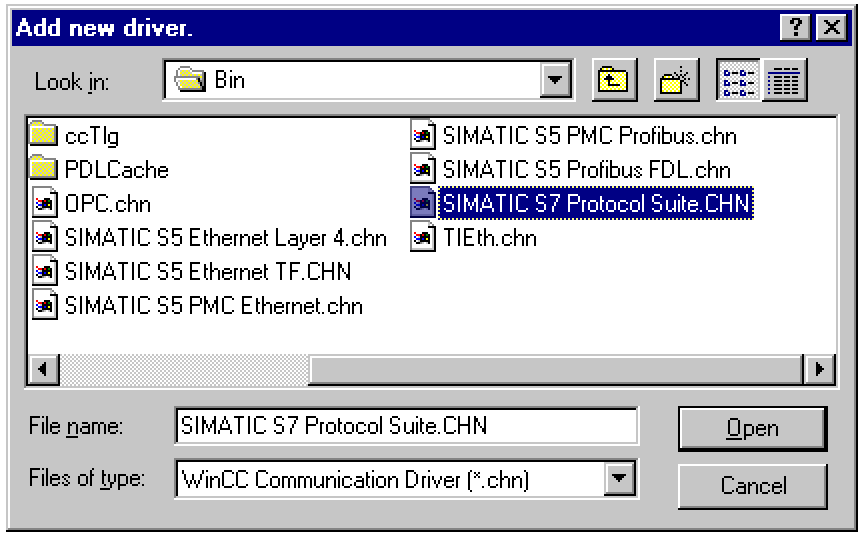
B: Creating the Connection

Step	**B: Creating the Connection**
1	The new project will be displayed in the *WinCC Explorer*. Installation of the required communication driver. This is performed via a R on *Tag Management* and selecting *Add New Driver* from the pop-up menu. 

<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>2</td><td>

The dialog box *Add New Driver* will be displayed.

This dialog box lists all communication drivers that can be installed. For the communication to the *SIMATIC S7*, the driver *SIMATIC S7 Protocol Suite* is required. Select this driver from the dialog box. Exit the dialog box by clicking on *Open*.

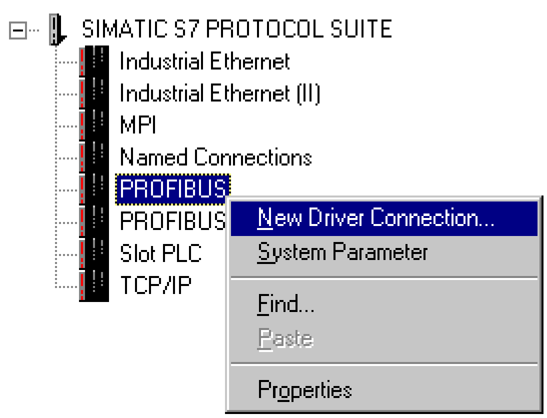


</td></tr>
<tr><td>3</td><td>

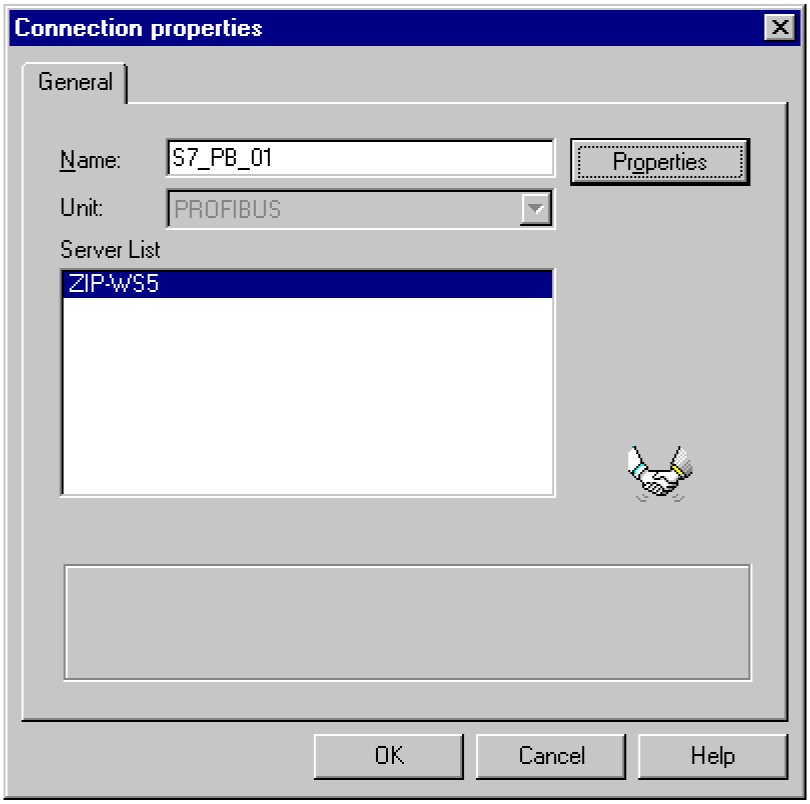
The newly added driver *SIMATIC S7 Protocol Suite* will be displayed as a sub-entry to *Tag Management*.

The driver contains eight different channel units. To operate a computer with two *CP 1413* communication processors, two channel units for the *PROFIBUS* are available.

In this sample, the channel unit *PROFIBUS* is used. Create a new connection for this channel unit by R on *PROFIBUS* and then selecting *New Driver Connection* from the pop-up menu.

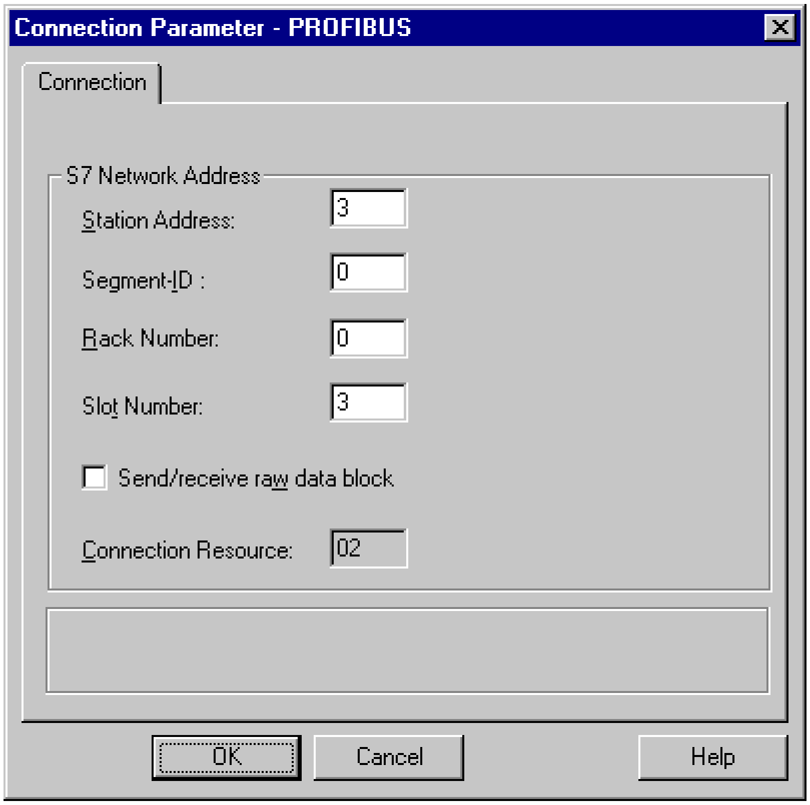


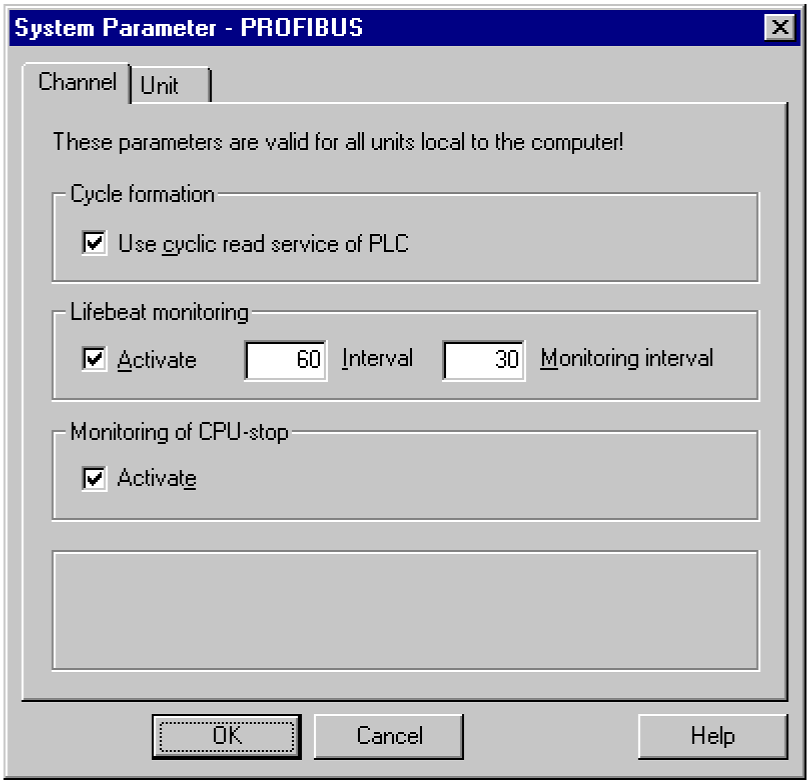
</td></tr>
</table>

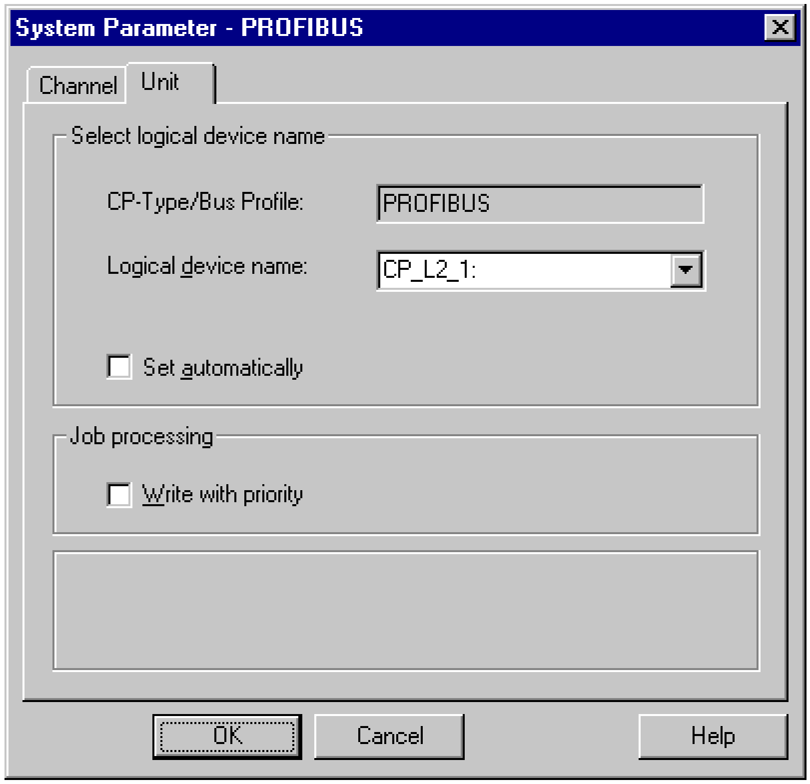
<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>4</td><td>The properties dialog box of the connection will be displayed.
In the General tab, the Name of the new connection is entered. In this sample, this is S7_PB_01.
Click on the Properties button to define the connection properties.


</td></tr>
</table>

Step	B: Creating the Connection
5	The dialog box Connection Properties will be displayed. In the *Station Address* field, the address that has been set for the communication processor *CP 443-5 BASIC* is entered. For this sample, this is the Address *3*. Additionally, the Rack Number and Slot Number of the CPU module to be accessed must be entered. Make sure that the values of the CPU module are entered here and not the values of the communication processor. Close the dialog box by clicking on *OK*.

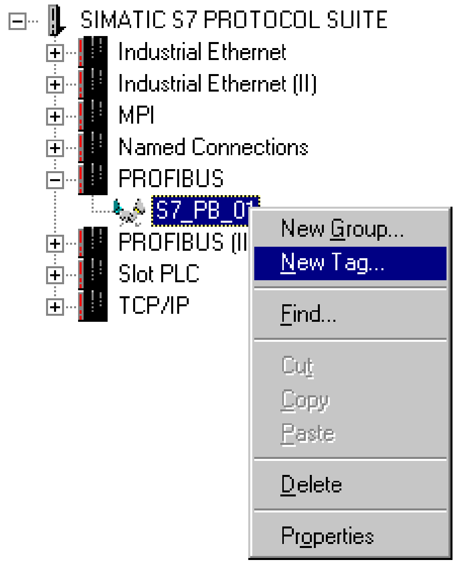


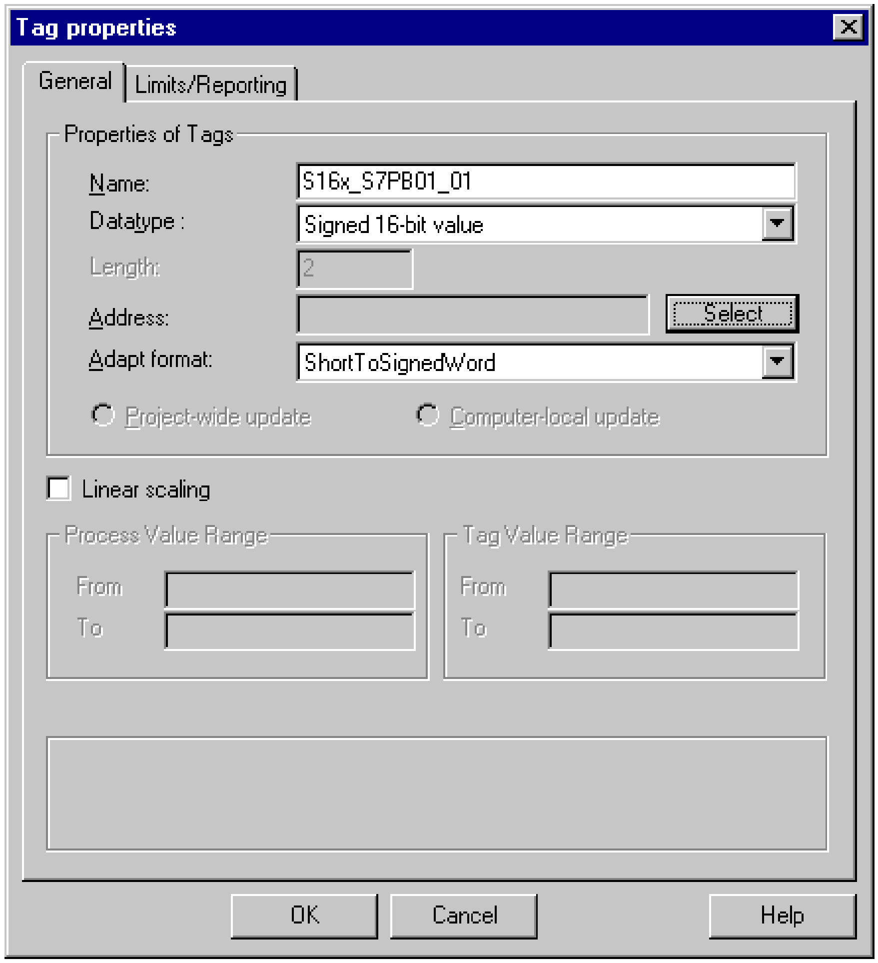
Step	B: Creating the Connection
6	Setting the system parameters of the *PROFIBUS* channel unit. These settings are made in the *System Parameters* dialog box, which is accessed via a R on the *PROFIBUS* entry and then selecting *System Parameters* from the pop-up menu. In the *Channel* tab, various settings pertaining to the communication and monitoring a communication can be made. These settings will apply to all channel units of the communication driver. 

<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>7</td><td>
In the Device tab, the access point used by the connection to access the PLC is specified.
By default, the access point CP_L2_1: is set. Previously, the communication processor CP 5412 A2 has been assigned to the access point CP_L2_1: in the program Setting the PG/PC Interface. If you want the access point to be set automatically, make sure that the correct one is being used, especially if multiple communication processors are used.
Close the dialog box by clicking on OK.


</td></tr>
</table>

C: Creating the WinCC Tags

Step	C: Creating the WinCC Tags
1	Creation of the WinCC tags required for the sample. This is done via a R on the newly created connection *S7_PB_01* and then selecting *New Tag* from the pop-up menu. 

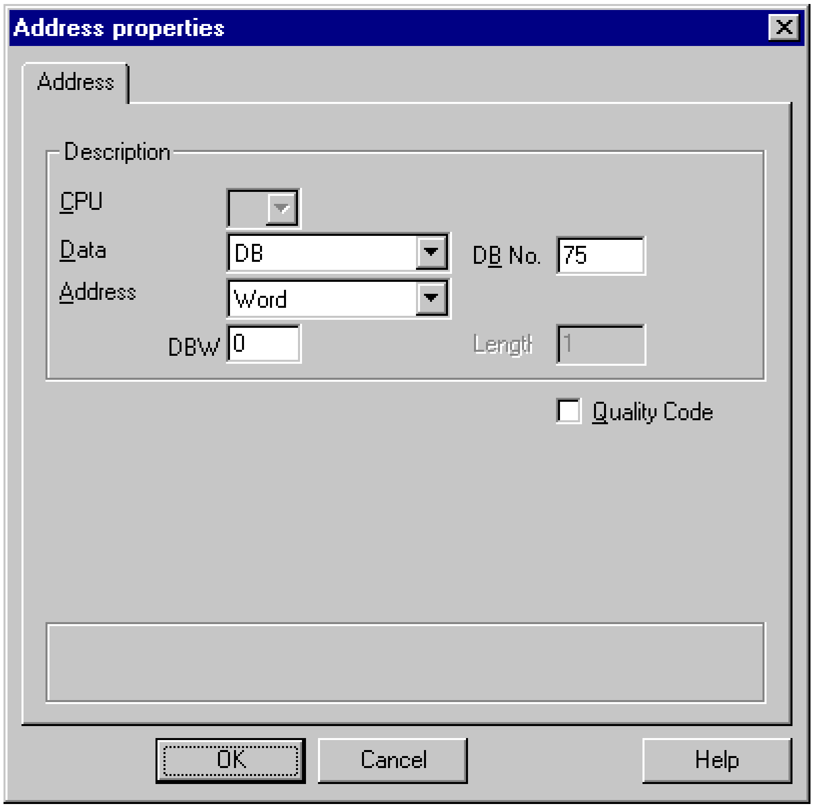
Step	C: Creating the WinCC Tags
2	The properties dialog box of the tag will be displayed. In the sample, the *Name* of the first tag is *S16x_S7PB01_01*. The tag is of the *Signed 16-Bit Value* data type. Click on the *Select* button to set the *Address* of the new tag. 

<table>
<tr><th>Step</th><th>C: Creating the WinCC Tags</th></tr>
<tr><td>3</td><td>

The dialog box *Address Properties* will be displayed.

Set *DB* as the *Data Range* and the value *75* as the *DB No.*. Set *Word* in the Address field and the value *0* in the *DBW* field. Close the dialog box by clicking on *OK*. The properties dialog box of the tag is also closed by clicking on *OK*.

The just created tag is addressed in the range of the PLC, where the first of the two values to be added is located.



</td></tr>
<tr><td>4</td><td>

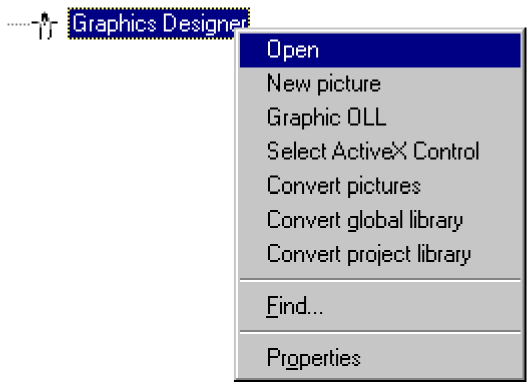
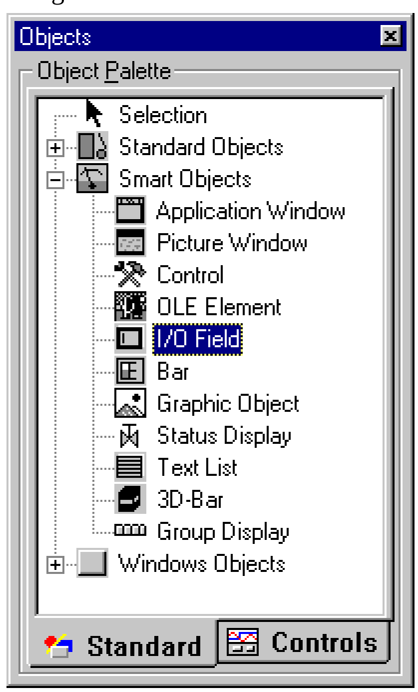
Creation of the remaining WinCC tags required.

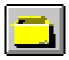
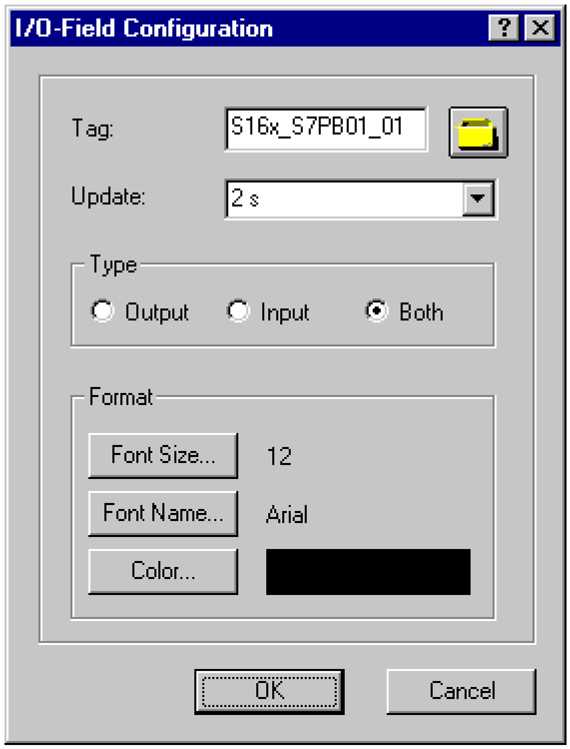
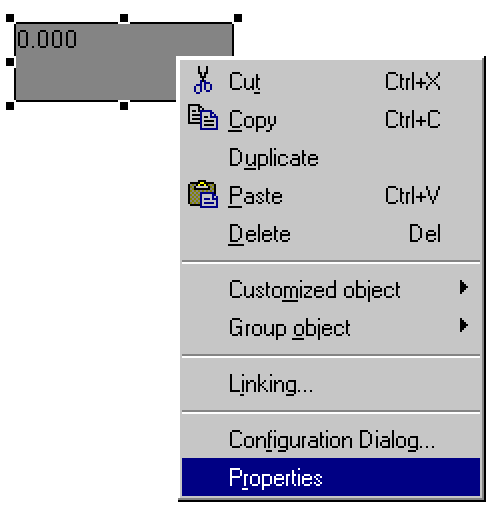
Follow steps 1 to 3 for the creation of the remaining tags. The names, data types and addresses of the tags used in this sample are listed in the following graphic.

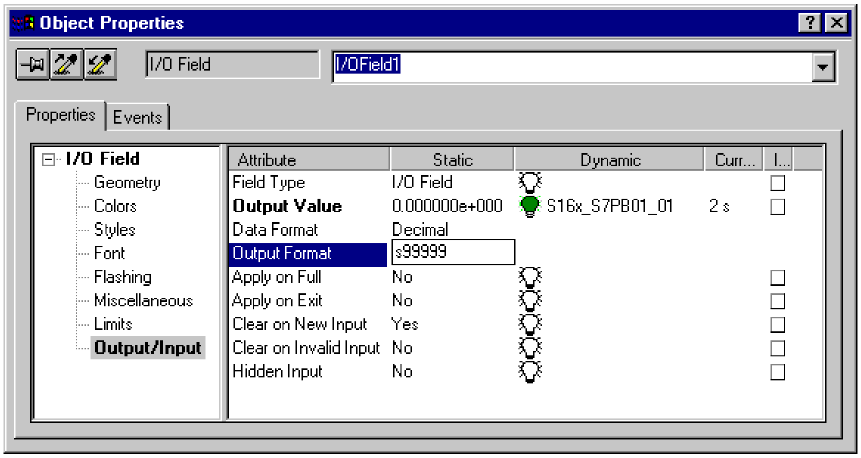
<table>
<tr><th>Name</th><th>Type</th><th>Parameters</th></tr>
<tr><td>S16x_S7PB01_01</td><td>Signed 16-bit value</td><td>DB75,DW0</td></tr>
<tr><td>S16x_S7PB01_02</td><td>Signed 16-bit value</td><td>DB75,DW2</td></tr>
<tr><td>S16x_S7PB01_03</td><td>Signed 16-bit value</td><td>DB75,DW4</td></tr>
<tr><td>S16x_S7PB01_04</td><td>Signed 16-bit value</td><td>DB75,DW6</td></tr>
<tr><td>S16x_S7PB01_05</td><td>Signed 16-bit value</td><td>DB75,DW8</td></tr>
</table>

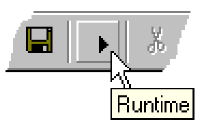
</td></tr>
</table>

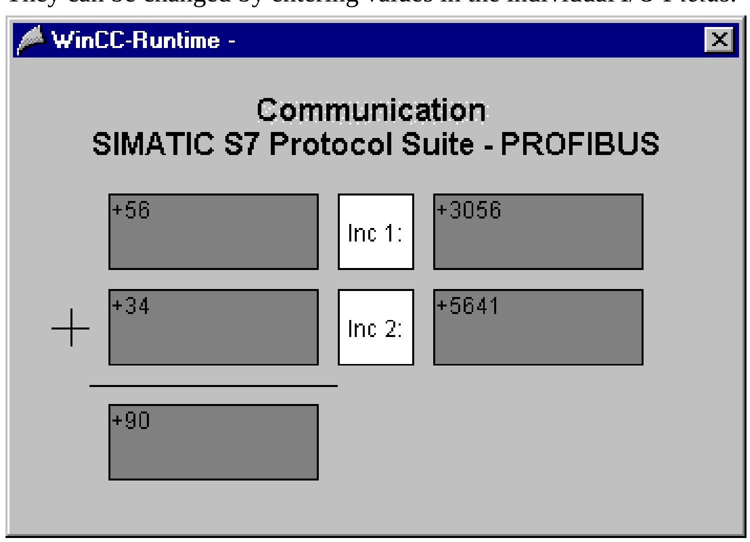
D: Creating the WinCC Screen

Step	D: Creating the WinCC Screen
1	Creation of a WinCC screen in which the previously created tags are visualized. Open the *Graphics Designer* editor via a R and then selecting *Open* from the pop-up menu. 
2	This will open the *Graphics Designer* editor with a new (blank) screen. To display the first tag, configure a *Smart Object* → *I/O Field*. To do so, select the *I/O Field* object from the *Object Palette* and place it on the screen using the mouse. 

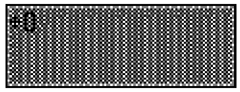
Step	D: Creating the WinCC Screen
3	After placing the *I/O Field* on the screen, its *Configuration* dialog box will be displayed. In the *Tag* field, set the tag *S16x_S7PB01_01* via the button displayed below.  Leave the *Update* of the tag at *2 s*. Keep the default settings for the remaining options. Close the dialog box by clicking on *OK*. 
4	Changing the output format of the *I/O Field*. For this, open its properties dialog box via a R on the *I/O Field* and then select *Properties* from the pop-up menu. 

<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>5</td><td>
The dialog box Object Properties will be displayed.
On the left side of the Properties tab, select the entry Output/Input. Via a D on the output format set, the field can be edited. Select the new format s99999. This format enables the I/O Field to display signed values with a maximum of 5 digits.


</td></tr>
<tr><td>6</td><td>
Creation of four additional I/O Fields for the display of the remaining tags.
Follow steps 2 to 5 to create the remaining I/O fields.
</td></tr>
<tr><td>7</td><td>
Save the screen.
In the sample project, the screen is saved under the name com_S7PB_01.pdl. The screen can be switched directly to runtime from the Graphics Designer via the button displayed below.


If the screen is in runtime, the PLC started and the network connection established, the current values of the PLC will be displayed in the I/O fields. They can be changed by entering values in the individual I/O Fields.


</td></tr>
</table>

Step	D: Creating the WinCC Screen
	If there is no connection to the PLC, the *I/O Fields* will be displayed grayed out. In this case an error is present at some point of the communication connection. 

6.4 Diagnosis of the Communication Connection

The following describes the options available for diagnosing the communication connection between the WinCC project *WinCC_S7_PB* and the SIMATIC S7 station.
A diagnosis of the sample according to this description makes only sense, if the checks listed below have been completed successfully.
Startup of the Communication Processor CP 5412 A2

- E: Testing the Communication Processor

Creation of the STEP7 Project S7_PB

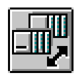
- F: Testing the Hardware Configuration
- H: Testing the STEP7 Program

Setting the PG/PC Interface

<table>
<tr><th>Step</th><th>Setting the PG/PC Interface</th></tr>
<tr><td>1</td><td>

Diagnosis of the communication connection via the program *Setting the PG/PC Interface*.

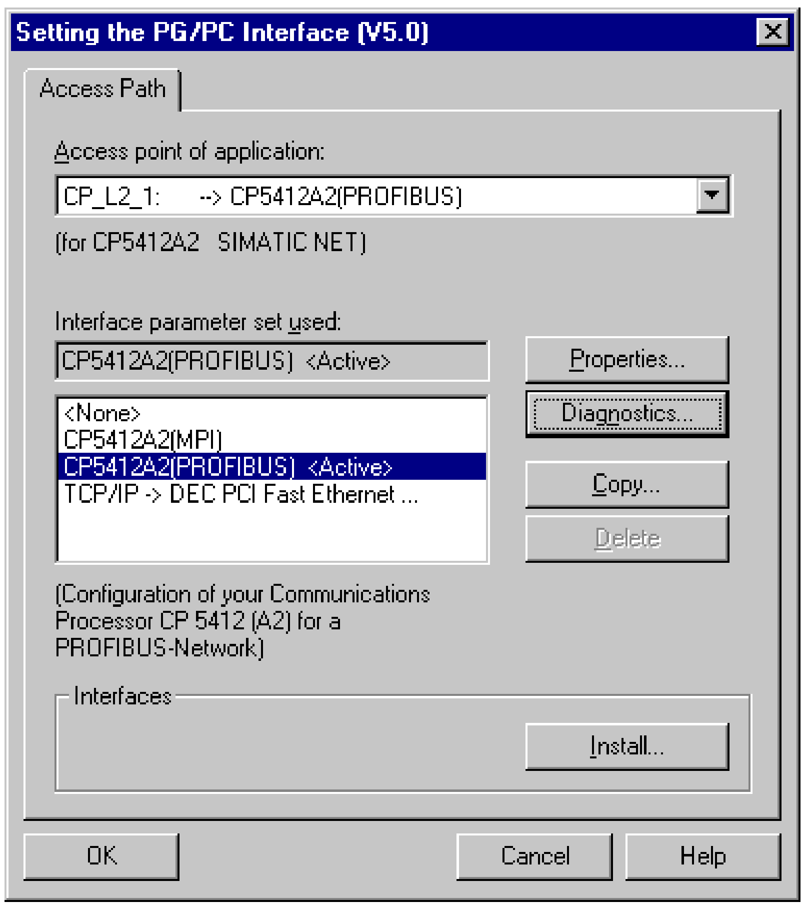
This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*.



</td></tr>
<tr><td>2</td><td>

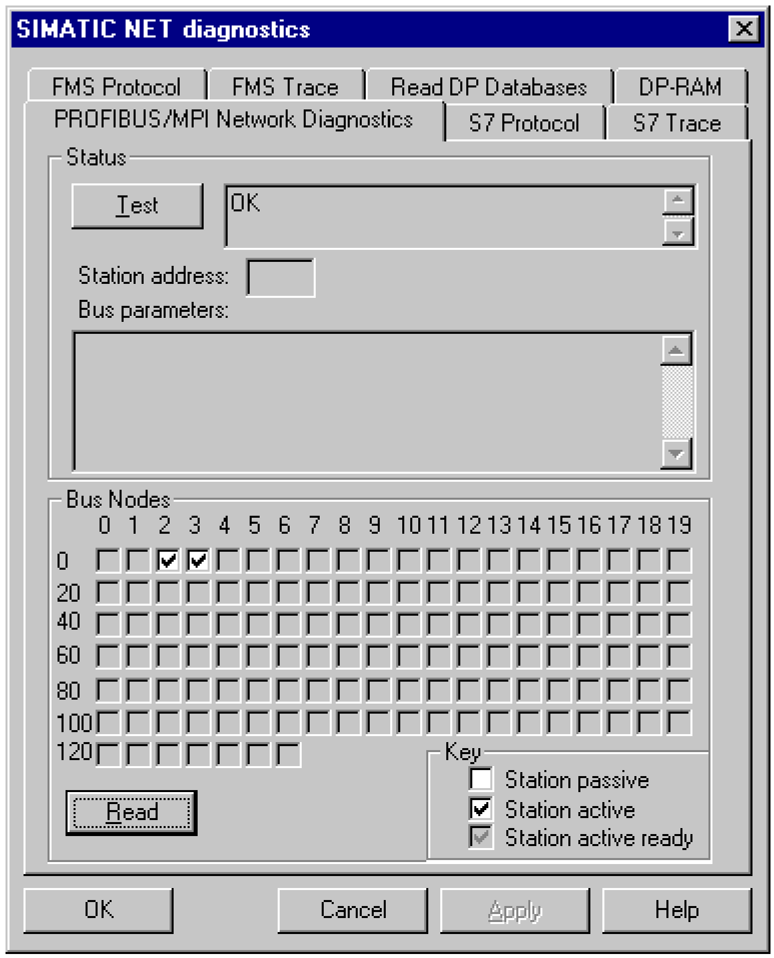
The program *Setting the PG/PC Interface* will be displayed.

Select the interface *CP 5412 A2 (PROFIBUS)*. Make sure that the assignments between access points and the interfaces are not changed. The diagnosis of the communication connection is started by clicking on the *Diagnostics* button.



</td></tr>
</table>

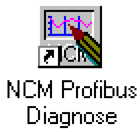
Step	Setting the PG/PC Interface
3	The dialog box *Simatic NET Diagnostics* will be displayed. From the *PROFIBUS/MPI Network Diagnostics* tab, the diagnosis of the communication connection is started by clicking on the *Read* button. This will display all stations accessible on the bus. For this sample, the address *2* of the communication processor *CP 5412 A2* as well as the address *3* of the communication processor *CP 443-5 BASIC* must be marked as occupied. The dialog box can be exited by clicking on *OK*.



NCM S7 PROFIBUS Diagnosis

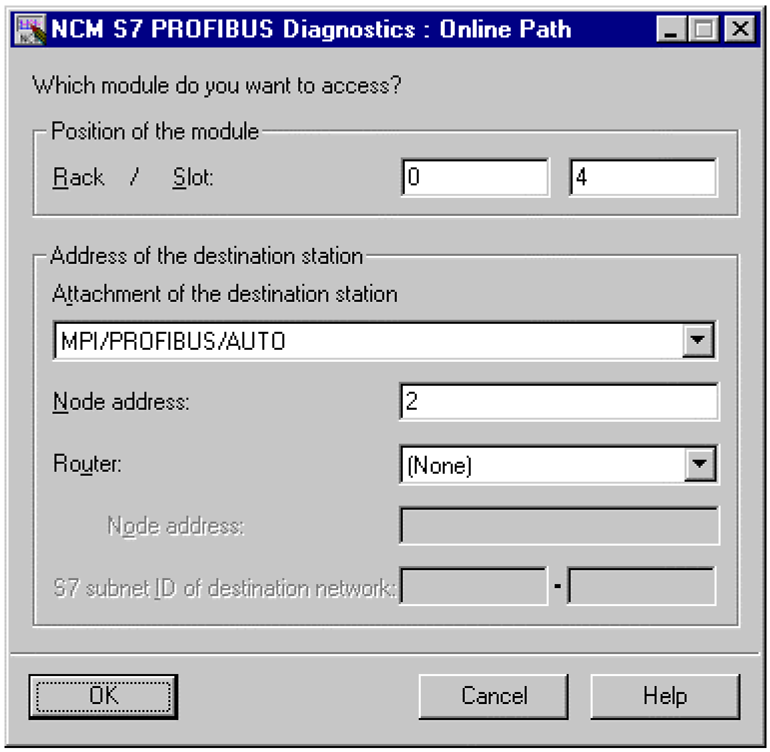
<table>
<tr><th>Step</th><th>NCM S7 PROFIBUS Diagnosis</th></tr>
<tr><td>1</td><td>Diagnosis of the communication connection via the program NCM S7 PROFIBUS Diagnosis.

This program is started via Start → Simatic → STEP7 → NCM S7 PROFIBUS → PROFIBUS Diagnosis.

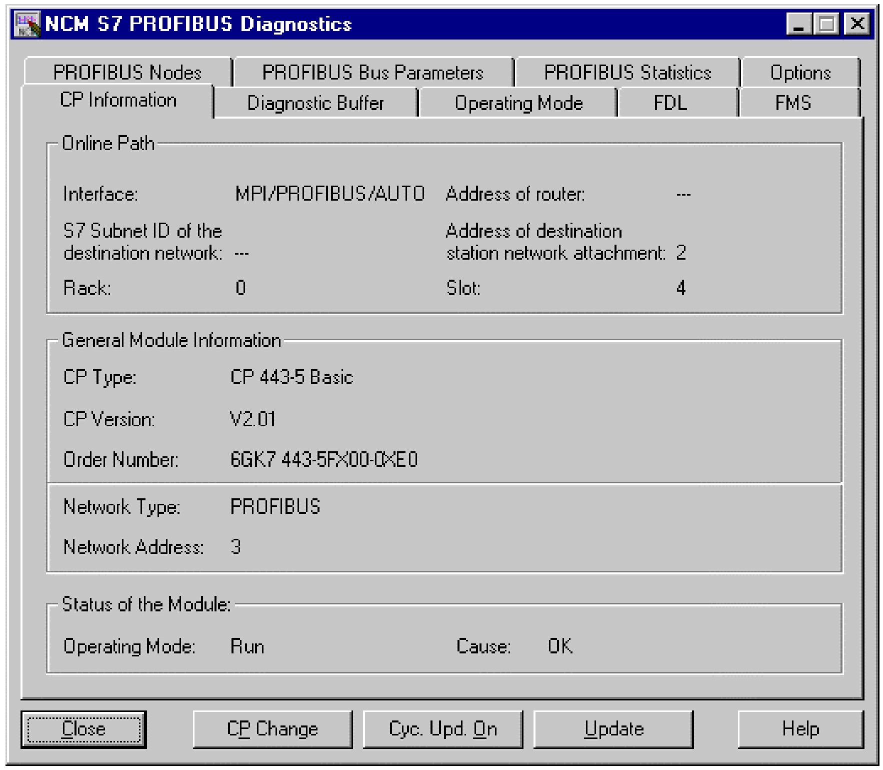

</td></tr>
<tr><td>2</td><td>A dialog box for specifying the module to be accessed will be displayed.

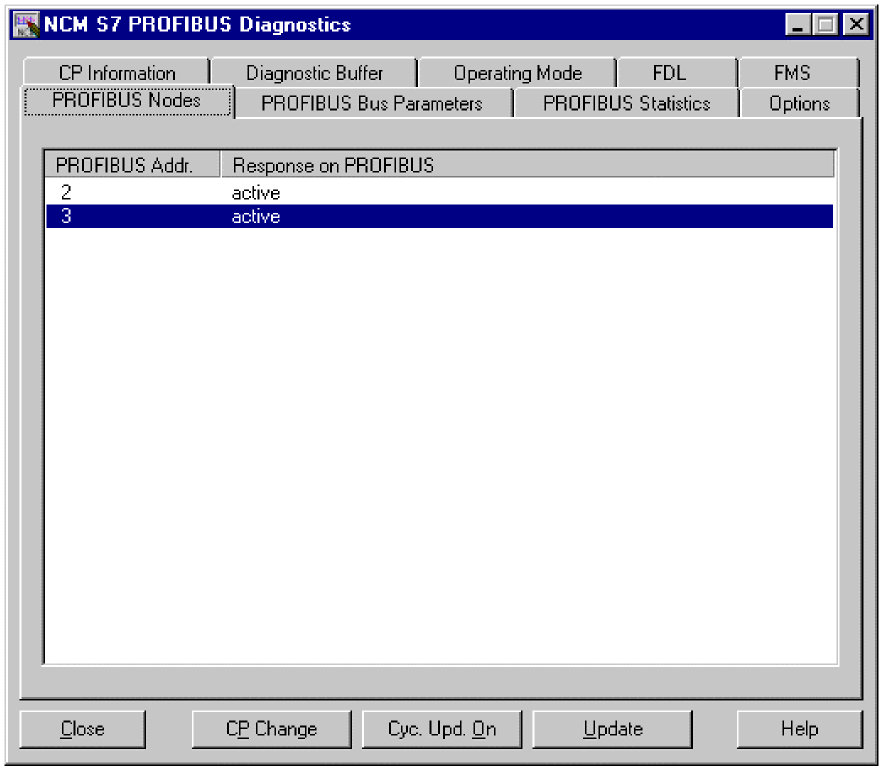
In this sample, the communication processor CP 443-5 BASIC in slot 4 is being accessed. The target station is accessed via the MPI interface of the CPU module with the address 2. Your system might use different settings.

Exit the dialog box by clicking on the OK button.

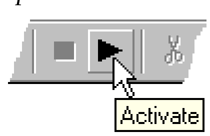

</td></tr>
</table>

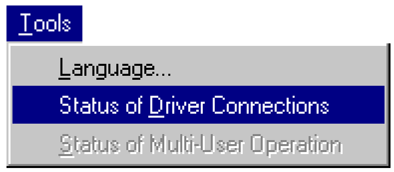
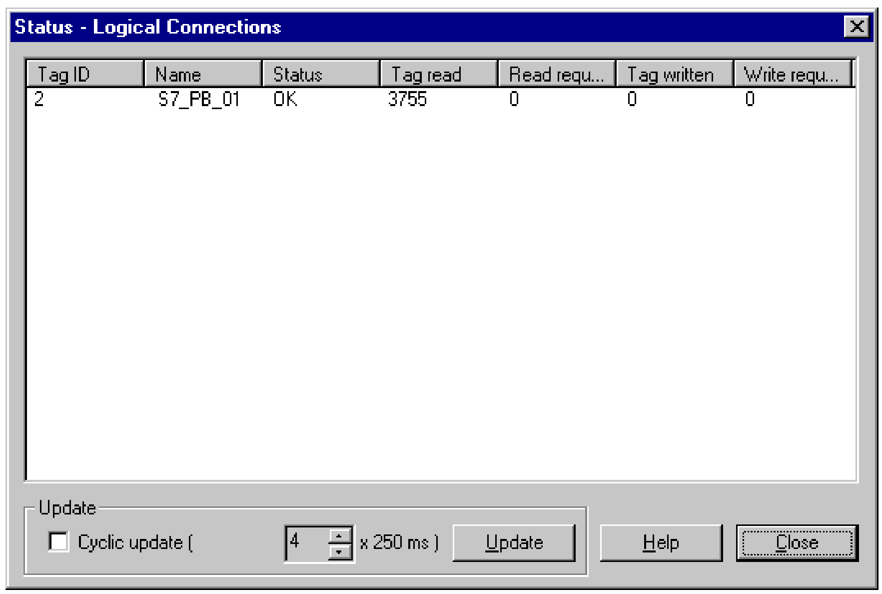
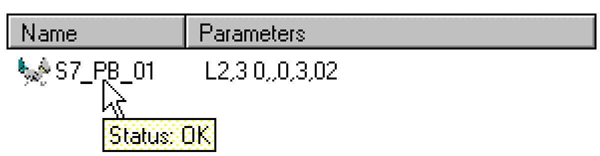
Step	NCM S7 PROFIBUS Diagnosis
3	The dialog box *NCM S7 PROFIBUS Diagnosis* will be displayed. The *CP Information* tab displays general information about the communication processor. Among other things, the *Network Address* configured with the STEP7 software is displayed.

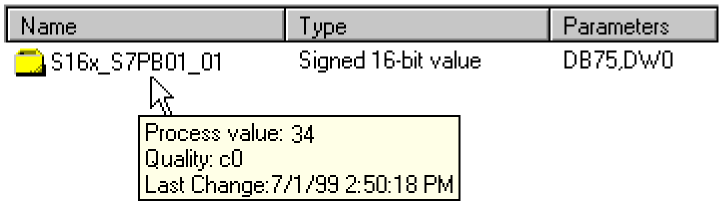


Step	NCM S7 PROFIBUS Diagnosis
4	The *PROFIBUS Station* tab lists all communication stations that can be accessed via the *PROFIBUS*. In this sample, these are the communication processors *CP 5412 A2* in the computer with the address *2* and the *CP 443-5 BASIC* in the PLC with the address *3*. 

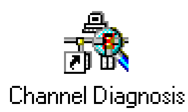
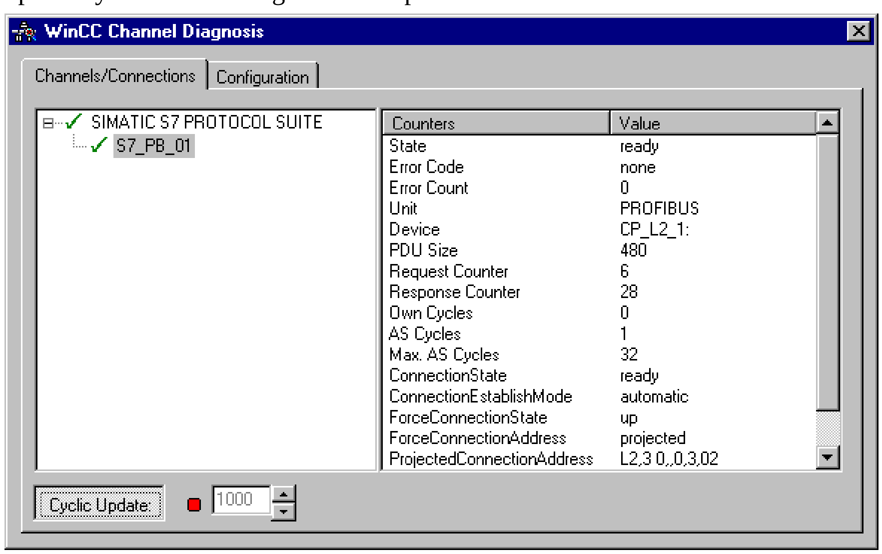
WinCC Explorer

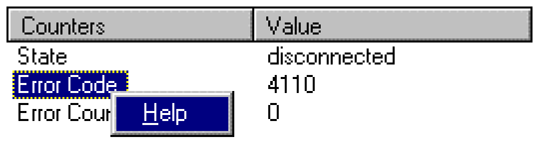
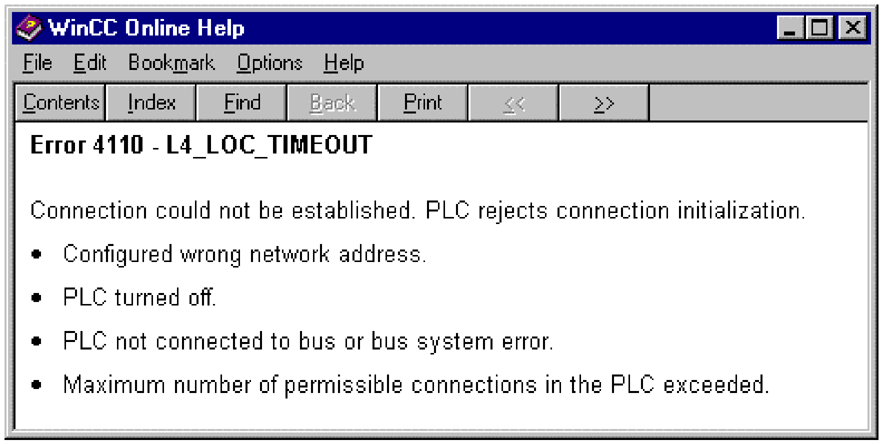
Step	WinCC Explorer
1	Diagnosis of the communication connection from the *WinCC Explorer*. Switch the project *WinCC_S7_PB* into runtime. This is done from the *WinCC Explorer* via the toolbar button displayed below.  The created WinCC screen *com_S7PB_01.pdl* can also be switched directly from the *Graphics Designer* into runtime.

<table>
<tr><th>Step</th><th>WinCC Explorer</th></tr>
<tr><td>2</td><td>In the WinCC Explorer, a dialog box for monitoring all configured connections can be accessed via the Tools → Status of Driver Connections menu. This menu point is only accessible if the project is in runtime.

</td></tr>
<tr><td>3</td><td>The dialog box Status - Logical Connections will be displayed.
This dialog box lists all configured connections. For this sample, only the connection S7_PB_01 will be displayed.
The displayed values correspond to the status at the moment the dialog box was opened. By selecting the appropriate check-box, a Cyclic Update of the display can be achieved.

</td></tr>
<tr><td>4</td><td>Another way to obtain information about the connection status in general and about the connection status of individual tags is provided by Tag Management.
The status of a configured connection can be displayed as a tooltip by simply pointing the mouse on the connection in question.

</td></tr>
</table>

Step	WinCC Explorer
	The current process value of a certain tag as well as its status can be displayed as a tooltip by pointing the mouse on it. This allows you to detect errors concerning an individual tag and not the entire connection. 

Channel Diagnosis

Step	Channel Diagnosis
1	Diagnosis of the communication connection via the program *WinCC Channel Diagnosis*. Start this program via *Start* → *Simatic* → *WinCC* → *Channel Diagnosis*. 
2	The program *WinCC Channel Diagnosis* will be displayed. The *Channels/Connections* tab displays detailed information about the status of each configured connection. By default, the display is updated every second. The update cycle can be changed in the input field located at the bottom. 

Step	Channel Diagnosis
3	If a connection error is detected, the *Error Code* line in the right window half will display a value specifying the error cause. Detailed information about this error code is displayed by R on the *Error Code* entry and then selecting *Help* from the pop-up menu. 
4	This opens the Online Help to WinCC containing a description of the corresponding error code. Additionally, possible error causes are also listed. 

7 Communication to the SIMATIC S5 via Industrial Ethernet

The projects created in this chapter can also be copied directly from the online document to your hard drive. By default, they will be copied to the folder *C:\Communication_Manual*. You have the option to copy the following components to the hard drive:


S5_IEHst

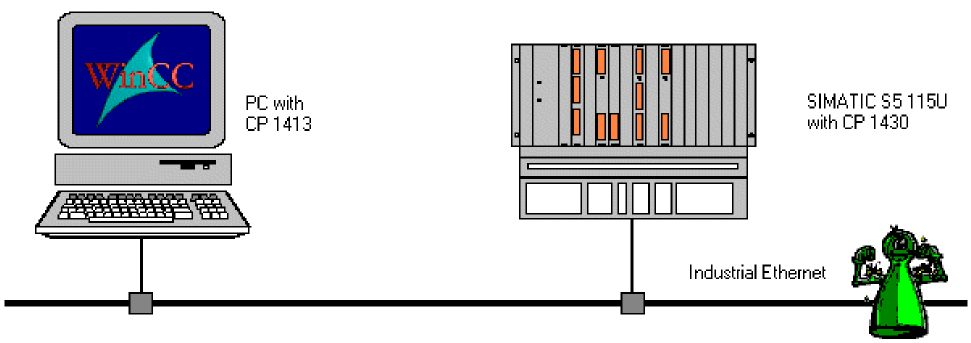
The STEP5 project we will create including the database file of the communication processor CP 1430 TF.


WinCC_S5_IEH

The WinCC project we will create.

This chapter describes in detail the startup of a communication connection between a SIMATIC S5 and WinCC. The communication connection is realized via the Industrial Ethernet. The communication card CP 1413 used in the computer has its own CPU onboard. This will free the CPU of the computer from communication tasks.

Overview of the Structure of the Sample



On the computer side, the connection to the *Industrial Ethernet* network is established via the communication processor *CP 1413*. To install this communication processor in the computer, the driver *IE TF-1413*, located on the *SIMATIC NET* CD-ROM, is needed.
In the WinCC project, the communication driver *SIMATIC S5 Ethernet Layer 4* must be installed. This communication driver is used to configure the connection to the *SIMATIC S5*.
The PLC SIMATIC S5 115U is equipped with the CPU module CPU 944. The connection to the network is established via the communication processor CP 1430 TF. For the configuration of this communication processor, the communication package SINEC NCM for COMs is required.

Overview of the Configuration Steps

The following lists all configuration steps necessary for the creation of the communication connection:

- Startup of the Communication Processor CP 1413
- Creation of the STEP5 Project S5_IEHst
- Creation of the WinCC Project WinCC_S5_IEH
- Diagnosis of the Communication Connection

Required Software

Name	Description
SIMATIC NET	Driver *IE TF-1413* from the *SIMATIC NET* CD-ROM for the installation of the communication processor *CP 1413*.
STEP5	STEP5 software for the creation of the STEP5 project. Communication package *SINEC NCM for COMs* for the configuration of the communication processor *CP 1430 TF*.
WinCC	WinCC with communication driver *SIMATIC S5 Ethernet Layer 4* for the creation of the WinCC project and for the configuration of the connection to the PLC.

Required Computer Hardware

Name	Description
Communication Processor	Communication processor *CP 1413* to establish the connection to the PLC's communication processor.

Required PLC Hardware

Name	Description
Rack	Rack *CR 700-3*.
Power Supply	Power supply *PS 951*.
CPU Module	CPU module *CPU 944*.
Communication Processor	Communication processor *CP 1430 TF*.

7.1 Startup of the Communication Processor CP 1413

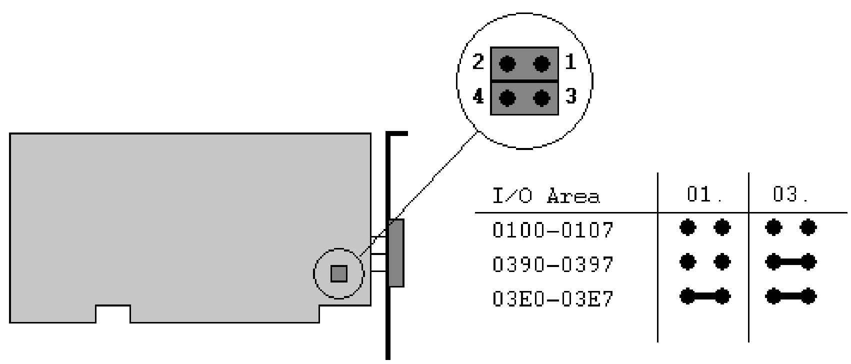
The following description details the configuration steps necessary to successfully start up the communication processor *CP 1413*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to start up the communication processor *CP 1413*:

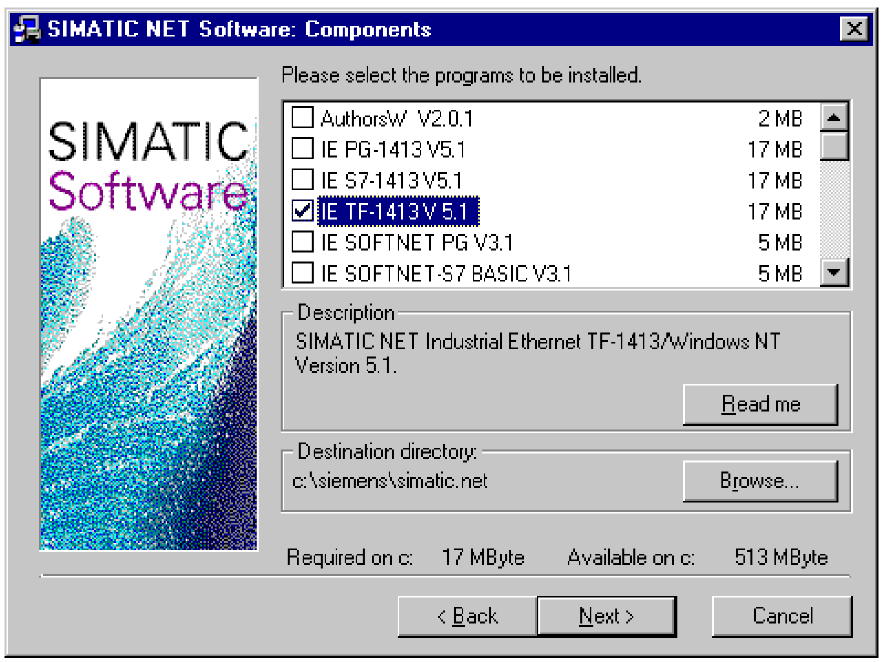
- A: Mounting the Communication Processor in the Computer
- B: Installing the Communication Driver
- C: Installing the Communication Processor
- D: Assigning the Communication Processor
- E: Testing the Communication Processor

A: Mounting the Communication Processor in the Computer

Step	A: Mounting the Communication Processor in the Computer
1	Check the selected jumper settings at the *CP 1413*. During the installation of the *CP 1413*, its *I/O Range* must be specified. The I/O Range is set via *jumpers*. By default, the *I/O Range* is set to *03E0-03E7*. The settings *0100-0117* and *0390-0397* are also possible. The following graphic illustrates the jumper settings necessary for the various *I/O Ranges*. 
2	Mount the module according to the installation instructions. Among other things, follow the steps for handling electrostatic sensitive devices (ESD). The module must only be installed while the computer is off. For the communication card *CP 1413*, a free ISA slot in the computer is required. After the installation of the *CP 1413*, close the computer's case and start the computer.

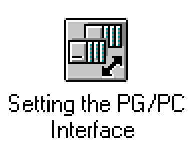
B: Installing the Communication Driver

<table>
<tr><th>Step</th><th>B: Installing the Communication Driver</th></tr>
<tr><td>1</td><td>
Installation of the communication driver IE TF-1413 from the SIMATIC NET CD-ROM.
After inserting the SIMATIC NET CD-ROM, the installation program is automatically started. If this is not the case, open the Windows NT Explorer and start the setup.exe program located on the CD-ROM.
The installation of the software is started via the button displayed below.


Follow the instructions of the installation program. On the Components page, the check-box of the driver IE TF-1413 to be installed must be selected. Finish the installation.


</td></tr>
</table>

C: Installing the Communication Processor

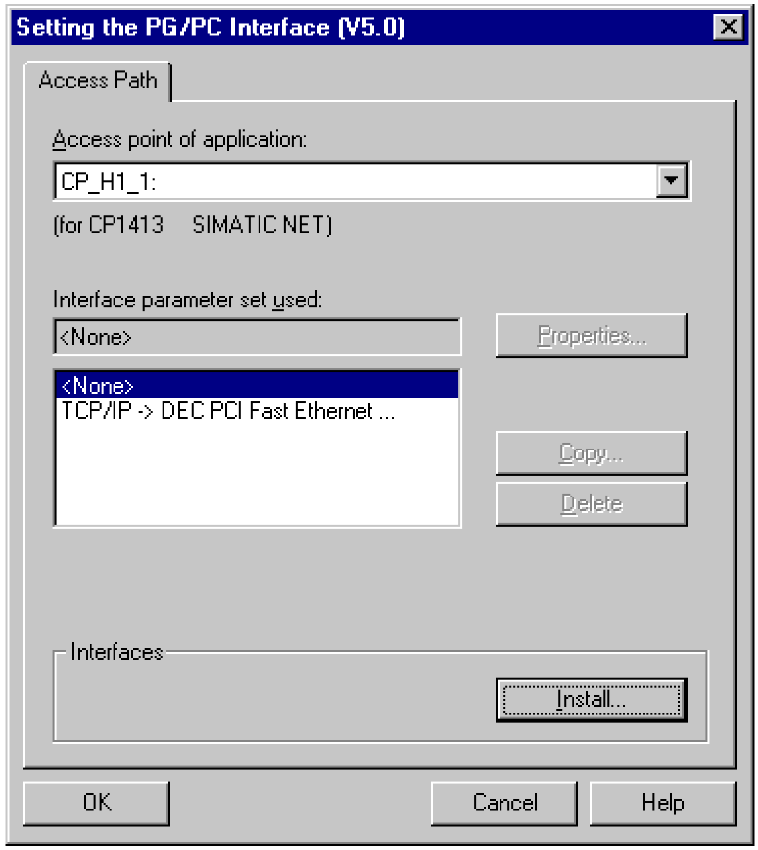
<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>1</td><td>
Install the communication processor CP 1413 via the program Setting the PG/PC Interface.
This program is accessed via Start → Settings → Control Panel → Setting the PG/PC Interface.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>2</td><td>

The program *Setting the PG/PC Interface* will be displayed.

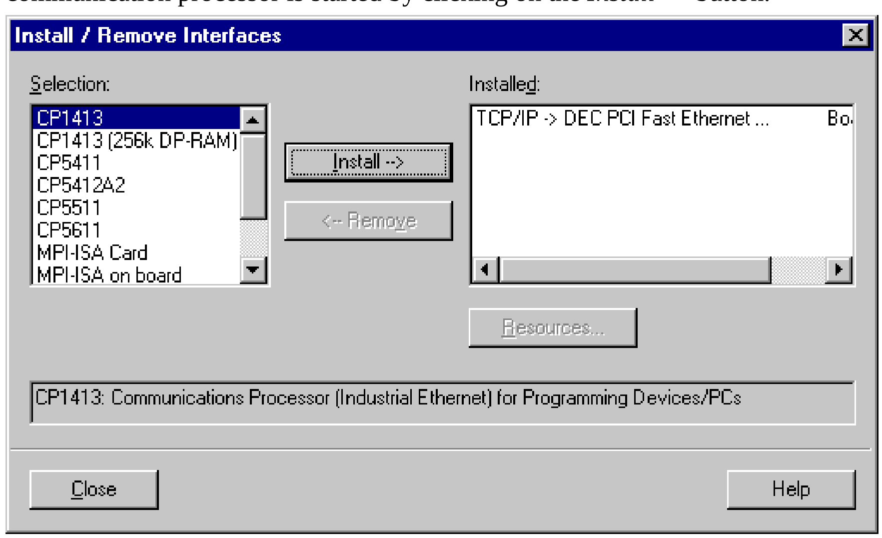
The dialog box for installing a new interface is opened via the *Install* button.



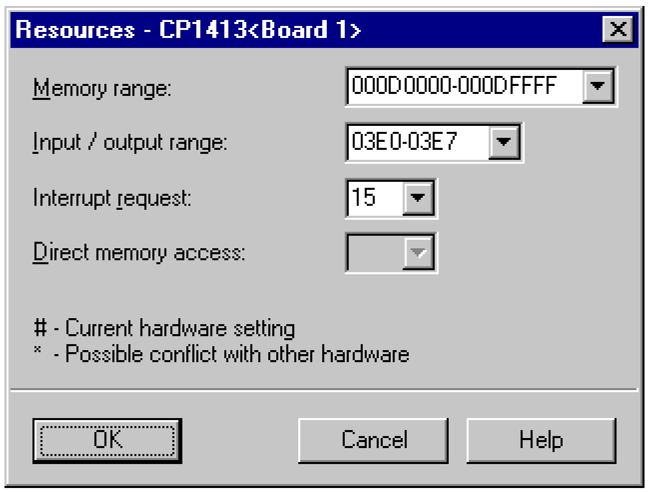
</td></tr>
<tr><td>3</td><td>

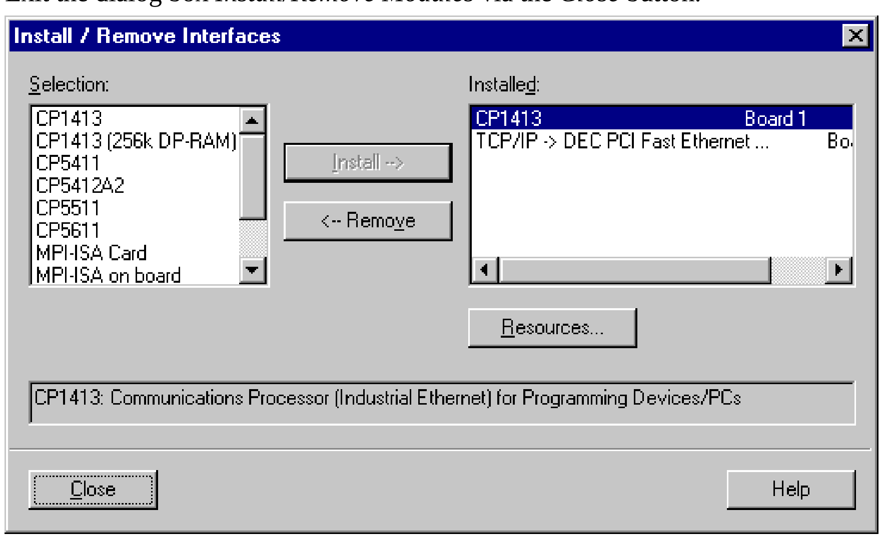
The dialog box *Install/Remove Modules* will be displayed. The *Selection* field lists all interfaces that can be installed. Among them will be the entry *CP 1413*, if the communication driver has been installed previously as outlined in step B.

From the *Selection* field, select the entry *CP 1413*. The installation of the communication processor is started by clicking on the *Install ->* button.



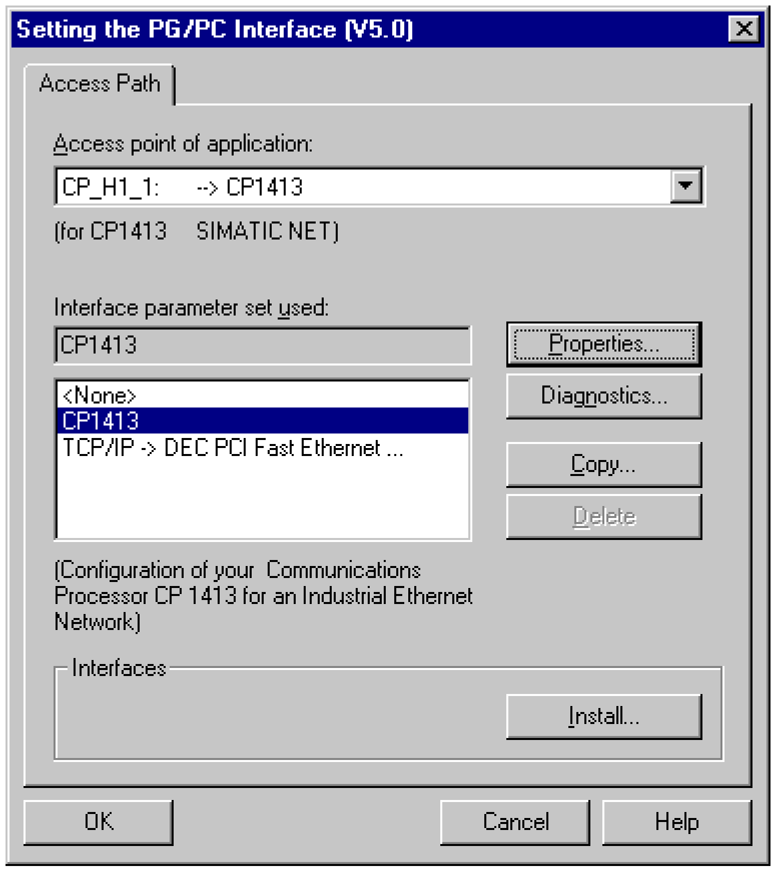
</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>4</td><td>
The dialog box Resources - CP 1413 will be displayed.
The settings for the Memory Range, I/O Range and Interrupt have to be specified.
The I/O Range has already been determined via the Jumper Settings at the CP 1413.
Make sure that the assigned resources have not already been taken by other modules in the computer. Information about already taken system resources can be obtained from the Resources tab accessed via Start → Programs → Administrative Tools (Common) → Windows NT Diagnostics.
Close the Resources tab by clicking on OK.


</td></tr>
<tr><td>5</td><td>
In the dialog box Install/Remove Modules, the Installed field will now contain the entry for the CP 1413.
Exit the dialog box Install/Remove Modules via the Close button.


</td></tr>
</table>

D: Assigning the Communication Processor

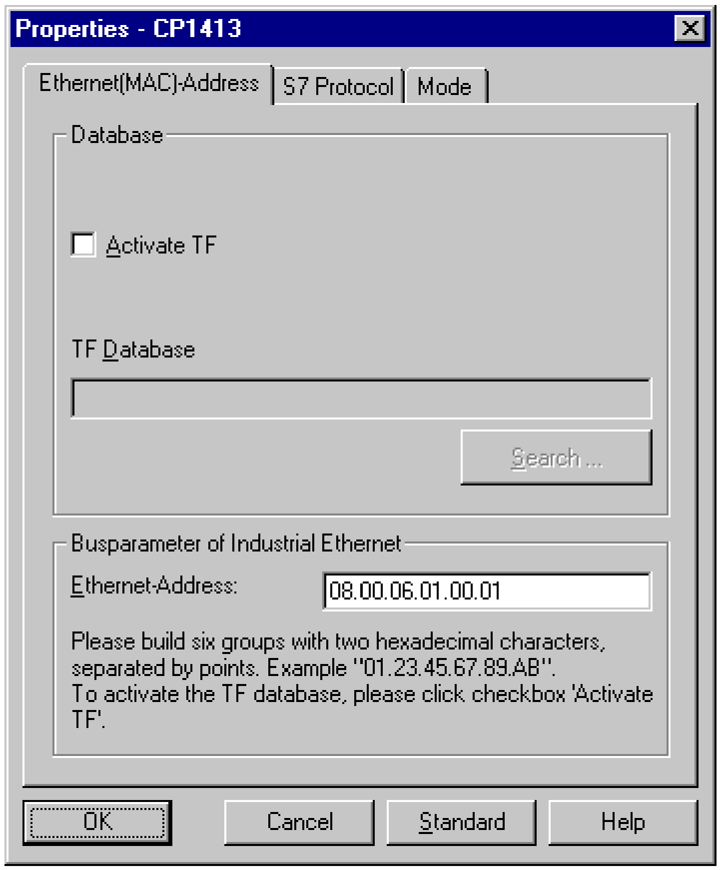
<table>
<tr><th>Step</th><th>D: Assigning the Communication Processor</th></tr>
<tr><td>1</td><td>
In the program Setting the PG/PC Interface, assign the access point CP_H1_1: to the just installed interface.
The access point CP_H1_1: is the default access point used by WinCC for the communication via the Industrial Ethernet. It has been created automatically during the installation of the communication driver IE TF-1413.
In the field Access Point of the Application, set the entry CP_H1_1:. In the field below, select the entry CP1413. This completes the assignment between the access point and the communication processor.


</td></tr>
<tr><td>2</td><td>
Setting the properties of the communication processor CP 1413.
The dialog box for setting the properties is opened via the Properties button of the Setting the PG/PC Interface program.
The dialog box Properties - CP 1413 will be displayed.
In the Ethernet (MAC) Address tab, enter the Ethernet Address of the CP 1413. In this sample, the address is 08.00.06.01.00.01, which must be specified during the configuration of the Transport Connections for the communication processor CP 1430.
</td></tr>
</table>

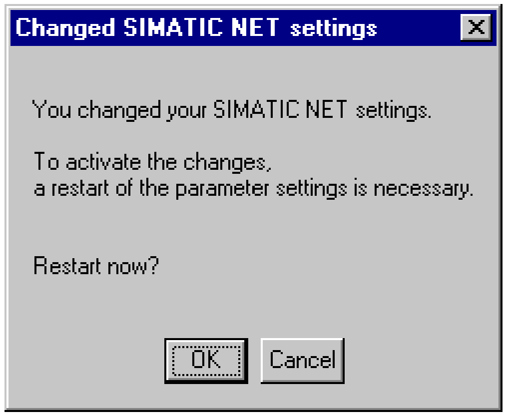
<table>
<tr><th>Step</th><th>D: Assigning the Communication Processor</th></tr>
<tr><td></td><td>

The *Ethernet Address* is six Bytes long and structured as follows for SIEMENS devices:

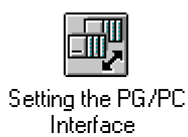
- *08.00.06*: The first six digits of the hexadecimal value correspond to the number for SIEMENS.
- *01*: The next two digits specify the range for SIEMENS.
- *0*: The next digit signifies the SIMATIC system.
- *0.01*: The last three digits correspond to the significant station address of a SIEMENS device.

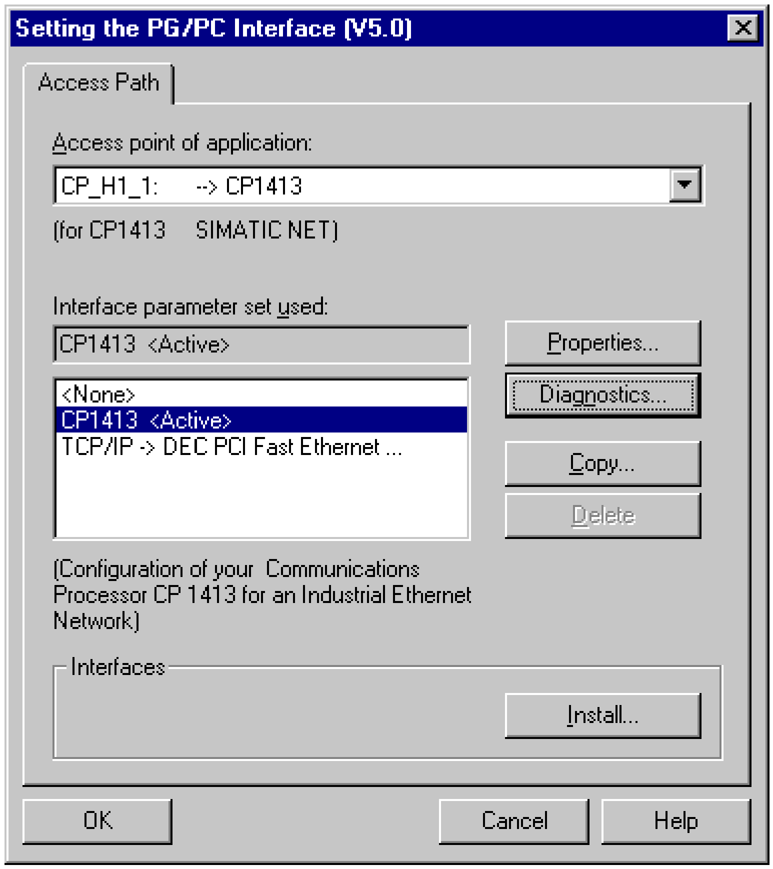


</td></tr>
</table>

Step	D: Assigning the Communication Processor
3	Exit the program *Setting the PG/PC Interface* via the *OK* button. A dialog box will be displayed requesting the restart of the *CP 1413*. Acknowledge this dialog box by clicking on *OK*, which will result in the restart of the communication processor *CP 1413*. This completes the installation of the communication processor. 

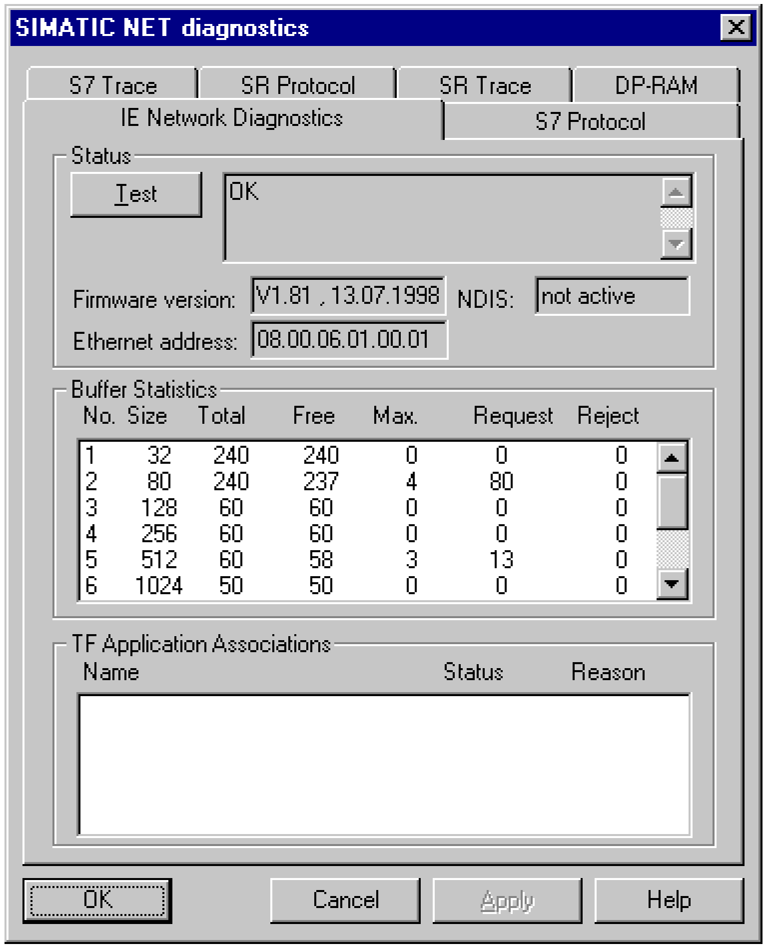
E: Testing the Communication Processor

Step	E: Testing the Communication Processor
1	Check the proper installation of the communication processor *CP 1413* via the program *Setting the PG/PC Interface*. This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*. 

<table>
<tr><th>Step</th><th>E: Testing the Communication Processor</th></tr>
<tr><td>2</td><td>
The program Setting the PG/PC Interface will be displayed.
Select the interface to be checked. In this case, select the entry CP 1413. Make sure that the assignments between access points and the interfaces are not changed.
The check for a proper installation is activated by clicking on the Diagnostics button.


</td></tr>
</table>

Step	E: Testing the Communication Processor
3	The dialog box *Simatic NET Diagnostics* will be displayed. In the *IE Network Diagnostics* tab, the diagnosis is started via the *Test* button. The result of the diagnosis will be displayed immediately following. If the result of the diagnosis is positive (correct installation), the dialog box can be exited with *OK*. In this case, the program *Setting the PG/PC Interface* can also be closed by clicking on *OK*. The configuration of the communication to the S5 via the *Industrial Ethernet* is continued in the following section. However, if the result of the diagnosis is negative (incorrect installation), the error must be localized and corrected. Troubleshooting procedures are described in the section Is the Communication Module in the Computer operational?.



7.2 Creation of the STEP5 Project S5_IEHst

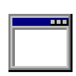
The following description details the configuration steps necessary to create and start up the STEP5 project *S5_IEHst*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to create the STEP5 project *S5_IEHst*:

- A: Installing the Hardware and Software
- B: Creating the STEP5 Program
- C: Configuring the Communication Processor
- D: Starting up the PLC

A: Installing the Hardware and Software

Step	A: Installing the Hardware and Software
1	Rack-mounting of the modules used. In this sample, the modules to be installed are the power supply *PS 951*, the CPU module *CPU 944* and the communication processor *CP 1430*. Establishing the connection from the programming device to the programming interface of the CPU module. Establishing the connection from the communication processor *CP 1413* in the computer to the communication processor *CP 1430* in the PLC.
2	Installing the communication package SINEC NCM for COMs from the corresponding installation disk. This communication package is required for the configuration of the communication processor *CP 1430*. The installation disk contains the program file *install.exe*. Start this program. Follow the instructions of the installation program and complete the installation.  Install.exe

B: Creating the STEP5 Program

Step	B: Creating the STEP5 Program
1	Creation of a new project with the STEP5 software. Start the STEP5 software. From the *Object* → *Project* → *Settings* → *Page1* and *Page2* menus, define the settings for the new project. In the *Program File* field, specify the name of the new program file to be created. In this sample, the name *S5_IEHST.S5D* is used. Only the first six characters of the file name can be changed by the user.
2	Creation of a data block. In STEP5, this is accomplished via the *Editor* → *Data Block* → *menus of the program file*. As the name of the data block, this sample uses *DB5*.

<table>
<tr><th>Step</th><th>B: Creating the STEP5 Program</th></tr>
<tr><td></td><td>

In this data block, two tags with a length of 16 Bits are created. Their sum is to be determined in *OB1* and then be written to another tag with a length of 16 Bits. One additional tag with a length of 16 Bits is created, whose value is cyclically incremented in *OB1*.

The tags created in the data block *DB5* are visualized in the WinCC project. To do so, WinCC tags with corresponding addresses are created there.

The following graphic displays the programmed data block *DB5*.

```
DB   5

   0:KH  = 0000                                        value 1
   1:KH  = 0000                                        value 2
   2:KH  = 0000                                        sum
   3:KH  = 0000                                        inc
   4:KH  = 0000
   5:KH  = 0000
   6:KH  = 0000
   7:KH  = 0000
   8:KH  = 0000
```

</td></tr>
<tr><td>3</td><td>

Creation of a program block for the communication.

The communication to WinCC via the communication processor CP 1430 is carried out by calling the data handling blocks SEND and RECEIVE. For the SIMATIC S5 115U PLC used in this sample, these are the blocks FB244 and FB245. These blocks must be called once every program cycle. As the request number A-NR, 0 is assigned to these blocks to allow execution of the Send All and Receive All functions.

In this sample, the data handling block calls are carried out in a program block, which is called in the *OB1*.

In STEP5, the creation of a new program block is carried out via the *Editor → STEP5 Block → menus of the program file*. As the name of the program block, this sample uses *PB5*.

```
PB   5
NETZWERK 1 von 1          CP1430 Communication
     :SPA FB 244                                    SEND ALL
NAME :SEND
SSNR :     KY 000,000
A-NR :     KY 000,000
ANZW :     MW 100
QTYP :     KC NN
DBNR :     KY 000,000
QANF :     KF +0
QLAE :     KF +0
PAFE :     MB 104
     :SPA FB 245                                    RECEIVE ALL
NAME :RECEIVE
SSNR :     KY 000,000
A-NR :     KY 000,000
ANZW :     MW 105
ZTYP :     KC NN
DBNR :     KY 000,000
ZANF :     KF +0
ZLAE :     KF +0
PAFE :     MB 109
     :BE
```

</td></tr>
</table>

Step	B: Creating the STEP5 Program

4	Creation of a function block, which makes available the functionality of the sample program.
	Two values stored in the *DB5* are added and the sum again stored in the *DB5*. Additionally, a value stored in the *DB5* is incremented every program cycle. If this value reaches 10000, it is reset back to 0.
	In STEP5, the creation of a new function block is carried out via the *Editor → STEP5 Block → menus of the program file*. As the name of the program block, this sample uses *FB6*.
	`FB 6`
	`NETZWERK 1 von 1          Add and Increment`
	`NAME :ADD_INC`
	`     :A   DB 5                    Add Values`
	`     :L   DW 0`
	`     :L   DW 1`
	`     :+F`
	`     :T   DW 2`
	`     :L   DW 3                    Increment Value`
	`     :L   KF +10000`
	`     :<F`
	`     :SPB =M001`
	`     :L   KF +0                   Set 0 if 10000 is reached`
	`     :T   DW 3`
	`     :BEA`
	`M001 :L   DW 3`
	`     :L   KF +1`
	`     :+F`
	`     :T   DW 3`
	`     :BE`

5	Creation of the *OB1*.
	In the *OB1*, the previously created blocks *PB5* and *FB6* are called.
	`OB 1`
	`NETZWERK 1 von 1          Communication Manual`
	`     :`
	`     :SPA PB 5                    Communication`
	`     :`
	`     :SPA FB 6                    Add and Increment`
	`NAME :ADDCNT`
	`     :`
	`     :BE`

6	Creation of the startup blocks.
	During the startup of the PLC, the communication processor *CP 1430* must be synchronized. This is done by the data handling block *SYNCHRON*. For the *SIMATIC S5 115U* PLC used in this sample, this is the block *FB249*.
	`OB 21`
	`NETZWERK 1 von 1          Synchronize CP 1430 TF`
	`     :SPA FB 249`
	`NAME :SYNCHRON`
	`SSNR :     KY 000,000`
	`BLGR :     KY 000,000`
	`PAFE :     MB 110`
	`     :BE`

7	Loading the STEP5 program into the PLC. In STEP5, this is done via the *Object → Blocks → Transfer → PLC File* menus. In the Selection field, the option *All Blocks* must be selected to load all previously created blocks to the PLC.

C: Configuring the Communication Processor

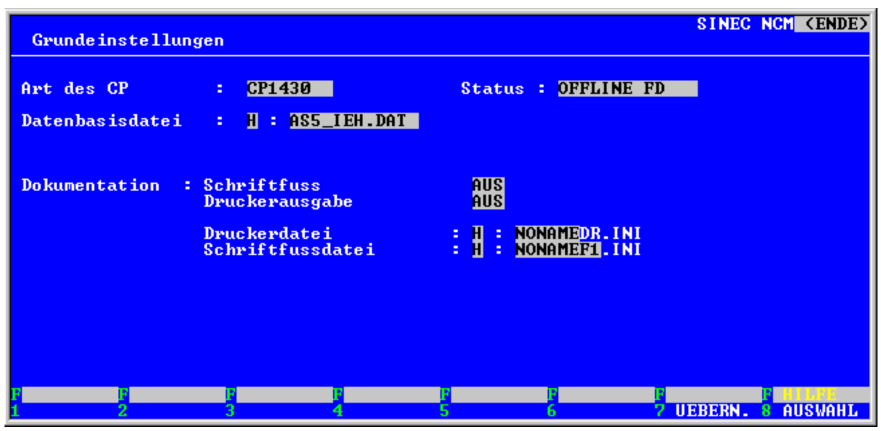
<table>
<tr><th>Step</th><th>C: Configuring the Communication Processor</th></tr>
<tr><td>1</td><td>Start the communication package SINEC NCM for COMs to configure the communication processor CP 1430.

From STEP5, start the communication package via the Change → Additional → SINEC NCM for COMs menus.</td></tr>
<tr><td>2</td><td>This will open the communication package SINEC NCM for COMs.

If no database file is set, the Basic Settings entry mask will initially be displayed. This entry mask can also be opened via the File → Select (or Init. → Edit) menus.

In the CP Type field, indicate the type of communication processor used. Via the F8 function key, one of the available communication processors can be set. Select the CP 1430. Set the Status field to OFFLINE FD via the F8 function key. This stores the configuration made in the program to a database file. In the Database File field, specify the name of this database file. This name has to start with the letter A. For this sample, the name AS5_IEH.DAT is used for the database file.

The settings made in the Basic Settings entry mask are applied via the F7 function key.


</td></tr>
</table>

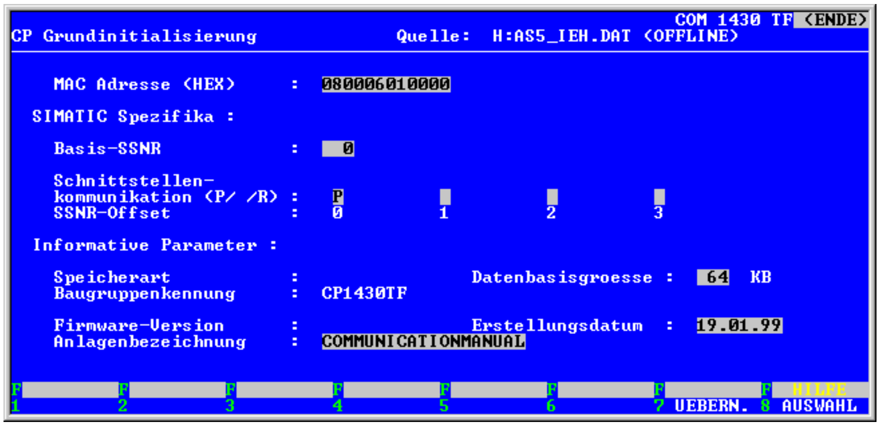
<table>
<tr><th>Step</th><th>C: Configuring the Communication Processor</th></tr>
<tr><td>3</td><td>

The settings for the basic initialization of the communication processor must be made.

They are entered in the *Basic Initialization* entry mask. This entry mask is opened via the *Edit* → *CP Init.* menus.

In the *MAC Address (HEX)* field, the *Ethernet address* of the communication processor *CP 1430* is specified. In this sample, the address *080006010000* has been entered. This address is one of the parameters that have to be set during the creation of the connection in WinCC.

The remaining settings can be seen in the following graphic. The settings made in the *Basic Initialization* entry mask are applied via the F7 function key.



</td></tr>
<tr><td>4</td><td>

Creation of the transport connections.

This is done in the *Transport Connection* entry mask. This entry mask is opened via the *Edit* → *Connections* → *Transport Connections* menus.

Two connections are needed: One processes the write requests of WinCC, the other one the read requests of WinCC. The PLC is set to passive for both connections by entering *P* in the *Active/Passive* field.

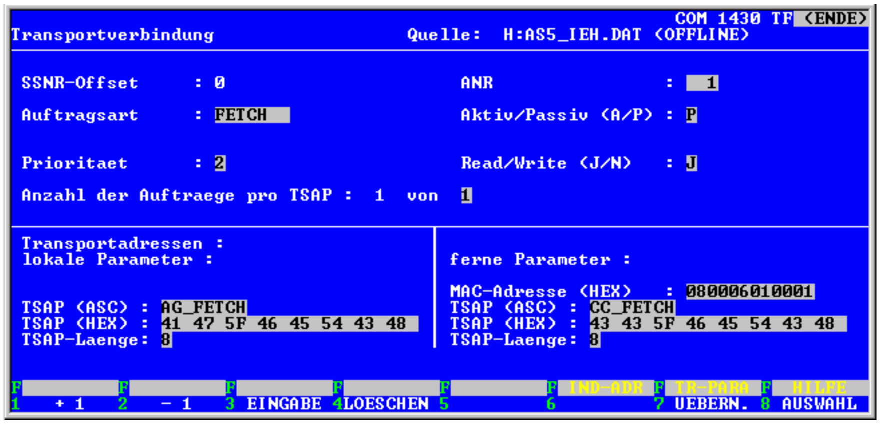
For the connection used to process the read requests from WinCC, this sample keeps *1* as the value of the request number *ANR*. In the *Request Type* field, *FETCH* is specified. In the *Transport Addresses* area, *TSAP* with *PLC_FETCH* is set for the *Local Parameter* in ASCII-Code, and *TSAP* with *CC_FETCH* for the *Remote Parameter*. The remote parameter also requires the specification of the Ethernet address in the *MAC Address* field that has been entered for the communication processor *CP 1413* in the computer. In this sample, the address *080006010001* has been set during the installation of the communication processor *CP 1413*.

By hitting the F3 function key, the parameters for the next transport connection can be entered. This transport connection will process the write requests of WinCC. In this sample, the value *2* for the request number *ANR* is kept. In the *Request Type* field, *RECEIVE* is specified. In the *Transport Addresses* area, *TSAP* with *PLC_RECVE* is set for the *Local Parameter* in ASCII-Code, and *TSAP* with *CC_RECVE* for the *Remote Parameter*. For the remote parameter, also enter the Ethernet address of the communication processor *CP 1413* from the computer.

</td></tr>
</table>

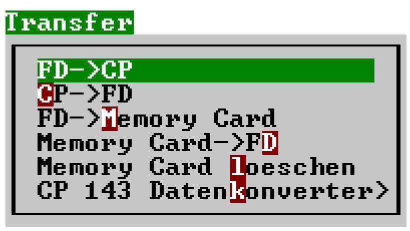
<table>
<tr><th>Step</th><th>C: Configuring the Communication Processor</th></tr>
<tr><td></td><td>
The connection parameters just defined must also be set during the creation of the connection in the WinCC project. For the TSAP values set, note that there is a difference between an entered blank space and no entered character. Always check the hexadecimal code.

The settings made in the *Transport Connection* entry mask are applied via the F7 function key.



</td></tr>
<tr><td>5</td><td>
Loading the configuration data of the database file to the communication processor *CP 1430*.

This is done via the *Transfer* → *FD->CP* menus. The configuration data can only be uploaded while the communication processor is in the *STOP* operating mode.



</td></tr>
</table>

D: Starting up the PLC

<table>
<tr><th>Step</th><th>D: Starting up the PLC</th></tr>
<tr><td>1</td><td>
Starting the individual modules of the PLC.

Previously, the STEP5 program and the database file of the communication processor *CP 1430* must have been loaded to the PLC.

First, the operating mode switch of the communication processor *CP 1430* is set to the RUN position. The status LEDs *RUN* and *STOP* will light up at the communication processor, indicating that the module has not be synchronized.

Next, the operating mode switch of the CPU module is set to the *RN* position. During the startup of the CPU module, the communication processor is synchronized by the startup block. The communication processor's status LED *STOP* go out. At the CPU module, only the status LED *RN* will be illuminated.
</td></tr>
</table>

7.3 Creation of the WinCC Project WinCC_S5_IEH

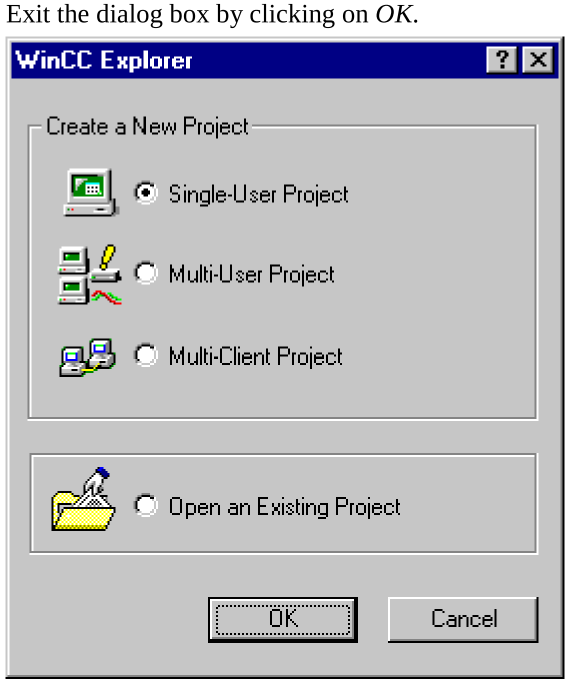
The following description details the configuration steps necessary to create and start up the WinCC project *WinCC_S5_IEH*.

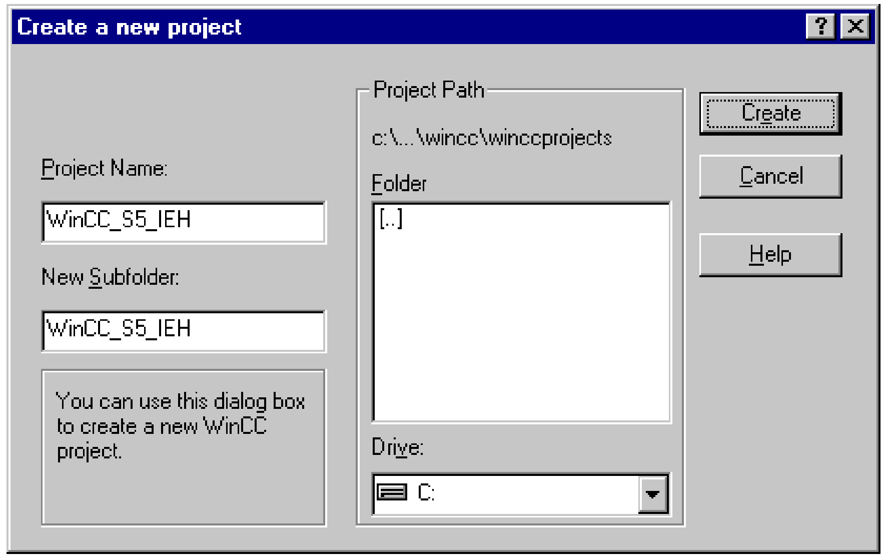
Overview of the Configuration Steps

The following lists the configuration steps necessary to create the WinCC project *WinCC_S5_IEH*:

- A: Creating the WinCC Project
- B: Creating the Connection
- C: Creating the WinCC Tags
- D: Creating the WinCC Screen

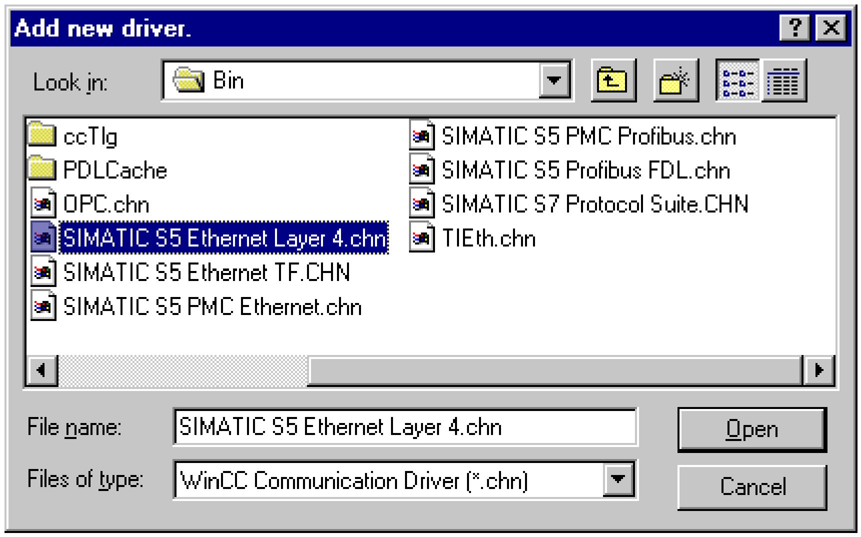
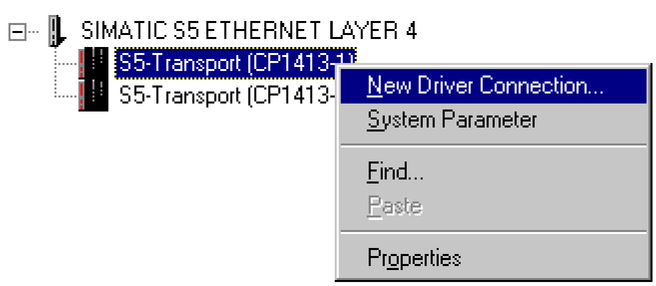
A: Creating the WinCC Project

Step	A: Creating the WinCC Project
1	Creation of a new WinCC project in the *WinCC Explorer*. The WinCC Explorer is started via *Start* → *Simatic* → *WinCC* → *Windows Control Center*. 
2	This will display the *WinCC Explorer*. Via the menus *File* → *New*, the dialog box for specifying the properties of a new WinCC project will be opened. For this sample project, a *Single-User Project* is created. Exit the dialog box by clicking on *OK*. 

Step	A: Creating the WinCC Project
3	The dialog box *Create a new Project* will be displayed. Specify a *Project Name* for the new project. The names of the WinCC projects created within the framework of this manual all start with *WinCC* and also include a reference to the communication partner and communication type used. The project of this sample has the name *WinCC_S5_IEH*. In the *Project Path* field, set the storage location of the new project. The dialog box *Create a new Project* is concluded by clicking on the *Create* button. 

B: Creating the Connection

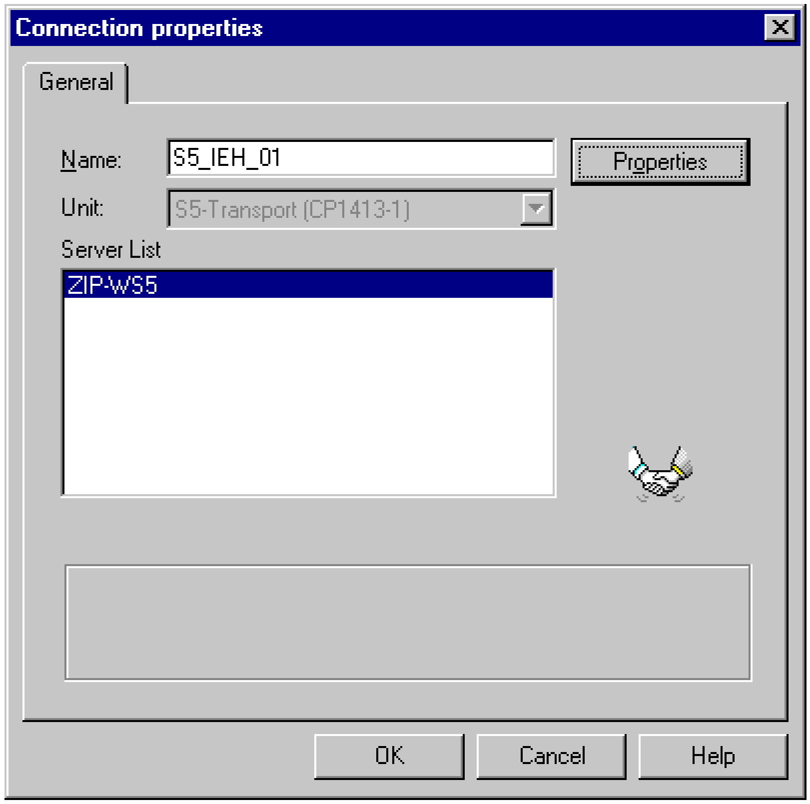
Step	B: Creating the Connection
1	The new project will be displayed in the *WinCC Explorer*. Installation of the required communication driver. This is performed via a R on *Tag Management* and selecting *Add New Driver* from the pop-up menu. 

Step	B: Creating the Connection
2	The dialog box *Add New Driver* will be displayed. This dialog box lists all communication drivers that can be installed. For the communication to the *SIMATIC S5* via *Industrial Ethernet*, the driver *SIMATIC S5 Ethernet Layer 4* is required. Select this driver from the dialog box. Exit the dialog box by clicking on *Open*. 
3	The newly added driver *SIMATIC S5 Ethernet Layer 4* will be displayed as a sub-entry to *Tag Management*. The driver contains two channel units. The second channel unit is needed if two *CP 1413* communication processors are operated in the computer. A new connection for the *S5-Transport (CP1413-1)* channel unit is created by R on *S5-Transport (CP1413-1)* and then selecting *New Driver Connection* from the pop-up menu. 

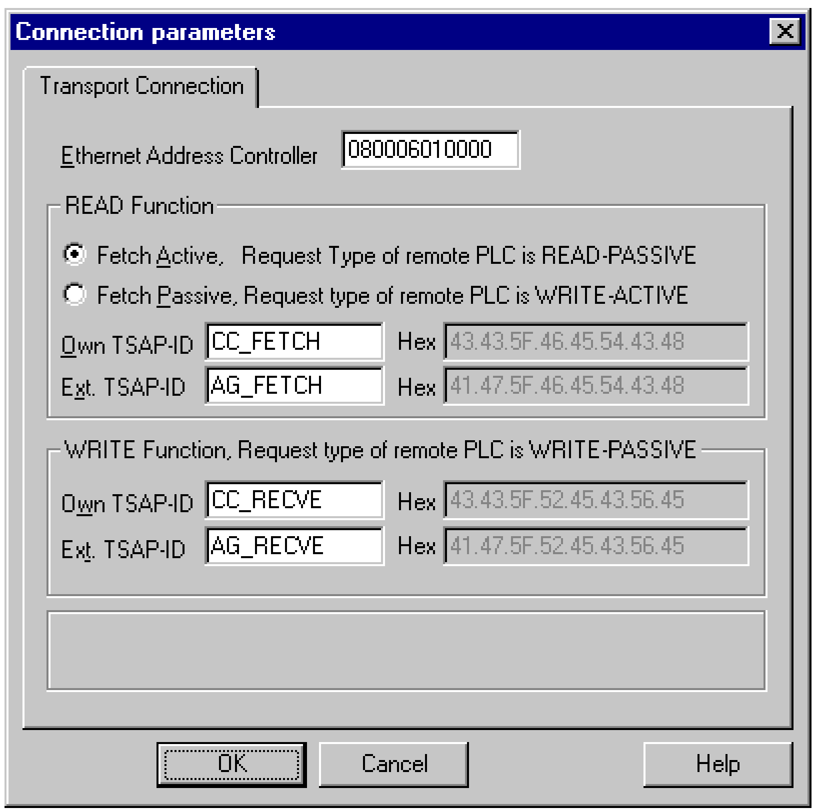
<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>4</td><td>The properties dialog box of the connection will be displayed.

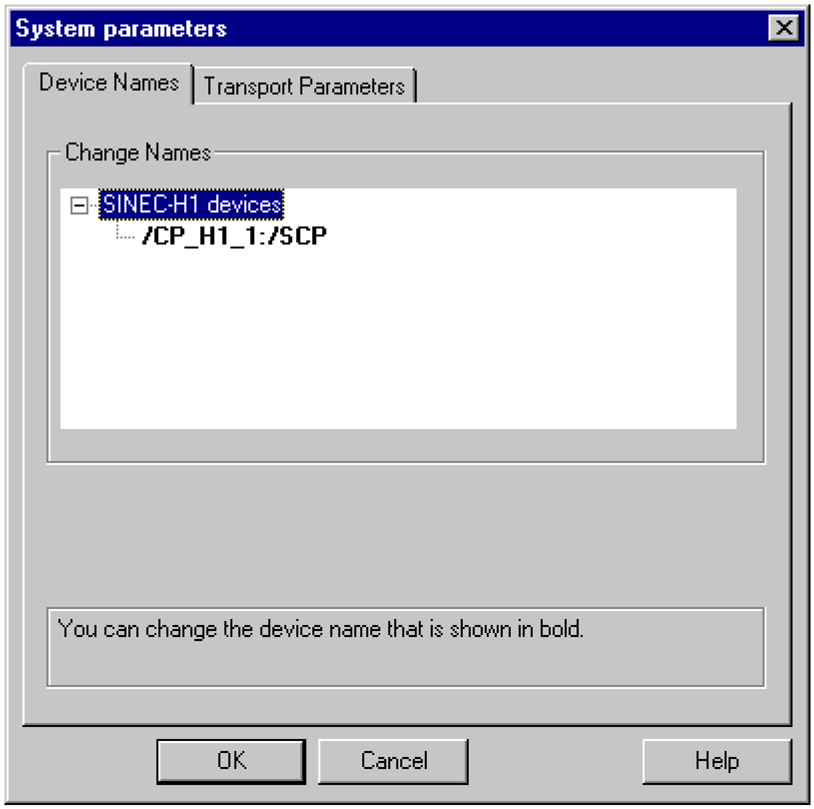
In the General tab, the Name of the new connection is entered. In this sample, this is S5_IEH_01.

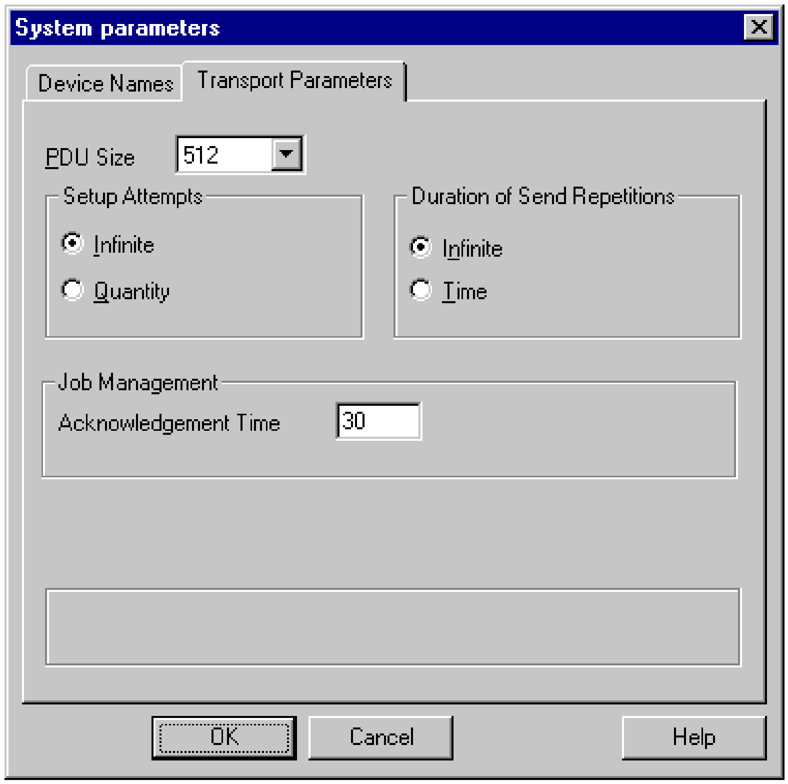
Click on the Properties button to define the connection properties.


</td></tr>
</table>

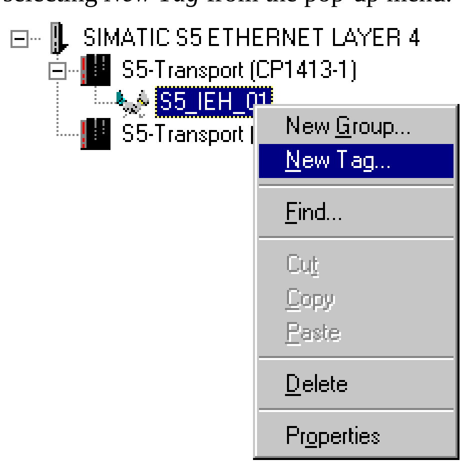
Step	B: Creating the Connection
5	The dialog box *Connection Properties* will be displayed. In the *Transport Connection* tab, the parameters of the desired communication connection are defined. In the *PLC Ethernet Address* field, the Ethernet address specified for the PLC is entered. In this sample, the address *080006010000* has been defined during the configuration of the communication processor *CP 1430*. In the *READ Function* area, the connection settings for reading data from the PLC are made. In order for WinCC to request the data actively, the radio-button *Fetch Actively, Request Type of the Partner is READ-PASSIVE* must be selected. For the local and remote TSAPs, the values defined during the creation of the transport connections for the communication processor *CP 1430* are entered. In this sample, the value *CC_FETCH* is entered in the *Local TSAP* field and the value *PLC_FETCH* in the *Remote TSAP* field. In the *WRITE Function* area, the connection settings for writing data to the PLC are made. In this sample, the value *CC_RECVE* is entered in the *Local TSAP* field and the value *PLC_RECVE* in the *Remote TSAP* field. The parameters that have just been set were defined during the configuration of the transport connections for the communication processor *CP 1430*. Close the dialog box by clicking on *OK*. Also close the *Connection Properties* dialog box by clicking on *OK*.

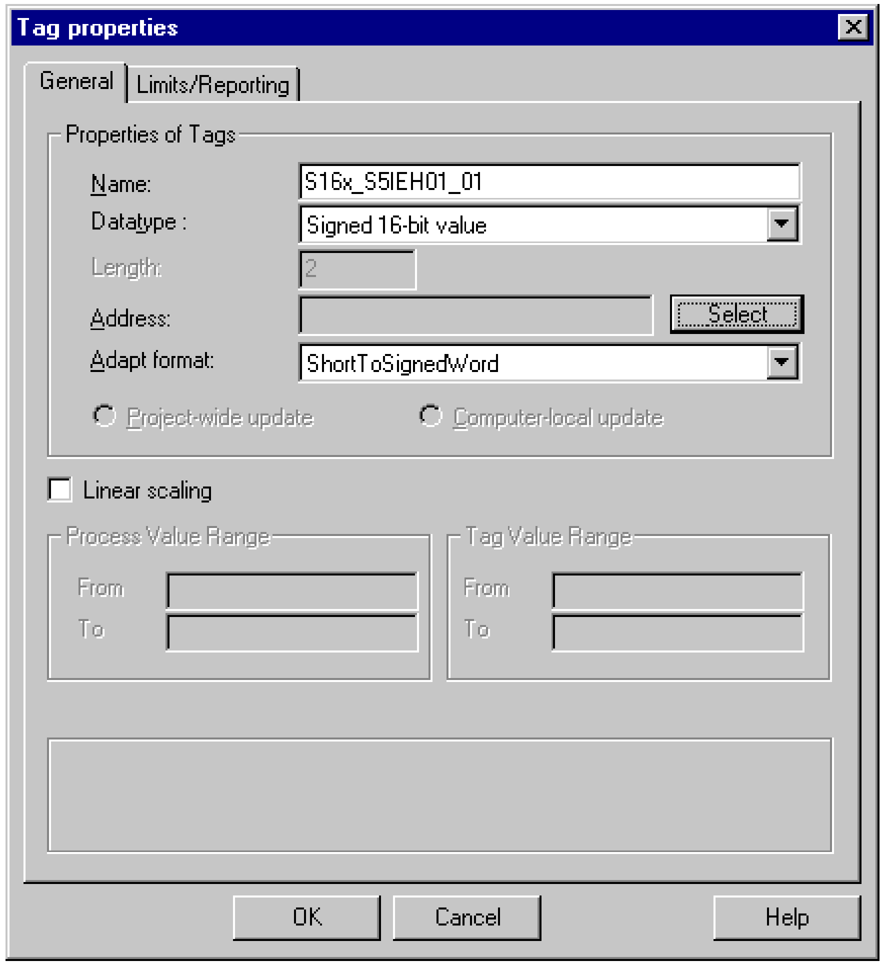


Step	B: Creating the Connection
6	Setting the system parameters of the channel unit. These settings are made in the System Parameters dialog box, which is accessed via a R on the *S5-Transport (CP1413-1)* entry and then selecting *System Parameters* from the pop-up menu. In the displayed dialog box, the name of the access point, which is used by WinCC to access the PLC, can be changed. By default, the access point *CP_H1_1:* is set. Previously, during the installation of the communication processor in the computer, the *CP 1413* has been assigned to the access point CP_H1_1:. 

Step	B: Creating the Connection
7	In the *Transport Parameters* tab, various settings affecting the communication can be edited. In this sample, all existing settings are kept. Close the dialog box by clicking on *OK*. 

C: Creating the WinCC Tags

Step	C: Creating the WinCC Tags
1	Creation of the WinCC tags required for the sample. This is done via a R on the newly created connection *S5_IEH_01* and then selecting *New Tag* from the pop-up menu. 

<table>
<tr><th>Step</th><th>C: Creating the WinCC Tags</th></tr>
<tr><td>2</td><td>The properties dialog box of the tag will be displayed.
In the sample, the Name of the first tag is S16x_S5IEH01_01. The tag is of the Signed 16-Bit Value data type. Click on the Select button to set the Address of the new tag.

</td></tr>
</table>

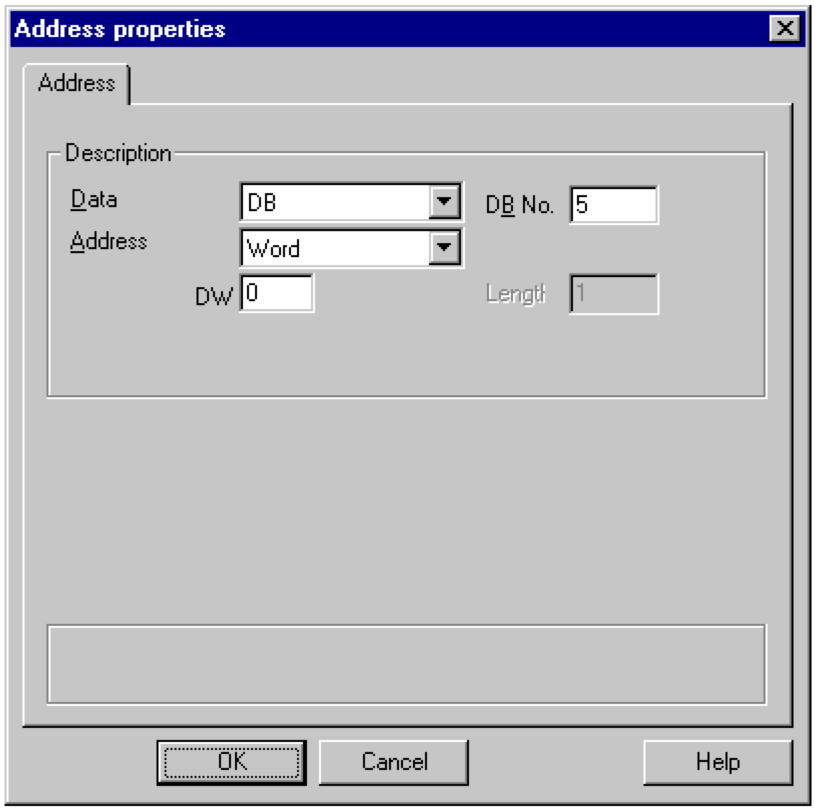
<table>
<tr><th>Step</th><th>C: Creating the WinCC Tags</th></tr>
<tr><td>3</td><td>

The dialog box *Address Properties* will be displayed.

Set *DB* as the *Data Range* and the value *5* as the *DB No.*. Set *Word* in the Address field and the value *0* in the *DW* field. Close the dialog box by clicking on *OK*. The properties dialog box of the tag is also closed by clicking on *OK*.

The just created WinCC tag is addressed in the range of the DB5, where the first of the two values to be added is located.

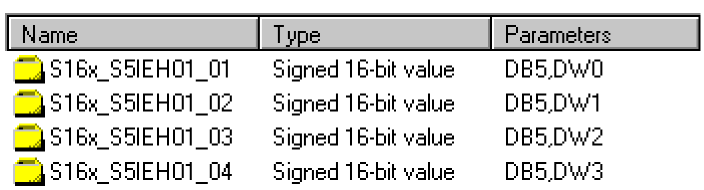
The *Address Properties* and *Tag Properties* dialog boxes can be closed by clicking on the *OK* button.



</td></tr>
<tr><td>4</td><td>

Creation of the remaining WinCC tags required.

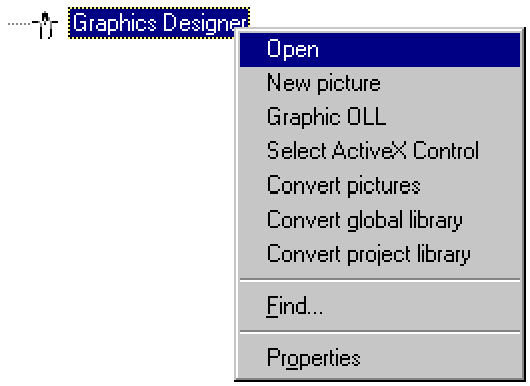
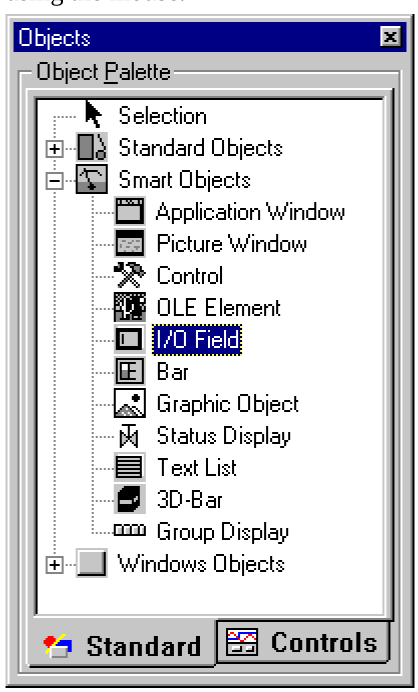
Follow steps 1 to 3 for the creation of the remaining tags. The names, data types and addresses of the tags used in this sample are listed in the following graphic.

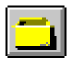
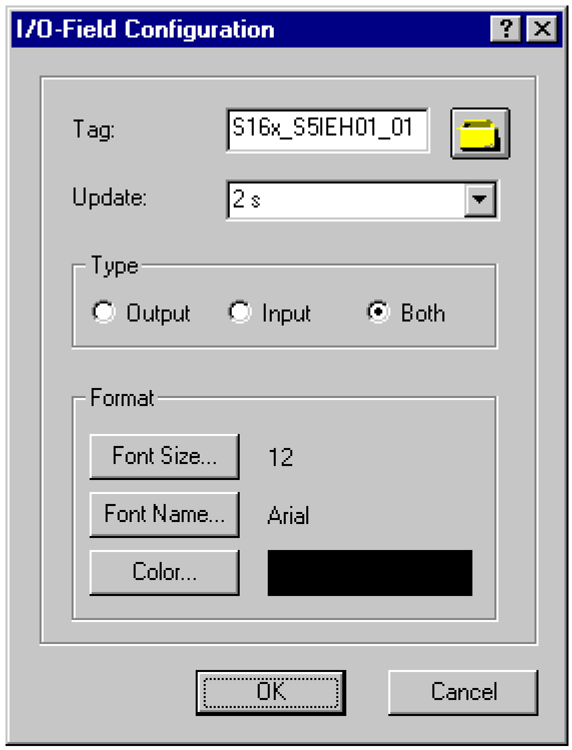
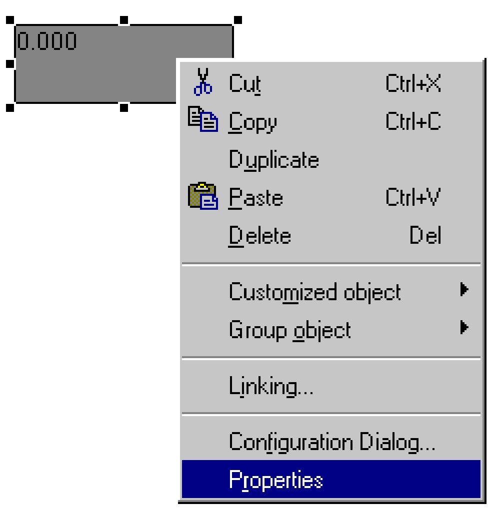


Name	Type	Parameters
S16x_S5IEH01_01	Signed 16-bit value	DB5,DW0
S16x_S5IEH01_02	Signed 16-bit value	DB5,DW1
S16x_S5IEH01_03	Signed 16-bit value	DB5,DW2
S16x_S5IEH01_04	Signed 16-bit value	DB5,DW3

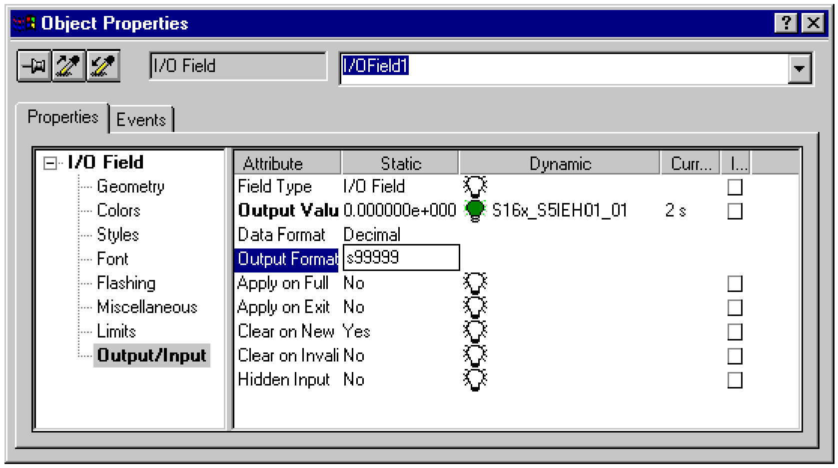
</td></tr>
</table>

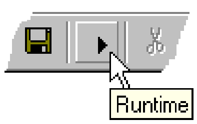
D: Creating the WinCC Screen

Step	**D: Creating the WinCC Screen**
1	Creation of a WinCC screen in which the previously created tags are visualized. Open the *Graphics Designer* editor via a R and then selecting *Open* from the pop-up menu. 
2	This will open the *Graphics Designer* editor with a new (blank) screen. To display the first tag, configure a *Smart Object* → *I/O Field*. To do so, select the *I/O Field* object from the *Object Palette* and place it on the screen using the mouse. 

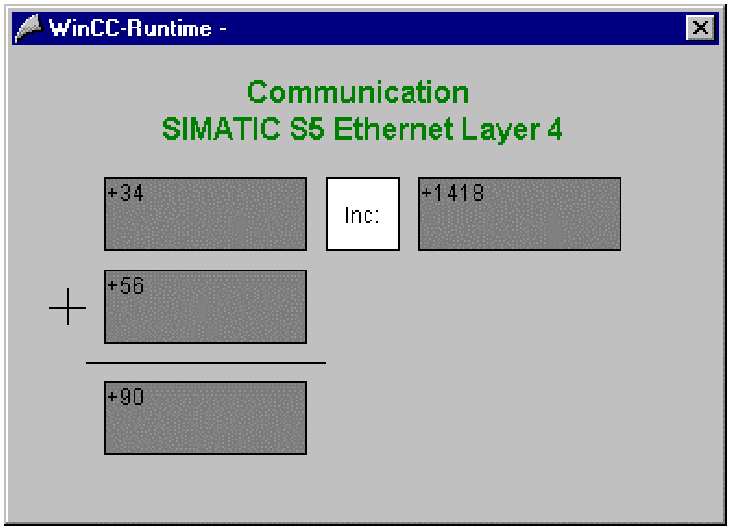
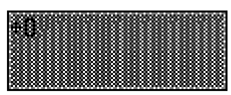
<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>3</td><td>After placing the I/O Field on the screen, its Configuration dialog box will be displayed.
In the Tag field, set the tag S16x_S7IEH01_01 via the button displayed below.

Leave the Update of the tag at 2 s. Keep the default settings for the remaining options. Close the dialog box by clicking on OK.

</td></tr>
<tr><td>4</td><td>Changing the output format of the I/O Field.
For this, open its properties dialog box via a R on the I/O Field and then select Properties from the pop-up menu.

</td></tr>
</table>

<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>5</td><td>
The dialog box Object Properties will be displayed.

On the left side of the Properties tab, select the entry Output/Input. Via a D on the output format set, the field can be edited. Select the new format s99999. This format enables the I/O Field to display signed values with a maximum of 5 digits.


</td></tr>
<tr><td>6</td><td>
Creation of three additional I/O Fields for the display of the remaining tags.
Follow steps 2 to 5 to create the remaining I/O fields.
</td></tr>
<tr><td>7</td><td>
Save the screen.
In the sample project, the screen is saved under the name com_3_S5IEH_01.pdl. The screen can be switched directly to runtime from the Graphics Designer via the button displayed below.


</td></tr>
</table>

Step	D: Creating the WinCC Screen
	If the screen is in runtime, the PLC started and the network connection established, the current values of the PLC will be displayed in the I/O fields. They can be changed by entering values in the individual *I/O Fields*.  If there is no connection to the PLC, the *I/O Fields* will be displayed grayed out. In this case an error is present at some point of the communication connection. 

7.4 Diagnosis of the Communication Connection

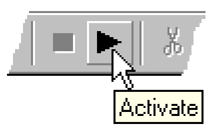
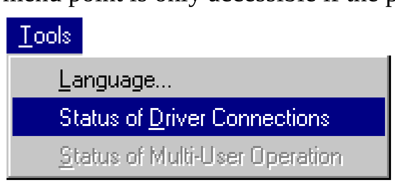
The following describes the options available for diagnosing the communication connection between the WinCC project *WinCC_S5_IEH* and the SIMATIC S5 station.
A diagnosis of the sample according to this description makes only sense, if the checks listed below have been completed successfully.
Startup of the Communication Processor CP 1413

- E: Testing the Communication Processor

Creation of the STEP5 Project S5_IEHst

- D: Starting up the PLC

WinCC Explorer

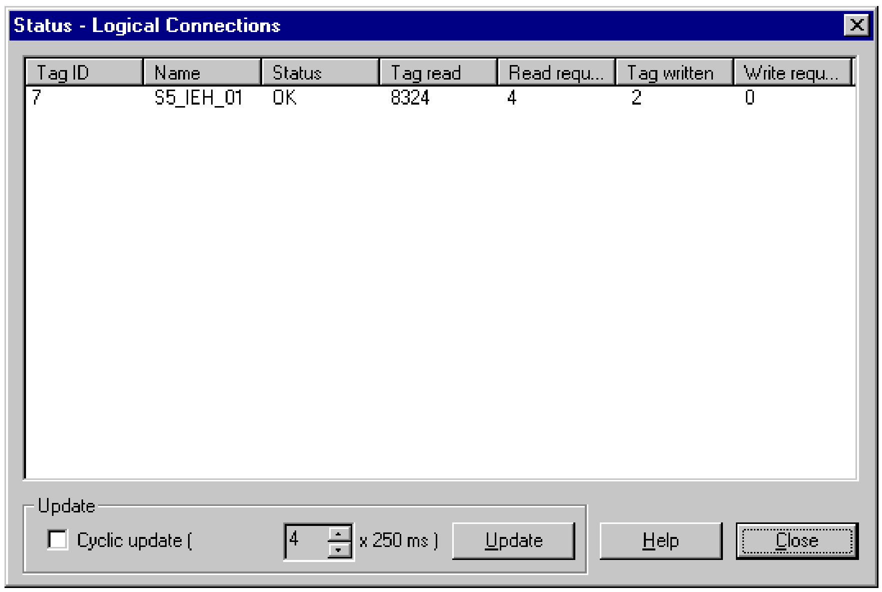
Step	WinCC Explorer
1	Diagnosis of the communication connection from the *WinCC Explorer*. Switch the project *WinCC_S5_IEH* into runtime. This is done from the *WinCC Explorer* via the toolbar button displayed below.  The created WinCC screen *com_3_S5IEH_01.pdl* can also be switched directly from the *Graphics Designer* into runtime.
2	In the *WinCC Explorer*, a dialog box for monitoring all configured connections can be accessed via the *Tools* → *Status of Driver Connections* menu. This menu point is only accessible if the project is in runtime. 

<table>
<tr><th>Step</th><th>WinCC Explorer</th></tr>
<tr><td>3</td><td>

The dialog box *Status - Logical Connections* will be displayed.

This dialog box lists all configured connections. For this sample, only the connection *S5_IEH_01* will be displayed.

The displayed values correspond to the status at the moment the dialog box was opened. By selecting the appropriate check-box, a *Cyclic Update* of the display can be achieved.

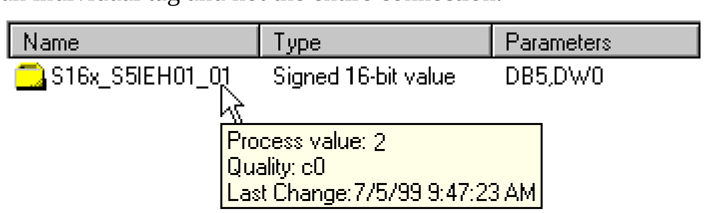


</td></tr>
<tr><td>4</td><td>

Another way to obtain information about the connection status in general and about the connection status of individual tags is provided by *Tag Management*.

The status of a configured connection can be displayed as a tooltip by simply pointing the mouse on the connection in question.

The current process value of a certain tag as well as its status can be displayed as a tooltip by pointing the mouse on it. This allows you to detect errors concerning an individual tag and not the entire connection.

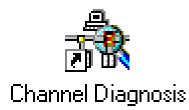


</td></tr>
</table>

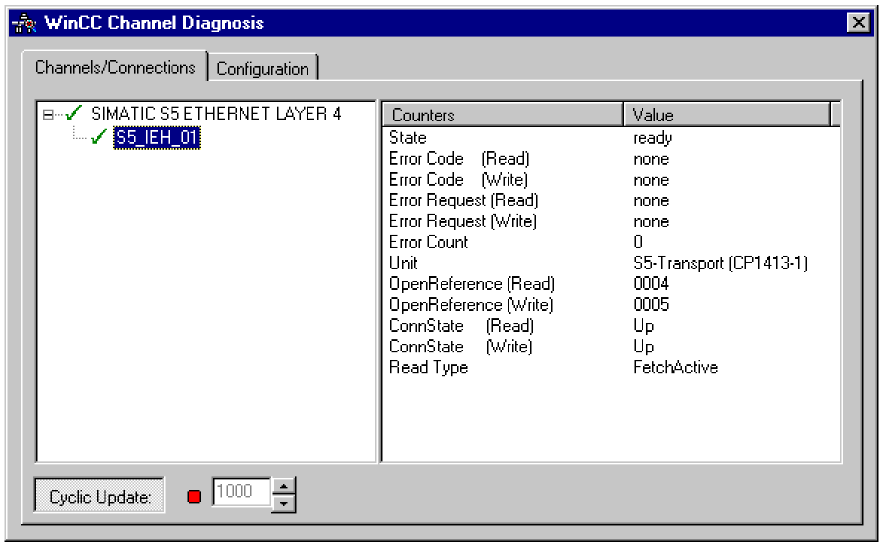
Channel Diagnosis

<table>
<tr><th>Step</th><th>Channel Diagnosis</th></tr>
<tr><td>1</td><td>Diagnosis of the communication connection via the program WinCC Channel Diagnosis.

Start this program via Start → Simatic → WinCC → Channel Diagnosis.

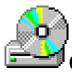

</td></tr>
<tr><td>2</td><td>The program WinCC Channel Diagnosis will be displayed.

The Channels/Connections tab displays detailed information about the status of each configured connection. By default, the display is updated every second. The update cycle can be changed in the input field located at the bottom.


</td></tr>
</table>

8 Communication to the SIMATIC S5 via PROFIBUS FMS

The projects created in this chapter can also be copied directly from the online document to your hard drive. By default, they will be copied to the folder C:\Communication_Manual. You have the option to copy the following components to the hard drive:

comprofibus_S5FMS

The database file of the communication processor CP 5412 A2 and the files generated during its creation.

S5_FMSst

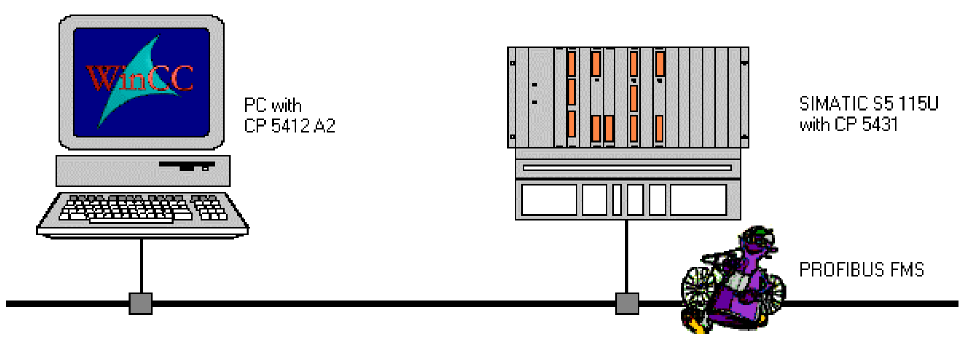
The STEP5 project we will create including the database file of the communication processor CP 5431 FMS/DP.

WinCC_S5_FMS

The WinCC project we will create.

This chapter describes in detail the startup of a communication connection between a SIMATIC S5 station and a WinCC station. The communication connection is implemented via the PROFIBUS, on which the FMS Protocol (Fieldbus Message Specification) is running.

Overview of the Structure of the Sample



On the computer side, the connection to the *PROFIBUS* network is established via the communication processor *CP 5412 A2*. To install this communication processor in the computer, the driver *PB FMS-5412*, located on the *SIMATIC NET* CD-ROM, is needed. In the WinCC project, the communication driver *PROFIBUS FMS* must be installed. This communication driver is used to configure the connection to the *SIMATIC S5*.
The PLC *SIMATIC S5 115U* is equipped with the CPU module *CPU 944*. The connection to the network is established via the communication processor *CP 5431 FMS/DP*. For the configuration of this communication processor, the communication package *SINEC NCM for COMs* is required.

Overview of the Configuration Steps

The following lists all configuration steps necessary for the creation of the communication connection:

- Startup of the Communication Processor CP 5412 A2
- Creation of the STEP5 Project S5_FMSst
- Creation of the WinCC Project WinCC_S5_FMS
- Diagnosis of the Communication Connection

Required Software

Name	**Description**
SIMATIC NET	Driver *PB FMS-5412* from the *SIMATIC NET* CD-ROM for the installation of the communication processor *CP 5412 A2*.
STEP5	STEP5 software for the creation of the STEP5 project. Communication package *SINEC NCM for COMs* for the configuration of the communication processor *CP 5431 FMS/DP*.
WinCC	WinCC with communication driver *PROFIBUS FMS* for the creation of the WinCC project and for the configuration of the connection to the PLC.

Required Computer Hardware

Name	**Description**
Communication Processor	Communication processor *CP 5412 A2* to establish the connection to the PLC's communication processor.

Required PLC Hardware

Name	**Description**
Rack	Rack *CR 700-3*.
Power Supply	Power supply *PS 951*.
CPU Module	CPU module *CPU 944*.
Communication Processor	Communication processor *CP 5431 FMS/DP*.

8.1 Startup of the Communication Processor CP 5412 A2

The following description details the configuration steps necessary to successfully start up the communication processor *CP 5412 A2*.

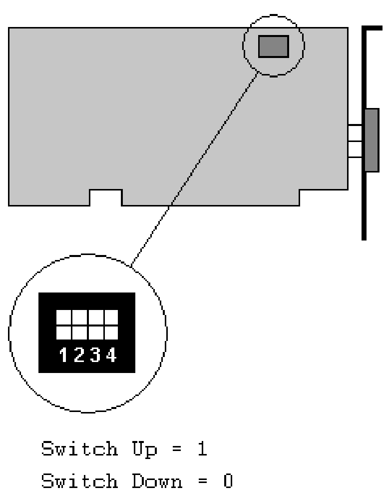
Overview of the Configuration Steps

The following lists the configuration steps necessary to start up the communication processor *CP 5412 A2*:

- A: Mounting the Communication Processor in the Computer
- B: Installing the Communication Driver
- C: Creating the Database File
- E: Assigning the Communication Processor
- F: Testing the Communication Processor

A: Mounting the Communication Processor in the Computer

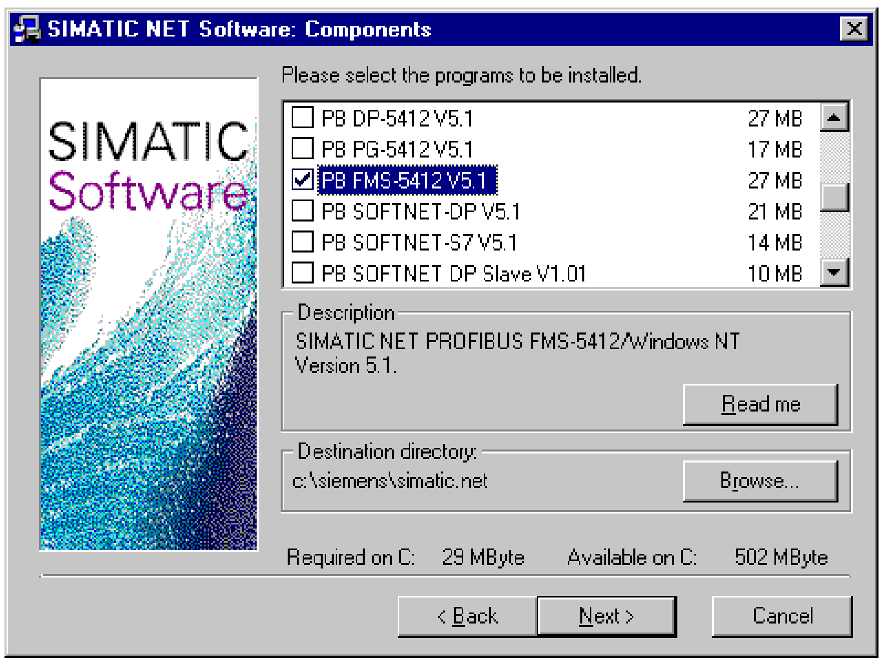
<table>
<tr><th>Step</th><th>A: Mounting the Communication Processor in the Computer</th></tr>
<tr><td>1</td><td>
Check the selected jumper settings at the CP 5412 A2.
During the software installation of the CP 5412 A2, the I/O Range must be specified. The I/O Range is set via jumpers.
By default, the I/O Range is set to 0240-0243. However, other settings are also possible. The following graphic illustrates the jumper settings necessary for the various I/O Ranges.



<table>
<tr><th>I/O Area</th><th>1-2-3-4</th></tr>
<tr><td>0240-0243</td><td>0 0 0 0</td></tr>
<tr><td>0244-0247</td><td>0 0 0 1</td></tr>
<tr><td>0248-024B</td><td>0 0 1 0</td></tr>
<tr><td>024C-024F</td><td>0 0 1 1</td></tr>
<tr><td>0280-0283</td><td>0 1 0 0</td></tr>
<tr><td>0284-0287</td><td>0 1 0 1</td></tr>
<tr><td>0288-028B</td><td>0 1 1 0</td></tr>
<tr><td>028C-028F</td><td>0 1 1 1</td></tr>
<tr><td>0300-0303</td><td>1 0 0 0</td></tr>
<tr><td>0304-0307</td><td>1 0 0 1</td></tr>
<tr><td>0308-030B</td><td>1 0 1 0</td></tr>
<tr><td>030C-030F</td><td>1 0 1 1</td></tr>
<tr><td>0390-0393</td><td>1 1 0 0</td></tr>
<tr><td>0394-0397</td><td>1 1 0 1</td></tr>
<tr><td>0398-039B</td><td>1 1 1 0</td></tr>
<tr><td>039C-039F</td><td>1 1 1 1</td></tr>
</table>
</td></tr>
<tr><td>2</td><td>
Mount the module according to the installation instructions. Among other things, follow the steps for handling electrostatic sensitive devices (ESD). The module must only be installed while the computer is off.
For the communication card CP 5412 A2, a free ISA slot in the computer is required. After the installation of the CP 5412 A2, close the computer’s case and start the computer.
</td></tr>
</table>

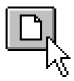
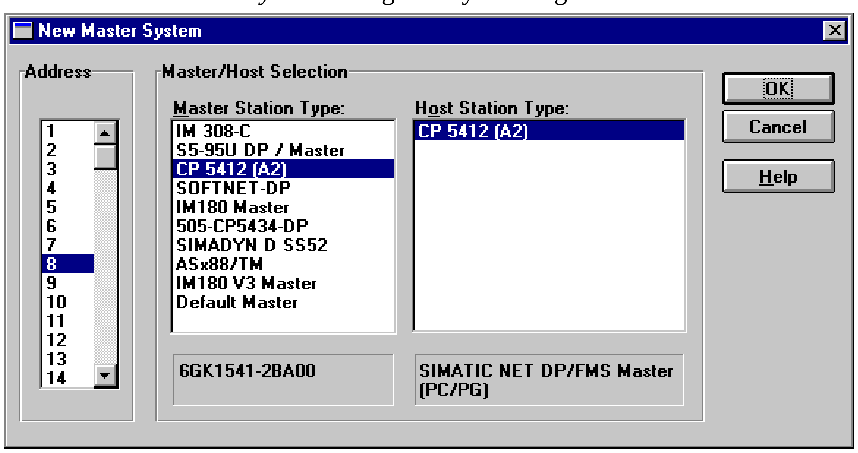
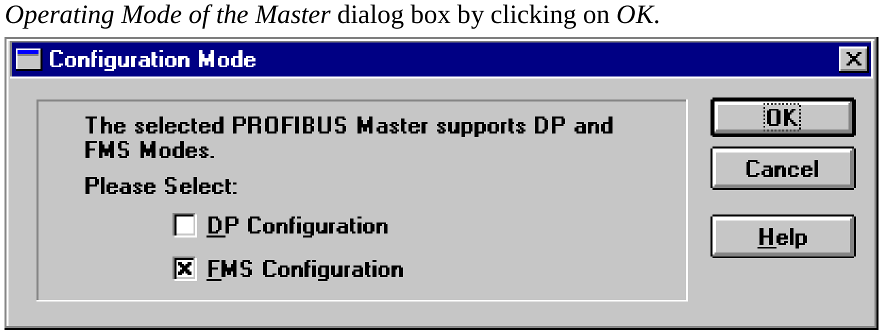
B: Installing the Communication Driver

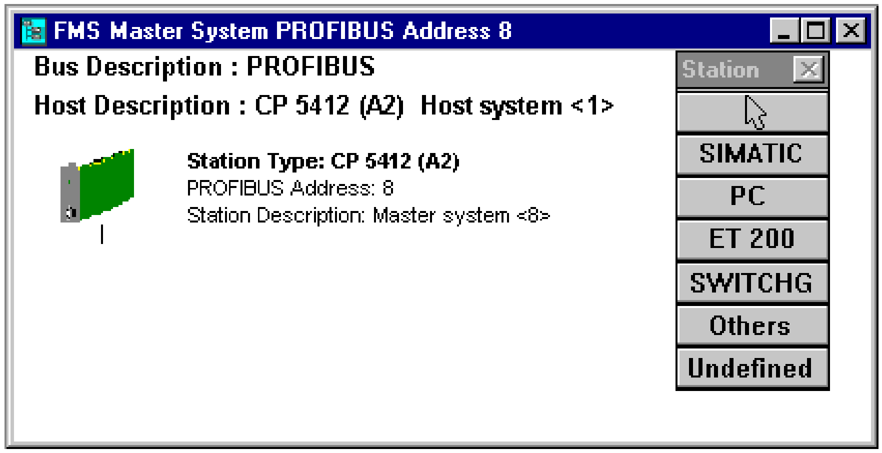
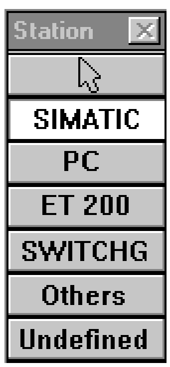
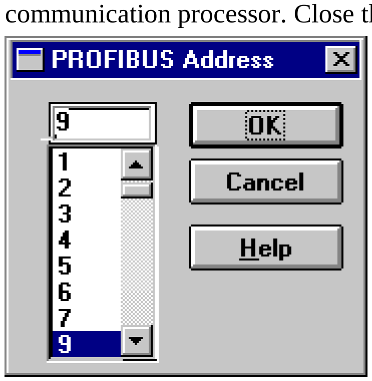
<table>
<tr><th>Step</th><th>B: Installing the Communication Driver</th></tr>
<tr><td>1</td><td>
Installation of the communication driver PB FMS-5412 from the SIMATIC NET CD-ROM.
After inserting the SIMATIC NET CD-ROM, the installation program is automatically started. If this is not the case, open the Windows NT Explorer and start the setup.exe program located on the CD-ROM.
The installation of the software is started via the button displayed below.


Follow the instructions of the installation program. On the Components page, the check-box of the driver PB FMS-5412 to be installed must be selected. Finish the installation.


</td></tr>
</table>

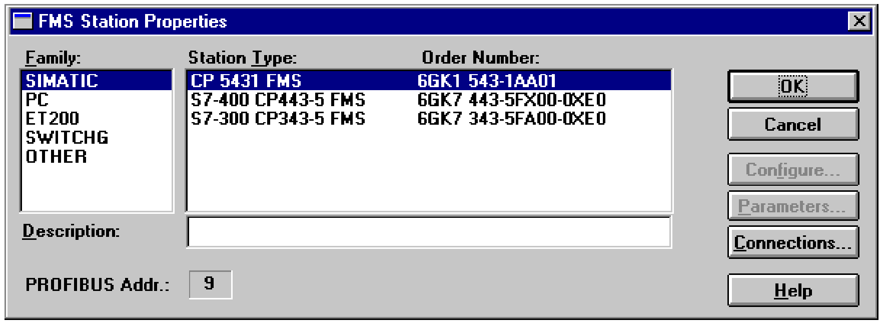
C: Creating the Database File

Step	C: Creating the Database File
1	Creation of the database file for the communication via the FMS protocol PROFIBUS. This is done with the COM PROFIBUS program. This program has already been installed with the communication driver PB FMS-5412. Start the program via *Start* → *Simatic* → *SIMATIC NET* → *COM PROFIBUS*. 
2	The program *COM PROFIBUS* will be opened. A new file is created by clicking on the button displayed below. 
3	The dialog box *New Master System* will be displayed. In this dialog box, the parameters of the WinCC station must be specified. In the *Master Station Type* field, select the entry *CP 5412 (A2)*. The Bus Address *of the WinCC station is set* to *8*. For the following installation of the communication processor *CP 5412 A2* in the computer, the address specified here must be used as the local station address. Close the *New Master System* dialog box by clicking on *OK*. 
4	The *Operating Mode of the Master* dialog box will be displayed. In this dialog box, the check-box *FMS Configuration* is selected. Close the *Operating Mode of the Master* dialog box by clicking on *OK*. 

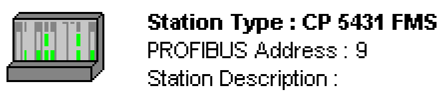
Step	C: Creating the Database File
5	The *FMS Master System* dialog box will be displayed. It displays the current settings. At the moment, only the communication processor *CP 5412 A2* is listed as a master. This master has a *PROFIBUS Address* of *8*. 
6	Specifying the communication partner. Select the *SIMATIC* entry from the *Station* selection dialog box. If the mouse pointer is then moved over the *FMS Master System* window, its appearance will change. The new station is inserted via a mouse click on this window. 
7	The *PROFIBUS Address* dialog box will be displayed. In this sample, *9* is set as the PROFIBUS address for the new station. This PROFIBUS address must be set in the PLC during the configuration of the communication processor. Close the dialog box by clicking on *OK*. 

<table>
<tr><th>Step</th><th>C: Creating the Database File</th></tr>
<tr><td>8</td><td>The FMS Station Properties dialog box will be displayed.

In this dialog box, the type of the communication partner is specified. In this sample, this is CP 5431 FMS. Close the dialog box by clicking on OK.


</td></tr>
<tr><td>9</td><td>In the FMS Master System dialog box, the newly inserted station will be displayed.

For this station, a connection must be created which is used for the communication to the WinCC station. This is done by D on the icon of the newly inserted station.

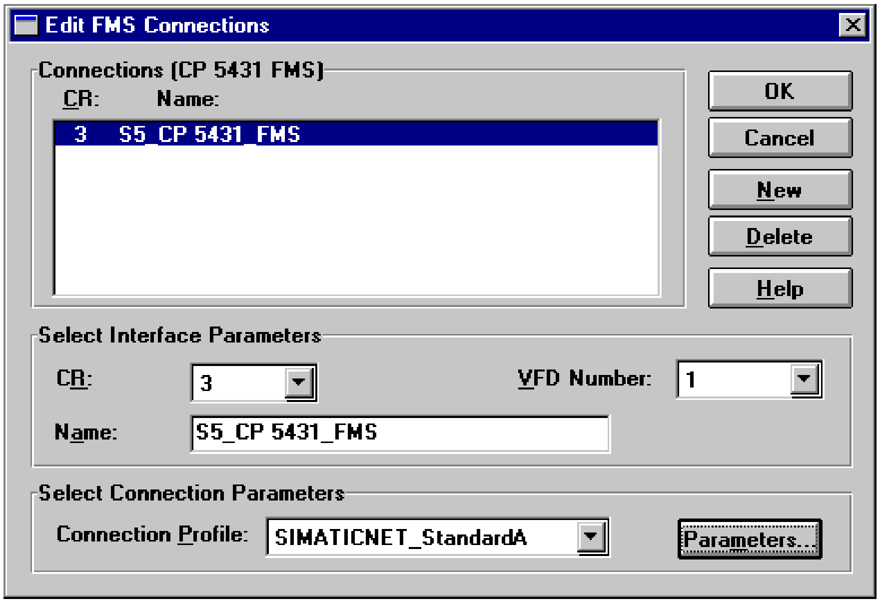

</td></tr>
<tr><td>10</td><td>The Edit FMS Connections dialog box will be displayed.

A new connection is created by clicking on the New button.

In the CR field, a unique communication reference is assigned to the new FMS connection, and a unique connection name is assigned in the Name field. In this sample, the value 3 is kept for the CR and the Name S5_CP5431_FMS is entered. Using these two values, the connection created in the WinCC project is assigned to this FMS connection.</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Creating the Database File</th></tr>
<tr><td></td><td>As the Connection Profile, the predefined SIMATICNET_StandardA profile is set.

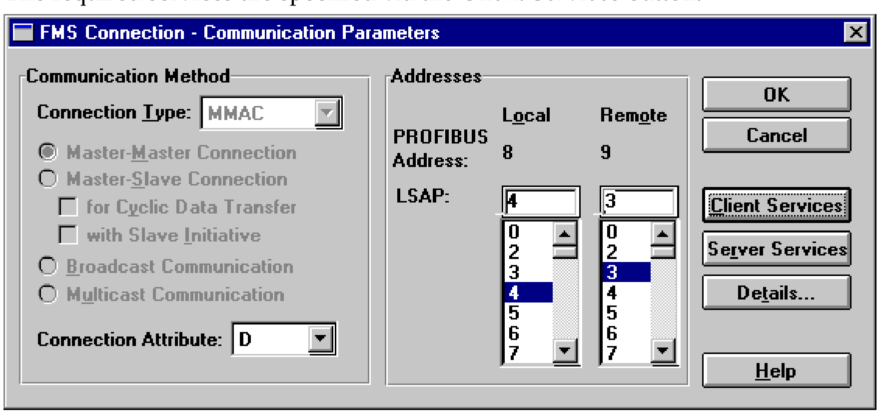
Clicking on the Parameters button displays additional setting options for the new connection.

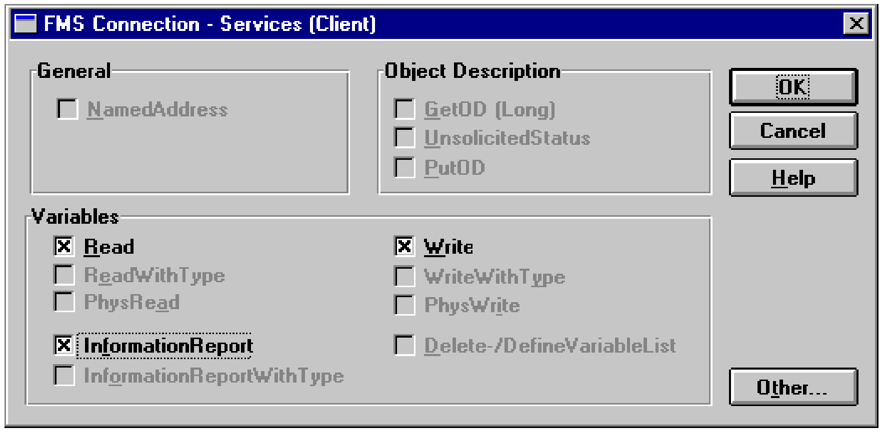

</td></tr>
<tr><td>11</td><td>The FMS Connection - Communication Parameters dialog box will be displayed.

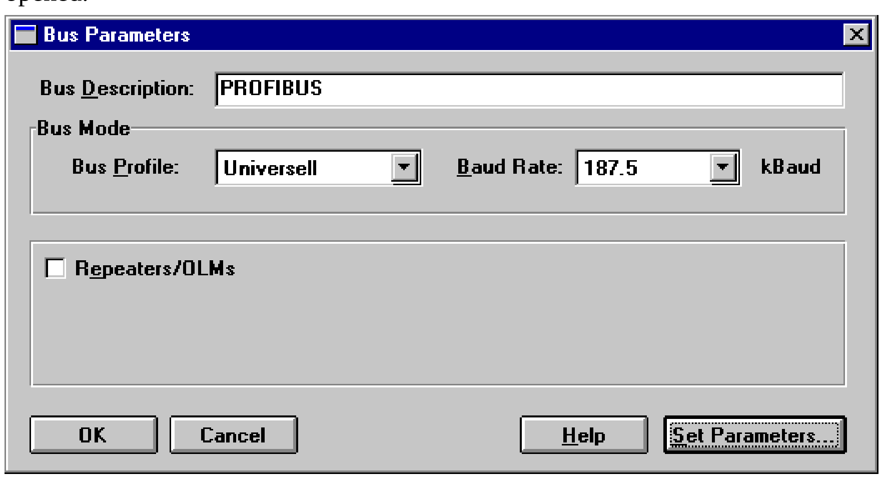
The local and remote LSAP settings must be made. In this context, the local LSAP is the LSAP (Local Service Access Point) of the communication processor CP 5412 A2 in the WinCC station and the remote LSAP is the one of the communication processor CP 5431 in the SIMATIC S5 station. These LSAP values must also be used for the connection configuration of the communication processor CP 5431.

In this sample, the value 4 is set in the Local field and the value 3 in the Remote field.

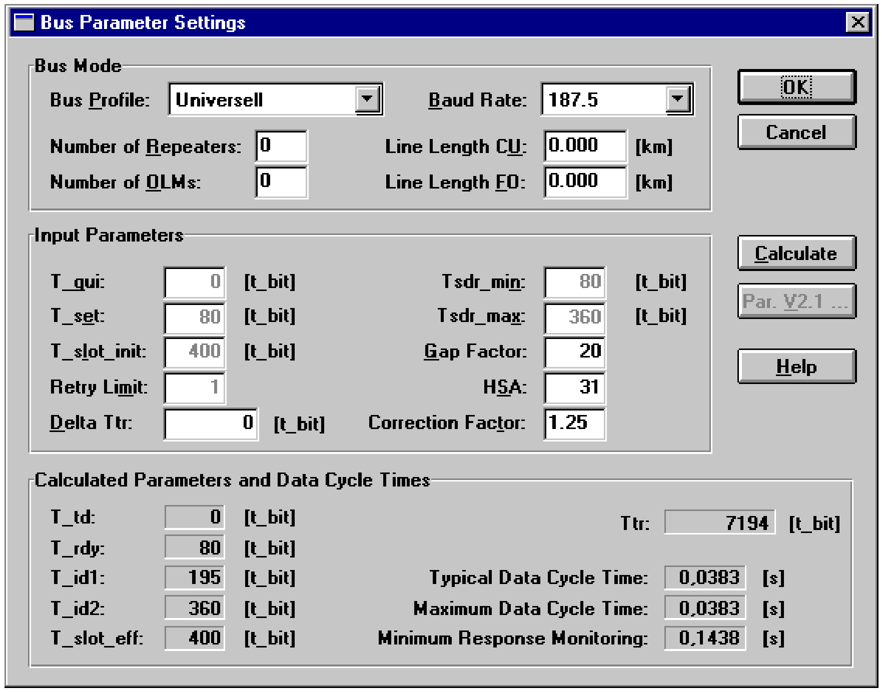
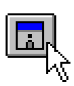
The required services are specified via the Client Services button.


</td></tr>
</table>

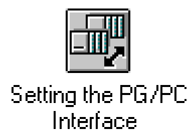
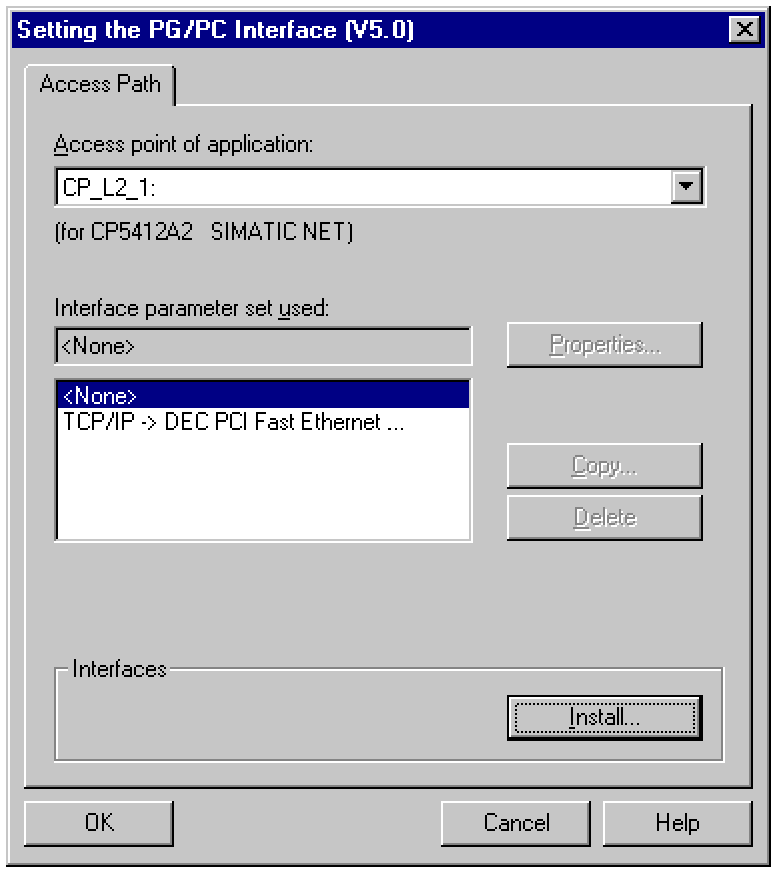
<table>
<tr><th>Step</th><th>C: Creating the Database File</th></tr>
<tr><td>12</td><td>
The FMS Connection - Services (Client) will be displayed.
In this dialog box, all available services (Read, Write and InformationReport) are selected.
Close the dialog box by clicking on OK. The FMS Connection - Communication Parameters and the Edit FMS Connections dialog boxes are also closed with OK.


</td></tr>
<tr><td>13</td><td>
Setting the Bus Parameters for the PROFIBUS network.
This is done from the COM PROFIBUS program via the Configure → Bus Parameters menus. The Bus Parameters dialog box will be displayed. The following settings must also be used for the network parameters during the installation of the communication processor CP 5412 A2 and for the network parameters during the configuration of the communication processor CP 5431 in the PLC.
As the Bus Profile, Universal is set. As the Baud Rate, this sample uses 187.5 kBaud.
By clicking on the Setting Parameters button, an additional dialog box will be opened.


</td></tr>
</table>

Step	C: Creating the Database File
14	The *Bus Parameter Settings* dialog box will be opened. In this sample, the highest station address in the PROFIBUS network is set to *31*. This value is entered in the *HSA* field. Close this and the *Bus Parameters* dialog boxes by clicking on *OK*. 
15	Save the configuration. This is done via the toolbar button displayed below or the *File* → *Save As* menus. In this sample, the file is saved under the name *S5FMS.ET2*. 
16	Using the file just created, a database file for the communication via the *CP 5412 A2* is generated. This is done via the *File* → *Export* → *NCM File* menus. In this sample, the file has been saved under the name *S5FMS.ldb*.  S5FMS.ldb

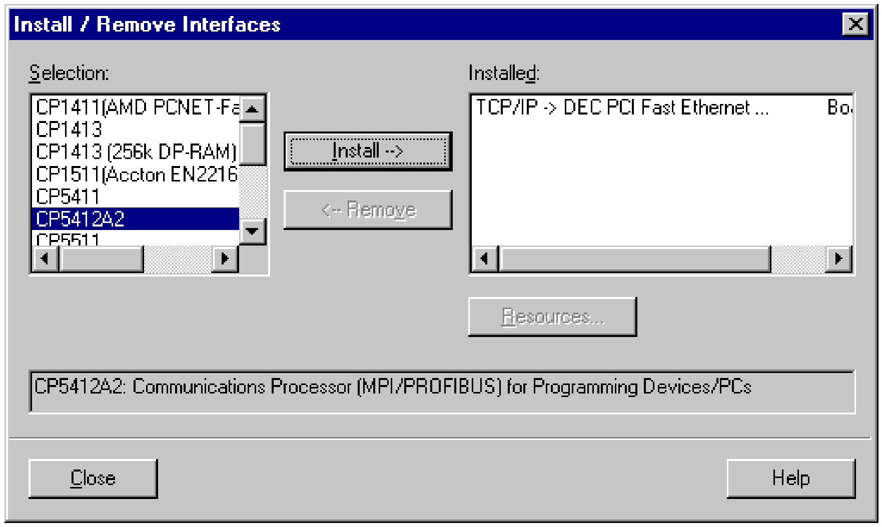
D: Installing the Communication Processor

Step	D: Installing the Communication Processor
1	Install the communication processor *CP 5412 A2* via the program *Setting the PG/PC Interface*. This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*. 
2	The program *Setting the PG/PC Interface* will be displayed. The dialog box for installing a new interface is opened via the *Install* button. 

<table>
<tr><th>Step</th><th>D: Installing the Communication Processor</th></tr>
<tr><td>3</td><td>

The dialog box *Install/Remove Modules* will be displayed. The *Selection* field lists all interfaces that can be installed. Among them will be the entry for the *CP 5412 A2*, if the communication driver has been installed previously as outlined in step B.

From the *Selection* field, select the entry *CP 5412 A2*. The installation of the communication processor is started by clicking on the *Install* -> button.



</td></tr>
<tr><td>4</td><td>

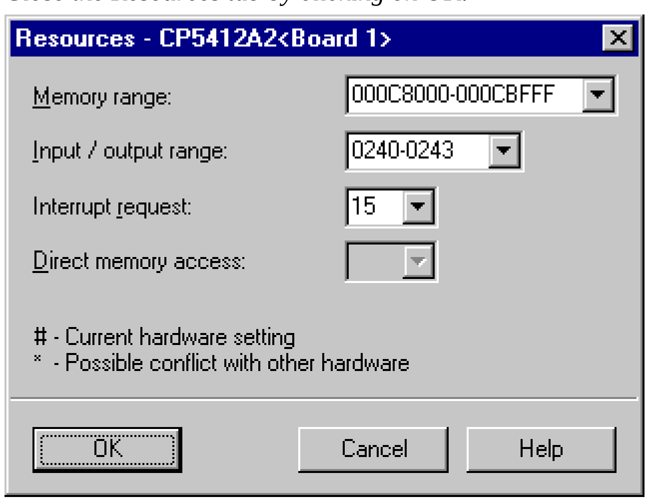
The dialog box *Resources - CP 5412 A2* will be displayed.

The settings for the *Memory Range*, *I/O Range* and *Interrupt* have to be specified.

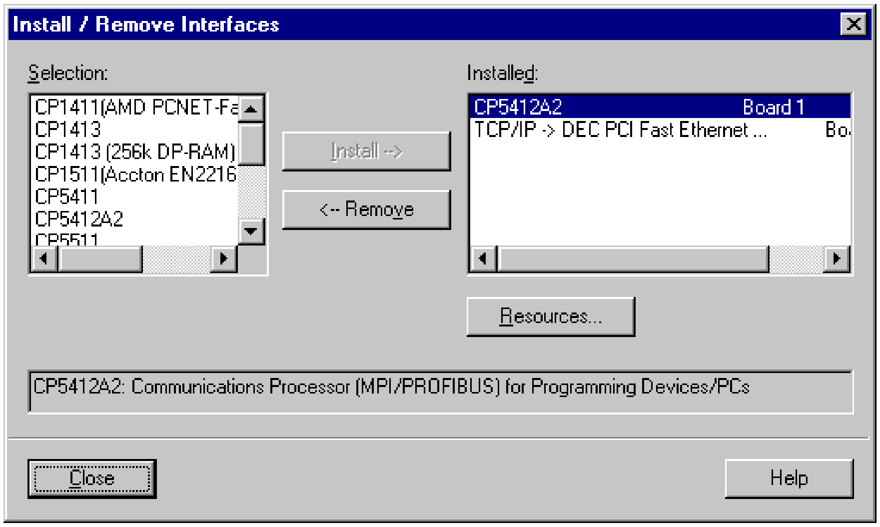
The *I/O Range* has already been determined via the Jumper Settings at the *CP 5412 A2*.

Make sure that the assigned resources have not already been taken by other modules in the computer. Information about already taken system resources can be obtained from the Resources tab accessed via *Start* → *Programs* → *Administrative Tools (Common)* → *Windows NT Diagnostics*.

Close the Resources tab by clicking on OK.



</td></tr>
</table>

Step	D: Installing the Communication Processor
5	In the dialog box *Install/Remove Modules*, the *Installed* field will now contain the entry for the *CP 5412 A2*. Exit the dialog box *Install/Remove Modules* via the *Close* button. 

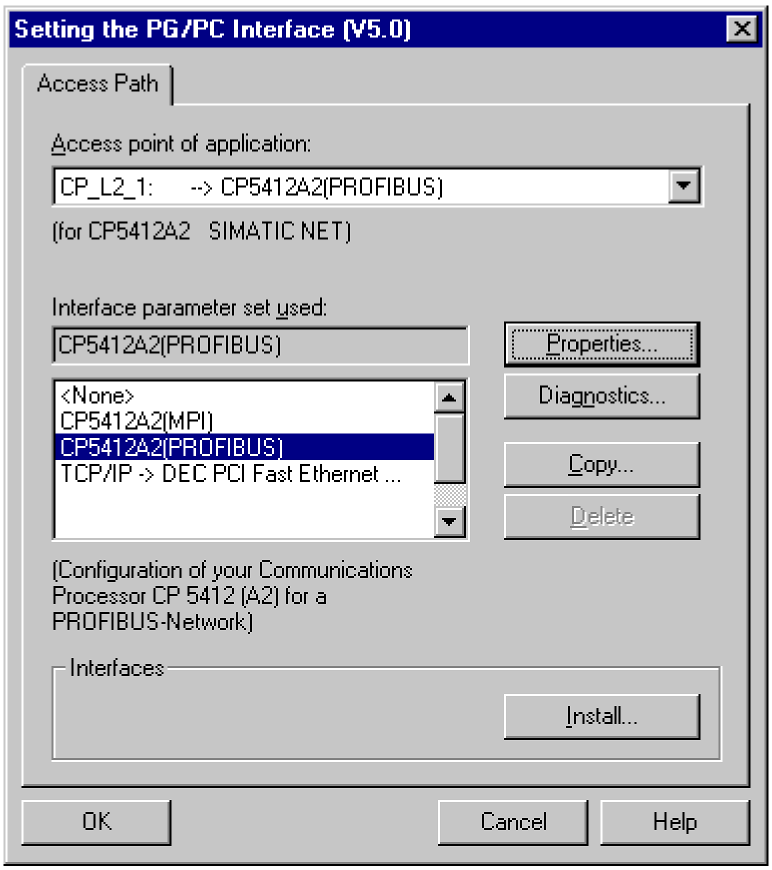
E: Assigning the Communication Processor

<table>
<tr><th>Step</th><th>E: Assigning the Communication Processor</th></tr>
<tr><td>1</td><td>

In the program *Setting the PG/PC Interface*, assign the access point *CP_L2_1:* to the just installed interface.

The access point CP_L2_1: is the default access point used by WinCC for the communication via the *PROFIBUS*. It has been created automatically during the installation of the communication driver *PB FMS-5412*.

In the field *Access Point of the Application*, set the entry *CP_L2_1:*. In the field below, select the entry *CP 5412 A2 (PROFIBUS)*. This completes the assignment between the access point and the communication processor.



</td></tr>
</table>

<table>
<tr><th>Step</th><th>E: Assigning the Communication Processor</th></tr>
<tr><td>2</td><td>

Setting the properties of the communication processor *CP 5412 A2*.

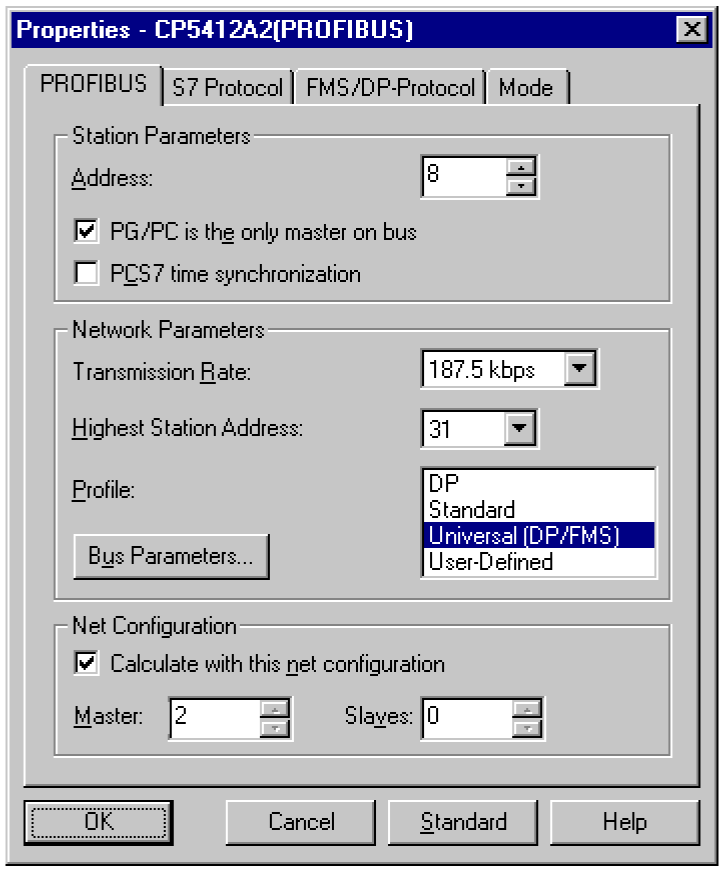
The dialog box for setting the properties is opened via the *Properties* button of the *Setting the PG/PC Interface* program.

The dialog box *Properties - CP 5412 (PROFIBUS)* will be displayed.

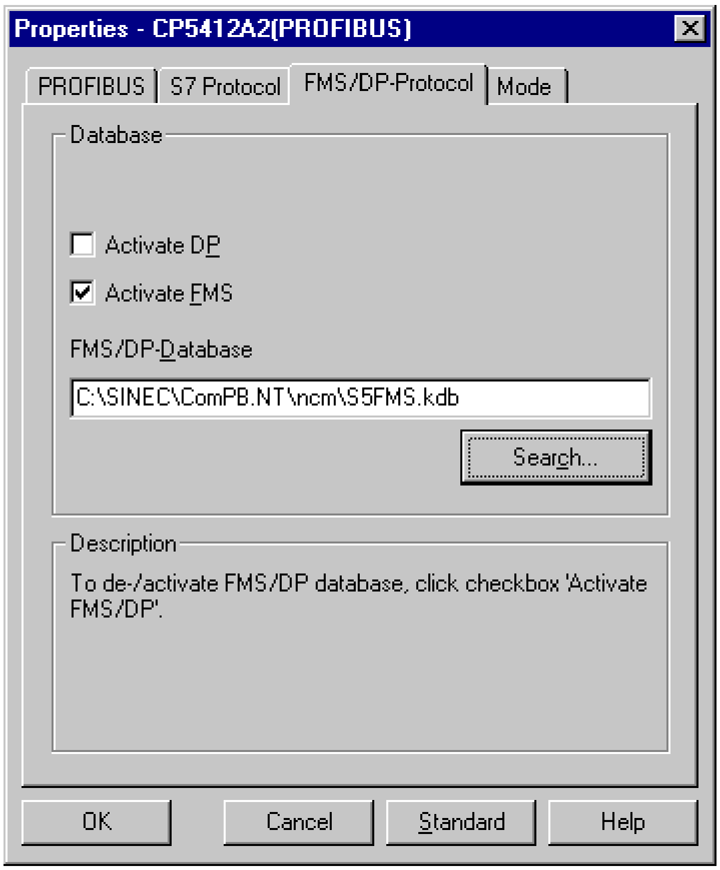
In the *PROFIBUS* tab, station and network related parameters are set.

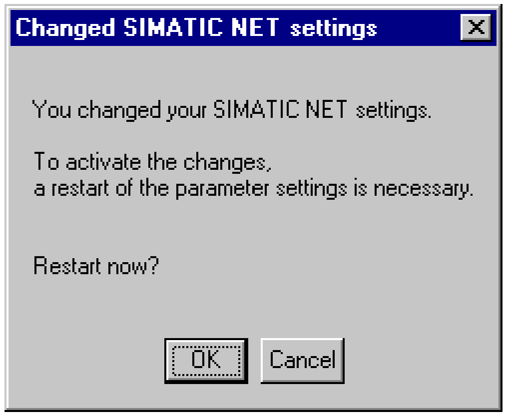
As the *Local Station Address* of the communication processor *CP 5412 A2*, this sample uses *8*. This address has already been defined during the creation of the database file with the assignment of the bus address for the communication processor.

For the *PROFIBUS Network*, a *Baud Rate* of *187.5 kBit/s* is selected. The *Highest Station Address* is set to the value of *31*. As the *Profile*, *Universal (DP/FMS)* is selected. The settings just made for the network parameters must agree with the settings for the bus parameters of the previously generated database file.

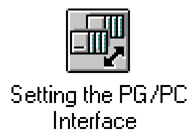
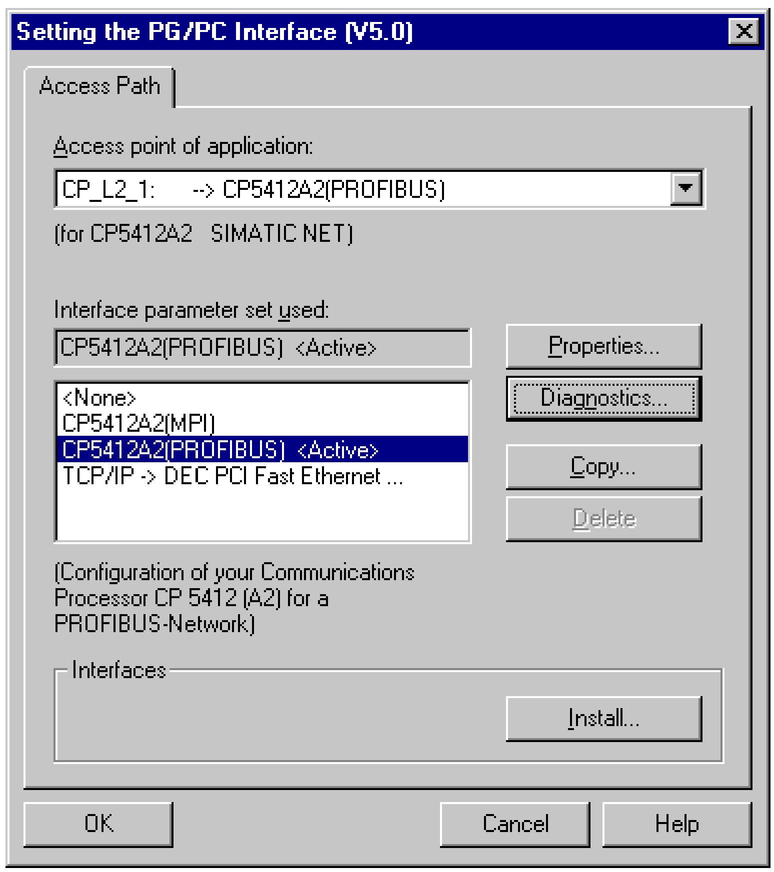


</td></tr>
</table>

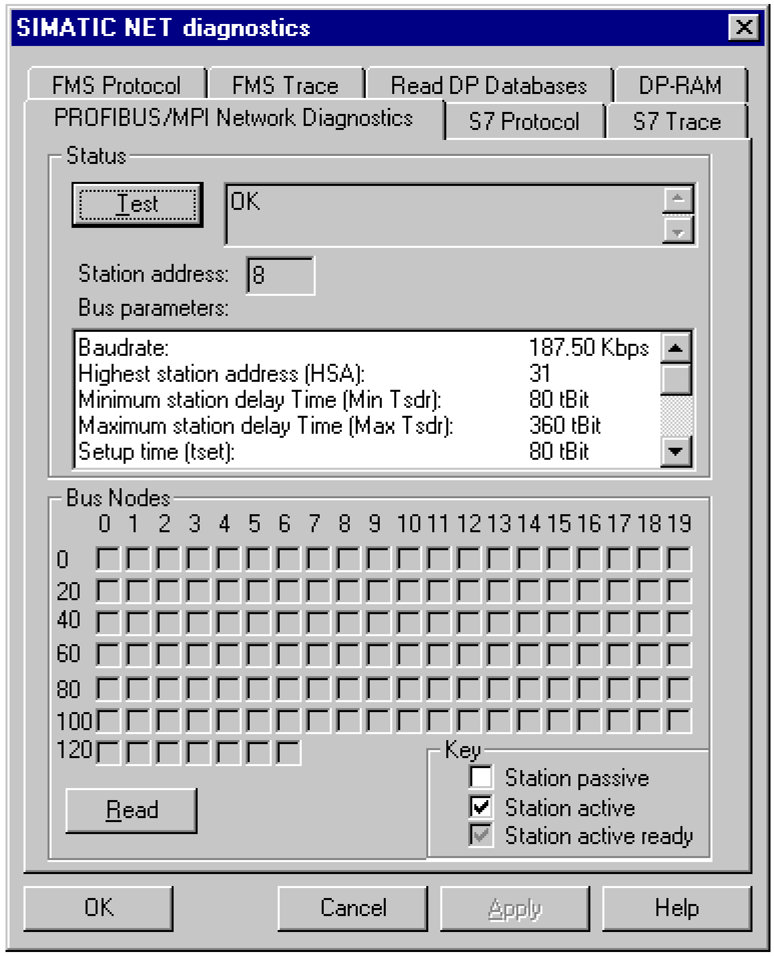
Step	**E: Assigning the Communication Processor**
3	Assigning the database file for the *FMS Protocol*. This is done in the *FMS/DP Protocol* tab of the *Properties - CP 5412 (PROFIBUS)* dialog box. Select the check-box *Activate FMS*. This will enable the *FMS/DP Database* field. In here, specify the previously created database file S5FMS.ldb. Via the *Browse* button, the database file can easily be located and selected. Close the dialog box by clicking on *OK*. 

Step	E: Assigning the Communication Processor
4	Exit the program *Setting the PG/PC Interface* via the *OK* button. A dialog box will be displayed requesting the restart of the *CP 5412 A2*. Acknowledge this dialog box by clicking on *OK*, which will result in the restart of the communication processor *CP 5412 A2*. This completes the installation of the communication processor. 

F: Testing the Communication Processor

Step	F: Testing the Communication Processor
1	Test the communication processor *CP 5412 A2* via the program *Setting the PG/PC Interface*. This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*. 
2	The program *Setting the PG/PC Interface* will be displayed. Select the interface to be checked. In this case, select the entry *CP 5412 A2 (PROFIBUS)*. Make sure that the assignments between access points and the interfaces are not changed. The check for a proper installation is activated by clicking on the *Diagnostics* button. 

Step	F: Testing the Communication Processor
3	The dialog box *Simatic NET Diagnostics* will be displayed. In the *PROFIBUS/MPI Network Diagnostics* tab, the diagnosis is started via the *Test* button. The result of the diagnosis will be displayed immediately following. If the result of the diagnosis is positive (correct installation), the dialog box can be exited with *OK*. In this case, the program *Setting the PG/PC Interface* can also be closed by clicking on *OK*. The configuration of the communication to the S5 via *PROFIBUS FMS* is continued in the following section. However, if the result of the diagnosis is negative (incorrect installation), the error must be localized and corrected. Troubleshooting procedures are described in the section Is the Communication Module in the Computer operational?.



8.2 Creation of the STEP5 Project S5_FMSst

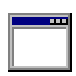
The following description details the configuration steps necessary to create and start up the STEP5 project *S5_FMSst*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to create the STEP5 project *S5_FMSst*:

- A: Installing the Hardware and Software
- B: Creating the STEP5 Program
- C: Configuring the Communication Processor
- D: Starting up the PLC

A: Installing the Hardware and Software

Step	A: Installing the Hardware and Software
1	Rack-mounting of the modules used. In this sample, the modules to be installed are the power supply *PS 951*, the CPU module *CPU 944* and the communication processor *CP 5431*. Establishing the connection from the programming device to the programming interface of the CPU module. Establishing the connection from the communication processor *CP 5412 A2* in the computer to the communication processor *CP 5431* in the PLC.
2	Installing the communication package SINEC NCM for COMs from the corresponding installation disk. This communication package is required for the configuration of the communication processor *CP 5431*. The installation disk contains the program file *install.exe*. Start this program. Follow the instructions of the installation program and complete the installation.  Install.exe

B: Creating the STEP5 Program

Step	B: Creating the STEP5 Program
1	Creation of a new project with the STEP5 software. Start the STEP5 software. From the *Object* → *Project* → *Settings* → *Page1* and *Page2* menus, define the settings for the new project. In the *Program File* field, specify the name of the new program file to be created. In this sample, the name *S5_FMSST.S5D* is used. Only the first six characters of the file name can be changed by the user.

<table>
<tr><th>Step</th><th>B: Creating the STEP5 Program</th></tr>
<tr><td>2</td><td>

Creation of a data block.

In STEP5, this is accomplished via the *Editor* → *Data Block* → *menus of the program file*. As the name of the data block, this sample uses *DB5*.

In this data block, two tags with a length of 16 Bits are created. Their sum is to be determined in *OB1* and then be written to another tag with a length of 16 Bits. One additional tag with a length of 16 Bits is created, whose value is cyclically incremented in *OB1*.

The following graphic displays the programmed data block *DB5*. The data of the *DB5* is made visible to WinCC via FMS tags created during the configuration of the communication processor *CP 5431*.

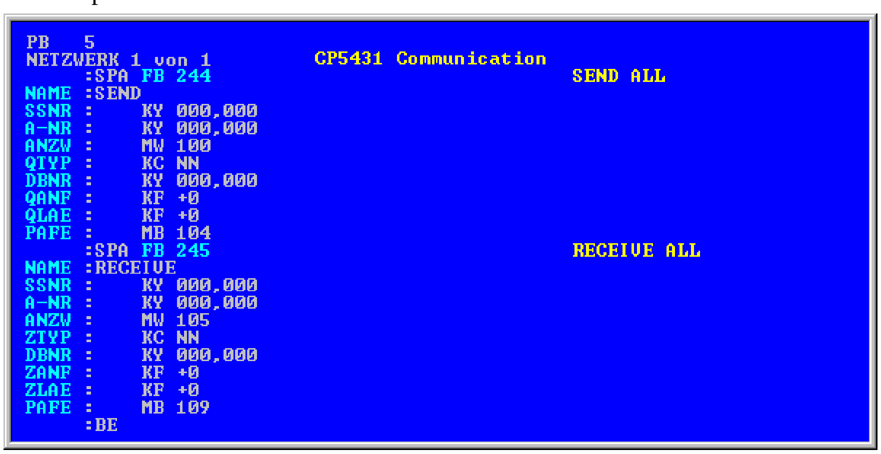
</td></tr>
<tr><td>3</td><td>

Creation of a program block for the communication.

The communication to WinCC via the communication processor *CP 5431* is carried out by calling the data handling blocks *SEND* and *RECEIVE*. For the *SIMATIC S5 115U* PLC used in this sample, these are the blocks *FB244* and *FB245*. These blocks must be called once every program cycle. As the request number *A-NR*, *0* is assigned to these blocks to allow execution of the Send All and Receive All functions.

In this sample, the data handling block calls are carried out in a program block, which is called in the *OB1*.

In STEP5, the creation of a new program block is carried out via the *Editor* → *STEP5 Block* → *menus of the program file*. As the name of the program block, this sample uses *PB5*.



</td></tr>
</table>

<table>
<tr><th>Step</th><th>B: Creating the STEP5 Program</th></tr>
<tr><td>4</td><td>
Creation of a function block, which makes available the functionality of the sample program.
Two values stored in the DB5 are added and the sum again stored in the DB5. Additionally, a value stored in the DB5 is incremented every program cycle. If this value reaches 10000, it is reset back to 0.
In STEP5, the creation of a new function block is carried out via the Editor → STEP5 Block → menus of the program file. As the name of the program block, this sample uses FB6.
<pre>
FB   6
NETZWERK 1 von 1   Add and Increment
NAME :ADD_INC

     :A   DB 5   Add Values
     :L   DW 0
     :L   DW 1
     :+F
     :T   DW 2
     :L   DW 3   Increment Value
     :L   KF +10000
     :<F
     :SPB =M001
     :L   KF +0   Set 0 if 10000 is reached
     :T   DW 3
     :BEA
M001 :L   DW 3
     :L   KF +1
     :+F
     :T   DW 3
     :BE
</pre>
</td></tr>
<tr><td>5</td><td>
Creation of the OB1.
In the OB1, the previously created blocks PB5 and FB6 are called.
<pre>
OB   1
NETZWERK 1 von 1   Communication Manual
     :
     :SPA PB 5   Communication
     :
     :SPA FB 6   Add and Increment
NAME :ADDCNT
     :
     :BE
</pre>
</td></tr>
<tr><td>6</td><td>
Creation of the startup blocks.
During the startup of the PLC, the communication processor CP 5431 must be synchronized. This is done by the data handling block SYNCHRON. For the SIMATIC S5 115U PLC used in this sample, this is the block FB249.
<pre>
OB 21
NETZWERK 1 von 1   Synchronize CP 5431
     :SPA FB 249
NAME :SYNCHRON
SSNR :   KY 000,000
BLGR :   KY 000,000
PAFE :   MB 110
     :BE
</pre>
</td></tr>
<tr><td>7</td><td>
Loading the STEP5 program into the PLC.
In STEP5, this is done via the Object → Blocks → Transfer → PLC File menus. In the Selection field, the option All Blocks must be selected to load all previously created blocks to the PLC.
</td></tr>
</table>

C: Configuring the Communication Processor

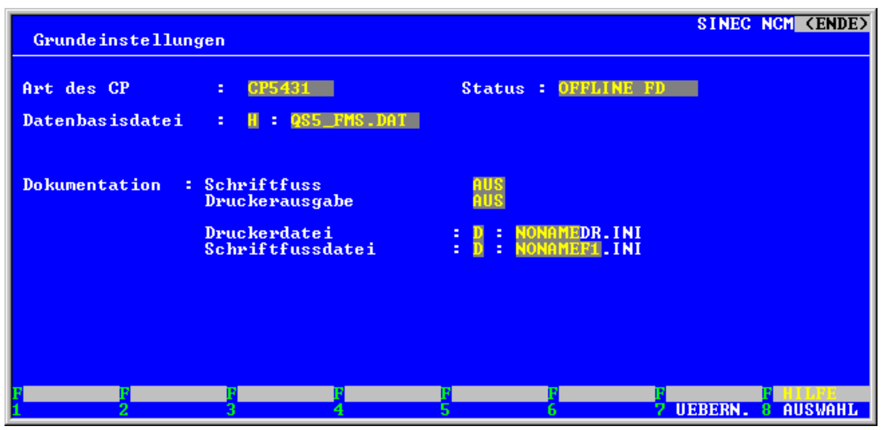
<table>
<tr><th>Step</th><th>C: Configuring the Communication Processor</th></tr>
<tr><td>1</td><td>Start the communication package SINEC NCM for COMs to configure the communication processor CP 5431.

From STEP5, start the communication package via the Change → Additional → SINEC NCM for COMs menus.</td></tr>
<tr><td>2</td><td>This will open the communication package SINEC NCM for COMs.

If no database file is set, the Basic Settings entry mask will initially be displayed. This entry mask can also be opened via the File → Select (or Init. → Edit) menus.

In the CP Type field, indicate the type of communication processor used. Via the F8 function key, one of the available communication processors can be set. Select the CP 5431. Set the Status field to OFFLINE FD via the F8 function key. This stores the configuration made in the program to a database file. In the Database File field, specify the name of this database file. This name has to start with the letter Q. For this sample, the name QS5_FMS.DAT is used for the database file.

The settings made in the Basic Settings entry mask are applied via the F7 function key.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Configuring the Communication Processor</th></tr>
<tr><td>3</td><td>
The settings for the basic initialization of the communication processor must be made.
They are entered in the Basic Initialization entry mask. This entry mask is opened via the Edit → CP Init. menus.
In the L2 Address field, the PROFIBUS Address of the communication processor CP 5431 is specified. In this sample, the value 9 has been entered. This is the PROFIBUS Address that has been specified during the database file creation of the communication processor CP 5412 A2 for the CP 5431.
The remaining settings can be seen in the following graphic. The settings made in the Basic Initialization entry mask are applied via the F7 function key.


</td></tr>
<tr><td>4</td><td>
Setting the global network parameters.
This is done in the Global Network Parameters entry mask, which is opened via the Edit → Global Network Parameters menus.
Specify the Network Parameters. Use the bus parameters that have been defined during the database file creation of the communication processor CP 5412 A2 for the PROFIBUS. Among other things, the Baud Rate is set to 18750 Baud and the Highest Station Address (HSA) to 31.
The settings made in the Global Network Parameters entry mask are applied via the F7 function key.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Configuring the Communication Processor</th></tr>
<tr><td>5</td><td>

Creation of an FMS Connection.

This is done in the *CP Connection Configuration* entry mask, which is opened via the *Edit* → *Connections* → *FMS Connections* menus.

For the *Connection Configuration*, the same values must be specified that have been used for the connection in the database file of the communication processor *CP 5412 A2*. However, local and remote parameters (e.g. LSAP values) must be switched correspondingly. Among other things, in this sample, the value *3* is set for the *Local LSAP* and the value *4* for the *Remote LSAP*.

The settings made in the *CP Connection Configuration* entry mask are applied via the F7 function key.

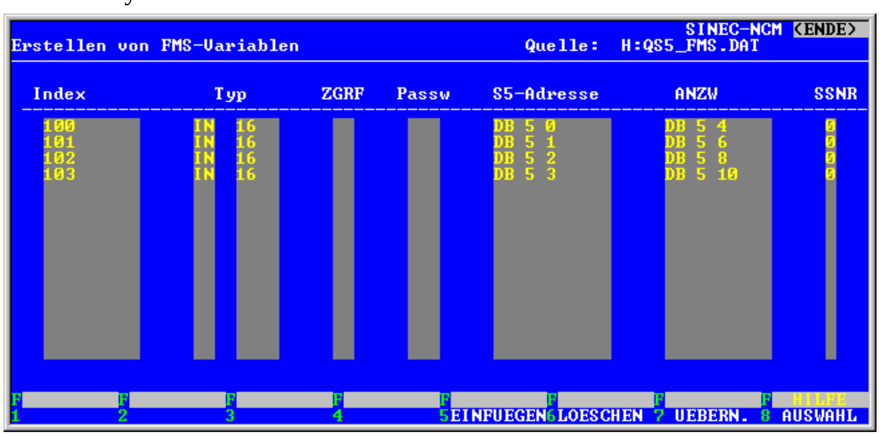
</td></tr>
<tr><td>6</td><td>

Creation of the FMS tags.

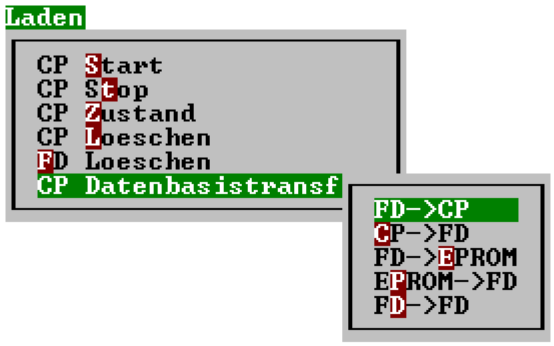
This is done in the *Creation of FMS Tags* entry mask, which is opened via the *Edit* → *VFD Tag Editor* menus.

In this sample, 4 FMS tags of the *IN 16* (Integer 16 Bit) type are created. These FMS tags correspond to the tags previously created in the DB5. Each tag is marked with an Index, which is used by WinCC for addressing purposes.

The settings made in the *Creation of FMS Tags* entry mask are applied via the F7 function key.



</td></tr>
</table>

Step	C: Configuring the Communication Processor
7	Loading the configuration data of the database file to the communication processor *CP 5431*. This is done via the *Load* → *CP Database Transfer* → *FD->CP* menus. The configuration data can only be uploaded while the communication processor is in the *STOP* operating mode. 

D: Starting up the PLC

Step	D: Starting up the PLC
1	Starting the individual modules of the PLC. Previously, the STEP5 program and the database file of the communication processor *CP 5431* must have been loaded to the PLC. First, the operating mode switch of the communication processor *CP 5431* is set to the RUN position. The status LEDs *RUN* and *STOP* will light up at the communication processor, indicating that the module has not be synchronized. Next, the operating mode switch of the CPU module is set to the *RN* position. During the startup of the CPU module, the communication processor is synchronized by the startup block. The communication processor’s status LED *STOP* go out. At the CPU module, only the status LED *RN* will be illuminated.

8.3 Creation of the WinCC Project WinCC_S5_FMS

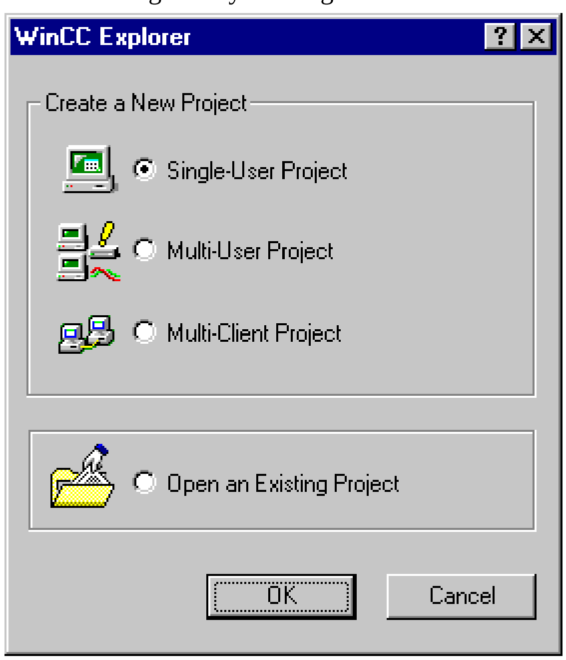
The following description details the configuration steps necessary to create and start up the WinCC project *WinCC_S5_FMS*.

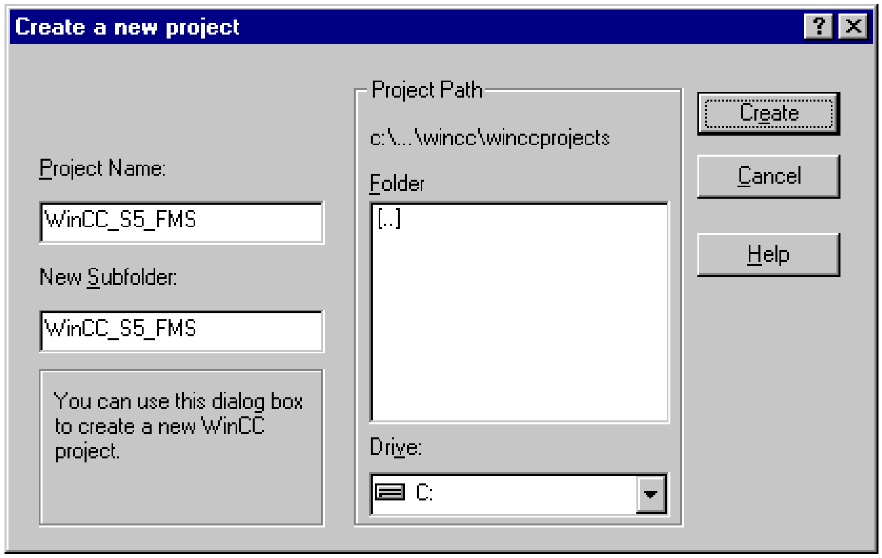
Overview of the Configuration Steps

The following lists the configuration steps necessary to create the WinCC project *WinCC_S5_FMS*:

- A: Creating the WinCC Project
- B: Creating the Connection
- C: Creating the WinCC Tags
- D: Creating the WinCC Screen

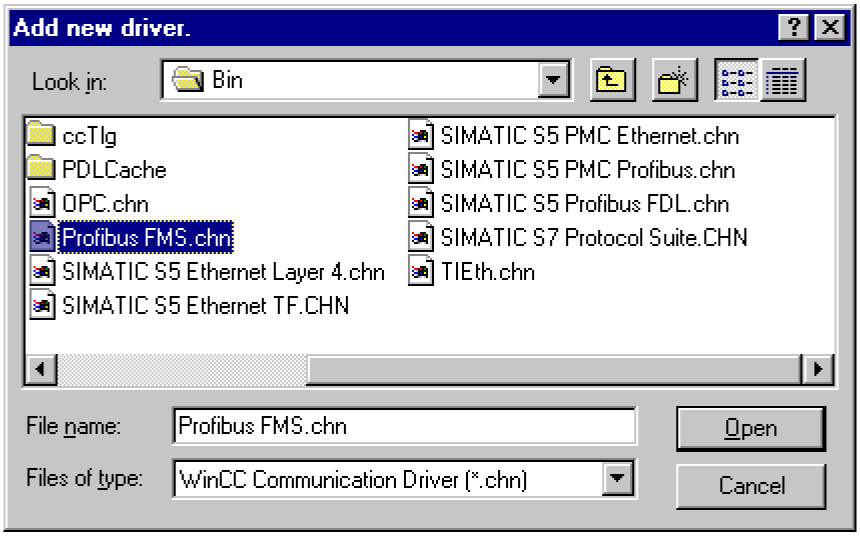
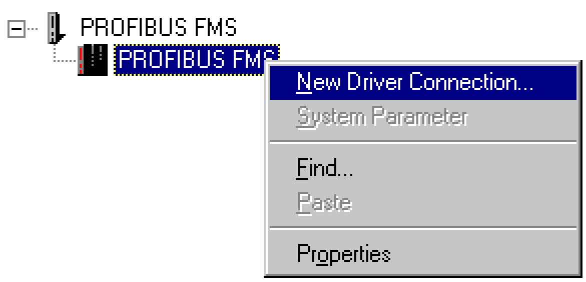
A: Creating the WinCC Project

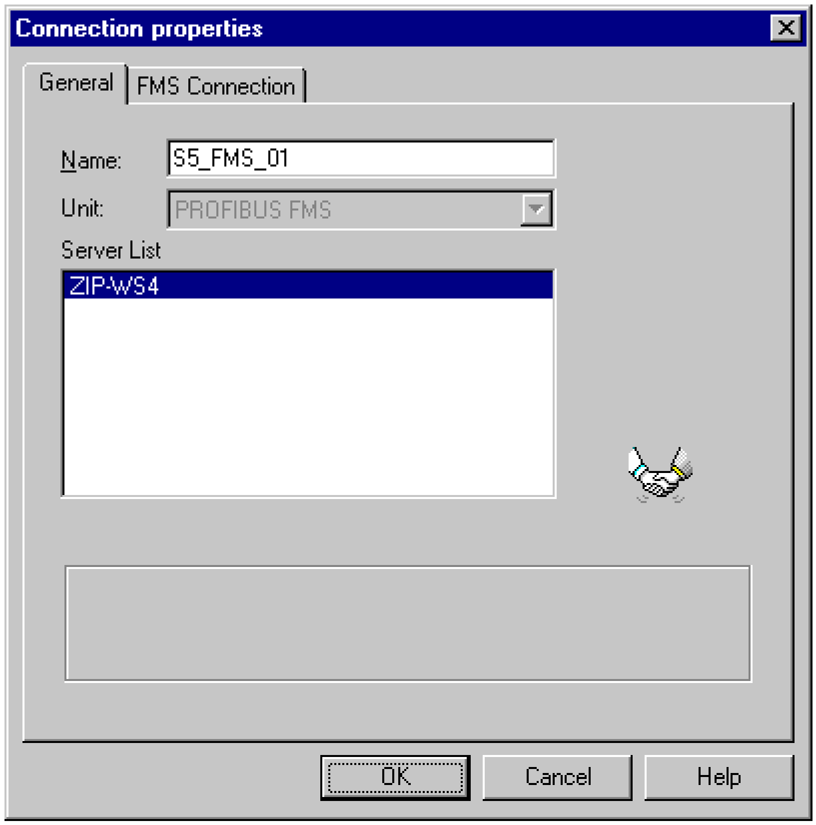
Step	A: Creating the WinCC Project
1	Creation of a new WinCC project in the *WinCC Explorer*. The WinCC Explorer is started via *Start* → *Simatic* → *WinCC* → *Windows Control Center*. 
2	This will display the *WinCC Explorer*. Via the menus *File* → *New*, the dialog box for specifying the properties of a new WinCC project will be opened. For this sample project, a *Single-User Project* is created. Exit the dialog box by clicking on *OK*. 

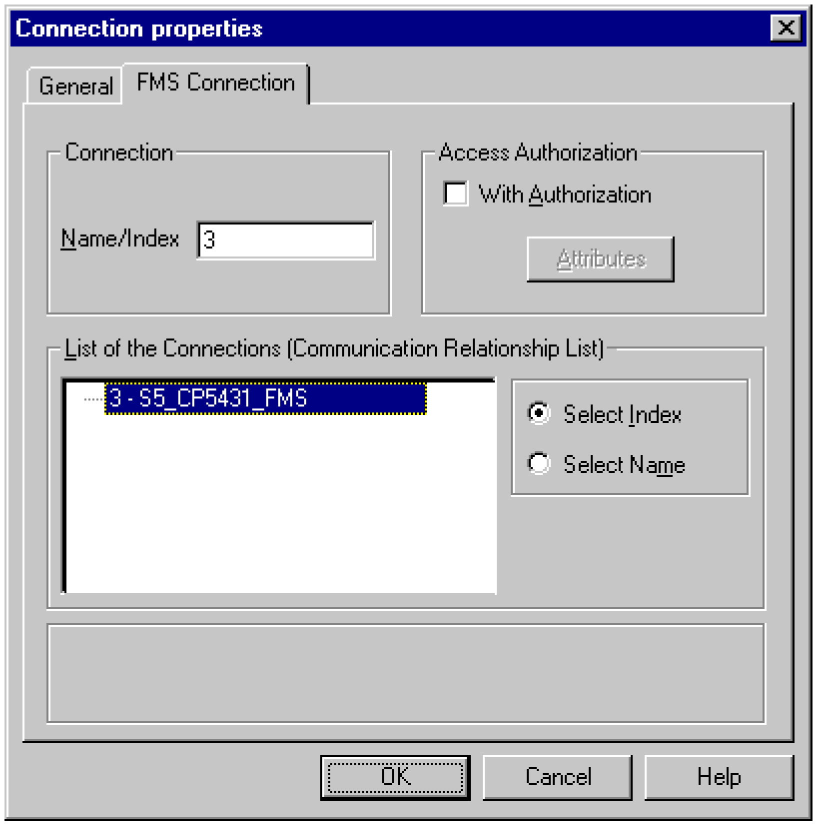
Step	A: Creating the WinCC Project
3	The dialog box *Create a new Project* will be displayed. Specify a *Project Name* for the new project. The names of the WinCC projects created within the framework of this manual all start with *WinCC* and also include a reference to the communication partner and communication type used. The project of this sample has the name *WinCC_S5_FMS*. In the *Project Path* field, set the storage location of the new project. The dialog box *Create a new Project* is concluded by clicking on the *Create* button. 

B: Creating the Connection

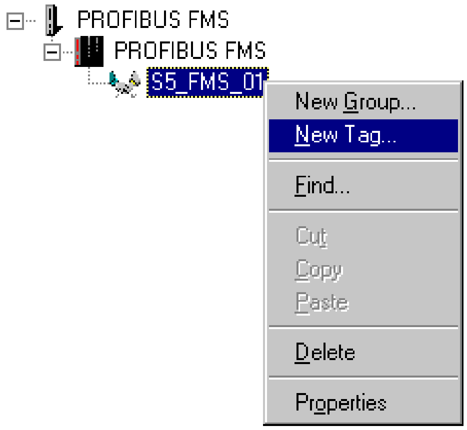
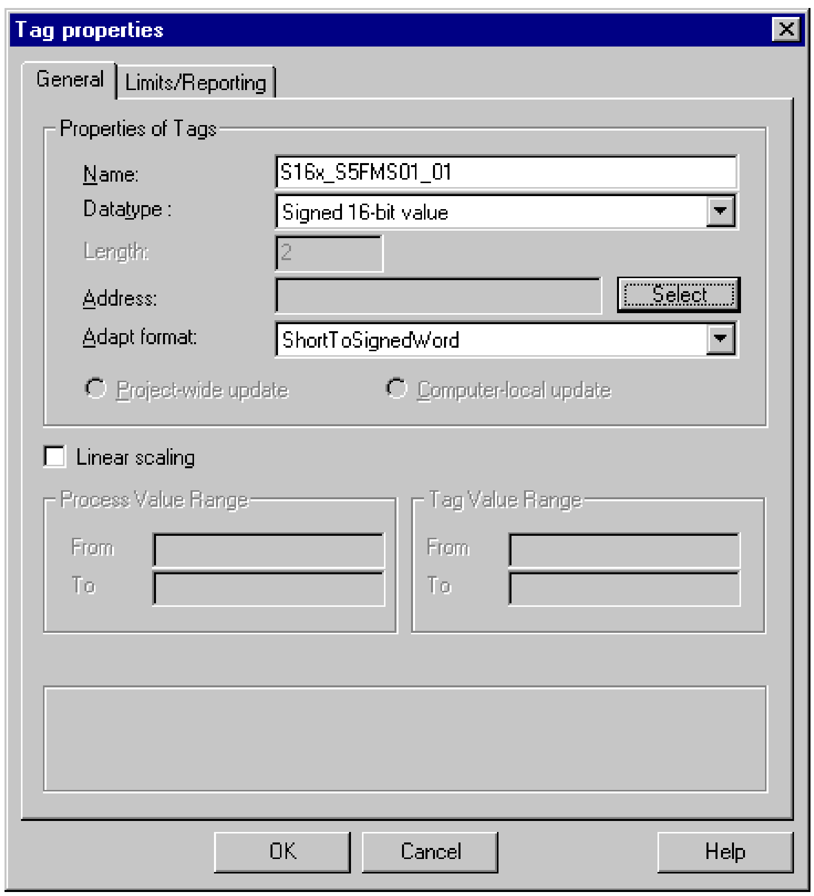
Step	B: Creating the Connection
1	The new project will be displayed in the *WinCC Explorer*. Installation of the required communication driver. This is performed via a R on *Tag Management* and selecting *Add New Driver* from the pop-up menu. 

Step	B: Creating the Connection
2	The dialog box *Add New Driver* will be displayed. This dialog box lists all communication drivers that can be installed. For the communication to the *SIMATIC S5* via *PROFIBUS FMS*, the driver *PROFIBUS FMS* is required. Select this driver from the dialog box. Exit the dialog box by clicking on *Open*. 
3	The newly added driver *PROFIBUS FMS* will be displayed as a sub-entry to *Tag Management*. The driver contains a channel unit named *PROFIBUS FMS*. Create a new connection for this channel unit by R on *PROFIBUS FMS* and then selecting *New Driver Connection* from the pop-up menu. 

Step	B: Creating the Connection
4	The properties dialog box of the connection will be displayed. In the *General* tab, the *Name* of the new connection is entered. In this sample, this is *S5_FMS_01*. 

Step	B: Creating the Connection
5	In the *FMS Connection* tab, specify the desired communication connection. The *Connections List* shows all connections that have been created in the database file of the communication processor *CP 5412 A2*. The desired connection can be selected from this list. In this sample, only the FMS connection *S5_CP5431_FMS* with the index of *3* exists for the database. Select this connection. Close the dialog box by clicking on *OK*. 

C: Creating the WinCC Tags

Step	C: Creating the WinCC Tags
1	Creation of the WinCC tags required for the sample. This is done via a R on the newly created connection *S5_FMS_01* and then selecting *New Tag* from the pop-up menu. 
2	The properties dialog box of the tag will be displayed. In the sample, the *Name* of the first tag is *S16x_S5FMS01_01*. The tag is of the *Signed 16-Bit Value* data type. Click on the *Select* button to set the *Address* of the new tag. 

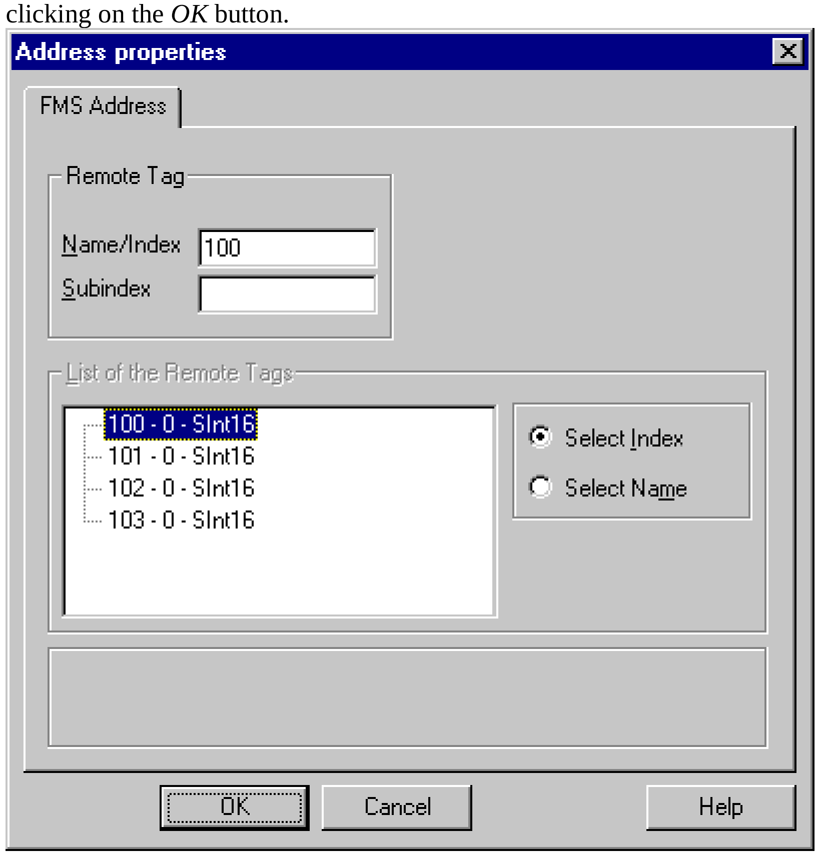
<table>
<tr><th>Step</th><th>C: Creating the WinCC Tags</th></tr>
<tr><td>3</td><td>

The dialog box *Address Properties* will be displayed.

In the *Name/Index* field, the index of the desired FMS tag is entered. This will be the index that has been defined previously during the creation of the FMS tags in the communication processor *CP 5431*. If a connection to the communication processor *CP 5431* already exists, all FMS tags created for this connection will be shown in the *List of removed Tags* field. This allows for a convenient selection of the desired FMS tags.

In this sample, the WinCC tag *S16x_S5FMS01_01* to be created is assigned the FMS tag with the index *100*. This is the tag representing the first of the two values to be added.

The *Address Properties* and *Tag Properties* dialog boxes can be closed by clicking on the *OK* button.



</td></tr>
<tr><td>4</td><td>

Creation of the remaining WinCC tags required.

Follow steps 1 to 3 for the creation of the remaining tags. The names, data types and addresses of the tags used in this sample are listed in the following graphic.

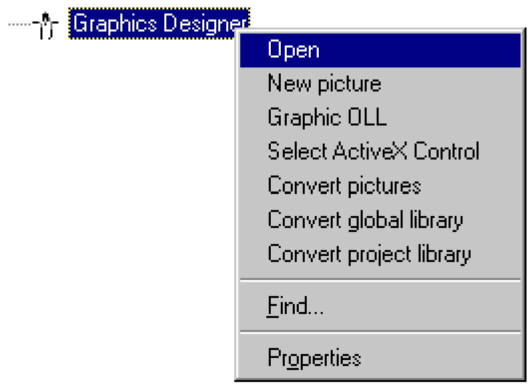
<table>
<tr><th>Name</th><th>Type</th><th>Parameters</th></tr>
<tr><td>S16x_S5FMS01_01</td><td>Signed 16-bit value</td><td>100;0;0</td></tr>
<tr><td>S16x_S5FMS01_02</td><td>Signed 16-bit value</td><td>101;0;0</td></tr>
<tr><td>S16x_S5FMS01_03</td><td>Signed 16-bit value</td><td>102;0;0</td></tr>
<tr><td>S16x_S5FMS01_04</td><td>Signed 16-bit value</td><td>103;0;0</td></tr>
</table>

</td></tr>
</table>

D: Creating the WinCC Screen

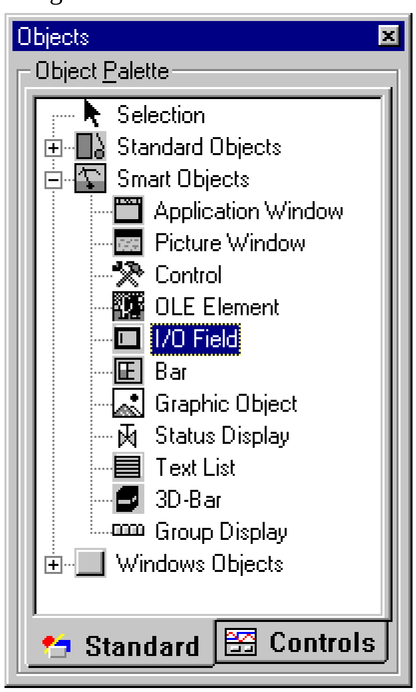
<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>1</td><td>
Creation of a WinCC screen in which the previously created tags are visualized.

Open the *Graphics Designer* editor via a R and then selecting *Open* from the pop-up menu.

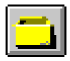
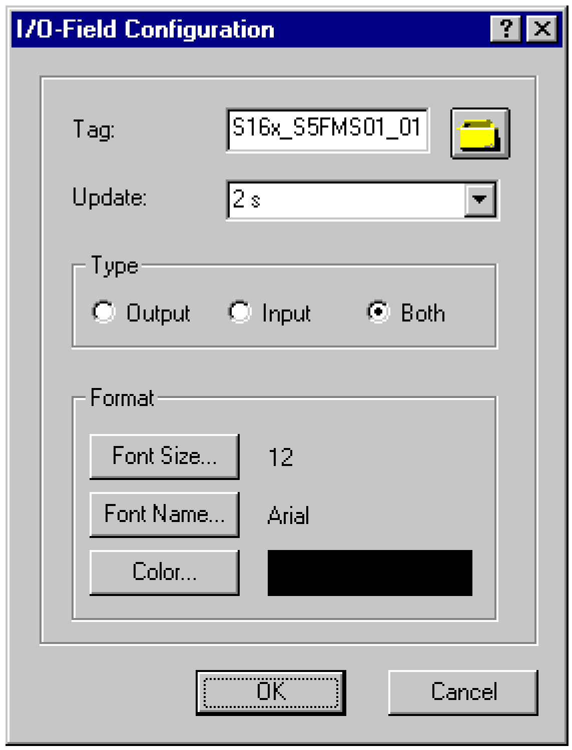


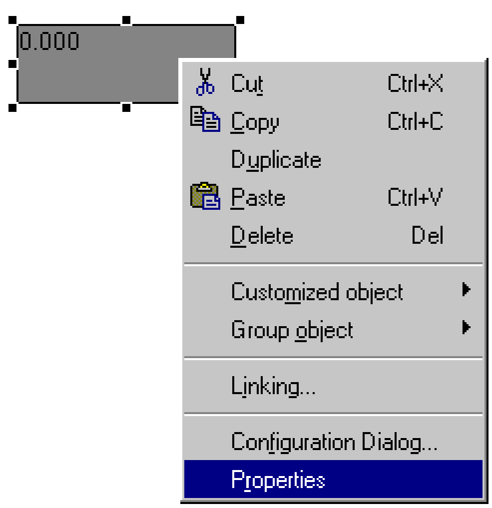
</td></tr>
<tr><td>2</td><td>
This will open the *Graphics Designer* editor with a new (blank) screen.

To display the first tag, configure a *Smart Object* → *I/O Field*. To do so, select the *I/O Field* object from the *Object Palette* and place it on the screen using the mouse.



</td></tr>
</table>

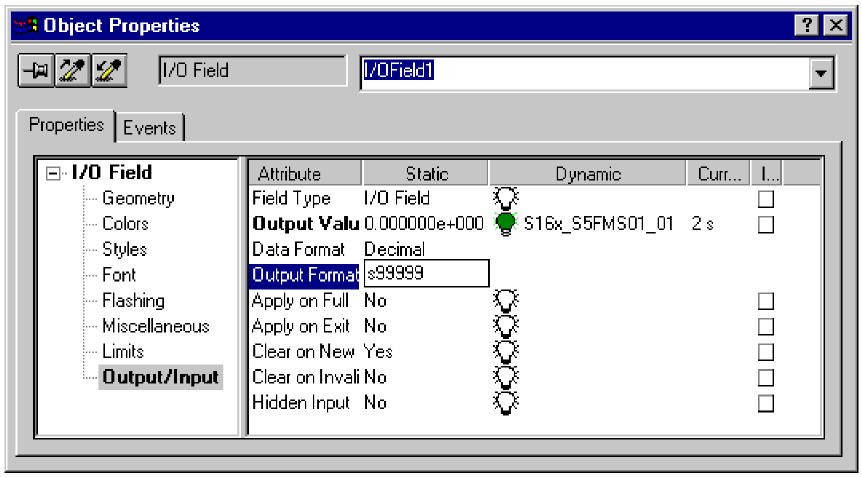
<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>3</td><td>
After placing the I/O Field on the screen, its Configuration dialog box will be displayed.
In the Tag field, set the tag S16x_S5FMS01_01 via the button displayed below.

Leave the Update of the tag at 2 s. Keep the default settings for the remaining options. Close the dialog box by clicking on OK.


</td></tr>
<tr><td>4</td><td>
Changing the output format of the I/O Field.
For this, open its properties dialog box via a R on the I/O Field and then select Properties from the pop-up menu.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>5</td><td>
The dialog box *Object Properties* will be displayed.

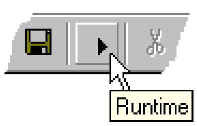
On the left side of the *Properties* tab, select the entry *Output/Input*. Via a D on the output format set, the field can be edited. Select the new format *s99999*. This format enables the *I/O Field* to display signed values with a maximum of 5 digits. Close the dialog box by clicking on *OK*.



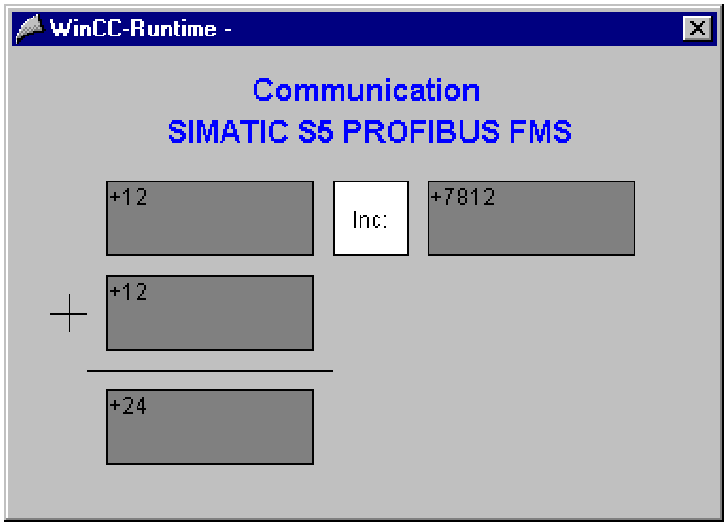
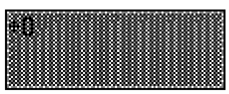
</td></tr>
<tr><td>6</td><td>
Creation of three additional *I/O Fields* for the display of the remaining tags.

Follow steps 2 to 5 to create the remaining I/O fields.
</td></tr>
<tr><td>7</td><td>
Save the screen.

In the sample project, the screen is saved under the name *com_3_S5FMS_01.pdl*. The screen can be switched directly to runtime from the *Graphics Designer* via the button displayed below.



</td></tr>
</table>

Step	D: Creating the WinCC Screen
	If the screen is in runtime, the PLC started and the network connection established, the current values of the PLC will be displayed in the I/O fields. They can be changed by entering values in the individual *I/O Fields*.  If there is no connection to the PLC, the *I/O Fields* will be displayed grayed out. In this case an error is present at some point of the communication connection. 

8.4 Diagnosis of the Communication Connection

The following describes the options available for diagnosing the communication connection between the WinCC project *WinCC_S5_FMS* and the SIMATIC S5 station.
A diagnosis of the sample according to the following description makes only sense, if the checks listed below have been completed successfully.

Startup of the Communication Processor CP 5412 A2

- F: Testing the Communication Processor

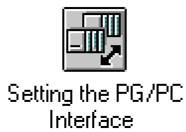
Creation of the STEP5 Project S5_FMSst

- D: Starting up the PLC

Setting the PG/PC Interface

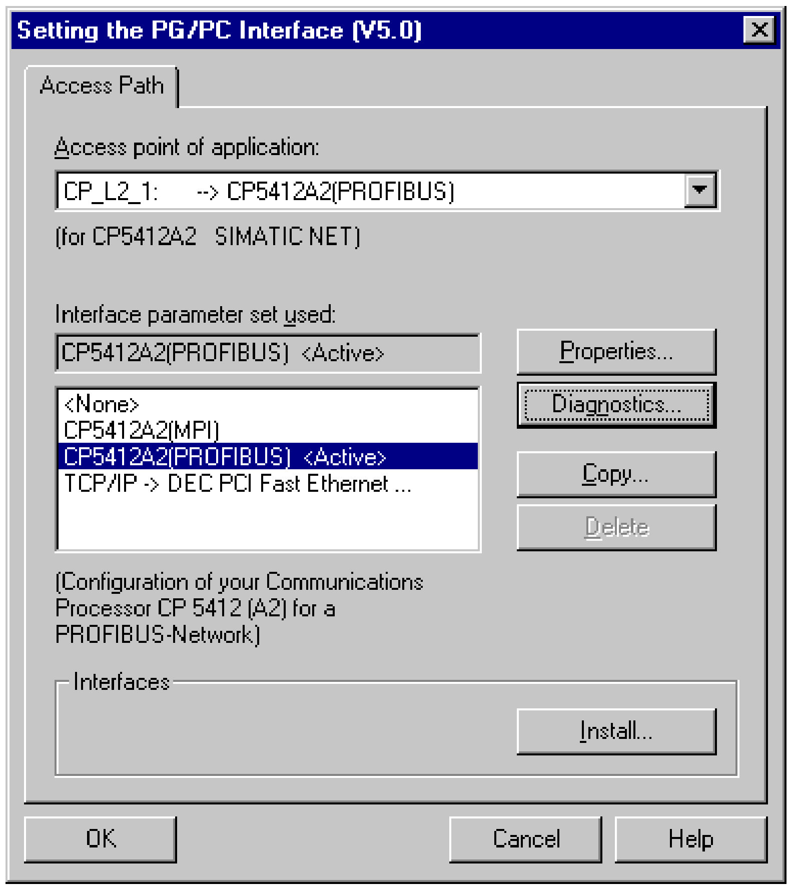
<table>
<tr><th>Step</th><th>Setting the PG/PC Interface</th></tr>
<tr><td>1</td><td>Diagnosis of the communication connection via the program Setting the PG/PC Interface.

This program is accessed via Start → Settings → Control Panel → Setting the PG/PC Interface.


</td></tr>
<tr><td>2</td><td>The program Setting the PG/PC Interface will be displayed.

Select the interface CP 5412 A2 (PROFIBUS). Make sure that the assignments between access points and the interfaces are not changed.

The diagnosis of the communication connection is started by clicking on the Diagnostics button.

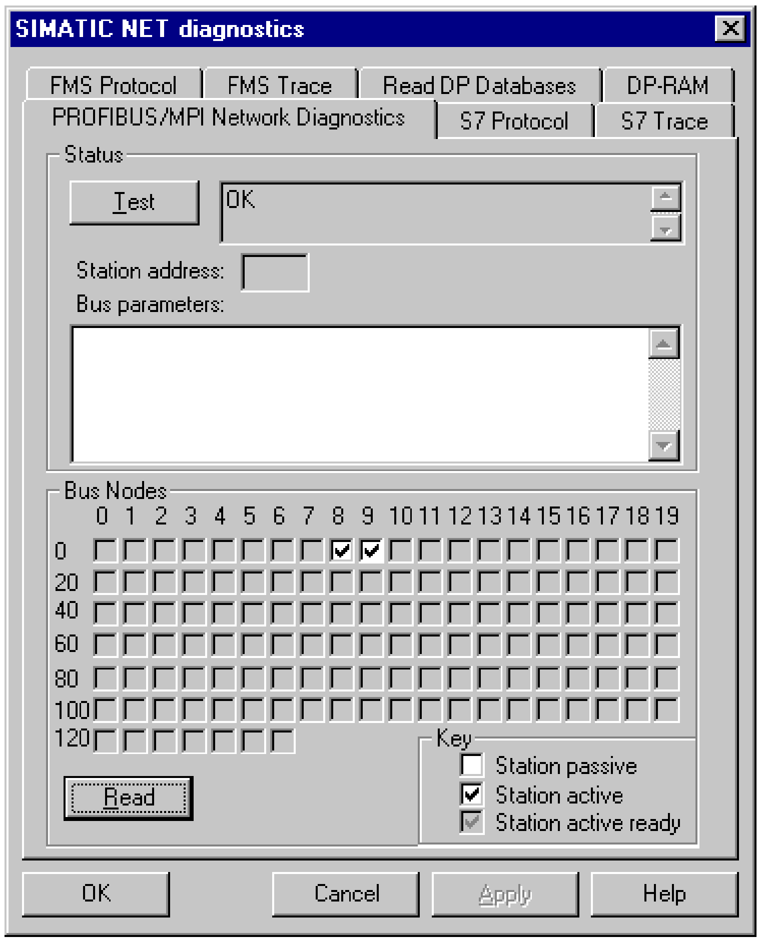

</td></tr>
</table>

<table>
<tr><th>Step</th><th>Setting the PG/PC Interface</th></tr>
<tr><td>3</td><td>

The dialog box *Simatic NET Diagnostics* will be displayed.

From the *PROFIBUS/MPI Network Diagnostics* tab, the diagnosis of the communication connection is started by clicking on the *Read* button. This will display all stations accessible on the bus. For this sample, the address *8* of the communication processor *CP 5412 A2* as well as the address *9* of the communication processor *CP 5431* must be marked as occupied.

The dialog box can be exited by clicking on *OK*.



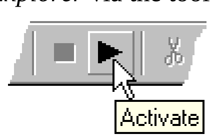
</td></tr>
</table>

WinCC Explorer

<table>
<tr><th>Step</th><th>WinCC Explorer</th></tr>
<tr><td>1</td><td>

Diagnosis of the communication connection from the *WinCC Explorer*.

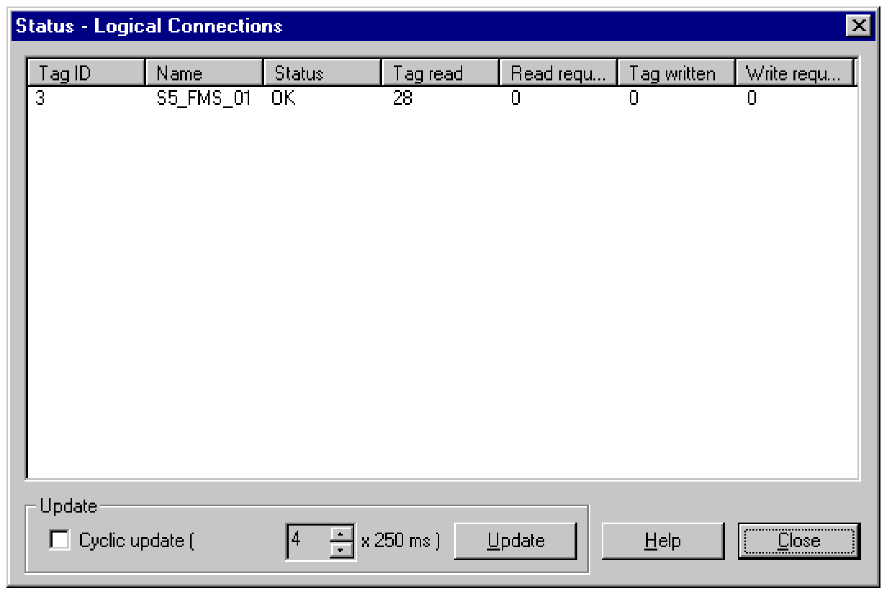
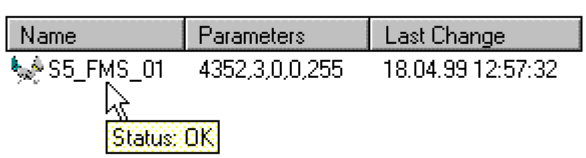
Switch the project *WinCC_S5_FMS* into runtime. This is done from the *WinCC Explorer* via the toolbar button displayed below.

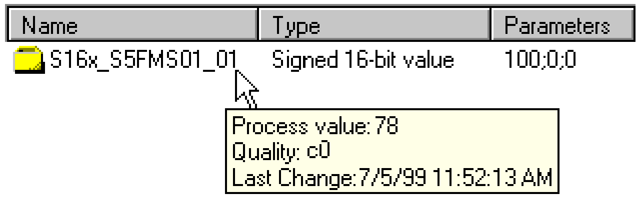


The created WinCC screen *com_3_S5FMS_01.pdl* can also be switched directly from the *Graphics Designer* into runtime.

</td></tr>
</table>

<table>
<tr><th>Step</th><th>WinCC Explorer</th></tr>
<tr><td>2</td><td>In the WinCC Explorer, a dialog box for monitoring all configured connections can be accessed via the Tools → Status of Driver Connections menu. This menu point is only accessible if the project is in runtime.

</td></tr>
<tr><td>3</td><td>The dialog box Status - Logical Connections will be displayed.
This dialog box lists all configured connections. For this sample, only the connection S5_FMS_01 will be displayed.
The displayed values correspond to the status at the moment the dialog box was opened. By selecting the appropriate check-box, a Cyclic Update of the display can be achieved.

</td></tr>
<tr><td>4</td><td>Another way to obtain information about the connection status in general and about the connection status of individual tags is provided by Tag Management.
The status of a configured connection can be displayed as a tooltip by simply pointing the mouse on the connection in question.

</td></tr>
</table>

Step	WinCC Explorer
	The current process value of a certain tag as well as its status can be displayed as a tooltip by pointing the mouse on it. This allows you to detect errors concerning an individual tag and not the entire connection. 

9 Communication to the SIMATIC S5 via PROFIBUS FDL

The projects created in this chapter can also be copied directly from the online document to your hard drive. By default, they will be copied to the folder C:\Communication_Manual. You have the option to copy the following components to the hard drive:

S5_FDLst

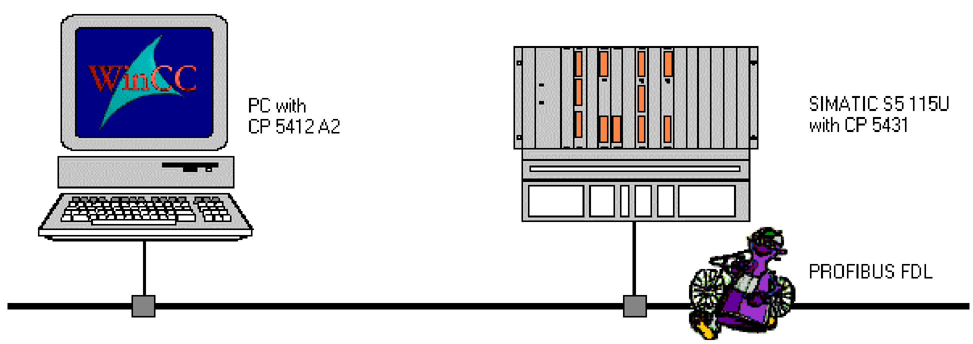
The STEP5 project we will create including the database file of the communication processor CP 5431 FMS/DP.

WinCC_S5_FDL

The WinCC project we will create.

This chapter describes in detail the startup of a communication connection between a SIMATIC S5 and WinCC. The communication connection is implemented via the PROFIBUS, on which the FDL Protocol (Fieldbus Data Link) is running.

Overview of the Structure of the Sample



On the computer side, the connection to the *PROFIBUS* network is established via the communication processor *CP 5412 A2*. To install this communication processor in the computer, the driver *PB DP-5412*, located on the *SIMATIC NET* CD-ROM, is needed. However, it is also possible to use the *PB S7-5412* or *PB FMS-5412* drivers.
In the WinCC project, the communication driver *SIMATIC S5 PROFIBUS FDL* must be installed. This communication driver is used to configure the connection to the *SIMATIC S5*.
The PLC *SIMATIC S5 115U* is equipped with the CPU module *CPU 944*. The connection to the network is established via the communication processor *CP 5431 FMS/DP*. For the configuration of this communication processor, the communication package *SINEC NCM for COMs* is required.

Overview of the Configuration Steps

The following lists all configuration steps necessary for the creation of the communication connection:

- Startup of the Communication Processor CP 5412 A2
- Creation of the STEP5 Project S5_FDLst
- Creation of the WinCC Project WinCC_S5_FDL
- Diagnosis of the Communication Connection

Required Software

Name	Description
SIMATIC NET	Driver *PB DP-5412* from the *SIMATIC NET* CD-ROM for the installation of the communication processor *CP 5412 A2*.
STEP5	STEP5 software for the creation of the STEP5 project. Communication package *SINEC NCM for COMs* for the configuration of the communication processor *CP 5431 FMS/DP*.
WinCC	WinCC with communication driver *SIMATIC S5 PROFIBUS FDL* for the creation of the WinCC project and for the configuration of the connection to the PLC.

Required Computer Hardware

Name	Description
Communication Processor	Communication processor *CP 5412 A2* to establish the connection to the PLC's communication processor.

Required PLC Hardware

Name	Description
Rack	Rack *CR 700-3*.
Power Supply	Power supply *PS 951*.
CPU Module	CPU module *CPU 944*.
Communication Processor	Communication processor *CP 5431 FMS/DP*.

9.1 Startup of the Communication Processor CP 5412 A2

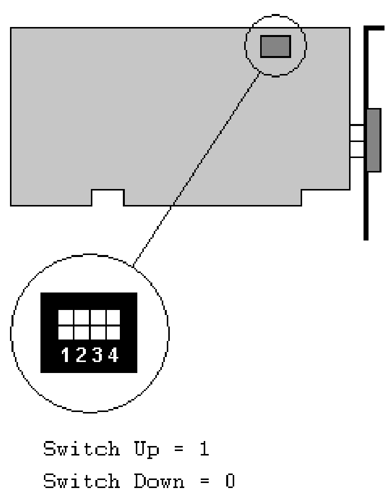
The following description details the configuration steps necessary to successfully start up the communication processor *CP 5412 A2*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to start up the communication processor *CP 5412 A2*:

- A: Mounting the Communication Processor in the Computer
- B: Installing the Communication Driver
- C: Installing the Communication Processor
- D: Assigning the Communication Processor
- E: Testing the Communication Processor

A: Mounting the Communication Processor in the Computer

<table>
<tr><th>Step</th><th>A: Mounting the Communication Processor in the Computer</th></tr>
<tr><td>1</td><td>
Check the selected jumper settings at the CP 5412 A2.
During the installation of the CP 5412 A2, the I/O Range must be specified. The I/O Range is set via jumpers.
By default, the I/O Range is set to 0240-0243. However, other settings are also possible. The following graphic illustrates the jumper settings necessary for the various I/O Ranges.


<table>
<tr><th>I/O Area</th><th>1-2-3-4</th></tr>
<tr><td>0240-0243</td><td>0 0 0 0</td></tr>
<tr><td>0244-0247</td><td>0 0 0 1</td></tr>
<tr><td>0248-024B</td><td>0 0 1 0</td></tr>
<tr><td>024C-024F</td><td>0 0 1 1</td></tr>
<tr><td>0280-0283</td><td>0 1 0 0</td></tr>
<tr><td>0284-0287</td><td>0 1 0 1</td></tr>
<tr><td>0288-028B</td><td>0 1 1 0</td></tr>
<tr><td>028C-028F</td><td>0 1 1 1</td></tr>
<tr><td>0300-0303</td><td>1 0 0 0</td></tr>
<tr><td>0304-0307</td><td>1 0 0 1</td></tr>
<tr><td>0308-030B</td><td>1 0 1 0</td></tr>
<tr><td>030C-030F</td><td>1 0 1 1</td></tr>
<tr><td>0390-0393</td><td>1 1 0 0</td></tr>
<tr><td>0394-0397</td><td>1 1 0 1</td></tr>
<tr><td>0398-039B</td><td>1 1 1 0</td></tr>
<tr><td>039C-039F</td><td>1 1 1 1</td></tr>
</table>
</td></tr>
<tr><td>2</td><td>
Mount the module according to the installation instructions. Among other things, follow the steps for handling electrostatic sensitive devices (ESD). The module must only be installed while the computer is off.
For the communication card CP 5412 A2, a free ISA slot in the computer is required. After the installation of the CP 5412 A2, close the computer’s case and start the computer.
</td></tr>
</table>

B: Installing the Communication Driver

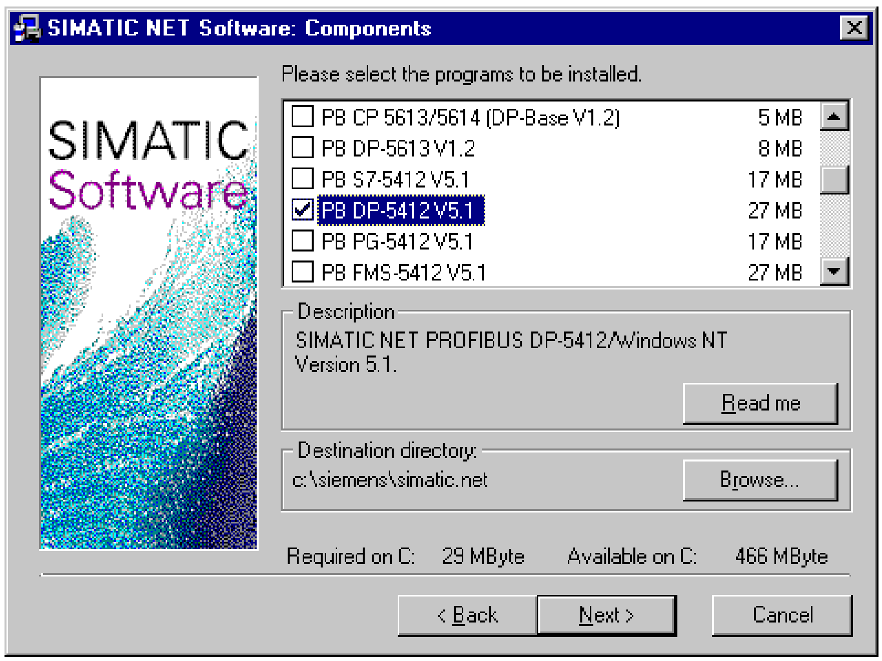
<table>
<tr><th>Step</th><th>B: Installing the Communication Driver</th></tr>
<tr><td>1</td><td>

Installation of the communication driver *PB DP-5412* from the *SIMATIC NET* CD-ROM.

After inserting the *SIMATIC NET* CD-ROM, the installation program is automatically started. If this is not the case, open the *Windows NT Explorer* and start the *setup.exe* program located on the CD-ROM.

The installation of the software is started via the button displayed below.

Follow the instructions of the installation program. On the *Components* page, the check-box of the driver *PB DP-5412* to be installed must be selected. Finish the installation.

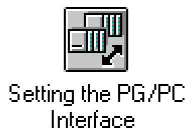
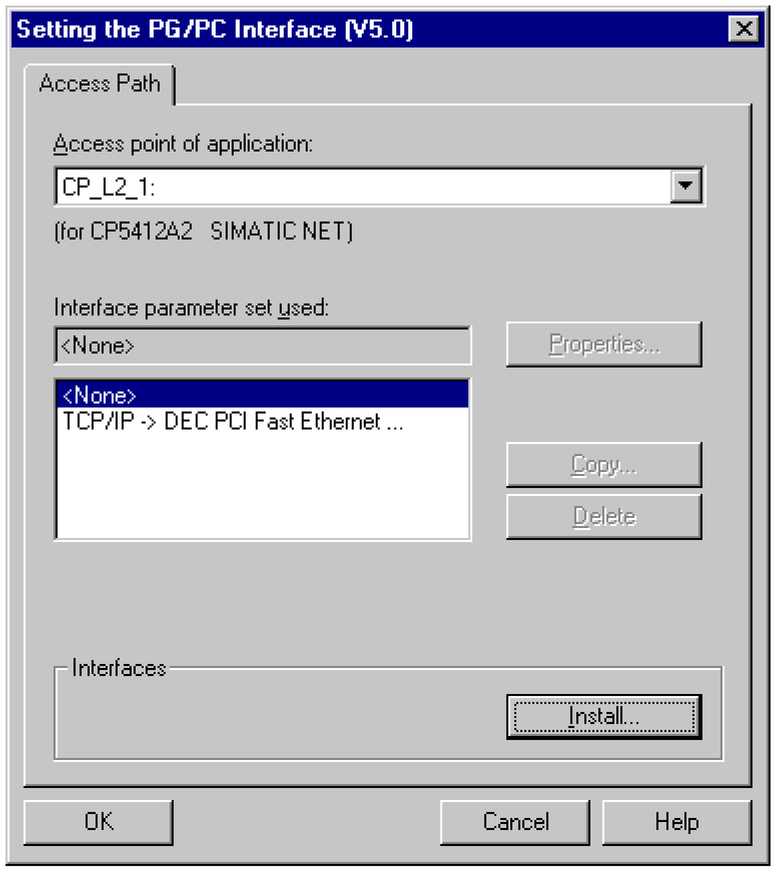


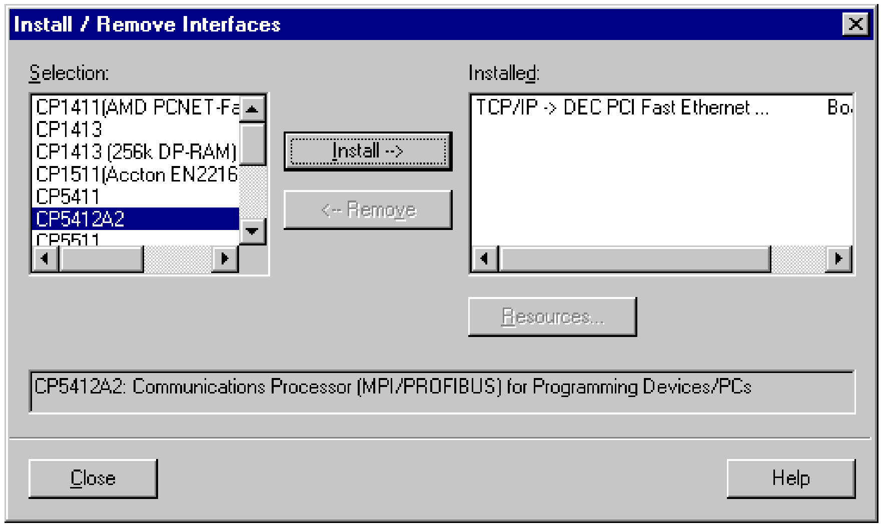
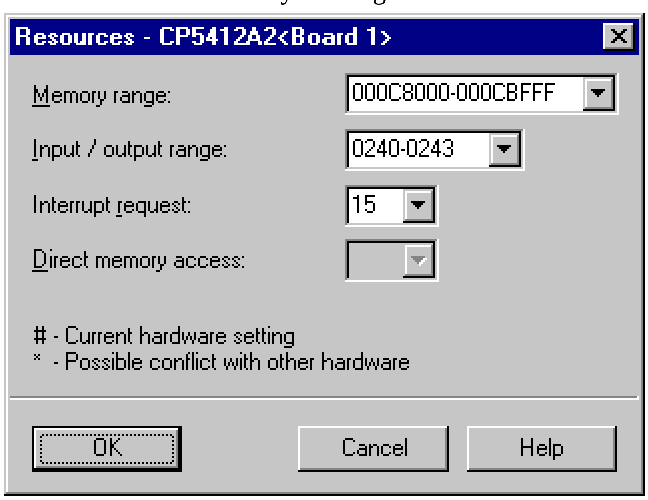
</td></tr>
</table>

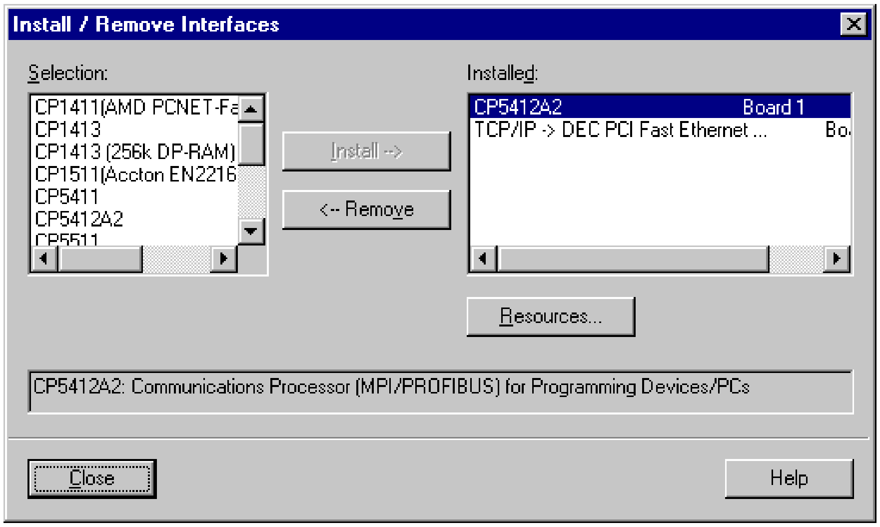
C: Installing the Communication Processor

<table>
<tr><th>Step</th><th>C: Installing the Communication Processor</th></tr>
<tr><td>1</td><td>Install the communication processor CP 5412 A2 via the program Setting the PG/PC Interface.

This program is accessed via Start → Settings → Control Panel → Setting the PG/PC Interface.

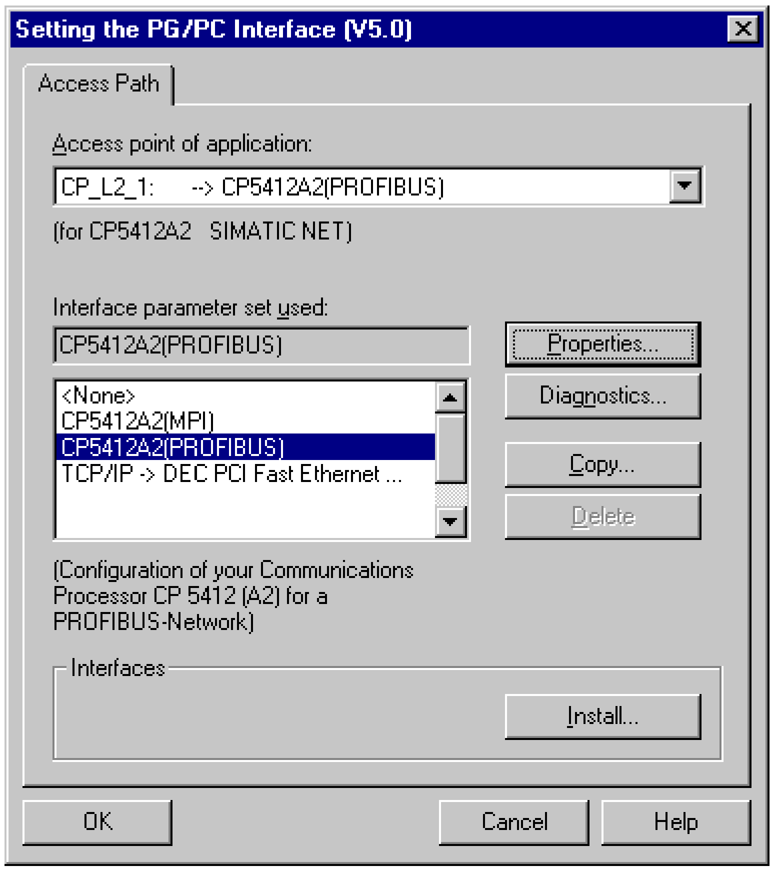

</td></tr>
<tr><td>2</td><td>The program Setting the PG/PC Interface will be displayed.
The dialog box for installing a new interface is opened via the Install button.

</td></tr>
</table>

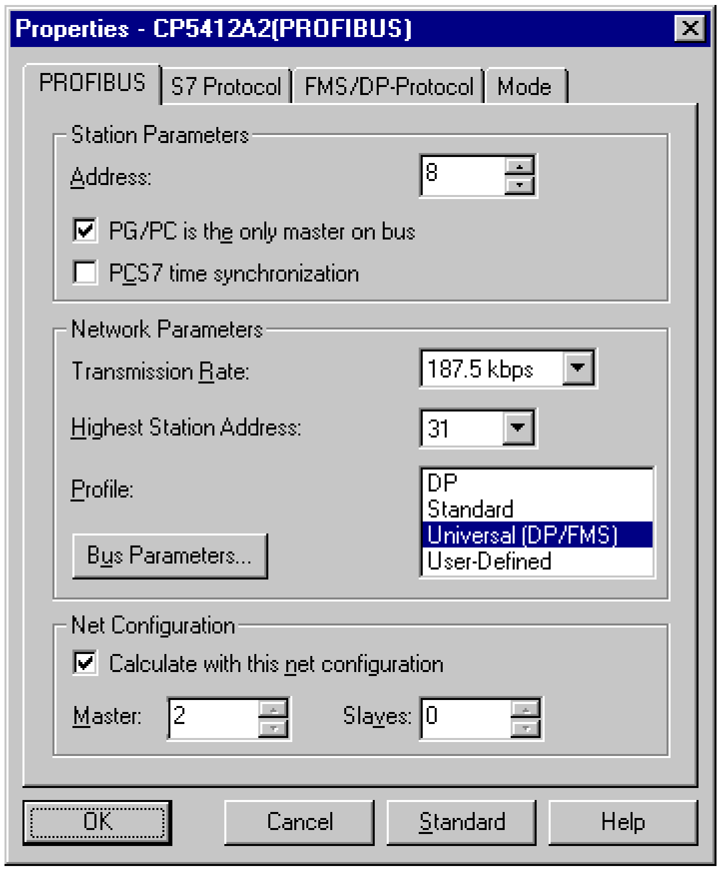
Step	C: Installing the Communication Processor
3	The dialog box *Install/Remove Modules* will be displayed. The *Selection* field lists all interfaces that can be installed. Among them will be the entry for the *CP 5412 A2*, if the communication driver has been installed previously as outlined in step B. From the *Selection* field, select the entry *CP 5412 A2*. The installation of the communication processor is started by clicking on the *Install ->* button. 
4	The dialog box *Resources - CP 5412 A2* will be displayed. The settings for the *Memory Range*, *I/O Range* and *Interrupt* have to be specified. The *I/O Range* has already been determined via the Jumper Settings at the *CP 5412 A2*. Make sure that the assigned resources have not already been taken by other modules in the computer. Information about already taken system resources can be obtained from the *Resources* tab accessed via *Start* → *Programs* → *Administrative Tools (Common)* → *Windows NT Diagnostics*. Close the *Resources* tab by clicking on *OK*. 

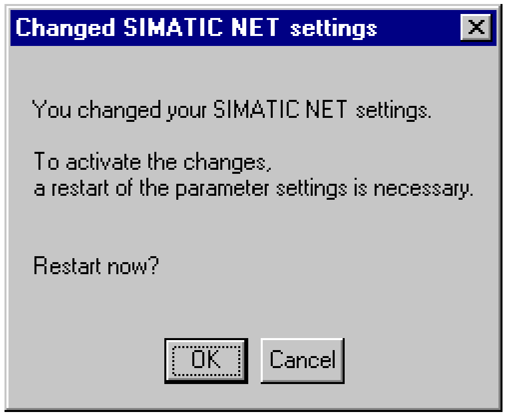
Step	C: Installing the Communication Processor
5	In the dialog box *Install/Remove Modules*, the *Installed* field will now contain the entry for the *CP 5412 A2*. Exit the dialog box *Install/Remove Modules* via the *Close* button. 

D: Assigning the Communication Processor

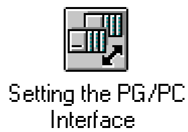
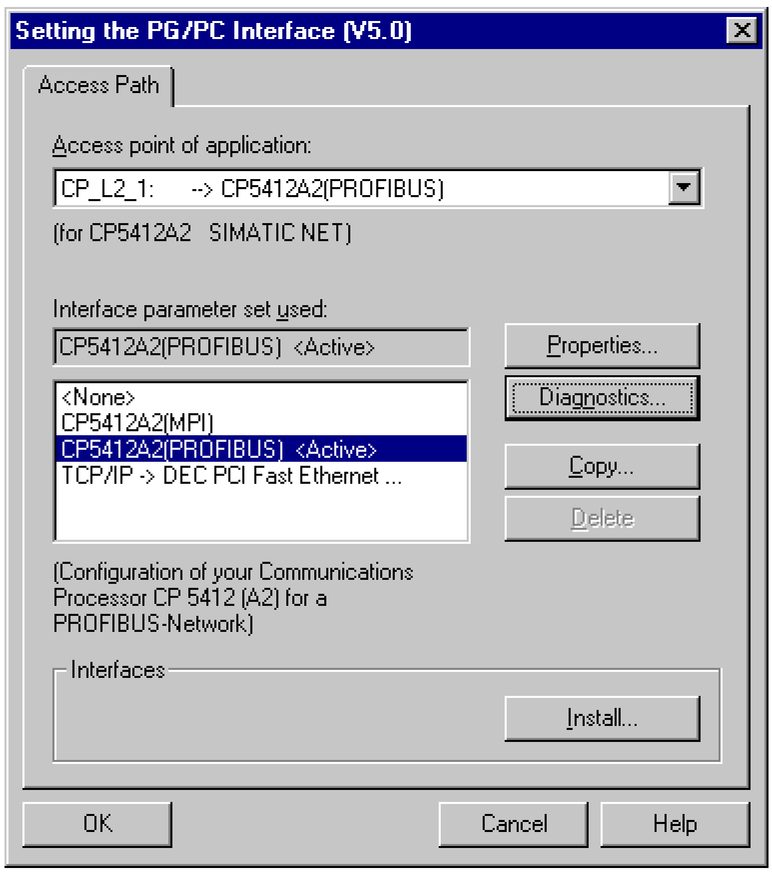
Step	**D: Assigning the Communication Processor**
1	In the program *Setting the PG/PC Interface*, assign the access point *CP_L2_1:* to the just installed interface. The access point CP_L2_1: is the default access point used by WinCC for the communication via the *PROFIBUS*. It has been created automatically during the installation of the communication driver *PB DP-5412*. In the field *Access Point of the Application*, set the entry *CP_L2_1:*. In the field below, select the entry *CP 5412 A2 (PROFIBUS)*. This completes the assignment between the access point and the communication processor.



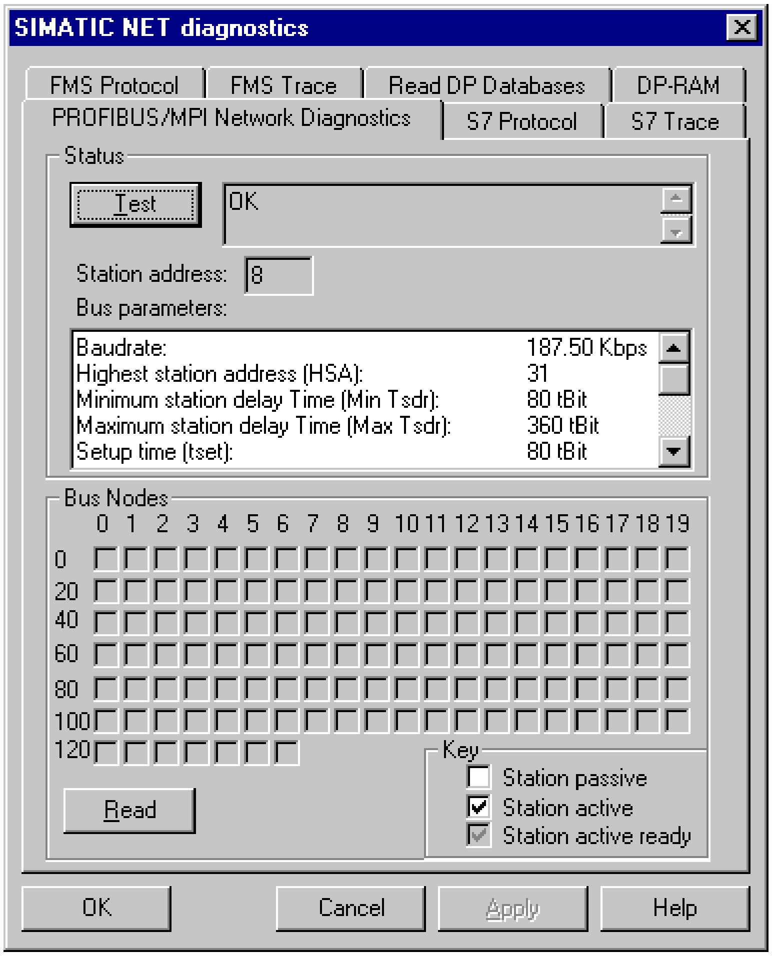
Step	D: Assigning the Communication Processor
2	Setting the properties of the communication processor *CP 5412 A2*. The dialog box for setting the properties is opened via the *Properties* button of the *Setting the PG/PC Interface* program. The dialog box *Properties - CP 5412 (PROFIBUS)* will be displayed. In the *PROFIBUS* tab, station and network related parameters are set. In this sample, the *Local Station Address* of the communication processor is set to *8*. For the *PROFIBUS Network*, a *Baud Rate* of *187.5 kBit/s* is selected. The *Highest Station Address* is set to the value of *31*. As the *Profile*, *Universal (DP/FMS)* is selected. The network settings just made for all stations in the *PROFIBUS network* must be uniform. They must also be entered as the network parameters in the database file created for the communication processor *CP 5431*. 

Step	**D: Assigning the Communication Processor**
3	Exit the program *Setting the PG/PC Interface* via the *OK* button. A dialog box will be displayed requesting the restart of the *CP 5412 A2*. Acknowledge this dialog box by clicking on *OK*, which will result in the restart of the communication processor *CP 5412 A2*. This completes the installation of the communication processor. 

E: Testing the Communication Processor

Step	E: Testing the Communication Processor
1	Test the communication processor *CP 5412 A2* via the program *Setting the PG/PC Interface*. This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*. 
2	The program *Setting the PG/PC Interface* will be displayed. Select the interface to be checked. In this case, select the entry *CP 5412 A2 (PROFIBUS)*. Make sure that the assignments between access points and the interfaces are not changed. The check for a proper installation is activated by clicking on the *Diagnostics* button. 

Step	E: Testing the Communication Processor
3	The dialog box *Simatic NET Diagnostics* will be displayed. In the *PROFIBUS/MPI Network Diagnostics* tab, the diagnosis is started via the *Test* button. The result of the diagnosis will be displayed immediately following. If the result of the diagnosis is positive (correct installation), the dialog box can be exited with *OK*. In this case, the program *Setting the PG/PC Interface* can also be closed by clicking on *OK*. The configuration of the communication to the S5 via *PROFIBUS FDL* is continued in the following section. However, if the result of the diagnosis is negative (incorrect installation), the error must be localized and corrected. Troubleshooting procedures are described in the section Is the Communication Module in the Computer operational?.



9.2 Creation of the STEP5 Project S5_FDLst

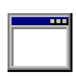
The following description details the configuration steps necessary to create and start up the STEP5 project *S5_FDLst*.

Overview of the Configuration Steps

The following lists the configuration steps necessary to create the STEP5 project *S5_FDLst*:

- A: Installing the Hardware and Software
- B: Creating the STEP5 Program
- C: Configuring the Communication Processor
- D: Starting up the PLC

A: Installing the Hardware and Software

Step	A: Installing the Hardware and Software
1	Rack-mounting of the modules used. In this sample, the modules to be installed are the power supply *PS 951*, the CPU module *CPU 944* and the communication processor *CP 5431*. Establishing the connection from the programming device to the programming interface of the CPU module. Establishing the connection from the communication processor *CP 5412 A2* in the computer to the communication processor *CP 5431* in the PLC.
2	Installing the communication package SINEC NCM for COMs from the corresponding installation disk. This communication package is required for the configuration of the communication processor *CP 5431*. The installation disk contains the program file *install.exe*. Start this program. Follow the instructions of the installation program and complete the installation.  Install.exe

B: Creating the STEP5 Program

Step	B: Creating the STEP5 Program
1	Creation of a new project with the STEP5 software. Start the STEP5 software. From the *Object* → *Project* → *Settings* → *Page1* and *Page2* menus, define the settings for the new project. In the *Program File* field, specify the name of the new program file to be created. In this sample, the name *S5_FDLST.S5D* is used. Only the first six characters of the file name can be changed by the user.
2	Creation of a data block. In STEP5, this is accomplished via the *Editor* → *Data Block* → *menus of*

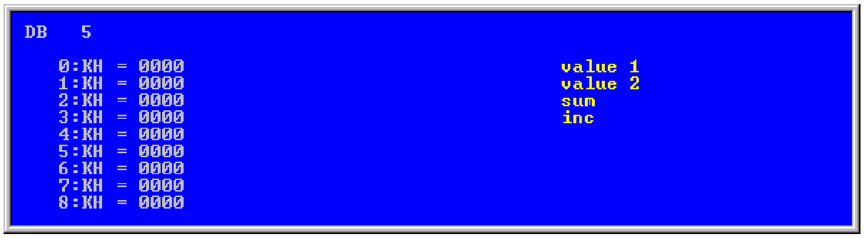
<table>
<tr><th>Step</th><th>B: Creating the STEP5 Program</th></tr>
<tr><td></td><td>

the program file. As the name of the data block, this sample uses *DB5*.

In this data block, two tags with a length of 16 Bits are created. Their sum is to be determined in *OB1* and then be written to another tag with a length of 16 Bits. One additional tag with a length of 16 Bits is created, whose value is cyclically incremented in *OB1*.

The tags created in the data block *DB5* are visualized in the WinCC project. To do so, WinCC tags with corresponding addresses are created there.

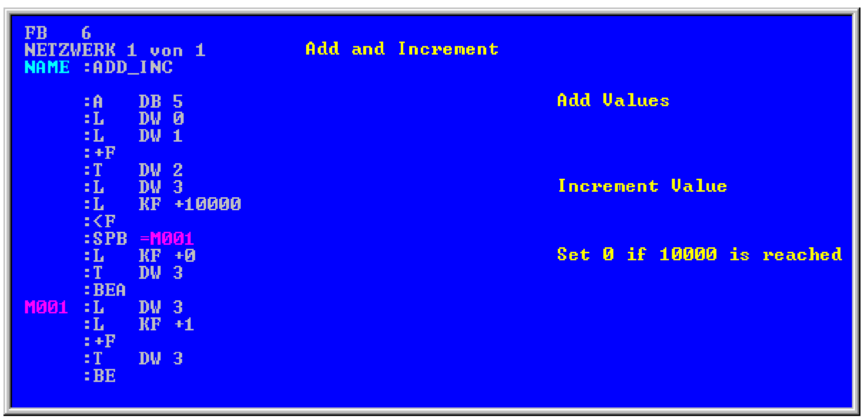
The following graphic displays the programmed data block *DB5*.



</td></tr>
<tr><td>3</td><td>

Creation of a function block, which makes available the functionality of the sample program.

Two values stored in the *DB5* are added and the sum again stored in the *DB5*. Additionally, a value stored in the *DB5* is incremented every program cycle. If this value reaches 10000, it is reset back to 0. In STEP5, the creation of a new function block is carried out via the *Editor* → *STEP5 Block* → *menus of the program file*. As the name of the program block, this sample uses *FB6*.



</td></tr>
<tr><td>4</td><td>

Transfer of the blocks required for the communication into STEP5. The blocks can be found on the WinCC CD-ROM or they can be copied from the supplied STEP5 project.

These are the standard function blocks *FB9 L2STARTUP* and *FB10 L2SNDRCV*. They must be transferred into the STEP5 program. The blocks support 5 different FDL connection instruction types.

For each of these instruction types, a predefined work-DB is available, which contains various message data. For this sample, only instructions for read and write request from WinCC are required. This requires the transfer of the work-DBs *DB11* and *DB12* into STEP5.

In the PLC, the handling blocks *SEND*, *RECEIVE*, *SYNCHRON* and *CONTROL* must be available. For the *SIMATIC S5 115U* PLC used in this sample, these are the blocks *FB244*, *FB245*, *FB247* and *FB249*.

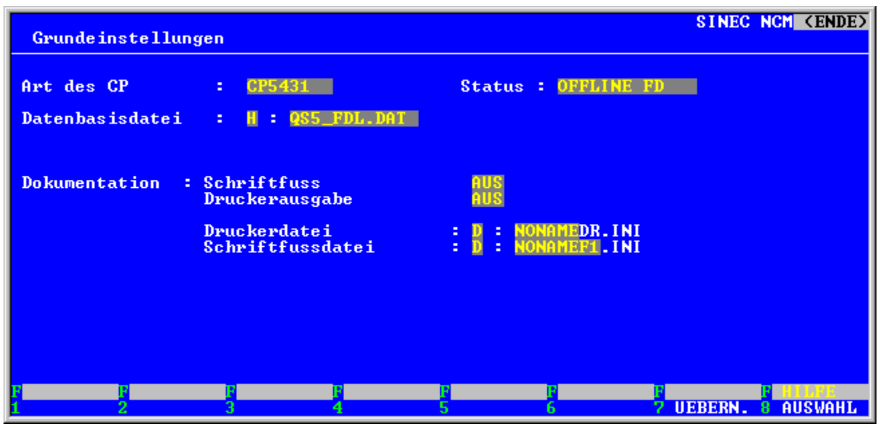
</td></tr>
</table>

Step	B: Creating the STEP5 Program
5	Creation of the startup blocks. The startup blocks define the communication parameters, register the work-DBs and synchronize the communication processor. These steps are all performed by a call of the function block *FB9 L2STARTUP*. During the call of the function block, the interface number *SSNR* of the *CP 5431* is transferred as a parameter. As the *RADR* parameter, the PROFIBUS address of the communication processor *CP 5412 A2* in the computer is specified. In this sample, this is *8*. In addition, the connection parameters of the instruction types used must be specified. On the one hand, these are the parameters *RVC4* and *RVC5*, which indicate the Service Access Points of the WinCC station. These SAPs are specified in WinCC during the creation of the connection. On the other hand, these are the parameters *ANR4* and *ANR5*. These are the instruction numbers, which have been set during the configuration of the FDL connections for the communication processor *CP 5431*. For both instructions, the numbers of the work-DBs must be indicated as well. The remaining call parameters of the *FB9* are not important for the functionality of this sample.

```
OB   21
NETZWERK 1 von 1         Synchronisieren CP 5431
     :
     :SPA FB 9
NAME :L2ANLAUF
SSNR :    KF +0                          SSNR of CP 5431
TIM3 :    KT 000.0                       nr
TIM7 :    KT 000.0                       nr
RADR :    KF +8                          PROFIBUS-Address WinCC Station
RVC3 :    KF +0                          nr
RVC4 :    KF +4                          SAP WRITE
RVC5 :    KF +6                          SAP READ
RVC6 :    KF +0                          nr
RVC7 :    KF +0                          nr
ANR3 :    KF +0                          nr
ANR4 :    KF +134                        ANR WRITE
ANR5 :    KF +135                        ANR READ
ANR6 :    KF +0                          nr
ANR7 :    KF +0                          nr
DBX3 :    KY 000,000                     nr
DBX4 :    KY 000,011                     Work-DB WRITE
DBX5 :    KY 000,012                     Work-DB READ
DBX6 :    KY 000,000                     nr
DBX7 :    KY 000,000                     nr
S/R3 :    KF +0                          nr
     :
     :BE
```

<table>
<tr><th>Step</th><th>B: Creating the STEP5 Program</th></tr>
<tr><td>6</td><td>
Creation of the OB1.
The communication to WinCC via the communication processor CP 5431 is carried out by the function block FB10 L2SNDRCV. In this sample, WinCC is able to send and request data. For this purpose, only two transfer parameters are relevant during the call of the FB10. These are the parameters DBX4 and DBX5, which indicate the numbers of both work-DBs of the instruction types used.
In addition, the previously created block FB6 is called in the OB1.
<pre>
OB   1
NETZWERK 1 von 1   Communication Manual
      :
      :SPA FB 10   Communication
NAME :L2SNDRCV
STR3 :   M 0.0   nr
STR7 :   M 0.0   nr
RDY   :   MB 0   nr
FAIL :   MB 0   nr
TVC3 :   T 0   nr
TVC7 :   T 0   nr
DBX3 :   KY 000,000   nr
DBX4 :   KY 000,011   Work-DB WRITE
DBX5 :   KY 000,012   Work-DB READ
DBX6 :   KY 000,000   nr
DBX7 :   KY 000,000   nr
      :
      :SPA FB 6   Add and Increment
NAME :ADD_INC
      :
      :BE
</pre>
</td></tr>
<tr><td>7</td><td>
Loading the STEP5 program into the PLC.
In STEP5, this is done via the Object → Blocks → Transfer → PLC File menus. In the Selection field, the option All Blocks must be selected to load all previously created blocks to the PLC.
</td></tr>
</table>

C: Configuring the Communication Processor

Step	C: Configuring the Communication Processor
1	Start the communication package *SINEC NCM for COMs* to configure the communication processor *CP 5431*. From STEP5, start the communication package via the *Change* → *Additional* → *SINEC NCM for COMs* menus.
2	This will open the communication package *SINEC NCM for COMs*. If no database file is set, the *Basic Settings* entry mask will initially be displayed. This entry mask can also be opened via the *File* → *Select* (or *Init.* → *Edit*) menus. In the *CP Type* field, indicate the type of communication processor used. Via the F8 function key, one of the available communication processors can be set. Select the *CP 5431*. Set the *Status* field to *OFFLINE FD* via the F8 function key. This stores the configuration made in the program to a database file. In the *Database File* field, specify the name of this database file. This name has to start with the letter *Q*. For this sample, the name *QS5_FDL.DAT* is used for the database file. The settings made in the *Basic Settings* entry mask are applied via the F7 function key. 

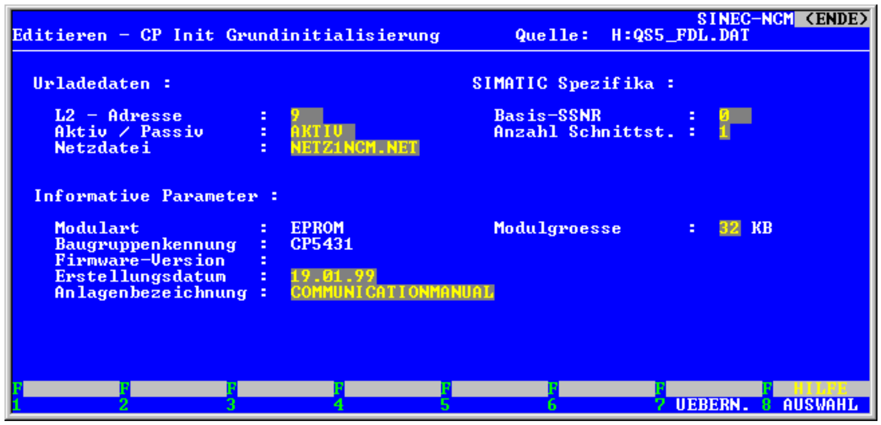
<table>
<tr><th>Step</th><th>C: Configuring the Communication Processor</th></tr>
<tr><td>3</td><td>

The settings for the basic initialization of the communication processor must be made.

They are entered in the *Basic Initialization* entry mask. This entry mask is opened via the *Edit* → *CP Init.* menus.

In the *L2 Address* field, the *PROFIBUS Address* of the communication processor *CP 5431* is specified. In this sample, the value *9* has been entered. This value is one of the parameters that have to be specified during the creation of the connection in WinCC.

The remaining settings can be seen in the following graphic. The settings made in the *Basic Initialization* entry mask are applied via the F7 function key.



</td></tr>
<tr><td>4</td><td>

Setting the global network parameters.

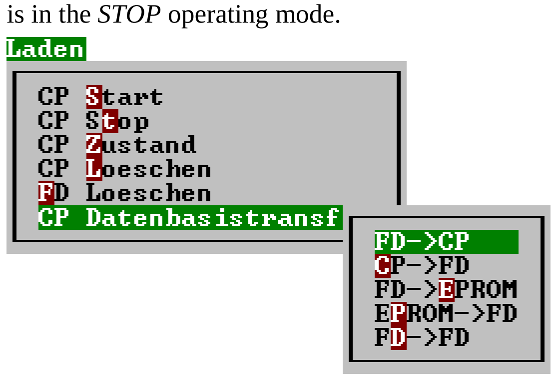
This is done in the *Global Network Parameters* entry mask, which is opened via the *Edit* → *Global Network Parameters* menus.

The same *network parameters* must be used that have been specified as the network parameters during the installation of the communication processor *CP 5412 A2*. Among other things, the *Baud Rate* is set to *18750 Baud* and the *Highest Station Address (HSA)* to *31*. The value for the *Default SAP* is set to *2*.

The settings made in the *Global Network Parameters* entry mask are applied via the F7 function key.

</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Configuring the Communication Processor</th></tr>
<tr><td>5</td><td>
Creation of the FDL connections.
This is done in the Connection Editor entry mask. This entry mask is opened via the Edit → Connections → Free Layer2 Connectionsmenus.
Two connections are needed: One processes the write requests of WinCC, the other one the read requests of WinCC. The priority of both connections is set to Low. For the connection used to process the write requests of WinCC, this sample uses the value 3 for the Service Access Point SSAP and the value 134 for the instruction number ANR. By hitting the F4 function key, the parameters for the next FDL connection can be entered. This connection will be used to process the read requests of WinCC. This sample uses the value 5 for the SSAP and the value 135 for the ANR.
The instruction numbers used for the individual FDL connections were already specified in the startup blocks of STEP5. The SAP values are specified as remote parameters during the creation of the connection in WinCC.
The settings made in the Connection Editor entry mask are applied via the F7 function key.


</td></tr>
<tr><td>6</td><td>
Loading the configuration data of the database file to the communication processor CP 5431.
This is done via the Load → CP Database Transfer → FD->CP menus. The configuration data can only be uploaded while the communication processor is in the STOP operating mode.


</td></tr>
</table>

D: Starting up the PLC

Step	D: Starting up the PLC
1	Starting the individual modules of the PLC. Previously, the STEP5 program and the database file of the communication processor *CP 5431* must have been loaded to the PLC. First, the operating mode switch of the communication processor *CP 5431* is set to the RUN position. The status LEDs *RUN* and *STOP* will light up at the communication processor, indicating that the module has not be synchronized. Next, the operating mode switch of the CPU module is set to the *RN* position. During the startup of the CPU module, the communication processor is synchronized by the startup block. The communication processor's status LED *STOP* go out. At the CPU module, only the status LED *RN* will be illuminated.

9.3 Creation of the WinCC Project WinCC_S5_FDL

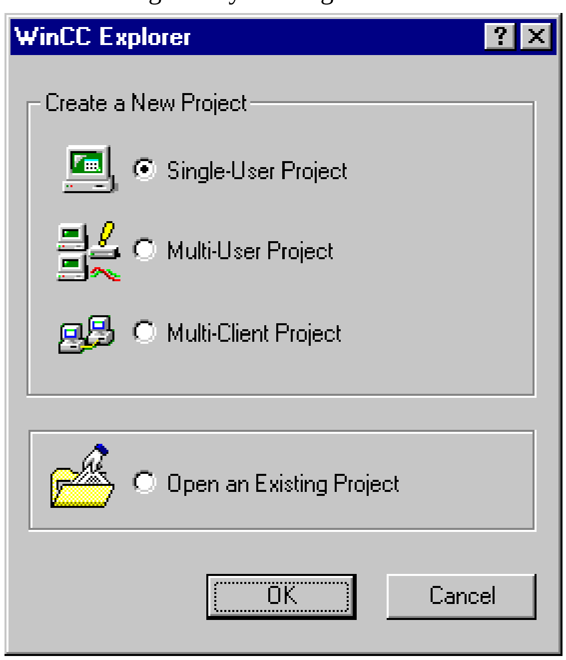
The following description details the configuration steps necessary to create and start up the WinCC project *WinCC_S5_FDL*.

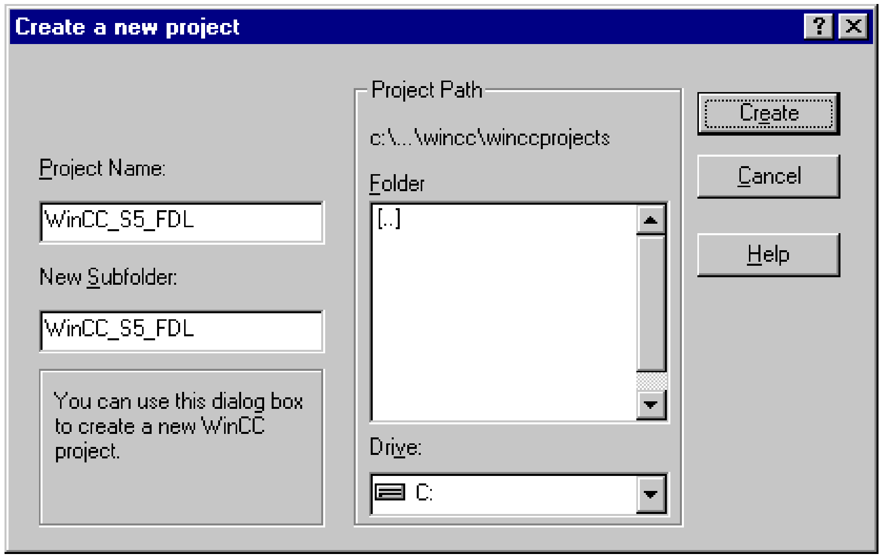
Overview of the Configuration Steps

The following lists the configuration steps necessary to create the WinCC project *WinCC_S5_FDL*:

- A: Creating the WinCC Project
- B: Creating the Connection
- C: Creating the WinCC Tags
- D: Creating the WinCC Screen

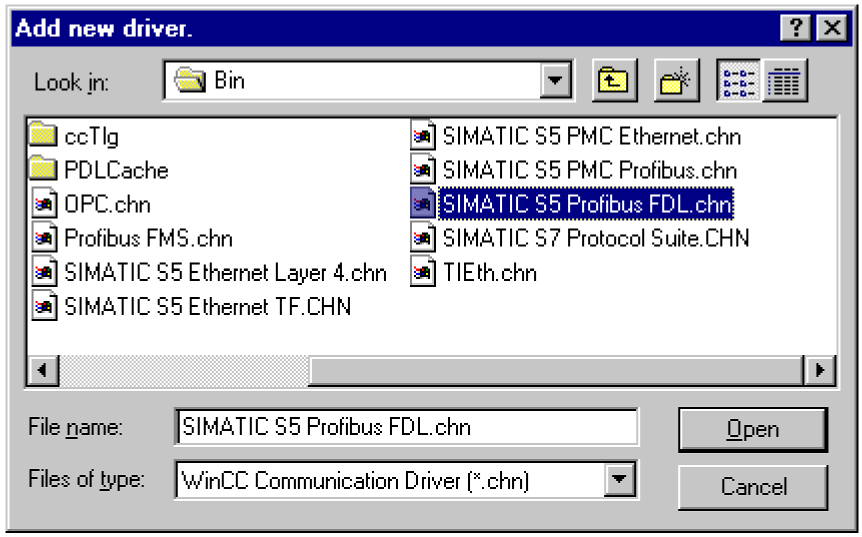
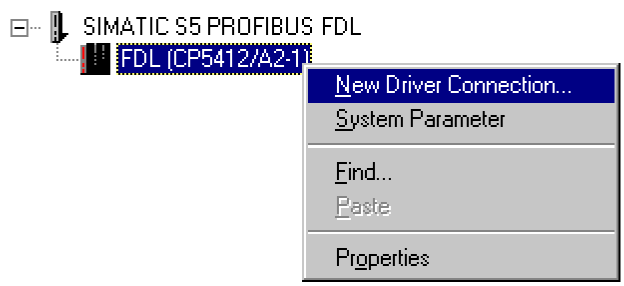
A: Creating the WinCC Project

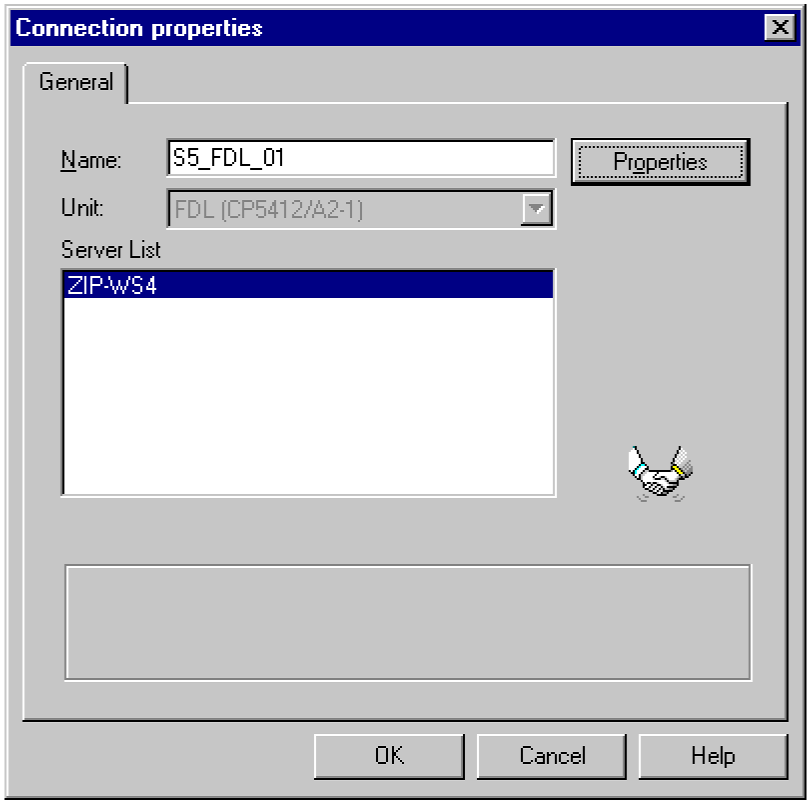
Step	A: Creating the WinCC Project
1	Creation of a new WinCC project in the *WinCC Explorer*. The WinCC Explorer is started via *Start* → *Simatic* → *WinCC* → *Windows Control Center*. 
2	This will display the *WinCC Explorer*. Via the menus *File* → *New*, the dialog box for specifying the properties of a new WinCC project will be opened. For this sample project, a *Single-User Project* is created. Exit the dialog box by clicking on *OK*. 

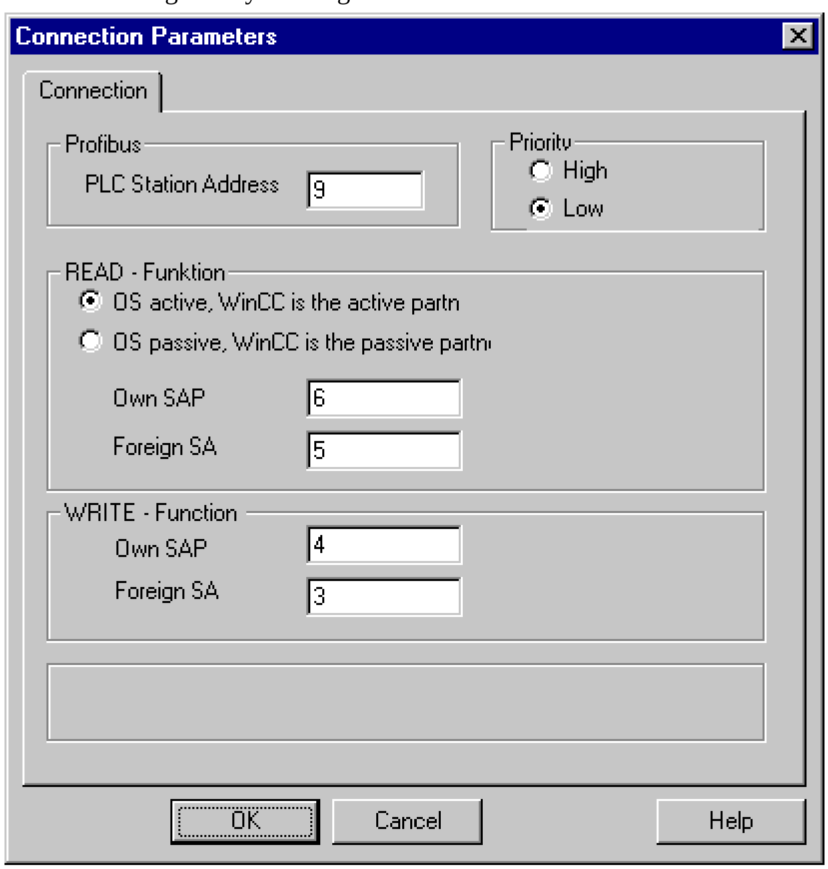
Step	A: Creating the WinCC Project
3	The dialog box *Create a new Project* will be displayed. Specify a *Project Name* for the new project. The names of the WinCC projects created within the framework of this manual all start with *WinCC* and also include a reference to the communication partner and communication type used. The project of this sample has the name *WinCC_S5_FDL*. In the *Project Path* field, set the storage location of the new project. The dialog box *Create a new Project* is concluded by clicking on the *Create* button. 

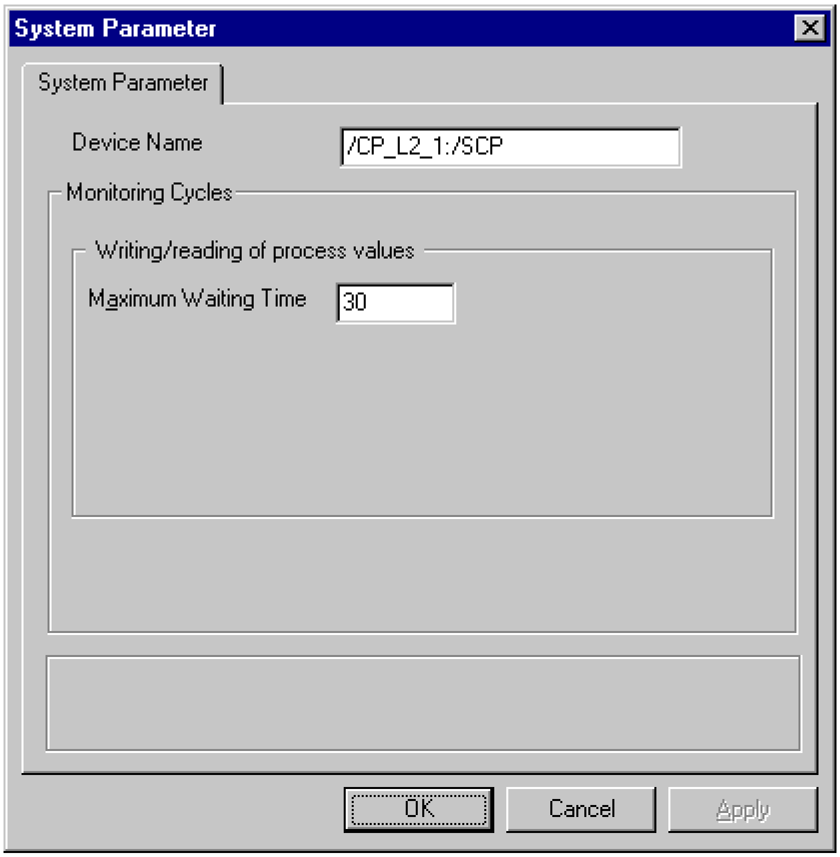
B: Creating the Connection

Step	B: Creating the Connection
1	The new project will be displayed in the *WinCC Explorer*. Installation of the required communication driver. This is performed via a R on *Tag Management* and selecting *Add New Driver* from the pop-up menu. 

Step	B: Creating the Connection
2	The dialog box *Add New Driver* will be displayed. This dialog box lists all communication drivers that can be installed. For the communication to the *SIMATIC S5* via *PROFIBUS FDL*, the driver *SIMATIC S5 PROFIBUS FDL* is required. Select this driver from the dialog box. Exit the dialog box by clicking on *Open*. 
3	The newly added driver *SIMATIC S5 PROFIBUS FDL* will be displayed as a sub-entry to *Tag Management*. The driver contains a channel unit named *FDL (CP5412/A2-1)*. Create a new connection for this channel unit by R on *FDL (CP5412/A2-1)* and then selecting *New Driver Connection* from the pop-up menu. 

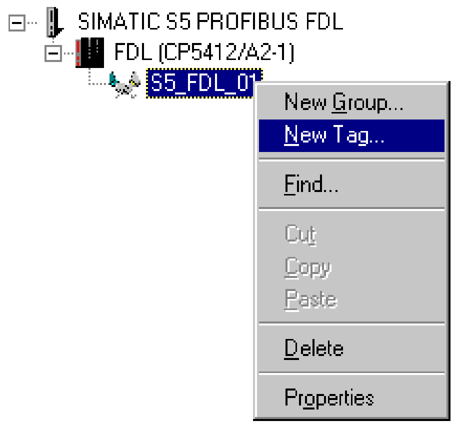
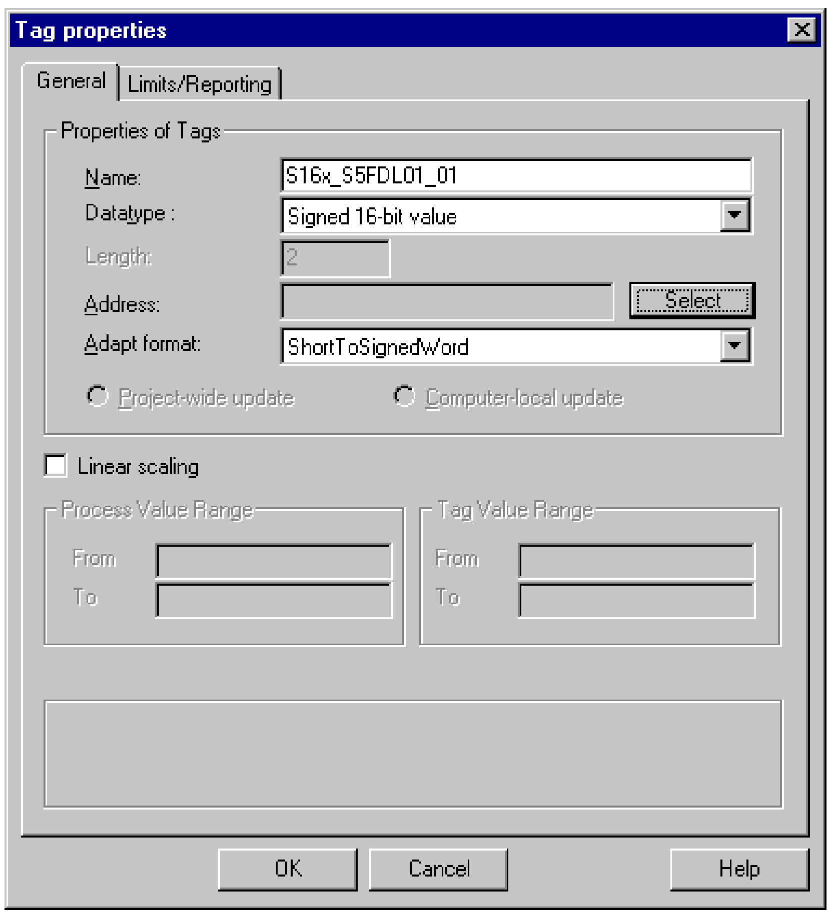
<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>4</td><td>The properties dialog box of the connection will be displayed.
In the General tab, the Name of the new connection is entered. In this sample, this is S7_FDL_01.
Click on the Properties button to define the connection properties.

</td></tr>
</table>

Step	B: Creating the Connection
5	The dialog box *Connection Properties* will be displayed. In the *Connection* tab, the parameters of the desired communication connection are defined. In the *Profibus* field, the PROFIBUS address of the PLC in entered. In this sample, the *PLC Station Address* has the value *9*. The *Priority* is set to *Low*. In the *READ Function* area, the connection settings for reading data from the PLC are made. In order for WinCC to request the data actively, the radio-button *OS active, WinCC is the active Partner* must be selected. The values for the local Service Access Point and the remote Service Access Point must be defined. In this sample, the value *6* is entered in the *Local SAP* field and the value *5* in the *Remote SAP* field. In the *WRITE Function* area, the connection settings for writing data to the PLC are made. The values for the local Service Access Point and the remote Service Access Point must be defined. In this sample, the value *4* is entered in the *Local SAP* field and the value *3* in the *Remote SAP* field. The values entered in this dialog box for the remote SAP have been defined during the creation of the FDL connections for the communication processor *CP 5431*. The values for the local SAP were already entered in the startup blocks during the creation of the STEP5 program. Close the dialog box by clicking on *OK*. 

Step	B: Creating the Connection
6	Setting the system parameters of the channel unit. These settings are made in the System Parameters dialog box, which is accessed via a R on the *FDL (CP5412/A2-1)* entry and then selecting *System Parameters* from the pop-up menu. In the displayed dialog box, the access point used by WinCC to access the PLC is defined in the *Device Name* field. By default, the access point *CP_L2_1:* is set. Previously, during the installation of the communication processor in the computer, the *CP 5412 A2* has been assigned to the access point CP_L2_1:. Close the dialog box by clicking on *OK*. 

C: Creating the WinCC Tags

<table>
<tr><th>Step</th><th>C: Creating the WinCC Tags</th></tr>
<tr><td>1</td><td>Creation of the WinCC tags required for the sample.

This is done via a R on the newly created connection S5_FDL_01 and then selecting New Tag from the pop-up menu.

</td></tr>
<tr><td>2</td><td>The properties dialog box of the tag will be displayed. In the sample, the Name of the first tag is S16x_S5FDL01_01. The tag is of the Signed 16-Bit Value data type. Click on the Select button to set the Address of the new tag.

</td></tr>
</table>

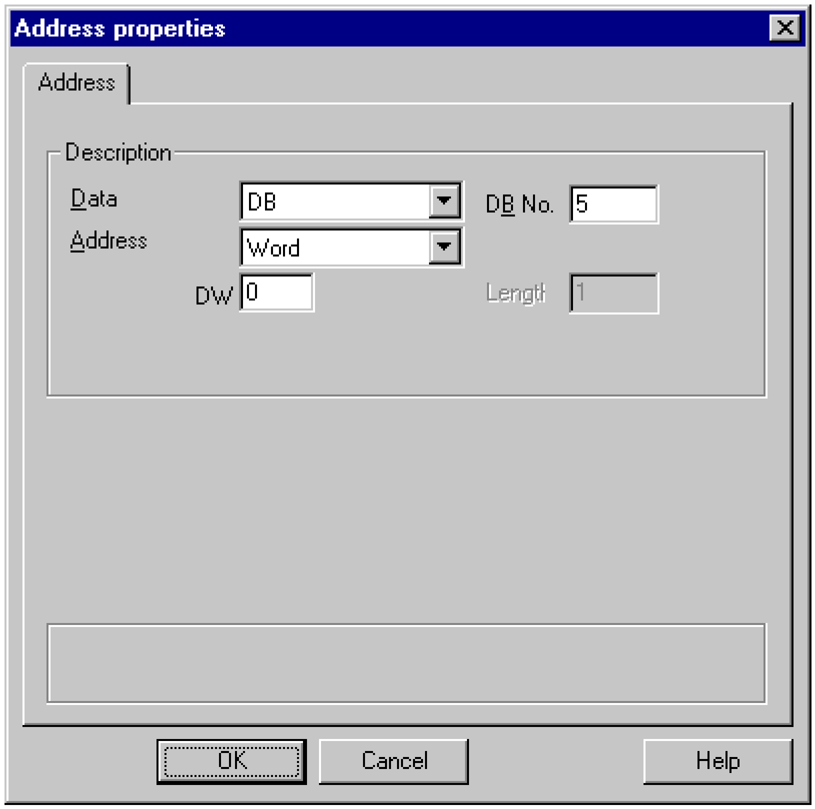
<table>
<tr><th>Step</th><th>C: Creating the WinCC Tags</th></tr>
<tr><td>3</td><td>

The dialog box *Address Properties* will be displayed.

Set *DB* as the *Data Range* and the value *5* as the *DB No.*. Set *Word* in the Address field and the value *0* in the *DW* field. Close the dialog box by clicking on *OK*. The properties dialog box of the tag is also closed by clicking on *OK*.

The just created WinCC tag is addressed in the range of the DB5, where the first of the two values to be added is located.

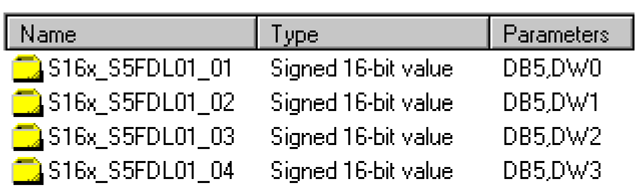
The *Address Properties* and *Tag Properties* dialog boxes can be closed by clicking on the *OK* button.



</td></tr>
<tr><td>4</td><td>

Creation of the remaining WinCC tags required.

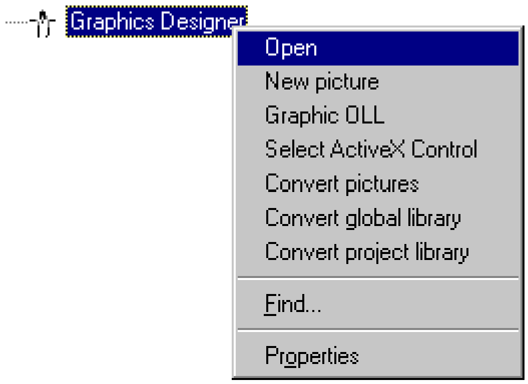
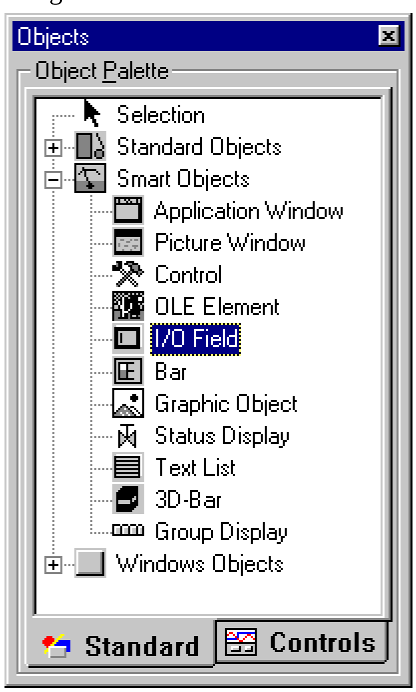
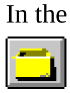
Follow steps 1 to 3 for the creation of the remaining tags. The names, data types and addresses of the tags used in this sample are listed in the following graphic.



Name	Type	Parameters
S16x_S5FDL01_01	Signed 16-bit value	DB5,DW0
S16x_S5FDL01_02	Signed 16-bit value	DB5,DW1
S16x_S5FDL01_03	Signed 16-bit value	DB5,DW2
S16x_S5FDL01_04	Signed 16-bit value	DB5,DW3

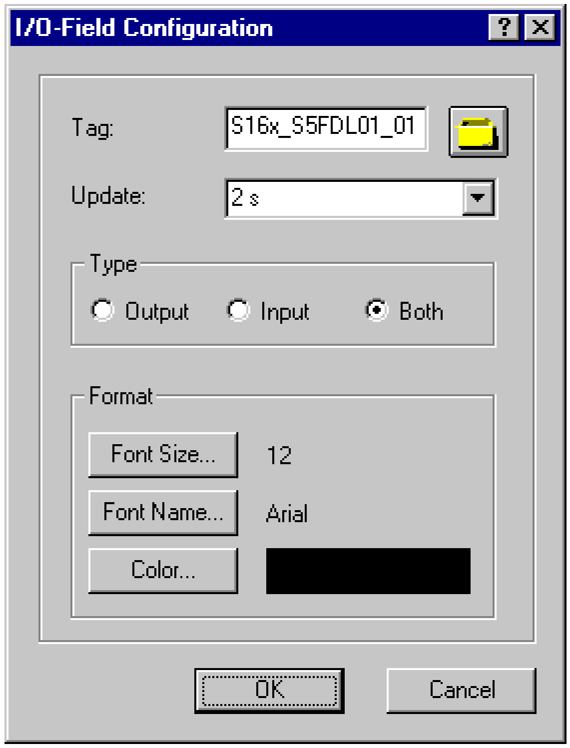
</td></tr>
</table>

D: Creating the WinCC Screen

Step	D: Creating the WinCC Screen
1	Creation of a WinCC screen in which the previously created tags are visualized. Open the *Graphics Designer* editor via a R and then selecting *Open* from the pop-up menu. 
2	This will open the *Graphics Designer* editor with a new (blank) screen. To display the first tag, configure a *Smart Object* → *I/O Field*. To do so, select the *I/O Field* object from the *Object Palette* and place it on the screen using the mouse. 
3	After placing the *I/O Field* on the screen, its *Configuration* dialog box will be displayed. In the *Tag* field, set the tag *S16x_S5FDL01_01* via the button displayed below. 

<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td></td><td>

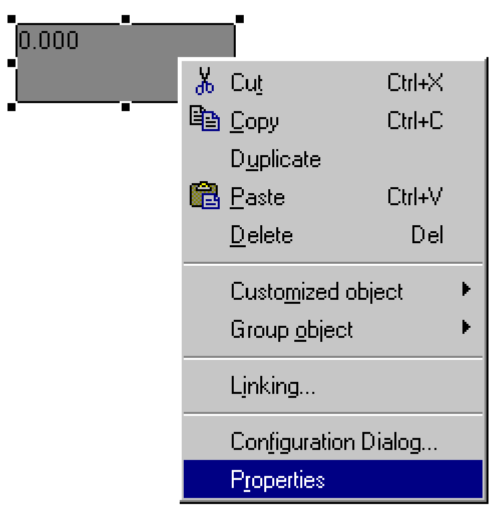
Leave the *Update* of the tag at *2 s*. Keep the default settings for the remaining options. Close the dialog box by clicking on *OK*.



</td></tr>
<tr><td>4</td><td>

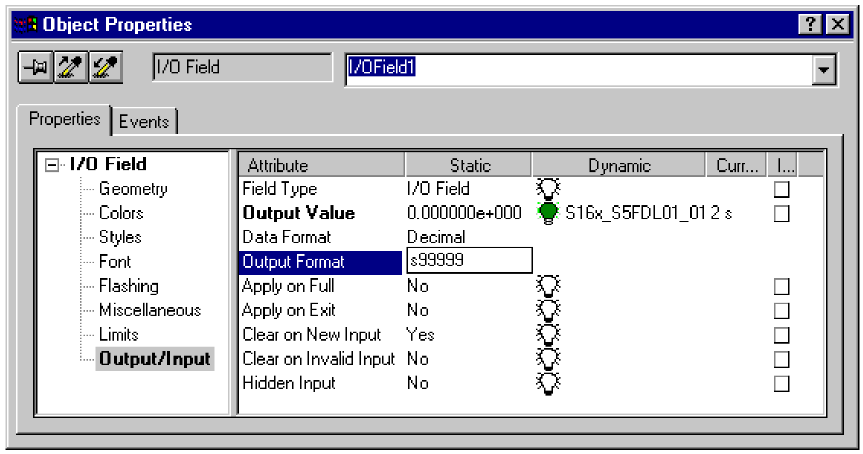
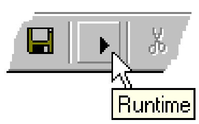
Changing the output format of the *I/O Field*.

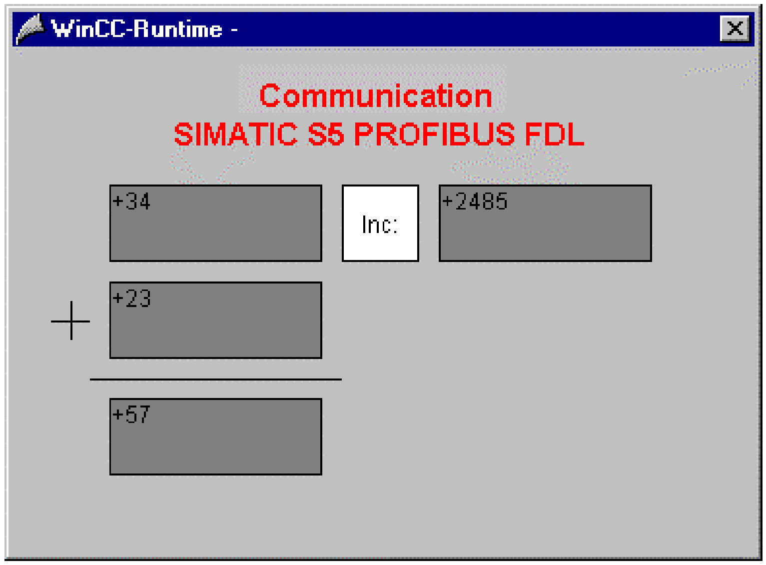
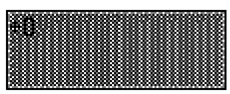
For this, open its properties dialog box via a R on the *I/O Field* and then select *Properties* from the pop-up menu.



</td></tr>
</table>

<table>
<tr><th>Step</th><th>D: Creating the WinCC Screen</th></tr>
<tr><td>5</td><td>The dialog box Object Properties will be displayed.

On the left side of the Properties tab, select the entry Output/Input. Via a D on the output format set, the field can be edited. Select the new format s99999. This format enables the I/O Field to display signed values with a maximum of 5 digits. Close the dialog box by clicking on OK.

</td></tr>
<tr><td>6</td><td>Creation of three additional I/O Fields for the display of the remaining tags.
Follow steps 2 to 5 to create the remaining I/O fields.</td></tr>
<tr><td>7</td><td>Save the screen.
In the sample project, the screen is saved under the name com_3_S5FDL_01.pdl. The screen can be switched directly to runtime from the Graphics Designer via the button displayed below.

</td></tr>
</table>

Step	D: Creating the WinCC Screen
	If the screen is in runtime, the PLC started and the network connection established, the current values of the PLC will be displayed in the I/O fields. They can be changed by entering values in the individual *I/O Fields*.  If there is no connection to the PLC, the *I/O Fields* will be displayed grayed out. In this case an error is present at some point of the communication connection. 

9.4 Diagnosis of the Communication Connection

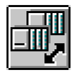
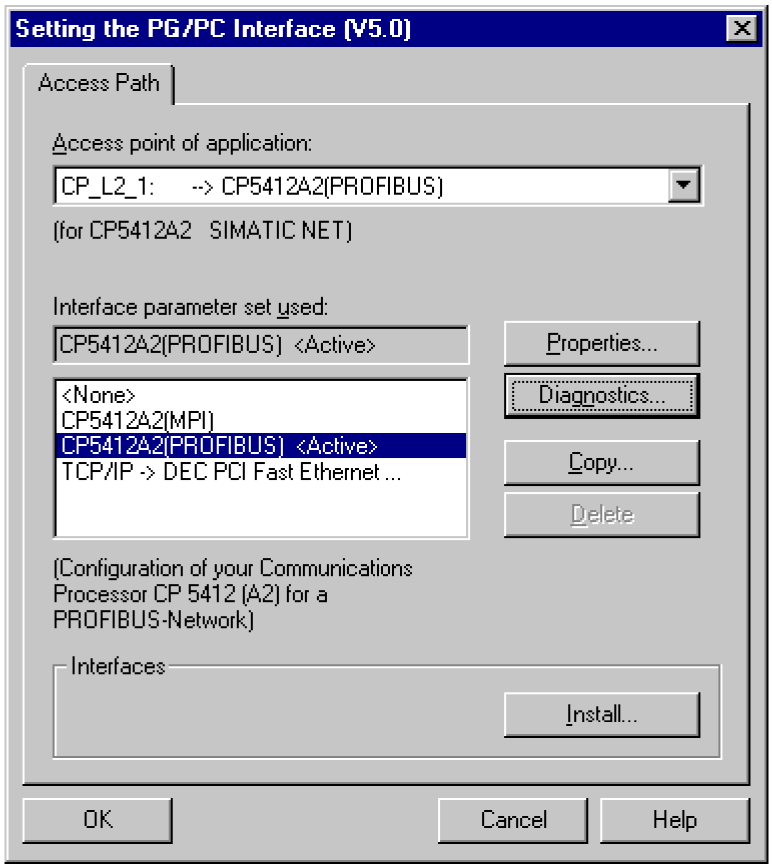
The following describes the options available for diagnosing the communication connection between the WinCC project *WinCC_S5_FDL* and the SIMATIC S5 station.
A diagnosis of the sample according to this description makes only sense, if the checks listed below have been completed successfully.
Startup of the Communication Processor CP 5412 A2

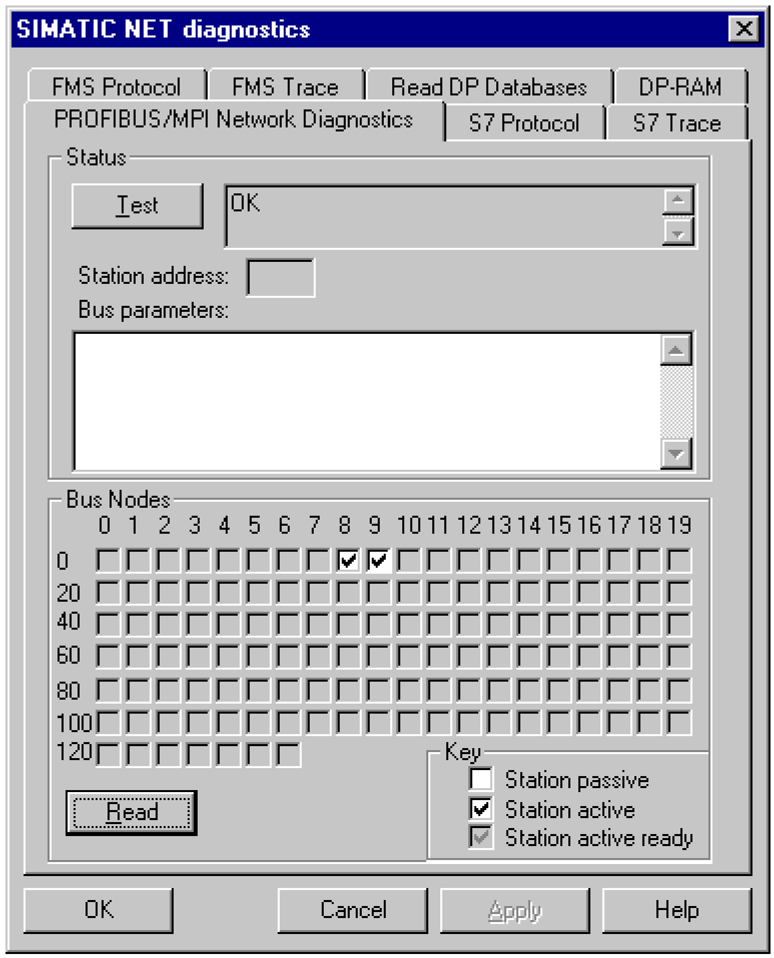
- E: Testing the Communication Processor

Creation of the STEP5 Project S5FDLst

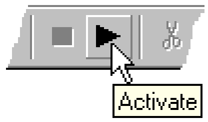
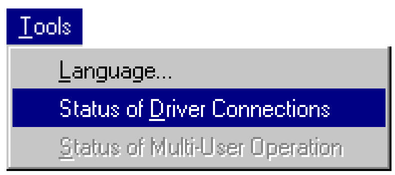
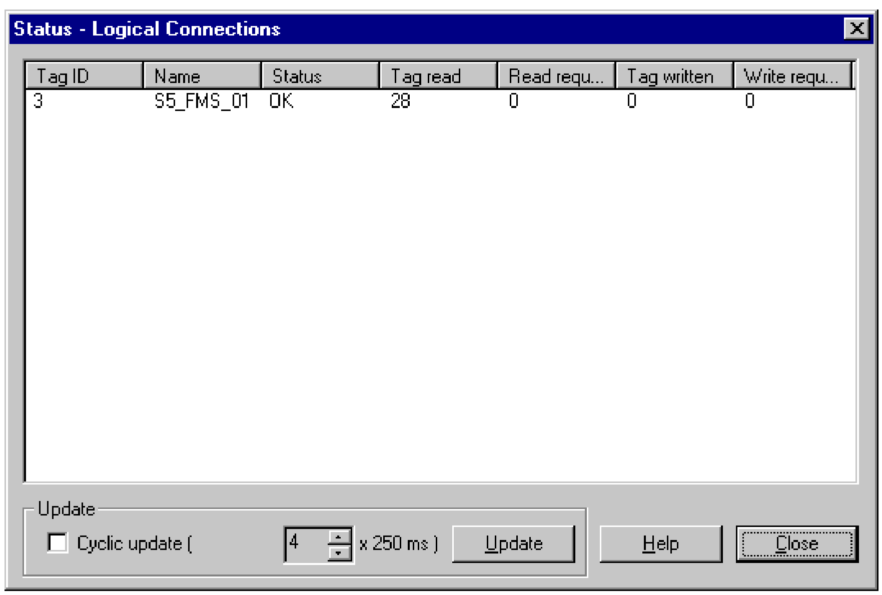
- D: Starting up the PLC

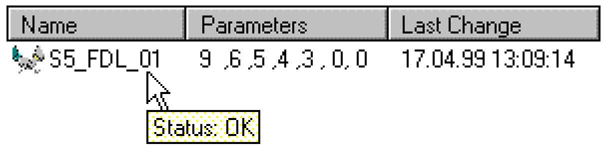
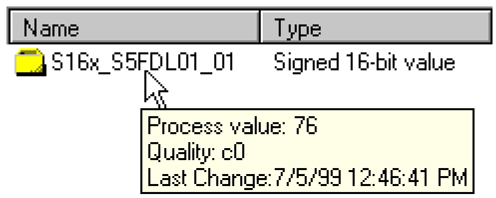
Setting the PG/PC Interface

Step	Setting the PG/PC Interface
1	Diagnosis of the communication connection via the program *Setting the PG/PC Interface*. This program is accessed via *Start* → *Settings* → *Control Panel* → *Setting the PG/PC Interface*. 
2	The program *Setting the PG/PC Interface* will be displayed. Select the interface *CP 5412 A2 (PROFIBUS)*. Make sure that the assignments between access points and the interfaces are not changed. The diagnosis of the communication connection is started by clicking on the *Diagnostics* button. 

Step	Setting the PG/PC Interface
3	The dialog box *Simatic NET Diagnostics* will be displayed. From the *PROFIBUS/MPI Network Diagnostics* tab, the diagnosis of the communication connection is started by clicking on the *Read* button. This will display all stations accessible on the bus. For this sample, the address *8* of the communication processor *CP 5412 A2* as well as the address *9* of the communication processor *CP 5431* must be marked as occupied. The dialog box can be exited by clicking on *OK*. 

WinCC Explorer

Step	WinCC Explorer
1	Diagnosis of the communication connection from the *WinCC Explorer*. Switch the project *WinCC_S5_FDL* into runtime. This is done from the *WinCC Explorer* via the toolbar button displayed below.  The created WinCC screen *com_3_S5FDL_01.pdl* can also be switched directly from the *Graphics Designer* into runtime.
2	In the *WinCC Explorer*, a dialog box for monitoring all configured connections can be accessed via the *Tools* → *Status of Driver Connections* menu. This menu point is only accessible if the project is in runtime. 
3	The dialog box *Status - Logical Connections* will be displayed. This dialog box lists all configured connections. For this sample, only the connection *S5_FDL_01* will be displayed. The displayed values correspond to the status at the moment the dialog box was opened. By selecting the appropriate check-box, a *Cyclic Update* of the display can be achieved. 

Step	**WinCC Explorer**
4	Another way to obtain information about the connection status in general and about the connection status of individual tags is provided by *Tag Management*. The status of a configured connection can be displayed as a tooltip by simply pointing the mouse on the connection in question.  The current process value of a certain tag as well as its status can be displayed as a tooltip by pointing the mouse on it. This allows you to detect errors concerning an individual tag and not the entire connection. 

10 Communication WinCC-WinCC via OPC

The projects created in this chapter can also be copied directly from the online document to your hard drive. By default, they will be copied to the folder C:\Communication_Manual. You have the option to copy the following components to the hard drive:

WinCC_OPC_SERVER

The server WinCC project we will create.

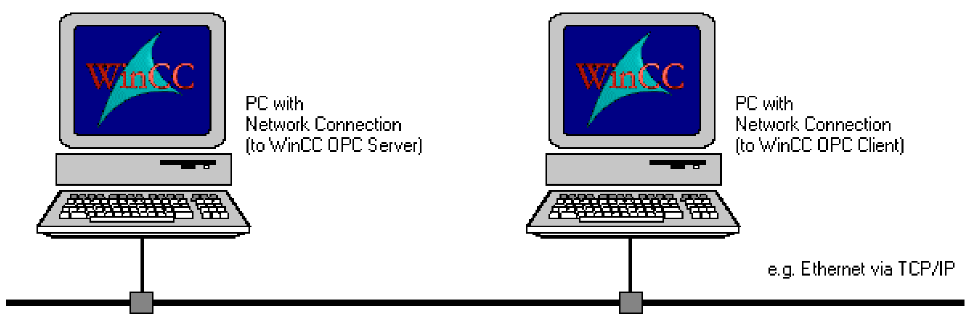
WinCC_OPC_CLIENT

The client WinCC project we will create.

This chapter describes in detail the startup of a communication connection between two *WinCC Stations* via *OPC.*

On the computer acting as the server, the *WinCC OPC Server* is installed, which makes the data of a WinCC project available to other applications on the same computer and to applications on computers that are accessible from the network.

Overview of the Structure of the Sample



On the computer designated as the server, the *WinCC OPC Server* from the *WinCC CD-ROM* must be installed. This can be done during the installation of WinCC.
On the computer designated as the client, the *WinCC OPC Client* from the *WinCC CD-ROM* must be installed. This can be done during the installation of WinCC as well.
Both WinCC stations can be connected to each other using any type of network connection.

Overview of the Configuration Steps

The following lists all configuration steps necessary for the creation of the communication connection:

- Configuration of the WinCC Stations
- Creation of the WinCC Project WinCC_OPC_SERVER
- Creation of the WinCC Project WinCC_OPC_CLIENT
- Diagnosis of the Communication Connection

Required Software

Name	Description
WinCC	WinCC with *OPC Server* and *OPC Client* for the creation of the WinCC projects.

Required Compute Hardware

Name	Description
Network Access	Any type of network access to establish a connection to the network.

10.1 Configuration of the WinCC Stations

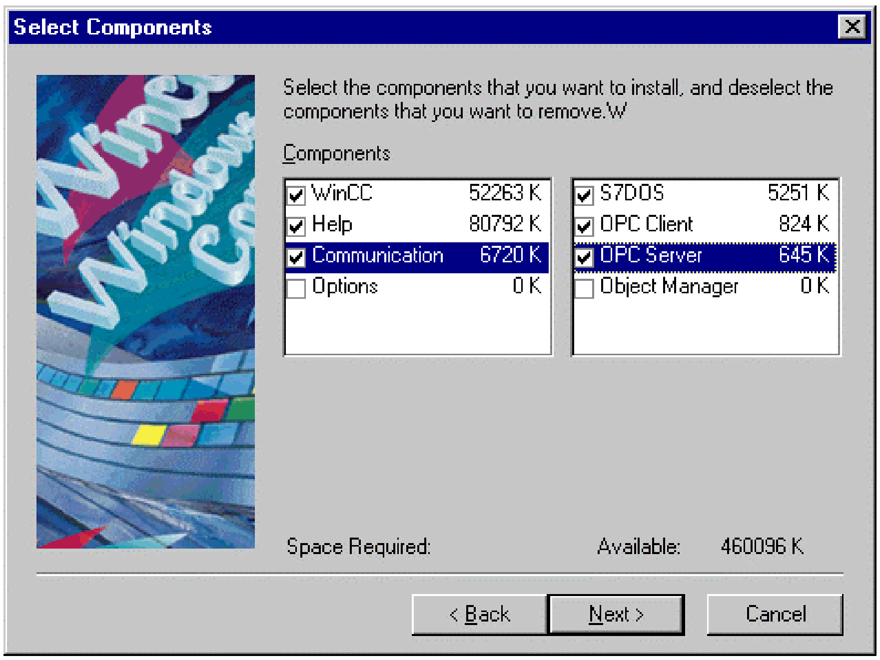
The following description contains notes that should be observed during the configuration of the WinCC stations.
In general, three configurations for the access from a WinCC client station to an OPC server are possible. These configurations differ, depending on where both components are located:

- Server and client are located on the same computer
- Server and client are located on different computers of the same workgroup
- Server and client are located on different computers within the same domain or in different domains with trust setting

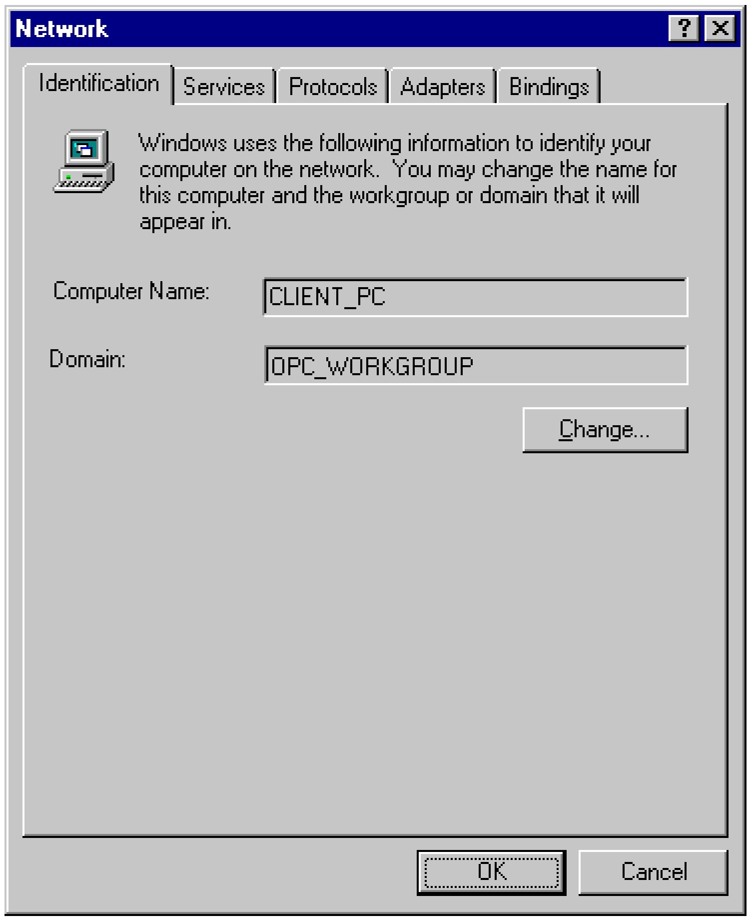
The first of the configurations mentioned is not practical for the communication between a WinCC OPC server and a WinCC OPC client. However, this configuration can be applied to other cases, e.g. for the communication to the S7 OPC Server.
For the steps described below, the conditions existing on site must be considered.

- A: Installing the Software Components
- B: Organization of the Network
- C: Organization of the User Structure
- D: Setting the DCOM Configuration

A: Installing the Software Components

Step	A: Installing the Software Components
1	The *OPC Server* and the *OPC Client* from WinCC are required. Both components are located on the WinCC installation CD-ROM. On the computer designated as the server, the *OPC Server* must be installed. This can be done during the installation of WinCC or at a later time. On the computer designated as the client, the *OPC Client* must be installed. This can also be done during the installation of WinCC. After these components have been installed on the respective computers, they must be restarted. 

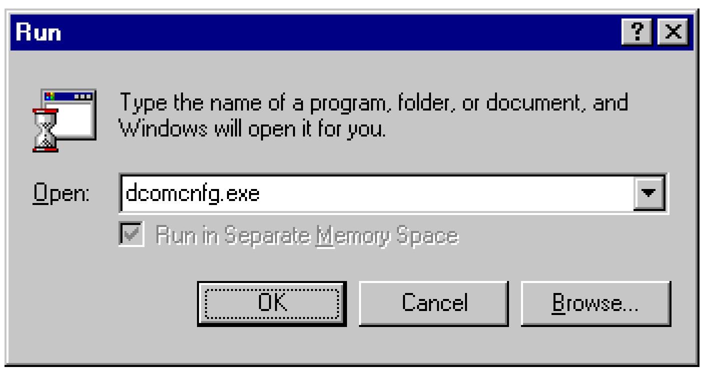
B: Organization of the Network

Step	B: Organization of the Network
1	Organization of the network. The settings required on each computer for the organization of the network are made in the *Network* program of the Windows Control Panel. This program is accessed via *Start* → *Settings* → *Control Panel* → *Network*. In the *Identification* tab, the assignment of the computer to either a workgroup or a domain can be changed via the *Change* button. 

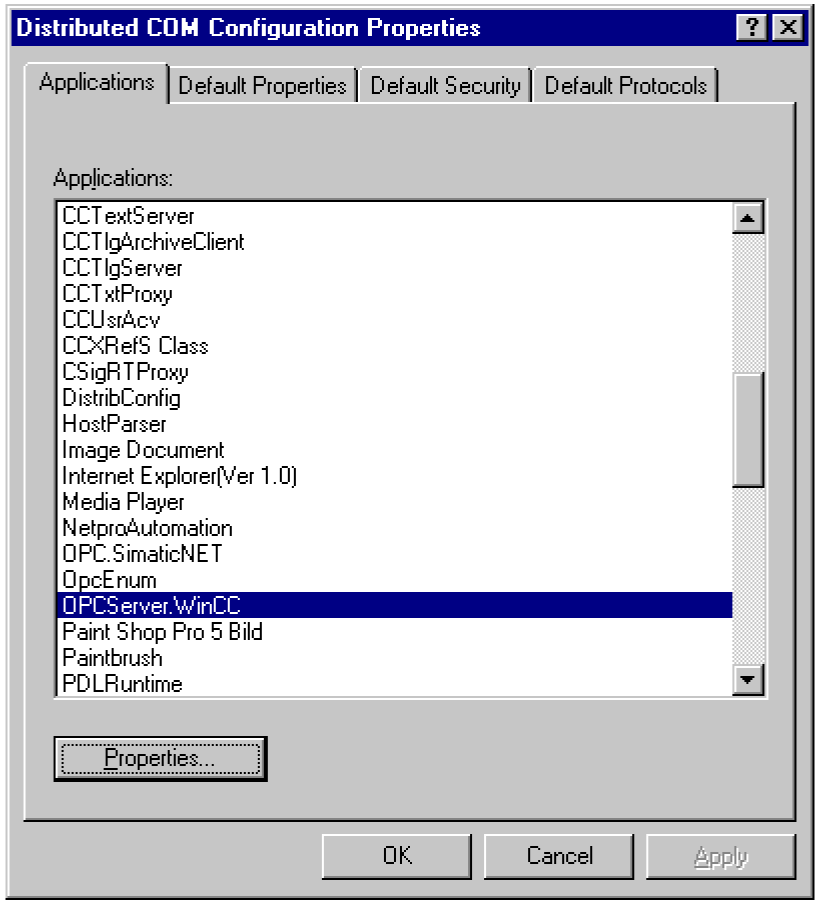
C: Organization of the User Structure

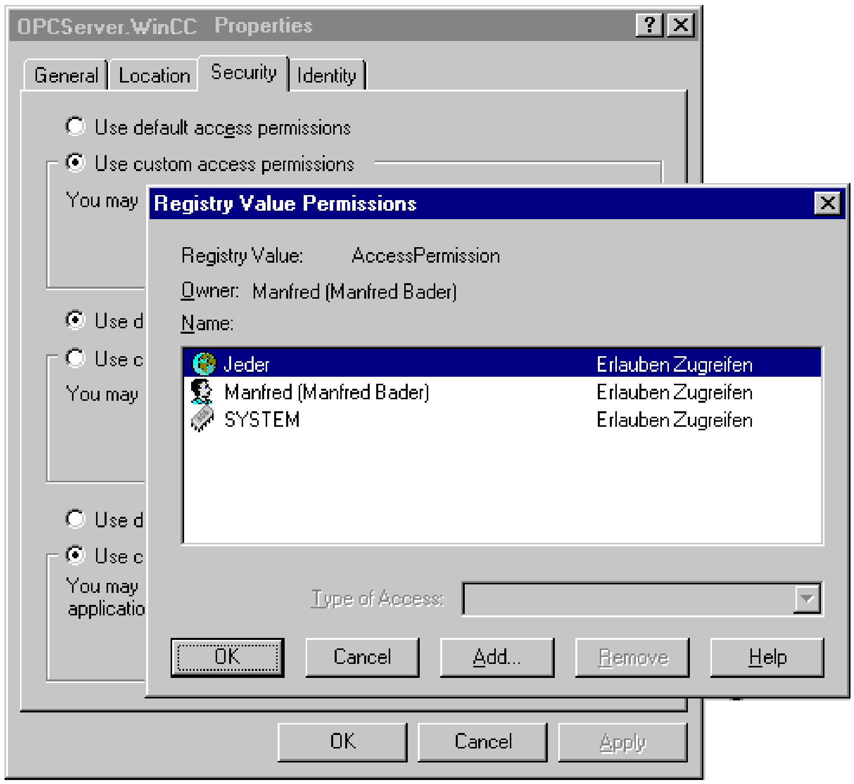
Step	C: Organization of the User Structure
1	Definition of the users on both computers. This is done for each computer in the *User Manager* program. This program is started via *Start* → *Programs* → *Administrative Tools (Common)* → *User Manager*. If a workgroup is used, ensure that the user of the client station is known on the server station. Additionally, the user of the server station must also be known on the client station in order for the full functionality of *OPC* to be utilized. If the domain concept is used, this must not be remembered, because all users are known in the entire domain. However, for the access to a server station across domains, a mutual trust setting on both domains is required.

D: Setting the DCOM Configuration

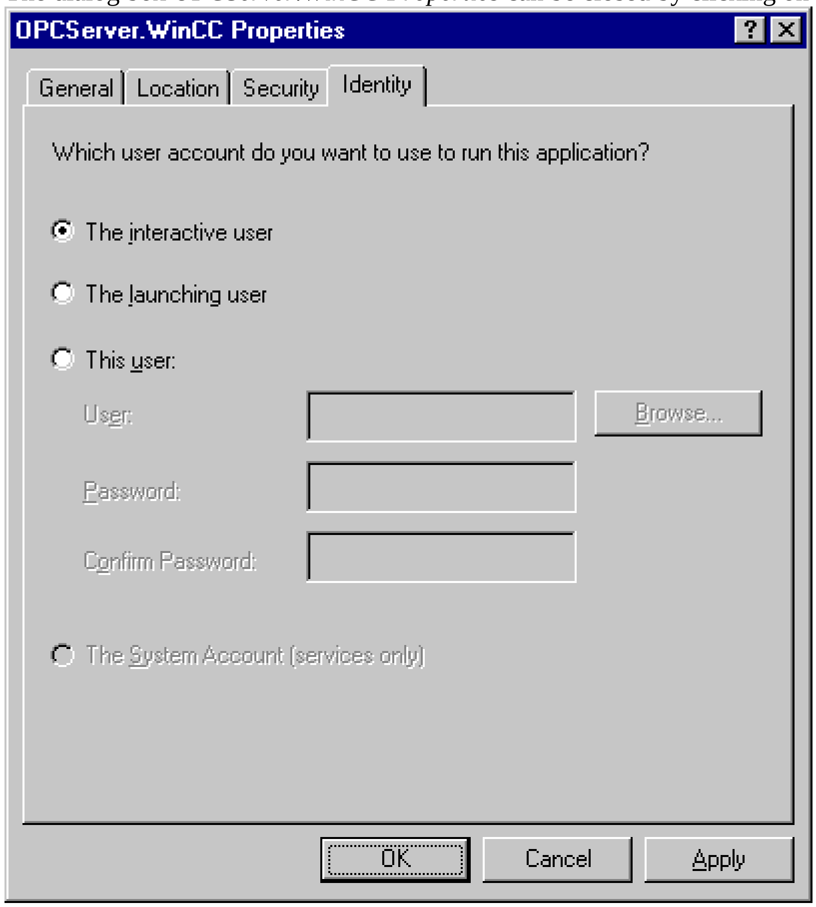
Step	D: Setting the DCOM Configuration
1	Setting the DCOM configuration for the *WinCC OPC Server*. The DCOM configuration is set via the program *DCOM Configuration Properties*. This program is started via *Start* → *Run* and then entering the program file name *dcomcnfg.exe*. 

Step	D: Setting the DCOM Configuration
2	The program *DCOM Configuration Properties* will be displayed. In the *Applications* tab, select the entry of the *WinCC OPC Server*. This is the entry *OPCServer.WinCC*. Clicking on the *Properties* button will open its properties dialog box.



Step	D: Setting the DCOM Configuration
3	The dialog box *OPCServer.WinCC Properties* will be displayed. In the *Security*tab, specify who has access to the *WinCC OPC Server*. The radio-button *Use custom access permissions* is selected. By clicking on the now enabled *Edit* button, the access permissions can be set. Among other things, the *System* must be accessible. During the configuration phase it makes sense to give access permissions to everybody to rule out problems due to insufficient access rights. After the successful commissioning of the communication, you can still limit the access rights of certain users if necessary. 

Step	D: Setting the DCOM Configuration
4	In the *Identity* tab, the radio-button *The interactive user* is selected. The dialog box *OPCServer.WinCC Properties* can be closed by clicking on *OK*.



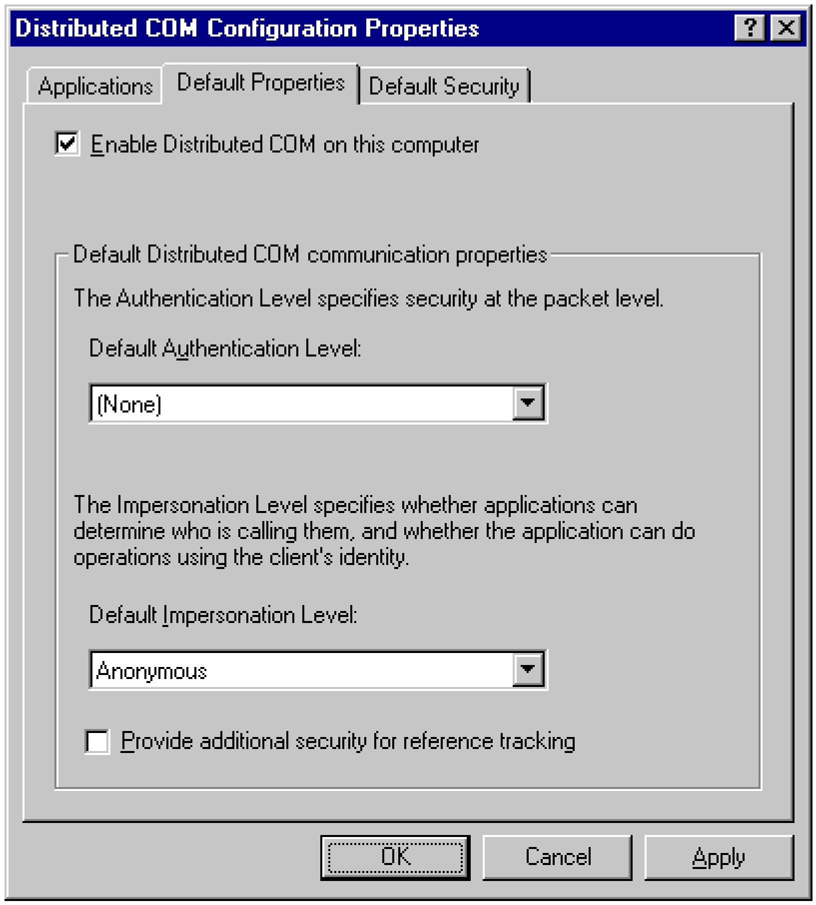
<table>
<tr><th>Step</th><th>D: Setting the DCOM Configuration</th></tr>
<tr><td>5</td><td>

In the *Default Properties* tab, the general properties of the DCOM communication are defined.

DCOM must be activated on the computer. Via the *Default Authentication Level* list box, the desired security at the packet level can be defined. Via the *Default Impersonation Level* list box, you can specify if accessing clients can be identified.

During the configuration phase it makes sense to choose the lowest security level for both settings. This rules out problems caused by these settings from the beginning.

The program *DCOM Configuration Properties* can also be exited by clicking on *OK*.



</td></tr>
</table>

10.2 Creation of the WinCC Project WinCC_OPC_SERVER

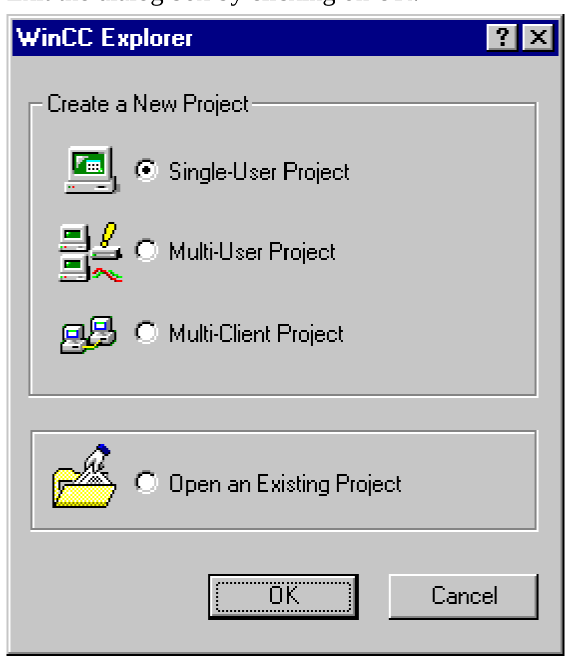
The following description details the configuration steps necessary to create and successfully start up the WinCC project *WinCC_OPC_SERVER*.

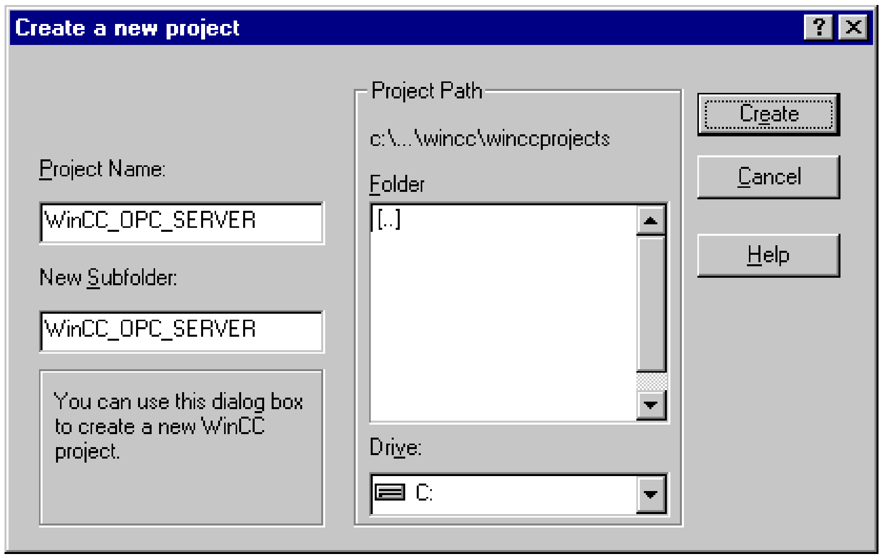
Overview of the Configuration Steps

The following lists the configuration steps necessary to create the WinCC project *WinCC_OPC_SERVER*:

- A: Creating the WinCC Project
- B: Creating the Internal Tags
- C: Creating the WinCC Screen

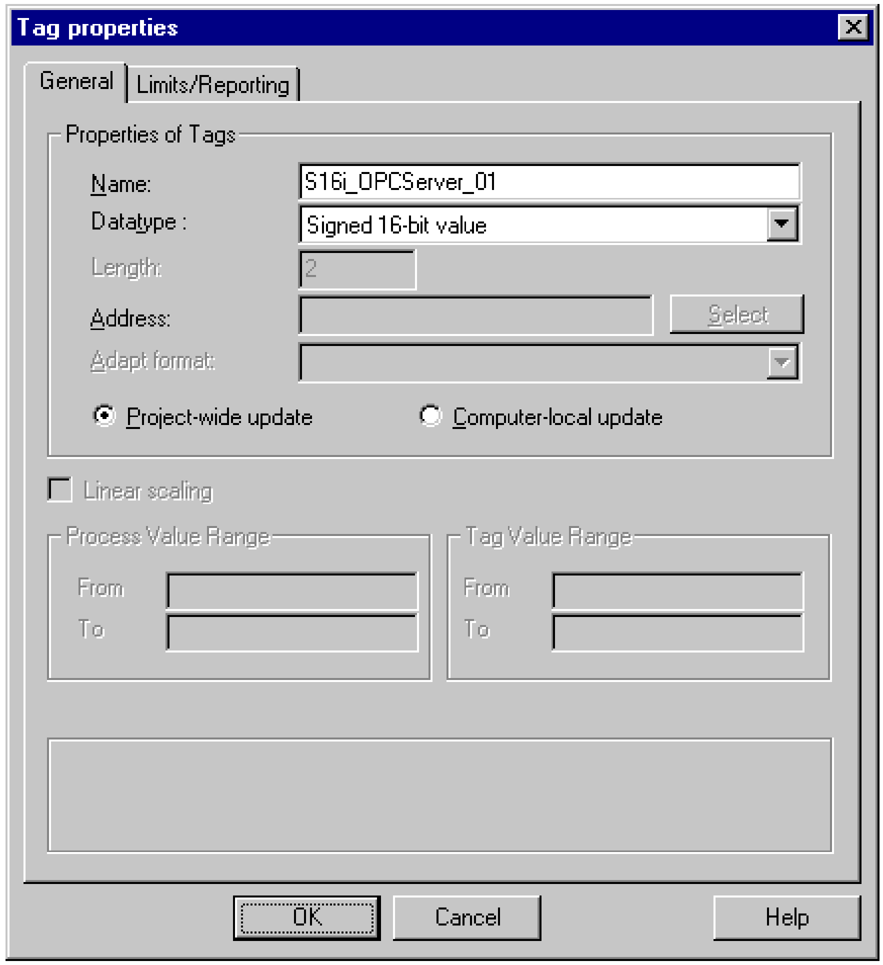
A: Creating the WinCC Project

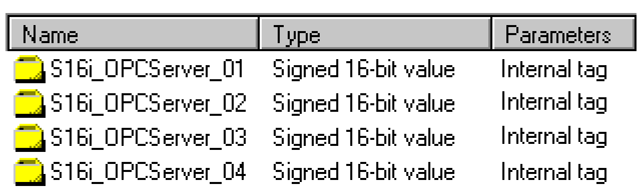
Step	A: Creating the WinCC Project
1	Creation of a new WinCC project in the *WinCC Explorer*. The WinCC Explorer is started via *Start* → *Simatic* → *WinCC* → *Windows Control Center*. 
2	The *WinCC Explorer* will be displayed. Via the menus *File* → *New*, the dialog box for specifying the properties of a new WinCC project will be opened. For this sample project, a *Single-User Project* is created. Exit the dialog box by clicking on *OK*. 

Step	A: Creating the WinCC Project
3	The dialog box *Create a new Project* will be displayed. Specify a *Project Name* for the new project. The names of the WinCC projects created within the framework of this manual all start with *WinCC* and also include a reference to the communication partner and communication type used. The project of this sample has the name *WinCC_OPC_SERVER*. In the *Project Path* field, set the storage location of the new project. The dialog box *Create a new Project* is concluded by clicking on the *Create* button. 

B: Creating the Internal Tags

Step	B: Creating the Internal Tags
1	Creation of the internal tags required for the sample. This is done in *Tag Management* via a R on the *Internal Tags* entry and then selecting *New Tag* from the pop-up menu. 

<table>
<tr><th>Step</th><th>B: Creating the Internal Tags</th></tr>
<tr><td>2</td><td>The properties dialog box of the tag will be displayed.
In the sample, the Name of the first tag is S16i_OPCServer_01. The tag is of the Signed 16-Bit Value data type.


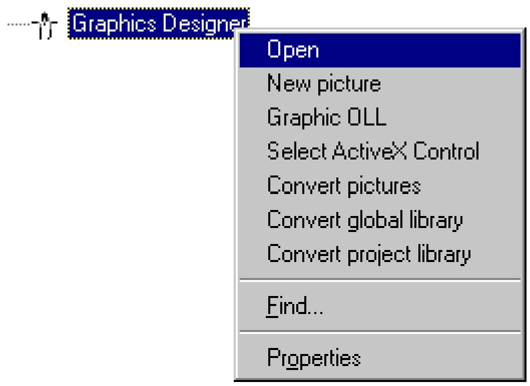
</td></tr>
<tr><td>3</td><td>Creation of the remaining tags required.
Follow steps 1 to 3 for the creation of the remaining tags. The names, data types and addresses of the tags used in this sample are listed in the following graphic.


</td></tr>
</table>

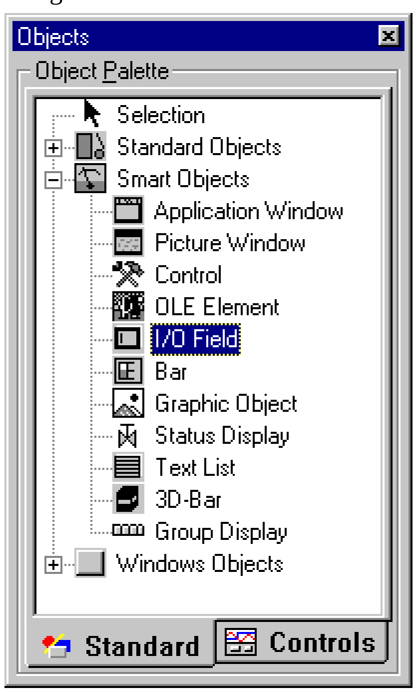
C: Creating the WinCC Screen

<table>
<tr><th>Step</th><th>C: Creating the WinCC Screen</th></tr>
<tr><td>1</td><td>Creation of a WinCC screen in which the previously created tags are visualized.

Open the Graphics Designer editor via a R and then selecting Open from the pop-up menu.

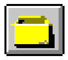

</td></tr>
<tr><td>2</td><td>This will open the Graphics Designer editor with a new (blank) screen.

To display the first tag, configure a Smart Object → I/O Field. To do so, select the I/O Field object from the Object Palette and place it on the screen using the mouse.

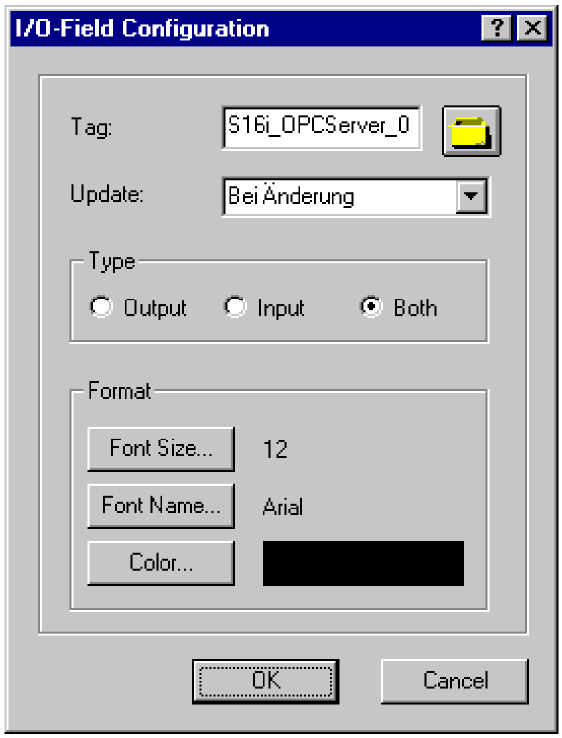

</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Creating the WinCC Screen</th></tr>
<tr><td>3</td><td>After placing the I/O Field on the screen, its Configuration dialog box will be displayed.

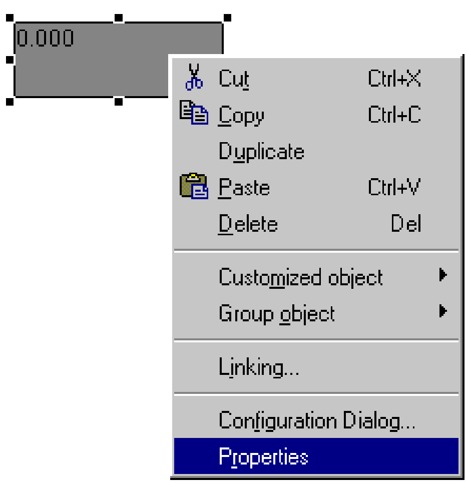
In the Tag field, set the tag SERVER_PC_S16i_OPCServer_01 via the button displayed below.

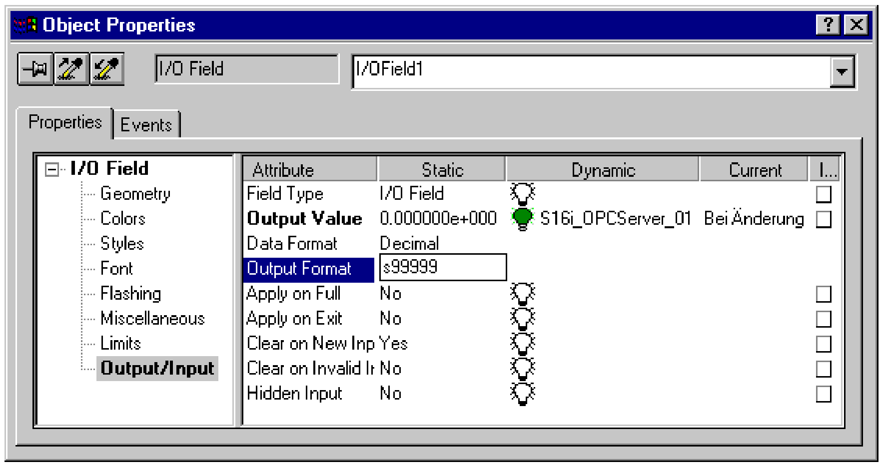


The Update of the tag is set to Upon Change. Keep the default settings for the remaining options. Close the dialog box by clicking on OK.

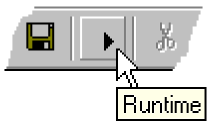

</td></tr>
<tr><td>4</td><td>Changing the output format of the I/O Field.

For this, open its properties dialog box via a R on the I/O Field and then select Properties from the pop-up menu.

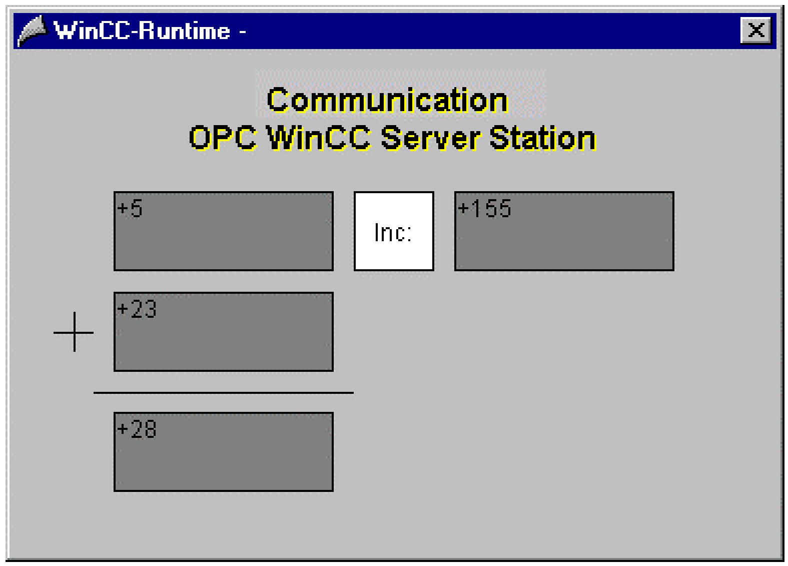

</td></tr>
</table>

Step	C: Creating the WinCC Screen
5	The dialog box *Object Properties* will be displayed. On the left side of the *Properties* tab, select the entry *Output/Input*. Via a D on the output format set, the field can be edited. Select the new format *s99999*. This format enables the *I/O Field* to display signed values with a maximum of 5 digits. 
6	Creation of three additional *I/O Fields* for the display of the remaining tags. Follow steps 2 to 5 to create the remaining I/O fields.
7	Creation of a simple tag simulation. The sum of the tags *S16i_OPCServer_01* and *S16i_OPCServer_02* is to be stored in the tag *S16i_OPCServer_03*. The value of the tag *S16i_OPCServer_04* is to be incremented every 250ms. These tasks are performed by to *C Actions*. These actions are configured at the *Properties* → *Geometry* → *Position X* of the *I/O Fields* displaying the results. For a detailed description of the *C Actions* used, refer to section at the end.

<table>
<tr><th>Step</th><th>C: Creating the WinCC Screen</th></tr>
<tr><td>8</td><td>
Save the screen.
In the sample project, the screen is saved under the name com_3_OPCServer_01.pdl. The screen can be switched directly to runtime from the Graphics Designer via the button displayed below.



By entering values in the individual I/O Fields, the tag values can be changed.



</td></tr>
</table>

C Action for Generating the Sum

```
#include "apdefap.h"
 long _main(char* lpszPictureName, char* lpszObjectName, char* lpszPropertyName)
{

//get tag values
int iValue_01 = GetTagSDWord("S16i_OPCServer_01");
int iValue_02 = GetTagSDWord("S16i_OPCServer_02");

//calculate sum and set tag value
SetTagSDWord("S16i_OPCServer_03",(iValue_01 + iValue_02));

//return constant property value
return GetLeft(lpszPictureName,lpszObjectName);

}
```

- The *C Action* displayed above is configured for the *I/O Field3* object at *Properties* → *Geometry* → *Position X*. The *C Action* is triggered upon the change of the tags *S16i_OPCServer_01* and *S16i_OPCServer_02*.
- The values of the tags *S16i_OPCServer_01* and *S16i_OPCServer_02* are read and their sum written into the tag *S16i_OPCServer_03*.
- The *C Action* is configured at an object property, which only serves for providing a trigger. The current value of the property is returned back to it.

C Action to Increment

```
#include "apdefap.h"
 long _main(char* lpszPictureName, char* lpszObjectName, char* lpszPropertyName)
{

//get tag value
int iValue = GetTagSDWord("S16i_OPCServer_04");

if (iValue < 10000)
{
	//increment and set tag value
	SetTagSDWord("S16i_OPCServer_04", ++iValue);
}
else
{
	//reset tag value
	SetTagSDWord("S16i_OPCServer_04", 0);
}

//return constant property value
return GetLeft(lpszPictureName,lpszObjectName);

}
```

- The *C Action* displayed above is configured for the *I/O Field4* object at *Properties* → *Geometry* → *Position X*. The *C Action* is triggered every *250ms*.
- The value of the tag *S16i_OPCServer_04* is read. If this value has not reached 10000, it will be incremented and written back to the tag. Otherwise the tag value is set to zero.
- The *C Action* is configured at an object property, which only serves for providing a trigger. The current value of the property is returned back to it.

10.3 Creation of the WinCC Project WinCC_OPC_CLIENT

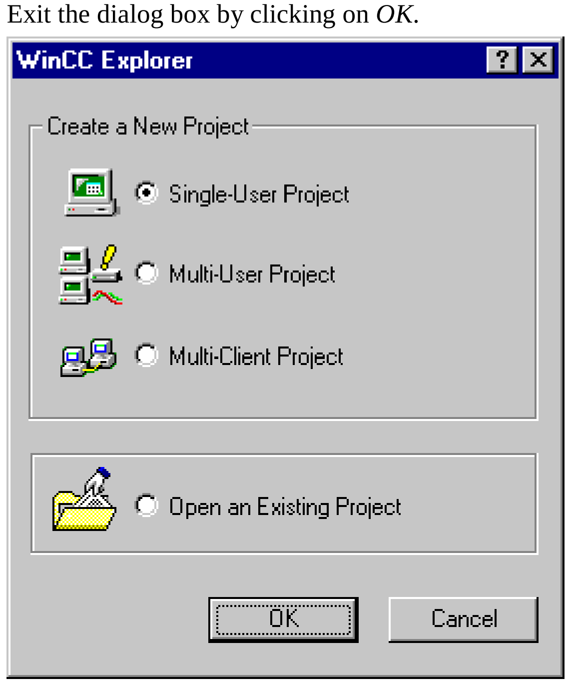
The following description details the configuration steps necessary to create and successfully start up the WinCC project *WinCC_OPC_CLIENT*.

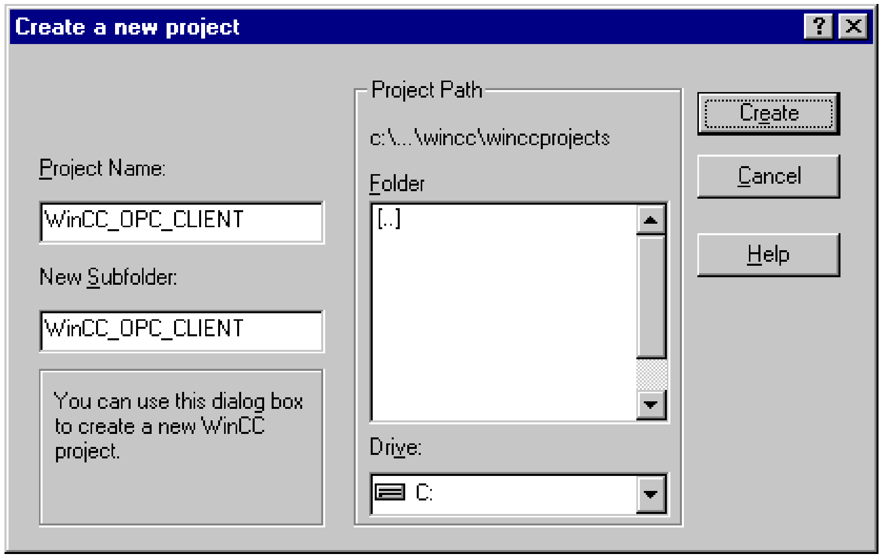
Overview of the Configuration Steps

The following lists the configuration steps necessary to create the WinCC project *WinCC_OPC_CLIENT*:

- A: Creating the WinCC Project
- B: Creating the Connection
- C: Creating the WinCC Screen

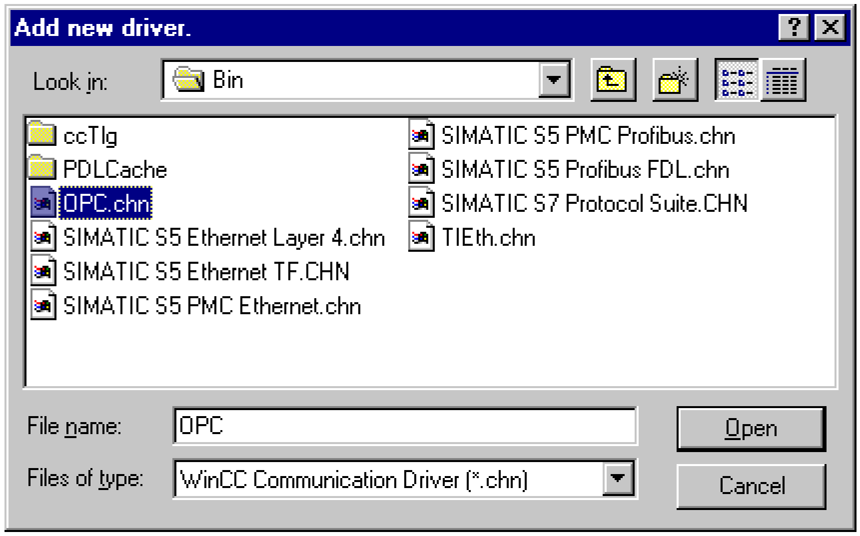
A: Creating the WinCC Project

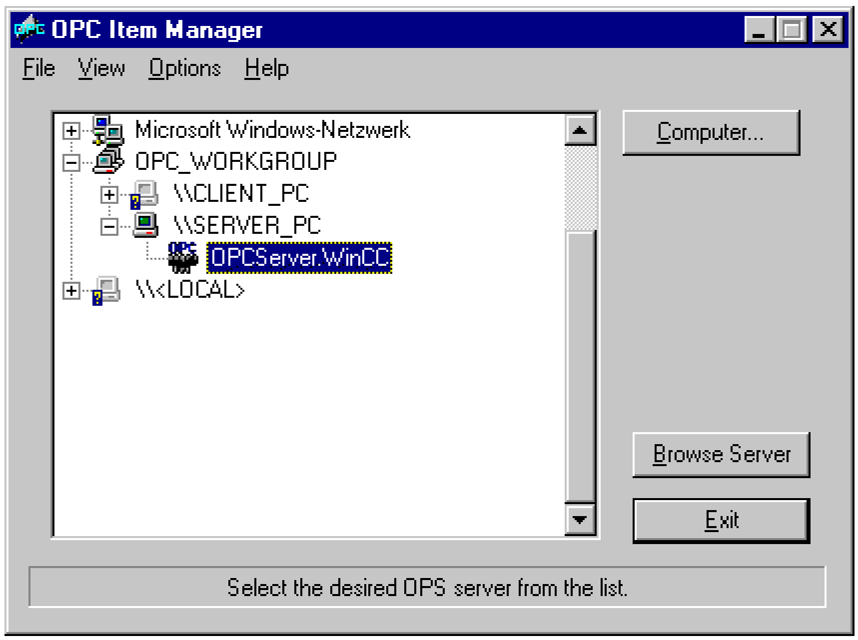
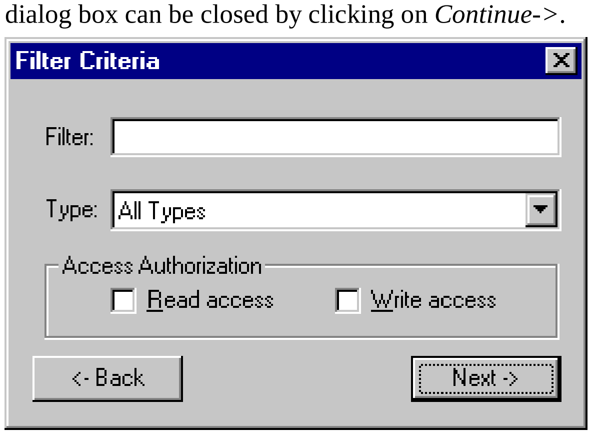
Step	A: Creating the WinCC Project
1	Creation of a new WinCC project in the *WinCC Explorer*. The WinCC Explorer is started via *Start* → *Simatic* → *WinCC* → *Windows Control Center*. 
2	The *WinCC Explorer* will be displayed. Via the menus *File* → *New*, the dialog box for specifying the properties of a new WinCC project will be opened. For this sample project, a *Single-User Project* is created. Exit the dialog box by clicking on *OK*. 

Step	A: Creating the WinCC Project
3	The dialog box *Create a new Project* will be displayed. Specify a *Project Name* for the new project. The names of the WinCC projects created within the framework of this manual all start with *WinCC* and also include a reference to the communication partner and communication type used. The project of this sample has the name *WinCC_OPC_CLIENT*. In the *Project Path* field, set the storage location of the new project. The dialog box *Create a new Project* is concluded by clicking on the *Create* button. 

B: Creating the Connection

Step	B: Creating the Connection
1	The new project will be displayed in the *WinCC Explorer*. Installation of the required communication driver. This is performed via a R on *Tag Management* and selecting *Add New Driver* from the pop-up menu. 

Step	B: Creating the Connection
2	The dialog box *Add New Driver* will be displayed. This dialog box lists all communication drivers that can be installed. This sample requires the communication driver *OPC*. Select this driver from the dialog box. Exit the dialog box by clicking on *Open*. 
3	The newly added communication driver *OPC* will be displayed as a sub-entry to *Tag Management*. The communication driver *OPC* contains one channel unit. The creation of a connection to a certain OPC server and the selection of the items required by this server can be carried out via the *OPC Item Manager*. The OPC Item Manager is started via R on the channel unit *OPC Groups (OPCHN Unit #1)* and then selecting *System Parameters* from the pop-up menu. 

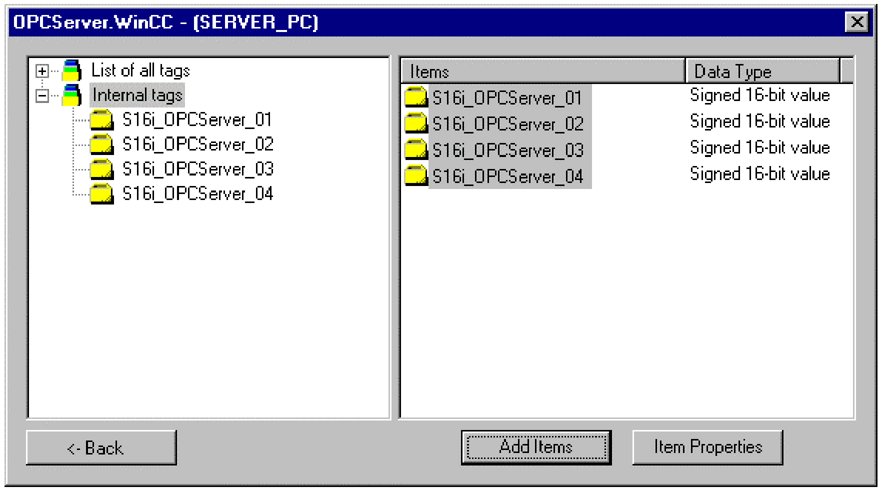
Step	B: Creating the Connection
4	The *OPC Item Manager* will be displayed. The desired OPC server can be selected from here. This server can be located on the local computer or on another computer accessible by the network. As illustrated below, the desired OPC server of this sample is located on the *SERVER_PC* computer in the *OPC_WORKGROUP* workgroup. Via a D on the entry of a workgroup or domain, all available computers contained in it will be listed. Via a D on the entry of a computer, all available OPC servers configured on it will be listed. From the desired server station, select the entry *OPCServer.WinCC* of the *WinCC OPC Server*. Via the *Browse Server* button, a listing of all items made available by this *WinCC OPC Server* can be displayed. However, this will only be the case if the WinCC project has been opened on the server station. 
5	The dialog box *Filter Criteria* will be displayed. Using this dialog box, the type of the desired items can be specified more exactly. If you want to display all available items, no settings are required. The dialog box can be closed by clicking on *Continue->*. 

<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>6</td><td>

A dialog box for selecting the desired items will be displayed.

The four internal tags previously created in the server project will be offered for selection as items of the *WinCC OPC Server*. However, this will only be the case if the WinCC project on the server station is in runtime.

Select these four items from the right window. By clicking on the button *Add Items*, they will be inserted into the WinCC project.



</td></tr>
<tr><td>7</td><td>

This requires the creation of a new connection into which these items can be inserted as WinCC tags.

This connection can be created automatically by the *OPC Item Manager*. The dialog box *New Connection* will be displayed. In this dialog box, only the name of the new connection must be entered. In this sample, the name *WinCC_OPC_01* is used. Close the dialog box by clicking on *OK*.

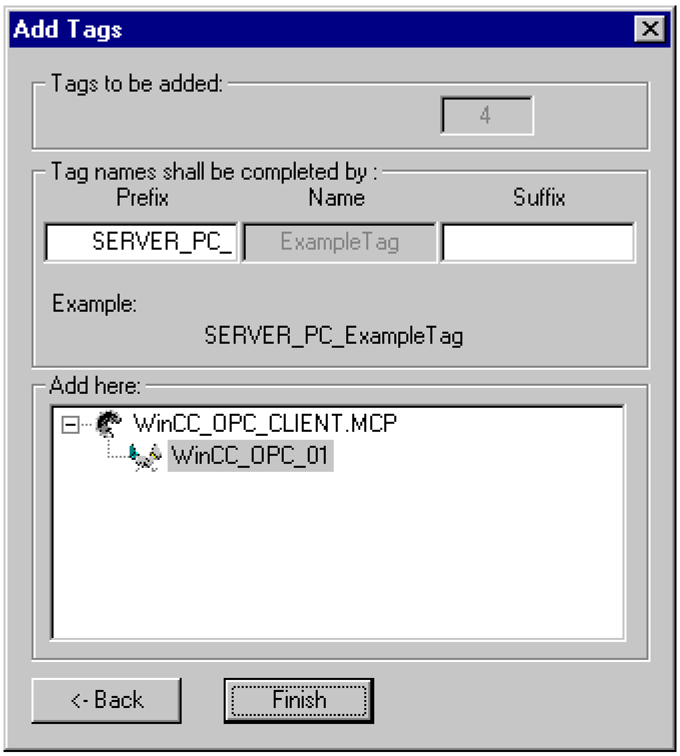
</td></tr>
</table>

<table>
<tr><th>Step</th><th>B: Creating the Connection</th></tr>
<tr><td>8</td><td>The dialog box Add Tags will be displayed.

In this dialog box, the connection is defined to which the tags are added. In this sample, the tags are added to the connection WinCC_OPC_01 created previously. This connection is selected from the field Add Here at the bottom.

Optionally, a Prefix and a Suffix can be added to the tag names used by the OPC Item Manager. In this sample, the prefix SERVER_PC_ is placed in front of the tag names.

Clicking on the Finish button creates the WinCC tags.

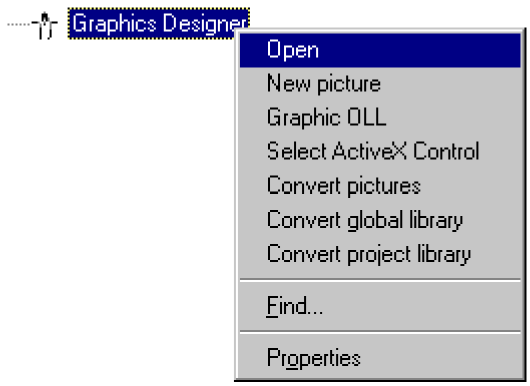
The dialog box for the selection of the desired items can be exited via the <-Back button. The OPC Item Manager can be exited via the Close button.


</td></tr>
<tr><td>9</td><td>The following graphic lists the WinCC tags created by the OPC Item Manager.
<table>
<tr><th>Name</th><th>Type</th><th>Parameters</th></tr>
<tr><td>SERVER_PC_S16i_OPCServer_01</td><td>Signed 16-bit value</td><td>"S16i_OPCServer_01", "", 2</td></tr>
<tr><td>SERVER_PC_S16i_OPCServer_02</td><td>Signed 16-bit value</td><td>"S16i_OPCServer_02", "", 2</td></tr>
<tr><td>SERVER_PC_S16i_OPCServer_03</td><td>Signed 16-bit value</td><td>"S16i_OPCServer_03", "", 2</td></tr>
<tr><td>SERVER_PC_S16i_OPCServer_04</td><td>Signed 16-bit value</td><td>"S16i_OPCServer_04", "", 2</td></tr>
</table>
</td></tr>
</table>

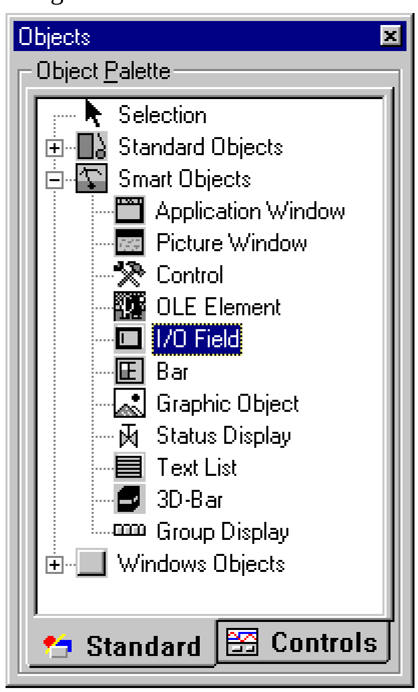
C: Creating the WinCC Screen

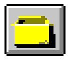
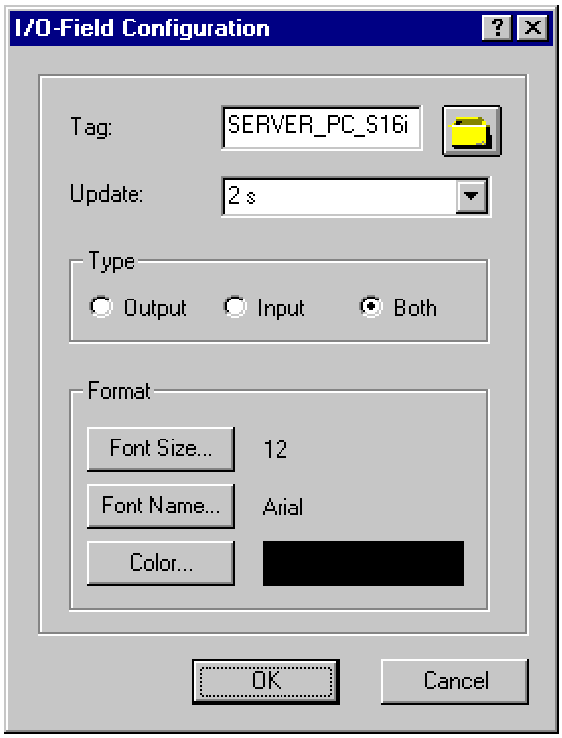
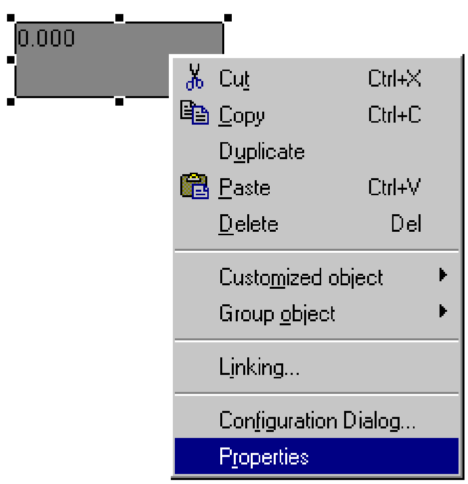
<table>
<tr><th>Step</th><th>C: Creating the WinCC Screen</th></tr>
<tr><td>1</td><td>Creation of a WinCC screen in which the previously created tags are visualized.

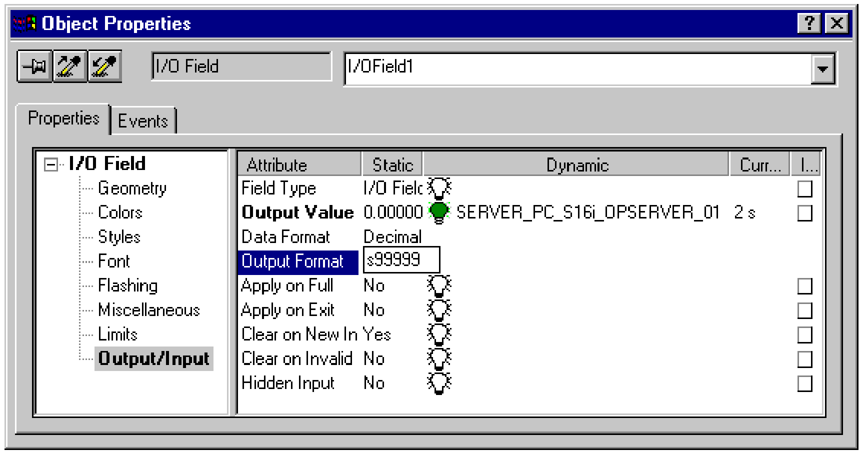
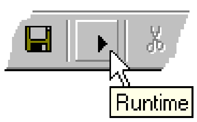
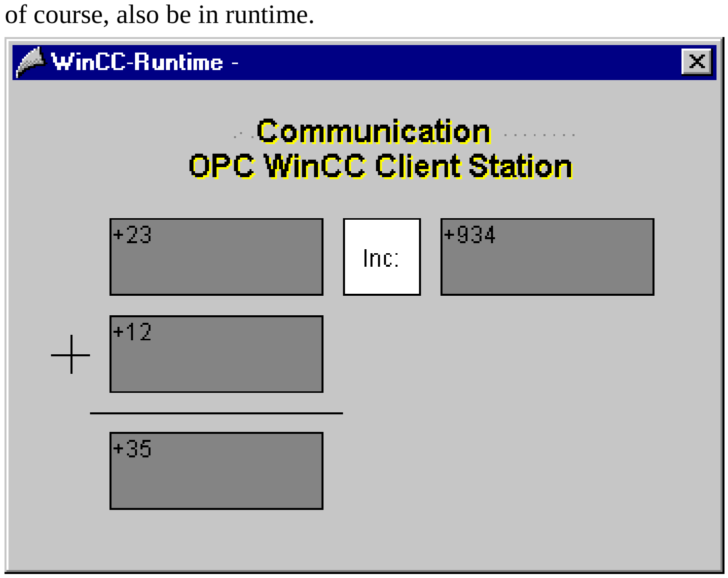
Open the Graphics Designer editor via a R and then selecting Open from the pop-up menu.

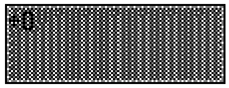

</td></tr>
<tr><td>2</td><td>This will open the Graphics Designer editor with a new (blank) screen.

To display the first tag, configure a Smart Object → I/O Field. To do so, select the I/O Field object from the Object Palette and place it on the screen using the mouse.


</td></tr>
</table>

<table>
<tr><th>Step</th><th>C: Creating the WinCC Screen</th></tr>
<tr><td>3</td><td>After placing the I/O Field on the screen, its Configuration dialog box will be displayed.
In the Tag field, set the tag SERVER_PC_S16i_OPCServer_01 via the button displayed below.

Leave the Update of the tag at 2 s. Keep the default settings for the remaining options. Close the dialog box by clicking on OK.

</td></tr>
<tr><td>4</td><td>Changing the output format of the I/O Field.
For this, open its properties dialog box via a R on the I/O Field and then select Properties from the pop-up menu.

</td></tr>
</table>

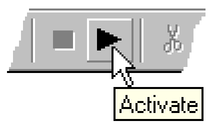
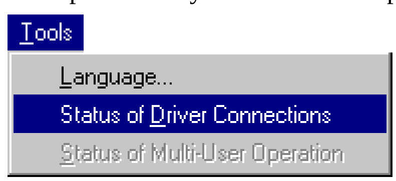
Step	C: Creating the WinCC Screen
5	The dialog box *Object Properties* will be displayed. On the left side of the *Properties* tab, select the entry *Output/Input*. Via a D on the output format set, the field can be edited. Select the new format *s99999*. This format enables the *I/O Field* to display signed values with a maximum of 5 digits. 
6	Creation of three additional *I/O Fields* for the display of the remaining tags. Follow steps 2 to 5 to create the remaining I/O fields.
7	Save the screen. In the sample project, the screen is saved under the name *com_3_OPC Client_01.pdl*. The screen can be switched directly to runtime from the *Graphics Designer* via the button displayed below.  If the screen is in runtime and the network connection established, the current values of the server project will be displayed in the I/O fields. They can be changed by entering values in the individual *I/O Fields*. The server project must, of course, also be in runtime. 

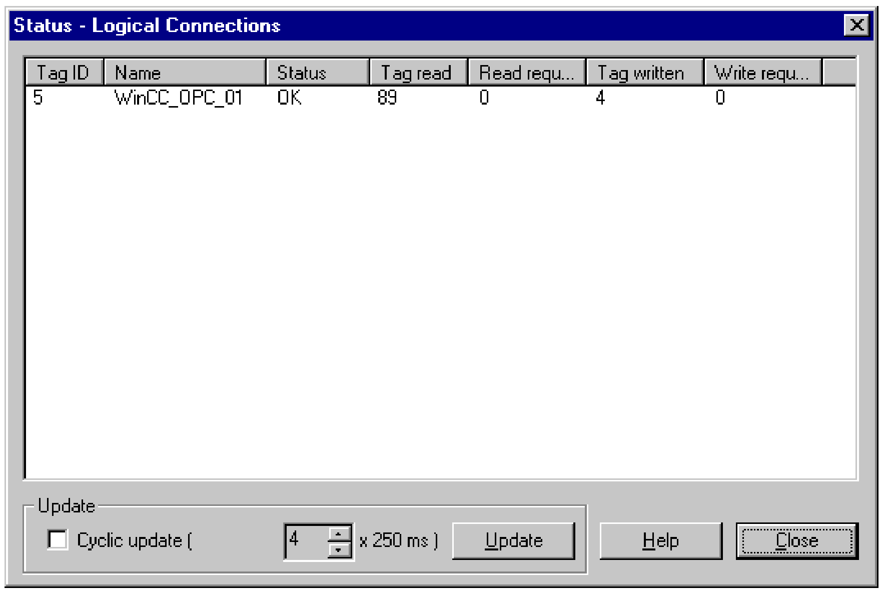
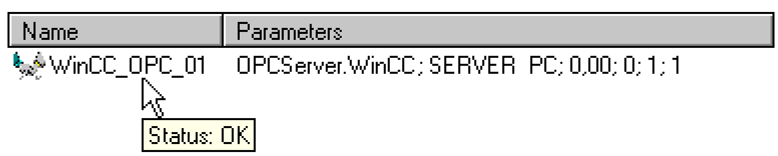
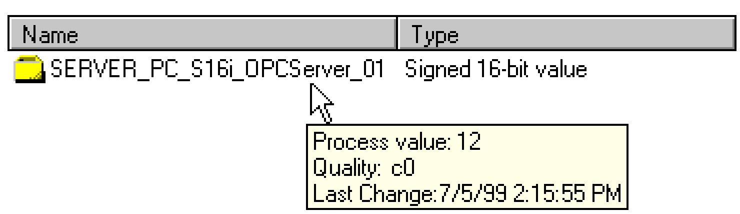
Step	C: Creating the WinCC Screen
	If there is no connection, the *I/O Fields* will be displayed grayed out. In this case an error is present at some point of the communication connection. 

10.4 Diagnosis of the Communication Connection

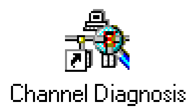
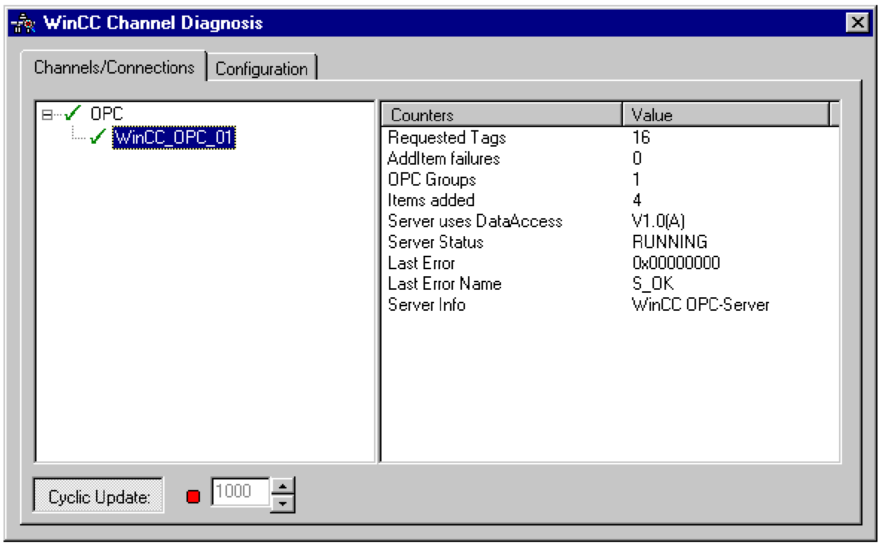
The following describes the options available for diagnosing the communication connection between the WinCC project *WinCC_OPC_SERVER* and the WinCC project *WinCC_OPC_CLIENT*.
Depending on the transport protocol used (e.g. TCP/IP), timeout times of up to 6 minutes can occur. Because of this, corrections may only show effects after several minutes.

WinCC Explorer

Step	WinCC Explorer
1	Diagnosis of the communication connection from the *WinCC Explorer*. Switch the project *WinCC_OPC_CLIENT* into runtime. This is done from the *WinCC Explorer* via the toolbar button displayed below. The project *WinCC_OPC_SERVER* must also be in runtime. 
2	In the *WinCC Explorer*, a dialog box for monitoring all configured connections can be accessed via the *Tools* → *Status of Driver Connections* menu. This menu point is only accessible if the project is in runtime. 

Step	WinCC Explorer
3	The dialog box *Status - Logical Connections* will be displayed. This dialog box lists all configured connections. For this sample, only the connection *WinCC_OPC_01* will be displayed. The displayed values correspond to the status at the moment the dialog box was opened. By selecting the appropriate check-box, a *Cyclic Update* of the display can be achieved. 
4	Another way to obtain information about the connection status in general and about the connection status of individual tags is provided by *Tag Management*. The status of a configured connection can be displayed as a tooltip by simply pointing the mouse on the connection in question.  The current process value of a certain tag as well as its status can be displayed as a tooltip by pointing the mouse on it. This allows you to detect errors concerning an individual tag and not the entire connection. 

Channel Diagnosis

Step	Channel Diagnosis
1	Diagnosis of the communication connection via the program *WinCC Channel Diagnosis*. Start this program via *Start* → *Simatic* → *WinCC* → *Channel Diagnosis*. 
2	The program *WinCC Channel Diagnosis* will be displayed. The *Channels/Connections* tab displays detailed information about the status of each configured connection. By default, the display is updated every second. The update cycle can be changed in the input field located at the bottom. 

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