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SIMATIC

Windows Automation Center WinAC Slot Version 4.0

Hardware Installation and Operating Manual

This manual is part of the documentation package WinAC Slot V4.0 with the order number:
6ES7673-2CC40-0YA0 (CPU 412-2 PCI) or
6ES7673-6CC40-0YA0 (CPU 416-2 PCI)

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Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring to property damage only have no safety alert symbol. The notices shown below are graded according to the degree of danger.

Danger
indicates that death or severe personal injury **will** result if proper precautions are not taken.

Warning
indicates that death or severe personal injury **may** result if proper precautions are not taken.

Caution
with a safety alert symbol indicates that minor personal injury can result if proper precautions are not taken.

Caution
without a safety alert symbol indicates that property damage can result if proper precautions are not taken.

Notice
indicates that an unintended result or situation can occur if the corresponding notice is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel.** Within the context of the safety notices in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

Warning
This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.
Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Preface

Purpose of the Documentation

This documentation provides detailed information about the WinAC Slot software and hardware that includes the CPU 412-2 PCI and the CPU 416-2 PCI. You install the WinAC Slot software and documentation from the installation CD.

The CPU 412-2 PCI and the CPU 416-2 PCI are the programmable logic controllers (PLCs) for the Windows Automation Center (WinAC). A CPU 41x-2 PCI is a card that fits in a PC in a PCI slot for 3/4-length cards. The CPU 41x-2 PCI is part of the WinAC family of PC-based controllers. You can also use SIMATIC products with PC-based controllers, such as WinCC flexible.

The PC-based controllers use a PROFIBUS DP network to communicate with distributed I/O, such as an ET 200M. In addition, you can use PG/OP communication (PROFIBUS, MPI, or Industrial Ethernet) to connect the PC-based controllers to STEP 7 or to another computer.

Basic Knowledge Requirements

General knowledge about automation systems is needed to understand this documentation.

In addition, the following knowledge is required:

- Comprehensive knowledge of the S7-400
- Comprehensive knowledge of STEP 7

Scope of Documentation

This documentation applies to the following modules:

CPU	Order number	Product Version (or higher)	
		Firmware	Hardware
CPU 412-2 PCI	6ES7 612-2QH10-0AB4	4.0	1
CPU 416-2 PCI	6ES7 616-2QL10-0AB4	4.0	1

This documentation describes all applicable modules at the time of publication. We reserve the right to provide product information bulletins containing current information for any new modules or modules with a new release number.

This documentation describes how the CPU 412-2 PCI and CPU 416-2 PCI differ from the CPUs of the S7-400 family. For more information, refer to the manuals for S7-400.

What's New?

The following changes have been made compared to WinAC Slot 41x, Version 3.4:

- Enhanced performance
- The PS Extension Board is integrated on the CPU. As a result, the CPU 41x-2 PCI only requires one slot.
- The fan interface of the PC fan is improved. The PC fan is not regulated and no longer runs continuously.

Location of Documentation

The installation of WinAC Slot V4.0 includes the following documentation:

- WinAC Slot as online help and as a PDF file
- WinAC Time Synchronization V4.0 as online help and as a PDF file (if installed)
- SIMATIC S7-400 instruction list containing the programming instructions for the CPU 41x-2 PCI.

The online help is started from the controller panel. The PDF files are accessible from the **Start > Simatic > Documentation** menu command.

Approvals

The CPU 41x-2 PCI has the following approvals:

Underwriters Laboratories (UL) in accordance to

- Standard UL 60950, File-No. E115352 and Canadian Standard C22.2 No. 60950 (I.T.E) and
- Standard UL 508, File-No. E85972 and Canadian Standard C22.2 No. 14 05 (IND.CONT.EQ)

CE Mark

The CPU 41x-2 PCI meets the requirements and protection goals of the following EC directives.

- EC Directive 89/336/EWG “EMC Directive”

C-Tick Mark

The CPU 41x-2 PCI meets the requirements of AS/NZS CISPR 22 (Australia and New Zealand).

Standards

The CPU 41x-2 PCI satisfies the requirements and criteria of IEC 61131-2.

Relationship to Other Manuals

This manual describes how the CPU 412-2 PCI and CPU 416-2 PCI differ from the CPUs of the S7-400 family. The following documents are also needed:

- *STEP 7 - Programming with STEP 7*. This manual provides basic information on designing and programming a WinAC Slot STEP 7 user program.
- *STEP 7 - System and Standard Functions for S7-300 and S7-400*. This manual provides you with descriptions of the system functions, organization blocks, and loadable standard functions.
- *STEP 7 - Working with STEP 7*. This manual explains the usage and the functions of the STEP 7 automation software. This manual provides you with an overview of the procedures used to configure WinAC Slot and to develop STEP 7 user programs.
- *SIMATIC NET - Commissioning PC Stations* This manual supports you when commissioning your SIMATIC NET PC modules in a PC station. All SIMATIC NET software tools and their operation are described (available once SIMATIC NET is installed).
- *SIMATIC NET - Industrial Communication with PG/PC, Parts 1 and 2.* This manual helps you with setting up industrial communications over PROFIBUS and Industrial Ethernet communications networks (available if you install SIMATIC NET)
- *SIMATIC S7-400 Programmable Controllers CPU Specifications Reference Manual*. This manual describes the operation of the S7-400 with PROFIBUS DP, the memory concept, and the estart methods.
- *SIMATIC S7-400 Programmable Controllers Hardware and Installation Installation Manual*. This manual describes the networking and commissioning (resetting the CPU with the mode selector; warm restart and hot restart with mode selector).
- *SIMATIC S7-400 Programmable Controllers Module Specifications Reference Manual*. This manual provides a description of the RS 485 repeater.
- *SIMATIC S7-400 Instruction List*. This manual provides you with a complete list of instructions that are applicable to the WinAC Slot PLCs as well as information on addressing and performance data. The instruction list is included as a PDF file in this documentation package. The CPU 412-2 PCI corresponds to the specifications for the CPU 412-2 (6ES7 412-2XG04-0AB0), and the CPU 416-2 PCI to those for CPU 416-2 (6ES7 416-2XK04-0AB0).

The SIMATIC manuals can be accessed on the PC with the installed SIMATIC software using the **Start > Simatic > Documentation** menu command.

Guide

The manual contains the following tools to help you locate information quickly:

- At the beginning of the manual, you will find a complete table of contents as well as a list of figures and a list of tables.
- Following the appendices, you will find a glossary containing the important terms used in the manual along with their definitions.
- At the end of the manual, you will find a detailed index enabling you to access needed information quickly.

Recycling and Disposal

The CPU 41x-2 PCI can be recycled due to their non-toxic material content. For environmentally safe recycling or disposal of your old device, contact a waste disposal company certified to handle electronic scrap.

Further Support

If you have questions regarding the products described in this manual, contact your Siemens representative.

To locate your representative, point your browser to:

http://www.siemens.com/automation/partner

You can find a guide to the technical documentation offered for the individual SIMATIC Products and Systems at:

http://www.siemens.de/simatic-tech-doku-portal

The online catalog and online ordering system is available at:

http://mall.automation.siemens.com/

Training Center

We offer training courses to help you get started using SIMATIC S7. For more information, contact your regional training center or the main training center at P.O. Box 4844, D-90327 Nuremberg.

Telephone: +49 (911) 895-3200.

Internet: http://www.sitrain.com

Technical Support

Technical support for all A&D products is available

- By filling out a Support Request at

http://www.siemens.de/automation/support-request

- Telephone: + 49 180 5050 222
- Fax: + 49 180 5050 223

For additional information regarding technical support, point your browser to http://www.siemens.de/automation/service

Service & Support on the Internet

In addition to documentation, you can access our complete knowledge base on the Internet at

http://www.siemens.com/automation/service&support

There, you will find:

- Newsletters with the latest information on your products.
- Relevant documentation via the search function in Service & Support.
- A forum where users and specialists from around the world exchange information.
- Your local Siemens Automation & Drives representative.
- Information on local service, repairs, and spare parts and much more is available under "Services“.

Table Of Contents

1 Product Overview

1.1 Introduction to PC-Based Automation

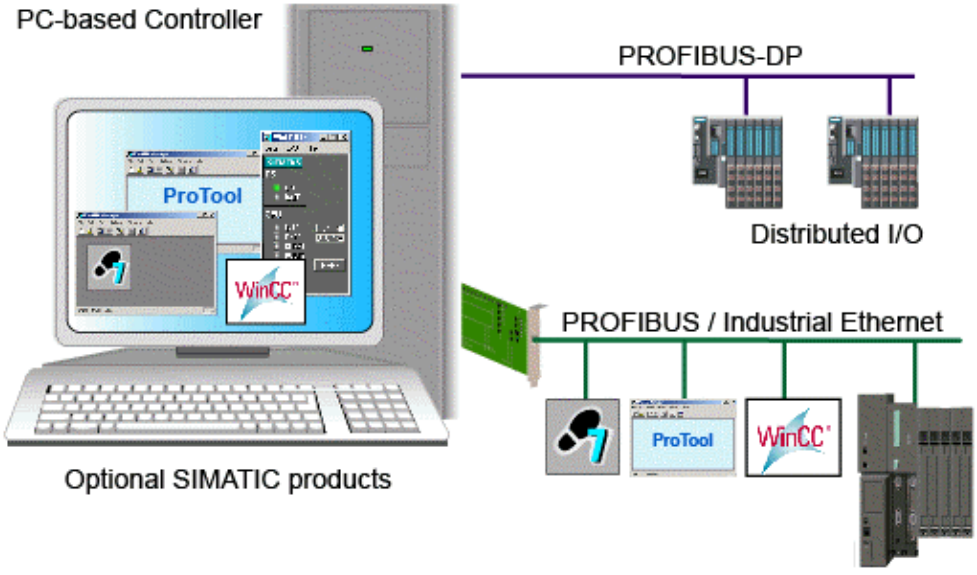
The WinAC (Windows Automation Center) PC-based controllers are operated within a standard PC and provide the same functionality as SIMATIC S7 CPUs (hardware controllers). The controllers include

- WinLC Basis
- WinLC RTX
- WinAC Slot

WinAC Slot is a PCI slot card that is used in a PC.

The CPU 41x-2 PCI supports multiple networks and connects to distributed I/O and/or Industrial Ethernet stations over the PROFIBUS DP or MPI interface or Industrial Ethernet cards that you have installed in your computer.

As part of the SIMATIC family of products, die CPU 41x-2 PCI can also communicate with STEP 7 or other SIMATIC products, such as WinCC, WinCC flexible, ProTool Pro or other SIMATIC S7 controllers, including any of the PC-based controllers, over PROFIBUS, MPI or Industrial Ethernet networks.



You can use the same programming languages, program structure and programming user interface (STEP 7) as for hardware PLCs to develop your process control solution. Programs designed for S7 controllers can run on PC-based controllers and vice versa. The PC-based controllers also contain a controller panel that runs on the PC. With these functions, you can use the CPU 41x-2 PCI in a typical factory automation configuration.

1.2 Components of a PLC with a CPU 41x-2 PCI

Overview

The WinAC Slot 41x package includes the following components:

- WinAC controller - CPU 412-2 PCI or CPU 416-2 PCI slot PLC, two CPUs from the S7-400 product line for PC-based applications.
- Controller panel, which represents the operating controls and displays of the CPU 41x-2 PCI on a screen.
- WinAC Time Synchronization for synchronization of the CPU 41x-2 PCI using a SIMATIC NET CP (Industrial Ethernet or PROFIBUS) or the PC-internal clock.
- SIMATIC NET OPC Server on the provided SIMATIC NET CD.

CPU 41x-2 PCI (WinAC Controller)

You use the CPU 41x-2 PCI to control your process. It provides an effective hardware solution for your automation projects. The I/O are connected via PROFIBUS DP.

Controller Panel

The CPU is operated with a controller panel that is displayed on the PC screen. The panel is based on the front panel of an S7-CPU and provides the corresponding functionality.

You can also use the controller panel to read out the content of the diagnostic buffer.

A password can be used to restrict access to the controller from the controller panel so that only authorized personnel can change the settings.

Time Synchronization (WinAC Time Synchronization)

WinAC Time Synchronization enables the real-time clock of the WinAC controller (e.g., WinLC RTX or CPU 41x-2 PCI) to be synchronized to a central time-of-day source. Synchronization to the following is possible:

- Central real-time transmitter via a PC communications processor (e.g., CP 5613 or CP 1613)
- PC-internal clock

WinAC Time Synchronization is implemented as a Windows service. The service is started automatically when the computer is booted. Time synchronization starts if the service was not stopped before the computer was turned off. The update period is fixed at 10 s.

Separate documentation is available for WinAC Time Synchronization. Refer to the online help for WinAC Time Synchronization.

Programming

The WinAC controller is configured and programmed the same as SIMATIC S7 with STEP 7. The LAD, FBD, STL, S7-SCL programming languages and all graphical programming languages such as S7-GRAPH, S7-HiGRAPH, and CFC can be used.

Programming can be done locally on the same PC as well as remotely via networks or the integrated PROFIBUS interfaces.

Access to Process Data

Process data are accessed via the SIMATIC NET OPC Server. You can install this server from the provided SIMATIC NET CD.

Interface to Display

The SIMATIC WinCC/WinCC flexible HMI system and the ProTool Pro visualization software can be linked via an optimized interface.

A SIMATIC NET OPC server with data access interface is available to link any visualization system based on Windows 2000/XP. You can install this server from the provided SIMATIC NET CD.

Communication

If you want to perform communication via Industrial Ethernet or a PROFIBUS subnet, a communication module (CP) must be installed in your PC.

The **options for communicating** with other nodes are:

- Connection to PROFIBUS DP via the integrated interface
- Connection to MPI or PROFIBUS DP via the second integrated interface
- Connection to PC via the PCI interface
- Connection to another network such as Industrial Ethernet/PROFIBUS via a communications processor (CP)

Technology on the PC

WinAC Slot is equipped with a shared memory interface on the PCI bus. This enables very fast data exchange between a PC application and WinAC Slot. Development of this PC application is supported through WinAC ODK 4.1.

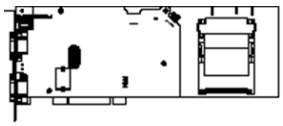
Multi Slot

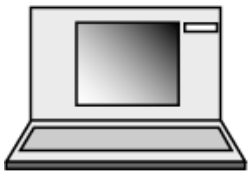
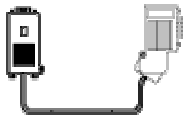
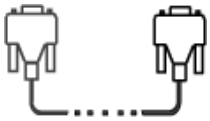
You can operate up to four CPUs 41x-2 PCI in one PC or up to three CPUs 41x-2 PCI together with WinAC Basis V4.1 and higher or WinAC RTX V4.1 and higher.

Each of the CPUs works autonomously, i.e., operating states are not coordinated and the CPUs do not have any common I/O or data areas. Thus, multi-slot mode is not the same as "multicomputing" in the S7-400.

Components

The following components are available for setting up and commissioning WinAC Slot:

Component	Function	Illustration
CPU • CPU 412-2 PCI • CPU 416-2 PCI	• Executes the user program. • Communicates with other CPUs or with a programming device via the MPI interface. • Communicates with DP masters and DP slaves via the DP interface. • Communicates with applications in the PC via the PCI interface.	

Component	Function	Illustration
PC, e.g., • Box PC 627, 840 • Panel PC 577, 677, 877 • Rack PC IL 43, 840 • Workstation PCU 50 • Standard PC	... accepts the CPU 41x-2 PCI. The PC can configure, parameterize, and program the CPU 41x-2 PCI, provided you have installed a STEP 7 package.	
Memory card	... stores the user program and parameters.	
Programming device (PG) or PC	... for configuring, parameterizing, programming, and testing the CPU 41x-2 PCI via MPI. You do not have to have a separate programming device to configure the CPU 41x-2. You can also use the licensed STEP 7 package on the PC.	
PROFIBUS bus cable with bus connector	... connects nodes of an MPI or PROFIBUS subnet to one another.	
PG cable	... connects the CPU 41x-2 PCI to another PG/PC via the MPI interface.	
SIMATIC NET components	CP 1613 , CP 5613 (also A2), CP 5611, or Standard Ethernet card for connection of the CPU 41x-2 PCI to Industrial Ethernet.	

Location of order numbers and release number

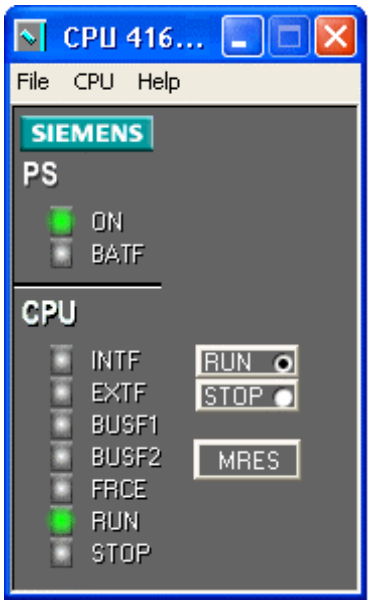
The order number and release number are noted on a label on each CPU 41x-2 PCI. The appropriate release number is marked with an "X".

1.3 Introduction to the Controller Panel

The controller panel corresponds to the faceplate of the SIMATIC S7 CPUs.

The controller panel is a display window on your PC that contains the following elements for working with the controller:

- Two operating mode selector switch positions for changing the operating mode of the controller
  (similar to the mode selector switch on an S7 CPU front panel.)
- Status indicators for the controller
- MRES switch for resetting the CPU
- Menus for controller operations



Opening or closing the controller panel does not influence the state of the controller. The status of the operator switches and the LEDs are stored in the controller.

1.4 Key Communication Data

Communication with the PG or OS or configured AS-AS communication via Industrial Ethernet, MPI, or DP is possible. The following interfaces can be used: CP 1612, CP 1613, CP 5613, CP 5611, integrated and standard interfaces of the PC.

Constraints: the FMS and FDL protocols and AG-Send/AG-Receive are not supported!

CP/ interface	Required SIMATIC NET software license	Protocol	Number of Connections via WinAC Slot 41x[1, 2]	Communication via WinAC Slot 41x	
				Communication with PG, OS, etc.	Configured AS-AS Communication
CP 1612[3]	SOFTNET-S7	Industrial Ethernet	64	Yes	Yes
	SOFTNET-S7 Lean	Industrial Ethernet	8	Yes	Yes
	SOFTNET-PG	Industrial Ethernet	64	Yes	No
CP 1613	S7-1613	Industrial Ethernet	64	Yes	Yes
CP 5613	S7-5613	PROFIBUS	50	Yes	Yes
		MPI	50	Yes	Yes
CP 5611	SOFTNET-S7	PROFIBUS	8	Yes	Yes
		MPI	8	Yes	Yes
Integrated interfaces		PROFIBUS	CPU 412-2 PCI: 16 CPU 416-2 PCI: 32	Yes	Yes
		MPI	CPU 412-2 PCI: 16 CPU 416-2 PCI: 44	Yes	Yes
PC-internal		S7	64	Yes	Yes

[1] The number of S7 connections applies when Credit = 1 and PDU size = 480 bytes. For other settings, refer to the Product Information for SIMATIC NET.

[2] For CPU 412-2 PCI, a maximum of 16 connections are permitted; for CPU 416-2 PCI, a maximum of 64 connections are permitted.

[3] Applies also to standard Ethernet interface of a PC.

1.5 System Requirements

To use the CPU 41x-2 PCI, your personal computer (PC) must meet the following criteria:

Category	Requirement
Operating System	One of the following operating systems: • Microsoft Windows 2000 Professional Service Pack 3 or higher • Microsoft Windows XP Professional Service Pack 1 or higher
Processor and memory	Pentiumsystem: • 300 MHz • At least 128 Mbytes of RAM
Hard drive	A hard disk with 120 Mbytes of free space for the complete installation The setup program uses at least 60 Mbyte of available memory on Drive C: for the setup program (setup files are deleted once the installation is complete).
Operator interface	A color monitor, keyboard, and mouse or other pointing device (optional) that are supported by Windows
Slot	At least one free PCI slot of 3/4 length for the CPU 41x-2 PCI. PCI: 3.3 V or 5 V; at 3.3 V max. 66 MHz, at 5 V max. 33 MHz.
Siemens software	Programming and configuration software: STEP 7 V5.3 SP2 or higher with the installed hardware update for WinAC Slot V4.0

1.6 Windows User Privileges

You are not required to have Windows Administrator (ADMIN) privileges in order to perform operations, such as changing the operating mode of the controller, archiving or restoring control programs, or setting the security options.

With Power User, User, or even with Guest privileges, you can perform any operation from the controller panel.

As shown in the following table, some operations are restricted to certain Windows User privilege classes.

Operation	Administrator	Power User	User	Guest
Installing WinAC Slot software	Allowed	Not allowed	Not allowed	Not allowed
Configuring or modifying the PC Station	Allowed	Allowed	Not allowed	Not allowed
Performing WinAC operations	Allowed	Allowed	Allowed	Allowed

1.7 Using Help

The online help system provides information about the controller panel and the controller. This topic provides information about using online help:

- Accessing Help from the Controller Panel
- Using the Table of Contents
- Using the Index
- Using Full-Text Search
- Printing Help Topics
- Changing the Language of a Help Topic

Access to the Online Help in Windows XP SP2

In Windows XP SP2, the online help display may be blocked based on your security settings.

If the following message appears: "To help protect your security, this file has been restricted from showing active content that could access your computer," proceed as follows:

1. Click the message to display your options.
2. Select "Allow blocked content…".
3. Click "Yes" to confirm the security warning.

Result: You can now access the online help. Access ends when you close the online help.

We recommend that you follow this procedure to access the online help. For security reasons, do not change your firewall settings or your Internet Explorer settings!

1.7.1 Accessing Help from the Controller Panel

To access online help from the controller panel, use one of the following methods:

Help on Panel

The **Help > Help on Panel** command opens the initial page of the online help for the controller panel. This help system describes the controller panel when it is not connected to a controller. The table of contents is in the left navigation pane.

Help on Controller

The **Help > Help on Controller** command displays the initial page of the online help for the controller that is connected to the controller panel. It describes controller and controller panel operations. The table of contents is in the left navigation pane.

Introduction

The **Help > Introduction** command displays a topic that provides an introduction to PC-based control and the controller itself.

Getting Started

The **Help > Getting Started** command displays a topic that helps you get started when you begin using the controller panel to work with the controller for the first time.

- Click the Help button in a dialog or message box to view information about that specific dialog or message box.
- Press the F1 key to view context-sensitive help on the currently selected item (for example, a window, dialog, or menu).

Using the Table of Contents

The table of contents is in the left pane of the web browser and provides navigation within the online help system:

- Click a book to open it and display the books and topics that it contains.
- Click the book again to close it.
- Click any topic within the table of contents to display that topic.
  - The topic you are currently viewing is highlighted in the table of contents.
  - The table of contents can be either hidden or displayed:
- Click the "x" in the left navigation pane to close the table of contents.
- Select the Contents button on the browser or the "Show" link in a topic to display it. (The "Show" link appears only when you have displayed a context-sensitive topic from the application.)

1.7.2 Using the Index

The index provides access to information about a specific subject. Use one of the following methods to access the index:

- Select the Index button on the browser. (If the Index button is not visible, click the "Show" link at the top of the topic. The "Show" link appears only when you have displayed a context-sensitive topic from the application.)
- Click the Index button in any help topic.

1.7.3 Using Full-Text Search

To use the full-text search capabilities of the online help, use the search field that is displayed above the topic, or select the Search button on the browser. (If the Search field and Search button are not visible, click the "Show" link at the top of the topic. The "Show" link appears only when you have displayed a context-sensitive topic from the application.)

The full-text search supports the Boolean operators AND, OR, and NOT and parentheses in your search expression. Wildcards ("*") are not supported.

1.7.4 Printing Help Topics

To print a single topic that is displayed in your browser, right-click in the topic pane and select Print from the context menu. Select the print options of your choice.

1.7.5 Changing the Language of a Help Topic

The browser contains language buttons for each of the supported languages. To see the current help topic in another language, click the language button of your choice. The current topic is displayed in the language you selected, but the contents, index, and search features of the online help system remain in the original language. This may be helpful if a topic is unclear and you want to read it in another language.

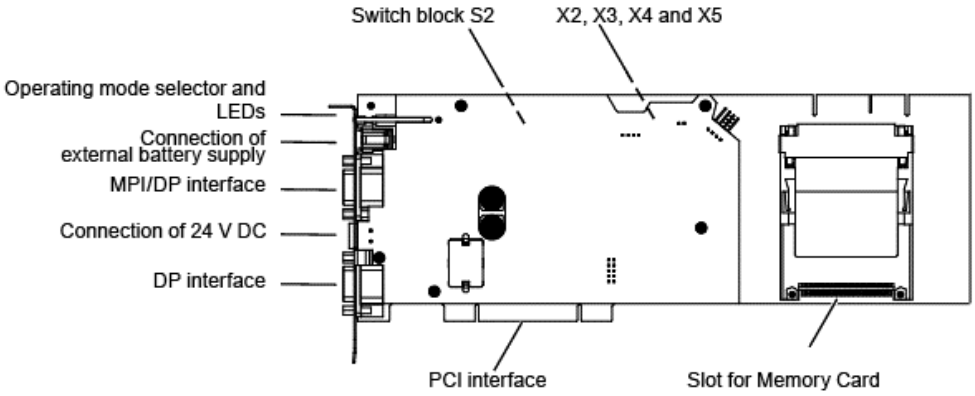
If you select a language that you have not installed, the online help system cannot display the topic in that language and displays a "Page not found" error. Changing the language of an online help topic does not change the display language of the controller panel.

2 Installing the CPU 41x-2 PCI and the Software

2.1 Interfaces

CPU Interfaces

The figure below shows the interfaces of the CPU 41x-2 PCI:



- PROFIBUS DP interface

  The CPU 41x-2 PCI has an integrated PROFIBUS DP interface. You can use this interface to connect distributed I/O.

  The CPU 41x-2 PCI can be operated as a DP master or DP slave on PROFIBUS DP.

- MPI/PROFIBUS DP interface

  You can use the MPI/PROFIBUS DP interface either as an MPI interface or as a PROFIBUS DP interface (default: MPI interface).

  The multipoint interface (MPI) of the CPU 41x-2 PCI is used to connect to an MPI subnet or for direct connection of an OP or a PC or programming device with STEP 7.

  The MPI interface can also be parameterized as a DP interface. For this purpose, you can use SIMATIC Manager in STEP 7 to reassign the MPI interface. Here, you can configure a DP line with a maximum of 32 DP slaves. The boundary conditions of the PROFIBUS DP interface are applicable (see above).

Note

Pin 7 of the MPI-/ PROFIBUS DP interface does not have 24 V available, e.g., for supplying operator panels.

- Slot for memory card

  You can insert a memory card in this slot on the CPU 41x-2 PCI. A detailed description is available in Memory Cards.

- Connection of external 24 VDC voltage supply
- Connection of external backup battery
- Connection of PC fan (X3, X4, or X5 - depending on the connector type)
- Connection of fan supply (X2) to motherboard or power unit
- Operating mode selector

  The operating mode selector allows you to switch the CPU 41x-2 PCI to RUN mode irrespective of the operating mode of the PC.

- LEDs on the slot bracket

  The slot bracket of the CPU 41x-2 PCI contains LEDs. These are in addition to the LED displays on the controller panel. For the meaning of the LEDs, refer to Changing the Operating Mode of the Controller and Status Displays.

  - SF (INTF, EXTF)
  - R (RUN)
  - S (STOP)

2.2 Fitting the CPU 41x-2 PCI

Procedure

The following table shows you the basic procedure for fitting the CPU 41x-2 PCI.

Step	Procedure
1	Switch off the PC
2	Open the PC
3	Set up the battery monitoring
4	Insert the memory card
5	Insert the CPU 41x-2 PCI into the PC
6	Connect the CPU 41x-2 PCI to the power supply
7	Connecting a Fan
8	Close the PC

Requirement

The CPU 41x-2 PCI requires a PCI slot with standard clearance.

Switching Off and Opening the PC

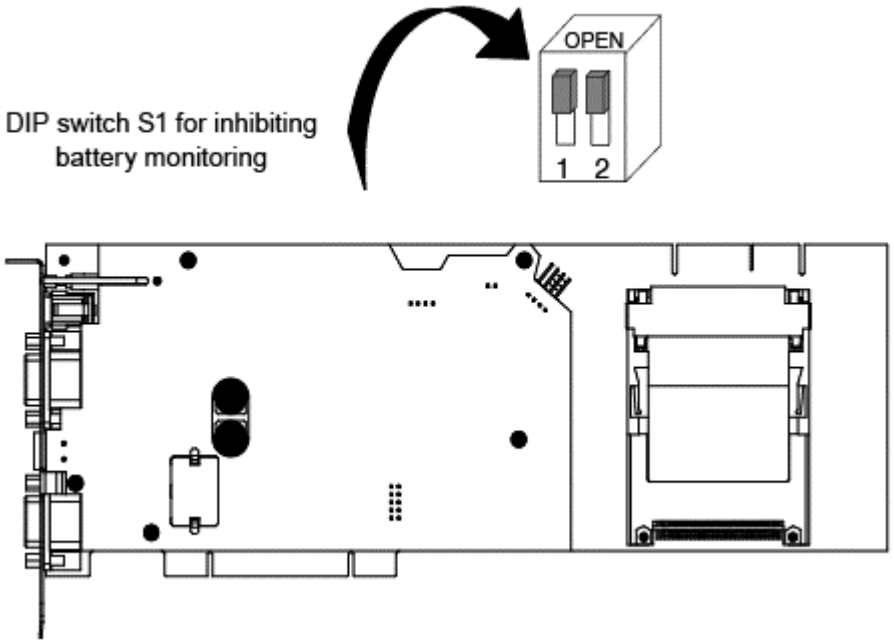
Caution

The electronic components on the printed circuit boards are extremely sensitive to electrostatic discharges. Observe the rules for handling electrostatic sensitive devices (see Guideline for Handling Electrostatic Sensitive Devices ESD).

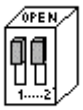
1. Switch off the PC and remove the power plug for the 230 V supply on the rear panel.
2. Open the PC as described in the owners manual for your PC or programming device.
3. Use switch block S2 on the CPU 41x-2 PCI to specify whether or not battery monitoring is to be suppressed. You should suppress battery monitoring if you are not using a battery. Otherwise, the BATF LED would be constantly illuminated on the controller panel even though no backup battery is being used.

Note

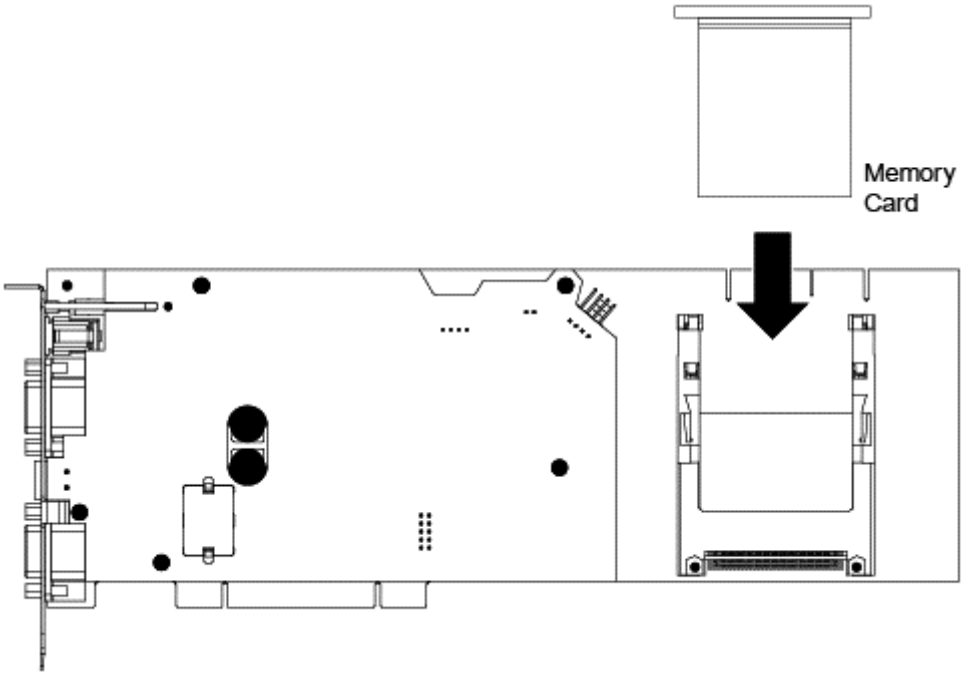
Switch block 2 is located on the main board of the CPU 41x-2 PCI between the two circuit boards.



Suppressing the Battery Monitoring: Switch Setting

If ...	Then ...	Switch Setting
You are not using battery monitoring	Set DIP Switch 1 to the OPEN position	
You are using battery monitoring	Set DIP Switch 1 to the NOT OPEN position	

4. Insert the memory card.



5. Insert the CPU 41x-2 PCI onto an available PCI slot on the mother board.
6. Screw the CPU 41x-2 PCI to the back panel of the PC.

   If you want to use more than one CPU 41x-2 PCI in multi-slot mode, repeat the steps indicated above.
7. Connect the PC fan to the CPU, if applicable. For more information, refer to Connecting the Fan.
8. Finally, connect the PC as described in the relevant manual and reconnect the network cable.

2.3 Connecting the CPU 41x-2 PCI to the Power Supply

2.3.1 Important Information

This section provides decision-making guidance for connecting the CPU 41x-2 PCI to the power supply. Depending on the power supply type and the settings in the Restart Method and Autoload dialogs (refer to Status and Error Indications), the restart behavior of the CPU 41x-2 PCI will vary.

- Operation without an external independent 24 VDC power supply and without a backup battery

  When the PC is switched off, the data are lost.

  You have the option of storing the STEP 7 user program in a memory card file on the PC and loading this file automatically to the CPU 41x-2 PCI after Power On.

  The automatic warm restart/hot restart feature is **not** available.

- Operation without an external independent 24 VDC power supply but with a backup battery

  The CPU 41x-2 PCI is independent of the PC as long as the power supply of the PC functions, i.e., a warm restart of the PC does not affect operation of the CPU 41x-2 PCI.

  If the PC is switched off, the CPU 41x-2 PCI stores the current values of the STEP 7 user program in such a way that an automatic warm restart/hot restart is possible after Power On.

- Operation with an external independent 24 VDC power supply and with a backup battery

  In this case, you can switch off the PC - the CPU 41x-2 PCI will continue running!

  The CPU 41x-2 PCI is independent of the PC. The PC can be switched off or can even fail, and the CPU 41x-2 PCI will continue running (uninterrupted power supply switchover). Here again, an automatic warm restart/hot restart is possible.

Note

In order to operate the CPU 41x-2 PCI independently of the PC, OB 84 must be programmed. If you have not programmed OB 84 and the PC is switched off or it crashes, the CPU 41x-2 PCI goes to STOP.

For more detailed information, refer to .Responding to Diagnostic Events.

Restart Behavior of the CPU 41x-2 PCI after Power On of PC

The restart behavior of the CPU 41x-2 PCI after Power On varies according to how you connected the CPU 41x-2 PCI to the power supply. The restart behavior of the CPU 41x-2 PCI after Power On of the PC depends on several factors:

- Whether or not backup battery is available
- Whether or not the CPU 41x-2 PCI is connected to an external independent power supply (UPS)
- Type of memory card (FLASH card or RAM card)

Independent 24 VDC power supply	Backup battery	What happens after a Power Off/Power On of the PC?
No	No	When the PC is powered off, the CPU 41x-2 loses its power supply - a backup battery is not available, and the user program is aborted. A user program on the FLASH card is retained. All RAM contents (work and integrated load memory, RAM card) are lost. After the PC is powered on, the mode selector is on STOP and the CPU 41x-2 PCI performs an automatic memory reset and remains in STOP mode (cold restart).
No	Yes	When the PC is powered off, the CPU 41x-2 PCI rescues the necessary data and goes to STOP mode in order to be ready for restart. RAM contents are retained. After the PC is powered on, the CPU 41x-2 PCI performs a warm restart/hot restart/cold restart or remains in STOP mode, depending on the parameter assignment and the mode selector setting.
Yes	Yes/No	The CPU 41x-2 PCI continues running in spite of Power On/Power Off of PC.

2.3.2 When are the Warm Restart and Autoload Features Available?

Autoload

If the CPU 41x-2 PCI is not connected to an external 24 VDC power supply, you can use the Autoload feature to load user data.

With the Autoload feature, the PC automatically retrieves a STEP 7 user program (stored in a file on the memory card) and loads the program onto the CPU 41x-2 PCI following a Power Off/Power On. Then, the CPU 41x-2 PCI automatically selects the previously stored operating mode and executes the STEP 7 user program accordingly.

The use of a backup battery, an independent 24 VDC supply, or a Flash Card precludes the use of the Autoload feature:

- If you are using a backup battery, the STEP 7 user program is retained after Power Off/Power On.
- If you connect the CPU 41x-2 PCI to an independent 24 VDC supply, the STEP 7 user program continues running or is retained after Power Off/Power On, depending on the error OB.
- If you are using a FLASH card, the STEP 7 user program is automatically loaded from the FLASH card after Power Off/Power On.

Independent 24 VDC power supply	Backup battery	Memory card	Warm restart possible after Power On of PC?	Autoload feature available?
No	No	RAM card/none	No	Yes
		FLASH card	No	No
No	Yes	RAM card/none	Yes	No
		FLASH card	Yes	No
Yes	No	RAM card/none	CPU continues to be supplied from external 24 VDC power supply!	No
		FLASH card	CPU continues to be supplied from external 24 VDC power supply!	No
Yes	Yes	RAM card/none	CPU continues to be supplied from external 24 VDC power supply!	No
		FLASH card	CPU continues to be supplied from external 24 VDC power supply!	No

Requirements for External Connection to 24 VDC

If you connect the CPU 41x-2 PCI externally to an independent 24 VDC power supply, all of the 24 VDC supplied must be generated as safety extra-low voltage (SELV).

The 24 VDC power supply must conform to LPS (Limited Power Source) or NEC Class 2. If the 24 VDC power supply does not conform to LPS or NEC Class 2, the CPU 41x-2 PCI must be operated in restricted access locations.

Warning

Personal injury and property damage can occur.

If you configure the 24 VDC supply for the CPU 41x-2 PCI incorrectly, components can be damaged and personal injury can result.

The 24 VDC supply must satisfy the following requirements:

Only extra-low voltage that is safely isolated from the supply system can be used. Safe isolation can be achieved, for example, by following the requirements in VDE 0100 Part 410 / HD 384-4-41 / IEC 364-4-41 (as functional extra-low voltage with safe isolation) or VDE 0805 / EN 60950 / IEC 60950 (as safety extra-low voltage) or VDE 0106 Part 101.

Cable for Connecting the 24 VDC to the CPU 41x-2 PCI

The cable must comply with the following boundary conditions:

- < 2 m: 0.5 mm^2 to 2.5 mm^2 cross section
- > 2 m: 0.75 mm^2 to 2.5 mm^2 cross section

Connecting the CPU 41x-2 PCI to an External 24 VDC Supply (Optional)

1. A 2-pin connector equipped with a screw terminal is shipped with the CPU 41x-2 PCI.

   Connect L+ to 24 VDC and M to ground (see slot bracket for marking).

2. Insert the 2-pin connector onto the slot bracket of the CPU 41x-2 PCI.

2.4 Installing and Connecting the Backup Battery

Use of a Backup Battery

You must use a backup battery:

- For backing up a user program that you want to store in a power failure-proof manner in RAM.
- If you want to use the automatic warm restart/hot restart for the CPU 41x-2 PCI.
- If you want to retentively store bit memory, timers, counters, time-of-day, system data, and data in variable data blocks after Power Off/Power On.

A lithium cell (AA size, 3.6 V) is used for the backup battery supply of the CPU 41x-2 PCI .

Note

The backup time of the supplied lithium cell is as follows:

- CPU 412-2 PCI:
  - Typical backup time: 2900 hrs = 120 days
  - Minimum backup time (worst case): 1110 hrs = 46 days
- CPU 416-2 PCI:
  - Typical backup time: 1610 hrs = 67 days
  - Minimum backup time (worst case): 740 hrs = 31 days

The typical backup time is empirically derived based on the backup current, while the minimum backup time represents the sum of the values specified by the manufactures of the memory chips.

Warning

Danger of personal injury and property damage, danger of release of harmful substances.

Incorrect handling can cause a lithium battery to explode, improper disposal of old lithium batteries can cause harmful substances to be released. Therefore, follow the instructions below without exception:

- Do not throw batteries in fire or apply solder to the outside of the battery (maximum temperature of 100 °C). Likewise, do not recharge the batteries. There is a risk of explosion!
- Do not open the battery. Always replace with a battery of the same type. Obtain replacement batteries from Siemens. This ensures that the battery will be short-circuit proof.
- Whenever possible, provide old batteries to battery manufacturers/recyclers or dispose of them as hazardous waste.

Affixing the Battery Holder

There are several options for affixing the backup battery to a battery holder on the PC:

- Mount battery holder in place of a free slot bracket on the PC
- Affix the battery holder to the PC housing
- **Box PC 627:** affix battery holder to the PC

Warning

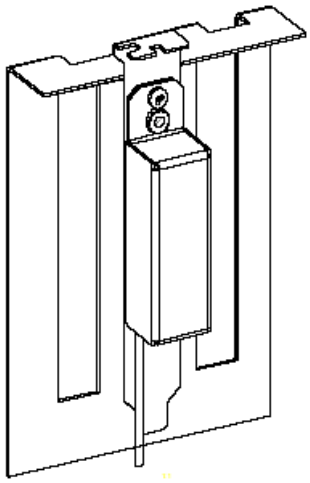
When opening the PC, always observe the relevant safety notes in the manual for the PC.

Warning

For safety reasons, the lithium battery may only be affixed in a location that is protected from mechanical damage.

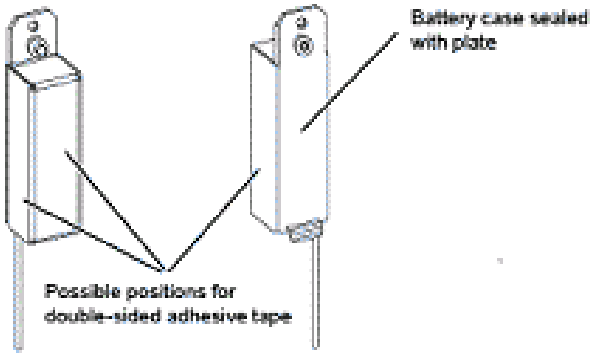
Battery Holder on the Slot Bracket

You can mount the backup battery with the provided battery holder (slot bracket with cover) in place of a free slot in the PC (see figure below).



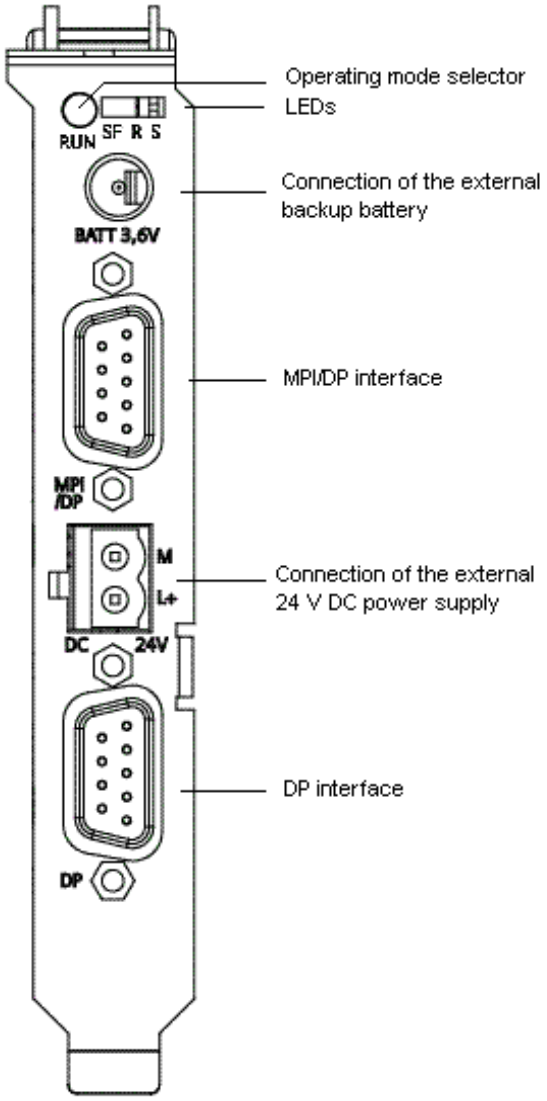
Battery Holder on PC Housing

You can also affix the backup battery directly to the PC housing. To do so, unscrew the battery housing from the slot bracket and reseal it with the bracket provided (see figure below). Affix the sealed battery housing to the PC housing using two-sided adhesive tape so that the connecting cable can still reach the CPU 41x-2 PCI.



Connection of External Backup Battery Infeed

Here, you can see the position of this interface on the slot bracket.



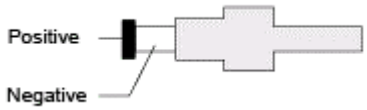
A lithium cell (AA size, 3.6 V) is used for the backup battery supply of the CPU 41x-2 PCI .

The WinAC Slot 41x package includes a battery pack with a suitable backup battery and a battery holder.

A 2-pin, 4.95 mm socket is provided on the slot bracket of the CPU 41x-2 PCI for infeed purposes. This socket is available for an SO connector without sliding sleeve per DIN 45323 for connection of external power sources for battery-fed devices.

However, the assignment does not correspond to DIN, i.e., the inner contact is the positive pole and the outer contact is the negative pole. As a result, a short circuit with the slot bracket of the CPU does not occur when the connector to the backup battery is removed/inserted.

Assigning the Connector



Contact	Assignment
Inner	Battery, positive
Outer	Battery, negative (M)

For more information on the backup battery, refer to Removing the Passivation Layer of the Backup Battery.

2.5 Connecting the Fan

If you connect the CPU 41x-2 PCI to an external 24 VDC supply, you should feed the fan connection through the CPU 41x-2 PCI to ensure that it is adequately cooled even in the event the PC power supply fails:

- If the PC supply voltage is switched on, the fan will operate, regulated by the PC. The fan rotation is regulated by the PC motherboard according to the temperature in the PC case (if the PC supports this mode).
- If the PC supply voltage fails or you switch off the PC, the CPU 41x-2 PCI will take over the fan operation to prevent overheating. In this case, the fan is always operated at maximum rotation.

Approved PC Fans

Only UL-/CSA-approved fans within the technical specifications are permitted.

Connection Options

There are three options for connecting the fan of the PC to the CPU 41x-2 PCI (X3, X4, or X5) - depending on the connector type. Together, the X3, X4 and X5 connections provide a maximum of 500 mA at 12 V. The current for the fan is supplied from the PC motherboard or, if the PC is switched off, from the optional external 24 VDC supply.

The X2 to X5 terminals are located on the smaller of the two printed circuit boards. The terminals have the following meaning:

Terminal	Meaning
X2	Terminal for connection to the motherboard or power supply
X3	Terminal for 3-pin or 4-pin connector from fan. Both types can be inserted.
X4	Terminal for 2-pin connector from fan (depending on the connector type)
X5	Terminal for 2-pin connector from fan (depending on the connector type)

1. Remove the connector that is connected to the fan in the PC or is connected from the motherboard or power supply and connect it to X3, X4, or X5, depending on the connector type.
2. Three fan cables are shipped with the product. Select the appropriate cable and insert it onto the terminal on the motherboard or power supply that has been made available.

   Use the 4-pin cable if the connection to the motherboard or the power supply is a 3-pin connection.
3. Insert the other end of the cable onto X2 on the PC board of the CPU 41x-2 PCI.

Now, the PC fan will be operated by the CPU 41x-2 PCI, even if the PC is switched off.

Connecting the Fan in Multi-Slot Operation

If you are operating more than one CPU 41x-2 PCI, connect the fan to one of the CPUs 41x-2 PCI.

Warning

The CPU 41x-2 PCI, on which the fan is used always has to be connected to the external 24 VDC power supply.

2.6 Checks Before the Initial Turn-On of the PC with the CPU 41x-2 PCI

Introduction

After you have installed and wired your CPU 41x-2 PCI, we recommend that you check the steps you have performed thus far before you turn on the PC for the first time.

Checks Prior to Initial Turn-On

Checklist
Is the CPU 41x-2 PCI properly inserted and screwed?
Is a memory card inserted?
Is the PC fan connected to the CPU 41x-2 PCI (optional)?
Is the connector for the external 24 VDC supply (USP) infeed, if present, properly wired?
Is the backup battery, if any, connected?
Is the battery monitoring switch setting correct?

Initial Turn-On of PCs with the CPU 41x-2 PCI

When you turn on the PC in which the CPU 41x-2 PCI is installed for the first time, the CPU automatically detects the PCI voltage.

When shipped, the PCI voltage of the CPU 41x-2 PCI is set to 5 V. If a different PCI voltage is used in the PC, the CPU 41x-2 PCI will briefly switch back to STOP mode in many instances when turned on the **first** time.

2.7 Installation of WinAC Slot 41x Software

2.7.1 Installing the WinAC Slot 41x Software

Die WinAC Slot 41x software has a setup program for the CPU 412-2 PCI or CPU 416-2 PCI. This setup program also installs the controller panel and WinAC Time Synchronization software components.

System Requirements

When installing the components of WinAC Slot 41x, you should observe the notes under System Requirements.

Requirements

Before you can install a software package, you must log on with Administrator rights. Otherwise, the Setup will be canceled.

If an Older Version of WinAC Slot is Already Installed

Prior to installation, you must always uninstall any older versions of WinAC Slot. For instructions on how to do this, refer to Uninstalling the WinAC Slot 41x Software.

Installation Sequence

If you are installing software packages individually, we recommend the following sequence:

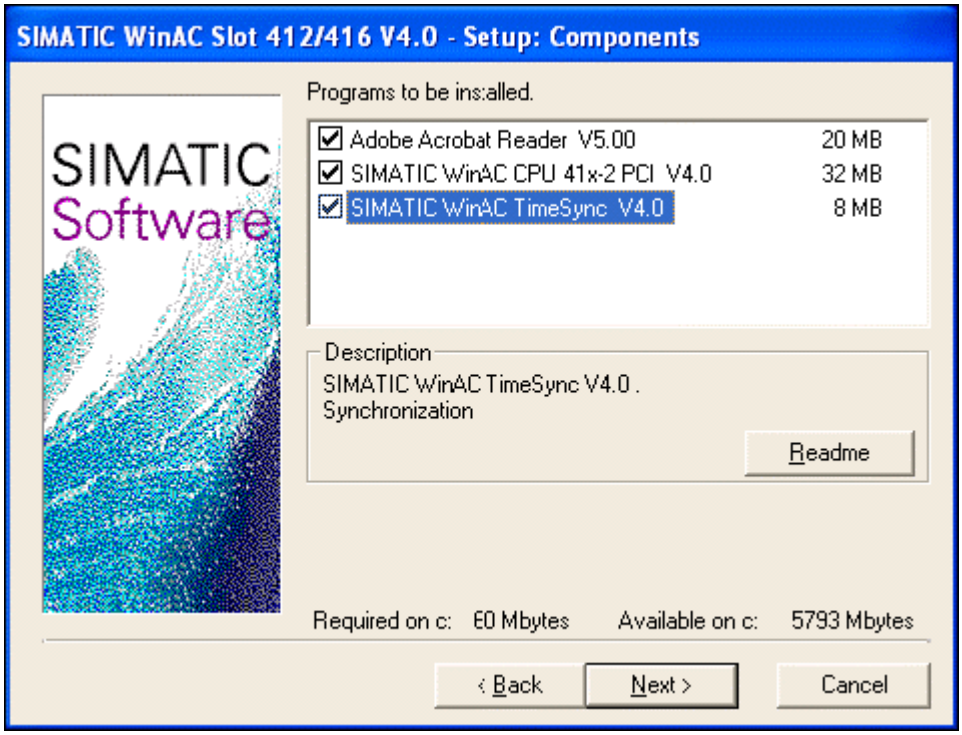
1. Install the following components using the general setup
   - SIMATIC WinAC CPU 41x-2 PCI (minimum)
   - WinAC Time Synchronization, if you want to synchronize the CPU 41x-2 PCI using a SIMATIC CP or the PC clock.
2. If necessary, STEP 7 or the hardware update of WinAC Slot for STEP 7
3. If necessary, the SIMATIC Net CD for network components
4. If necessary, WinCC or WinCC flexible

Installing the Components of WinAC Slot 41x

The WinAC Slot 41x software includes a setup program that automatically performs the installation.

The installation program leads you step by step through the installation operation. You can advance to the next step or return to the previous step at any time. Proceed as follows to access the installation program.

1. Place the CD in the CD drive.
2. Select the Setup.exe file by double-clicking it.
3. Follow the instructions that appear on the next screen.



4. Select the components to be installed. The setup automatically selects the components that were not found on the PC.

   If the installation was completed successfully, a corresponding message is displayed on the screen.

5. Install the hardware update for the CPU 41x-2 PCI in the STEP 7 Hardware Configuration application by selecting Options > Install hardware updates....

Note

If you want to use the SIMATIC NET OPC Server, you must install the provided SIMATIC NET CD.

Installation of Several WinAC Controllers (Ring Feature)

During installation, the WinAC Slot software automatically detects how many WinAC Slot CPUs are installed. The WinAC controllers are automatically entered in the Station Configuration Editor.

The Ring feature allows you to assign the controller panel of the CPU 41x-2 PCI:

1. In the Windows taskbar, double-click the  symbol in order to access the Station Configuration Editor.
2. Select the CPU 41x-2 PCI in the Station Configuration Editor.
3. Select the Ring ON button or select the Ring ON command from the shortcut menu (right-click).

   Result: The SF-LED on the CPU 41x-2 PCI on the back of your computer and the FRCE-LED in the controller panel flash at 2 Hz.
4. Select the Ring OFF button to terminate the "Ring" feature.

Errors during Installation

The following errors cause the installation to abort:

- **Not enough memory space:** you need at least 120 MB of free memory space on your hard drive.
- **Defective CD:** if you determine that the CD is defective, contact your Siemens representative.
- **No Administrator rights:** Log on with Administrator rights.

2.7.2 Uninstalling the WinAC Slot 41x Software

Note the following items before you start to uninstall the software:

- The corresponding software components must not be in use when the software is uninstalled.

Uninstalling the WinAC Slot 41x Software Components

To uninstall the WinAC Slot 41x software on your computer, proceed as follows:

1. Double-click the "Software" icon in Control Panel.
2. Select one of the WinAC Slot 41x components to be uninstalled from the list of installed software. Click the Change/Remove button to uninstall the software.
3. If the Remove Shared Files dialog appears, click No if you are unsure how to respond.
4. Restart your PC. This removes the remainder of the files from the hard disk of your PC.

Note
Refer to the Readme files for the relevant software components.

3 Getting Started

3.1 Definition of Terms

3.1.1 What Is a PC Station?

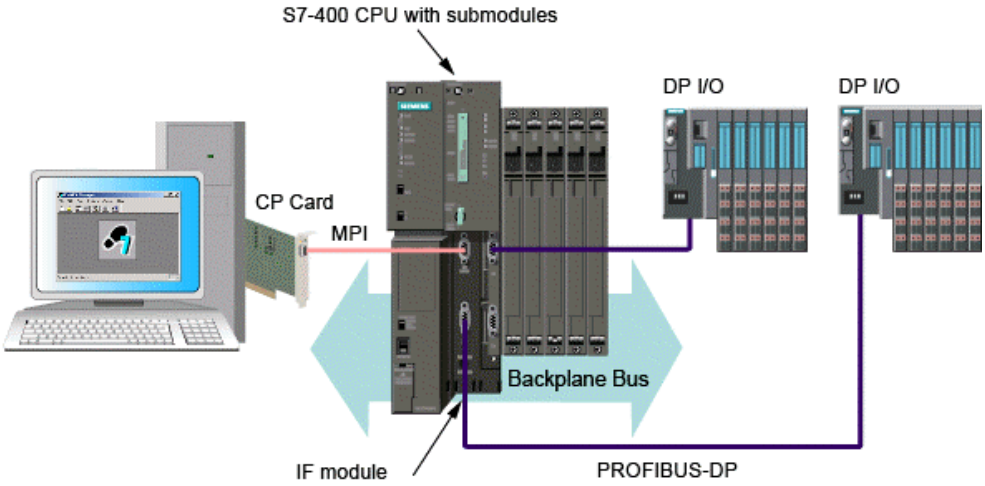
The PC station is a software-based virtual rack represented in the Station Configuration Editor that is used for creating a PC-based automation system. Like a hardware rack of an S7 CPU-based automation system, it contains space for several modules required for the PC-based automation system.

When you install the WinAC Slot software, the controller appears by default in the third slot (index) of this virtual rack in the Station Configuration Editor. The PC Station is also represented in the STEP 7 Hardware Configuration editor.

3.1.1.1 Communication Model with S7-400

A PC-based controller is similar to an S7-400 hardware controller. The S7-400 controller consists of modules in a rack that communicate over the backplane bus of the rack. Communications for an S7-400 are defined as follows:

- STEP 7 communicates with the controller (in this example, an S7-400 CPU module) over an MPI subnet, using a CP card that is installed in the computer.
- The controller communicates with expansion modules over the backplane bus of the rack.
- The S7-400 CPU communicates with distributed I/O over a PROFIBUS DP subnet using a built-in submodule interface or an IF module.

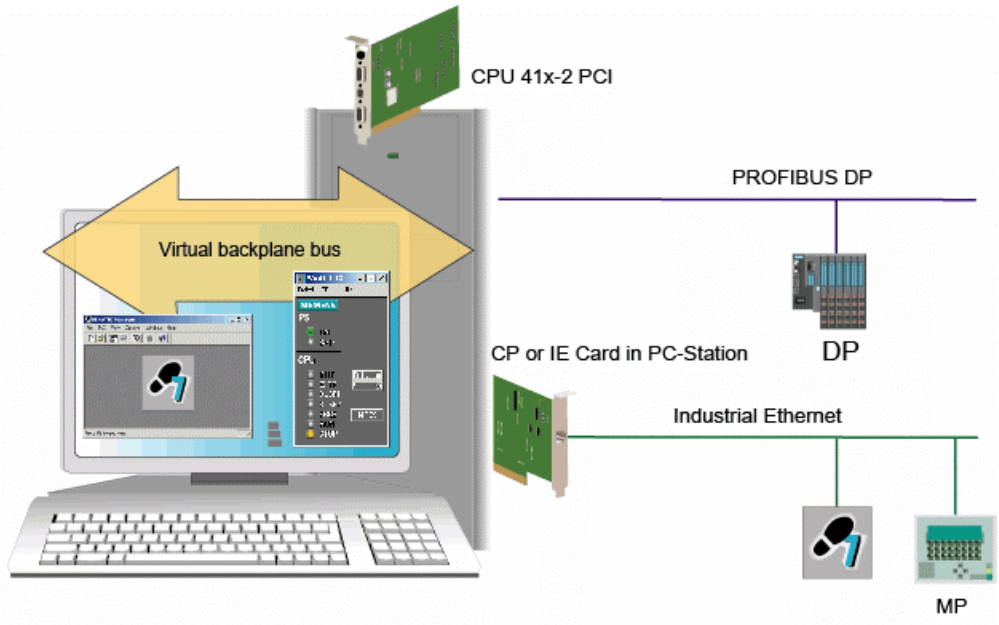


In an S7-400 station, the following types of communications are possible:

Onboard Interfaces	CP Modules used over Backplane Bus
Operation of PROFIBUS DP/IO Supported interfaces: • MPI • PROFIBUS	Operation of central I/O Supported communication processors: • PROFIBUS • Industrial Ethernet

3.1.1.2 Communication Model with PC Station and PC-based Controller

WinAC Slot and any other communications interfaces that are installed in the computer communicate over the virtual backplane bus. WinAC Slot communicates with the DP I/O through the DP interface or the MPI/DP interface.



3.1.1.3 Configuration for a PC-based Controller

You use the Station Configuration editor to configure components of the PC Station.

In the same way that you use STEP 7 to create the system and program blocks for an S7-400, you use the STEP 7 Hardware Configuration tool to configure the components that you installed in the PC station.

After you complete hardware configuration in STEP 7 you can download your STEP 7 user program to the controller.

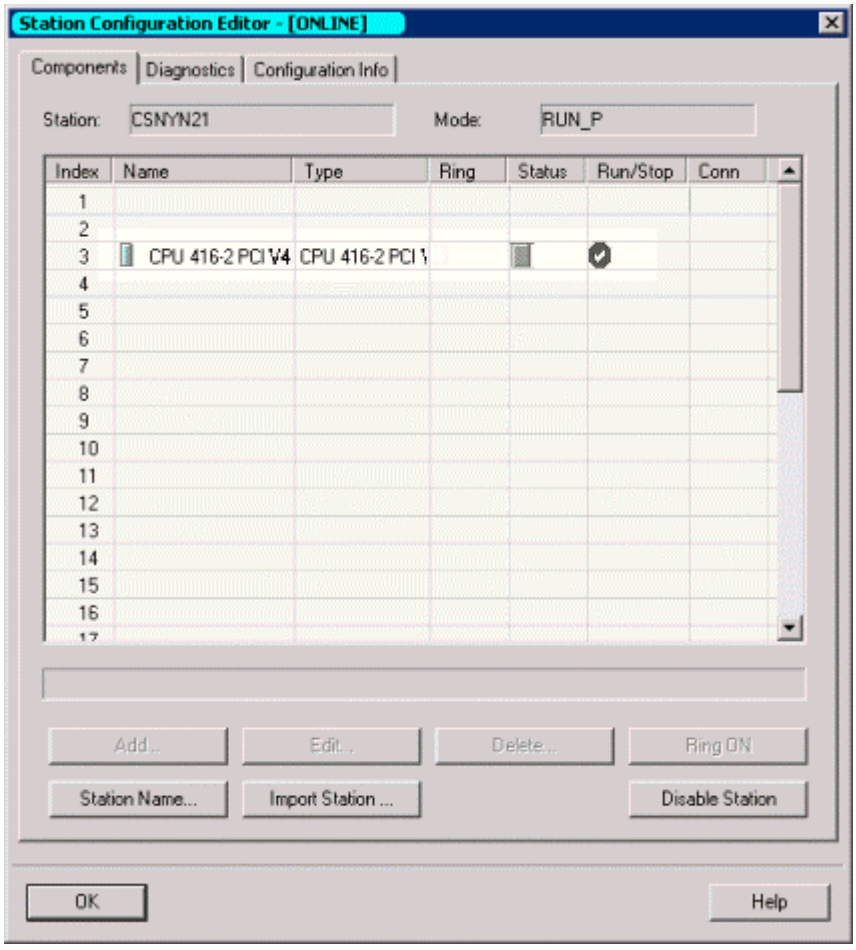
3.1.2 What Is an Index?

An index is a numbered slot in the virtual rack of the PC station. The PC-based controller occupies one index. The PC station contains other slots for the SIMATIC components of a PC-based controller, such as those listed below:

- CP card(s) (requires installation of SIMATIC NET)
- SIMATIC HMI
- SIMATIC NET OPC Server (requires installation of SIMATIC NET)
- WinLC RTX
- WinLC Basis

Each slot in the PC station corresponds to a number or index. When you install a CPU 41x-2 PCI, the setup program configures the controller in the third index slot by default. The Station Configuration Editor shows the configuration of your PC station.

The index number for the CPU 41x-2 PCI must be between 2 and 18. However, the index number in the Station Configuration Editor must be the same as the slot number in the STEP 7 Hardware Configuration tool for the same component.



3.2 Configuring the Controller in STEP 7

3.2.1 Hardware Configuration in STEP 7

You configure the STEP 7 project for a PC station with a PC-based controller in STEP 7 as you would for any S7 hardware controller. Refer to the STEP 7 help system and documentation for detailed information.

3.2.1.1 Creating the Project and PC Station with the SIMATIC Manager

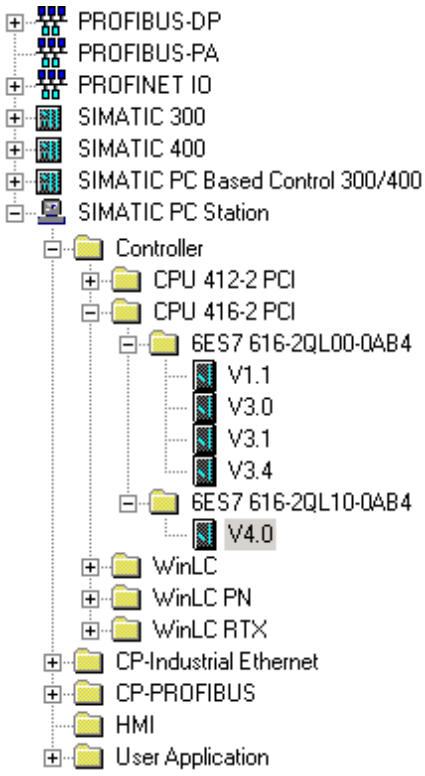
To create the project and PC station, follow these steps:

1. Select the **File > New** menu command from the SIMATIC Manager to create a new project.
2. Select the **Insert > Station > SIMATIC PC Station** menu command to insert a PC station into the project.
3. Change the name of the PC station to match the name of the PC station defined in the Station Configuration Editor on the computer where the CPU 41x-2 PCI resides. To verify the station name, open the Station Configuration Editor and click the Station Name button.

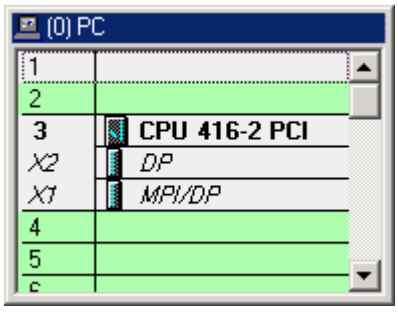
3.2.1.2 Configuring the PC Station Hardware with the STEP 7 Hardware Configuration Application

To configure the PC-based controller and DP I/O for the PC Station, follow these steps:

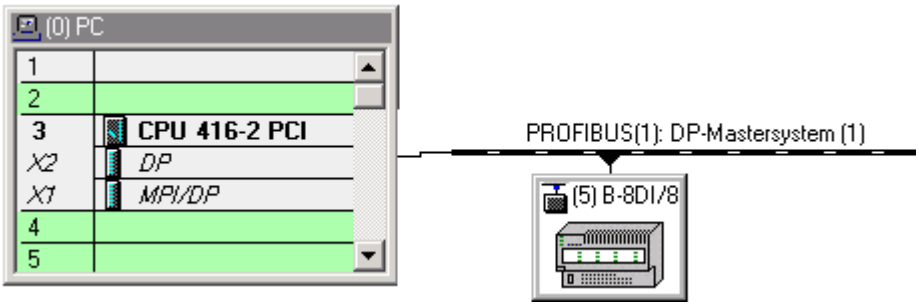
1. Open the PC Station folder in the project and double-click the Configuration icon to invoke the STEP 7 Hardware Configuration application.
2. Navigate to your specific controller under SIMATIC PC Station.



3. Drag the controller into the same index it occupies in the Station Configuration Editor on the target computer.



4. Verify that the name of the controller matches the name of the controller configured in the Station Configuration Editor.
5. Configure the distributed I/O.



3.2.1.3 Additional Hardware Configuration Options

The following tasks are optional, depending on your specific application:

1. Insert any additional CPs needed for your application into the PC station.
2. Insert any HMI devices, for example, text displays or operator panels.
3. Configure the CPU 41x-2 PCI for peer-to-peer communications:
   - Select the controller name in the SIMATIC Manager.
   - Double-click the Connections icon in the right-hand pane.
   - Use NetPro to describe the network.

After you have configured the CPU 41x-2 PCI you can use SIMATIC Manager to develop and to download your STEP 7 user program.

3.2.2 Connecting STEP 7 to the Controller

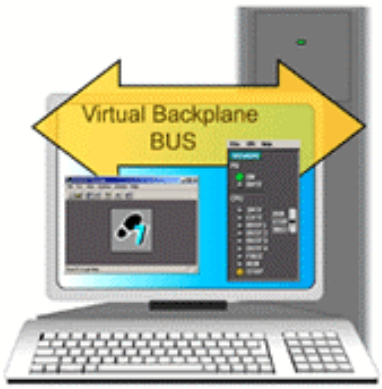
You must establish a connection from STEP 7 to the controller to download the configuration and blocks of the STEP 7 user program. This type of communication is called PG/OP communication. The controller can connect to STEP 7 in any of the following ways:

- Through the virtual backplane bus to STEP 7 on the same computer as the controller
- Through the MPI/DP interface to a CP on the computer with STEP 7
- Through the DP interface to a CP on the computer with STEP 7
- Through an Industrial Ethernet card configured in the PC Station of the computer with WinAC Slot to an Industrial Ethernet card on the computer with STEP 7

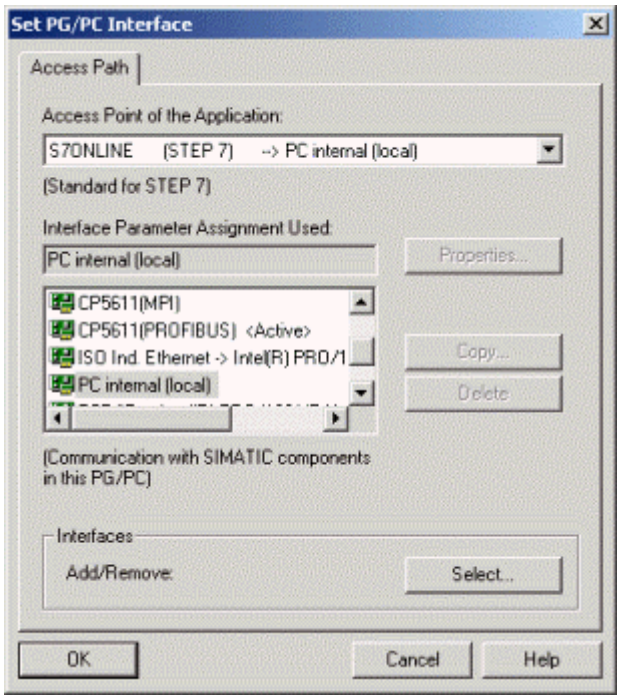
Note: Configuring a communications interface in the PC Station requires the installation of SIMATIC NET, an additional software package.

3.2.2.1 Connecting STEP 7 to the Controller on the Same Computer

On the same computer, STEP 7 and the controller communicate across the virtual backplane bus:

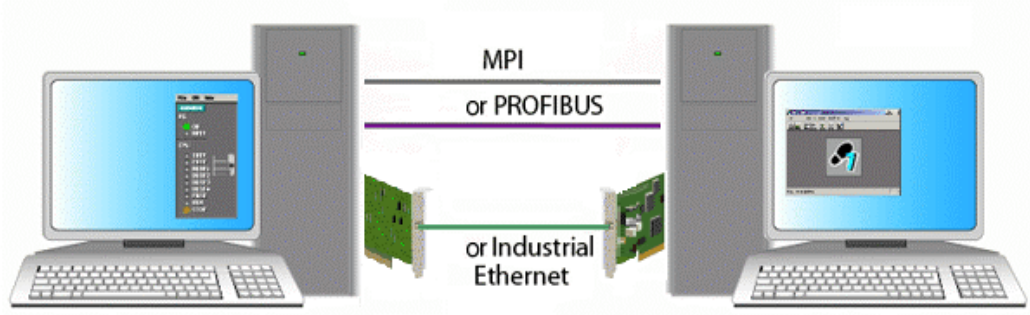


To configure communications between the controller and STEP 7 on the same computer, use the PC internal access point:

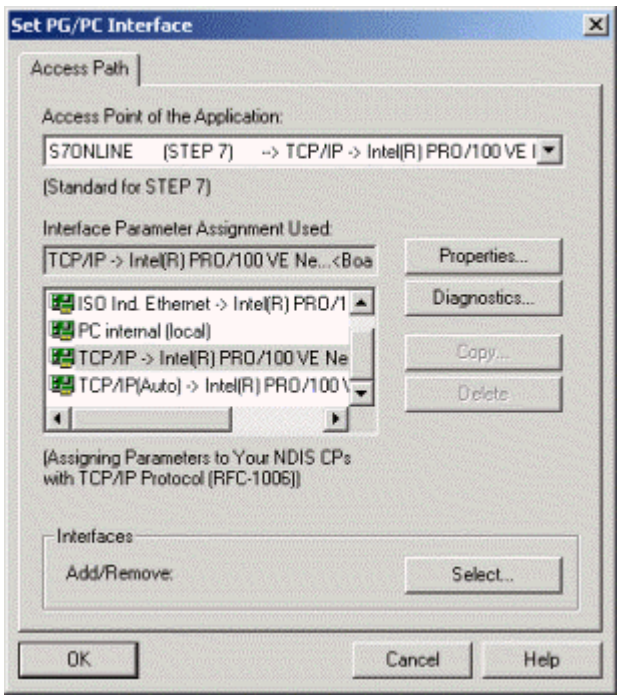


3.2.2.2 Connecting STEP 7 to the Controller on a Different Computer

WinAC Slot connects to STEP 7 on a different computer from either the MPI/DP interface or the DP interface of the CPU 41x-2 PCI to a communications interface on the other computer. WinAC Slot can also communicate to STEP 7 on a different computer through a communications interface configured in the PC Station. To configure a communications interface in the PC Station requires SIMATIC NET to be installed on your computer.



To configure communications between the controller and STEP 7 on a different computer or programming device, set the PG/PC interface to the access point for the specific communications interface and the type of communications, for example, an Industrial Ethernet card using the TCP/IP protocol:



3.2.2.3 Connecting STEP 7 to a Networked Controller on a Different PC within the STEP 7 Project

If you want to use STEP 7 to access a different controller in the same project, enter "PC internal" as the interface.

With the PC internal interface, STEP 7 communicates to all controllers (S7 CPUs or PC-based controllers) that have been configured with NetPro in PC Stations in the STEP 7 project.

3.3 Using the Station Configuration Editor to Configure PC Components within the PC

Function of the Station Configuration Editor

The Station Configuration Editor allows you to communicate the following settings to the PC:

- Station name, maximum of 24 characters
- Type of WinAC controller

Note

The settings in the Station Configuration Editor must agree with the subsequent configuration made in the STEP 7 Hardware Configuration application:

- Station name
- Type
- Index (corresponds to the slot in "Hardware Config")

Index

The CPU 41x-2 PCI can be operated on an index from 2 to 18. The index corresponds to a virtual slot in the PC.

Name of the WinAC Controller

You can select any name for the controller in STEP 7 (default: CPU 41x-2 PCI). Only characters that can be used in file names are permitted. Leading blanks are not permitted.

Note

The name assigned to the controller in STEP 7 corresponds to the name that you use to access the controller panel of the PCU via the taskbar. For example, if you name the CPU 41x-2 PCI "Slot_PLC", you then access the controller panel via Start > Simatic > PC Based Control > Slot_PLC.

Opening the Station Configuration Editor

To assign the name to the PC station, open the Station Configuration Editor by clicking the  symbol in the toolbar.

Information on the Station Configuration Editor

For more information, e.g., on diagnostics in the Station Configuration Editor, refer to the relevant online help.

3.4 Commissioning

3.4.1 Recommended Procedure for Commissioning

Commissioning a PC with CPU 41x-2 PCI

To commission a PC with a CPU 41x-2, we recommend the following procedure:

1. Check again to make sure that the CPU 41x-2 PCI has been properly installed and parameterized (see checklist in Checks Before Initial Turn-On of the PC with CPU 41x-2 PCI) and that the WinAC Slot software package has been properly installed.
2. Disconnect any DP line that is connected.
3. Turn on the PC.
4. Access the controller panel:
   Start > Simatic > PC Based Control > CPU 412-2 PCI V4or
   Start > Simatic > PC Based Control > CPU 416-2 PCI V4

   Note
   It is assumed in the following that you have saved the CPU 41x-2 PCI in the Station Configuration Editor under the name "CPU 412-2 PCI" or "CPU 416-2 PCI".

5. The following LEDs light up on the controller panel:
   - Green ON display
   - Yellow STOP display

   Check the backup battery and the position of the DIP Switch S1 on Switch Block S2 for suppression of battery monitoring if the red BATF display is lit as well.

   More up-to-date information about the controller panel, when available, is provided in the Readme file. You can access this Readme file in the following directory:

   Start > Simatic > Product Info > English

6. Activate the RUN button on the controller panel.
   The STOP LED display goes out and the RUN LED display lights up. The CPU is now in RUN mode.
7. Activate the STOP button on the controller panel.

   The RUN LED display goes out and the STOP LED display lights up. The CPU is now in STOP mode.
8. If you want to test the internal supply through the PCI, you can remove the external power supply and check whether the CPU 41x-2 PCI continues to operate.
9. Connect the CPU 41x-2 PCI step-by-step to the remaining components.

4 Operating the Controller - CPU 41x-2 PCI

4.1 Turning On and Turning Off the Controller

The controller operates independently from the controller panel:

- Closing the panel (**File > Exit** menu command) does **not** turn off the controller.
- Turning off the controller does **not** close the controller panel.

The Autoload feature affects the behavior of the controller when it is turned off and on.

4.1.1 Powering On the CPU 41x-2 PCI

If the controller panel is not open, select the **Start > Simatic > PC Based Control** menu command. Then select **CPU 412-2 PCI**, **CPU 416-2 PCI** or the name of the WinAC Slot PLC as configured in the Station Configuration Editor.

When you power on the CPU 41x-2 PCI by selecting **CPU > Power ON**, it performs powerup initialization and goes to either STOP or RUN mode, depending on the previous setting, the mode selector switch position, and the setting in the Autoload option, if configured.

When you power on the CPU 41x-2 PCI, it performs powerup initializations and goes to either STOP or RUN mode, depending on the previous setting, the mode selector switch position, and the setting in the Autoload option, if configured.

Note: The **CPU > Power ON** menu command enables the functionality of the CPU 41x-2 PCI. The CPU 41x-2 PCI is already being supplied with working voltage by the power supply unit on the PC as well as from an external 24 VDC voltage supply.

4.1.2 Turning Off the CPU 41x-2 PCI

Select the **CPU > Power Off** menu command to turn off the CPU 41x-2 PCI. This action does not close the controller panel. This command is only available from the controller panel when the controller is operating. After you turn off the controller, you can still change customization options.

4.2 Restart Options for the Controller

4.2.1 Selecting the Restart Method

The restart method determines which startup OB the controller executes whenever a change from STOP mode to RUN mode occurs. The startup OB allows you to initialize your STEP 7 user program and variables. The CPU 41x-2 PCI supportsthree restart methods:

- **Warm restart:** The controller executes OB 100 before starting the free cycle (OB 1). A warm restart resets the peripheral inputs (PII) and places the peripheral outputs (POI) into a pre-defined safe state (default is 0). A warm restart also saves the current value of the retentive memory areas for bit memory (M), timers (T), counters (C), and data blocks (DBs).
- **Hot restart:** All data areas (timers, counters, bit memory, data blocks) and their contents are retained. The controller executes OB 101, reads in the process input image, and then continues processing the user program at the position where it was last stopped. A manual hot restart is only possible with STEP 7.
  Requirement You must enable the hot restart beforehand in STEP 7/HW Config.
- **Cold restart:** The controller executes OB 102 before starting the free cycle (OB 1). Like a warm restart, a cold restart resets the peripheral inputs (PII) and changes the peripheral outputs (POI) to a pre-defined safe state (default is 0). A cold restart resets the retentive memory (M, T, and C) to their default values (DB).

You specify the restart method to be performed automatically after Power Off/Power On in STEP 7. The automatic restart method is stored in the configuration (system data) for the controller that you download with your STEP 7 user program.

Whenever you click (using the left mouse button) the RUN mode selector position on the panel to change from STOP mode to RUN mode, the CPU 41x-2 PCI performs a warm restart, executing OB 100.

To select a specific restart method, choose one of the following options to change the controller from STOP mode to RUN mode:

- Select the **CPU > RUN** menu command to change the controller from STOP to RUN mode.
- Right-click (using the right mouse button) the RUN mode selector switch position.

Both of these actions display the Restart Method dialog that allows you to select either a warm or cold restart.

Note

If you have configured the confirmation security option, you must acknowledge a confirmation dialog before the controller panel displays the Restart Method dialog.

If you have configured a password as the security option and the password prompt interval is either 0 or has expired, the controller panel displays the Access Verification dialog for you to enter the password. After verifying successful password entry, the controller panel displays the Restart Method dialog.

After executing OB 100 (warm restart) or OB 102 (cold restart) according to your selection, the controller executes the free cycle (OB 1).

4.2.2 Setting the Autoload Feature

You use the "Autoload" feature of WinAC Slot 41x to define how WinAC Slot 41x reacts to a Power Up of the PC. This feature is particularly useful during the commissioning phase of the automation system, or in unbuffered operation of the CPU 41x-2 PCI. The Autoload feature enables you to configure the controller to perform the following actions upon restart:

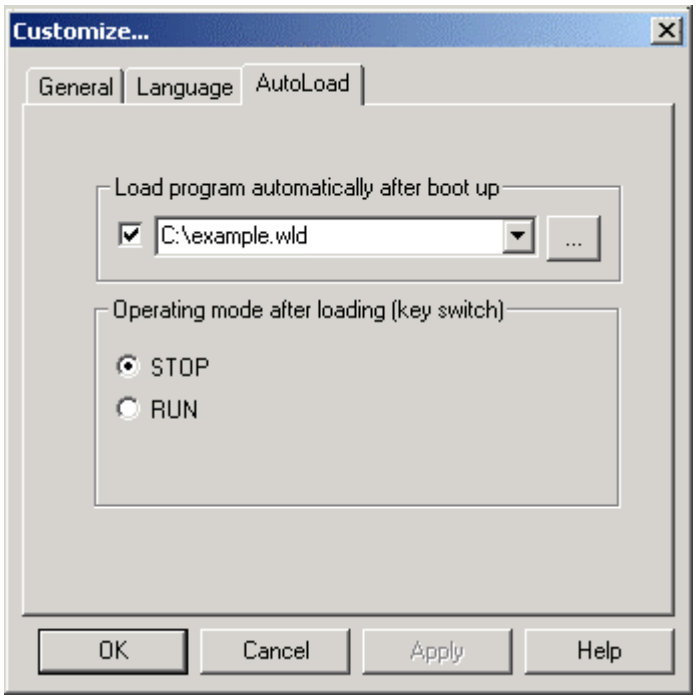
- Load a STEP 7 user program that was previously archived
- Set the operating mode to a defined state after loading the STEP 7 user program

The topic Archiving and Restoring STEP 7 User Programs describes how to archive a STEP 7 user program that can be configured as the autoload program.

To use the Autoload feature, your system must meet these requirements:

- No FLASH card is plugged into the CPU 41x-2 PCI
- The CPU 41x-2 PCI is operated without a backup battery
- An external, independent 24 VDC supply is not connected
- An archive file (.wld file) exists

The Autoload dialog is displayed.



Use the following procedure to enable the Autoload feature:

1. Select the **CPU > Options > Customize** menu command to display the Customize dialog.
2. In the Customize dialog, select the Autoload tab.
3. Select an archive file (.wld file) to load on restart.
4. Select the operating mode to set for the controller on restart.
5. Click OK to confirm your configuration. This closes the dialog.

4.2.3 Enabling a Warm Restart after Power On

You can specify that the CPU 41x-2 PCI perform a warm restart after power on. When a warm restart is performed, the controller executes OB 100 and starts the user program from the beginning.

Retentive data and the contents of data blocks are retained.

For the controller to execute a warm restart, the following conditions must be met:

- The CPU 41x-2 PCI has a backup battery.
- Warm restart is configured in the Object Properties for the CPU 41x-2 PCI in STEP 7.

4.2.4 Enabling a Hot Restart after Power On

You can specify that the CPU 41x-2 PCI is to perform a hot restart after Power On. When a hot restart is performed, the controller executes OB 101 and reads the process input image and then continues processing the user program at the location where it was last stopped (due to STOP or Power Off).

Retentive data and the contents of data blocks are retained.

For the controller to execute a hot restart, the following conditions must be met:

- The CPU 41x-2 PCI has a backup battery.
- "Hot restart" is configured in the object properties for the CPU 41x-2 PCI in STEP 7.

4.3 Changing the Operating Mode of the Controller

The controller panel provides a mode selector switch that allows you to change the operating mode of the controller. Set the mode selector switch to RUN or STOP (or select the appropriate command on the **CPU** menu) to change the operating mode of the controller either to RUN mode or STOP mode.

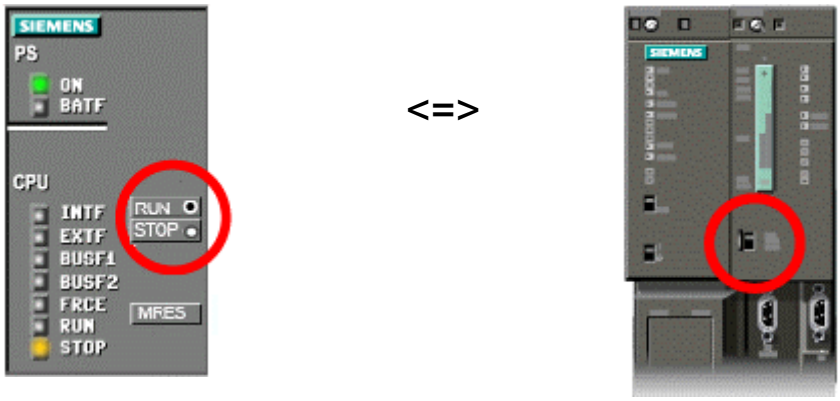
The mode selector switch positions on the controller panel correspond to the mode selector switch positions of an S7 hardware controller:

- RUN: The controller executes the STEP 7 user program.
- STOP: The controller does not execute the STEP 7 user program. Outputs are set to their safe states.

Specific controller actions are allowed or prohibited based on the operating mode.

4.3.1 Operating Mode (RUN/STOP) and Status Indicators

The mode selector switch on the controller panel functions like the manual mode selector switch on a S7 hardware controller allowing you to switch between RUN mode and STOP mode.



For both hardware controllers and PC-based controllers, the RUN and STOP status indicators show the current operating mode of the controller. If the status indicator shows a different operating mode than the mode selector switch position, the controller has changed operating mode, possibly due to some error in the program or because you used STEP 7 to change the operating mode.

4.3.2 Allowed and Prohibited Actions for each Operating Mode

The operating mode allows or prohibits access to the controller for some types of operations as shown in the following table:

Operating Mode	Description
RUN	Allowed: • Downloading a program to the controller • Downloading individual blocks to the controller • Using STEP 7 to modify program variables • Performing a memory reset from either the controller panel or STEP 7 • Changing the operating mode with STEP 7 The controller automatically goes to STOP mode when you reset the memory using STEP 7. Not allowed: • Archiving and restoring a STEP 7 user program
STOP	Allowed: • Downloading a program or individual blocks to the controller • Using STEP 7 to modify program variables • Performing a memory reset from either the controller panel or STEP 7 • Archiving and restoring a STEP 7 user program Not allowed: • Changing the operating mode with STEP 7 (if mode selector switch on STOP)

4.4 Resetting the Memory Area : MRES Command (CPU Menu)

MRES performs a memory reset of the controller by resetting the controller to its initial (default) state. A memory reset deletes the STEP 7 user program and the system data (configuration) and also disconnects any online communications, for example, STEP 7, WinCC, WinCC flexible, PROFIBUS, or S7 communications.

You typically perform an MRES before downloading a new program to the controller. You **must** perform a memory reset if the STOP indicator on the controller panel is flashing slowly. This can occur when:

- CPU 41x-2 PCI has been inserted or moved in the Station Configuration Editor.
- Memory card has been removed and inserted.

Use one of the following methods to reset the memory:

- Click the MRES button on the control panel
- Select the **CPU > MRES** menu command
- Press the ALT+C+M keys

You can also use STEP 7 to perform a memory reset.

MRES switches the controller to STOP mode, if necessary, and then performs the following tasks:

- Deletes the entire STEP 7 user program (OBs, DBs, FCs, FBs, and the system data) from both the work memory area and the load memory area
- The content of the memory areas (I, Q, M, T, and C) is reset to 0 (except for time of day).
- System settings are reset to their default values (e.g., size of process image areas and size of diagnostic buffer).
- Deletes all active communications jobs (for example, TIS) and all open communications
- If a FLASH card is not inserted, the reset controller has a memory utilization of "0". The utilization can be read out with STEP 7.
  If a FLASH card is inserted, the controller copies the user program and the system parameters stored on the FLASH card onto the work memory area when the memory reset is complete.

After MRES, the 120 most recent diagnostic buffer entries are retained.

The STOP indicator flashes while the memory reset is in progress. After the memory has been reset, the diagnostics buffer is resized to its default size. Input (I) and output (Q) memory areas are also reset to their default sizes. After a memory reset, you must reconfigure these values to your own specifications.

4.5 Using the Status Indicators

The status indicators on the control panel display the current operating mode and are helpful in troubleshooting an error condition. These indicators correspond to the LED indicators on a hardware S7 PLC.

You cannot change the status of the controller by clicking the status indicators.

If the control program reaches a break point set by the STEP 7 Program Editor, both the RUN and STOP indicators turn on while the breakpoint is active: the RUN indicator flashes, and the STOP indicator is on.

During a change from STOP mode to RUN mode, the RUN indicator flashes, and the STOP indicator is on. When the STOP indicator turns off, the outputs are enabled.

The table below describes the different status indicators for the control panel:

Indicator	Description
ON	Power supply. Lights up (solid) when you start the controller. Turns off when you power off the controller.
BATF	Battery fault.
INTF	This indicator lights up (solid) to show error conditions within the controller, such as programming errors, arithmetic errors, timer errors, and counter errors. If the STEP 7 user program handles the error by executing OB 80 or OB 121, the INTF indicator goes off after 3 seconds if there is no subsequent error condition.
EXTF	This indicator lights up (solid) to show error conditions that exist outside of the controller, such as hardware faults, parameter assignment errors, loss of communication or other communication errors, and I/O faults. If the STEP 7 user program handles the error by executing OB 122, the EXTF indicator goes off after 3 seconds if there is no subsequent error condition.
BUSF1 BUSF2	These indicators light up (flashing) to identify fault conditions in the communication with the distributed I/O. BUSF1 corresponds to the MPI/DP communications interface and BUSF2 corresponds to DP.
FRCE	This indicator lights up (steady), if variables are being forced. A force job as configured in STEP 7 enables you to force variables of your choice to values that you specify.
RUN STOP	Lights up (solid) to show the operating mode (RUN or STOP). When RUN is flashing and STOP is lit (solid), the control program has reached a breakpoint. (RUN light flashes at 0.5 Hz.) **Note:** The RUN and STOP indicators show the actual operating mode of the controller. The RUN and STOP mode selector switch positions show the selected mode (similar to the mode selector switch position on an S7 CPU front panel), which can differ from the current operating mode. For example: Changing the operating mode with STEP 7 causes the status indicators to change, but the mode selector switch does not change.

Flashing Indicators

Flashing patterns of the RUN and STOP indicators provide additional information about the controller or the STEP 7 user program:

Indicator		Description
RUN	STOP	
flashing 2 Hz	flashing 2 Hz	The controller is in DEFECT mode. All status indicators are flashing (see Corrective Action if All Status Indicators are Flashing).
flashing 0.5 Hz	on	The STEP 7 user program halted at a breakpoint.
flashing 2 Hz	on	A warm restart or hot restart is in progress. The RUN indicator continues to flash until the restart completes. The time required for the restart operation depends on the time required to execute the startup OB.
off	flashing 0.5 Hz	The controller must be reset (MRES, see Corrective Action if the STOP Indicator is Flashing Slowly).
off	flashing 2 Hz	A memory reset (MRES) is being performed, see Corrective Action if the STOP Indicator is Flashing Slowly.

4.5.1 Corrective Action if the STOP Indicator is Flashing Slowly

If the STOP indicator flashes slowly, the controller requires a memory reset (MRES). To recover from this condition, you must use the MRES command to reset the controller.

4.5.2 Corrective Action if All Status Indicators are Flashing

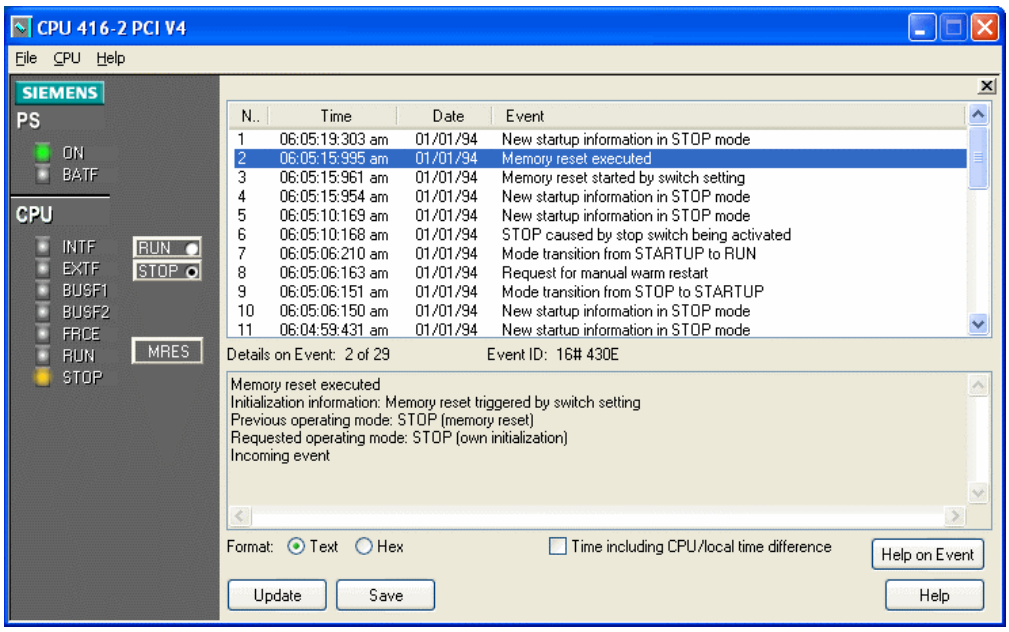
If all of the status indicators are flashing at the same time, the controller is in a defective state and has encountered an error condition that cannot be fixed by resetting the memory with the MRES command. To recover from this condition, you must perform the following steps:

1. Power off the controller.
2. Power on the controller. The STOP indicator flashes with the RUN indicator off.
3. Use the MRES command to reset the memory.
4. Use STEP 7 to download the control program and system configuration, or to restore an archived control program.
5. If either powering off or restarting the controller does not resolve the problem, you may need to reboot your computer.

4.6 Diagnostic Buffer Command (CPU Menu)

Select the **CPU > Diagnostic Buffer** menu command to display the SIMATIC Diagnostic Buffer.

The diagnostic buffer allows you to view system diagnostic information without having to access STEP 7. It consists of an upper panel that displays an event list and a lower panel that displays specific event details.



The diagnostic buffer is implemented as a ring buffer that contains single event entries. The events are displayed in descending order by time, with the most recent event at the top. If the ring buffer is full, a new event overwrites the oldest entry in the buffer.

The Diagnostic Buffer displays the following information:

Event List (upper panel): A list of all the events in the diagnostic buffer. The following information is shown for each diagnostic event:

- The number of the entry
- The date and time of the event
- A brief description of the event

Event ID (between the upper and the lower panels): Displays the ID number of a selected event.

- **Event Details** (lower panel): Displays the event details in either text or hexadecimal format.

  If you have chosen Text format, the following details about a selected event appear in the lower panel:

- A brief description

  Additional information, depending on the event, such as the address of the instruction that caused the diagnostic event and the mode transition that was caused by the event

- The event state (incoming or outgoing)

  If a single parameter of text cannot be identified, the diagnostic buffer displays the string "###". If no text exists for new modules or new events, the event numbers and the single parameters are displayed as hexadecimal values.

  If you have chosen Hexadecimal format, the hexadecimal values of the selected event appear in the lower panel.

4.6.1 Sorting Events (upper panel)

You can sort the events listed in the upper panel by clicking the specific column:

- Number (determined by time and date)
- Event description

4.6.2 Choosing Format (lower panel)

You can display the diagnostic information in the lower panel in text or hexadecimal (Hex) format. In Hex format, the hexadecimal values of the 20 bytes of the selected event are displayed. To select the format:

- Click Text to display the event details in text format.
- Click Hex to display the hexadecimal values of the event.

4.6.3 Time of Day including Time Difference CPU/Local

If the check box is not active, the entries in the diagnostic buffer are stamped with the time of day on the module, for example, the CPU. You use this setting if this time is the same as the time at the location of the diagnostic buffer reader (the same time zone).

If the check box is active, the correction value set for the time-of-day display is applied. You use this setting if the location of the diagnostic buffer reader is in a different time zone than the module. The check box can only be activated for modules which support time-of-day status.

If you change the settings, the time entries in the diagnostic buffer are updated immediately.

4.6.4 Updating the Diagnostic Buffer

To display the most up-to-date information in the window, select the "Update" button.

4.6.5 Saving the Diagnostic Buffer

To save a text file containing the event list and the detailed information for every event, click the Save button. The text file contains the information either in text or in hexadecimal format.

4.6.6 Displaying Help

To display help on the diagnostic buffer, click the Help button. To display help on a specific event:

1. Select the event in the upper panel.
2. Click the Help on Event button.

4.7 Archiving and Restoring STEP 7 User Programs

The Archive from CPU command enables you to save the configuration and STEP 7 user program to an archive file (*.wld). The archive file allows you to easily restore the configuration and STEP 7 user program for the controller.

You can only archive or restore (Restore to CPU command) a STEP 7 user program when the controller is in STOP mode. You cannot archive or restore a STEP 7 user program when the controller is in RUN mode or is shut down.

The archive file functions like the removable memory cartridge (EEPROM cartridge) of an S7 CPU; however, it differs in that the controller does not automatically restore the archive file after a memory reset (MRES). You must manually restore the archive file.

Automatic Restart with Autoload Feature: You can also configure the CPU 41x-2 PCI to load a specific archive file (*.wld) after restart. For this option, you must enable the "Autoload" feature and specify which archive file to load after restart.

4.7.1 Creating an Archive File

An Archive file stores the current STEP 7 user program, the current system configuration, and the current values of the DBs. The Archive file does **not** store the configuration of the PC station.

To create an Archive file, select the **File > Archive** menu command. This command displays the Save As dialog, which allows you to give a name to the file. The controller then creates the archive file with the extension .wld.

You can also use the SIMATIC Manager of STEP 7 to create an Archive file. Select the **File > Memory Card File > New** menu command.

4.7.2 Restoring an Archive File

When you restore an archive file, you reload the STEP 7 user program and the configuration for the controller. You can only restore archive files of extension .wld.

Before you can restore an archive file, you must set the controller to STOP mode. Use the following procedure to load an archived configuration and STEP 7 user program:

1. Click the STOP button to place the controller in STOP mode.
2. Select the **File > Restore to CPU** menu command.
3. Select the specific archive file to restore and click OK.

4.8 Closing the Controller Panel

Select the **File > Exit** menu command to close the controller panel.

Note: Closing the controller panel does not turn off the controller or affect the operating mode.

4.9 Customizing and Security Options

4.9.1 Customize Command (CPU Menu)

To open the Customize dialog box, select the **CPU > Options > Customize** menu command. The tabs of the dialog box allow you to customize the controller panel as follows:

4.9.1.1 General

Select **Always On Top** to display the controller panel on top of all other open windows.

4.9.1.2 Language

You can change the display language for the controller panel menus and online help.

To change the display language, follow these steps:

1. To open the Customize dialog box, select the **CPU > Options > Customize** menu command.
2. In the Customize dialog, select the Language tab.
3. Select the language for the controller panel.
4. Click Apply to change the language.
5. Click OK to close the Customize dialog.

The controller panel automatically changes to the selected language.

4.9.1.3 Autoload

WinAC Slot 41x features the Autoload function, which defines how WinAC Slot 41x reacts to a Power Up and Power Down of the PC. This feature is described in "Setting the Autoload Feature".

4.9.2 Setting the Security Options

4.9.3 Security Command (CPU Menu)

Select the **CPU > Options > Security** menu command to change security options. The controller panel displays the Access Verification dialog. You must enter your password in this dialog in order to make any changes to the security settings for the controller.

Note: The default password is an empty field containing no characters. To enter the password the first time, press the Enter key.

4.9.3.1 Security Level

The Security dialog allows you to set levels of password security that limit access to the controller. The following security access options are provided:

- **Password**: When you select Password, certain controller panel operations such as changing the operating mode and archiving and restoring a STEP 7 user program, require that the user enter a password.
- **Confirmation**: When you select Confirmation, operating mode changes require that the user acknowledge a confirmation dialog box.
- **None**: When you select None, no confirmation or password is required.

4.9.3.2 Password Prompt Interval

You can set the Password Prompt Interval to a time interval of your choice, from 0 to a maximum of 23 hours, 59 minutes. After you have entered your password, you are not prompted for it again until this time interval has expired. The default setting of 0 means that you must enter a password for each protected operation.

Shutting down and starting the controller does not affect the expiration of the Password Prompt Interval; however, it is reset whenever you shut down the controller panel. The next time you start the controller panel and access a password-protected function, you will be prompted for password entry.

4.9.3.3 Change Password

Click the Change Password button to display the Change Password dialog.

Note: If you create a password, but set the security level to None (disabling the password), you still need to enter the configured password in the Access Verification dialog before you can access the Security dialog box again.

Warning

Running the controller without confirmation or password protection increases the risk that an operator may change the controller mode inadvertently, which could cause the process or equipment to operate unpredictably, resulting in potential damage to equipment and/or serious injury to personnel.

Exercise caution to ensure that you do not inadvertently change the operating mode or permit unauthorized persons to access the machine or process. Always install a physical emergency stop circuit for your machine or process.

4.9.4 Changing the Password

The Change Password dialog allows you to change the current password.

Note: The default password is an empty field containing no characters. To enter the password the first time, press the Enter key.

Use the following procedure to change the password:

1. In the Old Password field, enter the old password.
2. In the New Password field, enter the new password (maximum length 12 characters).
3. In the Confirm New Password field, enter the new password again.
4. Click OK to apply all the changes made in this dialog.

To subsequently access the security options, you must enter the password at the Access Verification dialog.

4.10 Removing the Passivation Layer on the Backup Battery

When lithium batteries (lithium/thionyl chloride) are used as backup batteries, the battery may not function immediately if the battery has been stored a long time and has developed a passivation layer. Under certain circumstances, this can cause an error message to be displayed after the CPU 41x-2 PCI is switched on.

The CPU 41x-2 PCI is in the position of removing the passivation layer on the lithium battery through defined loading of the battery. This operation can take several minutes. When the passivation layer is removed and the lithium battery has reached its rated voltage, the error message can be acknowledged in the controller panel by selecting **CPU > FMR**.

Since the storage time of the lithium battery is generally not known, we recommend the following procedure:

1. Connect the backup battery to the BATT. socket on the slot bracket of the CPU 41x-2 PCI.
2. Acknowledge any battery error message in the controller panel (BATF LED display) by selecting **CPU > FMR.**
3. If the battery error cannot be acknowledged, repeat the acknowledgment attempt after a few minutes.
4. If the battery error still cannot be acknowledged, remove the battery and short-circuit it for 1 to 3 s.
5. Apply the battery again and re-attempt the acknowledgment by selecting CPU > FMR.
   - If the display for the battery error message goes out, the battery is functional.
   - If the display for the battery error message does not go out, the battery is empty.

Note

If the power supply for the CPU 41x-2 PCI fails while you are changing the backup battery, the user program and data that you wanted to store retentively will be lost.

Remedy: connect the CPU 41x-2 PCI to an additional external 24 VDC.

4.11 Update Firmware

The **File > Update Firmware** menu command allows you to load updated firmware to the CPU 41x-2 PCI without a memory card. To do this, proceed as follows:

1. You can either download the files with the firmware update from the internet or copy the files from an update CD to your PC.

   The firmware consists of three files with the extension *.upd.
2. On the controller panel, select the **File > Update Firmware** menu command. A dialog box, which informs you about further steps to take, is displayed.
3. In this dialog box, select the cpu_hd.upd file.
4. Click OK.

The firmware will be updated automatically. A progress bar informs you about the progress of the update. At the conclusion of the update, a new dialog is displayed indicating whether or not the update was successful. In addition, the new version of the firmware is displayed.

5 STEP 7 Operations and Components

5.1 Using STEP 7 with the Controller

STEP 7 provides programming and configuration tools for working with the CPU 41x-2 PCI. You perform the following tasks with STEP 7:

- Define the controller and DP I/O configuration through the STEP 7 Hardware Configuration tool
- Develop a STEP 7 user program using any of the STEP 7 control programming languages
- Configure operational parameters and I/O addresses for the controller
- Download your configuration and STEP 7 user program to the controller

Refer to your STEP 7 documentation for additional information.

5.2 Configuring the Operational Parameters for the Controller

STEP 7 provides a Hardware Configuration application for configuring the operational parameters for the controller. This configuration is then stored in various SDBs in the System Data container.

After you download the System Data, the controller uses the configured parameters for the following events:

- Whenever you power up the controller
- On the transition to RUN mode (if you modified the hardware configuration online while the controller was in STOP mode)

To configure the operational parameters from the STEP 7 Hardware Configuration application, right-click the controller entry in the station window and select Object Properties. From the Properties dialog, you configure the operational parameters.

5.2.1 Accessing Operational Parameters

To configure any of these operational parameters in STEP 7, open the SIMATIC Manager and follow these steps:

1. In the SIMATIC Manager, select the PC station.
2. Click the Configuration icon.
3. Right-click the controller in the station window and select Object Properties.
4. Click the tab with the name of the parameter that you want to configure (such as Cyclic Interrupt) and enter the appropriate values in the dialog.
5. Click OK to confirm your configuration.

Refer to your STEP 7 documentation for specific information about configuring the controller properties and the operational parameters.

5.3 Protection Levels

With the CPU 41x-2 PCI, a protection level can be declared, by means of which the programs in the CPU can be protected from unauthorized access. The protection level is used to define which programming device functions a user can execute without having special authorization (password) on the relevant CPU. The password enables all programming device functions.

Setting the Protection Levels

You can set protection levels (1 to 3) for a CPU in the STEP 7 Hardware Configuration application.

The protection level set in the STEP 7 Hardware Configuration application can be removed by performing a manual memory reset with the controls, provided a RAM card is inserted. The protection level selected for the user program is retained on the FLASH card.

Protection levels 1 and 2 can also be set via the controls.

The following table shows the protection levels of the CPU 41x-2 PCI:

Protection Level	Function	Operating Mode Selector
1	• All programming device functions are permitted (default setting).	RUN/STOP
2	• All functions for process control, process monitoring, and process communication are permitted. • All information functions are permitted. • Loading of objects from the CPU to the programming device is permitted, i.e., only read-accessing programming device functions are permitted.	RUN
3	• Neither read- nor write-accessing programming device functions are permitted.	-

If the protection level settings made with the mode selector and STEP 7 are different, the higher protection level prevails (3 over 2, 2 over 1).

5.4 Loading and Storing the STEP 7 User Program

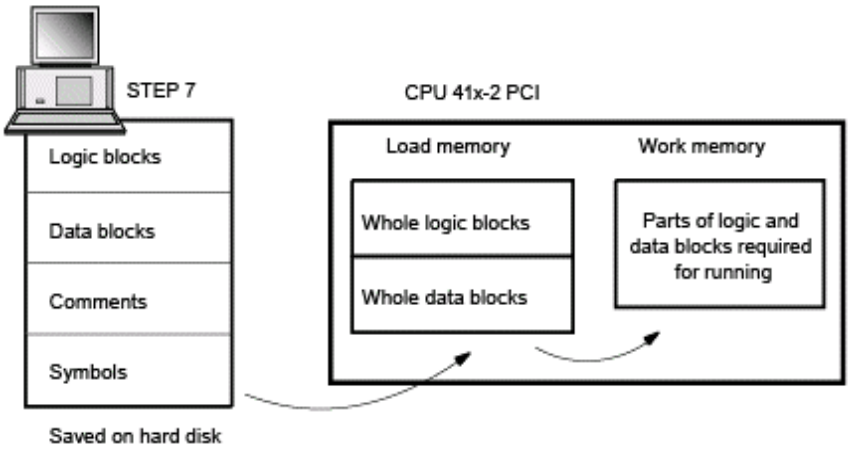
5.4.1 Load and Work Memory, Memory Card File

Load and Work Memory

When you load the STEP 7 user program to the CPU 41x-2 PCI, the code and data blocks are loaded to the load memory and work memory areas of the CPU 41x-2 PCI.

To ensure rapid processing of the STEP 7 user program, only those parts of the blocks that are relevant for program execution are loaded onto the **work memory** area. Block parts that are not required for program execution (e.g., block headers) remain in the **load memory** area.

The following diagram illustrates loading of the program to the CPU memory:



Structure of the Load Memory

The load memory can be expanded through use of a memory card. Depending on whether you select a RAM card or a FLASH card for expanding the load memory, the behavior during loading, reloading, and resetting can differ. For more information on this topic, refer to Types of Memory Cards.

Definition

A memory card file represents the content of the memory card. The memory card file contains the STEP 7 user program and the hardware configuration (SDBs).

- If you use STEP 7 to create the memory card file, the DBs will contain the initial values.
- If you use the controller panel to create the memory card file with **File > Archive CPU**, the DBs will contain the current values.

5.4.2 Archiving and Restoring STEP 7 User Programs

The memory card can only be removed and inserted when the PC is open. However, you have the option of reading STEP 7 user programs from the CPU 41x-2 PCI or saving them to the CPU 41x-2 PCI without having to remove and insert the memory card:

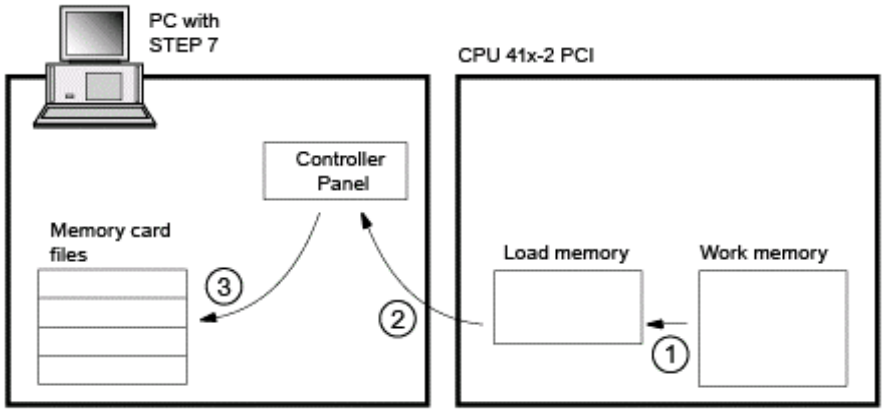
- The **File > Archive from CPU** command is used to load the STEP 7 user program and the hardware configuration from the load memory area of the CPU 41x-2 PCI to the PC (memory card file).
- The **File > Restore to CPU** command is used to load a STEP 7 user program and the hardware configuration from the PC (memory card file) to the load memory area of the CPU 41x-2 PCI.
- With the **CPU > Options > Autoload** command, the PC retrieves a memory card file that you have preselected and loads it onto the load memory area of the CPU 41x-2 PCI following a Power On. Then, the CPU 41x 2 PCI switches to the operating mode stored in the Memory Card file.

Archiving from CPU

The **File > Archive** function can be used to save the STEP 7 user program and the hardware configuration located on the CPU 41x-2 PCI to the PC. The controller panel reads out the load memory of the CPU 41x-2 PCI and stores this file with the extension *.wld on the hard disk.

This file (memory card file) contains the STEP 7 user program and the current hardware configurations (SDBs).

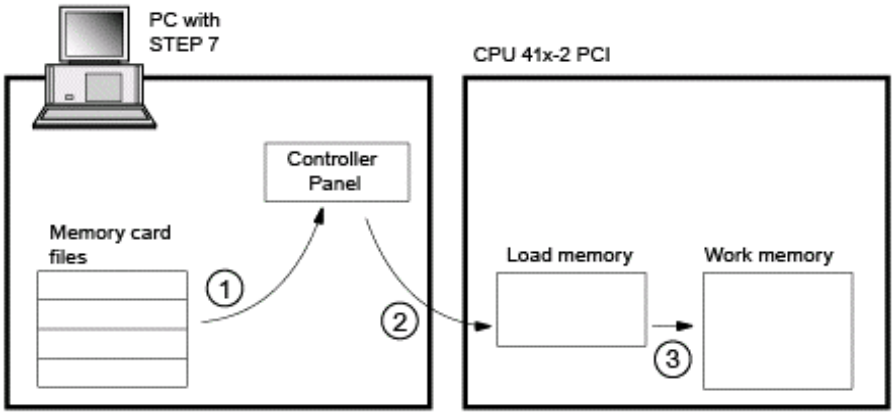
This function is also supported in SIMATIC Manager with **File > Memory Card File**.



Restoring to CPU

The **File > Restore to CPU** command is used to load a STEP 7 user program and the hardware configuration from the PC to the load memory of the CPU 41x-2 PCI.

First, select a memory card file with the extension *.wld and transfer it to the load memory of the CPU 41x-2 PCI.



Autoload

Application: you can use the Autoload feature to transfer a STEP 7 user program and the hardware configuration to the CPU 41x-2 PCI after the PC is powered on. This is primarily useful in the following cases:

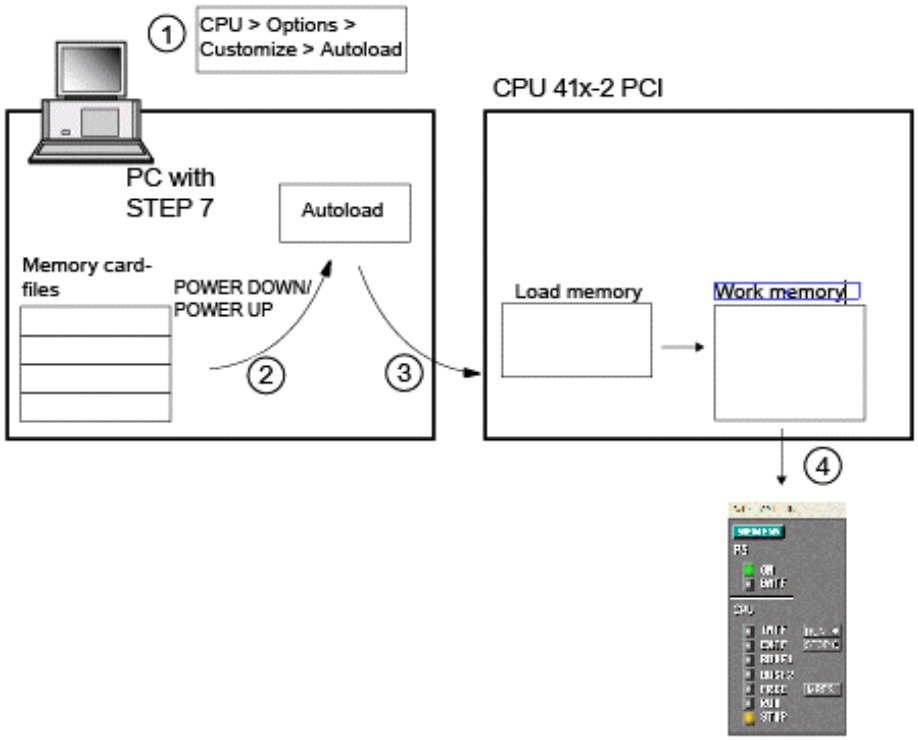
- During commissioning
- During operation of the CPU 41x-2 PCI without battery backup

Requirements: to utilize the Autoload feature

- you must not have inserted a FLASH card in the CPU 41x-2 PCI
- you must be operating the CPU 41x-2 PCI without a backup battery
- An independent, external 24 VDC supply must not be connected.

The following figure shows the basic sequence of the Autoload feature:

1. With the Autoload feature, you select a memory card file and the setting of the mode selector.
2. Following a Power Off/ Power On of the PC, the PC loads the memory card file that you selected beforehand.
3. Then, the PC writes this file to the load memory of the CPU 41x-2 PCI.
4. Then, the CPU 41x-2 PCI starts the loaded memory card file and goes to the operating state specified in the memory card file (STOP, RUN).



6 Troubleshooting

6.1 Error Detection via Status Indicators

For the meaning of the LEDs on the controller panel, refer to Status Indicators.

The LEDs on the slot bracket correspond to the status indicators of the LEDs on the controller panel :

- SF corresponds to INTF and EXTF
- R corresponds to RUN
- S corresponds to STOP

Troubleshooting Network Problems

The controller panel provides the EXTF and BUSF status indicators that can be used to diagnose problems with the PROFIBUS-DP network. The table below describes the activity of the EXTF and BUSF indicators based on the particular error. In addition, possible remedies are provided.

EXTF	BUSF	Description	Action
Off	Off	No configuration	Ensure that the DP configuration has been entered into your STEP 7 project. Download the project's System Data container to the controller.
		Normal operation	The configured DP slaves are responding. No action is required.
On	Flashing	Station failure	Check to see that the bus cable is connected to the MPI/DP port of the CPU 41x-2 PCI and that all segments are correctly terminated at powered nodes. Check to see that the bus is not interrupted.
		At least one of the DP slaves could not be accessed	Wait for completion of the power-on cycle. If the indicator continues to flash, check the DP slaves or evaluate the diagnostic data for the DP slaves.
—	On	Bus fault (hardware failure)	Check the bus cable for an electrical short, or a broken wire or connection.
On	Off	Diagnostic error	Indicates that a fault condition has not been cleared or that a DP module with diagnostic capability has initiated OB 82.

In addition to these visual indicators, you can use the Diagnose Hardware feature of the STEP 7 programming software to determine which nodes are experiencing problems and to determine the nature of the problem.

6.2 Responding to Diagnostic Events

If an error is detected by the controller, the error condition is logged in the diagnostic buffer as a diagnostic event. The diagnostic events that are typically associated with distributed I/O can cause the controller to execute the following OBs :

- OB 40 responds to hardware interrupts (process alarms) generated by an I/O module with configured interrupt capability.
- OB 82 responds to diagnostic interrupts generated by an I/O module with configured diagnostic interrupt capability.
- OB 83 responds to module removal/insertion at a DP Slave, (for example, ET 200M), which has been configured for module pull/plug support.
- OB 84 responds to CPU hardware faults or PC failure. With the CPU 41x-2 PCI, causes include:
  - CPU hardware faults
  - PC is switched off, is starting up, or has crashed. For this reason, you must always program OB 84 so that the CPU 41x-2 PCI can be operated independently of the PC.
- OB 85 responds to a priority class error. There are multiple causes for OB 85 relating to the DP I/O system. If the controller attempts to copy a module's inputs to (or outputs from) the process image during the I/O cycle, and the module is not operational, then OB 85 is executed.
- OB 86 responds to a station failure or some other interruption of the physical network (such as a short circuit).
- OB 122 responds to an I/O access error by the user program. If OB 122 is not programmed, the controller goes to STOP mode.

You can use SFC 39 to SFC 42 to disable, delay, or re-enable any of these OBs. If a non-loaded OB was requested, the controller goes to STOP mode.

The local variables for these OBs contain restart information indicating the cause for executing the OB. The program for the OB can use this information for responding to the event. You can also use SFC 13 (DPNRM_DG) to read the diagnostic information from a DP slave.

For information on using OBs and SFC 13, refer to the STEP 7 online help.

7 Getting Started: Communication between a CPU 416-2 PCI and an S7-400

7.1 Preliminary Remarks on Getting Started

Information Regarding Getting Started

This section will familiarize you with how to work with WinAC Slot 41x using an example of establishing a connection. As part of these hands-on exercises, we will show you the most important dialogs and procedures.

Familiarity with mouse operation, windowing systems, pull-down menus, etc., and basic knowledge about PLCs is also useful.

Training courses are available in which you can add to the knowledge you have gained with Getting Started and learn how to create complete automation solutions with STEP 7.

Requirements for Working with Getting Started

To perform the hands-on exercises in this Getting Started, you need the following:

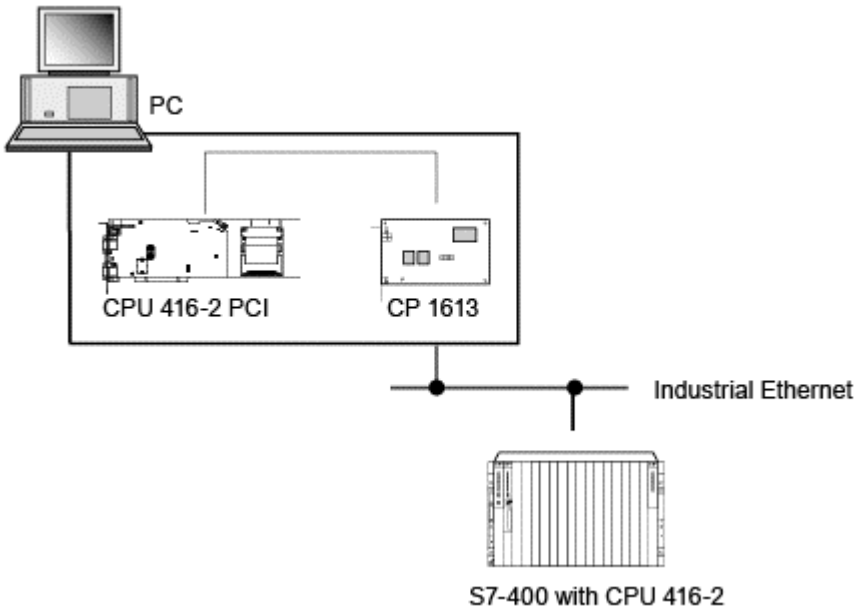
- Siemens programming device or PC
- STEP 7 software package and authorization diskette
- SIMATIC S7-400 automation system

The Getting Started section is organized as follows.

1. Starting the Controller Panel of WinAC Slot 41x
2. Task: Communication from the CPU 416-2 PCI over the CP 1613 to an S7-400
3. Installing the Components of WinAC Slot 41x
4. Station Configuration Editor
5. Creating a Project in SIMATIC Manager
6. Hardware Configuration for Box PC 840
7. Hardware Configuration for S7-400 Station
8. Configuring the Network
9. Configuring a Connection
10. Communication
11. Going Online with STEP 7 to the CPU 41x-2 PCI

7.2 Problem Definition: Communication from the CPU 416-2 PCI over the CP 1613 to an S7-400

In this example, a PC station containing a CPU 416-2 PCI will be connected to an SIMATIC S7-400 station via Industrial Ethernet (IE).



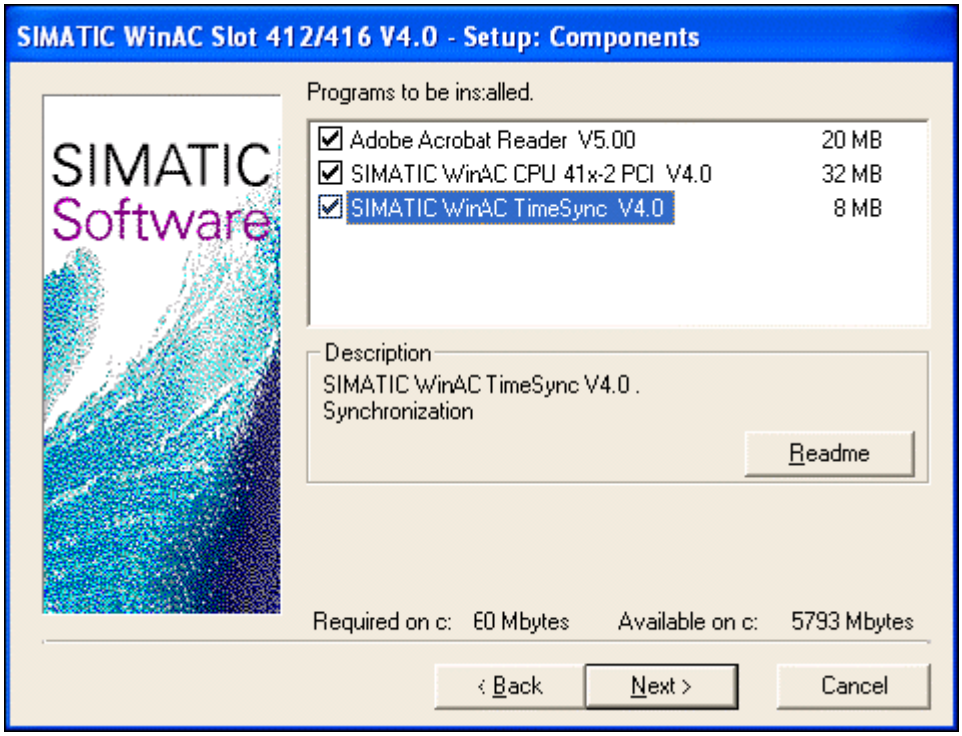
7.3 Step 1: Installing the Components of WinAC Slot 41x

The WinAC Slot 41x software includes a setup program that automatically performs the installation.

The installation program leads you step by step through the installation operation. You can advance to the next step or return to the previous step at any time. Proceed as follows to access the installation program.

1. Place the CD in the CD drive.
2. Select the Setup.exe file by double-clicking it.

Result: A dialog box is displayed where you can select the components you want to install.



3. Select the components to be installed. The setup automatically selects the components that were not found on the PC.
4. Continue with the remaining dialog boxes.

If the installation was completed successfully, a corresponding message is displayed on the screen.

7.4 Step 2: Station Configuration Editor

Function of the Station Configuration Editor

The Station Configuration Editor allows you to communicate the following settings to the PC:

- Station name
- Type of CPU 41x-2 PCI
- Adding CP 1613

Note

The following settings in the Station Configuration Editor must agree with the subsequent configuration made in the STEP 7 Hardware Configuration application:

- Station name
- Type
- Index (corresponds to the slot in the STEP 7 Hardware Configuration application)

Index

The CPU 41x-2 PCI can be operated on an index from 2 to 18. The index corresponds to a virtual slot in the PC.

Name of the CPU 41x-2

You can select any name for the CPU 41x-2 PCI in STEP 7 (default: CPU 41x-2 PCI). Only characters that can be used in file names are permitted. Leading blanks are not permitted.

Note

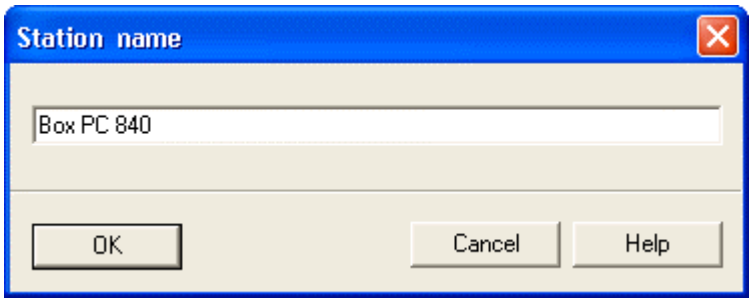
The name that you assign to the CPU 41x-2 PCI in STEP 7 corresponds to the name that you use to access the controller panel of the CPU via the PC desktop. For example, if you name the CPU 41x-2 PCI "Slot_CPU", you then access the controller panel via **Start > Simatic > PC Based Control > Slot_CPU**.

Information on the Station Configuration Editor

For more information, e.g., on diagnostics in the Station Configuration Editor, refer to the relevant online help.

Procedure

1. To communicate the station name to the PC:
2. Open the Station Configuration Editor by clicking the symbol in the taskbar.
   Result: the Station Configuration Editor is displayed.
3. Click on Station Name.
4. Enter "Box PC 840" as the station name, and click OK.



Adding CP 1613

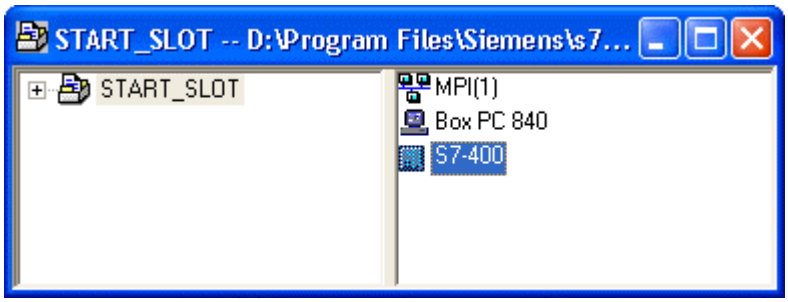
To add a CP 1613 to the station, proceed as follows:

1. Select an available slot in the Station Configuration Editor.
2. Click the Add button.
   Result: a list of inserted CPs and CPs not yet added to the station is displayed.
3. Select the CP 1613 in the list.
4. Confirm by clicking OK twice.
   Result: the component properties are displayed.
5. Click OK. You specify the properties of the CP 1613 later in the STEP 7 Hardware Configuration application.
6. Click OK to exit the Station Configuration Editor.

7.5 Step 3: Creating a Project in SIMATIC Manager

Proceed as follows:

1. Create a project named "START_SLOT".
2. Insert the Box PC 840 by selecting Insert > Station > SIMATIC PC-Station, and enter "Box PC 840" as the PC station name.
3. Insert the S7-400 station by selecting Insert > Station > SIMATIC 400-Station, and enter "S7-400" as the SIMATIC S7-400 station name.



Note

The following settings in the Station Configuration Editor must agree with the subsequent configuration made in the STEP 7 Hardware Configuration application:

- Station name (= Name of the PC station)
- Type
- Index (corresponds to the slot in the STEP 7 Hardware Configuration application)
- Name.

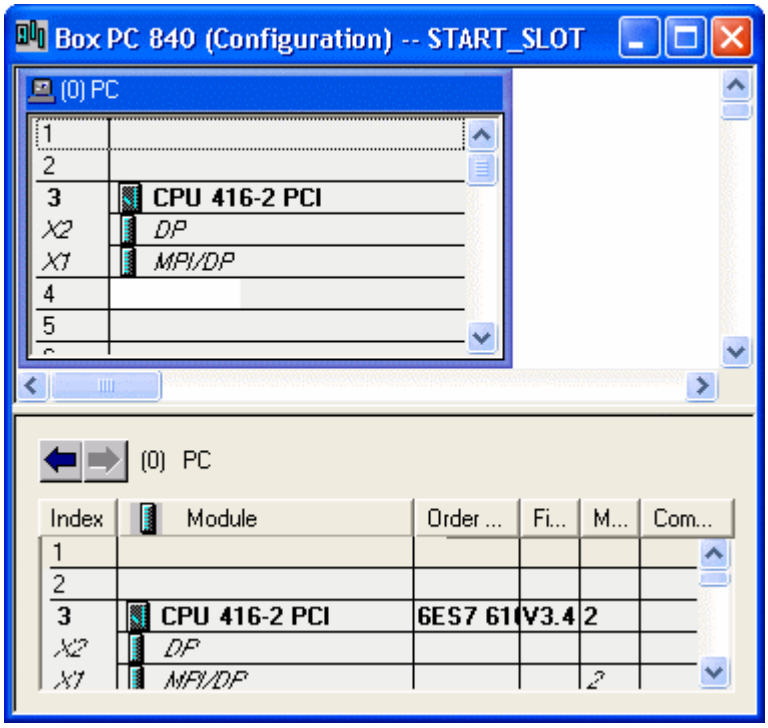
7.6 Step 4: Hardware Configuration of the Box PC 840

Selecting the Rack

1. Select the Box PC 840.
2. Double-click on Configuration to open HW Config.
3. Open the catalog and navigate to SIMATIC PC Station > Controller > CPU 416-2 PCI > 6ES7 616-2QL10-0AB4 > V4.0
4. Use a drag-and-drop operation to insert the CPU 416-2 PCI onto Slot 3.

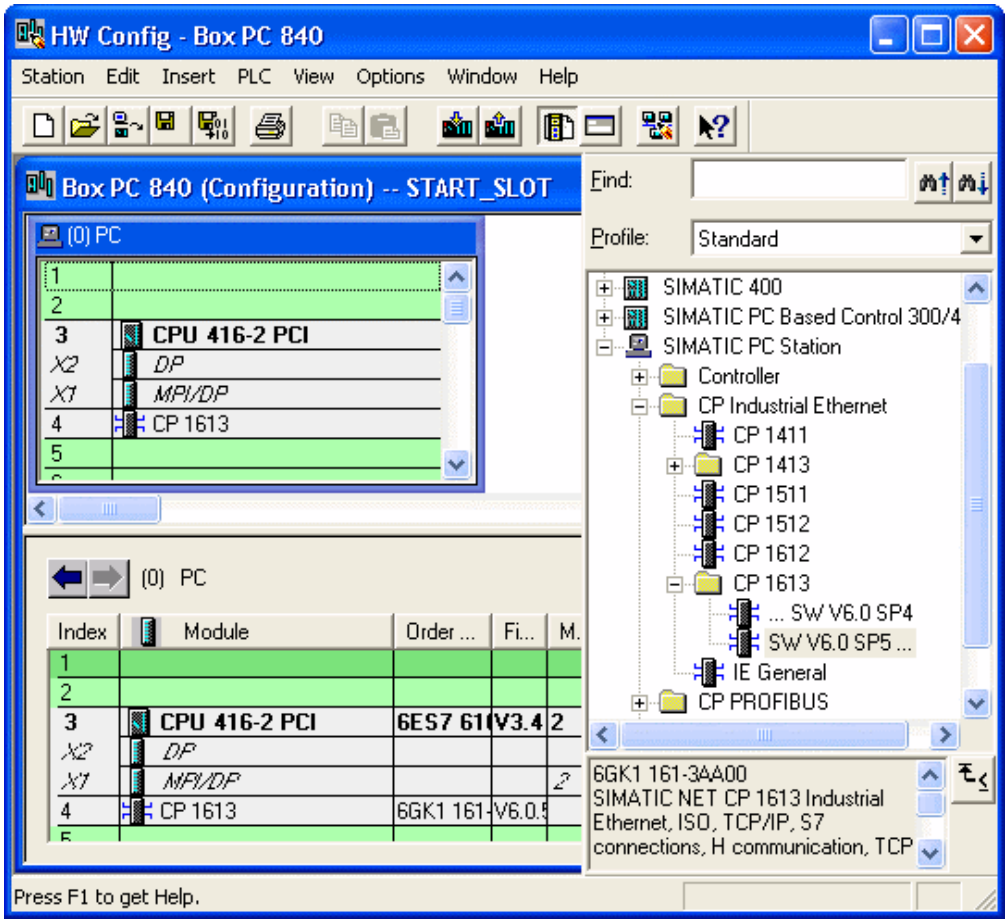
   Slot 3 corresponds to Index 3 in the Station Configuration Editor. The slot and the index must always be the same!

   Result: the Properties - PROFIBUS Interfaces DP Master dialog is displayed.
5. Do not link the subnet for the DP master.
6. Click OK.



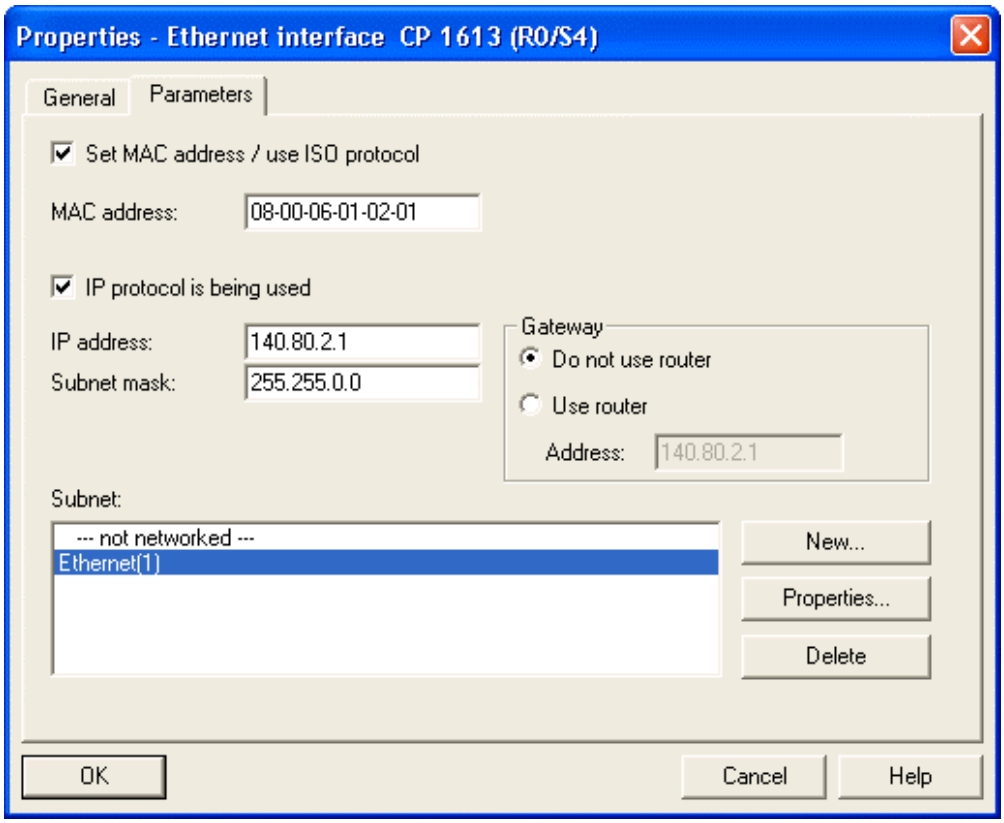
Assigning the CP

1. Navigate to SIMATIC PC Station > CP-Industrial Ethernet.
2. Use a drag-and-drop operation to insert the CPU 1613 PCI on Slot 4.



Slot 4 corresponds to Index 4 in the Station Configuration Editor. The slot and the index must always be the same!

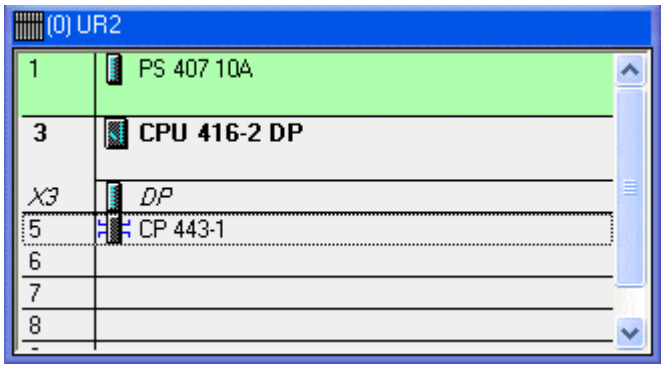
Result: the Properties - Ethernet Interface CP 1613 dialog is displayed.



3. Fill in the properties of the Ethernet interface according to the figure above (create a MAC address and new subnet), and click "OK".
4. Click "Save and Compile" to close the dialog.

7.7 Step 5: Hardware Configuration of the S7-400 Station

1. Select the components listed below and assemble them as shown in the figure below.
   - Rack
   - Power supply
   - CPU 416-2
   - CP 443-1

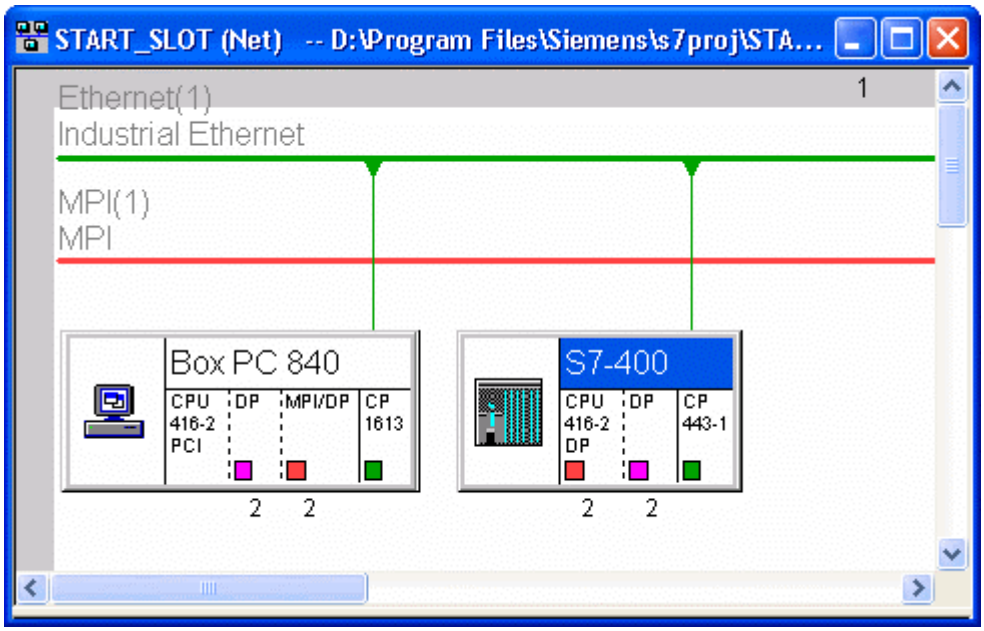


2. Fill in the properties of the Ethernet interface (create a MAC address and new subnet) and click OK.
3. Click "Save and Compile" to close the dialog.

7.8 Step 6: Configuring a Network

Open NetPro by clicking the Configure Network button.

Result: the NetPro - [START_SLOT] window is displayed.



7.9 Step 7: Configuring a Connection

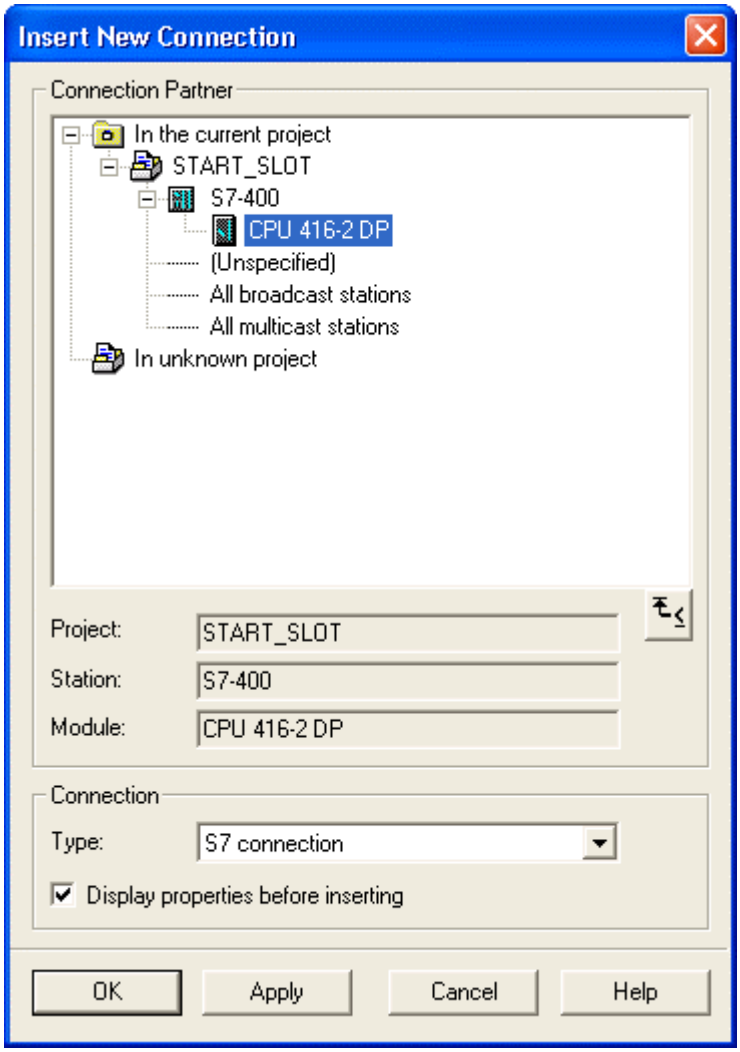
Configuring a Connection

A connection defines the communication relationship between two nodes. The following is specified as part of the connection:

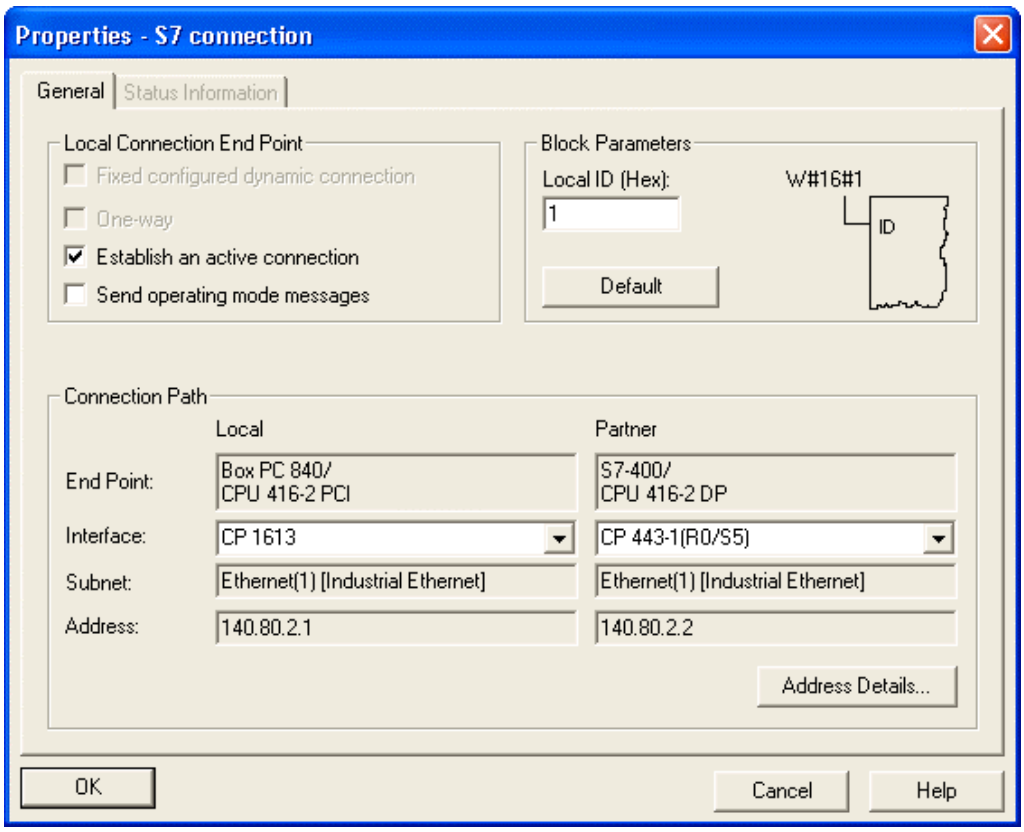
- The two communication nodes
- The type of connection (in this case, an S7 connection)
- Special properties that depend on the type of connection (e.g., whether a connection is permanently established or is dynamically set up and removed in the user program).

To enter a connection, proceed as follows:

1. Select the CPU 416-2 module (connection table is visible).
2. Double-click on an empty row in the connection table, or select **Insert > New Connection ...**
   Result: the New Connection dialog is displayed.



3. In the Station and Module fields, select the programmable module to be connected with (connection partner or remote station indicated).
4. Select the connection type (S7 connection only) in the Type field.
5. Select the "Display properties before inserting" check box.
6. Click Apply to confirm. The Properties - S7 Connection dialog is displayed.



7. Check the settings (interface and type) based on the figure above.
8. Click OK to confirm your entries.

This creates the first connection.

STEP 7 enters the connection in the connection table of the local node and assigns the local ID for this connection. If necessary, STEP 7 also assigns the partner ID that you need for programming the communication function blocks (value for the ID block parameter).

These settings conclude the configuration of the START_SLOT project.

9. Use the Save and Compile button to compile.
10. Download the data to the respective station.

7.10 Step 8: Communication

Integrate the appropriate communication blocks (e.g., Put/Get) into your user program.

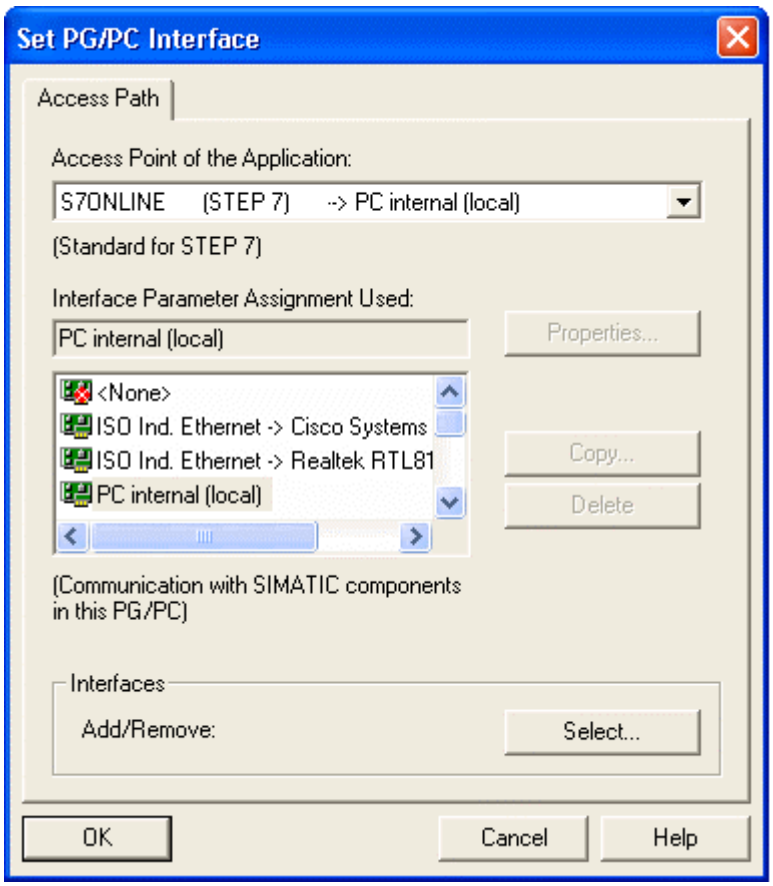
7.11 Going Online with STEP 7 to the CPU 41x-2 PCI

Connecting STEP 7 to the CPU 41x-2 PCI on the Same Computer

Proceed as follows if you want to configure STEP 7 for communication with the CPU 41x-2 PCI on the same computer.

1. Open the interface tool in WinAC Slot using the following command: **CPU > Set PG/PC Interface**.
2. Perform the following steps to set up STEP 7 as a local access point:
   – In the Access Point of the Application field, select **S7ONLINE (STEP 7)** (see figure).
   – In the Interface Parameter Assignment Used field, select "PC internal (local)" as the interface parameter.

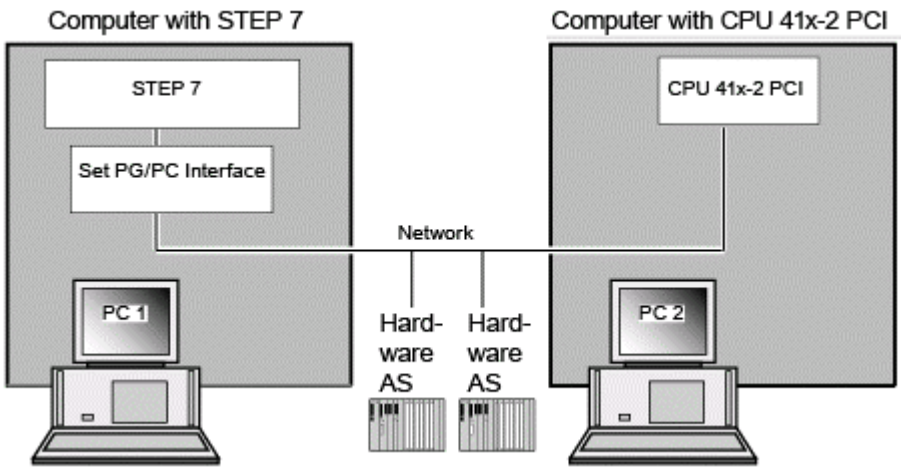
STEP 7 is now configured for communication with the CPU 41x-2 PCI on the same computer.



Connecting STEP 7 to the CPU 41x-2 PCI on A Different Computer

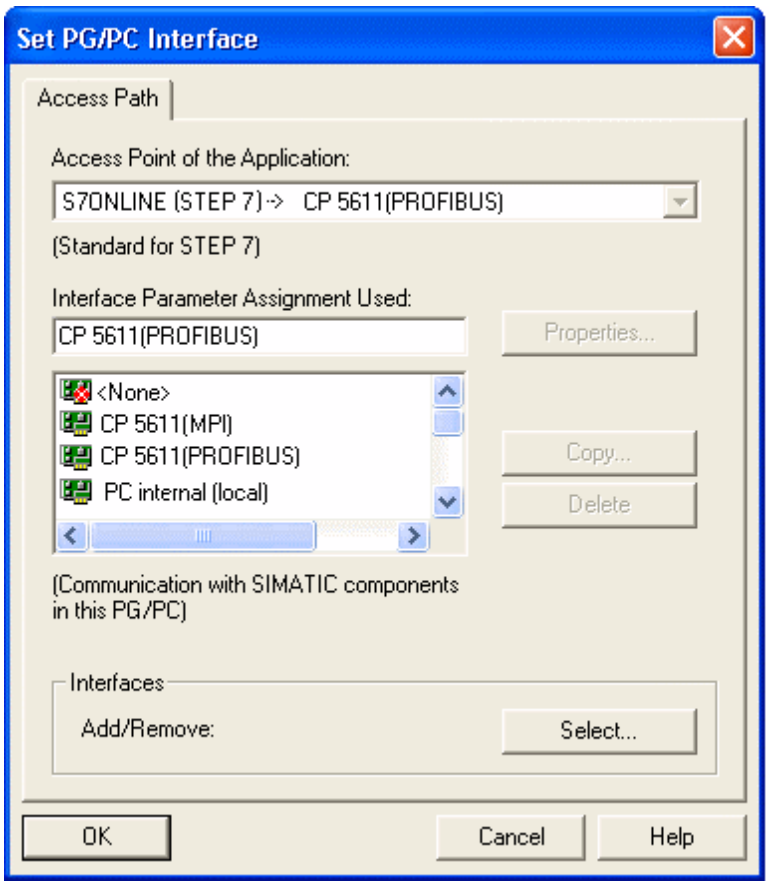
You can connect STEP 7 to the CPU 41x-2 PCI located on another computer. You must define the network connection that STEP 7 and the CPU 41x-2 PCI communicate over by setting up the PG/PC interface on the remote computer.

STEP 7 must be installed on the remote computer, and the CPU 41x-2 PCI must be installed on the computer to which you want to establish the connection.



Proceed as follows if you want to configure STEP 7 for communication with WinAC Slot on a remote computer.

1. Access the interface configuration tool in SIMATIC Manager on the Options menu.



2. In the Access Point of the Application field, select S7ONLINE (STEP7).
   - In the case of MPI communication, select an MPI interface, e.g., **CP5611(MPI)**.
   - In the case of PROFIBUS DP communication, select a PROFIBUS DP interface, e.g., **CP5611(PROFIBUS).**

8 Getting Started : Connecting the Controller to the SIMATIC NET OPC Server

The CPU 41x-2 PCI can use the SIMATIC NET OPC Server to read and write data over the network. You use the following tools to configure the OPC connection:

- OPC Scout for configuring the connection to the SIMATIC NET OPC Server
- STEP 7 (HW Config and NetPro) for configuring the CPU 41x-2 PCI
- Station Configuration Editor for configuring the PC station

Configuring an OPC Server connection requires the installation of SIMATIC NET.

Note: The critical step most frequently overlooked is Step 3: Configuring the S7 connection for the OPC server in NetPro. After adding the connection for the OPC server, you must set the connection type to "S7 connection" and enter a Local ID for the connection.

8.1 Task Overview

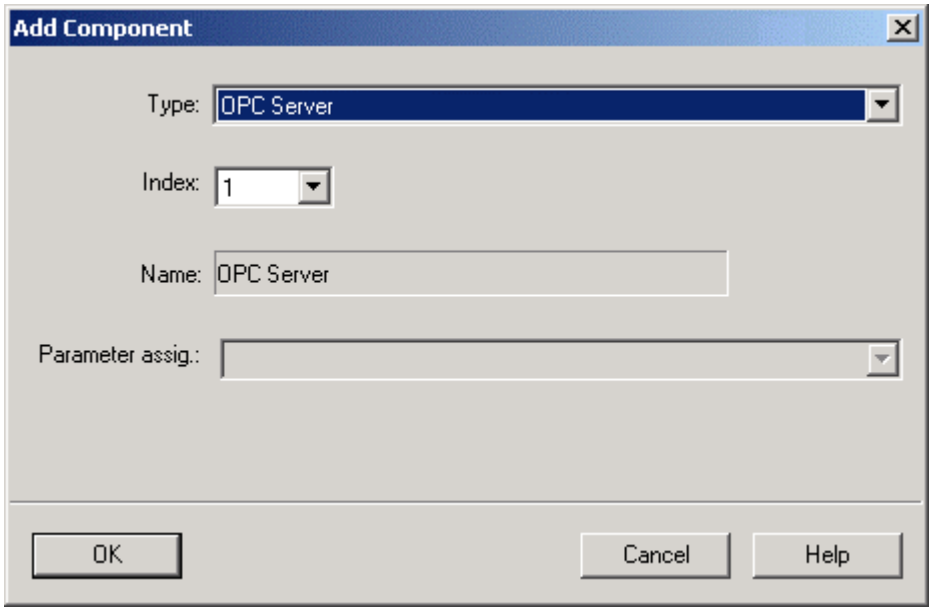
	**Step 1: Station Configuration Editor (SIMATIC NET)** Add the OPC server to the PC station.
	**Step 2: HW Config (STEP 7)** Add the OPC server to the hardware configuration in STEP 7.
	**Step 3: NetPro (STEP 7)** Add an S7 connection for the OPC server to the configuration of the CPU 41x-2 PCI.
	**Step 4: SIMATIC Manager (STEP 7)** Download the configuration to the controller
	**Step 5: OPC Scout (SIMATIC NET)** Connect the controller to the OPC server.

8.2 Step 1: Add the OPC Server to the PC Station

Tool: Station Configuration Editor (SIMATIC NET)

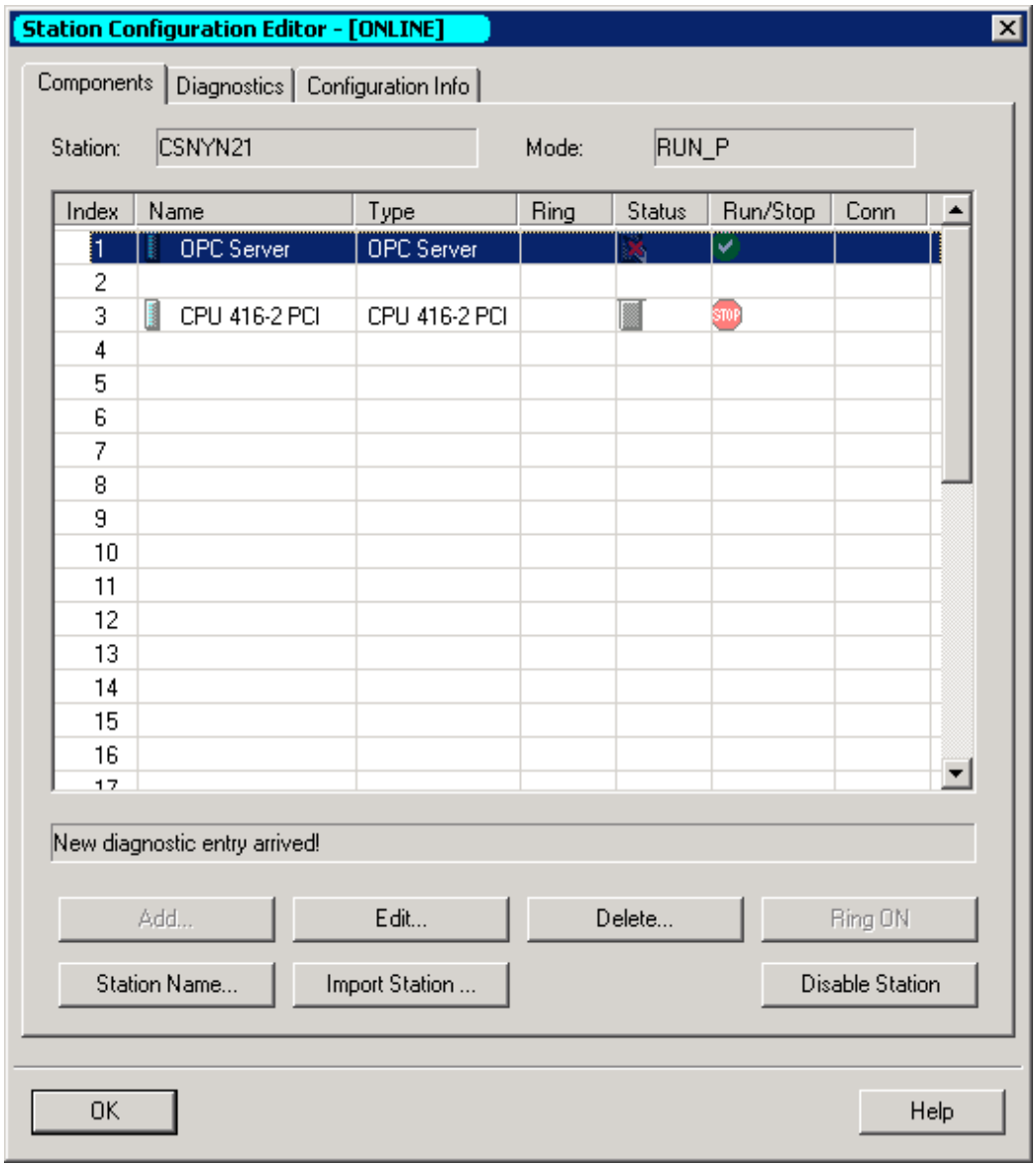
To configure the OPC server in the PC Station, follow these steps:

1. Open the Station Configuration Editor and select any index in the Station Configuration Editor.
2. Right-click the mouse to display the Add button. Click the Add button to display the Add Component dialog.
3. Select "OPC Server" from the drop-down list of component types:



4. Click OK to add the OPC server to the station configuration. The Station Configuration Editor displays the OPC server in the index selected. (For this example, the OPC server is configured for Index 1.)

5. Click OK to save the PC station configuration and to close the Station Configuration Editor dialog.



8.3 Step 2 : Add the OPC Server to the Hardware Configuration

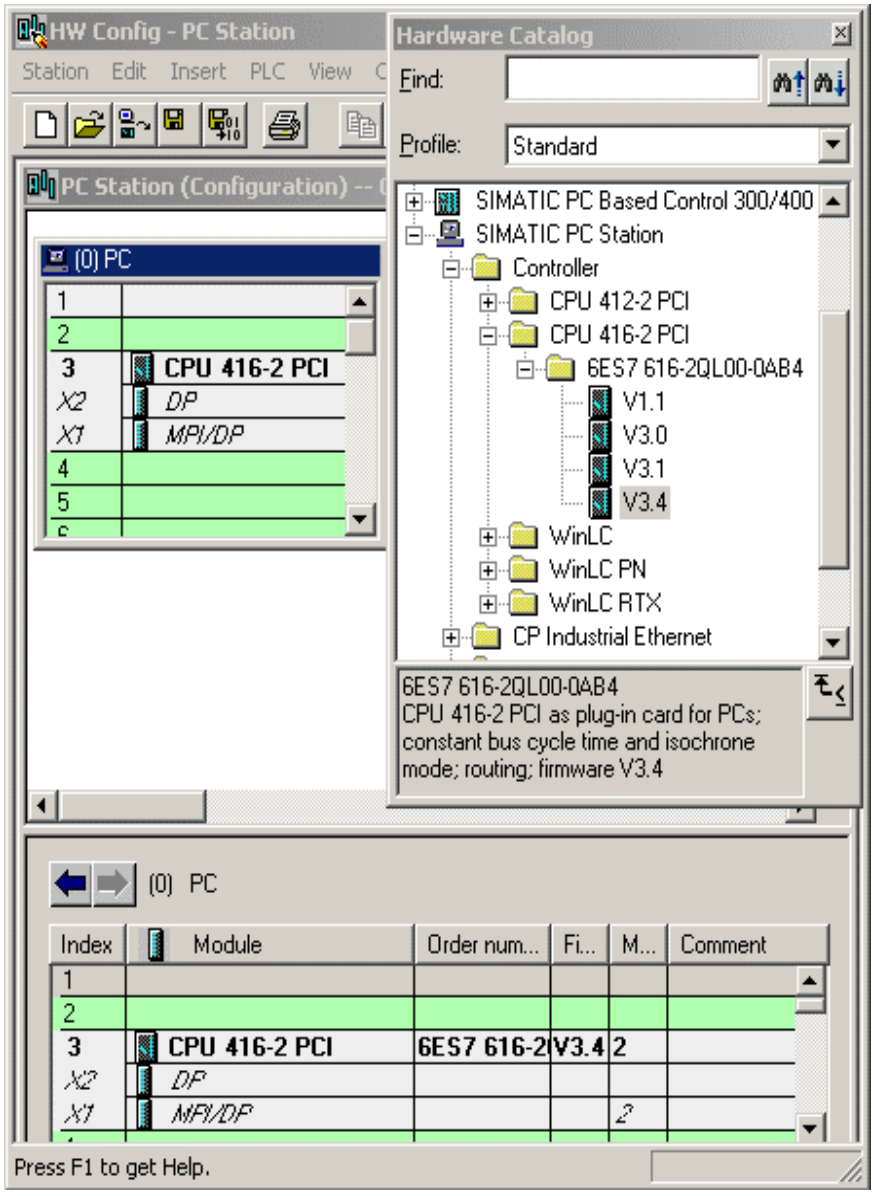
Tool: HW Configuration (STEP 7)

Task Summary:

- Create a STEP 7 project for a PC station with a CPU 41x-2 PCI.
- Insert the OPC server into the hardware configuration.
- Configure the OPC server.

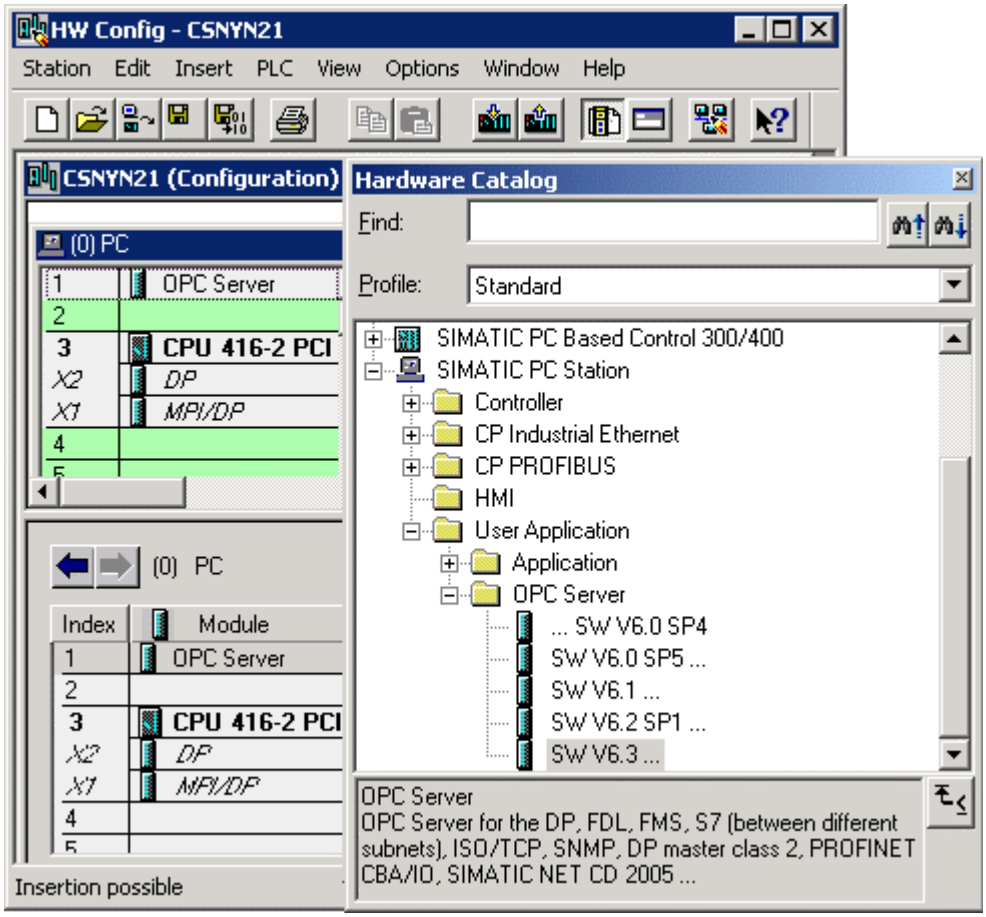
8.3.1 Creating the STEP 7 Project

1. Open STEP 7 and create a project (for example, OPCProject).
2. Insert a SIMATIC PC Station with the same name as entered in the Station Configuration Editor.
3. Double-click the Configuration icon for the PC Station to open the STEP 7 Hardware Configuration application.
4. Insert the CPU 41x-2 PCI in the same index as configured in the Station Configuration Editor.



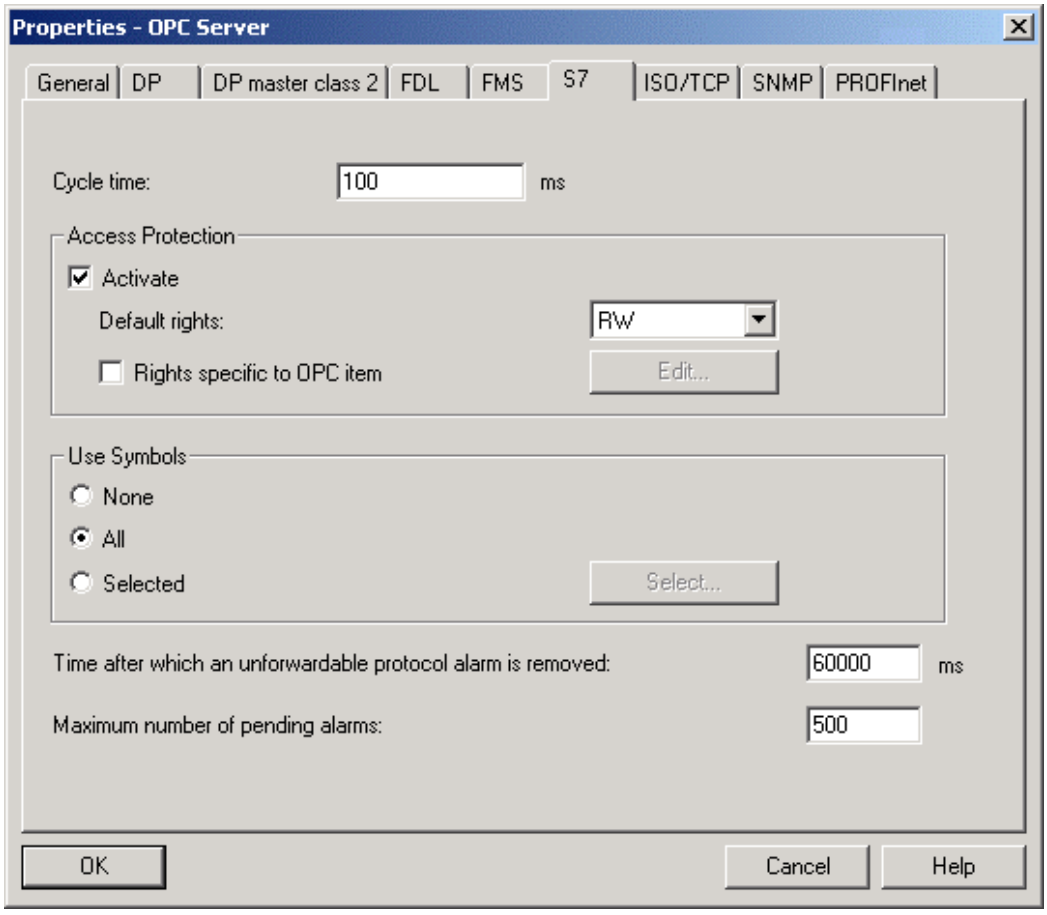
Adding the OPC Server to the Hardware Configuration

1. Expand the User Application folder in the Hardware Catalog.
2. Expand the OPC Server folder and select the following component:
3. SW V6.3
4. Drag and drop the SW V6.3 component to the same index as configured in the Station Configuration Editor. (For this example, the OPC server is configured for Index 1.)



8.3.2 Configuring the OPC Server

1. Double-click the OPC Server entry (Index 1) to open the Properties dialog.
2. Click the S7 tab and select the Activate option (under Access Protection).
3. To use the STEP 7 symbols for accessing controller data from the OPC Server, select the option for All (or for Selected, to specify specific entries in the symbol table) under the Use Symbols field.
4. Click OK to close the Properties dialog.
5. Click the Save and Compile icon to create the hardware configuration for the PC station.



After you have compiled the configuration into the STEP 7 project, you can close HW Config and return to SIMATIC Manager.

8.4 Step 3: Add an S7 Connection for the OPC Server in NetPro

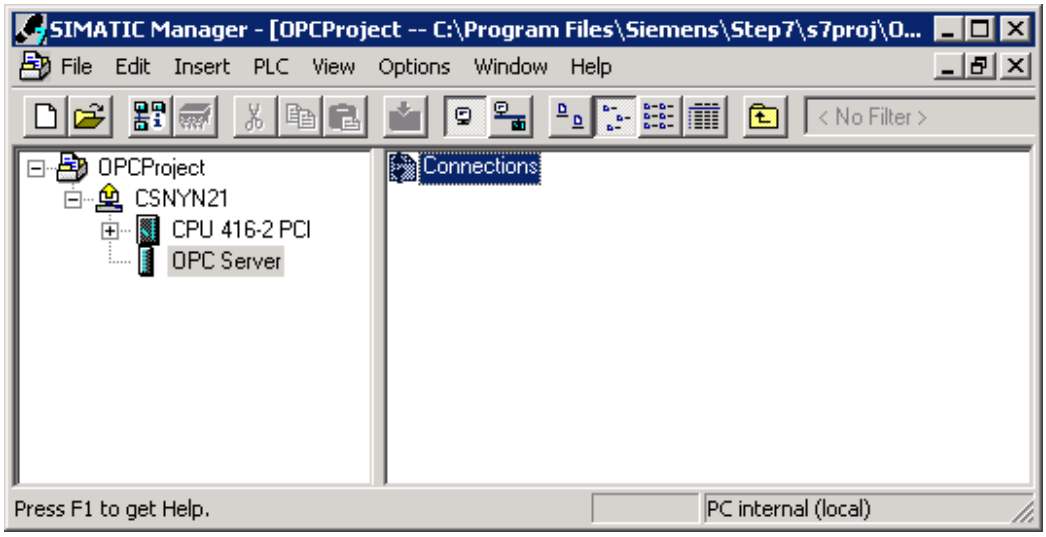
Tool: NetPro (STEP 7)

Task Summary:

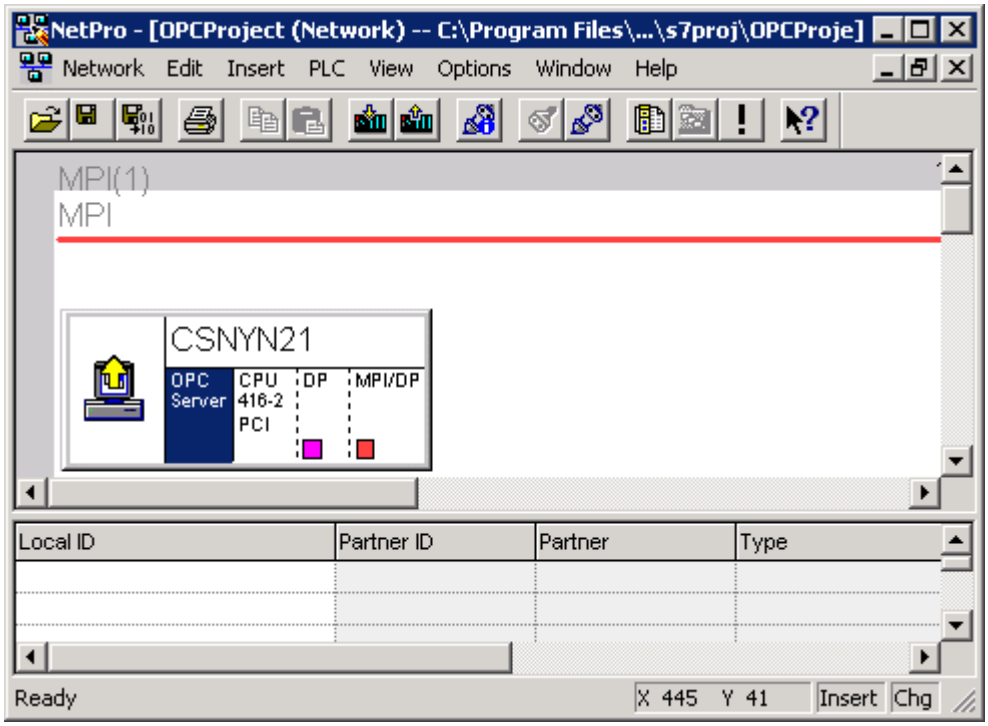
- Configure an S7 connection for the OPC server to the PC Station configuration.
- Assign a Local ID for the OPC server connection.

8.4.1 Configuring an OPC Server Connection in NetPro

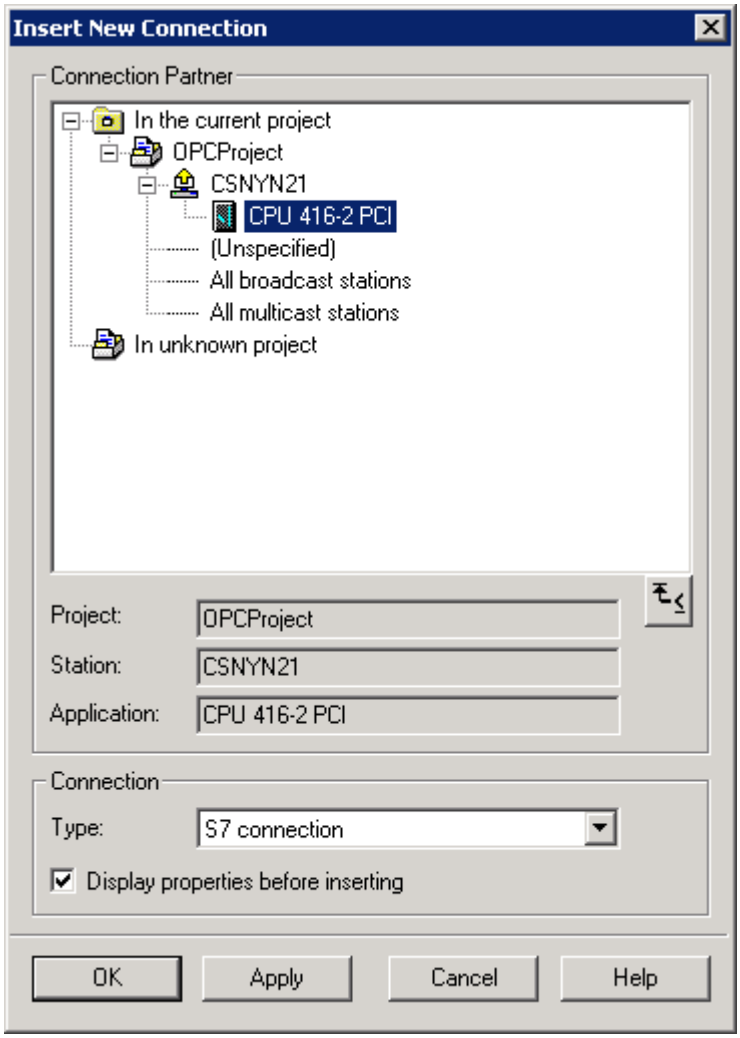
1. In SIMATIC Manager, browse to the OPC server and double-click the Connections icon to open NetPro.



2. Select the OPC Server in the PC station.



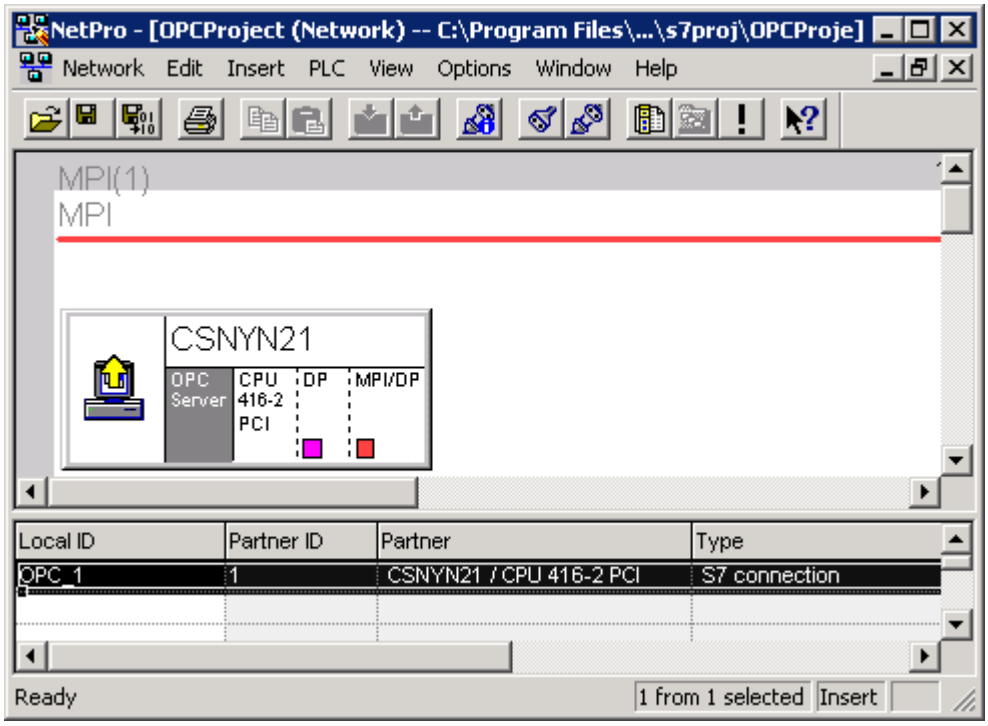
3. Right-click the OPC server to display the context menu. Select the **Insert New Connection** menu command to open the Insert New Connection dialog.



4. Set the connection type to S7 connection and click OK to add the S7 connection for the OPC server. The Properties dialog for the S7 connection opens automatically.

8.4.2 Assigning a Local ID for the OPC Server Connection

1. In the Properties dialog, enter the Local ID for the S7 connection (such as OPC_1).
2. Click OK to add the S7 connection to NetPro.
3. Click the Save and Compile icon to save and compile your changes into the STEP 7 project.



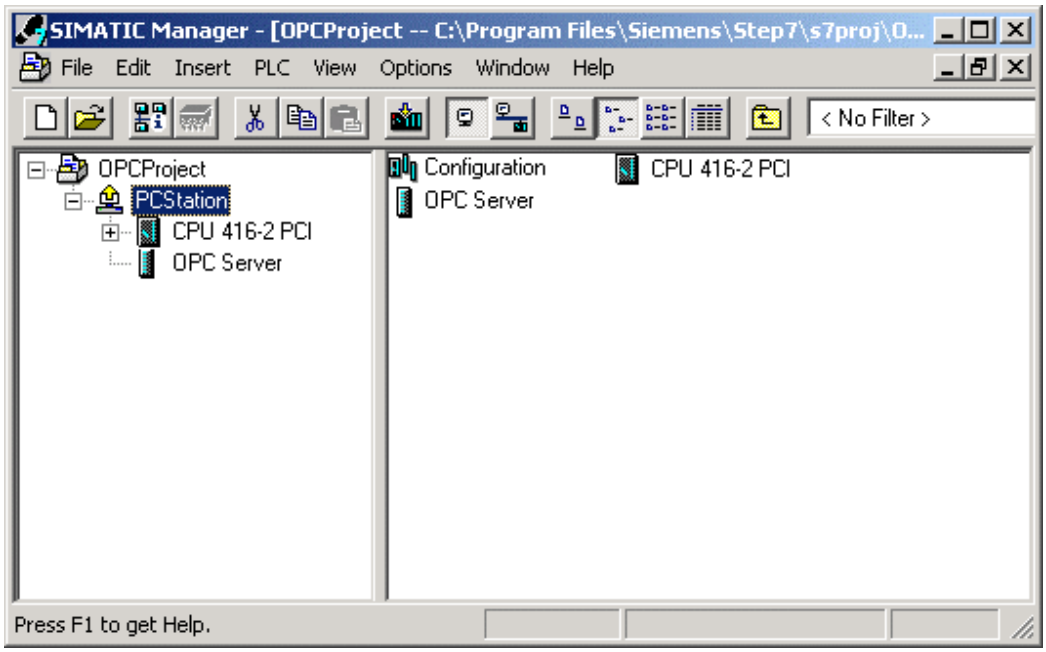
After you have compiled the S7 connection for the OPC server into the STEP 7 project, you can close NetPro and return to SIMATIC Manager.

8.5 Step 4: Download the Configuration to the Controller

Tool: SIMATIC Manager (STEP 7)
Note: The controller must be running in order to download the configuration from STEP 7.

To download the configuration, follow these steps:

1. If the controller is not running, power it on.
2. In SIMATIC Manager, select the SIMATIC PC Station icon.
3. Select the **PLC > Download** menu command or click the Download icon on the toolbar.



8.6 Step 5 : Connect the Controller to the OPC server

Tool: OPC Scout
Task Summary:

- Create an OPC Project.
- Add the connection to the SIMATIC NET OPC server.
- Define the items to be accessed through the OPC server.

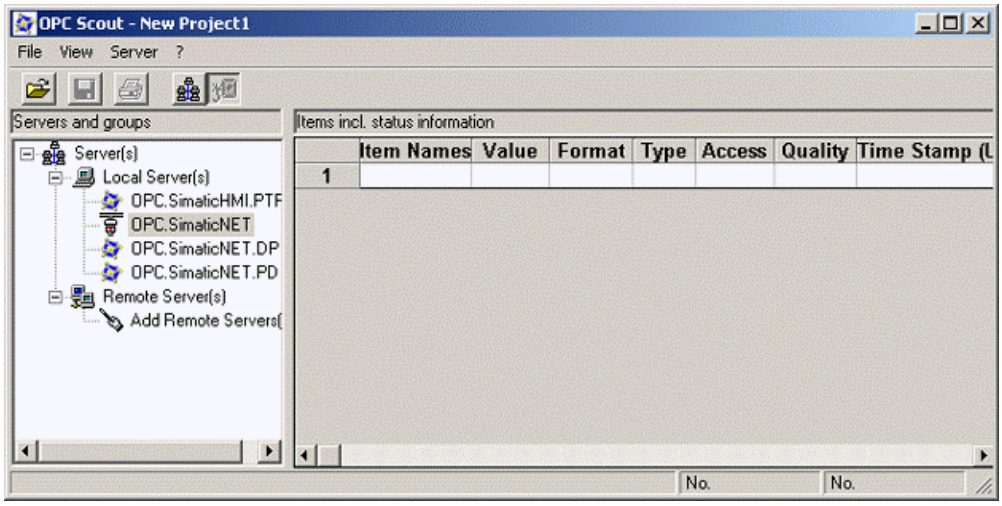
8.6.1 Creating an OPC Project

Select the **Start > SIMATIC >SIMATIC NET > OPC SCOUT** menu command to create a new project in OPC Scout.

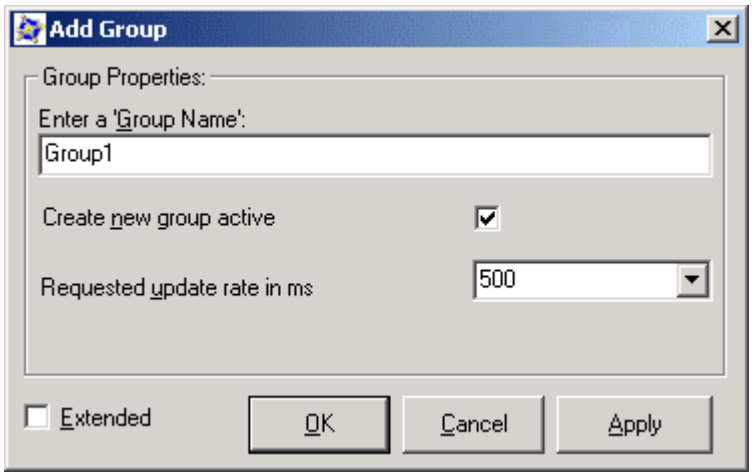
8.6.2 Adding a Connection (Group) for the OPC Server

To add a connection to the SIMATIC NET OPC server, follow these steps:

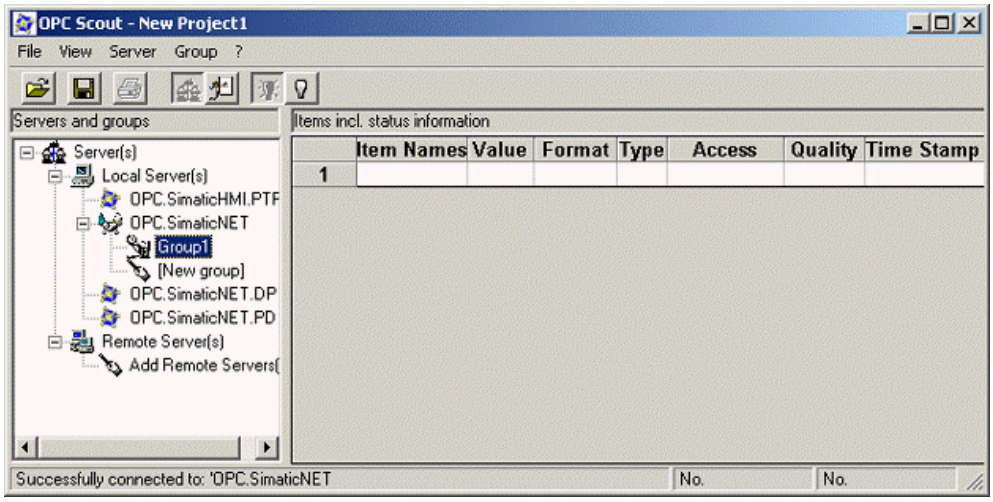
1. Expand the Local Server(s) directory in the Servers and Groups for the project.
2. Double-click the OPC.SimaticNet element to add a connection (or group) for the SIMATIC NET OPC server.



3. In the Add Group dialog, enter the Group Name for the connection (for example, Group1).



4. Click OK to add the group to the OPC server. OPC Scout adds the connection (Group1) to the OPC server.

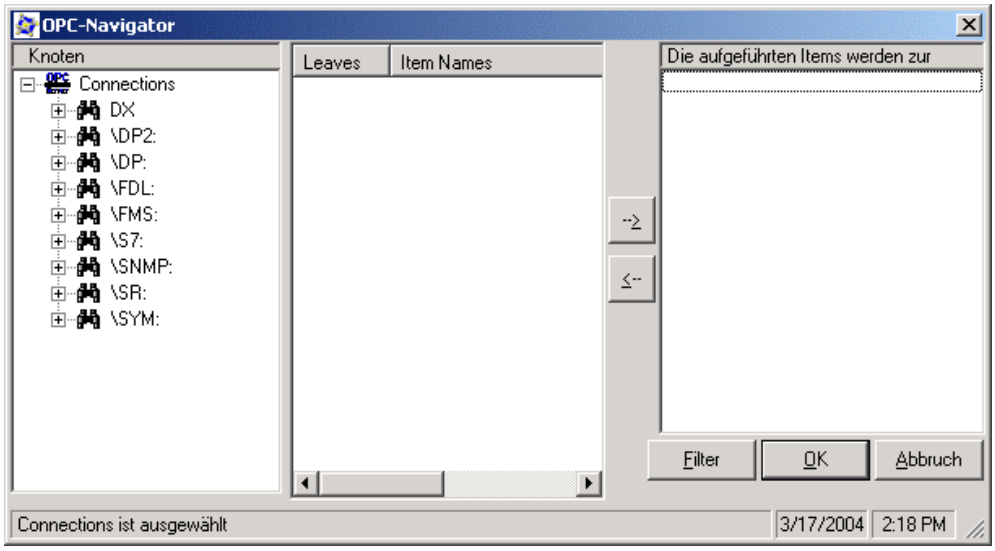


8.6.3 Configuring the Items to be Accessed (Using Absolute Addressing)

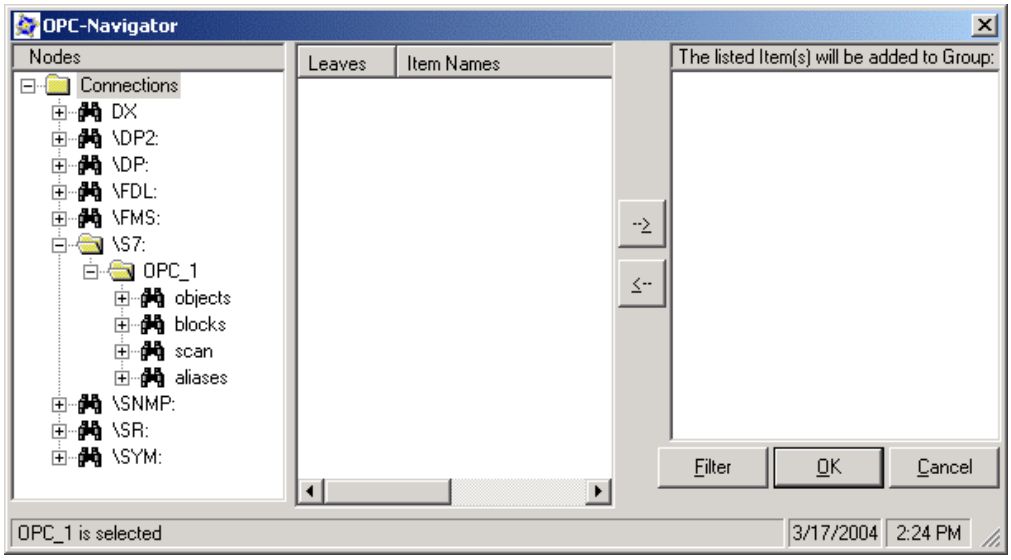
Note: This procedure describes how to use absolute addressing when configuring the OPC server. You can also use the STEP 7 symbol table to connect the OPC server. This procedure is described in "Configuring the Items to be Accessed (Using the STEP 7 Symbol Table)".

Use the following procedure to configure the OPC server to use an absolute address for accessing data in the controller:

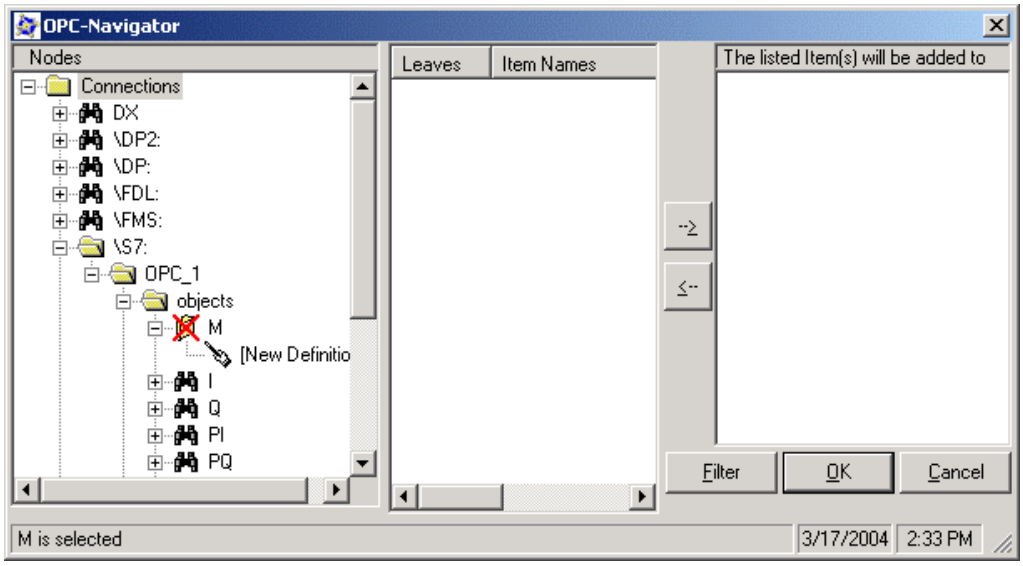
1. Open the OPC Navigator by double-clicking the connection (Group1) for the OPC server.



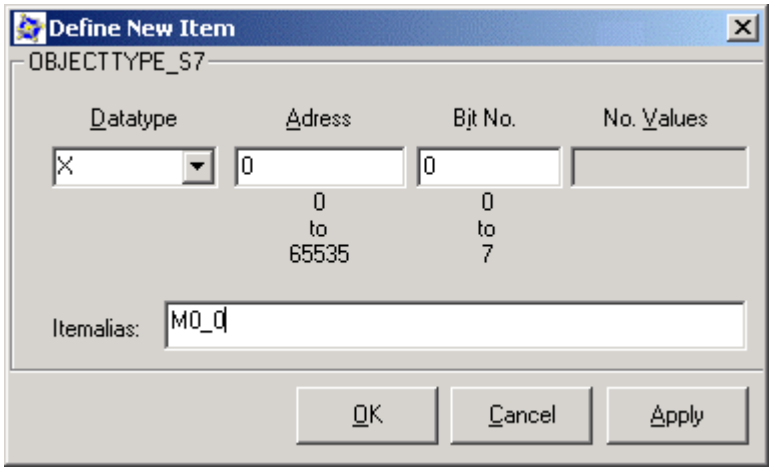
2. To add an item to be accessed, expand the \S7: folder and select OPC_1.



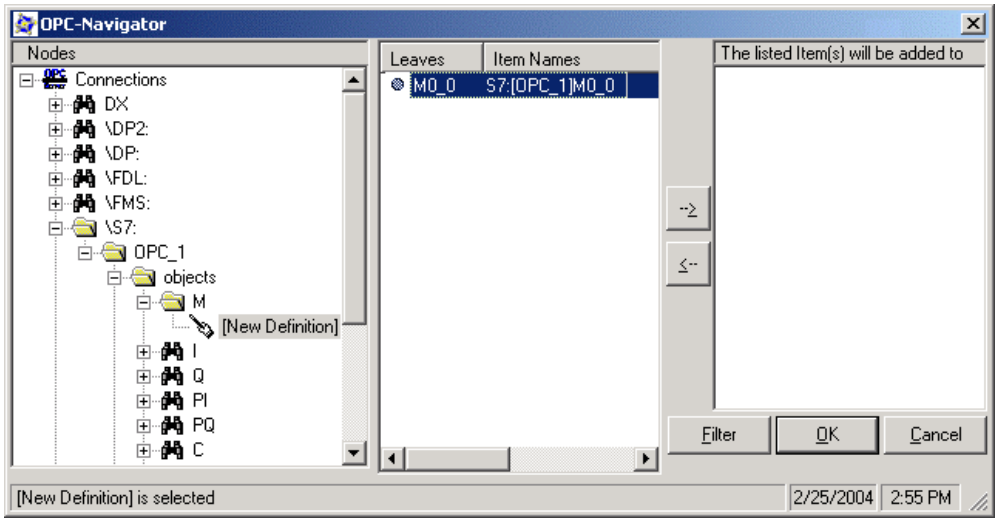
3. To configure access to M 0.0, expand the Objects folder and expand the M folder (for the bit memory area).



4. Double-click the New Definition icon to open the Define New Item dialog.
5. To define a connection for M0.0, select X (for bit) from the Data Type drop-down list and enter the byte address (0) and bit number (0). (You can also enter an alias for the item.)



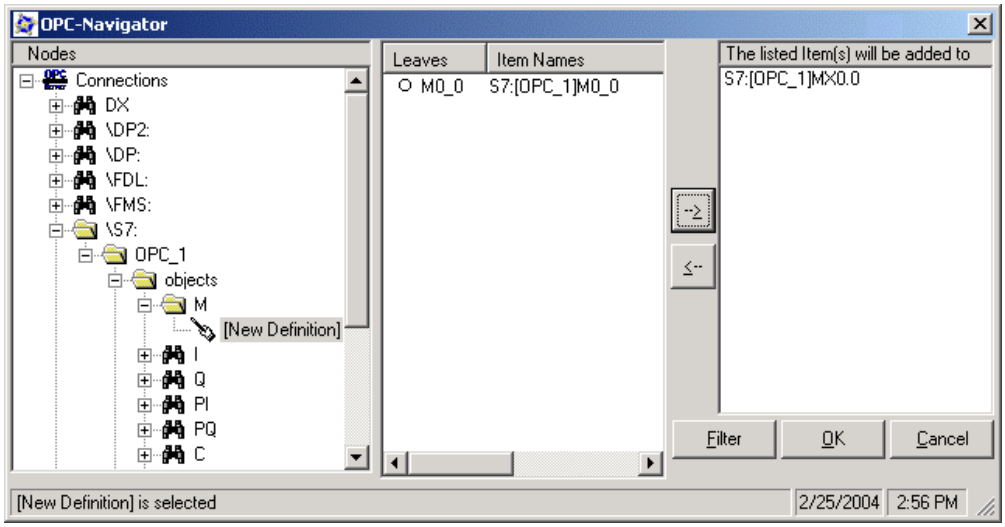
6. Click OK to define an item for M0_0.



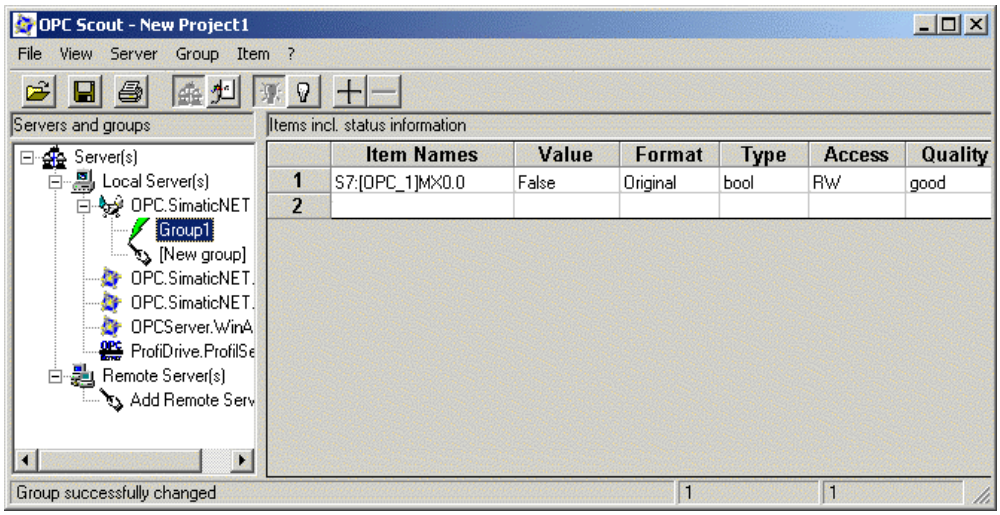
7. Select the MX0.0 entry and click the Add arrow (-->) to enter the following syntax that defines a connection for MX0.0:

   S7:[OPC_1]MX0.0

8. Select the entry (S7:[OPC_1]MX0.0) and click OK to add the connection for MX0.0 to Group1.



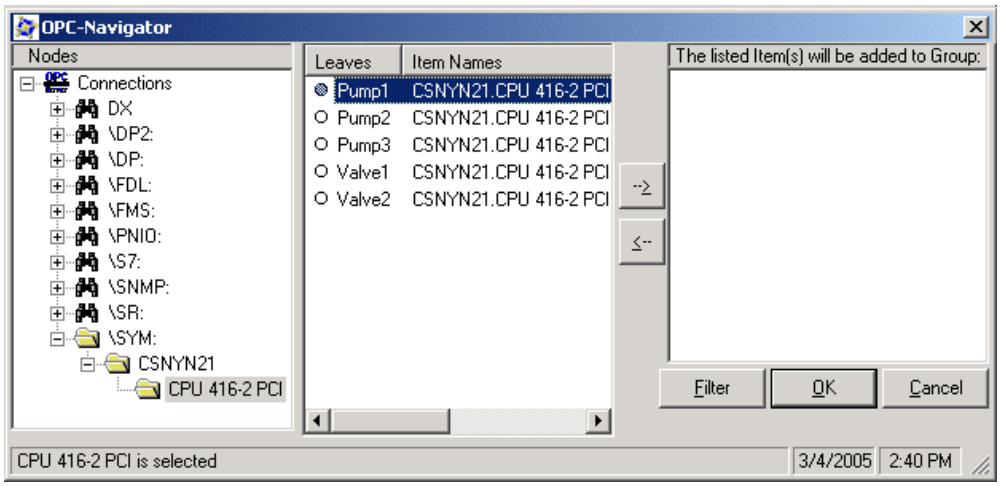
After adding the item to Group1, OPC Scout displays name and other parameters for the item. You can now use any of the methods supported by SIMATIC NET OPC Server.



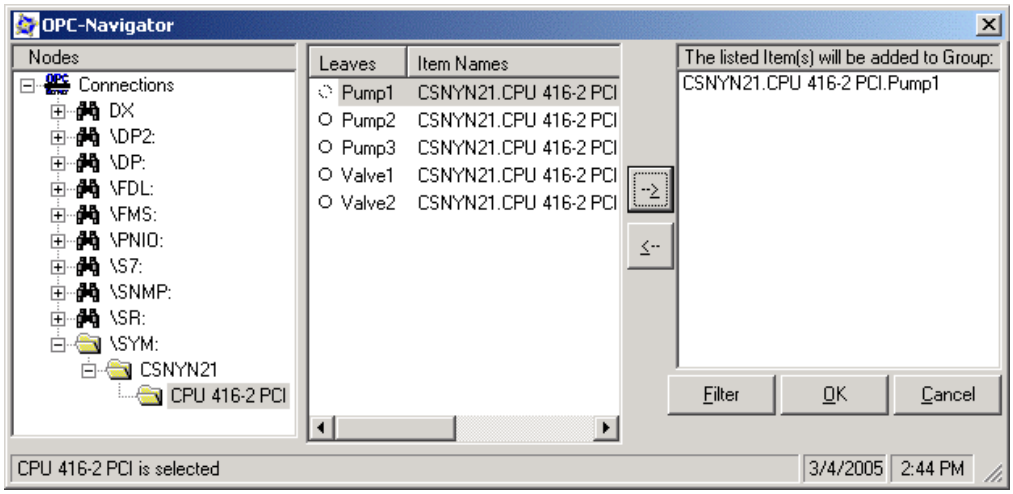
8.6.4 Configuring the Items to be Accessed (Using the STEP 7 Symbol Table)

If you created a symbol table for the STEP 7 program that you downloaded, you can use the symbols for connecting the OPC server to the data in the controller. To configure the items to be accessed using the STEP 7 symbol table, follow these steps:

1. Open the OPC Navigator by double-clicking the connection (Group1) for the OPC server.
2. Browse to the folder for the controller to display the symbols that have been downloaded to the controller.

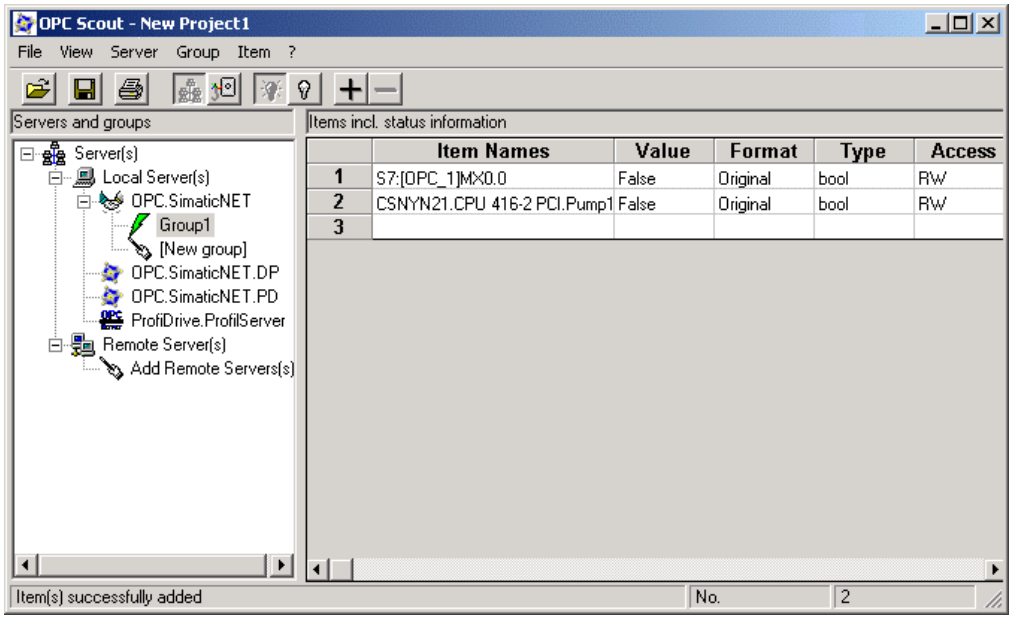


3. After selecting the symbols for the data to be connected to the OPC server, click the Add button (-->).



4. Click the OK button to add the symbol to Group1.

After adding the item to the group, OPC Scout displays symbol name and other parameters for the STEP 7 symbol.



9 Reference Information

9.1 General Technical Specifications

9.1.1 Standards, Certificates, and Approvals

Introduction

This section presents information on

- The primary standards met by the modules
- Certificates and approvals for the modules

CE Mark

Our modules satisfy the requirements of EC Directive 89/336/EWG "Electromagnetic Compatibility" (EMC Directive).

The EC Declarations of Conformity are held for the relevant authorities at:

Siemens Aktiengesellschaft
Automation Group
A&D AS RD ST
P.O. Box 1963

D-92209 Amberg

Area of Application

SIMATIC products are designed for use in industrial settings.

Area of Application	Requirements	
	Interference emission	Interference immunity
Residential, business, and commercial operations as well as small businesses	EN 6100-6-3: 2001	EN 6100-6-1: 2001
Industrial	EN 6100-6-4: 2001	EN 6100-6-2: 2001

Test Environment

All technical specifications were proven in the SIMATIC Box PC 627 test environment.

Approvals

The CPU 41x-2 PCI has the following approvals:

Underwriters Laboratories (UL) in accordance to

- Standard UL 60950, File-No. E115352 and Canadian Standard C22.2 No. 60950 (I.T.E) and
- Standard UL 508, File-No. E85972 and Canadian Standard C22.2 No. 14 05 (IND.CONT.EQ)

9.1.2 Electromagnetic Compatibility

Definition

The CPU 41x-2 PCI satisfies the requirements of the applicable European standards if set up according to the guidelines thereof.

The modules have been tested in a device that likewise complies with the standards indicated below. If the modules are operated in a device that does not comply with these standards, adherence to the relevant values cannot be guaranteed.

Information on interference immunity and radio interference suppression is provided below.

Pulse-Shaped Interferences

The following table presents the electromagnetic compatibility of modules with respect to pulse-shaped interferences. This presupposes that the system complies with the specifications and guidelines on electrical installation.

Pulse-Shaped Interference	Tested with	Correspond-ing Severity
Electrostatic discharge in accordance with IEC 61000-4-2	Air discharge: ± 8 kV Contact discharge: ± 6 kV	3
Burst pulses in accordance with IEC 61000-4-4	2 kV	3
High-energy surge in accordance with IEC 61000-4-5 • Asymmetrical interference • Symmetrical interference	2 kV (supply line) DC voltage with protectors 2 kV (data line) 1 kV (supply line) DC voltage with protectors	3

Sinusoidal Interferences

The following table presents the EMC behavior with respect to sinusoidal interferences:

Sinusoidal Interference	Tested with	Corresponding Severity
HF radiation (electromagnetic fields) in accordance with IEC 61000-4-3	10 V/m with 80% amplitude modulation of 1 kHz over the range of 80 MHz to 1000 MHz and 1,4 GHz to 2 GHz	3
Conducted RF interference on cables and cable shields in accordance with IEC 61000-4-6	Test voltage of 10 V with 80% amplitude modulation of 1 kHz over the range of 10 KHz to 80 MHz	3

Emission of Radio Interferences

Radio interference in accordance with EN 55022: Limit Class B.

Performing Work on the Prod

To protect the product from discharge of static electricity, operating personnel must take appropriate action to discharge static electricity from their bodies prior to touching the module.

9.1.3 Shipping and Storage Conditions

Modules

The modules meet the shipping and storage condition requirements of IEC 61131, Part 2. The following specifications apply to modules that are shipped and stored in their original packaging.

The climatic conditions conform to Class 2K4 for shipping and storage.

The mechanical conditions conform to IEC 60721, Part 3-2, Class 2M2.

Type of condition	Permissible range
Free fall	≤ 1 m (up to 10 kg)
Temperature	From - 40 °C to + 70 °C
Air pressure	1080 to 660 hPa (corresponds to an altitude of -1000 to 3500 m)
Relative humidity	5 to 95%, without condensation
Sinusoidal vibrations in accordance with IEC 60068-2-6	5 to 9 Hz: 3.5 mm 9 to 500 Hz: 9.8 m/s2
Shock in accordance with IEC 60068-2-29	250 m/s2 6 ms, 1000 shocks

Shipping of Backup Batteries

Whenever possible, backup batteries should be shipped in their original packaging. No special measures are required for shipping backup batteries. The lithium content of the backup battery is less than 0.5 g.

Storage of Backup Batteries

Backup batteries must be stored in a cool, dry environment. Maximum storage time is 10 years.

Warning

Danger of personal injury and property damage. Danger of release of harmful substances.

Incorrect handling can cause a lithium battery to explode, improper disposal of old lithium batteries can cause harmful substances to be released. Therefore, follow the instructions below without exception:

- Do not throw new or discharged batteries in fire, and do not apply solder to the outside of the battery (maximum temperature of 100 °C). Likewise, do not recharge the battery. There is a danger of explosion!
- Do not open the battery. Always replace with a battery of the same type. Obtain replacement batteries through Siemens - this ensures that your battery will be short-circuit-proof.
- Return old batteries to the battery manufacturer or dispose of them as hazardous waste.

Passivation Layer

When lithium batteries (lithium/thionyl chloride) are used, the battery may not function immediately if the battery has been stored a long time and has developed a passivation layer. For remedies, refer to Removal of the Passivation Layer of the Backup Battery.

9.1.4 Mechanical and Climatic Environmental Conditions

Operating Conditions

The modules have been tested in a device that likewise complies with the standards indicated below. If the modules are operated in a device that does not comply with these standards, adherence to the values cannot be guaranteed.

Usage with Additional Measures Only

The CPU 41x-2 PCI must not be used without additional measures being taken

- At locations subject to a high degree of ionizing radiation
- At locations with harsh operating conditions; for example, due to
  - Dust
  - Corrosive vapors or gases
  - Strong electrical or magnetic fields
- In facilities requiring special monitoring, such as
  - Lifts
  - Electrical systems in particularly hazardous areas

An additional measure might be operation in an enclosure or cabinet.

Mechanical Environmental Conditions

The SIMATIC Box PC 627 is designed to meet stringent requirements for mechanical environmental conditions (vibration test with 1 g constant load at a frequency of 58 to 500 Hz). The CPU 41x-2 PCI complies with these requirements when operated in a SIMATIC Box PC 627.

If the CPU 41x-2 PCI is installed in other PCs with longer slots than 3/4 PCI and greater mechanical stresses, you must mechanically secure the back end of the PCB.

Requirement for External 24 VDC Power Supply

The 24 VDC power supply must conform to LPS (Limited Power Source) or NEC Class 2. If the 24 VDC power supply does not conform to LPS or NEC Class 2, the CPU 41x-2 PCI must be operated in restricted access locations.

Tests for Mechanical Environmental Conditions

The following table provides information on the type and scope of the tests for mechanical environmental conditions.

Test for	Test Standard	Remarks
Vibrations	Vibration test in accordance with IEC 60068 Part 2-6 (sine)	Vibration type: Frequency sweeps with change rate of 1 octave/minute. 10 Hz ≤ f < 58 Hz, constant amplitude of 0.075 mm 58 Hz ≤ f < 500 Hz, constant acceleration of 1 g Vibration period: 10 frequency sweeps per axis in each of 3 mutually perpendicular axes
Shock	Shock test in accordance with IEC 60068 Part 2-29	Type of shock: Half-sine Intensity of shock: 5 g peak value, 30 ms duration Shock direction: 100 shocks in each of 3 mutually perpendicular axes

Climatic Environmental Conditions

The modules may be used under the following climatic environmental conditions:

	Permissible range	Remarks
Temperature	5 to +60 °C	Temperature measured on the CPU 41x-2 PCI The CPU 41x-2 PCI functions in the complete approved temperature range as the Box PC 627.
Temperature change	Max. 10 °C/h	
Relative humidity	Max. 95% at +25 °C	No condensation, corresponds to RH Class 2 in accordance with IEC 61131-2
Air pressure	1080 to 795 hPa (corresponds to an altitude of -1000 to 2000 m)	
Pollutant concentration	SO2: < 0.5 ppm; RH < 60%, no condensation H2S: < 0.1 ppm; RH < 60%, no condensation	Test: 10 ppm; 4 days 1 ppm; 4 days

9.1.5 Certifications for USA, Canada, and Australia

9.1.5.1 USA

Federal Communications Commission

Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense:

Shielded cables

Shielded cables must be used with this equipment to maintain compliance with FCC regulations.

Modifications

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Conditions of operations

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

9.1.5.2 Canada

Canadian Notice

This Class B digital apparatus complies with Canadian ICES-003.

Avis Canadien

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

9.1.5.3 Note for Australia

WinAC Slot 41x satisfies the requirements of AS/NZS CISPR 22 (Class B).

9.2 CPU 41x-2 PCI: Technical Specifications

9.2.1 Overview of Parameters for the CPU 41x-2 PCI

Introduction

The properties and behavior of the CPU can be assigned. System data blocks contain parameter blocks that define the behavior of the operating system and CPU-internal initial settings.

Default Values

All parameters are set to default values when the product is shipped. These default values are suitable for a wide range of standard applications and enable the CPU 41x-2 PCI to be used directly without additional settings.

Assignable System Characteristics

The following list presents an overview of the assignable system characteristics that are available in the CPU 41x-2 PCI.

- General properties
- Startup
- Cycle/clock memory
- Retentivity
- Local data
- Interrupts (process interrupts, time-delay interrupts, asynchronous error interrupts)
- Time-of-day interrupts
- Cyclic interrupts
- Synchronous cycle interrupts
- Diagnostics/clock

Parameter Assignment Tool

The individual CPU parameters can be set in the STEP 7 Hardware Configuration application.

9.2.2 Performance Features and Technical Specifications of the CPU 412-2 PCI

Product version			
HW product version	01		
Firmware version	V4.0		

Voltages and currents			
Power consumption	19	W	With external 24 VDC supply and switched-off PC
	11	W	With external 24 VDC supply and switched-on PC
	10	W	With supply from the PC
Power loss, max.	11	W	
Load from fan connection, max.	500	mA	In addition, note the maximum load capacity of the fan infeed coming from the PC!
Requirements for external 24 VDC supply			
• Static	20.4 to 28.8	V	
• Dynamic	18.5 to 30.2	V	3-phase bridge rectifier

Current consumption			
Current consumption, max.	1.0	A	From external 24 VDC supply
	0.8	A	From PCI interface (5 V)
	0.4	A	From PCI interface (12 V)
			Backup battery
Voltage	3.6	V	Lithium
Backup current, max.	1.3	mA	Backup battery voltage: 3.6 V, Lithium; 2.3 Ah
Backup current, typ.	500	µA	

Memory/backup			
Memory			
Memory card, FLASH EPROM			For technical specifications, see Types of Memory Cards
Work memory			
Integrated (for program)	192	Kbytes	
Integrated (for data)	192	Kbytes	
Load memory			
Expandable FEPROM	Yes		Memory card (FLASH)
Expandable FEPROM, max.	64	Mbytes	
Integrated RAM, max.	256	Kbytes	
Expandable RAM	Yes		Memory card
Expandable RAM, max.	64	Mbytes	

CPU/blocks			
DB			
Number, max.	511		
Size, max.	64	Kbytes	
FB			
Number, max.	256		
Size, max.	64	Kbytes	
FC			
Number, max.	256		
Size, max.	64	Kbytes	
OB			
Number, max.	29		
Size, max.	64	Kbytes	
Number of time-of-day interrupt OBs	2		
Number of time-delay interrupt OBs	2		
Number of cyclic interrupts	2		
Number of hardware interrupt OBs	2		
Nesting depth			
Per priority class	24		
Additional tiers within an error OB	1		

CPU/execution times			
For bit operations, min.	0.1	µs	
For fixed-point arithmetic, min.	0.1	µs	
For floating-point arithmetic, min.	0.3	µs	

Timers/counters and their retentivity			
S7 counters			
Number	2048		
Retentivity			
Adjustable	Yes		
Lower limit	0		
Upper limit	2047		
Preset	Z 0 to Z 7		
Counting range			
Adjustable	Yes		
Lower limit	0		
Upper limit	999		
IEC counter			
Available	Yes		
Type	SFB		
S7 timers			
Number	2048		
Retentivity			
Lower limit	0		
Upper limit	2047		
Preset	No retentive timers		
Time setting range			
Lower limit	10	ms	
Upper limit	9990	s	
IEC timer			
Available	Yes		
Type	SFB		

Data storage areas and their retentivity			
Retentivity without UPS	None		
Retentivity with UPS	None		
Retentivity with battery	All data		Total work and load memory (with backup battery)
Bit memory			
Number	4	Kbytes	
Retentive bytes	MB 0 to MB 4095		
Retentivity preset	MB 0 to MB 15		
Amount of clock memory	8		

Address area			
Total I/O address area			
Inputs	4	Kbytes	
Outputs	4	Kbytes	
Distributed outputs			
MPI/DP interface, inputs	2	Kbytes	
MPI/DP interface, outputs	2	Kbytes	
DP interface, inputs	4	Kbytes	
DP interface, outputs	4	Kbytes	
Process image			
Inputs, adjustable	4	Kbytes	
Outputs, adjustable	4	Kbytes	
Inputs, preset	128	Bytes	
Outputs, preset	128	Bytes	
Number of process image partitions, max.	15		
Digital channels			
Inputs	32768		
Outputs	32768		
Analog channels			
Inputs	2048		
Outputs	2048		

Configuration			
Number of DP masters			
Total	2		
Integrated	2		

Time of day			
Clock			
Real-time clock	Yes		
Battery-backed	Yes		
Operating hours counter			
Number	8		
Time synchronization			
Supported	Yes		
With PC-CP, slave	Yes		
With MPI, master	Yes		
With MPI, slave	Yes		

S7 message functions			
Number of stations that can be logged on for message functions, max.	8		
SCAN procedure	Yes		
Process diagnostic messages	Yes		
Alarm-8 blocks	Yes		
Control system fault messages	Yes		

Test and commissioning functions			
Status/Force			
Status/Force Variable	Yes		
Force			
Force	Yes		
Status block	Yes		
Single step	Yes		
Diagnostic buffer			
Available	Yes		
Number of inputs, max.	400		
Preset	120		

1st interface			
Type of interface	RS 485 / PROFIBUS		
Power supply on interface from 5 V, max.	90	mA	
Physical level	RS 485		
Optically isolated	Yes		
Functionality			
MPI	Yes		
DP master	Yes		
DP slave	Yes		
MPI			
Number of connections	16		
Services			
PG/OP communication	Yes		
Routing	Yes		
Global data communication	Yes		
S7 basic communication	Yes		
S7 communication	Yes		
Transmission rates, max.	12	Mbps	
DP master			
Number of connections, max.	16		
Services			
PG/OP communication	Yes		
Routing	Yes		
Global data communication	No		
S7 basic communication	Yes		
S7 communication	Yes		
Equidistance support	Yes		
SYNC/FREEZE	Yes		
Enable/disable DP slaves	Yes		
Direct data exchange	Yes		
DPV0	Yes		
DPV1	Yes		
Transmission rates, max.	12	Mbps	
Number of DP slaves, max.	32		
Address area			
Inputs, max.	2	Kbytes	
Outputs, max.	2	Kbytes	

1st interface			
User data per DP slave			
Inputs, max.	244	Bytes	
Outputs, max.	244	Bytes	
DP slave			
PG/OP communication	Yes		
Routing	Yes		
Status/Force	Yes		
Programming	Yes		
Transmission rates	12	Mbps	
Transfer memory			
Inputs	244	Bytes	
Outputs	244	Bytes	
Address areas, max.	32		
User data per address area, max.	32	Bytes	
Amount of consistent user data per address area, max.	32	Bytes	

2nd interface			
Type of interface	RS 485 / PROFIBUS		
Power supply on interface from 5 V, max.	90	mA	
Physical level	RS 485		
Optically isolated	Yes		
Functionality			
MPI	No		
DP master	Yes		
DP slave	Yes		
PROFINET CBA	No		
PROFINET CBA-SRT	No		
PROFINET IO controller	No		
DP master			
Number of connections, max.	16		
Services			
PG/OP communication	Yes		
Routing	Yes		
Global data communication	No		
S7 basic communication	Yes		
S7 communication	Yes		
Equidistance support	Yes		
SYNC/FREEZE	Yes		
Enable/disable DP slaves	Yes		
Direct data exchange	Yes		
DPV0	Yes		
DPV1	Yes		
Transmission rates, max.	12	Mbps	
Number of DP slaves, max.	64		
Address area			
Inputs, max.	4	Kbytes	
Outputs, max.	4	Kbytes	
User data per DP slave			
Inputs, max.	244	Bytes	
Outputs, max.	244	Bytes	

2nd interface			
DP slave			
Services			
PG/OP communication	Yes		
Routing	Yes		
Status/Force	Yes		
Programming	Yes		
Transmission rates	12	Mbps	
Transfer memory			
Inputs	244	Bytes	
Outputs	244	Bytes	
Address areas, max.	32		
User data per address area, max.	32	Bytes	
Amount of consistent user data per address area, max.	32	Bytes	

Clock synchronization			
Isochronous mode	Yes		
Number of DP masters with clock synchronization	2		
User data per isochronous slave, max.	244	Bytes	
Maximum number of bytes and slaves in a process image partition			The following must be true: number of bytes/100 + number of slaves < 16
Equidistance	Yes		
Minimum clock cycle	1	ms	
Maximum clock cycle	32	ms	

CPU/programming			
Configuring software			
STEP 7	Yes	V5.3 SP2 and higher	
Programming language			
STEP 7	Yes		
LAD	Yes		
FBD	Yes		
STL	Yes		
SCL	Yes		
CFC	Yes		
GRAPH	Yes		
HiGraph®	Yes		
Software libraries			
Easy Motion Control	Yes		
Nesting levels	8		
User program protection/password	Yes		
Open development interfaces			
CCX (custom code extension)	No		
SMX (shared memory extension)	Yes		With WinAC ODK V4.1
Inputs	4	Kbytes	
Outputs	4	Kbytes	
CMI (Controller Management Interface)	Yes		With WinAC ODK V4.1

Dimensions and weight			
Width	288	mm	
Height	98	mm	
Depth	18.5	mm	
Required slots	1		PCI, format 3/4
Weight, approx.	300	g	

Hardware requirements			
Required hardware	PC with color monitor, keyboard, mouse or pointing device for Windows		
Memory requirement on hard disk, min.	60	Mbytes	
Main memory, min.	256	Mbytes	
Processor	Intel Pentium 300 MHz		
Multi-processor system	Yes		
Hyperthreading	Yes		

Software requirement			
Operating system			
Windows NT 4.0	No		
Windows 2000	Yes		Professional, SP3 and higher
Windows XP	Yes		Professional, SP1 and higher

9.2.3 Performance Features and Technical Specifications of the CPU 416-2 PCI

Product version			
HW product version	01		
Firmware version	V4.0		

Voltages and currents			
Power consumption	19	W	With external 24 VDC supply and switched-off PC
	11	W	With external 24 VDC supply and switched-on PC
	10	W	With supply from the PC
Power loss, max.	11	W	
Load from fan connection, max.	500	mA	In addition, note the maximum load capacity of the fan infeed coming from the PC!
Requirements for external 24 VDC supply			
• Static	20.4 to 28.8	V	
• Dynamic	18.5 to 30.2	V	3-phase bridge rectifier

Current consumption			
Current consumption, max.	1.0	A	From external 24 VDC supply
	0.8	A	From PCI interface (5 V)
	0.4	A	From PCI interface (12 V)
Backup battery			
Voltage	3.6	V	Lithium
Backup current, max.	1.95	mA	Backup battery voltage: 3.6 V, Lithium; 2.3 Ah
Backup current, typ.	900	µA	

Memory/backup			
Memory			
Memory card, FLASH EPROM			For technical specifications, see Types of Memory Cards
Work memory			
Integrated (for program)	1.6	Mbytes	
Integrated (for data)	1.6	Mbytes	
Load memory			
Expandable FEPROM	Yes		Memory card (FLASH)
Expandable FEPROM, max.	64	Mbytes	
Integrated RAM, max.	256	Kbytes	
Expandable RAM	Yes		Memory card
Expandable RAM, max.	64	Mbytes	

CPU/blocks			
DB			
Number, max.	4095		
Size, max.	64	Kbytes	
FB			
Number, max.	2048		
Size, max.	64	Kbytes	
FC			
Number, max.	2048		
Size, max.	64	Kbytes	
OB			
Number, max.	52		
Size, max.	64	Kbytes	
Number of time-of-day interrupt OBs	8		
Number of time-delay interrupt OBs	4		
Number of cyclic interrupts	9		
Number of hardware interrupt OBs	8		
Nesting depth			
Per priority class	24		
Additional tiers within an error OB	2		

CPU/execution times			
For bit operations, min.	0.08	µs	
For fixed-point arithmetic, min.	0.08	µs	
For floating-point arithmetic, min.	0.48	µs	

Timers/counters and their retentivity			
S7 counters			
Number	2048		
Retentivity			
Adjustable	Yes		
Lower limit	0		
Upper limit	2047		
Preset	Z 0 to Z 7		
Counting range			
Adjustable	Yes		
Lower limit	0		
Upper limit	999		
IEC counter			
Available	Yes		
Type	SFB		
S7 timers			
Number	2048		
Retentivity			
Lower limit	0		
Upper limit	2047		
Preset	No retentive timers		
Time setting range			
Lower limit	10	ms	
Upper limit	9990	s	
IEC timer			
Available	Yes		
Type	SFB		

Data storage areas and their retentivity			
Retentivity without UPS	None		
Retentivity with UPS	None		
Retentivity with battery	All data		Total work and load memory (with backup battery)
Bit memory			
Number	16	Kbytes	
Retentive bytes	MB 0 to MB 16383		
Retentivity preset	MB 0 to MB 15		
Amount of clock memory	8		

Address area			
Total I/O address area			
Inputs	16	Kbytes	
Outputs	16	Kbytes	
Distributed outputs			
MPI/DP interface, inputs	2	Kbytes	
MPI/DP interface, outputs	2	Kbytes	
DP interface, inputs	8	Kbytes	
DP interface, outputs	8	Kbytes	
Process image			
Inputs, adjustable	16	Kbytes	
Outputs, adjustable	16	Kbytes	
Inputs, preset	512	Bytes	
Outputs, preset	512	Bytes	
Number of process image partitions, max.	8		
Digital channels			
Inputs	12800		
Outputs	12800		
Analog channels			
Inputs	8000		
Outputs	8000		

Configuration			
Number of DP masters			
Total	2		
Integrated	2		

Time of day			
Clock			
Real-time clock	Yes		
Battery-backed	Yes		
Operating hours counter			
Number	8		
Time synchronization			
Supported	Yes		
With PC-CP, slave	Yes		
With MPI, master	Yes		
With MPI, slave	Yes		

S7 message functions			
Number of stations that can be logged on for message functions, max.	12		
SCAN procedure	Yes		
Process diagnostic messages	Yes		
Alarm-8 blocks	Yes		
Control system fault messages	Yes		

Test and commissioning functions			
Status/Force			
Status/Force Variable	Yes		
Force			
Force	Yes		
Status block	Yes		
Single step	Yes		
Diagnostic buffer			
Available	Yes		
Number of inputs, max.	3200		
Preset	120		

1st interface			
Type of interface	RS 485 / PROFIBUS		
Power supply on interface from 5 V, max.	90	mA	
Physical level	RS 485		
Optically isolated	Yes		
Functionality			
MPI	Yes		
DP master	Yes		
DP slave	Yes		
MPI			
Number of connections	44		
Services			
PG/OP communication	Yes		
Routing	Yes		
Global data communication	Yes		
S7 basic communication	Yes		
S7 communication	Yes		
Transmission rates, max.	12	Mbps	
DP master			
Number of connections, max.	32		
Services			
PG/OP communication	Yes		
Routing	Yes		
Global data communication	No		
S7 basic communication	Yes		
S7 communication	Yes		
Equidistance support	Yes		
SYNC/FREEZE	Yes		
Enable/disable DP slaves	Yes		
Direct data exchange	Yes		
DPV0	Yes		
DPV1	Yes		
Transmission rates, max.	12	Mbps	
Number of DP slaves, max.	32		
Address area			
Inputs, max.	2	Kbytes	
Outputs, max.	2	Kbytes	

1st interface			
User data per DP slave			
Inputs, max.	244	Bytes	
Outputs, max.	244	Bytes	
DP slave			
PG/OP communication	Yes		
Routing	Yes		
Status/Force	Yes		
Programming	Yes		
Transmission rates	12	Mbps	
Transfer memory			
Inputs	244	Bytes	
Outputs	244	Bytes	
Address areas, max.	32		
User data per address area, max.	32	Bytes	
Amount of consistent user data per address area, max.	32	Bytes	

2nd interface			
Type of interface	RS 485 / PROFIBUS		
Power supply on interface from 5 V, max.	90	mA	
Physical level	RS 485		
Optically isolated	Yes		
Functionality			
MPI	No		
DP master	Yes		
DP slave	Yes		
PROFINET CBA	No		
PROFINET CBA-SRT	No		
PROFINET IO controller	No		
DP master			
Number of connections, max.	32		
Services			
PG/OP communication	Yes		
Routing	Yes		
Global data communication	No		
S7 basic communication	Yes		
S7 communication	Yes		
Equidistance support	Yes		
SYNC/FREEZE	Yes		
Enable/disable DP slaves	Yes		
Direct data exchange	Yes		
DPV0	Yes		
DPV1	Yes		
Transmission rates, max.	12	Mbps	
Number of DP slaves, max.	125		
Address area			
Inputs, max.	8	Kbytes	
Outputs, max.	8	Kbytes	
User data per DP slave			
Inputs, max.	244	Bytes	
Outputs, max.	244	Bytes	

2nd interface			
DP slave			
Services			
PG/OP communication	Yes		
Routing	Yes		
Status/Force	Yes		
Programming	Yes		
Transmission rates	12	Mbps	
Transfer memory			
Inputs	244	Bytes	
Outputs	244	Bytes	
Address areas, max.	32		
User data per address area, max.	32	Bytes	
Amount of consistent user data per address area, max.	32	Bytes	

Clock synchronization			
Isochronous mode	Yes		
Number of DP masters with clock synchronization	2		
User data per isochronous slave, max.	244	Bytes	
Maximum number of bytes and slaves in a process image partition			The following must be true: number of bytes/100 + number of slaves < 40
Equidistance	Yes		
Minimum clock cycle	1	ms	
Maximum clock cycle	32	ms	

CPU/programming			
Configuring software			
STEP 7	Yes	V5.3 SP2 and higher	
Programming language			
STEP 7	Yes		
LAD	Yes		
FBD	Yes		
STL	Yes		
SCL	Yes		
CFC	Yes		
GRAPH	Yes		
HiGraph®	Yes		
Software libraries			
Easy Motion Control	Yes		
Nesting levels	8		
User program protection/password	Yes		
Open development interfaces			
CCX (custom code extension)	No		
SMX (shared memory extension)	Yes		With WinAC ODK V4.1
Inputs	4	Kbytes	
Outputs	4	Kbytes	
CMI (Controller Management Interface)	Yes		With WinAC ODK V4.1

Dimensions and weight			
Width	288	mm	
Height	98	mm	
Depth	18.5	mm	
Required slots	1		PCI, format 3/4
Weight, approx.	300	g	

Hardware requirements			
Required hardware	PC with color monitor, keyboard, mouse or pointing device for Windows		
Memory requirement on hard disk, min.	60	Mbytes	
Main memory, min.	256	Mbytes	
Processor	Intel Pentium 300 MHz		
Multi-processor system	Yes		
Hyperthreading	Yes		

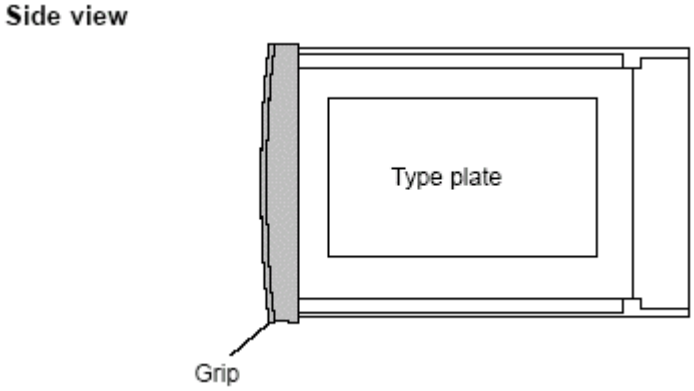
Software requirement			
Operating system			
Windows NT 4.0	No		
Windows 2000	Yes		Professional, SP3 and higher
Windows XP	Yes		Professional, SP1 and higher

9.3 Memory Cards

9.3.1 Memory Cards: Design and Function

Design

The memory card is somewhat larger than a credit card and is protected by a robust metal housing. It is inserted into a slot on the CPU; the insertion direction is determined by the design of the memory card.



Function

The memory card along with an integrated memory area on the CPU printed circuit board form the load memory of the CPU. During operation, the load memory can contain the following elements:

- Complete user program including comments, symbols, and supplementary information that permits decompilation of the user program
- All module parameters

To utilize the CPU memory completely, you should use a memory card with more memory capacity than the work memory of the CPU.

What is Stored on the Memory Card?

The memory card can store the following data:

- User program, i.e., blocks (OBs, FBs, FCs, DBs)
- Parameters that define the behavior of the CPU
- Parameters that define the behavior of I/O modules

9.3.2 Types of Memory Cards

You can use two types of memory cards:

- RAM card or
- FLASH card (FEPROM card)

Caution

Do not use non-system memory cards in the CPU 41x-2 PCI!

Which Type of Memory Card Should You Use?

Whether you use a RAM card or a FLASH card depends on how you want to use the memory card.

If ...	Then ...
You store the data in RAM and want to change your program even during RUN mode.	Use a **RAM card**
You want to save your user program permanently on the memory card even when the power is turned off (without battery backup or external to the CPU).	Use a **FLASH card**

Differences between RAM Card and FLASH Card

RAM Card	FLASH Card
The RAM card must be inserted in the CPU in order to load the user program. The user program is loaded with the aid of the programming device (PG).	You have two options for loading the user program: Switch the CPU to STOP with the mode selector, insert the FLASH card into the CPU, and load the user program onto the load memory area with the aid of the programming device. Load the user program onto the FLASH card in offline mode on the programming device and then insert the FLASH card into the CPU.

RAM Card	FLASH Card
You can load the entire user program or individual portions thereof (e.g., FBs, FCs, OBs, DBs, or SDBs) onto the load memory area in STOP mode or RUN mode.	You can only reload your user program in its entirety. You can reload small portions of your user program to the load memory area integrated in the CPU with the aid of the programming device. If changes involve large portions of your program, you have to reload the entire user program onto the FLASH card.
If you remove the RAM card from the CPU, the stored information will be lost. In addition, the CPU prompts you to perform a memory reset. The RAM card does not have an integrated backup battery. If an external backup voltage is fed to the "BATT." socket, the contents of the RAM card are retained after the PC has been switched off as long as the RAM card remains inserted in the CPU.	The FLASH card does not need voltage to store its contents -- in other words, the information contained on the card is retained if you remove the FLASH card from the CPU or operate your system without a backup battery (without external backup voltage at the "BATT." socket.

What Memory Card Capacity Should You Use?

The capacity of the memory card you use depends on the scope of the user program and the additional memory requirement resulting from the use of function modules and communication modules. You can estimate the memory requirement for these modules with STEP 7.

Changing a Memory Card

Warning

The memory card can only be removed and inserted when the PC is open. The memory card can also be replaced while the CPU 41x-2 PCI is operating.

Replacement of the memory card while the CPU 41x-2 PCI is operating is allowed only when the manufacturer of the PC authorizes the PC to be opened while the PC is energized.

Make sure that you do not touch any live parts when a PC is open!

You can replace the memory card when the power is turned off and while the CPU 41x-2 PCI is running.

To change the memory card, proceed as follows:

1. Click the STOP option.
2. Remove the inserted memory card.
3. Insert the memory card into the slot on the CPU and push it in as far as it will go.

   Result: The STOP indicator on the CPU flashes slowly (0.5 Hz), indicating that a memory reset is required.
4. Click the MRES option.

   Result: The STOP display flashes for at least 3 second at 2 Hz (memory is being reset) and then changes to a steady-light signal.

Technical specifications for memory cards		
Dimensions WxHxD (in mm)		7.5 x 57 x 87
Weight		Max. 35 g
EMC protection		Incorporated into design

Memory card-specific data				
Name	**Current consumption at 5 V**		**Buffer currents**	
	Typ.	**Max.**	**Typ.**	**Max.**
MC 952 / 64 KB / RAM	20 mA	50 mA	0.5 µA	20 µA
MC 952 / 256 KB / RAM	35 mA	80 mA	1 µA	40 µA
MC 952 / 1 MB / RAM	40 mA	90 mA	3 µA	50 µA
MC 952 / 2 MB / RAM	45 mA	100 mA	5 µA	60 µA
MC 952 / 4 MB / RAM	45 mA	100 mA	5 µA	60 µA
MC 952 / 8 MB / RAM	45 mA	100 mA	5 µA	60 µA
MC 952 / 16 MB / RAM	45 mA	100 mA	5 µA	60 µA
MC 952 / 64 MB / RAM	100 mA	150 mA	100 µA	500 µA
MC 952 / 64 KB / 5V FLASH	15 mA	35 mA	-	-
MC 952 / 256 KB / 5V FLASH	20 mA	45 mA	-	-
MC 952 / 1 MB / 5V FLASH	40 mA	90 mA	-	-
MC 952 / 2 MB / 5V FLASH	50 mA	100 mA	-	-
MC 952 / 4 MB / 5V FLASH	40 mA	90 mA	-	-
MC 952 / 8 MB / 5V FLASH	50 mA	100 mA	-	-
MC 952 / 16 MB / 5V FLASH	55 mA	110 mA	-	-
MC 952 / 32 MB / 5V FLASH	55 mA	110 mA	-	-
MC 952 / 64 MB / 5V FLASH	55 mA	110 mA	-	-

9.4 Frequently Asked Questions

9.4.1 Questions Regarding the Memory Card

When should I use a FLASH card and when a RAM card?

Answer:

FLASH card:

- Typical application: when program changes are no longer necessary. The program resides on the memory card.
- The **CPU > Options > Autoload** function is **not** possible!

RAM card:

- Die **CPU > Options > Autoload** function is possible!
- Typical application: during commissioning, i.e., as long as program changes are still necessary.

Additional Information

Memory cards are described in Memory Cards, the CPU > Options > Autoload function is described in Connecting the CPU 41x-2 PCI to the Power Supply

Is a memory card required for operation?

Answer:

No, as long as the load memory capacity of 256 Kbytes integrated in the CPU 41x-2 PCI is sufficient.

Additional Information

The technical specifications for the CPU 41x-2 PCI are provided in Performance Features and Technical Specifications of the CPU 412-2 PCI and Performance Features and Technical Specifications of the CPU 416-2 PCI.

9.4.2 Questions Regarding PROFIBUS DP

Can WinAC Slot 41x also be operated as a DP slave?

Answer:

Yes!

Additional Information

For additional information on operating the CPU 41x-2 PCI as a DP slave, refer to the S7-400 documentation.

Does the PROFIBUS DP interface that is integrated on the CPU 41x-2 PCI support the DP services (SFC58/59)?

Answer:

Yes!

9.4.3 Questions Regarding Communication

Does WinAC Slot 41x Support Network Routing?

Answer:

The "Routing" feature allows you to have online access to S7 stations across subnet boundaries using the programming device or PC. This means that you can access a DP slave from Industrial Ethernet using WinAC Slot 41x. Typical applications include:

- Loading application programs
- Loading hardware configuration
- Performing testing and commissioning functions

Special "routing tables" for the gateways are generated automatically for this purpose during network configuration. These routing tables represent special system data, and they also have to be loaded to the individual gateways, i.e., to the WinAC Slot 41x. Afterwards, the path to the selected automation device via the gateways can be found when you go online with the programming device.

Additional Information

For additional information on how routing works, refer to the STEP 7 online help:

Is additional software required when using the integrated Industrial Ethernet interface of SIMATIC PCs?

Answer:

The drivers are located on the SIMATIC NET CD, named according to the required function:

- Softnet S7 for Industrial Ethernet (64 S7 connections, PG/OP, OPC, S7 communication)
- Softnet S7 for Industrial Ethernet (8 S7 connections, PG/OP, OPC, S7 communication)
- Softnet PG for Industrial Ethernet (PG/OP only)

How can PC applications access process data of WinAC Slot 41x?

Answer:

There are several options available:

- Prodave MPI
- Technological application created with WinAC ODK
- SIMATIC NET OPC Server

Communication with WinCC or WinCC flexible takes place over integrated interfaces.

9.5 Compatibilities

Compatibility with STEP 7

WinAC Slot 412/416 PC Software CD	Firmware Version of WinAC Slot Module	Configuration in STEP 7 as	Required STEP 7 Version
V3.4	V3.4	CPU 41x-2 PCI V3.4	STEP 7 V5.3 or higher
V4.0	V3.4	CPU 41x-2 PCI V3.4	STEP 7 V5.3 or higher
V4.0	V4.0	CPU 41x-2 PCI V4.0	STEP 7 V5.3 SP2 or higher, plus installed hardware update for the CPU 41x-2 PCI, if necessary

Compatibility with SIMATIC NET

WinAC Slot 412/416 PC Software CD	Windows Version	Version of SIMATIC NET CD
V3.4	Windows 2000 SP3	11/2003 or later
	Windows XP SP1	11/2003 or later
V4.0	Windows 2000 SP3	Software Edition 2005 HF 1 or higher
	Windows XP SP1	Software Edition 2005 HF 1 or higher

Use of Shared Memory Interface (Dual Port RAM)

WinAC Slot 412/416 PC Software CD	WinAC Slot SMX	WinAC ODK
V3.4	V3.3	V4.1
V4.0	V3.3	V4.1

Configurations of WinAC Slot 412/416 V3.2 to V3.4 can be transferred to WinAC Slot 412/416 V4.0 without restrictions.

To utilize the new functions of the WinAC Slot 412/416 V4.0, the new firmware version CPU 41x-2 PCI, V4.0 must be transferred from the HW catalog.

Product Version Compatibility and Supported Operating Systems

The table shows the viable combinations of WinAC Slot PC software versions and firmware versions and Microsoft operating systems.

Firmware Version of WinAC Slot Module	WinAC Slot 412/416 PC Software CD	Microsoft Windows NT4 Workstation SP6	Microsoft Windows 2000 Professional SP3	Microsoft Windows XP Professional SP1
V3.4	V3.3	No	Yes	Yes
V3.4	V3.4	No	Yes	Yes
V3.4	V4.0	No	Yes	Yes
V4.0	V4.0	No	Yes	Yes

The WinAC Slot 412/416 V3.3, V3.4, and V 4.0 product versions are fully backward compatible. If you want to use Microsoft Windows NT4 Workstation, you can use SIMATIC WinAC Slot 412/416 V3.2, which is still available.

9.6 Spare Parts and Accessories - Order Numbers

For additional order numbers, refer to *Catalog ST 70*.

Spare Parts/Accessories	Order Number
CPU 412-2 PCI	6ES7 612-2QH10-0AB4
CPU 416-2 PCI	6ES7 616-2QL10-0AB4
Lithium battery 3.6 V	6ES7 971-2BA00-0AA0
Bus connector without a programming device socket	6GK1 500-0EA02
Bus connector with a programming device socket	6ES7 972-0BB40-0XA0 (Note that if you are using this bus connector you cannot plug in an external 24 VDC supply. Also, in certain PC models the bus connector may not be able to be plugged in.
Connector for external 24 VDC supply	Manufacturer: Phoenix Contact Item No. 1792524 Type MVSTBW 2,5/2-ST

9.7 Guideline for Handling Electrostatic Sensitive Devices (ESD)

Introduction

In this appendix, we explain

- What is meant by "electrostatic sensitive devices"
- The precautions you must observe when handling and working with electrostatic sensitive devices

What are ESDs?

Definition

All electronic modules are equipped with large-scale integrated ICs or components. Due to their design, these electronic elements are very sensitive to overvoltages and thus to any electrostatic discharge.

Electrostatic sensitive devices are frequently referred to by the abbreviation ESD. This is also the international abbreviation for such devices.

Electrostatic sensitive devices are identified by the following symbol:

Caution

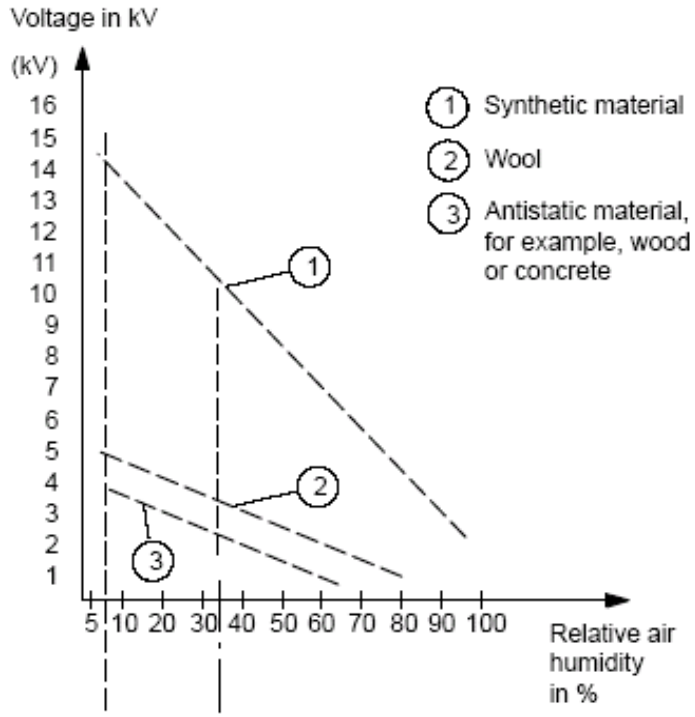
Electrostatic sensitive devices can be irrevocably damaged by voltages that are far below the voltage values that can by perceived by human beings. These voltages are present if you touch a component or the electrical terminals of a device without first discharging static electricity. In most cases, the damage to a device caused by an overvoltage is not immediately noticeable but rather is first apparent only after a prolonged period of operation.

Electrostatic Charging of Persons

Charging

Every person with a non-conductive connection to the electrical potential of his/her surroundings can be electrostatically charged.

The figure shows the maximum values for electrostatic voltages to which a person can be exposed when coming into contact with the materials indicated in the figure. These values correspond to the specifications of IEC 801-2.



General Protective Measures Against Electrostatic Discharge

Ensure sufficient grounding

Make sure that personnel, working surfaces, and packaging are sufficiently grounded when working with electrostatic sensitive devices. In this way, you avoid static charging.

For example, touch the PC housing before performing work in the PC.

Avoid direct contact

You should never touch electrostatic sensitive devices unless it is unavoidable (e.g., during maintenance work). Hold devices without touching the pins of the components or the printed conductors. In this way, the energy of electrostatic discharges cannot reach and damage the sensitive devices.

If you have to carry out measurements on a device, you must discharge your body before you start the measurement by touching grounded metal objects. Use only grounded measuring devices.

9.8 List of Abbreviations

Abbreviations	Description
CP	Communications processor
CPU	Central processing unit
DB	Data block
FB	Function block
FC	Function
FM	Function module
GD	Global data communication
IM	Interface module
LAD	Ladder logic
LWL	Fiber-optic cable
M	Ground connection
MPI	Multipoint interface
OB	Organization block
OP	Operator panel
POI	Process output image
PII	Process input image
PG	Programming device
PLC	Programmable logic controller
PS	Power supply
PZF	I/O area access error
SFB	System function block
SFC	System function
SM	Signal module
STL	Statement List (STEP 7 notation)

Glossary

Backplane bus:

For hardware controllers such as the S7-300 or S7-400, the backplane bus is the printedcircuit board on the inside panel of the rack into which modules are inserted.

Backup battery:

The backup battery ensures that the -> user program in the -> CPU is stored inthe event of a power failure and that defined data areas and memory markers,timers and counters are retentive.

Bit memory:

Bit memory is part of the -> system memory of the CPU for storing interim results. Bit-, byte-, word-, or double word-access of bit memory is possible.

Bus:

A bus is a communication medium connecting several nodes. Data transmissioncan be serial or parallel across electrical conductors or fiber-optic cables.

Chassis ground:

The chassis ground is the sum of all the interconnected inactive parts of aresource which cannot assume a hazardous contact voltage even in the event of afault.

Cold restart:

The controller executes OB 102 before starting the free cycle (OB 1). Like a warm restart, acold restart resets the peripheral inputs (PI) and changes the peripheral outputs (PQ) to a predefinedsafe state (default is 0). However, a cold restart does not save the retentive memory (M, T,C, or DB), but sets these areas to their default (initial) values.

Communication interface:

CP cards, Siemens PC built-in PROFIBUS interface, or Industrial Ethernetinterface that WinLC RTX uses for communications.

Configuration:

Assignment of modules to racks/slots and (for example, for signal modules)addresses.

Configuring:

By configuring we mean the grouping of individual modules to form an automationsystem.

Counter:

Counters are component parts of the -> CPU system memory. The contents of the"counter cells" can be modified by STEP 7 instructions (for example, countup/count down).

CP:

Communications processor: Communications processors are modules for point-to-point links and bus links.

CPU:

A central processing unit is the main processing unit of the automation system witha processor, arithmetic unit, memory, operating system and interface for theprogramming device.

Data block:

Data blocks (DB) are parts of the user program that contain the program data. There are global data blocks, which can be accessed by all logic blocks, and thereare instance data blocks, which are assigned to a specific FB call.

Default setting:

The default setting is a useful basic setting which is always used when no othervalue is specified (assigned).

Electromagnetic compatibility:

By electromagnetic compatibility we mean the ability of an electrically operatedresource to operate in a specified environment without influencing that environmentin an unauthorized manner.

Equipotential bonding:

Electrical connection (equipotential bonding conductor) which gives the bodies ofelectrical equipment and external conducting bodies the same or approximately thesame potential, in order to prevent interference or dangerous voltages from beinggenerated between these bodies.

Error handling using OB:

If the operating system detects a specific error (for example,an access error withSTEP 7), it calls the organization block (error OB) which is provided for this eventand which specifies the subsequent behavior of the CPU.

Error indication:

The error indication is one of the possible responses of the operating system to a-> runtime error. The other possible reactions are: -> error reaction in the userprogram, STOP mode of the CPU.

Error reaction:

Reaction to a -> runtime error. The operating system can respond in the followingways: conversion of the programmable controller to the STOP mode, call of anorganization block in which the user can program a response or display of theerror.

Flash EPROM:

FEPROMs are the same as electrically erasable EEPROMS in that they can retaindata in the event of a power failure, but they can be erased much more quickly(FEPROM = Flash Erasable Programmable Read Only Memory). They are used on -> memory cards.

Free cycle:

The free cycle consists of the basic tasks for priority class 1: writing to the outputs, reading theinputs, executing OB 1, and completing the sleep time requirement before triggering the next freecycle. The controller executes these tasks at the base, or lowest, internal priority level for executingthe OBs. (Priority level in this context refers to OB priority classes, not the operating system prioritylevel.)

Function block:

A function block (FB) in accordance with IEC 1131-3 is a -> logic block with ->static data. An FB allows parameters to be passed in the user program. Functionblocks are therefore suitable for programming complex functions, e.g. closed-loopcontrols, mode selections, which are repeated frequently.

Global data:

Global data are data that can be addressed from every logic block (FC, FB, OB). Specifically, these are bit memory (M), inputs (I), outputs (Q), timers (T), counters (C) and data blocks (DB). Both absolute access and symbolic access of global data are possible.

Global data communication:

Shared data communication is a procedure used to transfer shared data betweenCPUs (without CFBs).

Ground:

The conducting earth whose electric potential can be set equal to zero at any point. In the vicinity of grounding electrodes, the earth can have a potential different tozero. The term “reference ground” is frequently used to describe thesecircumstances.

Ground, to:

To ground means to connect an electrically conducting component to the groundingelectrode (one or more conducting components which have a very good contactwith the earth) across a grounding system.

Hardware:

Hardware is the name given to the complete physical and technical equipment ofan automation system.

Hot restart:

All data areas (timers, counters, bit memory, data blocks) and their contents are retained. The controller executes OB 101, reads in the process input image, and then continues processing the user program at the location where it was last stopped.

Index:

A numbered slot in the PC Station, or virtual rack that represents a PC-based automation system. The controller occupies one index. Other components can occupy other index slots.

Industrial Ethernet:

Physical communications layer that supports communication to STEP 7, S7 CPUs,PGs, OPs, and S7 applications.

Interface, multipoint: -> MPI

Interrupt:

Interrupt is the name given to the interruption of program scanning in the processorby an externally queued event – for example, timer expired, data request, etc.

Isolated:

On isolated input/output modules, the reference potentials of the control and load circuits are galvanically isolated, e.g., by optical coupler, relay contact, or transformer. Input/output circuits can be connected to common potential.

Load memory:

Memory area (RAM) allocated for all of the blocks downloaded from STEP 7 excluding thesymbol table and comments. It is implemented either as a plug-in memory card or apermanently integrated memory.

Local data:

Local data are temporary data of a block that are stored while the block is being processed in the L stack but are no longer available after block processing is complete.

Logic block:

A logic block in SIMATIC S7 is a block which contains a section of the STEP 7user program (as opposed to a -> data block, which only contains data).

Memory card:

Memory cards are memory media in smart card format for CPUs and CPs. They are implemented as -> RAM or -> Flash EPROM.

Mode:

The SIMATIC S7 automation systems have the following operating states: STOP, RESTART, RUN.

Mode switch:

The mode switch is used to set the mode you require on the CPU.

Module parameters:

Module parameters are values that can be used to control the behavior of themodule. A distinction is made between static and dynamic module parameters.

MPI:

The multipoint interface (MPI) is the programming device interface of SIMATIC S7. It enables the simultaneous operation of several stations (programming devices,text displays, operator panels) on one or more CPUs. Each station is identified bya unique address (MPI address).

Nesting depth:

One block can be called from another by means of a block call. Nesting depth isthe number of -> logic blocks called at the same time.

Network:

In terms of communications, a network is the interconnection of several CPUs andother terminal – for example, a programming device – by means of connectingcables. Data exchange is performed between the connected devices.

Node address:

The node number represents the "number" of a CPU, the programming device, or another intelligent I/O module if they communicate with one another over a network. The node address is assigned with the STEP 7 software.

Non-isolated:

On non-isolated input/output modules, there is an electrical connection betweenthe reference potentials of the control and load circuits.

OP:

Operator panel

Operating system of the CPU:

The operating system of the CPU organizes all functions and processes of theCPU that are not associated with a specific control task.

Organization block (OB):

Organization blocks (OBs) form the interface between the operating system and the user program. They are called from the operating system and control cyclic and interrupt-triggered program execution, the restart behavior of the controller,and error handling.

PC station:

Representation of a software-based virtual rack that defines a PC-based automation system.

PCI Bus:

Abbreviation for “peripheral component interconnect bus”. The PCI bus is thestandard bus on the AT-compatible PC.

PG/OP communication:

Communication between the controller and other S7 applications such asprogramming devices, operator panels, and S7 controllers. WinAC Slot supports PROFIBUS, MPI, and Industrial Ethernet for PG/OP communication.

PLC:

-> Programmable logic controller

Process image:

The process image is an integral part of the system memory of the S7-400CPU. The signal states of the input modules are written into the process-imageinput table at the start of the cyclic program. At the end of the cyclic program, thesignal states in the process-image output table are transferred to the outputmodules.

PROFIBUS:

Physical communications layer that can be used for PROFIBUS DP communications to I/O orS7 communications to STEP 7, S7 CPUs, and S7 applications.

PROFIBUS DP:

Using PROFIBUS-DP, you can set up a distributed I/O system. Digital and analogmodules are transferred by the automation system to the process on site – andover a distance of up to 23 km at that (when using fiber–optic cables). The digital and analog modules are connected to the automation system via thePROFIBUS-DP fieldbus and addressed in the same way as centralized I/O. PROFIBUS-DP conforms to the standard EN 50 170 Volume 2, PROFIBUS.

Programmable logic controller:

Programmable logic controllers (PLCs) are electronic controllers whose function issaved as a program in the control unit. The configuration and wiring of the devicetherefore do not depend on the function of the controller. The programmable logiccontroller has the architecture of a computer; it consists of -> CPU with memory,I/O modules and internal bus system. The I/O and the programming language aredesigned to meet the control engineering requirements.

Programming device:

Programming devices are essentially personal computers which are compact,portable and suitable for industrial applications. They are equipped with specialhardware and software for SIMATIC programmable controllers.

RAM:

A RAM (random access memory) is a semiconductor with random access.

RESTART:

RESTART mode is activated on a transition from STOP mode to RUN mode. It can be initiated by the mode selector switch, after a Power On, or through an operator input on the programming device.

Restart method:

The restart method determines which startup OB is executed whenever the controllerchanges from STOP mode to RUN mode. The startup OB allows you to initialize your STEP 7 userprogram and variables. The restart methods are: Cold restart (OB 102), hot restart (OB 101) and warm restart (OB 100).

Retentive data:

Retentive data are not lost in the event of a line voltage failure if there is a backupbattery.

Runtime error:

Errors that occur during running of the user program in the automation system (inother words, not in the process).

S7 communication:

Communication between controllers on the network, hardware or software, using theS7 communication functions.

S7 routing:

Communications between S7 controllers, S7 applications or PC Stations across differentsubnets through one or more network nodes acting as routers, configured with NetPro.

Scan cycle:

The scan cycle includes writing to the outputs, reading the inputs, executing OB 1 and all otherOBs, and completing the sleep time requirement.

Scan cycle time:

Time required to execute the complete scan cycle, which includes the execution of OB 1and the minimum sleep time.

Station Configuration Editor:

Tool, accessible from taskbar, for configuring the PC Station.

STEP 7:

Programming language for programming, configuring and assigning parameters touser programs for SIMATIC S7 PLCs.

STEP 7 user program:

Application program created with STEP 7 and downloaded to the controller forexecution. It includes all organization blocks (such as OB 1 or OB 35) and the other logic blocksthat they call, including functions (FCs), system functions (SFCs), function blocks (FBs), andsystem function blocks (SFBs).

System function (SFC):

Preprogrammed function that is integrated as a part of the operating system ofthe controller and can be accessed in the STEP 7 user program, when necessary.

System function block (SFB):

Function block that is integrated as a part of the operating system of thecontroller and is not downloaded as part of the STEP 7 user program. Like a function block (FB),an SFB is a block "with memory." You must also create an instance data block (DB) for the SFB. The instance DB is then downloaded to controller as part of the STEP 7 user program.

System memory:

The system memory is integrated on the CPU and implemented as RAM. Thesystem memory includes the operand areas (for example, timers, counters,memory markers, etc.) as well as the data areas (for example, communicationbuffers) required internally by the -> operating system.

Time synchronization:

The ability to broadcast a system standard time from a single source to all deviceswithin the system so that they may set their own clocks to the standard time.

Time synchronization service:

Software component of WinAC RTX that provides the capability tosynchronize time between components in the PC Station. (See the documentation for the WinACTime Synchronization Service.)

Timers:

-> Timers

Transmission rate:

Rate of data transfer (bps).

Ungrounded:

Without galvanic connection to ground

Version:

Products having the same order number are distinguished by their version. Theproduct version is incremented with each upwardly compatible function extension,production-related modification (use of new components) or bug fix.

Virtual backplane bus:

For PC-based controllers, the virtual backplane bus is a software-based, virtual"rack" that enables communications between the controller and other PC Station components.

Warm restart:

Type of restart where the controller executes OB 100 before starting the free cycle (OB 1). A warm restart resets the peripheral inputs (PI) and places the peripheral outputs (PQ) into a predefinedsafe state (default is 0). The warm restart also saves the current value for the retentivememory areas for the bit memory (M), timers (T), counters (C), and data blocks (DBs).

Warm restart:

When the CPU restarts (for example, after changing the mode selector switch: from STOP to RUN or after a Power ON), organization block OB 100 (Warm Restart) is executed before cyclic program processing (OB 1). With a warm restart, theprocess input image is read in and the STEP 7 user program is executedstarting with the first command in OB 1.

Work memory:

Memory area (RAM) allocated for the blocks used at runtime.

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