

SIMATIC NET

PG/PC - PROFINET CP 1604 / CP 1616

Operating Instructions

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Warning notice system

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 only to property damage have no safety alert symbol. These 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

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

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.

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WARNING

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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.

Preface

Overview of the variants of the CP 1604

CP 1604 modules are available in 2 variants:

- Communications processor CP 1604 / CP 1604 EEC
- RJ-45 connection board for CP 1604

Please check that the consignment you have received is complete. Otherwise contact your supplier or your local Siemens office immediately.

Communications processor CP 1604 - 6GK1160-4AA01

The following components ship with the product:

- CP 1604 communications processor
- Driver CD for CP 1604

Communications processor CP 1604 EEC - 6GK1160-4AT01

The device is suitable for use in environments according to EN50121.

The following components ship with the product:

- Communications processor CP 1604 EEC
- Driver CD for CP 1604 EEC

Note

Descriptions for CP 1604 EEC

All descriptions of the CP 1604 also apply to the CP 1604 EEC.

Exception: The temperature range of the operating temperature in the technical specifications

RJ-45 connection board for CP 1604 - 6GK1160-4AC00

RJ-45 connection board for CP 1604 + 40-pin ribbon cable

Components of the CP 1616 - 6GK1161-6AA02

Please check that the consignment you have received is complete. Otherwise contact your supplier or your local Siemens office immediately.

The following components are supplied with the CP 1616:

- CP 1616 communications processor
- Driver CD for CP 1616

CP 1616 onboard communications processor

The "CP 1616 onboard" communications processor is located on a SIMATIC PC. It operates like a plug-in CP 1616 or CP 1604 communications processor. In the documentation, the term CP 1616 is used for the CP 1616 communications module as well as the CP 1616 onboard communications processor. The figures show the module but apply equally to the CP 1616 onboard.

Validity of this documentation

These operating instructions are valid for the following products:

- CP 1604
- CP 1616

Note

CP 1616 onboard

The CP 1616 onboard is an integral part of the SIMATIC PC. You will therefore find this information in its documentation.

Content of this documentation

These operating instructions contain information about the installation and configuration of the CP 1616/ CP 1604 communications processors.

Updated operating instructions on the Internet

You will find the current version of these operating instructions on the Product Support pages under the following entry ID:

62607620 (<http://support.automation.siemens.com/WW/view/en/62607620>)

Further documentation

The documents listed below contain more detailed information on commissioning and using the communications processors. You will find this documentation on the Product Support pages on the Internet under the following entry link:

Support (<https://support.industry.siemens.com/cs/ww/en/ps>)

Enter the entry ID shown below of the relevant manual as the search item.

- **Configuration manual Commissioning PC Stations**
This provides you with detailed information on commissioning and configuring SIMATIC NET PC communications modules.
Entry ID:
109488960 (<https://support.industry.siemens.com/cs/ww/en/view/109488960>)
- **System manual SIMATIC NET Industrial Communication with PG/PC**
 - **Volume 1 - Basics**
Entry ID:
42783968 (<https://support.industry.siemens.com/cs/ww/en/view/77376110>)
 - **Volume 2 - Interfaces**
Entry ID:
42783660 (<https://support.industry.siemens.com/cs/ww/en/view/77378184>)
The system manuals introduce you to the topic of industrial communication and explain the communications protocols involved. There is also a description of the OPC interface as user programming interface.
- **Installation manual SIMATIC NET PC Software**
This document contains detailed information on installing the SIMATIC net PC software.
Entry ID:
61630923 (<https://support.industry.siemens.com/cs/ww/en/view/109488960>)
- **System manual Industrial Ethernet Network Manual**
In this document, you will find detailed information on setting up an Industrial Ethernet network.
Entry ID:
27069465 (<https://support.industry.siemens.com/cs/ww/en/view/27069465>)
- **Manual SIMATIC PROFINET System Description**
This provides you with basic knowledge of the PROFINET IO topics: network components, data exchange and communication, PROFINET IO, Component Based Automation, application example for PROFINET IO and Component Based Automation.
Entry ID:
19292127 (<https://support.industry.siemens.com/cs/ww/en/view/19292127>)
- **Manual From PROFIBUS DP to PROFINET IO**
You should read this document if you already have an installed PROFIBUS system and want to change to a PROFINET system.
Entry ID:
19289930 (<https://support.industry.siemens.com/cs/ww/en/view/19289930>)
- **Manual SIMATIC NET - Twisted Pair and Fiber-optic Networks**
With the information in this document, you can configure and set up your Industrial Ethernet networks.
Entry ID:
8763736 (<https://support.industry.siemens.com/cs/ww/en/view/8763736>)

- **Manual PROFINET IO Getting Started: Collection**

This document guides you through the individual steps in commissioning right through to a functioning application based on concrete examples.

Entry ID:

24842921 (<https://support.industry.siemens.com/cs/ww/en/view/24842921>)

- **Programming manual IO-Base User Programming Interface**

This manual introduces you to writing user programs in the C/C++ programming language.

Entry ID:

61630614 (<https://support.industry.siemens.com/cs/ww/en/view/26435491>)

- **Programming manual SIMATIC NET DK-16xx PN IO Porting Instructions and Layer 2 Interface**

This manual introduces you to initial commissioning of the DK-16xx PN IO in Linux, the porting of the driver for the CP 1616 and CP 1604 and the porting of the IO-Base Library to your target operating system.

Entry ID:

21972491 (<https://support.industry.siemens.com/cs/ww/en/view/21972491>)

SIMATIC NET documentation

You will find the entire SIMATIC NET documentation on the pages of Product Support: 10805878 (<https://support.industry.siemens.com/cs/ww/en/ps/15247>)

Go to the required product group and make the following settings:

→ Entry list → Entry type "Manuals / Operating Instructions"

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Industry Online Support

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Apart from news, there you will also find:

- Project information: Manuals, FAQs, downloads, application examples etc.
- Contacts, Technical Forum
- The option submitting a support query:
(<https://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=en&objid=38718979&caller=view>)

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To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under

(<https://support.industry.siemens.com/cs/ww/en/ps/15247/pm>)

List of available protocols (local access via a local network)

The following is a list of all available protocols and their ports through which the CP 1604/CP 1616 can be accessed.

Table 1 List of available protocols

Protocol	Protocol/ Port number	Default port status	Port configura- ble	Authentication	Encryption
PROFINET	UDP/34964 UDP/49152 UDP/49153 UDP/49154	Open	No	No	No
HTTP	TCP/80	Closed	✓	No	No
SNMP	UDP/161	Open	No	No	No
S7	TCP/80	Open	No	No	No

Explanation of the table:

- Authentication
Specifies whether authentication of the communication partner takes place.
- Encryption
Specifies whether the transfer is encrypted.

Special security information for CP 1604/CP 1616

NOTICE

TCP port 23 for service purposes

The TCP port 23 is available for service purposes. Protect the TCP port 23 using suitable means, e.g. firewall or security router.

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(www.siemens.com/sitrain)

SIMATIC NET glossary

Explanations of many of the specialist terms used in this documentation can be found in the SIMATIC NET glossary.

You will find the SIMATIC NET glossary on the Internet at the following address:

(<http://support.automation.siemens.com/WW/view/en/50305045>)

Recycling and disposal



The products are low in harmful substances, can be recycled and meet the requirements of the Directive 2012/19/EU for disposal of waste electrical and electronic equipment (WEEE).

Do not dispose of the products at public disposal sites.

For environmentally compliant recycling and disposal of your electronic waste, please contact a company certified for the disposal of electronic waste or your Siemens representative.

Note the different national regulations.

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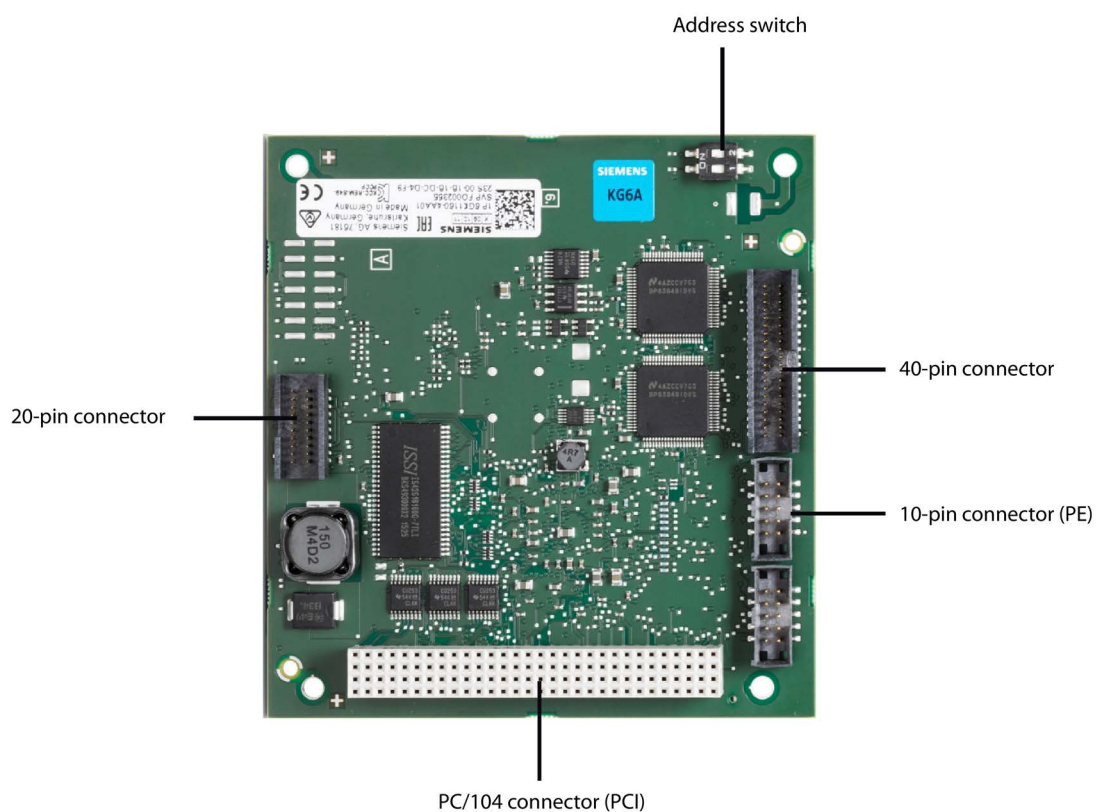
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Description of the device

1.1 CP 1604 communications processor

Appearance

The following graphic shows the CP 1604 communications processor:



Note

CP 1604 EEC

CP 1604 EEC has the same construction. The PCB is however varnished and it therefore has greater resistance to environmental influences.

Properties

The CP 1604 communications processor is a PCI module in the Universal PC/104 Plus format for connection of PCs in the PC/104 Plus format to Industrial Ethernet. The essential properties are as follows:

- Optimized for PROFINET IO
- With Ethernet realtime ASIC ERTEC 400
- 40-pin male connector for connection of the RJ-45 connection board for CP 1604
- 20-pin male connector for connection of an external power supply
- 10-pin male connector for the PROFIenergy controller
- Integrated 4-port real-time switch
- Automatic hardware detection is supported.

LED display

10 LEDs can be controlled by the CP 1604 communications processor. The LED signal cables are connected to the 20-pin and 40-pin connectors.

The BF and SF LEDs have the following significance:

BF LED	SF LED	Description
off	-	Communications connection is established.
on	-	Link status error has occurred.
flashing slowly	-	There are two possible causes: • An IO device cannot be addressed. • An IP address was assigned twice.
–	off	There are two possible causes: • No fault/error. • A download is in progress.
	on	Diagnostics information is available.
	flashing at 2 second intervals	The firmware of the module is in an inconsistent status. This status is possible, for example if the power supply was interrupted during a firmware update. Eliminate the error as described in the section "Eliminating problems (Page 90)".
alternating slow flashing		Flash test for module detection.
alternating fast flashing		A disruption has occurred. In this case, diagnostics via the Web or using SNMP is no longer possible.
		Note If this error occurs, contact Technical Support. The problem can be eliminated if you contact our specialists directly. You will find the contact data in the section "Preface (Page 3)". Resetting the firmware or restarting the PC will not eliminate the problem.

LEDs on the "RJ-45 connection board for CP 1604"

Within the frame of each RJ-45 jack, there are 2 LEDs.

The green LED is lit when a connection is established (Link LED).

The yellow LED is lit when sending and receiving (Activity LED).

Virtual LEDs

Note that apart from the visible LEDs there are also two "virtual" LEDs in the firmware. These are the operating mode LEDs RUN and STOP. They do not exist physically but can nevertheless be queried using SNMP. They are on in the RUN or STOP mode and never flash normally or quickly.

1.1.1 40-pin male connector for connection of the RJ-45 connection board for CP 1604**Description**

The 40-pin connector is used to connect the ribbon cable from the RJ-45 connection board for CP 1604. This has the Ethernet connectors that allow network operation.

The signals are processed in the integrated 4-port real-time switch of the CP 1604.

Ethernet connectors

The CP 1604 communications processor is intended for operation in Ethernet networks.

It also has the following features:

- The connectors are designed for 10BaseT and 100BaseTX (via RJ-45 connection board for CP 1604).
- Data transmission speeds of 10 and 100 Mbps in full/half duplex are supported.
- The adaptation is automatic (autonegotiation).
- The module includes a 4-port real-time switch.
- Autocrossing
- The CP 1604 can be a PCI master.

LED signaling

If the CP 1604 is used without the RJ-45 connection board for CP 1604, the 40-pin connector has 2 pins per channel for the Link and Activity signal. These can be used to control a total of 8 LEDs. The signals of the operating statuses group fault (SF) and bus fault (BF) are available at pin 3 (SF) and pin 37 (BF).

The wiring is the same as described for the 20-pin connector.

Pin assignment of the 40-pin connector

The pin assignment of the 40-pin connector is as follows:

Pin no.	Assignment	Pin no.	Assignment
1	P3V3	21	RDN_P2
2	M	22	RDP_P2
3	GPIO(6) – SF	23	M
4	LINK_P0_N	24	TDN_P2
5	ACT_P0_N	25	TDP_P2
6	LINK_P1_N	26	M
7	ACT_P1_N	27	RDN_P3
8	M	28	RDP_P3
9	RDN_P0	29	M
10	RDP_P0	30	TDN_P3
11	M	31	TDP_P3
12	TDN_P0	32	M
13	TDP_P0	33	LINK_P2_N
14	M	34	ACT_P2_N
15	RDN_P1	35	LINK_P3_N
16	RDP_P1	36	ACT_P3_N
17	M	37	GPIO(7) – BF
18	TDN_P1	38	P3V3
19	TDP_P1	39	M
20	M	40	P3V3

You will find the pin assignment of the connector on the labeling on the ribbon cable socket bar.

1.1.2 20-pin male connector for connection of an external power supply

Description

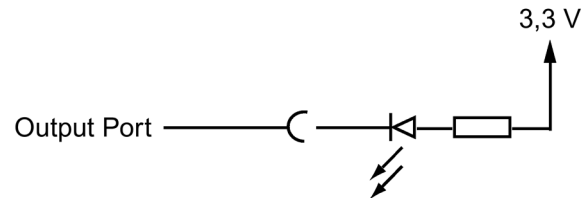
The 20-pin connector is used to connect an external power supply as well as 2 LEDs for signaling the operating statuses bus fault (BF) and group fault (SF). Siemens does not provide an external power supply for this module.

With the 5 V power supply, the integrated real-time switch can also operate when the PC is turned off. The 5 V power supply is optional. Without the external 5 V power supply, the switch operates with the 5 V power supply of the PC/104 PC.

LED connection (optional)

The following figure shows the circuit diagram for connecting an LED to a pin of the 20- or 40-pin connector.

The CP 1604 activates ground via a port. This means that via the resistor connected to the 3.3 V power supply, the current flows via the LED.



NOTICE

LED current

The LED current must not exceed 9 mA.

Pin assignment of the 20-pin connector

The pin assignment of the 20-pin connector is as follows:

Pin no.	Assignment
1	GND
2	GND
3	5 V power supply, +/-5%
4	5 V power supply, +/-5%
5	5 V power supply, +/-5%
6	5 V power supply, +/-5%
7	Connector for SF LED
8	GND
9	Reserved, do not assign!
10	GND
11	Reserved, do not assign!
12	GND
13	Connector for BF LED
14	GND
15	5 V power supply, +/-5%
16	5 V power supply, +/-5%
17	5 V power supply, +/-5%
18	5 V power supply, +/-5%
19	GND
20	GND

You will find the pin assignment of the connector on the labeling on the ribbon cable socket bar.

1.1.3 10-pin connector

Description

The 10-pin connector (PE) is used to signal the PROFlenergy commands to the host PC. As of firmware V2.6, the CP 1604 allows operation as a PROFlenergy device. With suitable commands from the PROFINET controller, the PC in which the CP 1604 is plugged in can be turned off and on again with the aim of reducing energy consumption. The device is turned off by certain commands (data records) on the IO-Base user programming interface. You will find these commands in the "IO-Base User Programming Interface" document.

Note

Hardware version for 10-pin connector

The 10-pin connector is available as of hardware version 7 (MLFB 6GK1160-4AA01).

Assignment

The pin assignment of the 10-pin connector (PE) is as follows:

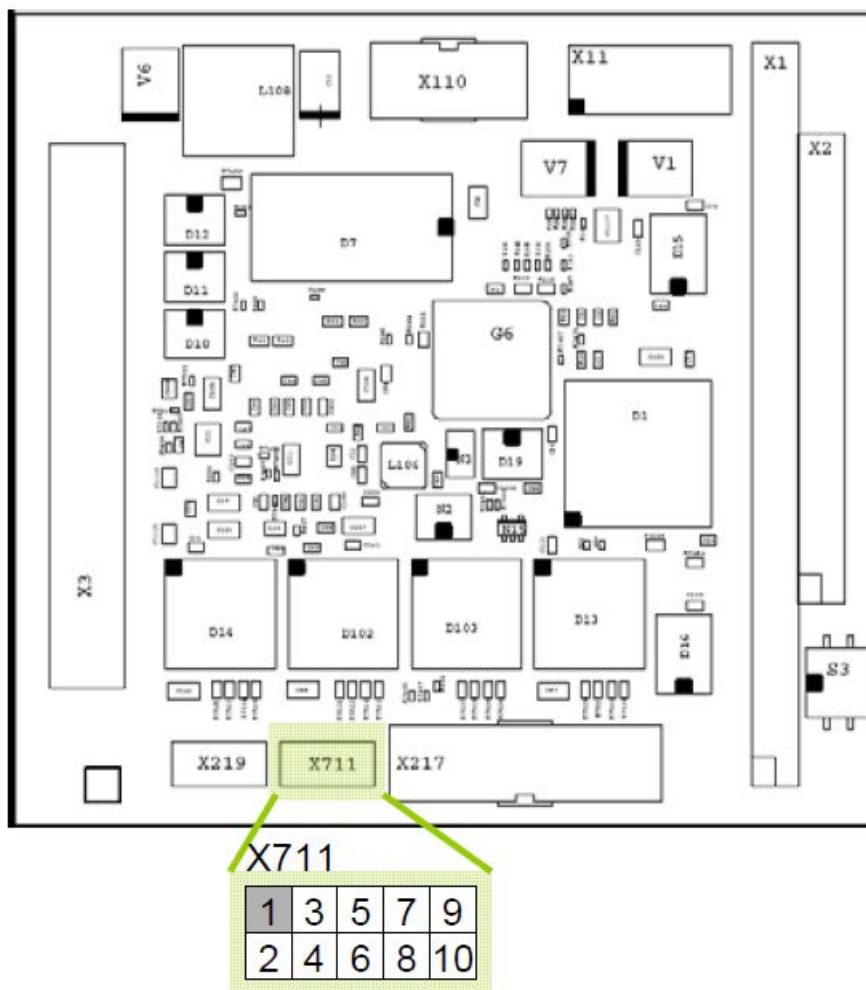


Figure 1-1 View of the 10-pin connector (PE) - X711 from above

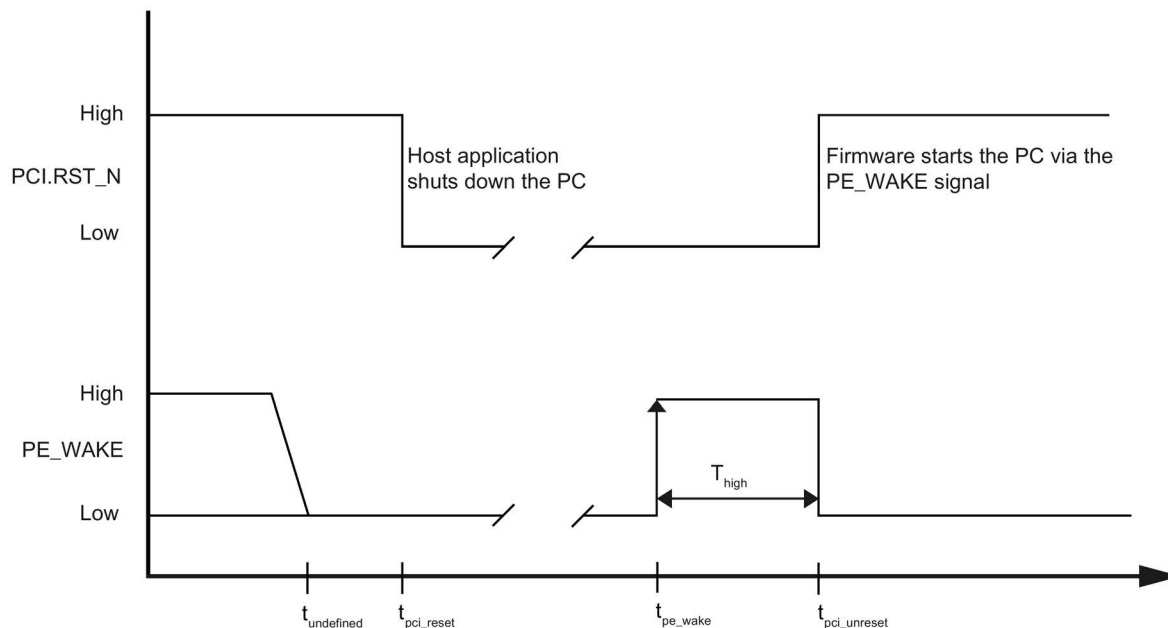
PIN number	Remarks
1	3.3 V
2	PE_WAKE signal
3	Do not connect!
4	Do not connect!
5	Do not connect!
6	Do not connect!
7	Do not connect!
8	Do not connect!
9	Do not connect!
10	Ground

! WARNING**Do not connect pins 3 to 9!**

Do not connect pins 3 to 9! Otherwise the CP may be destroyed.

Signal description "PE_WAKE"

The following diagram represents the "PE_WAKE" signal:



- t_{pci_reset} The host application shuts down the PC. The RST_N level on the PCI bus then falls to "Low".
- t_{pe_wake} The firmware receives the PROFlenergy end pause frame and initiates the startup procedure of the host PC with the PE_WAKE signal.
- $t_{pci_unreset}$ When it restarts, the host PC pulls the RST_N pin on the PCI bus to "High". The firmware then sets the PE_WAKE signal back to "Low".
- $t_{undefined}$ $t_{undefined} = 12$ seconds
After PC start, the PE_WAKE signal is not defined until this point in time. The PE_WAKE signal can only be used as controller for switching on the host PC system after the 12 seconds.

Electrical characteristics

The 10-pin connector (PE) has the following electrical properties:

PIN number	Value	Typical	Max	Min
1	I	-	20 mA	-
1	U	3.3 V	-	-
2	I	-	5 mA	-
2	U _{low}	0 V	0.8 V	-
2	U _{high}	3.3 V	-	2 V

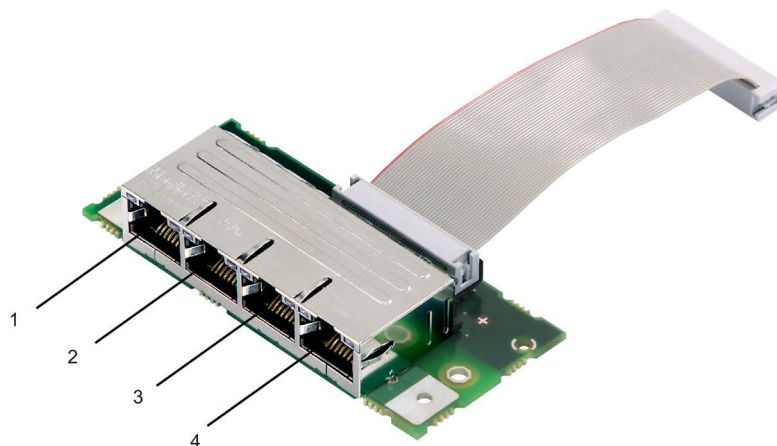
Mating component of the 10-pin connector (PE)

As the mating component of the 10-pin connector (PE), we recommend the TMM105-xx-S-D-x connector from the Samtec company.

1.1.4 RJ-45 connection board for CP 1604

Appearance

The following figure shows the RJ-45 connection board for the CP 1604 with a 40-pin ribbon cable and the port number.



Properties

The RJ-45 connection board for the CP 1604 has 4 RJ-45 jacks for connecting end devices or other network components. With the supplied 40-pin ribbon cable, the RJ-45 connection board for CP 1604 is connected to the CP 1604.

The signals of the 4 RJ-45 jacks are connected to the integrated real-time switch on the CP 1604.

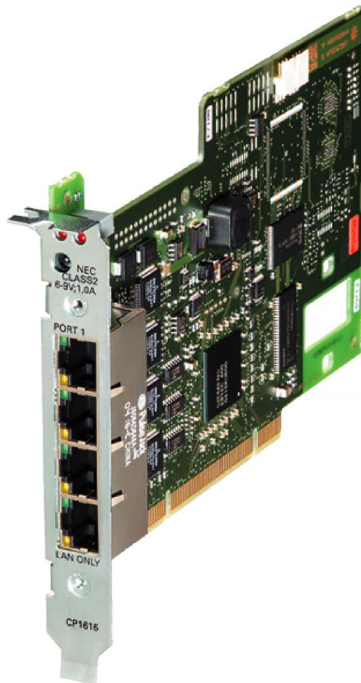
Apart from the RJ-45 connectors, there are also 2 LEDs (green and yellow) for each port.

LED description	Meaning
Green LED	Is lit if a connection is established (Link LED).
Yellow LED	Is lit when sending and receiving (Activity LED).

1.2 CP 1616 communications processor

Appearance

The following figure shows the CP 1616 communications processor.



Properties

The CP 1616 is a PCI module for connecting PGs/PCs to Industrial Ethernet. The essential properties are as follows:

- Optimized for PROFINET IO
- With Ethernet realtime ASIC ERTEC 400
- Four RJ-45 jacks for connection of end devices or other network components
- Integrated 4-port real-time switch
- Automatic hardware detection is supported

Hardware requirements

To be able to operate, the CP 1616 requires a 32-bit wide, short PCI slot with master capability.

LED display

On the front of the CP 1616, there are 10 LEDs.

Above the four RJ-45 jacks, there are 2 red LEDs labeled "BF" (bus fault) and "SF" (group fault).

LEDs in the frame of each RJ-45 jack

Within the frame of each RJ-45 jack, there are 2 LEDs.

The upper green LED is lit when a connection is established (Link LED).

The lower yellow LED is lit when sending and receiving (Activity LED).

BF and SF LED

The BF and SF LEDs have the following significance:

BF LED	SF LED	Description
off	-	Communications connection is established.
on	-	Link status error has occurred.
flashing slowly	-	There are two possible causes: • An IO device cannot be addressed. • An IP address was assigned twice.
–	off	There are two possible causes: • No fault/error. • A download is in progress.
	on	Diagnostics information is available.
	flashing at 2 second intervals	The firmware of the module is in an inconsistent status. This status is possible, for example if the power supply was interrupted during a firmware update. Eliminate the error as described in the section "Eliminating problems (Page 90)".
alternating slow flashing		Flash test for module detection.

BF LED	SF LED	Description
alternating fast flashing		A disruption has occurred. In this case, diagnostics via the Web or using SNMP is no longer possible.
		Note If this error occurs, please contact Technical Support. The problem can be eliminated if you contact our specialists directly. You will find the contact data in the section "Preface (Page 3)". Resetting the firmware or restarting the PC will not eliminate the problem.

Virtual LEDs

Remember that apart from the LEDs visible on the front panel, there are also two "virtual" LEDs in the firmware. These are the operating mode LEDs RUN and STOP. They do not exist physically but can nevertheless be queried using SNMP. They are on in the RUN or STOP mode and never flash normally or quickly.

External power supply

The CP 1616 has a socket for connecting an external power supply.

With this power supply, the integrated real-time switch can operate even if the PC is turned off.

Ethernet

The CP 1616 is intended for operation in Ethernet networks.

It also has the following features:

- The connectors are designed for 10BaseT and 100BaseTX.
- Data transmission speeds of 10 and 100 Mbps in full/half duplex are supported.
- Autonegotiation
- The module includes a 4-port real-time switch.
- Autocrossover

Four RJ-45 jacks

The connection of the CP 1616 to the LAN (Local Area Network) is via one of the four RJ-45 jacks on the front panel of the CP.

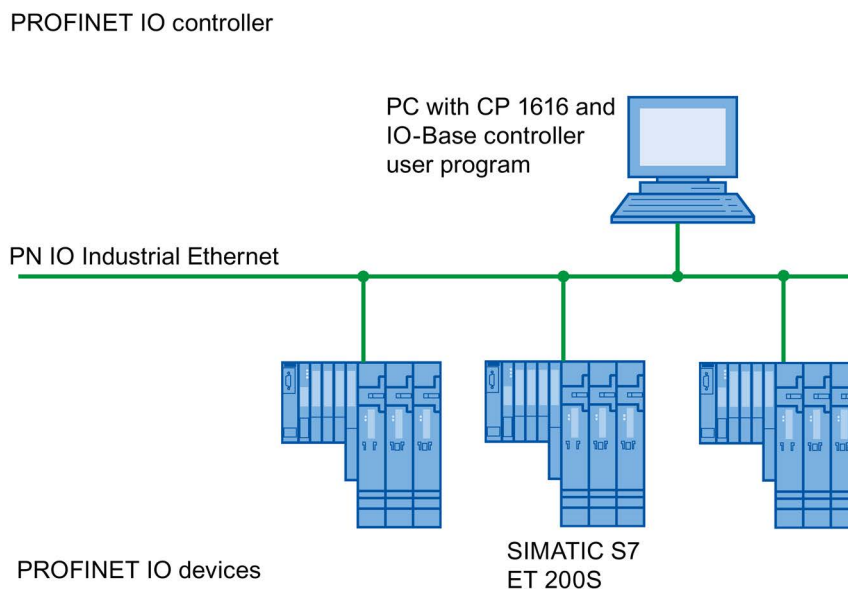
The four jacks are connected to the integrated real-time switch.

CP 1616 in a PC as IO controller

The following schematic illustrates a typical application:
PC with CP 1616 as PROFINET IO controller at the IO controller level.

The IO-Base controller user program runs on the PC and accesses the functions of the IO-Base user programming interface.

The data traffic is handled via a CP 1616 communications processor with several ET 200S SIMATIC S7 PROFINET IO devices via Industrial Ethernet.



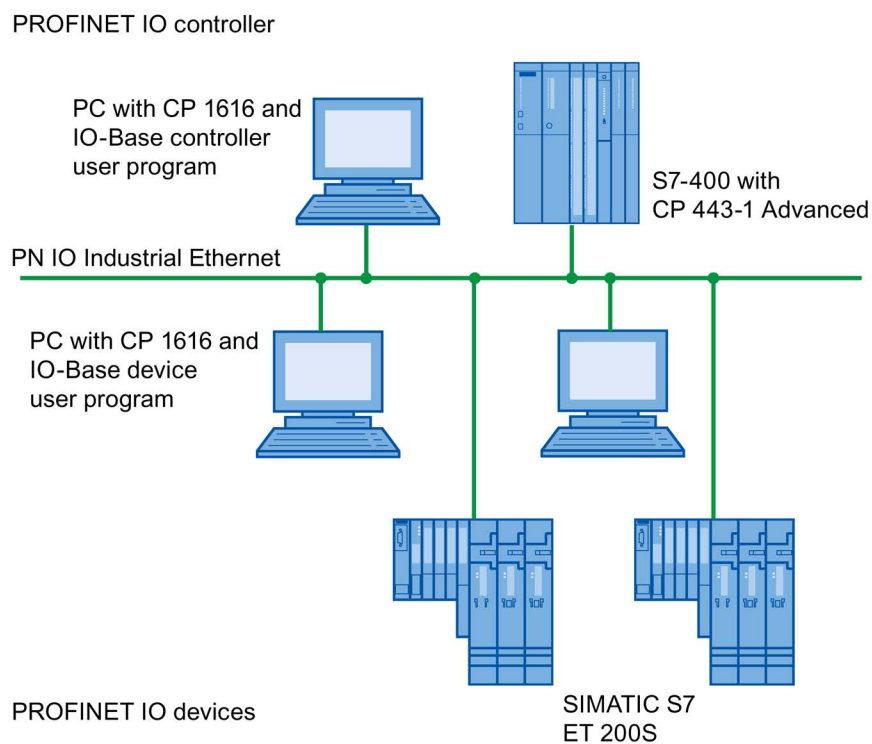
CP 1616 in a PC as IO device

The following schematic illustrates a typical application:

Two PCs each with a CP 1616 as PROFINET IO device at the IO device level.

There is also a PC with a CP 1616 as PROFINET IO controller, a SIMATIC S7-400 with a CP 443-1 as PROFINET IO controller and two SIMATIC S7 ET 200S PROFINET IO devices in the network.

On the IO device PCs, there is an IO-Base device user program that accesses the functions of the IO-Base user programming interface. The data traffic is via a CP 1616 communications processor to a PC as PROFINET IO controller or an S7-400 automation system with a CP 443-1 via Industrial Ethernet.



Hardware installation

2.1 CP 1604 communications processor

2.1.1 Important information

Electrostatic sensitive devices

Remember the measures to prevent electrostatic charge when installing the module
(ESD - Electrostatic Discharge)

Installing the modules

Opening the PC and plugging or pulling the modules is permitted only when the power is off.

Read the manual

Before installing the module, read the section "Requirements and notes (Page 27)" in the manual of your PC and the following section completely and keep to the instructions.

2.1.2 Requirements and notes

Recommendation for installation when using Linux

Install the CP 1604 communications processor first and then install the CP 1604 driver.

Recommendation for installation when using Linux RTAI

For the integrated graphic chip and the X server (graphic user Interface), we recommend a VESA-compatible driver to achieve stable IRT operation.

Activate the plug and play mechanism

If available, enable the plug-and-play mechanism in the BIOS of your computer.

Requirement for the PCI slot

The CP 1604 communications processor requires a PCI slot in the PC/104 Plus format.

Note

Multiple CP 1604 communications processors in one PC are not permitted.

Module address

The module address is set with the address switch as described below:

Module address	Switch 1	Switch 2	Comment
0	On	On	-
1	On	Off	-
2	Off	On	-
3	Off	Off	Not permitted!

Note

Make sure that all the module addresses in the stack are set differently.

Note

With certain variants of the SIMATIC Microbox, is not possible to use all module addresses; you will find further information on this in the appropriate operating instructions.

Note

Multiple CP 1604 communications processors in one PC are not permitted.

Note

If you use a PCI adapter, you should ideally set module address 0.

2.1.3 Procedure for installing the CP 1604

Installation and connection of the CP 1604

Follow the steps below when installing and connecting up the CP 1604 communications processor in the SIMATIC Microbox PC 420:

1. Turn off your computer and pull out the power cable connector from the socket.
2. Open the computer housing as described in the manual accompanying your PC.
3. Remove the CP 1604 communications processor from its packaging.

Note

When handling the module, make sure that you do not touch the connectors or the electronic components.

4. When necessary screw the supplied threaded sleeves onto the module on which the CP 1604 will be placed.
5. Insert the CP 1604 into the prepared PC/104 Plus slot.
Make sure that the CP 1604 sits firmly and uniformly.
6. Take the 4 supplied M3 screws and screw the CP 1604 to the underlying sleeves.
7. Set the module address on the CP 1604.
8. When required, install the Microbox expansion frame for the CP 1604 with the optional CP 1604 modules as described in the section "AUTOHOTSPOT".
9. Close the computer housing as described in the manual accompanying your PC.
10. If required, insert the connecting cables (TP) in the corresponding RJ-45 jacks of the RJ-45 connection board for the CP 1604.
11. Plug the power supply connector into the socket again and turn on your computer.

2.2 CP 1616 communications processor

2.2.1 Important information

Electrostatic sensitive devices

Please remember the measures to prevent electrostatic charge when installing the module (ESD - **E**lectrostatic **D**ischarge)

Installing the CP 1616

Opening the PC and plugging or pulling the modules is permitted only when the power is off.

Read the manual

Before installing the module, please read the section "Procedure for installing the CP 1616 (Page 31)" or similar in the manual of your PC and keep to the instructions.

External power supply

The CP 1616 has a socket for connecting an external power supply.

With this power supply (6 to 9 VDC), the CP 1616 can operate as a switch even if the PC is turned off.

NOTICE
UL approval These modules are intended for installation in Siemens PCs which are approved in accordance with UL 508 and listed under UL file number E85972. These PCs must comply with the UL 508 guidelines on "limited voltage / current" or have an "LPS supply" in accordance with UL 60950 or a "Class 2 supply" in accordance with UL 1310/UL 1885.

2.2.2 Procedure for installing the CP 1616

**WARNING**

Do not put any damaged parts into operation!

Do not use any parts that show evidence of damage!

Recommendation for installation when using Linux

Install the CP 1616 first and then install the CP 1616 driver.

Requirements and conditions

- If available, enable the plug-and-play mechanism in the BIOS of your computer.
- The CP 1616 communications processor requires a PCI slot with master capability.

Note**Note on the number of possible CP 1616s in one computer**

A maximum of one CP 1616 module can be installed in one PG/PC.

Installation and connection of the CP 1616

To install and connect up the CP 1616 follow the steps outlined below:

1. Turn off your computer and pull out the power cable connector from the socket.
2. Open the computer housing as described in the manual accompanying your PG/PC.
3. Remove the cover of a free PCI slot in your computer.
4. Remove the CP 1616 from its packaging.

Note

When handling the module, make sure that you do not touch the connectors or the electronic components.

5. Insert the CP 1616 the PCI slot. Make sure that the CP 1616 sits firmly and uniformly in the socket of the slot.
6. Close the computer housing as described in the manual accompanying your PG/PC.

7. Plug the connecting cable (TP) into the appropriate socket on the front panel of the CP 1616.
8. Plug the power supply connector into the socket again and turn on your computer.

Note

If you insert the CP 1616 in a suitable PCI slot and then secure the metal plate to the housing, the module sometimes skews in the slot in computers of some manufacturers.

After securing the module, please make sure that it is still sitting correctly and firmly in the slot!

Configuration

Configuring

After the communications processor has been installed in the computer, the CP still needs to be configured.

The further procedure is described in the "Commissioning PC Stations" manual and in the "PROFINET with STEP7 V14" Function Manual. You will find the manuals on the SIMATIC NET Product DVD in the directory: V2.X.X\CP16xx\doc.

Special point to be taken into regard when configuring the I&M data:

Die data "Higher-level designation" and "Location designation" that can be set in "STEP 7 Professional (TIA Portal)" can be loaded together with the STEP 7-project into the communications processor.

If the communications processor is also configured as an IO device, the data "HID" and "LID" can also be read out from any partner stations via the PROFINET protocol. This is effected by reading the data record "I&M 1". Responding to this data record is the task of the user application. Ensure that the data received from the application agree with the data configured in "STEP 7 Professional (TIA Portal)".

Downloading firmware

The CP ships with a current firmware version.

If you want to use the CP 16xx driver of a current SIMATIC NET CD, new firmware for the CP is also supplied with it. The following activities are then necessary:

- Download the firmware to the CP.
- Update and activate the driver of the CP on the PC.

Description

This section shows you how to use the firmware loader.

The Firmware Loader allows you to download new firmware versions to the SIMATIC NET modules.

For more detailed information about the individual download variants, refer to the integrated help in the program.

Firmware

Here, firmware means the system programs in the SIMATIC NET modules.

Uses of the Firmware Loader

The Firmware Loader allows you to download new firmware versions to the SIMATIC NET modules. It is used for the following:

- PROFIBUS modules
- Industrial Ethernet modules
- Modules for gateways (for example, IE/PB Link)

Installation

The firmware loader is available in Windows when you have installed STEP 7/NCM PC on your PC.

Load files

The load file contains the firmware of the CP and other information that can be displayed by the firmware loader. Based on this information, it checks the compatibility with the device.

The load file ships with the name "fw16xx-v.v.v.b.b.fwl"; where "v.v.v." stands for the version number and "b.b" for the build number.

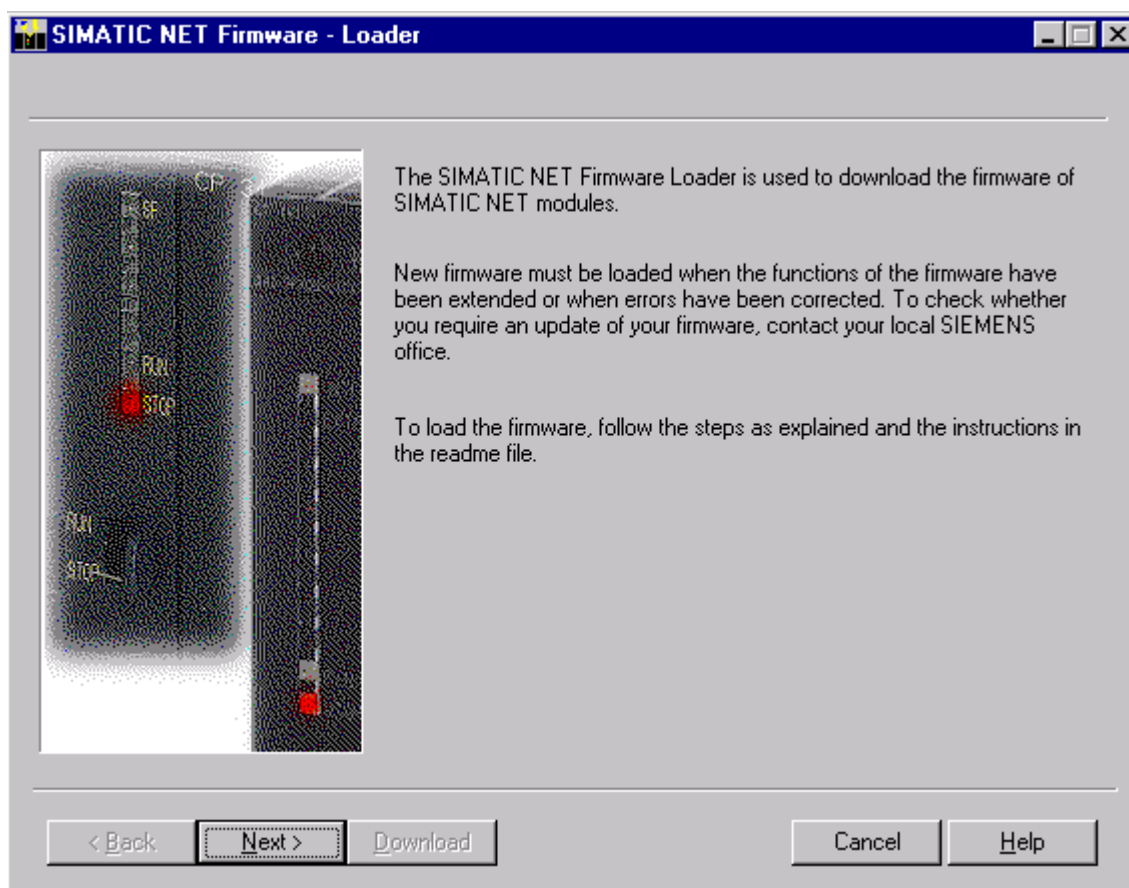
Working with the Firmware Loader

Depending on the module type, the download is prepared and executed in three or four dialog steps.

For more information, refer to the following section and the dialog boxes themselves.

Starting the firmware download

1. In the Windows Start menu, select "Start" > "SIMATIC" > "STEP 7" > "NCM S7" > "Firmware Loader".
2. Click the "Next" button and follow the instructions displayed in the dialog.



NOTICE

Interrupting the download can lead to problems

Remember that interrupting the download can lead to an inconsistent module status!

NOTICE

Load file used

Make sure that the load file you are using is intended as an update for the version of the firmware contained on your module. If you are in any doubt, contact your local Siemens advisor.

For more detailed information on the various load options, refer to the integrated help.

Note

Two MAC addresses

When loading the firmware or commissioning the module, please note that the CP has two MAC addresses (always consecutive addresses).

The first address printed on the module is for layer 2 communication, the second for the PROFINET protocol (first address plus one).

Example

The address "08.00.06.93.DA.76" printed on the communications processor is the address for layer 2 communication. This means that "08.00.06.93.DA.77" is the MAC address for PROFINET communication.

Eliminating problems

A disruption during the firmware download can lead to an inconsistent status on the module.

Status detection

You can recognize an inconsistent status on the CP as follows:

- The CP is not accessible with STEP 7/NCM PC (in the SIMATIC Manager/SIMATIC NCM Manager, select **configured PC station** in the STEP 7 project > menu command "PLC" > "Edit Ethernet Node").
- The red SF LED (group fault) flashes at 2-second intervals.
- Following a computer restart, all the LEDs of an unused RJ-45 jack light briefly and then go off again.

Note

Green Link LED

In contrast to the brief lighting up of the LEDs when the computer starts up, the green Link LED always lights up if a cable is inserted in the RJ-45 jack and a link is also established.

Troubleshooting

Download the current firmware file, for example "fw16xx-v.v.v.b.b.fwl", to the module again via the **ISO access point**.

Confirm the error "Error establishing connection to query the hardware version" with "yes"; in other words, ignore the error.

To download using the ISO protocol, you require the MAC address printed on the module.

Operating hardware

4.1 Diagnostics with SNMP

4.1.1 SNMP and CP 1616/CP 1604

Diagnostics with SNMP

Using SNMP (Simple Network Management Protocol), a network management station can configure and monitor SNMP-compliant devices. To allow this, a management agent is installed on the device with which the management station exchanges data using Get and Set requests.

MIB

A MIB (Management Information Base) is a type of database containing the description of the objects and functions of a device. SNMP clients access this information.

A distinction is made between standardized and private MIBs:

- Standardized MIBs are described in RFC documents.
- Private MIBs contain product-specific expansions.

MIB II describes a set of SNMP variables that is normally supported by all SNMP-compliant devices.

SNMP V1 and SNMP V2 protocols

With the SNMP V1 and SNMP V2 protocols, all the objects of MIB-II relevant for the product and the objects of a private MIB can be queried.

SNMP-compliance of a CP 1616/CP 1604

A management agent is integrated in the CP 1616/CP 1604.

The CP 1616/CP 1604 supports the SNMP V1 and SNMP V2 protocols.

In the MIB-II, the CP 1616/CP 1604 contains all groups except "egp and transmission" and "at".

Security concept

Access with SNMP is controlled by the concept of communities.

Access	Community
Read-only access	public
Read and write access	private

Meaning of the abbreviations/acronyms and sources of further information

In the following table, you can see the meaning of the abbreviations/acronyms used above and can also see where you can obtain further information.

Abbreviation/acronym	Meaning	Further information
SNMP	Simple Network Management Protocol	RFC 1157
SNMP V2	Simple Network Management Protocol Version 2 (administration, protocol operations and security)	RFC 1901 and RFC 1905
SMIv1	Structure and Identification of Management Information – Describes the structure of MIB objects.	RFC 1155
MIB-II	Management Information Base, Version 2	RFC 1213
Private MIB	MIB with product-specific expansions	Section "Private MIB of a CP 1616/CP 1604 (Page 42)"

4.1.2 SIMATIC NET SNMP OPC server

Description

The SIMATIC NET SNMP OPC server makes available the SNMP information from TCP/IP networks on the OPC interface with SNMP. Using the SIMATIC NET SNMP OPC server, any OPC client systems can access diagnostics and parameter data of SNMP-compliant components, for example the product WinCC.

Non SNMP-compliant components can also be included in the plant visualization using their IP addresses. Apart from simple device diagnostics, this also allows detailed information such as the network load distributions of entire TCP/IP networks. With the additional monitoring of this data, device failures can be detected and localized quickly. This increases operational safety and improves plant availability. You configure the devices to be monitored by the SIMATIC NET SNMP OPC server with STEP 7 (alternatively with NCM PC).

You will find further information on the SIMATIC NET SNMP OPC server on the Internet at the URL:

OPC server (<http://www.automation.siemens.com/mcms/industrial-communication/de/ie/software/netzwerkmanagement/snmp-opc-server/seiten/snmp-opc-server.aspx>)

Note

The SIMATIC NET SNMP OPC server is not part of this product.

Profile files and MIB compilers

The range of information that can be monitored by the devices with the SIMATIC NET SNMP OPC server depends on the particular device profile.

With the integrated MIB compiler of STEP 7/NCM PC, existing profiles can be modified and new device profiles created for any SNMP-compliant device. It requires MIB files according to the SMIv1 standard.

The SMIv1 MIB of the CP and a complete device profile are available on the supplied product CD or can be downloaded from Support:

MIB (<http://support.automation.siemens.com/WW/view/en/22414405>)

4.1.3 Variables of the MIB-II standard

Variables in the "System" directory

The following table shows several SNMP variables of the MIB II standard for monitoring the device standard from the "System" directory:

Variables	Access rights	Description
sysDescr	Read only	Contains a vendor-specific identification of the device, for example "SIEMENS", "SIMATIC NET", "CP 1616" or "CP 1604". A string with up to 255 characters is used. Data type: DisplayString
sysObjectID	Read only	Address (OID - Object Identifier) at which the device-specific SNMP variables are accessible. On the CP 1616/CP 1604, the OID is: 1.3.6.1.4.1.4196.1.1.9.1 for CP 1616 1.3.6.1.4.1.4196.1.1.9.2 for CP 1604
sysUpTime	Read only	Time since the last reset, for example since power-up – This information is in multiples of hundredths of seconds.
sysContact	Read and write	Here, you can enter the name of a contact person; factory default: empty string. The possible value is string with a maximum of 255 characters.
sysName	Read and write	Name for the device; factory default: empty string The possible value is string with a maximum of 255 characters.
sysLocation	Read and write	Location of the device; factory default: empty string. The possible value is string with a maximum of 255 characters.
sysServices	Read only	Shows the functions (services) provided by the component according to the ISO/OSI model. Each bit stands for one of seven OSI layers. For the CP 1616/CP 1604, the "OPC Scout" program displays the value "74" dec. (01001010 binary or 4A hex). Converted to a binary value, this means the following decoded from the back: Bit 2 set – Layer 2, primary switching Bit 4 set – Layer 4, configuration with RFC 1006 Bit 7 set – Layer 7, PROFINET IO

Variables in the "Interfaces" directory

The following table shows several SNMP variables for monitoring the device status from the "Interface" directory:

SNMP variable	Access rights	Description
ifDescr	Read only	Description of and possibly other information for a port. The possible value is string with a maximum of 255 characters; for example "SIEMENS", "SIMATIC NET", "CP1616", "<MLFB>", "HW:<hardware version>", "FW:<firmware version>", "Fast Ethernet Port <port number>". Explanation: The current value is entered in the pointed brackets. Data type DisplayString
ifInErrors	Read only	Number of received packages that were not forwarded to higher protocol layers because of an error. Data type: Counter
ifLastChange	Read only	Time the selected port has been in its current status; see "ifOperStatus". The information is in multiples of hundredths of seconds. Data type: TimeTicks
ifNumber	Read only	Number of different interfaces available in the component. For a CP 1616/CP 1604, the value 5 is displayed for this variable (4 physical ports + 1 virtual port for the CP 1616/CP 1604 itself). Data type: Integer
ifOperStatus	Read only	Current operating state of the Ethernet port The following values are possible: 1. up 2. down Data type: Integer
ifOutErrors	Read only	Number of packages that were not sent because of an error. Data type: Counter
ifPhysAddress	Read only	Port MAC addresses of the CP 1616/CP 1604 - Index 1 to 4: Port MAC address of the port - Index 5: MAC address for PROFINET IO Data type: PhysAddress
ifSpeed	Read only	Data transfer rate of the Ethernet port in bits per second For the CP 1616/CP 1604, either 10 Mbps or 100 Mbps is displayed. Data type: Gauge
ifType	Read only	For the CP 1616/CP 1604, the value 6 (ethernet-csmacd) is entered. Data type: Integer
ifSpecific	Read only	Specific reference Here, a fixed value ".0.0" is used because there is no reference. Data type OBJECT IDENTIFIER

Port indexes

Port-specific objects can be addressed with "SNMP variable.portnumber".

For the CP 1616/CP 1604, the interface index corresponds to the port number.

The virtual port has the number 5.

Example

The "IfOperStatus.1" variable determines the operating state (up, down etc.) of port 1 of the CP 1616/CP 1604.

4.1.4 Private MIB of a CP 1616/CP 1604

Only variables for the LED status

The private MIB contains the following variables for the LED status:

Variables	Access rights	Description of the variable	Meaning of the values
snCp1616BFledVal/ snCp1604BFledVal	Read only	Status of the bus fault LED	Data type for all LED value variables: Integer Possible values are as follows: 1: LED off 2: LED on 3: LED flashing 4: LED flashing fast
snCp1616SFledVal/ snCp1604SFledVal	Read only	Status of the system error LED	
snCp1616RunLedVal/ snCp1604RunLedVal	Read only	Status of the RUN LED	
snCp1616StopLedVal/ snCp1604StopLedVal	Read only	Status of the STOP LED	
snCp1616BFled/ snCp1604BFled	Read only	Status of the bus fault LED	Data type for all LED variables: DisplayString Possible values are as follows: off: LED off on: LED on blink: LED flashing fastBlink: LED flashing fast
snCp1616SFled/ snCp1604SFled	Read only	Status of the system error LED	
snCp1616RunLed/ snCp1604RunLed	Read only	Status of the RUN LED	
snCp1616StopLed/ snCp1604StopLed	Read only	Status of the STOP LED	

Note

For the meaning of the LED signaling, refer to the section "Description of the device (Page 13)" of the relevant CP.

Virtual LEDs

Remember that apart from the LEDs visible on the front panel, there are also two "virtual" LEDs in the firmware. These are the LEDs "RUN" and "STOP". They do not exist physically but can nevertheless be queried using SNMP.

Object identifier (OID)

For the CP 1616

The private MIB variables of the CP 1616 have the following object identifier (OID):

iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).siemensAD(4196)
.adProductMibs(1).simaticNet(1).iCP(9).iCP1616(1)

For the CP 1604

The private MIB variables of the CP 1604 have the following object identifier (OID):

iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).siemensAD(4196)
.adProductMibs(1).simaticNet(1).iCP(9).iCP1604(2)

4.2 Web server

4.2.1 Web server

Introduction

Note

In the "Web server" section, the term CP 1616 is used for the CP 1616, the CP 1616 onboard and the CP 1604.

The Web server provides you with the option of monitoring your CP 1616 via the Internet or the internal company intranet. This allows evaluations and diagnostics over large distances.

Messages and status information are displayed on HTML pages.

Web browser

To access the HTML pages on the CP 1616, you require a Web browser.

The following Web browsers are suitable for communication with the CP 1616:

- Internet Explorer (as of version 6.0)
- Mozilla Firefox (as of version 1.5)
- Opera (as of version 9.0)

Web access to the CP 1616 from a PG/PC

To access the Web server, follow these steps:

1. Connect the client (PG, PC) to the CP 1616 via the PROFINET interface.
2. Open the Web browser.

Enter the IP address of the CP 1616 in the "Address" box of the Web browser in the format `http://a.b.c.d` (example of an entry: `http://192.168.3.141`).

The Start page of the CP 1616 opens. From the Start page, you can navigate to the other information.

Note

A maximum of 5 HTTP connections are possible.

4.2.2 Language settings

Introduction

The Web server supports the following languages:

- German (Germany)
- English (USA)

Requirements for displaying texts in various languages

To ensure that the Web server displays the various languages correctly, you need to make two language settings in STEP 7:

- Set the language for display devices in the SIMATIC Manager
- Set the language for the Web in the Properties dialog of the CP 1616. You will find more detailed information in section Settings in HW Config, "Web" tab (Page 46).

Set the language for display devices in the SIMATIC Manager

Select the languages for display devices in the SIMATIC manager:

Options > Language for Display Devices

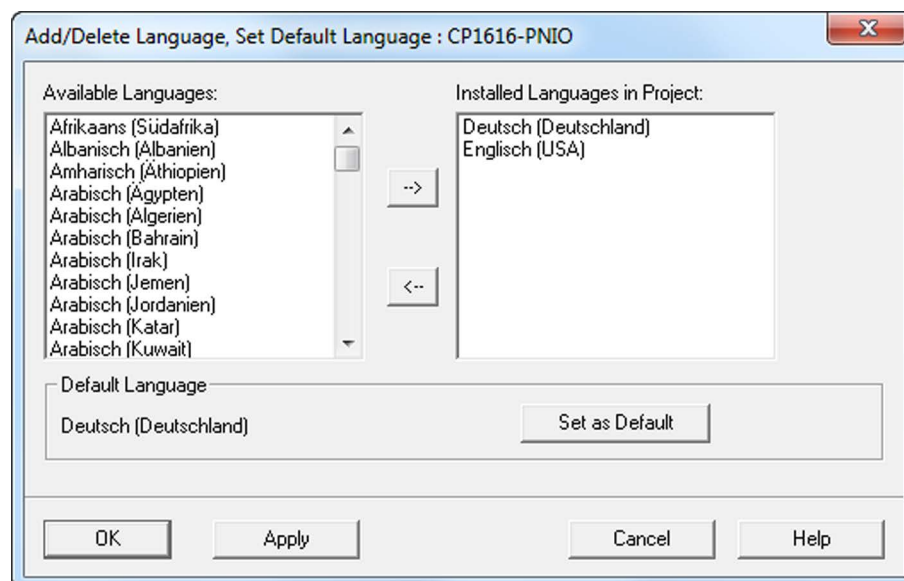


Figure 4-1 Example of language selection for display devices

4.2.3 Settings in HW Config, "Web" tab

Requirements

You have opened the Properties dialog of the CP 1616 in HW Config.

To be able to use the full functionality of the Web server, make the following settings in the "Web" tab:

- Enable the Web server
- Set the language for the Web
- Enable automatic updates (optional)

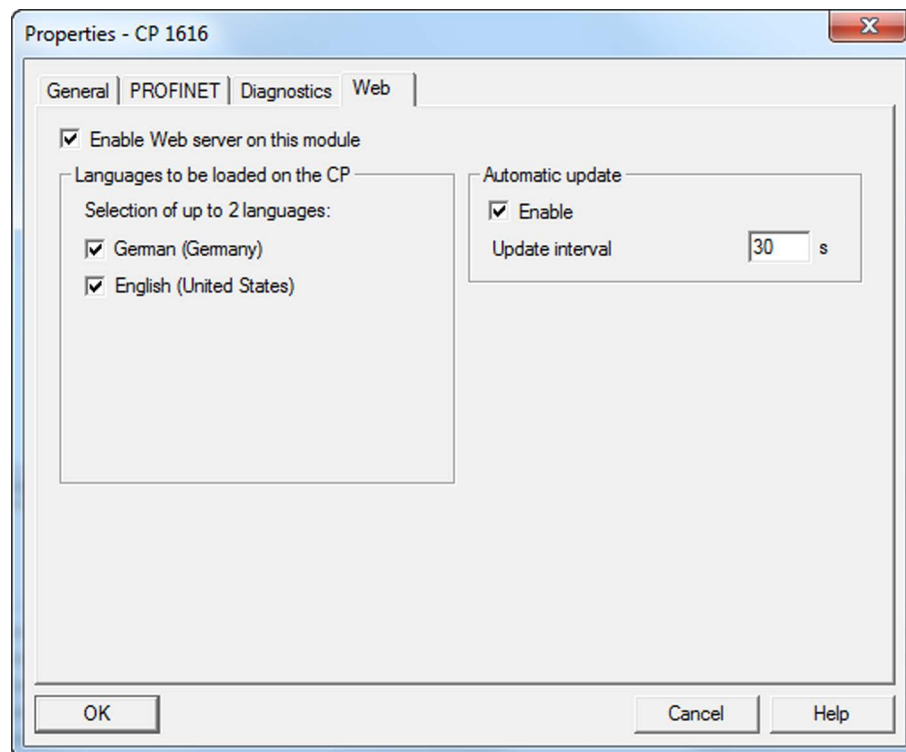


Figure 4-2 Settings in HW Config, "Web" tab

Enable the Web server

As default in HW Config, the Web server is disabled. You enable the Web server in HW Config.

In the properties dialog of the CP 1616:

- Select the "Enable web server on this module" check box

Set the language for the Web

Select a maximum of two of the installed languages available for display devices for the Web.

In the properties dialog of the CP 1616:

- Select up to two languages for the Web.

Note

If you enable the Web server and do not select a language, messages and diagnostics information will be displayed in hexadecimal code.

Enable automatic updates

The following Web pages can be updated automatically:

- Start page
- Diagnostic buffer
- Module information
- Information on communication
- Topology
- Media redundancy

To enable automatic updating, follow these steps:

- Go to the Properties dialog of the CP 1616 ("Web" tab) and select the "Enable" check box under "Automatic update"
- Enter the update interval

Note

Update time

The activation interval set in HW Config is the shortest update time. Larger amounts of data or multiple HTTP connections increase the update time.

4.2.4 Updating and storing information

Updated screen content

As default in HW Config, automatic updating is disabled.

This means that the screen display of the Web server returns static information.

You update the Web pages manually using the <F5> function key or the following icon:



Updated printouts

Printouts always show the current information of the CP 1616. It is therefore possible that the printed information is more up-to-date than the display on your screen.

You can obtain a print preview of the Web page with the following icon:



Filter settings have no influence on the printout. The printout of the "Module information" Web page always shows the complete content of the pages.

Disabling automatic updating for a single Web page

To disable the automatic updating of a Web page temporarily, select the following icon:



You can re-enable the automatic update with the <F5> function key or with the following icon:



Storing messages and diagnostic buffer entries

You can store diagnostic buffer entries in a csv file. You save the data with the following icon:



A dialog opens in which you can specify the file name and target directory.

Note

Opening the csv file in Microsoft Excel

To display the data correctly in Microsoft Excel, do not open the csv file by double clicking on it. Import the file into Excel using the "Data" and "Import External Data" menu command.

4.2.5 Report system error

To achieve the full functionality of module information, topology and diagnostic buffer entries in the Web server, it is also necessary to generate and load "Report system error" for the project.

To ensure that "Report system error" is also generated each time you save and compile the hardware configuration, we recommend that you make the setting required for this.

Follow the steps outlined below:

1. Open the Properties page of the SIMATIC PC station in HW Config or NetPro.
2. Select the "Settings" tab.
3. Under "Report system error", select the "Call during "Save and Compile"" check box.

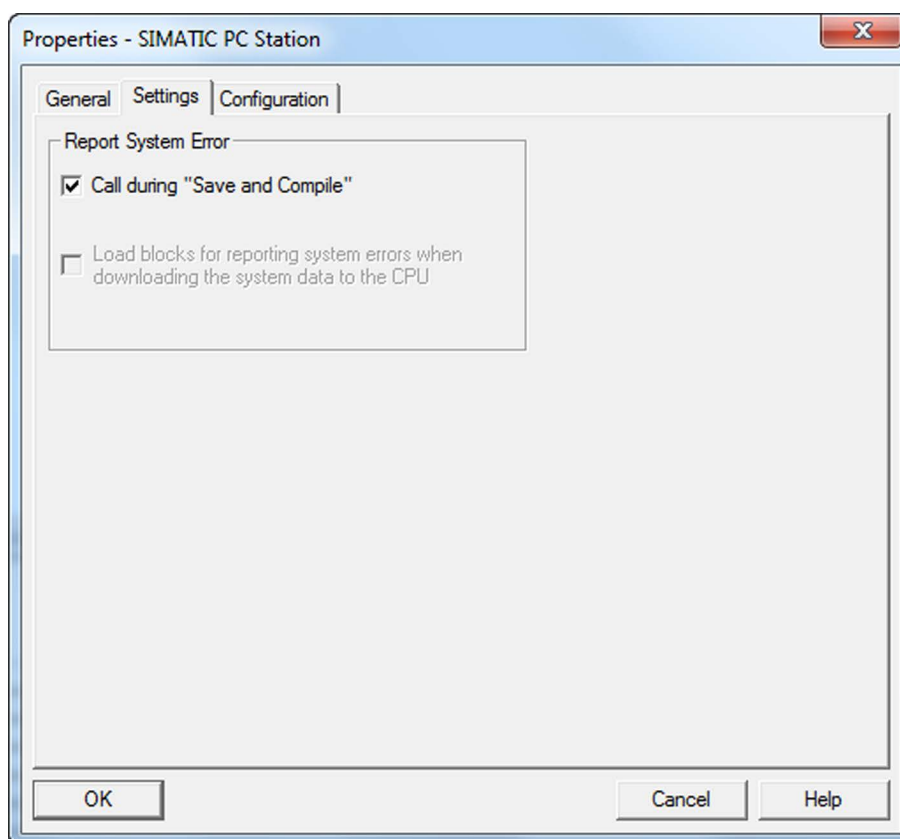


Figure 4-3 Setting for "Report system error"

4.2.6 Web pages

4.2.6.1 Intro

Establishing a connection to the Web server

You establish a connection to the Web server by entering the IP address of the configured CP 1616 in the address bar of the Web browser, for example <http://192.168.1.158>. The connection is established and the "Intro" page opens.

Here, we will show you how the various Web pages might look based on examples.

Intro

The following figure shows the first page (Intro) called up by the Web server.

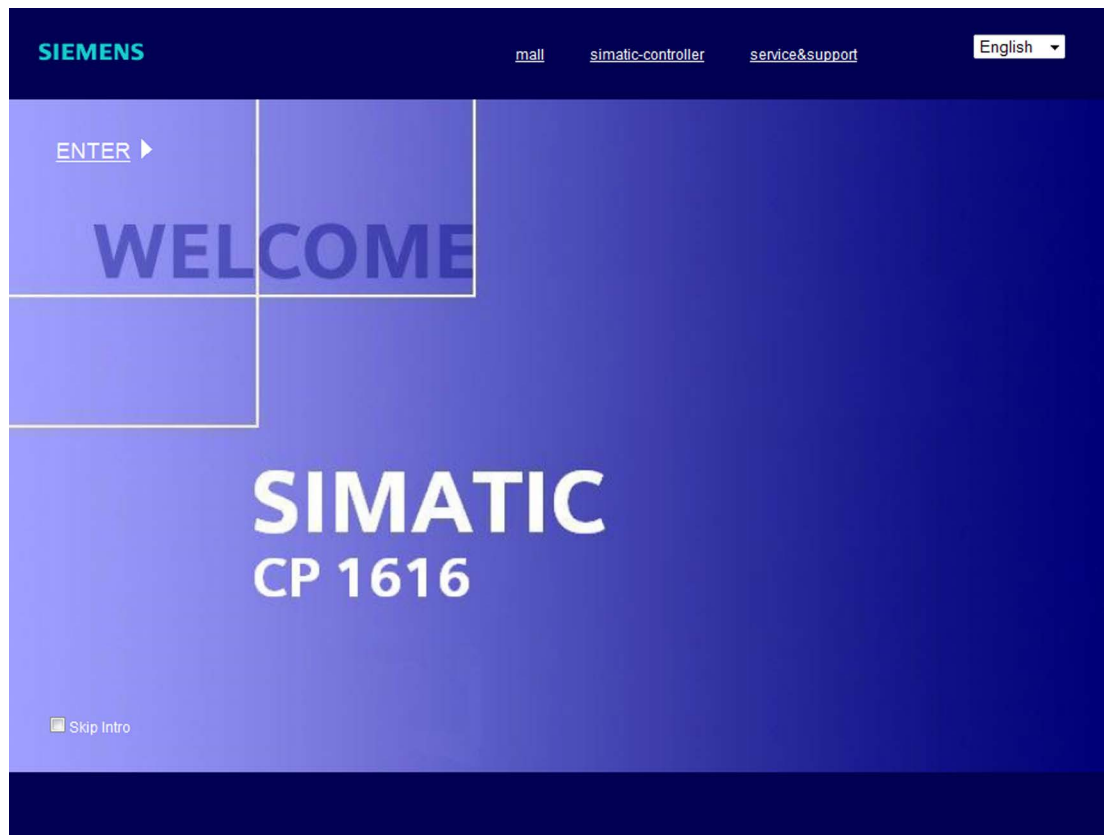


Figure 4-4 Intro

To access the pages of the Web server, click the ENTER link.

Note

Skipping the Intro Web page

Select the "Skip Intro" check box to skip the Intro. In future, you will then come directly to the Start page of the Web server. To display the Intro again when you start the Web server, click the "Intro" link on the Start page.

See also

Settings in HW Config, "Web" tab (Page 46)

4.2.6.2 Start page

Start page

The Start page provides you with information as shown in the following figure. The image of the CP 1616 indicates its current status regarding group errors and bus errors at the time the data was queried. The display of the port LEDs is static.

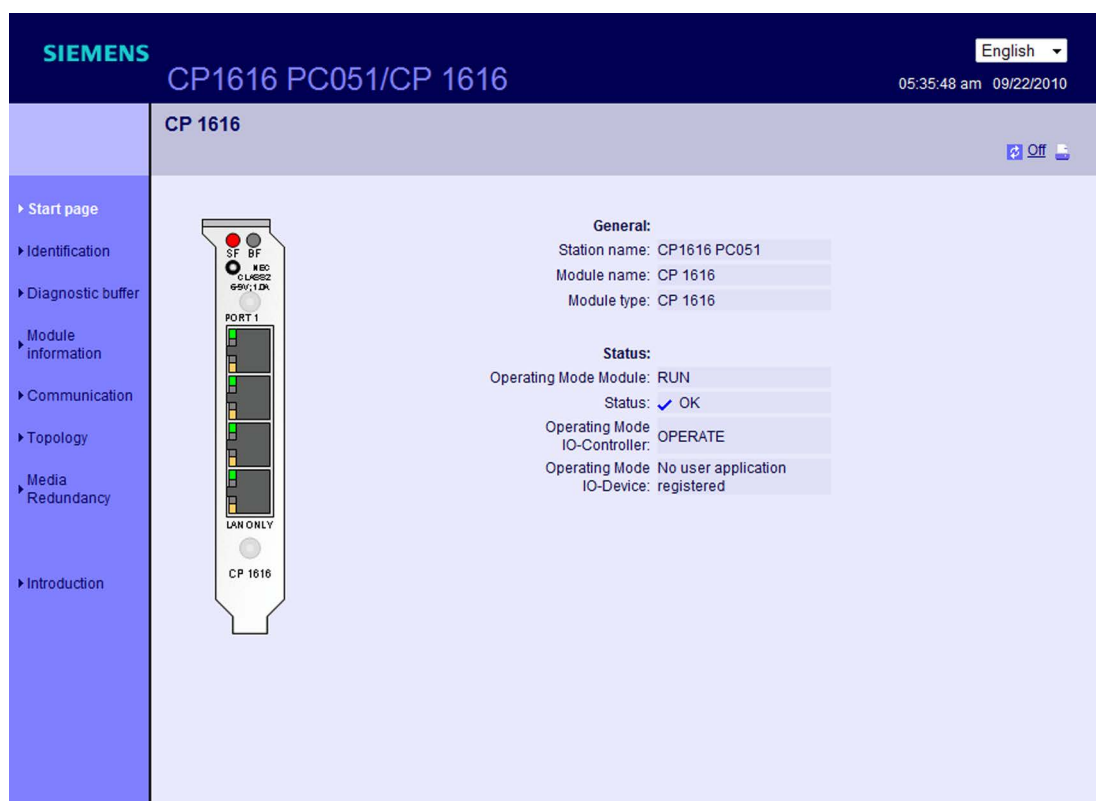


Figure 4-5 Start page

"General"

"General" contains information about the CP 1616 whose Web server you are currently connected to.

"Status"

"Status" contains information about the CP 1616 at the time of the query.

Reference

For information on http connections, see the section "Settings in HW Config, "Web" tab (Page 46)".

4.2.6.3 Identification

Characteristic data

You will find the characteristic data of the CP 1616 on the "Identification" Web page.



Figure 4-6 Identification

"Identification"

The "Identification" group includes the plant designation, location identifier and the serial number. The plant designation and location identifier can be configured in the Properties dialog of the CP 1616, "General" tab in HW Config.

"Order number"

You will find the order number of the hardware in the "Order number" box.

"Version"

You will find the versions of the hardware, firmware, boot loader and the host driver in the "Version" info box.

4.2.6.4 Diagnostic buffer

Diagnostic buffer

The content of the diagnostic buffer is displayed by the browser on the "Diagnostic buffer" Web page.

Number	Time	Date	Event
1	05:43:28:580 am	22.09.2010	The database of the PROFINET IO configuration is consistent.
2	05:43:28:560 am	22.09.2010	A new IP address was assigned by a STEP 7 configuration. IP address: 190.170.0.51
3	05:43:28:560 am	22.09.2010	A new IP address is expected from a STEP 7 configuration.
4	05:43:17:160 am	22.09.2010	Module STOP due to PG command
5	05:42:18:880 am	22.09.2010	A new IP address was assigned. The address was not set by downloading the configuration from STEP 7. IP address: 190.170.0.51
6	05:41:03:820 am	22.09.2010	The module was reset to the factory settings. The default MAC address set in the factory is active again.
7	05:41:03:820 am	22.09.2010	Memory reset executed
8	05:41:03:810 am	22.09.2010	Module STOP due to PG command
9	05:40:31:120 am	22.09.2010	Memory reset executed

Details: 1 Event ID: 16# F9C1

The database of the PROFINET IO configuration is consistent.
external error, incoming event

Figure 4-7 Diagnostic buffer

Requirement

You have enabled the Web server, made the language setting and compiled and downloaded the project with STEP 7.

"Diagnostic buffer entries 1-100"

The diagnostic buffer can hold up to 244 messages.

"Event"

The "Event" info box contains the diagnostic events with date and time.

"Details"

This box lists detailed information about the selected event.

Select the relevant event in the "Event" information box.

Configuration

The following steps are required for the configuration:

1. Open the "Object Properties" dialog in the shortcut menu of the relevant CP 1616.
2. Go to the "Web" tab and select the "Enable web server on this module" check box.
3. Select a maximum of two languages to be used to display plain language messages.
4. Save and compile the project and download the configuration to the CP 1616.

Point to note when switching over languages

In the top right corner, you can switch over the language, for example from German to English. If you change to a language that you have not configured, you will obtain the information as hexadecimal code instead of plain language.

4.2.6.5 Module information

Requirement

- You have made the following settings in HW Config:
 - enabled the Web server,
 - made the language setting,
 - generated and enabled "Report system error"
- You have compiled and downloaded the project with STEP 7 HW Config.
- The CP 1616 is in RUN.

Module information

The status of a station is displayed with icons and comments on the "Module information" Web page.

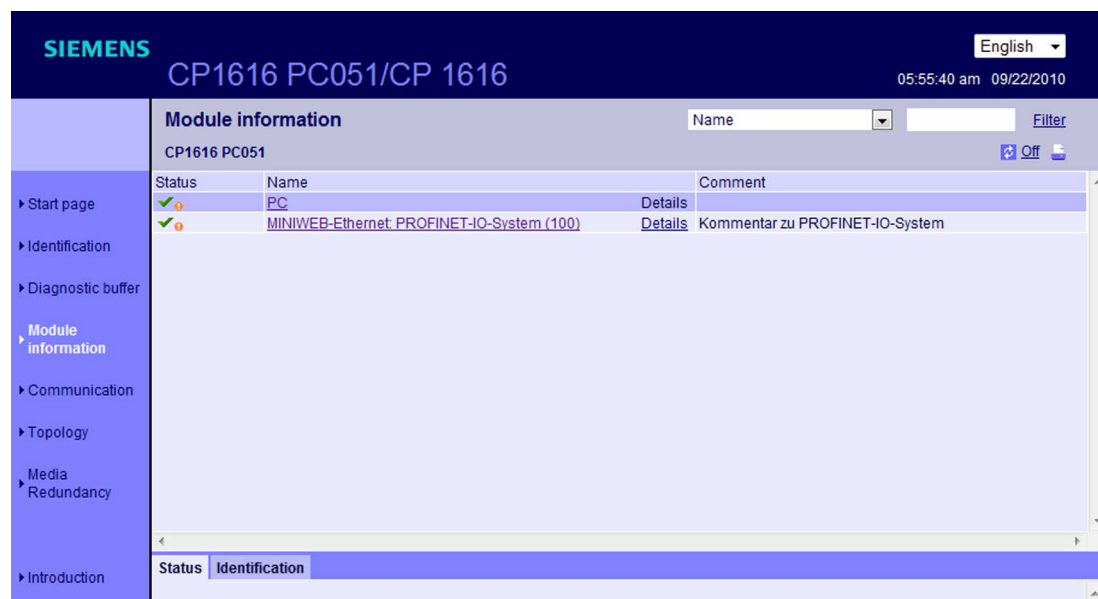


Figure 4-8 Module information - Station

Meaning of the icons in the "Icon" column.

Icon	Color	Meaning
	green	Component OK
	gray	Deactivated PROFIBUS slaves or PROFINET devices
	black	Component cannot be reached / status not available "Status not available" is always displayed when the CP 1616 is in STOP or during start up evaluation by "Report system error" for all configured I/O modules and I/O systems after re-starting the CP 1616. - This status can, however, also be displayed temporarily for all modules during operation if there is a flood of diagnostic interrupts. - No status can be obtained for modules of a subsystem connected to a CP.
	green	Maintenance required
	yellow	Maintenance demanded
	red	Fault - component failed or faulty
	-	Fault at a lower module level

Navigation to other module levels

The status of individual modules / submodules / components is displayed when you navigate to other module levels:

- To higher module levels via the links in the display of the module levels
- To lower module levels via the links in the "Name" column

The screenshot displays the Siemens CP1616 PC051/CP 1616 web interface. The top header shows the Siemens logo, the device name 'CP1616 PC051/CP 1616', a language dropdown set to 'English', and the date/time '06:00:01 am 09/22/2010'. A left sidebar contains navigation links: Start page, Identification, Diagnostic buffer, Module information (selected), Communication, Topology, Media Redundancy, and Introduction. The main content area is titled 'Module information' and shows a table of modules for 'CP1616 PC051 - MINIWEB-Ethernet: PROFINET-IO-System (100)'. The table has columns for Status, Name, Details, Order number, IP address, and Comment. Below the table, there are tabs for 'Status' and 'Identification'. The 'Identification' tab is active, showing details for the selected module: Manufacturer Siemens, Firmware version V3.0, Device class IM151-3PN, Plant designation AKZ (et200hs-153), Location identifier OKZ (et200hs-153), Installation date 11.08.2010, and Description Zusatzinformation (et200hs-153).

Status	Name	Details	Order number	IP address	Comment
✓	irt204-200	Details	6GK5 204-0BA00-2BA3	190.170.0.200	Topology
✓	et200hs-153	Details	6ES7 151-3BA60-0AB0	190.170.0.153	Topology
✓	et200s-155	Details	6ES7 151-3AA00-0AB0	190.170.0.155	Topology
✓	ipc427c	Details		190.170.0.20	Topology
✗	ie-asi-link-2m	Details	6GK1 411-2AB20	190.170.0.156	Topology
✓	et200hs-152	Details	6ES7 151-3BA60-0AB0	190.170.0.152	Topology

Status	Identification
	Manufacturer Siemens
	Firmware version V3.0
	Device class IM151-3PN
	Plant designation AKZ (et200hs-153)
	Location identifier OKZ (et200hs-153)
	Installation date 11.08.2010
	Description Zusatzinformation (et200hs-153)

Figure 4-9 Module information - Module

"Module information"

Depending on the selected level, the table shows information on the PC station, the DP master system, the PNIO master system, the nodes, the individual modules or even the submodules or components of the station.

"Display of the module levels"

Via the links, you go to the "Module information" of the higher module levels.

"Details"

With the "Details" link, you obtain further information on the selected module in the "Status" and "Identification" tabs.

"IP address"

If a link is available here, this will bring you to the Web server of the selected, configured device.

"Topology"

The "Module information" and "Topology" Web pages are linked. If you click on the selected module in "Topology", you automatically jump to this module in the graphic view of the set topology on the "Topology" Web page. The module appears in the visible area of the "Topology" Web page and the device head of the selected module flashes for several seconds.

"Filter"

You have the option of sorting the table according to certain criteria:

1. Select a parameter from the drop-down list.
2. If applicable, enter the value of the selected parameter.
3. Click on "Filter".

The filter conditions remain active even after updating a page.

To disable the filter settings, click "Filter" again.

"Status" tab

This tab contains information on the status of the selected module if there is a fault or a message pending.

"Identification" Tab

This tab contains data to identify the selected module.

Note

In this tab, only data that was configured offline is displayed, but no online data of modules.

Example: Module information - Submodule

The screenshot shows the Siemens CP1616 PC051/CP 1616 web interface. The title bar includes the Siemens logo, the device name, a language dropdown set to 'English', and the timestamp '06:02:30 am 09/22/2010'. The main content area is titled 'Module information' and displays a table of submodule data for 'CP1616 PC051 - MINIWEB-Ethernet: PROFINET-IQ-System (100) - et200hs-153'. The table has columns for Slot, Status, Name, Order number, I address, Q address, and Comment. The left sidebar contains navigation links: Start page, Identification, Diagnostic buffer, Module information (selected), Communication, Topology, Media Redundancy, and Introduction. At the bottom, there are tabs for 'Status' and 'Identification'.

Slot	Status	Name	Order number	I address	Q address	Comment
0	✓	et200hs-153	6ES7 151-3BA60-0AB0	16368		
1	✓	PM-E DC24V	6ES7 138-4CA01-0AA0	16366		Kommentar zu PM-E DC24V
2	✓	4DI DC24V HF	6ES7 131-4BD01-0AB0	0.0		Kommentar zu 4DI DC24V HF
3	✓	4DO DC24V/0,5A ST	6ES7 132-4BD02-0AA0		0.0	Kommentar zu 4DO DC24V/0,5A ST

Figure 4-10 Module information - Submodule

Example: Module information - Component

The screenshot shows the Siemens CP1616 PC051/CP 1616 web interface. The title bar includes the Siemens logo, the device name, a language dropdown set to 'English', and the timestamp '06:04:36 am 09/22/2010'. The main content area is titled 'Module information' and displays a table of component data for 'CP1616 PC051 - MINIWEB-Ethernet: PROFINET-IQ-System (100) - et200hs-153'. The table has columns for Slot, Status, Name, Order number, I address, Q address, and Comment. The left sidebar contains navigation links: Start page, Identification, Diagnostic buffer, Module information (selected), Communication, Topology, Media Redundancy, and Introduction. At the bottom, there are tabs for 'Status' and 'Identification'.

Slot	Status	Name	Order number	I address	Q address	Comment
X1	✓	PN-IQ	6ES7 151-3BA60-0AB0	16367		Kommentar zu X1
X1 P1 R	✓	Port 1	6ES7 151-3BA60-0AB0	16370		Kommentar zu Port 1
X1 P2 R	✗	Port 2	6ES7 151-3BA60-0AB0	16369		Kommentar zu Port 2

Figure 4-11 Module information - Component

Reference

You will find more detailed information on "Module information" and on the topic of "Report system error" in the *online help of STEP 7*.

4.2.6.6 Communication

Overview

On the "Communication" Web page, you will find detailed information about the following tabs:

- Parameter
- Statistics

"Parameter" tab

Summarized information about the integrated PROFINET interface of the CP 1616 can be found in the "Parameter" tab.

The screenshot displays the Siemens CP1616 PC051/CP 1616 web interface. The top header shows the Siemens logo, the device name 'CP1616 PC051/CP 1616', a language dropdown set to 'English', and a timestamp '06:06:02 am 09/22/2010'. The main navigation bar includes 'Communication' and 'Statistics' tabs, with 'Communication' selected. A left sidebar lists various system pages: Start page, Identification, Diagnostic buffer, Module information, Communication (highlighted), Topology, Media Redundancy, and Introduction. The main content area is divided into three sections: 'Network connection' showing MAC address (00-0E-8C-96-D1-64) and Device name (pc051); 'IP parameter' showing IP address (190.170.0.51), Subnet mask (255.255.0.0), and Default router (---); and 'Physical properties' which includes a table of port details.

Port number	Link status	Settings	Mode
1	OK	automatic	100 MBit/s full-duplex
2	OK	automatic	100 MBit/s full-duplex
3	disconnected	automatic	10 MBit/s half-duplex
4	OK	automatic	100 MBit/s full-duplex

Figure 4-12 Parameters of the integrated PROFINET interface

"Network attachment"

Here, you will find information identifying the integrated PROFINET interface of the relevant CP 1616.

"IP parameters"

Information on the configured IP address and number of the subnet in which the relevant CP 1616 is located.

"Physical properties"

The "Physical properties" info box contains the following information:

- Port number
- Link status
- Settings
- Mode

"Statistics" tab

You will find information on the quality of the data transfer in the "Statistics" tab.



Figure 4-13 Characteristic data of data transfer

"Data packages since"

Here you can see the time since the last power up / memory reset at which the first data packet was sent or received.

"Total statistics - sent data packages"

You can evaluate the quality of the data transfer on the send line based on the statistics in this info box.

"Total statistics - Received data packages"

You can evaluate the quality of the data transfer on the receive line based on the statistics in this info box.

"Statistics Port x - Sent data packages"

You can evaluate the quality of the data transfer on the send line based on the statistics in this info box.

"Statistics Port x - Received data packages"

You can evaluate the quality of the data transfer on the receive line based on the statistics in this info box.

4.2.6.7 Topology

Topology

Topology of the PROFINET nodes

On the "Topology" Web page, you obtain information about the topological structure and the status of the PROFINET devices of your PROFINET IO system.

There are three tabs for the following views:

- Graphic view (set and actual topology)
- Table view (only actual topology)
- Status overview (with no display of the topological relationships)

The table view and the status overview can be printed out. Prior to printing out, use the print preview of your browser and, if necessary, correct the format.

Set topology

Display of the topological structure of the configured PROFINET devices of a PROFINET IO system as configured in the Topology editor of STEP 7 with corresponding status display. Neighboring PROFINET devices are also displayed if their topological structure was also configured. Here, however, there is no status display.

The topological assignment of failed PROFINET devices and of the set-actual differences and swapped-over ports can be recognized in this view.

Note

In the following scenarios, the configured set topology is always displayed:

- When you call the "Topology" Web page using the navigation bar
- When you change from the "Module information" Web page from the overview of the PROFINET IO devices to the "Topology" Web page using the "Topology" link.

If there is no set topology configured, the actual topology is called up as default.

Actual topology

Displays the current topological structure of the "configured" PROFINET devices of a PROFINET IO system and the detectable directly neighboring unconfigured PROFINET devices (display of the neighbor relations as far as these can be detected; with these neighboring PROFINET devices, there is, however, no status display).

Topology - Graphic view

Requirement

For problem-free use of the topology, the following requirements must be met:

- You have made the language setting,
- The topological interconnection of the ports has been configured in the Topology editor of STEP 7 (this is a requirement to allow the display of the set topology and the corresponding set topological connections).
- The project has been compiled in HW Config.
- "Report system error" has been generated.
- The project is loaded.

Set topology and actual topology - Graphic view

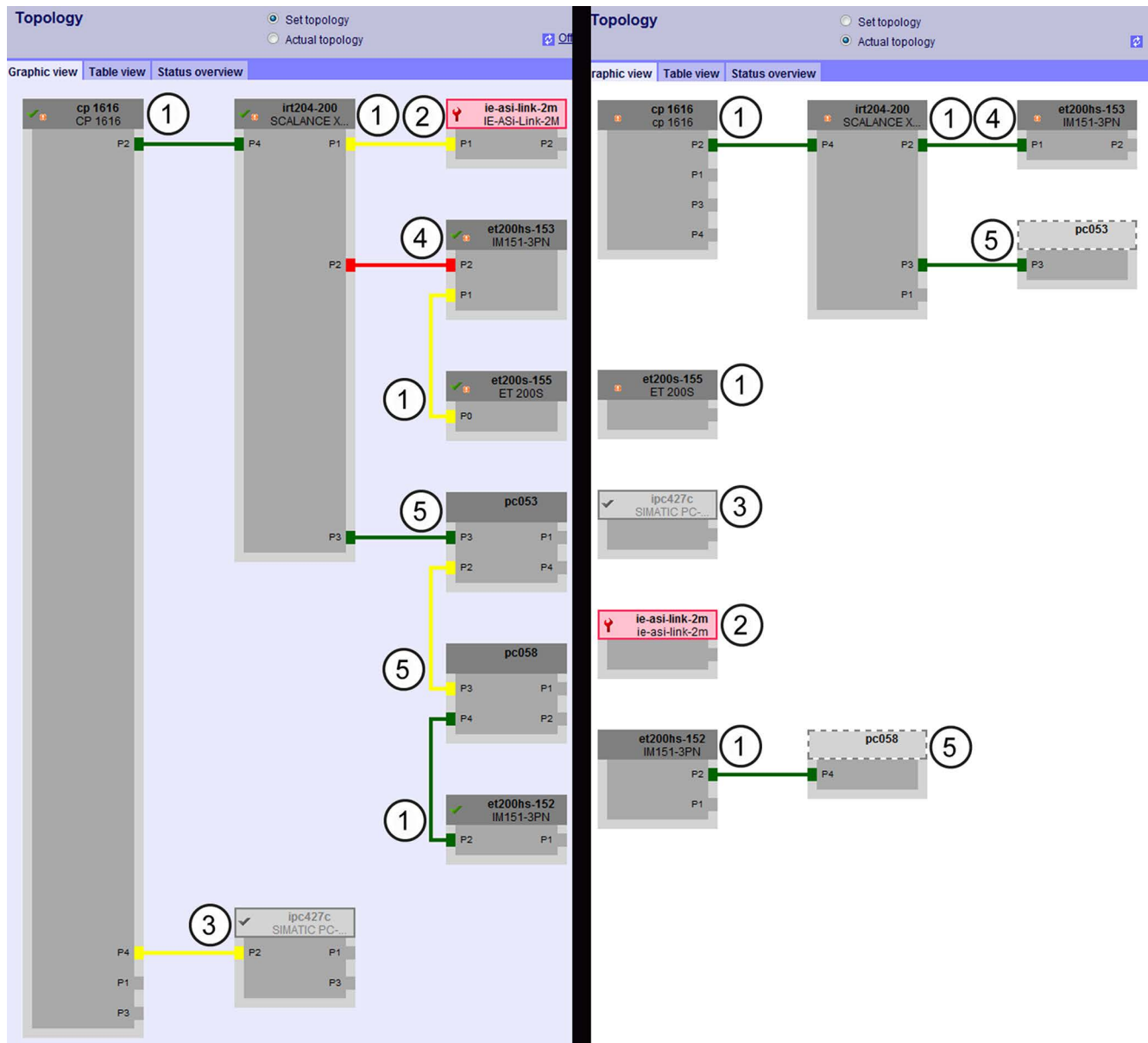


Figure 4-14 Graphic view - Set topology and actual topology

Meaning of the colored connections in the set/actual topology:

Connection	Meaning	
	Set topology	Actual topology
green	The current actual connection corresponds to the configured set connection.	Detected connections
red	The current actual connection does not correspond to the configured set connection (for example port swapped over).	-
yellow	The connection cannot be diagnosed. Causes: • Communication with a device is disrupted (for example cable unplugged), • The connection is a connection to a passive component, • The connection is a connection to devices/PROFINET devices of a different IO controller or IO subsystem.	-

① Configured and reachable PROFINET nodes

Configured and reachable PROFINET nodes are displayed in dark gray. The connections show the ports via which the PROFINET nodes of a station are connected.

② Configured but unreachable PROFINET nodes

The configured but unreachable PROFINET nodes are displayed pink with a red border (for example device failed, cable unplugged)

③ Deactivated nodes

All deactivated, configured PROFINET nodes are displayed light gray.

④ Swapped over ports

Swapped over ports are marked red in the set topology view. The actually connected ports are displayed in the actual topology and the configured set connection is shown in the set topology.

⑤ PROFINET devices of another PROFINET IO subsystem

- In the set topology:

A PROFINET device of another PROFINET IO subsystem is displayed with a green connection (or red connection if the ports are swapped over) if it is immediately adjacent to a configured, reachable PROFINET device ① and it is itself also reachable.

If the PROFINET device of another PROFINET IO subsystem is unreachable, a yellow connecting line is displayed.

The connection between two PROFINET devices that both belong to another PROFINET IO subsystem cannot be detected and is always displayed yellow.

- In the actual topology:

A PROFINET device of another PROFINET IO subsystem is only displayed when it is the immediate neighbor of a configured PROFINET device. This is displayed light gray with a dashed line.

For PROFINET devices of another PROFINET IO subsystem, there is **no** status display in the device head.

Views when the structure changes

- If a device fails, this device remains in the "Set topology" view at the same position but has a red border around the device head and a red wrench.
- If the device fails, the device is displayed separately in the lower part of the "Actual topology" and it has a red border around the device head and a red wrench.

Link between the "Topology" and the "Module information" Web pages

The "Topology" and "Module information" Web pages are linked. If you click on the head of a configured module in the topology view, you automatically jump to this module on the "Module information" Web page.

See also section Module information (Page 54).

Topology - Table view

The "table view" always shows the "actual topology".

SIEMENS CP1616 PC051/CP 1616					
English					
06:34:14 am 09/22/2010					
Topology					
Graphic view Table view Status overview					
Port	Status	Name	Module type	Port	Partner port
		cp 1616	cp 1616		
port-001					
port-002					
port-003					
port-004					
		irt204-200	SCALANCE X-200		
port-001					
port-002					
port-003					
port-004					
		et200hs-153	IM151-3PN		
port-001					
port-002					
port-003					
port-004					
		et200s-155	ET 200S		
port-001					
port-002					
		ipc427c	SIMATIC PC-CP		
		ie-asi-link-2m	ie-asi-link-2m		
		et200hs-152	IM151-3PN		
port-001					
port-002					
port-003					
port-004					
		pc053			
port-001					
port-002					
port-003					
port-004					
		pc058			
port-001					
port-002					
port-003					
port-004					

Figure 4-15 Topology - Table view

Meaning of the icons indicating the status of the PROFINET nodes

Icon	Meaning
	Configured and reachable PROFINET nodes
	Unconfigured and reachable PROFINET nodes
	Configured but unreachable PROFINET nodes
	Nodes for which no neighborhood relation could be detected or the neighborhood relation could not be read completely or only incorrectly

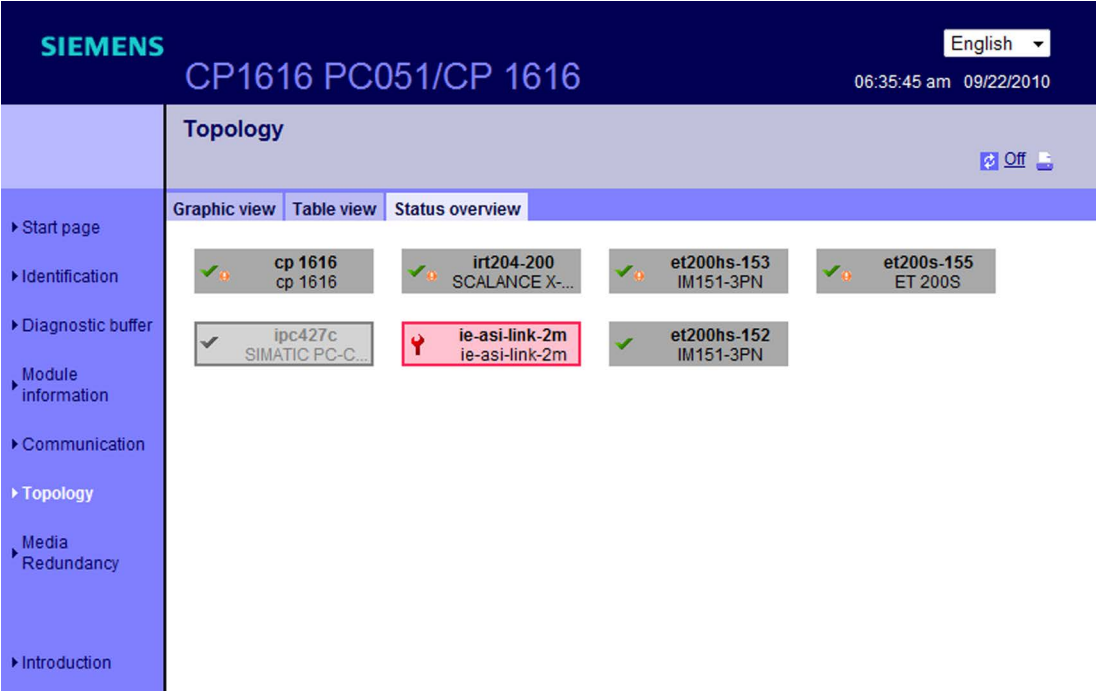
Meaning of the icons indicating the module status of the PROFINET nodes

Icon	Color	Meaning
	green	Component OK
	gray	Deactivated PROFIBUS slaves or PROFINET devices
	black	Component cannot be reached / status not available "Status not available" is displayed, for example whenever the CP 1616 is in STOP. - This status can, however, also be displayed temporarily for all modules during operation if there is a flood of diagnostic interrupts. - No status can be obtained for modules of a subsystem connected to a CP.
	green	Maintenance required
	yellow	Maintenance demanded
	red	Fault - component failed or faulty
	-	Fault at a lower module level

Topology - Status overview

The "Status overview" shows an overview of all PROFINET IO devices/PROFINET devices (without connection relations) on one page. Fast error/fault diagnostics as possible based on the icons indicating the module statuses.

Once again, there is a link between the modules and the "Module information (Page 54)" Web page.



SIEMENS CP1616 PC051/CP 1616 English 06:35:45 am 09/22/2010

Topology Off

Graphic view Table view **Status overview**

 cp 1616 cp 1616	 irt204-200 SCALANCE X-...	 et200hs-153 IM151-3PN	 et200s-155 ET 200S
 ipc427c SIMATIC PC-C...	 ie-asi-link-2m ie-asi-link-2m	 et200hs-152 IM151-3PN	

Navigation menu:

- Start page
- Identification
- Diagnostic buffer
- Module information
- Communication
- Topology**
- Media Redundancy
- Introduction

Figure 4-16 Topology - Status overview

4.2.6.8 Media redundancy

Description

The "Media redundancy" Web page contains information on the status of the redundancy. In addition to this, you can also configure media redundancy in a ring topology for a module that has had a memory reset.

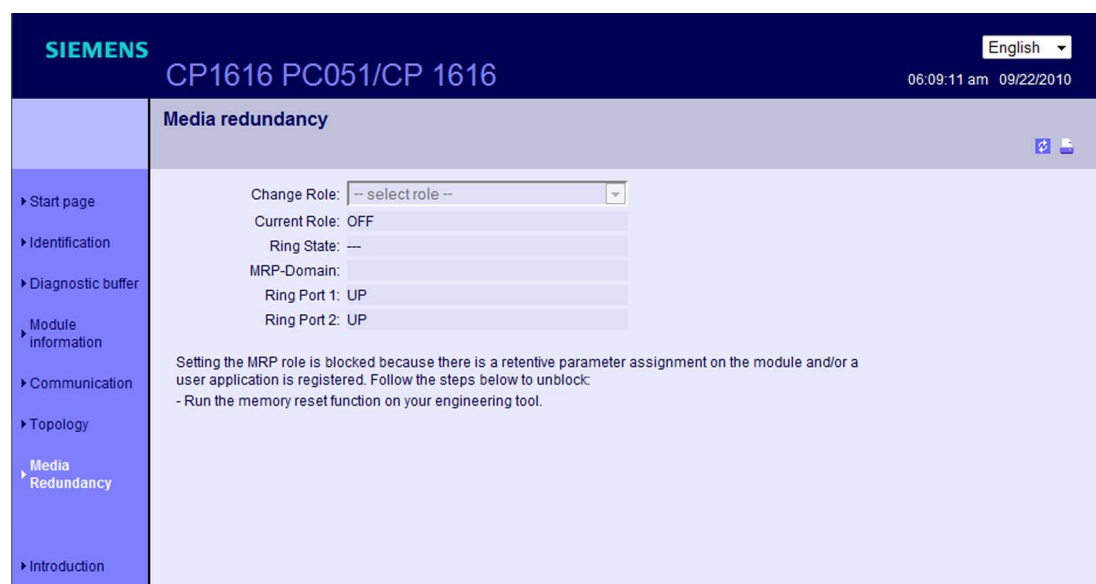


Figure 4-17 "Media redundancy" Web page

"Change role" drop-down list

Value	Meaning
OFF	Media redundancy is deactivated in the ring topology. This setting is selected when there is no ring topology.
MANAGER(AUTO)/CLIENT	Select this setting if you use media redundancy in a ring topology and the CP or other Siemens device is the redundancy manager. The redundancy manager is then specified automatically by the MRP protocol.
CLIENT	Select this setting if you use media redundancy in a ring topology and the redundancy manager is not a Siemens device.

"Current Role" display

Value	Meaning
OFF	Media redundancy is deactivated in the ring topology.
MANAGER	The device is redundancy manager.
CLIENT	The device is redundancy client.

"Ring State" display

Value	Meaning
---	The device is not redundancy manager. This means that the ring status cannot be displayed.
OPEN	The ring is open, there is a problem.
CLOSED	The ring is closed, there is no problem.

"MRP Domain" display

Name of the redundancy domain; this is set in STEP 7/NCM PC.

"Ring Port 1"/"Ring Port 2" display

The meaning of ring port 2 is analogous to that of ring port 1.

Value	Meaning
Port 1 - BLOCKED	The port does not allow any user data to pass through, only MRP frames.
Port 1 - DISABLED	The port was disabled.
Port 1 - UP	The port allows all frames through.
Port 1 - DOWN	The port does not have a link.

Note

Configuring in the STEP 7 project

As an alternative, you can also make this setting in STEP 7.

4.3 IO routing

This section answers the following questions:

- What is IO routing?
- When is IO routing used?
- What types of IO routing exist?
- How does the IO router work?

Configuring an IO router is described in the configuration manual "Commissioning PC Stations". This can be found on the "SIMATIC NET CP 1604/CP 1616 DVD" supplied with the CP 1616/CP 1604 product.

4.3.1 What is IO routing and when is it used?

Definition

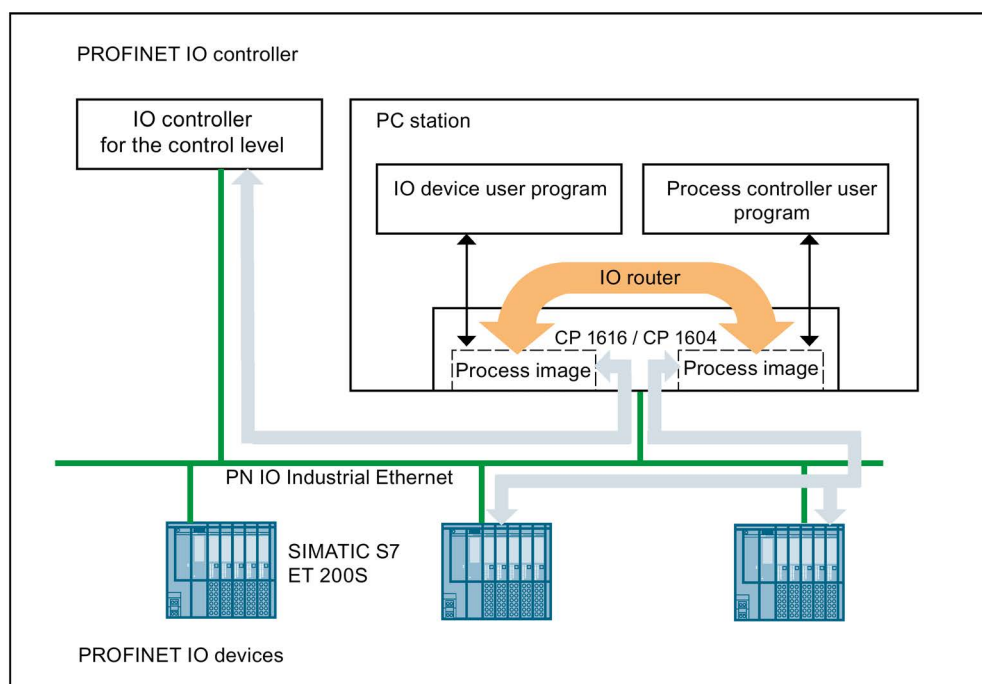
Using IO routing, process data is exchanged between two PROFINET IO systems.

Example

A process controller user program controls a robot.

IO routing makes input/output data of the robot controller accessible to an IO controller for the control level that can both read and write the data.

IO routing is a function that is configured for the IO Base interface.



When does it make sense to use IO routing?

The advantages of IO routing are in situations when a complex plant or machine is planned with networked PROFINET IO systems.

Note

IO routing functionality is available only with PROFINET IO RT communication.

4.3.2 What types of IO routing exist?

Overview

From the perspective of the IO controller for the control level, there are three IO routing tasks:

- Read process inputs
- Read process outputs
- Write process outputs

Read process inputs

The IO controller for the control level should read inputs of the process level. Because the IO controller of the control level cannot access the process level directly, IO routing transports process data from the inputs of the process level to the inputs of the control level. Any bit areas from input modules of the process level can be routed to any bit offsets of the control level. Target areas must not overlap. The size of the areas can be selected, from one bit up to the size of the module.

Read process outputs

The IO controller for the control level should read outputs of IO devices of the process level. Because the IO controller of the control level cannot access the process level directly, IO routing transports process data from the outputs of the process level to the inputs of the control level. Any bit areas from output modules of the process level can be routed to any bit offsets of the control level. Target areas must not overlap. The size of the areas can be selected, from one bit up to the size of the module.

Write process outputs

The IO controller for the control level should write outputs of IO devices of the process level. Because the IO controller of the control level cannot access the process level directly, IO routing transports process data from the outputs of the control level to the outputs of the process level. Any bit areas from output modules of the control level can be routed to any bit offsets of the process level. Target areas must not overlap. The size of the areas can be selected, from one bit up to the size of the module.

4.3.3 How does the IO router work?

Requirements

A CP 1616 or CP 1604 communications processor is required in a PC station. Only these CPs can be both IO controller and IO device at the same time.

Configuration

The CP is first configured as an IO controller. Its process controller user program controls the IO devices assigned to it on the Ethernet bus.

The same CP is also configured as an IO device of an IO controller for the control level. This IO device is assigned transfer areas of the type "TM" in the configuration, so-called **IO routing areas** that represent the routed data.

Each IO routing area receives at least one IO route during configuration (TIA Portal: "Transfer Module Mapping rule"). An IO route defines the source and destination of an IO data area to be routed.

IO routing areas are either inputs or outputs of the IO controller for the control level:

- Transfer relationships via which IO routing makes process inputs and process outputs available to the controller end in inputs.
- Transfer relationships via which IO routing transports IO data to process outputs start from outputs.

Note

The program for this IO device on the PC station can be any IO device user program. It must simply run through the full initialization phase according to the IO Base user program.

Note

Sample C programs for an IO device user program ("dev_rw_digital_io") are available on the SIMATIC NET software product CD.

Data exchange

The data exchange between the input and output data of the IO controller for the process level and input and output data of the IO controller for the control level is established automatically by the IO router.

Note on the IO Base user programming interface

To support IO router functions, there are also two diagnostics services available (PNIO_CTRL_DIAG_CONFIG_IOROUTER_PRESENT, PNIO_CTRL_DIAG_CONFIG_OUTPUT_SLICE_LIST). Using these services, all output areas that can be written by the process controller user program can be identified.

These functions are only available for the process controller.

Note on the I-device user programming interface

The function "PNIOD_get_non_routing_bits()" is also available to support the IO router functions. With this function, the IO device user program queries the configured gaps between the IO routes bit by bit. By reading/writing the gaps, the IO device user program exchanges IO data with the IO controller for the control level.

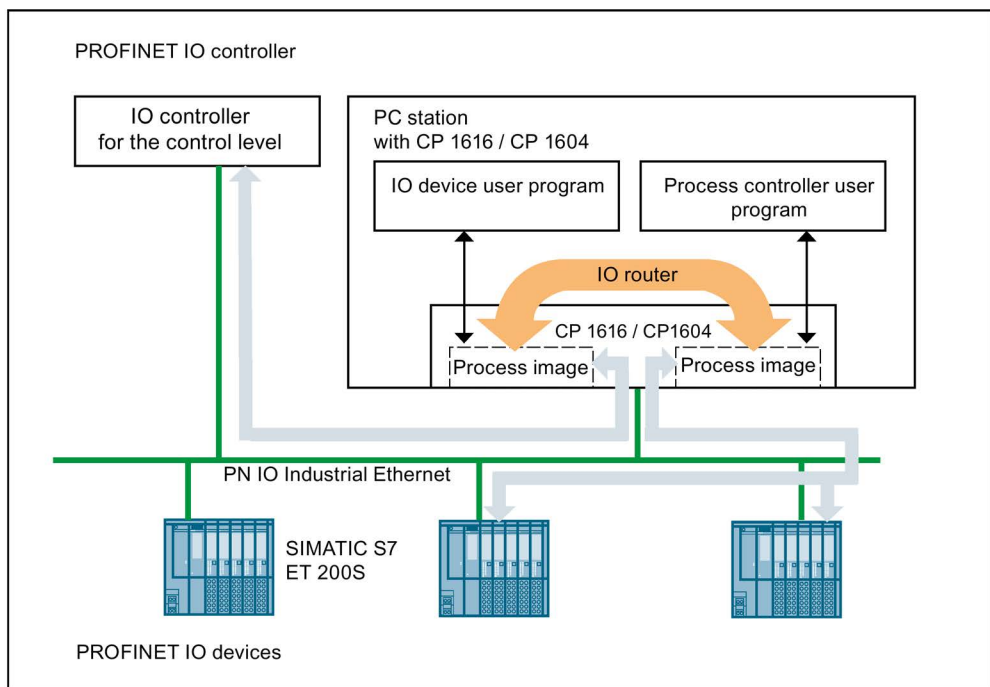
4.3.4 Examples of reading and writing

Introduction

A PC station contains an IO controller user program, referred to as the IO controller for the process level hereafter, which controls its IO devices via an inserted CP 1616/CP 1604.

Outside the PC station, there is an external IO controller, referred to as the IO controller for the control level hereafter, which can write and read input/output bits of the IO controller for the process level via the IO router.

Process data is exchanged using the IO router functions.



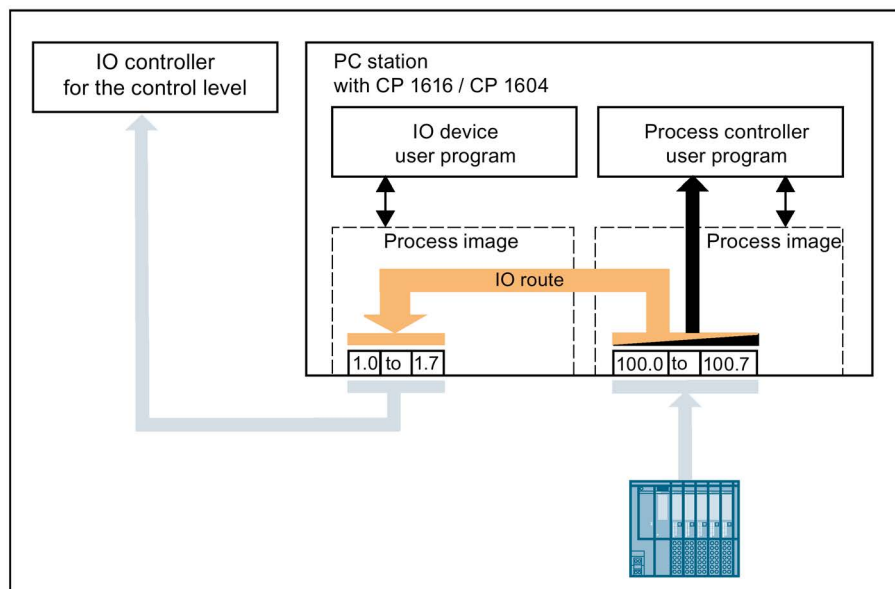
4.3.5 Example 1: Reading input data

Description

The input submodule with addresses 100.0 to 100.7 and a length of 1 byte is read by the process controller user program.

The table and the figure show that all bits of input 100 of the process level can be read via input 1 of the control level by the IO controller for the control level.

I/O bits of the IO controller for the control level	IO route (from the perspective of the IO controller for the control level)	I/O bits of the IO controller for the process level
1.0	read	100.0
to		to
1.7	read	100.7



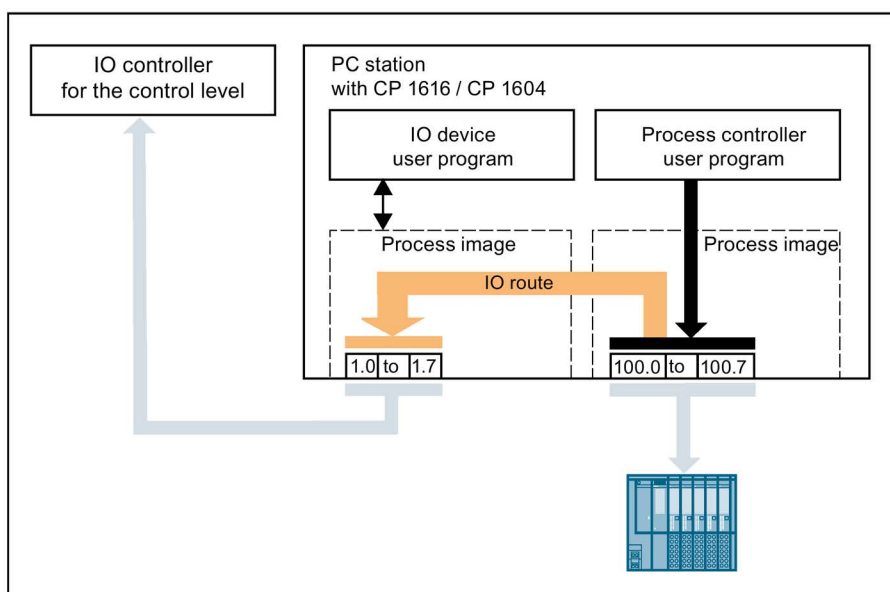
4.3.6 Example 2: Reading output data

Description

The output module with addresses 100.0 to 100.7 and a length of 1 byte is written by the process controller user program. The IO controller for the control level reads the data.

The table and figure show which bits are read by the IO controller for the control level via input 1.

I/O bits of the IO controller for the control level	IO route (from the perspective of the IO controller for the control level)	I/O bits of the IO controller for the process level
1.0	read	100.0
to		to
1.7	read	100.7



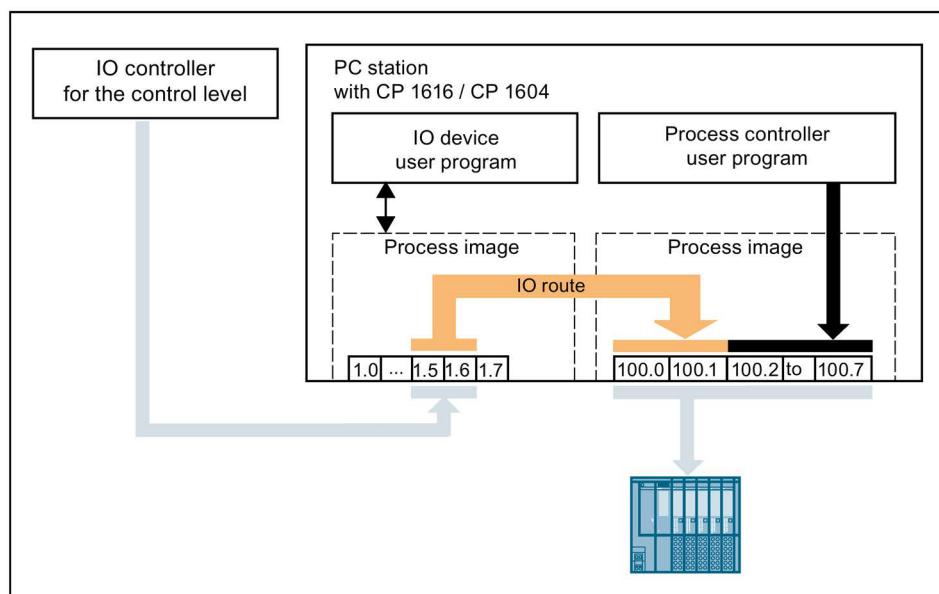
4.3.7 Example 3: Writing output data by the main controller and robot controller

Description

Both the IO controller for the process level and the IO controller for the control level will write input and output bits in output module 100. An IO route is therefore configured for address 1 in the IO routing area.

The table and schematic show which bits are written by the IO controller for the control level and which by the IO controller for the process level.

I/O bits of the IO controller for the control level	IO route (from the perspective of the IO controller for the control level)	I/O bits of the IO controller for the process level	Due to IO router configuration, assigned to ...
1.5	Write	100.0	IO controller for the control level
1.6	Write	100.1	
-	-	100.2	IO controller for the process level
		to	
-	-	100.7	



Note

The process controller user program always writes byte-oriented on the IO Base user programming interface.

Bits 100.0 and 100.1 are, however, replaced by the bits of the IO controller for the control level by the IO router.

4.3.8 Summary of the properties of IO routing

Read

Both IO controllers can read input modules of the process device at the same time.

Write

An output bit can only be written by one of the two IO controllers.

Two IO controllers can nevertheless write different bits of the same output byte.

Write/read access by the IO controller for the process level to the input/output data of the process image is module- and byte-oriented over the IO Base interface.

Note

The IO controller for the process level may not write to output modules in the process image that are configured fully for write access by the IO controller for the control level.

Write/read access by the IO device for the process level to the input/output data of the process image takes place module- and byte-oriented over the I-device interface.

Note

The IO device for the control level cannot write IO data for input modules of the IO controller for the control level which are configured completely for read access by IO devices for the process level.

Data status

Note the following about the data status if two IO controllers write to the same module:

Note

The local data status of a module written by both IO controllers is only GOOD if the local status of both write jobs is GOOD.

Observe the following note with respect to the data status of an IO routing area configured for read access to IO devices of the process level:

Note

The local data status of an IO routing area configured for read access to IO devices of the process level is only "GOOD" when the local status (provider status) of all read access operations is "GOOD".

Observe the following note with respect to the data status of an IO routing area configured for read access to IO data of the IO device user program and simultaneously for read access to IO devices of the process level:

Note

The local data status of an IO routing area configured for read access to IO data of the IO device user program and simultaneously for read access to IO devices is only "GOOD" when the local status (provider status) of all read access operations is "GOOD".

4.3.9 Configuring IO routing

Description

You configure the IO router in the STEP 7/NCM PC program.

In principle, the IO router is configured as follows.

Step	Description
1	Configure the CP 1616 as IO device for the IO controller of the control level and as IO controller for the process level.
2	Configure the IO router: • Example 1 covers the reading of inputs of the process level. • Example 2 covers bit-by-bit writing of outputs of the process level. • Example 3 covers bit-by-bit writing of outputs of the process level by the IO controller of the control and process level. • Example 4 covers bit-by-bit reading of inputs and IO data of the IO device user program by the IO controller of the control level.

Note

For a more detailed description of the configuration of IO routing, refer to the configuration manual "Commissioning PC Stations".

4.4 Media redundancy

Overview

This section answers the following questions:

- Which topologies are possible?
- What is media redundancy and how does it work in a ring topology?
- How do I configure media redundancy in a ring topology?
- How does "MRP" work and how is it engineered and configured?

4.4.1 General description

4.4.1.1 Options of media redundancy

Options of media redundancy

There are various options available to increase the network availability of an Industrial Ethernet network with optical or electrical linear bus topologies:

- Mesh networks
- Parallel connection of transmission paths
- Closing a linear bus topology to form a ring topology

4.4.1.2 Media redundancy in ring topologies

Structure of a ring topology

Nodes in a ring topology can be external switches and/or the integrated switches of communications modules.

To set up a ring topology with media redundancy, you bring together the two free ends of a linear bus topology in one device. Closing the linear bus topology to form a ring is achieved with two ports (ring ports) of a device in the ring. This device is the redundancy manager. All other devices in the ring are redundancy clients.

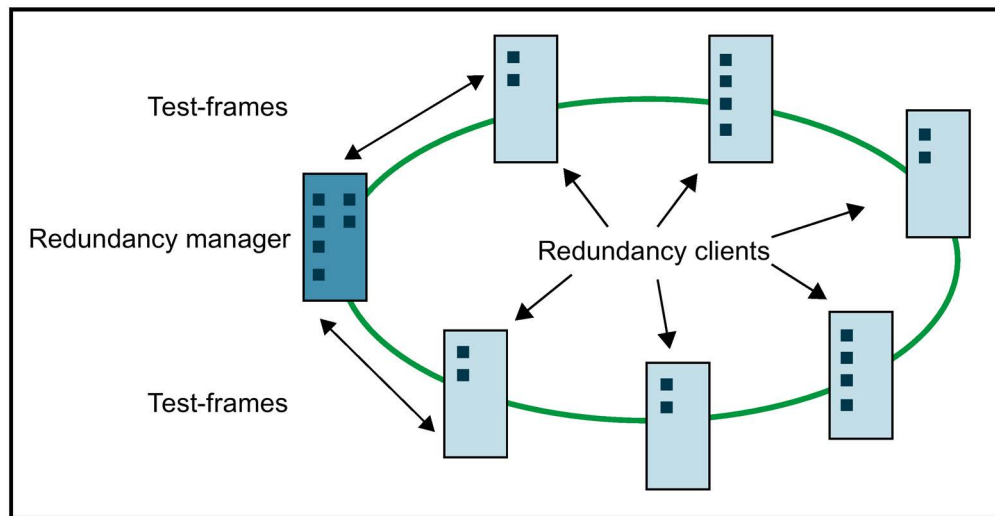


Figure 4-18 Devices in a ring topology with media redundancy

The two ring ports of a device are the ports that establish the connection to its two neighboring devices in the ring topology. The ring ports are selected and set in the configuration of the relevant device. On the S7 Ethernet CP modules, the ring ports are indicated by an "R" after the port number.

Note

Before physically closing the ring, download the configuration of your STEP 7 project to the individual devices.

How media redundancy works in a ring topology

When using media redundancy, the data paths between the individual devices are reconfigured if the ring is interrupted at one point. Following reconfiguration of the topology, the devices can once again be reached in the resulting new topology.

In the redundancy manager, the 2 ring ports are disconnected from each other if the network is uninterrupted. This prevents circulating data frames. In terms of data transmission, the ring topology is a linear bus topology. The redundancy manager monitors the ring topology. It does this by sending test frames both from ring port 1 and ring port 2. The test frames run round the ring in both directions until they arrive at the other ring port of the redundancy manager.

An interruption of the ring can be caused by loss of the connection between two devices or by failure of a device in the ring.

If the test frames of the redundancy manager no longer arrive at the other ring port, the redundancy manager connects its two ring ports. This substitute path once again restores a functioning connection between all remaining devices in the form of a linear bus topology.

The time between the ring interruption and restoration of a functional linear topology is known as the reconfiguration time.

If the redundancy manager fails, the ring becomes a functional linear bus.

Media redundancy methods

The following media redundancy methods are supported by SIMATIC NET products:

- HSR (High Speed Redundancy)
Reconfiguration time: 0.3 seconds
- MRP (Media Redundancy Protocol)
Reconfiguration time: 0.2 seconds

The mechanisms of these methods are similar. With both methods, up to 50 devices can participate in the ring. HSR and MRP cannot be used in the ring at the same time.

If you want to introduce media redundancy in a ring topology in your STEP 7 project, select the "MRP" function.

4.4.2 MRP

The "MRP" method conforms to the Media Redundancy Protocol (MRP) specified in the standard IEC 62439-2 Edition 2.0.

The reconfiguration time after an interruption of the ring is a maximum of 0.2 seconds.

Requirements

Requirements for problem-free operation with the MRP media redundancy protocol are as follows:

- MRP is supported in ring topologies with up to 50 devices. Exceeding this number of devices can lead to a loss of data traffic.
- The ring in which you want to use MRP may only consist of devices that support this function. This applies, for example, to the following devices:
 - Industrial Ethernet switches
SCALANCE X 200 as of firmware version V4.0,
SCALANCE X 200 IRT as of firmware version V4.0
 - Communications processors
CP 443-1 Advanced (6GK7 443 1GX20 0XE0) as of firmware version V2.0,
CP 343-1 Advanced (6GK7 343 1GX30 0XE0) as of firmware version V1.0,
 - Non-Siemens devices that support this functionality.

Further Siemens devices are planned that will support MRP.

- All devices must be interconnected via their ring ports.
- "MRP" must be activated on all devices in the ring (see "MRP configuration in PROFINET IO").
- Set all the ports involved in the ring to "Automatic settings" in the "Options" tab of the properties dialog during STEP 7 configuration.

Topology

The following schematic shows a possible topology for devices in a ring with MRP.

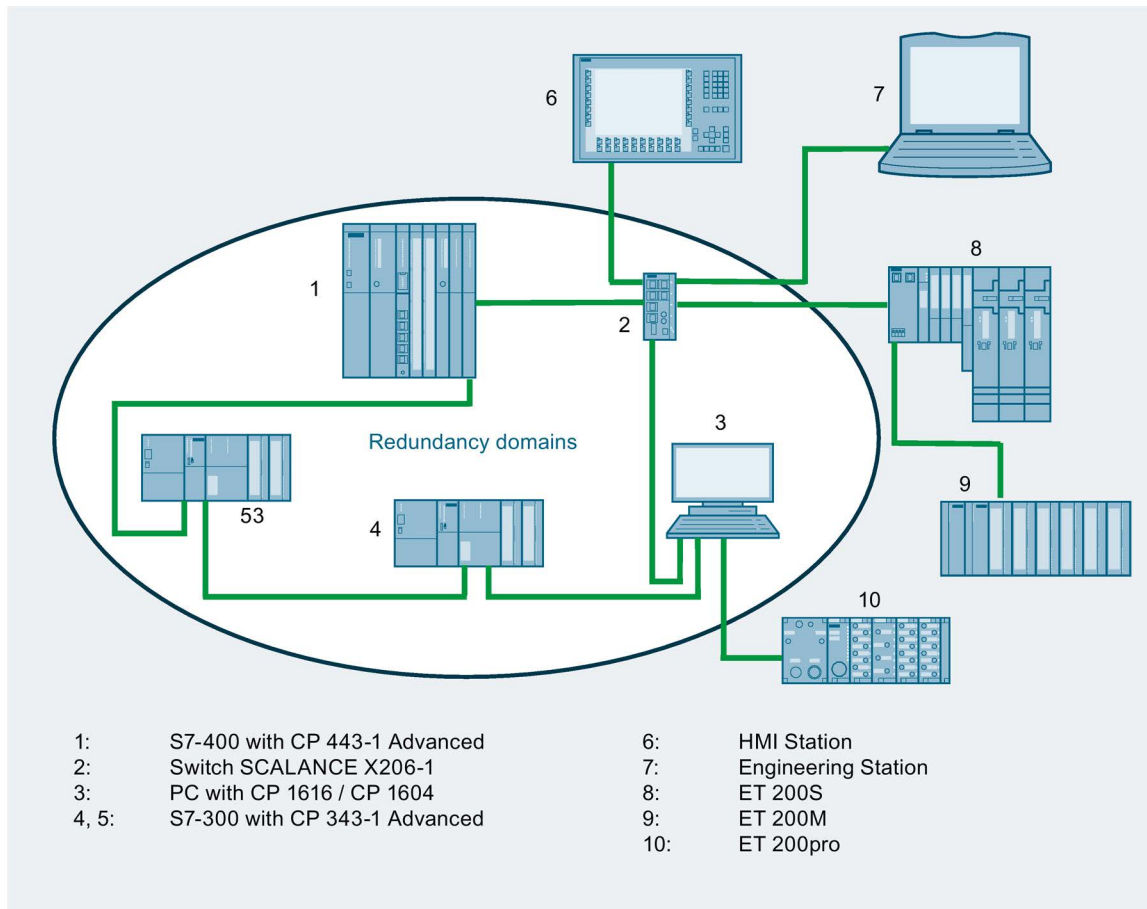


Figure 4-19 Example of a ring topology with the MRP media redundancy protocol

The following rules apply to a ring topology with media redundancy using MRP:

- All the devices connected within the ring topology are members of the same redundancy domain.
- One device in the ring is acting as redundancy manager.
- All other devices in the ring are redundancy clients.

Non MRP-compliant devices can be connected to the ring via a SCALANCE X switch or via a PC with a CP 1616.

Prioritized startup

If you configure MRP in a ring, you must not use the "prioritized startup" function in PROFINET applications on the devices involved.

If you want to use the "prioritized startup" function, then disable MRP in the configuration.

In the STEP 7 configuration, in the properties dialog of the PROFINET interface > "Media redundancy" tab > "MRP configuration" box, set the role to "Not node in the ring" in the "mrp-domain1" domain.

4.4.3 MRP configuration

Configuration in STEP 7

To create the configuration in STEP 7, select the parameter group "Media redundancy" on the PROFINET interface.

Set the following parameters for the MRP configuration of the device:

- Domain
- Role
- Ring port
- Diagnostic interrupts

These settings are described below.

Note

Valid MRP configuration

In the MRP configuration in STEP 7, make sure that all devices in the ring have a valid MRP configuration before you close the ring. Otherwise, there may be circulating frames that will cause a failure in the network.

One device in the ring needs to be configured as "redundancy manager" and all other devices in the ring as "clients".

Note

Note factory settings

MRP is disabled and spanning tree enabled for the following brand new IE switches and those set to the factory settings:

- SCALANCE XB-200 (Ethernet/IP variants)
- SCALANCE XP-200 (Ethernet/IP variants)
- SCALANCE XM-400
- SCALANCE XR-500

To load a PROFINET configuration into one of the specified devices, first disable spanning tree on the device.

Note

Changing the role

If you want to change the MRP role, first open the ring.

Note

Starting up and restarting

The MRP settings are still effective after a restart of the device or a power failure and hot restart.

Note

Prioritized startup

If you configure MRP in a ring, you cannot use the "prioritized startup" function in PROFINET applications on the devices involved.

If you want to use the "prioritized startup" function, then disable MRP in the configuration.

In the STEP 7 configuration, set the role of the relevant device to "Not a node in the ring".

Domain

Single MRP rings

If you want to configure a single MRP ring, leave the factory setting "mrpdomain 1" in the "Domain" drop-down list.

All devices configured in a ring with MRP must belong to the same redundancy domain. A device cannot belong to more than one redundancy domain.

If you leave the setting for "Domain" as the factory set "mrpdomain-1", the defaults for "Role" and "Ring ports" also remain active.

MRP multiple rings

If you configure multiple MRP rings, the nodes of the ring will be assigned to the individual rings with the "Domain" parameter.

Set the same domain for all devices within a ring. Set different domains for different rings. Devices that do not belong to the same ring must have different domains.

Role

The choice of role depends on the following use cases.

- You want to use MRP in a topology with **one ring** only with Siemens devices and without monitoring diagnostic interrupts:

Assign all devices to the "mrpdomain-1" domain and the role "Manager (Auto)".

The device that actually takes over the role of redundancy manager, is negotiated by Siemens devices automatically.

- You want to use MRP in a topology with **multiple rings** only with Siemens devices and without monitoring diagnostic interrupts (MRP multiple rings):
 - Assign the device that connects the rings the role of "Manager".
 - For all other devices in the ring topology, select the role of "Client".
- You want to use MRP in a ring topology that also includes non-Siemens devices or you want to receive diagnostic interrupts relating to the MRP status from a device (see "Diagnostic interrupts"):
 - Assign precisely one device in the ring the role of "Manager (Auto)".
 - For all other devices in the ring topology, select the role of "Client".
- You want to disable MRP:

Select the option "Not node in the ring" if you do not want to operate the device within a ring topology with MRP.

Note

Role after resetting to factory settings

With brand new Siemens devices and those reset to the factory settings the following MRP role is set:

- "Manager (Auto)"
CPs
- "Automatic Redundancy Detection"
 - SCALANCE X-200
 - SCALANCE XC-200
 - SCALANCE XB-200 (PROFINET variants)
 - SCALANCE XP-200 (PROFINET variants)
 - SCALANCE X-300
 - SCALANCE X-400

If you are operating a non-Siemens device as the redundancy manager in the ring, this may cause loss of the data traffic.

MRP is disabled and spanning tree enabled for the following brand new IE switches and those set to the factory settings:

- SCALANCE XB-200 (Ethernet/IP variants)
 - SCALANCE XP-200 (Ethernet/IP variants)
 - SCALANCE XM-400
 - SCALANCE XR-500
-

Ring port 1 / ring port 2

Here, select the port you want to configure as ring port 1 and ring port 2.

With devices with more than 8 ports, not all ports can be selected as ring port.

The drop-down list shows the selection of possible ports for each device type. If the ports are specified in the factory, the boxes are grayed out.

NOTICE
Ring ports after resetting to factory settings
If you reset to the factory settings, the ring port settings are also reset.
If other ports were used previously as ring ports before resetting, with the appropriate attachment, a previously correctly configured device can cause circulating frames and therefore the failure of the data traffic.

Diagnostic interrupts

Enable the "Diagnostic interrupts" option, if you want diagnostic interrupts relating to the MRP status on the local CPU to be output.

The following diagnostic interrupts can be generated:

- Wiring or port error

Diagnostic interrupts are generated if the following errors occur at the ring ports:

- Connection abort on a ring port
- A neighbor of the ring port does not support MRP.
- A ring port is connected to a non-ring port.
- A ring port is connected to the ring port of another MRP domain.

- Status change active/passive (redundancy manager only)

If the status changes (active/passive) in a ring, a diagnostics interrupt is generated.

Parameter assignment of the redundancy is not set by STEP 7 (redundancy alternatives)

This option only affects SCALANCE X switches. Select this option if you want to set the properties for media redundancy using alternative mechanisms such as WBM, CLI or SNMP.

If you enable this option, existing redundancy settings from WBM, CLI or SNMP, are retained and are not overwritten. The parameters in the "MRP configuration" box are then reset and grayed out. The entries then have no meaning.

4.4.4 How do I configure media redundancy in a ring topology?

Description

There are 2 configuration options:

- Using STEP 7/NCM PC (recommended)
- Using the Web page of the CP 1616 (possible)

Configuration with STEP 7 / NCM PC

If you use the CP 1616/CP 1604 as a PROFINET IO controller or as a PROFINET IO device, you will need to create the configuration with STEP 7/NCM PC. You will find more information on this topic in the "Commissioning PC Stations" configuration manual.

4.5 Prioritized startup

Definition

An IO device with the "prioritized startup" property can reach the data transfer phase extremely quickly after it is powered up.

Example

An industrial robot works with a tool whose actuators are controlled via IO devices. It has other tools stored in its magazine.

When the industrial robot changes tools, the "prioritized startup" property of the IO device is important. The faster the IO device is available for data transfer after turning on the power, the faster the robot can continue working.

How do I configure prioritized startup?

The "prioritized startup" property is taken into account in the configuration of the IO subsystem with the STEP 7/NCM PC program.

You will find more information on this topic in the "Commissioning PC Stations" configuration manual.

4.6 Eliminating problems

Eliminating problems

A disruption during the firmware download can lead to an inconsistent status on the module.

Status detection

You can recognize an inconsistent status on the CP as follows:

- The CP is not accessible with STEP 7/NCM PC (in the SIMATIC Manager/SIMATIC NCM Manager, select **configured PC station** in the STEP 7 project > menu command **PLC > Edit Ethernet Node**).
- The red SF LED (group fault) flashes at 2-second intervals.
- Following a computer restart, all the LEDs of an unused RJ-45 jack light briefly and then go off again.

Note

In contrast to the brief lighting up of the LEDs when the computer starts up, the green Link LED always lights up if a cable is inserted in the RJ-45 jack and a link is also established.

Troubleshooting

Download the current firmware file, for example "fw16xx-v.v.v.b.b.fwl", to the CP again via the **ISO access point**.

Confirm the error "Error establishing connection to query the hardware version" with "yes"; in other words, ignore the error.

To download using the ISO protocol, you require the MAC address printed on the module.

Technical specifications

5.1 Communications processor CP 1604 / CP 1604 EEC

Listing

The following technical specifications apply to the CP 1604 / CP 1604 EEC communications processor:

Data transfer	
Transmission rate	10/100 Mbps

Interfaces	
10BaseT/100BaseTx	4 RJ-45 connectors with 40-pin ribbon cable
Interface of the RJ-45 connection board for CP 1604	40-pin connector
Interface of external power supply	20-pin connector
Connection to PC	PC/104 Plus

Voltage	
PCI power supply	+5 VDC, +/-5%
5 VDC supply, external (optional)	+5 VDC, +/-5%

Current consumption	
PCI voltage at +5 V	max. 800 mA
5 VDC supply, external (optional)	max. 800 mA

Permitted ambient conditions	
Operating temperature	+5 °C to +60 °C (CP 1604) -40 °C to +70 °C (CP 1604 EEC)
Transportation/storage temperature	-20 °C to +60 °C (CP 1604) -40 °C to +85 °C (CP 1604 EEC)

Construction	
Module format	PC/104 Plus format
Dimensions (W x D x H) in mm	90 x 95 x 24
Weight	110 g

LED connectors	
Input current	max. 9 mA

Note

Multiple CP 1604 / CP 1604 EEC CPs in one PC are not permitted

Multiple CP 1604 / CP 1604 EEC communications processors in one PC are not currently permitted.

Note

Parallel operation is not permitted

Parallel operation of the communications processors CP 1604 / CP 1604 EEC and CP 1616 in one PC is not permitted.

5.1.1 RJ-45 connection board for CP 1604

Listing

The following technical specifications apply to the RJ-45 connection board for CP 1604:

Interfaces	
Connection to 10BaseT/100BaseTx	RJ-45 connector (four)

Permitted ambient conditions	
Operating temperature	+5 °C to +60 °C
Transportation/storage temperature	-20 °C to +60 °C

Construction	
Dimensions (W x D x H) in mm	83 x 37 x 15
Weight	33 g

5.2 CP 1616 communications processor

CP 1616

The following technical specifications apply to the CP 1616 communications processor:

Data transfer	
Transmission rate	10/100 Mbps

Interfaces	
Connection to 10BaseT/100BaseTx	RJ-45 ports (four)
Connection to PG/PC	PCI slot (3.3 V/5 V, 32 bits)

Voltage	
PCI power supply	5 VDC, +/5%
Power supply external	6 to 9 VDC

Current consumption	
PCI voltage at +5 V	max. 800 mA
External supply at +6 V	max. 650 mA
External supply at +9 V	max. 450 mA

Permitted ambient conditions	
Operating temperature	+5 °C to +70 °C
Transportation/storage temperature	-20 °C to +60 °C

Construction	
Module format	PC card, short PCI format
Dimensions (H x W x D) in mm	167 x 18 x 107
Weight	110 g
Space required	PCI slot, short

Requirements of the external power supply source	
Electrical isolation	required
Rated voltage range	6 to 9 VDC
CP 1616 current consumption	approx. 0.8 A

Feed-in	
Hollow plug	• Outer diameter: 3.5 mm (-) • Inner diameter: 1.35 mm (+)

 WARNING
External supply If supplied from a separate source, this must meet the requirements to comply with NEC Class 2.

Note

Parallel operation is not permitted

Parallel operation of the CP 1616 and CP 1604 communications processors in one PC is not permitted.

Approvals

Note

The specified approvals apply only when the corresponding mark is printed on the communications processor.

Electromagnetic compatibility - EMC directive

The communications processor meets the requirements of the EC Directive:2004/108/EEC (EMC directive).

The communications processor is designed for use in the following areas:

Area of application	Requirements	
	Emission	Immunity
Residential areas, business and commercial operations, and small businesses	EN 61000-6-3	EN 61000-6-1
Industrial environment	EN 61000-6-4	EN 61000-6-2

EC declaration of conformity

You will find the EC declaration of conformity for the communications processor on the Product Support pages under the following entry ID:

58826997 (<https://support.industry.siemens.com/cs/ww/en/view/58826997>)

C-TICK approval

The communications processor meets the requirements of the Australian AS/NZS 3548 standard according to EN 61000-6-3.

CSA approval

The communications processor has an approval in accordance with the Canadian CAN/CSA C22.2 No. 60950-1 standard.

ICES conformity

The communications processor meets the requirements of the Canadian standard ICES-003. It is rated as a digital device of Class B ("Class B digital apparatus").

FCC approval

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Siemens AG is not responsible for any radio television interference caused by unauthorized modifications of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by Siemens AG. The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user. The use of shielded I/O cables is required when connecting this equipment to any and all optional peripheral or host devices. Failure to do so may violate FCC and ICES rules.

UL approval

The communications processor has an approval in accordance with the US standard UL 60950-1.

Marking for the customs union



EAC (Eurasian Conformity)

Customs union of Russia, Belarus and Kazakhstan

Declaration of the conformity according to the technical regulations of the customs union (TR CU)