

## SIMATIC NET

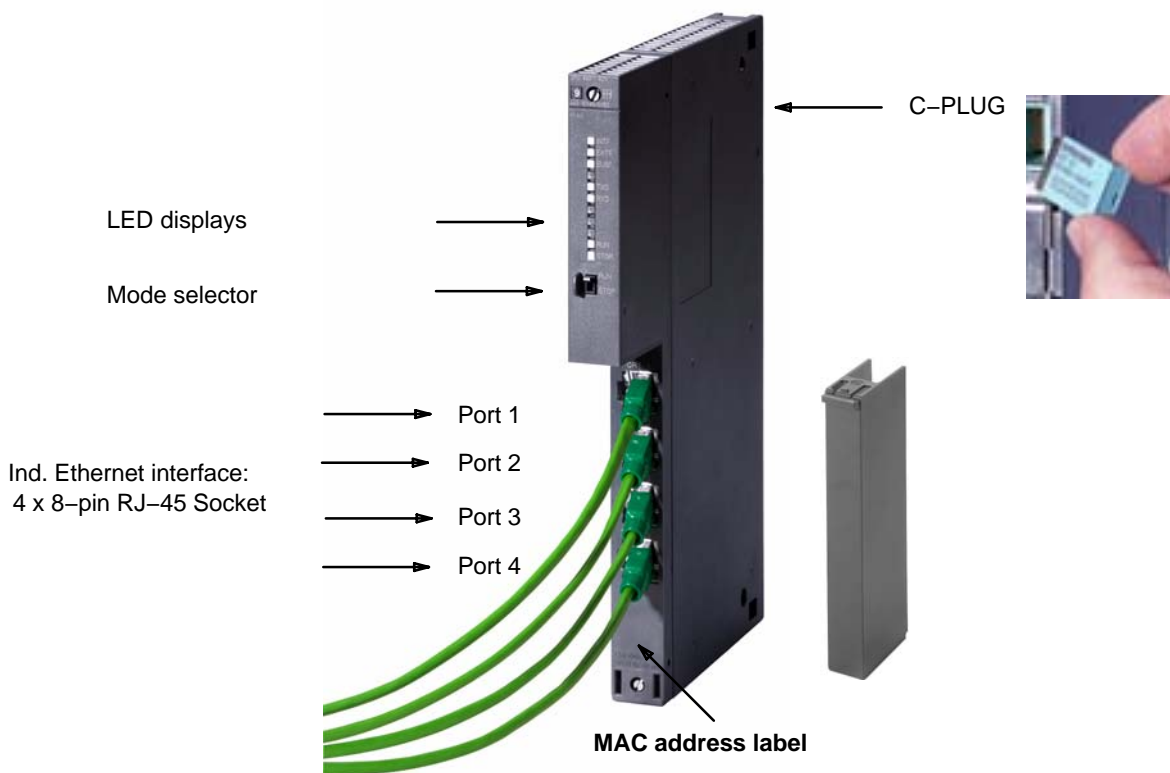
### S7-CPs for Industrial Ethernet

#### Manual Part B

#### CP 443-1 Advanced

6GK7 443-1EX41-0XE0  
for SIMATIC S7-400

Version 1 or higher (Firmware Version V1.0)



# Notes on the Product

## Compatibility with Previous Versions

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### Notice

Make sure that you read the information regarding **extended functions and restrictions** in Chapter 9 of this manual!

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## Address Label: Unique MAC address preset for the CP

The CP 443-1 Advanced is supplied with a MAC address preset in the factory.

To ensure a unique address assignment, we recommend that you use this MAC address when configuring the module!

## Additional Documentation on IT Functionality

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### Note

Please note the detailed description of the IT functionality in the Information Technology in SIMATIC S7 manual (entry ID = 24845107) or Part A of the manual (as of Release 04/2008, entry ID = 30335356). For the entry ID, refer to Section 14.

The CP 443-1 Advanced described here differs slightly in terms of the organization of the file system. The information in this device-specific manual is valid.

You can also obtain this manual from the Internet:

<http://support.automation.siemens.com/WW/view/en/1172744>

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# Contents

## Contents – Part A

**S7-CPs for Ind. Ethernet – Configuring and Commissioning . . . . See General Part**

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### Note

Please note Part A of the manual mentioned here. This also belongs to the description of the CP. Among other things, this includes the explanation of the safety notices used, Internet addresses and references as well as information that applies to all S7-CPs for Industrial Ethernet.

The general Part A version 1/2005 or higher also belongs to this Part B of the manual.

You can also obtain the current general Part A from the Internet at:

<http://support.automation.siemens.com/WW/view/en/30374198>

or

<http://support.automation.siemens.com/WW/view/en/27103175>

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## Contents – Part B

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# 1 Properties and Services

## Application

The CP 443-1 Advanced communications processor is designed for operation in an S7-400 (not fault-tolerant) programmable logic controller. It allows the S7-400 to be attached to Industrial Ethernet.

To set up small local area networks or to connect several Ethernet devices, a 4-port switch with autocrossing and autosensing has been integrated in the CP 443-1 Advanced.

## Communication Services

The CP 443-1 Advanced supports the following communication services:

- PROFINET IO Controller  
PROFINET IO allows direct access to IO devices over Ind. Ethernet.
- PROFINET CBA  
Use of a SIMATIC S7–400 for Component based Automation on the basis of the new PROFINET standard of the PNO. This standard allows:
  - Component technology in automation
  - Graphic configuration of communication between intelligent devices instead of laborious programming
  - Vendor-independent, plant-wide engineering
- S7 communication with
  - PG functions
  - Operator monitoring and control functions
  - Data exchange over S7 connections
- S5-compatible communication with
  - SEND/RECEIVE interface over ISO transport connections;
  - SEND/RECEIVE interface over TCP connections, ISO-on-TCP and UDP connections;  
With the SEND/RECEIVE interface via TCP connections, the CP 443-1 IT Advanced supports the socket interface to TCP/IP available on practically every end system.
  - Multicast over UDP connection  
The multicast mode is made possible by selecting a suitable IP address when configuring connections.

- FETCH/WRITE services (server services; corresponding to S5 protocol) via ISO transport connections, ISO-on-TCP connections, and TCP connections

Here, the SIMATIC S7-400 with the CP 443-1 Advanced is always the server (passive connection establishment) while the fetch or write access (client function with active connection establishment) is always initiated by a SIMATIC S5 or a third-party device / PC.

- LOCK/UNLOCK with FETCH/WRITE services (CPU-dependent; see Chapter 2);

- Open TCP/IP communication

To allow the user program to establish connections with other TCP/IP-compliant communication partners and to exchange data, STEP 7 provides a UDT for the connection parameter assignment and four FBs for high-performance data exchange. The following are supported:

- ISO-on-TCP connections

- IT functions

- Sending E-mail
- Monitoring devices and process data (HTML process control)
- FTP functions (File Transfer Protocol) for file management and access to data blocks in the CPU (client and server functions).

- Time-of-day synchronization over Industrial Ethernet according to the following configurable method:

- SIMATIC mode

The CP receives MMS time-of-day messages and synchronizes its local time.

You can choose whether or not the time of day is forwarded. You can also decide on the direction in which it is forwarded.

or

- NTP mode (NTP: Network Time Protocol)

The CP sends time-of-day queries at regular intervals to an NTP server and synchronizes its local time of day.

The time is also automatically forwarded to the S7 station so that the time is synchronized on the entire S7 station.

## Further services of the CP

- Addressable with the Factory-Set MAC Address  
The CP can be reached using the factory-set MAC address to allow IP address assignment; the CP supports the PST function (Primary Setup Tool).
- SNMP agent  
The CP supports data queries over SNMP version V1 (**S**imple **N**etwork **M**anagement **P**rotocol) according to the MIB II standard.
- IP access protection (IP-ACL)  
Using IP access protection gives you the opportunity of restricting communication over the CP of the local S7 station to partners with specific IP addresses.
- IP configuration  
You can configure how and with which method the CP is assigned the IP address, the subnet mask and the address of a gateway.  
  
It is also possible, as an alternative, to assign the connection configuration to the CP using STEP 7 or using a block interface in the user program (FB55: CP\_CONFIG) (see /Part A).  
  
Note: Does not apply to S7 connections.
- Diagnostic Buffer Extract Request  
With the aid of a Web browser, the CP supports the option of obtaining an extract of the diagnostic buffer containing the last ten diagnostic events of the CPUs and CPs located in the same S7 station as the CP.
- Connection diagnostics with FC10 AG\_CNTRL  
With FC10 AG\_CNTRL, it is possible to diagnose connections. When necessary, you can initiate connection establishment by the FC.
- S5/S7 addressing mode  
The addressing mode can be configured for FETCH/WRITE access as the S7 or S5 addressing mode (S7 addressing mode only for data blocks / DBs).
- IP double addressing detected in the network  
To save you time-consuming troubleshooting in the network, the CP detects double addressing in the network.  
  
When the CP starts up (after power down or after the initial addressing), the CP queries its own IP address on the network. If there is a response, the CP does not start up! The error is indicated by an LED ("STOP with internal error" is displayed) and an entry is made in the internal diagnostic buffer.
- 4-port switch integrated  
For setting up small local area networks or for connecting several Ethernet devices, a 4-port switch was integrated in the new CP 443-1 Advanced.  
  
Each port of the switch is designed for simple diagnostics and is equipped with a LINK and a RXD/TXD LED. Each port can also be set to a fixed mode manually using STEP 7, for example 10 or 100 Mbps half duplex / full duplex.

Each port can be disabled individually in the project engineering.

With the autocrossing mechanism with autosensing integrated in the switch, it is possible to use a standard cable to connect the PC/PG. A crossover cable is not necessary.

## Project engineering

You can configure the CP 443-1 Advanced over MPI or LAN/Industrial Ethernet. You require the following version of STEP 7 with NCM S7:

Table 1-1

Version STEP 7/NCM S7	Functions of the CP 443-1 Advanced
as of V5.4 + SP1	The full functionality as described in this document can be used.

### Note

Note the recommendations in Section 10.4 on operation with a higher communications load.

## Project engineering for the use of PROFINET CBA

To be able to work in the PROFINET CBA environment, you require the SIMATIC iMap engineering tool.

SIMATIC iMap requires a connection over Industrial Ethernet (TCP/IP protocol).

The following SIMATIC iMap project engineering software is required:

Table 1-2

Version of SIMATIC iMap	Functions of the CP 443-1 Advanced
as of V2.0 + SP2	The full functionality of the device can be used as of hardware version 1 and firmware version V1.

To operate PROFINET CBA, you require the current service packs of SIMATIC iMap containing the current FB88/FB90:

SIMATIC iMap as of V2.0 – Download Service Pack 2:

<http://support.automation.siemens.com/WW/view/en/23291636>

SIMATIC iMap STEP 7 add-on as of V3.0 – Download Service Pack 1:

<http://support.automation.siemens.com/WW/view/en/26574438>

Note: At the time of going to print, the entry ID for this download was not yet available. As soon as the entry is available, you will also be able to locate it using the search function provided with the link specified here.

## Using Programming Blocks for the SEND/RECEIVE Interface

For some communication services, there are ready-made blocks (FCs/FBs) available as the interface in your STEP 7 user program.

For data transfer on the SEND/RECEIVE interface, there are FCs for short and long data records:

Table 1-3

Function	Requirement
Transfer of data fields <= 240 bytes	<ul style="list-style-type: none"><li>You require the blocks AG_SEND FC5 and AG_RECV FC6 <b>or alternatively</b> the blocks AG_LSEND FC50 and AG_LRECV FC60.</li></ul>
Transfer of data fields > 240 bytes	<ul style="list-style-type: none"><li>You require the blocks AG_LSEND FC50 and AG_LRECV FC60.</li></ul>

For a detailed description of these blocks, refer to the general part of this manual (Part A/).

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### Notice

We recommend that you always use the current block versions for all module types.

You will find information on the current block versions and the current blocks to download from the Internet in our customer support.

<http://support.automation.siemens.com/WW/view/en/8797900>

With the older module types, this recommendation assumes that you are using the latest firmware for the particular block type.

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## 2 Requirements for Use

### Configuration Limits

When using the CP type described here, the following limits apply within a rack:

- Max. number of CPs: 14
- Number of CPs operating as PROFINET IO controllers: 4
- Number of CPs that can be configured for PROFINET CBA communication within an S7 station: 1 (system property)

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#### Notice

- The number of CPs operating as PROFINET IO controllers depends on the number of CP 443-5 Extended modules operating as DP masters in the S7-400 station. A total of 10 CPs can be operated as controllers for the distributed I/O (PROFINET IO controllers or DP masters); of those, however, only up to 4 as PROFINET IO controllers.
  - Please note the following regarding multiprocessor mode: When operating the CP as a PROFINET IO controller, only the process image of the assigned CPU can be distributed via the CP.
- 

### System Environment

The CP 443-1 Advanced is supported by the S7-400 CPUs and CPU operating systems with the order numbers as shown in the following table.

- The function block FB90 (PN\_InOut\_Fast) for PROFINET CBA is supported with all CPUs as of version V4.1.
- Open TCP/IP communication is supported with all CPUs as of version V4.1.

The table also contains the following information:

- The number of CPs that can be operated with one CPU
- The number of AG\_SEND or AG\_RECV calls that can be used at the same time on the SEND/RECEIVE interface
- Which CPUs support the LOCK/UNLOCK function with the FETCH/WRITE services
- Which CPU supports operation of the CP as PROFINET IO controller.

Table 2-1 CPU Data

CPU	Order number of the CPU: 6ES7...	As of version					
				Multiprocessing			
					Max. number of CPs		
					CPU resources for SEND-/RECEIVE jobs <sup>1)</sup>		LOCK/UNLOCK
							PROFINET IO
CPU412	..412-1XF04-0AB0	V4.0	+	14	24	+	–
	..412-1XJ05-0AB0	V5.0.1	+ <sup>2)</sup>	14	24	+	+
CPU412-2	..412-2XG04-0AB0	V4.0	+	14	24	+	–
	..412-2XJ05-0AB0	V5.0.1	+ <sup>2)</sup>	14	24	+	+
CPU414-2	..414-2XG04-0AB0	V4.0	+	14	24	+	–
	..414-2XK05-0AB0	V5.0.1	+ <sup>2)</sup>	14	24	+	+
CPU414-3	..414-3XJ04-0AB0	V4.0	+	14	24	+	–
	..414-3XM05-0AB0	V5.0.1	+ <sup>2)</sup>	14	24	+	+
CPU 414-3 PN/DP	..414-3EM05-0AB0	V5.0	+	14	24	+	+
CPU416-2	..416-2XK04-0AB0	V4.0	+	14	64	+	–
	..416-2XN05-0AB0	V5.0.1	+ <sup>2)</sup>	14	64	+	+
CPU416-2F	..416-2FK04-0AB0	V4.0	+	14	64	+	–
	..416-2FN05-0AB0	V5.0.1	+ <sup>2)</sup>	14	64	+	+
CPU416-3	..416-3XL04-0AB0	V4.0	+	14	64	+	–
	..416-3XR05-0AB0	V5.0.1	+ <sup>2)</sup>	14	64	+	+
CPU417-4	..417-4XL04-0AB0	V4.0	+	14	64	+	–
	..417-4XT05-0AB0	V5.0.1	+ <sup>2)</sup>	14	64	+	+
CPU 416-3 PN/DP	..416-3ER05-0AB0	V5.0	+ <sup>2)</sup>	14	64	+	+
CPU 416-3F PN/DP	..416-3FR05-0AB0	V5.0	+ <sup>2)</sup>			+	+

**Legend:**

- + => the feature is supported / the specified mode is possible  
 – => the feature is **not** supported / the specified the mode is **not** possible

<sup>1)</sup> Note:

The calculation of the maximum number of SEND/RECEIVE calls that can be used simultaneously per CP is described in Section 5.3.2.

<sup>2)</sup> Note

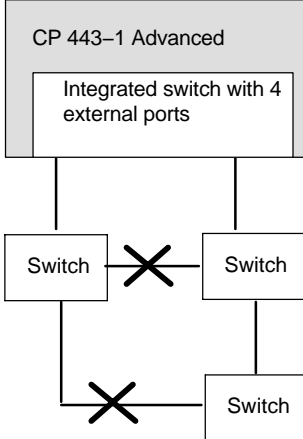
When operating the CP as a PROFINET IO controller, the multiprocessor mode is not supported; in other words, only the process image of the assigned CPU can be distributed via the CP (this does not influence communication protocols running at the same time in multiprocessor mode).

## 3 Installation and Commissioning

### 3.1 Procedure / Steps in Installation

Installing the CP 443-1 Advanced involves the following steps:

Step	Explanation / Meaning
<ol style="list-style-type: none"> <li>1. Turn off the power supply in the following situations: <ul style="list-style-type: none"> <li>– You want to insert the CP in a central rack;</li> <li>– You want to insert the CP in a universal rack operating as the central unit.</li> </ul> </li> <li>2. Inserting the CP 443-1 Advanced: Fit in the CP onto the rack from the top and push in at the bottom.</li> <li>3. Secure the CP with screws.</li> </ol> <p><b>Notice</b> When using the universal rack UR1 or UR2 as an expansion rack, a communication bus transceiver is necessary!</p>	<p>The CP 443-1 Advanced can be plugged into all racks with slots for P and K bus attachment. The following racks are suitable:</p> <ul style="list-style-type: none"> <li>• Central rack CR2 (central unit)</li> <li>• Universal rack UR1 or UR2 <ul style="list-style-type: none"> <li>– as central unit</li> <li>– as expansion rack with rack number 1–6 (only possible if PROFINET IO is not being used)</li> </ul> </li> </ul> <p>When the CP is installed in an expansion rack, you only need to turn off the power supply for the expansion unit.</p> <p>Suitable slots in the rack: With the exception of the slots reserved for the power supply, the CP 443-1 Advanced can be operated in all slots with a P and K bus attachment.</p>
<ol style="list-style-type: none"> <li>4. Connect the CP to Industrial Ethernet over an RJ-45 jack.</li> </ol>	<p>You will find examples of network attachments in the general Part A of this manual.</p>

Step	Explanation / Meaning
<p>5. Where necessary, connect other components to the remaining free RJ-45 jacks.</p>	<p>To set up small local area networks or to connect several Ethernet devices, a 4-port switch has been integrated in the new CP 443-1 Advanced.</p> <p>With the autocrossing mechanism integrated in the switch, it is possible to use a standard cable to connect a laptop or PG directly. A crossover cable is not necessary.</p> <p>Please note the following points:</p> <ul style="list-style-type: none"> <li> <b>Manual configuration</b>                      If a port is set to manual configuration, the autocrossing mechanism is also deactivated for this port. The port then behaves like the interface of a switch. Which cable you can use depends on the partner device.                      As default, the ports are set for automatic configuration.                 </li> <li> <b>Connecting switches</b>                      If you connect further switches, make sure that no ring is formed in the network.                 </li> </ul> <p>You will find examples of network attachments in the general Part A of this manual.</p> 

Step	Explanation / Meaning
<p>6. The remaining steps in commissioning involve downloading the configuration data and user programs.</p> <p>Requirements:</p> <p>You have configured the CP in a STEP 7 project with HW Config and NetPro for the services you want to use.</p>	<p>You can connect the PG when configuring the CP as follows:</p> <ul style="list-style-type: none"> <li>• via MPI</li> <li>• via Industrial Ethernet</li> </ul> <p>For more detailed information is, please refer to /Part A/:</p> <ul style="list-style-type: none"> <li>– First addressing (node initialization)</li> <li>– Downloading the defined configuration</li> </ul> <p>The PG/PC requires a LAN attachment, for example via a CP 1613 or CP 1411 and must have the necessary software (for example the S7-1613 package or SOFTNET IE). The TCP/IP protocol or ISO protocol must be installed. The protocol used must then be applied to the S7ONLINE access point.</p>
<p>7. User diagnostics for commissioning and to analyze problems.</p>	<p>The following options are available:</p> <ul style="list-style-type: none"> <li>• Hardware Diagnostics and Troubleshooting with STEP 7;</li> <li>• Communication diagnostics with NCM S7 Diagnostics</li> <li>• Standard information using HW Config</li> </ul>
<p>8. Optional when using with PROFINET CBA: Download PROFINET CBA component</p>	<p>If the S7 station in which the CP is operated is used as a PROFINET CBA component, the interconnections are downloaded using SIMATIC iMap; with standard components, programs and configuration data are also downloaded with SIMATIC iMap.</p> <p>For more detailed information, refer to the topic "Using the CP with PROFINET CBA".</p>

### Caution

When installing the CP for use as a PROFINET IO controller, note the following points about the power supply:

When using the CP in the central rack or in a universal rack operating as central rack, you should not insert or remove the CP 443-1 Advanced when the power is on. If you remove the CP when the power supply is on, the CPU changes to STOP and indicates "I/O error" (in contrast to previous modules!).

After inserting the module with power applied, it is essential to turn the power supply off and on again.

Note:

If the CP is operated without PROFINET IO, it is possible to insert and remove the CP when the power is no without affecting the CPU.

## 3.2 C-PLUG (Configuration Plug)

### Exchangeable C-PLUG

The CP has an exchangeable configuration plug (C-PLUG). This can store up to 32 MB of data in nonvolatile memory.

The retentive parameters include:

- IP address and IP parameters
- A newly set MAC address
- LAN settings
- Interconnection information for PROFINET CBA
- Data in the flash file system (see also Flash Area in Section 5.10 Memory Organization)
- SNMP Variables (modifiable)

This configuration plug simplifies replacement of modules. By simply exchanging the plug, all the data can be transferred to the replacement module.

---

#### Notice

The CP will not start up without a C-plug!

---

### Area of Application

The C-PLUG is an exchangeable medium for storing configuration and project engineering data of the basic device (CP 443-1 Advanced). This means that configuration data remains available if the basic device is replaced.

### Principle

The power is supplied by the basic device. When powered down, the C-PLUG retains all data permanently.

### Inserting in the C-PLUG Slot

The slot for the C-PLUG is on the rear panel of the device.

The C-PLUG is inserted in the receptacle.

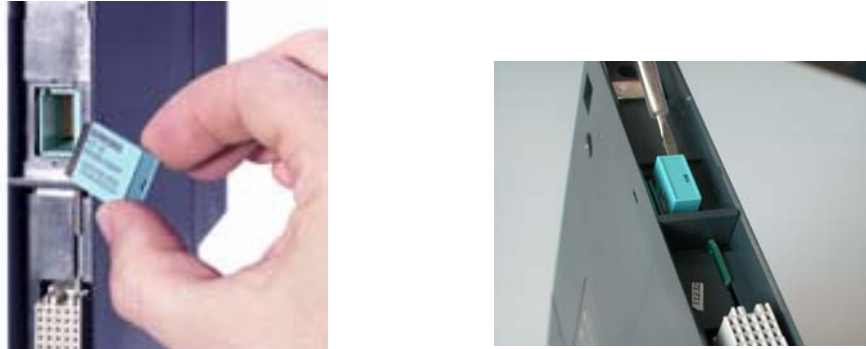


Figure 3-1 Fitting the C-PLUG in the CP and Removing It from the CP with a Screwdriver

### Function

If the C-PLUG has not yet been written to (as shipped), when the device starts up, all the configuration data of the CP is saved automatically on it.

If the C-PLUG is inserted, the basic device automatically uses the configuration data of the C-PLUG. This assumes that the data was written by a compatible device type.

If a fault occurs, the basic device can then be replaced much faster and more simply. If a device needs to be replaced, the C-PLUG is simply taken from the failed component and inserted in the replacement. As soon as it starts up, the replacement automatically has the same device configuration as the failed device.

### Using a C-PLUG with old Configuration Data

Use only C-PLUGs that are formatted for the CP 443-1 Advanced. C-PLUGs that have already been used and formatted in other device types must first be formatted for the CP 443-1 Advanced.

You do this with STEP 7 / NCM Diagnostics. For more detailed information, refer to the online help in the topic "General Diagnostics Functions – C-PLUG Diagnostics Object".

After formatting, all data areas are deleted on the C-PLUG. The project engineering is adopted by the CPU only after reloading or after turning on the power supply again.

### Removing the C-PLUG

It is only necessary to remove the C-PLUG if a fault occurs on the CP (see Figure 3-1).

## Diagnostics

Inserting a C-PLUG containing the configuration of an incompatible device type or general malfunctions of a C-PLUG are signaled by the diagnostic mechanisms of the CP (F LED red).

## 3.3 Module Replacement without PG

### General Procedure

The configuration data for the CP 443-1 Advanced is stored on the CPU; this means that the module can be replaced with the module of the same type (identical order number) without a PG.

For information on replacing previous modules, please refer to the section "Compatibility".

---

#### Notice

The "Replace module without PG" functionality (configuration data stored on the CPU) can no longer be used fully after downloading PROFINET CBA interconnections since the interconnection information is stored only on the CP.

You have the following two options:

- Using the C-PLUG in new modules  
You insert the previously used C-PLUG in the replacement module; interconnection information is then available again.
  - Using a new module with a new C-PLUG  
After replacing a module, you must download the interconnection information to the new CP using SIMATIC iMap.
- 

### Module replacement: Special feature of IP address assignment from a DHCP server

During configuration of the CP you can specify the IP configuration in the properties dialog; one option is to obtain the IP address from a DHCP server.

---

**Notice**

When replacing modules, remember that the factory-set MAC address of the new module is different from the previous module. When the factory-set MAC address of the new module is sent to the DHCP server, this will return either a different or no IP address.

Ideally, you should therefore configure IP as follows:

Always configure a client ID if you want to obtain the same IP address from the DHCP server after replacing the module.

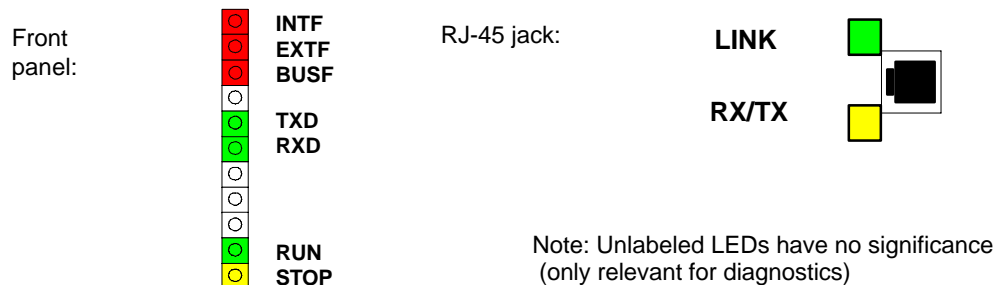
If you have configured a new MAC address instead of the factory-set MAC address (generally the exception), the DHCP server always receives the configured MAC address and the CP obtains the same IP address as the replaced module.

---

## 4 Displays and Mode Selectors





















### LED Display


The display on the front panel has seven LEDs to display the mode has been extended by an additional display with two LEDs beside the RJ-45 jack to display the communication status (covered by the front flap).



### CP Mode / LED Displays

INTF LED (red)	EXTF LED (red)	BUSF LED (red)	RUN LED (green)	STOP LED (yellow)	CP Operating Mode
					Starting (STOP→RUN)
					Running (RUN)
					Stopping (RUN→STOP)
					Stopped (STOP) In the STOP mode, it is still possible to configure and run diagnostics on the CP.
					STOP with internal error or memory reset. (For example IP double addressing detected in the network) In this status: <ul style="list-style-type: none"> <li>The CPU and intelligent modules in the rack are still accessible using PG functions (over MPI or ISO protocol).</li> <li>The SNMP function and access over HTTP or FTP are not possible</li> </ul>
					STOP
					Waiting for firmware update (CP currently has an incomplete or incorrect firmware version) Note: LEDs flash alternately

INTF LED (red)	EXTF LED (red)	BUSF LED (red)	RUN LED (green)	STOP LED (yellow)	CP Operating Mode
					Ready for firmware loading (this mode is active for ten seconds following power up when the mode selector is set to STOP)
					RUN with external error; One or more IO devices are not obtainable.
					RUN with external error; Diagnostic information from one or more IO devices is available.
					Module fault / system error

Legend:  on  off  flashing

## CP Communication Status

In addition to the LEDs that signal the CP mode, the front panel and the RJ-45 socket also include LEDs that provide information about the status of the CP interface to Industrial Ethernet.

Table 4-1

LED	Meaning (LED on)
TXD LED (green)	Flashing: CP is sending over Ind. Ethernet (note: in the current version, it may also be permanently lit)
RXD LED (green)	Flashing: The CP is receiving over Ind. Ethernet
LINK (green)	Indicates an established connection to Ind. Ethernet: <ul style="list-style-type: none"> <li>Not flashing = port set to 100 Mbps</li> <li>Flashing 0.5 Hz = port set to 10 Mbps</li> <li>Flashing 2 Hz = "Buzz" (flash test)</li> </ul>
RX/TX-LED (yellow)	Flashing: Port sending/receiving over Ind. Ethernet

## Force Mode

You can control the mode of the CP 443-1 Advanced as follows:

- Mode selector
- STEP 7 / NCM S7 configuration software

To control the mode from STEP 7 / NCM S7, the mode selector must be set to RUN.

## Mode Selector

With the mode selector, you can set the following modes:

- Switch from STOP to RUN:

The CP reads the configured and/or downloaded data into the work memory and then changes to the RUN mode.

- Switch from RUN to STOP:

The CP changes to STOP with the following results:

- Established connections (ISO transport, ISO-on-TCP, TCP connections) are terminated (transitional phase with LED display “STOPPING”);

The reaction is as follows in STOP:

- All connections are terminated
- The configuration and diagnostics of the CP is possible (system connections for configuration, diagnostics, and PG channel routing are retained);
- The downloading of interconnections for PROFINET CBA communication is not possible;
- FTP access to the file system is possible
- HTTP access is possible
- The routing function is active
- The time of day is not forwarded
- PROFINET CBA is disabled;
- PROFINET IO is disabled.

---

### Note

If you plug in the CP with the mode selector set to STOP or turn on the power supply, the display “Ready for Start of Firmware Download” appears for approximately 10 seconds. When necessary, this function allows the current firmware version to be updated. In normal operation, you can ignore this display and switch to RUN immediately.

For more information on downloading new firmware, refer to Section 11.

---

## 5 Performance Data

### Note

Measurements of transmission and reaction times in Ethernet, PROFIBUS and PROFINET networks for a series of configurations can be found on the Internet at the following address:

<http://support.automation.siemens.com/WW/view/en/25209605>

### 5.1 General Characteristic Data

Table 5-1

Characteristic	Explanation / Values
Total number of connections on Industrial Ethernet	In total (S7 connections + SEND/RECEIVE connections + CBA + FTP + HTTP ), the number of connections is restricted to 128.

### Example

You can, for example, operate:

64 S7 connections

30 ISO-on-TCP connections

10 TCP connections

10 UDP connections

8 ISO transport connections

If you require FTP and HTTP access at the same time, (for FTP 2 x TCP connections and for HTTP 4 x TCP connections; see Section 5.7).

## 5.2 Characteristic Data for S7 Communication

Table 5-2

Characteristic	Explanation / Values
Total number of S7 connections on Industrial Ethernet	128 max.
LAN interface – data field length generated by CP per protocol data unit <ul style="list-style-type: none"><li>• sending</li><li>• receiving</li></ul>	480 bytes / PDU 480 bytes / PDU
<ul style="list-style-type: none"><li>• Number of PG connections</li><li>• Number of OP connections</li></ul>	2 max. 30 max.

## 5.3 SEND/RECEIVE Interface

### 5.3.1 Characteristic data

The SEND/RECEIVE interface provides access to communication over TCP, ISO-on-TCP, ISO transport, E-mail, and UDP connections.

The following characteristics are important:

Table 5-3

Characteristic	Explanation / Values
Number of SEND/RECEIVE connections	<ul style="list-style-type: none"> <li>• TCP connections: 1...64 <sup>1)</sup> <sup>2)</sup></li> <li>• ISO-on-TCP connections 1 to 64</li> <li>• ISO transport connections 1...64</li> <li>• UDP connections (specified and free) configurable in total 1 to 64 (of those, up to 48 multicast mode)</li> <li>• E-mail connection: 1</li> <li>• Max. number of connections in total (ISO transport + ISO-on-TCP + TCP+ UDP + E-mail) &lt;= 64</li> </ul> <p>Refer to the example in Section 5.1</p> <p><sup>1)</sup> Note: The flow control on TCP connections <b>cannot</b> control permanent overload of the receiver. You should therefore make sure that the processing capabilities of a receiving CP are not permanently exceeded by the sender (approximately 150–200 messages per second).</p> <p><sup>2)</sup> TCP connections for FTP Of the available to CP connections, a maximum of 20 TCP connections can be configured / used with the "Use FTP protocol" option (see Section 5.7).</p>
Maximum data length for AG_SEND and AG_RECV blocks	AG_SEND and AG_RECV were shipped with predecessors of the CP 443-1 Advanced and allow the transfer of data fields with a length from 1 to 240 bytes. The version of the CP 443-1 Advanced described here continues to support these blocks.
Maximum data length for AG_LSEND and AG_LRECV blocks	AG_LSEND and AG_LRECV allow the transfer of data fields with the following lengths: <ol style="list-style-type: none"> <li>1. ISO-on-TCP, TCP, ISO Transport: 1 to 8192 bytes</li> <li>2. UDP: 1 to 2048 bytes</li> <li>3. E-mail (job header + user data): 1 to 2048 bytes</li> </ol>
Runtime for AG_LSEND in CPU 6ES7417-4XL04-0AB0 (data length < 300 bytes)	Job active      0.050 ms Job completed   0.065 ms
Runtime for AG_LRECV in CPU 6ES7417-4XL04-0AB0 (data length < 300 bytes)	Job active      0.050 ms Job completed   0.095 ms

Table 5-3 , continued

Characteristic	Explanation / Values
Performance AG_LSEND and AG_LRECV	<p>Note: In this test constellation, a head station sends data to 8 partner stations as fast as possible over a separate connection to each station.</p> <ul style="list-style-type: none"> <li>Blocks of data <math>\leq 212</math> bytes: ISO-on-TCP, TCP, UDP, ISO transport: 315 messages/s</li> <li>Blocks of data 213–240 bytes: ISO-on-TCP, TCP, UDP, ISO transport: 190 messages/s</li> <li>Blocks of data <math>&lt; 800</math> bytes <sup>1)</sup>: ISO-on-TCP, TCP, UDP, ISO transport: 75 messages/s</li> </ul> <p><sup>1)</sup> Note: A further increase in the user data length reduces the specified performance.</p>
Restrictions for UDP <ul style="list-style-type: none"> <li>Transfer is not confirmed</li> <li>Data field length</li> <li>No reception of UDP broadcast</li> </ul>	<p>The transmission of UDP frames is unconfirmed, in other words the loss of messages is not detected or displayed by the send blocks (AG_SEND or AG_LSEND).</p> <p>The maximum length of the data fields is 2048 bytes.</p> <p>To avoid overload resulting from a high broadcast load, the CP does not permit reception of UDP broadcast.</p> <p>As an alternative, use multicast mode over a UDP connection; this gives you the opportunity of registering the CP specifically as a member of a multicast group.</p>
LAN interface – data field length generated by CP per protocol data unit	<ul style="list-style-type: none"> <li>sending ISO-Transport, ISO-on-TCP, TCP: 400 bytes / TPDU</li> <li>receiving               <ul style="list-style-type: none"> <li>ISO transport: 512 bytes / TPDU</li> <li>ISO-on-TCP: 1024 bytes / TPDU</li> <li>TCP: 1460 bytes / TPDU</li> </ul> </li> </ul>

**Notice**

If you use the SEND/RECEIVE interface on the CP, one(!) system connection resource is used by S7 functions. Remember this in conjunction with the maximum number of CPU connection resources. Remember also that it is not normally possible to use all the system connection resources available for S7 functions for CPs.

### 5.3.2 Number of simultaneous SEND/RECEIVE calls

The number of SEND/RECEIVE calls that can be used at the same time is limited both by the CPU and by the CP.

If the maximum number of simultaneous SEND/RECEIVE calls is exceeded, the value 8302<sub>H</sub> (no receive resources) is indicated in the STATUS of the surplus SEND functions. This can, for example, happen when too many SEND/RECEIVE calls are sent at the same time in OB1.

#### Limitation by the CPU

In productive operation, the number of simultaneous SEND/RECEIVE calls depends on the CPU resources being used. Note the information on the available CPU resources in Section 2.

The following CPU resources are required:

- Per SEND job short (FC5) or long (FC50): 1 resource
- Per RECEIVE job short (FC6): 1 resource
- Per RECEIVE job long (FC60): 2 resources

#### Limitation by the CP

A maximum of 64 SEND/RECEIVE connections can be operated by the CP.

At an assignment of 1 CP per CPU, the maximum number of SEND/RECEIVE calls that can be used at one time is limited as follows:

- SEND calls short (FC5) or long (FC50): max. 32<sup>\*)</sup> / 12<sup>\*\*)</sup> per CPU
- RECEIVE calls short (FC6): max. 64<sup>\*)</sup> / 24<sup>\*\*)</sup> per CPU
- RECEIVE calls long (FC60): variable <sup>\*\*\*)</sup>

<sup>\*)</sup> The values apply to the CPUs 416 and CPU 417.

<sup>\*\*)</sup> The values apply to the CPUs 412 and CPU 414.

<sup>\*\*\*)</sup> The number of FC60s that can be used at the same time depends on the number of SEND calls active at the same time (see Tables 5-4 and 5-5).

Table 5-4 Dependency of the maximum number of RECEIVE calls long (FC60) used at the same time on the number of SEND calls (CPU 412/414)

Number of simultaneous SEND calls	0	1	2	3. 4	5	6	7	8 9	10	11	12
Max. number of simultaneous FC60s per CPU 412/414	19	18	17	16	15	14	13	12	11	10	9

Table 5-5 Dependency of the maximum number of RECEIVE calls long (FC60) used at the same time on the number of SEND calls (CPU 416/417)

Number of simultaneous SEND calls	0	1	2	3. 4	5	6	7	8 9	10	11	12	13 14	15	16
Max. number of simultaneous FC60s per CPU 416/417/41x-H	51	50	49	48	47	46	45	44	43	42	41	40	39	38
Number of simultaneous SEND calls	17	18 19	20	21	22	23 24	25	26	27	28 29	30	31	32	
Max. number of simultaneous FC60s per CPU 416/417/41x-H	37	36	35	34	33	32	31	30	29	28	27	26	25	

The maximum number of SPEED SEND/RECEIVE calls that can be used simultaneously (FC53, FC63) depends only on the CPU (see above).

## 5.4 Characteristics of Open TCP/IP Communication

Table 5-6

Characteristic	Explanation / Values
Number of dynamically generated connections over Industrial Ethernet	<ul style="list-style-type: none"> <li>ISO-on-TCP connections 1 to 64</li> </ul>
Max. data length	1452 bytes

## 5.5 Characteristic Data for PROFINET IO

The CP supports the following maximum configuration as a PROFINET IO controller:

Table 5-7

Characteristic	Explanation / Values
Number of possible PROFINET IO devices	125
Size the input area over all PROFINET IO devices	4 Kbytes max.
Size the output area over all PROFINET IO devices	4 Kbytes max.
Size of the IO data area per submodule of a module in an IO device <ul style="list-style-type: none"> <li>Inputs</li> <li>Outputs</li> </ul>	240 bytes 240 bytes
Size of the consistency area for a submodule	240 bytes

### Note

Note the following for PROFINET IO: If you use modules with  $\geq 32$  bytes of input/output data, this can lead to I/O access errors; access errors are entered in the diagnostic buffer of the CPU.

These I/O errors occur during operation only in the “consistent user data” mode and at a low OB1 cycle time.

### Notice

In PROFINET IO, the number of possible slots is limited.

The maximum number of slots depends on the CPU being used:

CPU 416–3 PN/DP: 2173 slots  
 CPU 416–3F PN/DP: 2173 slots  
 CPU 414–3 PN/DP: 1632 slots

## 5.6 Characteristic Data for PROFINET CBA

### 5.6.1 Typical Values and Limit Values

The CP supports PROFINET CBA interconnections between PROFINET CBA components.

The “typical” values specified below are values that cause the SIMATIC iMap configuration tool to generate a warning if they are exceeded; it is nevertheless possible that the configuration can be operated.

If one of the limit values specified for the interconnections is exceeded, they cannot be downloaded to the module. When the interconnections are downloaded, the SIMATIC iMap configuration tool generates an error message to this effect. If a limit value relating to the number or size of components is exceeded, the CPU will not change to RUN!

Table 5-8 Characteristic Data for PROFINET CBA Communication

Characteristic	Typical value	Limit value	
		with FB88	with FB90
PROFINET CBA			
Number of remote interconnection partners	32	64	
Total of all I/Os	600	600	
Data length of all incoming I/Os	3200 bytes	8192 bytes	1452 bytes
Data length of all outgoing I/Os	3200 bytes	8192 bytes	1452 bytes
Data length for arrays and structures (acyclic interconnections), maximum	2048 bytes	8192 bytes	1452 bytes
Data length for arrays and structures (cyclic interconnections), maximum	450 bytes	450 bytes	450 bytes
Data length for arrays and structures (local interconnections), maximum	–	2400 bytes	1452 bytes
Remote interconnections with acyclic transmission			
Sampling frequency: sampling interval, min. Possible values: 100, 200, 500, and 1000 ms	Fast value: 20% Medium value: 40% Slow value: 40%	100 ms minimum	
Number of incoming interconnections	64	150 maximum	
Number of outgoing interconnections	64	150 maximum	
Data length of all incoming interconnections	2048 bytes	8192 bytes	1452 bytes
Data length of all outgoing interconnections	2048 bytes	8192 bytes	

Table 5-8 Characteristic Data for PROFINET CBA Communication, continued

Characteristic	Typical value	Limit value	
		with FB88	with FB90
Remote interconnections with cyclic transmission			
Transmission frequency: transmission interval, min. Possible values *): 10, 20, 50, 100, 200, 500 and 1000 ms	Fast value: 20% Medium value: 40% Slow value: 40%	10 ms minimum	
Number of incoming interconnections	125	250	
Number of outgoing interconnections	125	250	
Data length of all incoming interconnections	1000 bytes	2000 bytes	1452 bytes
Data length of all outgoing interconnections	1000 bytes	2000 bytes	
HMI variables over PROFINET (acyclic)			
Number of stations that can register for HMI variables (PN OPC/iMap) Stations are 2 * PN OPC and 1 * SIMATIC iMap	–	3	
HMI variable update	–	500 ms minimum	
Number of HMI variables	–	200 maximum	
Data length of all HMI variables	1600 **)	8192 bytes	
Device–internal interconnections			
Number of device–internal interconnections	50	300	
Data length of all device–internal interconnections	400 bytes	2400 bytes	
Interconnections with constants			
Number of interconnections with constants	200	500 maximum	
Data length of all interconnections with constants	1600	4000	
PROFIBUS proxy functionality			
Supported	No	No	

Table 5-8 Characteristic Data for PROFINET CBA Communication, continued

Characteristic	Typical value	Limit value	
		with FB88	with FB90
Access to S7extended variables			
Maximum number of S7 connections for access to variables with the PROFINET attribute "s7extended".  Note: The PROFINET attribute "s7extended" is used only by OPC applications over the OPC server; variables with this attribute can only be used with OPC applications.	16  (not checked by iMap)	32 maximum  Note: You should also keep in mind the maximum number of connections according to Section 7.3	

\*) The configurable transmission cycle is directly related to the actual cycle time. For technical reasons, the cycle time is based on the basic cycle time of 1 ms to the power of two. The actual cycle time is therefore the next lower power of two of the configured frequency of transmission; for the specified values, this results in the following relationships "frequency of transmission <--> cycle time" :

10<-->8 | 20<-->16 | 50<-->32 | 100<-->64 | 200<-->128 | 500<-->256 | 1000<-->512

\*\*) The value is not checked by iMap.

### Note

For information on the data length and data type in PROFINET CBA communication, refer to the online help on SIMATIC iMap, the "Creating PROFINET Components" manual and the "Configuring Plants with SIMATIC iMap" manual.

### Notice

With a large configuration or when using other services at the same time (for example monitoring online), the configured frequency of transmission cannot be guaranteed in all cases. To remedy this, we recommend that you increase the frequency of transmission.

## 5.6.2 Cycle Times

### Communication load and extension of the cycle

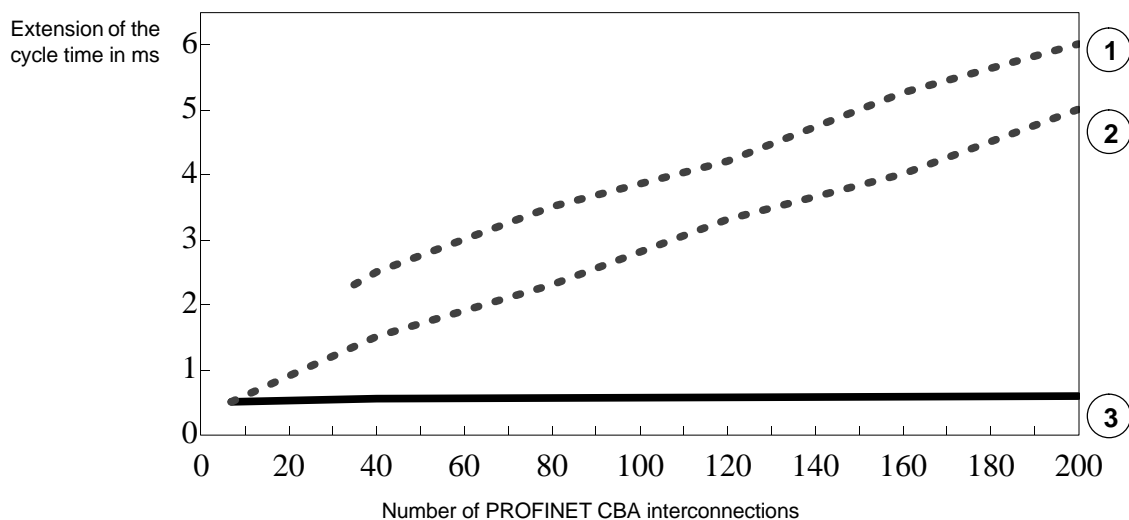
When using the CP 443–1 Advanced, there is little influence by PROFINET CBA on the cycle time of OB1. The influence does not depend on the number of PROFINET CBA partners or on the number of PROFINET CBA interconnections.

### Comparing CPU and CP 443–1 Advanced

In the documentation of the CPU 317–2 PN/DP, for example, you can see the influence as shown in the following graphic. Lines 1 and 2 show this influence when the CPU interface is used for PROFINET CBA.

The additional line in the graphic shows the influence when you use the PROFINET CBA interface of a CP 443–1 Advanced (here: 6GK7 443–1EX40) in an S7–400 station.

It can be seen that in contrast to operation over a CPU network attachment, the OB1 cycle remains practically uninfluenced by the CBA communication if PROFINET CBA is operated over a CP 443–1 Advanced.



Legend:

- ① OB1 cycle with 32 PROFINET CBA partners and network attachment on the CPU 317–2 PN/DP.
- ② OB1 cycle with 5 PROFINET CBA partners and network attachment on the CPU 317–2 PN/DP.
- ③ OB1 cycle with an S7–400 station with CPU 416–2 and with network attachment on the CP 443–1 Advanced (the number of PROFINET CBA partners has no influence).

### 5.6.3 Reaction Times

#### Definition

The reaction time is the time from recognizing an input signal until the associated output signal changes.

#### Influences

The actual reaction time is subject to certain fluctuations. The achievable reaction times for PROFINET CBA communication depend on the following factors:

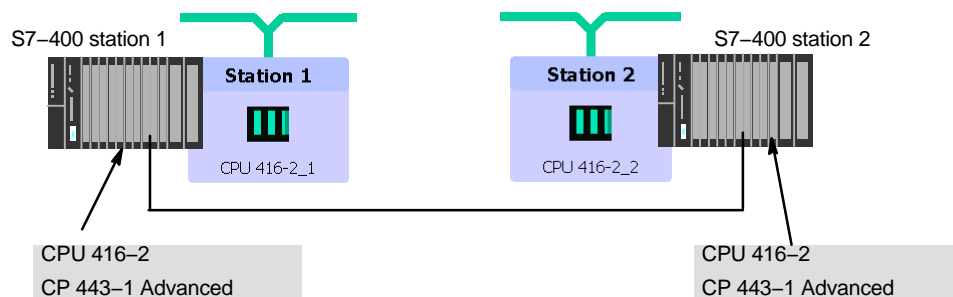
- Type of interconnection (cyclic or acyclic) and the transmission frequency or scanning frequency;
- The size of the configuration on the component interface (size of the interface DB for PROFINET CBA);
- CPU cycle time and CPU type;
- Parallel operations with other types of communication types such as PROFINET IO or with services such as online monitoring.

As a result, the reaction times for cyclic PROFINET CBA interconnections may exceed the configured value for the transfer frequency. You should therefore check the reaction time that can be achieved during commissioning and, if necessary, change the project engineering.

#### Measurements in a Sample Configuration

Measurements were made to help you to estimate the influence of the configured transfer frequency and the configuration (interface DB) with cyclic PROFINET CBA interconnections.

These measured results relate to a certain sample configuration. Two S7-400 stations each with a CP 443-1 Advanced were used (here: 6GK7 443-1EX40). FB90 was used in the user program (FB90 has better time characteristics than FB88).



Measurement principle:

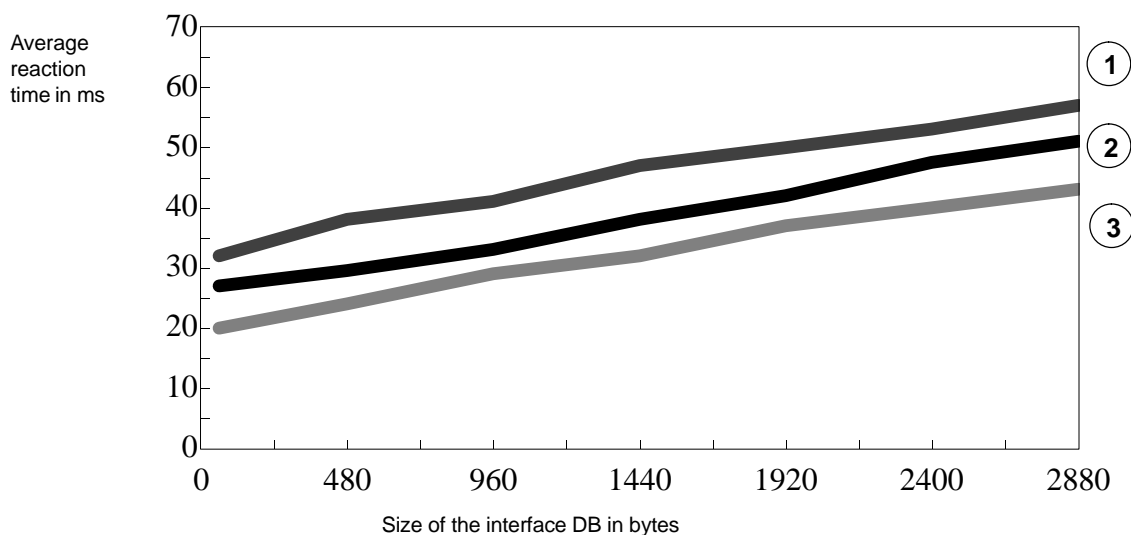
Output data is generated by station 1 and interconnected as input data with station 2. The input data is mirrored there and transferred over interconnections back to station 1 where it is evaluated and forwarded etc. The time required for the individual transfer and evaluation cycle is measured in station 1. This corresponds to approximately twice the reaction time according to the definition above.

The CPU cycle time (cycle time of OB1) for this measurement is 6 ms.

Note: With shorter cycle times, the reaction times are further reduced and with longer cycle times they are correspondingly extended.

## Measurement results

From the following diagram, you can see the average values for the reaction time of the cyclic interconnections depending on the size of the interface DB.



### Legend

The transfer frequency set in the parameters in SIMATIC iMap is as follows for the recorded lines:

① 50 ms      ② 20 ms      ③ 10 ms

## Evaluation

From the diagram, you can see that the transfer frequencies configured at 10 ms or 20 ms in the sample configured are not achieved. On the other hand, at a configured transfer frequency of 50 ms, a corresponding reaction time of 50 ms with 2400 bytes is kept to.

---

**Note**

The values of the utilization parameters displayed by SIMATIC iMap as of V2.0 with the “Edit / Check utilization” function relate to the data exchange as far as the CP. They do not apply to data access from the user program.

---

## 5.7 Characteristic Data HTTP and FTP Operation

### TCP Connections for FTP

FTP actions are transferred from the CP over TCP connections. Depending on the mode, the following characteristic data apply:

- FTP in client mode:  
Per configured FTP connection, up to 2 TCP connections are occupied; a maximum of 20 FTP connections can be configured.
- FTP in server mode:  
Per FTP session, up to 2 TCP connections are occupied (1 control connection and 1 data connection); a maximum of 10 FTP sessions at the same time are possible.

### Characteristic Data for the FTP Client Mode

To allow use of the FTP client blocks, a TCP connection must be configured with the "Use FTP protocol" option. Of the available TCP connections, a maximum of 20 TCP connections with the "Use FTP protocol" option can be configured / used.

The following table shows the memory requirements of the FCs available for FTP services.

The block execution times in FTP depend on the reaction times of the partner and the length of the user data; a general statement about the times is therefore not possible.

Table 5-9

Name	Version	FC no.	Load memory bytes	Work memory bytes	MC7 bytes	Local data bytes
FTP_CONNECT	1.0	40	1482	1236	1200	86
FTP_STORE	1.0	41	1794	1514	1478	102
FTP_RETRIEVE	1.0	42	1934	1642	1606	106
FTP_DELETE	1.0	43	1478	1232	1196	86
FTP_QUIT	1.0	44	968	796	760	46

## 5.8 Characteristic Data of TCP Connections for HTTP

Each HTTP session occupies up to 4 TCP connections as soon as you use one or more Web browsers to display data or files of the CP.

## 5.9 Characteristic Data for the Use of Java Applets

To transfer larger amounts of data efficiently from the S7BeansAPI using Java applets and the Java bean "S7Variable", you can make use of arrays.

### Maximum Array Size

The maximum array size for the CP 443-1 Advanced

- is 400 bytes when writing data to the CPU and
- 400 bytes when reading data from the CPU.

---

#### Note

Please note that the maximum block size in bytes is specified here and that the maximum number of array elements is decided by the byte size of the array basic data type.

---

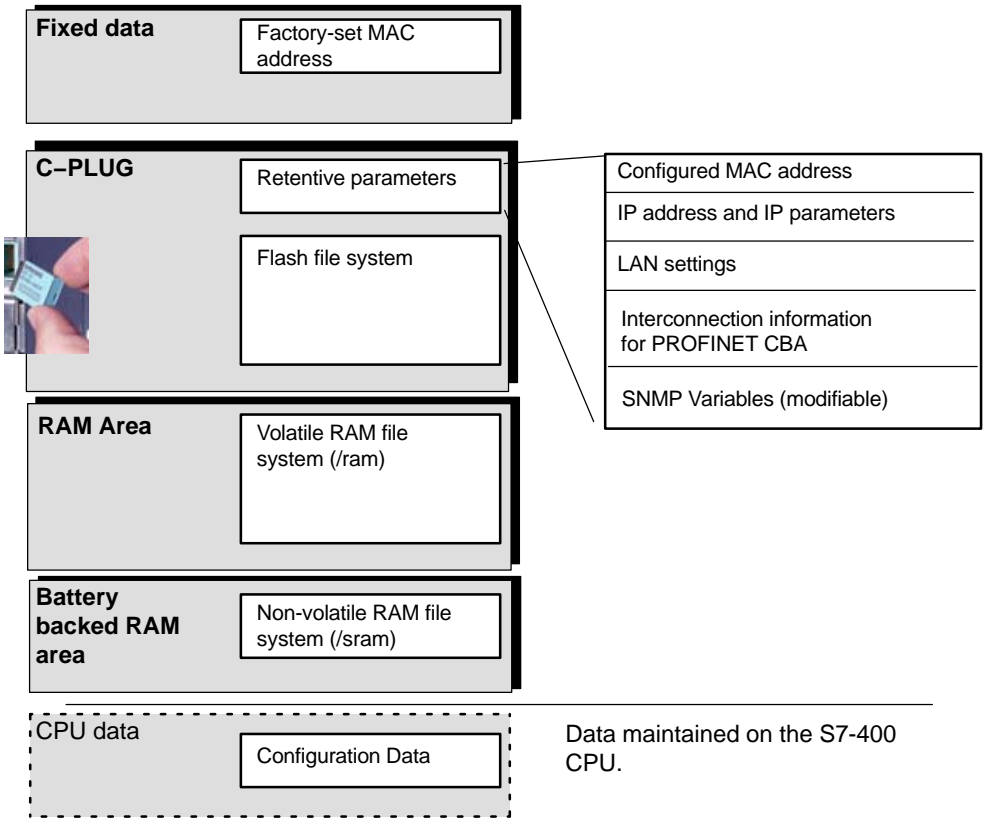
### Example

The CP 443-1 Advanced can transfer a maximum of 100 array elements of the type DWORD or REAL with a read job since each element of the type DWORD or REAL occupies four bytes.

## 5.10 Memory Organization in the CP 443-1 Advanced

### 5.10.1 Memory Distribution

The data areas of the CP 443-1 Advanced are organized as follows:



## 5.10.2 File Systems

### Notice

Please note the detailed description of the FTP functionality in the Information Technology in SIMATIC S7 manual (entry ID = 24845107) or Part A of the manual (as of Release 04/2008, entry ID = 30335356). For the entry ID, refer to Section 14.

In terms of the organization of the file system, the characteristics of the CP 443-1 Advanced described here differ slightly from those described there. The information in this device-specific manual is valid.

### Structure of the File System of the CP 443-1 Advanced as Shipped

If you open the system page “Server Information”, the file system of the CP 443-1 Advanced appears as follows:

The screenshot shows a web browser window titled "SIMATIC NET IT-CP - Microsoft Internet Explorer bereitgestellt von CAT@Siemens XP SP2". The address bar shows "http://200.12.1.144/index.htm". The page has a green header with the Siemens logo and navigation links: [Find](#), [Contact](#), [Home](#), and [Automation & Drives](#). Below the header, there are more links: [Server Information](#), [Device Structure & Status](#), [Send Test Mail](#), [Information](#), and [Filesystem Version](#).

### Server Information

Device-Name:	CP443-1 Advanced, 6GK7 443-1EX41-0XE0
Firmware-Version:	V1.0.0
HTTP-Server-Version:	HTTP-Server V1.38

### Filesystem Information

Filesystem Type	Mount Point	Total Bytes	Free Bytes	Total Inodes	Free Inodes	Bad Blocks
Nonvolatile FLASH Filesystem	/	29,89 MB (31351808 Bytes)	29,20 MB (30618624 Bytes)	16119	16092	0 (0 Bytes)
Volatile RAM Filesystem	/ram	15,19 MB (15933440 Bytes)	15,19 MB (15932416 Bytes)	8190	8189	-
Battery Buffered Filesystem	/sram	0,47 MB (497152 Bytes)	0,47 MB (496128 Bytes)	255	254	-
ROM Filesystem	/SYS	0,49 MB (520704 Bytes)	read only (0 Bytes)	24	0	-

A callout box points to the "/SYS" mount point in the ROM Filesystem row, containing the text: "Storage location in the file system".

Figure 5-1

Note on Figure 5-1:

For the latest information on the configuration limits, refer to the table on page B-42 or the current system page of your CP.

## Meaning of the Memory Areas

On the CP 443-1 Advanced, the file system is divided into 3 areas:

- **Flash Area in the C-PLUG** (non-volatile memory):

The flash area allows data to be stored and retained if there is a power down.

Since the number of times it is possible to write to this area is restricted, you should avoid repetitive write operations to this area, when such operations are necessary, write to RAM.

---

### Notice

The flash area of the file system allows a limited number of write cycles (approximately 100 000). You should therefore avoid writing data cyclically.

If you are writing temporary data often, you should use the RAM file system located in the subfolder /ram or /sram. The files of the RAM file system (/ram) are lost if there is power down.

---

- **RAM area** (/ram volatile memory):

In contrast to the flash area, the RAM can be written to and read from any number of times. The data in the RAM are retained as long as the CP is supplied with power.

The RAM is intended to store data that change during operation and need to be recorded (data recording services). The RAM is also suitable for temporary storage.

The RAM is located in the file system below the “/ram” folder. All files and folders below this folder are lost when there is a power down.

- **Battery Backed RAM Area** (/sram – backed by the battery of the power supply):

The battery backed RAM area can be used in the same way as the volatile RAM described above. This RAM is located in the file system below the “/sram” folder.

If you turn off the power or if there is a power down, the stored data is retained. However, if you remove the module from the rack, this data is also lost since is backed by the battery of the power supply.

**Please remember the following restrictions:**

Table 5-10

Characteristic	Explanation / Values
File Names	The length of file names is limited to 64 characters for the file name itself and up to 256 characters for the path. The file names are case-sensitive.
File Size	The file size is limited to a maximum of 8 MB.
Memory Area for the File System	<ul style="list-style-type: none"><li>– Flash area (non-volatile memory) 30 MB</li><li>– RAM area (volatile memory) 16 MB</li><li>– RAM (SRAM) – backed by the battery of the power supply module 512 Kbytes</li></ul>

## 5.11 Characteristic Data of the Integrated 4–Port Switch

### Learning addresses / deleting addresses (aging time)

The 4-port switch integrated in the CP automatically learns the addresses of the DTEs connected via a port by evaluating the source addresses in the data packets. If the switch receives a data packet, it directs this packet only to the port via which the appropriate DTE can be obtained.

The switch monitors the age of the learned addresses. Addresses that exceed the “aging time” are deleted.

The aging time set on the CP 443-1 Advanced is 5 minutes.

### Ports can be deactivated individually

The individual ports of the 4–port switch integrated in the CP can be deactivated in STEP 7 / HW Config. This can, for example, be used for service purposes.

The port is turned off completely when it is deactivated. The LINK and RX/TX LEDs are turned off.

## 6 Using the CP 443-1 Advanced for PROFINET IO

PROFINET IO allows direct access to PROFINET IO devices over Ind. Ethernet.

To access the field devices connected to PROFIBUS DP, there are gateways available that are used as PROFINET IO proxies (IE/PB Link).

### 6.1 Configuring the CP 443-1 Advanced as a PROFINET IO Controller

#### PN IO System in STEP 7

In principle, you configure for PROFINET IO as follows:

To be able to use the CP as a PROFINET IO controller, create a PROFINET IO system in STEP 7 / HW Config. You can either assign an existing or a new Ethernet subnet to the CP as the PROFINET IO system.

Then add the PROFINET IO devices to the PROFINET IO system. STEP 7 automatically assigns addresses that you can modify if necessary. The address information is stored in the database of the CP. When the system starts up, the PROFINET IO controller (CP) no transfers this address information to the IO devices (Note: The I/O and diagnostic addresses remain on the IO controller).

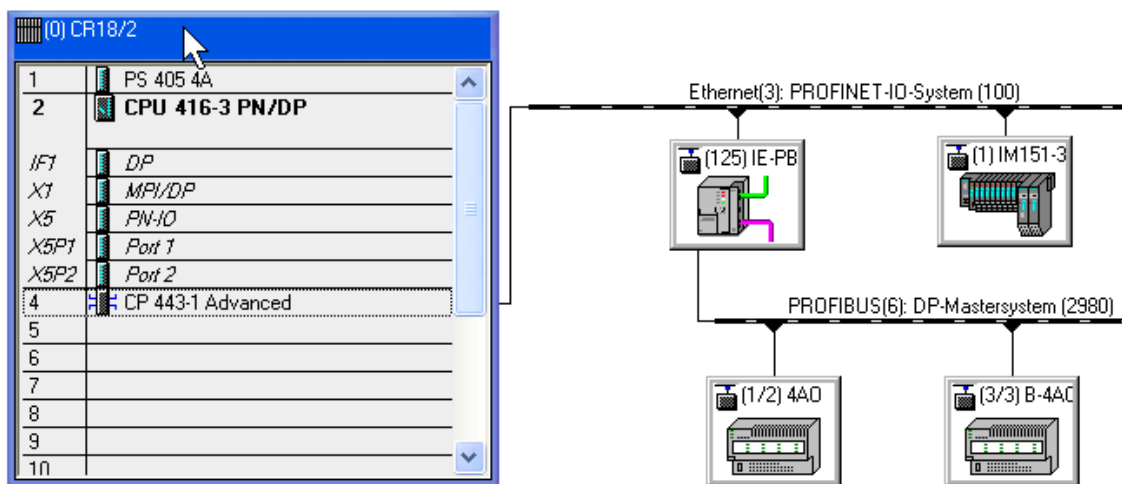


Figure 6-1 Example of the CP 443-1 Advanced as a PROFINET IO Controller with a PROFINET IO System

## Multicomputing Mode – Assigning the CP to the CPU

If you use the CP in an S7 station with several CPUs (multicomputing) for PROFINET IO operation, you must assign the CP to a CPU in the configuration.

---

### Notice

- CP slot in PROFINET IO mode  
PROFINET IO operation is possible only with one CP located in the central unit.
  - CPU “startup” configuration when using the IE/PB Link PN IO  
If you use the IE/PB Link PN IO as PROFINET IO device, you must select the option “Startup when expected/actual config. differ” for the CPU in the “Startup” tab. Otherwise your system will not start up automatically after power up or following a power outage.
- 

## Configuration Limits

When using the CP type described here, the following limits apply within an S7-400 station:

Number of CPs operating as PROFINET IO controllers: 4

## How PROFINET IO devices start up with a large operational configuration

When operating the module with a large configuration (up to 128 communication connections and up to 125 PROFINET IO devices), it may take several minutes when the station starts up before all PROFINET IO devices have received configuration data from the PROFINET IO controller. The IE/PB Link operating as PROFINET IO device is particularly affected by this.

To ensure that the CPU does not interrupt the distribution of project engineering data in this situation, the parameter assignment monitoring time must be increased on the CPU.

Possible remedy: Reduce the size of the configuration (for example, distribution on several CPs).

### Reduce the communication share reserved for PROFINET IO when operating alongside other services.

If cyclic data exchange over PROFINET IO is operating at the same time on the same Ethernet subnet, set the parameter "Communication component for PROFINET IO" in the properties dialog of the PROFINET IO system to a value <100%.

Reason: At the (default) setting 100%, the communication time is reserved primarily for PROFINET IO data exchange. Reducing the communication component for PROFINET IO increases the system-wide update time for PROFINET IO and creates additional time on the CP for processing other communication services.

## 6.2 Interface in the User Program: SFBs and SFCs

No special FBs or FCs are necessary for PROFINET IO operation. The interfacing of the PROFINET IO devices is either direct or over SFCs/SFBs of the CPU:

Table 6-1

Block		Meaning
SFB52	"RDREC"	Read data record.
SFB53	"WRREC"	Write data record.
SFB54	"RALRM"	Receive alarm.
SFB81	"RD_DPAR"	Read predefined parameters.
SFC70	"GEO_LOG"	Identify the start address of a module.
SFC71	"LOG_GEO"	Identify the slot belonging to a logical address.

For a detailed description of these blocks / functions, refer to the "System Software for S7-300/400 System and Standard Functions" manual.

### Assignment of an Initial Value with Consistent PN IO User Data > 32 Bytes

If you have consistent PROFINET IO user data areas > 32 bytes, the system does not assign initial values. You should therefore set the initial value for all PROFINET IO user data areas > 32 bytes using the corresponding error OBs.

### Further Information on PROFINET IO

When setting up a PROFINET IO system, please read the comprehensive system documentation:

- For PROFIBUS DP to PROFINET IO  
Programming Manual Siemens AG
- PROFINET System Description



The documents listed here are also on the Manual Collection CD supplied with every S7-CP.

## 7 Using the CP 443-1 Advanced with PROFINET CBA

To be able to use the CP 443-1 Advanced with PROFINET CBA, you create your user program with STEP 7 and configure the S7-400 station.

You then configure the interconnections between the PROFINET CBA components with SIMATIC iMap.

### 7.1 CBA Interface in the User Program with FB90 or FB88

#### PN\_InOut\_Fast (FB90) / PN\_InOut (FB88) and Interface DB

The interface to the user program is the interface DB for PROFINET CBA. The PN\_IO\_X (FB90) and PN\_InOut (FB88) blocks are responsible for transferring data from the interface DB to the CP and from the CP to the interface DB.

The function blocks FB90 and FB88 behave largely identically on the interface to the user program. The following applies:

- The interface parameters are identical;
- FB90 has several additional condition codes in the STATUS parameter;
- There are differences in the configuration limits of the interface DB (see Table 5-8).

Please refer to the documentation of the blocks in the online help of STEP 7 or in the general part of this manual.

If you use the CP with the firmware version V2.2 described here, we recommend that you use FB90. As a result, you can achieve shorter reaction times. Note the constraints regarding its use in this manual.

---

#### Notice

Replacing blocks:

- You can replace FB88 in your user program with FB90 without needing to run the componentization again.
  - If you replace FB90 in your user program with FB88, you will have to repeat the componentization.
- 

---

#### Notice

Only one of the two block types FB88 or FB90 can be used in the user program of an S7-400 station. Componentization is rejected if both block types are used at the same time.

---

## 7.2 Preparing for Configuration with STEP 7

During configuration, remember the following requirements for subsequent use with PROFINET CBA:

- Configure the modules for the S7–400 station in HW Config

You can assign the option “Use this module for PROFINET CBA to one (and one only) CP 443–1 Advanced in an S7–400 (in the “PROFINET” tab)

In multicomputing, the PROFINET CBA function is handled by the CPU that you assigned to the CP in the “Addresses” tab.

- Configuring the Ethernet Interface

When you later configure the Ethernet interface, make the following settings:

- Disable the “Set MAC address / use ISO protocol” option;

---

### Notice

ISO transport connections and S7 connections using the ISO protocol cannot be operated!

---

For more detailed information on adopting configuration data in the SIMATIC iMap engineering tool, please refer to the /6/ manual.

## 7.3 PROFINET CBA Configuration with SIMATIC iMap

### Function in the PROFINET CBA Environment

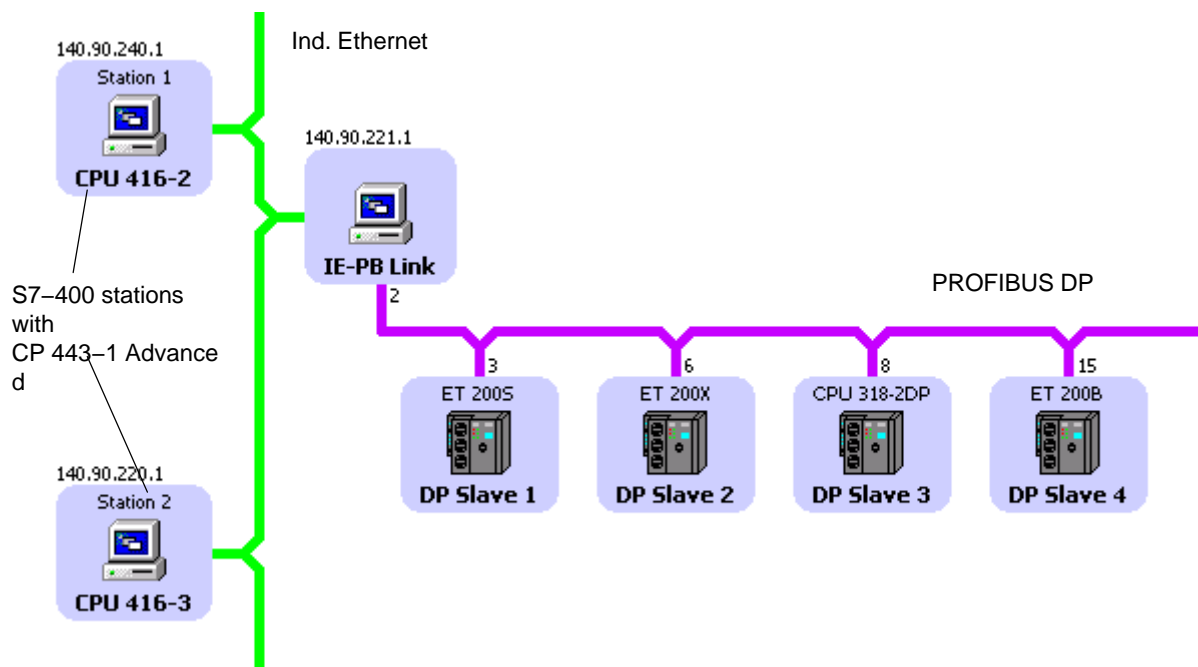
The CP 443-1 Advanced is a PROFINET CBA-compliant device. An S7-400 station equipped with this CP can be interconnected as a PROFINET CBA component in SIMATIC iMap.

The project engineering of the interconnections between the PROFINET CBA components is done in the plant view of SIMATIC iMap.

### Representation in SIMATIC iMap

- Network View in SIMATIC iMap

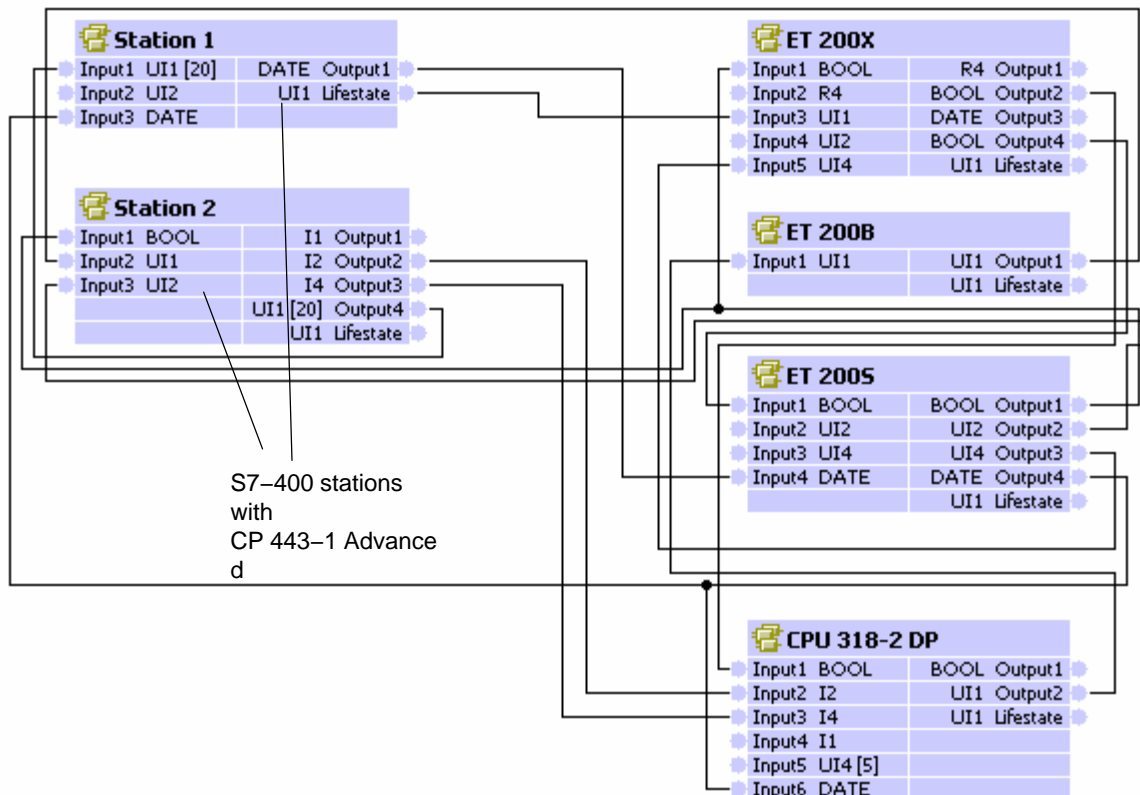
The following graphic shows the network view of SIMATIC iMap and illustrates how a CP 443-1 Advanced in an S7-400 station establishes a connection between DP slaves on PROFIBUS DP and the S7-400 station on Industrial Ethernet over an IE/PB Link.



- Plant view in SIMATIC iMap

In the plant view, the interconnection of input and outputs over the CP 443-1 Advanced becomes visible.

Here, you can only see the PROFINET CBA components with their interconnections to the process inputs and process outputs.



## Assigning Addresses and Properties

You assign addresses and properties depending on the component type of the S7-400 station as follows:

- S7-400 station as singleton component  
Addresses and properties can only be changed in STEP 7.
- S7-400 station as standard component  
Addresses and properties can only be changed in SIMATIC iMap.

## Downloading Configuration Data

When using PROFINET CBA, downloading configuration data depends on the component type of the S7-400 station, as follows:

- S7-400 station as singleton component

Step	Explanation / Meaning
1.	<ul style="list-style-type: none"> <li>• Downloading with STEP 7 Download the user program and configuration data to the S7-400 station with STEP 7.</li> </ul>
2.	Downloading the interconnection information of the process inputs and process outputs to the PROFINET CBA components over the Ethernet port with SIMATIC iMap.

- S7-400 station as standard component

Step	Explanation / Meaning
1.	<ul style="list-style-type: none"> <li>• Downloading with SIMATIC iMap Download the user program and configuration data to the S7-400 station with SIMATIC iMap.</li> </ul>
2.	Downloading the interconnection information of the process inputs and process outputs to the PROFINET CBA components over the Ethernet port with SIMATIC iMap.

### Note

When you reload user program blocks, data consistency is only guaranteed if the CPU is first changed to STOP.

### Caution

If problems occur while downloading interconnections from SIMATIC iMap, for example power down on the target station, it is not always possible to download the interconnections again when the power returns.

If this error occurs, SIMATIC iMap reports the station as being unreachable.

Remedy:

Using the module switch or the PG command, change the CP 443-1 Advanced from STOP to RUN to bring the target station back an operational status and to allow the interconnections to be downloaded again from SIMATIC iMap.

## Device Diagnostics in SIMATIC iMap

In online view of SIMATIC iMap, you can use diagnostic functions and, for example, read out device and functional information.

---

### Note

For more detailed information on adopting the configuration from STEP 7 and use with PROFINET CBA and the SIMATIC iMap engineering tool, refer to the documentation on SIMATIC iMap /6/.

---

## 7.4 Using PROFINET CBA Communication and Standard Communication at the same Time

---

### Notice

The information in this section applies only if a singleton component was created from the S7-400 station. With a standard component, the connection information configured in STEP 7 is lost.

---

### Overview

Parallel operation of PROFINET CBA communication and standard communication with the S7 communication and S5-compatible communication services is possible with the CP.

This mode is important for your application when, for example, you want to implement communication between existing “conventional” SIMATIC devices and PROFINET CBA devices in an existing system.

The special feature is that the configuration of the communication for PROFINET CBA devices is only possible in SIMATIC iMap. Communication with conventional devices, on the other hand, requires that the connections are configured in STEP 7.

### Recommended Procedure

Here, we would like to give you a few tips and recommendations.

For communication between a PROFINET CBA device and a conventional device, use S7 or TCP or ISO-on-TCP connections.

Configure the S7 and TCP connections in STEP 7 as follows:

- for S7 communication

- PROFINET CBA device:  
one-end passive (partner unspecified)  
(No configuration necessary, if the device is operated only as a server for S7 communication.
- conventional device: single-ended, active
- for S5-compatible communication (TCP / ISO-on-TCP connections)
  - PROFINET CBA device and specified, passive
  - conventional device: unspecified, active

This achieves the following:

- You can specify the connection after for the conventional devices at any time with STEP 7.
- You can use the PROFINET devices in SIMATIC iMap (in other words connect them) without having to change the connection configuration again in STEP 7; the devices are always ready to send and receive on the configured connections (connection is established by the active partner).

For the PROFINET CBA device, this means the following procedure:

Step	Explanation / Meaning
1.	First configure unspecified connections in STEP 7 (only with TCP – see above).
2.	Create suitable user programs in STEP 7 to handle communication with the conventional devices.
3.	Then generate the PROFINET CBA components in STEP 7 and enter these in the SIMATIC iMap library.
4.	Interconnect the PROFINET CBA component in SIMATIC iMap.
5.	Downloading the user program and configuration data to the S7-400 station with STEP 7.
6.	Downloading the interconnection information of the process inputs and process outputs to the PROFINET CBA components over the Ethernet port with SIMATIC iMap.

## 8 The CP 443-1 Advanced as Web Server: HTML Process Control

The CP 443-1 Advanced provides you with the function of a Web server for access using a Web browser.

The CP 443-1 Advanced provides an additional memory area for storage of files. This area is used to store HTML pages and S7 applets.

HTML pages are used to indicate and display information in a Web browser. S7 applets are Java applets specially written for SIMATIC S7 and that are used to allow write or read access to the S7-CPU.

When the CP 443-1 Advanced is supplied, there are HTML system pages, S7 applets, S7 beans and further information in the file system.

**Please note the following special features when operating IT functions:**

---

### Note

The data exchange for productive communication (S7 connections + SEND/RECEIVE connections) always has a higher priority than data exchange with the Web browser. This can lead to delays in the HTML process control in the Web browser.

---

### Web Browser

To access the HTML pages on the CP 443-1 Advanced, you require a Web browser.

The following Web browsers are suitable for communication with the CP 443-1 Advanced (other browsers also possible):

- Netscape Communicator (recommended version: 4.7 or higher)
- Internet Explorer (recommended version: 5.0 or higher)

These Web browsers support all the requirements necessary for the implementation of the IT functions (Java reference implementation – Java Development Kit) 1.1.x is supported) in conjunction with the CP 443-1 Advanced.

You will find these Web browsers, information and addons on the Internet.

## 9 Compatibility with Predecessor Products

### 9.1 Enhanced Functions

#### **This is new:**

#### **Functional enhancements compared with 6GK7 443-1EX40-0XE0 V2.4**

The CP 443-1 Advanced (6GK7 443-1EX41-0XE0) has an interface optimized for operation of PROFINET IO. To interface PROFINET IO devices, some of the SFCs/SFBs differ from those used with the predecessor module.

Operation as a PROFINET IO controller requires CPUs complying with version V5.x.

If you use CPUs complying with version V4.x, all other services are supported with the exception of PROFINET IO controller mode.

### 9.2 Restrictions

Compared with previous modules, please note the following general restrictions:

- The 15-pin D-sub female connector for connecting AUI or Ind. Twisted Pair has been omitted (applies to EX41 and EX40).
- The CP is not intended for operation with an S7-400H programmable controller (fault-tolerant system).

---

#### **Notice**

H connections are not yet supported when using this CP and configuring it with STEP 7 version V5.4.

---

### 9.3 Replacing Older Modules / Spares

The CP 443-1 Advanced described here allows communication both using the ISO transport protocol as well as the TCP/IP protocol. It also includes the full IT functionality of the CP 443-1 IT. It is fully compatible with and, taking into account the restrictions described above, can be used to replace previous modules:

You will find more information on the previous modules listed below in the rest of this chapter:

- CP 443-1 Advanced with order number 6GK7 443-1EX40-0XE0
- CP 443-1 with order number 6GK7 443-1EX11-0XE0
- CP 443-1 IT with order number 6GK7 443-1GX11-0XE0

## Module Replacement with the CP 443–1 Advanced (6GK7 443–1EX40–0XE0)

When replacing an older module with the new module (EX41) , please keep to the steps outlined below:

### Step 1: Replacing the CP

	Explanation / Meaning
1.	Remove the module you want to replace from the rack.
2.	Insert the C–PLUG from the replaced module in the new module.
3.	Insert the new module with the C–PLUG taken from the removed module (EX40) in the rack.

#### Notes:

- You do not need to turn the power off and on.
- The C–PLUG taken from the removed module has the ID “EX40”; this has no effect on operation of the new CP (EX41).

If, however, you do not want to keep this ID, you must either use the C–PLUG supplied with the new CP or reformat the C–PLUG of the old module. You must then, however, supply the CP with an IP address again (node initialization).

### Step 2: Adapting the configuration

	Explanation / Meaning
4.	In STEP 7 / HW Config, replace the previously configured CP with the new module from the hardware catalog.
5.	As soon as you drag the new module from the catalog to the module to be replaced in HW Config, the configured connections and data are adopted.
6.	if necessary, extend the configuration to meet your requirements, for example in the Properties dialog of the Ethernet subnet.
7.	Save and compile the project.
8.	Download the configuration data to the target system again.

## Replacing further modules

Depending on the module type and mode, there are different ways of making the replacement:

- 

In this case, it is not necessary to adapt or download the configuration data; all characteristics of the new module are the same as those of the replaced module.

This variant is possible only when the originally used CP supports data storage on the CPU and you selected this option.

Step	Procedure
1.	Remove the module you want to replace from the rack.
2.	Insert the new module in the rack.

- **Data stored on the CP: Module replacement and download**

The module needs to be supplied with the existing or adapted configuration data.

This variant is necessary when the originally used CP only supports data storage on the CP (replacement without download not possible) or the option “Data storage on CP” was selected.

- Variant a: Adapt the module type in the configuration (ideal solution)

If you adopt the configuration data unchanged and therefore leave the “Data storage on CP” mode, you do not make use of the new option for protecting data from a power down as provided by the CP. We therefore recommend that you adapt the existing configuration to the new CP type whenever possible:

	Explanation / Meaning
1.	In STEP 7 / HW Config, replace the previously configured CP with the new module from the hardware catalog.
2.	As soon as you drag the new module from the catalog to the module to be replaced in HW Config, the configured connections and data are adopted. The mode is automatically configured as “Data storage on the CPU”.
3.	Save and compile the project.
4.	Download the configuration data to the target system again.

– Variant b: Module type unchanged

If you do not want to use any of the new performance of the CP and do not need to protect the data from power down, you can replace the module without any configuration changes as follows:

Step	Procedure
1.	Remove the module you want to replace from the rack.
2.	Insert the new module in the rack.
3.	Download the configuration data from the project on the PG/PC to the new module.

**Result:**

After downloading the configuration, the CP changes to RUN.

**Note:**

Following a power cycle (OFF/ON), the CP remains in STOP because there is no longer a configuration available; the configuration must be downloaded again.

From the following table 3-1, you can see which of the options described above exist for the available module types. Refer to the description above for the possible procedures.

Table 3-1 Response of the Module following Module Replacement

Previously Used Module	Data Storage (configurable)		Response / Notes
	CP	CPU	
6GK7 443-1EX11-0xE0	X	X	Replacement with non-identical spare is possible; response depending on data storage in the previous module.
6GK7 443-1GX11-0xE0	X	X	Replacement with non-identical spare is possible; response depending on data storage in the previous module. <ul style="list-style-type: none"> <li>Retentiveness of data storage on the CP: IP address is retained following a power cycle; this means that downloading and diagnostics is possible using the existing IP address.</li> <li>The IT functionality in the new CP corresponds to the range of functions of the previous module.</li> </ul>

---

**Caution**

When installing the CP for use as a PROFINET IO controller, note the following points about the power supply:

When using the CP in the central rack or in a universal rack operating as central rack, you should not insert or remove the CP 443-1 Advanced when the power is on. If you remove the CP when the power supply is on, the CPU changes to STOP and indicates "I/O error" (in contrast to previous modules!).

After inserting the module with power applied, it is essential to turn the power supply off and on again.

Note:

If the CP is operated without PROFINET IO, it is possible to insert and remove the CP when the power is no without affecting the CPU.

---

## 10 Further Notes on Operation

### 10.1 Memory Reset / Resetting the to the Factory Settings

The CP has a two-level function available for resetting memory:

- Clear / reset
- Resetting to factory settings

---

#### Notice

With the functions for memory reset and resetting to the factory settings described here, the configuration data on the CPU is not changed! Only the data maintained on the CP (C-PLUG and RAM areas) is deleted.

If you subsequently upload the configuration data from the CPU to a PG you will always object the configuration data that were previously on the CP (with parameters, connections, IP address).

---

#### How to Use the Functions

You can start the memory reset functions in STEP 7. The CP must be in STOP. If you use PROFINET IO, the CPU must also be in STOP mode.

- Clear / reset  
In STEP 7/HW Config with **PLC ▶ Clear/Reset**  
or  
In STEP 7 / NCM Diagnostics with **Operating Mode ▶ Clear/Reset Module**
- Resetting to factory settings  
In STEP 7 / NCM Diagnostics with **Operating Mode ▶ Reset to Factory Defaults**

#### Behavior after Memory Reset

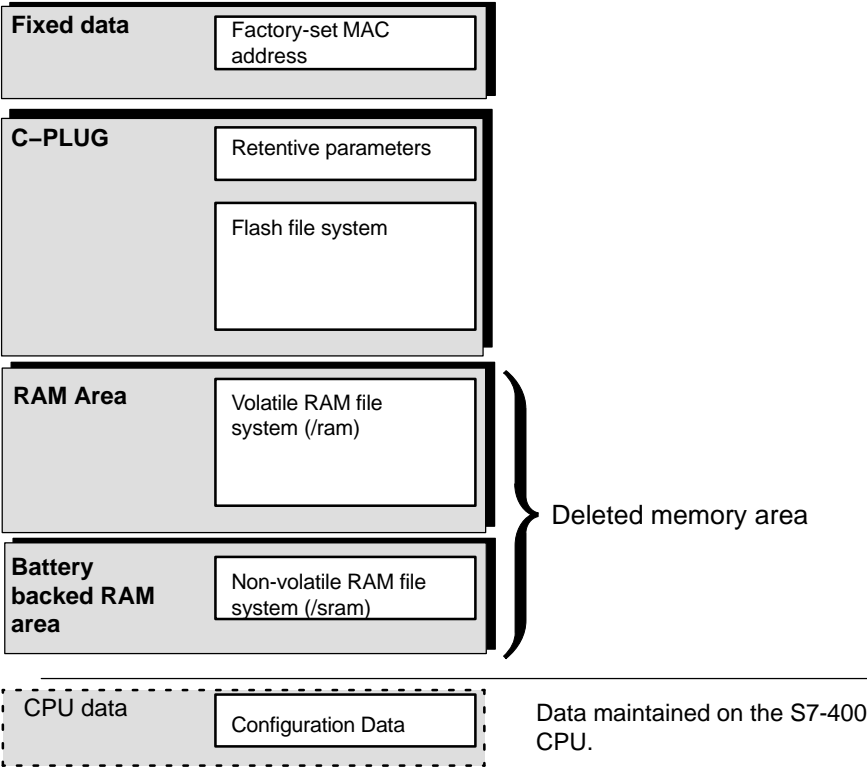
The CPU in the S7 station does not recognize that the CP memory was reset. The CP therefore changes to the “stopped with error” state (see Chapter 4).

The configuration data must then be reloaded. You can initiate this loading by turning the power off and on again.

Memory Reset – Effects

Following this memory reset, the CP retains the newly configured MAC address and the retentive parameters. The CP is therefore immediately ready for downloads using the IP address.

Overall, this has the following effects:

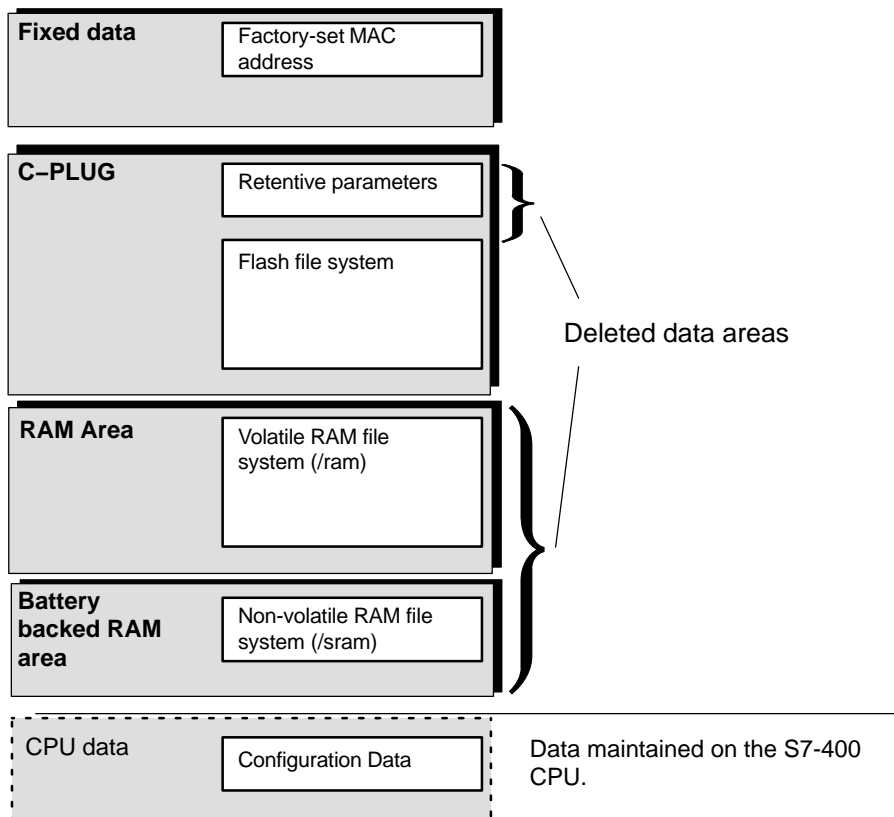


## Resetting to Factory Settings – Effects

After it has been reset to the factory settings, the CP still has the MAC address that was set in the factory (as shipped).

The data in the file system of the C-PLUG (flash area) is retained, the retentive parameters are deleted.

Overall, this has the following effects:



### Note

Please note that the interconnection information for PROFINET CBA belongs to the retentive parameters in the C-PLUG and will therefore be deleted when you reset to the factory settings.

## 10.2 Working with Fast Ethernet – automatic switchover

### How Autosensing and Autonegotiation Works

On all 4 ports, the CP has a 10/100 Mbps full duplex interface with autosensing and autonegotiation of the network settings. After turning on the CP, these functions work as explained below:

- The CP attempts to detect the transmission rate used by the partner.
- If detection is possible, the CP attempts to negotiate an optimum duplex mode with the partner.
- If no negotiation is possible, the CP uses the previously detected transmission rate and half duplex.

The duration of the steps described here is approximately 2 seconds.

### Automatic Setting or Individual Network Settings

As default, the CP is configured for automatic detection. As soon as you define a configuration manually when configuring the CP with STEP 7/HW Config (in the properties dialog of the CP – “Port Parameters” tab), the automatic switchover is no longer effective. This also applies to the autocrossing mechanism described below.

### Autocrossing Mechanism

With the autocrossing mechanism integrated in the switch, it is possible to use a standard cable to connect the PC/PG. A crossover cable is not necessary.

---

#### Notice

Manual configuration

If a port is set to manual configuration, the autocrossing mechanism is also deactivated for this port. The port then behaves like the interface of a switch. In this case, the following applies:

- Connecting an end device  
To connect an end device that does not have the autocrossing mechanism (for example CP 443-1 with order number 6GK7 443-1EX11-0XE0), you must **not** use a crossover cable.
  - Connecting to a switch  
To connect a switch, that does not support the autocrossing mechanism, use a crossover cable.
-

## Diagnostics

Diagnostics of the port settings for the CP described here is possible only using the entries in the diagnostic buffer over SNMP, NCM diagnostics, and the LED displays.

## Further Notes:

- 10/100 Mbps network components without “Autonegotiation”

If you use 10/100 Mbps network components that do not support “Autonegotiation”, it is possible that you will have to set the mode manually.

- Forcing a specific mode instead of “Autonegotiation”

If your application requires a fixed mode instead of “Autonegotiation”, you will need to match up the partner devices.

- No reaction to Autonegotiation query with manual configuration

Remember that if you configure the CP manually, it will not react to an autonegotiation query! As a result, a connected partner will not be able to set the required mode and communication will not be ideal.

Example:

If, for example, the CP is set to “100 Mbps – full duplex”, a CP connected as partner will set “100 Mbps – half duplex”. Reason: Due to the fixed setting, no autonegotiation response is possible; the connected partner recognizes the 100 Mbps with autosensing but nevertheless remains in half duplex.

- Recommendation: Change individual network settings only over MPI.

If you modify the LAN settings in the properties dialog of the CP in the “Port Parameters” tab using the “Transmission medium/Duplex” option, these changes will be adopted by the CP and activated when the configuration data is downloaded to the CP.

We therefore recommend that you download configuration data to the S7 station over an MPI connection if you change this setting.

If you download the configuration data over the LAN interface, depending on the selected setting, it is possible that the current download will not be completed due to the changes to the configuration taking immediate effect and an inconsistent configuration is reported.

Example:

The download is started initially with the setting TP/ITP at 10 Mbps half duplex. If the “Individual network setting” is now changed to 100 Mbps full duplex, the download cannot be completed.

## 10.3 Time-of-Day Synchronization

### Procedure

The CP supports the two modes explained below for time-of-day synchronization:

- SIMATIC mode

If the CP receives MMS time-of-day messages, its local time is synchronized providing the NTP mode was not defined during configuration (MMS = Manufacturing Message Specification).

The advantage of this mode is that it is generally more accurate than the NTP mode (guaranteed  $\pm 1$  ms). In contrast to the NTP mode, it is not possible to forward the time of day over routers; in other words, to other subnets.

- NTP mode (NTP: Network Time Protocol)

In the NTP mode, the CP sends time queries (in the client mode) at regular intervals to the NTP server in the subnet (LAN). Based on the responses of the server, the most reliable and most accurate time of day is calculated and the time synchronized on the station (in all modules with time-of-day functionality).

The advantage of this mode is that time-of-day synchronization is possible over different subnets. The accuracy depends on the quality of the NTP server used.

---

### Note

No automatic changeover to daylight saving is defined in NTP. As a result, you may need to implement this changeover using a program application.

---

---

### Notice

Note the following regarding time-of-day synchronization in NTP mode:

If the CP recognizes an NTP frame as being “not exact” (example: NTP server is not externally synchronized), it is not forwarded to the communication bus. If this problem occurs, none of the NTP servers is displayed as “NTP master” in the diagnostics; rather all NTP servers are displayed only as being accessible.

---

## Forwarding the Time-of-Day Message

You can configure the direction in which time-of-day messages are forwarded in STEP 7 / NCM S7 in the properties dialog of the CP.

The CP 443-1 Advanced forwards time-of-day messages in the following directions depending on the project engineering configuration:

- From the CPU to Industrial Ethernet over the K bus  
when the local CPU is time master (SIMATIC mode only) or when the time of day is forwarded by a difference CP on the K bus.
- From Industrial Ethernet over the communication bus to the CPU  
when one of the following components is the time master:
  - In the SIMATIC mode:
    - a remote CPU 41x
    - a SIMATIC NET time transmitter
    - a CP 1430 TF
  - an NTP server when using the NTP mode

As default, time-of-day synchronization is not activated for the CP and it does not therefore forward the time. However, the internal clock of the CP is also synchronized in this situation when a time-of-day frame is received from the communication bus or from Industrial Ethernet.

Synchronization using one of the two modes described here must be configured in STEP 7 in the properties dialog of the CP – “Time-of-Day Synchronization” tab.

For more detailed information on the parameters and options, please refer to the online help in the properties dialog.

## Coordinating Forwarding of the Time of Day with Several CPs

If there is more than one CP in a station connected to the same network, only one of these CPs is allowed to pass on time-of-day messages.

You can therefore make the following settings in the configuration:

- Automatic

The CP receives the time-of-day message from the LAN or from the station and forwards it to the station or to the LAN.

If several CPUs are being operated in the station, this automatic setting can lead to collisions. To avoid this, you can specify the direction of forwarding with the following options:

- From station to LAN
- From LAN to station

## 10.4 Recommendations for Use with a High Communications Load

### Background

When using the CP described here, the points below will help you to avoid overload situations on your CPU.

In particular when you replace an older CP with the CP described here and are then confronted with overload problems, you should check your application for the pitfalls outlined below.

### Known Problems

- The functions for sending and receiving (FC5/FC6 or FC50/60) are often called cyclically in OB1. This leads to constant communication between the CPU and CP. As a result, other types of communication such as PG functions cannot be executed or only very slowly.
- HMI systems access data of the CPU too often using S7 functions. This slows down communication generally and can lead to lack of resources on the CPU if SEND/RECEIVE FCs are called in OB1 cyclically (effect: reduced data throughput or increased reaction time).

### Remedy

The recommendations below will help to avoid these situations:

- Do not call communication blocks cyclically in OB1!  
Communication should be called time-controlled in a suitable cyclic-interrupt OB. The call interval of this OB should be significantly higher than the average cycle time of your program.
- You should set a minimum cycle time that is higher than the average runtime of OB1. This frees resources for communication on the CPU. This is, for example, a remedy for existing applications when communication already takes place cyclically in OB1.
- If necessary, reduce the time taken for communication processing on the CPU by changing the parameters set for “cyclic load due to communication” in the properties dialog of the CPU.

## 10.5 Interface in the User Program

### 10.5.1 FC Call Interface

#### Changing Call Parameters only after Job Confirmation

---

**Notice**

After a job has been triggered, you may only change the call parameters on the FC call interface of the FCs AG\_SEND or AG\_RECV again after the FC has confirmed job execution with DONE=1 or ERROR=1.

If this is ignored, it is possible that the execution of the job will be aborted with an error and resources could be permanently occupied on the CPU.

---

### 10.5.2 Programmed Communication Connections with FB55 IP\_CONFIG

#### Downloading the Configuration using FB55

FB55 allows program-controlled transfer of the configuration data.

---

**Note**

If the CP is in PG STOP mode, the configuration is downloaded using FB55, the CP then changes automatically to RUN.

---

#### IP Access Protection with Programmed Communication Connections

In principle, it is possible to set up communication connections using FB55 by programming and at the same time by configuring IP access protection. Please note the following point:

---

**Notice**

When configuring specified connections in STEP 7 / NCM S7, the IP addresses of the partners are entered automatically in the IP-ACL (IP Access Control List). The IP addresses of partners with unspecified connections (passive end points) and of partners on programmed communication paths are not entered in the IP-ACL.

---

### 10.5.3 Open TCP/IP communication

#### Use

To allow the user program to exchange data with other TCP/IP-compliant communication partners, STEP 7 provides a UDT for the connection parameter assignment and four FBs.

- UDT 65 "TCON\_PAR" with the data structure for connection parameter assignment
- FB65 "TCON" for connection establishment
- FB66 "TDISCON" for connection termination
- FB63 "TSEND" for sending data
- FB64 "TRCV" for receiving data

TCP/IP communication is connection-oriented. Data can be transmitted only when a connection has been established to the communication partner. The CPU can use several connections to a communications partner at the same time.

The following protocol variants are supported:

- ISO on TCP according to RFC 1006

#### Uses / Advantages

Higher data throughput than with the configured connections of the SEND/RECEIVE interface.

## Programming

Make the following parameter settings in the connection description (UDT 65):

- local\_tsap\_id: Byte 1 = 0xE0 (value mandatory for correct functionality)
- local\_tsap\_id: Byte 2 = Rack/slot number
- remote\_tsap\_id: Byte 1 = 0xE0 (value mandatory for correct functionality)
- remote\_tsap\_id: Byte 2 = Rack/slot number

Note: The TSAPs can be 2–16 bytes long. The first two bytes must be occupied as described, you can use the other bytes to suit your task.

---

### Notice

Note that the number of dynamically established connections also depends on the number of configured, statically established connections.

You will obtain appropriate condition codes on the call interface of the FBs....

---

Please refer to the documentation of the FBs in the online help and in the documentation on STEP 7. There, you will also find examples of parameter settings!

## 10.6 SNMP Agent

### SNMP (Simple Network Management Protocol)

The CP 443-1 Advanced supports data queries over SNMP in version 1.

SNMP is protocol language for managing networks and is easy to handle. To transmit data, SNMP uses the connectionless UDP protocol.

The information on the properties of SNMP-compliant devices is entered in MIB files (MIB = Managed Information Base). For more detailed information on working with MIB files, refer to the documentation of the SNMP client you are using (example of an SNMP client: SNMP OPC Server from SIMATIC NET).

### Supported MIB Objects

The CP supports all MIB objects of the standard MIB according to MIB II (RFC 1213).

Exceptions / Restrictions:

- Write access is permitted only for the following MIB objects:  
sysContact, sysLocation and sysName;  
For security reasons, only read access is permitted for all other MIB objects.
- Traps are not supported by the CP.

### MIB Object “Interfaces”

The “Interfaces” MIB object provides status information on the CP interfaces, with the following assignment:

Index	ifDescr
1–4	Port 1–4
5	Internal CP interface

### Access Permissions using Community Name

The CP uses the following community names for assigning permissions:

- For read access: “public”
- for read and write access: “private”

(note the use of lowercase letters!)

## 10.7 IT Functionality – “Device Structure and Status” in the System

As described in the “Information Technology with CP 343–1 IT and CP 443–1 IT” manual, the diagnostic texts can only be displayed when the STEP 7 event database is located in the file system of the CP. The STEP 7 event database must be stored there with the following file name:

/config/S7wmeld.edb (case-sensitive)

When the CP ships, this file in German in the file system and is located in the following directory:

Program files\Common files\Siemens\s7wmeldb\data

You can change the language of the diagnostic messages by copying the events database from your STEP 7 installation on a PC/PG and replacing the existing file.

The files are stored there with the naming scheme “s7wmeldb” and you must change this to “S7wmeldx.edb”.

(where x = {a,b,c,d,e,j})

a= German; b=English; c=French; d=Spanish; e=Italian; j=Japanese)

## 10.8 Possible Security Gaps on Standard IT Interfaces / Preventing Illegal Access

With various SIMATIC NET components, such as OSMs/ESMs, a wide range of parameter assignment and diagnostic functions (for example, Web servers, network management) are available over open protocols and interfaces. The possibility of unauthorized misuse of these open protocols and interfaces by third parties, for example to manipulate data, cannot be entirely excluded.

When using the functions listed above and these open interfaces and protocols (for example, **SNMP**, HTTP, Telnet), you should take suitable security measures to prevent unauthorized access to the components and the network particularly from within the WAN/Internet.

---

### Notice

We expressly point out that automation networks must be isolated from the rest of the company network by suitable gateways (for example using tried and tested firewall systems). We do not accept any liability whatsoever, whatever the legal justification, for damage resulting from non-adherence to this notice.

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If you have questions on the use of firewall systems and IT security, please contact your local Siemens office or representative. You will find the address in the SIMATIC catalog IKPI or on the Internet at

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

## 10.9 Special Features of IP Configuration

**Configured S7 connections cannot be operated if the IP address is assigned over DHCP**

---

**Notice**

If you obtain the IP address over DHCP, any S7 connections you may have configured will not work. Reason: The configured IP address is replaced by the address obtained over DHCP during operation.

---

## 10.10 Reserved Port Numbers

The following port numbers are reserved; You should not use these for other purposes in the connection configuration.

- The following port numbers are used for NTP:

65532	local port
65533	local port
65534	local port
65535	local port
- The following port numbers are used for other services:

20 and 21	TCP / FTP	local port
25	TCP / SMTP	local port
80	TCP / HTTP	local port
102	TCP / RFC106	local port
135	TCP RPC-DCOM	
161	UDP / SNMP_REQUEST	local port
34964	UDP / PN I/O	local port

## 10.11 Restart after Detection of a Duplicate IP Address in the Network

To save you time-consuming troubleshooting in the network, the CP detects double addressing in the network.

When you eliminate the cause by removing the device with the same IP address or changing its address, you must then restart the CP.

Change the mode selector to STOP and then back to RUN.

## 10.12 IP Access protection – LOG File in the File System

If IP access protection is activated for the CP (STEP 7/NCM S7, properties dialog of the CP), blocked attempts at access are registered on the CP and can be viewed with NCM diagnostics in the “IP access protection” diagnostic object. A LOG file is also created in the file system of the CP that you can view in a WEB browser.

In contrast to the recording in NCM Diagnostics, the LOG file has space for 512 entries.

You will find the LOG file as an HTML file in the file system of the CP in the following directory:

- ram/security/**IPLogFile.htm**

Further properties:

The LOG file is created as a ring buffer. When more than 512 entries have been recorded, the oldest entries are then overwritten.

Entries are made chronologically and there are no other criteria for sorting.

The LOG file is available only after IP access protection is activated for the first time.

## 10.13 Ping: Permitted length of ICMP packets

Pings with a packet size of more than 1000 bytes are evaluated as an attack and filtered by the CP. This response is deliberate and serves to increase robustness in an industrial environment.

A ping only serves to check reachability. Support of extremely long ICMP packets is not therefore a necessity.

## 10.14 Further Available Information on the CP

You will find detailed information (FAQs) on using the CP described here on the Internet under the following entry number:

<http://support.automation.siemens.com/WW/view/en/17844971>

# 11 Loading New Firmware

## Requirements

You download new firmware to a SIMATIC NET CP using the firmware loader shipped with the STEP 7 / NCM S7.

To download firmware, you require an Industrial Ethernet CP module in the PG/PC (for example, CP 1613) or a normal Ethernet module with the "Softnet PG" software package.

## How to Load New Firmware

You must always start the download using the **factory-set** MAC address of the CP!

---

### Notice

When you download the firmware, only **one** LAN cable may be attached to the 4-port switch of the module. This LAN cable must provide a PtP connection to the PG/PC with which you are downloading. Downloading over the existing Ethernet network is not permitted.

---

Follow the steps outlined below:	
1.	Set the mode selector of the CP to STOP and turn the power off and on again. The STOP LED is lit permanently for approximately 3 seconds. Following this, the LED combination "Ready for start of firmware download" is displayed for approximately 10 seconds.
2.	Connect the CP module with the PG/PC as described above.
3.	Start the download on your PG/PC. The firmware is downloaded in 2 steps. First the existing firmware is deleted. This takes approximately 10 seconds; during this time, the RUN LED and the STOP LED light up alternately. The new firmware is then accepted. While the data is being adopted, the RUN LED flashes. After the download, the CP remains in STOP.

**How to React to an Aborted Download**

Disturbances or collisions on the network can lead to packets being lost. In such cases, this can lead to an interruption of the firmware download. The firmware loader then signals a timeout or negative response from the module being loaded.

Repeat the download using the factory-set MAC address.

If you cannot start the download again following an aborted attempt, you should turn off the entire rack and turn it on again. You can then trigger the firmware download again within 10 seconds with the mode selector set to STOP. In this case, you must always use the factory-set MAC address.

During this time, the CP indicates "Ready for Firmware Download".

## 12 Technical Specifications

Table 6-1 Technical Specifications

Transmission rate	10 Mbps and 100 Mbps Note: To operate with PROFINET IO and PROFINET CBA, the transmission rate of 100 Mbps full duplex is an absolute necessity.
Interfaces	
Attachment to Industrial Ethernet	4 RJ-45 jacks
Aging time (4-port switch)	5 minutes
C-PLUG (memory submodule)	Number of write cycles: approx. 100 000
Current consumption via the S7 backplane bus from 5 V:	1.8 A maximum
Current consumption for battery backed RAM file system (/sram) from battery of power supply module	0.018 mA typical 0.063 mA maximum
Power loss	7.25 W
Permitted ambient conditions <ul style="list-style-type: none"> <li>Operating temperature</li> <li>Transportation/storage temperature</li> <li>Relative humidity max.</li> <li>Altitude</li> </ul>	0 °C to +60 °C –40 °C to +70 °C 95% at +25 °C up to 2000 m above sea level
Design	
Dimensions, module in casing H x W x D (mm)	290 x 25 x 210
Weight	approx. 700 g

In addition to the specifications listed here, the "General Technical Specifications" listed in the reference manual S7-400/M7-400 "Module Data" /13/ apply to the CP 443-1 Advanced.

- Electromagnetic compatibility
- Transportation and storage conditions
- Mechanical and climatic ambient conditions
- Insulation tests, class of protection and degree of protection



## 13 Other Information available about the CP

### FAQs on the Internet

You will find detailed information (FAQs) on using the CP described here on the Internet under the following entry number (entry type "FAQ"):

<http://support.automation.siemens.com/WW/news/en/17844971>

### You will find the following information in the general Part A of the manual:

- A list of the documents require for configuration, commissioning and operation (Preface)
- Detailed descriptions of configuration and commissioning of the module
- Description of the IT functions
- Description of Web diagnostics and NCM S7 Diagnostics
- The approvals of the device (Appendix)
- A glossary (Appendix)

The general Part A of the manual is available in the Manual Collection that ships with the device or on the Internet at the following address:

<http://support.automation.siemens.com/WW/view/en/30374198>

# 14 References and Literature

## Locating Siemens literature

The order numbers for Siemens documentation can be found in the catalogs "SIMATIC NET Industrial Communication, catalog IK PI" and "SIMATIC Products for Totally Integrated Automation and Micro Automation, catalog ST 70".

You can obtain these catalogs and any further information you require from your local SIEMENS office or national head office.



Some of the documents listed here are also in the SIMATIC NET Manual Collection supplied with every S7-CP.

Many SIMATIC NET manuals are available on the Internet pages of Siemens Customer Support for Automation:

<http://support.automation.siemens.com/WW/view/de>

Enter the ID of the relevant manual as a search key. The ID is shown below the literature name in brackets.

Manuals that are installed with the online documentation of the STEP 7 installation on your PG/PC, can be selected from the Start menu (Start > SIMATIC > Documentation).

You will find an overview of the SIMATIC documentation at:

[http://www.automation.siemens.com/simatic/portal/html\\_76/techdoku.htm](http://www.automation.siemens.com/simatic/portal/html_76/techdoku.htm)

## On configuration, commissioning and use of the CP

- /1/ SIMATIC NET  
S7 CPs for Industrial Ethernet  
Manual  
Siemens AG  
(manual for each CP in the SIMATIC NET Manual Collection)
- /2/ Version history / current downloads for SIMATIC NET S7 CPs  
Siemens AG  
(SIMATIC NET Manual Collection)

## On configuration with STEP 7 / NCM S7

- /3/ NCM S7 for Industrial Ethernet  
Primer  
Siemens AG  
Part of the online documentation in STEP 7

- /4/** SIMATIC NET, Instructions  
Commissioning PC Stations  
Siemens AG  
(SIMATIC NET Manual Collection)
- /5/** SIMATIC  
Configuring Hardware and Connections with STEP 7  
Part of the STEP 7 documentation package STEP 7 Basic Knowledge”  
Part of the online documentation of STEP 7  
Siemens AG

### **On project engineering of PROFINET CBA (components and systems):**

- /6/** Component based Automation – Configuring Plants with SIMATIC iMap  
Manual  
Siemens AG  
(ID: 18404678)
- /7/** Basic Help in the SIMATIC iMap Engineering Tool (online help)  
Siemens AG
- /8/** Component Based Automation – Configuring Plants in SIMATIC iMap  
Siemens AG  
(ID: 22762190)
- You will find further information on SIMATIC iMAP at:  
<http://support.automation.siemens.com/WW/view/en/0805413>

### **On programming**

- /9/** SIMATIC NET  
Functions (FC) and Function Blocks (FBs) for SIMATIC NET S7 CPs  
Programming Manual  
Siemens AG  
(SIMATIC NET Manual Collection)
- /10/** Version history of the SIMATIC NET function blocks and functions for SIMATIC S7  
Reference work  
Siemens AG  
(SIMATIC NET Manual Collection)
- /11/** SIMATIC – Programming with STEP 7  
Part of the STEP 7 documentation package STEP 7 Basic Knowledge  
Part of the online documentation of STEP 7  
Siemens AG

- /12/**      Automatisieren mit STEP 7 in AWL und SCL (ISBN: 978–3–89578–280–0) /  
Automating with STEP 7 in STL and SCL (ISBN: 978–3–89578–295–4)  
User manual, programming manual  
Berger, Hans  
Publicis KommunikationsAgentur GmbH, GWA, 2006

### **For installation and commissioning of the CP**

- /13/**      SIMATIC S7  
S7–300 Automation System  
– CPU 31xC und 31x Installation: Operating Instructions (ID: 13008499)  
– Module Data: Reference Manual (ID: 8859629)  
Siemens AG
- and
- SIMATIC S7  
S7–400, M7–400 Automation system  
– Installation Manual (ID: 1117849)  
– Module Data: Reference Manual (ID: 1117740)  
Siemens AG

### **On using and configuring PROFINET IO**

- /14/**      SIMATIC  
PROFINET System Description  
System Manual  
Siemens AG  
(Part of the Manual Collection)
- /15/**      SIMATIC  
From PROFIBUS DP to PROFINET IO  
Programming Manual  
Siemens AG  
(Part of the Manual Collection)

### **On the IT functions of the CPs**

- /16/**      Data Security in Industrial Communication  
White Paper  
SIEMENS AG  
([http://www.automation.siemens.com/net/html\\_76/support/whitepaper.htm](http://www.automation.siemens.com/net/html_76/support/whitepaper.htm))
- /17/**      Creating Java Beans with IBM VisualAge  
SIEMENS AG  
(ID: 10499820)

- /18/** S7Beans / Applets for IT-CPs  
Programming Aid  
SIEMENS AG  
(SIMATIC NET Manual Collection)  
(ID: 24843908)

### **On setting up and operating an Industrial Ethernet network**

- /19/** SIMATIC NET  
Manual Twisted Pair and Fiber-Optic Networks  
Siemens AG  
(SIMATIC NET Manual Collection)
- /20/** SIMATIC NET  
Manual Triaxial Networks  
(SIMATIC NET Manual Collection)

### **SIMATIC and STEP 7 basics**

- /21/** Communication with SIMATIC  
System Manual  
Siemens AG  
(ID: 25074283)
- /22/** Documentation package "STEP 7 Basic Knowledge"  
with  
– Working with STEP 7 V5.4 Getting Started (ID: 18652511)  
– Programming with STEP 7 (ID: 18652056)  
– Configuring Hardware and  
Communication Connections with STEP 7 (ID: 18652631)  
– Form S5 to S7, Converter Manual (ID: 1118413)  
Siemens AG  
Order number 6ES7 810-4CA08-8AW0  
Part of the online documentation in STEP 7
- /23/** Documentation package "STEP 7 Reference"  
with  
– Statement List (STL) for S7-300/400 (ID: 18653496)  
– Ladder Diagram (LAD) for S7-300/400 (ID: 18654395)  
– Function Block Diagram (FBD) for S7-300/400 (ID: 18652644)  
– System and Standard Functions for S7-300/400 Volumes 1 and 2 (ID: 1214574)  
– System software for S7-300/400 System and Standard Functions Part 2  
Siemens AG  
Order number 6ES7 810-4CA08-8AW1  
Part of the online documentation in STEP 7

**Other topics**

- /24/** Ethernet, IEEE 802.3 (ISO 8802–3)  
(<http://www.ieee.org>)
- /25/** RFC1006 (ISO Transport Service on top of the TCP Version: 3)  
Request For Comment  
(<http://www.ietf.org>)
- /26/** RFC793 (TCP)  
(<http://www.ietf.org>)
- /27/** RFC791 (IP)  
(<http://www.ietf.org>)