SIEMENS

SIMATIC NET

CP 243-1
Communications processor
for Industrial Ethernet

Technical manual

CP 243-1
Ethernet CP

SF   LINK | RUN
RX/TX CFG

6GK7 243-1EX00-0XE0

Classification of safety instructions

This manual contains instructions that should be observed to ensure your personal safety and to protect the equipment from damage. The instructions are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

⚠ **Danger**

indicates an imminently hazardous situation which, if appropriate precautions are not taken, **will** result in death or serious injury.

⚠ **Warning**

indicates an imminently hazardous situation which, if appropriate precautions are not taken, **may** result in death or serious injury

⚠ **Caution**

used with a warning triangle indicates an imminently hazardous situation which, if appropriate precautions are not taken, may result in minor injury.

Caution

used without a warning triangle indicates an imminently hazardous situation which, if appropriate precautions are not taken, may result in property damage.

Attention

indicates an imminent situation which, if the instructions are not adhered to, may result in an undesirable result or state.

Note

highlights an important item of information about the product or its use, or indicates a section of the instructions that deserves careful attention as it contains information that may be beneficial to the user.

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Safety-related information on the product

Before using the product described here, it is imperative that you observe the following safety-related information.

Qualified personnel

The equipment may be commissioned and operated by qualified personnel only. For the purposes of the safety instructions in this instruction manual, a Qualified Person is one who is authorized to commission, ground and label devices, systems and circuits in accordance with accepted safety standards.

Intended use of hardware products

Please observe the following information regarding the intended use of hardware products:

Caution

The device may only be used in applications as provided for in the catalog and in the technical description, and only in connection with non-Siemens products and components that have either been recommended or approved.

Successful and safe operation of this equipment is dependent on proper transport, handling, storage, erection and installation, as well as careful operation and maintenance.

Before using the supplied sample programs or programs that you created yourself, ensure that running systems cannot endanger persons or damage machines.

EG regulation: Commissioning is prohibited until it has been established that the machine into which this component is to be installed is in compliance with the regulations of the 89/392/EWG directive.

Preface

Purpose of this manual

This manual is designed to support you in using the CP 243-1 communications processor. You are provided with information on how to employ this communications processor to communicate via Industrial Ethernet (IE).

Prerequisites

A prerequisite for understanding how the CP 243-1 works is familiarity with this manual and the "SIMATIC S7-200 Automation System" (MLFB: 6ES7298-8FA21-8AH0) manual. You must also have a basic understanding of the TCP/IP protocol.

Target group

This manual is directed toward engineers, programmers, commissioning engineers and maintenance technicians with a general knowledge of automation and communication systems and human machine interface systems.

Sample program

This manual contains a sample program that provides you with information and assistance in programming the CP 243-1. This sample program was created with STEP 7-Micro/WIN 32 (MLFB: 6ES7 810-2BC02-OYXO) and can be run on an S7-200 CPU, type 224. To run this sample program on another S7-200 CPU, you may have to adjust the configuration of the sample program.

Product Information

Address label: MAC address
The CP 243-1 is delivered with a fixed MAC address. The MAC address is affixed to the underside of the upper door of the device.

MLFB number, scope of delivery

Product name	MLFB	Scope of delivery
CP 243-1	6GK7 243-1EX00-0XE0	CP, documentation on CD-ROM

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1   Introduction

Definition and application

The CP 243-1 is a communications processor designed for operation in an S7-200 automation system. It is used for connecting an S7-200 system to Industrial Ethernet (IE**)**. The CP 243-1 also facilitates communication via Ethernet for the S7 product family. As a result, S7-200 can be remotely configured, programmed, and diagnosed via Ethernet using STEP 7 Micro/WIN 32. Moreover, an S7-200 can communicate with another S7-200, S7-300, or S7-400 controller via Ethernet. It can also communicate with an OPC server.

In the open SIMATIC NET communications system, Industrial Ethernet is the network for both the coordination level and the cell level. Technically, the Industrial Ethernet is an electrical network built on the basis of a shielded coaxial cable, twisted pair cabling, or an optical network using a fiber optic cable. Industrial Ethernet is defined by the international standard IEEE 802.3.

Continuous communication in the industry sector

Industrial Ethernet is an integral part of the SIMATIC NET concept, which together with PROFIBUS and the AS Interface ensures continuous networking of the coordination, cell and field levels.

Compatibility

The CP 243-1 (6GK7 243-1EX00-0XE0) described here can be used for S7 communication. The CP 243-1 can be connected to various types of S7-200 CPUs (222, 224, 226 and 226XM):

- CPU 222 Rel. 1.10 or higher   (Rel. 1.20 or higher is recommended)

- CPU 224 Rel. 1.10 or higher   (Rel. 1.20 or higher is recommended)

- CPU 226 Rel. 1.00 or higher   (Rel. 1.20 or higher is recommended)

- CPU 226XM Rel. 1.00 or higher   (Rel. 1.20 or higher is recommended)

A maximum of 2 expansion modules can be mounted on the CPU 222. In contrast, up to 7 expansion modules can be connected to the 224, 226 and 226XM CPUs.

A detailed compatibility specification you will find in Appendix D.

Attention

Only one CP 243-1 should be connected per S7-200 CPU. It cannot be guaranteed that the S7-200 system will operate properly if additional CP 243-1 are connected.

The CP 243-1 software is compatible with the following standards:

- S7 XPUT/XGET and S7 READ/WRITE
- S7-200 I/O bus specifications

The position in an S7-200 system in which a CP 243-1 can be operated depends on the firmware version of the S7-200 CPU, see also chapter 3 (Installation)

Planning

The CP 243-1 is configured using STEP 7 Micro/WIN 32, version 3.2.1. or higher. The CP 243-1 is always delivered with a fixed MAC address. The IP address and the subnet mask either must be configured or they must be retrieved from a BOOTP server via the BOOTP protocol. For the purpose of monitoring connections (Keep Alive), a time can be configured for all TCP transport connections with active and passive partners. A total of 8 connections to other controllers or OPC servers can be maintained at any one time.

Programming

To program the communication in the user program, use the "Ethernet Wizard" in STEP 7 Micro/WIN 32; see Chapters 4 and 5.

Configuration

The CP 243-1 firmware is programmed into the Flash memory during production and is permanently stored there.
System conditions or dynamic variable contents that are generated during CP 243-1 operation do not survive a loss of power.
The CP 243-1 is configured with STEP 7 Micro/WIN 32, version 3.2.1 or higher, and the configuration is stored in the V-Memory of the S7-200 CPU as non-volatile data. Upon booting, the CP 243-1 reads the configuration out of the CPU and initializes itself accordingly.

2 Features and Functions

2.1 Overview

The CP 243-1 features the following functions:

- S7 communication

    - Performant data communication via Industrial Ethernet. Communication is based on standard TCP/IP

    - Ethernet access via an RJ45 socket

    - Simple connection to an S7-200 system via the S7-200 bus

    - Facilitates a flexible and distributed automation structure

    - Remote programming, configuration and diagnostics of an S7-200 system (e.g. program upload and download or status displays) via Industrial Ethernet and STEP 7 Micro/WIN 32.

    - Basis for simple further processing and archiving of process data

    - Enables simultaneous communication with up to 8 S7 controllers

    - Provides a connection to S7-OPC

    - Simple network administration

    - Modules can be exchanged without requiring repeat programming/configuration (plug & play)

    - S7 communication services, "XPUT/XGET", as client and server

    - S7 communication services, "READ/WRITE", as server

- Watchdog timer
  The CP 243-1 is equipped with a Watchdog circuit. The Watchdog starts each time CP 243-1 starts up. Typically, the Watchdog monitoring time is 5 s. Due to component-related tolerances, this time can increase to 7 s. If the Watchdog monitoring time sets in, a reset of the CP 243-1 is automatically brought about. This restarts the CP 243-1. During this time, the CP 243-1 reports a "Parity Error" to the S7-200 CPU. Handling of this type of error is described in the STEP 7 Micro/WIN 32 documentation.

- Address assignment via preset MAC address (48 bit value).

    The MAC address is assigned to each CP 243-1 at the factory. It is printed on a label affixed to the underside of the upper door.
    An IP address can be assigned to the CP 243-1 via the preset MAC address using the BOOTP protocol.

2.2 S7 communication via Industrial Ethernet

2.2.1 Application

The S7 communication via Industrial Ethernet makes program-controlled communication via communication SFBs/FBs and configured S7 connections possible. The CP 243-1 supports S7 communication via Industrial Ethernet by means of the XPUT/XGET and READ/WRITE services. In general, up to 212/212 bytes of user data can be transmitted per command. However, if the CP 243-1 is being operated as a server, up to 222 bytes can be transmitted per read operation.

The CP 243-1 supports up to 8 communication channels to clients or servers on one or more remote communication partners. The CP 243-1 operates according to the client/server principle per channel. Per channel, only one command at a time is received, processed and responded to with a positive or negative response. Only after a response has been sent will the CP 243-1 accept another command.

If the CP 243-1 receives more than one command on a channel configured as a server, only the first command is processed and the following commands are ignored until the transaction is completed, i.e. until a response has been sent. The CP 243-1 is not equipped with channel-specific command management and does not buffer commands.

Prerequisites for communication with a PC/PG

As before, the S7-200 CPU can still be accessed by a PG/PC via the PPI interface. In addition, it can also be accessed via the CP 243-1 through Ethernet. The following prerequisites must be met to use this alternative:

- An Ethernet card is inserted in the PG/PC and configured, and there is an Ethernet or TCP/IP connection to the CP 243-1 (possibly through routers, firewalls, ...)

- STEP 7 Micro/WIN 32, version 3.2.1 or higher, is installed on the PC/PG.

- The CP 243-1 has been assigned a valid IP address. This address can be defined in the configuration or retrieved from a BOOTP server via the BOOTP protocol.

At this time, only one STEP 7 Micro/WIN 32 can simultaneously communicate with the S7-200 CPU via a CP 243-1.

2.2.2 Types of communication

The CP 243-1 is provided with three types of communication relationships that can be applied either individually or in combination.

1. Connection to STEP 7 Micro/WIN 32
2. Connection to further, remote components of the SIMATIC S7 family
3. Connection to OPC-based applications on a PC/PG

2.2.3 Communication partners

- S7-200 CPU with CP 243-1
- S7-300 CPU with CP 343-1 or CP 343-IT
- S7-400 CPU with CP 443-1 or CP 443-IT
- PG/PC with OPC server
- PG/PC with STEP 7 Micro/WIN 32

In the STEP 7 HW-Config program, you can identify which types of S7-300 CPUs and S7-400 CPUs support the S7 protocol, XPUT/XGET, and, hence, which ones can communicate with the CP 243-1. When you select an S7-300 or S7-400 CPU in the catalog window in the program, the selected CPU must support the "S7 communication" function.

For systems in the S7-300 series, XPUT/XGET can only be operated via Ethernet with a communications processor of version 1.1 or higher. You can identify the communications processor version by looking at the MLFB number, among other things. If you use a CP 343-1, the MLFB number must contain the sequence "EX11".

The CP 443-1 ISO cannot communicate with the CP 243-1, since the CP 443-1 ISO do not have TCP/IP and RFC 1006 on board.

Attention

Only one CP 243-1 should be connected per S7-200 CPU. It cannot be guaranteed that the S7-200 system will operate properly if additional CP 243-1 are connected.

Note

When communicating with an OPC server, it should be noted that the CP 243-1 does not support the service that automatically queries which objects are present in the S7-200 (e.g. DBxx...).

Overview:
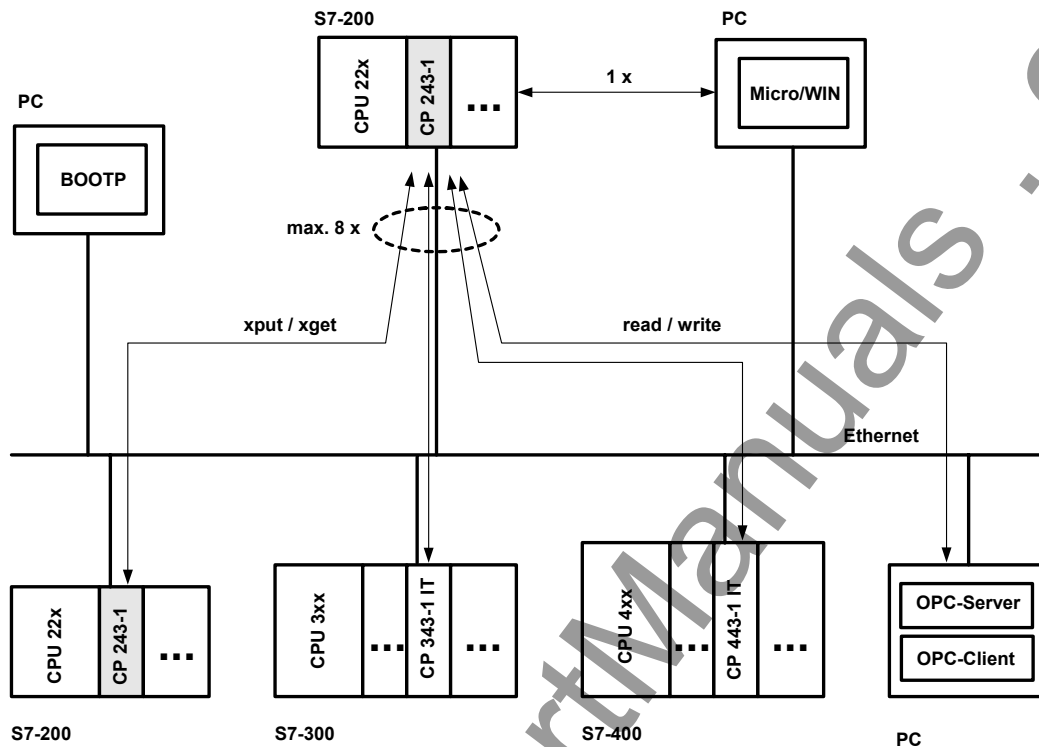
Fig. 1.   System overview

You can have a CPU 22x with CP 243-1 communicate with other S7-200, S7-300 and S7-400 systems, as well as with an OPC server.
In this case, a maximum of 8 connections are possible in addition to a STEP 7 Micro/WIN connection (see Fig. 1).

Configuring and programming connections for S7 stations

In order to configure the communication between an S7-200 and an S7-300, S7-400 or OPC server, you will require both STEP 7 Micro/WIN 32, version 3.2.1 or higher, and STEP 7, version 5.1 or higher, with Service Pack 3 or higher (with NCM for Industrial Ethernet) (see Chapter 4.5).

STEP 7 Micro/WIN 32 is used for configuring and programming the S7-200 station, while STEP 7 with NCM for Industrial Ethernet is required for configuring and programming the S7-300, S7-400 or the OPC server.

Data exchange via Industrial Ethernet

The exchange of data via the CP 243-1 is based on Ethernet and is therefore not deterministic, i.e. response times cannot be guaranteed. Network support is provided for 10 and 100 Mbit networks, each in full-duplex and half-duplex mode.

Furthermore, the CP 243-1 supports the "Auto Negotiation" function for the automatic negotiation of the mode and the transmission rate to be used. The mode and the transmission rate can also be defined by the user when configuring the CP 243-1. If the CP 243-1 was not provided with a valid configuration, it always uses the "Auto Negotiation" mode by default.

Note

The Auto Negotiation (Auto Detect Communications) mode only operates if all connected network components support this mode.

Industrial Ethernet and TCP/IP do not permit time-deterministic data flows. It cannot be predicted at what time a remote CPU will execute the requested commands. The responses from the remote CPU are asynchronous to the CPU scan of the local CPU. Therefore, TCP/IP-based communication has only limited suitability for distributed applications with time-related requirements (e.g. control loop, periodic sampling).

S7 communication

The S7 services, XPUT and XGET, are used for data exchange between two controllers. Here, the CP 243-1 can be implemented as both a client and a server.

Communication between a CP 243-1 and an OPC server running on a PC/PG is based on the S7 services, READ and WRITE. In this case, the CP 243-1always acts as the server. Other S7 services, such as the service that automatically queries which objects are currently present in an S7-200 (DBs, ...), are not supported.

The following data types or data areas are supported by the CP 243-1:

CP 243-1 as client:

Read and write access:

- The data type is always BYTE

- Only variables can be accessed on the local system.

- The memory areas that are accessible on the partner system when an S7-200 is acting as a partner are inputs, outputs, flags and variables.

- The memory areas that are accessible on the partner system for an S7-300 or an S7-400 are inputs, outputs, flags and data areas.

CP 243-1 as server:

Write access:

- The data type is BOOL, BYTE, WORD or DWORD

- Accessible memory areas on the local system are inputs, outputs, variables, flags and status bits.

Read access:

- The data type is BOOL, BYTE, WORD or DWORD

- Accessible memory areas on the local system are inputs, outputs, variables, flags, system areas and status bits.

Further compatibility see Appendix D.

Communication with STEP 7 Micro/WIN 32

The CP 243-1 is always the server for communication between a CP 243-1 and STEP 7 Micro/WIN 32. In this case, STEP 7 Micro/WIN 32 always acts as client.

I/O bus communication

All data areas of the S7-200 CPU can always be accessed. Read and write access is independent of whether the CPU is in the RUN, TERM or STOP state.

2.3 Security

2.3.1 Configuration

The CP 243-1 configuration is stored in the S7-200 CPU as non-volatile data. The validity of the configuration is ensured using a CRC mechanism.

When a CP 243-1 configuration is stored, STEP 7 Micro/WIN 32 calculates a CRC checksum. This checksum is stored together with the configuration. When the CP 243-1 reads out the configuration, it checks this checksum and in this way can recognize unintentional changes to the stored configuration data.

This CRC mechanism can also be disabled. The configuration can then be changed either manually or from an S7-200 user program.

Attention

The CP 243-1 cannot completely check the configuration data for consistency with regard to intentional and unintentional changes after the CRC check has been switched off. In this case, therefore, there is no guarantee whatsoever that the CP or the components connected in the network will function correctly.

Attention

The CP 243-1 recognizes that the CRC is disabled when a certain byte in its configuration is set to a particular value. If precisely this value should happen to be set in the configuration, either intentionally or unintentionally, the CRC check will be disabled. Therefore, it is strongly advised that the configuration be generated with the Ethernet Wizard integrated in the STEP 7 Micro/WIN 32, and that the S7-200 program be checked for memory operations running in the data area in which the CP 243-1 configuration data is stored.

2.3.2 Data security

The CP 243-1 represents a physical connection between Ethernet and the S7-200 I/O bus. Therefore, it offers:

- no protection against intentional or unintentional manipulation of data area and/or system status of the local or remote CPUs
- no firewall functionality

Therefore, it is recommended that it be used exclusively within local Intranets that are shielded from the public network by appropriate security mechanisms.

The CP 243-1 terminates an active STEP 7 Micro/WIN 32 connection if no STEP 7 Micro/WIN commands have been sent to the CPU for 60 seconds. This prevents the Micro/WIN server in the CP 243-1 from remaining blocked due to network faults and hindering a reconnection with STEP 7 Micro/WIN.

Note

The CP 243-1 allows server access to the S7-200 CPU, both in RUN and STOP mode of the CPU. However, the program variables or peripheral values are not updated in the STOP mode.

2.3.3 Integrity of communication

The CP 243-1 is equipped with a life-signs monitoring mechanism ("Keep Alive" mechanism). With the aid of this mechanism, the CP 243-1 is able to automatically detect, within a configurable time period, that a communications partner or the associated connection has failed.

The Keep Alive time specified when configuring the CP 243-1 is the time period after which internal mechanisms that attempt to reach the communications partner are started. Processing of these mechanisms takes approx. 10 seconds. If the communications partner cannot be reached within this time period, the CP 243-1 automatically terminates the connection to this partner. If the CP 243-1 was being operated as a client, it then attempts to re-establish this connection. The user is notified of the failure of a communications partner by the mechanisms described in Chapter 6.

In general, you should activate the Keep Alive mechanism in all system involved in communication, provided these system are equipped with such a mechanism.

Note

For the Keep-Alive mechanism to function, this mechanism must also be supported by the communications partner in accordance with RFC1122 and RFC793.

2.4   Connections

Front view:

Integrated ribbon cable with socket for I/O bus

Connector for I/O bus

8-pin RJ45 socket for Ethernet connection

Terminal block for 24 V DC supply voltage and ground connection
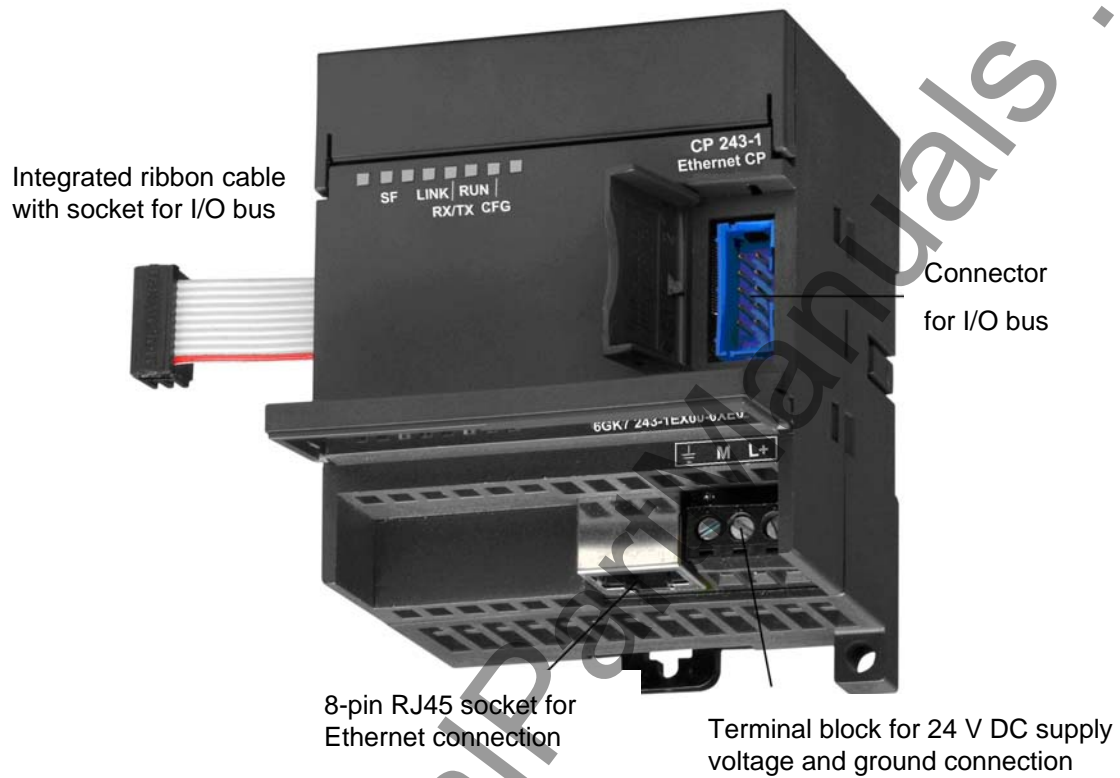
Fig. 2.   Connections

The CP 243-1 has the following connections:

- Terminal block for 24 V DC supply voltage and ground connection
- 8-pin RJ45 socket for Ethernet connection
- Plug connector for I/O bus
- Integrated ribbon cable with socket for I/O bus

The connections are located underneath the covers of the front doors.

2.5 Displays: Front LEDs

Fig. 3. Front with LED displays

Five LEDs are located on the front to indicate:

LED display	Color	Meaning
SF	Red, continuous	System error: Lights up when an error occurred
	Red, flashes	System error: Flashes (approx. every second), if the configuration is faulty and a BOOTP server cannot be found.
LINK	Green, continuous	Connection via the RJ45 interface: Ethernet connection has been established
RX/TX	Green, flickering	Ethernet activity: Data is being received and transmitted via the Ethernet **Note**: A packet received via the Ethernet is not necessarily intended for the CP 243-1. The CP 243-1 initially accepts every packet transmitted on the Ethernet. Only then does it decide whether the package is intended for it. The RX/TX LED also flashes as soon as the CP 243-1 attempts to send a packet if the Ethernet cable has been unplugged.

LED display	Color	Meaning
RUN	Green, continuous	Operational: The CP 243-1 is ready for communication
CFG	Yellow, continuous	Configuration: Lights up when STEP 7 Micro/WIN 32 actively maintains a connection to the S7-200 CPU via the CP 243-1

Table 1: Functions of individual LED displays

While the CP 243-1 is booting, the SF LED blinks twice. Then, the LINK LED and the RX/TX LED blink several times. As soon as the RUN LED lights up, the CP 243-1 has finished booting.

3   Installation and Commissioning

Installation

The devices of the S7-200 series can be installed either in a control panel or on a DIN rail. The modules can be arranged both horizontally and vertically. The S7-200 CPU and the expansion modules are designed to naturally dissipate heat by means of convection. Therefore, leave a space of at least 25 mm both above and below the device to ensure adequate heat dissipation. Long operating times at maximum ambient temperature and maximum load shorten the operating life of the electronic components.

Note

The position in an S7-200 system in which a CP 243-1 can be operated depends on the firmware version of the S7-200 CPU.

When using firmware version 1.20 or higher, the CP 243-1 can be installed in any one of 7 positions in an S7-200 system. For firmware versions below version 1.20, the CP 243-1 must be installed in position 0 unless another intelligent module occupies position 0 then the CP 243-1 may be installed in position 1.

Wiring

Warning

If you attempt to install or remove the CP 243-1 or other devices with the equipment switched on, you may receive an electric shock or the devices may not operate properly.

If the power supply for the CP 243-1 and all connected devices is not switched off while the devices are being installed or removed, this may result in personal injury and/or damage to equipment.

Take all necessary safety precautions and ensure that the power supply for the S7-200 and the CP 243-1 has been switched off before wiring the system.

General guidelines

General guidelines to follow when wiring your automation system:

- Ensure that all applicable and binding standards are complied with when wiring the CP 243-1. Observe the appropriate national and regional regulations when installing and operating the device. Inquire at local authorities regarding standards and regulations that must be complied with in your particular case.

- Wire the S7-200 CPU and the CP 243-1 in a de-energized state only!

- Use cables with a cross section appropriate for the current in each case. The 24 V supply of the CP 243-1 can be wired with cables with a cross section between 0.50 mm² and 1.50 mm². For wiring ground terminals, use cables with a diameter of 1.50 mm².

- Do not tighten the connecting terminals excessively. The maximum permissible torque is 0.56 Nm.

- Always lay the cables over as short a distance as possible. Cables should be laid in pairs: a neutral conductor together with a phase conductor or signal cable.

- Separate AC wiring and high-voltage DC wiring with rapid switching sequences from low-voltage signal wiring.

- Provide cables at risk of being struck by lightning with a suitable surge protection.

- The S7-200 CPU and the CP 243-1 should be connected to the same power supply!

- The CP 243-1 is supplied with an integrated ribbon cable with a connector socket for quick connection to other S7-200 components.

- The firmware version of the S7-200 CPU in use dictates in which position a CP 243-1 can be operated (see note on page 20).

- A maximum of one CP 243-1 can be used per CPU.

Electrical requirements

The nominal input voltage is +24 V DC.
Only apply 24 V DC voltage from power sources that are reliably electrically isolated from 120/230 V AC sources and similar sources of danger. Reliable electrical isolation is defined, for example, in the following standards:

– PELV in accordance with EN60204-1

– Class 2 or circuit with limited voltage/current in accordance with UL 508

The supply voltage on the S7-200 bus is supplied by the respective S7-200 CPU.

Ensure that the CP 243-1 is properly grounded.

Space requirements for installation

Observe the following guidelines when installing your module:

- The CP 243-1 is designed to naturally dissipate heat by means of convection. Therefore, leave a space of at least 25 mm both above and below the device to ensure adequate heat dissipation. Long operating times at maximum ambient temperature and maximum load shorten the operating life of the electronic components.

- When installed horizontally, the CP 243-1 must always be installed immediately to the right of the CPU.

- When installed vertically, the maximum allowable ambient temperature is lower by 10 °C. The CP 243-1 must be arranged above the CPU. If you use a vertical standard DIN rail, you should use the standard DIN rail stopper to prevent the module from shifting.

- The depth required for installation is 75 mm.

Note

Erect the devices in such a manner that there is sufficient space for the wiring of the inputs and outputs and for the communications cable connections.
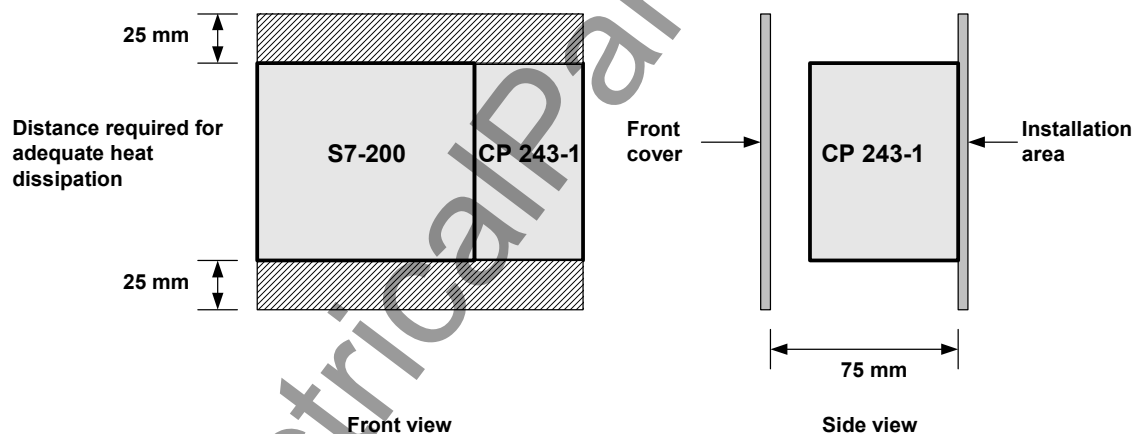
Fig. 4.   Space requirements for installation

3.1   Dimensions for installation in a control panel

The CP 243-1 is provided with drill holes that facilitate installation in a control panel.

	CPU		CP 243-1	

96 mm

88 mm

80 mm

63.2 mm

71.2 mm

Minimum clearance of 9.5 mm between the modules when installed in control panel with M4 screws
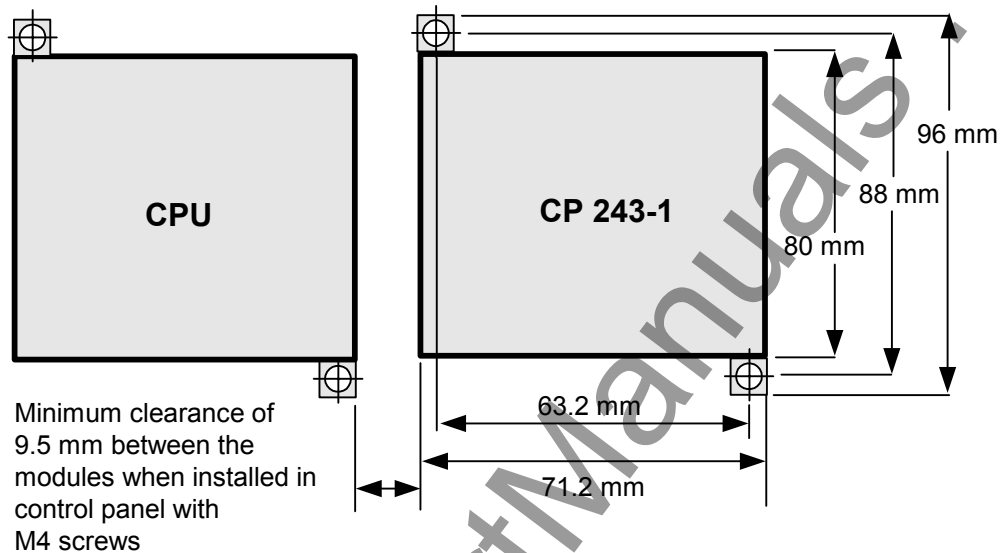
Fig. 5.   Dimensions for installation in a control panel

3.2   Dimensions for installation on a DIN rail

The CP 243-1 can be installed on a DIN rail (DIN EN 50 022).

The following diagram shows the dimensions of a standard DIN rail:

1.0 mm

35 mm

7.5 mm
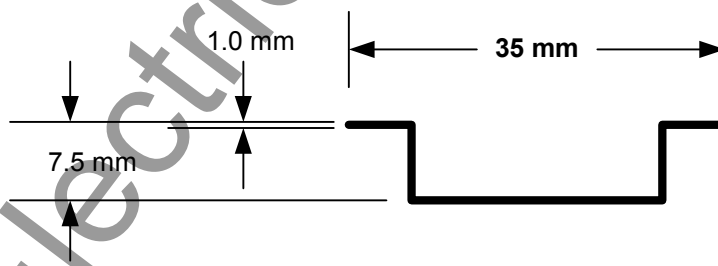
Fig. 6.   Dimensions for installation on a DIN rail

3.3   Installation in a control panel

Procedure / steps

1. Provide the control panel with drill holes for bolts of size DIN M4. Adhere to the notes and dimensions stated in Sections 3 and 3.1 for installation in a control panel.

2. Screw the CP 243-1 into the control panel immediately to the right of the CPU for horizontal installation and over the CPU for vertical installation. Use bolts of size DIN M4.

3. Insert the ribbon cable of the CP 243-1 in the connector provided beneath the front door of the adjacent module or of the S7-200 CPU. The plug is shaped in such a way that it cannot be incorrectly connected.

4. Connect the ground terminal:
   Connect the ground terminal of the CP 243-1 to the next available ground to achieve maximum interference immunity. Connecting all ground terminals separately is recommended. Use cables with a cross section of 1.5 mm^2.

5. Connect the voltage supply.

6. Connect the Ethernet cable.
   The transmission line is a 2 x 2-wire, shielded twisted-pair cable with a characteristic impedance of 100 Ohm. The transmission characteristics of this cable must meet the specifications of Category 5 (Cat5 cable). The maximum length of the connection between terminal device and network component (link segment) is limited to 100 m for the components defined in IEEE802.3.
   Because the RJ45 connector in the CP 243-1 is also shielded, use of a shielded Ethernet cable results in a continuous cable shield that ensures interference-free Ethernet transmission. The RJ45 connector shield is connected to the CP 243-1 ground terminal.
   It is recommended that you ensure that the shield is well-grounded at both ends of the transmission line. If, contrary to this recommendation, unshielded cables are used or the shielding is not or improperly grounded at either end, it cannot be guaranteed that the technical data with regard to electromagnetic radiation and interference immunity will be met. In this event, responsibility for complying with the maximum legal limits for electromagnetic radiation and interference immunity (CE mark) lies with the operator of the system.

Installation of the device is now complete.

Note

The front doors of the CP 243-1 must be kept closed during operation.
The device must be installed in such a manner that the upper and lower air ducts of the module are not obstructed and that air can circulate freely.

3.4   Installation on a standard DIN rail

Procedure / steps

1. Open the locking latch and mount the CP 243-1 on the DIN rail immediately to the right of the CPU or over the CPU.

2. Close the locking latch to fasten the CP 243-1 onto the rail. Ensure that the latch engages properly and that the device is securely fastened to the rail.

Note

In environments subject to strong vibrations, or for vertical installation, it may be necessary to prevent the devices from shifting on the DIN rail by using standard DIN rail stoppers.

3. Insert the ribbon cable of the CP 243-1 into the connector provided beneath the front door of the adjacent module or the S7-200 CPU. The plug is shaped in such a way that it cannot be incorrectly connected.

4. Connect the ground terminal:
   Connect the ground terminal of the CP 243-1 to the next available ground to achieve maximum interference immunity. Connect all ground terminals separately is recommended. Use cables with a cross section of 1.5 mm^2.

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   The transmission line is a 2 x 2-wire, shielded twisted-pair cable with a characteristic impedance of 100 Ohm. The transmission characteristics of this cable must meet the specifications of Category 5 (Cat5 cable). The maximum length of the connection between terminal device and network component (link segment) is limited to 100 m for the components defined in IEEE802.3.
   Because the RJ45 connector in the CP 243-1 is also shielded, use of a shielded Ethernet cable results in a continuous cable shield that ensures interference-free Ethernet transmission. The RJ45 connector shield is connected to the CP 243-1 ground terminal.
   It is recommended that you ensure that the shield is well-grounded at both ends of the transmission line. If, contrary to this recommendation, unshielded cables are used or the shielding is not or improperly grounded at either end, it cannot be guaranteed that the technical data with regard to electromagnetic radiation and interference immunity will be met. In this event, responsibility for complying with the maximum legal limits for electromagnetic radiation and interference immunity (CE mark) lies with the operator of the system.

Installation of the device is now complete.

Note

The front doors of the CP 243-1 must be kept closed during operation.
The device must be installed in such a manner that the upper and lower air ducts of
the module are not obstructed and that air can circulate freely.

3.5   Replacement of the CP 243-1

If the CP 243-1 (6GK7 243-1EX00-0XE0) has to be replaced, reprogramming is not
required since the configuration data and the user program is stored in the
S7-200 CPU as non-volatile data.

3.6   Removing the CP 243-1

⚠ **Warning**

If you attempt to install or remove the CP 243-1 or other devices with the equip-
ment switched on, you may receive an electric shock or the devices may not oper-
ate properly.

If the power supply for the CP 243-1 and all connected devices is not switched off
while the devices are being installed or removed, this may result in personal injury
and/or damage to equipment.

Take all necessary safety precautions and ensure the power supply for the S7-200
and the CP 243-1 has been switched off before installing or removing the system.

Proceed as following to remove the CP 243-1 or any other expansion module of
the S7-200:

1. Switch off the voltage supply to the S7-200 CPU, the CP 243-1 and all expan-
   sion modules.

2. Detach all cables and lines from the device that you wish to remove.

3. Open the front door and detach the ribbon cable from the adjacent modules.

4. Unscrew the screws or open the locking latch and remove the module from the
   control panel or DIN rail.

⚠ **Warning**

Installing the wrong device can lead to unexpected results when operating the
S7-200.

Replacing the CP 243-1 by another version or not aligning the device properly can
lead to personal injury and/or damage to the equipment.

Therefore, always replace the CP 243-1 by the same version and align it properly.

4 Configuration

4.1 Configuration options

An S7-200 system can communicate with another S7-200 system and with an S7-300, S7-400 or OPC-based system via the CP 243-1A.

There are two methods of configuring a communication of this type in an S7-200 system:

- Configuration using STEP 7 Micro/WIN 32, version 3.2.1 or higher
- Configuration using an S7-200 user program

Attention

The system can only be configured via an S7-200 user program if the CRC mechanism has been switched off.

Since the configuration data can no longer be fully checked for consistency with regard to intended and unintended changes after the CRC check of the CP 243-1 has been switched off, there can be no guarantee in this case that the CP or the components connected in the network will operate correctly.

In both cases, the configuration data is stored in the data block of the S7-200 CPU. Every time the CP 243-1 is restarted, the data is read once from that location.

Attention

To protect the configuration data of the CP 243-1 if the system goes into a no-voltage state, these data must be stored in a non-volatile data storage area of the S7-200 CPU.

In a standard S7-200 system, the entire data block is defined as non-volatile. However, this default setting on your S7-200 system could have been modified if changes were made to the configuration.

If STEP 7 Micro/WIN 32 is used for reconfiguring or modifying the configuration of the CP 243-1, the new configuration becomes effective only after the CP 243-1 is restarted. If the S7-200 CPU changes from STOP to RUN mode after such a re-configuration, the CP 243-1 is automatically restarted. However, if the CP 243-1 is configured directly in the S7-200 user program, the configuration can be enabled by calling up the "ETHx_CFG" subroutine in the user program. Calling up the sub-routine also causes the CP 243-1 to restart.

The TCP/IP address parameter (IP address, subnet mask, IP address of a Gate-way) can either be defined during configuration or the CP 243-1 can be configured in such a way that it dynamically retrieves the TCP/IP address parameters from a BOOTP server while booting.

If an S7-200 system is to communicate with an S7-300, S7-400 or OPC-based system via a CP 243-1, configure such an S7-300, S7-400 or OPC-based system using STEP 7, version 5.1 or higher, with Service Pack 3 or higher (with NCM S7 for Industrial Ethernet).

Note

The CP 243-1 may independently switch to another Gateway after booting due to special network-based services ("ICMPRedirect"). After approx. 30 seconds, the CP 243-1 switches back to the Gateway originally configured. Thus, the Gateway actually used by CP 243-1 can temporarily deviate from the one defined in the configuration.

You can read out the Gateway the CP 243-1 is using at any particular time from the storage area of the S7-200 CPU in which the NPB data block is stored (see Chapter 4.4.3). To do so, use the CP 243-1 diagnostics window in STEP 7 Micro/WIN 32 or make use of a user program.

4.2 Value ranges of the configuration data

4.2.1 IP address

The IP addresses to be specified at various points within the configuration must comply with the general conventions defining IP address validity.

According to these conventions, certain IP addresses serve specific purposes. These addresses will not be accepted by the CP 243-1. They include:

- Loopback: 127.0.0.0 - 127.255.255.255
- "Class D" addresses: 224.0.0.0 - 239.255.255.255
- "Class E" addresses: 240.0.0.0 - 247.255.255.255
- Broadcast addresses: e.g. 255.255.255.255

4.2.2 Subnet mask

If a subnet mask is specified during configuration, its structure must comply with the general conventions defining subnet mask validity.

Please note that the validity of an IP address and an associated subnet mask are interdependent.

4.2.3 TSAPs

The TSAPs consist of 2 bytes. The first byte specifies the connection and the second byte is composed of the rack number and the position of the communications module. The following value ranges apply for the first byte.

- Local TSAP value range: 16#02, 16#10 - 16#FE
- Remote TSAP value range: 16#02, 16#03, 16#10 - 16#FE

The structure of the second byte is not checked by the CP 243-1.

4.3   Configuring a CP 243-1 using STEP 7 Micro/WIN 32

After you have installed and started STEP 7 Micro/WIN 32 on your PC, start the Wizard for the CP 243-1. It is located in the "Tools" menu under the "Ethernet Wizard..." item. It is also found on the left side of the window in STEP 7 Micro/WIN 32 in the window with the navigation bar under the "Tools" item, provided the appropriate view is enabled in your STEP 7 Micro/WIN 32.

The Ethernet Wizard supports you when configuring your CP 243-1. You can enter all relevant parameters in several masks. User guidance is designed such that you cannot enter a new mask until all entries in the present mask are complete and correct. Otherwise, an error message appears.

The individual configuration steps through which the Wizard guides you are briefly described below.

Note

Detailed information is available in the STEP 7 Micro/WIN 32 documentation that is supplied together with the STEP 7 Micro/WIN 32 Help system.

After you have started the Wizard, an entry dialog containing general information appears. After you have read the contents, click on "Continue>" to proceed.

Defining the position of the CP 243-1 in the S7-200 system

Using the second dialog, define the position of the CP 243-1 in the S7-200 system.

This position can be manually entered, or the Wizard can search for a CP 243-1 in your S7-200 system. If it locates a CP 243-1, its position is automatically displayed in the S7-200 system. Otherwise, an error message appears.

Defining the TCP/IP address parameters and transmission type

The next dialog is used to define the TCP/IP address parameters and the transmission type to be used.

There are two methods for setting the TCP/IP address parameters:

1. Enter the parameters in the appropriate entry window manually.

2. Activate the access to a BOOTP server. In this case, the CP 243-1 retrieves the TCP/IP address parameters from a BOOTP server as it boots. If the CP 243-1 cannot locate a BOOTP server in your TCP/IP network, it goes into Reset mode, restarts and again attempts to establish contact with a BOOTP server. It continues doing so until it locates a BOOTP server from which it can retrieve TCP/IP address parameters.

Defining the address of the control byte and the number of connections

Use the next dialog to specify the address of the byte in the memory address space of your S7-200 system from which the CP 243-1 can be addressed from the S7-200 CPU. This address depends on the position of the CP 243-1 in your S7-200 system and on the number of outputs in your S7-200 system. If, when you began configuring the system, you had the Ethernet Wizard determine the position of the CP 243-1 in your S7-200 system, the Wizard will now provide you with the address to be used.

Basically, you can determine the memory address spaces occupied by the modules present in your S7-200 system by enabling the "Information..." entry in the "PLC" menu in STEP 7 Micro/WIN 32. In this manner you will also find the address under which your CP 243-1 can be addressed in your S7-200 system.

In this dialog, you can also define the maximum number of connections your CP 243-1 should maintain in parallel at any one time. Up to 8 such connections can be maintained. A dialog in which you can configure the connection then appears for each connection you specify here.

Configuring the individual connections

The connections that you established in the previous dialog are configured in the dialogs that follow. For each connection, you must first define whether your S7-200 system should be operated as a client or server. This will determine the structure of the dialog.

If your S7-200 system is to be operated on the connection as a client, then you must specify the address of the communication partner and the communications end point ("TSAP") in this partner. Moreover, in an additional dialog, you must specify which data is to be exchanged between your S7-200 system and the specified communication partner. At this point you also define whether these data is to be read or written. Up to 32 read/write commands can be defined per connection.

If your S7-200 system is operated on the connection as a server, then you can define to which communication partner you wish to grant access to your system by assigning an IP address. However, you can also set each server so that it always grants access from any IP address. You must also define the communications end point ("TSAP") in your communication partner from which you grant access to your S7-200 system.

A Keep Alive system can be enabled for both client and server connections.

Please use the communications end points ("TSAPs") of your communication partner specified in the configuration of that partner. In an S7-200 system, it is generated using STEP 7 Micro/WIN 32. In an S7-300, S7-400 or OPC-based system, use STEP 7 to do so (see also Chapter 4.4).

Note

The specifications for the communications end points ("TSAPs") in STEP 7 and in STEP 7 Micro/WIN 32 must be mutually compatible.

Enabling / disabling the CRC mechanism and defining the Keep Alive time

Once you have configured the connections, you must specify in the next dialog whether or not your configuration data on the S7-200 CPU are to be protected by a CRC mechanism against being unintentionally overwritten.

If the CRC mechanism is enabled, the CP 243-1 checks, while it is booting, whether its configuration data, which it reads out of the memory of the S7-200 CPU, were overwritten by the user program. If so, it stops booting and attempts to retrieve its TCP/IP address parameters from a BOOTP server. If successful, it continues booting. In this case, however, only the MicroWN channel is enabled. Thus, the CP 243-1 can then only communicate with STEP 7 Micro/WIN 32 but not with other communication partners.

Activating the CRC mechanism is recommended. This is the only way that the CP 243-1 can recognize unintended changes to the configuration data by the user program.

If the CRC mechanism is not enabled, you can change the configuration data of the CP 243-1 in the user program. However, the CP 243-1 will not be able to recognize if the data have been unintentionally overwritten.

Attention

An S7-200 user program can only be used to configure data if the CRC mechanism has been switched off.

The CP 243-1 cannot completely check the configuration data for consistency with regard to intentional and unintentional changes after the CRC check has been switched off. Therefore, in this case there is no guarantee whatsoever that the CP or the components connected in the network will function correctly.

In the same dialog you also can set a common monitoring time (Keep Alive time) for all configured connections. The value entered here determines the time after which the CP 243-1 IT recognizes the communication problem described in chapter 2.3.3

You have already specified which connections are to be monitored with this time when you configured the individual connections.

Defining the memory area for storing the configuration

Finally, use the next dialog to define the memory area in which your configuration data is to be stored on the S7-200 CPU. The Wizard will assist you in doing so.

The Wizard then informs you about which subroutines it is establishing on the basis of your configuration and where your configuration data is being stored.

Configuration of the system is now complete.

Attention

Ensure that the memory area in which the Ethernet Wizard stores the configuration data is not used by your S7-200 user program.

4.4 Configuring a CP 243-1 from a user program

The configuration data of the CP 243-1 **is** stored in the S7-200 CPU memory and can therefore be changed directly from an S7-200 user program. The cyclic redundancy check (CRC) must be disabled for the configuration data so that the CP 243-1 will accept configuration data which was changed in this way during the next startup. For this purpose, the value 16#AC must be entered for Byte 13 of the CDB data structure. This takes place automatically as soon as the CRC mechanism is switched off in the Ethernet Wizard.

Attention

Configuring the CP 243-1 from a user program is only recommended for experienced programmers.

The CP 243-1 cannot completely check the configuration data for consistency with regard to intentional and unintentional changes after the CRC check has been switched off. Therefore, in this case there is no guarantee whatsoever that the CP or the components connected in the network will function correctly.

Note

Data of the "WORD" (2 bytes) or "DWORD" (4 bytes) type are stored in an S7-200 in "big-endian" format, i.e.

Address n: MSB

Address n+1:   LSB   (analogous for DWORD).

4.4.1 Occupied system flag area (SM area)

The CP 243-1 occupies 50 bytes in the S7-200 CPU system flag area. The address of these 50 bytes depends on the position in which a CP 243-1 is currently located in an S7-200 system. Primarily general information and status information of the CP 243-1 are stored in these 50 bytes. The last four bytes contain a pointer through which one can access the CP 243-1 configuration data. These configuration data is consecutively stored in the S7-200 CPU variables memory. They are subdivided into the:

- Configuration Data Block (CDB)

- Network Parameter Block (NPB)

- Network Data Block (NDB)

The following table shows the relationship between the position of a module in the S7-200 system and the associated system flag area.

Position in S7-200 system	Occupied SM area
CPU	-
0	200..249
1	250..299
2	300..349
3	350..399
4	400..449
5	450..499
6	500..549

Table 2: System flag area

Note

When using firmware version less than 1.20 then the CP 243-1 must be in position 0 (next to the CPU) or it may be in position 1 if another intelligent module occupies position 0.

4.4.2 Structure of the Configuration Data Blocks (CDB)

The CDB is generated by the Ethernet Wizard in STEP 7 Micro/WIN 32. The following table shows the structure of the CDB.

Byte offset in variables memory	Description	Data format	Example
Header			
0-4	Module name	5 bytes ASCII	16#4350323433 "CP243"
5-6	Length of CDB	2 bytes hex	16#006C (108 decimal)
7-8	Length of NPB	2 bytes hex	16#0014 (20 decimal)
General information			
9	Internal use	1 byte hex	
10	Internal use	1 byte hex	
11-12	Reserved for STEP 7 Micro/WIN	2 bytes hex	---

13-14	Common Flag
	Bit [0] Duplex Mode
	   0: Half Duplex
	   1: Full Duplex
	Bit [1] Data Rate
	   0: 10 Mbit/s
	   1: 100 Mbit/s
	Bit [2] Auto Negotiation
	   0: No auto negotiation
	   1: Auto negotiation
	Bit [3] BOOTP
	   0: Use configured network parameters
	   1: BOOTP
	Bit [4-7] Not in use
	Bit [8-15] CRC validation
	   16#00 CRC check enabled
	   16#AC CRC check disabled
		2 bytes hex	16#0004:
			Auto negotiation,
			use configured network parameters,
			CRC check enabled
			
			16#AC04:
			Auto negotiation,
			use configured network parameters,
			CRC check disabled

15-18	Configured IP address This field should be set to 16#00000000 if BOOTP is used.	4 bytes hex	192.12.45.23: 16#C00C2D17
19-22	Configured subnet mask This field should be	4 bytes hex	255.255.255.0: 16#FFFFFF00

Byte offset in variables memory	Description	Data format	Example
	set to 16#00000000 if BOOTP is used.		
23-26	IP address of Gateway. 16#00000000 means: do not use Gateway. This field should be set to 16#00000000 if BOOTP is used.	4 bytes hex	192.12.45.24: 16#C00C2D18
27-28	Time parameter for Keep Alive in seconds	2 bytes hex	16#001E: 30 seconds
S7 connection 0 section (If not all bytes are used in this section, they should be filled in with 16#00)			

29	Flag byte
	 Bit [0] Server/Client
	     0: Server
	     1: Client
	 Bit [1] Keep Alive
	     0: No Keep Alive support
	     1: Keep Alive support
	 Bit [2-6] Not in use
	 Bit [7] Section valid
	     0: Section not in use
	     1: Section in use
		1 byte hex	16#82:
			 Server, Keep Alive support, the S7 connection, 0, is in use and contains valid data.

30-33	For server functionality: IP address space of client for access protection 16#00000000: No protection 16#XXXXXX00 Client of the same Class-C segment is permissible 16#XXXXXXXX only exactly the same address is allowable For client functionality: IP address of S7 server	4 bytes hex	192.12.45.22: 16#C00C2D16.
34-35	Local TSAP	2 bytes hex	16#1000
S7 connection 1 section (If not all bytes are used in this section, they should be filled in with 16#00)			
38	Flag byte See S7 connection 0 section.	1 byte hex	See S7 connection 0 section.
39-42	IP address of partner See S7 connection 0 section.	4 bytes hex	See S7 connection 0 section.
43-44	Local TSAP	2 bytes hex	16#1100

Byte offset in variables memory	Description	Data format	Example
45-46	Remote TSAP	2 bytes hex	See S7 connection 0 section.
S7 connection 2 section (If not all bytes are used in this section, they should be filled in with 16#00)			
47	Flag byte See S7 connection 0 section.	1 byte hex	See S7 connection 0 section.
48-49	IP address of partner See S7 connection 0 section.	4 bytes hex	See S7 connection 0 section.
52-53	Local TSAP	2 bytes hex	16#1200
54-55	Remote TSAP	2 bytes hex	See S7 connection 0 section.
S7 connection 3 section (If not all bytes are used in this section, they should be filled in with 16#00)			
56	Flag byte See S7 connection 0 section.	1 byte hex	See S7 connection 0 section.
57-60	IP address of partner See S7 connection 0 section.	4 bytes hex	See S7 connection 0 section.
61-62	Local TSAP	2 bytes hex	16#1300
63-64	Remote TSAP	2 bytes hex	See S7 connection 0 section.
S7 connection 4 section (If not all bytes are used in this section, they should be filled in with 16#00)			
65	Flag byte See S7 connection 0 section.	1 byte hex	See S7 connection 0 section.
66-69	IP address of partner See S7 connection 0 section.	4 bytes hex	See S7 connection 0 section.
70-71	Local TSAP	2 bytes hex	16#1400
72-73	Remote TSAP	2 bytes hex	See S7 connection 0 section.
S7 connection 5 section (If not all bytes are used in this section, they should be filled in with 16#00)			
74	Flag byte See S7 connection 0 section.	1 byte hex	See S7 connection 0 section.
75-78	IP address of partner See S7 connection 0 section.	4 bytes hex	See S7 connection 0 section.
79-80	Local TSAP	2 bytes hex	16#1500
81-82	Remote TSAP	2 bytes hex	See S7 connection 0 section.

Byte offset in variables memory	Description	Data format	Example
S7 connection 6 section (If not all bytes are used in this section, they should be filled in with 16#00)			
83	Flag byte See S7 connection 0 section.	1 byte hex	See S7 connection 0 section.
84-87	IP address of partner See S7 connection 0 section.	4 bytes hex	See S7 connection 0 section.
88-89	Local TSAP	2 bytes hex	16#1600
90-91	Remote TSAP	2 bytes hex	See S7 connection 0 section.
S7 connection 7 section (If not all bytes are used in this section, they should be filled in with 16#00)			
92	Flag byte See S7 connection 0 section.	1 byte hex	See S7 connection 0 section.
93-96	IP address of partner See S7 connection 0 section.	4 bytes hex	See S7 connection 0 section.
97-98	Local TSAP	2 bytes hex	16#1700
99-100	Remote TSAP	2 bytes hex	See S7 connection 0 section.
STEP 7 Micro/Win Server section			

101	Flag byte
	Bit [0] Server
	    0: Server
	    1: Not supported
	Bit [1] Keep Alive
	    0: No Keep Alive support
	    1: Keep Alive support
	Bit [2-6] Not in use
	Bit [7] Section valid
	    0: Not supported
	    1: Section in use
		1 byte hex	16#82:
			Server, Keep Alive support,
			the STEP 7 Micro/WIN Server section is in use and contains valid data.

102-105	Internal use	4 bytes hex	
CRC section			
106-107	CRC over all CDB bytes without the CRC section itself	2 bytes hex	

Table 3: CDB structure

4.4.3   Structure of the Network Parameter Blocks (NPB)

This data block is generated by the CP 243-1 itself in accordance with the current set of network parameters. It contains the TCP/IP parameter values currently in use, provided the CP 243-1 has been correctly configured. In the event of a configuration error, the NPB will not contain any valid data.

Byte offset in variables memory	Description	Calculation of the value	Data format	Example

108-109	Common flag byte
	
	Bit [0] Duplex Mode
	    0: Half Duplex
	    1: Full Duplex
	Bit [1] Data Rate
	    0: 10 Mbit/s
	    1: 100 Mbit/s
	Bit [2] Auto Negotiation
	    0: No auto negotiation
	    1: Auto negotiation
	Bit [3] BOOTP
	    0: Use configured network parameters
	    1: BOOTP
	Bit [4-15] Not in use
		Dependent on current configuration	2 Byte Hex	16#04: Auto negotiation,
				
				use configured network parameters

110-113	Current IP address	Dependent on current configuration	4 bytes hex	192.12.45.23: 16#C00C2D17
114-117	Current subnet mask	Dependent on current configuration	4 bytes hex	255.255.255.0: 16#FFFFFF00
118-121	IP address of current Gateways	Dependent on current configuration	4 bytes hex	192.12.45.24: 16#C00C2D18
122-127	MAC address	Read out from hardware	6 bytes hex	16#080006021F04 08-00-06-02-1F-04

Table 4: NPB structure

4.4.4 Structure of the Network Data Blocks (NDB)

The NDB is generated by the Ethernet Wizard in STEP 7 Micro/WIN 32. The read/write commands possible for clients are configured in this data bock. Up to 32 read/write commands can be configured for each of the 8 possible communication channels. If the CP 243-1 is operated on a channel as a server, then there is no entry in the NDB structure for this channel.

The following table shows the structure of the NDB. The codes for read/write commands are represented by the letters n, m, p = 0, ..., 31, and the channel codes are represented by the letter r = 0, ...,7.

Byte offset in variables memory	Name	Description	Data format
Header			
128-129	NDB_LENGTH	Specifies the length of the NDB	2 bytes hex
Entries for first client channel			
130	COM_CH0_ID	Code of first client channel	1 byte hex
131	COM_CH0_OFF	Specifies the offset to the first communication block (COM0)	1 byte hex
132	COM_CH0_LEN0	Specifies the length of the first communication blocks (COM0)	1 byte hex
	...		n bytes
n+132	COM_CH0_LENn	Specifies the length of the COMn structure	1 byte hex
n+5	COM_CH0_0	COM0 structure for read/write command 0 for first client channel: "<op>=<cnt>,<local_buffer>,<remote_buffer>" (For description, see Table 6)	ASCII
...	...	...	ASCII
$n + 5$ $+ \sum_{i=0}^{n-1} COM\_CH0\_LENi$	COM_CH0_n	COMn structure for read/write command n for first client channel: "<op>=<cnt>,<local_buffer>,<remote_buffer>" (For description, see Table 6)	ASCII
Entries for second client channel			
...	COM_CH1_ID	Code of second client channel	1 byte hex
...	COM_CH1_OFF		1 byte hex
...	COM_CH1_LEN0		1 byte hex
...	...		1 byte hex
...	COM_CH1_LENm		1 byte hex
...	COM_CH1_0		ASCII
...	...		ASCII
...	COM_CH1_m		ASCII
...	...	(up to 8 channels)	
Entries for n-th client channel			
...	COM_CHr_ID	Code of last client channel	1 byte hex

Byte offset in variables memory	Name	Description	Data format
...	COM_CHr_OFF		1 byte hex
...	COM_CHr_LEN0		1 byte hex
...	...		1 byte hex
...	COM_CHr_LENp		1 byte hex
...	COM_CHr_0		ASCII
...	...		ASCII
...	COM_CHr_p		ASCII
CRC section			
The last two bytes of the NDB	CRC over all NDB bytes without the CRC section itself	2 bytes hex	The last two bytes of the NDB

Table 5: NDB structure

Name	Description	Data format
<op>	Command type Value range: "R" for a "read", "W" for a "write"	ASCII
<cnt>	Number of bytes to be transmitted Value range: "1" to "212"	ASCII
<local_buffer>	Address of memory area in local system Value range: "VB0" to "VBx", where x is the max. V address	ASCII
<remote_buffer>	Address of memory area in communication partner Value range: "IB0" to "IBx", where x is the max. input address (S7-200 / S7-300 / S7-400) "QB0" to "QBx", where x is the max. output address (S7-200 / S7-300 / S7-400) "MB0" to "MBx", where x is the max. flag address (S7-200 / S7-300 / S7-400) "VB0" to "VBx", where x is the max. variables address (S7-200) "DB0.DBB0" to "DBx.DBBy", where x is the max. DB number, y is the highest address in the corresponding data block within the DB (S7-300 / S7-400)	ASCII

Table 6: Configuration of read/write commands

4.5 Configuring a communication partner with STEP 7

Using the S7-300 system as an example, the following section outlines the steps you need to take in STEP 7 to configure the system for communication with an S7-200 system via the associated Ethernet communications processor. The procedure for the S7-400 system is similar.

For the exact configuration steps, please refer to the STEP 7 description (MLFB: 6ES7 810-4CC05-0YX0) or the handbooks for the CP 343-1 and the CP 443-1.

In S7-300 and S7-400 systems, a distinction is made between configured and free connections. For configured connections, the connection parameters are specified by the user. In contrast, free connections do not have to be configured in STEP 7.

Configured connections

If you would like to work with a configured connection, you must first insert a new S7 connection in the STEP 7 NetPro program package. In the "Insert new connection" mask, specify the type of station with which you would like to establish a connection. For the connection partner, select the "(unspecified)" type.

These connections must now be configured. To do so, you must first define in the "Properties - S7 connection" mask (see Figure 7) whether your S7-300 or S7-400 system is to act as an active or passive participant. If your S7-300 or S7-400 system is to communicate with an S7-200 system, also define whether your system is to be operated as a client or server. If you would like to operate your S7-300 or S7-400 system as a client, enable the "Active connection generation" entry. Your system will be operated as a server if the entry is not enabled. Then make the settings necessary to process your S7 connection with the TCP/IP protocol. To do so, select the "TCP/IP" item. To establish the TCP/IP connection with your partner, also specify the partner's IP address.
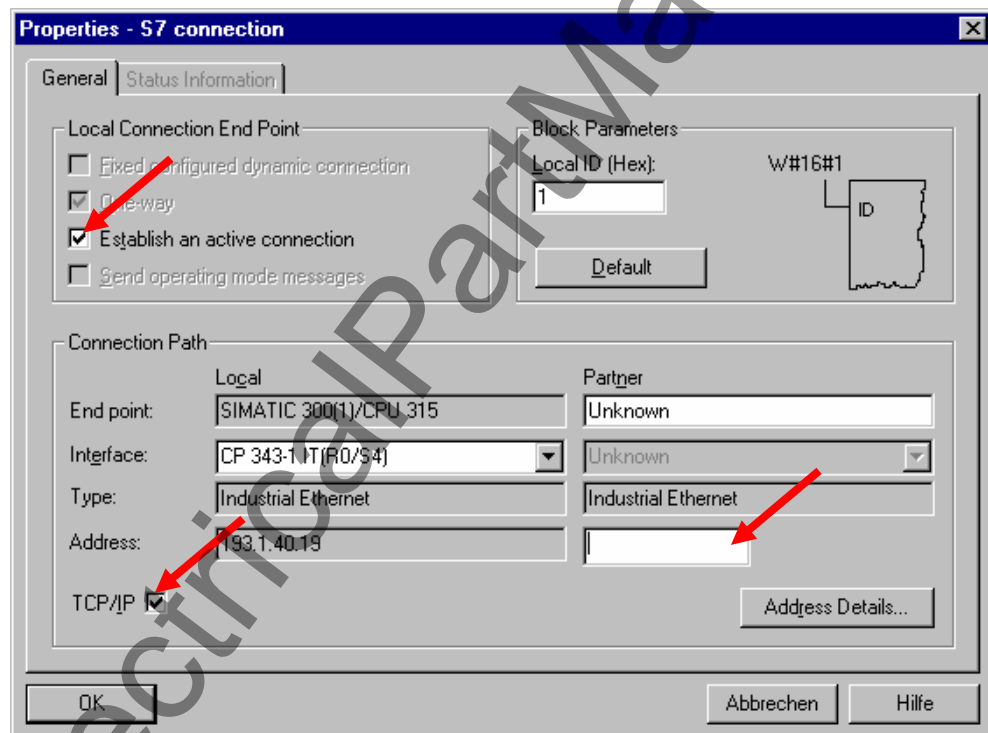
Fig. 7.   "Properties – S7 connection" dialog

Finally, in the "Address details" dialog, define the communication end points ("TSAPs") to be used. The TSAP of a connection in the S7-200 system is found in the STEP 7 Micro/WIN 32 in the dialog in which you configured the individual connections, under the "Local properties" entry. Enter the communication end point specified there in the fields provided for the partner's TSAP in the "Address details" dialog. The communication end point assigned for the connection in your S7-300 or S7-400 system is found in the same dialog under the "Local" entry in the "TSAP" field. Enter the value specified there in STEP 7 Micro/WIN 32 in the dialog from which you retrieved the communication end point used there. The value needs to be entered in the "Remote properties" entry in the "TSAP" field in that dialog.

S7-300 system as client

If you would like to operate an S7-300 system as a client, i.e. if you have enabled the "Active connection generation" item in the "Properties - S7 connection" dialog, then you cannot directly use the TSAP specified in STEP 7 in the "Local" entry in STEP 7 Micro/WIN 32 as a connection end point for your S7-300 system. You must first transform this TSAP according to the following rules:

1st byte of TSAP:
Taken over from STEP 7, "Address details" dialog, "Local" entry, "TSAP" field.

2nd byte of TSAP:
Derived from the rack and position of your Ethernet communications processor in your S7-300 system.
The number of the rack in which your Ethernet communications processor is inserted in your S7-300 system is specified in the first 3 bits.
The remaining 5 bits contain the position of your Ethernet communications processor in your S7-300 system.
These two values are found in the STEP 7 HWConfig program package.

Example:

A CP 343-1 is inserted in your S7-300 system in position 4 in rack 0. When you configure a connection with STEP 7, a value of 10.02 is displayed as the local TSAP. In STEP 7 Micro/WIN 32, you must use a TSAP of 10.04 for the communication end point in the S7-300 system (1st byte (here: 10) is taken over, 2nd byte is derived from the rack (here 0) and the position (here 4)).

Attention

The definitions for the communication end points ("TSAPs") in STEP7 and in STEP 7 Micro/WIN 32 must be mutually compatible. No client services operated from communication partners are allowed to a CP's client connection. A clear client-server connection is indispensable.

Free connections

A free connection can only be used if your S7-300 or S7-400 system is to be operated as a server. Free connections do not have to configured in STEP 7. Standard S7-300 and S7-400 systems are set up to communicate via free connections.

If you would like to make use of the mechanism for free connections in your S7-300 or S7-400 system, the client side for each of these connections must still be configured. In STEP 7 Micro/WIN 32, there is not difference between use of these connections and communicating via connections that were configured in the S7-300 or S7-400 system. For free connections, you must merely ensure that the first byte of the TSAP over which these connections pass to the S7-300 and S7-400 systems is always assigned a value of 0x03. The second byte of the TSAP is derived, as described above, from the rack and position number of the CPU used in your S7-300 or S7-400 system.

Note

S7-200 systems do not support free connections. This means that you must configure each connection in an S7-200 system, regardless of whether your system is to be operated as a client or server.

4.6   Behavior of CP 243-1 in the event of configuration errors

If the CP 243-1 recognizes an invalid configuration, it attempts to retrieve its TCP/IP address parameters (IP address, subnet mask, IP address of Gateway) via a BOOTP service. The CP 243-1 continues the attempt for approx. 1 minute. If it does not receive a response from a BOOTP service within this time or if the response is invalid or faulty, the red LED ("SF") flashes for approx. 30 seconds. This procedure is cycled through until the CP 243-1 either finds a valid configuration in the S7-200 CPU memory or receives a valid response from a BOOTP server.

If the CP 243-1 receives a valid BOOTP response, it configures itself as follows:

- IP address, subnet mask and IP address of the Gateway are taken over from the BOOTP response

- The transmission type is set to "Auto Negotiation" (Auto Detect Communications).

- The Keep Alive time for connections is set to 30 seconds.

When configured in this way, the CP 243-1 is able to access the S7-200 CPU from STEP 7 Micro/WIN 32 through Ethernet. A new valid configuration can now be loaded in this way. Communication with other controllers is not possible under these conditions. After a reset, the CP 243-1 configures itself in accordance with the new configuration.

Note

The Auto Negotiation mode (Auto Detect Communications) only operates if all connected network components support this mode.

5   Programming

Use STEP 7 Micro/WIN 32 to develop S7-200 user programs. For you to be able to use the CP 243-1 functions in these programs, the STEP 7 Micro/WIN 32 you use must be version V3.2.1 or higher.

To be able to operate the CP 243-1 as a client or as a server, at least one of the communications channels of the CP 243-1 must be configured accordingly. In addition, the S7-200 user program must also be programmed accordingly.

The CP 243-1 is programmed in the S7-200 user program in the following subroutines, where the position in which a CP 243-1 is located in the S7-200 system is included in the name of the subroutine:

- ETHx_CTRL   (x stands for the module position, possible values: 0.1, ...6)

- ETHx_CFG   (x stands for the module position, possible values: 0.1, ...6)

- ETHx_XFR   (x stands for the module position, possible values: 0.1, ...6)

These subroutines are generated by the Ethernet Wizard integrated in STEP 7 Micro/WIN 32 when configuration is completed. You will then find these subroutines in STEP 7 Micro/WIN 32 in the window in the operation tree under the "Subroutine calls" entry. Which subroutines are generated by the Wizard when configuration is completed depends on the data that you specified during configuration.

Attention

These subroutines may not be called up in the S7-200 user program by interrupt routines.

5.1 ETHx_CTRL

The ETHx_CTRL subroutine is used to initialize and monitor the CP 243-1. You must call up this subroutine in your S7-200 user program at the start of each cycle if you wish to access the functions of a CP 243-1. Calling up the subroutine causes the CP 243-1 to restart when the CRC check is switched on, provided the CP 243-1 has recognized a change in the configuration data. In contrast, if the CRC check is switched off, the CP 243-1 is always restarted after a user program or a new configuration is downloaded into the S7-200 CPU from STEP 7 Micro/WIN 32 and the S7-200 CPU is subsequently started.

The return values provide information on the general state of the CP 243-1 and the state of the up to eight possible communication channels. If an error occurred in the CP 243-1, you can read out the associated error code from the Error return parameter. The ETHx_CTRL subroutine is always generated by the Ethernet Wizard in STEP 7 Micro/WIN 32 as soon as you have finished configuring the CP 243-1.

Call:
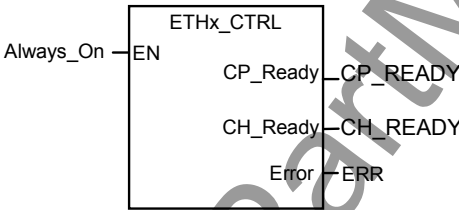
Fig. 8. Calling the ETHx_CTRL subroutine

Input parameters:

Name	Type	Meaning
-	-	-

Table 7: Input parameters (ETHx_CTRL)

Return parameters:

Name	Type	Meaning
CP_Ready	BOOL	Status of CP 243-1
		0: CP not ready for operation
		1: CP ready for operation
CH_Ready	WORD	Status of individual channels (= first byte)
		Bit 0 corresponds to Channel 0
		Bit 1 corresponds to Channel 1
		Bit 2 corresponds to Channel 2
		Bit 3 corresponds to Channel 3
		Bit 4 corresponds to Channel 4
		Bit 5 corresponds to Channel 5
		Bit 6 corresponds to Channel 6
		Bit 7 corresponds to Channel 7
		0: Channel is not ready
		1: Channel is ready
Error	WORD	Error code
		0x0000: No error occurred
		other: Error (description: see Chapter 6.2)

Table 8: Return parameters (ETHx_CTRL)

A value of 1 in a bit of the CH_Ready return parameter indicates that the associated channel is ready. This means that a communication connection to the partner defined in the configuration can be established with the communication parameters specified there (IP address, TSAPs, ...).

5.2   ETHx_CFG

By calling up the ETHx_CFG subroutine, you induce the CP 243-1 to read in the configuration data that is stored in the S7-200 CPU memory. The CP 243-1 automatically performs a reset after these data is read in. The configuration read in from the S7-200 CPU memory becomes effective when the system restarts after the reset.

You will require this subroutine if you wish to dynamically reprogram a CP 243-1 from your S7-200 user program while this program is running. It is only generated by the Ethernet Wizard in STEP 7 Micro/WIN 32 if the CRC mechanism for your configuration is not enabled there. If the ETHx_CFG subroutine is called up, the CP 243-1 aborts all existing connections and performs a reset. However, as soon as you have enabled the CRC mechanism, you can no longer change the associated configuration from a user program. It then can only be modified using the Ethernet Wizard in STEP 7 Micro/WIN 32.

Call:


```
            ┌─────────────────┐
            │    ETHx_CFG     │
Always_On ──┤EN               │
            │                 │
START_BIT ──┤START            │
            │                 │
       Done ┤DONE             │
            │                 │
      Error ┤ERR              │
            └─────────────────┘
```
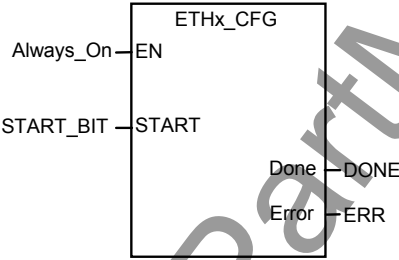
Fig. 9.   Calling up the ETHx_CFG subroutine

Input parameters:

Name	Type	Meaning
START	BOOL	Entry conditions for activating a new configuration 0: Do not activate new configuration 1: Activate new configuration

Table 9: Input parameters (ETHx_CFG)

Return parameters:

Name	Type	Meaning
Done	BOOL	Status of the subroutine call
		0: Subroutine not yet executed
		1: Subroutine executed and thus ready for next execution
Error	BYTE	Error code
		16#00: No error occurred
		other Error (description: see Chapter 6.2)

Table 10: Return parameters (ETHx_CFG)

5.3 ETHx_XFR

By calling up the ETHx_XFR subroutine, you induce CP 243-1 to transfer data to another S7 system or to query data from such a system. The type of data access performed by your CP 243-1 is specified during configuration. Thus, you define the following parameters during configuration:

- which data you would like to access.

- whether you would like to read or write this data.

- from which communication partner you would like to retrieve this data or to which communication partner you would like to hand over this data.

When you call up the ETHx_XFR subroutine, you then specify which of the data accesses configured for the client channels you would like to execute by calling up the subroutine call.

The ETHx_XFR subroutine is only generated by the Ethernet Wizard in STEP 7 Micro/WIN 32 if you have configured at least one of the CP 243-1 channels as a client. Only after this action you can trigger data accesses from a S7-200 user program.

Only one ETHx_XFR subroutine can be active per channel at any one time. Several data accesses in parallel on one channel is not possible. Therefore, it is recommended that you link the "START" input with both the Done return value of the ETHx_XFR subroutine and the corresponding bit of the CH_Ready return value of the ETHx_CTRL subroutine.

Call:

```
              ETHx_XFR
Always_On —| EN

START_BIT —| START
CHANNEL   —| Chan_ID    Done |— DONE
DATA      —| Data       Error|— ERR
ABORT     —| Abort
```
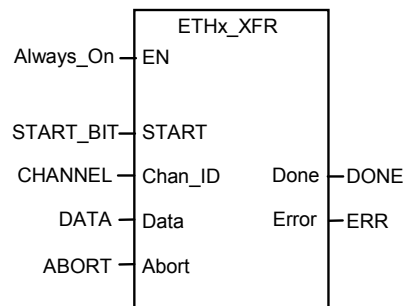
Fig. 10. Calling up the ETHx_XFR subroutine

Input parameter:

Name	Type	Meaning
START	BOOL	Input condition for issuing a read/write command
		0: Do not issue read/write command
		1: Issue read/write command
Chan_ID	BYTE	Number of channel through which data is to be accessed. This channel must be configured as a client.
		Value range: 0 .. 7
Data	BYTE	Number of channel-specific data block from of the configuration that describes the read/write command to be executed.
		Value range: 0 .. 31
Abort	BOOL	Input conditions for aborting a data access
		0: Do not abort data access
		1: Abort data access

Table 11: Input parameters (ETHx_XFR)

Return parameters:

Name	Type	Meaning
Done	BOOL	Status of the subroutine call
		0: Subroutine not yet executed
		1: Subroutine executed, read/write command completed, subroutine ready for next execution
Error	BYTE	Error code
		16#00: No error occurred
		other: Error (description: see Chapter 6.2)

Table 12: Return parameters (ETHx_XFR)

Attention

The execution time of an S7-200 user programs has a direct influence on the duration of the read/write commands used therein.

If you would like to minimize the execution time of the read/write commands you use, you should try to keep the cycle time of your user program as short as possible.

---

6 Diagnostics

6.1 Diagnostics options

The following means are available for diagnostics:

- Ping server:

    The "ping" program, which is available on all standard computers with, for example, a Windows operating system by Microsoft, can be used to determine whether a CP 243-1 is basically available under a certain address that can be entered.

- STEP 7 Micro/WIN 32:

    Under the "Information ..." entry in the "PLC" menu, you can retrieve general information on your S7-200 system. This includes information on which modules are connected to your S7-200 system. When you select the "CP 243-1 ETHERNET" module by double-clicking on this entry in the module overview, a window appears that contains the following specific information on your CP 243-1:

    - General module information (module type, version in use)

    - TCP/IP address parameters (IP address, subnet mask, IP address of the Gateway, MAC address). The values presented here are invalid if a configuration error occurs and the system then boots via the BOOTP mechanism. The same applies if the user program has not run through at least one cycle.

    - Status messages

    - Information on the embedding of the CP 243-1 in the S7-200 CPU memory address space

    - Configuration and status of the channels

    - Error messages

    - Reading out of the SM memory area:

        CP 243-1-specific information can also be read out from the SM area currently being used by the CP (see Table 2) and processed during runtime by an S7-200 user program. If global errors occur in a CP 243-1, the associated error codes are found in this area. The storage location of the information is provided below.

Byte offset in SM area	Meaning	Format
0-15	Module type	16 byte ASCII
16-19	Software version	4 byte ASCII ◆
20-21	Error code (see Chapter 6.2)	2 byte hex

22	Status CP 243-1
	
	Bit [0]
	    0: CP 243-1 not booting
	    1: CP 243-1 booting
	Bit [1]
	    0: BOOTP sequence not executed
	    1: BOOTP sequence is being executed
	Bit [2]
	    0: CP 243-1 not ready for operation
	    1: CP 243-1 ready for operation
	Bit [3]
	    0: STEP 7 Micro/Win 32 not enabled
	    1: STEP 7 Micro/Win 32 enabled
	Bit [4]
	    0: Configuration accord. to CDB
	    1: No valid configuration in CDB
	Bit [5] Reserved
	Bit [6]
	    0: No Ethernet connection
	    1: CP 243-1 connected to Ethernet
	Bit [7]
	    0: No error in CP 243-1
	    1: CP 243-1 in error state
		1 byte hex

23	Reserved	
24	Hardware version	1 byte ASCII

Table 13: Global errors and their error codes

- Reading out of the NPB memory area:

  In the bytes 46 to 49 of the SM area currently being used for a CP 243-1, a pointer is located at the memory area in which the configuration data of the CP 243-1 is stored. If you raise this pointer by 108, you fill find the NPB memory area in which the TCP/IP configuration parameters currently being used by the CP 243-1 are stored, provided the CP 243-1 was correctly configured and that at least one cycle of the user program has been run through. The NPB does not contain valid values if the configuration is faulty. The following table shows the structure of these memory areas.

Byte offset in variables memory	Meaning	Format

108 - 109	Common flag byte
	
	Bit [0] Duplex Mode
	
	    0: Half Duplex
	    1: Full Duplex
	
	Bit [1] Data Rate
	
	    0: 10 Mbit/s
	    1: 100 Mbit/s
	
	Bit [2] Auto Negotiation
	
	    0: Auto Negotiation not enabled
	    1: Auto Negotiation enabled
	
	Bit [3] BOOTP
	
	    0: Network parameters from configuration
	    1: Network parameters via BOOTP
	
	Bit [4] - Bit [15]: Reserved
		2 bytes hex

110-113	Current IP address	4 bytes hex
114- 117	Current subnet mask	4 bytes hex
118-121	IP address of the Gateway currently in use	4 bytes hex
122-127	MAC address	6 bytes hex

Table 14: Structure of NPB memory areas

- LED indicators (see Chapter 2.5)

Note

If there is a sudden termination of a CP 243-1 with active client connections (e.g. due to power failure) while the server continues running, the server may not recognize this interruption in the connection. If the client then attempts to reconnect, a system-related waiting period equal to the configured Keep Alive time may arise, beginning when the CP 243-1 is switched on again, until all connections are re-established.

6.2   Error messages of the CP 243-1

The most important CP 243-1 error messages for the user are presented below. All other error messages refer to specific internal CP 243-1 errors. Please consult the Service Hotline if such an error message should occur.

Attention

In the event of a module error / system error, the module must be switched off and on again.

Basically, the CP 243-1 has two mechanism for reporting an error:

- As a return value of a subroutine:

  Errors are reported by the "Error" return value. Depending on the subroutine, this parameter can be of the BYTE or WORD type.

- As an error code that is returned through the SM memory area of the S7-200 CPU:

  Which SM memory area is currently in use depends on the position in which your CP 243-1 is connected in the S7-200 system. Depending on the type of error, the following bytes in the current SM area of your CP 243-1 are used for error messages:

  – Global errors are carried over in byte offset 20 and 21. They are to be interpreted as Word (SMW)

  – Channel-specific errors are carried over in the following bytes, depending on the associated channel:

    Byte offset 25   for channel 0

    Byte offset 26   for channel 1

    Byte offset 27   for channel 2

    Byte offset 28   for channel 3

    Byte offset 29   for channel 4

    Byte offset 30   for channel 5

    Byte offset 31   for channel 6

    Byte offset 32   for channel 7

  – Command-specific errors are returned in the byte with offset 33.

The error codes of the individual errors and their meanings are listed in the following tables. These tables also indicate by which mechanism the individual errors are returned, which error code can occur for which subroutine, and which error is carried over in which byte of the current SM memory. If error messages occur that are not described in these tables, please consult the Service Hotline (see Chapter 7).

If no remedies are suggested in the following tables, manual troubleshooting using STEP 7 Micro/WIN 32 is always required. The Ethernet Wizard integrated in STEP 7 Micro/WIN 32 should always be used for configuring the CP 243-1.

If your CP 243-1 should still return errors that suggest problems in the configuration, then you should check whether the configuration has been overwritten by your user program.

Attention

If the 24 V voltage supply should fail, the CP 243-1 cannot return error messages.

Error byte		Description	Reaction / remedy	Return mechanism	
hex	**dec**			**Byte offset in SM area**	**Return value (ETHx_)**
16#01	1	Timeout on the S7 bus	Automatic reboot	25 - 32 33	_XFR _CFG
16#02	2	Data access was aborted due to an ABORT command	A new read/write command can be started	25 - 32	_XFR
16#03	3	The "DATA" transfer parameter is outside of the configured range	A new read/write command with other parameters can be initiated.	25 - 32	_XFR
16#04	4	The connection could not be set up at the S7 level	The attempt to establish the connection is repeated	25 - 32	_XFR
16#05	5	The connection was aborted, or an attempt was made to execute a read/write command on a channel that was not ready	Check connection path to communication partner	25 - 32	_XFR
16#06	6	Logistic errors are contained in a response packet	A new read/write command can be initiated. The configuration should be checked.	25 - 32	_XFR
16#07	7	The read command failed	A new read/write command can be initiated. The parameter of the corresponding read command should be checked.	25 - 32	_XFR

Error byte		Description	Reaction / remedy	Return mechanism	
hex	**dec**			**Byte offset in SM area**	**Return value (ETHx_)**
16#08	8	The write command failed	A new read/write command can be initiated. The parameters of the corresponding write command should be checked.	25 - 32	_XFR
16#09	9	Channel not configured	A new read/write command with other parameters can be initiated.	25 - 32	_XFR
16#0A	10	Although the channel is configured as a SERVER, an attempt was made to initiate a read/write command	A new read/write command with other parameters can be initiated.	25 - 32	_XFR
16#0B	11	Preceding read/write command not yet completed	A new read/write command can be initiated. Evaluate the "DONE" return parameter of the preceding read/write command	25 - 32	_XFR
16#0C	12	Invalid command code	A new read/write command can be initiated	25 - 32	_XFR
16#0D	13	All data transmissions were aborted because a reconfiguration was initiated by the user program.	Restart of the system	25 - 32 33	_XFR _CFG
16#80	128	There is no 24 V external supply voltage	Wait until ready	25 - 32 33	
16#81	129	The channel being used is not ready or is not operating properly	Wait until ready Evaluation of the return parameters of the ETHx_CTRL subroutine		_XFR _CFG
16#82	130	The channel being used is busy	Wait until ready		_XFR _CFG
16#83	131	A command with an unallowable channel number was started	A new read/write command can be initiated The user program should be checked		_XFR

Error byte		Description	Reaction / remedy	Return mechanism	
hex	**dec**			**Byte offset in SM area**	**Return value (ETHx_)**
16#84	132	A command with an unallowable data block number was started.	A new read/write command can be initiated The user program should be checked		_XFR

Table 15: Error messages (error byte)

Error word		Description	Reaction / troubleshooting	Return mechanism	
hex	**dec**			**Byte offset in SM area**	**Return value (ETHx_)**
16#0001	1	Timeout on the S7 bus	Automatic warm start	20,21	_CTRL
16#000D	13	All data transmissions were aborted because a reconfiguration was initiated by the user program.	Restart of the system	20,21	_CTRL
16#0030	48	The configuration could not be called up from the CPU within a specified time period.	Automatic warm start	20,21	_CTRL
16#0031	49	A syntactically correct CDB configuration was not found in the S7-200 CPU memory.		20,21	_CTRL
16#0032	50	The CRC checksum of the configuration data (CDB, NDB) is incorrect.		20,21	_CTRL
16#0033	51	The configuration data for the CP 243-1 is faulty or incorrectly stored.		20,21	_CTRL
16#0034	52	The pointer to the CDB is faulty or no CDB is loaded.	Ensure that the ETHx_CTRL subroutine generated by wizard is called up at the beginning of the user programs.	20,21	_CTRL

Error word		Description	Reaction / troubleshooting	Return mechanism	
hex	dec			Byte offset in SM area	Return value (ETHx_)
16#0035	53	The transmitted configuration has an invalid format code		20,21	_CTRL
16#0036	54	TSAPs are not well-defined or are present more than once in the configuration		20,21	_CTRL
16#0038	56	The configuration is not well-defined (IP addresses are faulty, neither the clients nor the server are configured, channel for STEP 7 Micro/WIN 32 is not enabled)		20,21	_CTRL
16#003A	58	The module name for the CP 243-1 in the configuration was changed.		20,21	_CTRL
16#003B	59	The configuration contains an invalid IP address		20,21	_CTRL
16#003C	60	The configuration contains an invalid Gateway address		20,21	_CTRL
16#003D	61	The configuration contains an invalid value in the "Keep Alive" parameter		20,21	_CTRL
16#003E	62	A valid configuration was not received, neither from the S7-200 CPU memory nor via BOOTP	Cyclical attempt to receive a valid configuration either from the S7-200 CPU memory or via a BOOTP server	20,21	_CTRL
16#0042	66	The NDB contains syntactically incorrect read/write commands or length specifications.		20,21	_CTRL
16#0093	147	The BOOTP command failed	Automatic warm start	20,21	_CTRL
16#0094	148	The BOOTP server contains in-valid data	Automatic warm start	20,21	_CTRL
16#0095	149	The specified Keep Alive time was not accepted by the TCP/IP stack.	Automatic warm start	20,21	_CTRL
16#0096	150	The specified IP address for a client was not accepted by the TCP/IP-Stack.	Automatic warm start	20,21	_CTRL
16#0097	151	The specified subnet mask was not accepted by the TCP/IP stack.	Automatic warm start	20,21	_CTRL

Error word		Description	Reaction / troubleshooting	Return mechanism	
hex	**dec**			**Byte offset in SM area**	**Return value (ETHx_)**
16#0098	152	The specified Gateway address was not accepted by the TCP/IP stack.	Automatic warm start	20,21	_CTRL
16#00F0	240	The CP 243-1 was not recognized by the S7-200 CPU	Check the configuration and the structure of the S7-200 system		_CTRL
16#00F1	241	The address of the output byte over which the CP 243-1 should be accessible according to the configuration is not compatible with the actual position of the CP 243-1 in the S7-200 system.	Check the configuration and the structure of the S7-200 system		_CTRL
16#0100 to 16#0108	256 to 264	A timeout was found on the S7 bus	Automatic warm start	20,21	_CTRL
16#8080	32896	CP 243-1 has not yet finished booting	Check 24 V voltage supply if necessary	20,21	_CTRL

Table 16: Error messages (error word)

Appendix A Technical Data

Physical structure • Modular format • Dimensions (W x H x D) Weight	 S7-200 expansion module 71.2 x 80 x 62 mm Approx. 150 g
Transmission rate Flash memory size SDRAM memory size	10 Mbit/s and 100 Mbit/s 1 Mbyte 8 Mbyte
Interfaces Connection to Industrial Ethernet (10/100 Mbit/s)	8-pin RJ45 socket
Input voltage	DC +24 V (-15%/+20%) = 20.4 to 28.8 V
Current consumption • From S7-200 bus • From external DC 24 V	 55 mA 60 mA
Power dissipation	1.75 W
Max. connections	Max. 8 S7 connections (XPUT/XGET and READ/WRITE) + 1 connection to STEP 7 Micro/WIN 32
Allowable ambient conditions • Operating temperature • Transport/storage temperature • Relative humidity, max. • Operating altitude	 0°C to +55° C for horizontal installation 0°C to +45° C for vertical installation -40° C to +70° C 95% at +25° C Up to 2000 m above sea level; cooling may be less effective at higher altitudes, requiring a reduction in the maximum operating temperature.
Degree of protection Ethernet Standard Standards	IP 20 IEEE 802.3 CE mark UL 508 or cULus CSA C22.2 Number 142 or cULus FM 3611 EN 50081-2 / EN 61000-6-4 EN 60529 EN 61000-6-2 EN 61131-2
Starting time or restart time after a re-set	Approx. 10 seconds
User data quantities	As client: up to 212 bytes for XPUT / XGET As server: up to 222 bytes for XGET or READ up to 212 bytes for XPUT or WRITE

◆ Table 17: Technical data

Appendix B   Example

The following example shows how the CP 243-1 is handled as a client. It explains how subroutines generated by the Ethernet Wizard, which is integrated in STEP 7 Micro/WIN 32, at the end of configuration are used in the program. The data block in which the associated configuration is stored by the Ethernet Wizard is presented after the program code.

The sample program provided here and the associated configuration is contained on the QuickStart CD for SIMATIC NET as a STEP 7 Micro/WIN 32 project. To run this program, a second S7-200 system on which an appropriately configured server will run must be accessible through Ethernet.

Program code

Project name:	Example_Client
Version:	01.01
Date	06.10.2002
Target hardware:	CPU 224 with CP 243-1 in position 0
Description:	Sample program for communication between 2 S7-200 stations via Industrial Ethernet.

A character string ("CP243") that is stored at address VB200 and higher and that has a length of 5 bytes is sent from the local S7-200 system to another S7-200 system, stored there at the same address and then read back from there. This procedure is repeated continuously.

The associated server must be configured as a corresponding counterpart. The user program that runs on the server merely has to call up the ETHx_CTRL subroutine. Calls of the ETHx_XFR subroutine are not required for operating the server.

The CRC check is switched on.

The configuration (IP address, ...) must be adapted to the current conditions. The "CP243" character string must be stored at address VB200 and higher.

NETWORK 1

The ETHT0_CTRL subroutine initializes and monitors the CP 243-1.

The SM0.0 status bit is generated at input "EN". It ensures that the subroutine is always active. As soon as the CP 243-1 has finished booting, the "CP_Ready" and "CH_Ready" outputs are set. If an error occurred in the configuration, the "Error" output is set. The error code that is carried over is stored in flag word 2. It can be read out in the status table.

```
LD      Always_On
CALL    ETH0_CTRL, cp_ready, ch_ready, cp_error
```

Symbol	Address	Comment
Always_On	SM0.0	Always 1 for system-related reasons
ch_ready	MW8	
cp_error	MW2	
cp_ready	M0.0	
ETH0_CTRL	SBR1	This POU was generated by the Ethernet Wizard for use with CP 243-1

NETWORK 2

As soon as channel 0 is ready for transmission and "ch0_ready" is set, the "start" variable is set. This can take several cycles.

```
LD      ch0_ready
S       start, 1
```

Symbol	Address	Comment
ch0_ready	M8.0	Bit for channel 0 in the CH_READY return value of the ETH0_CTRL subroutine
Start	M4.0	Flip-flop for automatic start of data transmission

NETWORK 3

For an S7-200, the "First_Scan_On" bit is only set in the first cycle for system-related reasons. Thus, the "start" variable is reset. This procedure is required so that the "start" variable always generates a switching edge for the start of the ETHx_XFR subroutine, even for repeated start/stop procedures of the CPU.

```
LD      First_Scan_On
R       start, 1
```

Symbol	Address	Comment
First_Scan_On	SM0.1	1 in the first cycle (for system-related reasons), otherwise always 0
Start	M4.0	Flip-flop for automatic start of data transmission

NETWORK 4

The local S7-200 station sends data from the VB200 (data length of 5 Byte) on the Ethernet connection to another S7-200 station. There the data is stored in VB200.

The read/write command only takes place after a positive edge at the "START" parameter, if the "Done" bit of any preceding read command is set. The "Done" bit is carried over in the "ch0_done_read" variable. The outputs of the read and write command are linked in such a manner, that only one command per channel can be processed at any one time. Thus, a new command is only initiated after the preceding command is finished.

The "Chan_ID" parameter specifies the number of the channel through which the data access is to take place. In the present case, this would be the channel with the number 0. The "Data" parameter specifies the number of the channel-specific data block. A command that has been initiated can be aborted using the "Abort" parameter. To do so, the M7.0 flag must be set. In this example, this flag also acts on the read command from Network 5.

After flag M7.0 is cleared, read/write commands are again issued since the "Done" bit is always set along with the "Error" bit after a command is aborted.

Applying special flag SM0.0 ensures that the ETH0_XFR subroutine is always enabled.

As soon as the write command is finished, a 1 is returned in the "Done" return parameter. Any errors that occurred are returned by the "Error" parameter. Otherwise, a 0 is returned in this parameter.

```
LD        Always_On
=         L60.0
LD        ch0_done_read
EU
U         ch0_ready
LD        start
EU
OLD
=         L63.7
LD        L60.0
CALL      ETH0_XFR, L63.7, Connection0_0, Write_1,
          Connection_abort, ch0_done_write, ch0_error_write
```

Symbol	Address	Comment
Always_On	SM0.0	Always 1 for system-related reasons
ch0_done_read	M5.0	Done bit of the read command
ch0_done_write	M5.1	Done bit of the write command
ch0_error_write	MB14	Error flag of channel 0, "write" command
ch0_ready	M8.0	Bit for channel 0 in CH_READY return value of the ETH0_CTRL subroutine
Connection0_0	VB166	

Symbol	Address	Comment
Connection_abort	M7.0	Transmission is aborted
ETH0_XFR	SBR2	This POU was generated by the Ethernet Wizard for use with CP 243-1
Start	M4.0	Flip-flop for automatic start of the data transmission
Write_1	VB167	

NETWORK 5

The local S7- 200 station now reads out data from the VB200 of another S7-200 station and stores these in the VB200 of the local S7-200 station.

Before the read command is executed, the two variables, "ch0_done_write" and "ch0_ready", are evaluated to ensure that, firstly, the preceding write command is finished and, secondly, that the status of channel 0 is "ready".

```
LD        Always_On
=         L60.0
LD        ch0_done_write
EU
U         ch0_ready
=         L63.7
LD        L60.0
CALL      ETH0_XFR, L63.7, Connection0_0, Read_1, Connec-
          tion_abort, ch0_done_read, ch0_error_read
```

Symbol	Address	Comment
Always_On	SM0.0	Always 1 for system-related reasons
ch0_done_read	M5.0	Done bit of read command
ch0_done_write	M5.1	Done bit of write command
ch0_error_read	MB6	Error flag of channel 0, "read" command
ch0_ready	M8.0	Bit for channel 0 in CH_READY return value of the ETH0_CTRL subroutine
Connection0_0	VB166	
Connection_abort	M7.0	Transmission is aborted
ETH0_XFR	SBR2	This POU was generated by the Ethernet Wizard for use with CP 243-1
Read_1	VB168	

Data block of associated configuration

```
//
//DATA BLOCK COMMENTS
//
//Press F1 for help and example data block
//
//---------------------------------------------------------------------
// CP 243-1 Ethernet Module Configuration block. Generated by the
// Ethernet Wizard
//---------------------------------------------------------------------
VB0    'CP243'         // Module ID for CP 243-1 Ethernet module at
                       // position 0
VW5    16#006C         // Length of CDB
VW7    16#0014         // Length of NPB
VB9    16#01           // Configuration Data Version
VB10   16#00           // Project Configuration Version
VW11   16#0000
VW13   16#0004         // Auto Detect Communications , User Configured
                       // IP Address, CRC protection enabled.
VD15   16#C1012807     // IP Address for module (193.1.40.7)
VD19   16#FFFFFF00     // Subnet mask address for module (255.255.255.0)
VD23   16#C1012801     // Gateway Address (193.1.40.1)
VW27   30              // Keep Alive Interval in seconds
//--------------------------------------------- Connection 0
VB29   16#83           // Client Connection,  Keep Alive Enabled.
VD30   16#C1012812     // Address of Server for this connection
                       //(193.1.40.18)
VW34   16#1000         // Local TSAP for this connection (10.00).
VW36   16#1000         // Remote TSAP for this connection (10.00).
//--------------------------------------------- Connection 1
VB38   16#00           // Connection not defined.
VD39   16#00000000
VW43   16#0000
VW45   16#0000
//--------------------------------------------- Connection 2
VB47   16#00           // Connection not defined.
VD48   16#00000000
VW52   16#0000
VW54   16#0000
//--------------------------------------------- Connection 3
VB56   16#00           // Connection not defined.
VD57   16#00000000
VW61   16#0000
VW63   16#0000
//--------------------------------------------- Connection 4
VB65   16#00           // Connection not defined.
VD66   16#00000000
VW70   16#0000
VW72   16#0000
//--------------------------------------------- Connection 5
VB74   16#00           // Connection not defined.
VD75   16#00000000
VW79   16#0000
VW81   16#0000
```

```
//------------------------------------------- Connection 6
VB83   16#00           // Connection not defined.
VD84   16#00000000
VW88   16#0000
VW90   16#0000
//------------------------------------------- Connection 7
VB92   16#00           // Connection not defined.
VD93   16#00000000
VW97   16#0000
VW99   16#0000
//---------------------------- STEP 7-Micro/WIN reserved connection.
VB101  16#82
VD102  16#00000000
VW106  16#641F
//------------------------------------------------------------------
// Network Parameter Block Section
// This section is used by the CP 243-1 Ethernet Module
//------------------------------------------------------------------
VW108  16#0000
VD110  16#00000000
VD114  16#00000000
VD118  16#00000000
VB122  16#00
VB123  16#00
VB124  16#00
VB125  16#00
VB126  16#00
VB127  16#00
//------------------------------------------------------------------
// Network Data Block Section
//------------------------------------------------------------------
VW128  16#0026
VB130  16#00
VB131  16#03
VB132  16#0F
VB133  16#0F
VB134  'W=5,VB200,VB200' // Message 0 for Connection 0.
VB149  'R=5,VB200,VB200' // Message 1 for Connection 0.
VW164  16#7E73
//------------------------------------------------------------------
//Symbol Initializations
//------------------------------------------------------------------
VB166  0
VB167  0
VB168  1
//------------------------------------------------------------------
VB200  'CP243'        // Module ID for testing
```

Appendix C Timeouts

The values presented in the following tables are the times after which the associated action is initiated at the earliest.

At the Ethernet

Meaning	Action at timeout	Fixed time in seconds
Maximum waiting time until a telegram must have been received in its entirety via TCP/IP.	Telegram fragment discarded, CP closes the connection	3
Maximum waiting time until a telegram must have been sent in its entirety via TCP/IP.	Abort sending, CP closes the connection	3
Maximum waiting time of the CP until the CPU responds to a command sent to it by an external client.	Discard action, CP waiting for new commands, client does not receive response	60
Logout time if all channels are occupied and STEP 7-Micro/WIN 32 is not yet connected (so that the STEP 7-Micro/WIN 32 can always establish a connection).	The oldest of the connected TCP/IP servers that could not yet be assigned via TSAP aborts the connection and waits for the connection to be re-established	60
Interval in which incoming connection establishment requests are processed.	Delay of next connection establishment	1
Waiting time after unsuccessful connection establishment attempt by a client	Attempt to establish a connection is repeated	10
Waiting time of a client for the confirmation of a connection establishment request	Client closes the connection and reconnects	6
Maximum time for successful BOOT command	New attempt to receive a valid configuration either from the S7-200 CPU memory or via a BOOTP server	24 attempts in intervals of 2.5 seconds = 60 seconds

Table 18: Timeouts at the Ethernet

At the S7 bus:

Meaning	Action at timeout	Fixed time in seconds
Maximum time for a communication cycle between CP 243-1 and S7-200 CPU via the S7 bus **Note:** Per read/write command, generally 3 cycle times are required on the client side and 1 cycle time on the server side. Execution times of the read/write commands can be expected to be long if the user programs are extremely long and communication takes place over many channels simultaneously.	Command is discarded, CP 243-1 performs a warm start	10 (per cycle)
Timeout for the successful transmission of the CDB / NDB during booting of the CP	CP 243-1 performs a warm start.	120
Time after which the S7 CPU should have physically recognized the CP 243-1 as it boots.	CP 243-1 performs a warm start.	1

Table 19: Timeouts at the S7 bus

Appendix D Compatibility

Standard (STEP7) supported access from S7-300/400 Clients to:

CPU Firmware Version	S7-200 mit CPU222, CPU224, CPU 226/XM		
	<1.21	1.21	>1.21
Data Types			
BOOL	√	√	√
BYTE	√	√	√
CHAR		RO	√
WORD	√	√	√
INT		RO	√
DWORD	√	√	√
DINT		RO	√
REAL		RO	√
Data Areas			
INPUT	√	√	√
OUTPUT	√	√	√
MEMORY	√	√	√
DATA BLOCK			
VARIABLES *	√	√	√
ANALOG_INPUT			
SPECIAL MEMORY (FLAGS)			

√	means: supported
	means: generally not supported
▨	means: not possible if CPU with this firmware version is used
RO	means: "read only access"
*	means: the access to VBxx should be treated as DB1.DBBxx (Standard STEP7)

STEP7 Micro/WIN 32 Wizard supported CP 243-1 access as client to...

	S7-300/400		S7-200 mit CPU222, CPU224, CPU 226/XM		
CPU Firmware Version			<1.21	1.21	>1.21
Data Types					
BOOL					
BYTE	√		√	√	√
CHAR					
WORD					
INT					
DWORD					
DINT					
REAL					
TIME					
COUNTER					
Data Areas					
INPUT	√		√	√	√
OUTPUT	√		√	√	√
MEMORY	√		√	√	√
DATA BLOCK	√				
VARIABLES				√	√
ANALOG_INPUT					
SPECIAL MEMORY (FLAGS)					
S7-COUNTER					
S7-TIMER					

√	means: supported
	means: generally not supported
(shaded)	means: not possible if CPU with this firmware version is used

Simatic-NET OPC supported access to...

	S7-200 mit CPU222, CPU224, CPU 226/XM		
CPU Firmware Version	<1.21	1.21	>1.21
Data Types			
BOOL	√	√	√
BYTE	√	√	√
CHAR		RO	√
WORD	√	√	√
INT		RO	√
DWORD	√	√	√
DINT		RO	√
REAL		RO	√
Data Areas			
INPUT	√	√	√
OUTPUT	√	√	√
MEMORY	√	√	√
DATA BLOCK			
VARIABLES*	√	√	√
ANALOG_INPUT			
SPECIAL MEMORY (FLAGS)			

√	means: supported
	means: generally not supported
	means: not possible if CPU with this firmware version is used
RO	means: "read only access"
*	means: the access to VBxx should be treated as DB1.DBBxx (Standard STEP7)

Abbreviations

AC	Alternating Current
ASCII	American Standard Code for Information Interchange
BDT	Block Data Transfer
BOOTP	Bootstrap Protocol
CDB	Configuration Data Block
CP	Communication Processor
CPU	Central Processing Unit
CRC	Cyclic Redundancy Code
DB	Data Block (in S7-200 systems this is called V-Memory)
DC	Direct Current
FB	Function Block
GUI	Graphical User Interface
HW	Hardware
ICMP	Internet Control Message Protocol
ID	Identifier
IE	Industrial Ethernet
IP	Internet Protocol
ISO	International Standardization Organization
LED	Light Emitting Diode
LSB	Least Significant Byte
MAC	Medium Access Control
MLFB	Machine-Readable Product Name
MPI	Multi-Point Interface
MSB	Most Significant Byte
MW	Memory Word
NDB	Network Data Block
NPB	Network Parameter Block
OPC	OLE for Process Control
PDU	Protocol Data Unit
PELV	Protective Extra Low Voltage
PG	Programming Device
PPI	Point-to-Point Interface
RFC	Request For Comments
SDRAM	Synchronous DRAM (volatile memory)
SFB	System Function Block
SM	System Flag
TCP	Transmission Control Protocol
TSAP	Transport Service Access Point
VB	Variables Byte

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Training center

Siemens offers a number of training courses to familiarize you with the SIMATIC S7 automation system. Please contact your regional training center or our central training center in D 90327 Nuremberg, Germany for details:

Telephone: +49 (911) 895-3200.

Internet: http://www.sitrain.com

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The H/F Competence Center in Nuremberg offers a special workshop on the subject of fault-tolerant SIMATIC S7 automation systems. The H/F Competence Center also provides support in the configuration and installation of the equipment and with any problems that may arise on location.

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Additional support

If you have any further questions on SIMATIC NET products, please contact your Siemens partner in the branch office responsible for your area.

The addresses are found:

- in our IK PI catalog

- in the Internet
  http://www.siemens.de/automation/partner

- in the Interactive Catalog CA01
  http://www.siemens.de/automation/ca01

- on the Quickstart CD

Internet

You will find additional detailed information on using the CP described in this manual on the Internet under:

http://www.ad.siemens.de/csi/net

By entering the following **Article IDs**, you can call up current information (FAQ - Frequently Asked Questions). At the time of printing of this handbook, the following articles of relevance for this CP were available:

Article ID	Topic / question
2073614	Assigning the subnet masks of IP addresses in the "Subnetting" operating mode in the IP memory address space
6810459	Settable range of "Keep Alive" time intervals for Industrial Ethernet CPs (V1.1.0 and higher).

Table 20: Frequently asked questions