SIEMENS

SINEC

CP 143 TF with
NCM COM 143 TF

Manual

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Volume 1 of 2

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SINEC
CP 143 TF with NCM COM 143 TF

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Note

We would point out that the contents of this product documentation shall not become a part of or modify any prior or existing agreement, commitment or legal relationship. The Purchase Agreement contains the complete and exclusive obligations of Siemens. Any statements contained in this documentation do not create new warranties or restrict the existing warranty.

We would further point out that, for reasons of clarity, these operating instructions cannot deal with every possible problem arising from the use of this device. Should you require further information or if any special problems arise which are not sufficiently dealt with in the operating instructions, please contact your local Siemens representative.

General

This device is electrically operated. In operation, certain parts of this device carry a dangerously high voltage.

Failure to heed warnings may result in serious physical injury and/or material damage.

WARNUNG !

!

Only appropriately qualified personnel may operate this equipment or work in its vicinity. Personnel must be thoroughly familiar with all warnings and maintenance measures in accordance with these operating instructions.

Correct and safe operation of this equipment requires proper transport, storage and assembly as well as careful operator control and maintenance.

Personnel qualification requirements

Qualified personnel as referred to in the operating instructions or in the warning notes are defined as persons who are familiar with the installation, assembly, startup and operation of this product and who posses the relevant qualifications for their work, e.g.:

— Training in or authorization for connecting up, grounding or labelling circuits and devices or systems in accordance with current standards in saftey technology;

— Training in or authorization for the maintenance and use of suitable saftey equipment in accordance with current standards in safety technology;

— First Aid qualification.

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Notes

1   Introduction

1.1   What is the CP 143 and What Does it Do?

The SINEC CP 143 TF communications processor (normally abbreviated to CP 143) is the communications interface for connecting SIMATIC S5 programmable logic controllers to the cell and area network SINEC H1/H1FO (see Figure 1.1).

The SINEC NCM COM 143 TF software package (normally abbreviated to COM 143) is used to configure the communications links of the CP 143 communications processor. This software package can run on programming devices (PGs) or on PCs/ATs with the STEP 5 package V 6.3.
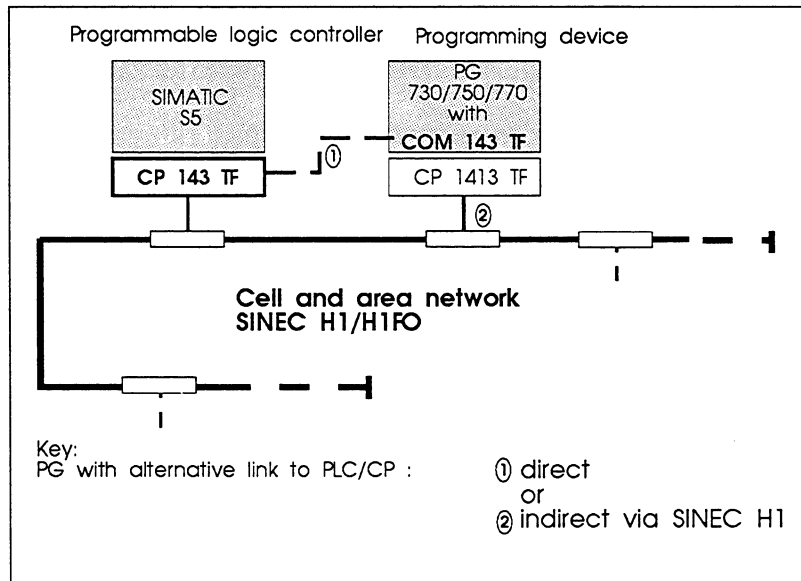
Fig. 1.1:   Integration of the CP 143 and the Configuration Software COM 143 TF

Modern, economic automation concepts demand that complex tasks are subdivided into simple subtasks and that the programmable logic controllers can be programmed using modular techniques. The programmable logic controllers (abbreviated to PLC) can therefore be programmed for particular applications using programming devices (PGs).

The automation programs in the various devices must be able to communicate with each other. The most economic solutions (in terms of planning, installation and operation) are bus systems. In the manufacturing field, SINEC H1/H1FO (the cell and area network from Siemens) has proved a reliable bus system.

Communication between the individual automation programs with SINEC H1/H1FO makes use of uniform communications protocols implemented on all the communications processors. With a network connection using the CP 143 communications processor, the most commonly used communications protocol "SINEC technological functions" (SINEC TF) has been implemented.

The SINEC TF communications protocol is based on the reference model for open communication according to the ISO/OSI (international standards organisation / open system interconnection). Table 1.1 shows the seven layers and their specific tasks.

7	**Application layer**	Uniform access to application-specific services
6	**Presentation layer**	Linguistic conventions
5	**Session layer**	Establish, maintain and terminate communications sessions
4	**Transport layer**	Transfer raw information reliably
3	**Network layer**	Provide network links
2	**Data link layer**	Establish, terminate data links
1	**Physical layer**	Operate a physical link for bit transfer

Table 1.1: Reference Model According to ISO/OSI and the Tasks of the Individual Layers

1

Open communication between different types of devices (heterogeneous) is only possible when the communications protocol of the device interfaces implements all seven layers of the reference model.

The SINEC TF communications protocol on the CP 143 therefore implements the functions of all seven layers. It has two points of access for communication between automation programs on the various S5 devices, the TF interface and the transport interface (see Figure 1.2).

For homogeneous communication between SIMATIC S5 devices, the protocol services of layers 1 to 4 are adequate. The transport layer transfers raw information reliably from S5 device to S5 device. Since the representation and meaning of the information exchanged is known to the S5 devices involved due to their programming, the services of layers 5 to 7 are not required. This reduces the protocol runtime per data exchange and the communications protocol is able to transfer messages more quickly.

For heterogeneous communication between SIMATIC S5 devices and automation components of other types, the protocol services of layers 1 to 7 are necessary. This allows open communication between heterogeneous automation devices provided they use the TF protocol.

	Automation program of the SIMATIC programmable controller	
	TF interface access	Transport interface access
	Communications interface	

7 6 5	TF interface SINEC TF = MMS
	SINEC AP protocol
4	Transport interface
	Transport protocol (ISO 8073 3)
3	Empty
2b	LLC protocol (IEEE 802.2)
2a 1	MAC protocol and networking (IEEE 802.3 - Ethernet)
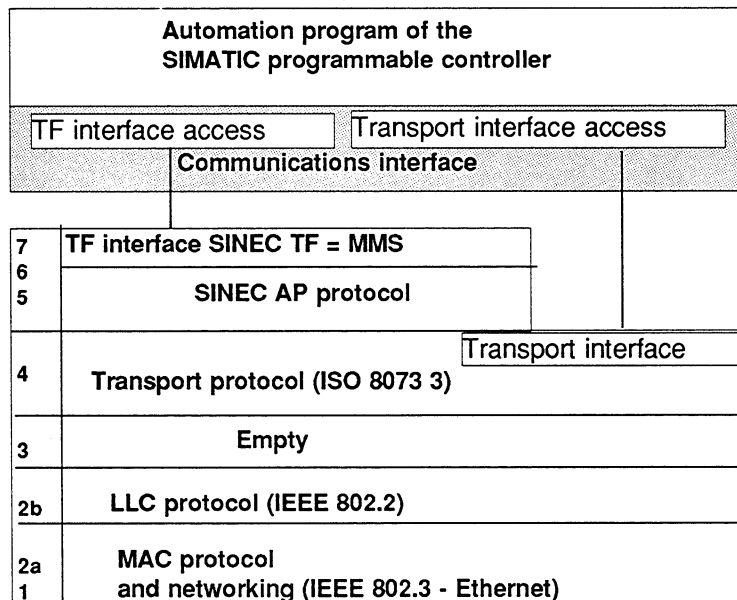
Fig. 1.2:   Protocol Profile of the SINEC CP 143 TF Communications Processor

The communications protocol of the CP 143 (see Figure 1.2) implements protocols according to ISO and IEEE in the transport-oriented layers 1 to 4. The implemented user interface to the transport protocol is used for homogeneous communication between two S5 devices.

In the application-oriented layers 5 to 7, the communications protocol of the CP 143 implements the SINEC AP protocol with the SINEC technological functions user interface (SINEC TF). This protocol implements the open communication between automation devices of different types.

The TF interface SINEC TF is based on the specifications of the international standard ISO 9506, Manufacturing Message Specification (MMS).

1

Advantages of using the CP 143 TF on SINEC H1/H1FO

Using the cell and area network SINEC H1/H1FO and the CP 143 communications processor has the following advantages for the user:

➤ The CP 143 allows efficient communication between your automation programs on S5 devices using the transport layer (transport interface).

➤ The CP 143 allows open communication via the application layer (TF interface) between the automation programs on S5 devices and on devices of other types.

➤ SINEC H1/H1FO networks your automation components via a shielded coaxial cable (SINEC H1) and via fiber optic cables (SINEC H1FO) and is suitable for industrial environments.

➤ You have the reliability and expandability of an industrial bus system.

➤ The investments you make in your SINEC H1/H1FO network are safe for the future, since the network corresponds to the widespread standard IEEE 802.3 (Ethernet).

➤ You have the reassurance that you are using a system that has proved itself in several thousand SINEC H1 network installations with thousands and thousands of SINEC connections.

1.2   Notes on Using the Manual and Overview of the Contents of Volumes 1 and 2

1.2.1   Overview of the Chapters

The manual consists of two volumes and a supplement with the following contents:

Volume 1:

Chapter 2

Overview of the CP's performance and mode of operation

This chapter provides you with the basic information required to understand the way in which the CP functions. This will help you to recognize the requirements when configuring a CP and writing PLC programs. The chapter is therefore helpful when selecting the CP functions suitable for your task.

Chapter 3

Technical description and guidelines for installing the CP 143

This chapter describes the hardware of the CP 143 TF (technical data, interfaces, operating statuses, memory modules) in greater detail. Topics such as module connections and starting up the module are discussed. The chapter also describes the start/stop response of the module in interaction with the CPU.

Chapter 4

Configuring and programming the CP 143 TF

This chapter describes the steps to be taken before putting the CP into operation. The basic information to understand the interaction between the PLC and the CP is explained step-by-step.

The other aspects resulting from the TF interface are described in Volume 2.

1

Chapter 5
NCM/COM 143 TF configuration software

The CP 143 TF communications processor provides a graduated range of performance for your communications tasks. by configuring the module, you adapt it to your particular tasks. Using COM 143 TF under SINEC **NCM** (**N**etwork and **C**ommunication **M**anagement) allows you to configure all the required parameters for the CP guided by menus.

Chapter 6
Example to introduce the transport interface

As a first-time user, this chapter familiarizes you with using the transport interface (S5S5 communication) of the CP 143 TF. The emphasis is on assigning parameters to the CP 143 TF using the COM 143 TF software package.

The aim of this chapter is to set up a small communications system to allow simple control of communications procedures. Example programs for SIMATIC programmable logic controllers and examples of parameter assignments for communications processors are provided (see also the notes at the end of this section).

Chapter 7
Configuration steps and basic configuration

This chapter describes the steps required depending on the selected type of communication and the initialization and basic configuration for operating the CP.

This chapter is based on the explanations of the steps in Chapter 4 and the introduction to the COM 143 TF configuration software in Chapter 5.

Chapter 8
Using the transport interface

If you decided to use the transport interface, you will find descriptions of the required functions of the COM 143 TF tool and the required parameters in this chapter.

The main point of interest is the description of the link in the data link block. Apart from the configuration functions for the data link block, the tools for documenting, starting up and testing the connection are described.

Chapter 9
Detailed information about the CP 143 TF

This chapter contains more detailed information about operating the CP 143 TF. This information is required particularly for links to non-SIMATIC components. It is intended to help you to install such heterogeneous links.

Chapter 10
Appendix
A Examples of Transport Connection Types
B Abbreviations
C Index
D Literature

Volume 2:

Description of the TF interface of the CP 143 TF

Supplement 'SINEC COM 143 TF Configuration Tool'

This provides an overview of the functions and screens of the SINEC COM 143 TF configuration tool.

1.2.2   Text Conventions, Extra Information

General symbols used in the text:

✓ This character indicates an activity or operation for you to perform.

☞   **This symbol highlights special features and dangers.**

This reference in the margin indicates the screen number of the screen in the supplement.

Prior knowledge:
To able to understand the complete examples, you require:

➤ knowledge of programming with STEP 5

➤ basic knowledge about using handling blocks (HDBs). The HDBs are described in the manual for your programmable logic controller or in separate descriptions.

Training offer:
Siemens provides SINEC users with a comprehensive range of training opportunities.

For more detailed information contact your local Siemens office.

Order numbers for the products mentioned in this manual can be found in the current catalogs.

1.2.3   User Groups and Topics

The CP143 TF with COM143 TF manual is intended for the following users:

➤ Users wishing to configure SINEC H1/H1FO cell and area networks with SIMATIC S5 stations

➤ Programmers of communicating application programs for SIMATIC S5 programmable logic controllers

➤ Personnel for installing SINEC H1FO cell and area networks with SIMATIC S5 stations

The manual contains the information required for the following:

➤ Assigning parameters to the CP 143

➤ Configuring links on the transport layer and application layer

➤ Configuring communication objects such as variables, domains and program invocations

➤ Operating the interfaces supported by the CP 143

➤ Configuring job buffers in the user programs of the SIMATIC S5 programmable logic controller for communication on the application layer

➤ Configuration of host computer functions for domain and program invocation services on the programming devices❑

2 Overview of the CP's Performance and Mode of Operation

To be able to use the CP 143 TF optimally for your tasks, you should be aware of the alternatives available with the functions implemented on the CP. These alternatives, particularly those involving the transport and TF interface were briefly mentioned in the introduction.

This chapter provides you with the basic knowledge required to understand how the CP functions. This will make it easier for you to recognize what is involved in configuring the CP and writing PLC programs. The chapter should therefore be helpful when you select the CP functions for your task.

The following points are dealt with:

> the significance of the SINEC H1/H1FO network and the functions provided by the CP 143 TF

> how to connect PLCs to the network with the CP 143 TF

> how the connection between the PLC program and the CP functions

> how send and receive jobs are handled

> what transport connections provide and how they are defined

> how application associations are defined and the extra performance they provide compared with transport connections

At the end of the chapter, a table compares the criteria for using the transport and TF interfaces.

2.1 Networking with SINEC H1/H1FO in an Industrial Environment

The cell and area network SINEC H1/H1FO is an industrial communications network for use in manufacturing and in industrial systems.

SINEC networks are, for example, used in the following areas of application:

➤ the automobile industry

➤ the chemical industry

➤ power stations

➤ food industry

➤ paper and printing industry

➤ traffic control systems

➤ water supply and sewage disposal systems

➤ mechanical engineering

The cell and area network SINEC H1/H1FO is based on the specifications in the IEEE 802.3 (Ethernet) standard. The standard defines a bus system. It describes the physical networking in layer 1 of the basic reference model and the bus access technique CSMA/CD (carrier sense multiple access with collision detect) in layer 2.

SINEC H1/H1FO is an industrial implementation of the specifications in this standard.

The customer can select the cable routing and connection points for the stations to be networked using the SINEC H1/H1FO network. The customer's network can be designed with both electrical and optical network segments.

SINEC H1 network segments are used for electrical connection via single screened coaxial bus cables (triaxial cables). Each cable can be up to 500 meters long and allows the connection of up to 100 transceivers. The communicating devices (e.g. SIMATIC S5 programmable logic controllers or computers of different types) are then connected to the transceivers via a drop cable which can be up to 50 meters long. The individual bus cables are connected via repeaters, bridges or star couplers.

2

SINEC H1FO network segments are optical segments implemented via fiber optic cables. The optical network segments are connected via star couplers and allow complex optical networking within a system. One advantage of the optical network is that the segments are immune to electrical interference and that distances up to 2500 meters can be covered. In a SINEC H1FO network, the communicating devices are either connected directly to star couplers via a drop cable or they are connected via drop cables to SINEC H1FO optical transceivers connected via optical network segments to star couplers (see Fig. 2.1).

⬜DTE	Data Terminal Equipment

———— Drop cable to station (up to 50 m)

━━━━ SINEC H1 bus cable (up to 500 m)

⬜ SINEC H1 bus transceiver

◩ SINEC H1 FO optical transceiver

‾FOC‾ SINEC H1 FO network seg. (up to 2500 m)

✳ SINEC H1 FO active star coupler

R SINEC H1 repeater
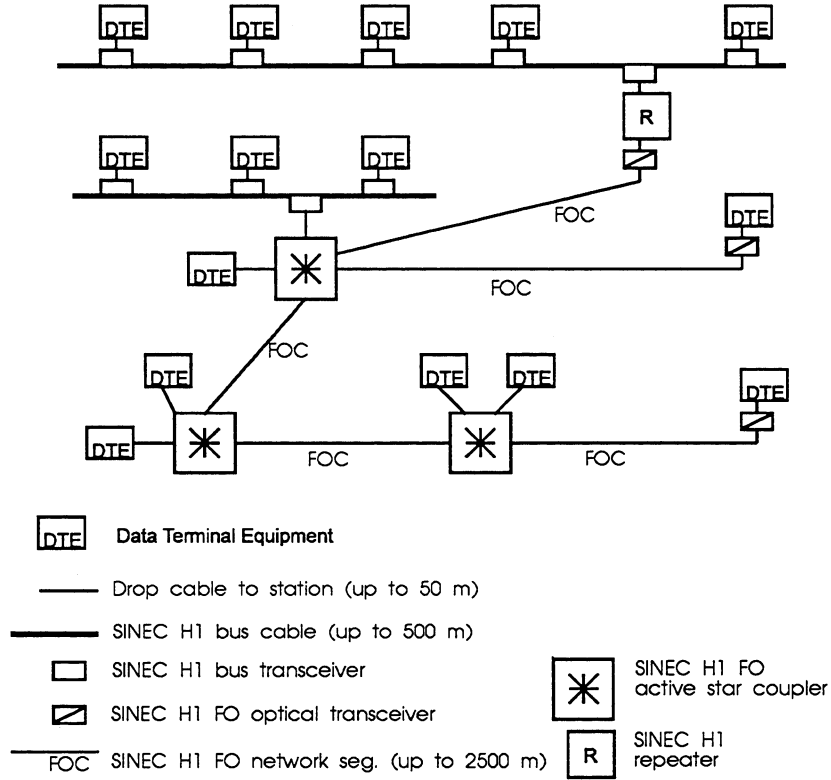
Fig. 2.1:   Example of a SINEC H1/ H1FO Cell and Area Network

2.2   CP 143 TF Communications Processor for SIMATIC S5

System integration
The CP 143 communications processor is the communications interface to the SINEC H1/H1FO cell and area network for the following types of SIMATIC S5 programmable logic controllers:

➣ SIMATIC S5-115 U/H

➣ SIMATIC S5-135 U

➣ SIMATIC S5-155 U/H

The CP 143 is designed specifically for these devices and is inserted as a module in the S5 rack.

Functions
The CP 143 TF provides communication via the following:

➣ a transport interface for homogeneous (S5-S5) networks with

  – data transfer services in the expedited and normal mode
  – data transfer in connection-oriented and connectionless operation.

➣ a SINEC TF interface for open communication with the services for the following:

  – device monitoring -> VMD services
  – data and program supply for the PLCs -> domain services
  – device control -> program invocation services
  – language-independent data transfer -> variable services
  – time synchronization -> clock services

Comparison of the interfaces

For direct communications links, the CP 143 TF provides data transfer on the transport layer 4 and the application layer 7. The following sections illustrate the differences. The table below summarizes the differences. Based on the table, you can decide which interface is suitable for your application. For more detailed information, refer to the documentation indicated in the table.

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Interface	Transport interface	TF interface
Characteristics	Byte-oriented communication	Message-oriented communication with services for controlling devices and transferring variables
	Communication specific to SIMATIC S5	Communication standardized according to MMS
Area of application	**Homogeneous network** of SIMATIC controllers	**Open network** SIMATIC controllers with connections to host computers or systems of other vendors
	Communication possible with existing CP 535 systems	
Documentation	CP 143 Manual Volume 1, Chap. 1 and 2 Introduction Chap. 4 and 8	CP 143 Manual Volume 1, Chap. 1 and 2 Introduction Volume 2 TF Interface

Mode of operation

The CP 143 operates as a slave processor of the programmable logic controller and exchanges messages with the CPU of the programmable logic controller via a dual-port RAM and the S5 backplane bus.

With send jobs from the S5 device, the CP 143 packs the data to be sent to a partner system in one or more protocol data units (PDUs) and transmits these PDUs via the SINEC H1/H1FO cell and area network to a partner system.

The CP 143 receives the PDUs addressed to it from the SINEC H1/H1FO network and decodes the PDUs to form messages that can be interpreted by the S5 device (see Fig. 2.2).

Messages exchanged via HDBs
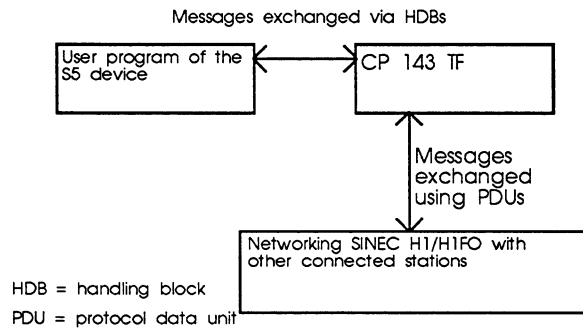
Fig. 2.2:   Message Exchange between the S5 Device, CP 143 and SINEC Network

2.3   Transport Connections and the Transport Interface of the CP 143 TF

2

Meaning

Messages are exchanged between the communications program of the CP 143 and the partner station using protocol data units (PDUs) transmitted via transport connections.

A transport connection is a logical connection between two access points for transport services on different stations. The transport connection is based on address information which describes the transport route between the two access points.

Access points for transport services

Station access via station addresses

Transport-connections via H1

SINEC H1/H1FO cell and area network
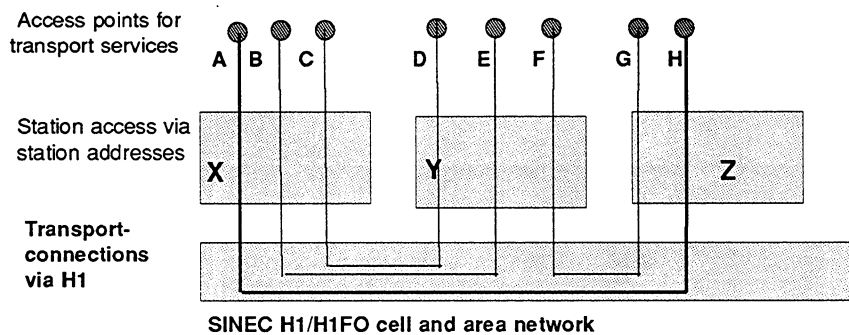
Fig. 2.3:   Access to the Transport Services

Description of the connection

From Table 1.1 it is clear that the task of a transport connection is to transfer raw information reliably. Fig. 1.2 illustrates the protocols implemented by the CP 143. Each of the three protocols up to layer 4 of the ISO/OSI reference model has specific address information.

The MAC protocol according to IEEE 802.3 (Ethernet) manages and uses MAC addresses also known as station addresses or Ethernet addresses. The station addresses uniquely identify the access to the stations connected via the SINEC H1/H1FO cell and area network.

The LLC protocol according to IEEE 802.2 identifies the logical connection between the MAC protocol and the protocols of the higher layers. With the ISO protocols of the higher layers, the LLC address has the hexadecimal value FE. Since on the CP 143, the ISO transport protocol is above the LLC protocol, the value of the LLC address is always FE. The LLC address is therefore not an individual parameter for transport connections of the CP 143.

The transport protocol according to ISO 8073 manages and uses the address information of transport service access points (abbreviated to TSAP). The TSAPs of the transport protocol identify the access points for services of the transport protocol on the individual stations. Two access points form the start and the end of a transport connection via which the PDUs can be transferred reliably in both directions.

A transport connection between two CP 143 communications processors of stations X and Z with access points A and H (see Figures 2.3 and 2.4) is described uniquely in both stations using the following parameters:

	Station X		Station Z
local station address	X		Z
remote station address	Z		X
local TSAP	A		H
remote TSAP	H		A
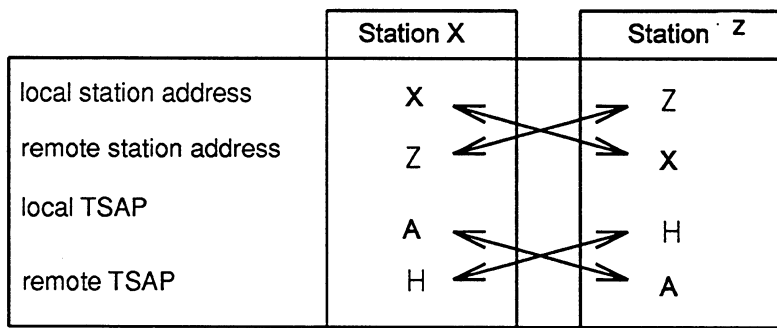
Fig. 2.4:   Parameters for a Transport Connection

The connection description on the CP 143

These parameters are specified with the COM 143 configuration tool and stored in data link blocks and SYSID blocks on stations X and Z.

Each station has only one SYSID block with the local station address whereas it has a separate data link block for every transport connection containing the connection parameters and the local parameters (see Figures 2.4 and 2.5).
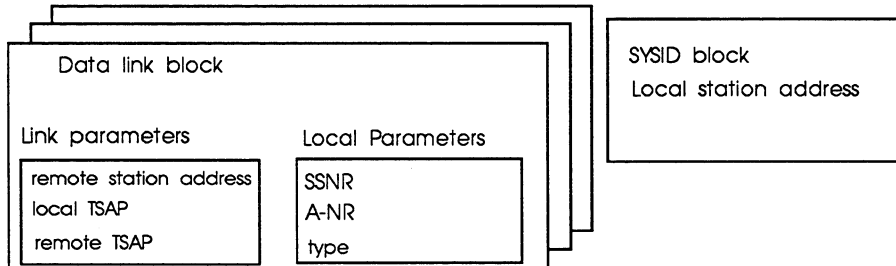
Fig. 2.5:   Data Link Block and SYSID Block with Transport Parameters

Using transport connections, messages are transferred reliably from S5 device to S5 device (S5-S5 communication).

Understanding the content of a message

To ensure that the content of a message is understood in the S5 devices in terms of syntax and semantics, this must be programmed in the automation programs.

PLC-CP link via handling blocks

Information is exchanged between the S5 device and the CP 143 using SIMATIC S5 handling blocks (abbreviated to HDB). The handling blocks SEND and RECEIVE are available for transmitting and receiving messages.

When there is a send job to be executed, the automation program supplies the SEND handling block with parameter values and transfers the send job via the dual-port RAM to the communications program of the CP 143. The communications program executes the send job and reports the status of the job back to the automation program.

When there is a receive job, the automation program supplies the RECEIVE handling block with parameter values and transfers this receive job via dual-port RAM to the communications program of the CP 143. The communications program then executes the receive job and reports the status of the job back to the automation program (see Figure 2.3).

As described above, the communications program receives the jobs from the PLC program via the dual-port RAM. For this job to be passed on its way, the background communication must be triggered. In this case, the SEND-ALL handling block is called in the user program to trigger send jobs and the RECEIVE-ALL handling block to trigger receive jobs.
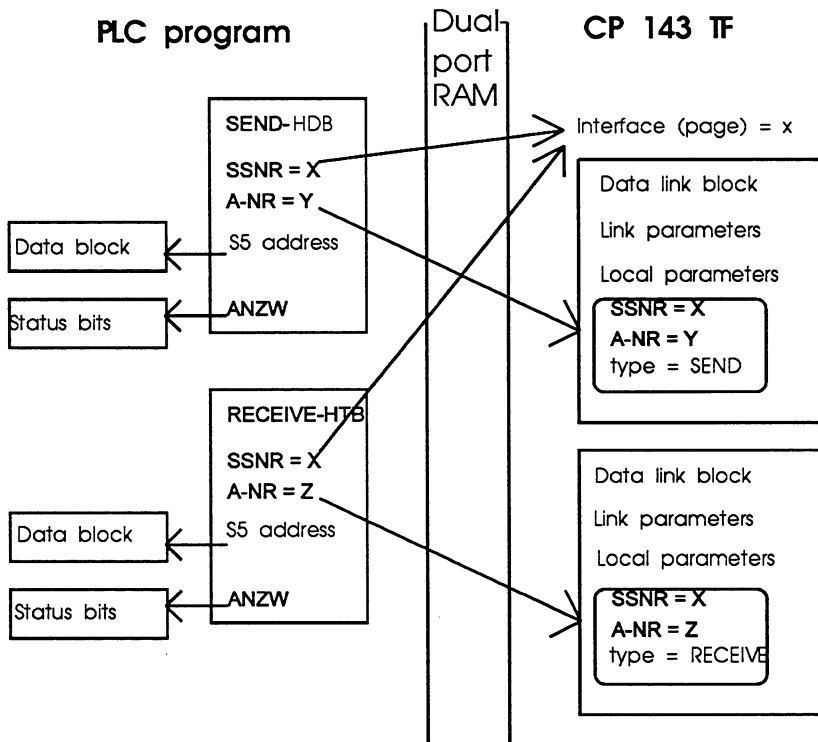
Fig. 2.6:   SEND and RECEIVE Handling Blocks

Meaning of the parameters

The SEND and RECEIVE handling blocks are represented in Figure 2.6 with parameter values.

The following parameters identify an HDB call:

➤ SEND and RECEIVE identify the type of job

➤ The interface number (SSNR) identifies the base address of the dual-port RAM for the exchange of information between the S5 device and CP143

➤ The job number (A-NR) identifies the individual job to be transferred from the automation program to the communications program of the CP 143. Only one job for one job number can be triggered at any one time.

➤ The S5 address indicates the start address and the length of the data buffer in the S5 device. With send jobs, these data buffers contain information to be transferred, with receive jobs, the received information is located in this data buffer when the job is complete.

➤ The status word (ANZW) identifies the address of a status word in the S5 device. The status of the job is indicated to the automation program using the status word.

The job number (A-NR) parameter allows the communication job to be assigned to a data link block. This contains the parameters which describe the connection to a partner station.

The communications programs of the CP 143 and the partner station communicate by means of protocol data units (PDUs). This allows the transfer of data to the user and a data flow check with the receive enable and receive acknowledgment messages.

Sequence of job processing

The chronological sequence of a send job is as follows:
The SEND HDB call starts a send job on the CP 143 and transfers the S5 address of the information to be sent and the address of the status word assigned to the job to the communications program of the CP 143.

The CP 143 makes a data buffer available and transfers all the data to be sent to the data buffer via the background communication (SEND-ALL). When the receive enable is set on the partner station, the PDU is transferred via the network to the proper station.

After the PDU has been received in the partner station, the CP 143 receives an acknowledgment via the network and transfers the status of the send job to the assigned status word (see Figure 2.7) via the background communication (RECEIVE-ALL).
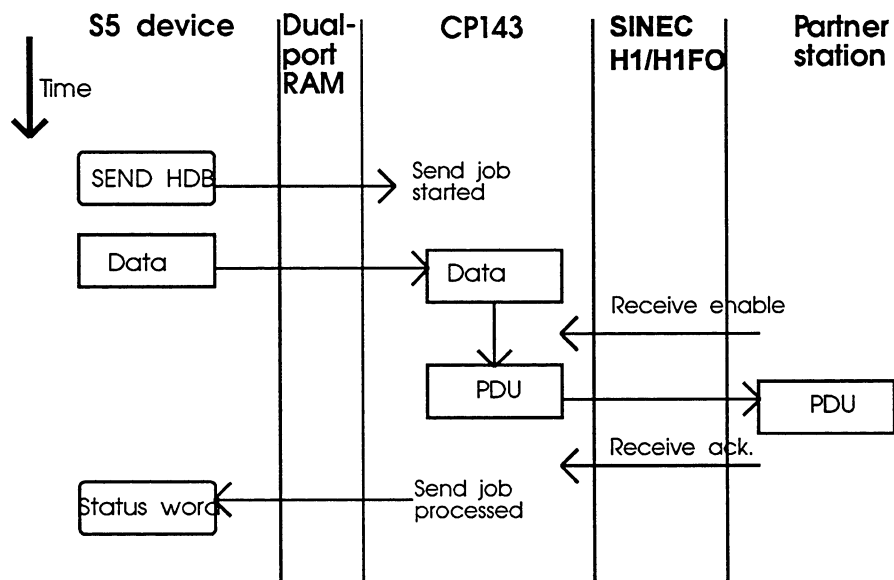
Fig. 2.7:   Chronological Sequence of a Send Job

The chronological sequence of receive jobs is as follows:

The RECEIVE HDB call starts a receive job on the CP 143 and transfers the S5 address for the data to be received and the address of the status word assigned to the job to the communications program of the CP 143.

The CP 143 makes a data buffer available and sends a receive enable to the partner station for this link.

Following this, the partner station sends the PDU for this connection. The CP 143 receives the PDU and extracts the data to be received. With the help of the background communication (RECEIVE-ALL), the communication program transfers the data to the data buffer of the S5 address and terminates the receive job by updating the status word.
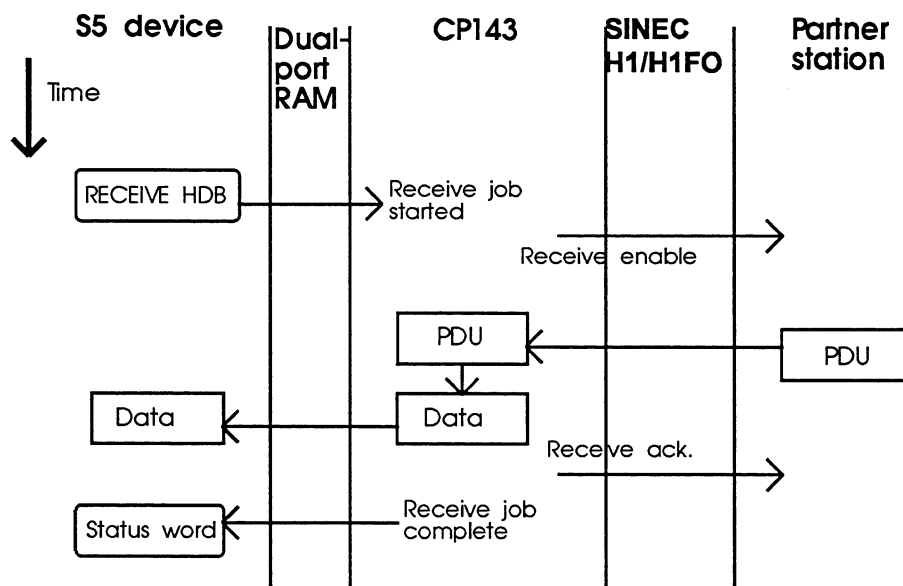
Fig. 2.8:   Chronological Sequence of a Receive Job

2.4 Application Associations and TF Interface of the CP 143 TF

2

Overview

With transport connections between S5 devices and devices of other vendors, the syntax and semantics of the exchanged data structures are not known on the transport layer. With communication between heterogeneous devices, additional parameters are therefore required and a protocol to manage these parameters to allow the messages to be understood.

Figure 1.2 illustrates the performance required in layers 5 to 7 above the transport layer. As this diagram shows, the protocol for these tasks is the SINEC AP protocol implemented on the CP 143 with the interface to the SINEC technological functions (SINEC TF).

The application associations of the CP 143 are managed via this protocol. Application associations allow communication between different types of devices.

The following simple example illustrates the most important aspects of application associations and TF services.

Example of a task

A host station wants to read process values belonging to a particular control task on an S5 station.

The problem is the language barrier

The host processes the process variables in its own syntax (e.g. high level language C syntax). The data presentation in the programmable logic controller, on the other hand, conforms with the S5 conventions. There is therefore a barrier to communication between the devices (cf. Figure 2.9).

Host computer system
with TF interface

C data structure for the
process variables

CHAR   Type;
INT8   Value1;
INT8   Value2;
INT16   Value3;

Language barrier

SIMATIC S5
programmable logic
controller

S5 data blocks for the process
variables

KS = X
KH = 2B01
KH = 1111
KY = 9,7
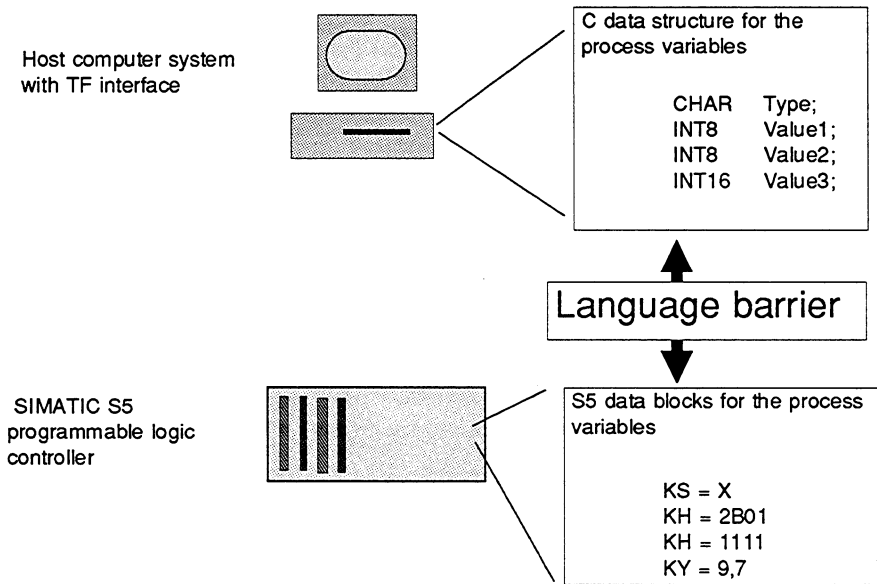
Fig. 2.9:   Language Barriers in Communication between Heterogeneous Devices

The standardized TF interface provides the solution

The TF interface available on the CP 143 TF provides a flexible solution that can be implemented using COM 143 TF. The decisive factor is that the specific characteristics of the S5 device are masked by the CP 143 TF with its TF services. In the example, the specific data presentation within an S5 data block on the one hand and the C data structure on the other hand must be disguised. The S5 device appears to the host as a virtual device (VMD = virtual manufacturing device) via the CP interface with standardized programs and data.

The following diagram illustrates the access to the SINEC H1 network via the TF interfaces at both ends. The language barrier then no longer exists.

Host system with TF interface

TF interface

SINEC H1/H1FO cell and area network

Virtualized view of the PLC via the TF interface and the TF functions on the CP 143 TF.

CP 143 TF with TF interface and TF services

SIMATIC S5 programmable logic controller

CPU with PLC programs and data
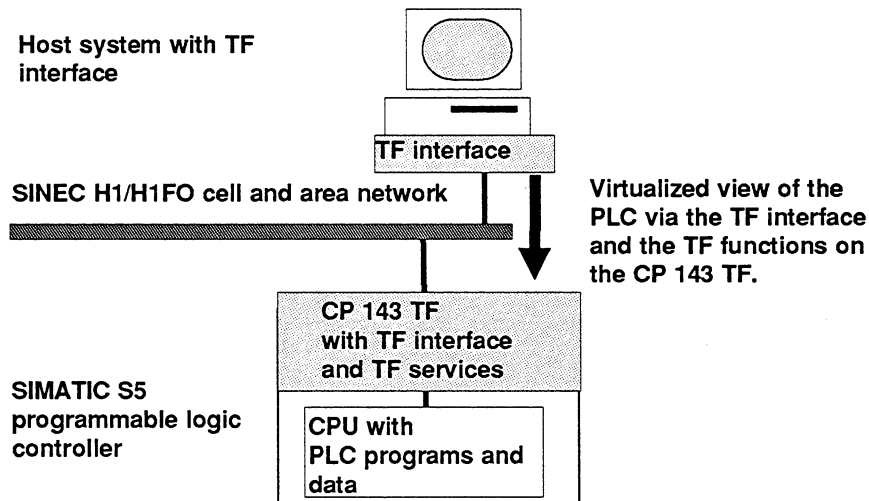
Fig. 2.10:   TF Interface of the CP 143 TF for Connection to Heterogeneous Systems

The TF services

By using the TF interface instead of the transport interface, the host has access to a variety of services required to control and monitor the PLC.

In the example, these are TF variable services which break down the language barrier. An overview of the services and their performance can be found on the following page.

Overview of the TF services

By means of application associations, the following services can be implemented on the CP 143 TF:

➤ VMD services

With the VMD services, information about the characteristics and status of a VMD can be obtained (which services can be executed by the device, which objects exist etc.).

➤ Domain services

Program and data can be transferred with these services. The transfer can also be initiated by a third device, e.g. loading a program from a file server to a PLC.

➤ Program invocation services

The program invocation models an executable program section. The defined services include create, start, stop and delete program invocations.

➤ Variable services

Variable services are services for writing and reading the values of variables. This data can be simple (integer) to complex (structures). A uniform syntax is designed to describe the data structure removing language barriers occurring in the data type description (in the example: the S5 data block can be read in the host computer).

Initiating an application association

To be able to use the TF services, an application association must be initiated between the host and the PLC.

To understand the steps described below for using the TF interface, you must be aware of the difference between the definition of an application association and the definition of a transport connection with SIMATIC S5.

Addressing

At the SIMATIC S5 end, there is only a slight expansion of the addressing and assignment strategy compared with the representation for transport connections. A transport connection is still required, but the connection between the application and the transport connection can now be described by an additional multiplex address. This MUX address is unique for the transport connection and applies to both end points of the transport connection. Using this expansion, more applications can maintain application associations using one transport connection.

SINEC H1/H1FO cell and area network
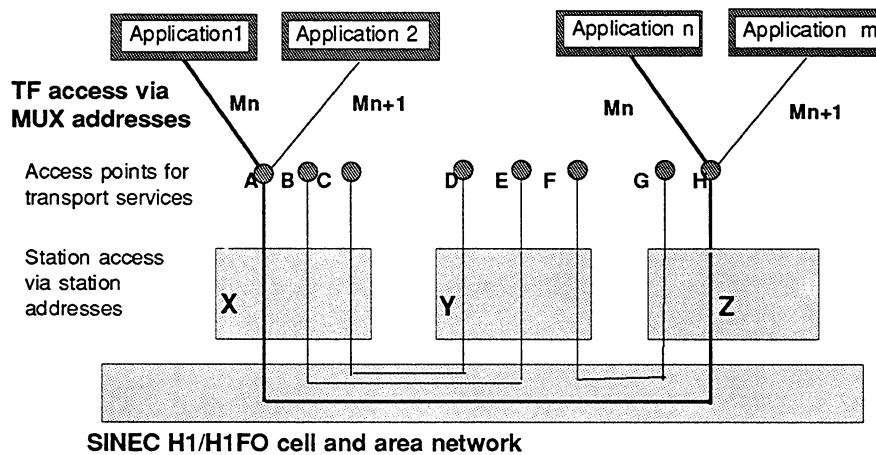
Fig. 2.11:   Access by Application Associations to the Transport Services

An application association between two CP 143 TF communication processors of stations X and Z with transport access points A and H and application access Mn is described uniquely in both stations using the following parameters:

	Application 1 in station X		Application n in station Z	
local station address	X		Z	
remote station address	Z		X	
MUX address	Mn		Mn	
local TSAP	A	H		
remote TSAP	H		A	
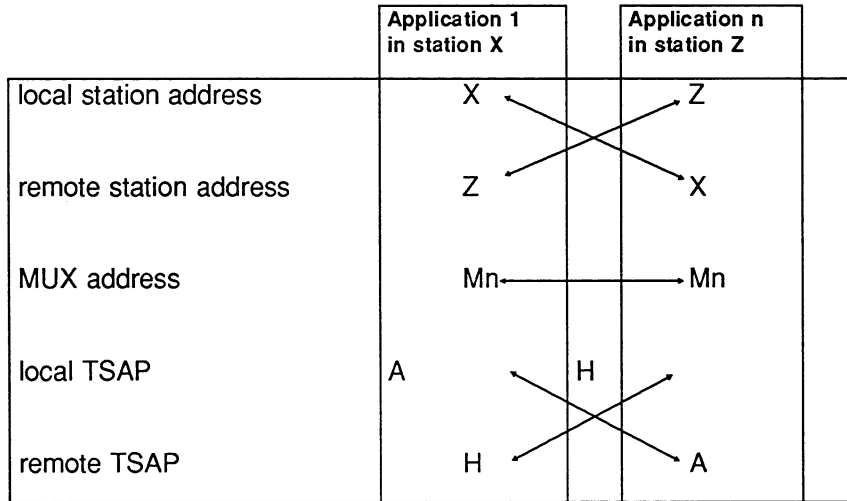
Fig. 2.12: Parameters for an Application Association

These parameters, just as with the transport connections, are stored in data link blocks and SYSID blocks on stations X and Z. With application associations, parameter storage is as shown below:

Data link block

Link parameters   Local parameters

remote station address	SSNR
local TSAP	A-NR
remote TSAP	
MUX address	

SYSID block

local station address
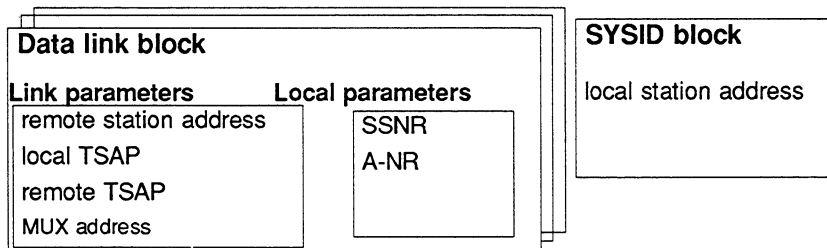
Fig. 2.13: Data Link Block and SYSID Block for Application Associations

Using the TF interface

What needs to be done by the user to implement a communications task with the TF services? In outline, the following steps must be taken:

2

➤ Link configuration

Application associations are configured on the CP using the COM 143 TF configuration tool. The link parameters configured here include the station address and local and remote link parameters just as for the transport connections (see Figure 2.13). The transport connections continue to be used at a lower level for data transfer.

➤ Configuring variables

Structure information is stored on the CP. This information describes the data areas which can be addressed via the TF interface. Depending on the task in hand, this information is stored either for a specific link in the data link blocks or globally for all CP links. The global use of information with the assignment of variables to a scope is explained in detail in the TF description.

➤ S5 programming

The data to be read are generated or updated by the PLC programs and saved in data blocks on the PLC.

Client TF jobs such as read variable or write variable are formulated using the REQUEST EDITOR configuration tool in the form of job buffers and transferred to the CP for processing during the running of the program. These are transferred in much the same way as with the transport services using the SEND-DIRECT handling block.

It is possible to write the program in such a way that the PLC can check whether a partner has read a local variable. It could, for example, be possible to update values based on the result of such a check.

The TF interface in the example

Steps at the S5 end

Based on the example "reading process variables", the following steps must be taken on the SIMATIC S5 (PLC):

➤ Link configuration

One application association between the host and PLC must be configured with COM 143 TF.

➤ Configuring variables

The data structures of the process variables to be read must be specified as a variable description when configuring the link with COM 143 TF. The tool makes sure that the entries are syntactically correct.

➤ S5 programming

The process variables are generated and updated by the PLC program. By evaluating condition codes (status bits), read access can be detected and can lead to a defined reaction in the PLC program.

On the host computers:

➤ Configuring the link and variables

Application associations are also configured on the CP of the host computer. The way in which these are configured depends on the particular system being used. Transport connections continue to be used for data transfer.

➤ Host computer programming

On the host computer, the TF services are called, in our example to read variables. How the call is made depends on the application association being used on the computer.

The following diagram illustrates the storage of the information produced during configuration at the SIMATIC S5 end on the CP 143 TF.

2

**Host computer
system with TF
interface**

TF interface　　　　　　　　　　　　　Appl. association

SINEC H1/H1FO cell and area network

**CP 143 TF
with TF interface
and TF services**

Data link block with
- link parameters
- variable description

**SIMATIC S5
programmable logic
controller**

**CPU with
PLC programs and data**
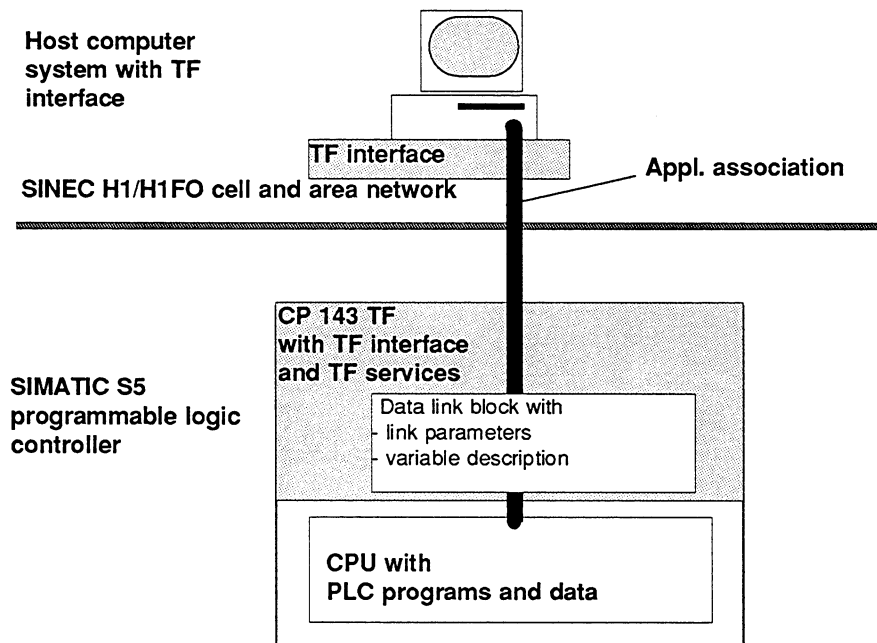
Fig. 2.14:　TF Interface of the　CP 143 TF for Connection to Heterogeneous Systems

Using other facilities of the TF services

Based on a simple read procedure, the example shows how the TF interface is used. The overview of the TF services is simply an outline of the broad spectrum of all the available services.

At the TF interface level, you have a powerful instrument for controlling the programmable logic controller and adapting it flexibly to the process. These TF services are all used according to the same principles outlined in the example.

Notes

3   Technical Description and Guidelines for Installing the CP 143 TF

The CP 143 communications processor is used to attach programmable controllers belonging to the SIMATIC S5 family to the SINEC H1 serial bus system. It can be used in all the programmable controllers of the U and H series

This chapter describes the communications processors based on the CP 143 hardware (6GK1 143 0AA01 and 6GK1 143 0AB01).

The chapter provides you with an overview of the following:

➢ the construction of the CP.

➢ how the interface between the PLC and CP functions.

➢ the steps required for installation

➢ the technical data of the CP

➢ the pin assignments of the connectors

➢ synchronization and start up of the CP

The principles of the CP 143 TF software are explained in the following chapter.

Note the references to the screens in the accompanying supplement.

3.1   CP 143 Hardware

3.1.1   Overview

Purpose
The CP 143 communications processor connects the SIMATIC programmable logic controllers S5-150 U, S5-135 U, S5-155 U/H und S5-115 U/H to the SINEC H1 network.

Versions
Two versions of the CP 143 are available. One without a +15 V power supply module, the other with a +15 V power supply module.

The version with a + 15 V power supply module is required with the S5-115 U/H to supply the SINEC H1 transceiver. The other PLCs provide the +15 V on the backplane bus and this can be used by the CP 143.

On board, the CP 143 has 60×2^{10} bytes of RAM for configuration data (no extra RAM module needs to be plugged in). This memory is backed up by the PLC battery and no data are lost if there is a power failure.

Notes on installation
The CP 143 can be installed in every slot of a PLC that is allowed for CP operation (slot label: "CP"). With PRIORITY 0 jobs, the CP 143 triggers an interrupt to the CPU of the PLC at the receive end. Since not all CP slots have interrupt lines, you must select a slot wired for interrupts if you intend to use jobs with priority PRIORITY 0.

You will find more detailed information about PLC slots in the appropriate PLC manuals.

Before installing the CP, settings such as the base interface number and deactivation of the +15 V FAULT LED should be made.

Via the base interface number, the PLC selects the communications processor (the board) and therefore the four interfaces via which it communicates. The base interface number (four pages) is set with the DIP switch S2. For normal purposes, the base SSNR can be set from 0, 4, 8, 12, to 228. The base interface numbers 232 and 236 activate backplane bus communication (PLC functions via the path PG->H1->CP 143->backplane bus-> CPU).

The CP is connected to the SINEC H1 network using a transceiver cable (drop cable).

3

To install and configure the CP, you require the following configuration tool

➢ COM 143 TF, described in detail in this manual

➢ or the previous product COM 143 V1.1

The PG is connected to the CP via the serial interface (AS511/PG cable). After naming the node (entering the Ethernet address in the SYSID ONLINE and running a cold restart on the CP 143) the CP can be configured both via the AS511 or via the SINEC H1 interface ONLINE or the database can be loaded and saved.

You can also transfer the configuration data of the CP from the PG to an EPROM module OFFLINE and then insert the EPROM in the module slot of the CP.

For PLC functions using bus selection (path: PG->H1->CP 143->CPU or PG->H1->CP 143->CORC->CPU) and for domain and program invocation services you require a signal line (swing cable).

Caution when working with the CP 143
The CP 143 contains electrostatically sensitive devices (ESD). Please keep to the ESD guidelines when working with the CP 143.

The CP 143 must only be inserted or removed from the PLC when the power supply is switched off.

The same applies to memory modules.

3.1.2   Design

The CP 143 is mounted on a double Euroformat board. The width of the front panel is 1 1/3 standard slots (approximately 20 mm).

The CP 143 is equipped with the following:

➤ two 48-pin backplane connectors (row 2),

➤ one 15-pin socket connector to connect a programmer

➤ one 15-pin socket connector with locking device to connect an Ethernet transceiver via a transceiver cable.

The design of the board is shown in Fig. 3.1. This indicates the positions of all the plug-in jumpers for hardware parameter assignment of the CP 143. The diagram shows the CP with the default base interface number = zero.

The front panel of the CP 143 has a rectangular slot to accommodate a memory module (EPROM or RAM). It also has controls and displays.

Key:
Jumper inserted: ▬
Jumper not inserted: ▭

Jumper X14 does not exist with CP version
-0AB01
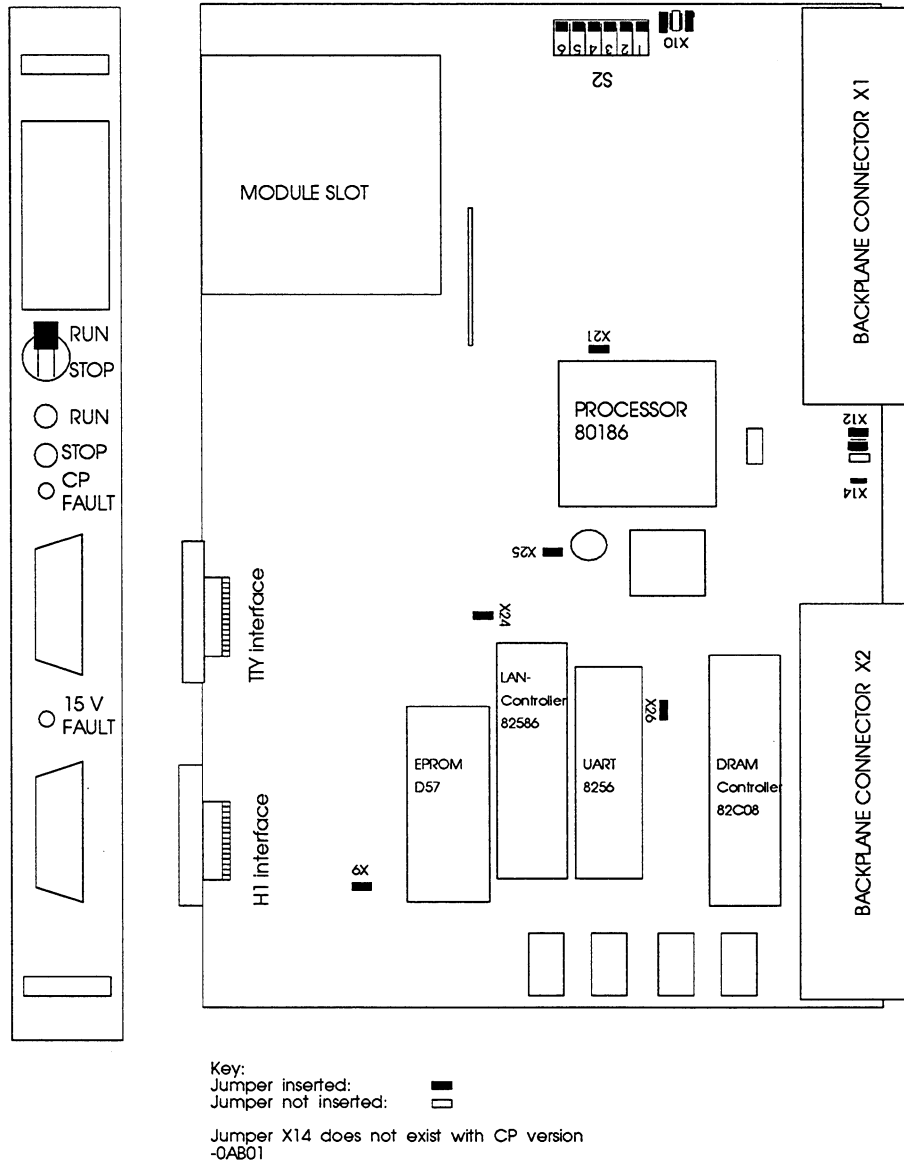
Fig. 3.1:   Structure of the Board of the CP 143 TF -View from Front and Sidet

3.1.3   Displays and Controls

The CP 143 has the following displays and controls (Figure 3.1:)

Displays:

RUN
Signals the status "interface to SINEC H1 active".
The green RUN LED can only light up if the operating mode selector is set
to RUN.

STOP
Signals the status "interface to SINEC H1 inactive".
The red STOP LED can also light up when the operating mode selector is
set to RUN.

CP FAULT
Indicates that the available memory space has been exceeded.

15V FAULT CP 143/A1
Indicates that the 15 V power supply is faulty or absent.

Controls

RUN / STOP switch:
Using the mode selector, you can change the CP 143 from the RUN to the
STOP state (see above). Providing it has not stopped for any other reason,
you can use the mode selector to bring about the opposite change of state,
i.e. from STOP to RUN.

3.1.4   Memory Modules

RAM and EPROM modules can be inserted in the CP 143 memory slot. A RAM module with a memory capacity less than 64×2^{10} bytes is pointless, since the CP 143 itself has 60×2^{10} bytes on board.

EPROM modules with a memory capacity of 16×2^{10}, 32×2^{10} and 64×2^{10} bytes can be used.

The CMOS technology of EPROM blocks has replaced the NMOS technology. The new modules now use CMOS technology. When programming EPROM modules, make sure that you select the suitable programming number.

3

☞   **If you select the wrong programming number, the CMOS - EPROM module is destroyed.**
Programming a CMOS EPROM module with the old COM 143 V1.1 also destroys the module.

To program a CMOS EPROM. use the NCM COM143 or COM EPROM V1.02 and make sure that you use the correct programming number.

RAM modules:

➤ 6ES5377-0AA32   memory capacity 64×2^{10} bytes

➤ 6ES5377-0BA31   memory capacity 64×2^{10} bytes   (with back-up battery on the module)

NMOS EPROM modules:

➤ 6ES5376-0AA11 memory capacity 16×2^{10} bytes, programming no.:   56

➤ 6ES5376-0AA21 memory capacity 32×2^{10} bytes, programming no.:   59

➤ 6ES5376-0AA31 memory capacity 64×2^{10} bytes, programming no.: 162

CMOS EPROM modules:

➤ 6ES5376-1AA11 memory capacity 16×2^{10} bytes, programming no.: 456

➤ 6ES5376-1AA21 memory capacity 32×2^{10} bytes, programming no.: 459

➤ 6ES5376-1AA31 memory capacity 64×2^{10} bytes, Programmier Nr.: 462

3.1.5 Dual-Port RAM Interface

The CP 143 communicates with the SIMATIC PLC with the aid of handling blocks via the DUAL-port RAM. It allows "simultaneous" access by both partners. The PLC selects the relevant CP using the base SSNR and at the same time its 4×2^{10} byte long dual-port RAM.

S5 - CPU   **CP143**

HTB   SSNR   Kachelauswahlregister   Basis-Schnittstellennummer
                         (SSNR)   (DIP Schalter)

FFFF   A   B
FEFF

                              A=B

F7FF   Freigabe der Baugruppe und
F400   Zuordnung der Schnittstelle (Kachel)

Adressfenster
                                        Dual Port RAM des
                                        CP 143 (4x1KByte)

0000
S5 Adressbereich
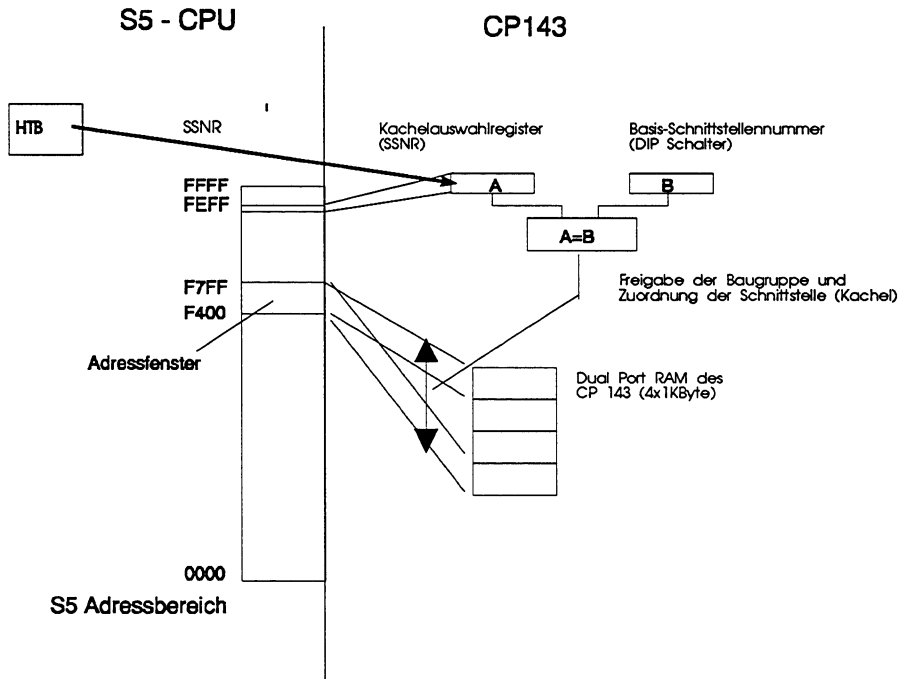
Fig. 3.2:   Addressing Procedure on the Dual-Port RAM Interface

A CPU addresses the four pages via the 1×2^{10} byte long address window F400 H to F7FF H. The page is selected via the page selection register according to the SSNR specified in the handling block.

If there are several communications processors being used in one programmable logic controller, make sure that there is no double addressing. This means that a base SSNR must be unique in the PLC. If, for example, a CP 5430 (order number 6GK1543-0AA00) exists in the PLC,

remember that its dual-port RAM uses 8×2^{10} bytes of memory (note: the new CP 5430 TF, order number: 6GK1543-0AA01) uses only 4×2^{10} bytes.

The default base SSNR of the CP 143 is zero (all DIP switches OFF; see Figure 3.1)

The dual-port RAM is divided into four pages each with 1×2^{10} bytes. Each page forms an interface in the CP to the PLC.

	Page 1	Page 2	Page 3	Page 4

	Page 1	Page 2	Page 3	Page 4
3FF each 32 bytes 3E0	Handshake 1	Handshake 2	Handshake 3	Handshake 4
3DF each 224 bytes 300	Status 1	Status 2	Status 3	Status 4
2FF 256 bytes 200	SD1	SD2	SD3	SD4
1FF each 512 bytes 000	Data 1	Data 2	Data 3	Data 4

Fig. 3.3:   Division of the Dual-Port RAM into Pages and Structure of the Pages

Special features occurring in the multiprocessor mode are desribed in Section 4.3, Page 4-43.

3.1.6   Settings on the CP 143

- Base interface number in DIP switch S2

- +15 V FAULT LED deactivated with jumper X10/3-4
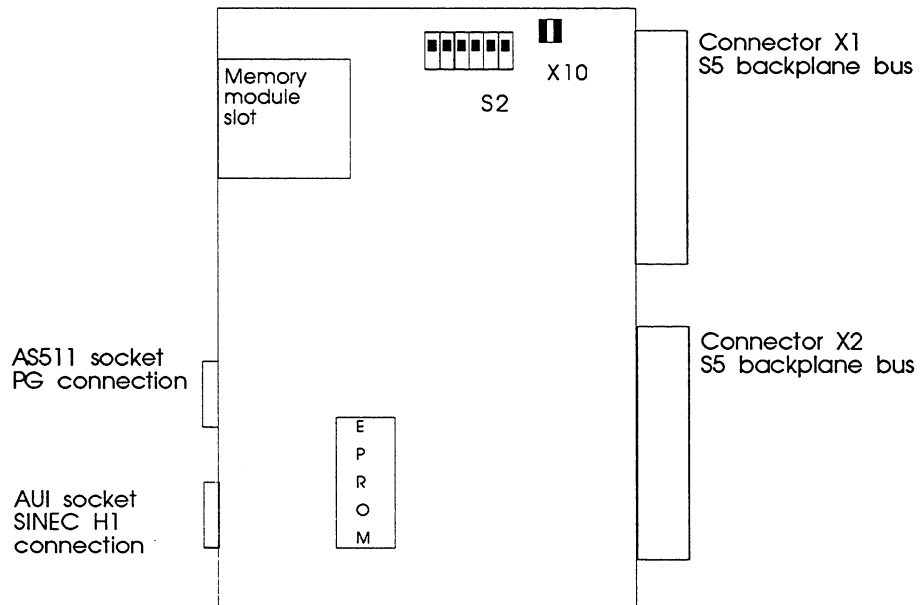
Fig. 3.4:   Default Settings

Setting the base interface number (base SSNR)

Example of base SSNR = 0	Example of base SSNR = 4	Example of base SSNR = 8	Example of base SSNR =
6 5 4 3 2 1	6 5 4 3 2 1	6 5 4 3 2 1	6 5 4 3 2 1
S2	S2	S2	S2
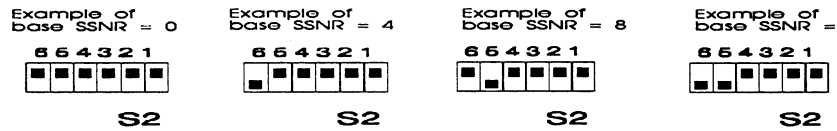
Activating/deactivating the +15 V Fault LED[*]

Setting for activating -> +15 V LED **lit** if +15 V fault:

```
5 3 1
6 4 2
X10
```
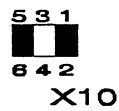
Jumper X10 / 3-4 not inserted (default)

Setting for deactivating -> +15 V LED **not lit** if +15 V fault:

```
5 3 1
6 4 2
X10
```
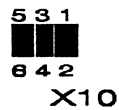
Jumper X10 / 3-4 inserted

*) The function is only possible from CP hardware version 5 (i.e. the version label has a cross at position 5).

3.1.7   Installing the CP 143 in the PLC Rack

The CP 143 can be installed in every slot of a PLC that is allowed for CP operation (slot label: "CP"). With PRIORITY 0 jobs, the CP 143 triggers an interrupt to the CPU of the PLC at the receive end. Since not all CP slots have interrupt lines, you must select a slot wired for interrupts if you intend to use jobs with priority PRIORITY 0.

You will find more detailed information about PLC slots in the appropriate PLC manuals.

3.1.8   Connecting the CP 143 to the SINEC H1 Network

If the CP is connected to the SINEC H1 network via a transceiver, the CP 143 must supply the transceiver with +15 V. A multipoint receiver for example does not require this supply from the CP 143.

The S5-150 U, S5-135 U and S5-155 U/H programmable controllers supply the +15 V on the backplane bus which the CP 143 connects through to its AUI socket on the front panel.

the S5-115U does not provide this +15 V supply. For this reason, a CP 143 version is available with a +15 V power supply module. The +15 V module converts the +5 V of the PLC to the required +15 V voltage.

Order number: 6GK1 143-0AA01 **without** +15V power supply.

Order number: 6GK1 143-0AB01 **with** +15V power supply (for use in the S5-115U/H)

CP 143 without +15V module
Order no. 6GK1 143-0AA01

CP 143 with +15V module
Order no. 6GK1 143-0AB01

1 1/3
standard slots

Transceiver cable
Order no. 6ES5 727-1....

2 2/3
standard slots

Transceiver

Transceiver

SINEC H1 bus cable
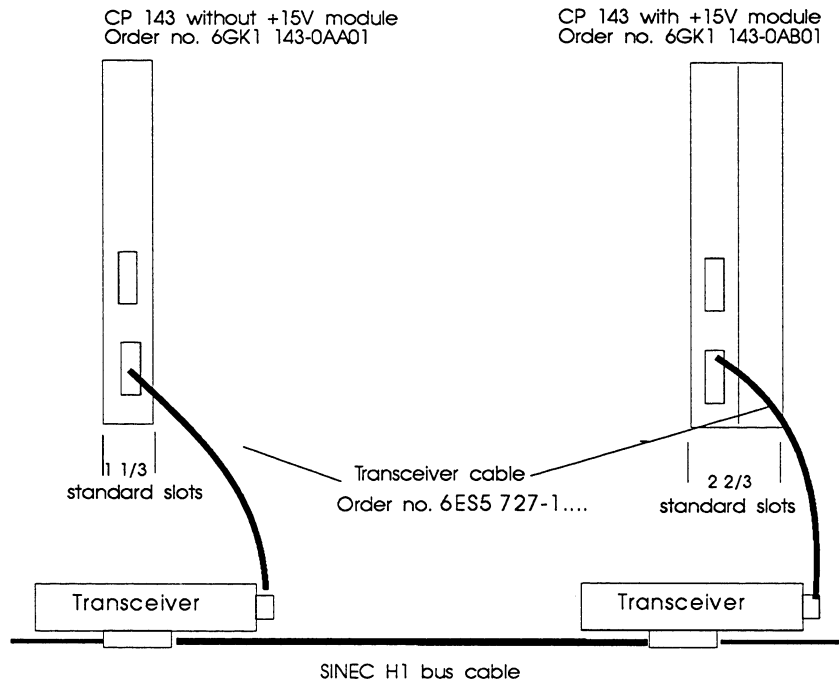
Fig. 3.5:   Connection to the SINEC H1 Network

3.1.9   Connecting the Signal Line (Swing Cable)

The CP 143 can be connected to the PLC via a signal cable (swing cable). The signals are transferred via this cable when PLC functions are active via the path or when domain or PI services are active.

The +24 V must be available on the PLC to allow the AS511 interface to the CPU to function.

The signal cable has a 15 pin D-sub connector on both ends. Make sure that the polarity is correct as specified in the description of the connector.
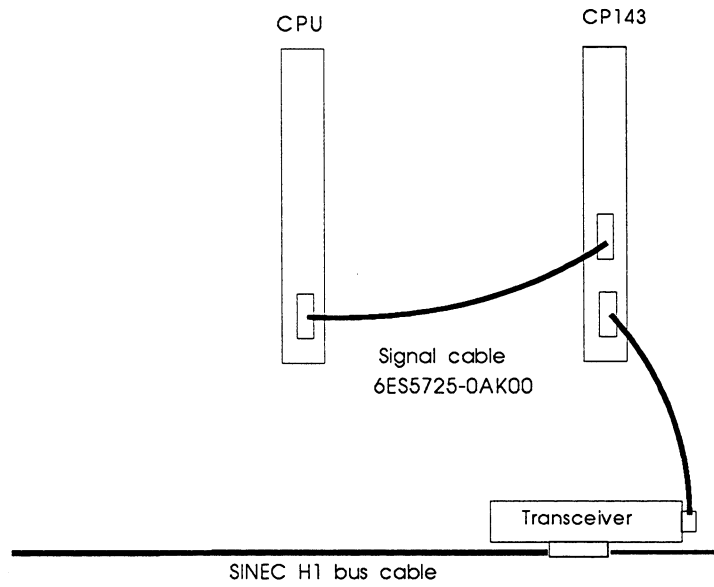
Fig. 3.6:   Connecting the Signal Line (Swing Cable)

One end of the signal cable is the CP end, the other the CPU end.

3.1.10 Starting up the CP 143

To start up the CP 143, you require a SIMATIC programmer with S5-DOS software V 6.3 and the COM 143 TF configuration tool. You also require a PG cable connecting the PG to the CP via the AS511 interface.

After switching on the PLC, the basic initialization of the CP must be performed using the COM 143 configuration tool (see also Chapter 7).

(COM 143 ONLINE, menu EDIT | CP BASIC INITIALIZATION).

It is sufficient to simply enter the Ethernet address and the base SSNR. The base SSNR must match the hardware setting of the CP 143 DIP switch.

After pressing OK (function key F7) in the basic initialization screen and then putting the CP through a cold restart, the CP can then be configured or a database loaded via the AS511 interface or via the SINEC H1 interface with the CP in the STOP mode.

If you do not perform the basic configuration, no database can be loaded. The error message "*module not initialized*" appears.

Starting up in the single processor mode

✓1. Set the base SSNR using the DIP switch and insert the CP in the PLC with the mode selector set to RUN.

✓2. After switching on and starting up the CP, it displays the IDLE status (red and green LED lit.)

✓3. Connect the PG cable to the AS511 socket of the CP, start STEP 5, select the AS511 interface and start the COM 143 configuration tool on the PG.

M 1-1

✓4. Set the status of the PG to ONLINE in the "NCM Basic Settings" screen.

✓5. Set the CP to STOP: COM 143 menu LOAD - STOP CP or press the STOP switch on the CP.

M 2-1

✓6. Set the required Ethernet address and the base SSNR (must be identical to the hardware setting on the DIP switch) in the "CP INIT" screen. When you press function key F7 the settings become valid for the CP.

✓7. Restart the CP with COM 143 using the menu Transfer - Start CP.

Once started up, the CP is set to the Ethernet address and base SSNR. Following this, a database can be loaded (also via the SINEC H1 interface).

✓8. Synchronize the CP with the base SSNR.

After a successful synchronization, the green RUN LED is lit.

Starting up in the multiprocessor mode

In the multiprocessor mode, follow the same steps as for the single processor mode.

After step 6, the parameter "active interfaces" in the CP initialization block must **also** be set to 2 for two CPUs or 3 or 4 for three or four CPUs.

Once the configuration data have been transferred to the CP, all the active interfaces must be synchronized by SYNCHRON blocks.

3

3.1.11 Backplane Bus Communication for the S5-155H and S5-155U/CPU948

Introduction:

From version V3.0 and higher of the CP 143, it is possible to use the PG functions online via the path PG->SINEC H1->CP 143->parallel PLC backplane bus-> CPU. With this improved communication, you can, for example, load user software in the STOP mode four times as quickly.

For more detailed information, refer to the S5-155H or S5-155U/CPU948 manual.

Requirements:

The following CPUs support backplane bus communication:

S5-155H	**CPU946R** from MLFB no. 6ES5 946-3UR21, version = 3	
	CPU947R from MLFB no. 6ES5 947-3UR21, version = 6	
S5-155U	**CPU948** from MLFB no. 6ES5 948-3UA11, version = 1	
	CPU948 from MLFB no. 6ES5 948-3UA21, version = 1	

PG software V6.3

Mode of operation:

The backplane bus communication function becomes active as soon as the base interface number (base SSNR) 232 or 236 is set on the CP 143 and the PLC is put through a cold restart. Of the four pages (SSNR of the CP 143), two continue to be used for the handling block (HDB) interface and the other two are used for backplane bus communication (system pages).

Note the allocation of the interface number to the CPU number in the multiprocessor mode:
➤ If the CP 143 has base SSNR: 232, you can reach CPU 1 and 2.
➤ If the CP 143 has base SSNR: 236, you can reach CPU 3 and 4 (however only for PG functions via the backplane bus).

Single processor mode:
S5-155U
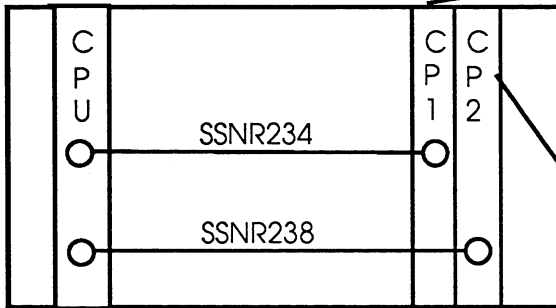
DIP switch: S2

■ Switch depressed
Base SSNR: 232

DIP switch: S2

■ Switch depressed
Base SSNR: 236

3

Multiprocessor mode:
S5-155U
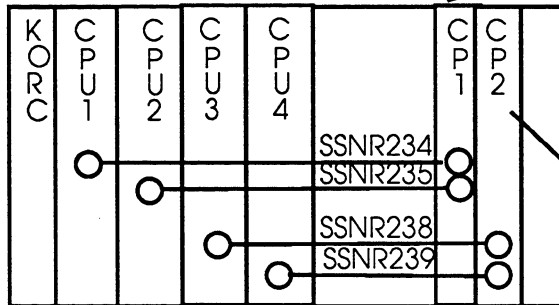
DIP switch: S2

■ Switch depressed
Base SSNR: 232

DIP switch: S2

■ Switch depressed
Base SSNR: 236

Fig. 3:7:   Setting for Backplane Bus Communication Single/Multiprocessor Mode

Activating backplane bus communication

✓1 Set the CP 143 base interface number as shown in Fig. 3.7.

✓2 Configure base SSNR = 232 or 236.

M 2-1

In the COM143 configuration tool, the base SSNR can be found in screen 2-1 "CP Init"

✓3 In the multiprocessor mode, the number of active interfaces must be entered as 2 in the "Initialization block" screen.

M 2-2

Once the base interface no. (SSNR) is set, the CPU synchronizes the system pages and the backplane communication can be used. SSNR 232 can still be used for handling block communication for CPU 1 and SSNR 233 for CPU 2 as normal. For CPU 3 and CPU 4, a second CP 143 with base SSNR 236 is necessary to use PG functions via the backplane bus communication.

For HDB communication for CPU 3 and 4 via SINEC H1, you require a third CP 143 which can have any suitable base SSNR. Communication is via the base SSNR + 2 or base SSNR + 3.

CP 143 dual-port RAM with backplane communication:

Base SSNR + 0   HDB page to CPU 1

Base SSNR + 1   HDB page to CPU 2

Base SSNR + 2   System page for backplane bus communication

Base SSNR + 3   System page for backplane bus communication

3.1.12 Technical Data

Operating and Environmental Conditions

Type of protection: IP 00

Permissible ambient   0 to 55 °C
temperature during operation   no operation without fan

Temperature during   -40 to +70 °C
transport or storage

Humidity   95% humidity at 25°C,
                                      no condensation

Operating altitude:
CP 143   up to 3000 m above sea level

Mechanical and Electrical Data

Weight   approx.. 0.5 kg

PCB format   double Euroformat (160 x 233.4 mm)

Front panel width   20.32 mm (= 1 1/3 standard slots)

Backplane connector   ES 902, 2 x row 2, 48-pin

Front connector   2 x socket connector, 15-pin

Supply voltages   + 5 V, + 5%, - 5%
                                      +15 V, + 5%, - 5%
                                      +24 V, +25%, -15%

Current consumption:

- Version -0AA01	+ 5 V: 2.5 A max. +15 V: max. 500 mA +24 V: max. 40 mA
- Version -0AB01	+ 5 V: 4.5 A max. (with 15V module) +24 V: max. 40 mA

Logical Characteristics

Microprocesor	80186
Ethernet controller	82586
Ethernet serial interface	8023A
Memory capacity	- dynamic RAM 512 Kbytes - dual-port RAM 4 Kbytes - for configuration data 60 Kbytes - EPROM 384 Kbytes
Data transfer rates	- serial bus 10 Mbps - serial interface (TTY, 20 mA loop current) 9.6 Kbps

3.1.13 Pin Assignment

Backplane connectors

The CP 143 has two 48-pin row 2 backplane connectors with which it is connected to the bus board of a SIMATIC PLC rack. The following tables show the pin assignment of these two backplane connectors.

Backplane connector 1

	d	b	z
2	-	Ground	+ 5 V
4	UBATT	-	-
6	ADB 12	ADB 0	CPKL
8	ADB 13	ADB 1	/MEMR
10	ADB 14	ADB 2	/MEMW
12	ADB 15	ADB 3	/RDY
14	/IR A	ADB 4	DB 0
16	/IR B	ADB 5	DB 1
18	/IR C	ADB 6	DB 2
20	/IR D	ADB 7	DB 3
22		ADB 8	DB 4
24	-	ADB 9	DB 5
26	-	ADB 10	DB 6
28	/DSI	ADB 11	DB 7
30	-	-	-
32	-	Ground	-

Backplane connector 2

	d	b	z
2	-	Ground	+ 5 V
4		-	-
6			-
8			-
10			-
12			-
14			-
16			-
18			-
20			-
22	TxDs	/STOPPA	-
24	-	-	-
26	-	/RxDs	-
28	-	-	-
30	Ground for 15 V		Ground for 24 V
32	+ 15 V	Ground	+ 24 V

Connector of the Serial Interface

On the front panel, there is a 15-pin socket connector for connecting a programmer. The following table shows the pin assignment of this socket.

Serial interface

1	MEXT (external ground)
2	TTY IN - (current output)
3	-
4	+ 24 V
5	Masse (internal ground)
6	TTY OUT + (current input)
7	TTY OUT - (current output)
8	MEXT (external ground)
9	TTY IN + (current input)
10	Ground for 24 V
11	20 mA current source of transmitter
12	Ground (int. ground)
13	20 mA current source of receiver
14	Master scan
15	Ground (internal)

3

Transceiver Connector

On the front panel of the CP 143, there is a 15-pin socket connector with a locking device for connecting a transceiver cable. The pin assignment of this socket corresponds to the Ethernet standard IEEE 802.3 and is shown in the following table

Transceiver connector

1	MEXT (ext. ground, shield)
2	CLSN (collision +)
3	TRMT (transmit +)
4	-
5	RCV (receive +)
6	Ground for 15 V
7	-
8	-
9	CLSN (Collision -)
10	TRMT (Transmit -)
11	-
12	/RCV (Receive -)
13	+ 15 V
14	-
15	-

3.2   Modes and the START/STOP Procedure

3.2.1   Description

The CP is a slave of the PLC
The CP 143 TF is a slave processor system in the S5 rack and must therefore follow the same START/STOP procedure as the master (here the PLC).

Start up
Since the CP 143 is only equipped with non battery-backed dynamic RAM memory, the "warm restart following power failure" is not available on the CP 143. After power up, the CP 143 runs through a hardware test program. Following this, it establishes a management field (DJV dynamic job variables field) in the unbuffered RAM area for the internal management of each job defined in the parameter memory. It then waits for the start signal from the PLC. In this IDLE state (IDLE, RUN and STOP LEDs lit) all the programs that process system jobs or operate the PG interface are enabled, however, the data traffic to and from the PLC or the bus system is disabled.

Status after start up
Depending on the setting of the mode selector, the CP 143 then branches

➤ to the STOP state, if the mode selector is set to STOP, or

➤ to the RUN state, if the mode selector is set to RUN.

The STOP state is defined by the following:

➤ the system programs and the PG interface are enabled,

➤ the virtual circuits remain established or the module continues to establish them,

➤ the data transfer via the bus system and the interfaces to the PLC is blocked.

The RUN state is defined by the following:

➤ all CP 143 programs and all interfaces to the PLC are enabled,

➤ the PG interface is enabled and all ONLINE PG functions can be executed (exception: modifying the database)

➤ the data transfer is enabled and can be monitored with the COM 143 test functions.

Warm restart with the START/STOP selector
Whenever the status changes from STOP to RUN or from RUN to STOP and back to RUN (resynchronization by repeatedly activating the START/STOP selector on the PLC) the CP 143 executes a warm restart. All the previously established connections are cleared and then re-established. All the data buffered on the CP 143 are lost during this status change.

START/STOP request from the PG
The PG can also set the START or STOP request using the COM 143 functions START CP 143 TF and STOP CP 143 TF. A STOP set with the START/STOP selector can only be cleared again using the START/STOP selector.

The reactions of the CP to START/STOP instructions from the PG and to selector settings are illustrated in the following table:

CP switch	Request from PG	CP 143 TF status
RUN RUN or STOP STOP	RUN STOP RUN or STOP	RUN STOP STOP

Table 3.1 CP Statuses

If RUN is set at the PG or at the mode selector in the IDLE state (NOT SYNCHRONIZED), it does not affect the status of the CP 143 TF and is only evaluated after the PG exits this state. The following table and figure illustrate the states of the CP 143 TF.

Status	Displays	Activities
1.Hardware-test	RUN LED off STOP LED on CP-F LED off	Testing the CP 143 TF hardware
2.CP fault	RUN LED off STOP LED on CP-F LED on	Idle loop following detection of fault; all programs and interfaces are disabled
3.NOT SYNCHRO NIZED (IDLE)	RUN LED on STOP LED on CP-F LED off	Waiting for completion of synchronization; all active PLC interfaces must be synchronized by the PLC; PG interface enabled
4.RUN	RUN LED on STOP LED off CP-F LED off	The data traffic over the connections is enabled as well as the PG and PLC interface. COM test functions are possible
5.STOP	RUN LED off STOP LED on CP-F LED off BUS-F LED off	The connections remain established or establishment is continued; the PLC interfaces are disabled; the PG is enabled (however no test)

Table 3.2: Modes of the CP 143 TF

Also: The +15V FAULT LED indicates that the +15V for the transceiver are absent.

The status transitions of the CP are as follows:

FROM	Actions	TO

STOP ————————————————————————→ RUN
- Set STOP/RUN switch on front panel of CP 143 TF
  to RUN.
- Trigger PG function "START CP" (only when mode switch
  is set to RUN).
In the STOP -> RUN transition, all pending jobs
NOT   are deleted.
SYNCHR. ———————————————————————→ RUN

Synchron HDB call in a start-up OB of the programmable
controller; STOP/RUN switch on the front panel of the
CP 143 TF set to RUN.

RUN ————————————————————————————→ STOP
- Set START/STOP switch on front panel of the CP 143 TF
  from RUN to STOP.
NOT   - trigger PG function "Stop CP".
SYNCHR. ————————————————————————→ STOP

- Set START/STOP switch on front panel of the CP 143 TF
  from RUN to STOP.
RUN or   - Trigger PG function "Stop CP".   NICHT
STOP   ———————————————————————————→ SYNCHR.

Only after power down:
- the programmable controller is in the STOP
  mode
or
- No SYNCHRON HDB in start-up OB

Fig. 3.8:   Status Transitions and Actions

3.3   Basic Data about Jobs and Links

Overview

The CP 143 is capable of maintaining 64 virtual links (transport connections and application associations) simultaneously. With the possibility of combining "dynamic links" a maximum of 128 data link blocks can be defined containing a maximum of 128 jobs.

A maximum of 4 jobs can be configured on a link. This depends on the services used and is explained in detail in Chapter 4.

The remaining factors can be seen in the following tables.

3.3.1   Maximum Number of Jobs

For particular job types (as shown in the following tables), the maximum number depends on the number of buffers available and the data unit length set in the SYNCHRON block; this maximum number is indicated below by the parameter M. Table 3-1 shows the relationship between the data unit length and M (also referred to in the following tables).

PDU size/bytes	M
$\leq$ 128	127
256	127
512	63

Table 3.3:   Relationship Between PDU Size and M

3.3.2   Static Limits

Number of jobs

Table 3-2 contains the maximum values both for the number of particular job types as well as for the total number of definable jobs.

(a) Datagram jobs, incl. multicast and broadcast	32
(b) Total number of connection-oriented PRIORITY 0/1 jobs (expedited)	32
(c) Total number of PRIORITY 2 jobs	64
(d) Total number of PRIORITY 3 and PRIORITY 4 jobs	127
(e) Total number of PRIORITY 0 and PRIORITY 1 jobs	48
(f) Total number of READ/WRITE jobs	**M** (Table 3-1)
The following restrictions apply to - the total number of definable jobs ($0 <$ ANR ≤ 127) **Total number = (a) + (b) + (c) + (d) $\leq$ 127**	

Table 3.4: Maximum Numbers of Jobs

Number of multicast sets

A maximum of 10 multicast RECEIVE jobs are permitted on one CP 143. Values from 0 to 127 can be used as the multicast set number.

Number of connections

A maximum of 64 static connections are permitted per CP 143 (= connections for PRIORITY 0, PRIORITY 1 and PRIORITY 2 jobs).

3.3.3   Dynamic Limits

Number of connections established simultaneously
Table 3 -3 shows the maximum values for the number of simultaneously established connections.

(a) Number of connections with PRIORITY 0, PRIORITY 1 and PRIORITY 2 jobs (expedited and normal) including appl. ass. and file server links (at a max. TF-PDU size of 1024 bytes) [1]	64
(b) Number of simultaneous links with PRIORITY 3 and PRIORITY 4 jobs (slow)	64
The following restriction applies to the number of simultaneously established links L-total = (a) + (b) ≤ 64	

Table 3.5:   Maximum Number of Simultaneously Established Links

[1] If a greater value than the standard 1024 is set in the INIT block für die AP-PDU size, the following restriction then also applies for the number of application associations and file server links:-

$$\text{Sum of appl. ass. and fileserver AA} \; < \; \frac{192 \text{ Kbytes}}{3 \times \text{TF-PDU size}}$$

Number of simultaneously active jobs
Table 3 - 4 shows the maximum values for the number of sumultaneously active jobs.

(a) Number READ/WRITE jobs	M (see Tab 3-1)
(b) Number of sumultaneously active SEND/RECEIVE jobs with PRIORITY 2, PRIORITY 3 und PRIORITY 4	M (see Tab. 3-1)
The following restriction applies for the number of simultaneously active PRIORITY 2 (normal service) , PRIORITY 3 and PRIORITY 4 (slow service) jobs J-total = (a) + (b) ≤ M	

Tab. 3.6:   Maximum Number of Simultaneously Active Jobs ❑

❑

4   Configuring and Programming the CP 143 TF Communication

This chapter will familiarize you with the way in which the CP 143 functions. It explains the steps required to supply the CP 143 with configuration data and the PLC user program with communication calls. You will learn the basics necessary to understand the interaction between the PLC and CP and the connections between the CPs.

The aspects involving the TF interface are described in Volume 2. The topics dealt with here, however, apply in the main to the use of the transport interface and the TF interface.

4

At the end of the chapter you will have learnt about the following topics:

➤ The possibilities of transmitting via virtual connections and using datagram, multicast or broadcast services.

➤ How virtual connections are established via the SINEC-H1 bus.

➤ The significance of the software blocks on the CP.

➤ The principle of the PLC-CP link via handling blocks.

➤ The principle of job processing.

➤ The steps required to configure the CP and program the PLC.

A separate section is devoted to the multiprocessor mode.

In this chapter, note the margin references to the accompanying supplement COM 143 TF configuration tool.

4.1 Overview of the Required Steps

The steps shown below are explained in the following sections.
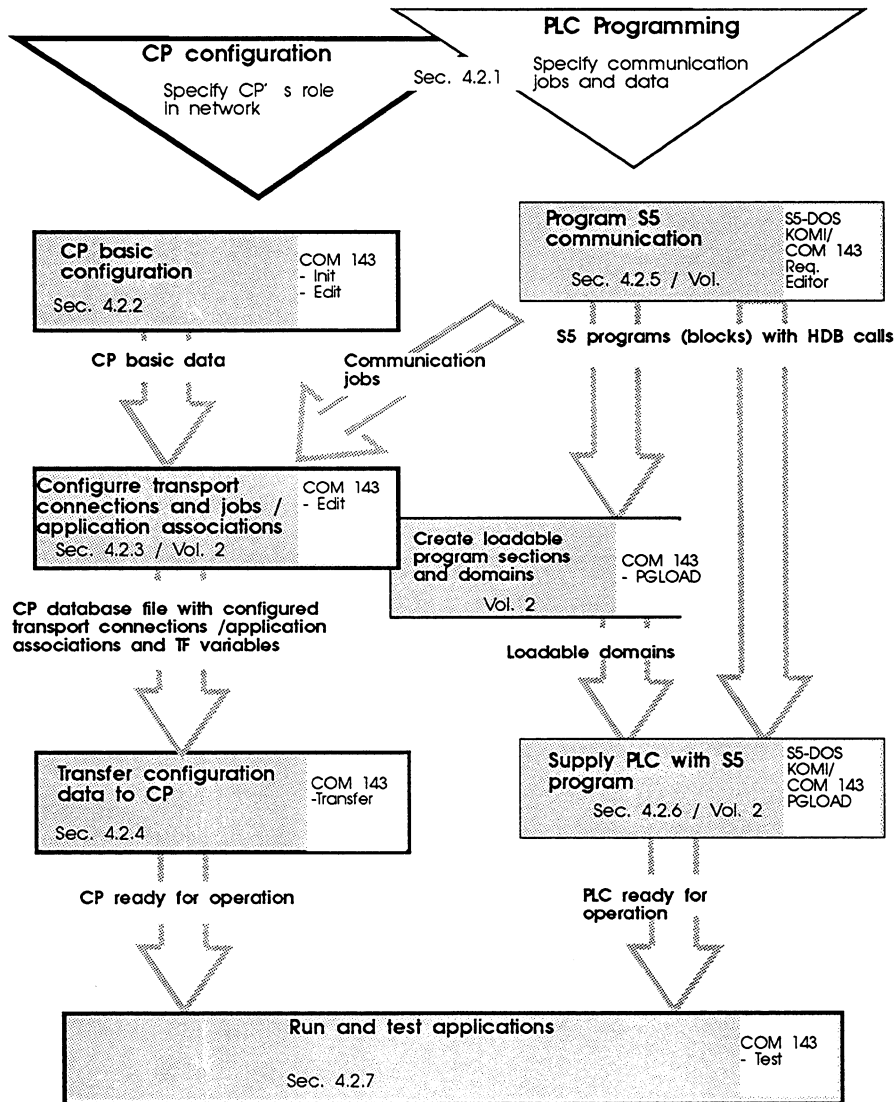
4.2   Explanation of the Congiguraion and Programming Steps

This chapter explains the steps necessary to configure the CP and program the PLC as outlined in Section 4.1. The titles of the sections are therefore based on these steps.

Please remember that Volume 1 only deals in detail with communication via the transport interface. You will recognise the alternative steps available when using the TF interface. These steps are described in detail in Volume 2.

4.2.1   Getting started

4

PLC programming
The PLC programs contain the functions for the automation task. The communications requirements are therefore also decided by these tasks. The following information must be specified:

➤ which partners are involved in the communication

➤ which data must be exchanged

➤ which services will be used.

With this information, the overall scope of the communication and the CP configuration is already implicitly fixed.

CP Configuration
The COM 143 TF configuration tool provides you with a flexible instrument for implementing communication according to the requirements (communication jobs) specified in the PLC programming.

➤ Connections can be stipulated or modified without affecting the programming.

➤ Programs can be assigned flexibly to the PLCs.

➤ If the TF interface is also used, PLCs can be adapted online to the requirements of the process using the domain services.

Deciding between transport and TF services

Section 2.2 explained the main differences between the interfaces available on the CP 143 TF. Based on the table there 'Comparison of the Interfaces' you can decide which communication interface is suitable for your task.

The following services are available on the transport interface:

Service	Priority	Meaning/Handling	Data length
Expedited data	PRIO 0	Data transfer - **with** hardware interrupt in receiving PLC - via static connection	16 bytes max.
	PRIO 1	Data transfer - **without** hardware interrupt in receiving PLC - via static connection	16 bytes max.
Normal service (used implicitly with TF services)	PRIO 2	Data transfer via static connection	2043 words max.
Slow service	PRIO 3	data transfer via **explicit** dynamic connection (connection established and terminated when required controlled by the user program)	2043 words max.
	PRIO 4	Data transfer via **implicit** dynamic connection (connection established when required controlled by the user program. Connection terminated implicitly after data transfer)	2043 words max.

Service	Priority	Meaning/Handling	Data length
Datagram	PRIO 0/1	Connectionless data transfer with the alternatives: - Multicast (transmission to several selected receivers, i.e. those whose multicast set corresponds to the multicast address). - Broadcast (transmission to all stations whose multicast set corresponds to the broadcast setting).	16 bytes max.

4

Key: Static connections are established when the CP is started up.

Dynamic connections are established when they are required, i.e. when a job is issued for a configured connection.

4.2.2   Basic CP Configuration

Overview

Storage of the configuration data on the CP

The CP 143 has a module slot for an EPROM memory module. 16, 32 and 64 Kbyte modules are available (see page 3-7).

Instead of the EPROM module data can be stored in the internal 60 Kbyte RAM (known as a background module).

Organization of the parameters in blocks

The CP 143 expects the global and local descriptions of a connection and the general settings in the memory module. The description of a connection is saved in a data link block , the general settings (e.g. local address) in an initialization block. The initialization block can and must only exist once on the module. To identify modules throughout the whole (S5) system there is also a system identification block (SYSID).

SYSID	System identification block: Identifies the module throughout the S5 system. The block is specified in the basic configuration.
INIT	Initialization block: Addresses and system data for CP 143 system software The block is specified in the basic configuration.
LINK 1	Data link block 1: Parameters of a transport connection or appl. ass. x
.	
.	Data link block n: Parameters of a transport connection or appl. ass. y
LINK n	Data link blocks are specified when the transport or TF interface is configured.

Fig. 4.1:   Structure of the CP Module File

The parameters in the system identification block

Function of the SYSID block

The SYSID block is used for the following:

> ➤ system-wide identification of S5 program or parameter assignment modules (EPROM modules),

> ➤ setting the Ethernet address,

> ➤ recognising the firmware release,

> ➤ recognising the release of the user software ("Date" field),

> ➤ entry of a password with which access from a PG to the module can be restricted, when the PG wants to establish a PG link via SINEC H1.

4

Configuring

M 2-1

The block parameters are configured with the COM 143 TF configuration tool in the CP Init screen. The configuration parameters themselves (ranges of values etc.) are described in detail in Chapter 7 Configuration Steps and Basic Configuration.

The CP adopts the values following a cold restart (CP transition from STOP to RUN).

The parameters in the initialization block

Function of the INIT block
The INIT block contains the initialization parameters of the CP 143 which are only adopted during system start up, i.e. a transition from STOP to RUN or after power up. Modification or re-entry of the INIT block is therefore only allowed in the STOP mode. The following parameters in the INIT block are processed by the CP 143, the remaining input fields are for COM 143 management.

Configuration
M 2-2
The block parameters are configured using the COM 143 TF configuration in the CP Initialization Block screen. The configuration parameters themselves (ranges of values etc..) are described in detail in Chapter 7 Configuration Steps and Basic Configuration.

Overview of the block parameters

➤ Dynamic Clock Master (Y/N)
   This entry decides whether or not the CP 143 performs clock master functions (see Volume 2 "Clock Functions").

➤ Cycle Time For SYNC Frames
   If the CP 143 is clock master, the transmission interval for clock synchronization frames is entered here in seconds (see Volume 2 "Clock Functions").

➤ (Local) Ethernet Address
   The Ethernet controller of the CP 143 is supplied with this Ethernet address during start up.

➤ Active Interfaces
   This entry informs the CP how many CPU interfaces must be processed.
   In the multiprocessor mode, up to 4 interfaces are possible.

➤ Max. TF-PDU Length
   This parameter specifies the maximum size of the buffers used for the
   TF services.

➤ Special File
   The entry of a special file in the parameter module is only possible for
   service purposes.

➤ Length of the special file
   The special file is only intended for service purposes.

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➤ Multicast Sets
   The structure of the CP 143 allows the bus controller to be supplied with
   up to 10 multicast addresses in addition to the station address. The
   CP 143 then also accepts data packets with these multicast addresses
   from the bus system. Multicast addresses or multicast sets can be
   compared with a circular sent through the post; the sender sends
   messages to a particular set of stations on the bus. An entry of the
   multicast list means that this CP 143 becomes a member of the
   particular multicast set.

   The parameter is only displayed here. The value results from the confi-
   guration of the connections.

4.2.3   Transport Services and Configuring Jobs

Function of the data link block
The data link block contains the global (oriented towards the partner in the network) and local (oriented towards the user program on the local station) parameters of a connection. Each data link block describes a virtual transport connection or a datagram specification.

With the parameters in the data link block, you specify the following:

➤ **The service**

A distinction is made between connection-oriented services and the datagram services (point-to-point/multicast/broadcast).

The services are described briefly in the table on page 4-4 .

➤ **The addresses**

The global address parameters of a connection are:
– local TSAP-ID (Transport Service Access Point Identifier)
– remote TSAP-ID

The combination of local and remote TSAP-ID produces the symbolic name of the transport connection. The TSAPs of a transport connection are normally generated automatically by COM 143 from the interface numbers (SSNR) and job numbers (A-NR) of the local parameters.

The local address parameters of a connection are as follows:
– local interface number (SSNR)
– local job number (A-NR)

➤ **The job types** (see also page 4-15 and Section 4.2.5, page 4-35 on the topic PLC programming)

The following are available:
– SEND/RECEIVE
– WRITE ACTIVE/PASSIVE
– READ ACTIVE/PASSIVE

➤ **Local memory assignments as default parameters**

Configuration

M 2-4-1

The block parameters are configured with the COM 143 TF configuration tool using the function Edit | Links | S5S5 Connections. Configuring is described in detail in Chapter 8 "Configuring the Transport Interface".

Note on the default parameters

The local memory assignments in the data link block on the CP, the fields SOURCE/DEST, LENGTH and STATUS WORD, serve as default parameters if no parameters are specified for the corresponding handling block (SEND/RECEIVE/FETCH) (S/ZTYP="NN"). If values are specified in the HDB these have priority over the values in the data link block. As described in Table 4.1, page 4-22, a maximum of 4 jobs or local parameter sets can be assigned to a connection depending on the priority and job type.

4

Assigning addresses

The global address parameters
A virtual transport connection is uniquely identified by the address information. This address information includes the station address (Ethernet address or MAC address) and the service access point for the transport layer TSAP (Transport Service Access Point).

Defining transport connections
COM 143 TF generates the identifiers of the service access points (TSAPs) automatically from the assigned interface and job numbers. If required they can, however, be freely assigned.

Automatic generation
The automatic generation of the connection names from a combination of SSNR/A-NR is suitable for a homogeneous network (connection of S5 programmable logic controllers).

The following diagram illustrates the formation of the TSAP name from the job and interface number.
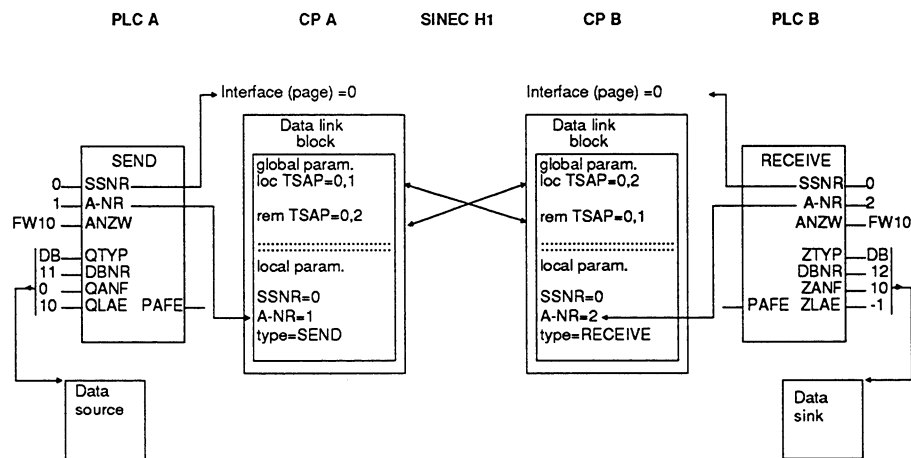
Fig. 4.2:   Automatic Generation of Connection Names

Configuring Transport Connections and Jobs (continued)

Free naming of the TSAPs

COM 143 TF also allows the names of the TSAPs to be selected by the user. The parameter list on the CP 143 then functions as a conversion table between the TSAP on the one hand and the interface and job numbers on the other.

The free assignment of connection names is useful when, starting with communication channels, a connection to other systems must be established (e.g. SICOMP, SINUMERIK, SIROTEC, other systems). Free naming is necessary for connections to other systems (other vendors).

The following diagram illustrates the assignment of a freely selected TSAP name to the job and interface number.
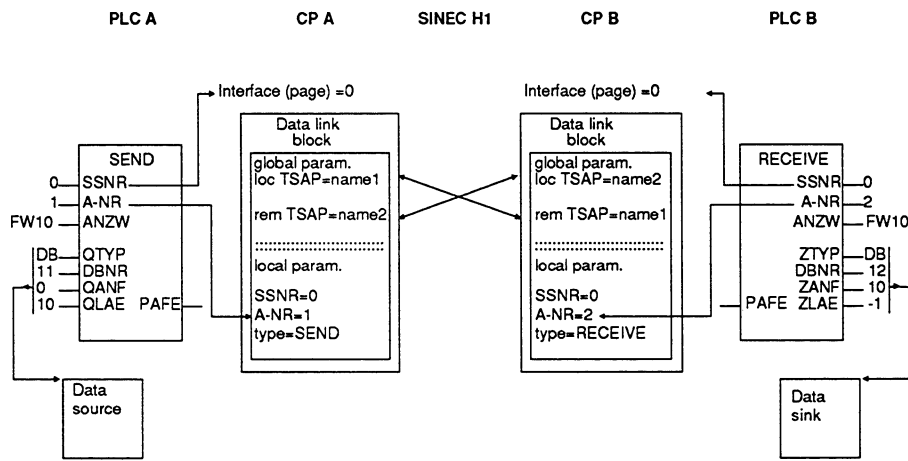
Fig. 4.3:   Freely Assigned Connection Names

The local address parameters

The interface and job number identify a communication job at the S5 end, i.e. if the user (S5 programmer) wants to start or monitor the communication job, he must supply the handling blocks with the interface and job numbers specified here. The base interface number can also be set with the switches on the CP 143 hardware (see Chapter 3 Technical Description of the Hardware).

Job types of the transport connections

Meaning
The distinction between job types takes into account the different ways in which data can be accessed (SEND/WRITE) and which station is responsible for what (SEND/WRITE, READ)

The following job types can be configured:
➢ SEND / RECEIVE
   Send and receive frames:
   The user program of the sending station specifies the source address of the data. The program of the receiving station specifies where the data will be stored.

➢ WRITE ACTIVE/PASSIVE
   As SEND/RECEIVE but with transfer of parameters:
   Activity is initiated by the sending station which specifies both the source address and the destination address of the transferred data.

➢ READ ACTIVE/PASSIVE
   As SEND/RECEIVE but with transfer of parameters:
   Activity is initiated by the receiving station which specifies both the source address and the destination address of the transferred data.

Job type SEND/RECEIVE

Principle of sending and receiving
Communication links between parts of the program in two different programmable controllers can be compared with a postal system. A SEND job on the CP 143 represents the post-box, a RECEIVE job (in another CP) represents the PO box. Using the SEND handling block, messages can be put into the post-box and then transported by the CP 143 transport system to the PO box of the addressee. Then, using the RECEIVE block, the message can be collected. The transport system ensures that neither the post-boxes nor the PO boxes can be overfilled.

Possible priority classes for SEND/RECEIVE:

➤ PRIORITY 0 and 1 as expedited data service

➤ PRIORITY 2 as normal service

➤ PRIORITY 3 and 4 for messages which are not urgent (slow service)

Job type WRITE ACTIVE/PASSIVE

Meaning and differences compared with SEND/RECEIVE
The WRITE function allows a data frame to be transferred from a programmable controller (ACTIVE end) to a remote device (PASSIVE end). In contrast to SEND/RECEIVE, with WRITE the parameter set which defines the data sink (data destination) is also transmitted on the bus. The active partner using the WRITE function can therefore force data onto the passive partner (similar to a DOWNLOAD function).

WRITE requires a fixed priority
Since any data can be exchanged with the WRITE function, and the receiver must always be ready to accept the data (PASSIVE end), the WRITE function can only be used in the normal priority class PRIORITY 2. The WRITE function requires static connections via which data can be transmitted using the normal service.

Configuring WRITE

The WRITE function is called by the COM 143 software by having the following:

a SEND at the active end with the identifier READ/WRITE = YES,

a RECEIVE at the passive end with the identifier READ/WRITE = YES.

Job type READ ACTIVE/PASSIVE

Meaning

The READ function enables a data record to be read out of a remote programmable controller (PASSIVE end). With the READ function, the parameter set which describes the data source is also transmitted on the bus. The ACTIVE end of the READ function can therefore read a data record from the PASSIVE end directly (similar to an UPLOAD function).

READ requires a fixed priority

Since any data can be exchanged with the READ function, and the PASSIVE end should always be ready to have data read from it, the READ function can only be used with the normal priority class PRIORITY 2. The READ function requires static links for exchange of data using the normal data service (no limitation to 16 bytes net data).

Configuring READ

The READ is selected during configuration with the COM 143 software by having:

a FETCH-ACTIVE at the active end with the identifier READ/WRITE = YES,

a FETCH-PASSIVE at the passive end with the identifier READ/WRITE = YES.

Modes of the transport connections

Meaning
The modes determine how the communication partners can use a transport connection for data transfer.

Overview of the modes
➤ SIMPLEX (either transmitting or receiving via one TSAP)

➤ SIMPLEX with additional "expedited data service"

➤ HALF-DUPLEX (Write/Fetch jobs)

➤ DUPLEX (transmitting and receiving via one TSAP)

➤ DUPLEX with additional "expedited data service"

Specifying the modes
The modes are specified implicitly. The deciding factors are:
- the job type
- the number of jobs configured for the connection
- the priority

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SIMPLEX mode

In the simplex mode, data can only be transmitted in one direction. This transmission mode results from the assignment of only one SEND or only one RECEIVE in the data link blocks.

The simplex mode is possible on connections with PRIORITY 0 to 4.

The following diagram illustrates

➤ the job type to be specified when configuring the CP (SEND for PLC1).

➤ the handling block to be used in the PLC program (SEND-HDB for PLC1).

➤ the direction of data flow
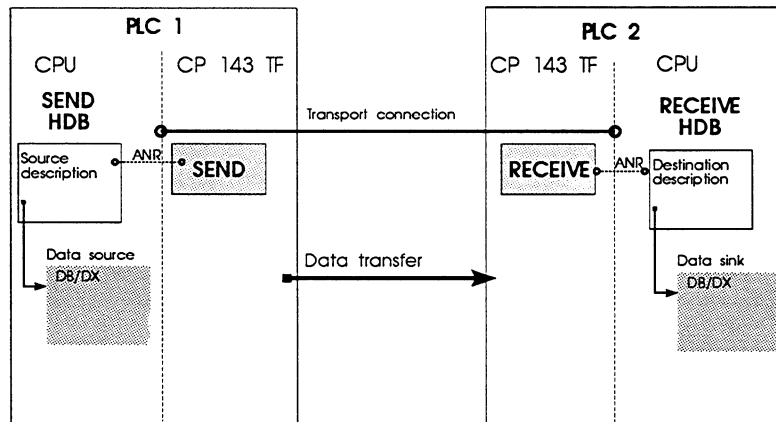
Fig. 4.4:   Simplex Transmission

HALF-DUPLEX mode

The half-duplex mode is used with READ and WRITE jobs The initiator of the READ job sends a negotiated data frame which is replied to by the station addressed (FETCH-PASSIVE). With FETCH jobs, only one job can be assigned per data link block.

This mode is only possible with PRIORITY 2 connections .

The diagrams below illustrate the following for the job types READ and WRITE

➤ the job type to be specified when configuring the CP (e.g. FETCH active R/W=Y for PLC1).

➤ the handling block to be used in the PLC program (e.g. FETCH-HDB for PLC1).

➤ the direction of data flow
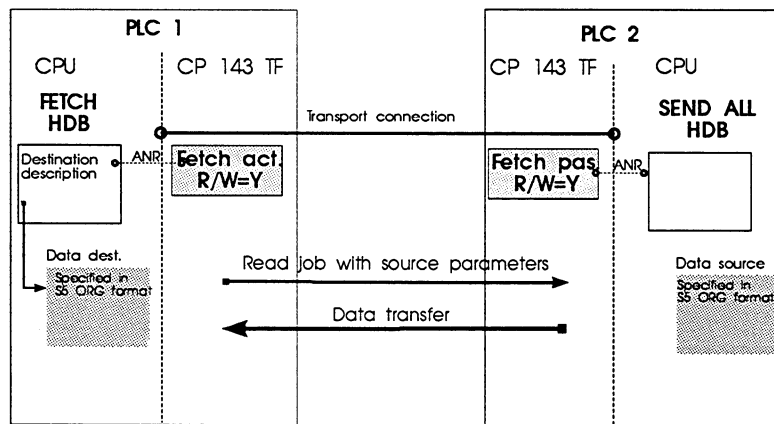
Fig. 4.5:   Half-Duplex Transmission READ Job

Note: the S5-Org formats can be found in Appendix A of this manual in Tables A.1 to A.3 .
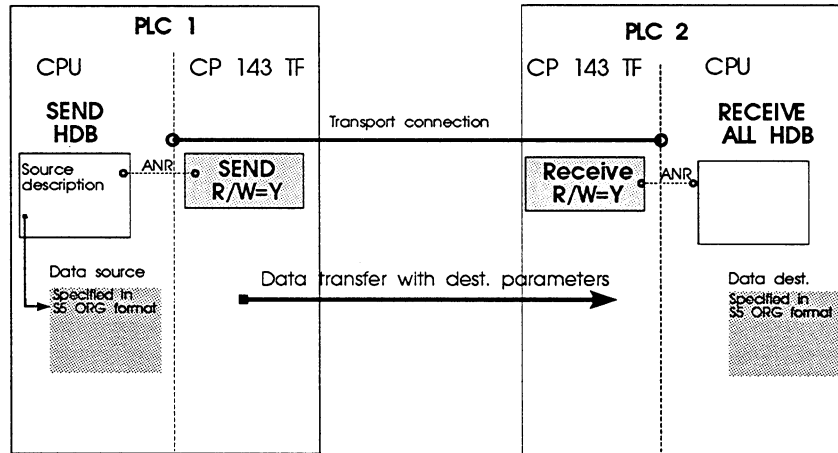
Fig. 4.6:   Half-Duplex Transmission WRITE Job

Note: the S5-Org formats can be found in Appendix A of this manual in
Tables A.1 to A.3 .

DUPLEX mode

In the duplex mode, both ends of a connection can be active simultaneously and can transmit data. The duplex mode results when a SEND and a RECEIVE job are defined in a data link block.

The duplex mode is possible on connections with PRIORITY 0,1,2,3 and 4.

The following diagram illustrates

➢ the job type to be specified when configuring the CP (SEND for PLC1).

➢ the handling block to be used in the PLC program (SEND-HDB for PLC1).

➢ the direction of data flow

4
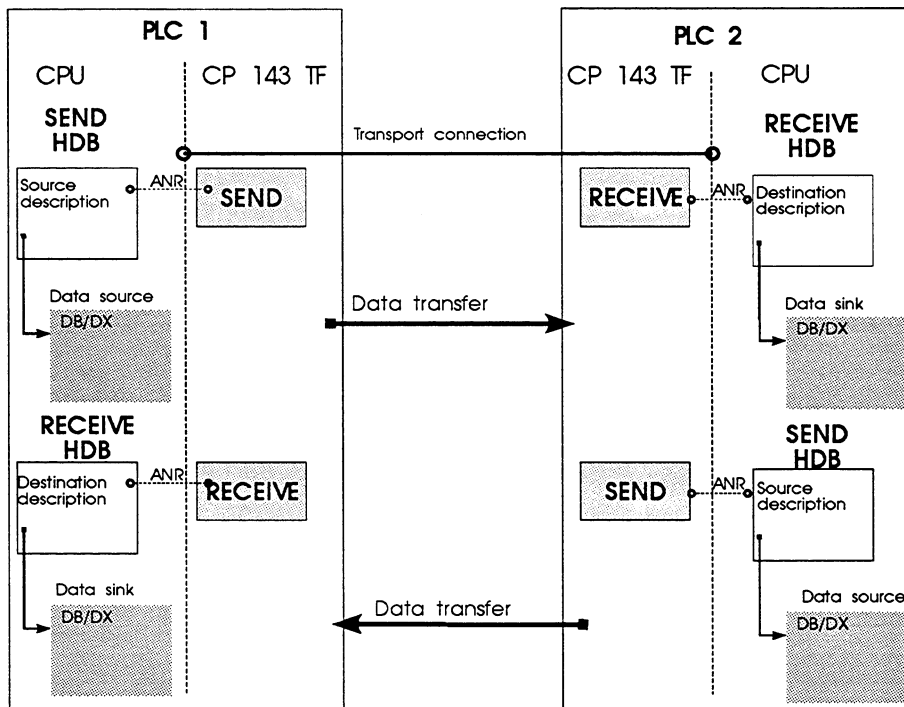
Fig. 4.7:   Duplex Transmission

The following table is an overview of the possible combinations of jobs on a transport connection. depending on how the connection is used, there are 8 possible variations.

Mode		1st job	2nd job	3rd job	4th job
1	N: Simplex	SEND PR2			
		RECV PR2			
2	N: Simplex	SEND PR2	SEND PR0/1		
	E: Simplex	RECV PR2	RECV PR0/1		
3	N: Simplex	SEND PR2	SEND PR0/1	RECV PR0/1	
	E: Duplex	RECV PR2	RECV PR0/1	SEND PR0/1	
4	N: H-Duplex	READ A			
		READ P			
		WRITE A			
		WRITE P			
5	N: Duplex	SEND PR2	RECV PR2		
		RECV PR2	SEND PR2		
6	N: Duplex	SEND PR2	RECV PR2	SEND PR0/1	RECV PR0/1
	E: Duplex	RECV PR2	SEND PR2	RECV PR0/1	SEND PR0/1
7	E: Simplex	SEND PR0/1			
		RECV PR0/1			
8	E: Duplex	SEND PR0/1	RECV PR0/1		
		RECV PR0/1	SEND PR0/1		

Key:

N: = normal service
E: = expedited data service
A = ACTIVE
P = PASSIVE
H- = half duplex
PR0/1 = PRIO 0 or PRIO 1 (see table on page 4- 4)
PR2 = PRIO 2 (see table on page 4-4)
SEND = job type SEND (see section on page 4-15)
RECV = job type RECEIVE (see section on page 4-15)
WRITE = job type WRITE (see section on page 4-15)
READ = job type READ (see section on page 4-16)

Table 4.1: Job Combinations

Example:
The standard application corresponds to mode 5. In this situation, the table shows the following:

With the duplex mode, a SEND and then a RECV with PRIORITY 2 or a RECV and then a SEND with PRIORITY 2 can be issued by a data link block. The opposite combination must be configured on the partner.

The table also shows that a maximum of 4 jobs per connection (SEND/RECEIVE PRIORITY 2 and SEND/RECEIVE PRIORITY 0/1) can be configured (mode 6).

4

Connection establishment

When is the connection established?
When the connection is established depends on the service (priority class) selected for the connection.

After the CP has started up, the connections for the following priority classes are established or attempted:

➤ PRIORITY 0, expedited data service with interrupt.

➤ PRIORITY 1, expedited data service without interrupt

➤ PRIORITY 2, normal service

Connections of the following priority classes are only established after a handling block (SEND/FETCH) has been processed:

➤ PRIORITY 3, dynamic establishment, explicit termination

➤ PRIORITY 4, dynamic establishment, implicit termination

Conditions for connection establishment
The CP 143 establishes a virtual connection between two data link blocks in the following situation:

➤ the names describing this connection match, i.e. the local TSAP-ID matches the remote TSAP-ID and the remote TSAP-ID matches the local TSAP-ID of the peer block.

➤ the bus addresses of the two modules defined in the data link blocks match, i.e. the remote Ethernet address matches the local Ethernet address of the peer block.

Initiative for connection establishment

The initiative for connection establishment is from the active end and depends on the configuration. The active end is either the sender of a message (in duplex the end with the first SEND) or the end configured as active.

The passive end confirms the connection establishment. The passive end is the receiver of a message (RECEIVE HDB or FETCH-PASSIVE HDB).

Monitoring connection establishment

The time required for the connection establishment phase for PRIORITY classes 0 to 2 is not monitored by the CP 143, while the connection establishment of the lower priority jobs (PRIORITY 3/4) is terminated after approximately one minute.

Owing to the different establishment philosophies, it is not possible to have high priority jobs (PRIORITY 0/1/2) combined with low priority jobs (3/4) in one data link block.

4

Monitoring established connections

Established connections are checked by the CP 143 operating system at intervals of 10 seconds. To do this, an IDLE frame is sent that must be acknowledged by the receiving station within the monitoring time. If the IDLE acknowledgement is not received three consecutive times (i.e. after 30 seconds) the connection is aborted. Depending on the job type and job priority, the user is informed of this error immediately or with the next trigger by means of the job status (status word of the handling block).

Behavior of a PRIORITY 2 transport connection

A PRIORITY 2 transport connection can operate in two ways:

1. Assumption: The send end receives a disconnect request

   If the active end (connection endpoint configured with SEND) receives a disconnect request PDU, it replies with disconnect confirm and the connection is and remains terminated until a SEND is triggered with the job number of the connection. This SEND job is completed with 'job ended with error' but the connection is immediately re-established.

2. Assumption: receive end after breakdown on the partner.

If the send end breaks down (e.g. brief loss of power on the PLC), the transport timer of the partner (passive end, connection end point configured with RECEIVE block) elapses and the connection is terminated. A renewed connect request is replied to with a disconnect request until a RECEIVE direct is triggered with the job number of the connection. This receive job is completed with 'job ended with error' but the connect request of the partner is accepted and the connection is re-established.

Datagram, multicast and broadcast service

Overview

Apart from the virtual connections the CP 143 can also handle the following:

➢ datagram service: sending messages without explicit connection and without without acknowledgment.

➢ multicast service: sending to a particular set of stations.

➢ broadcast service: sending to all stations.

Datagram service

The datagram service can be used for direct messages (data exchange between two partners, e.g. for fast messages that do not require any acknowledgment). The datagram service is also used implicitly with multicast and broadcast messages.

Connections are not negotiated. Reception of the data is not confirmed.

The CP 143 cannot report the loss of data frames to the user (e.g. if the receiver does not have sufficient buffer space available).

Multicast and Broadcast service

The multicast or broadcast services allow a message to be sent on the SINEC H1 bus to all stations (broadcast) or to a specific set of stations (multicast).

Broadcast and multicast messages are possible since the bus controller of the CP 143 not only recognizes a particular address on the bus (own bus address in the INIT block) but also the broadcast address FFFFFFFFFFFFH and all multicast addresses (multicast sets) in the INIT block (maximum 10 multicast sets).

4

The following diagram illustrates

> the job type to be specified when configuring the CP (SEND Datagr.=Y for PLC1).

> the handling block to be used in the PLC program (SEND-HDB for PLC1).

> the direction of data flow
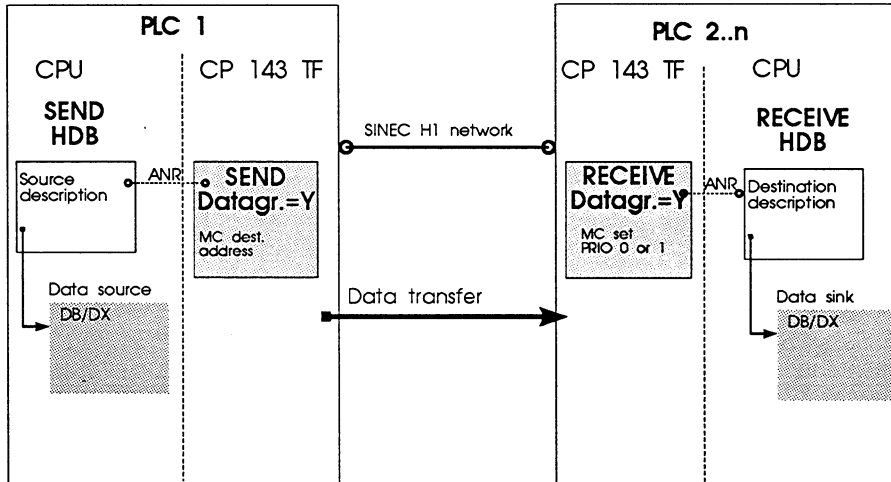
Fig. 4.8:   Datagram Service

Priority and data length
The datagram, multicast and broadcast services can only be handled by the CP 143 in priority levels 0 and 1, i.e. the net data field is limited to 16 bytes.

4.2.4 Supplying the CP with Configuration Data

Definition of the parameters by configuring
There are three possible ways of programming or entering/changing the SYSID, INIT and data link blocks as follows:

➤ OFFLINE (EPROM module):
The blocks are created in the database file on the PG; the database file is transferred to an EPROM and the programmed EPROM is inserted in the CP 143 (power must be off).

➤ OFFLINE (RAM module):
The blocks are created in the database file on the PG, the database file is transferred to the RAM module of the CP directly. For this transfer phase, the PG must be connected to the CP 143 ONLINE. The transfer function is only possible when the CP 143 is in the STOP state.

This is only possible in the following situation:

If the SYSID/INIT block is entered ("original initialization" of the CP 143 with the COM 143 software via the PG interface of the CP), a central PG can establish a PG connection to this CP via the SINEC H1 bus and transfer the remaining parameter sets to the CP (central booting via the bus system).

➤ ONLINE:
The blocks are created in the database file on the PG; the entries/modifications are stored on the CP and become effective after a cold restart (STOP/RUN) on the CP. The INIT and SYSID blocks can only be modified when the CP is in the STOP mode.

4.2.5   Programming SIMATIC S5 Communication

Intention
The creation of the PLC programs is largely independent of the configuration and is therefore shown as a parallel path in the figure on page 4.2 . The PLC programs contain the communication calls for the particular task.

Dual-port-RAM as PLC-CP interface
The interface between the PLC and CP is a dual-port RAM (DPR) which has the same organization on all S5-CPs. The CP 143 has four such DPR interfaces so that every CPU in a multiprocessor PLC can communicate independently with the CP 143.

Handling blocks as program interface
STEP 5 user programs control the CPs via the DPR using handling blocks (HDBs). The STEP 5 user cannot access the CPs directly (bypassing the handling blocks). The following system calls, i.e. HDBs, are available:

➤ **SEND**

The SEND block is used to transfer a job (with or without the user data for transfer) to the CP. The SEND-HDB is used for the configurable job types SEND and WRITE.

If the SEND block is assigned the job number 0, it functions as a SEND_ALL block for triggering the data acceptance between the PLC and CP (exception: on the S5 135 U a special SEND_ALL block must be used).

➤ **RECEIVE**

The RECEIVE block is used to accept a job (with or without received user data) from the CP.

If the RECEIVE block is assigned the job number 0, it functions as a RECEIVE_ALL block to trigger data acceptance between the PLC and CP (exception: on the S5 135 U a special RECEIVE_ALL block must be used).

➤ **FETCH**

The FETCH block triggers the fetching of data (with job type READ).

➤ **CONTROL**

The CONTROL block is used for requesting the status of a job.

➤ **RESET**

The RESET block resets one or all jobs (RESET_ALL function) for the specified connection.

➤ **SYNCHRON**

During start up, the Synchron block establishes the synchronization between the PLC and CP. At the same time, the transfer area of the interface is cleared and the field length negotiated between the CP and PLC; i.e. the Synchron block proposes the field length to be used.

4

> The handling blocks are contained in special function blocks belonging to the SIMATIC S5 PLCs. The following table shows which FBs belong to which PLC.

HDB	PLC S5		
	115U	135U (R Proc/CPU 928 / 928B)	155U
SEND	FB244	FB120	FB120
RECEIVE	FB245	FB121	FB121
FETCH	FB246	FB122	FB122
CONTROL	FB247	FB123	FB123
RESET	FB248	FB124	FB124
SYNCHRON	FB249	FB125	FB125

Tab. 4.2:   HDB Numbers in the Various PLCs

☞   **Note:**

Detailed information about the handling blocks of the individual PLCs, particularly when the blocks are integrated in the operating system can be found in the descriptions of the PLCs or /7/.

Addressing concept

Identification of the connections
All the handling blocks must be assigned an interface number and a job number (SYNCHRON only requires the interface number).

Page and interface number
The interface number (SSNR) identifies the address of the CP module in the S5 rack. In much the same way as a normal I/O module is addressed, a CP module must also be set to a certain address (in this case known as page or interface). Since the CP 143 has four of these pages, only the first page (base SSNR) can be set on the hardware; the other three interfaces then occupy the next three consecutive page addresses.
The following diagram illustrates the assignment of the SSNR in a single processor PLC, i.e. when using one CPU and one or more interface modules.
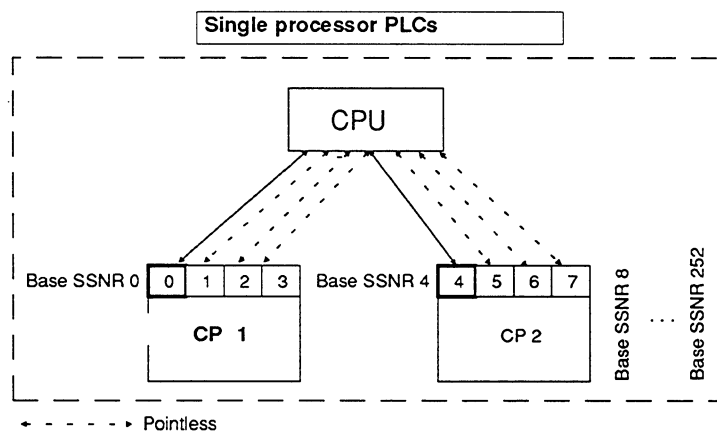
Fig. 4.9:   Interface Addressing Single Processor PLC

The job number identifies the connection and the job
The job number (A-NR) identifies a task on the CP. In the CP 143, the job number "conceals" a number of parameters which define the assignment to a connection, the data direction and the class of priority.

The connection between the communication call and the CP parameters

The fundamental link between the STEP 5 user program and a particular action on the CP 143 therefore takes the form of an SSNR/A-NR combination. To prevent the system reacting incorrectly, you must make sure that an SSNR/A-NR combination is only assigned once in an S5 PLC. Figure 4-10 illustrates the relationship between the STEP 5 user program and the parameters on the CP 143.
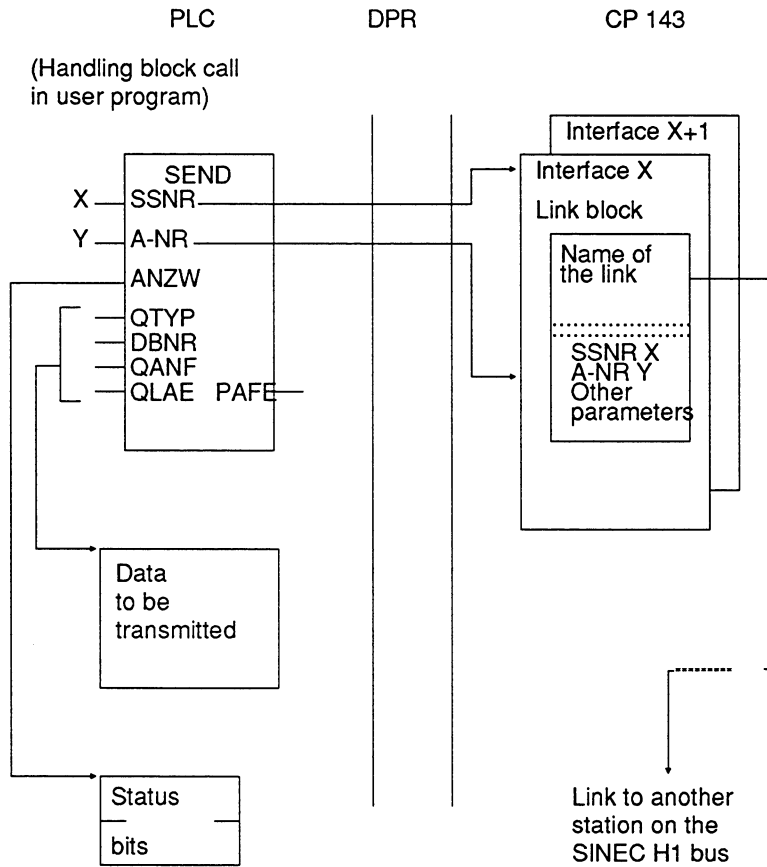
Fig. 4.10:   Assignment of Call Parameters to the CP Parameter Lists

SEND/RECEIVE job on the PLC

Principle of sending and receiving

Communication links between parts of the program in two different programmable controllers can be compared with a postal system. A SEND job on the CP 143 represents the post-box, a RECEIVE job (in another CP) represents the PO box. Using the SEND handling block, messages can be put into the post-box and then transported by the CP 143 transport system to the PO box of the addressee. Then, using the RECEIVE block, the message can be collected. The transport system ensures that neither the post-boxes nor the PO boxes can be overfilled. This function is called flow control.

With the handling blocks of the PLCs, a function is initiated on the CP 143 in the same way for PRIORITY 0/1 and PRIORITY 2/3/4 jobs. Only the time of the data transfer or data acceptance is different (with PRIORITY 0/1 directly during the block run through, with PRIORITY 2/3 and 4 with the background communication).

4

Data handling dependent on the service

The buffer management of the CP 143 is designed so that the expedited data service operates with static buffers, while the normal and slow services operate with dynamic buffers.

"Static buffer" means that during the start up a 16 byte buffer is allocated to each of these PRIORITY 0 and 1 jobs

With the dynamic buffer management, i.e. with jobs in priority classes 2, 3 and 4, the buffers are only requested as required and are released again when they are no longer needed. Because of the different ways in which the buffers are organized, different methods of job triggering must be differentiated.

Description of the job triggering according to priority classes

➤ Expedited data service (priority classes 0/1)
With the expedited data service, the user data are sent directly when the handling block is run through (SEND) and received directly (RECEIVE). The RECEIVE block is ready to receive immediately following the connection establishment or immediately following the acceptance of a data frame by the PLC.

The reception of messages is indicated in the status word, so that the RECEIVE block can take the data directly. In PRIORITY 0, in addition to the status code, an interrupt is also triggered at the PLC.

As already mentioned above, the expedited data service is restricted to net data of maximum 16 bytes.

☞ **The expedited data service should not be used for cyclic transmission (i.e. triggered in each user cycle), since the communications processor can be subjected to too much load and other services may be blocked.**

Repetition of expedited data service frames (e.g. when the receiver has not made a receive buffer available) would result in delays and unnecessary load on the communication network.

When using the expedited data service with interrupt (PRIORITY 0) the receive HDB on the receiver must be implemented in the interrupt OB (the exact designation of the block depends on the particular device). The CP only resets the interrupt signal when the job that triggered the interrupt signal is processed (handling block run).

➤ Normal service (priority classes 2-4)
In the normal and slow services, the PLC transfers the SEND or RECEIVE job to the CP 143 with the handling blocks (i.e. informs the CP 143 that it wishes to send a data frame or is ready to receive a message and indicates the memory area in which the received data are to be stored). The transport management then makes data buffers available. Connections belonging to the slow service are now established, providing they do not already exist (PRIORITY 3).

With a SEND job, the data for transmission are requested from the PLC via the background communication (SEND-ALL), and with the RECEIVE job, the organized data buffers (length depending on length of data to be received) are made available.

In this sense, "background communication" means that the CP 143 uses code bits to request the PLC to transfer or receive data. The background communication is implemented by the handling blocks SEND-ALL or RECEIVE-ALL, which must be called at least once in the PLC cycle for every active CP 143 interface. With RECEIVE, the data to be received are also transferred (on arrival) to the PLC via the background communication (in this case, RECEIVE-ALL). Once all the data have been transferred, the SEND and RECEIVE return the data buffers to the transport management. The load on the buffers can be monitored with the PG using the test functions "Status All" and "Trace All".

WRITE job on the PLC

A WRITE function is triggered at the ACTIVE end by a SEND block with QTYP = RW. The description of the data source (i.e. data source in local PLC) and the description of the data destination (i.e. data destination in remote PLC) is written to a data block and the operating system (SEND block) is informed of this with the parameters DBNR and QANF.

At the PASSIVE end, the CP 143 sets itself automatically to receive, i.e. reception does not need to be triggered by the RECEIVE block. For the data transfer to the PLC, the RECEIVE-ALL block must be called at least once in the PLC cycle.

The destination descriptions, which can be assigned as parameters in the WRITE-PASSIVE function on the CP 143 serve as default parameters if no parameter description is sent from the ACTIVE end. Just as the destination description, the output of a status word at the PASSIVE end is to be recommended; if no status word is specified in the data link block, the PASSIVE end operates without sending status bits to the user program in the PLC.

READ job on the PLC (with Fetch block)

A READ function is triggered at the ACTIVE end by a FETCH block with ZTYP = RW. The description of the data source (i.e. data source in the remote PLC) and the description of the data destination (i.e. data destination in the local PLC) is written to a data block and the operating system (FETCH block) is informed of this with the parameters DBNR and ZANF.

At the PASSIVE end, the CP 143 sets itself automatically to receive the READ request frame, i.e. this does not need to be triggered by a handling block. To read out the requested data from the PLC, however, the SEND-ALL block must be called at least once in the PLC cycle.

The source descriptions, which can be assigned as parameters in the READ-PASSIVE function on the CP 143 serve as default parameters if no parameter description is sent from the ACTIVE end. Just as with the source description, the output of a status word at the PASSIVE end is to be recommended; if no status word is specified in the data link block, the PASSIVE end operates without sending status bits to the user program in the PLC.

Blocks for synchronizing the PLC and CP

During the start up of a PLC each CP interface used must be synchronized by the SYNCHRON handling block. Since this applies to all types of PLC restart, the necessary number of SYNCHRON blocks is required in

OB20 for a cold restart

OB21 for manual warm restart

OB22 for warm restart after power down.

☞

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The data unit length BLGR in the SYNCHRON block must be set to the value BLGR = 255 to obtain a data unit length of 512 bytes. The value BLGR = 6 causes errors; only 496 bytes are transferred. At a TF-PDU size of 512 bytes, only 504 bytes of data are transferred with data unit length 255, since several bytes are required as the protocol header.

Handling RESET

Meaning of RESET
A job which has started on the CP 143 can be reset using the RESET function. The RESET function is useful in the following situations:

➤ With SEND/RECEIVE PRIORITY 0/1/2 or with READ/WRITE if the job is not completed within a certain time (e.g. the sender does not transfer or the receiver does not accept any data). The CP 143 itself does not monitor the times of jobs.

➤ With SEND/RECEIVE PRIORITY 3, to terminate an established connection and therefore make memory area available again.

➤ With SEND/RECEIVE PRIORITY 3/4 when a connection was not established within a given time. The monitoring time for establishing PRIORITY 3/4 connections is set to approximately 60 seconds on the CP 143.

RESET job on the PLC
The RESET function is triggered by the RESET handling block which is supplied with the appropriate interface and job number. The RESET-ALL function, i.e. a RESET with job number 0, is not implemented on the CP 143.

The RESET block only operates RLO-dependent, i.e. the RESET can be sent regardless of the status of the job on the communications processor.

How RESET functions
The following flow diagram shows that the RESET interrupts an established connection (generation of a BREAK signal). If several jobs are defined for a connection in one data link block, resetting one job will also reset any other jobs on this connection. You should keep this in mind when you use a RESET or when you plan multiple use of a connection.

The following diagram illustrates the RESET processing sequence.

```
                    ┌──────────────┐
                    │    START     │
                    └──────┬───────┘
                           │
                    =====  │         RESET by PLC
                           │
        ┌──────────────────┼──────────────────────┐
        │   Connection is  ────── Connection is established
        │   not established │
        │                  ┌┴─────────────┐
        │                  │ Terminate    │
        │                  │ connection   │
        │                  └┬─────────────┘
        │                   │
        │            =====  │       Connection is interrupted
        │                   │
        └──────────────────►│
                    ┌───────┴──────┐
                    │ Reset all    │
                    │ data buffers │
                    │ for the job  │
                    └───────┬──────┘
                            │
              ┌─────────────┴──── Job with ──────┬──── Job with
              │                   PRIO 0/1/2      │     PRIO 3/4
        ┌─────┴────────┐                          │
        │ Establish    │                          │
        │ conn. again  │                          │
        └─────┬────────┘                          │
              │◄──────────────────────────────────┘
        ┌─────┴──────────┐
        │ Status of job  │
        │ = RESET ended  │
        │                │
        │ Reset control  │
        │ of the job     │
        │ (Transport     │
        │ status = 0)    │
        └─────┬──────────┘
              │
        ┌─────┴────┐
        │   END    │
        └──────────┘
```
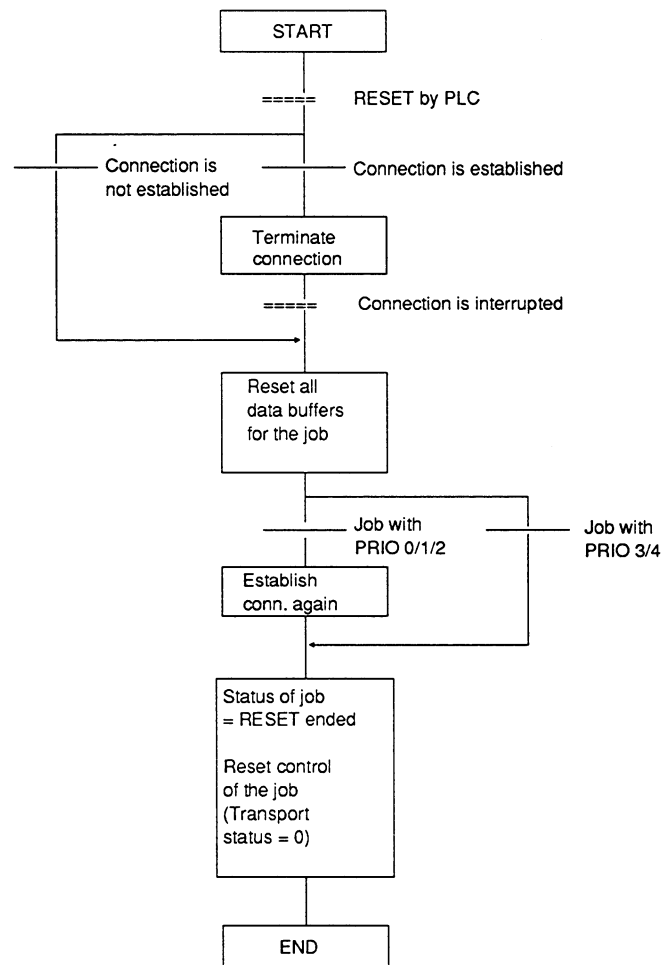
Fig. 4.11:   Processing RESET

Limitation

The use of the RESET handling block is pointless with datagrams (including broadcast and multicast).

4.2.6   Supplying the PLC with S5 programs

If you only use the transport interface of the CP 143 TF, PLC blocks are transferred to the PLC with communication calls using the load functions of S5-DOS KOMI.

When using the TF interface there are further possibilities. For more detailed information on this topic refer to the domain services, the Request Editor and PGLOAD in Volume 2 of this manual.

4.2.7   Operating and Testing Applications

To operate the communications interface via the CP 143 TF the following is required:

➢ PLC and CP are synchronized (see also Chapter 3)

➢ The PLC has been supplied with the program and data blocks containing the communication calls.

➢ The CP 143 TF has a completely configured database (i.e. SYSID, initialization blocks, data link blocks).

Depending on the configuration, the application associations are initiated during start up or when required, i.e. when a send job is issued.

The test functions of the COM 143 TF configuration tool allow you to monitor the communication and to check the status of the CP and the connections.

4.3 The Multiprocessor Mode

Overview

When you use more than one CPU, the PLC is operating in the multiprocessor mode. In the multiprocessor mode there is a fixed assignment between the CPU and a CP page (interface):

➤ CPU 1 communicates via page 1   (base SSNR+0)

➤ CPU 2 communicates via page 2   (base SSNR+1)

➤ CPU 3 communicates via page 3   (base SSNR+2)

➤ CPU 4 communicates via page 4   (base SSNR+3)

The diagram illustrates the assignment between the CPU and CP using the base SSNR.
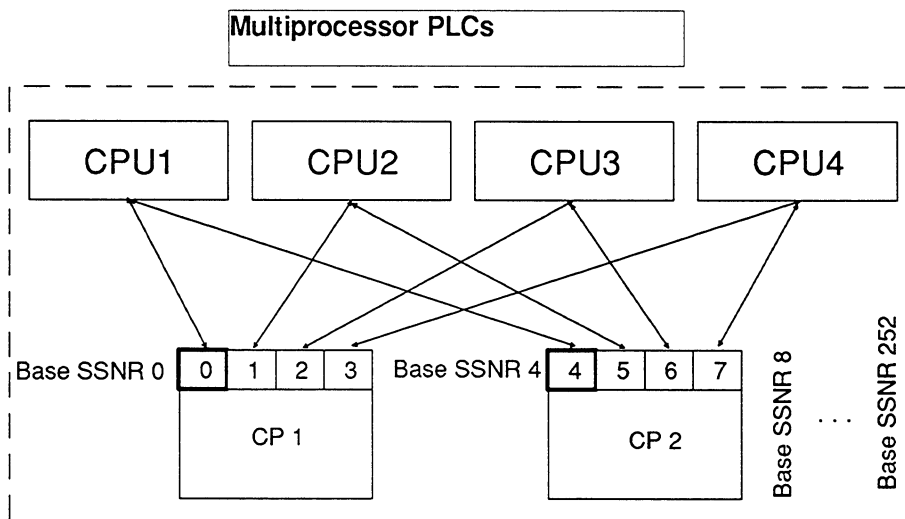
Fig. 4.12:   Interface Addressing Multiprocessor PLC

Special features of the multiprocessor mode

Expedited data service (priority class 0)
With jobs with interrupt servicing (PRIORITY 0 jobs) the CP 143 sets the
interrupt line (IR) assigned to the interface on which the job was defined
(IR line A is assigned to the first CP interface, IR line B to the second CP
interface etc.).

Unique job assignment
When working with a multiprocessor system, remember that a job is only
valid for one CPU.

Synchronization
In the multiprocessor mode, the interfaces for each CPU-CP assignment
must be synchronized. The following example illustrates the necessary
steps.

If, for example, you want CPU no. 2 to communicate via the CP 143 TF,
you must set the active interfaces parameter to 2 in the CP initialization
block screen and synchronize both interfaces (base SSNR and base
SSNR+1). The CPU 2 communication then takes place via the handling
blocks that use SSNR+1.

The same procedure is necessary for the third and fourth CPU.

☞   **If a different number of interfaces was synchronized during
           installation instead of the number expected by the CP 143
           TF according to the configuration, the CP will not
           synchronize even if the correct number of synchronization
           blocks is processed during a PLC restart.**

           Remedy:
           **Change the CP 143 TF to STOP and then synchronize the CP
           143 TF with the correct number of interfaces. Then bring the
           CP 143 TF back to RUN (green and red LEDs lit) and
           synchronize again.**
           **Or: change the order in which the interfaces are
           synchronized so that the interface that was added is
           synchronized last.**

Synchronizing with a fast CPU (CPU 946/947, 948) PAFE 81
After synchronization of the CP 143 TF, a PAFE 81 (interface not ready) may occur briefly with the HDB-ALL call. In the next PLC cycle the interface is ready again.☐

4

Notes

5 SINEC NCM COM 143 TF Configuration Software

The CP 143 communications processor provides a graduated range of performance for your communication tasks. By configuring the module, you adapt the CP for your specific tasks. This adaptation is made convenient by the SINEC NCM COM 143 TF configuration tool (abbreviated to COM 143). COM 143, under the SINEC **NCM** (Network and Communication Management) user interface, allows menu-guided configuration of all parameters for the CP.

After working through this chapter, you will be familiar with the following topics:

➤ the concept underlying the COM 143 configuration software

➤ how to install and start COM 143

➤ how to operate COM 143

➤ which files are set up and managed under COM 143

➤ how to transfer and archive configuration data

5

COM 143 TF, also simply referred to as COM below, can be run on all PGs or PC/ATs with S5-DOS Stage VI.

5.1   Convenient Configuration with the NCM COM software

SINEC NCM

SINEC NCM is the name of a family of network management products within the range of SINEC. The following products belong to the NCM family:

➤ SINEC COM and SINEC NML

     Software packages for configuring the communication functions of SINEC communications processors. The software packages contain functions for configuration, test and diagnosis and for downloading databases onto the CP modules.

➤ SINEC CHECK and SINEC SCOPE

     Software test packages for protocol analysis, generating and analyzing loads and network monitoring.

Operating philosophy

The COM software is operated solely using screen displays. The function key menus indicate the possible options in a given context. The mouse is supported.

The menu guidance is based on the SAA standard .

Advantages

➤ The standardized user interface makes it easier to use the various configuration and test tools. Switching from one configuration tool to another is also easier.

➤ With this format, configuration steps can be clearly followed, the "flat" menu hierarchy provides a better overview.

➤ The use of the mouse further increases convenience and allows you to work faster.

A first impression

Have a look at the supplement "SINEC NCM COM 143 TF Configuration Tool". to gain a first impression of the possible selections and available screens.

5.2   Conditions for Using COM 143

The package
The SINEC NCM COM 143 TF software package contains the following:

➤ Software on 3,5" diskette (1,44 Mbytes):
  The diskette contains the software in compressed format. The following files are important:
  - READ143.ME   -> Up-to-date information about the package
  - INSTALL.EXE   -> Installation program

  The diskette also contains the function blocks FB103 for the program invocation services and several example programs. For a full list of the files, refer to the Product Information.

➤ This manual CP 143 with COM 143.

➤ A Product Information with up-to-date information.

Environment
The COM 143 configuration software can be run on PG 7xx programming devices or AT-compatible PCs. The operating system required is S5-DOS/ST, Version 6.x.

Note: a detailed list of the permitted system configurations can be found in the READ143.ME file on the diskette.

Conditions for running the COM
To run SINEC NCM you must have the following:

➤ At least 560 Kbytes of free working memory at the MS-DOS 5.0 operating system level to be able to load the required drivers, STEP5/ST and COM 143 in the working memory.

➤ Sufficient space on your hard disk. Per COM, you should have approximately 1.5 Mbytes available. When you install under MS-DOS, the installation tool checks that there is enough space.

5.3   Installing and Starting COM 143

The next step
The next step should be to install the configuration software. Install the software as described in the following sections. After installation, you should also have a look at the screens.

☞   **Before installing the software, please read the "read143.me" file on the diskette.**

Notes on directory and file organization
Under S5-DOS/ST Version 6.x, COM 143 uses the S5-DOS directory structure.

COM 143 accesses the following directories and the files they contain:

➤ SIMATIC system directory
  – Printer file
  – Path file

➤ Working directory (file storage for a specific project)
  – shelinit.cfg (NCM settings)
  – Footer file
  – S5 program files
  – CP database files

    etc.

After installing COM 143 the following directory is also created:

➤ NCM directory (e.g. SIN_COM see next page)
  – COM 143 system files

Installing COM 143

✓ Insert the COM diskette in the floppy disk drive and start installation from the root directory
e.g. **A:INSTALL**

Once the installation program has been called, you are guided through a dialog. You can specify the destination drive and select an existing directory in a pull-down menu. You can also set up a new directory.

Install COM 143 in an NCM directory. You can select any suitable directory name e.g. SIN_COM.

☞   **COM 143 must not be installed in the SIMATIC system directory.**

✓ Once the required path is set (as indicated on the screen), you can trigger the installation with function key F7.

The installation program checks the space available on the hard disk. If there is not enough space, a message is displayed and you can stop the installation.

Before copying the files, the installation program checks whether or not there is already COM software installed in the selected directory on the hard disk. If the same software has already been installed, the release of the software is checked. If the release is older than that on the installation diskette, a new installation is carried out. If the version is not older, installation is only continued at your specific request.

Following installation, the following settings are recommended:
If the working directory and the NCM directory are on the same drive, it is advisable to create a virtual drive for the NCM directory (e.g. you can enter "Subst i: c:\sin_com" in autoexec.bat and re-boot). You should then enter this virtual drive in the operating system screen Settings-> Enter Start Directory.

This has the advantage that "SINEC NCM V3.10" is displayed immediately when you use the function Change -> Others!

Starting COM 143

✓ Start the S5-DOS command interpreter KOMI by typing in S5.

✓ Select your working directory in S5-Komi.

✓ Select the required interface in S5-KOMI (AS511 or SINEC H1).

✓ Select the drive that COM 143 will access in S5-KOMI.

✓ Start NCM with Change->Others

✓ Select the CP type "CP 143"

Further help is provide by the help texts.

5.4   Using the Keyboard and Mouse

General information
The keyboard assignment of the COM software is based on the normal principle found in SIMATIC S5 packages. For this reason, there are a few differences compared with the input using common PC software products.

Basic functions
Functions are executed using standard keys or a combination of them.

The following list shows the assignment of the most commonly required COM functions to the keys of the PG/PC keyboard.

COM functions	Keyboard
Page, search backwards for files	<Arrow up > or Line & Page function key "Page-1""Line-1"
Page, search forwards for files	<Arrow down> or Line & Page function key "Page+1""Line+1"
Move to next input field	Enter key or <arrow right>
Back or cancel	<ESC> or cancel key
Enter	<F7> or enter key
Selection, i.e. possible parameters are displayed for selection	<F8>
Help, i.e. help texts about the current input field are displayed	<HELP> (PG) and SHIFT F8
Delete the information on the screen	<DEL>

Note:
Depending on the PC/PG, other key assignments are possible.

5

Using the mouse
The mouse allows flexible positioning of the cursor on all input fields and softkeys on the screen. The softkeys can be triggered using the left mouse button. Input of data within an input field is made solely via the keyboard.

5.5   Menu Structure and Operation

5.5.1   The Menu Bar for Selecting Functions

COM 143 after start up

The start screen has a menu bar in which all the function groups provided by the COM for configuration and testing are displayed as menu items. At the lower edge of the screen, there is help bar in which a help text is displayed whenever you select a menu item (see Supplement). The area between the menu bar and the help bar is available for the user dialog. Here, pull-down menus, help texts, special windows etc. are displayed.
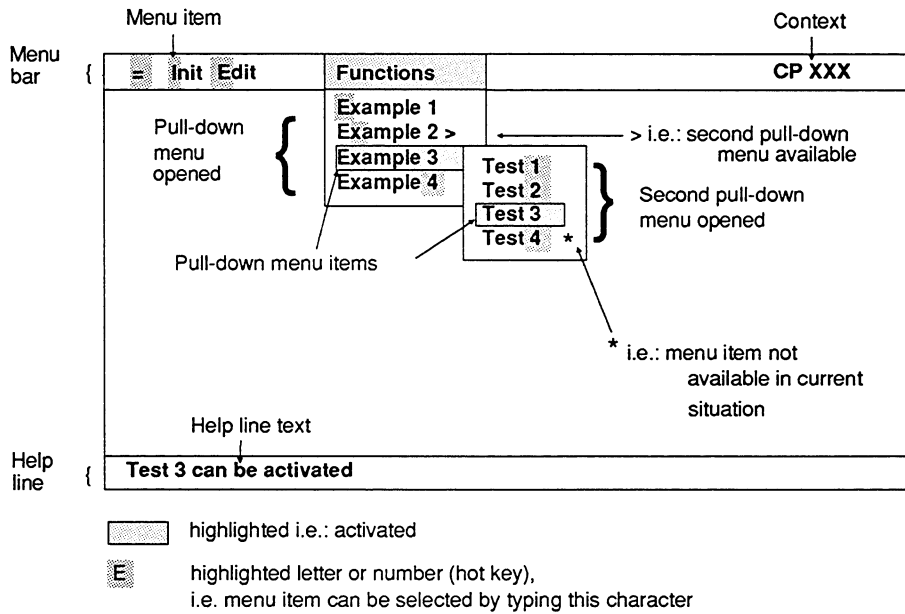
Fig. 5.1:   SINEC NCM Basic Screen Layout

Structure of the menu bar and pull-down menus:
You can obtain all menu items via the menu bar. The menu items in the menu bar each represent a group of functions. The pull-down menu items represent commands for activating the COM function screens. The NCM selection screen disappears once a COM function screen is activated with a pull-down menu item.

If you select a menu item marked with an "arrow head" (>), you obtain a second pull-down menu in which further functions can be selected.

Pull-down menu items marked with an asterisk (*) are disabled.

Selecting pull-down menu items (i.e. commands)
There are three ways of selecting a menu item:

> Selection with the arrow keys and the enter key

> Selection with the mouse and pressing the left mouse key

> Selection by pressing a hot key, i.e. the highlighted character in the name of the menu item You can cancel any action and return to the previous menu by pressing the <ESC> key. When you activate a menu item, the corresponding COM screen is displayed. Once you have completed your entries in a screen, you return to the main menu.

5.5.2   COM 143 Screen Structure and Operation

Overview

You operate the COM software exclusively via screens and the softkey menus. The softkey menus indicate the functions available with the function keys F1 to F8.

The cancel or ESC key returns you to the previous screen or cancels the currently active function.
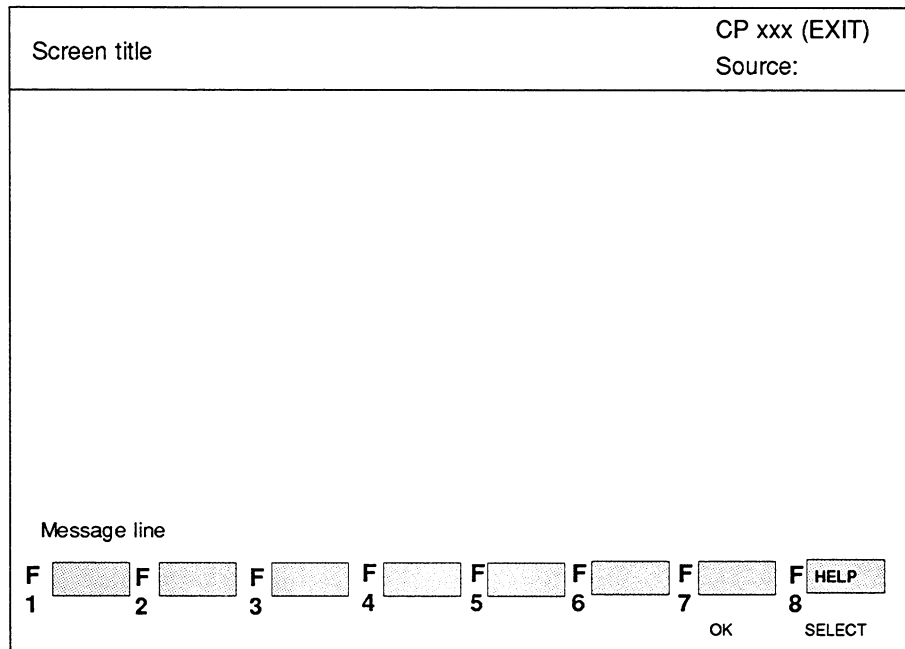
Fig. 5.2:   Screen Layout and Function Keys

Screen title

Screen name: Brief description of the path, e.g. "Init-Edit"

Context: CP-specific screens: CP designation otherwise
                    SINEC NCM

Source: Module file / bus parameter file / path name

Message line
This line above the softkeys is used for messages (warnings, errors, instructions etc.). A message remains displayed until a key is pressed.

Softkeys
Softkeys are displayed for each screen at the lower edge of the screen. They are assigned to the function keys F1 to F8. The softkeys may have a further function which is activated by pressing the SHIFT key and the function key together. The display of the softkeys with a second function is therefore divided into an upper (SHIFT function) and a lower field.

General notes on input
Field highlighted: If a field is highlighted, changes or input can be made.

Field not highlighted: The field is simply a display field.

General notes on operation
Changes or input can only be made in highlighted fields selected with the cursor keys.

If you want information about the possible entries in a field, press F8 (Select). The possible entries displayed in the selection window can be selected with the cursor keys or mouse and entered in the current field with <CR> or the enter key.

Confirm an entry you have made manually in a field with <CR>. If the input is permitted, the cursor jumps automatically to the next input field.

Help

The help functions provide you with a help text referring to the current input field.

Entering data

Once you have completed input in a screen and want to enter the data, press the function key F7 or the enter key to enter the data in the current database file. Before the data is entered the system prompts you to confirm your intention. If you decide not to enter the data, press <ESC>.

5

5.5.3   General Description of the Function Keys

While you are working with the configuration screens, the functions available in the present context are displayed in a bar at the bottom edge of the screen. Some of the function keys always have the same significance regardless of the currently displayed screen. These general functions are outlined below.

Page forwards

| +1 | Select the next set of parameters.

| PAGE +1 | Select the next page.

| LINE +1 | Scroll the display when data is displayed in lines.

Page backwards

| -1 | Select the previous set of parameters.

| PAGE -1 | Select the previous page.

| LINE -1 | Scroll the display when data is displayed in lines.

Empty screen for data input

| INPUT | A new set of parameters is created. The input fields are reset to the default values.

Delete screen content

| DELETE | Depending on the context, individual input fields or whole parameter sets are deleted.

Further parameters in next screen.

| NEXT SCR | The displayed parameter set is extended by other parameters in the next screen.

Complete input and enter data

| OK |

The data you have input will be entered in the database. You may be prompted to confirm that this is what you want to do.

| F8 |
| SELECT |

If the range of values is limited, the possible values are displayed when you press this function key. The displayed values can be selected with the mouse or arrow keys and entered with OK.

Help texts

| ^F8 |
| HELP |

You can display help texts about the currently displayed screen.

5

5.6   File Concept

The database file

During the configuration of a CP 143, the configuration data for a module (the database) are saved in a database file. This file was also known as module file in other configuration tools. The database file is specified in the screen M 1-1.

Name conventions

You can use any text string for the name of the database for a CP (module file) except for the first character. A separate database file is created on the data diskette for every CP module. This contains all the parameters for operating the CP.

You can change a file name proposed by the COM software using alphanumeric characters and the period, however the first character must remain "P".

Example: PTESTS51.CP1

Note:

Remember that other database files may exist in your directory, which use the same name conventions but belong to a different CP type. These cannot be read or processed by COM 143.

Storage and transfer

The database file is created with the appropriate COM 143 functions, managed on the PG or PC and loaded on the CP. The file can be loaded via one of the possible interfaces, the AS511 interface or the SINEC H1 bus interface.

❑

6   Example to Introduce theTransport Interface

Aims

This part of the manual is intended to introduce the first-time user of the CP 143 to the transport interface for the SINEC H1 bus system as designed for SIMATIC S5. Particular emphasis is placed on assigning parameters to the CP 143 using the software package COM 143.

The aim of this chapter is to construct a small communication system which will enable the communication procedures to be controlled as simply as possible. You will be given examples of programs for SIMATIC S5 programmable controllers and examples of parameter assignments for communications processors (see the note at the end of this section).

The following elementary tasks are introduced by the example:

> connecting the CP to the PLC-CPU and synchronizing them

> preparing data in the PLC for transmission

> formulating calls in the PLC program for sending and receiving

> configuring transport connections.

> starting up communication links and testing them

6

6.1   Requirements

6.1.1   Experience

The example anticipates the detailed instructions in the following chapters, but nevertheless is restricted to simple situations avoiding dealing with all the possible aspects and alternatives of configuring a CP. The next chapters can, however, be used for reference when working through the example.

You should be familiar with CP handling blocks. These are standard function blocks that allow the communication functions to be used by the programmable logic controller programs.

6.1.2   Software and Hardware

The following minimum equipment must be available:
2 programmable logic controllers (e.g. S5-155 U) with memory and additional 15 V modules in the power supply

2 CP 143 communications processors

2 EPROMs each with 16 Kwords (=32 Kbytes)

Communications link consisting of
2 transceivers,
2 transceiver cables,
2 terminators,
1 bus cable with coaxial connectors

A programming device (e.g. PG 730 / PG 750)

TTY cable for PG connection

(For remote control via a PC, a CP1413 module is required)

In addition to the hardware listed above, the following software packages are also necessary:
COM 143 TF

PG software for the programming language STEP 5,

Handling blocks for the appropriate PLCs

The example files supplied on the COM 143 diskette.

Overview of the chapter
The aims of the introductory example are explained in more detail in Section 6.2. To implement the example, the programmable logic controllers must be programmed in the STEP 5 language, Statement List (STL) and the CP 143 communications processors must have parameters assigned to them. The appropriate programs for the S5-155 U can be found in Section 6.3. Section 6.4 deals with the parameter assignment required for the CP 143 using the PG software package COM 143 on the PG 750.

The monitoring of the implemented communications procedures is described in Section 6.5.

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☞   **Please note that the lists of function and data blocks are intended to illustrate the text. The actual values are in the example files on the diskette. Use these files to program the PLC!**

6.2   Task

A programmable logic controller PLC1 sends data every second to another programmable logic controller PLC2.

Tasks of PLC 1
In data block DB10, data words DW0 and DW49 are incremented at second intervals.

After these data words have been incremented, the area DW0 to DW49 of data block DB10 is transferred to PLC 2 by the handling block SEND.

SEND has the job number A-NR = 1 and the interface number SSNR = 0.

The specification of the source parameters is stored in data block DB9 from data word DW15 onwards.

For the interface number SSNR = 0, you must set the appropriate jumpers on the CP 143 module.

Switch block S2: all switches OFF.

Tasks for PLC 2
The data sent by PLC 1 should be received at PLC 2 and stored in data block DB12.

The RECEIVE handling block is used for this. It has the job number A-NR = 1 and the interface SSNR = 0.

The destination parameters are stored in data block DB11 from data word DW16 onwards.

For the interface number SSNR = 0, the CP 143 must have suitable parameters assigned to it (jumper settings). In this example, the assignment is identical to that of the CP 143 in PLC 1.

Figure 6.1 illustrates the required system structure with the components listed in Section 6.1.
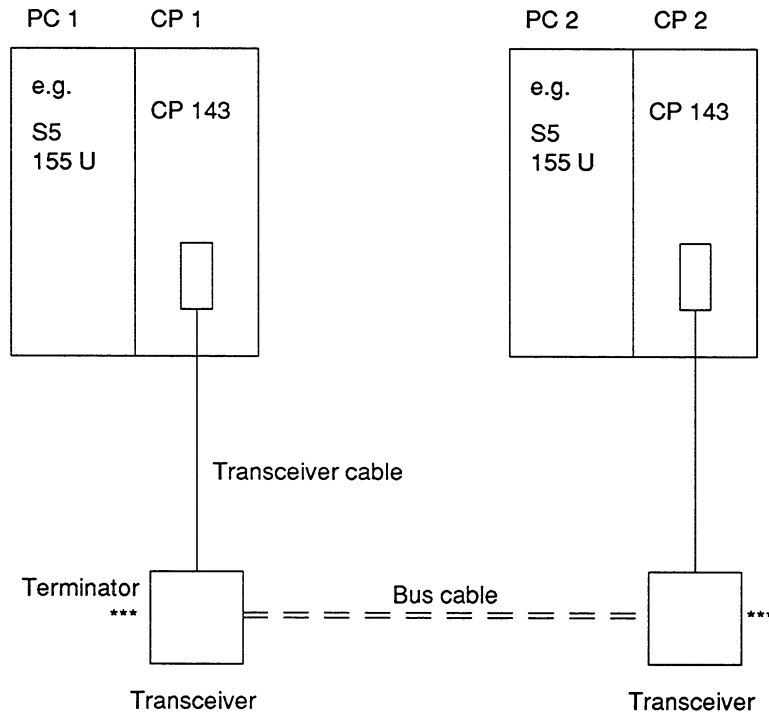
Fig. 6.1:   System Structure for the Example

The functions required and the necessary presettings are now known. Further details for the assignment of parameters to the handling blocks can be found in the programs in Section 6.3. The parameter assignment for the CP 143 is described in detail in Section 6.4.

6.3   STEP 5 Programs for the S5-155 U

The same program can be used for the S5-135 U, S5-115 U or S5-150U after modifying the handling blocks specific to these PLCs.

6.3.1   Blocks for Synchronizing the PLC and CP

When a PLC is started up, each CP interface to be used must be synchronized by the handling block SYNCHRON. Since this applies to every type of start-up with the PLC, the required number of SYNCHRON blocks must be programmed in

OB20 for cold restart

OB21 for manual warm restart

OB22 for warm restart following power failure.

In the current example, the manual warm restart has been omitted and OB21 was therefore not programmed (Fig. 6.2).

In function block FB210 (not a standard FB!) a check is made to ensure that the synchronization was carried out without errors. If an error occurred, the program is stopped by the stop command (STP).

The programs in Fig. 6.2 are appropriate for both PLC 1 and PLC 2 in this example.

```
OB20                                                         LEN= 14    ABS
                                                             PAGE 1
SEGMENT 1
0000           :JU  FB125               SYNCHRON COLD RESTART
0001 NAME      :SYNCHRON
0002 SSNR      :       KY0,0
0003 BLGR      :       KY0,0
0004 PAFE      :       FY15
0005           :
0006           :JU  FB210               JUMP TO EVALUATION
0007 NAME      :SYNERR?
0008           :BE                      FROM PAFE.RETURN.
```

```
OB22                                                         LEN= 14    ABS
                                                             PAGE 1
SEGMENT 1
0000           :JU  FB125               SYNCHRON WARM RESTART
0001 NAME      :SYNCHRON
0002 SSNR      :       KY0,0
0003 BLGR      :       KY0,0
0004 PAFE      :       FY15
0005           :
0006           :JU  FB210               JUMP TO EVALUATION
0007 NAME      :SYNERR?
0008           :BE                      FROM PAFE. RETURN
```

```
FB210                                                        LEN= 14    ABS
                                                             PAGE 1
SEGMENT 1
NAME           :SYNERR?
0005           :AN  F 15.0              EVALUATION OF PAFE. BIT 0
0006           :JC = SYOK
0007           :STP                     STOP IF SYNCHRON. ERROR
0008 SYOK      :BE                      SYNCHR. O.K., RETURN
```

Fig. 6.2: OB20, OB22 and FB210 for PLC 1 and PLC 2

6.3.2   Programs for PLC 1

The transmission is triggered in PLC 1 by a SEND handling block. This is called in the function block FB1 (Fig. 6.4). The jump to FB1 is the first command in the cycle organization block OB1 (Fig. 6.3). The send job has parameters assigned as follows (Fig. 6.4):

Job number A-NR = 1.

Source type QTYP = XX, i.e. the actual parameters for defining the source data are in a data block. Data block DB9 is used from data word DW15 onwards (see Fig. 6.4).

The data to be sent are in data block DB 10 (Fig. 6.5). According to the information in DB9, the first 50 words starting from DW0 will be sent.

```
OB1                                                LEN=20      ABS
                                                   PAGE 1
SEGMENT 1
0000          :JU  FB1              JUMP TO SENDER
0001 NAME     :SENDER
0002          :
0003          :JU  FB126            CALL SEND ALL
0004 NAME     :SND-A
0005 SSNR     :         KY0,0
0006 A-NR     :         KY0,0
0007 ANZW     :         FW4
0008 PAFE     :         FY13
0009          :
000A          :BE
```

Fig. 6.3: OB1 for PLC 1

```
FB1                                                LEN=34    ABS
                                                   PAGE 1

SEGMENT 1
NAME        :SENDER
0005        :A  F 100.0          = 1 SET TO SEND
0006        :AN T 10             TIMER 10 IS 2ND CONDITION
0007        :L  KT100.0          TO TRIGGER SEND
0009        :SE T 10
000A        :JC = SEND           SEND, IF RLO = 1
000B        :JU = AKTU           RLO = 0 --> DO NOT SEND,
000C        :                    ONLY UPDATE ANZW (STATUS WORD)
000D SEND   :JU FB10             INCREMENT DWO AND DW49
000E NAME   :COUNTER
000F        :A  F 100.0          SET RLO = 1 --> SEND
0010        :
0011 AKTU   :JU FB120            CALL SEND
0012 NAME   :SEND
0013 SSNR   :      KY0,0
0014 A-NR   :      KY0,1
0015 ANZW   :      FW8
0016 QTYP   :      KSXX
0017 DBNR   :      KY0,9
0018 QANF   :      KF+ 15
0019 QLAE   :      KF+ 0
001A PAFE   :      FY14
001B        :
001C        :BE                  RETURN


FB10                                               LEN=17    ABS
                                                   PAGE 1

SEGMENT 1
NAME        :COUNTER
0005        :C  DB10             INCREMENT DWO AND DW49 OF DB10
0006        :L  DW0
0007        :ADD KF+1
0009        :T  DW0
000A        :T  DW49
000B        :BE                  RETURN


DB9                                                LEN=24    ABS
                                                   PAGE 1

  0         :    KS= SEND PARAMETER FOR A-NR 1
 14         :    KH= 0000;
 15         :    KS= DB
 16         :    KY= 000,010;
 17         :    KF= + 00000;
 18         :    KF= + 00050;
 19         :
```

Fig. 6.4: FB1, FB10 and DB9 for PLC 1

DB10   LEN=55   ABS

```
 0      :   KH= 0000;
 1      :   KH= 0001;
 2      :   KH= 0002;
 3      :   KH= 0003;
 4      :   KH= 0004;
 5      :   KH= 0005;
 6      :   KH= 0006;
 7      :   KH= 0007;
 8      :   KH= 0008;
 9      :   KH= 0009;
10      :   KH= 5C5C;
11      :   KH= 5C5C;
12      :   KH= 5C5C;
13      :   KH= 5C5C;
14      :   KH= 5C5C;
15      :   KH= 5C5C;
16      :   KH= 5C5C;
17      :   KH= 5C5C;
18      :   KH= 5C5C;
19      :   KH= 5C5C;
20      :   KH= A3A3;
21      :   KH= A3A3;
22      :   KH= A3A3;
23      :   KH= A3A3;
24      :   KH= A3A3;
25      :   KH= A3A3;
26      :   KH= A3A3;
27      :   KH= A3A3;
28      :   KH= A3A3;
29      :   KH= A3A3;
30      :   KH= 3355;
31      :   KH= 3355;
32      :   KH= 3355;
33      :   KH= 3355;
34      :   KH= 3355;
35      :   KH= 3355;
36      :   KH= 3355;
37      :   KH= 3355;
38      :   KH= 3355;
39      :   KH= 3355;
40      :   KH= CCAA;
41      :   KH= CCAA;
42      :   KH= CCAA;
43      :   KH= CCAA;           47   :   KH= CCAA;
44      :   KH= CCAA;           48   :   KH= CCAA;
45      :   KH= CCAA;           49   :   KH= 0000;
46      :   KH= CCAA;           50   :
```

Fig. 6.5: DB10 for PLC 1

Further notes on the program on PLC1
To trigger a SEND job in this example, two conditions are decisive:

You must set the flag bit F 100.0 to 1 (e.g. with FORCE VAR)

Timer 10 in this example is programmed to 1 second, so that a SEND job is initiated at 1 second intervals.

Before every SEND call, which actually sends a message, data words DW0 and DW49 of data block DB10 are incremented. This takes place in function block FB10 (Fig. 6.4). A SEND call only results in the actual transfer of a message when RLO = 1 before the call. Calls when RLO = 0 only bring about the updating of the status word. In the current example, the handling block SEND is only called at 1 second intervals to actually transfer data!

6.3.3   Programs for PLC 2

The data sent by PLC 1 are received in PLC 2 by the handling block RECEIVE. The RECEIVE call is entered in organization block OB 1 (Fig. 6.6). The following parameters are assigned:

Job number A-NR = 1

6

Destination type ZTYP = XX, i.e. the actual definition of the destination parameters is stored in a data block. In this case, data block DB11 is used from data word DW16 onwards (Fig. 6.6).

The received data are stored in data block DB12 (Fig. 6.7).

The RECEIVE handling block call as described here only triggers the reception of data. The actual transportation of the data from the CP 143 to the CPU of the PLC requires the RECEIVE ALL call. This is the normal RECEIVE with the special job number A-NR = 0 (see Fig. 6.6).

```
OB1                                                      LEN=28    ABS
                                                                   PAGE 1
SEGMENT 1
0000          :JU  FB121              CALL RECEIVE
0001 NAME     :RECEIVE
0002 SSNR     :   KY0,0
0003 A-NR     :   KY0,1
0004 ANZW     :   FW8
0005 ZTYP     :   KSXX
0006 DBNR     :   KY0,11
0007 ZANF     :   KF+16
0008 ZLAE     :   KF+0
0009 PAFE     :   FY14
000A          :
000B          :JU  FB127              CALL RECEIVE ALL
000C NAME     :REC-A
000D SSNR     :   KY0,0
000E A-NR     :   KY0,0
000F ANZW     :   FW4
0010 PAFE     :   FY13
0011          :
0012          :BE
```

```
DB11                                                     LEN=25    ABS
                                                                   PAGE 1
SEGMENT 1
 0            :   KS= PARAMETER FOR RECEIVE IN OB1
15            :   KH= 0000;
16            :   KS= DB
17            :   KY= 000,012;
18            :   KF= + 00000;
19            :   KF= + 00050;
20            :
```

Fig. 6.6: OB1 and DB11 for PLC 2

DB12   LEN=55   ABS
                                                          PAGE 1

0	:	KH= 0000;
1	:	KH= 0001;
2	:	KH= 0002;
3	:	KH= 0003;
4	:	KH= 0004;
5	:	KH= 0005;
6	:	KH= 0006;
7	:	KH= 0007;
8	:	KH= 0008;
9	:	KH= 0009;
10	:	KH= 5C5C;
11	:	KH= 5C5C;
12	:	KH= 5C5C;
13	:	KH= 5C5C;
14	:	KH= 5C5C;
15	:	KH= 5C5C;
16	:	KH= 5C5C;
17	:	KH= 5C5C;
18	:	KH= 5C5C;
19	:	KH= 5C5C;
20	:	KH= A3A3;
21	:	KH= A3A3;
22	:	KH= A3A3;
23	:	KH= A3A3;
24	:	KH= A3A3;
25	:	KH= A3A3;
26	:	KH= A3A3;
27	:	KH= A3A3;
28	:	KH= A3A3;
29	:	KH= A3A3;
30	:	KH= 3355;
31	:	KH= 3355;
32	:	KH= 3355;
33	:	KH= 3355;
34	:	KH= 3355;
35	:	KH= 3355;
36	:	KH= 3355;
37	:	KH= 3355;
38	:	KH= 3355;
39	:	KH= 3355;
40	:	KH= CCAA;
41	:	KH= CCAA;
42	:	KH= CCAA;
43	:	KH= CCAA;
44	:	KH= CCAA;
45	:	KH= CCAA;
46	:	KH= CCAA;

47	:	KH= CCAA;
48	:	KH= CCAA;
49	:	KH= 0000;
50	:	

Fig. 6.7: DB12 for PLC 2

6.4   CP 143 Configuration with COM 143 TF

6.4.1   Assigning Parameters to the CP 143 in PLC 1

Start COM 143 as described in Chapter 5 SINEC NCM/COM 143 TF Configuration Software.

Specify the configuration environment

Select the Init | Edit function to specify the configuration environment. Make the following entries or accept the defaults if they are already correct:

CP TYPE: CP143

STATUS: OFFLINE FD

DATABASE FILENAME: PBU1PLC1.CP1

Complete the screen with F7.

CP Basic configuration - CP Init screen

M 2-1

The next step is to create the SYSID block. Select the function Edit | CP Init. In the displayed screen, you will see the CP type and the name of the selected database file at the top of the screen.

Some of the fields in the screen already have values entered or are purely display fields.

The "FIRMWARE VERSION" field is only a display field. The "PASSWORD" is intended to protect the block from unauthorized changes. Since the SYSID block of the module is being called up for the first time here, there is no password entered. To keep things simple we will leave the password field empty for the example.

In the "DATE CREATED" field, you can enter the current date (free format). The base interface number (BASE SSNR) of module 1 is the default "0" (set the hardware to match!).

"MODULE SIZE" is already correctly set to 32K BYTES. When using 64K byte modules, this must be changed accordingly.

The Ethernet address can be specified either in this screen or in the "INITIALIZATION BLOCK" screen - as in this example.

6

You call the "INITIALIZATION BLOCK" screen by pressing the function key F2 "INIT" (note: F2 INIT is only displayed during the first configuration of the data base. If you want to make changes later you must use the menu bar!).

M 2-2 **CP basic configuration - CP initialization block screen**

In the "CP INITIALIZATION BLOCK" screen form only change the Ethernet address to 080006010001. All other parameters remain unchanged or without a value. With the exception of the Ethernet address, any changes to the values displayed in the default fields should be left to a SIMATIC S5 specialist.

Complete your entry with the function key "OK" (F7). The file "PBU1PLC1.CP1" is now set up on the hard disk. You have now completed the data specifically required for the CP 143 and you now simply need to assign parameters to the data link block.

If you are working on the basic configuration for the specified database for the first time, you initially return to screen M 2-1 after entering the values. Confirm the entries there once again with F7. If you are prompted whether or not to overwrite the module file reply with YES. The basic configuration data are now saved on the hard disk.

To configure the data link block, select the function Edit | Links | S5S5 Connections.

Configuring the transport interface

M2-4-1.1 Complete the screen displayed after selecting Edit | Links | S5S5 Connections "S5S5 Connections" as follows:

FROM   SSNR: 0
LOCAL PLC:

            ANR : 1

            JOB TYPE : SEND

            ACTIVE/PASSIVE : P

TO   ETHERNET ADDRESS: 080006010002
REMOTE PLC

            SSNR: 0

            ANR: 1

Explanation:

Establishing the link between the PLC-CPU and CP:
The job numbers (ANR) in the local and remote PLC are the same and also the same as those used in the PLC program assigned to the parameter A-NR. Select the base interface (= page 0) as the interface via which the communication should be carried out.

Selecting the job type:
Station 1 (= PLC 1) is to transfer a counter status to station 2 (= PLC 2); the job types are therefore a SEND in PLC 1 and a RECEIVE in PLC 2. The parameter "ACTIVE/PASSIVE" is irrelevant for SEND and RECEIVE.

Entering the values:
You complete the data link block by pressing the function key "OK" (F7) and the PG displays the prompt "OVERWRITE MODULE FILE?" on the PG screen. If you answer "YES" (F1) the "old" file PBU1PLC1.CP1, which did not contain the data link block, is overwritten with the "new" file PBU1PLC1.CP1, which now contains the data link block. You have now created the module file for module 1.

6

6.4.2   Assigning Parameters to the CP 143 in PLC 2

You now create the module file for module 2.

Specifying the configuration environment
Once again, select the menu Init | Edit, to specify the new database file.
Follow the analogous procedure as for PLC1.

M 1-1   Make the following entries or accept the defaults if they are correct:

CP TYPE: CP143

STATUS: OFFLINE FD

DATABASE FILENAME: PBU1PLC2.CP2

Complete your input with F7.

M 2-1   **CP basic configuration - CP Init screen**

The next step is to create the SYSID block for CP2 . Select the function
Edit | CP Basic Initialization. The screen displays the CP type and selected
database file at the top.

The defaults for the parameters DATE CREATED, BASE SSNR and
MODULE SIZE do not need to be changed. Enter the Ethernet address
again in the "INITIALIZATION BLOCK" screen form. Complete the input of
the SYSID block with the function key "INIT" (F2).

M 2-2   **CP basic configuration - CP Initialization Block**

In the "INITIALIZATION BLOCK" screen form, you only need to change the
Ethernet address to 080006010002; the other parameters once again
remain unchanged. Complete the entry with the function key "OK" (F7).

M 2-4-11   **Configuring the transport interface**

Select the function Edit | Links | S5S5 Connections.

Complete the "S5S5 Connections" screen as follows:

FROM
LOCAL PLC:

                SSNR: 0

                ANR : 1

                JOB TYPE : RECEIVE

                ACTIVE/PASSIVE : P

TO   ETHERNET ADDRESS: 080006010001
REMOTE PLC:

                SSNR: 0

                ANR: 1

Pressing the function key "OK" (F7) completes the settings for the data link block and the prompt "OVERWRITE MODULE FILE?" appears on the PG screen. If you answer "YES" (F1), the old file PBU1PLC2.CP2, which did not contain the data link block, is overwritten with the "new" file PBU1PLC2.CP2, which does contain the data link block. The module file for module 2 is now complete.

Both module files are now stored on the hard disk and must now be transferred to EPROM.

▓M 3-53▓ Programming the EPROM modules

Preparations:
Insert an empty EPROM into the slot of the PG . Using the function Init |
Edit, select the database file for the module of the CP in PLC1.

Start the transfer
To call the transfer functions select Transfer | Transfer Database |
FD->EPROM. Now complete the programming number field to match the
selected EPROM type (use the Select function!). Confirm your entry with
"OK" (F7); the transfer is then started.

☞   **Make absolutely sure that the EPROM type matches the
       programming number. If you select the wrong number, you
       will destroy the EPROM.**

Programming EPROM 2
After you have programmed the first EPROM, you can program the EPROM
for module 2. Replace the already programmed EPROM with an empty one.
Select the appropriate database file using the function Init | Edit. Then
select the transfer functions as already explained.

Module card not changed
If you forget to change the module card, the message "EPROM NOT
EMPTY" appears on the screen. In this case, simply replace the already
programmed EPROM with an empty one and start the transfer again with
the function key "OK" (F7).

CP start up
The programming of the EPROMs is now completed and the memory cards can be inserted in the slot of the CP 143. The two CP 143s in the PLCs now have all the necessary parameters assigned for the required data transfer via SINEC H1.

☞   **To ensure that the CP 143 works with all the newly selected parameters, you must restart the CP.**

6

6.5   Starting and Monitoring the Transmission

This section describes how the STEP 5 programs are started and how the communication can be monitored. There are different ways of monitoring the transmission as follows:

PG online with PLC:
monitoring of status and data words using the standard PG software package.

PG online with CP 143:
monitoring the statuses of transport connections using COM 143.

Section 6.5.1 deals with the first possibility, monitoring via the PLC. As an example, we have assumed that the STEP 5 programs were created for an S5-155 U. Section 6.5.2 describes the monitoring of the transport links directly at the CP 143.

6.5.1   Starting and Monitoring the Transmission at the Programmable Logic Controller

Before starting, an overall reset must be executed on the programmable controllers, and their RUN/STOP switches must be set to STOP. You can now load the STEP 5 programs described in Section 6.3 in both PLCs and then start both CP 143s by switching the RUN/STOP switch to RUN. Now carry out a cold restart at the PLCs. The green LEDs must then be lit on both the PLCs and CPs (and no other LEDs).

Link the sending PLC (PLC 1) to the PG and call the function "FORCE VAR". Set bit 0 in flag byte FY100 to 1. This enables the transmission. By monitoring the flag words or bytes specified in the STEP 5 program, the transmission can be monitored from the transmitter end (Fig. 6.21):

FW4 : status word for SEND (A-NR = 0, "SEND ALL")

FW8 : status word for SEND (A-NR = 1)

FY13: parameter assignment error byte for SEND (A-NR = 0)

FY14: parameter assignment error byte for SEND (A-NR = 1)

FY15: parameter assignment error byte for SYNCHRON

You can now interpret the status words and parameter assignment error bytes according to the description of the handling blocks. Flag word FW8 = 0022 means, for example, job active, data transfer successful, no errors. In addition to the flag words mentioned above in PLC 1, you can also select DB10 where data words DW0 and DW49 are particularly significant. If the STEP 5 program is running correctly, these two data words should be the same and should be incremented at 1 second intervals. These two data words are, however, not conclusive evidence that the SEND job has been correctly executed. Data word DW30 as shown in Fig. 6.21 shows the defaults as found in Fig. 6.5.

Now connect PLC 2 to the PG and check the following flag words and bytes:

FW4 : status word for RECEIVE (A-NR = 0, "RECEIVE ALL")

FW8 : status word for RECEIVE (A-NR = 1)

FY13: parameter assignment error byte for RECEIVE (A-NR = 0)

FY14: parameter assignment error byte for RECEIVE (A-NR = 1)

FY15: parameter assignment error byte for SYNCHRON

In addition to this, select data block DB12 in PLC 2 and check data words DW0 and DW49 (Fig. 6.22). Data block DB12 is the destination of the transmission and if the programming was error-free, both data words will once again be the same and will be incremented at 1 second intervals. Data word DW30 is also displayed again as a check. It must always contain the default value from data block DB10 in PLC 1 as shown in Fig. 6.5

Once again, you can interpret the flag words based on the description of the handling blocks. Flag word FW8 = 0042 means, for example, job active, data received, no error.

If two programmers are available, you can monitor both PLCs at the same time. If the programming was correct, data words DW0 and DW49 in data

blocks DB10 and DB12 are all the same and are incremented practically simultaneously (there is a time lag caused by the time required for transmission).

OPERANDS:	FORCE PROCESS IMAGE:	PLC IN CYCLE
FY100	KH=01	
FW4	KH=0000	
FW8	KH=0022	
FY13	KH=00	
FY14	KH=00	
FY15	KH=00	
DB10		
DW0	KH=0799	
DW30	KH=3355	
DW49	KH=0799	
FORCE VAR		

Fig. 6.21 Monitoring the Transmission (from sender end)

OPERANDS:	FORCE PROCESS IMAGE:	PLC IN CYCLE
FW4	KH=0000	
FW8	KH=0042	
FY13	KH=00	
FY14	KH=00	
FY15	KH=00	
DB12		
DW0	KH=0799	
DW30	KH=3355	
DW49	KH=0799	

Fig. &.22 Monitoring the Transmission (from receiver end)

6.5.2   Monitoring the Transport Connection at the CP 143

Using COM 143, you can monitor the transport connection between the two
CP 143 communications processors, either from the transmitter or from the
receiver end.

Preparing for monitoring at PLC1
Connect your PG to the PG interface of the CP 143 in PLC 1. Then load
COM 143 in the PG and proceed as follows:

Establishing the link to the CP

M 1-1   Select NCM Basic Settings with Init | Edit and switch the status to ONLINE.

Monitoring a connection/job
Go back to menu selection and select Test | S5S5 Connections | Job Test.

M 4-1-3   The screen SELECT CONNECTION is displayed first. Enter the SSNR and
ANR according to the configuration, i.e.:

SSNR: 0   ANR: 1

M 4-1-3.1   With the OK key, you call the next screen JOB TEST UNDER USER
CONTROL.

In the upper part of the display, you can see the connection you
programmed in Section 6.4. The lower part of the screen form displays the
current status of the connection. The status messages displayed in the
TRSP line change as follows:

1H : WAITING FOR TRIGGER	The CP expects a job from the PLC.
3H : WAITING FOR PLC DATA	The CP has received a SEND job and is waiting for the SEND-ALL job.
5H : DATA SENT, WAITING FOR ACK.	The CP has sent the data and is waiting for an acknowledgment from the partner PLC.

Monitoring at PLC2
At the receiver end, the transmission can be monitored in a similar way. Connect the PG to the CP 143 in PLC 2 and then follow the same procedure as for CP1.

M 4-1-3 With the RETURN key, you first return to connection selection. Enter the following for your configuration:

SSNR: 0

ANR: 1

M 4-1-3.1 Press OK to display the next screen JOB TEST UNDER USER CONTROL. This is the counterpart of the screen at the sender end.

In the upper part of the display, you can see the connection you programmed in Section 6.4. The lower part of the screen form displays the current status of the connection. The status messages displayed in the TRSP line change as follows:

1H : WAITING FOR TRIGGER	The CP expects a job from the PLC.
3H : WAITING TO RECEIVE DATA	The CP has received a RECEIVE JOB and is waiting for data from the partner PLC.
5H : WAITING FOR PLC TO TAKE DATA	The CP has received the data. It is waiting for the PLC to take the data with a RECEIVE ALL.

❑

7   Configuration Steps and Basic Configuration

When using the CP 143 TF communications processor, you decide which of the two supported types of communication you require for your task:

➤ communication via the transport interface

➤ communication via the TF interface

This chapter describes the steps for initialization and basic configuration required to operate the CP regardless of the type of communication.

The chapter continues from the explanations of the basics made in Chapter 4 Configuring and Programming the CP 143 TF and Chapter 5 COM 143 TF Configuration Software.

In this chapter, remember that the screen references in the margin refer to the screens in the supplement ' COM 143 TF Configuration Tool'. You can open this supplement to the appropriate screen and follow the explanation with the screen in front of you.

7

7.1   Overview of the Configuration Steps

The following overview shows the steps necessary for configuring the communication. The entries in the black boxes are menu items of the COM 143 user interface. They are shown when relevant to this chapter.

Vol 1

Specifying the configuration

Init | Edit

Init | Path Definitions

CP Basic Configuration

Edit | CP Basic Initialization

Edit | Initialization Block

Edit | Transport Parameters

Vol 1

Using the transport interface

Using the TF interface

Vol 2

Configure the transport interface

Configure the TF interface

Document configuration

Document configuration

Load configuration data

Load configuration data

Test the transport interface

Test the TF interface

Fig. 7.1:   Configuration Steps

Explanation of the configuration steps

Specifying the configuration environment
The first step is to make the preparations for configuring. You decide where the data will be stored and how the connection to the CP is established.

CP basic configuration
You supply the CP with basic information required regardless of the type of communication you decide to use.

Using the transport interface
You configure connections for simple byte-oriented data transfer. You have direct access via the transport interface.
This is explained in the next chapter.

Using the TF interface
When you configure the TF interface, you can use the wide range of options provided by communication conforming with the MMS standard.
These steps are explained in Volume 2.

7

7.2   General Guidelines

Basic procedure
When designing your bus system, follow the guidelines below:

Find out how many PLCs are required for your application. Assign the station (Ethernet/MAC) addresses carefully, since subsequent modification of the addresses after configuration can be laborious.

All the configuration data should be stored in files, i.e. whenever possible work "OFFLINE FD", with the hard disk of the PG or PC.

Creating the blocks
In the Init-Edit screen, there are two ways of making entries or modifying them when configuring:

➢ **OFFLINE FD:** you create the blocks on disk and transfer the complete set of parameters directly to a RAM module using the function Transfer | Transfer Database | FD->CP. The transfer function is only possible when the CP is in the STOP state (Transfer | Start CP/ Stop CP) or the switch on the CP is set to STOP.
It is also possible to blow an EPROM with the created set of parameters using the Transfer -> Transfer Database -> FD -> EPROM function. The EPROM must be plugged into the PG EPROM interface.

➢ **ONLINE CP:** you create the blocks directly on the CP. blocks can only be modified or transferred with the CP in the STOP state (Transfer -> Start CP / Stop CP or the switch on the CP is set to STOP):

If you select ONLINE CP, it is assumed that the PG is directly connected to a CP or connected to a remote station on the bus via a bus selection path (bus selection utility in S5-KOMI; see below: central booting via the bus system). The selected ONLINE functions basically perform the same tasks in the CP 143 as the OFFLINE functions on the hard disk.

Central booting via the bus system
If the SYSID block is entered ("Original initialization" of the CP with the COM via the PG interface of the CP), a central PG can establish a connection to the CP via a bus selection path and transport the remaining parameter sets to the CP.

Modifying blocks
If you want to modify existing blocks you have already stored in the memory module of the CP, follow the procedure outlined below:

✓ Transfer the block from the CP/EPROM to the data base file (Transfer -> Transfer Database -> CP -> FD or Transfer -> Transfer Database -> EPROM -> FD).

✓ Modify the block.

✓ Transfer the block back to the CP/EPROM (Transfer->Transfer Database->FD->CP or Transfer->Transfer Database->FD->EPROM).

☞ **The newly transferred data are effective after a CP cold restart.**

7

7.3   Specifying the Configuration Environment

7.3.1   Init | Edit

A module file (database file) is created on the disk for each CP module (communications processor). This contains all the parameters for operating a CP. The functions of this screen are used to create a database file for the communications processor.

When SINEC NCM is called for the first time, you are requested to select the CP type in the Init-Edit screen. You can select the type from a list. The name of the module then appears in the top line. You can only exit this screen when you have set all the necessary parameters or by pressing ESC. The settings made for the CP are stored in a configuration file and read in again when you next call SINEC NCM.

M 1-1 **Fields of the screen:**

CP TYPE: Here, you can choose one of the CPs integrated in
                    SINEC NCM.

STATUS: The status decides where the values you select with
                    the following functions will be stored.
                    (Possible entries: ONLINE CP, OFFLINE FD)
                    description in Chapter .4

DATABASE
FILENAME:

DRIVE: Here, you specify the drive on which you want to
                    work.

DATABASE   Apart from the first letter, you can specify any name
                    (text string) as the name of a CP database (module
                    file). A module file is set up for each CP 143 on the
                    data diskette. This contains all the parameters for
                    operating a CP

                    If a name is proposed, you can change it, however
                    the first letter must be "P" (possible entries:
                    alphanumeric characters and the period).

7

M 1-1 DOCUMENTATION:

FOOTER: This entry activates and deactivates the printing of a
                   footer at the end of a page. If you want to use a
                   footer, you must specify the footer file. (see below
                   footer file)
                   Possible entries: ON/OFF.

PRINTER   This decides whether output is only on the screen or
OUTPUT: on a printer and screen:
                   Possible entries: ON/OFF.

PRINTER FILE: Drive:
                   Here, you specify the drive containing the printer file.

                   Printer file:
                   This entry identifies a file containing the printer
                   parameters. The file is created using the S5-DOS
                   utility "Printer parameter file".

                   Possible entries: alphanumeric characters.

FOOTER   Drive:
FILE   You select the drive on which the footer file will be
                   stored.

                   Footer file:
                   This is the name of the footer file. The footer file is
                   created with the "Footer editor" utility.

                   Possible entries: alphanumeric characters.

☞   **The drives you want to access must first be enabled in
         S5-KOMI.**

7.3.2   Init | Path Selection

M 1-2

To be able to configure a CP via the network ONLINE or to transfer a database to this CP, a path is necessary. The path entry refers to a path file which was created with the S5 DOS Bus Selection function.

Input fields
CP LINK:
The CP link is required to transfer the configuration data to the CP.

If you want to configure the CP directly via the serial PG interface, you must delete the path specified in this screen for the CP link.

DR: This is the drive on which the CP path file is stored. You can only specify a drive if it was selected as a default drive in SIMATIC S5 KOMI. Use the select key to display possible drives.

PATH FILE: Here, you specify the name of the path file you set previously with S5 DOS Bus Selection. This is the communications path via a SIMATIC module to the CP.

                   If you do not specify a name, the CP is configured as standard via the serial interface.

                   Possible entries: xxxxxxAP.INI

PATH NAME: Each path file can contain several paths. These paths are identified by a path name.

                   Possible entries: max. 19 characters

7

7.4   CP Basic Configuration

7.4.1   Edit | CP Basic Initialization

The SYSID block, a data area in the module file or on an EPROM module in the CP 143, has the following functions:

➣ Uniform identification and assignment of the module within the SIMATIC S5 system with SINEC H1.

➣ Transfer of parameters which control certain responses of the module.

➣ Display of the firmware release of the module.

The SYSID block is assigned parameters with this function. If the database file has already been stored, the stored values are displayed, otherwise the default values are shown.

M 2-1   **The screen displays the following parameters:**

Input fields:
Initialization data:

ETHERNET   The Ethernet address is the physical address of the module
ADDRESS: on the SINEC H1 local area network. The address is unique
throughout the whole network and is assigned by COM 143
in 6 address bytes according to the following method :

```
080006  01  0   000
```

— Byte 5 (right nibble) and byte 6:
hexadecimal number for each module;
each position 0 ...9, A...F

— Byte 5 (left nibble):
each position 0 ... 9, A...E
default for SIMATIC S5 is 0

— Byte 4
number for SIEMENS internal area

— Bytes 1...3
number for SIEMENS
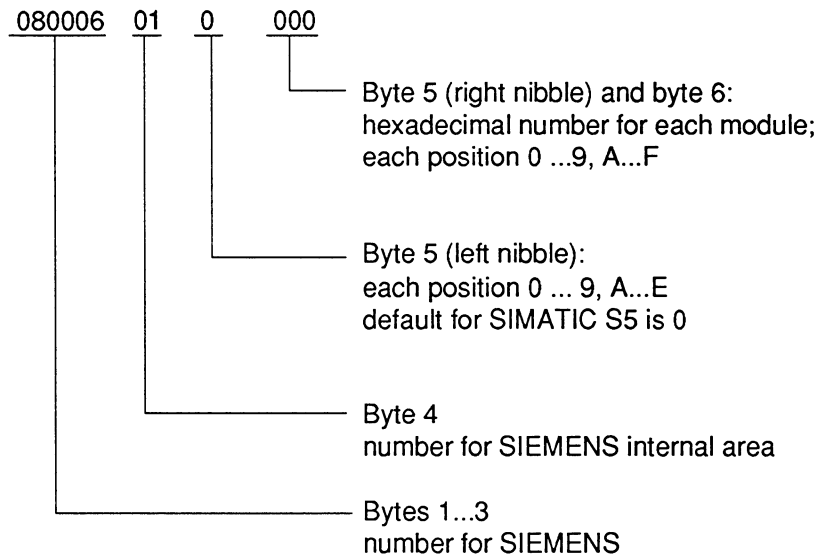
Note that addresses which have an odd hexadecimal
number in the second position from the left are
automatically multicast addresses.

If you make changes to the Ethernet address, the PG
automatically updates the SYSID block.

Possible entries: max. 12 characters

7

M 2-1

PASSWORD: Freely selectable character string to protect the CP 143 from unauthorised access from remote stations, e.g. with PG functions via the SINEC H1 bus.

Possible entries: The password must have 8 characters.

SIMATIC Features

BASE SSNR: The base interface number (base page) of the CP 143 module must be a multiple of 4. The default is 0.

If possible, you should no longer change the BASE SSNR if you have already created data link blocks with COM 143. If you change the base interface number, COM 143 asks you whether all the addresses in this module containing the interface number should be adapted automatically. The communication addresses in all the data link blocks of the partner modules must be changed manually using COM 143!

When you set the base interface number, make sure it is unique in the S5 device if you are using more than one CP.

Possible entries: 0,4,8,...248,252

Informative Parameters:

Board ID   COM 143 initially enters the expected board ID based on the configuration information. The entry may if necessary be updated with a transfer (UPLOAD).

M 2-1

Online:
Hardware ID entered by the firmware.

Offline:
Entry based on the module type.

Firmware-
Version:

In the ONLINE mode, the firmware release is displayed. In all other situations, this field remains empty.

Date created:

You can enter any date, e.g. the date of the parameter assignment.

Possible entries: max. 8 characters

Module Size

Length of the module card in Kbytes.
This field has a default of 32 Kbytes and can only be changed before the file is created.

Possible entries: 16, 32, 64

Softkeys (with an additional or context-specific meaning):

| F2 |
| INIT |

The "INIT" key allows you to call the initialization block when you first configure the database. At other times, this is called using the main menu 'Edit - CP Initialization Block'.

7

7.4.2   Edit | CP Initialization Block

M 2-2

You select the "CP INITIALIZATION BLOCK" screen in the "CP INIT" screen with the "INIT" function key or in the NCM basic menu. The name of the module appears in the top line. The INIT block is generated automatically by COM 143 and cannot be deleted. Changes in the INIT block are only necessary in special cases. The Ethernet address is identical to the entry in the SYSID block.

The screen contains the following parameters:

DYNAMIC   This parameter specifies whether the CP 143 module
CLOCK MASTER   sends clock synchronization frames (see Volume 2
                       "Clock services"). The default is N (no).

                       Possible entries: (Y/N)

CYCLE TIME   If the module sends clock synchronization frames,
FOR SYNC FRAMES   this parameter specifies the intervals at which they
                       are sent (1 sec ... 60 sec). The default is 10 sec.

MONITORING   This parameter is not relevant.
TIME FOR WATCHDOG

M 2-2

ETHERNET
ADDRESS:

Physical module address on the SINEC H1 bus. The entry is identical to that in the 'Edit- Basic Initialization' screen. If you change the entry in either of the screens, the entry in the other is updated automatically and there can be no discrepancies.

ACTIVE
INTERFACES:

This specifies the number of interfaces to the PLC (SSNR) which the CP 143 must manage. The default is "1". In multiprocessor PLCs, the CP 143 can process up to 4 interfaces simultaneously.

Possible entries : 1 to 4

MAX. TF-PDU
LENGTH

This specifies the maximum size of the buffer required when using the TF services.

SPECIAL FILE:

Only for service purposes. This field cannot be modified!

LENGTH (of the
special file):

Only for service purposes. This field cannot be modified!

MULTICAST SETS:

7

With multicast, it is possible to transmit the same frame to all the stations specified in the multicast set. The information about multicast sets for a bus to which the CP 143 belongs is contained in the INIT block. At this point, it cannot be changed, only reviewed. It is automatically entered and deleted when you create or delete the data link blocks.

M 2-2

Softkeys (with additional or context-specific meaning):

| F1 |
| PAGE +1 |

If there are more multicast sets than can be displayed at the same time in the screen form, you can use the function keys "PAGE +1", "PAGE -1", "LINE +1" and "LINE -1" to select the section to be displayed.

| F2 |
| PAGE -1 |

| F3 |
| LINE +1 |

| F4 |
| LINE -1 |

| F6 |
| SPECIAL |

The "SPECIAL" function key provides information about loaded special files and their releases.

7.4.3   Edit | Transport Parameters

M 2-3

The module allows certain transport parameters to be selected. This feature can be used for service and diagnostic purposes.

The significance of the individual parameters can be found in the reference manual "iNA 960, release 1.1".

It is generally not necessary to modify the defaults which were selected based on years of experience.

☞   **Remember that these parameters have profound effects on the module and certain settings can put the module completely out of action. In this case, the module must be deleted and the database reloaded.**◻

7

Notes:

8   Configuring the Transport Interface

If you have decided to use the transport interface, you will find descriptions of all the most important functions of the COM 143 TF configuration tool in this chapter.

The main topic is the description of the connection in the data link block. Apart from the configuration functions for the data link block, the tools required for documentation, starting up and testing are also explained.

The options range from the global start/stop of the CP to data-dependent monitoring of the communication.

It is advisable to follow the order in the overview below when configuring.

In this chapter, note the references to the supplement "COM 143 TF Configuration Tool" in the margin. These refer to the screens currently being described and it is helpful to open the supplement to these screens.

8

8.1   Overview

The diagram is an overview of the steps and functions available for configuring and operating a transport interface.

Steps and corresponding functions in COM 143 TF

Configuring Transport Connections Section 8.2	**Edit | S5S5 Connections** **Edit | Transport Parameters**
Documenting Configuration Data Section 8.3	**Edit | Documentation** **Job List (PLC Parameters)** **Job List (Bus Parameters)** **Direct Connections** **Multicast List** **All**
Transferring Configuration Data Section 8.4	**Transfer | Start CP** **Transfer | Stop CP** **Transfer | CP State** **Transfer | Delete Database** **Transfer | Delete DB File** **Transfer | Transfer Database**
Testing the Transport Interface Section 8.5	**Test | S5S5 Connections** **Status All** **Trace All** **Job Test**

Fig. 8.1:   Configuration Steps

8.2   Configuring Transport connections

The following menu item is available for configuring the transport connections in COM 143 TF: Edit | Links | S5S5 Connections. This menu item allows you access to all the parameters. You require a maximum of two screens for all the parameters. In normal situations, i.e. when using simple, direct connections, you only require the first screen, which is known as the basic screen.

8.2.1   Edit | S5S5 Connections

M2-4-1.1
M2-4-1.2

Procedure

With this function, you assign data link blocks for transport connections. The complete input of a data link block requires two screens, a basic and a second screen. For simple communications links it is sufficient to enter the parameters in the basic screen. In both screens, the module name is displayed in the top line.

The basic screen appears first. In this screen, you enter the parameters for a simple communication link between SIMATIC S5 programmable controllers. Some of the entries in this screen are identical to the parameters for handling block calls in the STEP 5 user programs.

A data link block must be entered in the remote and local CP 143 module for each communication link. Remember that the parameters must match each other. The parameters for each block are specified in the basic screen which contains the following parameter groups:

➤ Parameters assigned to the local PLC

➤ Parameters assigned to the remote PLC

8

Conditions
A data link block can only be defined when the module file has been completely initialized (see Chapter 7).

M2-4-1.1
M2-4-1.2 **Defaults**

A simple communications link is configuredas follows:

➣ connection-oriented

➣ simplex

➣ priority = 2

➣ local and remote TSAP-ID generated automatically from the job and interface numbers.

Special Applications

These defaults can be modified for special applications in the second screen. If you change the defaults, the message "DEFAULTS CHANGED" appears in the basic screen.

M2-4-1.1
M2-4-1.2 The principle of a simple communication link SEND - RECEIVE from the local PLC to the remote PLC.

```
ANR  x ─┐
        │  ┌────────┐
SSNR m ─┤  │  SEND  │
        └──│        │
           └───┬────┘
               │
       ┌───────┴────────┐
       │  SEND          │
       ├────────────────┤
       │ ANR:x  SSNR:m   │
       ├────────────────┤
       │ Ethernet address│
       ├────────────────┤
       │ ANR: y  SSNR: n │
       └───────┬────────┘
               │

    = = = = = = = = =    SINEC H1

               │
       ┌───────┴────────┐
       │ ANR:x  SSNR:m   │
       ├────────────────┤
       │ Ethernet address│
       ├────────────────┤
       │ ANR: y  SSNR: n │
       ├────────────────┤
       │ RECEIVE         │
       └───────┬────────┘
               │
ANR  x ─┐  ┌───┴──────┐
        │  │ RECEIVE  │
SSNR n ─┤  │          │
        └──│          │
           └──────────┘
```

Handling block in local PC
in STEP 5 program
ANR : job number
SSNR: interface number

Data link block
in local CP 143 memory module
block type: SEND, RECEIVE, FETCH

Local job and interface numbers

Remote Ethernet address

Remote job and interface numbers

SINEC H1

Data link block
in remote CP 143 memory module

Remote job and interface numbers

Remote Ethernet address

Local job and interface numbers

Block type: SEND, RECEIVE, FETCH

Handling block in remote PLC

Fig. 8.2:   Principle of a Communication Link

8

M2-4-1.1

M2-4-1.2 The following table shows the job types that can be used in direct connections:

Active side			Passive side		
Job type	PLC handling block	CP data link block	CP data link block	PLC handling block	Job type
Send (SEND)	SEND	SEND	RECEIVE	RECEIVE	Receive (RECEIVE)
Read (READ active)	FETCH QTYP=RW	FETCH ACTIVE/PASSIVE =A READ/WRITE =Y	FETCH ACTIVE/PASSIVE =P READ/WRITE =Y	*)	(READ passive)
Write (WRITE active)	SEND QTYP=RW	SEND READ/WRITE =Y	RECEIVE READ/WRITE =Y	**)	(WRITE passive)

*) at least one SEND-ALL call in the S5 PLC program
**) at least one RECEIVE-ALL call in the S5 PLC program

M2-4-1.1   **The parameters of the basic screen for S5S5 connections**

The attachment point FROM LOCAL PLC defines the local connection parameters.

Input fields:

SSNR

This specifies the interface number or page number via which the communication channel can be addressed. The number is derived from the base interface number and the selected page. The PG checks that the selected number is within the range of values and rejects illegal interface numbers.
The number specified here must also be specified in the handling block to identify the connection.

Possible entries: base SSNR + page no. (0 to 3)

ANR:

Along with the local interface number, the job number identifies the data link block uniquely. The same job number cannot be assigned more than once per SSNR of a CP 143 module.

In the control program, the job number and the interface number must be transferred to the handling block to identify the connection and the job.

Possible entries: 1 to 128

JOB TYPE:

This indicates whether it is a SEND, RECEIVE or FETCH block. It must have the same type as in the corresponding HDB call in the PLC program.

ACTIVE/
PASSIVE (A/P):

When using the block type FETCH, you must specify whether this is the active or passive side. The default is passive.

8

M 2-4-1.1 Attachment point of the remote PLC:

The attachment point in the remote PLC is only relevant for direct S5S5 connections. To define a multicast or broadcast job, you must branch to the second screen with F5.

Input fields:

ETHERNET   Physical module address of the remote PLC.
ADDRESS: If you enter 0000 0000 0000 for a RECEIVE job, the address is considered as unspecified. When a connection is established, any partner is accepted whatever its address.

SSNR: This is the interface number of the data link block in the remote PLC (on the remote CP 143).

ANR: Corresponding job number in the remote PLC (on the remote CP 143).

From the SSNR and ANR the PG automatically generates the 8-byte ASCII string of the local and remote TSAP-ID (transport address) as follows:
Byte 1 - 3   : free (= blanks)
Byte 4 - 5   : SSNR
Byte 6 - 8   : ANR

FUNCTION KEYS: (additional or with context-specific meaning):
If you have already created data link blocks for the module, when you select the basic screen for data link blocks the first block will be shown (in the order stored).

```
F2
+1
```
Press the function key "+1" to select the next data link block, and function key "-1" to select the previous block. If the currently displayed block is changed, it is written to the memory card. The display is cyclic, i.e. from the first element you return to the last element and vice-versa.

M 2-4-1.1

F3
INPUT

If you press the "INPUT" function key, you can input a new block. An empty screen is then displayed. Once you have completed the screen, the information is entered in the memory card when you press the function keys "+1" or "-1" or "INPUT". If you press the "INPUT" function key, a new empty screen is also displayed.

F4
DELETE

You can delete a data link block with the "DELETE" function key. To avoid accidental loss of the block, you are first prompted to confirm this is what you want to do.

F5
NEXT SCR

If you press the function key "NEXT SCR" you select the display for entering special parameters for the data link block.

The function key "OK" saves all the parameters in the module file or in the ONLINE mode directly in the CP 143 memory card. In the OFFLINE mode, it is advisable to save the parameters from time to time during editing by pressing this key.

8

M 2-4-1.2 **Parameters of the second screen for the data link block**

With the parameters of the screen "S5S5 Connections - Screen II", you can change the PG defaults for simple communications links. The parameters can be classified in the following groups:

➤ parameters for type and priority of the connection

➤ parameters for data source and data destination in the PLC

➤ parameters for special functions (only for service purposes)

➤ parameters for symbolic bus addresses according to the ISO reference model

➤ Parameters for the type and priority of the connection:

MULTICAST:
This specifies whether a frame is only exchanged between two stations that have established a connection or whether the frame is intended for a multicast set. Default: MULTICAST = N.

A multicast set can contain one or more transmitters and one or more receivers.

If you enter MULTICAST = Y, the specifications of the remote PLC in the previous screen are no longer valid. the PG corrects these entries automatically. By the same token, an entry for the remote PLC in the previous screen automatically resets the MULTICAST parameter to "N".

Multicast frames are only permitted for the block types SEND and RECEIVE.

M 2-4-12

MULTICAST SET: A maximum of 10 data link blocks for multicast sets
                   can be defined. The number of a multicast set is
                   assigned in this field.

                   The Ethernet address is generated automatically by
                   the PG. It cannot be changed if the number is 1 - 63.
                   If the set is specified as 0 you can define the address
                   as required; the multicast bit in the Ethernet address
                   (bit 0 in the first byte from the left) is however always
                   set to 1. It is particularly important with broadcast,
                   that "0" is specified as the set number, since the
                   corresponding Ethernet address is "FFFFFFFFFFFF".

                   Possible entries: 0 to 63

ETHERNET   The Ethernet address for multicast sets assigned a
ADDRESS: number other than 0 is generated automatically by
                   the PG using the following method:

                   Possible entries: 12 characters
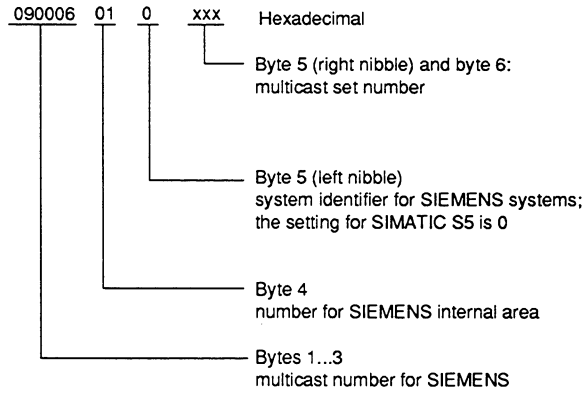
Fig. 8.3:   Structure of the Ethernet Address for Multicast Sets

When using a RECEIVE block with "MULTICAST=Y", the Ethernet address
and the number of the set are entered in the list in the INIT block.

8

M 2-4-1.2

DATAGRAM: For the classes of priority 0 and 1, a datagram service without "guarantee of delivery" is possible. If you select MULTICAST = Y, the PG automatically sets DATAGRAM = Y. This cannot be changed.

Possible entries: 1 character (Y/N)

PRIORITY: Specifies the priority of the frame on the CP 143. The following five priority classes are permitted:

Possible entries: 0 to 4

PRIORITY 0:
Short frame with a maximum data field length of 16 bytes. With RECEIVE, an interrupt is triggered at the PLC. With SEND, this priority has no effect and the procedure is as for PRIORITY = 1. The frame is always of the type "expedited". The frame is transferred directly via the dual-port interface and not with a RECEIVE-ALL or SEND-ALL.

PRIORITY 1:
This is the same as PRIORITY 0, however, the PLC is not interrupted. If you select DATAGRAM and/or MULTICAST = Y, the PG automatically sets PRIORITY = 1; you can only change this to PRIORITY = 0.

PRIORITY 2:
Normal frame with any data field length; if the data exceeds 512 bytes, the message is segmented. A virtual circuit is established for the data exchange between two CP 143/535 partners. The connection is established following the CP start-up and is generally maintained. Data transfer is triggered by a SEND/RECEIVE (direct) or FETCH in the PLC at both ends of the connection. The data is then transferred using SEND-ALL and RECEIVE-ALL.

M2-4-1.2

PRIORITY 3:
As PRIORITY 2, however, the transport connection is only established after the first SEND/RECEIVE handling block pair has been called. From this point, the connection is maintained until one of the partners terminates it with a RESET.

PRIORITY 4:
As PRIORITY 3, however, the connection is terminated again automatically on completion of the data exchange.

READ/WRITE: If MULTICAST = N and PRIORITY = 2, you can specify for the block types SEND, RECEIVE and FETCH whether the data description (source/destination) should be supplied via the cable (e.g. from the process computer). The parameters are set by the sender or by the active FETCH.

Possible entries: 1 character (Y/N)

Examples:

➤ Assigning parameters for a "WRITE" function:

READ/WRITE: Y   READ/WRITE:Y

| SEND | ▶ | RECEIVE |

Parameters specified
by sender
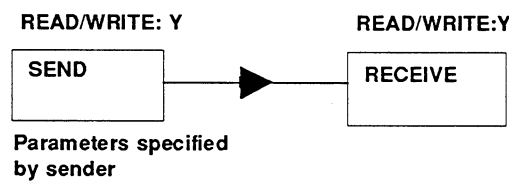
➤ Assigning parameters for a "READ" function:

READ/WRITE: Y   READ/WRITE:Y

| FETCH active | ◀ | FETCH passive |

Parameters specified
by active FETCH

8
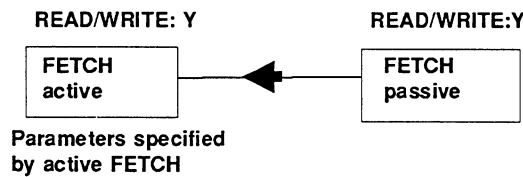
M2-4-1-2 Parameters for the data source and destination in the PLC:

SOURCE/DEST: With SEND and RECEIVE, this names the data source or data destination in the local PLC if this not specified in the handling block call in the PLC. If both parameters exist, the handling block specification has priority.

Possible entries: 12 characters

LENGTH   Specifies the length of the frame. The maximum length depends on the selected operand (block type in the PLC); refer to the table below.

Possible entries: 5 characters

The following table contains the possible options for the destination and source of the data to be transferred. The information corresponds to the organizational format of the handling blocks. The individual entries in the field must be separated by blanks. The length has its own separate field.

Examples:

DB 110 45
DB 6 8
FY 114

Edit |..| S5S5 Connections (continued)

M2-4-1.2

Operand	DB no.	Address	Length	
DB	1-255	0- 2047	1-2048 words	* Data block
FY	-----	0- 255 *)	1- 256 words	* Flag byte
IB	-----	0- 127	1- 128 words	* Input byte
QB	-----	0- 127	1- 128 words	* Output byte
PY	-----	0- 255	1- 256 words	* Peripheral byte
CB	-----	0- 255	1- 256 words	* Counters
TB	-----	0- 255	1-256 words	* Timers
RS	-----	0- 511	1- 512 words	* System data
AS	-----	0-32767	1-32768 words	* Absolute address
DX	1-255	0-2047	1- 2048 words	* Extended data block
DS	1-255	0-2047	1- 2048 words	* Data block external memory
OY	-----	0- 255	1- 256 words	* Byte in extended I/O area

*) with the S5-150, only up to FY 199

8

M2-4-12

STATUS WORD: For SEND, RECEIVE and FETCH (active), this
                      defines a data word from the PLC address area in
                      which the status bits were stored. Once again, the
                      PLC specification in the HDB has priority.

                      Possible entries: 10 Characters

                      The entries must be separated by blanks.

                      Example: DB 100 45

The following table shows the possible entries in the status word field.

Operand	DB no.	Address	
DB	1-255	0- 2047	* Data block
DX	1-255	0-2047	* Extended data block
FW	----	0- 255*)	* Flag word

*) with the S5-150, only up to FW 198

Parameters for special functions:

INTERPRETER: Only for service purposes.
                      This field must not be changed!

ADDRESS: Display field for service purposes.
                      Symbolic bus parameters according to the ISO
                      reference model.

M2-4-1.2

LOCAL TSAP-ID: For normal connections, this is obtained automatically
                  from the local ANR and SSNR and displayed in the
                  basic screen. If you select MULTICAST = Y, it is
                  formed as follows:

                  Byte 1 - 5 : free (= blanks)
                  Byte 6   : "M"
                  Byte 7 - 8 : Multicast set

REMOTE TSAP-ID: For normal connections, this is obtained automatically
                  from the remote ANR and SSNR and displayed in the
                  basic screen. If you select MULTICAST = Y, it is the
                  same as the local TSAP-ID.

Both TSAP-IDs have the same format:

LENGTH: Has the default "8". In connections to non-SIMATIC
                  S5 stations, it may be necessary to specify shorter
                  lengths.

HEX: The individual bytes of the TSAP-ID must be entered
                  as groups of two in hexadecimal representation
                  (values from 00 to FF). To make the value clearer to
                  read, the pairs should be separated by blanks. With
                  this type of input, the TSAP-ID can also have
                  numerical values. If you only enter zeros in this field,
                  the TSAP is considered as unspecified.
                  Possible entries: 8 bytes

ASC: The TSAP-ID entered in the hex field is displayed
                  here as an ASCII string. Blanks and characters that
                  cannot be interpreted are displayed as underlining
                  characters. If you enter the TSAP-ID here as an
                  ASCII string, it is displayed in the "HEX" field in
                  hexadecimal representation.
                  Possible entries: 8 characters

REMOTE TSAP-ID   Only relevant for service purposes.

8

M2-4-1.2   **Configuring several jobs per transport connection**

NUMBER OF   If you wish to change the default connection mode
JOBS PER TSAP   from simplex to duplex or if normal and expedited
                   data service are required using one connection, then
                   at least one further job must be entered for the TSAP.
                   To do this the number of jobs must be entered, up to
                   a maximum of four jobs per TSAP.

                   Possible entries: 1 to 4

After increasing the number of jobs, you must enter the next job as follows:

➤ return to the basic screen of the S5S5 connections

➤ press function key "+1"

➤ enter the job

➤ if necessary, correct the appropriate parameters in the second screen.

Example : Duplex mode --> 2 jobs per TSAP

```
┌──────┐ ┌──────┐
│ SEND │ │RECEIVE│        Job parameters
│ job  │ │ job  │
└──────┘ └──────┘
    │       │
    └───┬───┘
        │
┌────────┬────────┬─────┐
│TSAP-ID │TSAP-ID │ ... │    Connection
├────────┴────────┴─────┤    parameters
│       NSAP-ID         │
├───────────────────────┤
│       Layer 2         │
├───────────────────────┤
│       Layer 1         │
└───────────────────────┘
```
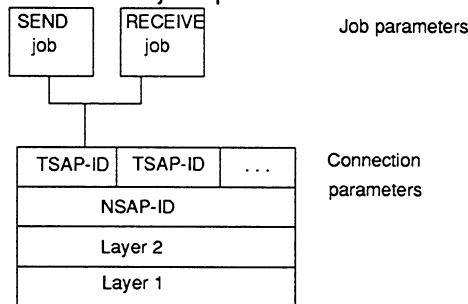
Function keys (additional or with context-specific meaning):

┌──────────┐
│   F3   │   The function key "PREV SCR" switches back to the
│ PREV SCR │   "S5S5 Connections" screen.
└──────────┘

8.3   Documenting Configuration Data

To document the configured communications parameters, there are a number of functions available for outputting lists. The lists are structured to reflect the configuration steps. All lists are displayed on the screen and can be printed out if required.

8.3.1   Documentation | Job List (PLC Parameters)

M 2-7-1

This lists the parameters which define the local connection between PLC and CP for all CP 143 jobs.

8.3.2   Documentation | Job List (Bus Parameters)

M 2-7-2

This lists the important parameters for the link via the bus.

8.3.3   Documentation | Direct Connections

M 2-7-3

This list displays both ends of a connection between two CP 143s simultaneously.

8.3.4   Documentation | Multicast List

M 2-7-4

This list displays the jobs belonging to the selected multicast sets.

8.3.5   Documentation | All

8

The menu item "ALL" generates all the lists one after the other in the order Job List PLC Par., Job List Bus Par., Direct Connections, Multicast List. The screens are essentially the same as M 2-7-1 to M 2-7-4

M 1-1 **Controlling output**

You can control the output on printer and decide whether or not a footer should be added in the 'Init | Edit' screen. You enable/disable the printer with the entry in the PRINTER OUTPUT field. You select or suppress the printing of a footer with the entry in the FOOTER OFF/ON field. If you require a footer, you must specify a footer file. You create the footer with the utility "footer editor".

8.4   Transferring Configuration Data

Range of functions
With the transfer functions, you can transfer a set of parameters, for example a CP database created locally. Functions are also available with which you can copy data from one file to another and transfer files to the PLC.

Modes

In the ONLINE mode, the transfer is between the hard disk (=FD) and the memory module of the CP. If the module is an EPROM, then only transfer from EPROM to diskette is possible online.

Controlling the status of the CP
The commands Start CP, Stop CP and Delete CP can be used to control the CP when transferring data or during the start-up phase.

The CP can adopt the modes RUN and STOP. The RUN mode is the normal operating status of the CP. In this mode, no changes can be made to the database online. only read access is possible. In contrast, the CP can be written to in the STOP mode. This means that prior to using the functions "Transfer Database | FD->CP" or "Transfer | Delete Database", the CP must be switched to the STOP status. This is possible by setting the CP START/STOP switch to STOP or using the COM function described here.

Setting the module type
When transferring from a memory module to hard disk, the MODULE TYPE parameter in the SYSID block is automatically changed to "EPROM" regardless of the actual module type. When transferring from diskette or hard disk to a module, the MODULE TYPE parameter is also matched automatically to the type being used.

8.4.1   Start CP

This function changes the CP to the RUN status. A message in a dialog box informs you whether or not this has been carried out (you exit the box by pressing a key or clicking with the mouse).

8.4.2   Stop CP

This function changes the CP to the STOP status. A message in a dialog box informs you whether or not this has been carried out (you exit the box by pressing a key or clicking with the mouse).

8.4.3   CP State

With this function, you can display the current CP Status. The status or any error that may have occurred is displayed in dialog box (you exit the box by pressing a key or clicking with the mouse).

The following status messages are possible:

CP status 'NOT SYNCHRON.'
CP status 'RUN'
CP status 'STOP'
CP status 'SWITCH STOP'

8.4.4   Delete Database

With this command, you can delete the content of the RAM module on the CP. To avoid the RAM being accidentally deleted, you are prompted to confirm that this is what you want to do.

Function keys (additional or with context-specific meaning):

| F1
YES | The database is deleted. |

| F3
NO | The database is retained. |

8.4.5   Delete DB File

With this command, you delete the contents of a database file. To avoid the file being accidentally deleted, you are prompted to confirm that this is what you want to do.

The question: Drive: source file name, Delete file? appears in the message line and you select your response with the function keys.

Function keys (additional or with context-specific meaning):

| F1 | Source file is deleted.
| YES |

| F3 | Source file is retained.
| NO |

8.4.6 Transfer Database | FD->CP

M 3-6.1

Module files created OFFLINE are transferred to the CP. The database file selected in Init->Edit is used as the module file.

COM asks you whether you want to transfer blocks singly or all blocks. You can cancel the function with ESC.

Function keys (additional or with context-specific meaning):

```
  F1
SINGLE
```

The blocks are transferred to the CP singly.
The meaning of the block identifiers is shown in the table below.

Block type	Block
VB1 to n	data link block(s)
OB1	Initialization block
OB4	Layer 4 parameters
OB5	VMD-specific variables
OB6	CPU configuration
OB13	Third-party association
OB 55- OB 63	Domain blocks

```
  F2
 ALL
```

All the blocks are transferred to the CP.

8.4.7   Transfer Database | CP->FD

M 3-6.2

The module files are transferred from the CP to FD. The destination file is the database file specified in the Init | Edit screen.

If the file already exists you will be asked whether the existing file should be overwritten on the destination station.

Output fields:

Dest file: The file in which the CP database will be stored .

Function keys (additional or with context-specific meaning):

```
┌──────────────┐
│      F1      │
│ SINGLE       │
└──────────────┘
```

The blocks are transferred singly to the destination file. The functions of the blocks can be seen in the table on page 8-24:

```
┌──────────────┐
│      F2      │
│     ALL      │
└──────────────┘
```

All the blocks are transferred to the destination file.

8.4.8   Transfer Database | FD->EPROM

M 3-6.3

The data records on the FD (diskette or hard disk) are written directly to the EPROM (blown).

Under S5DOS, NMOS and CMOS EPROMs can be programmed. The EPROM types are distinguished by programming numbers.

Input fields:

Programming   The programming number of the EPROM type you
number: are using is entered here. The NCM selection menu
                  displays the possible selections.

8

☞   **Make sure that the EPROM type matches the programming
                number. If you select the wrong number, the EPROM module
                will be destroyed.**

                **You must also make sure that the size of the EPROM is the
                same as the EPROM size set in "CP Init" (screen M 2-1).**

8.4.9   Transfer Database | EPROM->FD

M3-6.4

The data records on the EPROM are copied directly to the default database file.

If the file already exists you will be asked whether the existing file should be overwritten on the destination station.

Output fields

Dest file   This is the file in which the database from the EPROM will be stored.

Function keys (additional or with context-specific meaning):

| F1 SINGLE | The blocks are transferred singly from the EPROM to the destination file. The functions of the blocks can be seen in the table on page 8-24.

| F2 ALL | All the data are read from the EPROM and written to the destination file.

8.4.10 Transfer Database | FD->FD

M 3-6.5

This function duplicates the source file in the destination file.

If the file already exists you will be asked whether the existing file should be overwritten on the destination station.

Input fields:

Dest file: Here, you specify the drive (e.g. A: for floppy disk
                              drive or C: for a hard disk) and the name of the
                              destination file (Possible entries drive: "A" to "Z" file
                              names: alphanumeric characters and the period).

Function keys (additional or with context-specific meaning):

| F1 SINGLE |

The blocks are transferred singly to the destination file. The functions of the blocks can be seen in the table on page 8-24.

| F2 ALL |

All the blocks are transferred to the destination file.

8

8.5   Testing the Transport Interface

The following functions are available for testing the transport interface:

Status All (Overview of all Connections)
This provides you with an overview of the current status of all the transport connections of a CP. As well as the connection status, you also obtain an overview of the current buffer load.

Trace All
You can monitor the status of the transport connections and the information is constantly updated.

This function consists of the two sub-functions "Updated Status All" and "Trace All".

With "Status All", you can see at a glance which jobs exist, which have changed and the status of the connection following the last change.

With "Trace All", all the status changes of a job taking place between two scan/display cycles are displayed. If several jobs have status changes during a cycle, it is also possible to see the order in which the changes occurred.

Job Test
The "Job Test Under User Control" function allows step-by-step processing and monitoring of transport jobs followed by recording in log files.

The recording can also be controlled by setting trigger points. A trigger point can be as follows:
* pattern for comparison with connection status (LINK)
* pattern for comparison with transport status (TRSP)
* address and pattern for comparison with transmitted data

8.5.1   S5S5 connections | Status All

The PG fetches information from the CP 143 about all the connections which have had parameters assigned to them and displays them together with the current statuses in the form of a table (see "OVERVIEW OF ALL CONNECTIONS" screen). A maximum of 13 individual statuses can be displayed on one screen page. Once they are displayed they are no longer updated!

Output fields:

POS :   Consecutive status number from 1 to maximum 64. This is assigned automatically by the PG and is useful for gaining an overview when there are too many jobs to fit on the screen and you use the positioning keys to find a particular section.

SSNR: Interface number of the job

ANR :   Job number

TYPE :   Job type

PRIO :   Priority of the job

LINK, TRSP,   The status of a connection and the status of the
LINK-E, TRSP-E   transport control are described by these four parameters. The updated value is always output as a hexadecimal number. The significance of the individual values is shown in the table at the end of this section.

8

M4-1-1 The data buffer loads are displayed classified according to priority below the individual status.

MAX :   Maximum number of CP 143 buffers

OCC: Number of occupied buffers, as an absolute number and as a percentage.

FREE :   Number of free buffers remaining

Function keys (additional or with context-specific meaning):

F1
PAGE +1

If it is not possible to fit all the individual statuses on one screen page, you can move the section displayed forwards or backwards using the function keys "PAGE +1", "PAGE -1", "LINE +1" and "LINE -1". The positioning keys can also be used instead of these function keys.

F2
PAGE -1

F3
LINE +1

F3
LINE -1

Text table LINK" (connection status):

Significance of the most important statuses:
00	connection is terminated
01	connection is established
02	connection establishment active
04	connection establishment active
08	connection termination active
0A	connection termination active
10	connection is terminated
11	connection is established
12	connection establishment active
14	connection establishment active
18	connection termination active
20	connection abort active
24	connection abort active
94	connection abort pending

Based on the bit coding, all the status bits can be decoded:

Bit	0:	connection is established
Bits	1 - 3:	Request block of the DJV being processed with following status:
	000:	is deleted or not being sent
	001:	open request to iNA
	010:	connection request
	100:	close request, followed by status message to transport
	101:	close request, followed by error message to transport

Bits	4 - 5:	additional request blocks still being sent
	01:	time monitoring
	10:	abort connection request by close request

Bit	6:	not yet used
Bit	7:	an abort request is present

8

Example:
Status 02 'connection establishment active' can be decoded into 'connection establishment active with open request to INA'.

Status 04 'connection establishment active' can be decoded into 'connection establishment active with connection request'.

Text table "TRSP" (Transport status):

➢ With SEND

* with SEND PRIORITY 0 and 1
  0   connection not yet established
  1   waiting for trigger
  2   waiting for message from special task
  3   data sent, waiting for acknowledgement

* with SEND PRIORITY 2
  0   connection not yet established
  1   waiting for trigger
  2   waiting for free data buffer
  3   waiting for data from PLC
  4   waiting for message from special task
  5   waiting for acknowledgement
  6   waiting for connection termination after error

* with SEND PRIORITY 3 and 4
  0   waiting for trigger
  1   waiting for connection establishment
  2   waiting for free data buffer
  3   waiting for data from PLC
  4   waiting for message from special task
  5   data sent, waiting for acknowledgement
  6   waiting for connection termination

➢ With RECEIVE

* with RECEIVE PRIORITY 0 and 1
  0   connection not yet established
  1   waiting to receive data
  2   waiting for message from special task
  3   waiting for PLC to accept data

* with RECEIVE PRIORITY 2
  0   connection not yet established
  1   waiting for trigger
  2   waiting for free data buffer
  3   waiting to receive data
  4   waiting for message from special task
  5   waiting for PLC to accept data
  6   waiting for end identifier

Text table "TRSP" (Transport status) - continued 1-:

*   with RECEIVE PRIORITY 3 and 4
- 0   waiting for trigger
- 1   waiting for connection establishment
- 2   waiting for free data buffer
- 3   waiting to receive data
- 4   waiting for message from special task
- 5   waiting for the PLC to accept data
- 6   waiting for the end identifier
- 7   waiting for connection termination

➤ With WRITE ACTIVE

- 0   connection not yet established
- 1   waiting for trigger
- 2   waiting for data from the PLC
- 3   waiting for message from special task
- 4   data sent, waiting for acknowledgement
- 5   waiting for WRITE acknowledgement frame
- 6   waiting for connection termination after error

➤ With WRITE PASSIVE

- 0   connection not yet established
- 1   waiting to receive data
- 2   waiting for message from special task
- 3   waiting for the PLC to accept data
- 4   waiting for the end identifier
- 5   WRITE acknowledgement frame sent
- 6   waiting for connection termination after error

➤ With READ ACTIVE

- 0   connection not yet established
- 1   waiting for trigger
- 2   waiting for acknowledgement of request frame
- 3   waiting for data from partner
- 4   waiting for message from special task
- 5   waiting for the PLC to accept data
- 6   waiting for the end identifier

8

Text table "TRSP" (Transport status) - continued 2-:

➤ With READ PASSIVE

    0 connection not yet established
    1 waiting for request frame
    2 waiting for PLC to transfer data
    3 waiting for message from special task
    4 data sent, waiting for acknowledgement
    5 waiting for connection termination after error

Text table "LINK-E" (connection error):

    0 no error
    1 no error
    3 no error, last data frame
    4 no connection buffer
    5 no error
    6 connection terminated by partner
    7 connection terminated
    B no error
    E connection terminated by partner
    10 no acknowledgement from partner
    18 wrong transport setting at partner
    1 A wrong address
    FF system error

Text table "TRSP-E" (transport error):

0 no error
1 wrong Q/ZTYP in handling block
2 area does not exist in PLC (DB does not exist)
3 area in PLC too short
4 timeout in PLC
5 error in status word (ANZW)
6 not a valid ORG format
7 no free data buffer
8 no free transport connections
9 error in communication partner
A connection error (connection broken down or cannot be established)
B message error (error in firmware)
C trigger error (e.g. wrong job)
D abort after RESET
E job with READ/WRITE (trigger from PLC not possible)
F job does not exist
FF system error

8

8.5.2   S5S5 Connections | Trace All

M 4-1-2
M4-1-2.1

This function consists of the two sub-functions "Status All" and "Trace All".

The two functions "Status All" and. "Trace All" differ from each other as follows:

With "Status All", you can see at a glance which jobs exist, which have changed and the status of the connection following the last change.

With "Trace All", all the status changes of a job taking place between two scan/display cycles are displayed. If several jobs have status changes during a cycle, it is also possible to see the order in which the changes occurred.

M 4-1-2   **Updated Status All:**

With this sub-function the PG fetches information from the CP 143 about all the connections which have had parameters assigned to them and displays them together with the current statuses. The buffer load is displayed in the lower part of the screen.

In contrast to the function "Status All", the connection statuses and buffer loads are updated continuously. A change in the job status is indicated by an "X" in the "CHA" column.

1st column:
Change of status since the last cyclic scan. The frequency of these changes in status indicates the "activity" of a job

2nd column:
Identifier to indicate that there has been at least one change in status since the test function began. Jobs which, contrary to expectation, do not have an identifier in the second column after a period of time should be investigated.

The significance of the status information in the display fields is the same as in the overview function.

M4-1-2 Function keys (additional or with context-specific meaning):

| F5 |
| DELETE |

With this function key you can suppress the display of uninteresting jobs. Before you press this key, the positioning arrow must be at the left-hand edge of the line to be suppressed.

| F6 |
| STATUS |

With this function key, you can stop the status being updated on the screen or continue the updating.

| F7 |
| TRACE |

With this function key, you switch over to the "Trace All" function.

8

M4-1-2.1 **Trace All:**

In contrast to the "Updated Status All" function, this function displays all the status changes of all jobs. Both in the "Status All" function as well as in the "Trace All" function, all status changes are recorded in a (trace) buffer. If there is a buffer overflow, the oldest information is discarded in order to make room for the most recent changes. The newest information is therefore always at the end of the buffer. With the "Trace All" function, you can freeze the status output and can check and analyse the contents of the buffer at leisure.

The significance of the display fields with the "Trace All" function is the same as in the "Status All" function with the following exception:

POS: (4 C):   Consecutive number of a status change that has occurred since the "status of all connections" function was selected. The count and counter changes provide information about the bus activity of the CP 143.

Function keys (additional or with context-specific meaning):

| F1 |
| PAGE +1 |

The function keys "PAGE +1", "PAGE -1", "LINE +1" and "LINE -1" and the corresponding positioning keys are only effective when the trace recording is halted. With these keys you can scroll the section displayed on the screen and look through all the "frozen" recordings.

| F2 |
| PAGE -1 |

| F3 |
| LINE +1 |

| F3 |
| LINE -1 |

| F |
| STATUS |

"STATUS" enables or disables the current trace recording.

8.5.3   S5S5 connections | Job Test Under User Control

The function "Job Test under User Control" allows a job on a selectable connection to be tested in the following ways:

M 4-1-3
M4-1-3.1.1

➤ Job sequence check

A job on the CP 143 is processed under step by step control. The next step can be enabled either automatically by the PG or manually by the user.

The recording can also be controlled by setting trigger points. A trigger point can be a combination of the following independent parts:

* pattern for comparison with connection status (LINK)
* pattern for comparison with transport status (TRSP)
* address and pattern for comparison with transmitted data

➤ Job monitoring

After the function and the job have been selected and following each step of the job, the current processing status is displayed. If the job includes data transfer, the data are also displayed.

➤ Recording and outputting log files

If required, the processing of a job can be recorded in a log file.

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M 4-1-3 The "JOB TEST - SELECT CONNECTION" screen appears first.

You can select the connection to be tested in two different ways:

➢ by directly specifying the interface (SSNR) and the job number (ANR),

➢ by paging (= search) to find the required connection using the function keys "+1" or "-1".

Function keys (additional or with context-specific meaning):

F7
OK
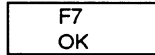
If you press the "OK" function key, the displayed connection is confirmed and you branch to the actual job test screen.

M 4-1-3.1 The fields of the "JOB TEST" screen have the following significance:

SSNR, ANR   The current connection selected in the previous
                   screen is displayed.

JOB TYPE   Displays the current job type selected in the previous
                   screen.

ACTIVE/PASSIVE   The local mode for connection establishment.

ENABLE   The enable control for the next job step is displayed
                   (= AUTOMATIC or MANUAL).

PRINTER   Status of the printer initialization.

TRG POINT   Displays the trigger status selected with the function
                   key (ON/OFF).

LINK   Displays the comparison pattern selected for the
                   trigger point for the connection status (refer to the text
                   table on page 32).

TRSP   Displays the comparison pattern selected for the
                   trigger point for the transport status (refer to the text
                   table on page 32).

ADR   Displays the comparison pattern selected for the
                   trigger point for the address of the transmitted data.

PATTERN   Displays the comparison pattern selected for the
                   trigger point for the data. Specified as any
                   hexadecimal value.

LOG FILE   Displays the selected log file mode (= OFF,
                   RECORDING, OUTPUT).

STATUS   Displays the current processing status of a job by means of
                the values "LINK", "TRSP", "LINK-E" and "TRSP-E"
                including the accompanying texts and the current CP 143
                status.

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Instead of the texts, the whole DJV field can also be displayed. Apart from the parameters "LINK", "TRSP", "LINK-E" and "TRSP-E" the DJV field also contains further information for the expert.

The following two fields only exist for jobs which include data transfer.

DATA: Since there may be more data than can be transmitted in one frame, the following information is displayed in the header line: the total number of bytes to be transmitted and the number of bytes still to be transmitted and the format of the data lines which follow.

DATA LINE: A maximum of 16 bytes can be displayed in one data line in an optional display format. Each line is preceded by the corresponding byte address area. The address area begins at zero and is incremented continuously by the number of transmitted bytes. If there is more data than the CP 143 can transmit at one time, the remaining data is supplied later in the next steps. In jobs with a READ/WRITE identifier (= boot identifier), the first 16 bytes represent the header.

Note:
If there are more data lines than can be displayed on the screen at one time, the section displayed can be moved upwards or downwards line by line or page by page using the screen control keys.

Job management in the dynamic job variable field DJV
During system start up, the CP 143 generates a separate management field
for every job defined on the module. This management field DJV (=dynamic
job variable) can be displayed by COM 143 TF in the test functions "Status
of a connection", "Status All" and "Trace All".

The data cells in the DJV field important for the job test

➤ Connection status (LINK)
The status of the connection is displayed here. From the connection
status, you can see whether or not a connection is already established
or terminated and whether or not the connection is in the establishment
or termination phase.

➤ Transport status (TRSP)
The status of the transport control of a job is displayed here.

➤ Connection error (LINK-E)
Any error status on a connection is displayed as a connection error.

➤ Transport error (TRSP-E)
The transport management stores all the error IDs detected on the CP
143 itself or supplied by the handling blocks. The error ID is only deleted
when the next job is triggered.

These IDs are also displayed in the test functions. Their significance is
explained in the previous section; the transport errors including remedies
are explained in Appendix B Status and Error messages.

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In the "single trace" and "single status" test functions, the entire DJV block can be displayed. The following table describes the structure of the DJV field.

Byte		Meaning
0 1	00H 01H	Pointer "connection name"
2 3	02H 03H	Pointer "job parameters"
4 5	04H 05H	Pointer "request block"
6 7	06H 07H	Connection reference
8	08H	Job type
9	09H	Job priority
10	0AH	Connection status
11	0BH	Transport status
12	0CH	Connection error
13	0DH	Transport error
14	0EH	PLC ID
15 16	0FH 01H	Number of data already transmitted L H
17 18 19 20 21 22	11H 12H 13H 14H 15H 16H	"Organization format" Q/ZTYP DBNR Q/ZANF Q/ZKAE
23 24 25	17H 18H 19H	Address of status word
26 27	1AH 1BH	Current L buffer size H
28 29 30 31	1CH 1DH 1EH 1FH	1. Buffer number 2. Buffer number 3. Buffer number 4. Buffer number

For key, see below.

Table Structure of the DJV Field

Key to structure of the DJV field

Job types: 81H=SEND, 82H=RECEIVE, 91H=WRITE ACTIVE,
92H=WRITE PASSIVE, 93H=READ ACTIVE,
94H=READ PASSIVE
Job priority: 0/1/2/3/4 = PRIORITY
PLC ID: internal IDs(e.g. EOM, in WS,)
ORG format: IDs for source/dest. parameters
Status word address: Byte 23=01: ANZW=MW;Byte 25=FW number
 Byte 23=02: ANZW=DW,Byte 24=DB-Nr;25=DW-Nr.
Byte 23=03: ANZW=DW,Byte 24=DX-Nr,25=DW-Nr.
Byte 23=FF: no ANZW,Byte 23=FE ANZW error
Current buffer size.:Number of currently transferred data

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M4-1-3.1 Function keys (additional or with context-specific meaning):

F1 AUTO/MAN	This switches over the enable control for the next processing step. In the "MANUAL" mode, you enable the next step explicitly by pressing the enter key - prompted by the message "WAITING FOR MANUAL ENABLE". In this mode, you can analyze the parameters exactly following each step. In the "AUTOMATIC" mode the PG enables the next step as soon as the current step is complete. This mode is useful in conjunction with a log file recording or when a trigger point is set.
F2 PR ON/OFF	Switches printer output off and on.
F3 TRG POINT	If you press this function key, you can edit the fields containing the trigger point patterns. You select the trigger point mode in a new function key menu.
F4 WITH TRG	Start or continue the job test taking into account a previously defined trigger point.
F4 NO TRG	This starts or continues the job test regardless of any trigger point which may have been set.
F5 STOP	In the automatic mode, the current job test is halted.
F6 LOG FILE	If you press this function key, you branch to the "JOB TEST - LOG FILE MANAGEMENT" screen. Once you have input the log file drive, an overview of all the log files in the drive is displayed. If the SSNR and ANR belonging to the recorded job are known, these are displayed after the log file name.
F7 FORMAT	A new function key menu is displayed in which you can select the required output format of the data buffers.

After selecting F3 TRG POINT, the softkey menu switches to the following keys:

| TO TRG | If the automatic mode is set, the job is processed and displayed on the PG until one of the trigger point conditions is reached. Following this, the processing of the job stops and control is returned to the user. |

| FROM TRG | The PG display is suppressed until one of the trigger point conditions is fulfilled. Once a trigger point condition has been reached, the PG display is once again updated continuously. |

| CYC TRG | The PG display is only updated whenever a trigger point is reached. |

8

M4-1-3.1 JOB TEST - LOG FILE MANAGEMENT

If there are several log files, you can select the log file required for the recording using the positioning keys "arrow down" or "arrow up". The valid log file is indicated by a marker and a display of the current mode.

Within the "LOG FILE MANAGEMENT" function, the following function keys are effective:

F1 NEW LF	This branches to a further screen which prompts you to enter a log file name (maximum 8 characters, no extension). The new log file is only permitted for the currently existing connection, for which the SSNR and ANR are displayed.
	If there is still sufficient space on the selected drive, a memory area of 32 Kbytes is reserved for the log file.
F2 DELETE	The marked log file is deleted.
F3 MODE OFF	The marked log file is neither used for recording nor for display (= default).
F4 RECORDING	All frames received by the PG from the CP 143 are recorded continuously in the selected log file. When the end of the file is reached, the oldest frames are overwritten cyclically by the new frames.
F5 OUTPUT	The frames recorded in the log file can be displayed in chronological order in the "JOB TEST" screen, as if the frames were coming directly from the CP 143.

Note on the use of log files:
A log file is only enabled for recording or displaying frames when the SSNR and ANR stored in it correspond to those of the currently selected connection.

To output a log file in the OFFLINE mode, the module file containing the connection which has been tested (and recorded in the log file) must first be read in. Before you select the log file, you must select this connection in the "JOB TEST - SELECT CONNECTION" screen. If you omit this, all further action will be rejected with the message "NO CONNECTIONS EXIST".

The log file management is restricted to 10 log files per drive.

| FORMAT | A new function key menu is displayed in which you can select the required output format of the data buffers. |

| BYTE HEX | Hexadecimal output in bytes, values from 00 to FF (= default). |

| BYTE DEC | Decimal output in bytes, values from 0 to 255. |

| WORD HEX | Hexadecimal output in words, values from 0000 to FFFF. |

| WORD DEC | Decimal output in words, values from 0 to 65535. |

| ASCII | Display in bytes as ASCII values. Non-representable values are replaced by "?". |

| DJV FIELD ON/OFF | As an alternative to the textual display of the transport and connection status, the 32-byte DJV field can be displayed and cleared from the screen again. |

| RETURN | Returns you to the "JOB TEST - SELECT CONNECTION" screen. You can either select a new connection to be tested or exit the function.□ |

8

Notes

A   Further Information about the CP 143

This section contains more detailed information about the operation of the CP 143. This information is required particularly when establishing connections to non-SIMATIC components.

The sequences of the jobs are represented in Section A.2 as state diagrams. Section A.3 illustrates the sequence of the jobs in the form of sequence diagrams.

A more convenient connection between SIMATIC components and non-SIMATIC components can be achieved with the TF interface provided by the CP 143 TF. The non-SIMATIC device must, however, have access to the SINEC TF/MMS protocol. The TF interface for the CP 143 TF is described in Volume 2 of this manual.

A.1   The CP 143 in a Non-System Environment Connections with Heterogeneous Systems

In a homogeneous network, i.e. when only CP 143s are connected to the network, the operator interface to the system is of chief importance to the user. In a heterogeneous network, the way in which information is exchanged between two (or more) systems assumes greater importance. As soon as any device other than a CP 143 is connected to SINEC H1, the network can be considered heterogeneous, since different systems must communicate via the bus. Since the SINEC H1 bus is an open communications system, the CP 143 of an S5 PLC can be connected to other systems without any great difficulty. In this context, "open" means the following:

➤ use of transmission protocols which are already standardized or in the process of being standardized,

➤ that the communications interfaces are defined.

In keeping with the need for standardization, the CP 143 operating system is structured according to the ISO/OSI 7-layer communications model.

A

	ISO/OSI model	Implementation with the CP 143
7	Application layer	Acc. to ISO IS 9506 T.1 (MMS) or a simple application protocol for READ/WRITE in the CP 143
6	Presentation layer	Acc. to SINEC AP/TF or not implemented
5	Session layer	Acc. to SINEC AP/TF or establishment of connections active establishment with SEND passive establishment with RECEIVE
4	Transport layer	ISO IS 8073 CLASS 4 with additional datagram service according to ISO 8602
3	Network layer	Not implemented (empty) NSAP absolute only
2b 2a	Data link layer	Logical link control according to IEEE 802.2 MAC (Media Access Control) according to IEEE 802.3 (CSMA/CD)
1	Physical layer	According to IEEE 802.3

Fig. A.1: ISO/OSI Communications Model

Layers 1 and 2 (2a), i.e. the physical layer and the data link layer operate using the CSMA/CD technique according to IEEE 802.3. Layer 2b (LLC) corresponds to IEEE 802.2.

Layer 3 (network layer) is not implemented with SINEC H1, i.e. only "empty protocols" are used. The NSAP-ID (NETWORK SERVICE ACCESS POINT IDENTIFIER) has a fixed structure; the length is fixed at 12 bytes.
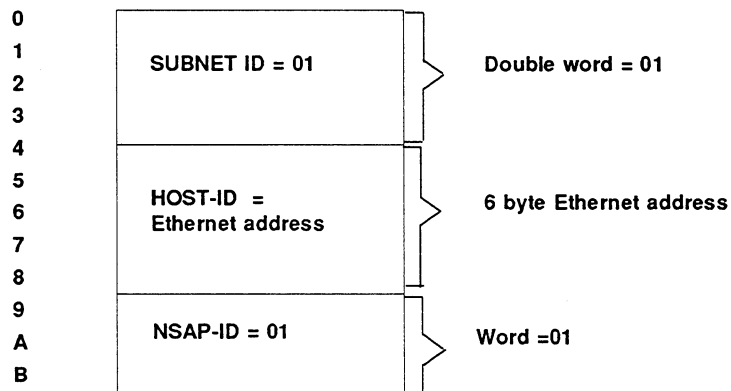
For the CP 143 (in SINEC H1), layer 4 (transport layer) is implemented according to the following specifications:

➤ ISO IS 8073

➤ ISO 8602

and contains the following:

➤ virtual circuits in CLASS 4

➤ expedited data

➤ datagram service

The parameters of the transport protocol are listed in Section A.1.1.

A

The establishment of connections is controlled as follows:

➢ connections which have been allocated an active job (SEND and READ-ACTIVE, WRITE-ACTIVE) open the connection establishment with

       * CONNECTION REQUEST

➢ connections which have been assigned a passive job (RECEIVE and READ-PASSIVE, WRITE-PASSIVE) participate passively in the connection establishment as follows:
       * CONNECTION AWAIT or with
       * CONNECTION CONFIRM

If several jobs are defined for one connection, then the first job listed in the data link block controls the establishment of the connection.

For layers 5 to 7, the CP 143 implements the protocols according to SINEC AP and SINEC TF (AP: Automation protocol, TF: Technological functions). The interface to layer 7 is described in Volume 2.

A simple protocol is used in layer 7 (the application layer), however, only with special S5 jobs. Normal SEND and RECEIVE jobs use the transport layer, i.e. with SEND/RECEIVE, the CP 143 does not generate an additional header. If an error occurs during the transfer of data to the PLC, then the side on which the error occurred interrupts the transport connection. A communication partner is informed of the error and the system does not become "jammed" as a result. The CP 143 immediately re-establishes the interrupted connections. With READ and WRITE, however, the CP 143 generates specific headers for request and acknowledgement frames. As standard, these headers are 16 bytes long and have the following structure:

a) for WRITE

WRITE request frame   WRITE acknowledgement frame

0	System identifier.........	="S"
1	....	="5"
2	..Header length...........	=16d.
3	..OP code id...............	=01..
4	..OP code length........	=03..
5	..OP code..................	=03..
6	..ORG field................	=03..
7	..ORG field length......	=08..
8	ORG identifier......................	
9	..DBNR...............................	
A	Start	H
B	..address.....................	L..
C	Length...........	H
D	....	L..
E	..Empty field...............	=FFh.
F	..Empty field length.....=02	

Data up to 64 K

0	System identifier.........	="S"
1	....	="5"
2	..Header length...........	=16d.
3	..OP code id...............	=01..
4	..OP code length........	=03..
5	..OP code..................	=04..
6	..Ack. field..................	=0Fh
7	..Ack. field length........	=03..
8	..Error number............	=Nr...
9	..Empty field...............	=FFh
A	..Empty field length....	=07
B		
C		
D		
E	free	
F		

A

b) for READ

READ request frame

0	System identifier.........	="S"
1	....	="5"
2	..Header length...........	=16d.
3	..OP code id..............	=01..
4	..OP code length........	=03..
5	..OP code..................	=03..
6	..ORG field................	=03..
7	..ORG field length......	=08..
8	ORG identifier......................	
9	..DBNR...............................	
A	Start	H
B	..address.....................	L..
C	Length...........	H
D	....	L..
E	..Empty field..............	=FFh.
F	..Empty field length....	=02

READ reply frame

0	System identifier.........	="S"
1	....	="5"
2	..Header length...........	=16d.
3	..OP code id..............	=01..
4	..OP code length........	=03..
5	..OP code..................	=04..
6	..Ack. field.................	=0Fh
7	..Ack. field length........	=03..
8	..Error number............	=Nr...
9	..Empty field..............	=FFh
A	..Empty field length....	=07
B		
C		
D		
E	free	
F		

Data up to 64 K but only if error number = 0

With READ and WRITE, the ORG field is optional. If the ORG format is not specified in the request frame, then the CP 143 uses the source or destination descriptions defined in the corresponding data link block (the ORG format is the brief description of a data source or a data destination in the S5 environment). The possible ORG formats are listed in the following tables; all error messages (error numbers) are described in the Section "Status and Error Messages".

S5 area	DB	FY	IB	QB
ORG identifier	01H	02H	03H	04H
Description	Source/destination data from/to data block in main memory	Source/destination data from/to flag area	Source/destination data from/to process image of inputs (PII)	Source/destination data from/to process image of outputs (PIQ)
DBNR	DB from which the source data are read out or to which the destination data are transferred	irrelevant	irrelevant	irrelevant
Permitted range	1...255			
Start address significance	DW number after which the data are read out or written in	Flag byte number after which the data are read out or written in	Input byte number after which the data are read out or written in	Output byte number after which the data are read out or written in
Permitted range	0...2047	0...255*)	0...127	0...127
Number significance	Length of the source/destination data field in words	Length of the source/destination data field in bytes	Length of the source/destination data field in bytes	Length of the source/destination data field in bytes
Permitted range	1...2048	1...256	1...128	1...128

*) With the S5-150, only up to FY 199

The "length" can also be specified as -1 (=FFFFH). With READ, the CP 143 then supplies the "remaining length" of the area read from. With WRITE, the CP 143 accepts all the data contained in the data field of the frame.

Table A.1: Organization Formats with S5 Programmable Logic Controllers, Part 1

S5 area	PY	CB	TB	RS
ORG identifier	05H	06H	07H	08H
Description	Source/destination data from/to peripheral modules. With source data, input modules: with destination data, output modules	Source/destination data from/to counter locations	Source/destination data from/to timer locations	Source/destination data from/to system data area (RS and RS')
DBNR Permitted range	irrelevant	irrelevant	irrelevant	irrelevant
Start address significance	Peripheral byte number after which the data are read out or written in	Number of the counter location after which the data are read out or written in	Number of the timer location after which the data are read out or written in	Number of the RS word after which the data are read out or written in
Permitted range	0...127 digit. peripherals 128...255 analog peripherals	0...255	0...255	0...511
Number significance	Length of the source/destination data field in words	Length of the source/destination data field in words (counter location = 1 word)	Length of the source/destination data field in words (counter location = 1 word)	Length of the source/destination data field in bytes
Permitted range	1...256	1...256	1...256	1...128

The "length" can also be specified as -1 (=FFFFH). With READ, the CP 143 then supplies the "remaining length" of the area read from. With WRITE, the CP 143 accepts all the data contained in the data field of the frame.

Table A.2: Organization Formats with S5 Programmable Logic Controllers, Part 2

S5 area	AS	DX	DE	OY
ORG identifier	09H	0AH	10H	11H
Description	Source/destination data from/to memory locations (absolute addresses)	Source/destination data from/to extended data block (with S5-135U)	Source/destination data from/to data block in external memory (only with 150U)	Source/destination data from/to I/O modules in the extended I/O area. With source data, input module: with destination data, output module. (only with S5-150U)
DBNR	irrelevant	DX from which the source data are read out or in which the destination data are written	DB from which the source data are read out or in which the destination data are written	irrelevant
Permitted range		1...255	1...255	
Start address significance	Absolute start address after which the data are read out or written in	DW number after which the data are read out or written in	DW number after which the data are read out or written in	Peripheral byte number after which the data are read out or written in
Permitted range	0...FFFFH	0...2047	0...255	0...511
Number significance	Length of source/destination data field in words	Length of source/destination data field in words	Length of source/destination data field in words	Length of source/destination data field in bytes
Permitted range	1...32767	1...2048	1...2048	1...256

The "length" can also be specified as -1 (=FFFFH). With READ, the CP 143 then supplies the "remaining length" of the area read from. With WRITE, the CP 143 accepts all the data contained in the data field of the frame.

Table A.3: Organization Formats with S5 Programmable Logic Controllers, Part 3

A.1.1   The Parameters of the Transport Protocol

Layers 2b and 4 are implemented by the Intel Corporation software package
iNA960 R1.1.

For a detailed description, refer to the ""iNA960 Architecture Reference
Manual, Order No. 122194-001, Intel Corp., Sta. Clara USA/CA".

Window Size:

Max Credit	=	depends on negotiated TPDU size
Min Credit	=	0

Transport address Limits:

Maximum Network Address Length	=	12 (OCH)
Maximum TSAP ID Length	=	8
Maximum NSAP ID Length	=	2

Client Request Defaults:

Default Persistence Count	=	14
Default Abort Timeout (units of 51 ms)	=	1800H => 313 s
Default Connection Negotiation Options	=	8342H

    8 =   don't care
    3 =   with Expedited
           no Checksum
    4 =   Class 4 Service
    2 =   31 bit Sequential Numbers

Internal Negotiation Options:

Max TPDU Size	=	AH=> 2^{10} = 1024 bytes

Retransmission Timer

Default Retransmission Timeout (units of 100 µs)	=	0x2710 => 1s
Minimum Retransmission Time (units of 100 µs)	=	0x1388 => 0.5 s
Closing Abort Timeout (units of 51 ms)	=	80 H = > 6.5 s

Flow Control Window Timeout   =   0x18630 => 10 s
(units of 100 µs)
Inactivity Maximum Count   =   3

Flow Control Parameters
Open Window Timeout   =   0x2710 = 1 s
(units of 100 µs)
Maximum Open Window Count   =   8

A.2   Sequence Diagrams of the Job Types

To make installation as well as testing and debugging in the communications network easier, the control of SEND/RECEIVE jobs in all priority classes is represented in the following as a sequential controller.

Key to diagrams:

S X	= Step X, the functions of the steps are described briefly
TY	= Transition Y, the number of the transition. (Status of the transport management corresponds to the transition number preceded by the "wait" state).
TU ═══ T ═══	= alternative branch ⌐ = internal transition
(z)	= connector (to next page) (z) V = connector (from preceding page)
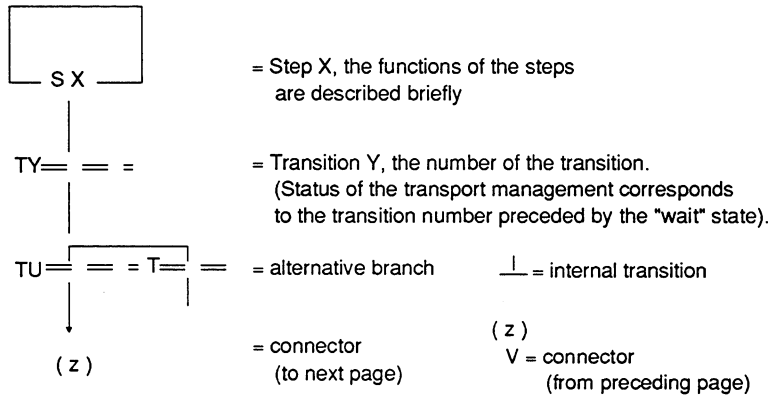
SEND HDB	= SEND handling block
RECEIVE HDB	= RECEIVE handling block
FETCH HDB	= FETCH handling block
SEND-ALL	= SEND-ALL handling block
RECEIVE-ALL	= RECEIVE-ALL handling block
Status	= status bits in the status word of an HDB

Notes on the diagrams:
The number of the transition prior to which the program waits corresponds to the display TRSP (transport status) in the test functions (Overview of all connectionss, Status/ Trace of all connectionss, Single status) of COM 143. The sequence can be followed best with the trace function.

A.2.1   SEND and RECEIVE Jobs PRIO 0/1

```
┌─────────────────────────┐
│ Disable SEND-HDB        │
│ Establish connection    │
│ └──────── START ────    │
└─────────────────────────┘
              │
T 0  ═════    Connection established
              │
┌─────────────────────────┐
│ Prepare buffers         │
│ Enable SEND-HDB         │
│ └──────── S  0 ────      │
└─────────────────────────┘
              │

T 1 ════  SEND triggered        T 1 ════  SEND triggered
          without error                   with error

┌─────────────────────┐      ┌──────────────────────────┐
│                     │      │ Store error identifier   │
│  No action          │      │ Status = end with error  │
│ ─────── S 1.1 ──    │      │ ──────── S 1.2 ──────     │
└─────────────────────┘      └──────────────────────────┘

┌─────────────────────┐
│  Send data          │
│ ─────── S 2 ────    │
└─────────────────────┘

T 3 ════  Data sent          T 3 ════  Connection
                                       error

┌─────────────────────┐      ┌──────────────────────────┐
│ Status = end without│      │ Status = disabled        │
│        error        │      │ Return data buffers      │
│ ─────── S 3.1 ──    │      │ Re-establish connection  │
└─────────────────────┘      │ ──────── S 3.2 ──────    │
                             └──────────────────────────┘
```

Fig. A.2: Sequence of SEND PRIO 0/1

```
              ┌──────────────────────────┐
              │ Disable RECEIVE-HDB       │
              │ Establish connection      │
              └──────────────┐           ─┘
                         START
                              │
                              │◄──────────────────────────────────────┐
          T 0  ═════   Connection established                         │
              ┌──────────────────────────┐                           │
              │ Prepare buffers           │                          │
              │ set to receive            │                          │
              └──────────── S   0 ────────┘                          │
                              │                                       │
     ┌────────────────────────┤                                      │
     │                        │                                      │
     │        T 1 ════  Receive data      T 1 ════  Connection       │
     │                                              error            │
     │          ┌──────────────┐        ┌──────────────────────────┐ │
     │          │  No action   │        │ Status = disabled         │◄┤
     │          │              │        │ Return data buffers       │ │
     │          │   S 1.1      │        │ Re-establish connection    │ │
     │          └───────┬──────┘        └──────── S 1.2 ────────────┘ │
     │                  │                         │                   │
     │                  │                         └───────────────────┘
     │          ┌──────────────────────────┐
     │          │ Enable RECEIVE-HDB        │
     │          │ with PRIO 0, set IR  1)   │
     │          └────────── S 2 ───────────┘
     │                  │
     │          T 3 ════ Data accepted    T 3 ════  Error accepting
     │                                              data
     │   ┌──────────────────────┐   ┌──────────────────────┐
     │   │ Disable RECEIVE-HDB   │   │ Disable RECEIVE-HDB   │
     │   │ Status = end w/o error│   │ Status = end with error│
     │   │ set to receive        │   │ set to receive        │
     │   └───────── S 3.1 ───────┘   └──────── S 3.2 ───────┘
     │             │                          │
     └─────────────┘                          │
```

Fig. A.3: Sequence of RECEIVE PRIO 0/1

A.2.2 SEND and RECEIVE Jobs PRIO 2

Fig. A.4: Sequence of SEND PRIO 2, Part 1

(1)   (2)   (3) (4)

A

Request data from PC
(trigger SEND-ALL)

S 2

T 3 ==== Data accepted from PC   T 3 ==== Error in follow-on frame   T 3 ==== Error, last follow-on frame

No action

S 3

Status = disabled
Return data buffers
Terminate connection

S 3.2

Status = end with error
Return data buffers

S 3.3

T 6 ===== Connection terminated

Send data, last frame with EOM

S 4

Re-establish connection

S 6

T 5 ===== Data sent, follow-on frame necessary   T 5 ===== Data sent, last frame   T 5 ===== Conn-ection error

Request follow-on frame from PC (SEND-ALL)

S 5.1

Return data buffers
Status = end, no error

S 5.2

Return data buffers
Status = disabled, establish connection

Fig. A.5: Sequence of SEND PRIO 2, Part 2

```
┌─────────────────────────┐
│Disable RECEIVE-HDB      │
│Establish connection     │
│   ┌──────START───────    │
└───┘                      │
```

T 0 =====   Connection established

```
    ┌────────────────────┐
    │Enable              │
    │RECEIVE-HDB         │
    │   ──────── S  0 ────│
    └────────────────────┘
```

T 1 =====   RECEIVE   T 1 =====   RECEIVE
            triggered   triggered
            without error   with error

```
┌────────────────────┐    ┌─────────────────────────┐
│Prepare buffers     │    │Store error identifier   │
│                    │    │Status = end with        │
│                    │    │error                    │
│   ──── S 1.1 ──────│    │   ──────── S 1.2 ───────│
└────────────────────┘    └─────────────────────────┘
```

────── Buffers free   ────── Buffers occupied

```
                          ┌─────────────────────────┐
                          │Following waiting        │
                          │time, re-attempt to      │
                          │prepare buffers          │
                          │   ──── S 1.3 ───────────│
                          └─────────────────────────┘
```

T 2 =====   Waiting   T 2 =====   Waiting
            time elapsed,   time el.
            buffers are free   buffers
                                   occ.

```
                          ┌─────────────────┐
                          │Status =         │
                          │completed        │
                          │with error       │
                          │   ──── S 2 ─────│
                          └─────────────────┘
```

```
┌─────────────────────┐
│Set to receive       │
│                     │
│   ──────── S 2 ──────│
└─────────────────────┘
```

(1)   (2)   (3)

Fig. A.6: Sequence of RECEIVE PRIO 2, Part 1

A

```
    (1)        (2)                                                (3)
     |          V                                                  V

        T3=====     Receive        T3=====  Connection
                    data                    error
       ┌──────────────────┐      ┌──────────────────────┐
       │                  │      │ Return data buffers  │
       │    No action     │      │ Status = disabled    │
       │                  │      │ Establish connection │
       └──────────────────┘      └────── S 3.2 ─────────┘


       ┌──────────────────┐
       │ PC to receive data│
       │ (RECEIVE-ALL)    │
       │                  │
       └─────── S 4 ──────┘


        T5====  Data received   T5====   All data      T5 ====  Too much
                by PC                     transferred             being
                                                                  sent
       ┌──────────────┐    ┌──────────────────┐    ┌──────────────┐
       │ Set to receive│    │ Status = end with│    │ Set to receive│
       │              │    │ or without error │    │              │
       │              │    │ Return data buffers│   │              │
       └──── S 5.1 ───┘    └───── S 5.2 ──────┘    └──── S 5.3 ───┘


        T6====  Last frame     T6====  Connection    T6 ====  Not
                received               error                  last
                                                              frame
       ┌──────────────┐    ┌──────────────────┐    ┌──────────────┐
       │ Status = end with│ │ Status = disabled│   │ Set to receive│
       │ or without error│ │ Return data buffers│  │              │
       │ Return data buffers│ │ Establish connection│ │            │
       └──── S 6.1 ───┘    └───── S 6.2 ──────┘    └──── S 6.3 ───┘
```

Fig. A.7: Sequence of RECEIVE PRIO 2, Part 2

A.2.3   SEND and RECEIVE Jobs PRIO 3/4

```
┌─────────────────────┐
│ Enable SEND-HDB     │
│                     │
│     ─START─         │
└─────────────────────┘
```

T 0====   SEND   T 0====   SEND triggered
          triggered w/o error   with error

          ─── Connection
Conn.   not established
establ.

```
┌─────────────────┐   ┌──────────────────────┐
│ Establish       │   │ Store error          │
│ connection      │   │ identifier           │
│                 │   │ Status = end with error │
│    S 0.1        │   │      S 0.2           │
└─────────────────┘   └──────────────────────┘
```

T 1====   Connection   T 1====   Establishment
          established   not possible

```
┌─────────────────┐   ┌──────────────────────┐
│ Prepare buffers │   │ Store error          │
│                 │   │ identifier           │
│                 │   │ Status = end with error │
│    S 1.1        │   │      S 1.2           │
└─────────────────┘   └──────────────────────┘
```

          ─── Buffers free   ─── Buffers occupied

```
                              ┌──────────────────┐
                              │ Following waiting │
                              │ time, re-attempt to│
                              │ prepare buffers   │
                              │      S 1.3        │
                              └──────────────────┘
```

                                                      Waiting
          T 2 ==== Waiting time   T 2==== time el.
                    elapsed, buffers   buffers occ.
                    free   ┌──────────────────┐
                                  │ Status =   │
                                  │ completed with   │
                                  │ error   │
                                  │   S 2   │
                                  └──────────────────┘

(1)   (2)   (3)

Fig. A.8: Sequence of SEND PRIO 3/4, Part 1

A

(1)   (2)

Request data from
PC (trigger SÉND-ALL)

S 2

T 3 ==== Data   T 3 ==== Error in   T 3 ==== Error in
transferred by PC   follow-on frame   last follow-
on frame

No action	Status = error Return data buffers	Status = error Return data buffers
S 3	S 3.2	S 3.3

(3)

Send data,
last frame
with EOM

S 4

T 5 ==== Data sent,   T 5 ==== Data sent,   T 5 ==== Conn-
follow-on frame   last frame   ection
necessary   error

Request follow-on frame from PC (SEND-ALL)	Return data buffers Status = end without error	Return data buffers Status = connection error
S 5.1	S 5.2	S 5.3

(3)

PRIO 3 ——— PRIO 4

Terminate or
delete connection

S 5.4

T 6 ==== Connection
terminated

Status = end with
or without error

S 5.4

Fig. A.9: Sequence of SEND PRIO 3/4, Part 2

```
                    ┌──────────────────┐
                    │ Enable           │
                    │ RECEIVE-HDB      │
                    │    ─START─       │
                    └──────────────────┘
```

Fig. A.10: Sequence of RECEIVE PRIO 3/4, Part 1

The flowchart contains the following labelled elements:

- T 0 ==== RECEIVE triggered without error
- T 0 ==== RECEIVE triggered with error
- Conn. establ.
- Connection not established
- Establish connection — S 0.1
- Store error identifier / Status = end with error — S 0.2
- T 1 ==== Connection established
- T 1 ==== Establishment not possible
- Prepare buffers — S 1.1
- Store error identifier / Status = end with error — S 1.2
- Buffers free
- Buffers occupied
- Following waiting time, re-attempt to prepare buffers — S 1.3
- T 2 ==== Waiting time elapsed, buffers free
- T 2 ==== Waiting time el. buffers occ.
- Status = completed with error — S 2
- Set to receive — S 2
- (1)   (2)   (3)

A

Fig. A.11: Sequence of RECEIVE PRIO 3/4, Part 2

A.2.4   WRITE ACTIVE/PASSIVE Jobs

```
┌─────────────────────┐
│ Disable SEND-HDB    │
│ Establish connection│
│     ──START──       │
└─────────────────────┘
              │
   T 0 ====   Connection is
              established

┌─────────────────────┐
│ Prepare data        │
│ buffers             │
│     ── S 0 ──       │
└─────────────────────┘
              │
       ── Buffers free        ── Buffers occupied
                              ┌─────────────────────┐
                              │ Indicate error      │
                              │ Disable SEND-HDB    │
                              │    ── S 0.3 ──      │
                              └─────────────────────┘
┌─────────────────────┐
│ Enable SEND-HDB     │
│                     │
│    ── S 0.2 ──      │
└─────────────────────┘

   T 1 ====  WRITE (SEND)      T 1 ====  WRITE (SEND)
             triggered                   triggered
             without error               with error
   ┌──────────────────┐       ┌──────────────────┐
   │ Request data     │       │ Status = end     │
   │ from PC          │       │ with error       │
   │ (SEND-ALL)       │       │                  │
   │  ── S 1.1 ──     │       │   ── S 1.2 ──    │
   └──────────────────┘       └──────────────────┘

   (1)         (2)                              (5)   (3)
```

Fig. A.12: Sequence of WRITE ACTIVE, Part 1

(1)   (2)   (3)   **A**

```
        ┌─────────────────────────────────────────────────────────────────────┐
        │  V                                                                     │
   ┌────┼──┬──────────────┬──────────┬──────────────┬──────────┬──────────────┐
   │ T2 ═══ Data re-       T2 ════   Error in        T2 ════   Error in         │
   │        ceived from PC            transfer of               transfer of      │
   │                                  1st frame                 f.-on frame      │
   │  ┌──────────────┐    ┌──────────────────┐    ┌──────────────────────┐      │
   │  │              │    │ Status = end     │    │ Status = disabled     │      │
   │  │  No action   │    │ with error       │    │ Return data buffers   │      │
   │  │              │    │                  │    │ Terminate conn.       │      │
   │  └─── S 2.1 ────┘    └──── S 2.2 ───────┘    └──── S 2.3 ────────────┘      │
   │         │                    │                         │                     │
   │         │                    │                         ├──────── (4)         │
   │         │                    ▼                 T 6 ════ Connection           │
   │         │                   (5)                         terminated           │
   │  ┌──────────────┐                            ┌──────────────────────┐       │
   │  │ Send data, 1st│                           │ Re-establish          │       │
   │  │ frame with destin-│                       │ connection            │       │
   │  │ ation parameters│                         │                       │       │
   │  └──── S 3 ──────┘                           └──── S 6 ──────────────┘       │
   │         │                                             │                      │
   ┌─────────┼─────────────┬──────────┬──────────────┬─────┼────────────────┐   │
   │ T 4 ════ Data sent,    T 4 ════  Data sent,     T 4 ════ Conn-          │   │
   │         follow-on frame           last frame             ection         │   │
   │         necessary                                        error          │   │
   │  ┌──────────────┐    ┌──────────────────┐    ┌──────────────────────┐  │   │
   │  │ Request follow-on│ │ Set to receive the│   │ Return data buffers   │  │   │
   │  │ frame from PC │    │ WRITE acknow-    │    │ Status = disabled     │  │   │
   │  │ (SEND-ALL)   │    │ ledgement PDU    │    │ Establish connection  │  │   │
   │  └──── S 4.1 ───┘    └──── S 4.2 ───────┘    └──── S 4.3 ────────────┘  │   │
   │         │                    │                         │                │   │
   ┌─────────┼─────────────┬──────────┬──────────────┬─────┼────────────────┐  │
   │ T 5 ════ WRITE         T 5 ════  Wrong PDU      T 1 ════ Conn-          │  │
   │         acknowlegement           received                ection         │  │
   │         PDU received                                     error          │  │
   │  ┌──────────────┐    ┌──────────────────┐    ┌──────────────────────┐  │  │
   │  │ Status = end  │    │ Status = error   │    │ Status = disabled     │  │  │
   │  │ with or without│   │ Return data buffers│  │ Return data buffers   │  │  │
   │  │ error        │    │ Terminate conn.  │    │ Establish conn.       │  │  │
   │  └──── S 5.1 ───┘    └──── S 5.2 ───────┘    └──── S 5.3 ────────────┘  │  │
            │                    │                         │
            │                    ▼                         │
                               (4)
```
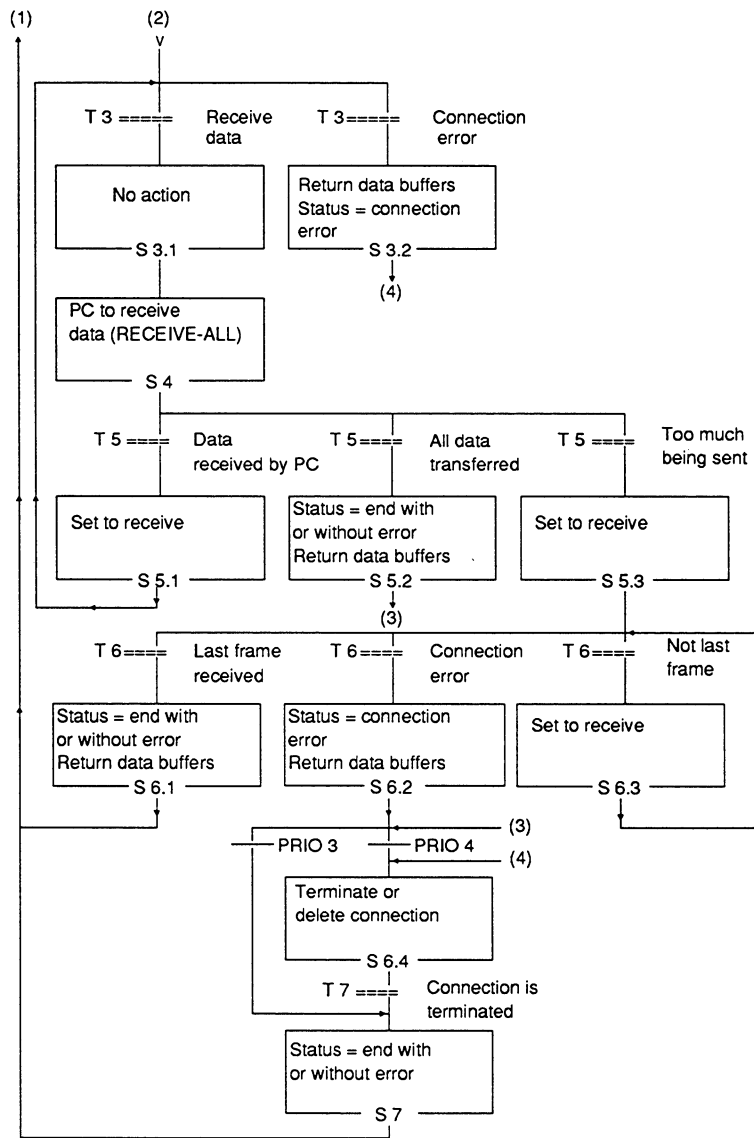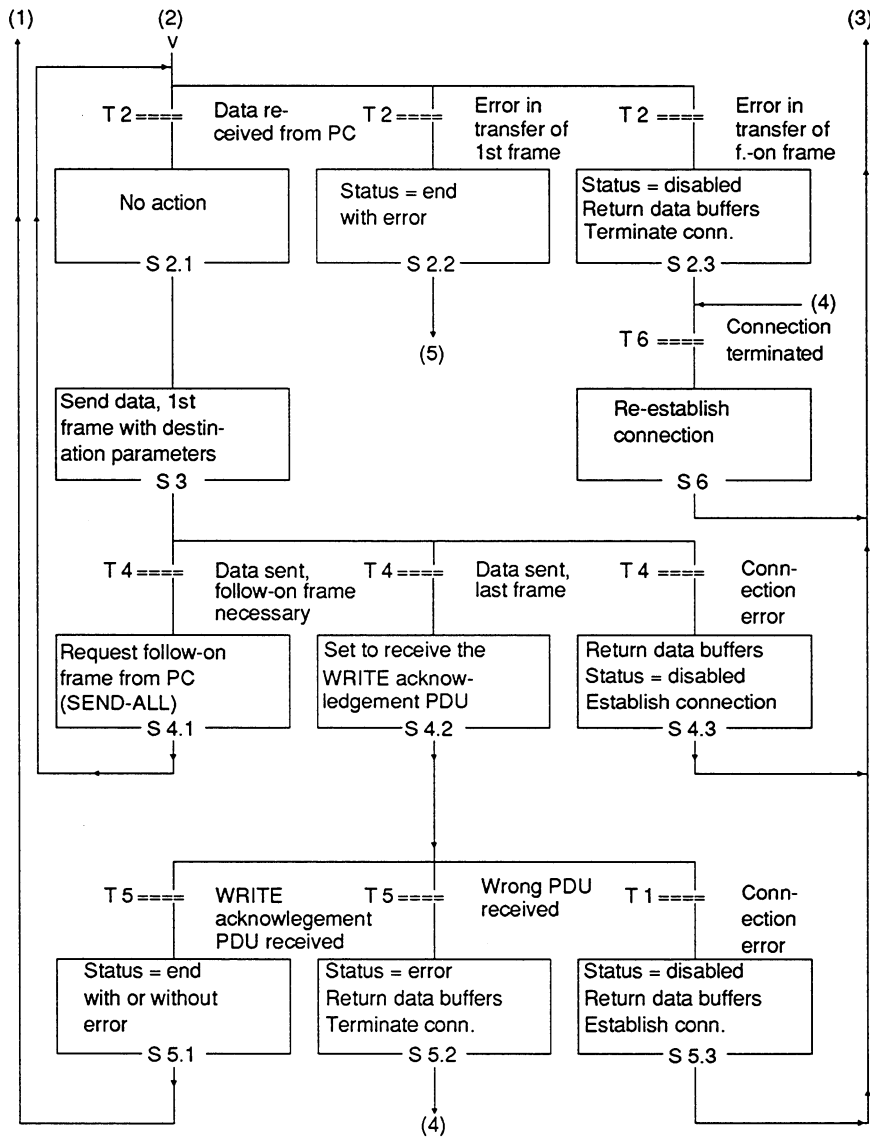
Fig. A.13: Sequence of WRITE ACTIVE, Part 2
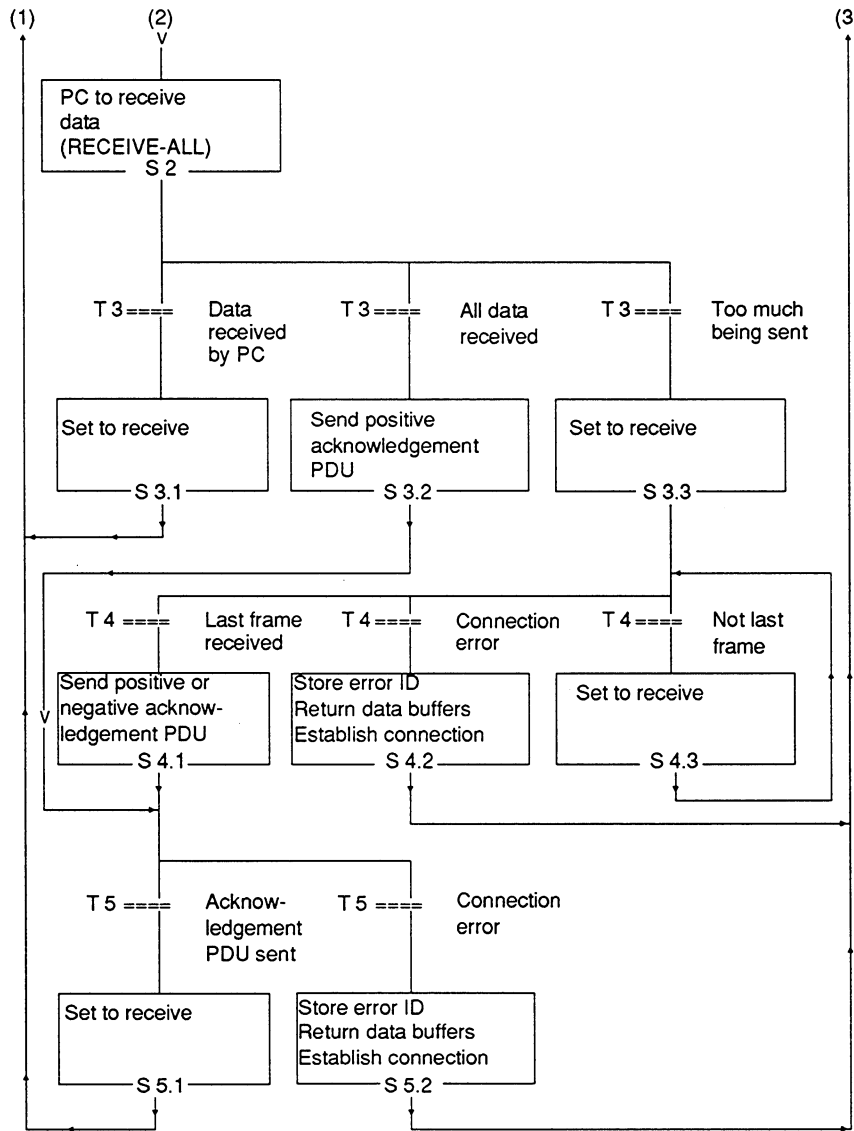
Fig. A.14: Sequence of WRITE PASSIVE, Part 1

The flowchart contains the following elements:

- Establish connection / START
- T 0 ==== Connection is established
  - Buffers free
  - Buffers occupied
    - Indicate error in status — S 0.2
- Set to receive — S 0.1
- T 1 ==== Receive data
  - No action — S 1.1
- T 1 ==== Connection error
  - Return data buffers / Status = disabled / Terminate connec. — S 1.2
- T 1 ==== Incorrect PDU received
  - Store error ID / Return data buffers / Terminate connec. — S 1.3
- T 6 ==== Connection terminated
  - Re-establish connection — S 6
- (1)   (2)   (3)

A

(1)   (2)   (3)

PC to receive data (RECEIVE-ALL) — S 2 —

T 3 ==== Data received by PC   T 3 ==== All data received   T 3 ==== Too much being sent

Set to receive — S 3.1 —   **Send positive acknowledgement PDU — S 3.2 —**   **Set to receive — S 3.3 —**

T 4 ==== Last frame received   T 4 ==== Connection error   T 4 ==== Not last frame

Send positive or negative acknowledgement PDU — S 4.1 —   **Store error ID / Return data buffers / Establish connection — S 4.2 —**   **Set to receive — S 4.3 —**

T 5 ==== Acknowledgement PDU sent   T 5 ==== Connection error

Set to receive — S 5.1 —   **Store error ID / Return data buffers / Establish connection — S 5.2 —**

Fig. A.15: Sequence of WRITE PASSIVE, Part 2

A.2.5   READ ACTIVE/PASSIVE Jobs

Fig. A.16: Sequence of READ ACTIVE, Part 1

A

(1)   (2)   (3)(4)

T 3 ==== Receive data   T 3 ==== Connection error   T 3 ==== Negative ack. received

| No action |
| S 3.1 |

| Return data buffers Status = disabled Establish conn. |
| S 3.2 |

| Status = end with "remote" error |
| S 3.3 |

| PC to receive data (RECEIVE-ALL) |
| S 4 |

T 5 ==== Data re-ceived by PC   T 5 ==== All data transferred   T 5 ==== Too much being sent

| Set to receive |
| S 5.1 |

| Status = end with or without error |
| S 5.2 |

| Set to receive |
| S 5.3 |

T 6 ==== Last frame received   T 6 ==== Connection error   T 6 ==== Not last frame

| Status = end with or without error |
| S 6.1 |

| Status = disabled Return data buffers Establish conn. |
| S 6.2 |

| Set to receive |
| S 6.3 |

Fig. A.17: Sequence of READ ACTIVE Part 2
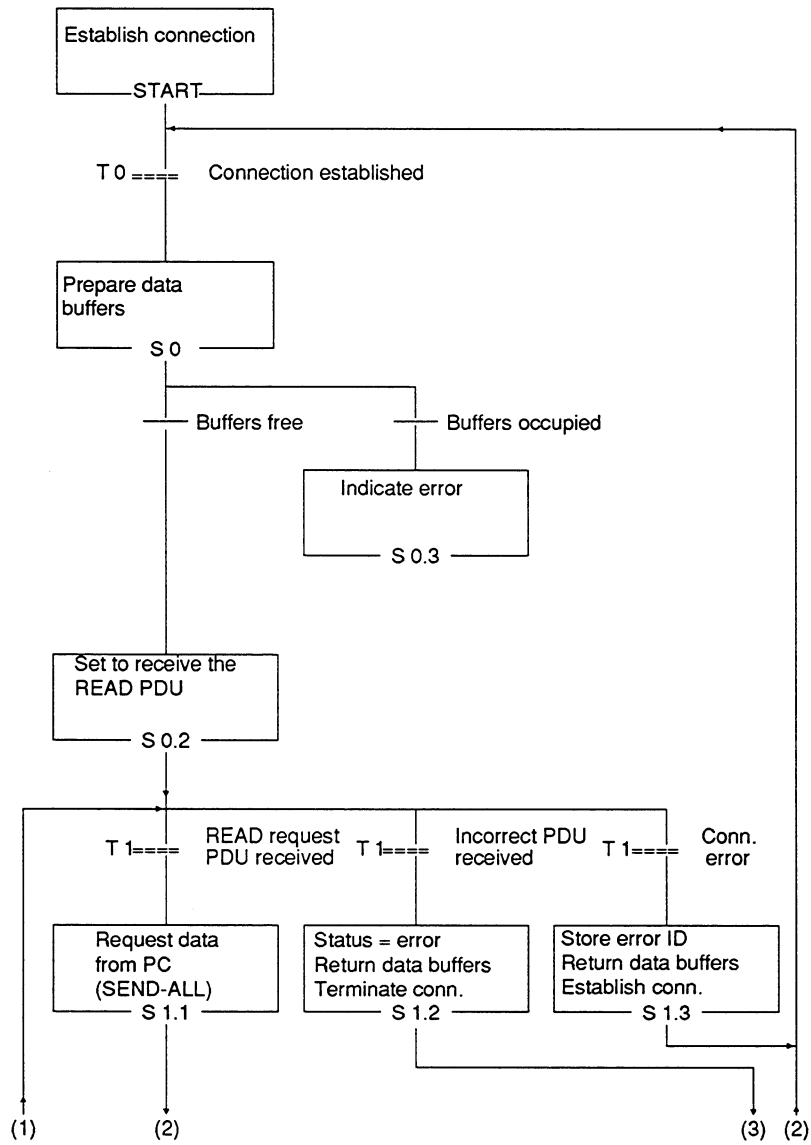
Fig. A.18: Sequence of READ PASSIVE, Part 1

A
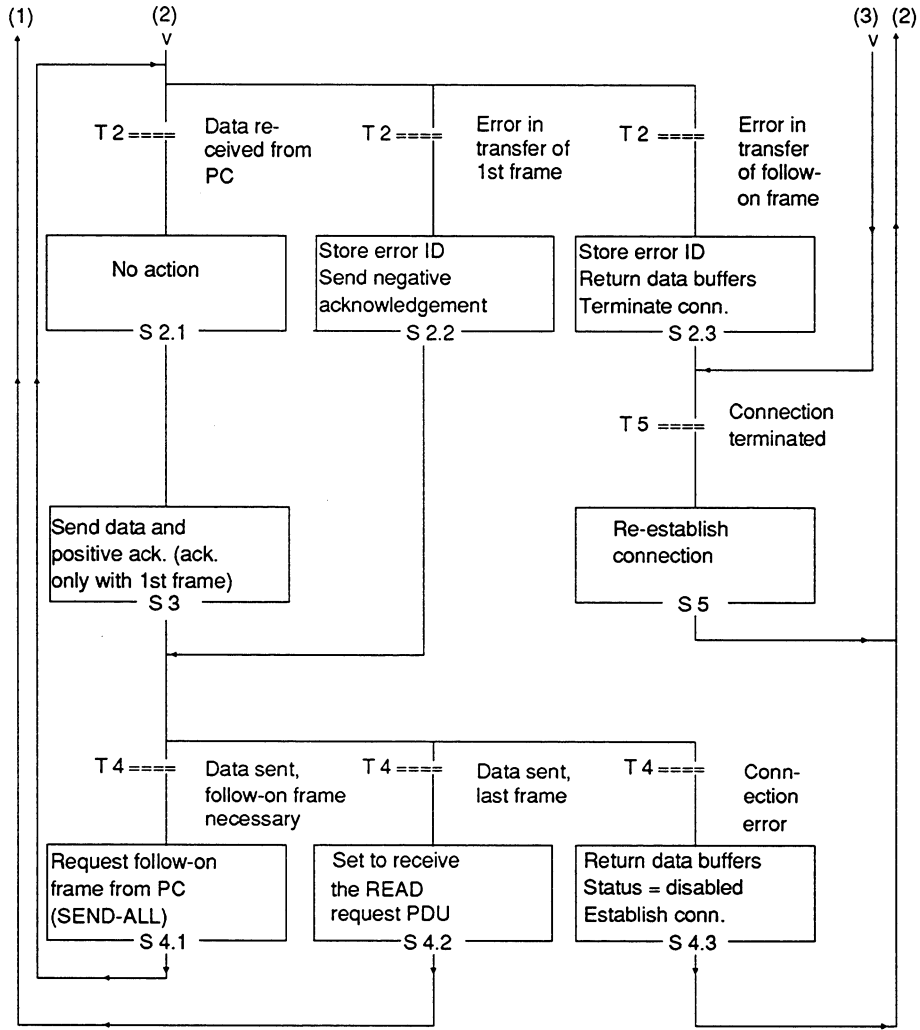
Fig. A.19: Sequence of READ PASSIVE, Part 2

A.3   Chronological Sequence of the Jobs

The following diagrams show the chronological sequences of

SEND/RECEIVE PRIO 0/1

SEND/RECEIVE PRIO 2

SEND/RECEIVE PRIO 3

SEND/RECEIVE PRIO 4

WRITE ACTIVE/PASSIVE

READ ACTIVE/PASSIVE

The terms and abbreviations used in the diagrams are explained below:

PLC1, PLC2	= programmable controller 1 or 2
CP1, CP2	= communications processor CP 143 1 or 2
INA	= part of the CP 143 operating system which processes the protocols on the bus system (transport protocol according to ISO IS 8073)
Cable	= PDUs on SINEC H1
OPEN	= opening a connection
CONNEC. REQUEST	= request to establish a connection
CONNEC. AWAIT	= wait for connection establishment
CONNEC. CONFIRM	= confirm connection establishment
CLOSE	= initiate termination of connection
DISCON. REQUEST	= request termination of connection
DISCON. CONFIRM	= confirm termination of connection
RETURN	= reply to request
CREDIT = 0	= connection not enabled for transmission
CREDIT = 1	= connection enabled for transmission of one frame
SEND DIR	= SEND-HDB in the "direct" mode (A-NR<> 0)

SEND ALL   = SEND-HDB in "ALL" mode
                              (A-NR = 0)
RECEIVE DIR   = RECEIVE-HDB in the "direct" mode
RECEIVE ALL   = RECEIVE-HDB in the "ALL" mode
SEND   = send data
RECEIVE   = set to receive (make receive buffers available)

A
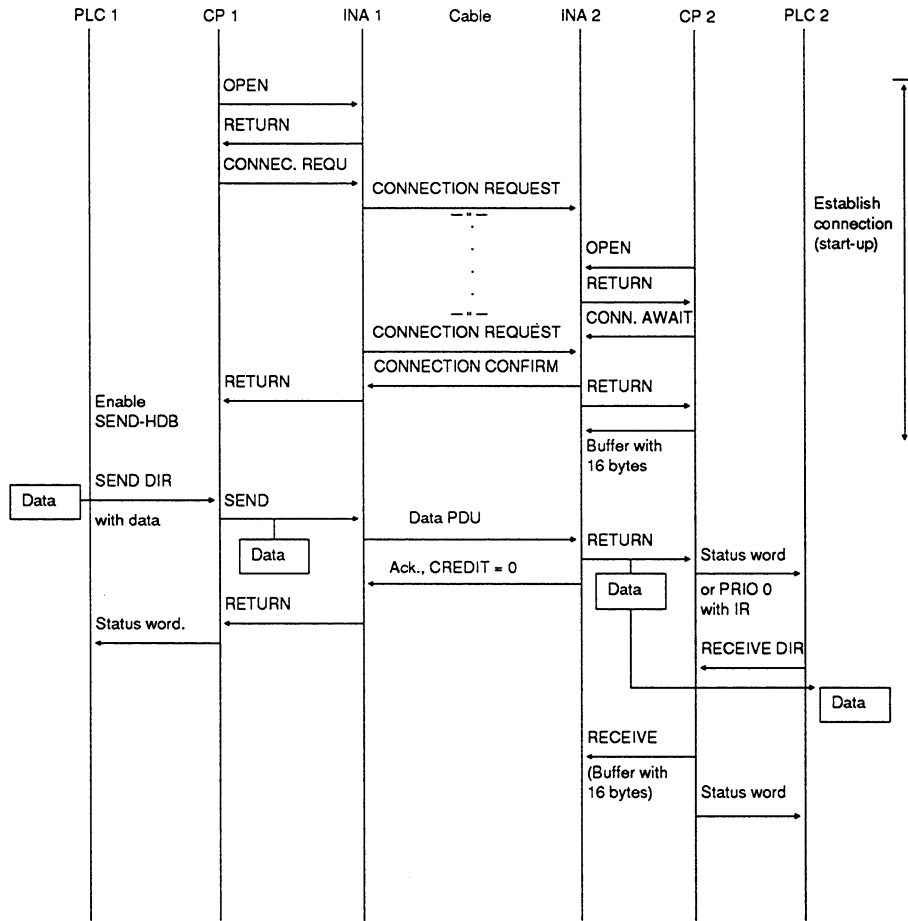
*   If no receive buffer can be prepared quickly enough at the receiver
    end, the data frame is repeated after the re-transmission time has
    elapsed

Fig. A.20: Chronological Sequence of SEND/RECEIVE PRIO 0/1
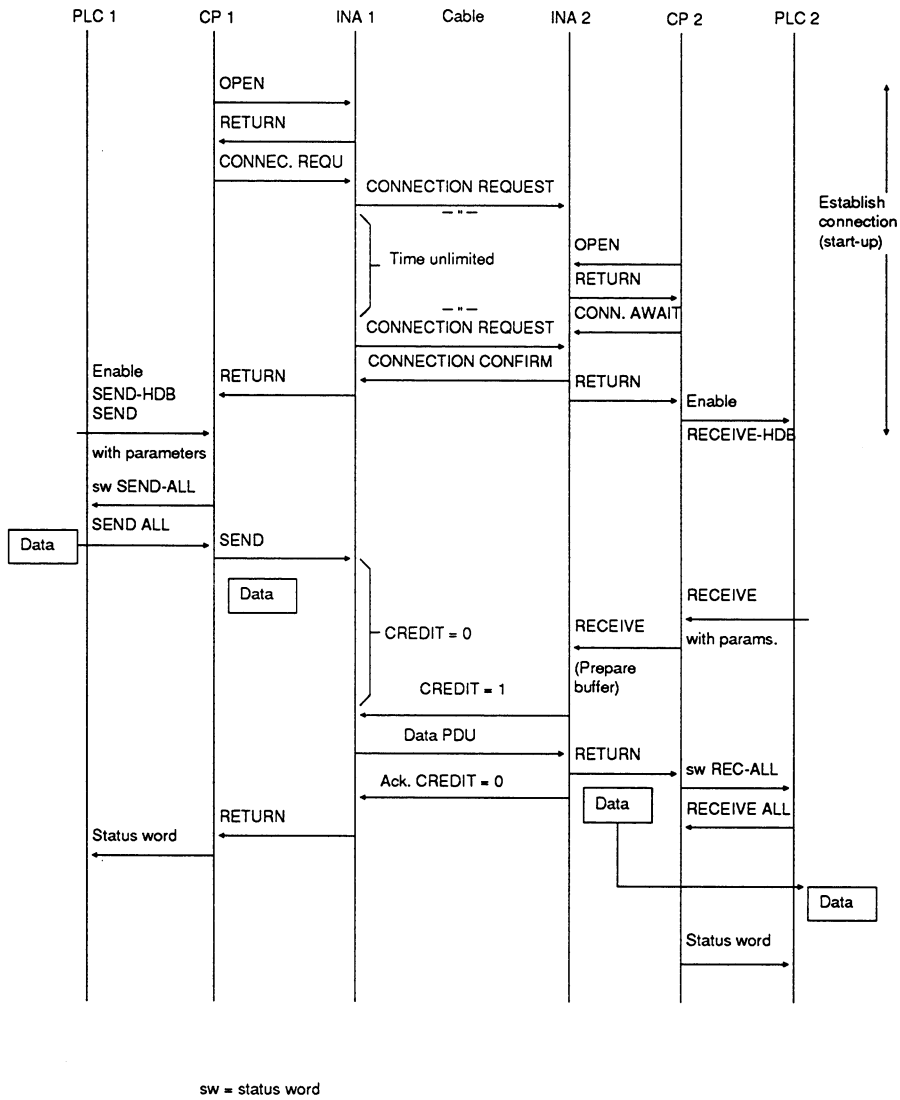
sw = status word

Fig. A.21: Chronological Sequence of SEND/RECEIVE PRIO 2

Connection termination can also be triggered by the passive side using the RESET-HDB
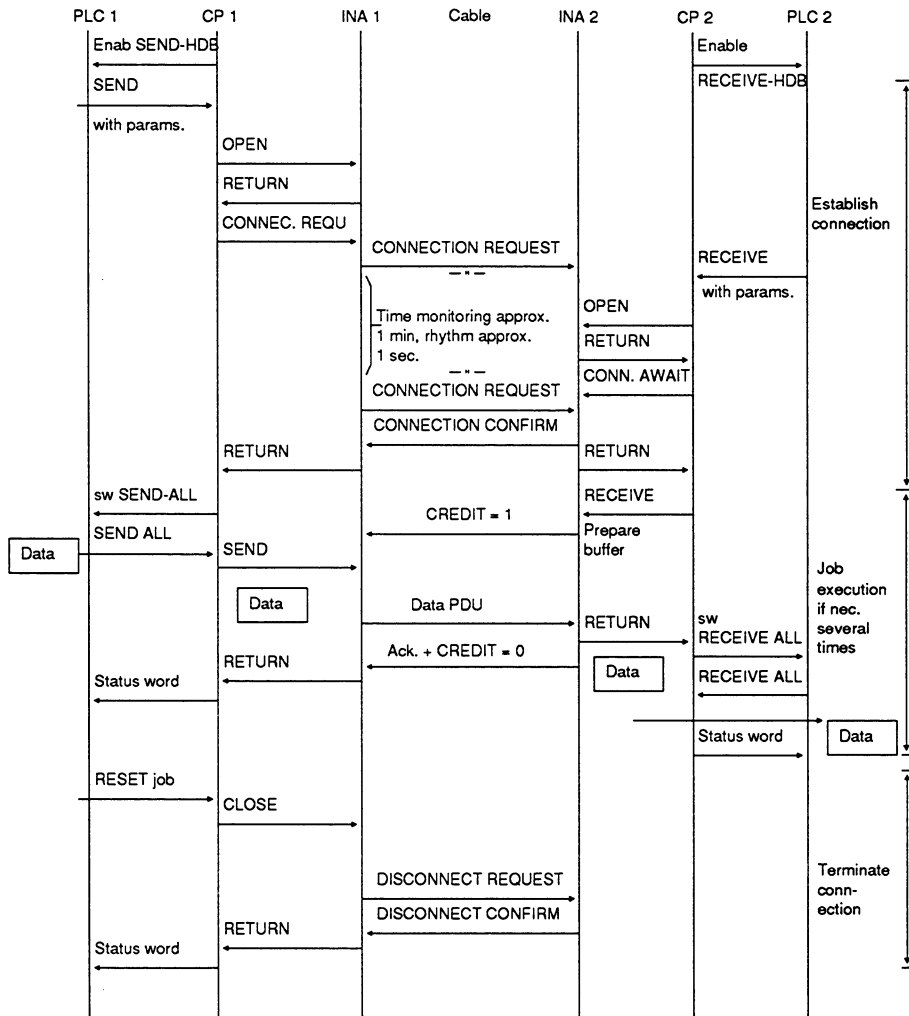
sw = status word

Fig. A.22: Chronological Sequence of SEND/RECEIVE PRIO 3
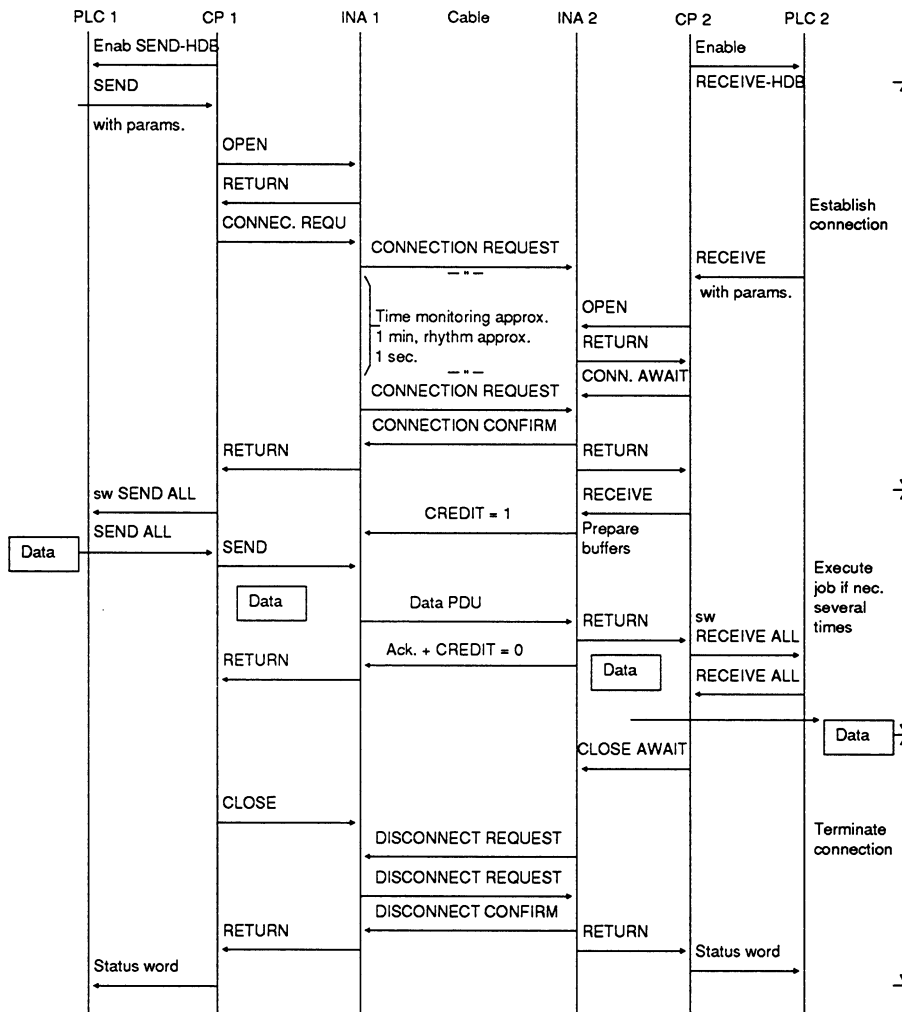
sw = status word

Fig. A.23: Chronological Sequence of SEND/RECEIVE PRIO 4

PLC 1   CP 1   INA 1   Cable   INA 2   CP 2   PLC 2

OPEN

RETURN

CONNEC. REQU

CONNECTION REQUEST

Establish connection (start-up)

— " —

OPEN

Time unlimited
Rhythm approx.
1 sec. — " —

RETURN

CONN. AWAIT

CONNECTION REQUEST

CONNECTION CONFIRM

Enable
SEND-HDB
SEND

RETURN

RETURN

WRITE function

status

with source and dest. params.

sw SEND-ALL

SEND ALL

Data

SEND

Data

RECEIVE

(Prepare buffer)

Data transfer

Credit = 1

Data PDU
with dest. parameters

Ack. Credit = 0

RETURN

RETURN

sw REC ALL

RECEIVE

Data

RECEIVE ALL

Data

Credit = 1

logical ack.

SEND

Transport ack., Credit=0

RETURN

RETURN

Status word

V
I
A

V

sw = status word

Fig. A.24: Chronological Sequence of WRITE-ACTIVE/PASSIVE

A
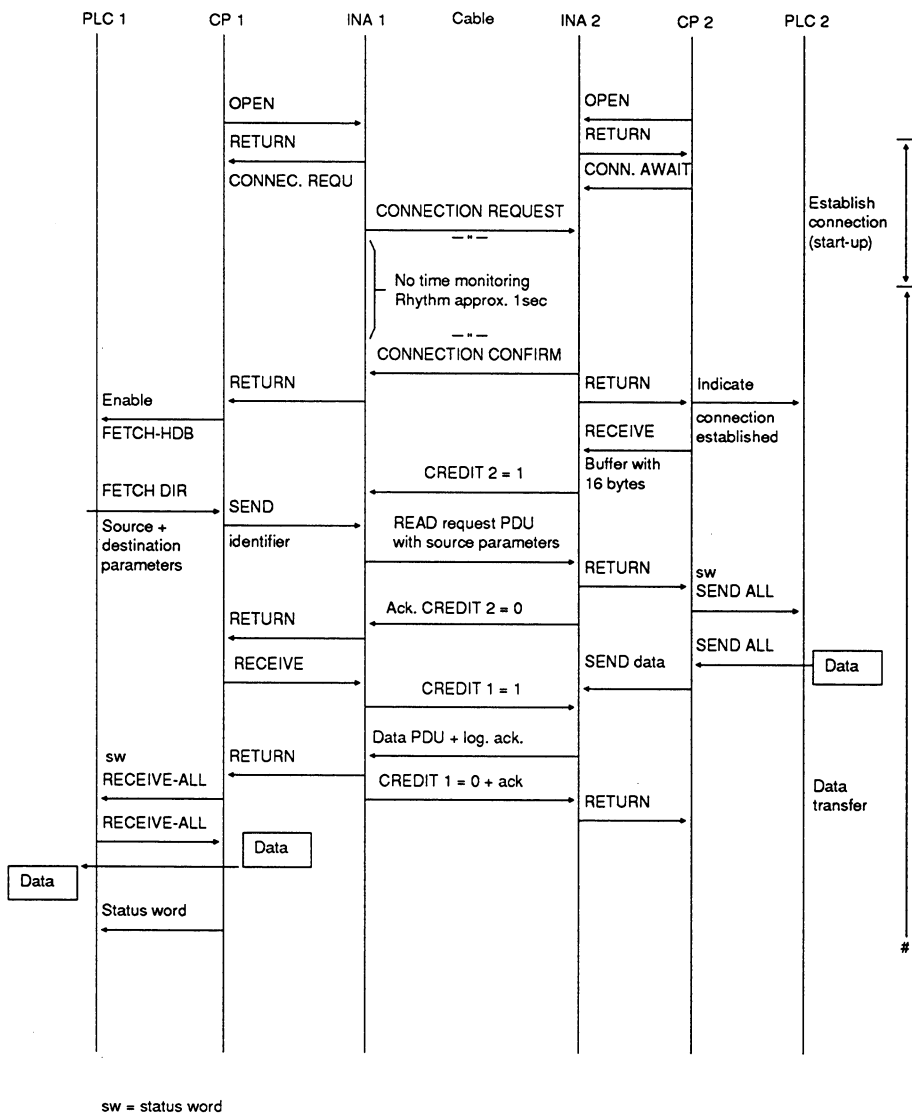
Fig. A.25: Chronological Sequence of READ-ACTIVE/PASSIVE

sw = status word

Notes

B   Status Word ANZW and Parameter Assignment Error Byte PAFE

B

Overview

The HDB interface to the CP 143 supplies status and error bits.

➤ using the status word ANZW (information about job processing)

➤ using the parameter assignment byte PAFE (to indicate that incorrect parameters were assigned to a job)

➤ via the test function "Status of a connection", "Status/ Trace of all connections" and "Overview of all connections" to the PG.

B.1   Meaning and structure of the ANZW

Output in hex format

While the error and status condition code is partially explained by text in COM 143, the S5 user only receives error information in hexadecimal format. Since the information displayed by COM 143 is described in detail in the test functions in the Section "Using the Transport Interface", only the codes in the status word are explained here.

Handling the ANZW

The status word is the reaction to a particular job. The structure of the S5 program must be selected so that a status word exists for each job defined on a CP 143.

The status word must be evaluated immediately after the handling block has been processed.

Structure of the ANZW
The status word has the following structure:

	15			0
1st word	Free	Error management	Data management	Status management
2nd word	**Length word**			
3rdword	**TF error (ERRCLS/ERRCOD)**			

The third word (TF error) is only valid for STF jobs (see Volume 2).

Meaning of the length word
In the length word, the handling blocks (SEND, RECEIVE) write the data already transferred for the corresponding job (with receive jobs the data already received, with send jobs the data already sent).

Explanation
The following sections explain how use the status bits. You will see how the bits are set, how they are reset and which evaluation is possible. The status word must be considered bit by bit. The bit assignment was explained in the description of the nibbles.

Special feature of READ/WRITE PASSIVE jobs
READ and WRITE PASSIVE jobs cannot be started by the handling blocks. Nevertheless, the status memory location of the READ or WRITE job can be read with the control block. If a status word is specified in the data link block of the CP 143 for these functions, the SEND or RECEIVE-ALL block can process the length word and the data nibble in the status word. The error ID is always "E" (boot job) and the job status is "A". Apart from RESET, the CP 143 accepts no more triggers for READ/WRITE jobs at the PASSIVE end.

B.2   Content of the Status Word

The status word itself (first word in the diagram on page B-2) is divided into four nibbles as follows:

➤ Nibble 1, bits 0 to 3, status bits of the job:
This indicates in code form whether a job has been started, whether errors have occurred, or whether the job is disabled, e.g. because the virtual circuit is not established. The COM 143 status display provides more precise information about the status of a job. Here, intermediate statuses such as "waiting for frame" or "connection establishment active" are indicated.

➤ Nibble 2, bits 4 to 7, data management of the job:
This indicates whether the data transfer for the job is still active, or whether the data transfer or data acceptance is already completed. With the "enable/disable" bit, the data transfer for the job can be blocked (disable = 1; enable = 0). The data management nibble is not displayed by COM 143.

➤ Nibble 3, bits 8 to 11, error bits of the job:
This indicates the error bits of the job. These error bits are only valid when the bit "job completed with error" is set at the same time in the status nibble. The error numbers indicated here appear in the same form in COM 143 as transport errors, however, in plain language.

➤ Nibble 4, bit 12 to 15
These bits are reserved for expansions.

B

Meaning of the bits in the status word

a) Bit 0: handshake useful

Set: By the handling blocks dependent on the "delete" bit in the
               job status. Handshake useful (=1) is used with the
               RECEIVE block.
               (Frame exists in PRIO 0/1 or receive trigger possible in
               PRIO 2/3/4.)

Evaluated: By the RECEIVE block; the RECEIVE block only starts the
               handshake with the CP when this bit is set.
               By the application for RECEIVE queries (query whether
               frame exists in PRIO 0/1).

b) Bit 1: Job active

Set: By the handling blocks when a job is allocated to the CP.

Cleared: By the handling blocks when a job has been processed by
               the CP (e.g. acknowledgement received).

Evaluated: By the handling blocks. A new job is only issued when the
               "old" job has been processed.

               By the application. To find out whether a new job can be
               triggered.

c) Bit 2: job completed without error

Set: By the handling blocks when a job was completed without
               errors.

Cleared: By the handling blocks when the job is triggered again.

Evaluated: By the application to check whether the job was completed
               without errors.

---

d) Bit 3: job completed with error

Set: By the handling blocks when the job was completed with
                errors. The cause of the error is then encoded in the high
                byte of the status word.

Cleared: By the handling blocks when the job is triggered again.

Evaluated: By the user to check whether the job was completed with
                errors. If the identifier "job completed with error" is set, the
                cause of the error is written to the high byte of the status
                word.

e) Bit 4: Data acceptance/data transfer active

Set: By the handling blocks SEND and RECEIVE when the
                transfer or acceptance of data for a job has begun, e.g.
                when data are being transferred via the ALL function
                (instead of DMA) although the job was triggered with SEND
                DIRECT.

Cleared: By the handling blocks SEND and RECEIVE when the data
                exchange for a job is complete (last frame transferred).

Evaluated: By the user: During the data transfer CP-PLC, the user
                must not change the data record of a job. In PRIO 0/1 jobs,
                this is of no great importance, since the data exchange can
                be completed by a single handling block call. Larger
                amounts of data can, however, only be transferred in data
                units and the fragmentation of the total data is distributed
                over several PLC cycles. To ensure the consistency of the
                data, the user must first check whether the data unit has
                just been transferred before changing the data of a job.

f) Bit 5: data transfer completed

Set: By the SEND handling block, when the data transfer for a
                    job is completed.

Cleared: By the SEND handling block when the transfer of data is
                    begun for a new job (data transfer for new job triggered).

                    By the user, following evaluation (signal edge).

Evaluated: By the user: With this bit, the user can determine whether
                    the data record for a job has already been transferred to the
                    CP or when a new data record for a currently active job can
                    be prepared (e.g. cyclic transfer).

g) Bit 6: data acceptance complete

Set: By the RECEIVE handling block when the acceptance of
                    data for a job has been completed.

Cleared: By the RECEIVE handling block, when the transfer of data
                    to the PLC for a new job has begun. By the user following
                    evaluation (signal edge).

Evaluated: With this bit, the user can determine whether the data
                    record of a job has already been transferred to the PLC or
                    when a new data record for a currently active job was
                    transferred to the PLC..

h) Bit 7: Disable/enable data field

Set: By the user to prevent an area being written to by the
                    RECEIVE block or an area being read from by the SEND
                    block (only with 1st data field).

Cleared: By the user to release the data area.

Evaluated: By the SEND and RECEIVE handling blocks. If bit 7 is set,
                    the blocks do not exchange data but signal the error to the
                    CP.

---

i) Bits 8 to 11: error byte

> If the CP signals an error identifier for a job in the job status, the handling blocks enter this identifier in the high byte of the status word.

B

Length word

Written: By the SEND and RECEIVE blocks during the data exchange. The length word is calculated from the following: number of data currently being transmitted + number of data already transmitted.

Cleared: Overwritten by each new SEND, RECEIVE, FETCH.

When the "job completed without error" or "data transfer/acceptance completed" bit is set, the current source or destination length is indicated in the length word.

When the "job completed with error" bit is set, the length word contains the number of data transferred before the error.

Important Status and Error Messages of the CP 143

Explanation
The important status and error messages which can occur in the status word are listed below. These messages are coded in hexadecimal patterns in the same way as they can be monitored in the PC using the status/force var test function of the PG 685. The character X stands for "not defined" or for "irrelevant"; No. is the error number.

Possible status words

Status word: X F X A

The error identifier "F" indicates that the corresponding job is not defined on the CP 143. The status identifier A disables the job (for SEND/FETCH and RECEIVE).

Status word: X A X A

The error identifier "A" indicates that the connection for the communication job has not or has not yet been established. The status identifier "A" disables SEND, RECEIVE and FETCH.

Status word: X 0 X 8

The connection has been re-established (e.g. following a CP cold restart) SEND is enabled (SEND communication job).

Status word: X 0 X 9

The connection has been re-established, RECEIVE is enabled (RECEIVE communication job).

Status word: X 0 2 4

SEND was processed without error, the data has been transferred.

Status word: X 0 4 5

RECEIVE was processed without error, the data has arrived at the PC.

Status word   X   0   X   2

SEND, RECEIVE, READ or WRITE job is active. With SEND, the partner has not yet set itself to RECEIVE. With RECEIVE, the partner has not yet issued a SEND. The CP 143 does not monitor the times of SEND, RECEIVE, READ or WRITE jobs.

The following table lists the most important statuses in the status word for the various job types.

1. Codes for SEND

Status	PRIO 0+1	PRIO 2	PRIO 3+4
after cold restart	0 A 0 A	0 A 0 A	0 0 0 8
after connection established	X 0 X 8	X 0 0 8	------
after trigger	X 0 X 2	X 0 X 2	X 0 X 2
complete without error	X 0 2 4	X 0 2 4	X 0 2 4
complete with error	X no.X 8	X no.X 8	X no.X 8
after RESET	X D X A	X D X A	X D X 8

2. For RECEIVE

Status	PRIO 0+1	PRIO 2	PRIO 3+4
after cold restart	0 A 0 A	0 A 0 A	0 0 0 1
after connection established	X 0 X 4	X 0 0 9	------
after trigger	X 0 X 4	X 0 X 2	X 0 X 2
frame there	X 0 X 1	------	------
complete without error	X 0 4 4	X 0 4 5	X 0 4 5
complete with error	X no.X 8	X no.X 9	X no.X 9
after RESET	X D X A	X D X A	X D X 9

3. For READ/WRITE-ACTIVE

Status	PRIO 0+1	PRIO 2	PRIO 3+4
after cold restart		0 A 0 A	
after connection established		X 0 0 8	
after trigger		X 0 X 2	
READ complete		X 0 4 4	
WRITE complete		X 0 2 4	
complete with error		X no.X 8	
after RESET		X D X A	

ANZW with HDB identifier "NN" (not source/destination parameter transfer)

4. For SEND

Status	PRIO 0+1	PRIO 2	PRIO 3+4
complete no error	x004	x004	x004

5. For RECEIVE

Status	PRIO 0+1	PRIO 2	PRIO 3+4
complete no error	x004	x005	x005

Table 6.5 Important Statuses in the Status Word

☞ **The status and error codes described here are only valid when using the layer 4 interface (SEND, RECEIVE, FETCH jobs). If the STF interface is used, the status and error codes must be evaluated as described in Volume 2. Remember to reserve three words for the status word. For more detailed information, refer to Volume 2**

The following codes can occur in nibble 3:

0: no error
   If the bit "job completed with error" is nevertheless set, this indicates that the CP
   143 has set up a connection following a cold restart or RESET.

1: Incorrect Q/ZTYP in handling block
   When the job was triggered, the handling block had an invalid TYPE identifier
   assigned to it.

   Remedy:
   Supply blocks with the type IDs intended for the PLC.

2: Area does not exist in PLC
   When the job was triggered, a DB (DBNR) was specified which did not exist in
   the PLC at the time of the data transfer.

   Remedy:
   Enter the DB in the PLC or assign the correct DB number.

3: Area in PLC too small
   The sum of Q/ZANF and Q/ZLAE exceeds the limits of the area. With data
   blocks, the limits of the area are the size of the block, with flags, timers, counters
   etc. the size of the area depends on the particular PLC.
   (Flags = 256 bytes, counters, timers = 256 words etc.). With the Z/QTYP AS
   "absolute storage address" no check is performed.

   Remedy:
   Lengthen the data block or match the Q/ZANF and Q/ZLAE to the area.

4: Timeout on the PLC
   The source or destination parameters specify an area in the PLC which is either
   not equipped with memory or where the memory is defect. The TO error (ti-
   meout) can only occur with Q/ZTYP AS (absolute storage), PB (peripheral area),
   OB (extended peripheral area) or with memory faults..

   Remedy:
   Correct the source/destination parameters or replace the memory module.

5: Status word error
   The assigned status word (ANZW) cannot be processed. This error can occur if
   a "data word" or "data double word" was defined with ANZW and does not exist
   or no longer exists in the specified data block (DB too short) or the specified
   data block does not exist.
   Remedy:
   Use a different ANZW or enter/lengthen the DB.

Bits in Nibble 3 (continued)

6: No valid ORG format
The data destination/data source for a job is specified neither in the handling block (Q/ZTYP = "NN") nor in the data length block.

Remedy: Supply the destination/source description in the data link block or in the PLC.

7: No free data buffer
In PRIO 2/3/4, the CP 143 operates with a "dynamic" data buffer. If, during operation, the data buffer capacity is exhausted (48 data buffers each with 128 bytes) the CP signals "buffer overflow".

Remedy: Start the job again, with READ/WRITE jobs using RESET.

8: No free transport connections
Exceeding the maximum transport connection capacity (e.g. by starting too many PRIO 3/4 jobs) leads to this error.

Remedy: Terminate connections which are not being used (ideally PRIO 3) with RESET or select more PRIO 3/4 jobs).

9: Remote error
on a transport connection (layer 4):
An error has occurred in the communication partner during a READ/WRITE job.
on an application association:
An error has occurred in an TF job
The TF error number is coded in the third word (see Volume 2 "Sequence on the client interface)

Remedy: Identify and correct the error in the communication partner.

A: Connection error
The connection for the job is not or not yet established or could not be established. With PRIO 0/1/2 jobs, the CP attempts to establish the connection indefinitely; with PRIO 3+4 jobs, the establishment phase is monitored and restricted to approximately 60 sec.

Remedy:
With PRIO 0/1/2 connections, the error status disappears automatically once the connection is established. This occurs only on condition that the communication partner has recognized the interruption and also attempts to establish the connection (if necessary, try a cold restart). If all the CP connections are interrupted, this is probably caused by a fault on the module or on the bus cable. It is also possible that the parameters assigned to the data link blocks do not match up. (Local address incorrect or the parameters "from local PLC" or "to remote PLC" do not make a feasible combination.)

B: Handshake error
   Either the data field is too long in PRIO 0/1 or a system error has occurred.

   Remedy: Reduce the length of the data field (PRIO 0/1).

C: Trigger error
   An incorrect HDB type was used to trigger the job or the data unit transferred
   with PRIO 0 and 1 jobs was too long (PRIO 0/1 maximum 16 bytes)

   Remedy: Use the correct HDB type
   * SEND job   - SEND handling block
   * RECEIVE job   - RECEIVE handling block
   * WRITE ACTIVE   - SEND-HDB with QTYP="RW"
   * READ ACTIVE   - FETCH-HDB with ZTYP="RW"

D: Termination after RESET
   This is in fact a status message rather than an error message. In PRIO 0/1/2, the
   connection is interrupted and established again as soon as the communication
   partner is ready (in the meantime, the jobs are disabled). In PRIO 3/4, the con-
   nection is terminated, it is possible to trigger a re-establishment phase.

   Remedy:
   As soon as the connection is re-established, the status message disappears.

E: Job with boot function
   This is also a status message rather than an error message. The job is a
   READ/WRITE PASSIVE and cannot be started from the PLC.

F: Job does not exist
   The specified job is not defined on the CP 143.

   Remedy:
   Enter the data link block or use a correct SSNR/A-NR combination in the hand-
   ling block.

Nibble 4, bits 12 to 15
This bits are reserved for expansions.

B.3   The Parameter Assignment Byte PAFE

PAFE is set when the handling block recognizes a parameter assignment error.

```
Bit    7                              0
      ┌──┬──┬──┬──┬──┬──┬──┬──┐
      │  │  │  │  │  │  │  │  │
      └──┴──┴──┴──┴──┴──┴──┴──┘
        ↑   ↑   ↑   ↑
        └───┴───┴───┘
          Error number
```
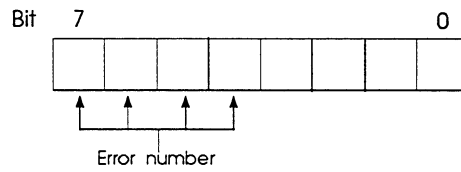
Meaning of the bits:

Bit 0	0 = no error
	1 = error
Bit 1..3	not used
Bit 4..7	output of the error number:

0	no error
1	wrong ORG format
2	area does not exist (DB)
3	area too small
4	QVZ error (timeout)
5	wrong status word
6	no source/destination parameter SEND / •RECEIVE-ALL
7	interface does not exist
8	interface not ready
9	interface overload
A	free
B	illegal job number ANR
C	interface not acknowledged or not enabled
D	not used
E	not used
F	not used
❏	

C   Abbreviations

A

ALI   Application Layer Interface

ANR   Job number (for handling blocks)

ANZW   Condition code word

AP   Automation protocol layers 5 to 7 of the ISO/OSI reference
                model

AS   Active star coupler

AS 511   511 interface, protocol for the communication between PLC
                and PG

ASCII   American Standard Code of Information Interchange

B

B   Block

BCD   Binary coded decimal

BE   Block end

C

CC   Central controller

CI   Cyclic interface

CIM   Computer Integrated Manufacturing

COM   Abbreviation for programming software for SIMATIC S5 CPs

COR   Coordination module

CP   Communications Processor

CPU   Central Processing Unit

CSF   Control System Flowchart, graphical representation of automation tasks with symbols

CSMA/CD   Carrier sense multiple access with collision detect

D
DA   Destination Address

DB   Data block

DCE   Data Communication Equipment

DIN   Deutsches Institut für Normung (German Standards Institute)

DIR   Directory of data medium and files

DMA   Direct Memory Access

DOS   Operating system

DP   Distributed peripherals

DPR   Dual Port RAM

DTE   Data Terminal Equipment

DW   Data word (16 bits)

DX   Extended data block

E
EG/EU   Expansion unit

EIA   Electronic Industries Association

EPROM   Erasable Programmable Read Only Memory

ET 200   Electronic Terminal 200

F
F   Flag bit

FB   Function block

FD   Floppy Disk (data medium)

FD   Flag double word

FDDI   Fiber Distributed Data Interface

FDL   Fieldbus Data Link (subfunction of layer 2)
FDL2   Free layer 2 communications

FlexOs   Multitasking operating system

FMA   Fieldbus Management Layer

FMS   Fieldbus   Message   Specification   (complying   with
                PROFIBUS)

FO   Fibre Optic

FW   Flag word

FY   Flag byte

G
GO   Global Object

GP   Global Peripherals

GPW   Global Peripheral Word

GRAPH 5   Software package for planning and programming sequence
                controllers

H

HDB   Handling blocks

HSA   Highest Station Address

I
IB   Input byte

IEC   International Electronics Commission

IEEE   Institution of Electrical and Electronic Engineers

IP   Intelligent peripheral module

ISO   International Standardization Organization

IW   Input word

K
KOMI   Command interpreter

L
LAD   Ladder Diagram, graphical representation of the automation
                 task with symbols of a circuit diagram

LAN   Local Area Network

LB   Link block

LED   Light Emitting Diode

LEN   Length of a block

LLC   Logical Link Control

LLI   Lower Layer Interface

LSB   Least Significant Bit

M
MAC   Medium Access Control

MAP	Manufacturing Automation Protocol
MMS	Manufacturing Message Specification

N
NCM	Network and Communication Management

O
OB	Organization block
OSI	Open System Interconnection
OW	Word from the extended peripherals
OY	Byte from the extended peripherals

P
PAFE	Parameter assignment error
PB	Program block
PC	Personal Computer
PCI	Protocol Control Information (for coordinating a protocol)
PCP/M-86	Operating system Personal CP/M-86
PDU	Protocol Data Unit (frames consisting of PCI and SDU)
PG	Programmer
PI	Program invocation
PI	Process image
PII	Process image of the inputs
PIQ	Process image of the outputs
PLC	Programmable controller

PNO   PROFIBUS user organization

PRIO   Priority

PROFIBUS   PROcess Field BUS

PW   Peripheral word

PY   Peripheral byte

Q
QB   Output byte

QW   Output word

R
RAM   Random Access Memory

RLO   Result of logic operation (code bits)

RS   Recommended Standard

RS 485   EIA standard (multipoint capability) standard for electrical
                 data transmission

S
S5S5   Special type of communication PLC with PLC

SA   Source Address

SAP   Service Access Point. Logical interface points on the
                 interface between the layers via which the PDUs are
                 exchanged between service users.

SB   Sequence block

SDA   Send Data with Acknowledge

SDN   Send Data with No Acknowledge

SDU	Service Data Unit. Information about the service used and the user data contained within it.
SINEC	Siemens network architecture for coordination and engineering
SINEC AP	SINEC automation protocol
SINEC H1	SINEC bus system for industrial applications based on CSMA/CD
SINEC H1FO	SINEC bus system for industrial applications based on CSMA/CD with fiber optics
SINEC H3	SINEC bus system for industrial applications based on FDDI
SINEC L2	SINEC bus system for industrial applications based on PROFIBUS
SINEC L2-FO	SINEC bus system for industrial applications based on PROFIBUS with fiber optics
SINEC L2-FMS	SINEC bus system for industrial applications based on PROFIBUS with the FMS protocol
SINEC L2-DP	SINEC bus system for industrial applications based on PROFIBUS with the DP protocol
SINEC L2TF	SINEC bus system for industrial applications based on PROFIBUS with the TF protocol
SINEC TF	SINEC technological functions
SRD	Send and Request Data
SSNR	Interface number
STEP 5	Programming language for programming programmable controllers of the SIMATIC S5 range

C

STL   Statement List, STEP 5 method of representation as a series of mnemonics of PLC commands (complying with DIN 19239)

Sub-D   Subminiature D (connector)

SYM   Symbolic addressing

SYSID   Block for system identification

S5-KOMI   S5 command interpreter

S5-DOS/MT   S5 operating system based on FlexOS

T
TF   Technological functions

TSAP   Transport Service Access Point

TSAP-ID   Transport Service Access Point Identifier

TSET   Set-up time

TSDR   Station delay

TSL   Slot-time

TTR   Target rotation time

TPDU   Transport Protocol Data Unit (size of the block of data transferred by the transport system)

TSDU   Transport Service Data Unit (size of the block of data transferred to the transport system with a job for transportation via a transport relation)

TSEL   Transport selector, term used as an alternative for TSAP-ID

V
VFD   Virtual Field Device

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VMD   Virtual Manufacturing Device

Z
ZP   Cyclic peripherals

❏

C

Notizen

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E Further Reading

/1/ Wege zur offenen Kommunikation
Das ISO-Referenzmodell im Umfeld der Kommunikation
Siemens AG DÖA PM Order no.: U 1474-J-Z72-11984
(only available in German)

/2/ [ISO/IEC 9506-1] Information Processing Systems Open Systems
Interconnection- Manufacturing Message specification, Part 1: Service
Definition

/3/ Kerner H.
Rechnernetze nach OSI
ADDISON-WESLEY 1992
ISBN 3-89319-408-8

/4/ Instructions
Installation of SINEC H1 Local Area Network
SIEMENS AG, Order no.: AR 463-220

/5/ Instructions
Installation of SINEC H1FO Local Area Network
SIEMENS AG, Order no.: AR 464-220

/6/ SINEC TF User Interface
User Interface for the SINEC Technological Functions
SIEMENS AG, Order no.: 6GK1971-1AB00-0AA1 Release 02

/7/ Handling blocks are described in the following:

for S5-115 as part of the device manual
Order no.: 6 ES 5998-3-UFX 1   for CPU 945
Order no.: 6 ES 5998-0-UFX 3   for CPU 941 - CPU 944

for S5-135 can be ordered as HDB software + description
Order no.: 6 ES 5842-7-CB 01   for CPU 928A/B - CPU 948

for S5-155 can be ordered as HDB software + description
Order no.: 6 ES 5846-7-CA 01   for CPU 946 / 947
❑

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