

SIMATIC NET

NCM S7 for Industrial Ethernet

Primer

Preface

Overview of the Steps

“PROJECT ETHERNET”
The S7 Sample Project

Communication on the
SEND/RECEIVE Interface...

...Between S7 Stations

...Between S7 and S5 Stations

References

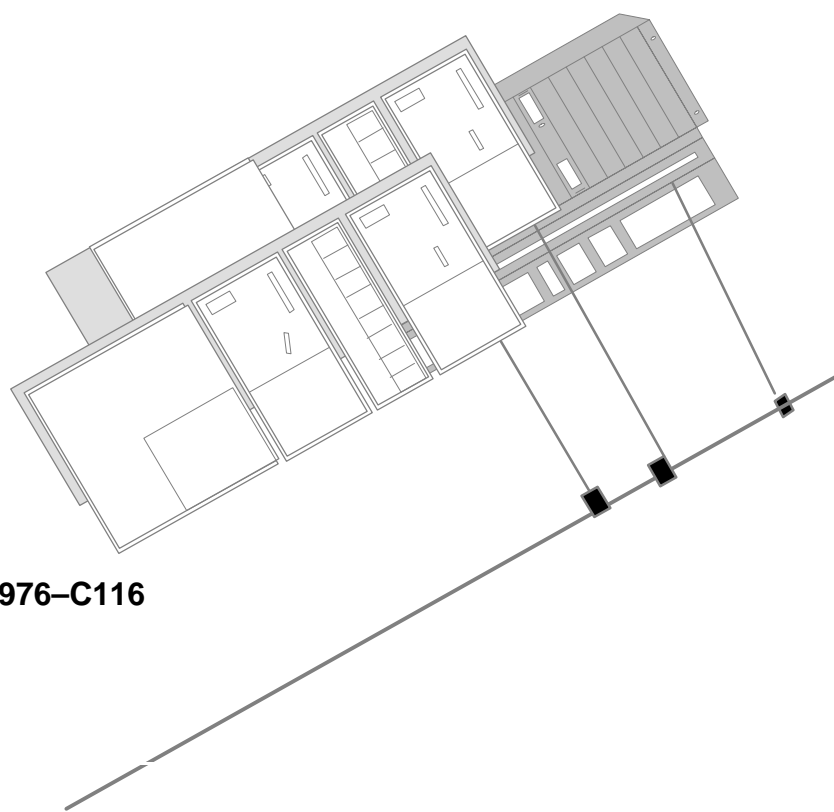
1

2

3

4

A



Classification of Safety-Related Notices

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:



Danger

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



Warning

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



Caution

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

Caution

without warning triangle indicates that damage to property can result if proper precautions are not taken.

Notice

indicates that an undesirable result or status can result if the relevant notice is ignored.

Note

highlights important information on the product, using the product, or part of the documentation that is of particular importance and that will be of benefit to the user.

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Note the following:



Warning

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This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

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Prior to Startup

Prior to startup, note the following:

Caution

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Siemens AG
Automation and Drives

Postfach 4848, D-90327 Nuernberg

Siemens Aktiengesellschaft

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We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Technical data subject to change.

G79000–G8976–C116–03

Preface

- Aims** You want to install our SIMATIC S7 CPs in your system and make optimum use of them.
- How to Achieve Your Aims** This primer will help you to become familiar with handling NCM S7 for Industrial Ethernet, the configuration tool for S7 CPs. Based on the configuration and program examples supplied with NCM, we introduce you to the typical steps required to make optimum use of NCM S7 for Industrial Ethernet with your SIMATIC S7 CPs.

Aims of the Primer...	...how to achieve the aims
You can learn how to use the product effectively in a short time...	...by working through the steps described and using the supplied example on a suitable system configuration.
You can learn how to use the product extremely effectively taking somewhat more time...	...by using the description to support you when you first configure and program an application of your own.

- Requirements** You should be familiar with the basics of STEP 7, in other words you should know the following:
- How to work with STEP 7
 - Which functions STEP 7 provides for managing hardware and software
 - How to handle projects
- Audience** This primer is intended for installation personnel and STEP 7 programmers as well as for service personnel.
- Scope of the Manual** This primer applies to Version V5.2 and higher of the NCM S7 configuration software and to Version 5.0 and higher of the STEP 7 software.
- Further Information...** For further information about STEP 7 documentation and the product, please refer to the accompanying manual “NCM S7 for Industrial Ethernet”.
- For further information about installing the NCM S7 for Industrial Ethernet software, please refer to the readme file.

Note

Please note that the NCM S7 for Industrial Ethernet product information bulletin may contain further information about the sample programs described in this primer.

Conventions

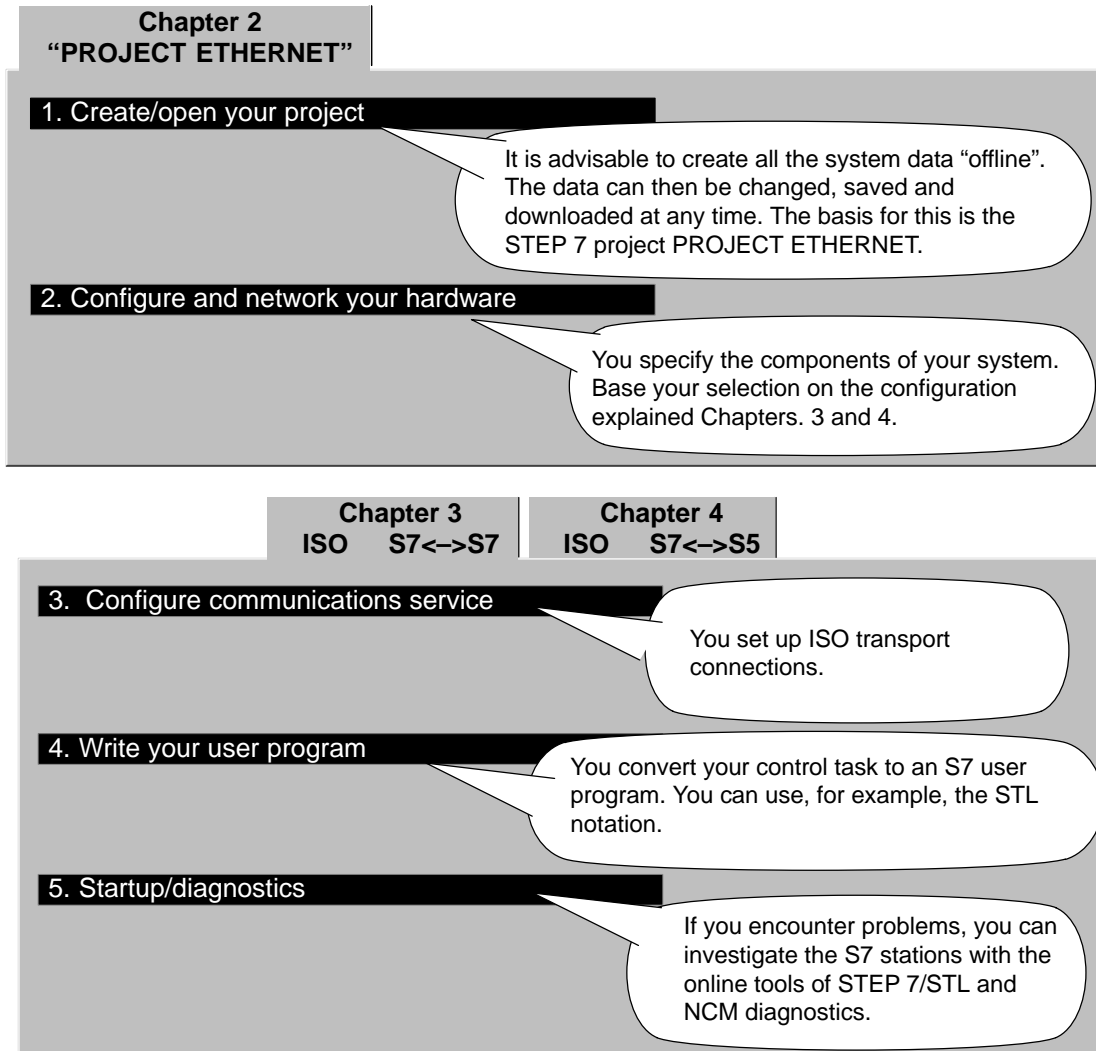
The following conventions are used in the primer:

- References to **other manuals and documentation** are indicated by numbers is slashes /.../. These numbers refer to the titles of manuals listed in the Appendix.
- Actions you are required to perform are indicated by the symbol " ↗ "



1 Overview of the Steps

Based on the sample configuration and the sample program “PROJECT ETHERNET”, the Primer will guide you through the following steps in the next chapters:



To achieve success quickly...

If your system configuration corresponds to the configuration selected for the sample, you can download the sample data directly to the S7 stations in steps 2, 3 and 4!

You will, however, learn more by working through the steps as outlined in this primer.

TIP
Skip the functions you already know.

2 “PROJECT ETHERNET” STEP 7 Samples for Ethernet CPs

This chapter explains how you can use the “PROJECT ETHERNET” with the configurations and programs for the communications samples.

How the chapter will help you:

- You will get to know how to create a project with CPs
- You will get to know all the steps involved in configuration

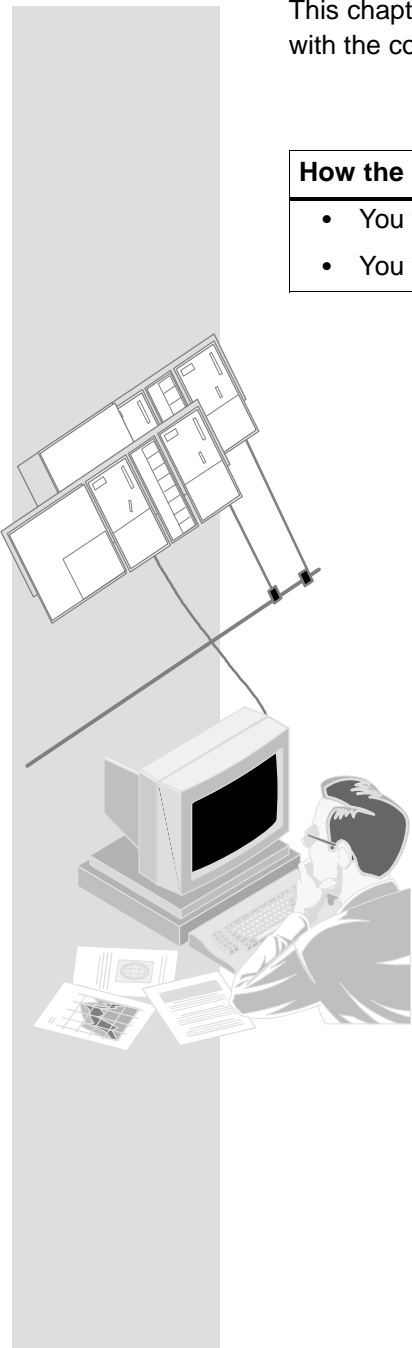
Requirements:

A working knowledge of STEP 7, experience with STL, a basic knowledge of PLCs.

If you require detailed information about the other functions of the configuration software, please refer to the corresponding manuals. This chapter also contains references to specific manuals.

Contents:

- Create/open your project 9
- Configure and network your hardware 12



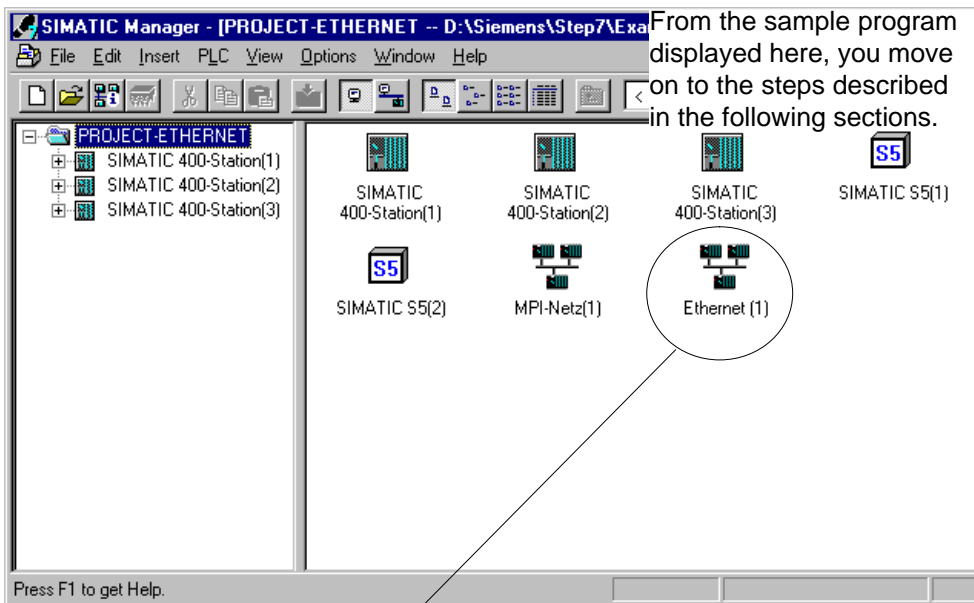
- 1. Create/open your project
- 2. Configure and network your hardware

User programs and an image of the S7 stations are managed in the STEP 7 project.

After installation of the NCM S7 optional software, the sample project is located in the project folder of STEP 7, for example in the folder C:\SIEMENS\STEP7\EXAMPLES\EXIE.

If you want to use the project in the S7 folder, follow the steps outlined below:

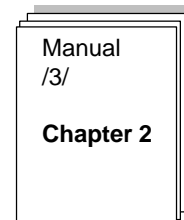
- ✓ Start the SIMATIC Manager.
- ✓ Open the supplied sample project **PROJECT ETHERNET** with **File ▶ Open ▶ Project...**



The sample project contains an Ethernet subnet. If you want to create a new or further Ethernet subnet or a different object,

- ✓ Select the function **Insert ▶ ... ▶ ...**

For more information...



If you want to create a working version of the ETHERNET sample project...

✓ ...Use the menu command **File ► Save As** to create a copy of the sample project in any folder you wish.

Device configuration

The following table shows the configurations in the individual stations. This will also indicate how much of the sample you can use directly and the extent to which you will have to adapt the sample.

Station	CP Type	MAC Address	Communicate s with Station	Description
SIMATIC 400 station(1)	CP 443-1	08.00.06.01.00.00	SIMATIC 400 station(2)	Communication via the SEND/RECEIVE interface with the CP 443-1. Data are transmitted in both directions. The FCs AG_SEND and AG_RECV are used.
SIMATIC 400 station(2)	CP 443-1	08.00.06.01.00.01	SIMATIC 400 station(1)	
SIMATIC 400 station(3)	CP 443-1	08.00.06.01.00.03	SIMATIC S5 station(1)	Communication via the SEND/RECEIVE interface with the CP 443-1. The user program is adapted to the program sample of the CP 1430 TF (see /14/). Data are sent from the SIMATIC 400 station(3) to the SIMATIC S5 station.
SIMATIC S5(1)	CP 1430 TF	08.00.06.01.00.02	SIMATIC 400 station(3)	

You have already created a configuration

If you have already created a configuration and simply want to use the sample programs for your CPU, follow the steps outlined below:

- ✓ Copy the sample programs (container with S7 programs) of the station from the sample project to the CPU of your existing project. Make sure that blocks do not overlap.
- ✓ Make sure that the hardware configuration and networking and the configured connections are adapted according to the descriptions below.

Summary of step 1 “Creating the Project”:

You have created a STEP 7 project

- in which you can configure your system
- and in which you can create and save your user programs.

1. Create /open your project

2. Configure and network your hardware

- Which components does the system include?
- How are the components attached to the network?

When completed, you will have downloaded the **hardware configuration** to the stations.

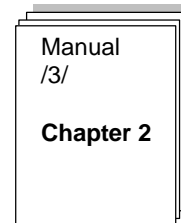
If you start with the existing sample configuration, you should get an overview of it before you download the configuration to the PLC. STEP 7 provides you with convenient methods of obtaining an overview. You can do the following:

TIP

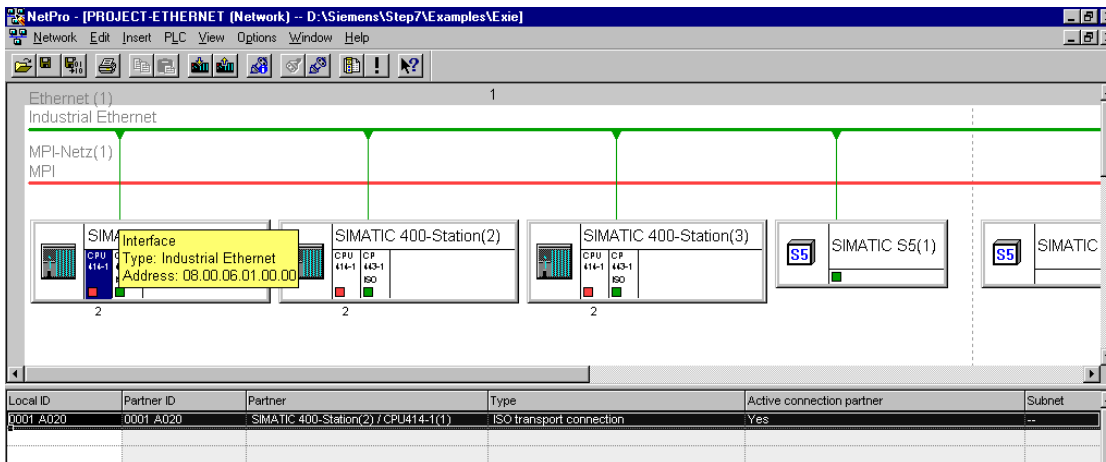
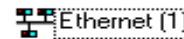
Page 2–8 deals with the topic “Downloading”

- Display the configuration in HW Config
- Display a station overview
- Display the networking of the stations graphically with NetPro.

For more information...



Double-click the object “Ethernet(1)” in your project in the SIMATIC Manager. This opens the NetPro view for your project.



From this display, you can start all the steps required for hardware and connection configuration.

As shown in the illustration,

- the connection table for the selected CPU is displayed in the lower part of the screen;
- information about the network attachment is displayed if you point to the symbol for the interface of the node with the mouse pointer.

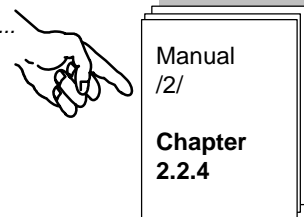
From the information relating to the network attachments, you can recognize the following situation:

The CP 443-1 has the configured MAC address (node). The CPU is shown with an MPI address. You require this MPI address, for example, when you want to run diagnostic functions on the CP via the MPI attachment of the CPU with NCM Ethernet Diagnostics.

If you want to modify the network address...

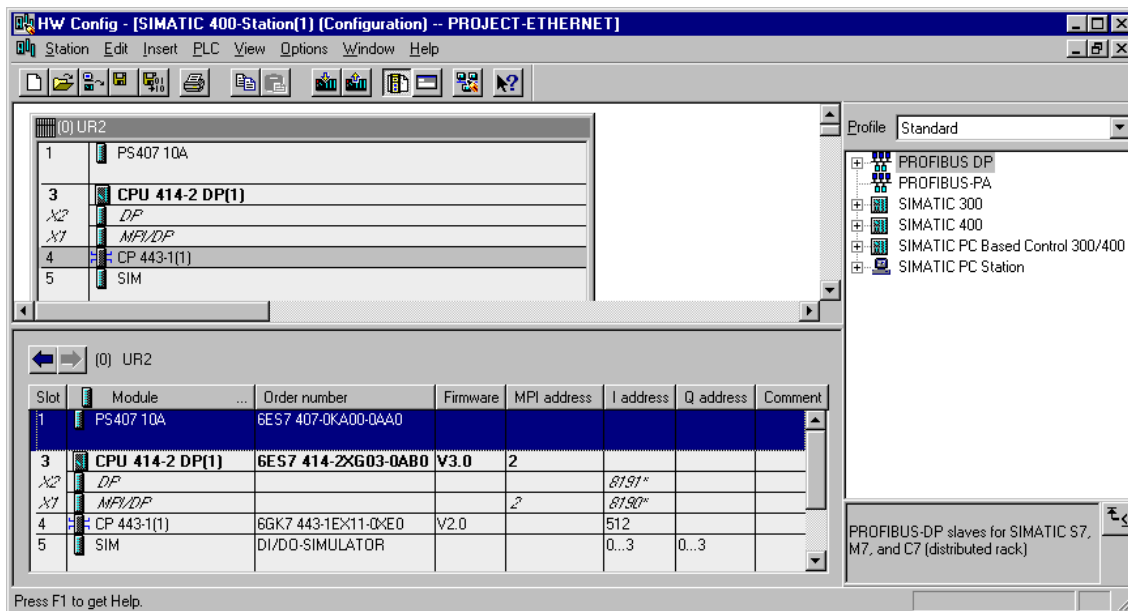
... you can do this in the Properties dialog of the Ethernet node. You can display this dialog by double-clicking the network node in the NetPro view. An address modification may, for example, be necessary when the configured Ethernet address is already being used in your network by another station.

For more information...



Checking the configuration in HW Config – here based on the example of the SIMATIC 400 station(1)

- ✓ Select the station or the CPU in the SIMATIC 400 station(1) in the NetPro view; then select **Edit ► Open Object**. You will see the hardware configuration with an overview and a detailed view.



If you want to see the configuration of one of the displayed modules in detail,

- ✓ position the cursor on the module, for example the CP 443-1 and select **Edit ► Object Properties**.

Adapting the configuration in HW Config

If your hardware configuration does not match the configuration required for the sample, you can now change the entries. You could, for example, make the following changes:

- Move modules to different slots.
 - The configuration of the connections is retained.
 - User programs may have to be adapted to a new module address.
- Work without a simulation module
To do this, delete the simulation module in slot 5.
- Use a different CP type
 - The configuration of the connections is retained.

Outputting a station overview

Use the print functions of STEP 7 to create your system documentation. You can print out the following:

- Entire station
- Selected module(s)

The printout for the CP you are using then appears as shown below:

```
SIMATIC                PROJECT-ETHERNET/SIMATIC 400-Station(1)                09/13/2002 10:43:48
-----
Rack 0, Slot 4
Short designation:      CP 443-1
Order no.:              6GK7 443-1EX11-0XE0
Designation:           CP 443-1(1)
Assigned CPU:          CPU number 1 - Slot 3
Location
Station:               SIMATIC 400-Station(1)
Width:                1
Network
Network type:         Ind. Ethernet
Network name:         Ethernet (1)
MAC address:          08.00.06.01.00.00
Addresses
Inputs
Start:                512
End:                  0
System selection:     - - -
Outputs
Start:                - - -
End:                  - - -
System selection:     - - -
Comment:
- - -
Required optional package:  NCM S7 Industrial Ethernet
```

Further information about networking the station

It is easy to obtain an overview of the existing network attachment configurations using the print functions in NetPro.

The printout for a configured network appears as shown in the example below:

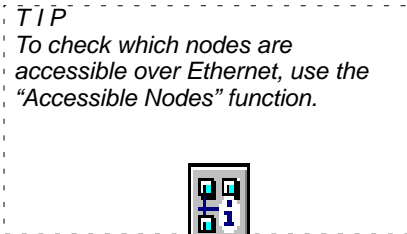
The screenshot shows a printout from a SIMATIC station. At the top, it displays 'SIMATIC', the path 'D:\siemens\STEP7V402\Examples\EXIE', and the date/time '03/25/1998 16:06:52'. Below this, a section titled 'Ethernet (1) contains the following network connections:' is followed by a table with five columns: Node Address, Station, Module, Rack, and Slot. The table lists three stations with their respective addresses and hardware configurations. A final section states 'MPI-Netz(1) contains no network connections.'

Node Address:	Station:	Module:	Rack:	Slot:
08.00.06.01.00.00	SIMATIC 400-Station(1)	CP 443-1 BGR(1)0 -		4
08.00.06.01.00.01	SIMATIC 400-Station(2)	CP 443-1 BGR(1)0 -		4
08.00.06.01.00.02	SIMATIC S5(1)	-	-	-
08.00.06.01.00.03	SIMATIC 400-Station(3)	CP 443-1 BGR(1)0 -		4

To download the hardware configuration to the PLC...

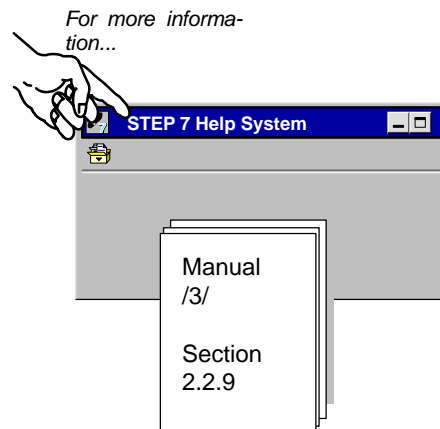
...follow the steps outlined below:

- ✓ Connect the PG to the MPI interface of the CPU using the MPI cable.
- ✓ Set the interface on your PG/PC for the required type of attachment. Select the PG/PC interface in the Windows control panel to match the CPs available on your PG and to match the bus attachment.



- ✓ Select the menu option **PLC ▶Download...**

STEP 7 then guides you through further dialog boxes to the required result.



Summary of Step 2 “Configuring and Networking Your Hardware”:

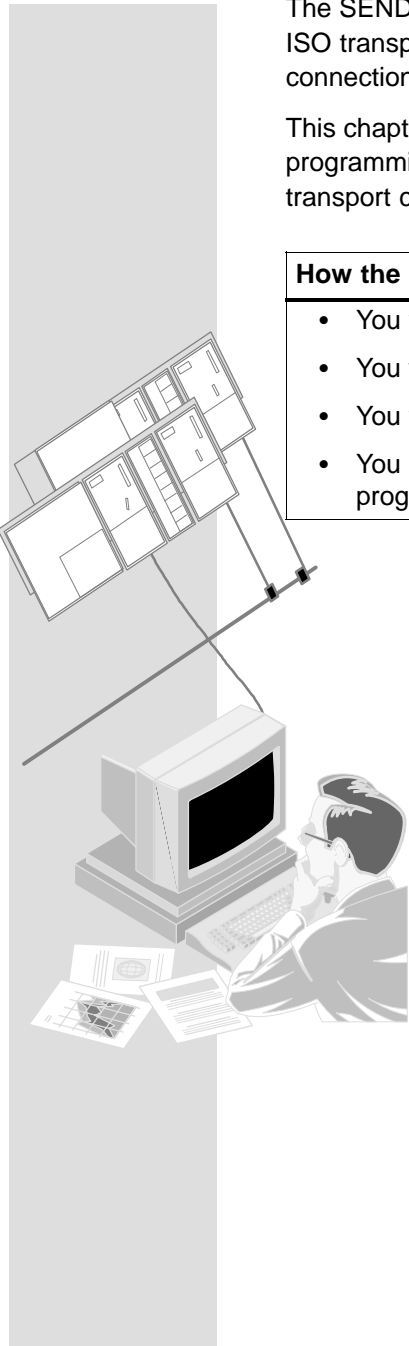
You have now done the following:

1. Configured the S7 stations in the STEP 7 project
2. Assigned the S7 stations to the Ethernet subnet and assigned addresses
3. Downloaded the configuration to both S7 stations.

The stations are now ready for you to configure the communication connections and download the user programs.



3 Communication on the SEND/RECEIVE Interface between S7 Stations



The SEND/RECEIVE interface allows data exchange on configured ISO transport connections, TCP connections, and ISO-on-TCP connections.

This chapter explains the steps required during configuration and programming to implement a simple communication task on ISO transport connections.

How the chapter will help you:

- You will get to know the steps involved in configuration.
- You will learn about downloading and starting up.
- You will become familiar with the SEND/RECEIVE call interface.
- You can use the sample program as a basis for creating PLC programs.

Requirements

A working knowledge of STEP 7, experience with STL, a working knowledge of PLCs.

If you require detailed information about the properties of the type of communication introduced here or about other functions provided by the configuration software, please refer to the corresponding manuals. The preface of the manuals provides you with an overview of the available documentation. This chapter also contains references to specific manuals.

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	– Configuring ISO transport connections	23
	– Creating a user program	29
	– Startup/diagnostics	36

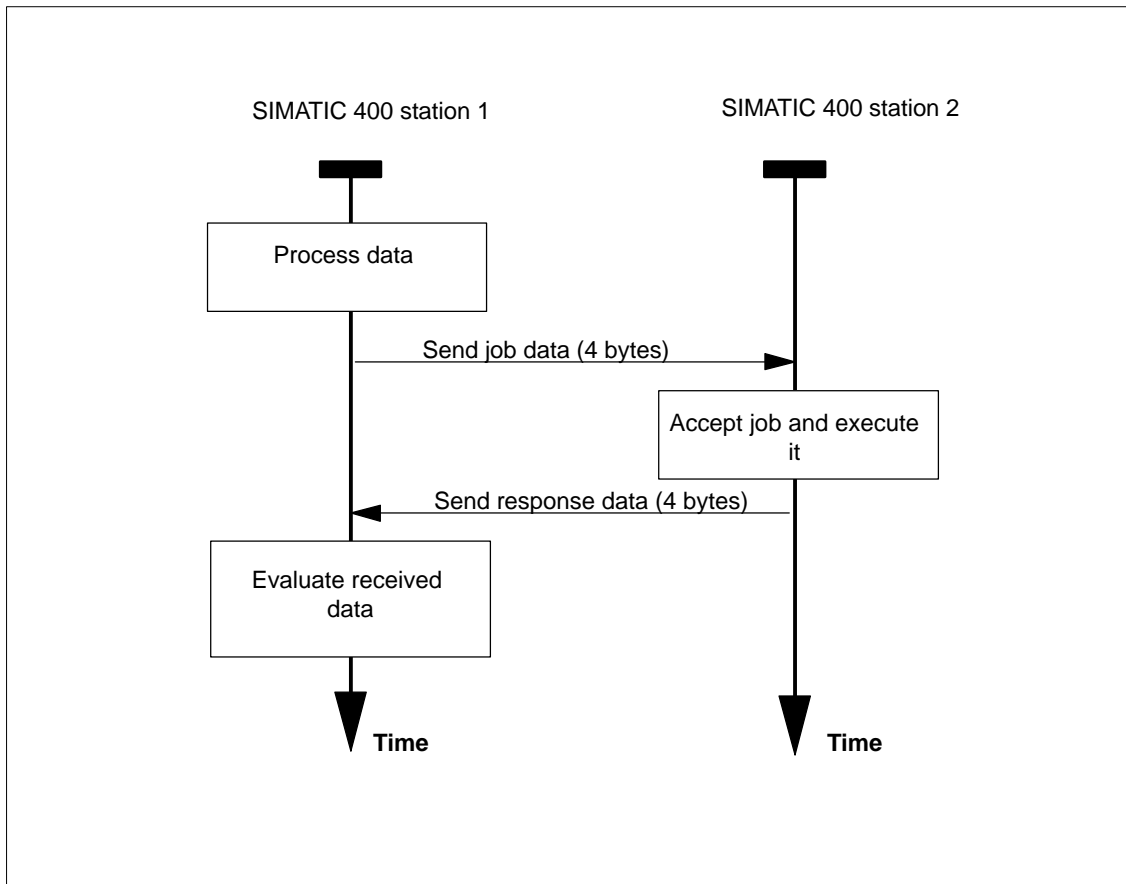
3.1 The Task

Sending and Receiving Data

The communication task illustrated by the sample program has deliberately been kept simple.

- A controller (SIMATIC 400 station 1) processes process data.
- It communicates with a further device (SIMATIC 400 station 2), for example to delegate a control job. The SIMATIC 400 station 2 returns data to station 1.

The following schematic illustrates how the program functions:

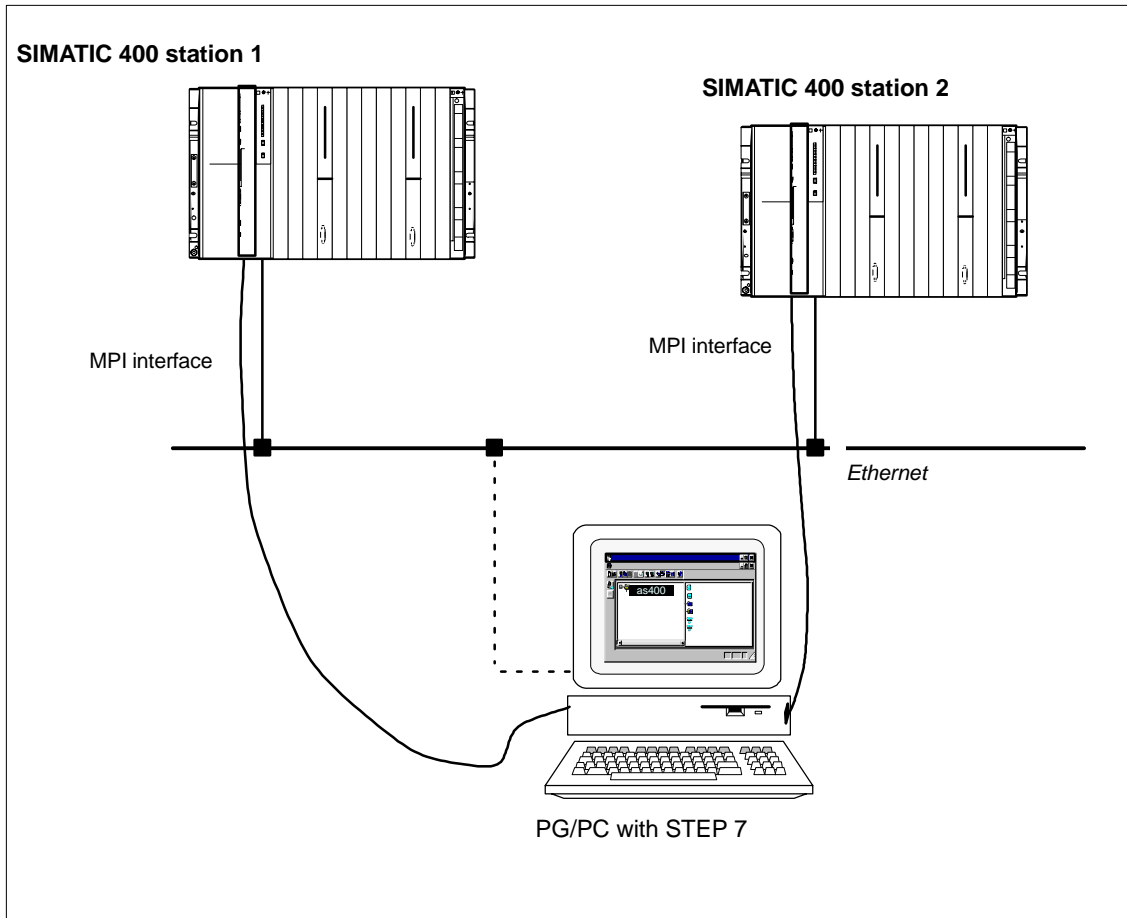


The jobs and responses in the example contain 4 bytes of user data.

3.2 System Configuration

Structure

The following system configuration is required for the supplied sample project (modifications / alternatives are possible → see following page):



Required Devices/Resources

You require the following components if you want to use the supplied example **unmodified**.

No. Required	Type	Order Number
2	S7-400 programmable controllers with CPU 414-1	see Catalog ST 70
2	CP 443-1	6 GK 7443-1EX11-0XE0 ¹⁾
2	Simulation modules DI/DO Can be replaced by Digital output module DO16xDC24V/2A or by Digital output module DO32xDC24V/0.5A	6ES7422-1BH10-0AA0 6ES7422-1BL10-0AA0
1	Transmission path	see /11/ /12/
1	Programming device (PG/PC) with <ul style="list-style-type: none"> • STEP 7 software version V5.2 or higher installed • Optional software NCM S7 for Ethernet version V5.2 or higher installed. • MPI attachment • As an option for the PG/PC mode on Ethernet: CP for Ethernet attachment → diagnostics/installation/service 	see Catalog ST 70

¹⁾ Newer versions of the module are normally compatible in terms of functionality; You can load the configuration data of the sample project on your module without needing to make changes. Please read the information in the manual of the CPs on the topic of compatibility and replacing devices!

Alternatives:

You can adapt the sample configuration to suit your own situation. Possible modifications are outlined below:

- S7-300 instead of S7-400
Instead of S7-400 stations, you can also use S7-300 stations (for example with the CP 343-1).
The appropriate adaptations must be made in HW Config and in the user program. You must also use different FC types with an S7-300.
- Using a different CPU type
- Doing without simulation modules
This only requires slight modification in the user programs (no output to the simulation module). It is then possible to monitor communication by displaying data blocks on the PG.
- Using other input/output modules
This may mean that module addresses are changed.
- Changing the order of the modules in the rack
This may mean that module addresses are changed with certain CPU types.

Notice

If you change the module address in the configuration, you must also adapt the user program and the configured connection.

3.3 The Example Step by Step

This description is based on the created project and on the configured stations. The steps “Create Project” and “Configuring and Networking Hardware” were explained in Chapter 2.

1. Create/open your project	}	Chapter 2
2. Configure and network your hardware		
3. Configure ISO transport connections	}	Chapter 3.3 / and pages following
4. Write your user program		
5. Startup		

To achieve success quickly...

If your system configuration corresponds to the configuration selected for the example, you can download the sample data directly to the S7 stations in steps 3 and 4.

You will, however, learn more by working through the steps as outlined in this primer.

TIP
Skip the functions that you already know.
Chapter 2 deals with the topic of “Downloading”.

1. Create/open your project
2. Configure and network your hardware
- 3. Configure ISO transport connections**
4. Write your user program
5. Startup

Set up communication connections for the CPUs.

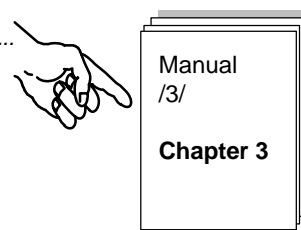
When completed, you will have downloaded the **connection configuration** to the stations.

Communication on the SEND/RECEIVE interface uses configured ISO connections. The next step is therefore to download the connection list to the station.

TIP
Page 27 contains more detailed information about "Downloading".

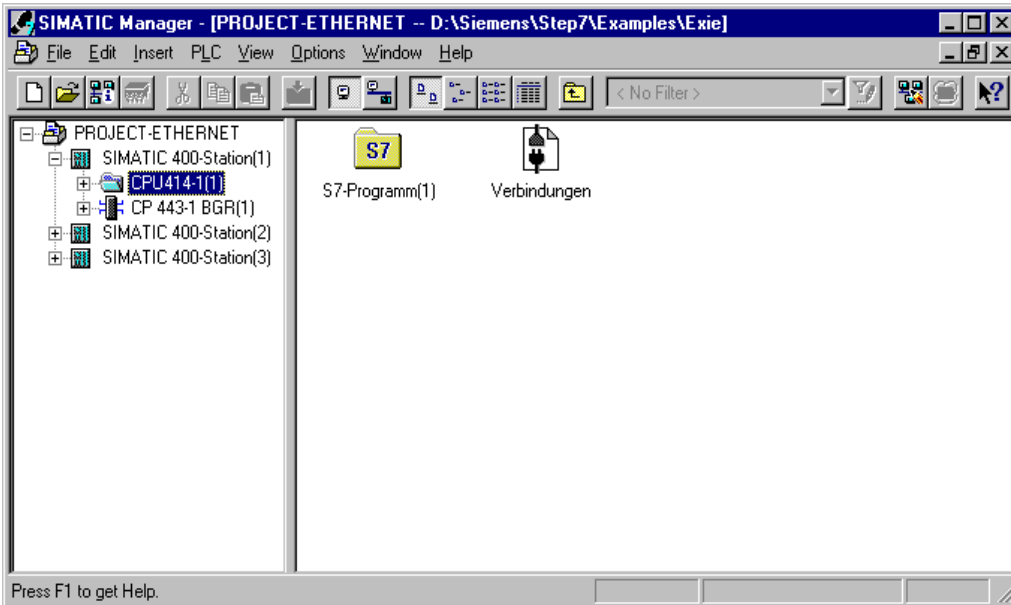
First, however, you should get an overview of the sample configuration by:

For more information...



Checking the connections in the connection table in NetPro

➤ Change back to the SIMATIC Manager and select the CPU in the required station.



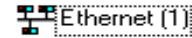
- ✓ Select the object “Connection” and then select **Edit ▶ Open Object**. The connection table is then displayed with the entries for the selected station.



Connection

or

- ✓ Change directly to the NetPro view by selecting the network.



The screenshot shows the NetPro software interface. At the top, there's a menu bar with options like Network, Edit, Insert, PLC, View, Options, Window, and Help. Below the menu is a toolbar with various icons. The main area displays a network diagram with a green line for Industrial Ethernet and a red line for MPI-Netz(1). Several SIMATIC 400-Station and SIMATIC S5 units are shown. A tooltip for the 'Interface' shows 'Type: Industrial Ethernet' and 'Address: 08.00.06.01.00.00'. At the bottom, a table lists connections:

Local ID	Partner ID	Partner	Type	Active connection partner	Subnet
0001_A020	0001_A020	SIMATIC 400-Station(2) / CPU414-1(1)	ISO transport connection	Yes	--

Here, you can select the connection properties with a double-click

Here, you can select “Change Partners” with a double-click.

From the display, the following situation is clear:

- **One** ISO transport connection is currently configured to the partner station SIMATIC 400 Station(2).
- Connection establishment is activated by SIMATIC 400 Station(1).

Note...
 ...By selecting the stations, you can obtain an overview of all the stations in the project and the configured connections.

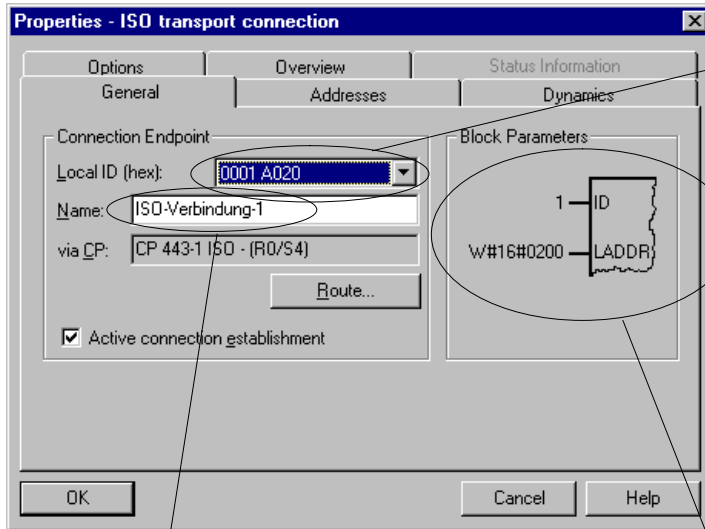
Further connections...

...You can configure further configurations to this or other partner stations in this overview.

- ✓ To insert a new connection in the connection list, select the function **Insert ▶ Connection**.

To check important connection parameters...

- ✔ Select the connection properties by double-clicking the connection in the connection table.



0001 is the ID that you use in the user program on the SEND/RECEIVE interface
A020 is the ID for ISO transport connections.

You can assign a name to the connection reflecting its purpose in your system.

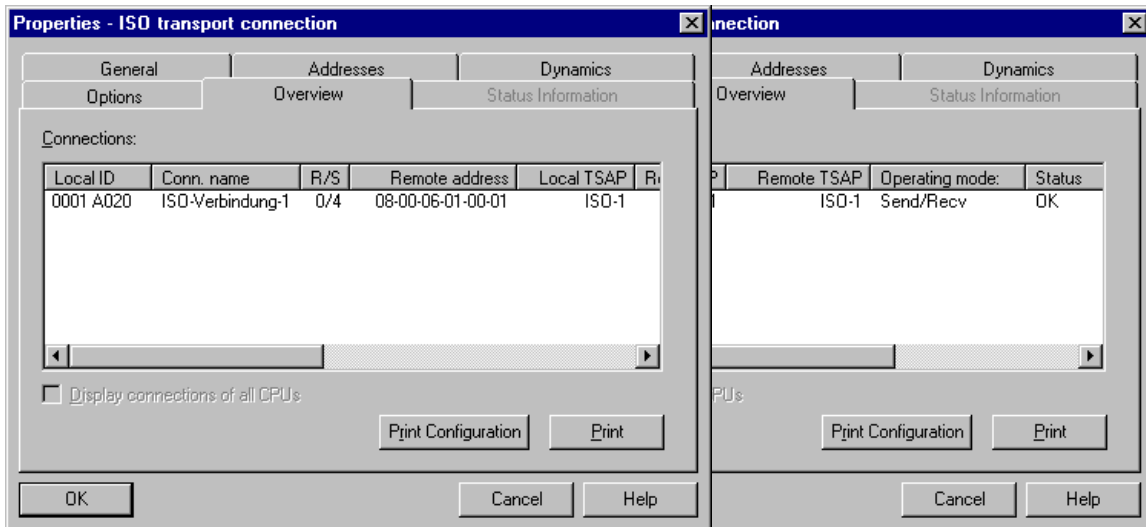
Note on the block parameters:
The module start address and the connection ID are required later when you program the SEND/RECEIVE interface.

Page 31 has a similar sample call.

“Addresses” Tab

The information in the “Addresses” tab page for a connection between S7 stations within a project does **not** normally need to be modified.

For further information about the status of the connection or the connection configuration, open the “Overview” tab.

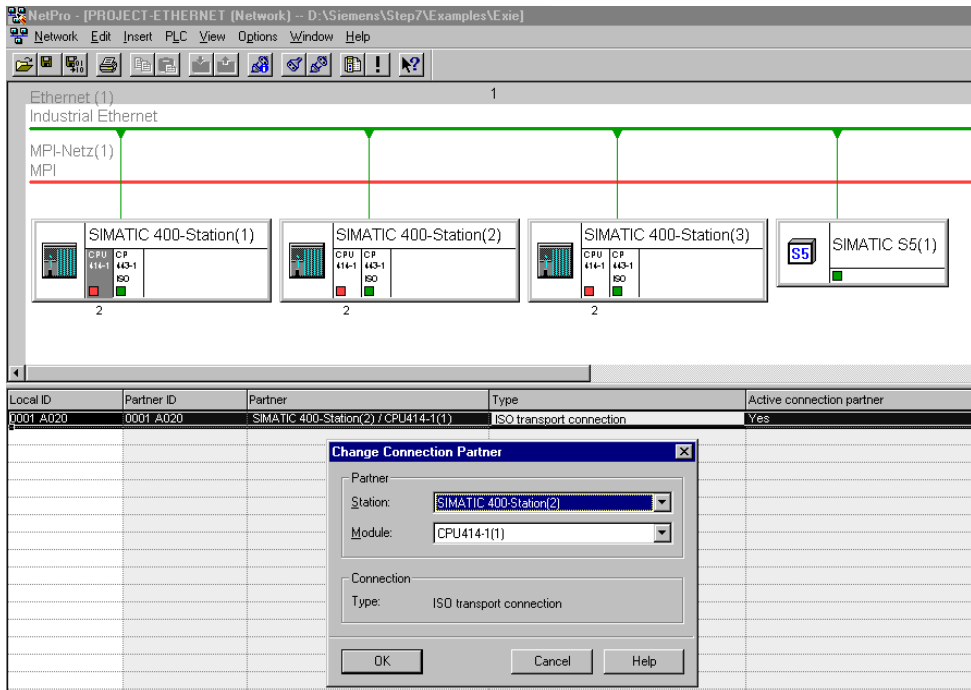


If the character “!” appears in the “Local ID” field, this indicates further relevant information in the “Status” field. Depending on the setting of the table header, this field may be hidden. You can readjust the display with the horizontal arrow key.

In the situation shown here, the status is when the connection configuration is completed.

If you want to address another communication partner...

- ✓ ...select the “Change Partners” dialog with the **Edit► Change Partners** menu command or by double-clicking the connection in the “Partner” column of the connection table.



- ✓ If required, select a different connection partner in the “Station” field.

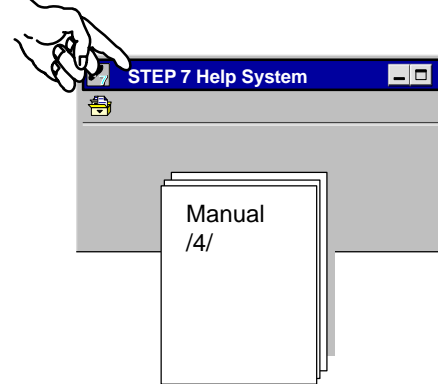
To download the connection configuration to the PLC...

...follow the steps outlined below:

- ✓ If you have made changes in the connection configuration, save your changes with **Connection Table ▶ Save**.
- ✓ Select the station in the connection table for which the Ethernet attachment exists.
- ✓ Select the menu command **PLC ▶ Download**.

Note:
During the download, you are asked whether you want to copy from RAM to ROM on the CP. If you want to save the data in non-volatile memory, answer with "Yes".

For more information...



- ✓ Attach the MPI to the SIMATIC 400 station (2).
- ✓ Repeat step 2 "Configuring/networking your hardware" and step 3 "Configuring ISO transport connections" for the SIMATIC 400 station(2) if you want to make changes to the existing configuration of the second station.

Summary of step 3 "Configuring ISO transport connections":

You have now done the following:

- Configured an ISO transport connection between the two SIMATIC 400 stations
- Downloaded the connection configuration to the two SIMATIC 400 stations

The stations are now ready for data exchange on the SEND/RECEIVE interface.

1. Create/open your project	✓
2. Configure and network your hardware	✓
3. Configure ISO transport connections	✓
4. Write your user program	✓
5. Startup	

– How is the SEND/RECEIVE interface supplied with data?
 – How are the status bits evaluated?
 When completed, you will have downloaded the **user programs** to the stations.

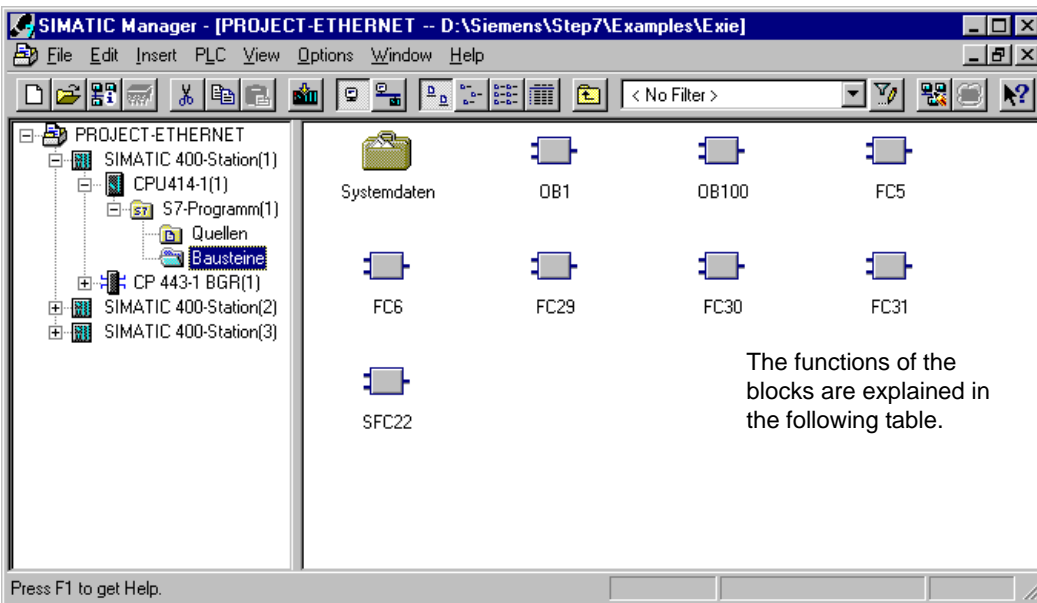
The tasks in the user program

The task described in Section 3.1 must now be converted to suitable programmable controller programs.

To execute the programs or to download them to the S7 stations...

✓ ...select the container with the program blocks in the required SIMATIC 400 station in the PROJECT-ETHERNET.

TIP
 Page 34 contains more detailed information about the topic "Downloading".



For a better overview...

✓ ...you should print out the program blocks and check them. The following page contains an overview of the FCs required for communication.

The table shows which blocks of the types OB and FC handle which tasks.

Task in SIMATIC 400 Station 1	Task in SIMATIC 400 Station 2	Description of the Task in the Program Blocks
Processing process data		Simulation of a changing process value: OB100 Creation of data blocks DB30 and DB31. The process values are saved in these data blocks. OB1 Coordination of the program sequence. FC29 A data word is incremented and decremented cyclically. The time interval for both incrementing and decrementing is 3 seconds. FC30/FC5 (AG_SEND) This data word is transferred to Station 2 as the current process value (job).
	Accept and process job	Accepting and further processing the job data: OB100 Creation of data blocks DB30 and DB31. The process values are saved in these data blocks. OB1 Coordination of the program sequence. FC31/FC6 (AG_RECV) Save the received data in the data block and output the data to the process simulation. FC30/FC5 (AG_SEND) Return the data to Station 1 as job confirmation.
Evaluate the received data		FC31/FC6 (AG_RECV) Accept and evaluate job confirmation. Output process data to the simulation module.

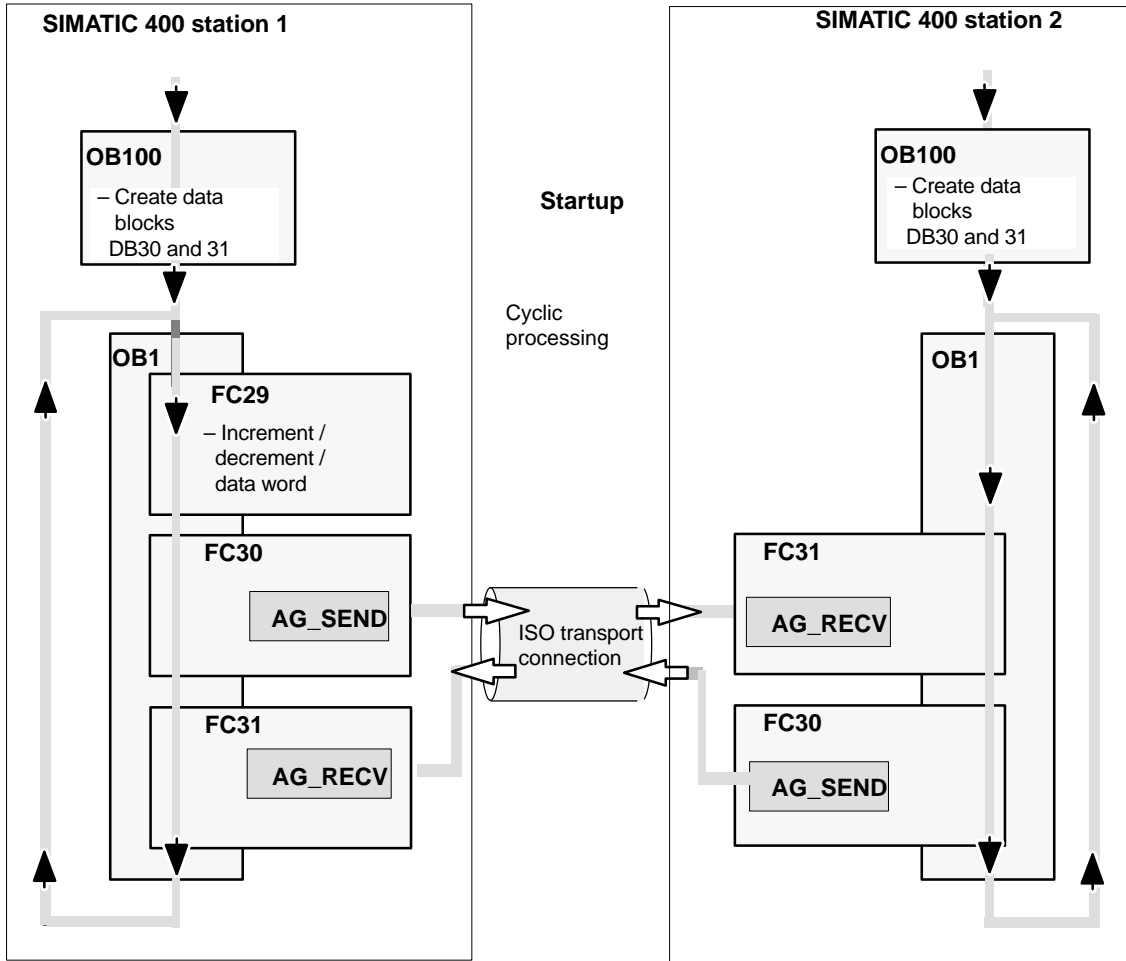
Notice

You can take and use the latest versions of the communications blocks (FC5/FC6) for your module from the SIMATIC NET block library of STEP 7.

If you are using an older module type, this is only possible if you use the latest firmware version for this module type.

The Program Sequence

The organization blocks in the example produce the following program sequence in the two S7 stations:



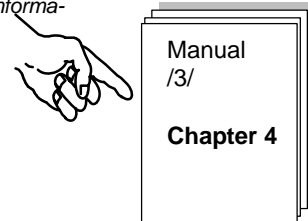
Legend:  Sequence of the CPU cycle

Programming Functions (FCs) for Communication

Two functions (FCs) are available for handling communication on the ISO transport connections, as follows:

- **AG_SEND (FC5)**
This block transfers the user data from the specified user data area to the Ethernet CP for transmission.
- **AG_RECV (FC6)**
This block enters the received user data in the user data area specified in the call.

For more information...



The user program in our example was written in STL notation. As an example, the parameter assignment for calling AG_SEND and AG_RECV in S7 station 1 is shown below.

STL	Explanation
call fc 5	//AG_SEND block call
ACT := M 50.0	//Bit for triggering job
ID := 1	//Connection ID
LADDR := W#16#0110	//Module address 272 _{Dec.} in hardware conf.
SEND := P#db30.dbx1.0 byte 240,	//Data area to be transferred
LEN := 4	// Length of the data area to be sent (4 bytes)
DONE := M 1.2	// Memory bit for return parameter DONE
ERROR := M 1.3	// Memory bit for return parameter ERROR
STATUS := MW 200	// Memory word for return parameter STATUS

STL	Explanation
call fc 6	//AG_RECV block call
	//
ID := 1	//Connection ID
LADDR := W#16#0110	//Module address 512 _{Dec.} in hardware conf.
RECV := P#DB31.DBX 1.0 BYTE 240	//Data area for receive data
NDR := M1.0	// Memory bit for return parameter NDR
ERROR := M1.1	// Memory bit for return parameter ERROR
STATUS := MW202	// Memory word for return parameter STATUS
LEN := MW10	// Area for length of received data

To see the complete code contained in these FCs, and the other OBs and FCs, please refer to the printouts of the sample project.

Setting Block Parameters Automatically

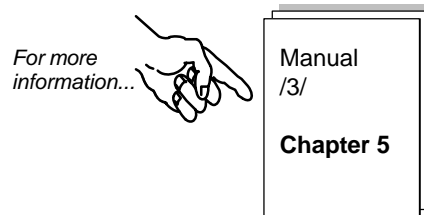
To ensure correct parameter settings for the block calls, The LAD/STL/FBD editor in STEP 7 provides you with the option of accepting all the relevant parameters from the hardware configuration (HW Config) and from the connection configuration automatically. When assigning the parameter values for the block in the user program, follow the steps outlined below:

- ✓ Select the block call and its block parameters;
- ✓ Select the menu command “**Connections...**” with the right mouse button.
- ✓ Depending on the block type, you can now select the connection intended for the block or module from a list.
- ✓ Confirm your selection; as far as possible, the available parameter values are entered in the block call.

FCs AG_LSEND/ AG_LRECV for longer data areas (CP 443-1)

The newer versions of the Ethernet CPs with the FCs AG_LSEND (FC50) and AG_LRECV can transfer larger data areas (up to 8192 bytes). Please check the manual of your CP for the supported data area and, if applicable, use the appropriate FCs.

Working with the FCs is explained in the manual.



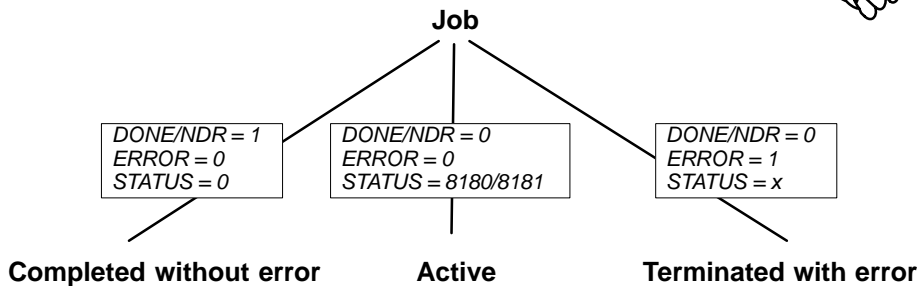
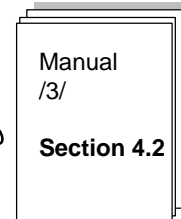
Extending the Sample Program

You can also extend the sample program or later your own applications. Some possibilities are shown below:

- Evaluation of the result codes of the FCs AG_SEND and AG_RECV to allow you to react to specific statuses in your system.
- Conditional initiation of communication calls depending on result codes, so that, for example, the send call on the client is only triggered again after the job confirmation has been received with the receive call.

✓ Evaluate the parameters DONE, ERROR and STATUS for AG_SEND and NDR, ERROR and STATUS for AG_RECV. You evaluate these parameters as shown below:

For more information about status bits



Typical error codes that must be handled by the user program:

- 8302_H Lack of resources on partner
- 8311_H Destination station not (yet) obtainable (e.g. due to startup)
- 80C3_H Resources occupied (due to maximum load on S7-400)
- 80D2_H Module start address wrong (e.g. you forgot to change the address after moving a module)
- 8304_H Connection not yet established

Example without simulation module

If you do not want to use simulation modules, simply deactivate the output “T QW ...” in the FC31 blocks on Simatic 400 station 1 and 2.

You can then follow the execution of the program by displaying the data blocks online in STEP 7/STL.

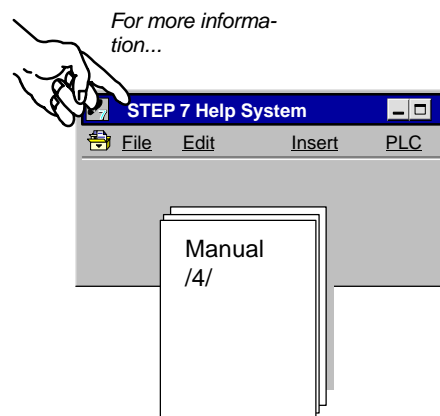
To download the user program to the PLC...

...follow the steps outlined below:

- ✓ Change the CPU to STOP or RUN-P.
- ✓ Select the Blocks container in the appropriate station in the SIMATIC Manager.
- ✓ Download the entire program (except for the system data) to the S7 station using the **PLC► Download** menu command.

Note:
In the RUN-P mode, the block order is important since the CPU cycle is active. Make sure that OB100 is only executed during startup.

- ✓ Change the CPU to RUN-P or RUN.



- ✓ Repeat the download procedure for the other station.

Summary of Step 4 "Creating the user program":

You have now done the following:

- Created user programs according to the task description for both SIMATIC 400 stations
- Extended the sample programs, for example by evaluating the status codes
- Downloaded the user programs to the CPUs of both SIMATIC 400 stations

Result:

If you are working with simulation modules, you should now see the active LED displays on the simulation modules or output modules indicating that communication is taking place.

If you cannot detect any communication, do one of the following:

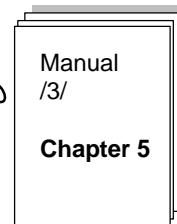
- ✓ Check the program sequence online in STEP 7/STL (monitor blocks). Check whether a changing data word is being output to the simulation module.
- ✓ Go on to the next step and check communication with NCM Ethernet diagnostics.

1. Create your project
2. Configure / network your hardware
3. Configure ISO transport connections
4. Create the user program
- 5. Startup / diagnostics**

Using Ethernet diagnostics, you can detect communication problems.

Use, for example, the following diagnostic functions to, check the status of stations and ISO transport connections.

For more information...



- Operating Mode
What is the status of the stations?
- ISO Transport
What is the status of the ISO transport connections?
Were frames sent?
How many successful?
How many with errors?
- Diagnostic Buffer
What do the diagnostic buffer entries say?

4 Communication on the SEND/RECEIVE Interface Between S7 and S5 Stations

In the first example, we showed you the steps involved in configuring and programming to implement a simple communication task with ISO transport connections.

In this chapter, we will now show you the (slight) differences that arise if you want to communicate with a “Non-S7” station. These stations are generally known as “Other Stations” in STEP 7.

Based on Chapter 1, you will learn the following:

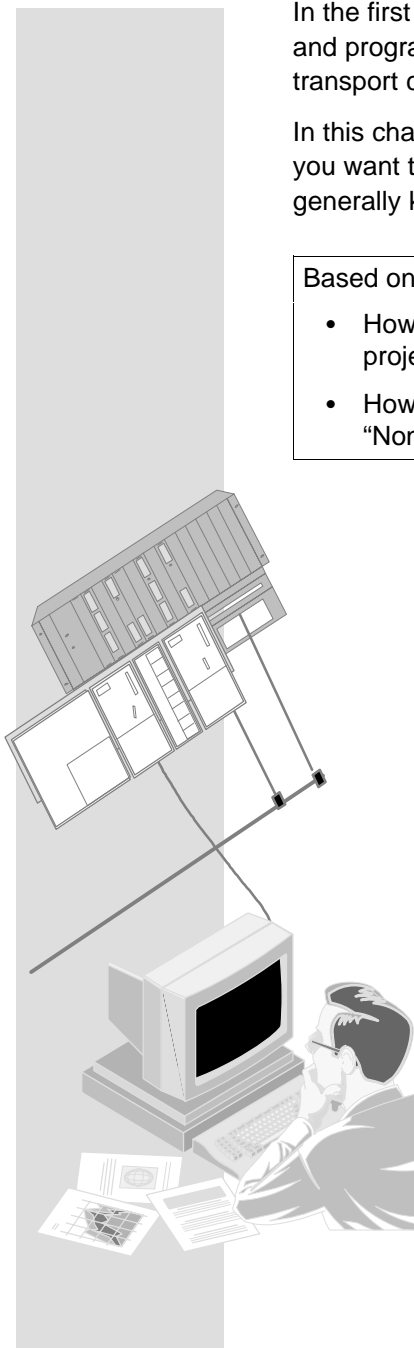
- How to handle SIMATIC S5 or “Non-S7 Stations” in the STEP 7 project
- How to handle ISO transport connections to SIMATIC S5 or “Non-S7 Stations”

Requirements:

Working knowledge of STEP 7, knowledge of STL, experience of working with a PLC, a working knowledge of SIMATIC S5

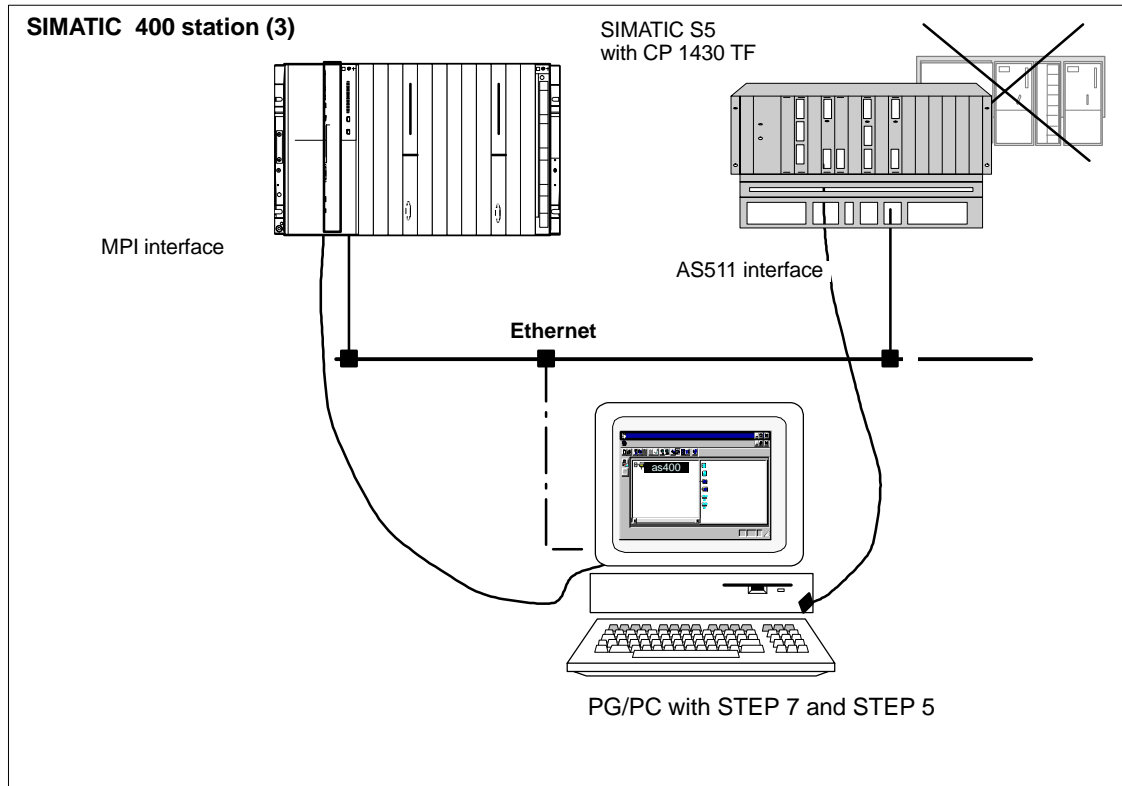
Contents:

4.1	Changed system configuration	37
4.2	The example step-by-step	39
	– Creating your project	41
	– Configuring / networking your hardware	42
	– Configuring ISO transport connections	46
	– Creating the user program	49



4.1 Changed System Configuration

In the system configuration shown in Section 3.2, the S7 station 2 must be replaced by a **SIMATIC S5 station** (modifications / alternatives are possible → see Section 3.2).



Required Devices/Resources

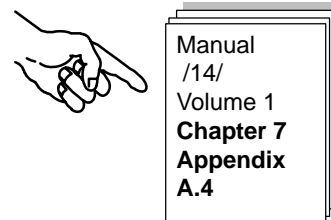
You require the following components if you want to use the supplied example **unmodified**.

No. Required	Type	Order Number
1	SIMATIC S7-400 programmable logic controllers	see Catalog ST 70
1	CP 443-1	6 GK 7443-1EX11-0XE0 ¹⁾
1	SIMATIC S5 programmable logic controllers	see catalogs ST52.3, ST54.1
1	CP 1430 TF	6 GK1 430-0TA0x 6 GK1 430-0TB0x

¹⁾ Newer versions of the module are normally compatible in terms of functionality; You can load the configuration data of the sample project on your module without needing to make changes. Please read the information in the manual of the CPs on the topic of compatibility and replacing devices!

1	Transmission path	see /7/, /11/, /12/
1	Programming device (PG/PC) with <ul style="list-style-type: none"> • STEP 7 V5.2 and STEP 5 V6.x software or higher installed • NCM S7 for Ethernet optional software installed • NCM COM 1430 TF software installed • MPI connection • As an option for the PG/PC mode on Ethernet: CP for Ethernet connection → diagnostics/installation/service 	

On the S5 station, you can use the example programs supplied with the NCM COM 1430 configuration tool. Depending on the hardware configuration (CPU type etc.), you must select the suitable sample programs. For more detailed information refer to



4.2 The Example Step-by-Step

The following example is based on the project that was created and the stations that have been configured. The steps “Creating your project” and “Configuring/networking your hardware” were explained in Chapter 2.



To achieve success quickly...

If your system configuration corresponds to the configuration selected for the example, you can download the sample data directly to the SIMATIC stations in steps 3 and 4.

You will, however, learn more by working through the steps as outlined in this primer.

TIP
Skip the functions that you already know.
Chapter 2 deals with the topic of “Downloading”.

1. Create your project

2. Configure and network your hardware

3. Configure FDL connections

4. Create the user program

5. Startup – Diagnostics

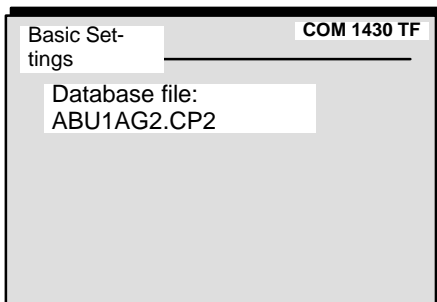
– Extra:

The S5 station is managed with NCM COM 1430 TF.

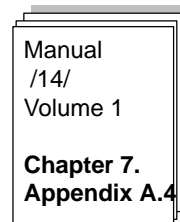
Managing station 2 (S5):

Use the familiar STEP 5 tools STEP 5 V6.x and NCM COM 1430 TF to edit the programs and the database file for the sample program for the CP 1430 TF.

Configuration Environment for SIMATIC S5 with CP 1430 TF



For more information, read:



Summary of Step 1 "Creating your Project":

You have created a project in STEP 7 in which you can configure your SIMATIC 400 station and save the corresponding user programs.

You have created a database file for the S5 station in which the CP configuration data can be saved.

1. Create your project
2. Configure / network your hardware
3. Configure ISO transport connections
4. Create the user program
5. Startup

Extra:
 – The SIMATIC S5 station must be made known in the STEP 7 project and networked.

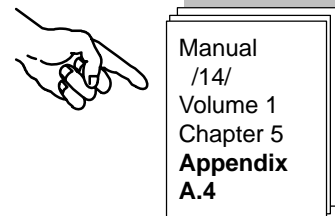
To configure the SIMATIC 400 station in the STEP 7 project...

...follow the procedure described in Chapter 2.

Managing the S5 Station

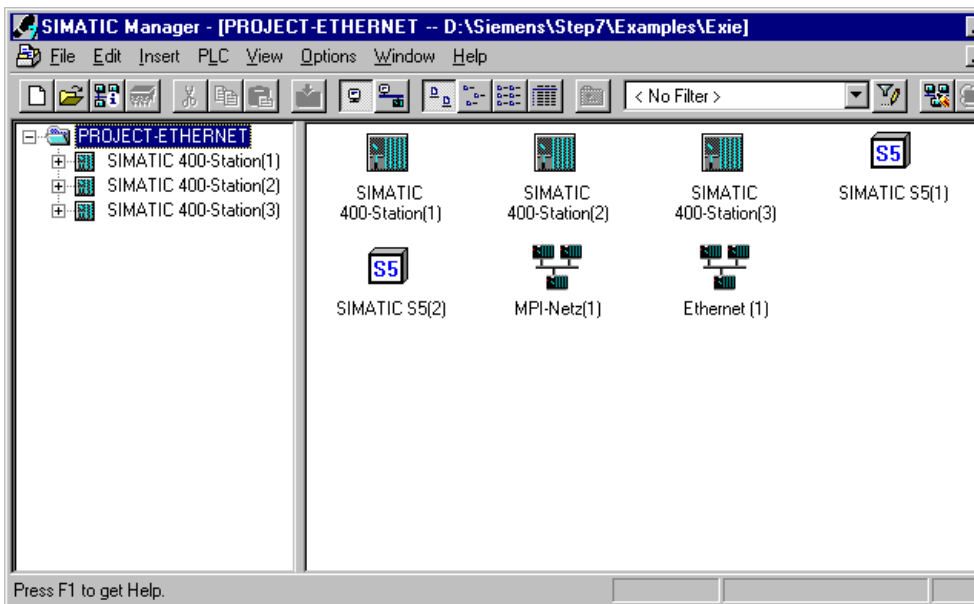
For information about managing the configuration data and the (sample) programs, please refer to

This provides you with information about handling the S5 tools.



To network the SIMATIC 400 station with the SIMATIC S5 station and to be able to obtain the station on ISO transport connections...

...this “S5 station” must be included in the STEP 7 project. In the sample project, a station of the type “SIMATIC S5” has been created.



If you want to continue working in a different project, you must now create a “SIMATIC S5 station”.

- Select your project.
- Select the **Insert ▶ Hardware ▶SIMATIC S5** menu command.

...Now network the station

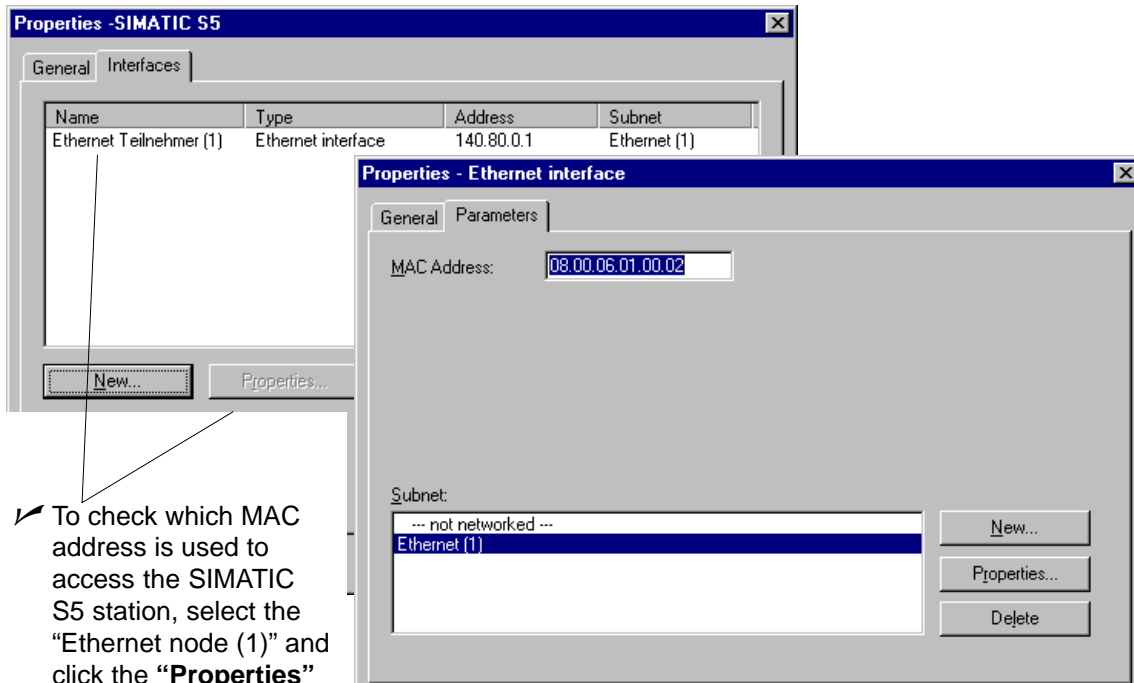
Networking the SIMATIC 400 station is also the same as in the first example. The main point of interest here is how to network the SIMATIC S5 station:

4. Select the SIMATIC S5 station that you want to check in your project using the SIMATIC Manager or the NetPro view.



SIMATIC S5(1)

5. Select the **Object Properties** dialog with the menu **Edit ▶Object Properties** or by double-clicking the icon.

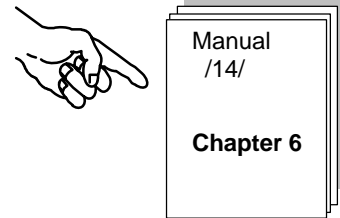


✓ To check which MAC address is used to access the SIMATIC S5 station, select the "Ethernet node (1)" and click the "Properties" button.

Downloading the hardware configuration to the PLC

To download the configuration data to the SIMATIC 400 station, follow the steps outlined below

- For the SIMATIC 400 station, as described in Chapter 2.
- For the SIMATIC S5 station, as described in...

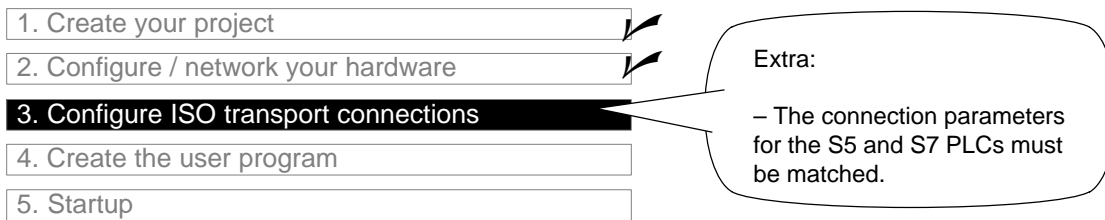


Summary of Step 2 "Configuring and Networking Your Hardware":

You have now done the following:

1. Configured the SIMATIC 400 station in the STEP 7 project
2. Assigned the SIMATIC 400 station to the Ethernet and assigned addresses
3. Downloaded the configuration to the SIMATIC 400 station
4. Adapted the network configuration of the SIMATIC S5 station with NCM COM 1430 TF.

The SIMATIC 400 station is now ready for you to configure communication connections and download user programs.



To create the ISO transport connections for S7–Station(3) in the STEP 7 project...

...follow the steps as described in Chapter 1:

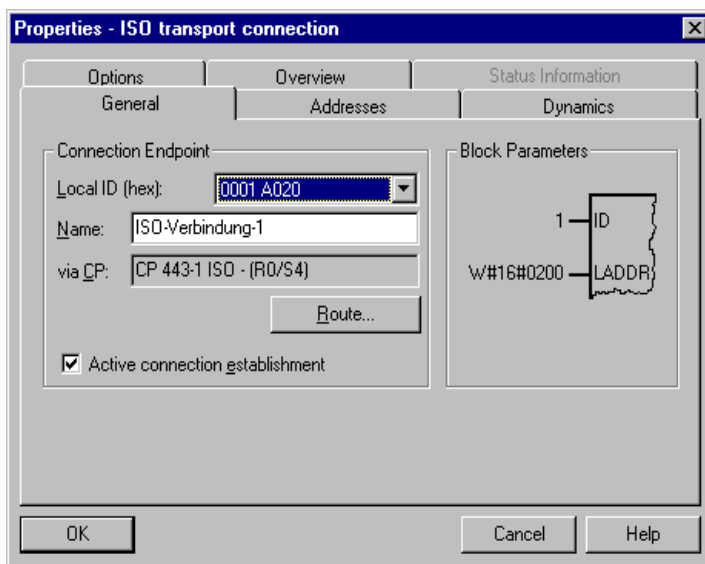
- Display and check the configured connections in the connection table.
- Download the configured connections to the PLC.

Checking/configuring connection parameters

In the Addresses tab page, adapt the TSAP setting so that it matches the configuration in S5–Station. Only then can the local endpoints of the connection be correctly identified so that a connection can be established successfully.

Follow the steps below:

- ✓ Open the connection table for the CPU in the SIMATIC 400 station.
- ✓ Select the connection properties by double-clicking the connection in the connection table.



- ✓ Check the “Active Connection Establishment” box. This must be selected.

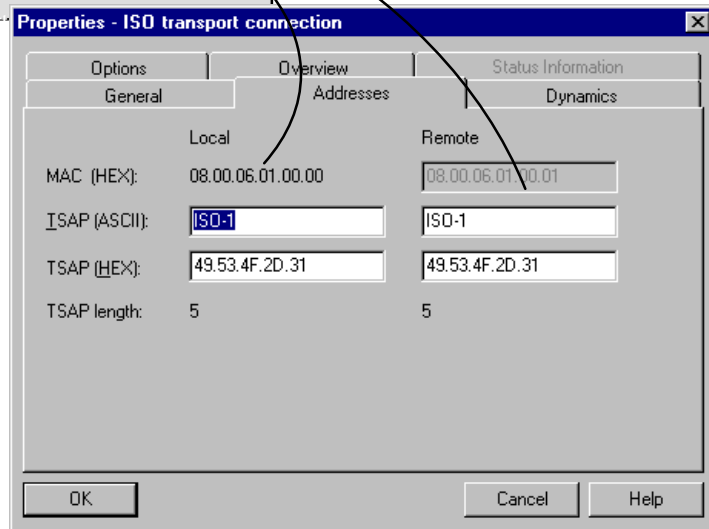
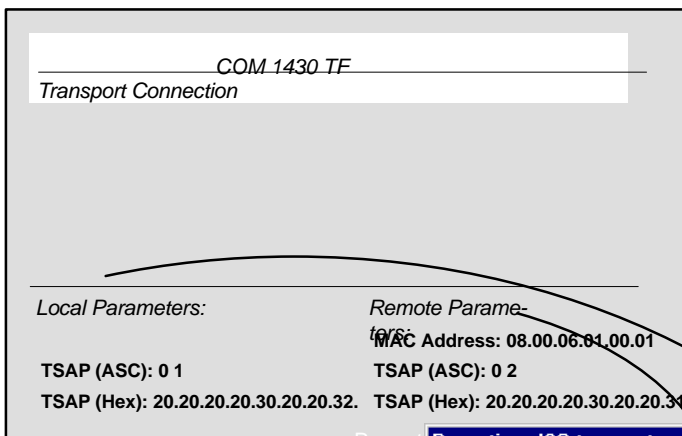
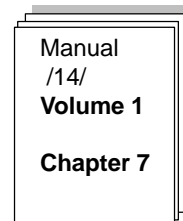
- ✓ Change to the “Addresses” tab page.
- ✓ Check the TSAP entries and if necessary adapt them to the configuration for the S5 station.

To check and adapt the ISO transport connections for the SIMATIC S5 station,

- ✓ Use the function “**Edit ▶Connections▶Transport Connections**” in COM 1420 TF:

- ✓ Check the following assignment:

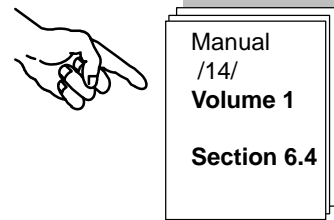
TSAP local (S5) = TSAP remote (S7)
TSAP remote (S5) = TSAP local (S7)



Downloading the connection configuration to the PLC

To download the configuration data to the stations, follow the steps outlined below:

- For the SIMATIC 400 station, as described in Section 1.3.
- For the SIMATIC S5 station, as described in...



Summary of Step 3 – “Configuring ISO transport connections”:

You have now done the following:

1. Configured an ISO transport connection between the SIMATIC 400 station and the SIMATIC S5 station
2. Downloaded the connection configuration to both stations

The stations are now ready for data exchange on the SEND/RECEIVE interface.



The tasks in the user program

Compared with the description of the task in Chapter 1, the sample must be adapted for the CP 1430 TF according to the description in /14/, as follows:

Data are only **sent** by the SIMATIC 400 station to the SIMATIC S5 station, they are **not returned** so that the send call in the SIMATIC S5 station and the receive call in the SIMATIC 400 station are omitted.

The table shows you which blocks of the type OB and FB in the SIMATIC S5 station are responsible for receiving the job data from the SIMATIC 400 station and processing it.

Task in the SIMATIC 400 Station	Task in the SIMATIC S5 Station	Description of the task in program blocks
Processing process data		Simulation of a changing process value: OB100 Creation of data blocks DB30 and DB31. The process values are saved in these data blocks. OB1 Co-ordination of the program sequence. FC29 A data word is incremented and decremented cyclically. The time interval for both incrementing and decrementing is 3 seconds. FC30 / FC5 (AG_SEND) This data word is transferred to Station 2 as the current process value (job).
	Receive and process job	Receiving and processing job data: OB1 Coordination of the program sequence. FB101 (HDB RECEIVE) Saves received data in the data block and outputs them to the process simulation.

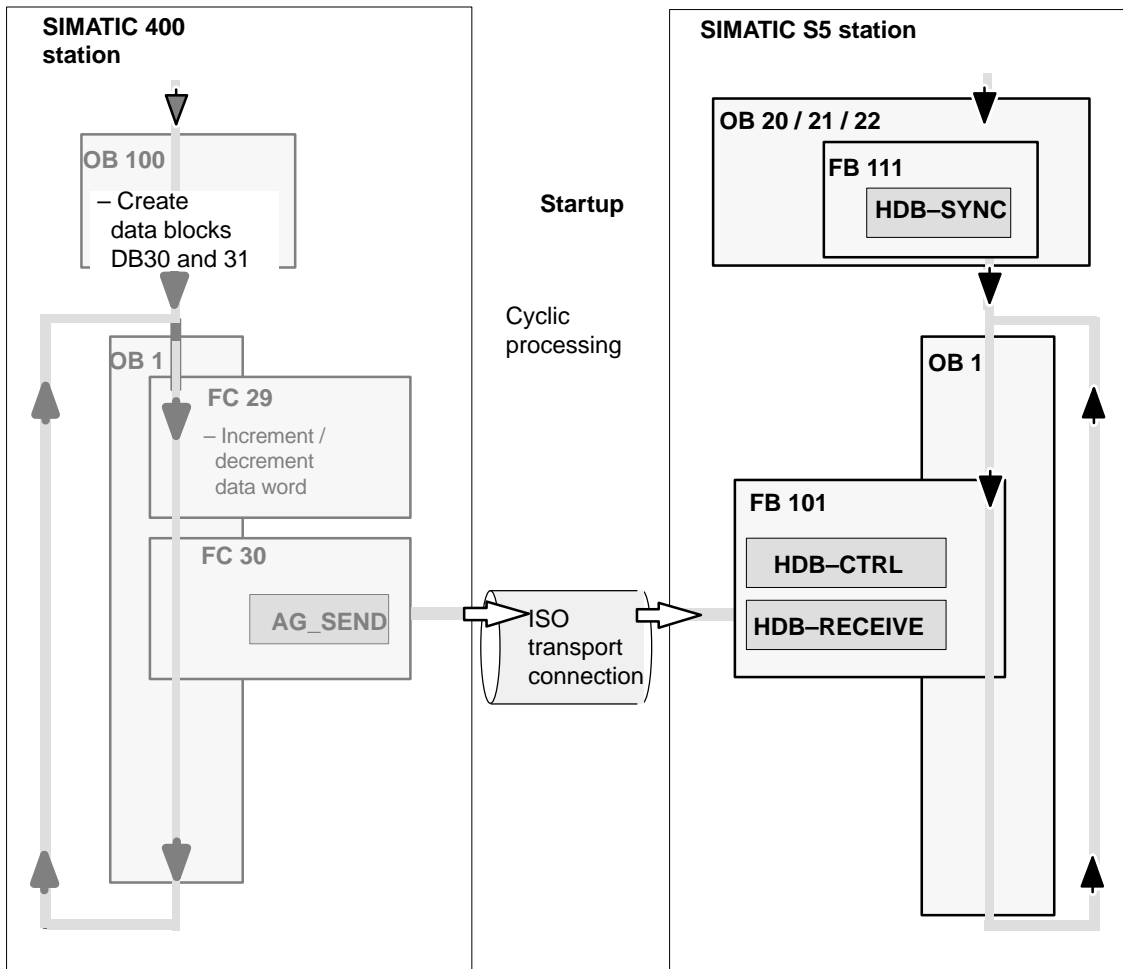
Notice

You can take and use the latest versions of the communications blocks (FC5/FC6) for your module from the SIMATIC NET block library of STEP 7.

If you are using an older module type, this is only possible if you use the latest firmware version for this module type.

The Program Sequence

In the example, the OB blocks organize the following program sequence in the two stations:



Legend: Sequence of the CPU cycle

To process or download the programs of the SIMATIC 400 station...

...follow the steps described in Chapter 1. The information in Chapter 1 about the program extensions, for example to evaluate the call status codes, also applies here.

For the SIMATIC S5 station ...

...you should adapt the program to obtain the required sequence, as follows:

- ✓ If the CP 1430 TF is not synchronized during startup, this may be caused by an incorrect OB20. Copy the content of OB21 to OB20 so that the HDB SYNC is correctly called.

Notice

Make sure that you use the correct HDBs for the specific CPU in the S5 station.
In the example, you require the following:

HDB-SYNC
HDB-CTRL
HDB-RECEIVE

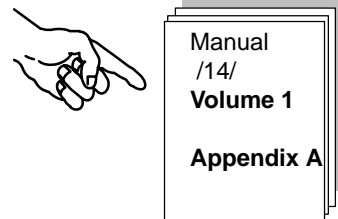
Summary of step 4 “Creating the user program”:

You have now done the following:

1. Created user programs according to the task for both stations
2. Extended the sample programs, for example to include evaluation of status codes
3. Downloaded the user programs to the CPUs of both stations.

Result:

To monitor the data transfer, follow the instructions in the manual of the CP 1430 TF. You monitor the updating of the data in the receive data block on the SIMATIC S5 station.



If you cannot detect any communication, do one of the following:

- ✓ Check the program sequence online in STEP 7/STL (monitor blocks). Follow the same procedure with the programs on the SIMATIC S5 PLC in STEP 5.
- ✓ Check communication with Ethernet diagnostics, as shown in Chapter 1.



A **References**

- /1/** Manual/ Product Information SIMATIC NET CP
Supplied with each CP
SIEMENS AG
- /2/** NCM S7 for PROFIBUS Manual
Supplied with the documentation package NCM S7 for PROFIBUS
SIEMENS AG
- /3/** NCM S7 for Industrial Ethernet Manual
Supplied with the documentation package NCM S7 for Industrial
Ethernet
SIEMENS AG
- /4/** SIMATIC STEP 7 User Manual
Part of the standard STEP 7 Documentation Package
SIEMENS AG
- /5/** SIMATIC STEP 7 Programming Manual
Part of the standard STEP 7 Documentation Package
SIEMENS AG
- /6/** SIMATIC STEP 7 Reference Manual
SIEMENS AG
- /7/** Industrial Twisted Pair Networks
SIEMENS AG
- /8/** Ethernet, IEEE 802.3
(ISO 8802-3)
- /9/** SINEC CP 1413
Manuals for MS-DOS, Windows
SIEMENS AG
- /10/** SIMATIC S7
S7-300 Programmable Controller
Hardware and Installation
Manual
SIEMENS AG

/11/ SINEC H1 Manual for Triaxial Networks SINEC H1
SIEMENS AG

/12/ SINEC H1FO Ethernet Manual
SIEMENS AG

/13/ SIMATIC Software
NetPro
Graphic Network Configuration
SIEMENS AG

/14/ SINEC
CP 1430 TF with NCM COM 1430 TF
Manual
SIEMENS AG
6 GK 1970-1TA43-0AA0

Order Numbers

The order numbers for the SIEMENS documentation listed above can be found in the catalogs "SIMATIC NET Industrial Communication, Catalog IK10" and "SIMATIC Programmable Controllers SIMATIC S7 / M7 / C7".

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