SIEMENS

SIMATIC S5

CP 544

Manual

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Release 01

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Disclaimer of Liability

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.

Safety-related guidelines

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 marked as follows:

Note
indicates that minor personal injury or property damage can result if proper precautions are not taken.

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons as referred to in the Safety-Related Guidelines for the User in this manual are defined as persons who are authorized to commission, to ground and to tag equipment, systems and circuits in accordance with established safety practices and standards.

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1

What is the CP 544 and How do you Use it?

Contents of Chapter 1

1 What is the CP 544 and How do you Use it?

1

The CP 544 communications processor enables data to be transferred between your programmable controller (PLC) and other programmable controllers or computers via a point-to-point coupling.

The CP 544 is the top-of-the-range communications processor in the range of coupling modules for the SIMATIC S5-115U, S5-135U and S5-155U programmable controllers. It can be used wherever the current coupling modules have reached their limits with respect to transmission speeds and protocol requirements.

The CP 544 offers:

- Two flexible, serial device interfaces which can be matched to the coupling partners via plug-in interface submodules
- Transmission speed up to 76800 baud
- Use of a powerful interface chip for implementation of protocols for data transmission and telecommunication
- Integration of the most important transmission protocols into the module firmware (RK 512 computer link, 3964/3964R procedure, open driver)
- Omission of additional user memory submodule when using the integrated transmission protocols: the parameters are stored in the internal RAM or in the user memory submodule of the CPU
- Use of introduced transmission protocols of the point-to-point coupling of the CPU 928B
- Better adaptation of transmission protocols through extended parameterization facilities
- Onboard PG interface

- Uniform parameterization interface for the point-to-point coupling of the CP 544 and CPU 928B using the COM PP parameterization software
- Information functions integrated in the COM PP to enable fast startup of module:
  error messages are output in plain text
- Complete parameterization and startup also possible via the backplane bus without the COM PP when using the data handling blocks.

The most important areas of application of the CP 544 are:

- Coupling of SIMATIC S5 devices to one another and to other systems (e.g. SICOMP)
- Logging.

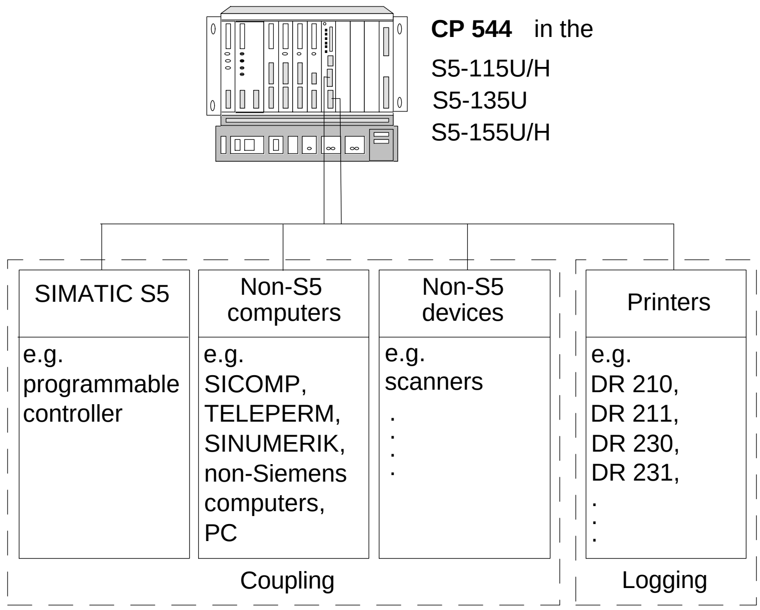


Fig. 1-1 Possible coupling partners of the CP 544

In order to use the CP 544, you must use a programmer

- to generate the STEP 5 program for the CPUs and
- to assign parameters to the CP 544 communications processor.

The jobs to the CP 544 are programmed in the STEP 5 program in the CPU memory by calling data handling blocks.

You can generate the interface parameters for the point-to-point linking to the CP 544 using the COM PP parameterization software.

A point-to-point connection with an asynchronous, bit-serial data transmission procedure is possible via each of the two device interfaces. Three link types can be implemented depending on the communication partner:

- Data transmission with RK 512 computer link
- Data transmission with 3964/3964R procedure
- Data transmission with open driver.

1.1 Which Components do you Require for the Point-to-point Link with the CP 544?

1

You require the following components for a point-to-point link with the CP 544 communications processor:

- The CP 544 module
- A programmer with connecting cable and adapter
- The COM PP parameterization software
- Data handling blocks of the respective programmable controller
- Interface submodules
- Connecting cables for the coupling partners
- User memory submodules (operation without these is also possible, see Section 1.1.6).

Refer to Chapter 11 for ordering information on components not included in the delivery of the CP 544.

1.1.1 CP 544 Module

Design

The electronics of the CP 544 communications processor is located on a single-width PCB of double Eurocard format which establishes the connection to the S5 bus via two backplane connectors.

The CP 544 is delivered without an interface submodule and without a user memory submodule. The openings on the front panel for fitting the interface submodules and the user memory submodules are closed by covers. Only remove these covers if you insert a submodule. Otherwise you may experience interference problems.

The control on the front panel is a ➛ **mode selector** with three positions. Statuses are indicated by two module-specific LEDs and four interface-specific LEDs (➛ **LED displays**).

You can insert a user memory submodule (EPROM or RAM card) into the opening next to the LEDs.

There are three independent interfaces on the CP 544:

- A PG interface to which you can connect programmers
- Two device interfaces (SI 1 and SI 2) which you can e-quip as required to use the interface for
  - the RK 512 computer link,
  - data transmission with the 3964/3964R procedures and
  - data transmission with the open driver.

The PG interface is integrated in the CP 544. You require one of the following interface submodules for the two device interfaces:

- V.24 submodule (RS 232C)
- TTY submodule
- RS422-A/485 submodule.

You must not use the RS422-A/485 submodule when operating the CP 544 without a fan subassembly.

Front panel

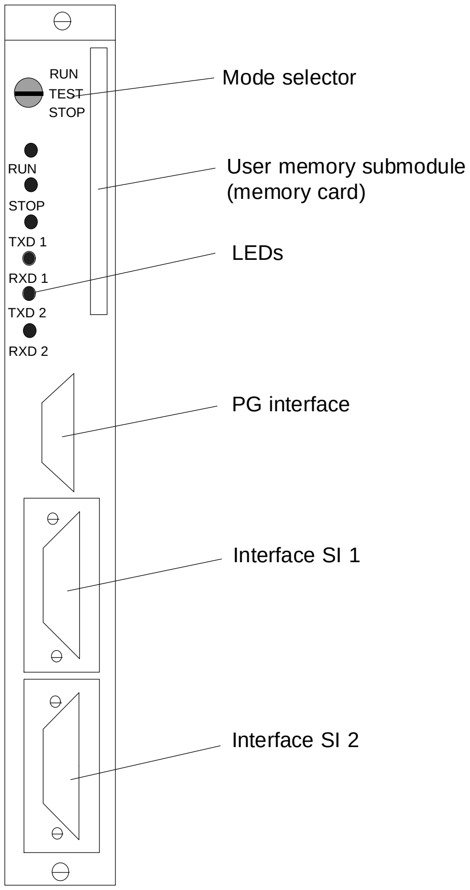


Fig. 1-2 Front panel of CP 544

1.1.2 Programmer

Connect the programmer to the PG interface of the CP 544 (see Section 2.7 for more details). If you have inserted a 923C coordinator module into the same subrack as the CP 544, you can also connect the PG to the coordinator.

Load the COM PP parameterization software, with which you assign the parameters to the two serial device interfaces of the CP 544, into the programmer.
Generate your user program by calling the required data handling blocks by means of the STEP 5 basic package on the programmer, transfer your user program to the CPU, and then test it.

1.1.3 COM PP Parameterization Software

The COM PP parameterization software is delivered with two different floppy disk formats (3.5" and 5.25") for the PCP/M operating system, and comprises:

- The command file S5PXCPPX.CMD (command file)
- The text file S5PDCPPX.DAT for German texts
- The text file S5PECPPX.DAT for English texts
- The text file S5PFCPPX.DAT for French texts.

By using the PCP/M emulator, you can also run the COM PP software with the MS-DOS operating system.

Function

Using COM PP you can:

- Assign parameters to the two serial device interfaces of the CP 544
- Transmit parameter sets to the CP 544
- Call information functions on the CP 544.

1.1.4 Interface Submodules

The device interfaces SI 1 and SI 2 of the CP 544 can be modified. You can establish a point-to-point link to different communication partners using different interface submodules. You can use the following interface submodules:

- RS422-A/485 submodule
- TTY submodule
- V.24 submodule.

RS422-A/485 submodule You can use the ➛ **RS422-A/485 submodule** in the RS422-A mode for the following:

- Data transmission with the RK 512 computer link
- Data transmission with the 3964/3964R procedures
- Data transmission with the open driver.

In the links listed above, you can only use the RS422-A/485 submodule in full-duplex mode (with respect to hardware). The electrical characteristics are based on the EIA standard RS422-A (CCITT recommendation V.11). The following Fig. shows how the interface is connected (transmit and receive lines).

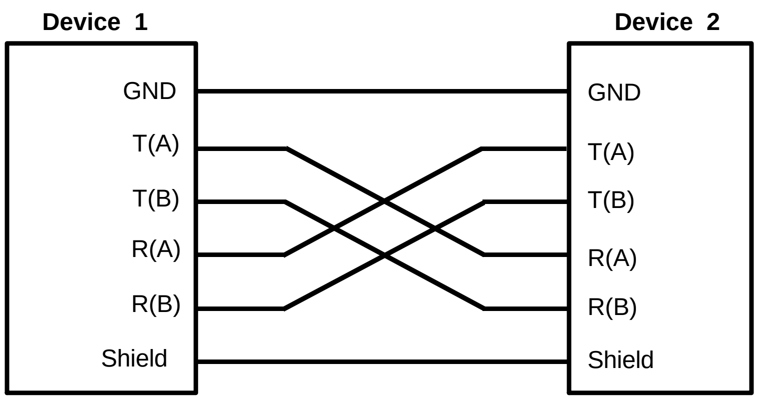


Fig. 1-3 RS422/485 submodule: full-duplex mode

Apart from the transmit and receive lines, the RS422-A/485 submodule has a number of control and status signals complying with the CCITT recommendation X.24 and ISO 8481. These control and status signals are not required for the links listed above, however, and need not be connected. The RS422-A/485 is a differential voltage interface and therefore has better noise immunity than a TTY or V.24 interface.

The following applies to the signals according to the EIA standard RS422-A (V.11):

Logical 0 (ON) corresponds to: $V_A > V_B$
Logical 1 (OFF) corresponds to: $V_A < V_B$.

With the RS422-A/485 submodule, the interface signals are electrically isolated from the power supply of the PLC.

Please note that you must not use the RS422-A/485 submodule in the CP 544 without a fan subassembly.

TTY submodule

You can use the ➽ **TTY submodule** for the following:

- RK 512 computer link
- Data transmission with the 3964/3964R procedures
- Data transmission with the open driver.

The TTY submodule is equipped with a transmitter and a receiver for 20-mA current loop signals.

The following Fig. illustrates the typical connections of the current loop signals:

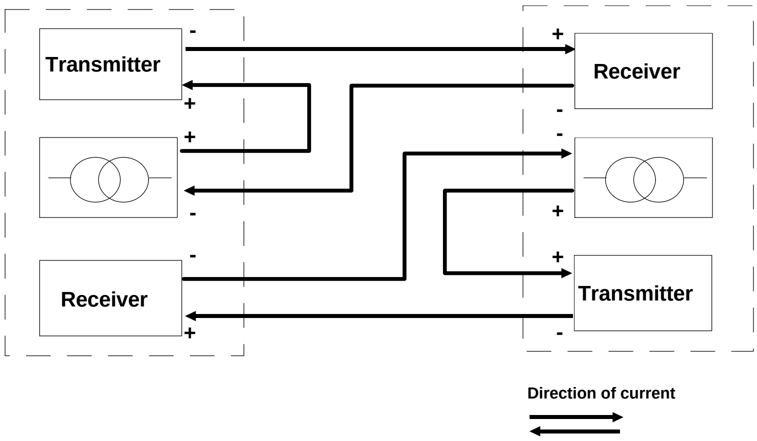


Fig. 1-4 TTY submodule: direction of loop current

The loop current can be supplied both by the TTY submodule and by the communications partner. Only the end supplying the current is non-floating.
If you use longer transmission lines, you should make sure that the transmitter always supplies the current.
The TTY submodule supplies the current (20 mA) via jumpers in the connector of the standard cable. The 24 V required to generate the current is obtained from the power supply of the PLC. With a correct current loop, 20 mA must flow in the quiescent state (logical 1). A logical 0 is present if the current is interrupted.

The following applies to the TTL signals:
Logical 0 is represented by: no current
Logical 1 is represented by: current (20 mA).

The TTY submodule corresponds to DIN 66258, Part 1.

V.24 submodule

You can use the ➻ **V.24 submodule** for the following:

- RK 512 computer link
- Data transmission with the 3964/3964R procedures
- Data transmission with the open driver.

The following Fig. illustrates how the V.24 interface is connected (transmit and receive lines):

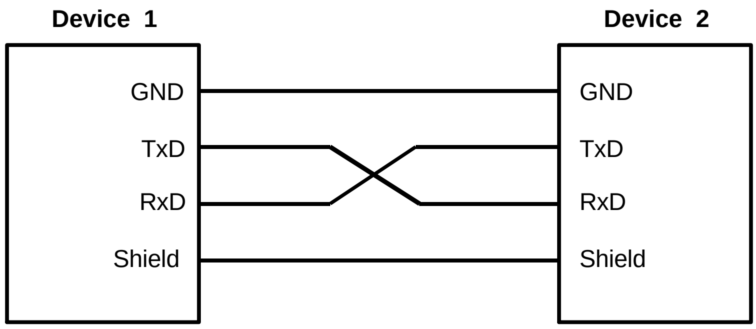


Fig. 1-5 V.24 interface

Apart from the transmit and receive lines, the V.24 submodule has a number of control and status signals complying with the CCITT recommendation V.24/V.28. These control signals are not required with the standard procedures of the RK 512, 3964/3964R and open driver, however, and are not used (exception: RTS/CTS with open driver).

The V.24 signals are differentiated as follows:
Logical 0 is represented by a voltage $\geq$ +3 V
Logical 1 is represented by a voltage $\leq$ -3 V.

1.1.5 Connecting Cables for the Coupling Partners

There are standard connecting cables to link the various interface submodules to the partner.

Table 1.1 Connecting cables for the coupling partners

Interface submodule	**RS422/485 submodule**	**TTY submodule**	**V.24 submodule**
Standard connecting cable between CP 544 and ...	CP 524 CP 544	CP 524/525 CP 544 CPU 928B	CP 524/525 CP 544 CPU 928B
		DR 210/DR 211 DR 230/DR 231	DR 210/DR 211 DR 230/DR 231

No standard connecting cables are available for the link to the 521SI and 523 CPs.
You can find more details on the connecting cables (e.g. lengths) and the pin assignments of the sub-D plugs in the interface submodule in the reference section, Chapter 10, under the description of the three submodules.

1.1.6 User Memory Submodules

You can use SIMATIC memory cards (full credit card format only) with a capacity up to 256 x 2^{10} bytes in the CP 544.

Two different types of memory submodules are available:

- EPROM submodules
- RAM submodules.

You do not usually require a RAM submodule for the CP 544 since this already contains an internal RAM whose 32 x 2^{10} bytes provide sufficient space to accommodate the parameters of the various protocols.

EPROM submodules

You can program EPROM submodules offline on the SIMATIC S5 programmers 7xx using the STEP 5 basic package (version 6 and later). The front of the PG contains a special plug to which the submodule is connected. Refer to the STEP 5 manual for a description of the EPROM submodule programming. The submodule can be inserted into the CP 544 once it has been programmed. The power supply to the programmable controller must be switched off in the process.

EPROM submodules are available for the CP 544 with the following capacity:

- 256 x 2^{10} bytes.

RAM submodules

RAM submodules are programmed online in the CP 544. The PG must be connected to the PG interface. A RAM submodule is only required if the parameters require more than 32 Kbytes of memory. This may be significant for later configurations. Note that the user program stored in the RAM submodule is lost if you pull the submodule out of the CP 544 or pull the CP 544 out of the programmable controller.

RAM submodules are available for the CP 544 with the following capacity:

- 256 x 2^{10} bytes.

A RAM submodule is only required if the parameters exceed 32 x 2^{10} bytes.

Without user memory submodule

You can also work without a user memory submodule. The parameters are then stored in the internal RAM (capacity 32×2^{10} bytes) of the CP 544. Note that the data stored in the internal RAM are lost when you remove the module. If you wish to prevent this, you can also store the parameters for the static parameter set and the dynamic parameter sets in a DB/DX on the user memory submodule of the CPU. You must then ensure that the parameters are transferred to the CP 544 during the startup using a special job.

You can find more details in the description of the data handling blocks in Section 6.3.8.

2

How do you Fit the Hardware Components?

Contents of Chapter 2

2 How do you Fit the Hardware Components?

This chapter describes how you fit and start the hardware components for your point-to-point coupling.

The following table summarizes the steps you must take:

Table 2.1 Fitting of hardware components step-by-step

1.	Make the required switch settings on the CP 544 and check the jumper settings.
2.	Check the jumper setting on the interface submodule and fit the submodule into the CP 544.
3.	Insert a programmed EPROM or RAM submodule into the CP 544 slot if required.
4.	Switch off the power supply to your PLC.
5.	Insert the CP 544 into a provided slot of your PLC.
6.	Establish the connection between the partner device and the CP 544.
7.	Check the setting of the mode selector switch on the CP 544. The switch must be in the RUN position to enable transmission to the partner.
8.	Make the required settings on the partner.
9.	Switch on the power supply to your PLC.

2.1 Which Settings must you Make on the CP 544?

The data transfer between the CPU and the CP 544 takes place via the page area of the dual-port RAM. A base page number must be assigned to each CP if several CPs are fitted in one PLC so that the CPU can specifically address the individual CPs. Starting with the base interface number, the further page numbers are assigned automatically depending on the number of pages per CP.

The following Fig. illustrates the distribution of the page numbers in the case of three CPs with different numbers of pages.

	CP1	CP2	CP3
Page number	0	8	16
Number of pages per device interface	4	4	2

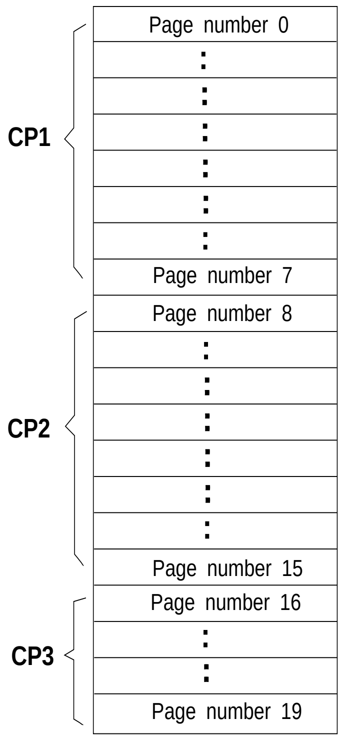


Fig. 2-1 Page numbers

You must therefore make or check the ➸ **switch settings** and jumper settings described below before you fit a CP 544 into your programmable controller:

- Set page frame number (interface number) (S2)
- Set number of pages (S5)
- Set coordination flag area (S4)
- Check jumper settings.

The following Fig. shows the positions of the switches on the module.

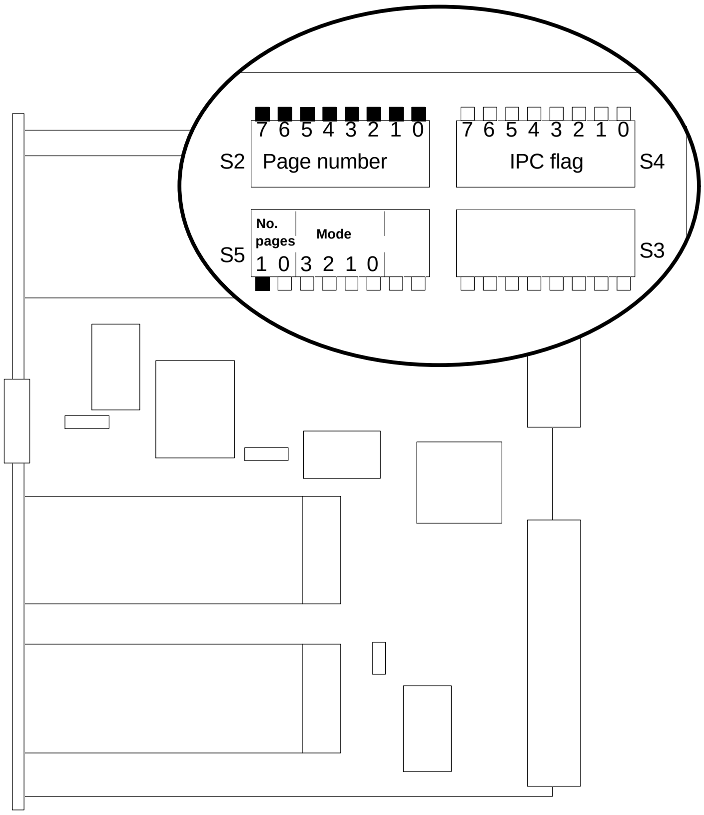
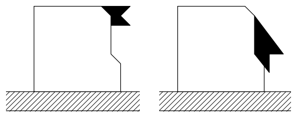


Fig. 2-2 Positions of switches on the module, and delivered state

Switch position

The following illustration shows the side view of the switches and explains the meanings of the switch positions.



□ Switch positioned upwards means 1

■ Switch positioned downwards means 0

Setting the page number

To enable the CPU to address the CP, you must enter a page number (interface number, parameter SSNR) when assigning parameters to the data handling blocks. The page number must be present in the area which you have set on the CP.

Up to four pages are available for each of the two device interfaces of the CP 544. To ensure that only the desired page is addressed during data transfer, each page is assigned its own number.

The even page numbers address device interface 1, the odd page numbers address device interface 2.

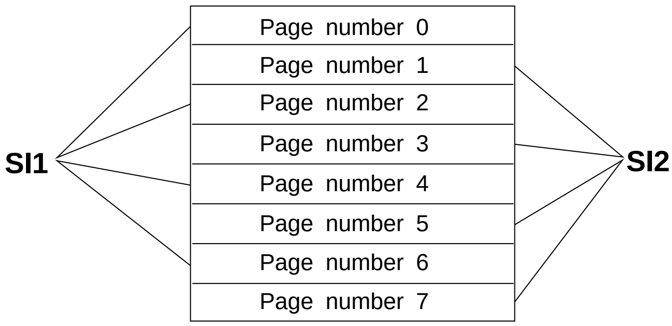
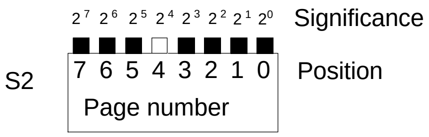


Fig. 2-3 Assignment of page numbers to device interfaces

You need only set the lowest page number in each case, the following numbers result from the number of pages. To set the number, position the associated switch in assembly S2 upwards. When delivered, all switches are pressed downwards.

The following example shows the setting of page number 16.



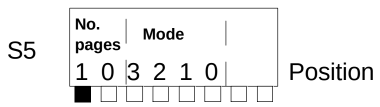
Page number 16 results from the equation

$$16 = 0 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0$$

Setting the number of pages

Set the number of pages using the first two switches of assembly S5.

When delivered, the switch for the number of pages with position 1 is pressed, and the switch with position 0 is in the upwards position, i.e. one page per device interface is set. The other switches of assembly S5 are positioned upwards and must not be changed since the module would otherwise respond in an undefined manner.



1, 2 or 4 pages are possible per device interface.

Number of pages per device interface	Switch in position 1	Switch in position 0
1 page	Down	Down or up
2 pages	Up	Down
4 pages	Up	Up

Four pages are set per interface if both switches are positioned upwards. This would result in the following distribution of page numbers, for example:

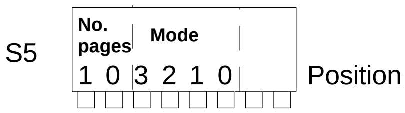
Page number 16, 18, 20, 22	Device interface SI 1
Page number 17, 19, 21, 23	Device interface SI 2

Note that the switches in assembly S2 with a lower significance may be unimportant depending on the number of pages you have set per device interface.

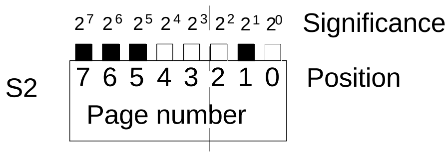
Set on S5	**Switch insignificant on S2**
1 page per device interface	Position 0
2 pages per device interface	Positions 1 and 0
4 pages per device interface	Positions 2, 1 and 0

Example:

4 pages are set per device interface.



Switch assembly S2 is as follows:



The switches at positions 2, 1 and 0 with significances 2^2, 2^1 and 2^0 are unimportant. Only the page numbers 0, 8, 16, 24, 32, 40 ... can be set.

Page number 24 is set in this example. The assignment of all 8 page numbers to the two device interfaces is thus as follows:

Page number 24, 26, 28, 30	Device interface SI 1
Page number 25, 27, 29, 31	Device interface SI 2

Setting the coordination flag area

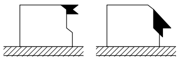
You can enable or disable the data transfer between the CPU and CP 544 using coordination flags (interprocessor communication flags). This is necessary to protect areas on the partner which are occupied by transmitted data from being overwritten by new data. You must identify the coordination flags as output flag bytes. They are stored in a memory area of 256 bytes which can be addressed by all modules (coordination flag/communication flag area).

If several CP 544s or several CPUs are used in the programmable controller, the coordination flag area must be divided between the various communications processors and the various CPUs.

Also note that you must disable the used coordination flag areas on an applied coordinator.

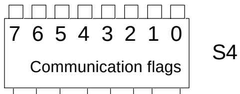
The coordination flag area is divided into 8 fields with 32 bytes each. You can disable one or more of these fields on the CP 544 using switch S4 by setting the associated switch upwards.

When delivered, all switches are positioned upwards, i.e. all coordination flags are disabled.



☐ Switch upwards = disabled

■ Switch downwards = enabled



Communication flag bytes	Address
224 - 255	F2E0 - F2FF
192 - 223	F2C0 - F2DF
160 - 191	F2A0 - F2BF
128 - 159	F280 - F29F
96 - 127	F260 - F27F
64 - 95	F240 - F25F
32 - 63	F220 - F23F
0 - 31	F200 - F21F

You must additionally enter the corresponding coordination flag bytes in the DB1 of the CPUs! They can then be addressed in the STEP 5 program.

Example of the distribution of the coordination flags between two CP 544s, two CPUs and a coordinator in the S5-135U.

Coordinator	**1st CPU**	**2nd CPU**	**1st CP 544**	**2nd CP 544**
	DB1 Output coordination flag bytes 8, 12, 70	DB1 Output coordination flag bytes 32, 35, 61	Coordination flag bytes *0 to 3*1	
				Coordination flag bytes *32 to 63*
Coordination flag bytes *96 to 255*			Coordination flag bytes *64 to 95*	

The first CPU is to coordinate the data transfer with the first CP 544 via the bits of the coordination flag bytes 8, 12 and 70.

- Therefore enable the coordination flag areas 0 to 31 and 64 to 95 on the first CP 544 (you can only enable or disable areas of 32 consecutive coordination flag bytes) and
- Enter bytes 8 and 12 as output communication flag bytes in the DB1 of the first CPU.

The second CPU is to coordinate the data transfer with the second CP 544 via the bits of the coordination flag bytes 32, 35 and 61.

- Enable the coordination flag area 32 to 63 on the second CP 544 and
- Enter bytes 32, 35 and 61 as output coordination flag bytes in the DB1 of the second CPU.

Since the coordination flag area only exists once in each PLC, it is now only possible to use the coordination flags 96 to 255 for other purposes.

Switch assembly S3

Switch assembly S3 is reserved for further applications. All switches must be positioned upwards when delivered.

Checking the jumper settings

The jumpers are set on the CP 544 when delivered such that it can be used immediately without modifications.

Use the following Fig. to check the jumper settings on your CP 544.

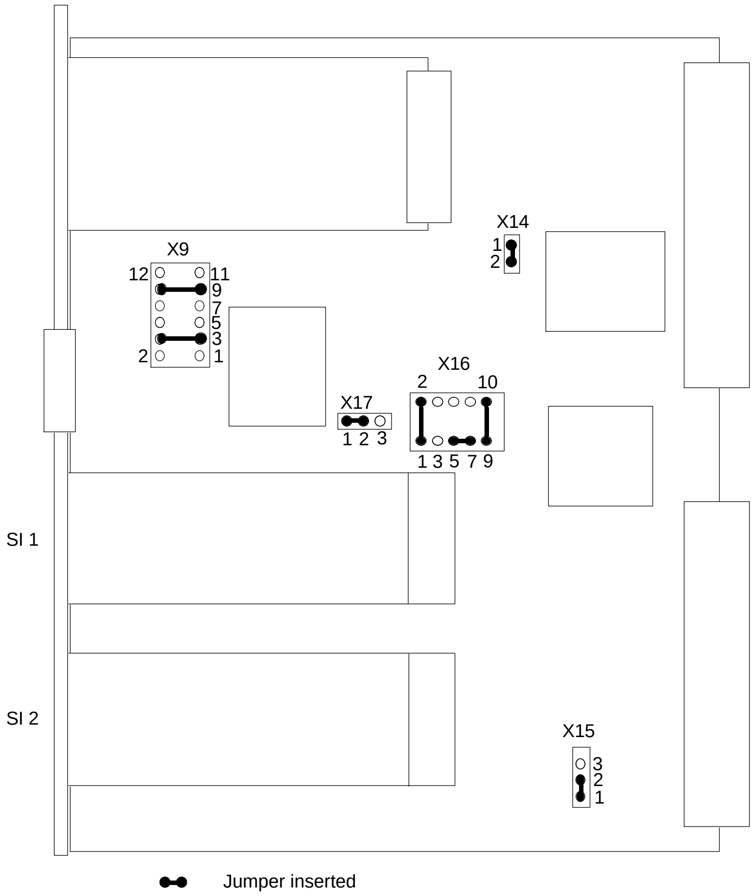


Fig. 2-4 Jumper settings on the CP 544 when delivered

2.2 What are the Jumper Settings on the Interface Submodule?

The jumpers are set on the interface submodules when delivered such that the submodules can be used immediately without modifications.

The reference section of this manual describes the jumper settings for the various submodules (➻ **RS422-A/485 submodule,** ➻ **TTY submodule,** ➻ **V.24 submodule**).

2.3 How are the Interface Submodules Installed?

You must install an ➻ **interface submodule** in the CP 544 outside the central controller.

Installation

Proceed as follows:

- Check the jumper settings on your interface submodule (see reference section)
- Switch off the power supply to your PLC
- Remove the CP 544
- Loosen the two screws which secure the receptacle cover on the CP 544, and remove the cover
- Insert the interface submodule through the front panel into the plug connection (components in same direction as CP 544)
- Secure the submodule using the two screws with which the cover was secured
- Insert the CP 544 into the central controller
- Switch the power supply to your PLC back on.

> **Note**
> For interference reasons it is absolutely essential to firmly tighten the two screws with which the interface submodule is secured. Only then can the EMC values (electromagnetic compatibility) be observed.

Removal

Proceed as follows to remove the interface submodule:

- Switch off the power supply to your PLC
- Remove the CP 544 from the central controller
- Loosen the two securing screws of the submodule and pull the submodule out of the receptacle.

2.4 How do you Insert a SIMATIC Memory Card?

You can insert a SIMATIC memory card with a full credit card format (EPROM or RAM submodule) into the CP 544 module from the front.

The parameters for your CP 544 user program are stored on the submodule.

Parameterization of the standard communication processes which are stored in the EPROM of the CP 544 is also possible without the memory card. The parameters are stored in the internal RAM in this case and are lost when the module is removed.

Insertion and removal

The memory card must only be inserted and removed with the power supply switched off.

2.5 How is the CP 544 Installed?

Installation

The CP 544 must not be inserted or removed under power!

- Switch off the power supply to your PLC
- Insert the CP 544 into the PLC subrack. Observe the permissible slots for the various programmable controllers (see below)
- Ensure that you do not tilt the module and that the contact springs of the guides in the subrack are not bent
- Lock the CP 544 in the subrack
- Switch the power supply to your PLC back on again
- Check the position of the mode selector on the CP 544. The switch must be in the RUN position to enable the transmission to the partner.

The CP 544 can be inserted into the following slots of the various programmable controllers:

Table 2.2 Permissible slots for the CP 544

Subrack/device	**Slot No. for CP 544**
S5-115U/H	
CR 700-2[1)] ER 701-3[1) 2)] CR 700-3	0, 1, 2, 3, 4, 5 0, 1, 2, 3, 4, 5, 6 0a, 0b, 1a, 1b, 2a, 2b, 3, 4, 5
S5-135U	
CC 135U	11, 19, 27, 35, 43, 51, 59, 67 (75, 83, 91, 99, 107, 115, 123, 131)[3)]
S5-155U	
CC 155U	19, 35, 43, 51, 59, 75, 83, 91, 99, 107, 115, 123, 131, (139, 147)[4)]
S5-155H	
CC 155U	35, 43, 51, 59, 67, 75, 83, 91, 99, 107, 115, 123, (139, 147)[4)]
EU 185U	19, 27, 35, 43, 51, 59, 67, 75, 83, 91, 99, 107, 115, 123, 131, 139

[1)]Adapter casing required. One module per adapter casing.
[2)]Not with interface module 311.
[3)]Not for CC 135-3UA..
[4)]Only possible following modification to jumpers on wiring backplane.

Removal

Proceed as follows to remove the CP 544:

- Set the mode selector on the CP 544 to STOP
- Switch off the power supply to your PLC
- Remove the CP 544 from the central controller.

2.6 How are the Coupling Partners Connected?

The connection line between the CP 544 and the partner must have a shield grounded at both ends and metal plugs. Standard connecting cables satisfy these requirements.

The following standard connecting cables are available:

Table 2.3 Standard connecting cables

CP 544 connected to	Submodule in CP 544	Connection in CP 544: power supply with transmitter, receiver
CP 544	TTY submodule	Active, passive
CP 524, CP 525	TTY submodule	Active, passive
CP 544	V.24 submodule	
CP 524	V.24 submodule	
DR 210/DR 211 DR 230/DR 231	TTY submodule	Active, passive
DR 210/DR 211 DR 230/DR 231	V.24 submodule	
CP 544	RS422-A/485 submodule	
CP 524	RS422-A/485 submodule	

You can obtain the order nos. from the ordering information in Chapter 11. No standard connecting cables are available for the connections to the CPs 521SI and 523.

You can find more details on the connecting cables (e.g. permissible lengths) in the reference section, Chapter 10, under the description of the three submodules.

Connect the shield at both ends with a large-area contact to the housing of the metal plug. In addition, the cable shield must always be connected to a shielding rail with a large-area contact.

An equipotential bonding conductor must be provided if there are large differences in ground potential between the CP 544 and the partner. Signal cables and power cables up to 1 kV must be spaced at least 10 cm apart. The spacing must be increased proportionally in the case of higher voltages.

You can find further information on installation in the reference section under the term ➻ **installation guidelines**.

If you do not wish to use the standard connecting cables, please refer to the pin assignments of the interface submodules in the reference section.

Refer to the respective manual on how to fit your partner device and to start it up.

2.7 How is a PG Connected?

The connection line between the CP 544 and the programmer must have a shield grounded at both ends and metal plugs. The cable shield must be connected at both ends to the plug housing and the shielding rail with a large-area contact.

PG connection on CP 544

Since the PG interface on the front panel of the CP 544 is provided with a screw lock, an adapter cable for the connection to the PG has been provided for the CP 544 (see ordering information for order no.).

PG connection on coordinator

If you have inserted a coordinator module 923C in your programmable controller, you can also connect the PG to the coordinator.

2.8 How can you Determine Whether you have Correctly Fitted all Hardware Components?

Using the following checklist you can check whether you have installed all hardware components of the CP 544 correctly.

Table 2.4 Checklist for installation of hardware components

1.	Is the correct page number (interface number) set on the CP 544?	
2.	Is the number of pages set correctly on the CP 544?	
3.	Is the coordination flag area set correctly on the CP 544?	
4.	Do the jumper settings on the CP 544 agree with the delivery state?	
5.	Do the jumper settings on the interface submodule agree with the delivery state?	
6.	Is the interface submodule inserted correctly into the connector?	
7.	Is the interface submodule screwed tightly to the front panel?	
8.	If you are using a user memory submodule: is a permissible user memory submodule inserted?	
9.	Is the CP 544 inserted into a slot permissible for your programmable controller?	
10.	Is the CP 544 correctly inserted and locked in the subrack?	
11.	Is your programmer correctly connected on the CP 544?	
12.	Is the cable between the coupling partners an approved cable and correctly fitted?	

2.9 How does the CP 544 Respond Following Power-up?

Switching on of power supply

Once you have switched on the power supply to your programmable controller,

- the STOP LED (➻ **LED displays**) lights up on the front panel of the CP 544,
- the operating system carries out a self-test,
- the STOP LED goes out after approx. 10 seconds and the RUN LED lights up if no errors have been detected and if the parameters for the device interfaces are complete and
- the TXD LEDs flash until the CP 544 receives the SYNCHRON jobs from the CPU.

Synchronization of CPU and CP 544

You must insert the SYNCHRON data handling block into the restart organization blocks of the CPU for each page frame you use. This block synchronizes the CPU and CP 544 and defines the maximum frame size for data transfer between the CPU and CP 544 (see Section 6.3.1, SYNCHRON).

Once the SYNCHRON job has been executed without errors, the CP 544 is ready to process jobs from the CPU (SEND, FETCH, RECEIVE etc) and from the partner.

2.10 How does the CP 544 Respond During Operation?

Once you have switched on the power supply, you can

- set the operating mode of the CP 544 using the mode selector and
- recognize the module status on the LED displays.

2.10.1 Mode Selector

The control element on the front panel of the CP 544 is a ➼ **mode selector switch** with the three positions RUN/TEST/STOP.

RUN

If the mode selector is set to RUN (and if a SYNCHRON job has been executed without errors), the CP 544 processes jobs coming from the CPU and the partner.

TEST

The TEST position does not currently have a special meaning. The CP 544 responds as in the switch position RUN.

STOP

If the mode selector is set to STOP, the transfer of useful data on the transmission link between the CPU and CP is interrupted.
Jobs arriving from the CPU are rejected with an error message (see also Chapter 8). Jobs from the partner are no longer routed on to the CPU.
The data of the partner job are lost if you are working with the 3964/3964R procedure or with the open driver. If you wish to prevent this, you must either use the RK 512 computer link or make a provision for protection of the useful data yourself.

2.10.2 LED Displays

The LED displays provide you with information on the CP 544. The following must be differentiated:

- The module-specific displays RUN and STOP
- The interface-specific displays TXD and RXD.

Module-specific displays

The status of the complete CP is indicated on the module-specific displays RUN and STOP.

Table 2.5 LED displays (module-specific)

LED RUN	**LED STOP**	**Meaning**
On (green)	Off	- CP is in RUN status - The CP can process jobs arriving from the CPU and the partner
Slow flashing	Off	- CP is in TEST status - The CP can process jobs arriving from the CPU and the partner
Off	On (red)	- CP is in STOP status - Module is in operation, but data transfer to the CPU via the S5 interface is no longer taking place
Off	Slow flashing	- CP is in "Error" status - An error has occurred which no longer enables reliable processing. This status can only be left by switching off the power.

Green interface-specific displays

The interface-specific displays TXD and RXD (green) indicate who has triggered the job (TXD) and who receives the job (RXD).

The TXD LED lights up when a job is transferred to the protocol software (RK 512, 3964/3964R procedures or open driver).
The TXD LED is switched off as soon as the protocol software has terminated the transmission procedure with a positive or negative result.

The RXD LED is switched on when a job has been received by the CP.
The RXD LED is switched off as soon as the job has been transferred to the CPU.

The LEDs do not indicate the activity on the line. For example, the TXD LED is switched on in the case of protocol errors, but no data are transmitted via the link. Furthermore, the LEDs do not necessarily provide information on the data transmission direction. For example, the TXD LED is switched on on the CP which triggered the job in the case of a FETCH job with the RK 512 computer link, but the data are transmitted in the opposite direction.

Red interface-specific displays

The interface-specific displays TXD1 and TXD2 (red) indicate the status of the device interface.

The displays and their meanings are listed in the following table.

Table 2.6 LED displays (module-specific)

TXD 1, TXD 2	
On (red), permanently	Interface submodule inserted but no interface parameters present
On (red), fast flashing	Incorrect/incomplete parameter or incorrect interface submodule inserted
On (red), slow flashing	Parameter correct but synchronization has not yet taken place via backplane bus
On (green)	Job has been triggered
Off	Interface is in operation, active and passive jobs can be executed, or no interface submodule inserted
RXD 1, RXD 2	
On (green)	Job has been received

2.10.3 Status Transitions

Each change in CP status has an effect on the data transmission. The most important transitions are described in this section.

Module-specific status transitions

These are status transitions which have an effect on the complete module. They can be triggered by:

- The mode selector
- Switching off the power supply

IF...	**THEN...**
the mode selector is switched from RUN or TEST to STOP	the currently processed job (job from CPU or from partner) will be processed completely (with continuation frames and timeout monitoring). the job queue will be deleted. further jobs from the CPU will be rejected, jobs from the partner will no longer be routed on to the CPU. the module will enter the STOP status.
the module changes from RUN, TEST or STOP to the ERROR status	all jobs will be aborted immediately. the STOP LED will flash.
the power supply fails during operation	the data stored in the internal RAM and in the user memory are buffered, i.e. the protocol parameters and the job list will be retained. the data transmission will be aborted and must be restarted by the user. The jobs stored on the CP in the queue will be lost.

Interface-specific status transitions

These are status transitions which have an effect on the individual device interface. They can be triggered by:

- Operator inputs via COM PP
- Calling of special jobs (data handling blocks) in the STEP 5 program.

2

IF...	**THEN...**
the device interface is switched to passive by the STOP job (data handling block job)	the currently processed job (job from CPU or from partner) will be processed completely (with continuation fields and timeout monitoring). the job queue will be deleted. further jobs from the CPU will be rejected, jobs from the partner will no longer be processed.
the device interface is synchronized in the cycle* by a SYNCHRON job (data handling block job)	the currently processed job from the CPU or the partner is aborted. the job queue will be deleted. further jobs from the CPU will be rejected, jobs from the partner will no longer be processed. jobs can be handled again via the device interface provided the synchronization was carried out successfully.

* Note:
A SYNCHRON job should be avoided in the cycle since secondary faults may always occur in this case. If it is impossible to avoid the SYNCHRON in the cycle, all current jobs should first be terminated on the CPU.

IF...	THEN...
the device interface is reparameterized using the special job "Parameterize device interface"	the parameterization job will be added to the queue. All previously added jobs are also processed. the job queue will be deleted as soon as the parameterization job has been processed. further jobs are rejected by the CPU, jobs from the partner will no longer be processed. the device interface will be switched to passive and the parameterization carried out. the device interface can be restarted following successful parameterization.
the device interface is reparameterized using COM PP	the currently processed job (job from CPU or from partner) will be processed completely (with continuation fields and timeout monitoring). the job queue will be deleted. further jobs from the CPU will be rejected, jobs from the partner will no longer be processed. the device interface will be switched to passive and the parameterization carried out. the device interface can be restarted following successful parameterization.

3

How do you Transmit Data with the RK 512 Computer Link?

Contents of Chapter 3

3 How do you Transmit Data with the RK 512 Computer Link?

Chapter 3 describes the functions of the RK 512 computer link and acquaints you with the generation of the STEP 5 program and the parameter sets for the CP 544.

3.1 Introduction

Using the RK 512 computer link, data can be exchanged between two communications partners connected via a point-to-point link.

Interface submodules

Various interface submodules are available for the RK 512 computer link:

- V.24 submodule
- TTY submodule
- RS422-A/485 submodule (only in the RS422-A mode).

Transmission speed

Set the transmission speed for the data exchange as suitable for the communications partner. The following transmission speeds are permissible:

- 300 bps to 76800 bps with the RS422-A/485 submodule
- 300 bps to 19200 bps with the V.24 submodule
- 300 bps to 9600 bps with the TTY submodule.

The total baud rate of 76800 bps must not be exceeded, however.

Transmission reliability

The SIMATIC S5 RK 512 computer link ensures the highest possible transmission reliability since the RK 512 protocol includes several layers of the ISO/OSI layer model (ISO IS 7498):

- The physical layer (layer 1):
  This layer stipulates the physical transmission of the data bytes (physical characteristics of the connection, transmission speed, ...)
- The data link layer (layer 2):
  The data bytes are transmitted using the 3964 or 3964R transmission procedure. This adds start and end characters to the data bytes and initiates repetitions if errors occur.
- The network layer (layer 3):
  This does not exist in the RK 512 since it is a pure point-to-point link.
- The transport layer (layer 4):
  The RK 512 replies to every correctly received command message with a reply message. This allows the sender to check that its data have arrived completely at the partner or whether the requested data are available at the partner.

Coupling partners

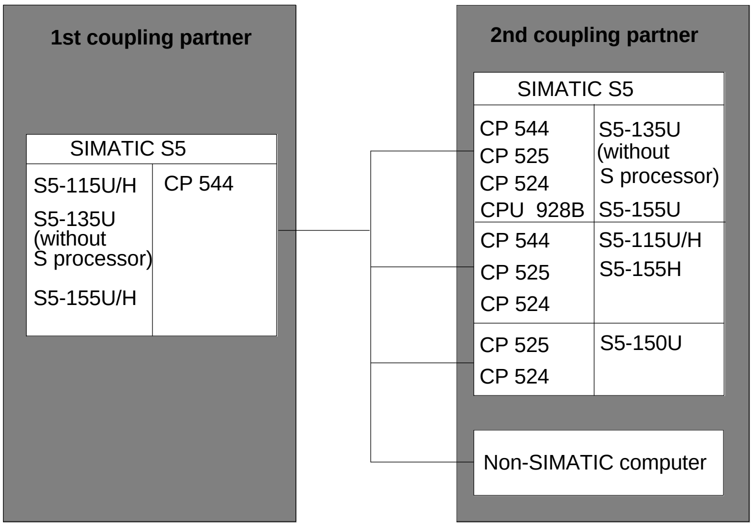


Fig. 3-1 Possible coupling partners with RK 512 data transmission

The RK 512 computer link implements the direct data exchange between the CP 544 in an S5-115U/H, S5-135U (without S processor), S5-155U/H and:

- another CP 544
  in the S5-115U/H, S5-135U (without S processor) and S5-155U/H programmable controllers
- a CPU 928B
  in the S5-135U and S5-155U programmable controllers
- a CP 525 or CP 524
  in the S5-115U/H, S5-135U, S5-150U and S5-155U/H programmable controllers
- a non-SIMATIC computer capable of handling the RK 512 (e.g. SICOMP M, SICOMP R).

Transmitted data

You can transmit the following data stored in a PLC using the RK 512 computer link:

- Data blocks, extended data blocks
- Flag bytes
- Input/output bytes
- I/O bytes
- Timers
- Counters
- System data
- Absolute addresses.

Transmission direction

You can implement the following jobs with the SIMATIC S5 RK 512 standard computer link:

- **Send data** (SEND job):
  The PLC 1 sends data to the PLC 2 via the CP 544 in the PLC 1 and the CP 544 in the PLC 2

- **Fetch data** (FETCH job):
  The PLC 1 fetches data from the PLC 2 via the CP 544 in the PLC 1 and the CP 544 in the PLC 2

- **Receive data** (RECEIVE-ALL job):
  The PLC 1 receives data from the PLC 2 via the CP 544 in the PLC 1 and the CP 544 in the PLC 2

- **Prepare data to be fetched** (SEND-ALL job):
  The PLC 1 prepares data for the PLC 2 via the CP 544 in the PLC 1 and the CP 544 in the PLC 2.

3.2 Data Exchange Sequence

The following Fig. shows the data exchange sequence between two programmable controllers, each of which is fitted with a CP 544.

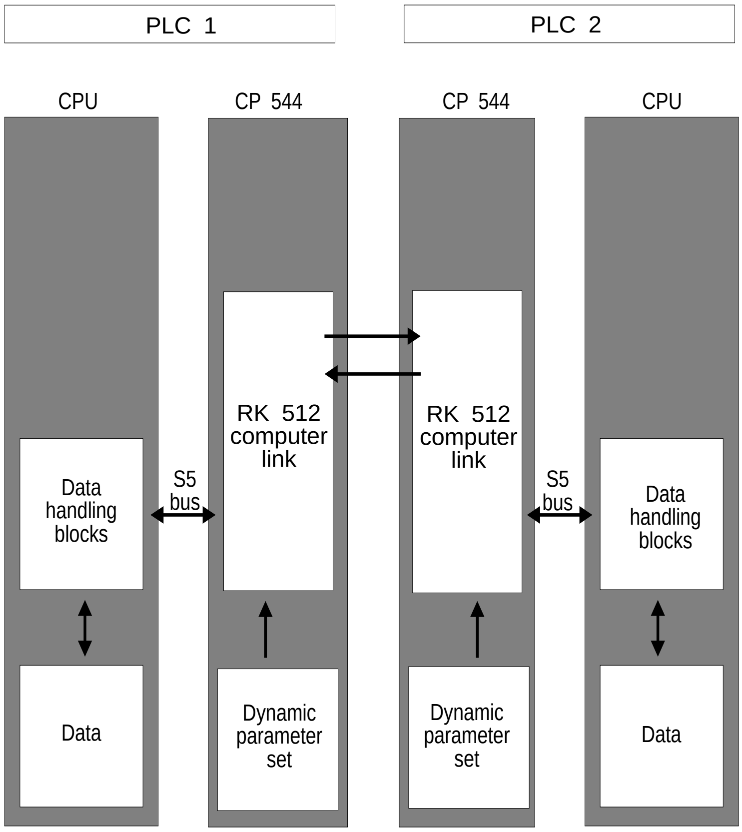


Fig. 3-2 Data exchange between two programmable controllers

Data handling blocks

The data handling blocks in the STEP 5 program of the CPU are used:

- to trigger and execute data exchange,
- to receive the transmitted data.

RK 512 computer link

The RK 512 computer link in the CP 544 modules of the 2 PLCs

- is provided with the parameters for the coupling partner via the dynamic parameter set,
- passes the data on to the CP in the other PLC.

The data exchange sequence described means that you have two important tasks:

- You must generate your STEP 5 program with the calls of the data handling blocks for the two CPUs
- You must assign parameters to the RK 512 computer link in the CP 544.

3.3 Program Elements for RK 512

The programming of the RK 512 computer link is based on only a few fundamental points - the STEP 5 program with the calls of the data handling blocks and the static and dynamic parameter sets on the CP.

3.3.1 STEP 5 Program with Data Handling Blocks

3

Incorporate the data handling blocks described below into your STEP 5 program to enable data transmission with the RK 512 computer link according to the particular task.

Once you have read this description, you will be able to generate a concept for the STEP 5 program for your particular task.

You can find a detailed description of the individual data handling blocks in Chapter 6.

3.3.1.1 SYNCHRON

Synchronizing CPU and CP

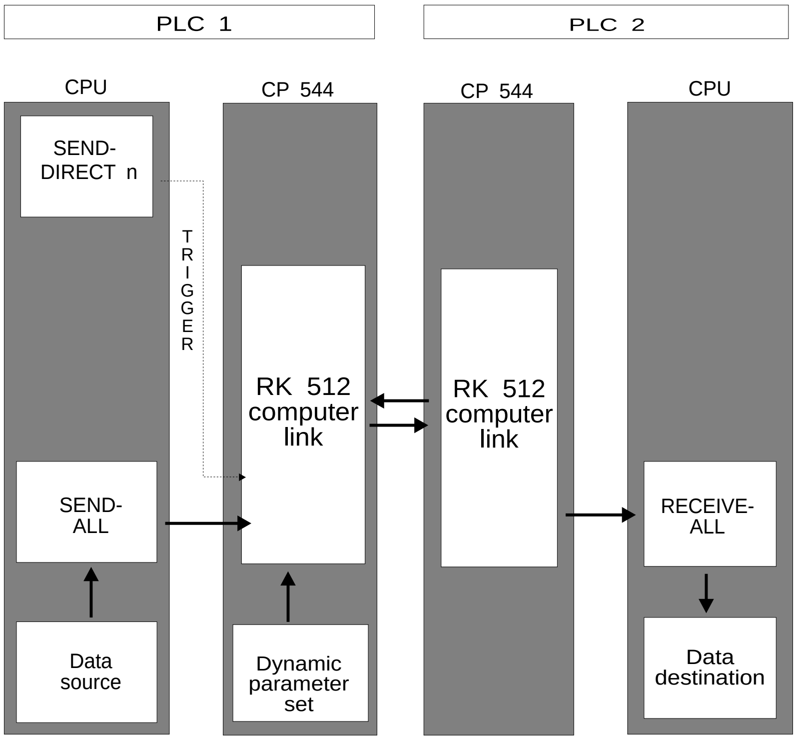
The data handling block SYNCHRON synchronizes the interface between the CPU and CP.

SYNCHRON must be called in the restart organization blocks of the CPU for every page frame used by you in the two device interfaces of the CP.

3.3.1.2 SEND

Send data

The data handling block SEND transmits data from the CPU to the CP 544. The job is triggered by the SEND-DIRECT. In order to transmit data, a SEND-ALL job must be additionally programmed in the user program and called cyclically. The matching partner job RECEIVE-ALL must be programmed in the STEP 5 program of the partner CPU to enable the data to be received by it.



n = job number

Fig. 3-3 SEND job

When transmitting data with the CP 544, the SEND-DIRECT data handling block is used for the following special jobs:

Parameterize device interface

You can use this special job to assign parameters to the two device interfaces of the CP 544 without the COM PP parameterization software in that you store the parameters in a data block.

Execute PSEUDO-WRITE function

You can use this special job to transmit data. All parameters on the source and destination are stored in a DB/DX. The special job enables you

- to modify the source and/or destination data of a job during execution of the program,
- to program this job without COM PP.

Start device interface

You can use this special job to start a device interface from the STEP 5 program.

Set date and time

You can use this special job to set the clock on the CP 544 from the CPU and to define whether the CP is to be the time master or slave.

3.3.1.3 FETCH

Fetch data

The data handling block FETCH only triggers the data transmission, the data are transmitted with the data handling block RECEIVE-ALL (must be additionally programmed in the STEP 5 program and called cyclically). The matching partner job SEND-ALL must be programmed in the STEP 5 program of the partner CPU to enable the data to be sent by it.

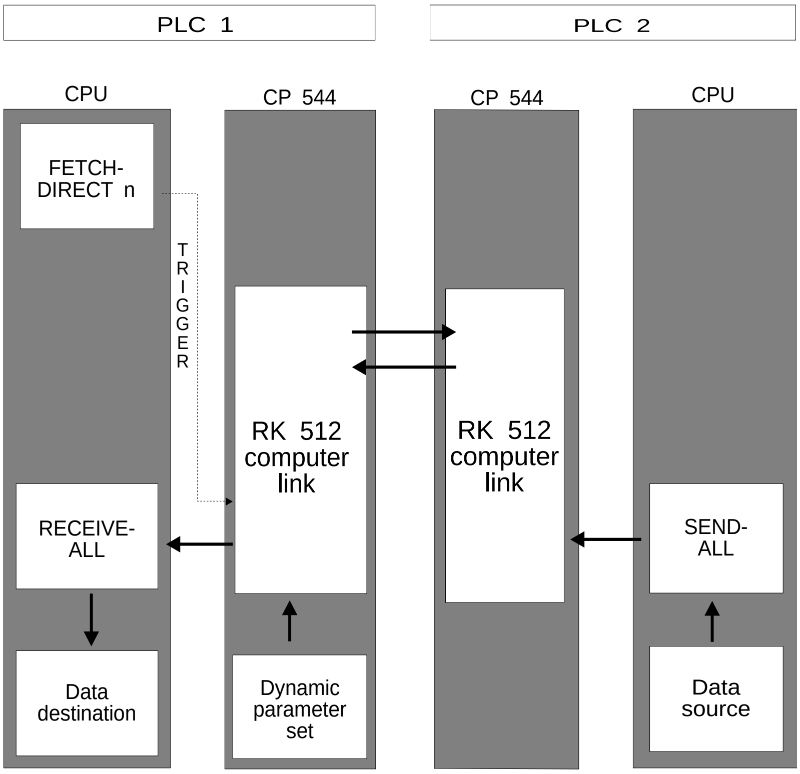


Fig. 3-4 FETCH job

When transmitting data with the CP 544, the FETCH-DIRECT data handling block is used for the following special jobs:

Execute PSEUDO-READ function

You can use this special job to fetch data. All parameters on the source and destination are stored in a DB/DX. The special job enables you

- to modify the source and/or destination data of a job during execution of the program,
- to program this job without COM PP.

3.3.1.4 RECEIVE

Receive data

The data handling block RECEIVE transmits data from the CP to the CPU.

The data handling block RECEIVE-DIRECT is only used for the following special jobs in the data transmission with the CP 544:

Read parameters of a device interface

You can use this special job to scan the parameters of a device interface independent of the COM PP parameterization software. The parameters are written into a defined data block.

Read error message area of SYSTAT

You can use this special job to read up to 3 error messages of the SYSTAT specific to the interface.

Read status

You can use this special job to scan the status of the CP 544 and the addressed device interface.

Read hardware parameters

You can use this special job to scan the hardware parameters which you have set using switches on the module (page frame number, number of pages, released coordination flag area) without having to remove the module.

Read complete SYSTAT status area

You can use this special job to read the complete SYSTAT, i.e. the error messages of both device interfaces of the CP 544.

Read SYSID identification area

You can use this special job to read data on the module, the memory submodule, the interface assignments and the output statuses of the loaded software from the SYSID.

Read date and time

You can use this special job to read the time on the CP 544 using the CPU.

3.3.1.5 CONTROL

Check job status

The data handling block CONTROL copies a job status into the defined status word. The job status provides information on the processing state of the job.

3.3.1.6 Coordination Flags

You can use the coordination flags to inhibit or release the transfer of data between the CPU and CP 544.

The coordination flags must be released using switches on the CP 544 module (see Section 2.1). The coordination flags must be defined in the PLC as output communication flags in the DB 1.

RK 512 computer link

Byte and bit numbers of the coordination flag are defined in the dynamic parameter set and transmitted to the partner in the SEND or FETCH message. If the partner CP receives a message with the byte and bit numbers of the coordination flag, it checks whether the coordination flag with this number is already set. If this is the case, it rejects the data exchange with the active CP and sends a reply message with an error number to the partner. This prevents data which have not yet been processed from being overwritten or read.

You can program the STEP 5 program in the CPU of the active CP 544 such that the received error number is evaluated and that the SEND or FETCH message is transmitted again at a later point in time.

Coordination flags with a SEND job

The coordination flag is defined in the SEND job. The byte and bit numbers of this flag are transmitted together with the data to the partner.

The byte number of the coordination flag appears in the status word of RECEIVE-ALL in the destination PLC in the last transmission cycle. Using this byte number you can recognize the job from which the data have arrived completely in the destination CPU. You can inhibit the repeated acceptance of this job if you set the coordination flag associated with the job in the STEP 5 program. A corresponding message is output on the COM PP, and the partner informed by means of a reply message. You can reset the coordination flag by the STEP 5 program as soon as the data have been saved from the destination area or processed further; the job is then accepted again.

Coordination flag with a FETCH job

A coordination flag is defined in the FETCH job of the CP 544. The byte and bit numbers of this flag are transferred to the partner in the request message. The byte number of the coordination flag appears in the status word of SEND-ALL in the last transmission cycle in the PLC in which the data source is present. Using this byte number you can recognize the job from which the data have been requested completely. You can prevent reading of the source data area of this job if you set the coordination flag associated with the job in the STEP 5 program. A corresponding message is output on the COM PP, and the partner informed by means of a reply message. You can reset the coordination flag as soon as the data are available in the source area; data are then transmitted again following request messages of the job.

Note that only the byte number of the coordination flag appears in the status word of SEND-ALL or RECEIVE-ALL, and not the bit number as well. You must therefore ensure that there is an unequivocal assignment between the byte number and coordination flag if you wish to evaluate the information of the status word in the program.

You can use every flag apart from flag 222 (DE hexadecimal) as a coordination flag, but only byte numbers from 1 to 223 can be indicated in the status word. Flag 222 is reserved to indicate the complete transmission of a job if no coordination flags are transmitted.

3.3.2 Assignment of Parameters to RK 512 Computer Link in CP 544

The COM PP parameterization software (see Chapter 7) supports you when assigning parameters to the RK 512 computer link in the CP 544. If you do not have this software package, you must assign parameters to the RK 512 computer link in the CP 544 by means of the special job SEND-DIRECT 189 (see Section 6.3.8).

You generate a static parameter set and a dynamic parameter set.

Static parameter set

In the static parameter set, you specify the parameters for the physical layer and the data link layer of the RK 512 computer link.

Dynamic parameter set

In the dynamic parameter set, you enter the job parameters associated with the partner.

Once you have read this section, you will be able to produce a concept for the parameter sets of the RK 512 computer link for your special requirements.

The following pages provide you with a summary of possible parameter settings.

3.3.2.1 Static Parameter Set

The static parameter set contains the parameters of the RK 512 computer link.

The following table shows you which values you can enter for the static parameter set.

3

Table 3.1 Static parameter set (RK 512)

Parameter	Input
Mode 1 Mode 2 Mode 3 Mode 4	RK 512 with 3964 procedure with default values RK 512 with 3964R procedure with default values RK 512 with 3964 procedure and selectable values RK 512 with 3964R procedure and selectable values
Baud rate[1])	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps [2)] 38400 bps [3)] 76800 bps [3)]
Parity	No Odd Even
Bits per character	8 bits per character
Stop bits	1 stop bit 2 stop bits
Priority	Low High
Character delay time	Monitoring time 0.01 s to 655.35 s (steps: 10 ms)
Acknowledgement delay time	Monitoring time 0.01 s to 655.35 s (steps: 10 ms)
Number of connection attempts	Number (range of values 1 to 255)
Number of repetitions	Number (range of values 1 to 255)

[1)]The total baud rate of 76800 bps must not be exceeded
[2)]Only with V.24 submodule and RS422-A/485 submodule
[3)]Only with RS422-A/485 submodule

The default values for mode 1 and mode 2 are:

	Mode 1	Mode 2
Character delay time	220 ms	220 ms
Acknowledgement delay time	550 ms	2000 ms
Number of connection attempts	6	6
Number of repetitions	6	6

Meaning of parameters

Mode Version of the two possible transmission procedures, 3964 or 3964R, either with default values or with selectable values.

Baud rate Data transmission speed in bps.

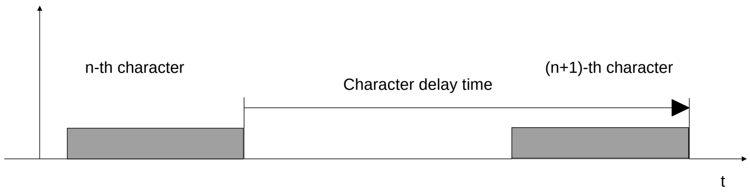
Parity The parity is even or odd depending on the value. This sequence of information bits is extended by one bit, the parity bit, which supplements the value of all bits to an agreed status by means of its added value (0 or 1). The parity bit is set to 1 if "No" is set, but not evaluated by the receiver/transmitter.

Bits per character Number of data bits used to form a character.

Stop bits Duration of stop bits relative to the time required to transmit an information bit. The stop bits follow each character transmitted in a start/stop transmission.

Priority A partner has high priority if its transmission request has priority over the transmission request of the partner. A partner has low priority if its transmission request must be deferred with respect to the transmission request of the partner. You must assign different priorities to the two coupling partners when using the computer link, i.e. one PLC is assigned a high priority, the other a low priority.

Character delay time The maximum permissible interval between two received characters (also refer to table below).



Acknowledgement delay time The maximum permissible time up to acknowledgement from the partner when establishing a connection (time between STX and acknowledgement DLE from partner) or clearing a connection (time between DLE ETX and acknowledgement DLE from partner) Also refer to table below.

Baud rate	**Smallest permissible character delay time**	**Smallest permissible acknowledgement delay time**
300 bps	60 ms	60 ms
600 bps	40 ms	40 ms
1200 bps	30 ms	30 ms
2400 bps	20 ms	20 ms
4800 bps	20 ms	20 ms
9600 bps	20 ms	20 ms
19200 bps	20 ms	20 ms
38400 bps	20 ms	20 ms
76800 bps	20 ms	20 ms

Number of connection attempts The maximum number of attempts made by the CP 544 to establish a connection.

Number of repetitions Maximum number of repetitions of a message (including the first message) in the event of faults.

3.3.2.2 Dynamic Parameter Set

The dynamic parameter set contains the job parameters which are relevant to the **partner**.
A job number is assigned to each dynamic parameter set. The job number must agree with the job number in the associated data handling block. The first dynamic parameter set has the job number 1, the second the job number 2 etc.

You must assign values to the corresponding dynamic parameter set before you trigger a SEND or FETCH job. When you specify a job number, the desired dynamic parameter set is selected for each SEND or FETCH job.

The following table shows the values you can select for the dynamic parameter set.

Table 3.2 Dynamic parameter set (RK 512)

Job No.	Parameter	Meaning
1	Job	SEND job or FETCH job
	Data destination (SEND) or Data source (FETCH)	Data block, extended data block, system data, absolute addresses Data block, extended data block, flag bytes, input bytes, output bytes, I/O bytes, timers, counters, system data, absolute addresses
	CPU number	Range of values 1 to 4, or no data
	DB number	See job tables for range of values
	Destination address (SEND) or Source address (FETCH)	See job tables for range of values See job tables for range of values
	Coordination flags	Range of values 0 to 233 for byte nos. Range of values 0 to 7 for bit nos. or no data
2		
188		

Meaning of the parameters

Job number

Each job has a number between 1 and 188; it must agree with the job number (parameter A-NR) which you have entered on the data handling block (SEND-DIRECT or FETCH-DIRECT).

Job

The job is either a SEND or FETCH job.

Data destination
Data source

The following destination types are permitted with a SEND job:
Data blocks, extended data blocks, system data or absolute addresses.
With a FETCH job, data can be fetched from the following source types:
data block, extended data block, flag bytes, input bytes, output bytes, I/O bytes, timers, counters, system data, absolute addresses.

CPU number

You must enter the CPU number (range of values 1 to 4) if a particular CPU in the partner PLC is to be addressed by this job.
The number of the partner CPU is only relevant if you exchange data with a multi-processor PLC (S5-135U, S5-155U) with several CPUs via a CP 544, CP 525 or CP 524. It is not necessary to enter a CPU number if the partner only has one CPU. The data are stored in the lowest page frame on the receiving interface.

DB number

The DB number must be entered if "Data block" or "Extended data block" is specified as the data destination or source.

Destination address
Source address

You must enter the destination address here for a SEND job, and the source address for a FETCH job. The permissible limits depend on the data type.

Coordination flag

You can enter a coordination flag if necessary if the source or destination is a data block or an extended data block. The coordination flag prevents the overwriting of transmitted data which have not yet been processed.
The coordination flag must first have been released using switches on the module (see Section 2.1).

Chapter 7 describes how you can load the COM PP parameterization software and enter its parameter sets.

3.3.2.3 Transmission of Parameters to the CP 544 User Memory

Once you have assigned parameters to the RK 512 computer link using COM PP, transfer the parameters which are stored in a file ......ST.S5D into the user memory (internal RAM or RAM submodule) of the CP 544.

Proceed as follows:

- Select the transmission direction in the COM PP screen form "TRANSFER" and enter the CP interface.
- Transmit the parameters by pressing the function key "TRANSFER".
- Restart the CP 544 by pressing the function key "RESTART SI1" or "RESTART SI2".

The LED TXD 1 must not subsequently light up red permanently on the front panel of the CP 544. The parameterization is not correct or not complete if this is the case.

3.4 Job Tables

All data types which can be transmitted are shown in the following tables together with their possible parameter settings in the data handling block and the dynamic parameter set. Data with respect to the addresses are PLC-dependent and do not always agree in the case of different types of PLC. In particular, you should use the documentation specific to the PLCs in the case of absolute addresses.

3.4.1 Send Data (SEND)

All data types which are generally stored in the partner in a destination DB or destination DX are permissible as the source (apart from absolute addresses AS and system data RS, see table).

The parameter QLAE (source length) is the number of bytes if the source is organized in bytes (the number of words if not). No message transfer is carried out if 0 is entered.

Caution with an odd number of bytes: since the destination is a DB or DX, only complete words can be stored there. If the partner is a CP 544, this will assign a 0 to the right data byte (DR) if it receives an odd number!

Table 3.3 Job table "Send data with RK 512"

Source, **send from PLC 1**	Destination, to PLC 2	Parameter settings on DHB in PLC 1 (source)				
		QTYP	DBNR	QANF	QLAE	
Data block	Data block	DB	3-255	0-2047	1-2048	
Extended DB	Data block	DX	3-255	0-2047	1-2048	
Flags	Data block	FA	Irrelevant	0-255	1-256	
Inputs	Data block	IA	Irrelevant	0-127	1-128	
Outputs	Data block	QA	Irrelevant	0-127	1-128	
Counters 1)	Data block	CA	Irrelevant	0-255	1-256	
Timers 1)	Data block	TA	Irrelevant	0-255	1-256	
I/O	Data block	PY	Irrelevant	0-255	1-256	
Sys addr. 1)	System address	RS	Irrelevant	0-511	1-512	
Absolute addresses 1)	Absolute address	AS	Irrelevant	0- +32767 -32768	1-2048	

1) These ranges are CPU-dependent.

Explanation of abbreviations

QTYP	Source type
DBNR	Data block number
QANF	Initial source address
QLAE	Source length

	Parameter settings in the COM PP in PLC 1 (destination)				Message header, bytes [2)]		
	ZTYP	Z-DB	Z-addr	CF permissible	3/4 Command mode	5/6 Z-DB/ Z-addr	7/8 Number in
	DB	3-255	0-255	Yes	AD	DB/DW	words
	DB	3-255	0-255	Yes	AX	DB/DW	words
	DB	3-255	0-255	Yes	AM	DB/DW	bytes
	DB	3-255	0-255	Yes	AE	DB/DW	bytes
	DB	3-255	0-255	Yes	AA	DB/DW	bytes
	DB	3-255	0-255	Yes	AZ	DB/DW	words
	DB	3-255	0-255	Yes	AT	DB/DW	words
	DB	3-255	0-255	Yes	AP	DB/DW	bytes
	RS	---	0-511 [1)]	No	AB	Address	words
	AS	---	0-65535 [1)]	No	AS	Address	words

Explanation of abbreviations

ZTYP	Destination type
Z-DB	Data block number of destination
Z-addr	Initial destination address
CF permissible	Coordination flag permissible?
Message header, bytes	Message header of data transmission on the line

1) These ranges are CPU-dependent.

2) You need only observe these data for the message header if you use a non-SIMATIC device as a partner where you wish to implement its communication software yourself or if you monitor the data traffic on the line using an interface test unit (FOXPG).

Source, **send from PLC 1**	Destination, to PLC 2	Parameter settings on DHB in PLC 1 (source)			
		QTYP	DBNR	QANF	QLAE
Data block	Extended data block	DB	3-255	0-2047	1-2048
Extended data block	Extended data block	DX	3-255	0-2047	1-2048
Flags	Extended data block	FA	Irrelevant	0-255	1-256
Inputs	Extended data block	IA	Irrelevant	0-127	1-128
Outputs	Extended data block	QA	Irrelevant	0-127	1-128
Counters [1)]	Extended data block	CA	Irrelevant	0-255	1-256
Timers [1)]	Extended data block	TA	Irrelevant	0-255	1-256
I/O	Extended data block	PY	Irrelevant	0-255	1-256

[1)] These ranges are CPU-dependent.

Explanation of abbreviations

QTYP	Source type
DBNR	Data block number
QANF	Initial source address
QLAE	Source length

	Parameter settings in the COM PP in PLC 1 (destination)				Message header, bytes [1]		
	ZTYP	Z-DB	Z-addr	CF permissible	3/4 Command mode	5/6 Z-DB/ Z-addr	7/8 Number in
	DX	3-255	0-255	Yes	OD	DX/DW	words
	DX	3-255	0-255	Yes	OX	DX/DW	words
	DX	3-255	0-255	Yes	OM	DX/DW	bytes
	DX	3-255	0-255	Yes	OE	DX/DW	bytes
	DX	3-255	0-255	Yes	OA	DX/DW	bytes
	DX	3-255	0-255	Yes	OZ	DX/DW	words
	DX	3-255	0-255	Yes	OT	DX/DW	words
	DX	3-255	0-255	Yes	OP	DX/DW	bytes

Explanation of abbreviations

ZTYP	Destination type
Z-DB	Data block number of destination
Z-addr	Initial destination address
CF permissible	Coordination flag permissible?
Message header, bytes	Message header of data transmission on the line

[1] You need only observe these data for the message header if you use a non-SIMATIC device as a partner where you wish to implement its communication software yourself or if you monitor the data traffic on the line using an interface test unit (FOXPG).

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3.4.2 Fetch Data (FETCH)

All data types listed in the table can be specified as the source in the partner PLC.
The destination on the DHB can only be a data block or an extended data block (RS/AS are exceptions). The destination length (ZLAE) can only be specified in words. If 5 input bytes are to be fetched, for example, "3" = 3 words = 6 bytes must be parameterized on the DHB. No message transfer is carried out if 0 is entered.

Table 3.4 Job table "Fetch data with RK 512"

Source, **fetch from PLC 2**	Destination, in PLC 1	Parameter settings on DHB in PLC 1 (destination)			
		ZTYP	DBNR	ZANF	ZLAE
Data block	Data block	DB	3-255	0-2047	1-2048
Extended DB	Data block	DB	3-255	0-2047	1-2048
Flags	Data block	DB	3-255	0-2047	1-128
Inputs	Data block	DB	3-255	0-2047	1-64
Outputs	Data block	DB	3-255	0-2047	1-64
Counters [1)]	Data block	DB	3-255	0-2047	1-256
Timers [1)]	Data block	DB	3-255	0-2047	1-256
I/O	Data block	DB	3-255	0-2047	1-128
Sys. addr. [1)]	System address	RS	Irrelevant	0-511	1-512
Absolute addresses [1)]	Absolute address	AS	Irrelevant	0- +32767 -32768	1-2048

[1)] These ranges are CPU-dependent.

Explanation of abbreviations

ZTYP	Destination type
DBNR	Data block number
ZANF	Initial destination address
ZLAE	Destination length

Parameter settings in the COM PP in PLC 1 (source)				Message header, bytes [2]		
QTYP	Q-DB	Q-addr	CF permis-sible	3/4 Command mode	5/6 Q-DB/ Q-addr	7/8 Number in
Data block	0-255	0-255	Yes	ED	DB/DW	words
Extended DB	0-255	0-255	Yes	EX	DX/DW	words
Flag	---	0-254	No	EM	Byte address	bytes
Input	---	0-126	No	EE	Byte address	bytes
Output	---	0-126	No	EA	Byte address	bytes
Counter [1]	---	0-255	No	EZ	Counter no.	words
Timer [1]	---	0-255	No	ET	Timer no.	words
I/O	---	0-254	No	EP	Peripheral address	bytes
Sys. addr [1]	---	0-511	No	EB	System address	words
Abs. addr. [1]	---	0-65535	No	ES	Absolute address	words

Explanation of abbreviations

QTYP	Source type
Q-DB	Data block number of source
Q-addr	Initial source address
CF permissible	Coordination flag permissible?
Message header, bytes	Message header of data transmission on the line

[1] These ranges are CPU-dependent.

[2] You need only observe these data for the message header if you use a non-SIMATIC device as a partner where you wish to implement its communication software yourself or if you monitor the data traffic on the line using an interface test unit (FOXPG).

Source, **fetch from PLC 2**	Destination, in PLC 1	Parameter settings on DHB in PLC 1 (destination)			
		ZTYP	DBNR	ZANF	ZLAE
Data block	Extended DB	DX	3-255	0-2047	1-2048
Extended DB	Extended DB	DX	3-255	0-2047	1-2048
Flags	Extended DB	DX	3-255	0-2047	1-128
Inputs	Extended DB	DX	3-255	0-2047	1-64
Outputs	Extended DB	DX	3-255	0-2047	1-64
Counters [1)]	Extended DB	DX	3-255	0-2047	1-256
Timers [1)]	Extended DB	DX	3-255	0-2047	1-256
I/O	xtended DB	DX	3-255	0-2047	1-128

[1)] These ranges are CPU-dependent.

Explanation of abbreviations

ZTYP	Destination type
DBNR	Data block number
ZANF	Initial destination address
ZLAE	Destination length

Parameter settings in the COM PP in PLC 1 (source)				Message header, bytes [2]		
QTYP	Q-DB	Q-addr	CF permis-sible	3/4 Command mode	5/6 Q-DB/ Q-addr	7/8 Number in
Data block	0-255	0-255	Yes	ED	DB/DW	words
Extended DB	0-255	0-255	Yes	EX	DX/DW	words
Flag	---	0-254	No	EM	Byte address	bytes
Input	---	0-126	No	EE	Byte address	bytes
Output	---	0-126	No	EA	Byte address	bytes
Counter [1]	---	0-255	No	EZ	Counter no.	words
Timer [1]	---	0-255	No	ET	Timer no.	words
I/O	---	0-254	No	EP	Peripheral address	bytes

Explanation of abbreviations

QTYP	Source type
Q-DB	Data block number of source
Q-addr	Initial source address
CF permissible	Coordination flag permissible?
Message header, bytes	Message header of data transmission on the line

[1] These ranges are CPU-dependent.

[2] You need only observe these data for the message header if you use a non-SIMATIC device as a partner where you wish to implement its communication software yourself or if you monitor the data traffic on the line using an interface test unit (FOXPG).

3

3.5 Example of Complete Parameter Settings

Job I: SEND job

100 data words from data block 20 (DB 20) starting at data word 10 (DW 10) are to be transmitted from a PLC 1 to data block 5 (DB 5) starting at data word 1 (DW 1) in PLC 2. PLC 1 and PLC 2 are each equipped with a CP 544.

You require the following for the CPU in PLC 1:

- The DHB **SEND-DIRECT** which triggers the job. The following parameter settings must be made in it:

SSNR	0	The interface number is 0
A-NR	1	The job number is 1
ANZW	FW12	The status word is flag word 12
QTYP	DB	The source is a data block
DBNR	20	with the no. 20 and
QANF	10	initial address 10
QLAE	100	100 data words are sent
PAFE	FY11	FY 11 is selected for parameterization errors

- The DHB **SEND-ALL** which transfers the data from the PLC to the CP. This requires the following parameter settings:

SSNR	0	The interface number is 0
A-NR	0	The job number is 0, thus the ALL function is selected
ANZW	FW16	The status word is FW 16
PAFE	FY19	FY 19 is selected for parameterization errors

The status word of the ALL job must be different from that with SEND-DIRECT since other information is displayed.

You require the following for the CP in PLC 1:

- A job in the dynamic parameter set:

Job number	1	Number as for DHB parameters
Job	SEND	Send is selected
Data destination	DB	Destination is a data block
CPU number	-	Only one CPU is present
DB No.	5	The destination DB number is 5
Destination word address	1	with the initial address 1
Coordination flag	-	Coordination flag not used

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- You must also enter the following parameters in the static parameter set:

Mode 2	RK 512 with 3964R procedure with default values	
Baud rate	9600 bps	
Parity	Even	
Bits per character	8	
Stop bits	1	
Priority	Low	
Character delay time	220 ms	These parameters are entered automatically in mode 2 (RK 512 with 3964R procedure with default values).
Acknowledgement delay time	2000 ms	
Number of connection attempts	6	
Number of repetitions	6	

You require the following for the CPU in PLC 2:

- The DHB **RECEIVE-ALL** which receives the data and enters them in the destination DB:

SSNR	0	The interface number is 0
A-NR	0	The job number is 0, thus the ALL function is selected
ANZW	FW6	The status word is FW 6
PAFE	FY4	FY 4 is selected for parameterization errors

You require the following for the CP in PLC 2:

- **No** dynamic parameter set as long as no active jobs (SEND-DIRECT, FETCH-DIRECT) are called in the PLC 2.

- However, you must enter the following parameters in the static parameter set for this CP:

Mode 2	RK 512 with 3964R procedure with default values	
Baud rate	9600 bps	
Parity	Even	
Bits per character	8	
Stop bits	1	
Priority	High	
Character delay time	220 ms	These parameters are entered automatically in mode 2 (RK 512 with 3964R procedure with default values).
Acknowledgement delay time	2000 ms	
Number of connection attempts	6	
Number of repetitions	6	

Job II: FETCH job

6 flag bytes are to be fetched from PLC 2 starting at FY 7. They are to be stored in data block 20 in PLC 1 starting at data word 30. A FETCH job is programmed in PLC 1 for this purpose.

You require the following for the CPU in PLC 1:

- The call of the DHB **FETCH-DIRECT** to trigger the job:

SSNR	0	As with job I
A-NR	1	Job number is 2 in this case
ANZW	FW34	Status words in FW 34
QTYP	DB	Destination is a DB
DBNR	20	with no. 20 and
QANF	30	initial address 30
QLAE	3	Fetch 6 bytes = 3 words
PAFE	FY33	Parameterization errors in FY 33

- You subsequently receive the fetched data with the DHB **RECEIVE-ALL**:

SSNR	0	The interface number is 0
A-NR	0	The job number is 0, thus the ALL function is selected
ANZW	FW27	Status word in FW 27
PAFE	FY26	Parameterization errors in FY 26

You require the following for the CP in PLC 1:

- The job with number 2:

Job number	2	Number as for DHB
Job	FETCH	
Data source	Flag	Source is the flag area
CPU number	-	Only one CPU present
DB No.	-	No data necessary
Source byte address	7	Starting at byte 7
Coordination flag	-	Coordination flag not used

- If you have carried out job I, the following parameters are already set in the static parameter set:

Mode 2	RK 512 with 3964R procedure with default values	
Baud rate	9600 bps	
Parity	Even	
Bits per character	8	
Stop bits	1	
Priority	Low	
Character delay time	220 ms	These parameters are entered automatically in mode 2 (RK 512 with 3964R procedure with default values).
Acknowledgement delay time	2000 ms	
Number of connection attempts	6	
Number of repetitions	6	

You require the following for the CPU in PLC 2:

- A DHB **SEND-ALL** which transmits the flag bytes to its CP:

SSNR	0	The interface number is 0
A-NR	0	The job number is 0, thus the ALL function is selected
ANZW	FW40	Status word in FW 40
PAFE	FY39	Parameterization errors in FY 39

You require the following for the CP in PLC 2:

- **No** dynamic parameter set, but the following parameters in the static parameter set (if not already present from job I):

Mode 2	RK 512 with 3964R procedure with default values	
Baud rate	9600 bps	
Parity	Even	
Bits per character	8	
Stop bits	1	
Priority	High	
Character delay time	220 ms	These parameters are entered automatically in mode 2 (RK 512 with 3964R procedure with default values).
Acknowledgement delay time	2000 ms	
Number of connection attempts	6	
Number of repetitions	6	

3.6 Protocol Definition of RK 512 Computer Link

The following section explains how the data transmission is executed with the RK 512 computer link.

The data transmission takes place at three levels:

- The hardware level
- The procedure level
- The message level.

Hardware level

The hardware level comprises the physical conditions of the data transmission. The CP 544 can be used either with TTY (20-mA current loop), with V.24 voltage level (RS232 C) or with the RS422-A/485 submodule.

Procedure level

All RK 512 messages (command and reply messages) are transmitted by the procedure level of the computer link, i.e. transmitted or received with the 3964 or 3964R procedure. The procedure provides the messages with start and end sequences, assigns a block check character to the resulting data blocks (only with the 3964R procedure) and automatically repeats the message if the acknowledgement from the receiver is faulty (see also Section 4.6).

Message level

The message level corresponds to the transport layer of the ISO/OSI layer model.
The CP 544 sends a command message to the partner which returns a reply message to the CP.

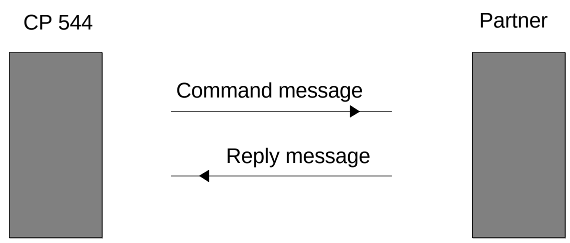


Fig. 3-5 Command message with reply message

Command messages are either SEND messages (SEND job) or FETCH messages (FETCH job).

The SEND message consists of the message header and data. In the case of a SEND message, the partner sends a reply message without data.

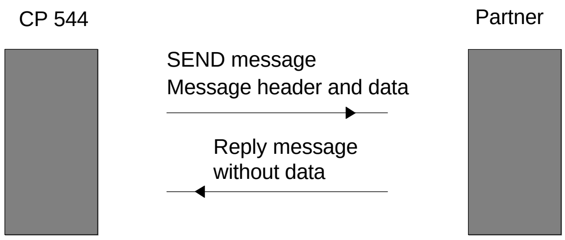


Fig. 3-6 SEND job

The FETCH message only consists of a message header. In the case of a FETCH message, the partner sends a reply message with data.

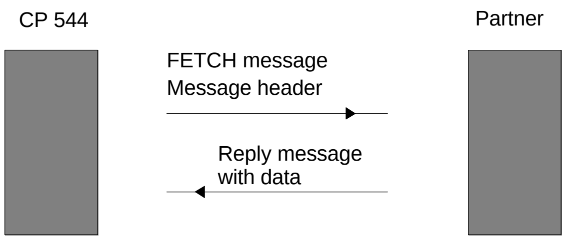


Fig. 3-7 FETCH job

Continuation messages are sent for all types of message if the data quantity exceeds 128 bytes.

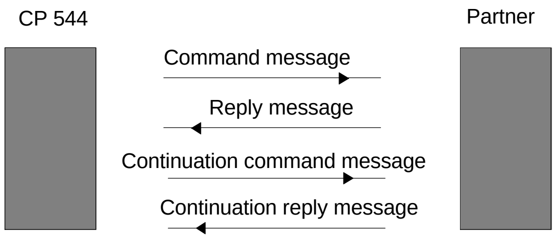


Fig. 3-8 Messages and continuation messages

3.6.1 Format of Command Message Header

A SEND message consists of the message header and data. A FETCH message only consists of the message header.

The message header comprises 10 bytes and contains information on the data destination in the case of a SEND message and information on the data source in the case of a FETCH message.

Byte

1	2	3	4	5	6	7	8	9	10
				High	Low	High	Low		
00H (FFH)	00H	Command		Destination/ source		Number		CF/CPU No.	

3

Format of message header

Table 3.5 Format of message header

Byte	Meaning	
1	Message identification with command messages (00H), with continuation command messages (FFH)	
2	Message identification (00H)	
3	'A'(41H)- for SEND job with destination DB or 'O'(4FH)- for SEND job with destination DX or 'E'(45H)- for FETCH job	
4	Data to be transmitted are from: 'D' (44H) = data block 'E' (45H) = input bytes 'M' (4DH) = flag bytes 'Z' (5AH) = counters 'S' (53H) = absolute adresses	 'X' (58H) = extended data block 'A' (41H) = output bytes 'P' (50H) =I/O bytes 'T' (54H) = timers 'B' (42H) = system addresses
5	Data destination with SEND job or data source with FETCH job, e.g. byte 5 = DB no., byte 6 = DW no.	
6		
7	Length of high byte	Length of data to be transmitted; in bytes or words depending on type
8	Length of low byte	
9	Byte number of coordination flag; FF_H is present here if you have not specified any coordination flags	
10	Bits 0 to 3:	Bit number of the coordination flag; F_H is present here if you have not specified any coordination flags
	Bits 4 to 7:	CPU number (1 to 4); 0_H is present here if you have not specified a CPU no. but have specified a coordination flag; F_H is present here if you have specified neither a CPU no. nor a coordination flag

The letters in bytes 3 and 4 are ASCII characters.

The message header of the continuation command message only consists of the bytes 1 to 4.

Once the command message has been transmitted, the RK 512 expects a reply message from the partner within the monitoring time. The length of the monitoring time depends on the transmission speed (baud rate).

1200–76800 bps	5 s
600 bps	7 s
300 bps	10 s

Since the data are already transmitted with the reply message in a FETCH job, you must ensure that all data are available on the partner CP within the monitoring time. You achieve this is that you

- define a large frame size in SYNCHRON for the partner,
- select a small message length,
- strive towards a short cycle time or program several SEND-ALL calls in one cycle.

Format and contents of the reply message:

The reply message comprises 4 bytes and contains information on the execution of the job.

Byte

1	2	3	4
00H (FFH)	00H	00H	Error number

Byte	Meaning
1	Message identification with reply messages (00H), with continuation reply messages (FFH)
2	Message identification (00H)
3	Contains 00H
4	Error number of partner (see Chapter 8): 00H if no errors have occurred during the transmission >00H error number

3.6.2 Send Data

SEND job:
CP 544 sends data to partner

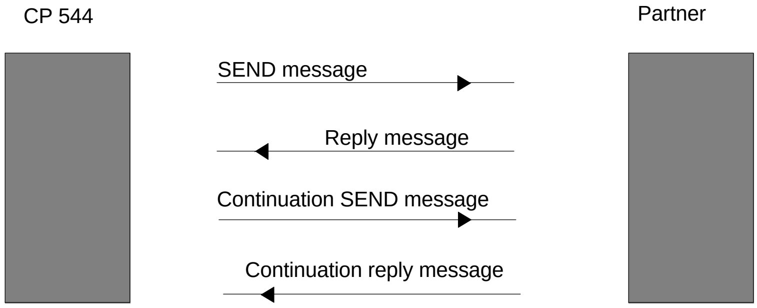


Fig. 3-9 SEND job

The SEND job is executed in the following order:

Active partner	Sends a SEND message which contains the message header and data.
Passive partner	Receives the message, checks the message header and the data, and acknowledges with a reply message.
Active partner	Receives the reply message. If the quantity of useful data exceeds 128 bytes, it sends a continuation SEND message.
Passive partner	Receives the continuation SEND message, checks the message header and the data, and acknowledges with a continuation reply message.

The partner enters an error number in the 4th byte of the reply message if the SEND message was not received without errors.

Meaning	CP 544	Contents	Partner	
SEND message				
Start character	→	STX 02H	→	
Pos. acknow-ledgement	←	DLE 10H	←	
	→	1st byte 00H	→	**Message header**
	→	2nd byte 00H	→	
SEND job	→	3rd byte 41H	→	
Data block	→	4th byte 44H	→	
Data destin. DB10	→	5th byte 0AH	→	
DW01	→	6th byte 01H	→	
Length	→	7th byte 00H	→	
50 DW	→	8th byte 32H	→	
No CF	→	9th byte FFH	→	
All CPUs	→	10th byte FFH	→	
1st data byte	→	11th byte	→	**Useful data**
2nd data byte	→	12th byte	→	
:		:		
n-th data byte	→	x-th byte	→	
End identifier	→	DLE 10H	→	
End identifier	→	ETX 03H	→	
Pos. acknow-ledgement	←	DLE 10H	←	
Reply message				
Start character	←	STX 02H	←	
Pos. acknow-ledgement	→	DLE 10H	→	
	←	1st byte 00H	←	
	←	2nd byte 00H	←	
	←	3rd byte 00H	←	
Error number	←	4th byte 00H	←	
End identifier	←	DLE 10H	←	
End identifier	←	ETX 03H	←	
Pos. acknow-ledgement	→	DLE 10H	→	

Fig. 3-10 Sequence of a SEND message with reply message

This SEND message has a maximum useful data length of 128 bytes and has been executed without faults (the 4th byte in the reply message does not contain an error number).

Continuation SEND messages

A continuation SEND message is started if the quantity of data exceeds **128 bytes**. The sequence corresponds to that of the SEND message.

A further continuation SEND message is started if more than 256 bytes are to be transmitted.

The next page shows the detailed sequence of a continuation SEND message with continuation reply message. The continuation SEND message has a maximum useful data length of 128 bytes and has been executed without faults (the 4th byte in the continuation reply message does not contain an error number).

Meaning	CP 544	Contents	Partner	
Continuation SEND message				
Start character		STX 02H	→	
Pos. acknow-ledgement	←	DLE 10H		
Continuation message		1st byte FFH	→	**Message header**
		2nd byte 00H	→	
SEND job		3rd byte 41H	→	
Data block		4th byte 44H	→	
129th data byte		5th byte	→	**Useful data**
130th data byte		6th byte	→	
:		:		
n-th data byte		x-th byte	→	
End identifier		DLE 10H	→	
End identifier		ETX 03H	→	
Pos. acknow-ledgement	←	DLE 10H		
Continuation reply message				
Start character	←	STX 02H		
Pos. acknow-ledgement		DLE 10H	→	
Continuation reply message	←	1st byte FFH		
	←	2nd byte 00H		
	←	3rd byte 00H		
Error number	←	4th byte 00H		
End identifier	←	DLE 10H		
End identifier	←	ETX 03H		
Pos. acknow-ledgment		DLE 10H	→	

Fig. 3-11 Sequence of a continuation SEND message with continuation reply message

3.6.3 Fetch Data

FETCH job:
CP 544 requests data from partner

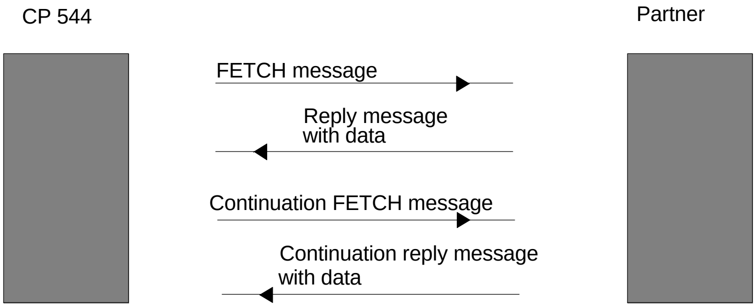


Fig. 3-12 FETCH job

The FETCH job is executed in the following order:

Active partner	Sends a FETCH message which contains the message header.
Passive partner	Receives the message, checks the message header and acknowledges with a reply message. This contains data.
Active partner	Receives the reply message. If the quantity of useful data exceeds **128 bytes,** it sends a continuation FETCH message. This contains bytes 1 to 4 of the message header.
Passive partner	Receives the continuation FETCH message, checks the message header and acknowledges with a continuation reply message with further data.

No data are added in the case of an error number which is not equal to 0 in the 4th byte of the reply message.

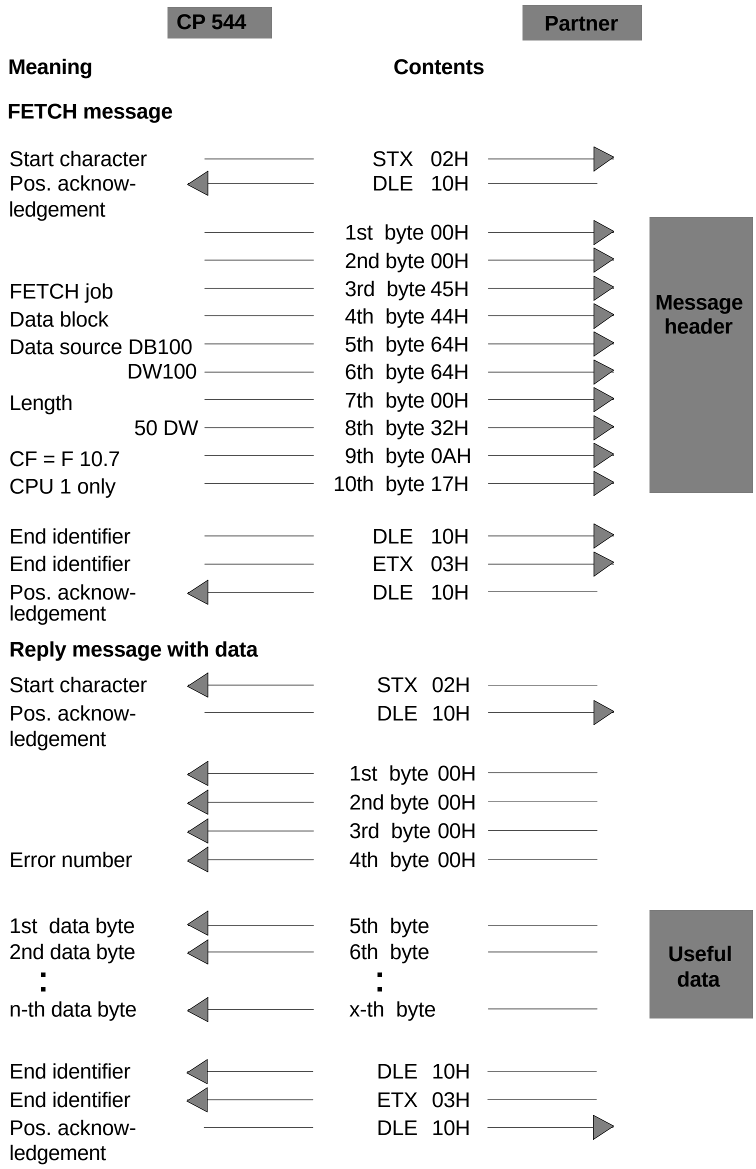


Fig. 3-13 Sequence of a FETCH message with reply message

This FETCH message has a maximum useful data length of 128 bytes and has been executed without faults (the 4th byte in the reply message does not contain an error number).

If more than 128 bytes are requested, these are automatically fetched in one or more continuation messages.

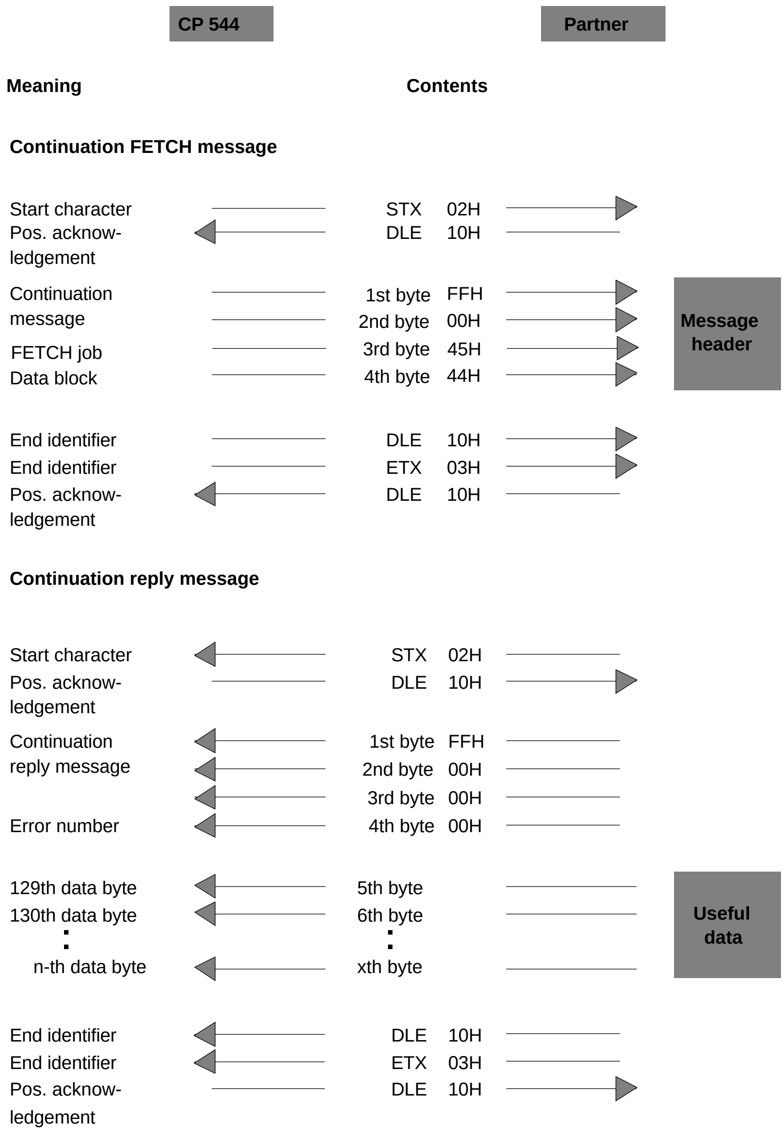


Fig. 3-14 Sequence of a continuation FETCH message with continuation reply message

3.6.4 Quasi Full-Duplex Mode

Quasis full-duplex means that the partners can send messages at any point in time except when the partner is currently transmitting.

If both CPs wish to transmit simultaneously, a SEND message of the partner may be transmitted prior to the reply message. This may be the case, for example, if a SEND message of the partner has been entered into the output buffer of the CP 544 prior to the reply message.

In the following example, the continuation reply message (*) for the first SEND message is only sent after the **SEND message of the partner**.

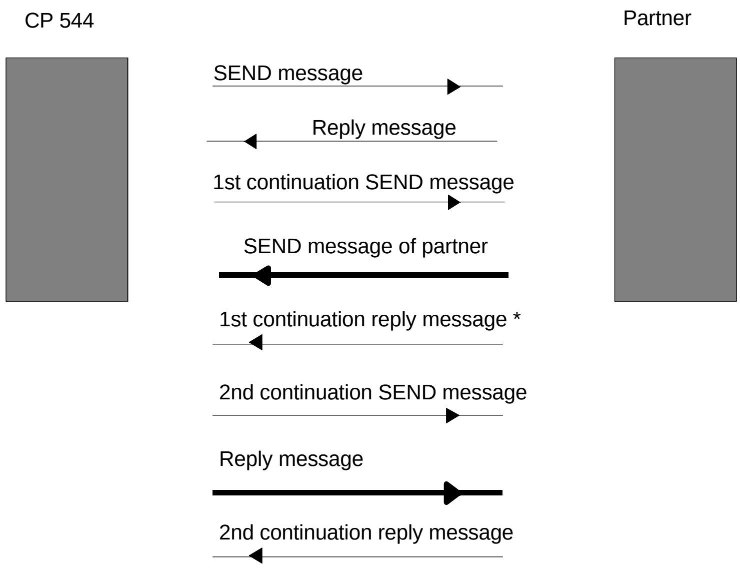


Fig. 3-15 Quasi full-duplex mode

3.6.5 3964/3964R Procedure

You can find more information on the 3964 and 3964R procedures which control the data flow between your programmable controller and a partner with the RK 512 computer link in Chapter 4 "3964/3964R Procedures".

4

How do you Transmit Data with the 3964/3964R Procedures?

Contents of Chapter 4

4 How do you Transmit Data with the 3964/3964R Procedures?

Chapter 4 describes the data transmission functions with the 3964/3964R procedures and acquaints you with generating the STEP 5 program and the static parameter set as well as defining the receive mailbox for the CP 544.

4.1 Introduction

Using the 3964/3964R procedures, data can be exchanged between two communications partners connected via a point-to-point link.

Interface submodules

Various interface submodules are available for data transmission with the 3964/3964R procedures:

- V.24 submodule
- TTY submodule
- RS422-A/485 submodule (only in the RS422-A mode).

Transmission speed

Set the transmission speed for the data exchange as suitable for the communications partner. The following transmission speeds are permissible:

- 300 bps to 76800 bps with the RS422-A/485 submodule
- 300 bps to 19200 bps with the V.24 submodule
- 300 bps to 9600 bps with the TTY submodule.

The total baud rate of 76800 bps must not be exceeded, however.

Transmission reliability

Data transmission with the 3964/3964R procedures ensures large transmission reliability since it includes the following layers of the ISO/OSI layer model (ISO IS 7498):

- The physical layer (layer 1):
  This layer stipulates the physical transmission of the data bytes (physical characteristics of the connection, transmission speed, ...)
- The data link layer (layer 2):
  The 3964 or 3964R transmission procedure adds start and end characters to the data bytes and initiates repetitions if errors occur.

The protocol of the procedures only ensures the reliable transmission of the data but not, however, the processing or evaluation of the transmitted data.

The 3964/3964R procedures are also used for the reliable transmission of data with the RK 512 computer link.

If a message is acknowledged positively by the partner (received/accepted), the message has been correctly received. This does not mean that the message is processed by the receiver (e.g. the data cannot be processed further by the CP if this is in the STOP status or received by the CPU if this is in the STOP status).

If you wish to make sure that the message is also processed, you must:

- either use the RK 512 computer link
- or take your own steps to ensure data protection.

Coupling partners

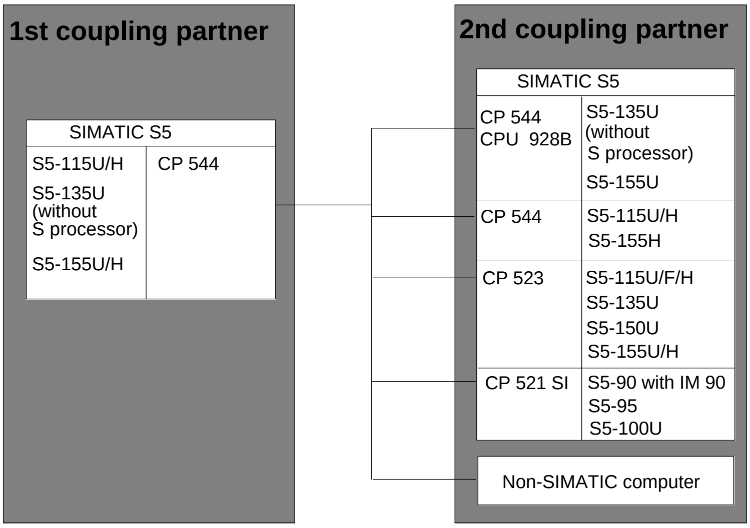


Fig. 4-1 Possible coupling partners for data transmission with the 3964/3964R procedures

Data transmission with the 3964/3964R procedures implements the data exchange between the CP 544 in an S5-115U/H, S5-135U (without S processor), S5-155U/H and:

- another CP 544
  in the S5-115U/H, S5-135U (without S processor) and S5-155U/H programmable controllers
- a CPU 928B
  in the S5-135U and S5-155U programmable controllers
- a CP 523
  in the S5-115U/F/H, S5-135U, S5-150U and S5-155U/H programmable controllers
- a CP 521 SI
  in the S5-90, S5-95, S5-100U programmable controllers
- a non-SIMATIC computer capable of handling the 3964/3964R procedures (e.g. SICOMP M, SICOMP R).

Transmitted data

You can transmit the following data stored in a PLC using the 3964/3964R procedures:

- Data blocks, extended data blocks
- Flag bytes
- Input/output bytes
- I/O bytes
- Timers
- Counters.

Transmission direction

You can implement the following jobs with the 3964/3964R procedures:

- Send data (SEND job):
  The PLC 1 sends data to the PLC 2 via the CP 544 in the PLC 1 and the CP 544 in the PLC 2

- Receive data (RECEIVE-ALL job):
  The PLC 1 receives data from the PLC 2 via the CP 544 in the PLC 1 and the CP 544 in the PLC 2.

4.2 Data Exchange Sequence

The following Fig. shows the data exchange sequence between two programmable controllers, each of which is fitted with a CP 544.

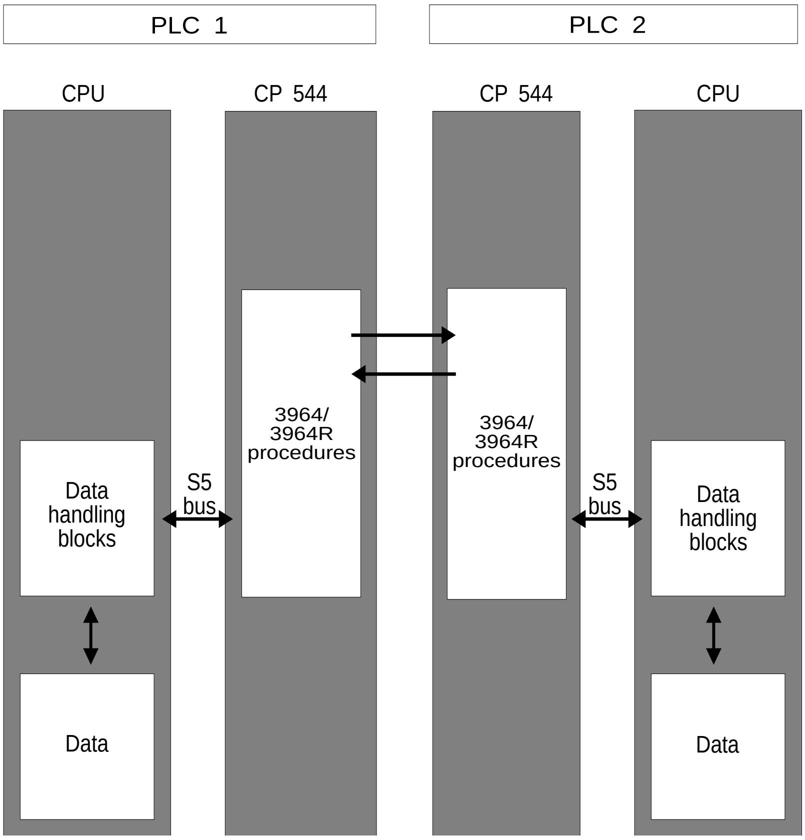


Fig. 4-2 Data exchange between two programmable controllers

Data handling blocks

The data handling blocks in the STEP 5 program of the CPU are used:

- to trigger and execute data exchange,
- to receive the transmitted data.

3964/3964R procedures

The 3964/3964R procedures in the CP 544 module of the coupling partner

- are provided with the required information on the data destination by the definition in the receive mailbox.

The 3964/3964R procedures in the CP 544 modules of the two PLCs

- pass the data on to the CP in the other PLC.

The data exchange sequence described means that you have three important tasks for the data transmission with the 3964/3964R procedures:

- You must generate your STEP 5 program with the calls of the data handling blocks for the two CPUs.
- You must assign parameters to the 3964/3964R procedures in the two CP 544 modules.
- You must define a receive mailbox in the CP 544 of the coupling partner.

4.3 Program Elements for the 3964/3964R Procedures

The programming of the 3964/3964R procedures is based on only a few fundamental points - the STEP 5 program with the data handling blocks, the establishment of the receiver data block (receive mailbox) in the CPU, the static parameter set on the CP and the definition of the receive mailbox.

4.3.1 STEP 5 Program with Data Handling Blocks

Incorporate the data handling blocks described below into your STEP 5 program to enable data transmission with the 3964/3964R procedures according to the particular task.

Once you have read this description, you will be able to generate a concept for the STEP 5 program for your particular task.

You can find a detailed description of the individual data handling blocks in Chapter 6.

4.3.1.1 SYNCHRON

Synchronizing CPU and CP

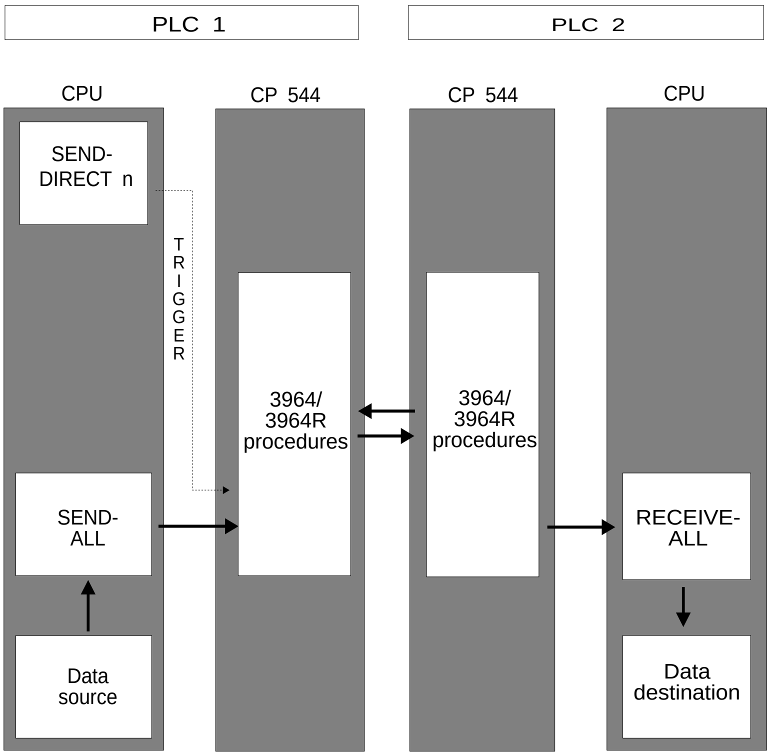
The data handling block SYNCHRON synchronizes the interface between the CPU and CP.

SYNCHRON must be called in the restart organization blocks of the CPU for every page frame used by you in the two device interfaces of the CP.

4.3.1.2 SEND

Send data

The data handling block SEND transmits data from the CPU to the CP 544. The job is triggered by the SEND-DIRECT. In order to transmit data, a SEND-ALL job must be additionally programmed in the user program and called cyclically. The matching partner job RECEIVE-ALL must be programmed in the STEP 5 program of the partner CPU to enable the data to be received by it.



n = job number

Fig. 4-3 SEND job

When transmitting data with the CP 544, the SEND-DIRECT data handling block is used for the following special jobs:

Parameterize device interface

You can use this special job to assign parameters to the two device interfaces of the CP 544 without the COM PP parameterization software in that you store the parameters in a data block.

Start device interface

You can use this special job to start a device interface from the STEP 5 program.

Execute PSEUDO-WRITE function

You can use this special job to transmit data. All parameters on the source and destination are stored in a DB/DX. The special job enables you

- to modify the source and/or destination data of a job during execution of the program,
- to program this job without COM PP.

Set date and time

You can use this special job to set the clock on the CP 544 from the CPU and to define whether the CP is to be the time master or slave.

4.3.1.3 RECEIVE

Receive data

The data handling block RECEIVE transmits data from the CP to the CPU.

The data handling block RECEIVE-DIRECT is only used for the following special jobs in the data transmission with the CP 544:

Read parameters of a device interface

You can use this special job to scan the parameters of a device interface independent of the COM PP parameterization software. The parameters are written into a defined data block.

Read error message area of SYSTAT

You can use this special job to read up to 3 error messages of the SYSTAT specific to the interface.

Read status

You can use this special job to scan the status of the CP 544 and the addressed device interface.

Read hardware parameters

You can use this special job to scan the hardware parameters which you have set using switches on the module (page frame number, number of pages, released coordination flag area) without having to remove the module.

Read complete SYSTAT status area

You can use this special job to read the complete SYSTAT, i.e. the error messages of both device interfaces of the CP 544.

Read SYSID identification area

You can use this special job to read data on the module, the memory submodule, the interface assignments and the output statuses of the loaded software from the SYSID.

Read date and time

You can use this special job to read the time on the CP 544 using the CPU.

4.3.1.4 CONTROL

Check job status

The data handling block CONTROL copies a job status into the defined status word. The job status provides information on the processing state of the job.

4.3.1.5 Coordination Flags

You can use the coordination flags to inhibit or release the transfer of data between the CPU and CP 544.

The coordination flags must be released using switches on the CP 544 module (see Section 2.1). The coordination flags must be defined in the PLC as output communication flags in the DB 1.

The coordination flag is defined in the definition of the receive mailbox of the partner CP. The byte number of the coordination flag appears in the status word of RECEIVE-ALL in the destination PLC in the last transmission cycle. Using this byte number you can recognize in the destination CPU that the data have arrived completely. You can inhibit the repeated acceptance of data if you set the coordination flag in the STEP 5 program of the destination CPU. You can reset the coordination flag by the user program as soon as the data have been saved from the destination area or processed further; the job is then accepted again.

Note that only the byte number of the coordination flag appears in the status word of SEND-ALL or RECEIVE-ALL, and not the bit number as well. You must therefore ensure that there is an unequivocal assignment between the byte number and coordination flag if you wish to evaluate the information of the status word in the program.

You can use every flag apart from flag 222 (DE hexadecimal) as a coordination flag, but only byte numbers from 1 to 223 can be indicated in the status word. Flag 222 is reserved to indicate the complete transmission of a job if no coordination flags are transmitted.

4.3.2 Assignment of Parameters to 3964/3964R Procedures in CP 544

The COM PP parameterization software (see Chapter 7) supports you when assigning parameters to the 3964/3964R procedures in the CP 544. If you do not have this software package, you must assign parameters to the 3964/3964R procedures in the CP 544 by means of the special job SEND-DIRECT 189 (see Section 6.3.8).

You generate a static parameter set and, if you receive data with the CP 544, you must define the position of the receive mailbox on the CPU.

Static parameter set

In the static parameter set, you specify the parameters for the physical layer and the data link layer of the 3964/3964R procedures.

Receive mailbox

The receive mailbox is a data block on the receiving CPU. You must create it on the receiving CPU and define the position of the receive mailbox on the receiving CP.

Once you have read this section, you will be able to produce a concept for the static parameter set and the receive mailbox of the 3964/3964R procedures for your special requirements.

The following pages provide you with a summary of possible parameter settings.

4.3.2.1 Static Parameter Set

The static parameter set contains the parameters of the 3964/3964R procedures.

The following table shows you which values you can enter for the static parameter set.

Table 4.1 Static parameter set (3964/3964R procedures)

<table>
<tr><th>Parameter</th><th colspan="2">Input</th></tr>
<tr><td>Mode 1
Mode 2
Mode 3
Mode 4</td><td colspan="2">RK 512 with 3964 procedure with default values
RK 512 with 3964R procedure with default values
RK 512 with 3964 procedure and selectable values
RK 512 with 3964R procedure and selectable values</td></tr>
<tr><td>Baud rate[1)]</td><td colspan="2">300 bps
600 bps
1200 bps
2400 bps
4800 bps
9600 bps
19200 bps [2)]
38400 bps [3)]
76800 bps [3)]</td></tr>
<tr><td>Parity</td><td colspan="2">No
Odd
Even</td></tr>
<tr><td>Bits per character</td><td colspan="2">6 bits per character
7 bits per character
8 bits per character</td></tr>
<tr><td>Stop bits</td><td colspan="2">1 stop bit
2 stop bits</td></tr>
<tr><td>Priority</td><td colspan="2">Low
High</td></tr>
<tr><td>Character delay time</td><td>Monitoring time
0.01 s to 655.35 s
(steps: 10 ms)</td><td rowspan="4">You need only enter these parameters in modes 3 and 4. The default values apply to modes 1 and 2.</td></tr>
<tr><td>Acknow-ledgement delay time</td><td>Monitoring time 0.01 s to 655.35 s
(steps: 10 ms)</td></tr>
<tr><td>Number of connection attempts</td><td>Number (range of values 1 to 255)</td></tr>
<tr><td>Number of repetitions</td><td>Number (range of values 1 to 255)</td></tr>
</table>

[1)] The total baud rate of 76800 bps must not be exceeded
[2)] Only with V.24 submodule and RS422-A/485 submodule
[3)] Only with RS422-A/485 submodule

The default values for mode 1 and mode 2 are:

	Mode 1	Mode 2
Character delay time	220 ms	220 ms
Acknowledgement delay time	550 ms	2000 ms
Number of connection attempts	6	6
Number of repetitions	6	6

Meaning of parameters

Mode Version of the two possible transmission procedures, 3964 or 3964R, either with default values or with selected values.

Baud rate Data transmission speed in bit/s (bps).

Parity The parity is even or odd depending on the value. This sequence of information bits is extended by one bit, the parity bit, which supplements the value of all bits to an agreed status by means of its added value (0 or 1). The parity bit is set to 1 if "No" is set, but not evaluated by the receiver/transmitter.

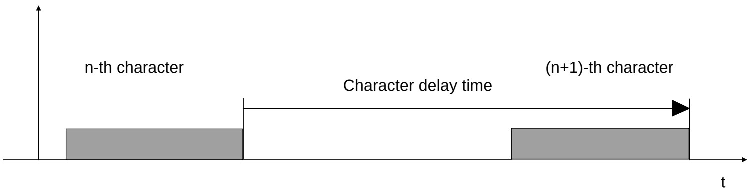
Bits per character Number of data bits used to form a character.

Stop bits Duration of stop bits relative to the time required to transmit an information bit. The stop bits follow each character transmitted in a start/stop transmission.

Priority A partner has high priority if its transmission request has priority over the transmission request of the partner. A partner has low priority if its transmission request must be deferred with respect to the transmission request of the partner. You must assign different priorities to the two coupling partners when using the 3964/3964R procedures, i.e. one PLC is assigned a high priority, the other a low priority.

Character delay time

The maximum permissible interval between two received characters (also refer to table below).



Acknowledgement delay time

The maximum permissible time up to acknowledgement from the partner when establishing a connection (time between STX and acknowledgement DLE from partner) or clearing a connection (time between DLE ETX and acknowledgement DLE from partner). Also refer to table below.

Baud rate	Smallest permissible character delay time	Smallest permissible acknowledgement delay time
300 bps	60 ms	60 ms
600 bps	40 ms	40 ms
1200 bps	30 ms	30 ms
2400 bps	20 ms	20 ms
4800 bps	20 ms	20 ms
9600 bps	20 ms	20 ms
19200 bps	20 ms	20 ms
38400 bps	20 ms	20 ms
76800 bps	20 ms	20 ms

Number of connection attempts

The maximum number of attempts made by the CP 544 to establish a connection.

Number of repetitions

Maximum number of repetitions of a message (including the first message) in the event of faults.

4.3.2.2 Receive Mailbox

The receive mailbox is located in a data block (DB) or extended data block (DX) on the CPU. The receive mailbox contains the received data and, in the first word, the length data (in bytes) of the received data. This is entered by the system program so that you can recognize how much data has been received. The length data does not count the word with the length data itself.

Length

The max. length of the receive mailbox is 2049 words (4098 bytes). The receive mailbox must always be one word larger than the data to be received.

Length of receive mailbox = net data + 1 word

Example: Receive mailbox

The example shows the format of a receive mailbox in data block 8 starting at data word 1 and with a length of 6 words. 7 bytes have been received.

DB 8

0:	KH = xxxx;	does not belong to receive mailbox, any contents
1:	KH = 0007;	length data in bytes, start of receive mailbox
2:	KH = 0102;	received data: 0102
3:	KH = 0304;	received data: 0304
4:	KH = 0506;	received data: 0506
5:	KH = 07yy;	received data: 07, yy was no longer received
6:	KH = yyyy;	contents of receive mailbox, was not received
7:	KH = xxxx;	does not belong to receive mailbox, any contents, need not exist

:
:

Receive mailbox

The following table shows the values you can select for the receive mailbox.

Parameter	Meaning
CPU No.	Range of values 1 to 4, or no data
Receive mailbox Data type DB or DX number starting from DW Length	 DB or DX Range of values 3 to 255 Range of values 2 to 2049 words
Coordination flags	Range of values 0 to 233 for byte no. Range of values 0 to 7 for bit no. or no data

Meaning of the parameters

CPU number

The CPU number defines the CPU for the received data. Only this CPU can receive the data from the CP. The data are stored in the lowest page frame on the receiving device interface. It is not necessary to enter a CPU number if only 1 CPU is inserted in the PLC.

Receive mailbox

A data block or extended data block can be entered as the receive mailbox. Further parameters to be entered are the data block number, the initial address in the data block and the length.

Coordination flag

You can enter a coordination flag to prevent the overwriting of transmitted data which have not yet been processed. The coordination flag must first have been released using switches on the module (see Section 2.1).

Chapter 7 describes how you can load the COM PP parameterization software and enter its parameter sets.

4.3.2.3 Transmission of Parameters to the CP 544 User Memory

Once you have assigned parameters to the 3964/3964R procedures using COM PP, transfer the parameters which are stored in a file ......ST.S5D into the user memory (internal RAM or RAM submodule) of the CP 544.

Proceed as follows:

- Select the transmission direction in the COM PP screen form "TRANSFER" and enter the CP interface.
- Transmit the parameters by pressing the function key "TRANSFER".
- Restart the CP 544 by pressing the function key "RESTART SI1" or "RESTART SI2".

The LED TXD 1 (interface 1) must not subsequently light up red permanently on the front panel of the CP 544. The parameterization is not correct or not complete if this is the case.

4.4 Job Tables

All data types which can be transmitted are shown in the following tables together with their possible parameter settings in the data handling block and the receive mailbox. Data with respect to the addresses are PLC-dependent and do not always agree in the case of different types of PLC. In particular, you should use the documentation specific to the PLCs in the case of absolute addresses.

All data types which are generally stored in the partner in a destination DB or destination DX are permissible as the source.

The parameter QLAE (source length) is the number of bytes if the source is organized in bytes (the number of words if not). No message transfer is carried out if 0 is entered.

Caution with an odd number of bytes: since the destination is a DB or DX, only complete words can be stored there. If the partner is a CP 544, this will assign a 0 to the right data byte (DR) if it receives an odd number!

Table 4.2 Job table "Send data with 3964/3964R procedures"

Source, **send from PLC 1**	Destination, to PLC 2,	Parameter settings on DHB in PLC 1 (source)				
		QTYP	DBNR	QANF	QLAE	
Data block	Data block	DB	3-255	0-2047	1-2048	
Extended DB	Data block	DX	3-255	0-2047	1-2048	
Flags	Data block	FA	Irrelevant	0-255	1-256	
Inputs	Data block	IA	Irrelevant	0-127	1-128	
Outputs	Data block	QA	Irrelevant	0-127	1-128	
Counters [1)]	Data block	CA	Irrelevant	0-255	1-256	
Timers [1)]	Data block	TA	Irrelevant	0-255	1-256	
I/O	Data block	PY	Irrelevant	0-255	1-256	

[1)] These ranges are CPU-dependent.

Explanation of abbreviations

QTYP	Source type
DBNR	Data block number
QANF	Initial source address
QLAE	Source length

	Parameter settings in the COM PP in PLC 2 (destination)			
	ZTYP	Z-DB	Z-addr	CF permissible
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes

Explanation of abbreviations

ZTYP	Destination type
Z-DB	Data block number of destination
Z-addr	Initial destination address
CF permissible	Coordination flag permissible?

Source, **send from PLC 1**	Destination, to PLC 2	Parameter settings on DHB in PLC 1 (source)				
		QTYP	DBNR	QANF	QLAE	
Data block	Extended data block	DB	3-255	0-2047	1-2048	
Extended data block	Extended data block	DX	3-255	0-2047	1-2048	
Flags	Extended data block	FA	Irrelevant	0-255	1-256	
Inputs	Extended data block	IA	Irrelevant	0-127	1-128	
Outputs	Extended data block	QA	Irrelevant	0-127	1-128	
Counters [1)]	Extended data block	CA	Irrelevant	0-255	1-256	
Timers [1)]	Extended data block	TA	Irrelevant	0-255	1-256	
I/O	Extended data block	PY	Irrelevant	0-255	1-256	

[1)] These ranges are CPU-dependent.

Explanation of abbreviations

QTYP	Source type
DBNR	Data block number
QANF	Initial source address
QLAE	Source length

	Parameter settings in the COM PP in PLC 2 (destination)			
	ZTYP	Z-DB	Z-addr	CF permissible
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes

Explanation of abbreviations

ZTYP Destination type
Z-DB Data block number of destination
Z-addr Initial destination address
CF permissible Coordination flag permissible?

4.5 Example of Complete Parameter Settings

100 data words from data block 20 (DB 20) starting at data word 10 (DW 10) are to be transmitted from a PLC 1 to data block 5 (DB 5) starting at data word 1 (DW 1) in PLC 2. PLC 1 and PLC 2 are each equipped with a CP 544.

You require the following for the CPU in PLC 1:

- The DHB **SEND-DIRECT** which triggers the job. The following parameter settings must be made in it:

SSNR	0	The interface number is 0
A-NR	1	The job number is 1
ANZW	FW12	The status word is flag word 12
QTYP	DB	The source is a data block
DBNR	20	with the no. 20 and
QANF	10	initial address 10
QLAE	100	100 data words are sent
PAFE	FY11	FY 11 is selected for parameterization errors

- The DHB **SEND-ALL** which transfers the data from the PLC to the CP. This requires the following parameter settings:

SSNR	0	The interface number is 0
A-NR	0	The job number is 0, thus the ALL function is selected
ANZW	FW16	The status word is FW 16
PAFE	FY19	FY 19 is selected for parameterization errors

The status word of the ALL job must be different from that with SEND-DIRECT since other information is displayed.

You require the following for the CP in PLC 1:

- A static parameter set with the following parameters:

<table>
<tr><td>Mode 2</td><td colspan="2">3964R procedure with default values</td></tr>
<tr><td>Baud rate</td><td colspan="2">9600 bps</td></tr>
<tr><td>Parity</td><td colspan="2">Even</td></tr>
<tr><td>Bits per character</td><td colspan="2">8</td></tr>
<tr><td>Stop bits</td><td colspan="2">1</td></tr>
<tr><td>Priority</td><td colspan="2">Low</td></tr>
<tr><td>Character delay time</td><td>220 ms</td><td rowspan="4">These parameters are entered automatically in mode 2 (3964R procedure with default values).</td></tr>
<tr><td>Acknowledgement delay time</td><td>2000 ms</td></tr>
<tr><td>Number of connection attempts</td><td>6</td></tr>
<tr><td>Number of repetitions</td><td>6</td></tr>
</table>

You require the following for the CPU in PLC 2:

- The DHB **RECEIVE-ALL** which receives the data and enters them in the destination DB:

SSNR	0	The interface number is 0
A-NR	0	The job number is 0, thus the ALL function is selected
ANZW	FW6	The status word is FW 6
PAFE	FY4	FY 4 is selected for parameterization errors

You require the following for the CP in PLC 2:

- The following parameters in the static parameter set:

<table>
<tr><td>Mode 2</td><td colspan="2">3964R procedure with default values</td></tr>
<tr><td>Baud rate</td><td colspan="2">9600 bps</td></tr>
<tr><td>Parity</td><td colspan="2">Even</td></tr>
<tr><td>Bits per character</td><td colspan="2">8</td></tr>
<tr><td>Stop bits</td><td colspan="2">1</td></tr>
<tr><td>Priority</td><td colspan="2">High</td></tr>
<tr><td>Character delay time</td><td>220 ms</td><td rowspan="4">These parameters are entered automatically in mode 2 (3964R procedure with default values).</td></tr>
<tr><td>Acknowledgement delay time</td><td>2000 ms</td></tr>
<tr><td>Number of connection attempts</td><td>6</td></tr>
<tr><td>Number of repetitions</td><td>6</td></tr>
</table>

- Data for the receive mailbox:

CPU No.	1
Receive mailbox	DB 5 starting at DX 1, length 100 data words
Coordination flag	Not used

4.6 Protocol Definition of the 3964/3964R Procedures

The 3964/3964R procedures allow simple data transmission in quasi full-duplex mode with a good transmission quality. Partners can be SIMATIC modules with a serial interface, units and computers from other manufacturers as well as the CP 544.

The procedures control the data flow between your CP 544 and the partner. They are **asynchronous, bit-serial transmission procedures**. The transmission and reception parameters (baud rate, parity, ...) must be the same in the CP 544 and the partner, the priority must be different in the CP 544 and the partner.

Both procedures add **control characters** to the information characters when data are transmitted. The partner can check with these control characters whether the data have been transmitted completely and without errors.

The CP 544 or the partner transmits the characters in bit-serial form as follows:

SA	I0	I1	I2	I3	I4	I5	I6 1)	I7 2)	PA	SO

SA = start bit
I0–7 = information bits nos. 0 to 7
PA = parity bit (if selected in the static parameter set)
SO = stop bit (length: 1 or 2 bits)

1) Only exists if 7 or 8 bits per character are selected in the static parameter set
2) Only exists if 8 bits per character are selected in the static parameter set

The control characters for the procedures apply with the DIN standard 66003 for the 7-bit code. The character length (6, 7 or 8 bits) is used for the transmission, however.

If the character DLE is transmitted as an information character, it is sent twice on the transmission line to distinguish it from the control character DLE used when establishing and clearing the connection (double DLE). The receiver cancels the doubling of the DLE.

No code is prescribed for the other information characters (code transparency).

4.6.1 Transmitting

The procedure sends the control character STX to establish the connection. If the partner replies with the DLE character before the acknowledgement delay time has expired (QVZ, see Section 4.3.2.1 for default values), the procedure moves on to the transmission. If the partner replies with NAK, any other character (except DLE) or does not reply within the acknowledgement delay time, the procedure repeats the establishment of the connection. The procedure stops attempting to establish the connection after the number of unsuccessful attempts as specified in the static parameter set, and sends the NAK character to the partner. The system program signals an error in establishment of the connection (error number in SYSTAT).

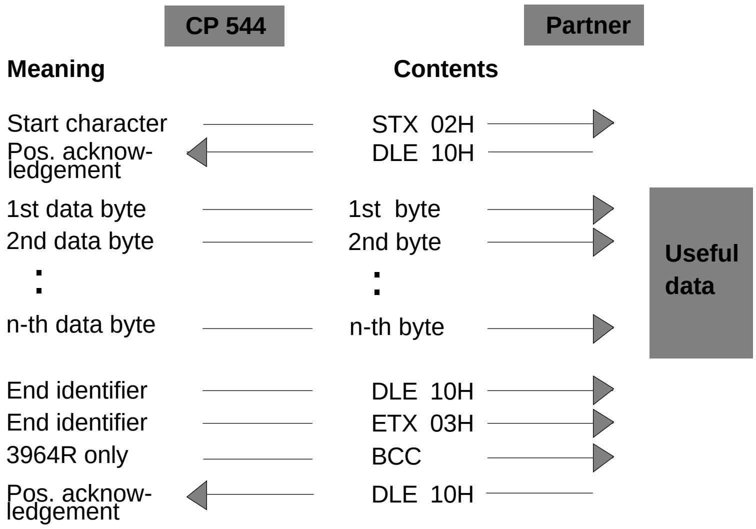
If the connection is established successfully, the useful data contained in the current output buffer are transmitted to the partner using the selected transmission parameters. The partner monitors the intervals between the incoming characters. The interval between two characters must not exceed the character delay time (ZVZ, see Section 4.3.2.1 for default values).

Each DLE character in the buffer is transmitted as two DLE characters (double DLE), i.e. each character \10H\ is sent twice. The receiver cancels the DLE doubling.

After transmitting the contents of the buffer, the procedure adds the DLE and ETX characters and - **only with the 3964R** - the block check character BCC as the end identifier, and waits for an acknowledgement character. The block check character BCC is a byte. It is formed from the even longitudinal parity of all characters (EXOR operation) commencing with the first character following establishment of the connection and finishing after the DLE ETX characters for clearance of the connection. The checksum is formed after the DLE doubling. If the partner sends the DLE character within the acknowledgement delay time (QVZ), this indicates that the data frame has been received correctly. If the partner replies with NAK, any other character (apart from DLE), a faulty character, or if the acknowledgement delay time expires without a reaction, the procedure repeats the transmission with the STX character for establishment of the connection. Once the sequence has attempted to transmit the data frame for the number specified in the static parameter set (number of repetitions), the procedure terminates the process and sends NAK to the partner. The system program signals the error (error number in SYSTAT).

If the partner sends the NAK character during a transmission, the procedure terminates the frame and repeats it in the manner described above. If any other character is transmitted, the procedure first waits until the character delay time ZVZ has expired and then sends NAK to set the partner to the idle state. The procedure then commences again with the STX character for establishment of the connection.

Example of an error-free data transmission:



4.6.2 Receiving

In the idle state, when there is no send job to be processed, the procedure waits for the connection to be established by the partner.

If the procedure receives any character in the idle state (apart from STX or NAK), it waits until the character delay time (ZVZ) has expired and then sends an NAK character. The system program signals the error (error number in SYSTAT).

If the procedure receives the STX character and has an empty receive buffer available, it replies with DLE. Incoming characters are now written into the receive buffer. If two consecutive DLE characters are received, only one is entered into the receive buffer. The connection is terminated with NAK if the receive buffer is full before the partner initiates the procedure for clearing the connection.

Following each received character, the procedure waits for the next character within the character delay time (ZVZ). If this delay time expires without another character being received, the NAK character is sent to the partner. The system program signals the error (error number in SYSTAT).

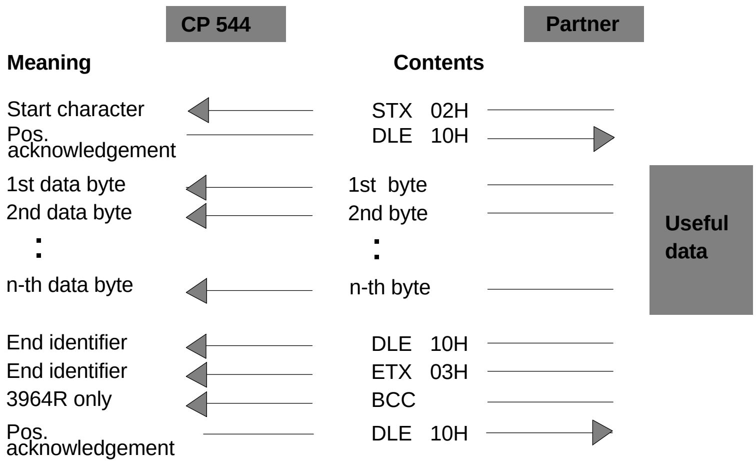
The **3964** procedure terminates reception if it recognizes the DLE ETX character string and sends DLE to the partner if the frame was received free of errors or NAK if errors were detected. The procedure returns to the idle state.

The **3964R** procedure terminates reception if it recognizes the DLE ETX BCC character string. It compares the received block check character BCC with the internally generated longitudinal parity. If the block check character is correct and if no other errors have occurred, the 3964R procedure sends DLE to the partner and returns to the idle state. If the BCC indicates an error or if there is any other error in reception, NAK is sent to the partner. The procedure then expects a repetition.

If an empty receive buffer is not available when the connection is established with STX, a wait time of 400 ms is initiated. If an empty receive buffer is still not available after this time, the system program signals the error (error number in SYSTAT). The procedure sends an NAK character and returns to the idle state. The procedure otherwise sends the DLE character and receives the data as described above.

If transmission errors occur during the reception (lost character, frame error, parity error etc.), the procedure continues to receive until the connection is cleared, and then sends NAK to the partner. A repetition is then expected. If the frame still cannot be received correctly following the number of repetitions specified in the static parameter set or if the partner does not repeat the transmission within a wait time of 4 seconds, the procedure terminates reception. The system program signals the error (with error number in SYSTAT).

Example of error-free reception of data:



Note:

The 3964/3964R procedures send the NAK character to the partner following initialization or resetting in order to set the partner to the idle state.

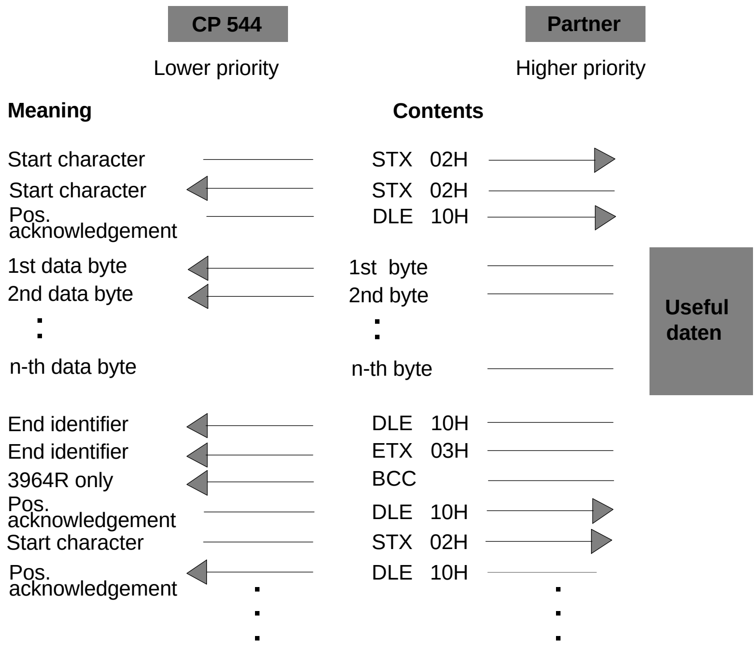
4.6.3 Initialization Conflict

There is an initialization conflict if a device does not reply to the transmit request (STX character) of a partner within the acknowlegement delay time QVZ with the acknowledgement DLE or NAK but with the STX character. Both devices wish to execute their own transmit job. The device with the lower priority retracts its transmit job and replies with the DLE character. The device with the higher priority sends its data as described above. Following clearance of the connection, the device with the lower priority can execute its transmit job.

You can set the priority of the CP 544 (static parameter set, see Section 4.3.2.1) in order to prevent initialization conflicts. You must set the opposite priority on the partner.

4

Example of handling an initialization conflict:



4.6.4 Procedure Errors

The procedure detects errors resulting from the incorrect response of the partner and also errors caused by interferences on the transmission line.

In both cases, the procedure first attempts to repeat the transmission or reception of the data. If the data cannot be transmitted or received free of errors by the time the maximum number of repetitions (as specified in the static parameter set) has been reached (or if a different error occurs), the procedure terminates the transmission or reception. It then signals the error number of the first detected error and enters the idle state. The system program signals the error (error number in SYSTAT).

If the system program frequently signals the error number in the SYSTAT for transmission and reception repetitions, you can assume that the data traffic is sporadically impaired. The large number of repetitions compensates this, however. In such a case we recommend that you examine the transmission line for interferences since the useful data rate and the reliability of the transmission are reduced with a large number of repetitions. The cause of the problem may also be the incorrect response of the partner.

If BREAK is detected on the receive line, the system program signals the BREAK state (SYSTAT). No repetitions are started. This status is retained until the BREAK state is eliminated.

The same number is signalled for all detected transmission errors (lost character, frame/parity error) regardless of whether the error was detected when transmitting or receiving a frame. The error is only signalled, however, if the previous repetitions were unsuccessful. If the faulty character is received while the procedure is in the idle state, the system program signals the error (error number in SYSTAT) to inform you of serious interferences on the transmission line.

5

How do you Transmit Data with the Open Driver?

Contents of Chapter 5

5 How do you Transmit Data with the Open Driver?

Chapter 5 describes the data transmission functions with the open driver and acquaints you with the generation of the STEP 5 program and the static parameter set as well as the definition of the receive mailbox for the CP 544.

5.1 Introduction

Using the open driver, data can be exchanged between two communications partners connected via a point-to-point link in half-duplex mode (simultaneous transmission and reception is not possible) or in full-duplex mode (simultaneous transmission and reception is possible).

In full-duplex mode, the data transmission always takes place in both transmission directions up to the user program independent of the data terminal. A mode with an automatic echo of incoming characters as in half-duplex mode is not provided.

Interface submodules

Various interface submodules are available for data transmission with the open driver:

- V.24 submodule
- TTY submodule
- RS422-A/485 submodule (only in the RS422-A mode).

Transmission speed

Set the transmission speed for the data exchange as suitable for the communications partner. The following transmission speeds are permissible:

- 300 bps to 76 800 bps with the RS422-A/485 submodule
- 300 bps to 19 200 bps with the V.24 submodule
- 300 bps to 9 600 bps with the TTY submodule

Note that the total baud rate of 76800 bps must not be exceeded in half-duplex mode, and the total baud rate of 38400 in full-duplex mode. You can work on one device interface in half-duplex mode and on the other in full-duplex mode, but you must double the set baud rate on the device interface with full-duplex mode in order to retain the total baud rate.

Example
If you work on one device interface in half-duplex mode with a baud rate of 38400 bps, you can still work on the second device interface in full-duplex mode with 19200 bps.

The permissible transmission speed is calculated in this case according to the equation:
Baud rate SI1 + 2 x Baud rate SI2 $\leq$ 76800 bps

Flow control

Flow control is a mechanism which synchronizes the transmission (CPU or partner) and reception (partner or CPU) of data if the data source operates faster than the data sink.
Control of the data flow using this flow control function is transparent for the user (apart from the required parameter settings). When using the flow control XON/XOFF (control characters XON = DC1 = 11H and XOFF = DC3 = 13H), this means that the useful data must not contain these control characters.

If you use the V.24 submodule and wish to parameterize RTS/CTS for the flow control (hardware flow control), it is essential to carry out complete wiring of the used interface signals in the plug connector. Messages which are received incorrectly are always rejected.

Special features when transmitting:

If the CP receives an XON/XOFF control character whilst receiving data, this character is not taken into consideration when monitoring the character delay time (ZVZ). In this case the interval between the character before XON/XOFF and the character after XON/XOFF is doubled. You must take this into account if you have set a short character delay time.

Special features when transmitting:

If the CP generates a control character between two messages which it is transmitting, this character has no influence on the time between the messages. You must take this into account if you have set a short character delay time on your partner and detect the end of the message by means of expiration of the ZVZ (mode 1).

Control signals

The data transmission with open driver does not completely comply with DIN 66021 or the CCITT V.24 specifications.

Please note the following **exceptions**:

- The M1/S1.1 control signals (107/108.1 of V.24 specification, DTR/DSR with RS 232) are not generated or evaluated.
- The M2/S2 control signals (106/105 with V.24, RTS/CTS with RS 232) are only generated or evaluated as the flow control with corresponding parameter settings.

Transmission reliability

The transmission with the open driver comprises the following layer of the ISO/OSI layer model (ISO IS 7498):

- The physical layer (layer 1):
  This layer stipulates the physical transmission of the data bytes (physical characteristics of the connection, transmission speed, etc.).

You must handle the data protection yourself for the open driver. The open driver does not guarantee that a message

- is received without errors or
- is processed by the partner.

For example, the data are not processed further by the CP if the CP is in the STOP state, and are not received by the CPU if the CPU is in the STOP state.

> **Note**
>
> You should provide the flow control function to prevent data being lost when internal buffers overflow. This particularly applies to high data transfer rates or if you are working with coordination flags.

If you want to be sure that a message is received without errors, you must

- carry out the data transmission with the 3964/3964R procedures.

If you want to be sure that a message is received without errors and processed by the partner, you must

- either user the RK 512 computer link or
- provide data protection for the useful data yourself.

Coupling partners

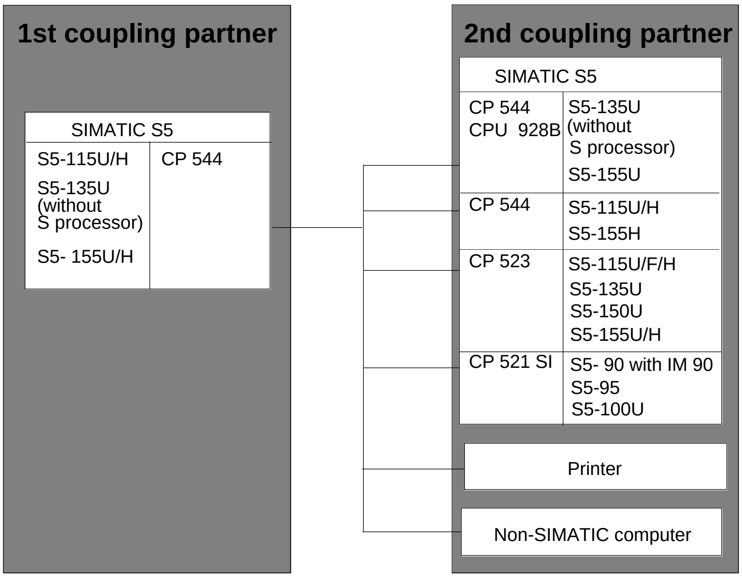


Fig. 5-1 Possible coupling partners for data transmission with open driver

The data transmission with open driver implements the direct data exchange between the CP 544 in an S5-115U/H, S5-135U (without S processor), S5-155U/H and one of the following partners:

- another CP 544
  in the S5-115U/H, S5-135U (without S processor), S5-155U/H programmable controllers
- a CPU 928B
  in the S5-135U and S5-155U programmable controllers
- a CP 523
  in the S5-115U/F/H, S5-135U, S5-150U and S5-155U/H programmable controllers,
- a CP 521 SI
  in the S5-90, S5-95, S5-100U programmable controllers
- an input/output device which operates with the same transmission mode, for example a printer
- a non-SIMATIC computer which operates with the same procedure.

Transmitted data

You can transmit the following data stored in a PLC using the data transmission with open driver:

- Data blocks, extended data blocks
- Flag bytes
- Input/output bytes
- I/O bytes
- Timers
- Counters.

Transmission direction

You can implement the following jobs with the SIMATIC S5 standard procedures for the open driver:

- Send data (SEND job):
  The PLC 1 sends data to the PLC 2 via the CP 544 in the PLC 1 and the CP 544 in the PLC 2
- Send data to an output device (SEND job in mode 4):
  The PLC sends data to an output device (printer) via the CP 544 in the PLC
- Receive data (RECEIVE-ALL job in modes 1 to 3):
  The PLC 1 receives data from the PLC 2 via the CP 544 in the PLC 1 and the CP 544 in the PLC 2.

Transmission mode

You can select one of four modes for the data transmission with the open driver. The transmission mode is defined in the static parameter set.

Mode 1
Fixed useful data length (end identifier: expired character delay time)

When *transmitting* n bytes of useful data, enter the number n of useful data bytes to be transmitted as the parameter "QLAE" when calling the data handling block SEND.

When *receiving* n bytes of useful data, the system program enters the number n of received useful data bytes into the first word of the receive mailbox. This length information does not include the word with the length data itself.

The end of the message is detected when the character delay time has expired.

Mode 2
Variable useful data length (end identifier: defined end character)

When *transmitting* n bytes of useful data, enter the number n of useful data bytes to be transmitted as the parameter "QLAE" when calling the data handling block SEND. The useful data are transmitted up to and including the end identifier (as defined in the static parameter set).

When *receiving*, the useful data up to and including the end identifier (as defined in the static parameter set) are transferred to the receive mailbox. The system program enters the number n (data in bytes) of the received useful data bytes (including the end identifier) into the first word of the receive mailbox. This length information does not include the word with the length data itself.

If the character delay time expires during reception of the useful data, the reception is terminated. The message is discarded.

Mode 3
Fixed useful data length, unsymmetrical (end identifier: defined message length)

When *transmitting* n bytes of useful data, enter the number n of useful data bytes to be transmitted as the parameter "QLAE" when calling the data handling block SEND

When *receiving*, the useful data are transferred to the receive mailbox up to the fixed message length parameterized for the mailbox. The system program enters the number n of received useful data bytes into the first word of the receive mailbox (must correspond to "fixed message length when receiving"). This length information does not include the word with the length data itself.

If the character delay time expires during reception of the useful data, the reception is terminated. The message is discarded.

Mode 4
Printer output

For the *output* of n bytes of useful data on the *printer*, enter the number n of useful data bytes to be transmitted as the parameter "QLAE" when calling the data handling block SEND. The useful data are transmitted up to and including the end identifier (as you have programmed in the static parameter set).

The data are prepared for printing during the output. Printing is terminated following transmission of the end identifier, the line counter and other values used for preparing printing remain valid, however.

The *reception* of characters does not take place in this mode. The only exceptions are control characters for flow control if these have been parameterized accordingly. Any other characters which may appear are not transferred.

5.2 Data Exchange Sequence

The following Fig. shows the data exchange sequence between two programmable controllers.

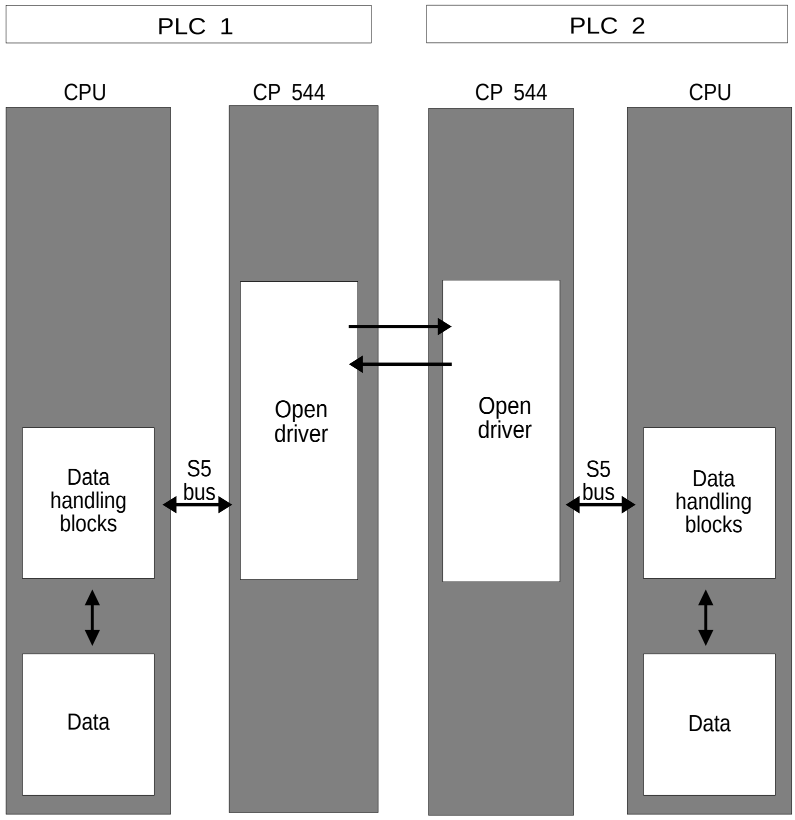


Fig. 5-2 Data exchange between two programmable controllers

Data handling blocks

The data handling blocks in the STEP 5 program of the CPU are used:

- to trigger and execute data exchange,
- to receive the transmitted data in modes 1 to 3.

Open driver (modes 1 to 3)

The open driver in the CP 544 modules of the two PLCs

- receives the required information on the data destination from the definition in the receive mailbox,
- passes on the data to the CP in the other PLC.

Open driver (mode 4)

The open driver in the CP 544 module of the PLC

- sends the data to the output device.

The data exchange sequence described means that you have the following important tasks for data transmission with the open driver:

- You must generate your STEP 5 program with the calls of the data handling blocks for the two CPUs
- You must assign parameters to the open drivers in the two CP 544 modules
- You must define a receive mailbox in the CP 544 of the partner if you use modes 1 to 3.

5.3 Program Elements for the Open Driver

The programming of the open driver is based on only a few fundamental points – the STEP 5 program with the data handling blocks, the functions of the receive data block (receive mailbox) in the CPU, the static parameter set on the CPU and the definition of the receive mailbox.

5.3.1 STEP 5 Program with Data Handling Blocks

Incorporate the data handling blocks described below into your STEP 5 program to enable data transmission with the open driver according to the particular task.

Once you have read this description, you will be able to generate a concept for the STEP 5 program for your particular task.

You can find a detailed description of the individual data handling blocks and their parameters in Chapter 6.

5.3.1.1 SYNCHRON

Synchronizing CPU and CP

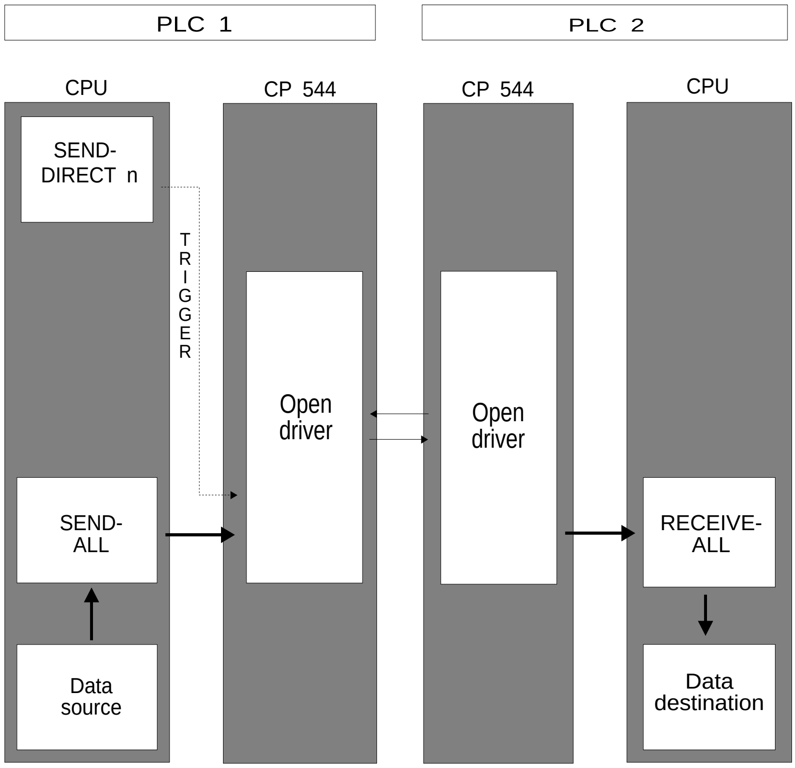
The data handling block SYNCHRON synchronizes the device interface between the CPU and CP.

SYNCHRON must be called in the restart organization blocks of the CPU for every page frame used by you in the two device interfaces of the CP.

5.3.1.2 SEND

Send data

The data handling block SEND transmits data from the CPU to the CP 544. The job is triggered by the SEND-DIRECT. In order to transmit data, a SEND-ALL job must be additionally programmed in the user program and called cyclically. The matching partner job RECEIVE-ALL must be programmed in the STEP 5 program of the partner CPU to enable the data to be received by it.



n = job number

Fig. 5-3 SEND job

When transmitting data with the CP 544, the SEND-DIRECT data handling block is used for the following special jobs:

Parameterize device interface

You can use this special job to assign parameters to the two device interfaces of the CP 544 without the COM PP parameterization software in that you store the parameters in a data block.

Import mode-specific static parameters

You can use this special job e.g. in mode 4 to modify the static parameters starting at DW 35 (print parameter) without having to reset the device interface.

Start device interface

You can use this special job to start a device interface from the STEP 5 program.

Set date and time

You can use this special job to set the clock on the CP 544 from the CPU and to define whether the CP is to be a time master or slave.

Execute PSEUDO-WRITE function

You can use this special job to transmit data. All parameters on the source and destination are stored in a DB/DX.
The special job enables you:

- To modify the source and/or destination data of a job during execution of the program
- To program this job without COM PP.

5.3.1.3 RECEIVE

Receive data

The data handling block RECEIVE transmits data from the CP to the CPU.

The data handling block RECEIVE-DIRECT is only used for the following special jobs in the data transmission with the CP 544:

Read parameters of a device interface

You can use this special job to scan the parameters of a device interface independent of the COM PP parameterization software. The parameters are written into a defined data block.

Read error message area of SYSTAT

You can use this special job to read up to 3 error messages of the SYSTAT specific to the interface.

Read status

You can use this special job to scan the status of the CP 544 and the addressed device interface.

Read hardware parameters

You can use this special job to scan the hardware parameters which you have set using switches on the module (page frame number, number of pages, released coordination flag area) without having to remove the module.

Read complete SYSTAT status area

You can use this special job to read the complete SYSTAT, i.e. the error messages of both device interfaces of the CP 544.

Read SYSID identification area

You can use this special job to read data on the module, the memory submodule, the interface assignments and the output statuses of the loaded software from the SYSID.

Read date and time

You can use this special job to read the time on the CP 544 using the CPU.

5.3.1.4 CONTROL

Check job status

The data handling block CONTROL copies a job status into the defined status word. The job status provides information on the processing state of the job.

5.3.1.5 Coordination Flags

You can use the coordination flags to inhibit or release the transfer of data between the CPU and CP 544.

The coordination flags must be released using switches on the CP 544 module (see Section 2.1). The coordination flags must be defined in the PLC as output communication flags in the DB 1.

The coordination flag is defined in the definition of the receive mailbox of the partner CP. The byte number of the coordination flag appears in the status word of the ALL job in the destination PLC in the last transmission cycle. Using this byte number you can recognize that the data have arrived completely in the destination CPU. You can inhibit the repeated acceptance of data if you set the coordination flag in the STEP 5 program of the destination CPU. You can reset the coordination flag by the user program as soon as the data have been saved from the destination area or processed further; the job is then accepted again.

Note that only the byte number of the coordination flag appears in the status word of SEND-ALL or RECEIVE-ALL, and not the bit number as well. You must therefore ensure that there is an unequivocal assignment between the byte number and coordination flag if you wish to evaluate the information of the status word in the program.

You can use every flag apart from flag 222 (DE hexadecimal) as a coordination flag but only byte numbers from 1 to 223 can be indicated in the status word. Flag 222 is reserved to indicate the complete transmission of a job if no coordination flags are transmitted.

5.3.2 Assignment of Parameters to Open Driver in CP 544

The COM PP parameterization software (see Chapter 7) supports you when assigning parameters to the open driver. If you do not have this software package, you must assign parameters to the open driver by means of the special job SEND-DIRECT 189 (see Section 6.3.8).

You generate a static parameter set and, if you receive data with the CP 544, you must define the position of the receive mailbox on the CPU.

Static parameter set

In the static parameter set, you specify the parameters for the physical layer of the open driver.

See Sections 5.3.2.1 to 5.3.2.4 to understand which parameters are required in which transmission mode.

Receive mailbox

The receive mailbox is a data block on the receiving CPU. You must create it on the receiving CPU and define its position on the receiving CP.

Once you have read this section, you will be able to produce a concept for the static parameter set and the receive mailbox of the open driver for your special requirements.

The following pages provide you with a summary of possible parameter settings.

5.3.2.1 Mode 1 – Fixed Useful Data Length (ZVZ)

When *transmitting* n bytes of useful data, enter the number n of useful data bytes to be transmitted as the parameter "QLAE" when calling the data handling block SEND.

When *receiving* n bytes of useful data, the system program enters the number n of received useful data bytes into the first word of the receive mailbox. This length information does not include the word with the length data itself.

The end of the message is detected when the character delay time has expired.

The following pages list the values you can use to parameterize the data transmission with the open driver in mode 1 – fixed useful data length (end identifier: ZVZ expired).

Static parameter set

You must enter the parameters for the physical layer as well as transmission-specific parameters in the static parameter set.

The following table shows you which values you can enter for the static parameter set.

Table 5.1 Static parameter set (open driver, mode 1)

Parameter	Input
Mode 1	Fixed useful data length (ZVZ)
Baud rate[1]	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps [2] 38400 bps [3] 76800 bps [3]
Parity	No Odd Even
Bits per character	6 bits per character 7 bits per character 8 bits per character
Stop bits	1 stop bit 2 stop bits
Flow control	None XON/XOFF RTS/CTS
Character delay time	Monitoring time 0.01 s to 635.35 s (steps: 10 ms)

[1] The total baud rate of 76800 bps must not be exceeded.
In full-duplex mode, the total baud rate is halved to 38400 bps.

[2] Only with V.24 submodule and RS422-A/485 submodule

[3] Only with RS422-A/485 submodule

The flow control must be set according to the requirements of your partner.

5

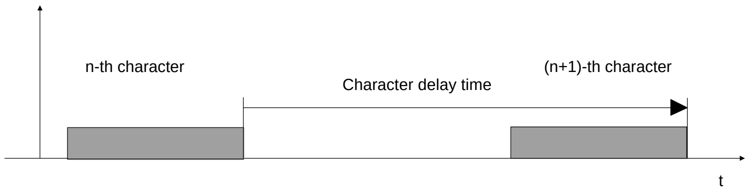
Meaning of parameters

Mode	Version of the possible data transmission modes.
Baud rate	Data transmission speed, data in bit/s (bps).
Parity	The parity is either even or odd. To check the parity, the string of information bits is extended by a further bit, the parity bit (0 or 1) which, when added to the information bits produces a selectable parity state. If "No" is set for the parity, the parity bit is set to 1 but not evaluated by the receiver/transmitter.
Bits per character	Number of data bits used to form a character.
Stop bits	Duration of the stop bits relative to the time required to transmit an information bit. The stop bits follow each transmitted character in a start/stop transmission.
Flow control	Mechanism which synchronizes the transmission (CPU or partner) and reception (partner or CPU) of data if the data source operates faster than the data sink. Controlling of the data flow using flow control is transparent for the user (with the exception of the required parameter settings). This means that if you use the flow control XON/XOFF (control characters XON=DC1=11H and XOFF=DC3=13H), the useful data must not contain these control characters. If you use flow control RTS/CTS, you must additionally wire the RTS and CTS signals.

Important
If you work with flow control, please refer to the information in Section 5.1.

Character delay time (ZVZ)

The maximum permitted interval between two received characters (see also table below):



Baud rate	**Minimum permissible character delay time ZVZ**
300 bps	50 ms
600 bps	30 ms
1200 bps	20 ms
2400 bps	10 ms
4800 bps	10 ms
9600 bps	10 ms
19200 bps	10 ms
38400 bps	10 ms
76800 bps	10 ms

When transmitting data with the open driver, the parameters of the physical layer on the partner must agree with those of the CP 544.

Receive mailbox

The receive mailbox is located in a data block (DB) or extended data block (DX). It contains the received data and, in the first word, the length of the received data (in bytes). This is entered by the system program so that you can recognize how many bytes have been received. The specified length does not include the word containing the length specification itself.

Length The maximum length of the receive mailbox is 2049 words (4098 bytes). The receive mailbox must always be one word larger than the data to be received.

Length of receive mailbox = net data + 1 word

Example: receive mailbox

The example illustrates the structure of a receive mailbox in data block 8 with a length of 6 words starting at data word 1. 7 bytes were received.

DB 8

0:	KH = xxxx;	does not belong to receive mailbox, contents irrelevant
1:	KH = 0007;	start of receive mailbox, length in bytes
2:	KH = 0102;	received data: 0102
3:	KH = 0304;	received data: 0304
4:	KH = 0506;	received data: 0506
5:	KH = 07yy;	received data: 07, yy was not received
6:	KH = yyyy;	contents of the receive mailbox, not received (filled with 00)
7:	KH = xxxx;	does not belong to the receive mailbox, contents irrelevant, need not exist
:		
:		

Receive mailbox

The following table shows the values with which you can parameterize the receive mailbox.

Parameter	Meaning
CPU No.	Range of values 1 to 4 or no data
Receive mailbox Data type DB or DX number starting at DW Length	 DB or DX Range of values 3 to 255 Range of values 2 to 2049 words
Coordination flag	Range of values for byte no. 0 to 223 Range of values for bit no. 0 to 7 or no data

Meaning of parameters

CPU number

The CPU number specifies the CPU for which the data stored in the receive mailbox are intended. Only this CPU can receive the data from the CP. The data are stored in the lowest page on the receiving interface. The specification of a CPU number is not necessary if only one CPU is inserted in the PLC.

Receive mailbox

A data block or an extended data block can be specified as the receive mailbox. Further parameters to be entered are the data block number, the initial address in the data block and the length.

Coordination flag

By specifying a coordination flag you can prevent transmitted data which have not yet been processed from being overwritten. The coordination flags must be enabled using switches on the module (see Section 2.1).

5

Protocol definition of open driver in mode 1

The following description is intended to help you if you wish to connect a non-SIMATIC device using the open driver in mode 1 (fixed useful data length (ZVZ)). It is also intended as a source of reference for engineers who have to develop a protocol compatible with the open driver on a non-SIMATIC computer.

The following aspects are described for transmitting and receiving:

- Structure of the transmitted/received data frame
- Restrictions, if any
- Basic sequence of events.

In the sequence of events shown, the bold lines indicate the standard sequence, the thin lines represent the error handling sequence.

Transmitting

In mode 1, only the useful data are transmitted without length information.

The data frame to be transmitted has the following structure:

Length of useful data: n bytes

1	n
Useful data - length n bytes	

XON (DC1 = 11H) or XOFF (DC3 = 13H) must not be present in the useful data when selecting the flow control with XON/XOFF.

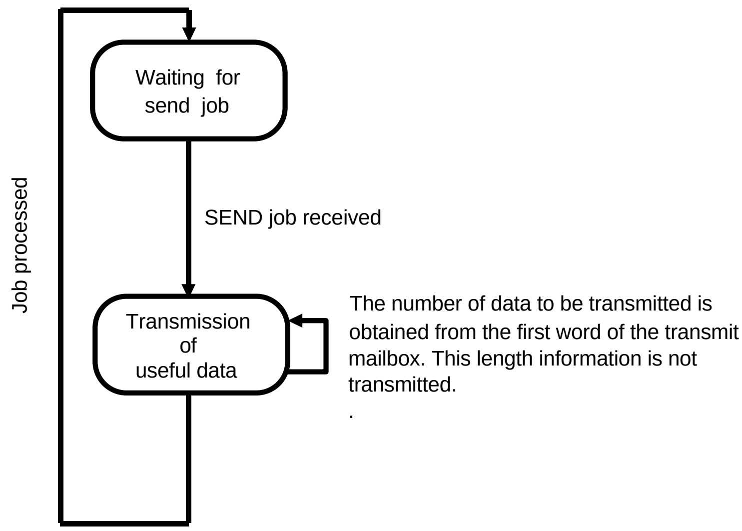


Fig. 5-4 Transmission sequence in mode 1

Receiving

The end of the message is recognized when the character delay time has expired.

The data frame to be received has the following structure:

Length of useful data: n bytes

1 … n
Useful data - length n bytes

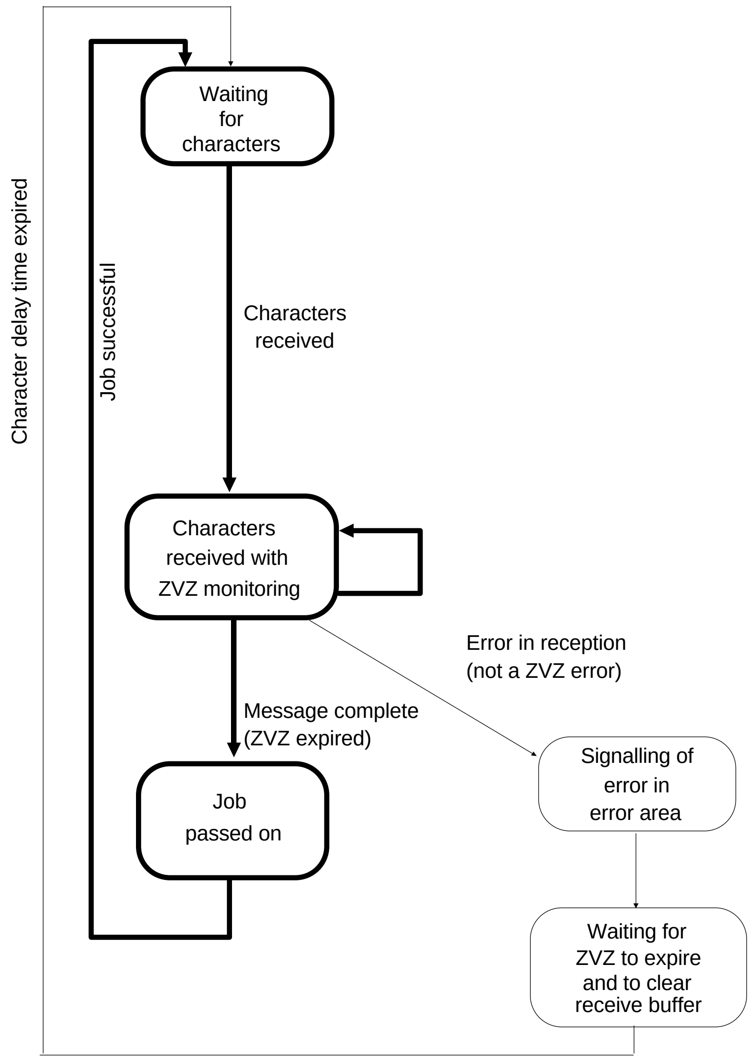


Fig. 5-5 Receiving sequence in mode 1

5.3.2.2 Mode 2 – Variable Useful Data Length (End Character)

When *transmitting* n bytes of useful data, enter the number n of useful data bytes to be transmitted as the parameter "QLAE" when calling the data handling block SEND. The useful data are transmitted up to and including the end identifier (as defined in the static parameter set).

When *receiving*, the useful data up to and including the end identifier (as defined in the static parameter set) are transferred to the receive mailbox. The system program enters the number n (data in bytes) of the received useful data bytes (including the end identifier) into the first word of the receive mailbox. This length information does not include the word with the length data itself.

If the character delay time expires during reception of the useful data, reception is terminated. The message is discarded.

The following pages list the values you can use to parameterize the data transmission with the open driver in mode 2 - variable useful data length (end identifier: defined end character).

Static parameter set

You must enter the parameters for the physical layer as well as transmission-specific parameters in the static parameter set.

The following table shows you which values you can enter for the static parameter set.

Table 5.3 Static parameter set (open driver, mode 2)

Parameter	Input
Mode 2	Variable useful data length (end character)
Baud rate[1]	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps [2] 38400 bps [3] 76800 bps [3]
Parity	No Odd Even
Bits per character	6 bits per character 7 bits per character 8 bits per character
Stop bits	1 stop bit 2 stop bits
Flow control	None XON/XOFF RTS/CTS
Character delay time	Monitoring time 0.01 s to 635.35 s (steps: 10 ms)
1st end identifier	00 Code of first end identifier, no second end identifier xx Code of first end identifier (range of values 01 to FF)
2nd end identifier	xx Code of second end identifier (range of values 01 to FF)

[1] The total baud rate of 76800 bps must not be exceeded.
In full-duplex mode, the total baud rate is halved to 38400 bps
[2] Only with V.24 submodule and RS422-A/485 submodule
[3] Only with RS422-A/485 submodule

The flow control must be set according to the requirements of your partner.

Meaning of parameters

Mode
Version of the possible data transmission modes.

Baud rate
Data transmission speed, data in bit/s (bps).

Parity
The parity is either even or odd. To check the parity, the string of information bits is extended by a further bit, the parity bit (0 or 1) which, when added to the information bits produces a selectable parity state. If "No" is set for the parity, the parity bit is set to 1 but not evaluated by the receiver/transmitter.

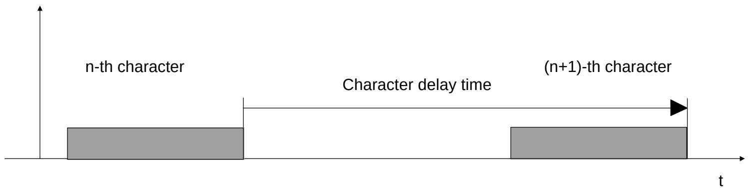
Bits per character
Number of data bits used to form a character.

Stop bits
Duration of the stop bits relative to the time required to transmit an information bit. The stop bits follow each transmitted character in a start/stop transmission.

Flow control
Mechanism which synchronizes the transmission (CPU or partner) and reception (partner or CPU) or data if the data source operates faster than the data sink. Controlling of the data flow using flow control is transparent for the user (with the exception of the required parameter settings). This means that if you use the flow control XON/XOFF (control characters XON=DC1=11H and XOFF=DC3=13H), the useful data must not contain these control characters.
If you use flow control RTS/CTS, you must additionally wire the RTS and CTS signals.

Character delay time (ZVZ)

The maximum permitted interval between two received characters (see also table below)



Baud rate	Minimum permissible character delay time ZVZ
300 bps	50 ms
600 bps	30 ms
1200 bps	20 ms
2400 bps	10 ms
4800 bps	10 ms
9600 bps	10 ms
19200 bps	10 ms
38400 bps	10 ms
76800 bps	10 ms

End identifier

The data transmission is terminated by the specified end identifier. The entry NUL is a valid end character in the first end identifier. This ensures that at least one valid end identifier is assigned as standard. The second end identifier is optional and is only effective if the first end identifier is not NUL.

When assigning the end identifier(s) make sure that bits 6 and 7 or bit 7 of the parameterized end identifier(s) are not transmitted for the data transmission with 6 or 7 bits per character.

When transmitting data with the open driver, the parameters of the physical layer on the partner must agree with those of the CP 544.

Receive mailbox

The receive mailbox is located in a data block (DB) or extended data block (DX).

It contains the received data, including the received end identifier, after the first data word. The system program enters the number n (in bytes) of received useful data bytes (including the end identifiers) into the first word of the receive mailbox. This specified length does not include the word containing the length specification itself. The end identifiers enable you to recognize how many bytes have been received in addition to the first data word in the receive mailbox. Make sure that the partner operates with the same end identifiers as you have assigned in the static parameter set.

Length

The maximum length of the receive mailbox is 2049 words (4098 bytes). The receive mailbox must always be one word larger than the data to be received.

Length of receive mailbox = net data + 1 word

Example: receive mailbox

The example illustrates the possible appearance of a receive mailbox in data block 8 with a length of 6 words starting at data word 1. In the static parameter set, 10H was assigned as the first end identifier and 03H as the second end identifier.

DB 8

0:	KH = xxxx;	does not belong to receive mailbox, contents irrelevant
1:	KH = 0009;	start of receive mailbox, length in bytes
2:	KH = 0102;	received data: 0102
3:	KH = 0304;	received data: 0304
4:	KH = 0506;	received data: 0506
5:	KH = 0710;	received data: 07, 1st end identifier: 10
6:	KH = 03yy;	2nd end identifier: 03, yy was not received (filled with 00)
7:	KH = xxxx;	does not belong to the receive mailbox, contents irrelevant, need not exist

:
:

Receive mailbox

The following table shows the values with which you can parameterize the receive mailbox.

Parameter	Meaning
CPU No.	Range of values 1 to 4 or no data
Receive mailbox Data type DB or DX number starting at DW Length	 DB or DX Range of values 3 to 255 Range of values 2 to 2049 words
Coordination flag	Range of values for byte no. 0 to 223 Range of values for bit no. 0 to 7 or no data

Meaning of parameters

CPU number

The CPU number specifies the CPU for which the data stored in the receive mailbox are intended. Only this CPU can receive the data from the CP. The data are stored in the lowest page on the receiving interface. The specification of a CPU number is not necessary if only one CPU is inserted in the PLC.

Receive mailbox

A data block or an extended data block can be specified as the receive mailbox. Further parameters to be entered are the data block number, the initial address in the data block and the length.

Coordination flag

By specifying a coordination flag you can prevent transmitted data which have not yet been processed from being overwritten. The coordination flags must be enabled using switches on the module (see Section 2.1).

Protocol definition of open driver in mode 2

The following description is intended to help you if you wish to connect a non-SIMATIC device using the open driver in mode 2 (variable useful data length (end identifier)). It is also intended as a source of reference for engineers who have to develop a protocol compatible with the open driver on a non-SIMATIC computer. The following aspects are described for transmitting and receiving:

- Structure of the transmitted/received data frame
- Restrictions, if any
- Basic sequence of events.

In the sequence of events shown, the bold lines indicate the standard sequence, the thin lines represent the error handling sequence.

Transmitting

In mode 2, the useful data are transmitted including the end identifier assigned in the static parameter set.

The data frame to be transmitted has the following structure:

Length of useful data: n bytes

1 … n	n+1	n+2
Useful data - length n bytes	E1	E2

E1: first end identifier
E2: second end identifier (if assigned in static parameter set)

XON (DC1 = 11H) or XOFF (DC3 = 13H) must not be present in the message when selecting the flow control with XON/XOFF.

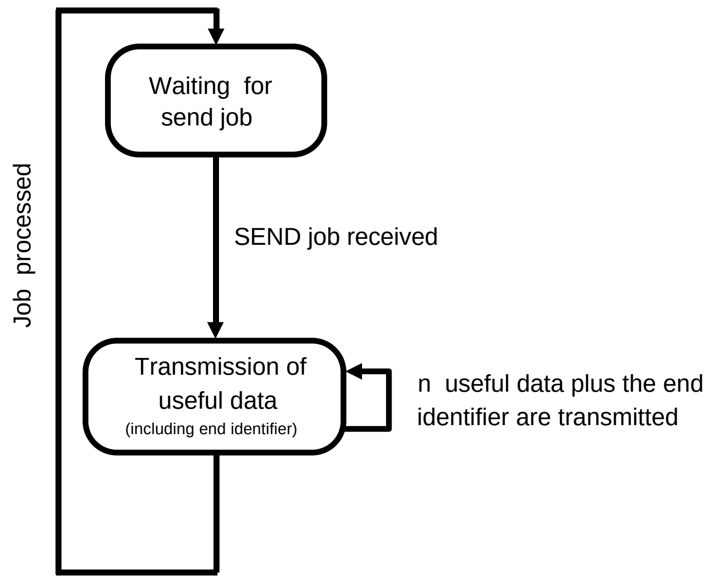


Fig. 5-6 Transmission sequence in mode 2

Receiving

The received characters including the end identifier are stored in the receive mailbox after the first data word. The data frame to be received has the following structure:

Length of useful data: n bytes

1 … n	n+1	n+2
Useful data - length n bytes	E1	E2

E1: first end identifier
E2: second end identifier (if assigned in static parameter set)

The reception of the end identifier indicates a valid message. An invalid message is indicated if the character delay time ZVZ has expired. Make sure that the two partners operate with the same end identifier.

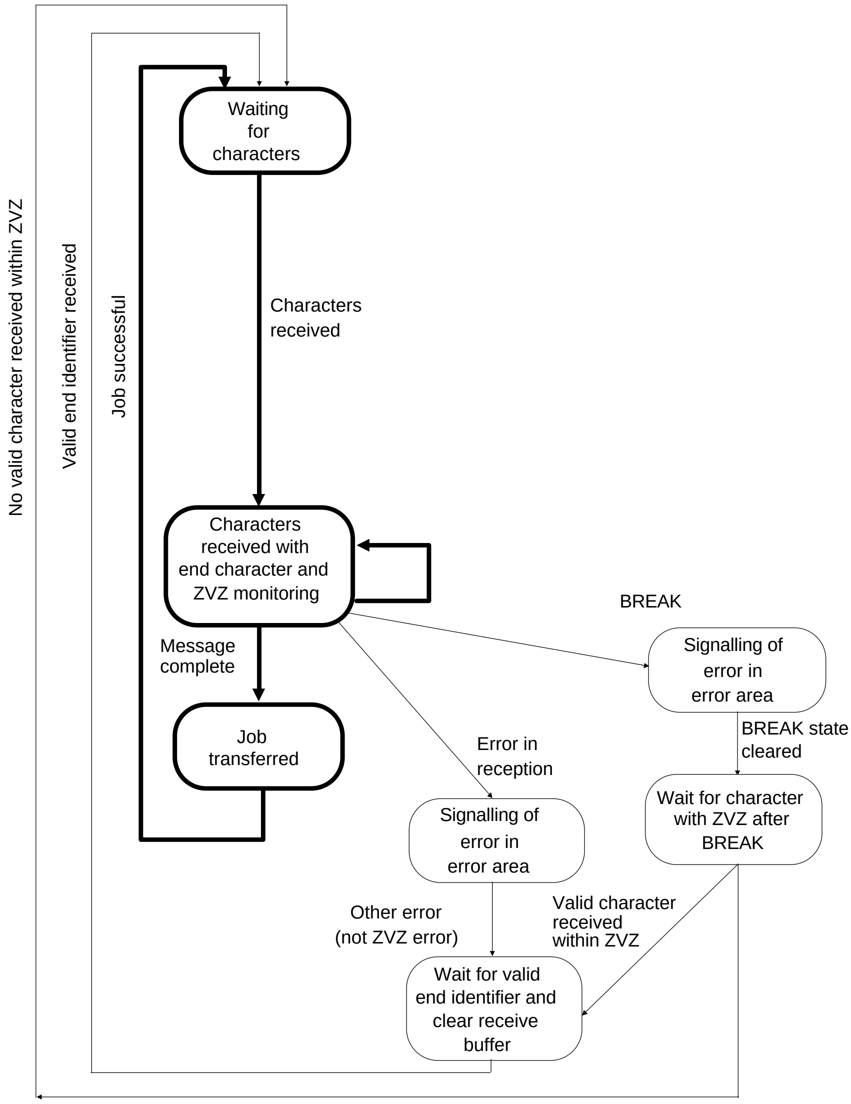


Fig. 5-7 Receiving sequence in mode 2

5.3.2.3 Mode 3 – Fixed Useful Data Length, Unsymmetrical

When *transmitting* n bytes of useful data, enter the number n of useful data bytes to be transmitted as the parameter "QLAE" when calling the data handling block SEND.

When *receiving*, the useful data are transferred to the receive mailbox up to the fixed message length parameterized for the mailbox. The system program enters the number n of received useful data bytes into the first word of the receive mailbox (must correspond to "fixed message length when receiving"). This length information does not include the word with the length data itself.

If the character delay time expires during reception of the useful data, reception is terminated. The message is discarded.

The following pages list the values you can use to parameterize the data transmission with the open driver in mode 3 – fixed useful data length, unsymmetrical (end identifier: fixed message length).

Static parameter set

You must enter the parameters for the physical layer as well as transmission-specific parameters in the static parameter set.

The following table shows you which values you can enter for the static parameter set.

Table 5.5 Static parameter set (open driver, mode 3)

Parameter	Input
Mode 3	Fixed useful data length, unsymmetrical
Baud rate[1]	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps [2] 38400 bps [3] 76800 bps [3]
Parity	No Odd Even
Bits per character	6 bits per character 7 bits per character 8 bits per character
Stop bits	1 stop bit 2 stop bits
Flow control	None XON/XOFF RTS/CTS
Character delay time	Monitoring time 0.01 s to 635.35 s (steps: 10 ms)
Fixed message length for reception	Length in bytes

[1] The total baud rate of 76800 bps must not be exceeded.
In full-duplex mode, the total baud rate is halved to 38400 bps
[2] Only with V.24 submodule and RS422-A/485 submodule
[3] Only with RS422-A/485 submodule

The flow control must be set according to the requirements of your partner.

5

Meaning of parameters

Mode
Version of the possible data transmission modes.

Baud rate
Data transmission speed, data in bit/s (bps).

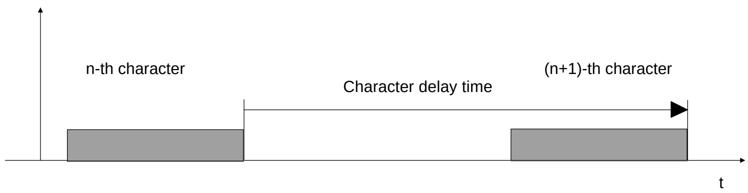
Parity
The parity is either even or odd. To check the parity, the string of information bits is extended by a further bit, the parity bit (0 or 1) which, when added to the information bits produces a selectable parity state. If "No" is set for the parity, the parity bit is set to 1 but not evaluated by the receiver/transmitter.

Bits per character
Number of data bits used to form a character.

Stop bits
Duration of the stop bits relative to the time required to transmit an information bit. The stop bits follow each transmitted character in a start/stop transmission.

Flow control
Mechanism which synchronizes the transmission (CPU or partner) and reception (partner or CPU) of data if the data source operates faster than the data sink. Controlling of the data flow using flow control is transparent for the user (with the exception of the required parameter settings). This means that if you use the flow control XON/XOFF (control characters XON=DC1=11H and XOFF=DC3=13H), the useful data must not contain these control characters.
If you use flow control RTS/CTS you must additionally wire the RTS and CTS signals.

Character delay time (ZVZ)
The maximum permitted interval between two received characters (see also table below):



Baud rate	**Minimum permissible character delay time ZVZ**
300 bps	50 ms
600 bps	30 ms
1200 bps	20 ms
2400 bps	10 ms
4800 bps	10 ms
9600 bps	10 ms
19200 bps	10 ms
38400 bps	10 ms
76800 bps	10 ms

Fixed message length for reception

If characters are received, the end of the message is detected based on the parameterized fixed message length.

When transmitting data with the open driver, the parameters of the physical layer on the partner must agree with those of the CP 544.

Receive mailbox

The receive mailbox is located in a data block (DB) or extended data block (DX).

It contains the received data after the first data word. The system program enters the number n (in bytes) of received useful data bytes into the first word of the receive mailbox (must correspond to the parameter "Fixed message length for reception" in the static parameter set). This specified length does not include the word containing the length specification itself. The number of received data can be determined by the parameter "Fixed message length for reception" in the static parameter set. Make sure that the partner really transmits the number of bytes selected in the static parameter set, otherwise the received data will be discarded.

The "Fixed message length for reception" must not exceed the length of the receive mailbox minus one word (see above). The maximum length of the receive mailbox is 2049 words (4098 bytes).

Remember to specify the length of the receive mailbox in **words**, but the parameter "Fixed message length for reception" in **bytes**.

Example: receive mailbox

The example illustrates the structure of a receive mailbox in data block 8 with a length of 6 words starting at data word 1. In the static parameter set, 9 bytes were parameterized as the "Fixed message length for reception".

DB 8

0:	KH = xxxx;	does not belong to receive mailbox, contents irrelevant
1:	KH = 0009;	start of receive mailbox, length in bytes
2:	KH = 0102;	received data: 0102
3:	KH = 0304;	received data: 0304
4:	KH = 0506;	received data: 0506
5:	KH = 0708;	received data: 0708,
6:	KH = 09yy;	received data: 09, yy was not received (filled with 00)
7:	KH = xxxx;	does not belong to the receive mailbox, contents irrelevant, need not exist

:
:

5

Receive mailbox

The following table shows the values with which you can parameterize the receive mailbox.

Parameter	Meaning
CPU No.	Range of values 1 to 4 or no data
Receive mailbox Data type DB or DX number starting at DW Length	 DB or DX Range of values 3 to 255 Range of values 2 to 2049 words
Coordination flag	Range of values for byte no. 0 to 223 Range of values for bit no. 0 to 7 or no data

Meaning of parameters

CPU number

The CPU number specifies the CPU for which the data stored in the receive mailbox are intended. Only this CPU can receive the data from the CP. The data are stored in the lowest page on the receiving interface. The specification of a CPU number is not necessary if only one CPU is inserted in the PLC.

Receive mailbox

A data block or an extended data block can be specified as the receive mailbox. Further parameters to be entered are the data block number, the initial address in the data block and the length.

Coordination flag

By specifying a coordination flag you can prevent transmitted data which have not yet been processed from being overwritten. The coordination flags must be enabled using switches on the module (see Section 2.1).

Protocol definition of open driver in mode 3

The following description is intended to help you if you wish to connect a non-SIMATIC device using the open driver in mode 3 (fixed useful data length, unsymmetrical). It is also intended as a source of reference for engineers who have to develop a protocol compatible with the open driver on a non-SIMATIC computer.

The following aspects are described for transmitting and receiving:

- Structure of the transmitted/received data frame
- Restrictions, if any
- Basic sequence of events.

In the sequence of events shown, the bold lines indicate the standard sequence, the thin lines represent the error handling sequence.

5

Transmitting

In mode 3, only the useful data are transmitted without length information.

The data frame to be transmitted has the following structure:

Length of useful data: n bytes

1	n
Useful data - length n bytes	

XON (DC1 = 11H) or XOFF (DC3 = 13H) must not be present in the useful data when selecting the flow control with XON/XOFF.

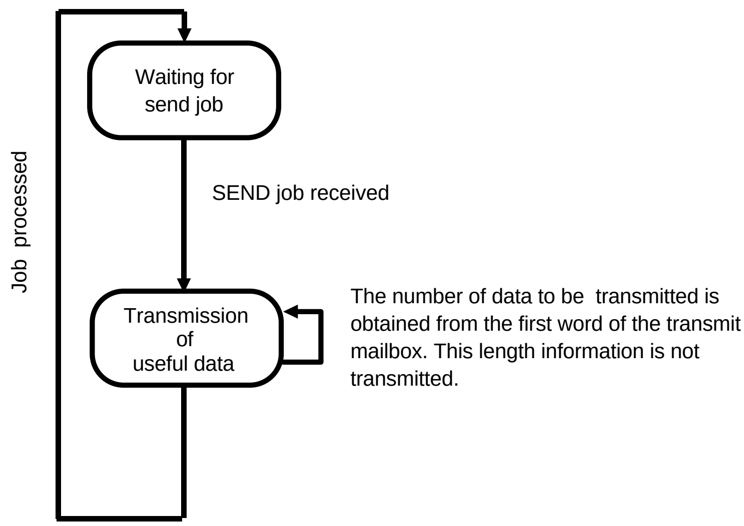


Fig. 5-8 Transmission sequence in mode 3

Receiving

The message length in bytes is determined by the length specified in the special static parameters. The receive mailbox contains the useful data after the first data word. The first data word of the receive mailbox contains the number (in bytes) of received useful data. A message has been transmitted completely and correctly if neither the character delay time has elapsed (gap between characters too large) nor a transmission error in the physical layer occurred during reception of the number of characters defined in the special static parameters.

The data frame to be received has the following structure:

Length of useful data : n bytes

1 … n
Useful data - length n bytes

The message is invalid if the character delay time (ZVZ) has expired.

The useful data length is obtained from the static parameter set.

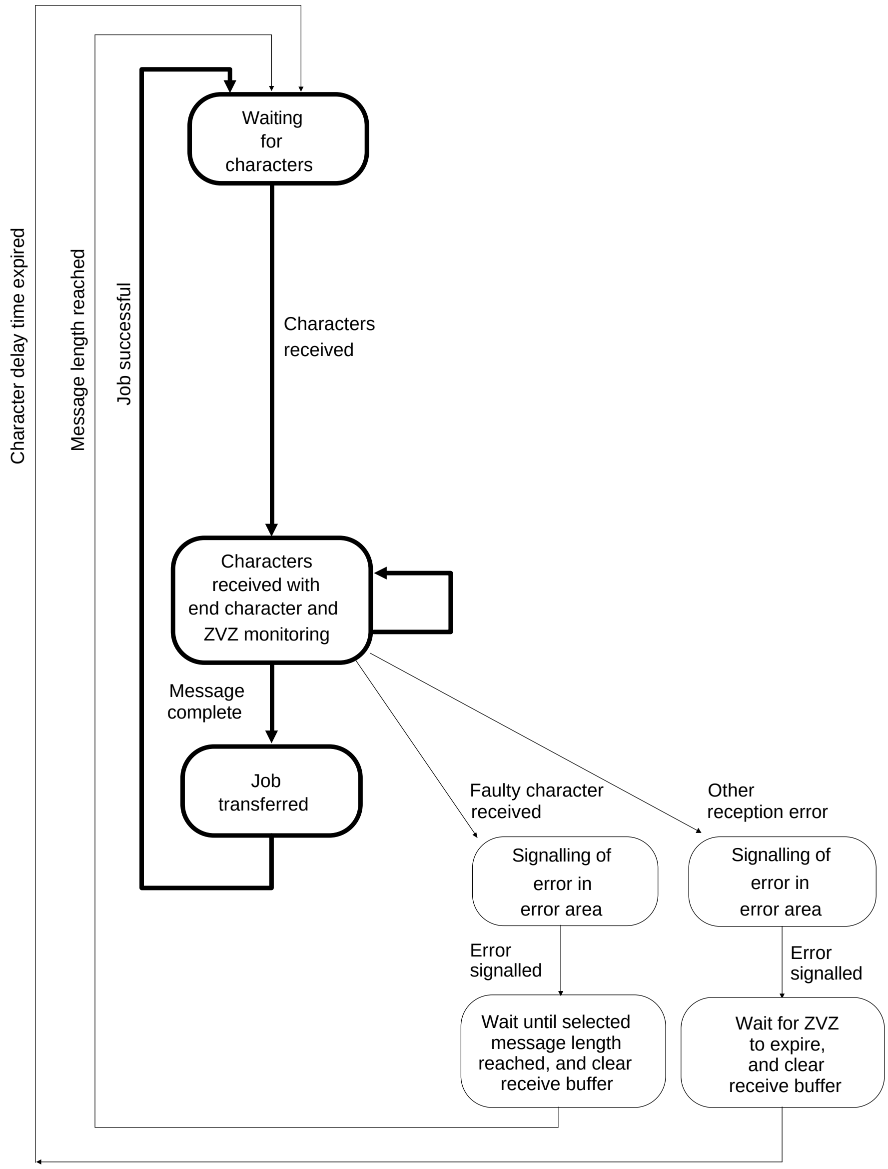


Fig. 5-9 Receiving sequence in mode 3

5.3.2.4 Mode 4 – Printer Output

For the *output* of n bytes of useful data on the *printer*, enter the number n of useful data bytes to be transmitted as the parameter "QLAE" when calling the data handling block SEND. The useful data are transmitted up to and including the end identifier (as you have programmed in the static parameter set).

The data are prepared for printing during the output. Printing is terminated following transmission of the end identifier, the line counter and other values used for preparing printing remain valid, however.

The *reception* of characters does not take place in this mode. The only exceptions are control characters for flow control if these have been parameterized accordingly. Any other characters which may appear are not transferred.

The following pages list the values you can use to parameterize the data transmission with the open driver in mode 4 (printer output).

Static parameter set

You must enter the parameters for the physical layer as well as transmission-specific parameters in the static parameter set.

The following table shows you which values you can enter for the static parameter set.

Table 5.7 Static parameter set 1(open driver, mode 4)

Parameter	Input
Mode 4	Printer output
Baud rate[1]	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps [2] 38400 bps [3] 76800 bps [3]
Parity	No Odd Even
Bits per character	6 bits per character 7 bits per character 8 bits per character
Stop bits	1 stop bit 2 stop bits
Flow control	None XON/XOFF RTS/CTS
1st end identifier	00 Code of first end identifier, no second end identifier xx Code of first end identifier (range of values 01 to FF)
2nd end identifier	xx Code of second end identifier (range of values 01 to FF)

[1] The total baud rate of 76800 bps must not be exceeded
[2] Only with V.24 submodule and RS422-A/485 submodule
[3] Only with RS422-A/485 submodule

The flow control must be set according to the requirements of your partner.

Table 5.8 Static parameter set 2 (open driver, mode 4)

Parameter	Input
Wait time following transmission of CR, LF, FF	Range of values 0 to 2550 ms
Lines per page	Range of values 1 to 255 (including header/footer lines)
Left margin	Number of spaces 1 to 255
Spaceholder for page number	Representable characters 20H to 7EH
Number of header/footer lines	Is entered automatically (max. 2)
Line terminator/ separator	CR Carriage return LF Line feed CR LF Carriage return and line feed

Meaning of parameters

Mode Version of the possible data transmission modes.

Baud rate Data transmission speed, data in bit/s (bps).

Parity The parity is either even or odd. To check the parity, the string of information bits is extended by a further bit, the parity bit (0 or 1) which, when added to the information bits produces a selectable parity state. If "No" is set for the parity, the parity bit is set to 1 but not evaluated by the receiver/transmitter.

Bits per character Number of data bits used to form a character.

Stop bits Duration of the stop bits relative to the time required to transmit an information bit. The stop bits follow each transmitted character in a start/stop transmission.

Flow control

Mechanism which synchronizes the transmission (CPU or partner) and reception (partner or CPU) of data if the data source operates faster than the data sink. Controlling of the data flow using flow control is transparent for the user (with the exception of the required parameter settings). This means that if you use the flow control XON/XOFF (control characters XON=DC1=11H and XOFF=DC3=13H), the useful data must not contain these control characters.
If you use flow control RTS/CTS, you must additionally wire the RTS and CTS signals.

End identifier

The data transmission is terminated by the specified end identifier. The entry NUL is a valid end character in the first end identifier. This ensures that at least one valid end identifier is assigned as standard. The second end identifier is optional and is only effective if the first end identifier is not NUL. The entry NUL in the second end identifier is counted as a non-parameterized end character.

Wait times

Wait times can be parameterized in the static parameters for output of carriage return (CR), line feed (LF) and form feed (FF). No further characters are output during the selected wait time.

CR: control character "Carriage return"
LF: control character "Line feed"
FF: control character "Form feed", carriage return and paper transport to the start of the next page are executed in the log.

Lines per page

The number of lines output is determined from the number of delimiters output. The number of lines per page also includes the header and footer lines. The value for the parameter "Lines per page" must therefore be selected at least one larger than the total number of header lines and footer lines:

Lines per page $\geq$ (No. of header lines + No. of footer lines) +1

Left margin

The left margin precedes every text, header or footer line in the form of blanks. You must make sure that the total length of a line can be handled by the printer.

Spaceholder for page number

The page number is printed with a maximum of four digits and can be selected in the header or footer. The defined character must be present as a spaceholder in the header or footer line. The driver replaces this character during the output by the page number with leading zeros. The highest page number that can be printed depends on the number of spaceholders. If the actual page number exceeds this value, the page numbering begins again at 1. The largest page number is therefore 0000!

Number of footer and header lines

The parameterized value specifies the number of lines for the header or footer. Remember that the number of lines per page also includes the header and footer lines.

Line terminator/delimiter

The defined delimiter for separating text lines as well as header and footer lines must be contained in the text, header and footer to be output.

When assigning the end identifier(s) make sure that bits 6 and 7 or bit 7 of the parameterized end identifier(s) are not transmitted for the data transmission with 6 or 7 bits per character.

The driver does not insert printer control characters (CR, LF, FF) between individual print jobs. These characters must be present in the text.

The control character FF (form feed) present in the text is only output as the control character for form feed to the printer within the header and footer lines. Within the text, the control character FF (form feed) is converted into delimiters. The number of delimiters output depends on the parameter "Lines per page" and the internal line counter.

When transmitting data with the open driver, the parameters of the physical layer on the partner must agree with those of the CP 544.

Example:

The example illustrates how you can parameterize a static parameter set in DB 10 from DW 04 onwards for a printer output. The parameters are transmitted to the CP with the data handling block SEND. The parameters are stored in data block 10 from DW 30 onwards. Note that you must fill the remaining data words according to Section 6.3.8.

DB 10

:		
30:	KH = 0008;	**Baud rate** = 9600 bps
31:	KH = 0002;	**Parity** = 2 = even
32:	KH = 0007;	**Bits per character**= 7
33:	KH = 0001;	**Stop bits** = 1
34:	KH = 0001;	**Flow control** = XON/XOFF
35:	KH = 0004;	**Mode** = 4 = printer output
36:	KH = 0000;	Reserved
37:	KH = 0000;	Character delay time not required in mode 4
38:	KH = 0000;	Reserved
39:	KH = 0000;	Reserved
40:	KH = 0000;	Reserved
41:	KH = 0010;	**Code of 1st end identifier** = 10H (DLE)
42:	KH = 0004;	**Code of 2nd end identifier** = 04H (EOT)
43:	KH = 0000;	Fixed message length not required
44:	KH = 0032;	**Wait time after CR** = 50 x 0.01s (=0.5 s)
45:	KH = 0032;	**Wait time after LF** = 50 x 0.01s (= 0.5 s)
46:	KH = 0064;	**Wait time after FF** = 100 x 0.01s (= 1 s)
47:	KH = 0042;	**Lines per page** = 66
48:	KH = 0008;	**Left margin** = 8 blanks
49:	KH = 0023;	**Spaceholder for page number** = "#"
50:	KH = 0002;	**Header lines** = 2 lines
51:	KH = 0001;	**Footer lines** = 1 line
52:	KH = 0003;	**Delimiter** = 3 = CR LF
53:	KH = 070C;	1st header line with control character:
54:	KS ='Siemens SIMATIC S5 ';	07 - BEL (bell character)
66:	KS =' Date: 01.06.92';	0C - FF (form feed)
78:	KH = 0D0A;	Delimiter: 0D 0A - CR LF
79:	KH = 1B30;	2nd header line with control character:
80:	KS ='Application example CP 54';	1B 30 - ESC 0 (underlining on)
92:	KS = 4 - DR21; Page: ##';	1B 39 - ESC 9 (underlining off)
104:	KH = 1B39;	
105:	KH = 0D0A;	Delimiter: 0D 0A - CR LF
106:	KS ='Copyright Siemens AG 199';	1st footer line
118:	KS ='3 ';	
119:	KH = 0D0A;	Delimiter: 0D 0A - CR LF
:		

Protocol definition of open driver in mode 4

The following description is intended to help you if you wish to connect an existing printer using the open driver in mode 4 (printer output).

The following aspects are described for transmitting:

- Structure of the transmitted data frame
- Restrictions, if any
- Basic sequence of events.

In the sequence of events shown, the bold lines indicate the standard sequence, the thin lines represent the error handling sequence.

Transmitting

In mode 4, the useful data are transmitted including the end identifier assigned in the static parameter set.

The data frame to be transmitted has the following structure:

Length of useful data: n bytes

1 ... n	n+1	n+2
Useful data - length n bytes	E1	E2

E1: first end identifier
E2: second end identifier (if assigned in static parameter set)

XON (DC1 = 11H) or XOFF (DC3 = 13H) must not be equal to the end identifier when selecting the flow control with XON/XOFF.

Print editing is executed according to the static parameters (wait times, margin, page counter, delimiters and control characters).

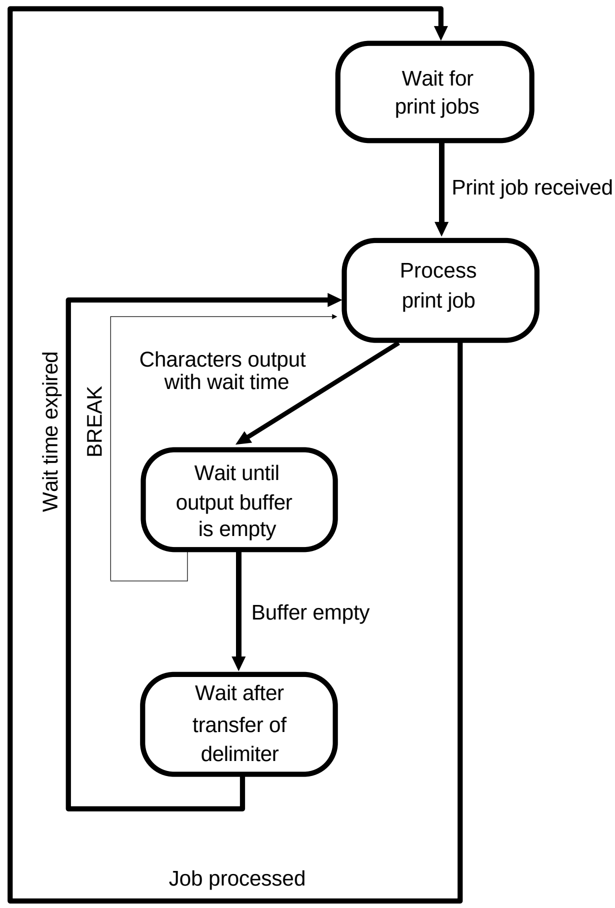


Fig. 5-10 Transmission sequence in mode 4

5.3.2.5 Transmission of Parameters into CP 544 User Memory

Once you have assigned parameters to the open driver using COM PP, transmit the parameters which are stored in a file ......ST.S5D into the user memory (internal RAM or RAM submodule) of the CP 544.

Proceed as follows:

- Select the transmission direction in the COM PP form "TRANSFER" and enter the CP interface.
- Transmit the parameters by pressing the function key "TRANSFER"
- Restart the CP 544 by pressing the function key "RESTART SI1" or "RESTART SI2".

The LED TXD1 (device interface 1) must not subsequently light up red permanently on the front panel of the CP 544. The parameter settings are not correct or are incomplete if this is the case.

5.4 Job Tables

All data types which can be transmitted are shown in the following tables together with their possible parameter settings in the data handling block and the receive mailbox. Data with respect to the addresses are PLC-dependent and do not always agree in the case of different types of PLC. In particular, you should refer to the documentation specific to the PLCs in the case of absolute addresses.

All data types which are generally stored in the partner in a destination DB or DX are permissible as the source.

The parameter QLAE (source length) is a number of bytes if the source is organized in bytes (the number of words if not). No message transfer is carried out if 0 is entered.

Caution with an odd number of bytes: since the destination area is a DB or DX, only complete words can be stored there. If the partner is a CP 544, this will assign 0 to the right data byte (DR) if it receives an odd number!

Table 5.8 Job table "Send data with open driver"

Source, **send from PLC 1**	Destination, to PLC 2	Parameter settings on DHB in PLC 1 (source)				
		QTYP	DBNR	QANF	QLAE	
Data block	Data block	DB	3-255	0-2047	1-2048	
Extended DB	Data block	DX	3-255	0-2047	1-2048	
Flags	Data block	FA	Irrelevant	0-255	1-256	
Inputs	Data block	IA	Irrelevant	0-127	1-128	
Outputs	Data block	QA	Irrelevant	0-127	1-128	
Counters [1]	Data block	CA	Irrelevant	0-255	1-256	
Timers [1]	Data block	TA	Irrelevant	0-255	1-256	
I/O	Data block	PY	Irrelevant	0-255	1-256	

[1] These ranges are CPU-dependent.

Explanation of abbreviations

QTYP	Source type
DBNR	Data block number
QANF	Initial source address
QLAE	Source length

	Parameter settings in the COM PP in PLC 2 (destination)			
	ZTYP	Z-DB	Z-addr	CF permissible
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes
	DB	3-255	0-255	Yes

Explanation of abbreviations

ZTYP	Destination type
Z-DB	Data block number of destination
Z-addr	Initial destination address
CF permissible	Coordination flag permissible?

Source, **send from PLC 1**	Destination, to PLC 2	Parameter settings on DHB in PLC 1 (source)				
		QTYP	DBNR	QANF	QLAE	
Data block	Extended DB	DB	3-255	0-2047	1-2048	
Extended DB	Extended DB	DX	3-255	0-2047	1-2048	
Flags	Extended DB	FA	Irrelevant	0-255	1-256	
Inputs	Extended DB	IA	Irrelevant	0-127	1-128	
Outputs	Extended DB	QA	Irrelevant	0-127	1-128	
Counters 1)	Extended DB	CA	Irrelevant	0-255	1-256	
Timers 1)	Extended DB	TA	Irrelevant	0-255	1-256	
I/O	Extended DB	PY	Irrelevant	0-255	1-256	

1) These ranges are CPU-dependent.

Explanation of abbreviations

QTYP	Source type
DBNR	Data block number
QANF	Initial source address
QLAE	Source length

	Parameter settings in the COM PP in PLC 2 (destination)			
	ZTYP	Z-DB	Z-addr	CF permissible
	DX	3-255	0-255	Yes
	DX	3-255	0-255	Yes
	DX	3-255	0-255	Yes
	DX	3-255	0-255	Yes
	DX	3-255	0-255	Yes
	DX	3-255	0-255	Yes
	DX	3-255	0-255	Yes
	DX	3-255	0-255	Yes

Explanation of abbreviations

ZTYP	Destination type
Z-DB	Data block number of destination
Z-addr	Initial destination address
CF permissible	Coordination flag permissible?

5.5 Example of a Complete Parameter Set

100 data words from data block 20 (DB 20) starting at data word 10 (DW 10) are to be transmitted by the open driver in mode 3 to data block 5 (DB 5) starting at data word 1 (DW 1) in PLC 2. PLC 1 and PLC 2 are each equipped with a CP 544.

You require the following for the CPU in PLC 1:

- The DHB **SEND-DIRECT** which triggers the job.
  The following parameter settings must be made in it:

SSNR	0	The interface number is 0
A-NR	1	The job number is 1
ANZW	FW12	The status word is flag word 12
QTYP	DB	The source is a data block
DBNR	20	with the No. 20 and
QANF	10	initial address 10
QLAE	100	100 data words are sent
PAFE	FY11	FY 11 is selected for parameterization errors

- The DHB **SEND-ALL** which transfers the data from the PLC to the CP. This requires the following parameter settings:

SSNR	0	The interface number is 0
A-NR	0	The job number is 0, thus the ALL function is selected
ANZW	FW16	The status word is FW 16
PAFE	FY19	FY 19 is selected for parameterization errors

The status word (ANZW) of the SEND-ALL job must be different from that with SEND-DIRECT since other information is displayed.

You require the following for the CP in PLC 1:

- A static parameter set with the following parameters:

Mode 3	Fixed useful data length, unsymmetrical
Baud rate	9600 bps
Parity	even
Bits per character	8
Stop bits	1
Flow control	XON/XOFF
Character delay time	100 ms
Fixed message length when receiving	20 byte

You require the following for the CPU in PLC 2:

- The DHB **RECEIVE-ALL** which receives the data and enters them in the destination DB:

SSNR	0	The interface number is 0
A-NR	0	The job number is 0, thus the ALL function is selected
ANZW	FW6	The status word is FW 6
PAFE	FY4	FY 4 is selected for parameterization errors

You require the following for the CP in the PLC 2:

- The following parameters in the static parameter set:

Mode 3	Fixed useful data length, unsymmetrical
Baud rate	9600 bps
Parity	even
Bits per character	8
Stop bits	1
Flow control	XON/XOFF
Character delay time	100 ms
Fixed message length when receiving	20 byte

- Data for the receive mailbox:

CPU No.	1
Receive mailbox	DB 5 from DW 1 onwards,, length 100 data words
Coordination flag	Not used

6

How do you Program the STEP 5 Program?

Contents of Chapter 6

6 How do you Program the STEP 5 Program?

Chapters 3 to 5 showed you which data handling blocks you can use for the type of link you have selected - RK 512 computer link, data transmission with the 3964/3964R procedures or open driver.

Using the concept of your STEP 5 program for your particular task you can now provide the data handling blocks with their required parameters.

You are supported in the process by the job tables in Chapters 3 to 5 and the information in this chapter on the various jobs.

The description of the data handling blocks in this manual is intended to provide a better overview. It does not claim to be complete, however. You can find more detailed information in the descriptions of the corresponding data handling blocks. These are available as individual descriptions for the S5-135U and S5-155U. You can find the description of the data handling blocks for the S5-115U in the S5-115U Manual (see references to further reading).

To enable better orientation, you are provided here with a summary of the various block numbers of the data handling blocks in the different programmable controllers and of the parameters of the data handling blocks.

6.1 Overview

The data handling blocks for the CP 544 have the following numbers in the various programmable controllers:

Table 6.1 Data handling blocks for CP 544

DHB	**Function**	**S5-115U**	**S5-135U S5-155U**
SYNCHRON	Synchronizes the CP	FB 249	FB 125
SEND-DIRECT n	Starts the send job with job number n	FB 244	FB 120
SEND-ALL	Transfers the data from the CPU to the CP	FB 244 Job No.= 0	FB 126 or FB 120 Job No.= 0
FETCH-DIRECT n	Starts the FETCH job with job number n	FB 246	FB 122
RECEIVE-ALL	Transmits the data from the CP to the CPU	FB 245 Job No.= 0	FB 127 or FB 121 Job No.= 0
RECEIVE-DIRECT n	Starts the RECEIVE job with job number n	FB 245	FB 121
RESET - DIRECT n	Starts the RESET job with job number n	FB 248	FB 124
CONTROL	Copies the status of the respective job into the specified status word	FB 247	FB 123

6.2 Parameters of the Data Handling Blocks

You specify the following parameters for the data handling blocks:

Designation	Meaning
SSNR	Interface number (page frame number)
A-NR	Job number
ANZW	Status word
QTYP/ZTYP	Type of data source or data destination
DBNR	Data block number
QANF/ZANF	Relative initial address within the area
QLAE/ZLAE	Number of source data or destination data
PAFE	Parameterization error
BLGR	Frame size

Interface number (page frame number) SSNR

Each CP in the PLC is assigned one (or several) interface numbers. The interface number of the lowest page of the CP (page number) and the number of pages per device interface (1, 2 or 4) are set using switches on the module.

Note

The even interface numbers address device interface 1; the odd interface numbers address device interface 2.

Parameter		Assignment		
Type	**Format**			
Data (byte)	KY	KY=	x,y	
			x = 0	Direct parameterization
			y = 0–255	Interface number (page number)
			x ≠ 0	Indirect parameterization
			y = 0–255	Data word number. The parameters SSNR, A-NR and ANZW (BLGR with SYNCHRON) are stored in the currently opened DB starting at the defined data word.

You can use a page number set for the device interface if the CPU sends (SEND) or fetches (FETCH) data; e.g. one page can be assigned to each CPU when using four pages per device interface. This ensures that the corresponding CPU can access the pages at any time.

Note

In the case of a SEND or FETCH job, the data in the partner CP are always transmitted via the **lowest** page of a device interface; i.e. the lowest page of the corresponding device interface must be defined as the page number for the corresponding ALL jobs on the partner CPU.

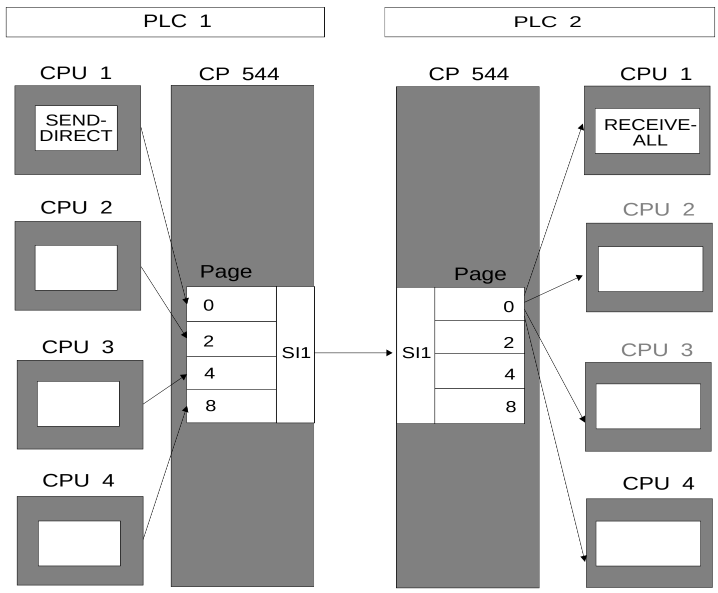


Fig. 6-1 Page assignment with a SEND job

The partner CPU which is authorized can fetch data or provide data on the lowest page.

The authorized CPU can be specified separately for each job in the dynamic parameter set in the case of the RK 512. In the case of the 3964/3964R procedures and the open driver, one CPU must be specified for all jobs when defining the receive mailbox.

Every CPU can access if a specific CPU is not defined. The data are then processed by the CPU which accesses first, the data are subsequently lost.

Interface number with special jobs

The ALL jobs for special jobs are executed on **all** set pages.

Job number (A-NR)

In the case of data transmission with the RK 512 computer link, every job (SEND/FETCH) is assigned a number which must agree with the number in the corresponding dynamic parameter set of the CP 544.

In the case of special jobs, the number is used to define which function is to be executed by the job.

Parameter		**Assignment**
Type	**Format**	
Data (byte)	KY	KY= 0,x x = 0 ALL function (not with FETCH) x = 1–223 Direct function Number of job to be executed

Status word ANZW

You can use this parameter to specify the address of a doubleword in which the status of a particular job is indicated (see also Section 6.2.1).

Parameter		Assignment		
Type	**Format**			
Address (word)	W	W	= xxyyy	Address of status word with direct parameterization
			xx =	FW, QW, IW, RS or DW
			yyy =	Number (dependent on xx)

Source type (QTYP) or destination type (ZTYP)

You can assign ASCII characters to these parameters which specify the type of data source (with SEND) or data destination (with RECEIVE or FETCH).

Parameter		Assignment		
Type	**Format**			
Data (character)	KS	KS	= yy	
			yy =	QA, AS, RS, DB, DX, IA, FA, PY, TA, CA, OY Direct parameterization: the data on the data source/destination are directly present in the parameters QTYP/ZTYP, DBNR, QANF/ZANF, QLAE/ZLAE.
		KS	= XX	Indirect parameterization: either the parameter set for the data source or destination is present in a data area which is specified using the parameters DBNR and QANF/ZANF. Only DB or DX is permissible with the special job PSEUDO-READ/WRITE, job numbers 190 to 199.

Data block number (DBNR)

Here you enter the number of the data block if you have selected DB, DX or XX as the source or destination type, or the High byte of the initial address if you have selected AS or RS.

Parameter		Assignment	
Type	**Format**		
Data (byte)	KY	KY= 0,x x = 3–255	Number of data block which contains the data, or the high byte of the initial address

Initial source address (QANF) or initial destination address (ZANF)

In the case of indirect parameterization - assignment of QTYP/ZTYP by XX - you enter the number of the DW here at which the parameter block commences.
In the case of direct parameterization, QTYP/ZTYP refers to the defined range. The permissible limits depend on the data type and are listed in the job tables in Sections 3.4 (RK 512), 4.4 (3964/3964R procedures) and 5.4 (open driver).

Parameter		Assignment	
Type	**Format**		
Data (fixed-point number)	KF	KF= x x =	See job tables for permissible range

6

Source length (QLAE) or destination length (ZLAE)

You enter the number of data to be transmitted here either in bytes or words depending on the data type (e.g. in bytes for flags, in words for data blocks). The permissible range of values also depends on the data type and is indicated in the job tables in the Sections 3.4 (RK 512), 4.4 (3964/3964R procedures) and 5.4 (open driver).

Parameter		**Assignment**
Type	**Format**	
Data (constant)	KF	KF= x x = See job tables for permissible range

Frame size BLGR

This parameter defines the size of the data frame which can be exchanged in one cycle of the DHB between the CPU and CP. It is only relevant to the DHB SYNCHRON. The data transfer time largely depends on the defined frame size. Using the DHB description for your CPU, you must decide which runtimes are applicable for your special application. Note with small frame sizes, i.e. short runtimes, that several data handling block calls are required for the data transfer depending on the amount of data.

Parameter		**Assignment**
Type	**Format**	
Data (bytes)	KY	KY= 0,y Frame size y = 0 - 255

Parameterization error byte PAFE

You use this parameter to specify the address of a byte in which a parameterization error of a particular job is to be indicated (see also Section 6.2.2).

Parameter		Assignment		
Type	**Format**			
Address (bytes)	BY	BY	= xxyy	Parameterization error byte
			xx =	Possible areas QA, IA, FA, OY
			yy =	Number of the QA/IA/FA/OY

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6.2.1 Status Word (ANZW)

With DIRECT jobs

The status word occupies a **double word** in the case of the DIRECT jobs SEND-DIRECT, FETCH-DIRECT, RECEIVE-DIRECT:

- The first part contains information on the job processing status
- The second part contains information on the length of the transmitted data.

The meanings of the bits in the first word of the status word of the DIRECT job are shown in the following table. The bits for the job status of the CP may also occur combined.

Table 6.2 Meaning of the bits in the first word of the status word

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Job status CP

- RECEIVE job ready = 1
- Job running = 1
- Job finished without errors = 1
- Job finished with errors = 1

Data management

- Data export/import running = 1
- Data export finished = 1
- Data import finished = 1
- Data disabling by user = 1/ data enabling = 0

Error number

0	0	0	0						No errors
0	0	0	1	→	0	1	0	1	PLC error, identical to PAFE
0	1	1	0	→	1	1	1	1	CP error (see also Chapter 8)

Vacant

SEND-ALL and RECEIVE-ALL enter the length of the data transmitted between the CPU and CP in the second part of the **status doubleword**. The ALL job adds the current number of data to the number which have already been imported. If several active ALL functions are required in order to execute the DIRECT job, the length value in the second part of the status doubleword grows continuously.
You should reserve a separate status doubleword for each DIRECT job. You can use

- the flag area FW 0 to 252 or
- the data words 0 to 254 in the open data block (DB or DX).

In order to guarantee reliable data transfer, it is sufficient if the STEP 5 program evaluates bits 1, 2 and 3 of the ANZW:

- Bit 1 indicates that the job has been accepted by the CP for processing. Renewed triggering of this job is only possible when bit 1 has been reset.
- Bits 2 and 3 identify that the CP has terminated processing of the associated job.

If the job is terminated without an error (bit 2 = 1), you can provide new useful data for the next transmission or process the incoming useful data.

An error number is entered in bits 8 to 11 of the ANZW if the job is terminated with an error (bit 3 = 1). Refer to Chapter 8 in this manual for a list of error numbers.

Note

If the RECEIVE-DIRECT jobs 200, 202, 204, 218 and 221 are parameterized with a length (ZLAE) which is greater than the required length, the value 15H is indicated in the ANZW.

With ALL jobs

The status word only occupies **one** data word or flag word in the ALL jobs RECEIVE-ALL and SEND-ALL. The **number of the DIRECT job** for which the data transport is carried out is indicated in this ANZW when the ALL function is executed. The value **"00H"** is entered if no function is executed.

The ALL function indicates **"FFH"** in the ANZW when it is active for a partner job.

"DEH" is indicated in the ANZW for the last data transfer if a coordination flag has not been specified for the partner job.

The **byte number of the coordination flag** is indicated in the ANZW for the last data transfer if a coordination flag has been specified for the partner job. This number can only have values from 1 to 223 since it is interpreted by the DHB like a job number. **"FFH"** is indicated in the ANZW if the number is too high. **"00H"** is indicated in the ANZW if no function is executed.

You can determine whether the partner job has been terminated using the status of the byte number of the coordination flag or the status "DEH" with the last data transfer.

You can then use the STEP 5 program
- to set the communication flag which corresponds to the coordination flag and either
- process the incoming useful data (if the partner issues a SEND job) or
- provide new useful data (if the partner issues a FETCH job).

The set coordination flag prevents the partner from accessing the data area again. The data area can be accessed again if you reset the communication flag.

With CONTROL jobs

Please refer to Section 6.3.7 for the meaning of the ANZW with CONTROL.

6.2.2 Parameterization Error Byte (PAFE)

You must specify a parameterization error byte (PAFE byte) in the data handling blocks.

If the DHB detects an error, it writes the associated error number into the PAFE byte. The DHB writes 00H into the PAFE byte if there are no errors.

In addition to the errors directly associated with parameterization, the PAFE byte indicates errors originating during communication between the CPU and CP 544.

You should immediately eliminate the causes if the mentioned errors occur so that no more error messages result during operation!

In certain exceptional cases, errors are signalled in the PAFE byte during operation which have been caused by the response of the CP 544 software in special operating situations:

- If more than 20 DIRECT jobs are processed in the cycle, i.e. 20 jobs have already been signalled as "running", and you wish to start a 21st job
- If the STEP 5 program sets the communication flag (which corresponds to the coordination flag) whilst the CP has just received a message for this coordination flag
- If a SEND or FETCH job is started before the SYNCHRON job has been executed once without errors.

You may also obtain a PAFE message in multi-processor mode if several CPUs simultaneously access the same page frame of the CP 544. The access is prevented (with a PAFE message) until the current CPU/CP communication has been terminated. This PAFE message does not indicate an error but identifies the current disabling of the access operation.

The PAFE error messages are listed below. Note that the meaning of the individual error numbers depends on the type of PLC. You should therefore always refer to the instructions of the data handling blocks for your PLC.

Table 6.3 PAFE error messages

PAFE No.	Meaning
11H	Incorrect ORG format: source/destination parameter type incorrect, illegal area (initial address, length)
21H	DB/DX or memory area does not exist
31H	Source/destination area too small
41H	Source/destination area does not exist (not equipped) Acknowledgement delay (QVZ) of area
51H	Error in status word
61H	No source/destination parameter with SEND/RECEIVE-ALL
71H	Interface does not exist (QVZ of CP 544) Check the jumper setting for the interface number of the CP 544
81H	Interface not ready or not synchronized. Check whether the SYNCRHON DHB is programmed in the restart OB and is being executed without errors
91H	Interface overloaded since a program section is currently being transmitted from the PG to the CP 544
A1H	CP interface currently occupied by other CPU in multi-processor mode (S5-135U and S5-155U) if several CPUs access one CP interface
B1H	Job number too large

PAFE No.	Meaning
C1H	Error in handshake (communication) with CP 544: - CP does not reply within monitoring time - CP rejects handshake, e.g. since more than 20 jobs have been triggered simultaneously (with 20 jobs, bit 1 in the ANZW is set to "Job running") - The coordination flag has been set whilst a message for this coordination flag has just been received
D1H	Frame size (SYNCHRON) faulty and group error for other handshake errors
E1H	DB call missing with indirect parameterization and group error for software errors of DHBs
F1H	Double calling of block (with possibility of interruption at command limits)

6.3 Which Data Handling Blocks can you Call in your STEP 5 Program?

Table 6.1 Jobs for data transmission with the CP 544

Job	Data handling block	Job number	Entry into queue	Destination length in words *
Synchronize CP and CPU	SYNCHRON	–	No	-
Send data	SEND	0–188	Yes	-
Fetch data	FETCH	1–188	Yes	-
Receive data	RECEIVE	0	Yes	-
Read data (PSEUDO-READ)	FETCH	190–199	Yes	-
Write data (PSEUDO-WRITE)	SEND	190–199	Yes	-
Check job status	CONTROL	0–223	No	-
Parameterize device interface	SEND	189	Yes	-
Read parameters of a device interface	RECEIVE	189	Yes	0 to 2043
Read error message area of SYSTAT	RECEIVE	200	No	2
Delete error message area of SYSTAT	RESET	200	No	-
Read complete SYSTAT	RECEIVE	221	No	16
Scan status	RECEIVE	205	No	1
Start device interface	SEND	202	No	-
Stop device interface	RESET	202	No	-
Import mode-specific static parameters	SEND	203	Yes	-
Read hardware parameters	RECEIVE	204	No	16
Set time	SEND	218	No	-
Read time	RECEIVE	218	No	5
Read SYSID	RECEIVE	223	No	≥ 64

* Information only for special jobs

6.3.1 Synchronize CP and CPU (SYNCHRON)

This job synchronizes the interface between the CP and CPU. SYNCHRON must be called in the restart organization blocks of the CPU for each page frame which you use in the two device interfaces of the CP. The frame size for data transfer between the CPU and CP 544 is also set during the synchronization.

Multi-processor mode

It is sufficient if the SYNCHRON is programmed in the startup organization blocks of a CPU for each page frame which you use. If a SYNCHRON is executed on a page, and if another SYNCHRON is started for this page, it is rejected with error number 12H in the SYSTAT.

You should monitor the PAFE byte of the SYNCHRON to ensure that the CPU/CP interface is actually synchronized (see Section 6.2.2 "Parameterization Error Byte").

Parameters

Param.	**Mode**	**Type**	**Meaning**
SSNR	D	KY	Interface number (page number)
BLGR	D	KY	Frame size with data transfer between CP and CPU 0 = 64 bytes (for S5-115U) 256 bytes (for S5-135U/155U) 1 = 16 bytes 2 = 32 bytes 3 = 64 bytes 4 = 128 bytes 5 = 256 bytes 6 = 512 bytes 7 - 254 = see 0 255 = 512 bytes
PAFE	Q	BY	Parameterization error status

6

6.3.2 Send Data (SEND)

The SEND job is used to transmit data from the CPU to the CP 544. It has two modes:

- SEND-DIRECT (job number ≠ 0)
  The SEND-DIRECT function triggers a specific SEND job defined by the job number.
- SEND-ALL (job number = 0)
  The SEND-ALL function checks whether a "communication request" is present at the interface. If this is so, the source parameters are provided by the CP and the data transfer is carried out.

SEND-DIRECT and SEND-ALL are used combined together:

- The SEND-DIRECT DHB is used to trigger a job (depending on the parameter settings of the DHB).
- The data of this job are then transferred from the interface to the CP by SEND-ALL.

6.3.2.1 SEND-DIRECT

If a SEND-DIRECT job is called in the STEP 5 program, it is entered into the internal queue for jobs in the CP 544.

Job processing

The CP 544 processes an internal queue for each device interface into which up to 20 DIRECT jobs (SEND-DIRECT and FETCH-DIRECT) can be entered. The CP 544 notes the order in which the jobs have been triggered and entered into the queue as well as the associated data handling block parameters and sets bit 1 "Job running" in the status word for each of these jobs.

The CP 544 processes the jobs in the order in which they have been entered into the queue. In the case of SEND jobs, the CP 544 subsequently requests the data from the CPU via a SEND-ALL. Once the job has been processed, either bit 2 "Job finished without errors" or bit 3 "Job finished with errors" is set in the status word. If an error occurs, an error number is entered into bits 8 to 11 of the status word and a more exact error number entered into the error message area of the SYSTAT.

If 20 jobs have already been entered into the queue, every further job is rejected with error number 7H in the status word, 15H in the error message area of the SYSTAT and C1H in the parameterization error byte.

The CPU cannot scan the filling status of the queue. Individual jobs cannot be deleted from the queue. All queue entries are deleted following a cold restart or synchronization of the CP.

If a job depends on the error-free processing of another job, you must implement this interlocking in your STEP 5 program. Jobs sent by the partner are processed outside the queue.

Special jobs are processed directly and not via the queue (SEND 189 and SEND 203 are exceptions).

Parameters

The block requires the following parameters for the SEND-DIRECT function:

Param.	**Mode**	**Type**	**Meaning**
SSNR	D	KY	Interface number
A-NR	D	KY	Number of DIRECT job
ANZW	I	W	Status word (1 doubleword is occupied)
QTYP	D	KS	Data type of source from which the data are sent
DBNR	D	KY	Number of data block if the source is a data block or an extended data block
QANF	D	KF	Relative initial address of data source
QLAE	D	KF	Number of data units (words or bytes) to be sent
PAFE	Q	BY	Parameterization error status

6.3.2.2 SEND-ALL

When transmitting data, a SEND-ALL must be called in addition to a SEND-DIRECT. The SEND-DIRECT data handling block first triggers a job on the CP 544. The CP 544 stores the source parameters of the SEND-DIRECT in the process and passes on an ALL request to the CPU, also informing the CPU of the desired data source. The SEND-ALL then transmits the data from the CPU (source) to the dual-port RAM of the CP 544. With larger quantities of data, it may be necessary to use several ALL functions in order to transport the data.

Note

SEND-ALL jobs must always be called **cyclically** in the user program so that the triggered DIRECT job can also be processed completely.

The source parameters which you must define with SEND-DIRECT are irrelevant with SEND-ALL; you can enter any values here.

If your STEP 5 program results in a long cycle time, it may be advisable to call SEND-ALL several times per cycle since the actual data transmission on the path only commences when the SEND-ALL has transmitted all data into the CP memory. If you call SEND-ALL several times, the time from triggering the job up to commencement of the transmission on the path is greatly reduced in the case of a data quantity which is larger than the set frame size. SEND-ALL jobs only extend the cycle time if useful data are actually transmitted.

Parameters

The block requires the following parameters for the SEND-DIRECT function:

Param.	**Mode**	**Type**	**Meaning**
SSNR	D	KY	Interface number
A-NR	D	KY	Job number
ANZW	I	W	Status word, a doubleword is occupied (see also Section 6.2.1)
PAFE	Q	BY	Parameterization error status

6.3.3 Fetch Data (FETCH)

The FETCH job is only used for data transmission with the RK 152 computer link. This data handling block only recognizes the operating mode

- FETCH-DIRECT

A job with the same number must be stored in the dynamic parameter set on the CP 544 for each FETCH-DIRECT job (apart from the special jobs) which you program in the STEP 5 program.

If a FETCH-DIRECT job is called in the STEP 5 program, it is entered into the internal queue for jobs in the CP 544.

Job processing

The CP 544 processes an internal queue for each device interface into which up to 20 DIRECT jobs (FETCH-DIRECT and SEND-DIRECT) can be entered. The CP 544 notes the order in which the jobs have been triggered and entered into the queue as well as the associated data handling block parameters and sets bit 1 "Job running" in the status word for each of these jobs.

The CP 544 processes the jobs in the order in which they have been entered into the queue. If 20 jobs have already been entered into the queue, every further job is rejected with error number 7H in the status word and 15H in the error message area of the SYSTAT.

The CPU cannot scan the filling status of the queue. Individual jobs cannot be deleted from the queue. All queue entries are deleted following a cold restart or synchronization of the CP.

If a job depends on the error-free processing of another job, you must implement this interlocking in your STEP 5 program. Jobs sent by the partner are processed outside the queue.

Parameters

The block requires the following parameters for the FETCH-DIRECT function:

Param.	**Mode**	**Type**	**Meaning**
SSNR	D	KY	Interface number
A-NR	D	KY	Job number
ANZW	I	W	Status word
ZTYP	D	KS	Data type of destination into which the data to be imported from the interface are stored
DBNR	D	KY	Number of data block if the destination is a data block or an extended data block
ZANF	D	KF	Relative initial address of data destination
ZLAE	D	KF	Number of data words to be imported
PAFE	Q	BY	Parameterization error status

6.3.4 Receive Data (RECEIVE)

The RECEIVE job is used to transmit data and parameters from the interface to the CPU.

The data handling block recognizes the two operating modes:

- RECEIVE-DIRECT (job number ≠ 0)
  The RECEIVE-DIRECT function carries out a specific RECEIVE job (special job) defined by the job number.

- RECEIVE-ALL (job number = 0)
  The RECEIVE-ALL function checks whether a "communication request" is present at the interface. If this is so, the source parameters are provided by the CP and the CPU fetches the data from the CP.

RECEIVE-DIRECT and RECEIVE-ALL are used together if the interface parameters are to be read (RECEIVE 189). In this case a RECEIVE-DIRECT triggers the job, the job is entered into the queue, and the CP 544 automatically delivers the individual data blocks to the RECEIVE-ALL once the job has been read out of the queue.

6.3.4.1 RECEIVE-DIRECT

The RECEIVE-DIRECT data handling block is used for special jobs.

Special jobs are processed directly and not via the queue (RECEIVE 189 is an exception).

Parameters

The block requires the following parameters for the RECEIVE-DIRECT function:

Param.	**Mode**	**Type**	**Meaning**
SSNR	D	KY	Interface number
A-NR	D	KY	Job number
ANZW	I	W	Status word
ZTYP	D	KS	Data type of destination into which the data to be imported from the interface are stored
DBNR	D	KY	Number of data block if the destination is a data block or an extended data block
ZANF	D	KF	Relative initial address of data destination
ZLAE	D	KF	Number of data units (words or bytes) to be imported
PAFE	Q	BY	Parameterization error status

6.3.4.2 RECEIVE-ALL

A FETCH-DIRECT or RECEIVE 189 data handling block first triggers a job on the CP 544. The CP 544 stores the destination parameters and passes on an ALL request to the CPU, also informing the CPU of the required data destination. The RECEIVE-ALL then transmits the requested data from the dual-port RAM of the CP 544 to the CPU (destination). With larger quantities of data, it may be necessary to use several ALL calls in order to transport the data.

Note
RECEIVE-ALL jobs must always be called **cyclically** in the user program so that the triggered DIRECT job can also be processed completely.

The destination parameters which you must define with FETCH-DIRECT are irrelevant with RECEIVE-ALL; you can enter any values here.

If your STEP 5 program results in a long cycle time, it is advisable to call RECEIVE-ALL several times per cycle in order to achieve a faster data transmission. RECEIVE-ALL calls only extend the cycle time if useful data are actually transmitted.

RECEIVE-ALL in partner jobs

RECEIVE-ALL not only transports data with jobs associated with its own CPU but also if the partner sends data on its own initiative.

A message sent by the partner is analyzed by the respective type of coupling on the CP 544. If this establishes that the partner wishes to send data, it extracts the source parameters present in the message header. The CP sends an ALL request to the CPU to transmit the useful data, and the RECEIVE-ALL DHB carries out the data transfer between the dual-port RAM and the CPU.

Parameters

The block requires the following parameters for the RECEIVE-ALL function:

Param.	**Mode**	**Type**	**Meaning**
SSNR	D	KY	Interface number
A-NR	D	KY	Job number
ANZW	I	W	Status word (see also Section 6.2.1)
PAFE	Q	BY	Parameterization error status

6.3.5 Read Data - PSEUDO-READ (FETCH 190 - 199)

The special job PSEUDO-READ can only be used for data transmission with the RK 512 computer link. It is used for the indirect assignment of the source and destination parameters.

A PSEUDO-READ/WRITE function is implemented in the CP 544 which is largely based on the function and format of the known R/W function (see description of data handling block). This function enables you to:

- Modify the source and/or destination data of a job during the program sequence
- Program this job without COM PP
- Specify a coordination flag and the CPU number.

All parameters for the source and destination are stored in a data block (DB) or extended data block (DX). The job numbers 190 to 199 are reserved for the PSEUDO-READ/ WRITE function.

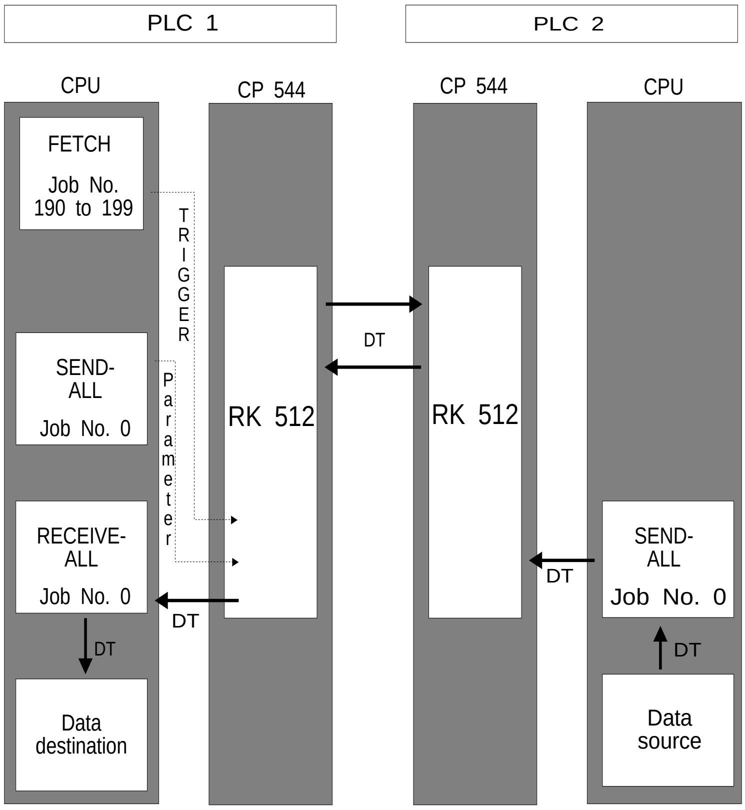
FETCH-DIRECT 190 to FETCH-DIRECT 199

You can start a FETCH job with the PSEUDO-READ function using one of the following data handling blocks:

FETCH-DIRECT 190 to
FETCH-DIRECT 199.

A PSEUDO-READ job is entered into the internal queue for jobs in the CP 544 if it is called in the STEP 5 program. As with the SEND job, the CP fetches the specified data block using SEND-ALL and evaluates the source/destination parameters. If these are within the permissible limits, the FETCH message is subsequently sent to the partner. The RECEIVE-ALL DHB enters the data into the defined destination once they have been received from the partner.

In contrast to normal DIRECT jobs, an additional data transfer between the CPU and CP is required with the PSEUDO-READ function. This data transfer is carried out via the SEND-ALL DHB which transfers the source/destination parameters to the CP 544.



DT = data transfer

Fig. 6-2 READ function of the SEND-DIRECT 190 to 199

6

The format of the data block with the destination parameters is shown below (parameter data block for FETCH-DIRECT 190 to FETCH-DIRECT 199).

The data are stored relative to the initial address ZANF which is specified on the data handling block.

ZANF +		
0:	KS= xx	Source type (in partner device) xx = DB, DX, CA, TA, RS, AS, FA, QA, IA, PY, OY not: XX, RW, NN
1:	KY= 0, y;	Number of source data block y = 3 to 255 with source type DB/DX Irrelevant with other source types
2:	KF= x;	Initial source address x = dependent on source type and PLC type (see job tables in Section 3.4)
3:	KF= x;	(Source length) Irrelevant! x = don’t care
4:	KS= xx	Destination type (in own PLC) xx = DB, RS, AS, DX, dependent on source type (see job tables in Section 3.4)
5:	KY= 0, y;	Number of destination data block y = 3 to 255 with source type DB/DX Irrelevant with other destination types
6:	KF= x;	Initial destination address x = dependent on destination type and PLC type (see job tables in Section 3.4)
7:	KF= x;	Destination length x = dependent on source type and PLC type (see job tables in Section 3.4)
8:	KY= x, y;	Coordination flag (dependent on source type) x = 0 to 223: byte number y = 0 to 7: bit number No coordination flag: x = 255, y = 255
9:	KF= x;	CPU No. of partner x = 1 to 4 or x = 0 with PLC with only one CPU

You can obtain detailed information on the transmission possibilities from the job tables in Section 3.4 (RK 512).

The data destination is in the own PLC for FETCH-DIRECT 190 to 199. Therefore the data on the length ZLAE in the parameter data block are decisive. The data in the parameter QLAE are not evaluated. All parameters for the data source refer to the partner device.

The jobs FETCH-DIRECT 190 to 199 are called in the STEP 5 program like "normal" jobs using e.g. "JU". You enter your data block with the parameters for the data on the block: ZTYP, DB No., ZANF and ZLAE. Therefore the data for QLAE are irrelevant.

The PSEUDO-READ/WRITE jobs can be called mixed together in any manner with normal SEND and FETCH jobs provided not more than 10 PSEUDO-R/W jobs are signalled as "running" simultaneously per page. The triggers must be mutually interlocked if more than 10 jobs are called.
Since each job number can only be assigned once, it is not possible, for example, to simultaneously activate a SEND-DIRECT 190 and a FETCH-DIRECT 190. If the job SEND-DIRECT 190 is set to "running" in the status word, a further job with the number 190 (e.g. FETCH 190) can only be started when SEND-DIRECT 190 is "finished", with or without errors.

6.3.6 Write Data - PSEUDO-WRITE (SEND 190 - 199)

The special job PSEUDO-WRITE is used for indirect setting of the source and destination parameters.

A PSEUDO-READ/WRITE function is implemented in the CP 544 which is largely based on the function and format of the known R/W function (see description of data handling block).
This function enables you to:

- Modify the source and/or destination data of a job during the program sequence
- Program this job without COM PP
- Specify a coordination flag and the CPU number.

All parameters for the source and destination are stored in a data block (DB) or extended data block (DX). The job numbers 190 to 199 are reserved for the PSEUDO-READ/WRITE function.

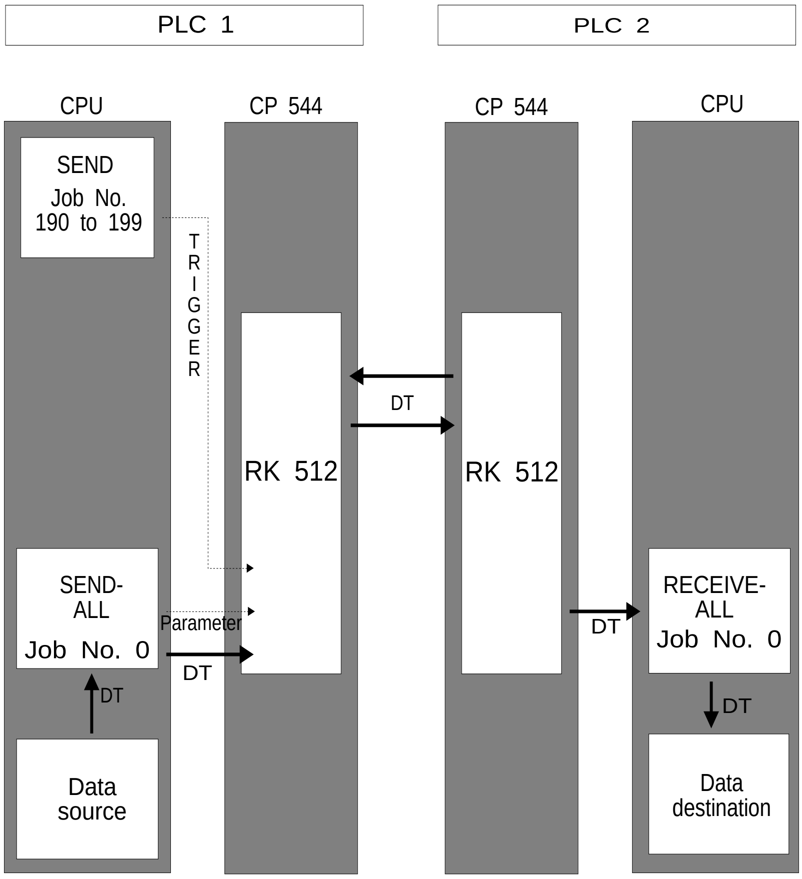
SEND-DIRECT 190 to SEND-DIRECT 199

You can start a SEND job with the PSEUDO-WRITE function using one of the following data handling blocks:

SEND-DIRECT 190 to
SEND-DIRECT 199.

The PSEUDO-WRITE job is entered into the internal job queue of the CP 544 like other DIRECT jobs.

Once processing has commenced, the CP 544 requests the parameterized data block (or extended data block) via the SEND-ALL DHB and checks the source and destination parameters present in it. If these are within the permissible limits, the CP 544 requests the first source data via a further SEND-ALL DHB and handles the SEND job in the usual manner.



DT = data transfer

Fig. 6-3 WRITE function of the SEND-DIRECT 190 to 199

6

The format of the data block with the source parameters is shown below (parameter data block for SEND-DIRECT 190 to SEND-DIRECT 199).

The data are stored relative to the initial address QANF which is specified on the data handling block.

QANF +		
0:	KS= xx	Source type (in own PLC) xx = DB, DX, CA, TA, RS, AS, FA, QA, IA, PY, OY not: XX, RW, NN
1:	KY= 0, y;	Number of source data block y = 3 to 255 with source type DB/DX Irrelevant with other source types
2:	KF= x;	Initial source address x = dependent on source type and PLC type (see job tables in Section 3.4)
3:	KF= x;	Source length x = dependent on source type and PLC type (see job tables in Section 3.4)
4:	KS= xx	Destination type (in partner device) xx = DB, RS, AS, DS, dependent on source type (see job tables in Section 3.4)
5:	KY= 0, y;	Number of destination data block y = 3 to 255 with source type DB/DX Irrelevant with other destination types
6:	KF= x;	Initial destination address x = dependent on destination type and PLC type (see job tables in Section 3.4)
7:	KF= x;	(Destination length) Irrelevant! x = don't care
8:	KY= x, y;	Coordination flag (dependent on source type) x = 0 to 223: byte number y = 0 to 7: bit number No coordination flag: x = 255, y = 255
9:	KF= x;	CPU No. of partner x = 1 to 4 or x = 0 with PLC with only one CPU

You can obtain detailed information on the transmission possibilities from the job tables in Section 3.4 (RK 512).

The data source is in the own PLC for SEND-DIRECT 190 to 199. The source length must be entered in the parameter data block (enter this in bytes if the QTYP is a byte area). The data for the parameter "Destination length" are irrelevant. All parameters for the data destination refer to the partner device.

The jobs SEND-DIRECT 190 to 199 are called in the STEP 5 program like "normal" jobs using e.g. "JU". You enter your data block with the WRITE parameters for the data on the block: QTYP, DB No., QANF and QLAE. Therefore the data for the parameter "Destination length" are irrelevant.

The PSEUDO-READ/WRITE jobs can be called mixed together in any manner with normal SEND and FETCH jobs provided not more than 10 PSEUDO-R/W jobs are signalled as "running" simultaneously per page. The triggers must be mutually interlocked if more than 10 jobs are called.

Since each job number can only be assigned once, it is not possible, for example, to simultaneously activate a SEND-DIRECT 190 and a FETCH-DIRECT 190. If the job SEND-DIRECT 190 is set to "running" in the status word, a further job with the number 190 (e.g. FETCH 190) can only be started when SEND-DIRECT 190 is "finished", with or without errors.

6.3.7 Check Job Status (CONTROL)

The CONTROL job copies the status of the respective job into the defined status word. The job status provides information on the processing states of the jobs.

The data handling block can be called at any position in the program. It has the following two modes:

- CONTROL-ALL (job number = 0)
  In the Low byte of the status word ANZW, the CONTROL-ALL function indicates which job is currently being processed by the CP 544. 0 is indicated in the low byte of the ANZW during processing of a partner job. The byte number of the coordination flag is indicated if it is the last data transfer, or DEH is indicated if you are working without coordination flags.
- CONTROL-DIRECT (job number ≠ 0)
  A job status exists in the interface for each job. It is handled by the interface and indicates whether a job is (still) running or if it has been terminated without an error or with a specific error. The CONTROL-DIRECT function transfers the job status selected by the parameter A-NR into the status word.

Parameters

The block requires the following parameters:

Param.	**Mode**	**Type**	**Meaning**
SSNR	D	KY	Interface number
A-NR	D	KY	Number of job to be monitored
ANZW	I	W	Status word: this contains the result of the scan
PAFE	Q	BY	Parameterization error status

6.3.8 Assign Device Interface Parameters (SEND 189)

SEND-DIRECT 189

You can also assign parameters to the device interfaces of the CP 544 using the special job

- SEND-DIRECT 189

You must assign the parameters for each device interface separately. The device interface is indirectly defined by the fixed assignment between page frame number and device interface. You must store the configured data sets in a data block for each device interface. The data blocks can then be transferred to the CP using the job SEND-DIRECT 189.

The following tables list the values with which you can parameterize the types of coupling, and how you must configure the data blocks used for this. All numbers are represented in hexadecimal notation.

Note that you must additionally call a SEND-ALL block in order to transmit the parameterization data block.

The SEND-DIRECT 189 is entered into the queue. The queue is deleted once the job has been executed, and the device interface switched to passive. Following successful parameter assignment ("Job completed without errors" is indicated in the status word), you can restart the device interface using the special job SEND-DIRECT 202. You can transmit data via this device interface as soon as this job has also been completed without errors.

Chapters 3 to 5 describe the parameters for the individual coupling types in detail.

Generating the parameter blocks

You can generate the parameter blocks either using the following parameter tables or using COM PP.

Proceed as follows if you wish to generate the parameter blocks using COM PP:

- Generate parameters for both device interfaces using COM PP
- Leave COM PP and call the program for the CPU using the STEP 5 package LAD/CSF/STL
- Transfer the DX1 and DX2 to the program for the CPU in succession using the transfer function.

Please note that you must change the names of the destination blocks when transferring the parameter blocks, since blocks DX1 and DX2 are reserved in the CPU for special functions.

Example:
TRANSFER SOURCE: B: CP EXAMPLE
BLOCK: DX1
TO DESTINATION: FD
BLOCK: DB11

Note

You must select the length of the parameter block such that all data relevant to the special link type can be transmitted. Thus you must transfer at least 41 data words for the 3964/3964R procedures. The remaining data words are automatically set to 0000 by the CP.

Parameter sets for data transmission with the RK 512 computer link

- Data words 0 to 19
  contain the link type and the pointers to all required parameters and parameter sets.
- Data words 30 to 40
  contain the static parameter set.
- Data words 600 to 699
  contain a comment field.
- Data words 700 to 1263
  contain the dynamic parameter sets.

Note

Please note that all data words which are not used must be set to 0000.

Data words 37 to 40 are only evaluated if you have entered 0003 or 0004 as the mode.

The standard values for modes 0001 and 0002 are:

	Mode 0001	**Mode 0002**
Character delay time	220 ms	220 ms
Acknowledgement delay time	550 ms	2000 ms
Number of connection attempts	6	6
Number of repetitions	6	6

Table 6.2 Parameterization of RK 512 computer link without COM PP

Parameter	DW	Range of values	Meaning
	0	4D41	Master
	1	534B	Slave
	2	5331 or 5332	Interface SI1 or SI2
Link type	3	0020	**RK 512 computer link**
Pointer to static parameter set	4	5801 or 5802	DX No. 1 or DX No. 2
	5	001E	DW No. 1E (30 decimal) onwards
Pointer to dynamic parameter sets	6	5801 or 5802 or 0000	DX No. 1 or DX No. 2 If the CP 544 only receives
	7	02BC or 0000	From DW No. 2BC (700 decimal) onwards If the CP 544 only receives
	8 - 29	0000	Not used
Baud rate	30	0003 0004 0005 0006 0007 0008 0009 000A 000B	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps (only with V.24/RS422-A/485 module) 38400 bps (only with RS422-A/485 module) 76800 bps* (only with RS422-A/485 module) (* maximum total baud rate 76800)
Parity	31	0000 0001 0002	No Odd Even
Bits per character	32	0008	8 bits per character
Stop bits	33	0001 0003	1 stop bit 2 stop bits

Parameter	DW	Range of values	Input
-	34	0000	Not used
Mode 1 Mode 2 Mode 3 Mode 4	35	0001 0002 0003 0004	RK 512 with 3964 procedure with default values RK 512 with 3964R procedure with default values RK 512 with 3964 procedure and selectable values RK 512 with 3964R procedure and selectable values
Priority	36	0000 0001	Low High
Character delay time[1)]	37	0001 to FFFF	Monitoring time 0.01 s to 655.35 s (steps: 10 ms)
Acknowledgement delay time[1)]	38	0001 to FFFF	Monitoring time 0.01 s to 655.35 s (steps: 10 ms)
Number of connection attempts	39	0001 to 00FF	Number (range of values 1 to 255)
Number of repetitions	40	0001 to 00FF	Number (range of values 1 to 255)
	600 ff.		Comment field (max. 180 characters)

1) Please observe the smallest permissible values depending on the baud rate (see Table "Acknowledgement delay time" in Section 3.3.2.1)

6

Job No.	DW	Parameter	Meaning
1	SEND/FETCH job with job number 1 under **RK 512 computer link**		
	700	41xx or 45xx	SEND job FETCH job xx Type of data to be transmitted: 44 Data block / 58 Extended DB 45 Input bytes / 41 Output bytes 4D Flag bytes / 50 I/O bytes 5A Counters / 54 Timers 53 Absolute addresses / 42 System addresses
	701	xxyy	Data destination No./data source No. xx, starting at DW No. yy
	702	xxyz	xx Byte number of coordination flag[1)] Range of values 00 to EF (0 to 223) y CPU number Range of values 1 to 4 (or 0,F)[2)] z Bit number of coordination flag Range of values 0 to 7 or F[3)]
2	SEND/FETCH job with job number 2		
	703		
	704		
	705		
. .		. .	. .
188	SEND/FETCH job with job number 188		
	1261		
	1262		
	1263		

1) You must enter the value FFH if you do not define a coordination flag, otherwise the job will be terminated with an error.

2) The CPU number of the partner is only relevant if you exchange data with several CPUs via a CP 544, CP 525 or CP 524 with a multi-processor PLC (S5-135U, S5-155U)
0H is present here if you enter a coordination flag but not a CPU.
FH is present here if you do not enter a CPU or a coordination flag.
All CPUs are possible in the partner in both cases.

3) FH is present here if you do not enter a coordination flag.

Parameter sets for data transmission with the 3964 and 3964R procedures

- Data words 0 to 19
  contain the link type and the pointers to all required parameters and parameter sets.
- Data words 30 to 40
  contain the static parameter set.
- Data words 600 to 699
  contain a comment field.

Note

Please note that all data words which are not used must be set to 0000.

Data words 37 to 40 are only evaluated if you have entered 0003 or 0004 as the mode.

The standard values for modes 0001 and 0002 are:

	Mode 0001	**Mode 0002**
Character delay time	220 ms	220 ms
Acknowledgement delay time	550 ms	2000 ms
Number of connection attempts	6	6
Number of repetitions	6	6

Table 6.3 Parameterization of 3964/3964R procedures without COM PP

Parameter	DW	Range of values	Meaning
	0	4D41	Master
	1	534B	Slave
	2	5331/5332	Interface SI1/SI2
Link type	3	0031	**Data transmission with 3964/3964R**
Pointer to static parameter set	4	5801 or 5802	DX No. 1 or DX No. 2
	5	001E	DW No. 1E (30 decimal) onwards
	6 - 10	0000	Not used
Pointer to receive mailbox	11	44xx or 58xx or 0000	DB No. xx or DX No. xx If CP 544 does not receive any data
	12	xxxx or 0000	DW No. xx onwards If CP 544 does not receive any data
	13	xxxx or 0000	Length of receive mailbox in words (range of values 0002 to 0801) If CP 544 does not receive any data
Communication flag, CPU No.	14	4Dxx 0000	Flag byte xx If a communication flag is not used
	15	00xy	CPU No. x (range of values 1 to 4, 0 and F)[1)] Communication flag bit y (range of values 0 to 7 or F)[2)]
	16 - 19	0000	Not used

[1)] The CPU number is only relevant if the CP 544 in a multi-processor PLC (S5-135U/S5-155U) exchanges data with several CPUs.
0H is present here if you enter a coordination flag but not a CPU.
FH is present here if you do not enter a CPU or a coordination flag.
All CPUs are possible in both cases.

[2)] FH is present here if you do not enter a coordination flag.

Parameter	DW	Range of values	Input
Baud rate	30	0003 0004 0005 0006 0007 0008 0009 000A 000B	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps (only with V.24/RS422-A/485 module) 38400 bps (only with RS422-A/485 module) 76800 bps* (only with RS422-A/485 module) (* maximum total baud rate 76800)
Parity	31	0000 0001 0002	No Odd Even
Bits per character	32	0006 0007 0008	6 bits per character 7 bits per character 8 bits per character
Stop bits	33	0001 0003	1 stop bit 2 stop bits
-	34	0000	Not used
Mode 1 Mode 2 Mode 3 Mode 4	35	0001 0002 0003 0004	**3964 procedure with default values** **3964R procedure with default values** **3964 procedure and selectable values** **3964R procedure and selectable values**
Priority	36	0000 0001	Low High
Character delay time[1)]	37	0001 to FFFF	Monitoring time 0.01 s to 655.35 s (steps: 10 ms)
Acknowledgement delay time[1)]	38	0001 to FFFF	Monitoring time 0.01 s to 655.35 s (steps: 10 ms)
Number of connection attempts	39	0001 to 00FF	Number (range of values 1 to 255)
Number of repetitions	40	0001 to 00FF	Number (range of values 1 to 255)
	600 ff.		Comment field (max. 180 characters)

[1)] Please observe the smallest permissible values depending on the baud rate (see Table "Acknowledgement delay time" in Section 3.3.2.1)

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Parameter sets for data transmission with the open driver

- Data words 0 to 19
  contain the link type and the pointers to all required parameters and parameter sets.
- Data words 30 to 40
  contain the static parameter set.
- Data words 600 to 699
  contain a comment field.

Note

Please note that all data words which are not used must be set to 0000.

Data words 0 to 19 are the same for all four data transmission modes with an open driver.

Table 6.4 Parameterization of open driver without COM PP

Parameter	DW	Range of values	Meaning
	0	4D41	Master
	1	534B	Slave
	2	5331/5332	Interface SI1/SI2
Link type	3	0030	**Data transmission with open driver**
Pointer to static parameter set	4	5801 or 5802	DX No. 1 or DX No. 2
	5	001E	DW No. 1E (30 decimal) onwards
	6 - 10	0000	Not used
Pointer to receive mailbox	11	44xx or 58xx or 0000	DB No. xx or DX No. xx If CP 544 does not receive any data
	12	xxxx or 0000	DW No. xx onwards If CP 544 does not receive any data
	13	xxxx or 0000	Length of receive mailbox in words (range of values 0002 to 0801) If CP 544 does not receive any data
Communication flag, CPU No.	14	4Dxx 0000	Flag byte xx If a coordination flag is not used
	15	00xy	CPU No. x (range of values 1 to 4, 0 and F)[1)] Communication flag bit y (range of values 0 to 7 or F)[2)]
	16 - 19	0000	Not used

[1)] The CPU number is only relevant if the CP 544 in a multi-processor PLC (S5-135U/S5-155U) exchanges data with several CPUs.
0H is present here if you enter a coordination flag but not a CPU.
FH is present here if you do not enter a CPU or a coordination flag.

[2)] FH is present here if you do not enter a coordination flag.

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Static parameter set for mode 1

Parameter	DW	Range of values	Input
Baud rate	30	0003 0004 0005 0006 0007 0008 0009 000A 000B	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps (only with V.24/RS422-A/485 module) 38400 bps (only with RS422-A/485 module) 76800 bps* (only with RS422-A/485 module) (* maximum total baud rate 76800)
Parity	31	0000 0001 0002	No Odd Even
Bits per character	32	0006 0007 0008	6 bits per character 7 bits per character 8 bits per character
Stop bits	33	0001 0003	1 stop bit 2 stop bits
Flow control	34	0000 0001 0002	None XON/XOFF RTS/CTS
Mode 1	35	0001	**Fixed useful data length (character delay time)**
	36	0000	Not used
Character delay time[1)]	37	0001 to FFFF	Monitoring time 0.01 s to 655.35 s (steps: 10 ms)
	38 - 40	0000	Not used
	600 ff.		Comment field (max. 180 characters)

[1)] Please observe the smallest permissible values depending on the baud rate (see Table "Acknowledgement delay time" in Section 3.3.2.1)

Static parameter set for mode 2

Parameter	DW	Range of values	Input
Baud rate	30	0003 0004 0005 0006 0007 0008 0009 000A 000B	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps (only with V.24/RS422-A/485 module) 38400 bps (only with RS422-A/485 module) 76800 bps* (only with RS422-A/485 module) (* maximum total baud rate 76800)
Parity	31	0000 0001 0002	No Odd Even
Bits per character	32	0006 0007 0008	6 bits per character 7 bits per character 8 bits per character
Stop bits	33	0001 0003	1 stop bit 2 stop bits
Flow control	34	0000 0001 0002	None XON/XOFF RTS/CTS
Mode 2	35	0002	**Variable useful data length (end character)**
	36	0000	Not used
Character delay time[1)]	37	0001 to FFFF	Monitoring time 0.01 s to 655.35 s (steps: 10 ms)
	38 - 40	0000	Not used
1st end code	41	0000 00xx	1st end code, no 2nd end code 1st end code (range of values 01-FF)
2nd end code	42	0000 00xx	No 2nd end code 2nd end code (range of values 01-FF)
	600 ff.		Comment field (max. 180 characters)

[1)] Please observe the smallest permissible values depending on the baud rate (see Table "Acknowledgement delay time" in Section 3.3.2.1)

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Static parameter set for mode 3

Parameter	DW	Range of values	Input
Baud rate	30	0003 0004 0005 0006 0007 0008 0009 000A 000B	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps (only with V.24/RS422-A/485 module) 38400 bps (only with RS422-A/485 module) 76800 bps* (only with RS422-A/485 module) (* maximum total baud rate 76800)
Parity	31	0000 0001 0002	No Odd Even
Bits per character	32	0006 0007 0008	6 bits per character 7 bits per character 8 bits per character
Stop bits	33	0001 0003	1 stop bit 2 stop bits
Flow control	34	0000 0001 0002	None XON/XOFF RTS/CTS
Mode 3	35	0003	**Fixed useful data length, unsymmetrical**
	36	0000	Not used
Character delay time[1)]	37	0001 to FFFF	Monitoring time 0.01 s to 655.35 s (steps: 10 ms)
	38 - 42	0000	Not used
Fixed message length on reception	43	0001 to 1000	Message length in bytes
	600 ff.		Comment field (max. 180 characters)

[1)] Please observe the smallest permissible values depending on the baud rate (see Table "Acknowledgement delay time" in Section 3.3.2.1)

Static parameter set for mode 4

Parameter	DW	Range of values	Input
Baud rate	30	0003 0004 0005 0006 0007 0008 0009 000A 000B	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps 19200 bps (only with V.24/RS422-A/485 module) 38400 bps (only with RS422-A/485 module) 76800 bps* (only with RS422-A/485 module) (* maximum total baud rate 76800)
Parity	31	0000 0001 0002	No Odd Even
Bits per character	32	0006 0007 0008	6 bits per character 7 bits per character 8 bits per character
Stop bits	33	0001 0003	1 stop bit 2 stop bits
Flow control	34	0000 0001 0002	None XON/XOFF RTS/CTS
Mode 4	35	0004	**Printer output**
	36-40	0000	Not used
1st end code	41	0000 00xx	1st end code, no 2nd end code 1st end code (range of values 01-FF)
2nd end code	42	0000 00xx	No 2nd end code 2nd end code (range of values 01-FF)
	43	0000	Not used
Waiting time following transmission of CR	44	0000 to 00FF	Range of values 0 to 2550 ms
Waiting time following transmission of LF	45	0000 to 00FF	Range of values 0 to 2550 ms
Waiting time following transmission of FF	46	0000 to 00FF	Range of values 0 to 2550 ms
Lines per page	47	0000 to 00FF	Range of values 1 to 255 (including header/footer lines)

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Parameter	DW	Range of values	Input
Left margin	48	0000 to 00FF	Number of spaces, 1 to 255
Spaceholder for page number	49	00xx	Spaceholder xx in header or footer, 20H to 7EH
Number of header lines	50	0000 0001 0002	
Numbers of footer lines	51	0000 0001 0002	
Line terminator or delimiter	52	0001 0002 0003	CR LF CR LF
	53		Header and footer including delimiter from DW 52 (max. 554 characters)
	600 ff.		Comment field (max. 180 characters)

6.3.9 Read Parameters of a Device Interface (RECEIVE 189)

RECEIVE-DIRECT 189

Using the job
- RECEIVE-DIRECT 189

you can read the parameters which you have generated using the job SEND-DIRECT 189.

For this purpose you must specify a data block into which the parameters are read.

You can select the size of the data block between 1 and 2043 words. You must additionally call a RECEIVE-ALL for the transmission.

The RECEIVE-DIRECT is entered into the queue.

6.3.10 Read Error Message Area of SYSTAT (RECEIVE 200)

The error message area of the SYSTAT is a data area in the dual-port RAM of the CP 544. Once the CP has detected an error, it enters the associated error number in the error message area of the SYSTAT. You determine how the CPU is to react to this by programming your STEP 5 program accordingly on the CPU.

RECEIVE-DIRECT 200

The CPU reads the error message area of the SYSTAT for the defined page frame of the CP using the job

- RECEIVE-DIRECT 200.

The job is not entered into the queue but is immediately executed on the CP following triggering and thus overtakes the jobs entered in the queue.

You define the area in the CPU (destination area) into which the error message area of the SYSTAT is to be transmitted by means of the parameter settings of the RECEIVE-DIRECT 200. This should be a data block.

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The RECEIVE-DIRECT 200 is only executed if an error number has been entered in the error message area of the SYSTAT since the bit "RECEIVE job ready" is only set in the ANZW (bit 0) in this case.

In certain cases (e.g. no SYNCHRON carried out or restart error of CP 544), the error message area cannot be read via the RECEIVE-DIRECT 200 (see Section 6.3.12 "Read Complete SYSTAT").

Format of destination area

If error numbers have been entered in the error message area, these are present in the selected area in the CPU (e.g. in the data block) following reading with RECEIVE-DIRECT 200.

Destination length

The destination length must be at least two words.

	DL								DR							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DW 0					F	U	B		Error number 1							
DW 1	Error number 2								Error number 3							

Explanations on destination area

DW	Bit	Status	Meaning
DL 0	Bit 7,6,5,4		Irrelevant
	Bit 3 (F)	0 1	No error in SYSTAT (not following executed RECEIVE-DIRECT 200) Error entered in SYSTAT This bit is always set with error entries - i.e. you can thus check whether data have been transmitted with RECEIVE-DIRECT 200. (You must have previously also set the receive area on the CPU to 0.)
	Bit 2 (U)	0 1	No error overflow (max. 3 error entries) Error overflow (more than 3 errors)
	Bit 1 (B)	0 1	No BREAK on the interface BREAK on the interface Bit 1 indicates the current status and does not mean an error in all cases. The error status BREAK is only dependent on the error number in DR 0, DL 1 and DR 1. The current BREAK status can only be indicated here if a coupling mode has been loaded and started.
	Bit 0		Irrelevant
DR 0 DL 1 DR 1			Error message 1 Error message 2 Error message 3 00 = no error

6.3.11 Delete Error Message Area of SYSTAT (RESET 200)

RESET-DIRECT 200

The CPU resets the error message area of the SYSTAT specific to the page frame using the job

- RESET-DIRECT 200.

All entries are deleted with the exception of the BREAK bits (B).

The job is not entered into the queue but is immediately executed on the CP following triggering and thus overtakes the jobs entered in the queue.

Parameters

The block requires the following parameters:

Param.	Mode	Type	Meaning
SSNR	D	KY	Interface number
A-NR	D	KY	Number of job to be reset (200)
PAFE	Q	BY	Parameterization error status

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The error message area of the SYSTAT is not deleted by a SYNCHRON call.

The CP 544 can enter up to 3 error numbers into the error message area. If further errors occur, these cannot be signalled if the "old" entries have not been deleted. Therefore the error message area must be reset sufficiently early using a RESET-DIRECT 200.

The destination area in the CPU should also be reset.

6.3.12 Read Complete SYSTAT (RECEIVE 221)

RECEIVE-DIRECT 221

In addition to the error message area of the SYSTAT, the complete SYSTAT of the CP can also be read using the job

- RECEIVE-DIRECT 221.

The read area then contains the error message area for both interfaces (in bytes 4 to 10). This job can also be executed if no error numbers are entered.

In certain cases (e.g. no SYNCHRON carried out or restart error of CP 544), the SYSTAT cannot be read via the RECEIVE-DIRECT 221. It must then be read directly out of the dual-port RAM (starting at address F660H).

The job is not entered into the queue but is immediately executed on the CP following triggering and thus overtakes the jobs entered in the queue.

Destination length

A destination length greater than or equal to 32 bytes (= 16 words) is required.

Note that you must set a frame size of at least 32 bytes in the SYNCHRON.

The transmitted area has the following format:

	DL								DR							
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DW 0	Irrelevant						RUN	STP	Irrelevant							
DW 1	Irrelevant								Irrelevant							TST
DW 2	F 2	U 2	B 2		F 1	U 1	B 1		F 4	U 4	B 4		F 3	U 3	B 3	
DW 3	Error number 1 from page frame 1								Error number 2 from page frame 1							+
DW 4	Error number 3 from page frame 1								Error number 1 from page frame 2							
DW 5	Error number 2 from page frame 2								Error number 3 from page frame 2							
DW 6	Error number 1 from page frame 3								Error number 2 from page frame 3							+
DW 7	Error number 3 from page frame 3								Error number 1 from page frame 4							
DW 8	Error number 2 from page frame 4								Error number 3 from page frame 4							
DW 9	F 6	U 6	B 6		F 5	U 5	B 5		F 8	U 8	B 8		F 7	U 7	B 7	
DW 10	Error number 1 from page frame 5								Error number 2 from page frame 5							+
DW 11	Error number 3 from page frame 5								Error number 1 from page frame 6							
DW 12	Error number 2 from page frame 6								Error number 3 from page frame 6							
DW 13	Error number 1 from page frame 7								Error number 2 from page frame 7							+
DW 14	Error number 3 from page frame 7								Error number 1 from page frame 8							
DW 15	Error number 2 from page frame 8								Error number 3 from page frame 8							

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The individual bits have the following meanings:

RUN	set:	mode selector is in RUN position
STP	set:	mode selector is in STOP position
TST	set:	mode selector is in TEST position
F bit	set:	at least 1 error has been entered
U bit	set:	more than 3 errors have occurred
B bit	set:	a BREAK is present on the receive line.

6.3.13 Scan Status (RECEIVE 205)

RECEIVE-DIRECT 205

You can use the job

- RECEIVE-DIRECT 205

to scan the status of the addressed device interface and the complete module.

When parameterizing the RECEIVE-DIRECT 205, you define the area in the CPU (destination area) in which the status is to be transmitted. This should be a data block.

The job is not entered into the queue but is immediately executed on the CP following triggering and thus overtakes the jobs entered in the queue.

Destination length

The destination length must be one word.

The status word has the following format:

Bit	**Status**
0	CP 544 in RUN
1	CP 544 in STOP
2	CP 544 in TEST
3	CP 544 in error status
4	SI (addressed device interface) not in operation
5	SI configuration faulty
6	SYNCHRON has not yet arrived
7	SI ready
8	SI is being reparameterized (INIT)
9	SI stopped (SW-STOP)
10	SI enabled (following INIT/SW-STOP)
11	Still vacant
12	SI in RUN (ready)
13	SI in TEST (ready)
14	SI in STOP (ready)
15	Still vacant

6.3.14 Start Device Interface (SEND 202)

SEND-DIRECT 202

You can use the job

- SEND-DIRECT 202

to start a device interface from the STEP 5 program. You must do this e.g. following a SEND 189 job (assign parameters to device interface).

The job is not entered into the queue but is immediately executed on the CP following triggering and thus overtakes the jobs entered in the queue.

The device interface is only started if the job has been signalled in the status word with "Job ready without errors". The data can be transmitted if the device interface has already been parameterized (SEND 189 job).

The parameters QTYP, DBNR, QANF and QLAE have no significance.

6.3.15 Stop Device Interface (RESET 202)

RESET-DIRECT 202

You can use the job

- RESET-DIRECT 202

to stop a device interface from the STEP 5 program.

Refer to Section 2.10 to find out how the module responds following a stop job.

The job is not entered into the queue but is immediately executed on the CP following triggering and thus overtakes the jobs entered in the queue.

6.3.16 Import Mode-specific Static Parameters (SEND 203)

SEND-DIRECT 203

You can use the job

- SEND-DIRECT 203

to import the mode-specific parameters of the static parameter set (starting at data word 35) without stopping the device interface (parameters DW 0 to DW 34 are not influenced).

This job is required for mode 4 of the link type "Open driver" in order to be able to modify the parameters for printing without resetting the device interface.

Refer to the description of the SEND-DIRECT 189 for the parameters of the open driver in mode 4.

Note that you must additionally call a SEND-ALL block for the transmission of the parameter block.

The SEND-DIRECT 203 is entered into the queue. Once the job has been executed, all further jobs are carried out with the modified parameter settings. In contrast to SEND 189, the device interface need not be restarted.

Note

You must only use the SEND-DIRECT 203 to transmit the parameters described in Section 6.3.8 starting at data word 35 (mode) (see also notes and paragraph "Generating the parameter blocks" in Section 6.3.8).

You must select the length of the parameter block such that all data relevant to the special link type are transmitted. Thus you must transmit at least 6 data words for the 3964/3964R procedure. The other data words are automatically set to 0000 by the CP.

All unused data words must contain 0000.

6.3.17 Read Hardware Parameters (RECEIVE 204)

RECEIVE-DIRECT 204

You can use the job

- RECEIVE-DIRECT 204

to read the hardware parameters (page number, number of pages, enabled coordination flag area) without having to remove the module. The job is not entered into the queue but is immediately executed on the CP following triggering and thus overtakes the jobs entered in the queue.

You define the area in the CPU (destination area) into which the hardware parameters are to be transmitted by means of the parameter settings of the RECEIVE-DIRECT 204. This should be a data block. The following Fig. shows the format of the first two words, words 3 to 16 are reserved.

Destination length

The destination length must be at least 16 words.

You must set a frame size of at least 32 bytes in the SYNCHRON.

Word 1

High byte (DL)								Low byte (DR)								
								2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	Signifi-cance
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	
Reserved								Page number (00 corresponds to page 0)								

Word 2

High byte (DL)								Low byte (DR)							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Communication flag area														Number of pages per SI	
224-255	192-223	160-191	128-159	96-127	64-95	32-63	0-32							(01 = 1page/SI 10 = 2 pages/SI 11 = 4 pages/SI)	

(FFH means that all communication flags are disabled)

6.3.18 Set Date and Time (SEND 218)

SEND-DIRECT 218

You can use the job

- SEND-DIRECT 218

– to set the time on the CP 544 and
– to define the time master or time slave function using the CPU.

The job is not entered into the queue but is immediately executed on the CP following triggering and thus overtakes the jobs entered in the queue.

A CP 544 can be defined either as the time master or the time slave.

- Time slave
  The CP initially responds as a time slave following a power-up. It can update its own date and time, but the CPU cannot read these.
- Time master
  The master delivers the system time, i.e. it must be able to provide this at all times.

If the CPU wishes to synchronize these CPs (at regular intervals or following certain events), it reads the system time from the time master and sets all time slaves using this time. The time slaves need not carry out unnecessary updating operations.

The CPU can set the date and time on a CP 544 at any time. However, it can only read the date and time of the CP 544 if this has previously been declared as the time master.

The date/time area which is transmitted when reading or writing has the following format:

	DL	DR
DW 0	Bit 0 = master identification 1 = master 0 = slave	0
DW 1	1/100 s	s
DW 2	min	h
DW 3	Day	Month
DW 4	Year	0

The date and time are BCD-coded and must be entered in the data format "KH" (hexadecimal).

Job number 218 is defined on the CP 544 for the jobs "Read/write date and time".
The CPU declares the CP as the master or slave by means of the job SEND-DIRECT 218. The CPU can also simultaneously transfer the date and time to the CP.

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Whether the CPU transfers the date and time depends on the defined source length (QLAE = length of data to be transmitted):

– QLAE = 1 word
  The CP 544 is declared as the master/slave by the contents of bit 0 (least significant bit) in the first byte; master: bit 0 = 1/slave: bit 0 = 0.
  In the case of a restart or warm restart of the CPU, SEND-DIRECT 218 must be called for the CP which is to become the master by using QLAE = 1 and master bit 0 = 1.
  The date and time on the CP 544 are not changed by QLAE = 1.

– QLAE = 5 words
  The CP is declared as the master/slave by means of the master identification, and the date and time are transferred.
  Note that the master identification must be set when transferring the time to a master which is to remain the master.

The time is checked for consistency when writing. The SEND job is rejected in the case of an error. 7 is output in the status word ANZW, and 1DH in the SYSTAT.

Remember that the date and time are only accepted by the CP during the handshake (synchronization via inputs or following reading of another clock).

The source from which the data are transferred to the CP should be a data block.

The CP 544 can be declared as the time master on one or both device interfaces. The date and time can only be read on the device interface on which the CP has been declared as the master.

If the CP on one device interface has been declared as the master and then on the other device interface as the slave, the CP becomes the time slave on both device interfaces. The following occurs: the error number 1F is entered in SYSTAT when reading the date/time from the first device interface. The handshake is not carried out when reading from the second device interface since the bit "RECEIVE job ready" is not set in the ANZW (bit 0). An error message does not appear.

SYNCHRON does not influence the master/slave response.

6.3.19 Read Date and Time (RECEIVE 218)

RECEIVE-DIRECT 218

You can use the job

- RECEIVE-DIRECT 218

to read the clock on the CP 544 from the CPU.

This assumes that the CP has previously been declared as the time master by means of SEND-DIRECT 218.

You should also use a data block as the destination in this case.

Destination length

The destination length must be 5 words.

The read data are only meaningful if the date and time have been set at least once following insertion of the module (using SEND-DIRECT 218, length: 5 words).

The date and time are BCD-coded and must be entered in the data format "KH" (hexadecimal).

6.3.20 Read SYSID (RECEIVE 223)

An identification area is specified on every CP 544. The CP 544 is described in the SYSID identification area and contains information on:

- The module
- The memory submodule
- The interface assignment
- The output statuses of the loaded software etc.

RECEIVE-DIRECT 223

The job

- RECEIVE-DIRECT 223

can be used by the CPU to read the SYSID of the CP 544. The job is not entered into the queue but is immediately executed on the CP following triggering and thus overtakes the jobs entered in the queue.

Frame length

A prerequisite is a frame size ≥ 128 byte, i.e. the BLGR data: KY 0.4/KY 0.5/KY 0.6 on the SYNCHRON.

Destination length

A destination length ≥ 64 words is also required.

"Ready with error" and error number 7 are entered in the status byte and the number 1E in the error message area of the SYSTAT if the frame size is smaller than 128 bytes.
The SYSID area is not transmitted in this case.
15H is indicated in the ANZW instead of 45H if fewer data are transmitted than specified.

The SYSID can also be read directly out of the dual-port RAM without data handling blocks (address F680H onwards). Refer to your PLC Manual for more details.

Format of the SYSID identification area

The SYSID contains a number of parameters which identify the CP. Each parameter is terminated by a carriage return (CR = 0 BH, is counted in the number of bytes). Non-assigned parameters only consist of CR. Some parameters have different meanings for different types of memory submodules. All parameters are represented in ASCII.

These parameters have the following format with the CP 544:

Parameter No. (max. length)	**Description**
0 (10 bytes)	Memory submodule identification/capacity F-EPROM: e.g. 374-2FH21 present here for Order No. 6ES5374-2FH21 RAM: Storage capacity of module RAM xxxkW, e.g. xxx = 64
1 (6 bytes)	CP 544 module identification
2 (3 bytes)	CP firmware version
3 (20 bytes)	System identification from memory submodule or internal parameter memory
4 (9 bytes)	Date of parameter generation
5 to 7 (1 byte each)	Not used with CP 544
8 (8 bytes)	Password for writing the SYSID area by means of COM
9 (6 bytes)	COM version with which the CP is parameterized
10 (6 bytes)	PROM software version which is used to program the memory submodule

Device interface SI 1

Parameter	Description	Example
11 (9 bytes)	Link type	RK 512
12 (3 bytes)	Version of link type	nn
13 (9 bytes)	Name of SCC driver (interface driver)	ESCC1-1
14 (3 bytes)	Version of SCC driver (interface driver)	nn
15 (4 bytes)	Module type	TTY

Device interface SI 2

Parameter	Description	Example
16 (9 bytes)	Link type	3964 procedure
17 (3 bytes)	Version of link type	nn
18 (9 bytes)	Name of SCC driver (interface driver)	ESCC1-1
19 (3 bytes)	Version of SCC driver (interface driver)	nn
20 (4 bytes)	Module type	V.24

nn = Version number

If the device interface is unused, the interface-specific parameters are filled by spaces (20H).

6.4 Multi-processor Mode

It is even more decisive in the case of multi-processor mode compared to single-processor mode that you carefully match the programming of the individual CPUs (STEP 5 programs) and the CP 544 (CP 544 parameter sets) to one another.

As the complexity of the application increases, you must also be increasingly careful that you enter the correct numbers of the various CPUs when assigning parameters to the CP 544.

If several CPUs are to provide jobs for a device interface of a CP 544, it is advantageous to reserve a separate page frame for each CPU (also refer to information on interface number in Section 6.2). The number of pages per device interface must then be set accordingly.

Note that not more than 20 jobs can be processed simultaneously on a device interface. If you trigger a 21st job, this is terminated with error number 07H in the ANZW and message 15H in the error message area. You can only trigger a job again when another job has been terminated with or without an error.

If jobs with the same job number and the same page number are programmed on several CPUs, you must design the STEP 5 programs such that only one CPU can start one of these jobs at a specific point in time. All other CPUs must wait until this job has been signalled as "ready" (with or without errors).

Reception of data

In contrast to the RK 512 (where the CPU is defined separately in the dynamic parameter set for each job), only one CPU can receive data with the 3964/3964R procedure and the open driver. The CPU number is defined when defining the receive mailbox (also refer to information on interface number in Section 6.2).

Any CPU can access if a CPU is not defined. The data are then processed by the CPU which accesses first. The data are then lost.

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How do you Work with the COM PP Parameter Assignment Software?

Contents of Chapter 7

7 How do you Work with the COM PP Parameter Assignment Software?

This chapter explains how you can enter, modify, transfer and test the parameters for your selected link type simply and using menus.

7.1 Function

The ➻ **COM PP** parameter assignment software package supports the generation of the parameters for the various link types on the CP 544 communications processor. You must generate separate parameter sets for each device interface. You can carry out the following with COM PP:

- Generate new parameter sets offline or online
- Modify the parameters of an existing user program offline or online
- Print parameter sets
- Transfer parameter sets between PG and CP
- Read the info file (memory submodule, interface assignments, output versions) on the CP 544
- Delete the two device interfaces of the CP 544
- Execute a CP 544 restart
- Execute test functions.

Refer to the descriptions of the individual link types in Chapters 3 to 5 for a description of the parameters.

COM PP creates the following parameter sets:

- **Static parameter set**
  This contains all parameters of the physical and data link layers.

- **Dynamic parameter sets**
  (only with RK 512 link type)
  These contain the partner information (destination or source) of the RK 512 jobs.

- **Definition of the receive mailbox**
  (only with data transmission with the 3964/3964R procedures and the open driver)
  This contains all information on the data area (data block DB or extended data block DX) on the CPU which accepts the data to be received.

7.2 Screen Form Tree Structure

The screen forms of the COM PP are divided into various hierarchical levels according to their functions.

The screen form tree on the following page provides you with a summary of all forms.

> **Note**
>
> If you wish to change the floppy disk or the CP during a COM session, you must return to the 1st section of the SELECTION form.

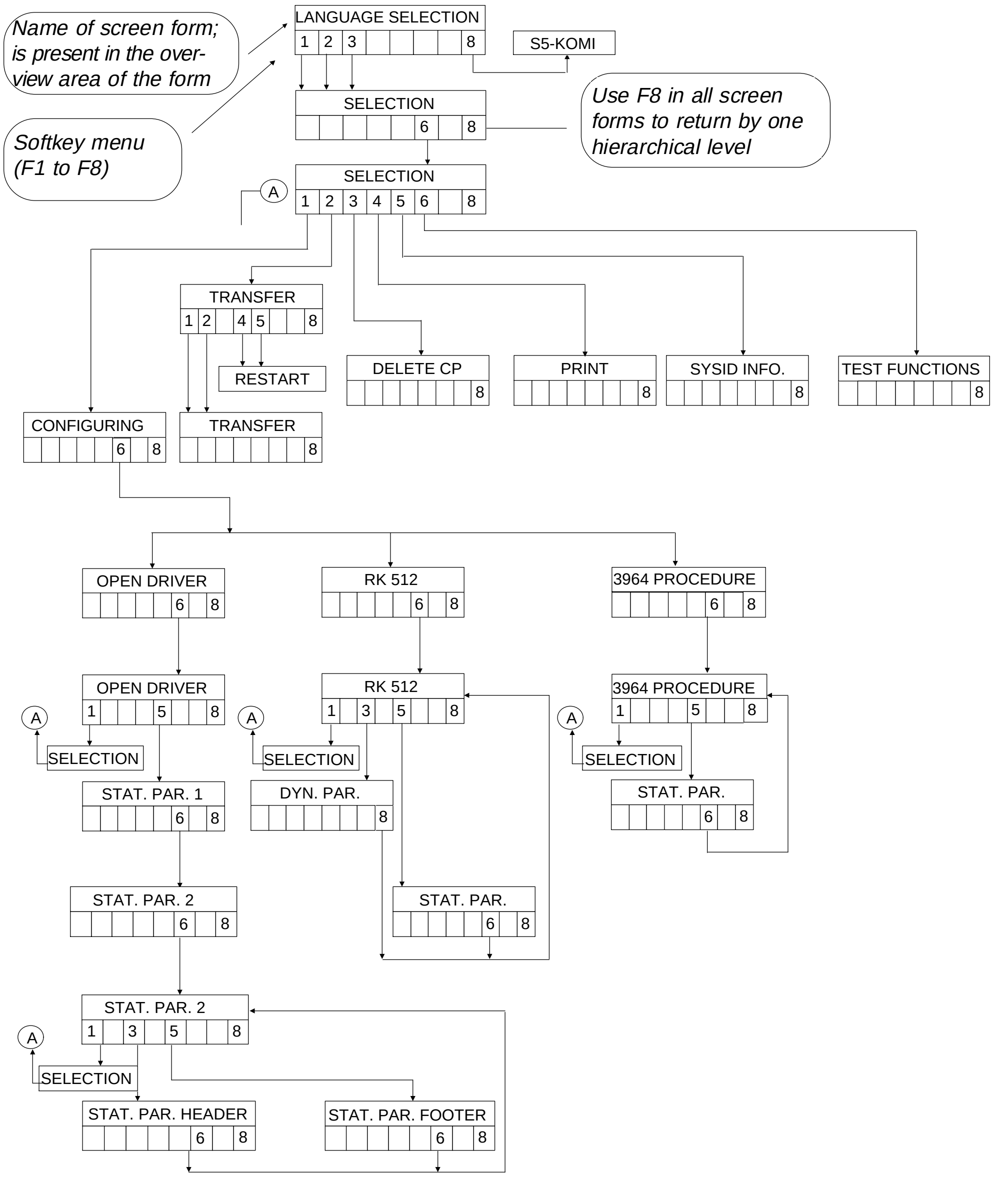

Fig. 7-1 Tree with screen forms of the COM PP parameter assignment software

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The following table lists the screen forms in which you can enter parameters:

Table 7.1 Parameters in the screen forms of COM PP

Screen form	Parameters
LANGUAGE SELECTION	German, English, French
SELECTION	Module, program file, SYSID file, path file, path name, configuring, plant designation, generation date, interface
CONFIGURATION	Link type, comment on interface
OPEN DRIVER	CPU No., receive mailbox, coordination flags
STAT.PAR. 1	Transmission mode, baud rate, parity, bits per character, stop bits, flow control, character delay time, 1st end identifier, 2nd end identifier, fixed message length on reception
STAT.PAR. 2 (PRINTER)	Wait time after sending, lines per page, left margin, placeholders for page number in header and footer, number of headers/ footers, line end character
STAT.PAR. 3 (HEADER)	Placeholder for page number in header and footer, line no., column no.
STAT.PAR. 3 (FOOTER)	Placeholder for page number in header and footer, line no., column no.
3964/3964R PROCEDURES	CPU No., receive mailbox, coordination flags
STAT.PAR	Transmission mode, baud rate, parity, bits per character, stop bits, priority, character delay time, acknowledgement delay time, attempts at establishment, number of repetitions
DYN.PAR	Job No., job, data destination/source, CPU No., DB No., destination address/source address, coordination flags

Screen form	Parameters
TRANSFER	Data medium, drive, interface, program name
DELETE CP	Data medium, interface
PRINT	Printer file, footer file, print data block assignment, print static parameter set, print dynamic parameter set
SYSID INFORMATION	Submodule, module, firmware version, plant, generation date, symbolic address, industry bus address, slave no. on PG bus, password, COM version, PROM version, interface 1/2: communication process name/version, driver name/version, submodule type
TEST FUNCTIONS	Number, date, time

7.3 How is the COM PP Parameter Assignment Software Loaded and Operated?

Scope of delivery

COM PP is supplied in two different floppy disk formats (3.5" and 5.25") under the PCP/M operating system. The software package comprises:

- The command file S5PXCPPX.CMD and
- text files in the following languages:
  - S5PDCPPX.DAT for German,
  - S5PECPPX.DAT for English and
  - S5PFCPPX.DAT for French texts.

You can also use COM PP under the MS-DOS operating system with the aid of the PCP/M emulator.

Making back-up copies

First of all, please make back-up copies of the floppy disks you have received. Do not copy the files onto HD disks, but onto disks of the following quality depending on the size of the originals:

Floppy disk size	**Floppy disk quality**
3.5"	DS, DD, 135 TPI
5.25"	DS, DD, 96 TPI

If you are working with a programmer from the PG 7xx family, use the *DISK* floppy disk management program to copy the originals. You can call this program from the command line. You can also call *DISK* on a PG 730, PG 750 or PG 770 by pressing function key *F2* when the following menu has been displayed immediately after booting your PG:

F1: Start S5-DOS
F2: Format, duplicate and check disks
F6: Load MS-DOS operating system
F7: Load FlexOS operating system
F8: Enter PCP/M-86 commands

You are guided through the floppy disk management program by menus.

When using programmers of the PG 6xx series, you can format and copy disks guided by menus using the *DSKMAINT* floppy disk management program.

Transfer COM PP onto hard disk

First transfer the COM PP files as system files onto the hard disk of your programmer (see also Section 9.4.1 "Install COM PP").

COM PP under PCP/M

It is assumed that the PCP/M-86 and S5-DOS operating systems are in user area 0 on the hard disk (as supplied). The files of these operating systems should also have the attribute SYS (system).

COM PP in all USER areas

Loading

If you find it more practical to work with COM PP in several USER areas, copy all files from the original disk into USER area 0 and declare these files as system files by assigning the attribute SYS to them. You can then work with COM PP in all USER areas.

Load the S5-DOS operating system using the call "S5". The S5-DOS command interpreter (S5-KOMI) is activated. The S5-KOMI displays the packages you can select.

Starting

Call COM PP by positioning the cursor in front of the COM PP package and pressing the function key *F1* (PACKAGE). The initial COM PP screen form then appears.

COM PP in one USER area

Loading

To create program files with COM PP, it is sensible to select an area other than area 0. Copy all the files from the original disk in PCP/M format into the USER area you have selected.

Starting

Set the hard disk and the USER area containing COM PP in the command level. The call is the same as when working with COM PP in a USER area.

COM PP under MS-DOS

Loading

If your PG has only one MS-DOS partition, you can still use COM PP with the aid of the PCP/M emulator. Use the command *PCOPY* to copy all COM PP files from the original disk into the directory of your hard disk which contains the PCP/M emulator and the STEP 5 basic package.

Starting

You can call COM PP by positioning the cursor in front of the COM PP package in the S5-DOS command interpreter (S5-KOMI) and pressing function key *F1* (PACKAGE). The initial COM PP screen form then appears.

Working with COM PP

Operation

Your dialog with COM PP is based on screen forms whose contents are largely self-explanatory.

A screen form consists of four basic areas:

- Overview area
- Configuring area
- Message line
- Softkey menu.

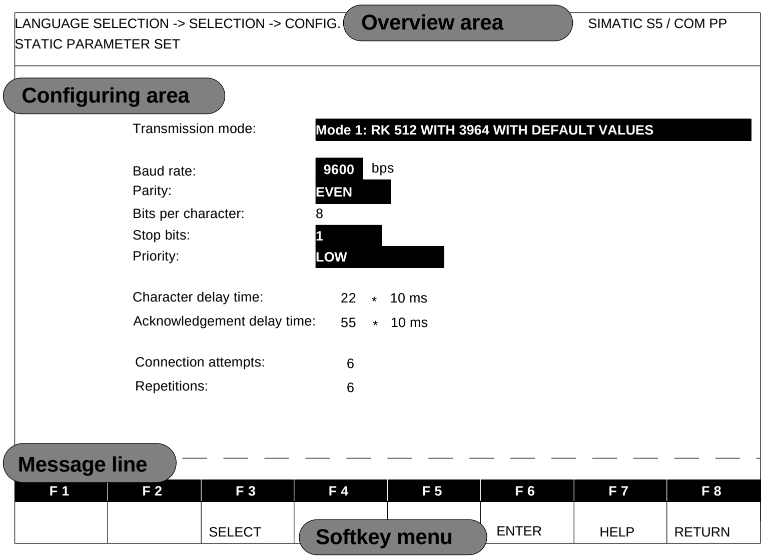

Fig. 7-2 Layout of a screen form

Overview area

This area helps you to see where you are in the program; a path to the current screen form (1st line) and the name of this form (2nd line) are displayed.

Configuring area

This area contains texts which you cannot change and inversely displayed input and output fields. You can position the cursor in input and output fields and modify the displayed parameters or enter new ones.

Message line

The message line displays error messages and processing messages.

Softkey menu

An important element of COM PP is the softkey menu *F1* to *F8*. The softkey menu of a screen form shows you the operations you can carry out with the function keys. Each screen form contains at least one softkey which tells COM PP to display a new screen form.

You can display two additional screen areas if necessary:

- Help window
- Selection window.

Help window

The help function supports you when entering parameters. You can call a help window for each input field.
Position the cursor within an input field and press *F7*. A help window is then displayed containing information on the input field you selected. The help window is closed again when you have correctly filled in the corresponding input field.

Selection window

There is a specific number of possible entries for each input field. You can call these fixed options by pressing *F3*. A different input is then displayed or - if there is a large number of possible entries for an input field - a selection window is opened.
The top entry in the selection window is selected when the window is opened. You can select a different entry using the cursor keys. You enter your selection by pressing *F6* (ENTER), and the selection window is then closed.

Input keys

Function keys, cursor keys and S5-specific keys are available for COM PP operations.
The significance of the eight keys *F1* to *F8* is displayed in the softkey menu of the currently displayed screen form. The cursor keys and the S5-specific keys (for example for calling the help function or for deleting characters) are described in more detail in the reference section.

Page forwards

Press one of the keys specified in the softkey menu to move on to the next screen form.

Page backwards

Press *F8* to return to the previous screen form. In some cases the softkey menu of the current screen form changes into an acknowledgement menu and you are warned in the message line of the risk of losing the data entered in the screen form and asked if you wish to save your inputs.

Importing inputs

You can import your inputs by pressing *F6*. All your inputs are checked by COM PP. Faulty operations are detected, and the storage of incomplete or incorrect data prevented. *F6* has different effects depending on the situation in which it is pressed:

- The importing of a screen form results in storage of the entered data and branching to the next operating level
- An entry selected in a selection window is imported into the input field, and the selection window closed. Importing in a selection window can also be carried out by pressing the RETURN key.

Printing parameter sets

You can output the generated parameter sets and a list of data blocks used to a printer or into a file. The log has a header and footer. The header cannot be modified, the footer can be specified by a footer file. You can specify this footer file and a printer parameter file in the screen form *PRINT*. The generation of footer and printer parameter files is not a component of COM PP, these files can be generated and edited using the SIMATIC utilities FOOTER and PRINTER.

Transferring parameter sets between PG and CP

You can transfer the parameter sets for a device interface from the PG to the CP and vice versa. The destination or source of the transfer is always the program file which was set with COM PP.

Read info file to CP 544

You can use this function to read online the firmware version and the module identification as well as the generation date and the plant designation.

Delete CP 544 device interfaces

You can delete the device interfaces of the CP 544. All parameter sets of a device interface are deleted, it is not possible to delete individual parameter sets. Error messages in the message line are not deleted by this function.

Execute cold restart of CP 544

Once you have transferred the parameters for a device interface to the CP, you can request a cold restart of the CP using this function. The restart is only carried out for the currently selected device interface.

Execute test functions

You can activate the following test functions:
Read error area, delete error area.

The error area is a circulating buffer in which the current error messages (max. 32) of a device interface are entered together with their date and time stamp. The same error numbers are used as are entered in the error message area of the SYSTAT (see Chapter 8).

Note, however, that the error area which you can read using COM PP is not identical to the error message area in the SYSTAT. The error area of COM PP is present once per device interface, the area message area in the SYSTAT is defined for each page frame.

The function "Delete error area" therefore has no effect on the error message area in SYSTAT. The same applies in the reverse direction to the function "Delete error message area of SYSTAT".

Change floppy disk or CP

If you wish to change the floppy disk or CP during a COM session, you must return to the 1st section of the SELECTION screen form.

Exiting COM PP

You can exit COM PP and return to S5-KOMI by repeatedly pressing *F8* (return function). You must react as necessary to acknowledgement menus.

7.4 How are the Parameters Stored?

Program file

The data blocks which you configure using COM PP are stored in so-called program files where you can select the first six characters of the name, the remaining component of the name is always *ST.S5D.* The first of the six characters must always be a letter. Special characters are not permitted (e.g. !, $, % etc.).

Example: *TEST01ST.S5D*

DX1, DX2

The parameters are stored in a data block for each device interface, in block DX 1 for device interface 1 and in block DX 2 for device interface 2.

SYSID file

The SYSID file is required when storing on a PROM outside the COM PP in the EPROM package. The plant designation and the generation date are stored in it. The name of the SYSID file corresponds to the name of the program file except for the ending ...SD.INI.

You must enter the file name in the field "SYSID file" in the STEP 5 package EPROM so that the plant designation and generation date are stored in the EPROM.

7.5 What must you Observe when Programming the EPROM Submodule?

You can find a detailed description of the EPROM submodule programming in the STEP 5 manual. You can only program the EPROM submodules on a PG 7xx programmer with the aid of the STEP 5 basic package (version 6 and upward).

Please note the following special points:

- If you have created a SYSID file with the COM PP, you must enter a SYSID file in addition to the program file in the screen form "Presets" of the STEP 5 package EPROM
- You must enter "Word/Field" as the operating mode in the default screen form
- If you have entered a SYSID file, you must store it in the EPROM submodule by pressing the keys "E info" and "SYSID INP" before closing the program file.

8

What must you do if the CP 544 or COM PP Outputs Error Messages?

Contents of Chapter 8

8 What must you do if the CP 544 or COM PP Outputs Error Messages?

This chapter tells you which messages are output by the CP 544 and COM PP. The messages contain a detailed error description arranged according to error numbers as well as information on elimination of the cause.

8.1 Which Messages do you Receive from the CP 544?

Errors which occur during data transmission may be caused at different positions.

CPU reactions

If the CP 544 has detected the errors, they are signalled to the CPU in as much detail as possible. You determine how the CPU is to react by writing your STEP 5 program accordingly on the CPU.

For example you can request that

- an error message is output on a printer, either via another CP 544, or via the other device interface of the same CP 544 or via a CP 525,
- the errors are identified on a screen by means of messages or
- the job is repeated.

Error numbers

Errors are signalled by:

- An error number in the PAFE byte of the data handling block
- An error number in the status word ANZW of the data handling block
- An error number in the error message area of the SYSTAT
- An error number in the reply message REATEL (the CP 544 only signals an error to the partner in the case of data transmission with the RK 512 computer link).

Error numbers in the PAFE byte of the data handling block (DHB)

PAFE byte

The PAFE byte is a parameter which you enter when calling a DHB. The data handling blocks indicate in the PAFE byte whether serious errors have occurred in conjunction with a CP or whether parameters have been entered incorrectly. See Section 6.2.2. for a detailed description of the PAFE byte error messages.

If you receive a PAFE error number, this means that the data transfer between the CPU and CP could not be started or has been aborted following unsuccessful attempts.

The following cases are exceptions where the error numbers 91H and C1H could mean that no serious errors are present:

- Following a transmission from the PG to the CP 544
- If the coordination flag is used incorrectly.

If such exceptions occur on your system, you should initially repeat the associated job.

Error numbers in the status word ANZW

Status word ANZW

The status word ANZW is also a parameter which you enter when calling a DHB. In the case of DIRECT jobs (SEND-DIRECT, FETCH-DIRECT, RECEIVE-DIRECT), the ANZW indicates whether the job is still running or has been finished.

An error number is entered in bits 8 to 11 in the ANZW if the job has been terminated with an error. Bit 3 is set in addition: "Job finished with error".

An error number is only entered in the ANZW if the error occurred when processing a DIRECT job!

Since only 4 bits are available for the error numbers in the ANZW, one error number usually comprises several error states. As a result of the low number of error numbers, the ANZW is suitable for evaluation by the STEP 5 program.

The errors are differentiated according to the different error sources:

Table 8.1 Assignment between ANZW error messages and error sources

No. for ANZW	Source
1 to 5	Parameterization errors detected by the CPU of the PLC and signalled to the CP
6	Errors detected by the CP during data transfer between the CPU and CP
7	Job cannot be executed, error in job parameters
9, A, B, C, D	Error during execution of a job, caused by a faulty reaction or error messages from the partner
E, F	Errors in data transfer between CP 544 and partner

Refer to the tables on the following pages for descriptions of the errors.

A status byte is reserved in the dual-port RAM for each job. If the CP detects an error which is related to a DIRECT job, it writes the error number and the bit "Job finished with error" into the status byte of the associated job in the dual-port RAM. To enable the job status to reach the status word, it is necessary to

- either call the CONTROL DHB with the corresponding job number in the cycle (OB 1) in the STEP 5 program
- or call the DIRECT job (SEND-DIRECT) using the JU command and RLO = 0.

Error numbers in the error message area of the SYSTAT

Error message area of the SYSTAT

The error message area of the SYSTAT is a data area in the dual-port RAM which can be read by the CPU using the special job RECEIVE-DIRECT 200. The error message area of the SYSTAT comprises three error message bytes for each interface and an additional status byte. You can find a detailed description in Section 6.3.10.

All errors detected by the CP are entered into the error message area of the SYSTAT. An error number is additionally entered in the status word if the error occurs in conjunction with a DIRECT job.

An error number is additionally transmitted in the reply message to the partner if the error occurs during data transmission with the RK 512 computer link in conjunction with a partner job.

The error entry in the SYSTAT is so detailed that it is particularly suitable for exact error analysis during the system startup.

Evaluation of individual error numbers by the program could also be possible. Remember that not only serious errors are entered in the SYSTAT.

The special job RECEIVE-DIRECT 200 for reading the error message area in the SYSTAT should be called in the OB1, in particular during the system startup. If errors occur – you can recognize this in that the CP sets bit 0 to 1 in the ANZW of the RECEIVE-DIRECT 200 – the error numbers are copied into the data block specified as the parameter. If a programmer is connected to the CPU of the PLC, you can directly view the errors on the screen in operating mode "STATUS variable" or "FORCE variable" in the STEP 5 package LAD/CSF/STL.

To delete the error entries in the SYSTAT, call the special job RESET-DIRECT 200.

Error numbers in the error area which you can read out via COM PP

The same numbers as those entered in the SYSTAT are also used for the error area which you can read out via COM PP (see also Chapter 7).

The errors are differentiated according to the various error sources:

Table 8.2 Assignment of SYSTAT error messages to error sources

No. for SYSTAT	Source
1 to 6	Parameterization error detected by the CPU of the PLC and signalled to the CP.
10 to 14	Error detected by the CP in the data transfer between CPU and CP.
15 to 1F	System error at start of job processing.
20 to 2F	Error detected by the CP during processing of a PLC job.
30 to 3A	Error detected by the partner during processing of a PLC job and passed on to the CP by means of an error number in the reply message.
40 to 53	Error detected by the CP during processing of a partner job.
5E to 5F	Reception of a message which cannot be evaluated.
B0 to B8	Error in data transfer between PG and CP.
C0 to CA	Hardware error on the module.
D0 to FF	Error in data transfer between CP and partner.

Error numbers in reply message
(only for data transmission with the RK 512 computer link)

Reply message

If an error status results in conjunction with a SEND or FETCH message of the partner, an error number is signalled in the 4th byte of the reply message. The partner job is then terminated.

The following tables contain detailed descriptions of the error numbers arranged according to:

- The numbers for ANZW
- The numbers for SYSTAT
- The numbers for REATEL.

The tables also describe how help can be obtained!

The numbers of the error messages are specified as hexadecimal values.

The tables generally contain 3 columns with error numbers (No. for ANZW/SYSTAT/REATEL). The error numbers in the 2nd and 3rd columns correspond to the numbers in the first column. Please note:

Error numbers are only entered in ANZW and REATEL if a corresponding job is being executed when the error occurs. For example:

- If noise occurs on the line during a pause in transmission, the procedure detects a faulty character. It then generates the error code FEH which is entered in the SYSTAT. The ANZW is not changed since the error did not occur during the actual transmission
- If the noise occurs whilst a PLC job is being sent, and if the repetitions are not successful, an error number (EH) is entered in the ANZW in addition to the SYSTAT entry (FEH).

The error description always commences with an underlayed line which is marked by abbreviations as follows:

RK 512 computer link	RK
Data transmission with 3964/R procedure	3964/R
Data transmission with open driver	OT
Input example:	RK 3964/R

Error description and remedy apply to RK 512 and 3964/R procedure.

8.1.1 Error Messages for SYSTAT, ANZW and REATEL, Arranged According to Numbers for SYSTAT

Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
			Parameterization errors detected by the CPU of the PLC and signalled to the CP:	
			RK 3964/R OT	
01H	01H	0AH	Source/destination type (e.g. DE) illegal,	Check parameter settings on CPU and CP and correct if necessary.
			Area (initial address, length) illegal (negative value)	RK
				Partner supplies illegal parameters in the message header.
			RK 3964/R OT	
02H	02H	14H	DB/DX does not exist or is illegal (e.g. DB 0, DB 1, DB 2, DX 0, DX 1, DX 2) or	Check parameter settings on CPU and CP, set up the block if necessary.
		0CH	other data type does not exist or is illegal	The permissible data types are listed in the job tables.
				RK
				Partner supplies incorrect parameters in the message header.
			RK 3964/R OT	
03H	03H	14H	DB/DX too short: (initial address + length)> area or	Check parameter settings on CPU and CP, check block/area if necessary.
		0CH	area too short for another data type (initial address + length) > area	RK
				Partner supplies incorrect parameters in message header.

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Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
04H	04H	0AH	RK 3964/R OT No access to area possible for user: e.g. hardware memory too small or input/output module not fitted	Check parameter settings on CPU and CP. The permissible initial addresses and lengths are listed in the job tables. RK Partner supplies incorrect parameter in message header.
05H	05H	0CH	RK 3964/R OT Incorrect status word: group message for all errors which can be attributed to the status word	Check whether the status word is permitted.
06H	06H	0AH	RK 3964/R OT Error indication from CPU to CP, which cannot interpret it	Evaluate PAFE on data handling block (STEP 5 program).
07H	-	-	RK 3964/R OT PAFE byte does not exist or is illegal	Check whether the PAFE byte is permitted.
			Errors detected by CP in data transfer between CPU and CP:	
10H	06H	0AH	RK 3964/R OT Timeout for ALL jobs	Check whether RECEIVE-ALL or SEND-ALL are called in the STEP 5 program, evaluate PAFE on data handling block.

Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
			RK 3964/R OT	
11H	06H	-	ALL job without request or DIRECT job despite overloading or job carried out on non-synchronized page	Check STEP 5 program, e.g. error in data handling block (message also possible following a transmission from the PG to the CP).
			RK 3964/R OT	
12H	06H	-	Error in data transmission between CPU and CP	Check STEP 5 program, e.g. error in data handling block
			RK 3964/R OT	
13H	06H	-	Unknown job type or illegal job number with DIRECT job	Check STEP 5 program, e. g. incorrect param. settings for DHB.
			RK 3964/R OT	
14H	06H	-	Error in the CP firmware	Switch the module off and on again. Replace the module if necessary.
			System errors at beginning of job processing:	
			RK 3964/R OT	
15H	07H	-	Number of simultaneously processed DIRECT jobs too large for CP 544 (queue full)	Modify STEP 5 program such that a maximum of 20 DIRECT jobs can run simultaneously.
			RK 3964/R OT	
16H	07H	-	Current job was terminated with error status by new SYNCHRON when restarting the CP (power up) or carrying out a cold restart of the CP by means of the PG	A remedy is not possible for the power up. In the case of the cold restart of the CP by means of the PG, you should ensure that no more CPU jobs are being executed before accessing an interface. The SYNCHRON DHB deletes the job statuses in the dual-port RAM, but not the SYSTAT entry!

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Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
17H	07H	-	RK 3964/R OT Area is occupied (resource)	Repeat the job.
18H	07H	-	RK 3964/R OT Job illegal in this status (e.g. device interface not parameterized)	Assign parameters to device interface.
1DH	07H	-	RK 3964/R OT Time faulty	Check the time parameters.
1EH	07H	-	RK 3964/R OT Frame size too small	Select larger frame length for SYNCHRON.
1FH	07H	-	RK 3964/R OT "Read time/date" (RECEIVE-DIRECT 218) illegal since CP is set as time slave	The CP must be set as the time master prior to reading – this then applies to the module. Check whether the CP is set as a slave on another interface.
20H	07H	-	**Parameterization errors detected by the CP in the STEP 5 program (e.g. in the PSEUDO-R/W parameters) or in the dynamic parameter set (CP 544 user program):** RK Dynamic parameter set does not exist or is faulty or the type of job (SEND/ FETCH) does not agree with the arrived job	Set or correct the parameters for this job using COM PP.

Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
21H	07H	-	**RK 3964/R OT** Error with data type (DB, QB...): unknown data type or data type illegal (e.g. DE) **RK** Data type in DHB parameters is illegal in conjunction with data type in dynamic parameter set	The permissible data types and their combinations are listed in the job tables.
22H	07H	-	**RK 3964/R OT** Initial address specified too high for desired data type, or initial address or DB/DX No. too low	The permissible initial addresses and the DB/DX numbers which may be specified in the CP 544 user program or in the STEP 5 program (PSEUDO-R/W parameters) are listed in the job tables.
23H	07H	-	**RK** Coordination flag illegal for this data type, or incorrect bit number entered	Coordination flags are not permissible for all data types. Check when using the PSEUDO-R/W function whether the bit number has been specified correctly (0 to 7).
24H	07H	-	**RK** CPU number specified too large for the PSEUDO-R/W parameters	Permissible CPU No.: none, 1, 2, 3 or 4

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Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
25H	07H	-	RK 3964/R OT Transmission length illegal	See the job tables for valid lengths.
26H	07H	-	RK 3964/R OT Transmission length too long for transmission (> 4 kbyte).	RK The permissible lengths for DHBs or PSEUDO-R/W parameters are listed in the job tables. RK 3964/R OT Divide the job into several shorter jobs.
27H	0CH	-	RK 3964/R OT Switch at STOP for PLC job.	Set the mode selector to the RUN position.
28H	0CH	-	RK Error when transmitting a command message. An associated procedure error number has been entered directly previously in SYSTAT (see error numbers E1 to E5 and F8 to FF).	See remedy measures for preceding procedure error numbers.

Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
			Error in reply message from partner, recognized by CP:	
			RK	
29H	0CH	-	Synchronization error of partner since - reply message arrived although no job is running or - the (continuation) FETCH message has not yet been sent or - a continuation reply message has been received following the transmission of a FETCH message or - a reply message has been received following the transmission of a continuation FETCH message.	This error is signalled following the cold restart of the own PLC in the case of long messages or with the cold restart of the partner. This is a normal startup reponse of the system and need not be corrected. The error may also occur during operation as a result of previous error statuses which have only been detected by the partner. Otherwise you can assume that the partner has responded incorrectly. The error may not occur with jobs < 128 byte.
			RK	
2AH	0BH	-	Error in format of received reply message: 1st byte not 00H or FFH	Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.
			RK	
2BH	0BH	-	Received reply message following FETCH job has too much data.	
			RK	
2CH	0BH	-	Received reply message following FETCH job has too few data.	
			RK	
2DH	0BH	-	Received reply message following SEND job arrived with data.	

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Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
			RK 3964/R OT	
2EH	0BH	-	An illegal parameter setting has been detected when starting the parameterized communication. The interface could not be parameterized.	Correct the illegal parameter setting and carry out a cold restart.
			RK	
2FH	0DH	-	A reply message has not arrived from the partner within the monitoring time following the transmission of a command message.	Is the partner a very slow device? This error is often indicated as a result of a previous error. For example, procedure reception errors (F0H to FFH) can be indicated after a FETCH message has been sent. Reason: the reply message could not be received because of interferences, the monitoring time elapses. This error may also occur if a cold restart has been carried out on the partner before it could answer the last FETCH message it received.

Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
			A reply message with an error number in the 4th byte is returned to the CP 544 if the partner detects an error when processing an external job. The CP generates a number for SYSTAT and for ANZW from this:	
			RK	
30H	09H	32H	DB/DX disabled on partner by coordination flag	In the partner program: reset the coordination flag again following processing of the last transmitted data! In the STEP 5 program: repeat job!
			RK	
31H	0AH	0AH	Error in partner or in CP 544 as partner: - Illegal source/destination type or - memory error in partner PLC or - error in CP/CPU communication with partner or - partner PLC is in STOP status	Check, whether the partner can transmit the desired data type. Check hardware design of partner. Set switch of partner PLC to RUN position.

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Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
32H	0AH	0CH	RK Memory access error on partner (memory does not exist) With CP 544 as partner: - Incorrect area with status word or - data area does not exist (except DB/DX) or - data area too short (except DB/DX)	Check whether the desired data area is present in the partner and is sufficiently large, or check the dynamic parameter sets in the CP 544 or the PSEUDO-R/W parameters in the STEP 5 program. Check the defined length on the DHB.
33H	0AH	14H	RK DB/DX access error on partner (DB/DX does not exist or is too short) With CP 544 as partner: - DB/DX does not exist or - DB/DX too short or - DB/DX No. illegal Permissible source area exceeded with FETCH job	
34H	0BH	16H	RK Error in message header, detected by partner: 3rd command byte in header is incorrect	Check whether the error is based on interferences or on a faulty response of the partner. Prove this using an interface test unit (FOXPG) inserted into the transmission line.
35H	0BH	10H	RK Error in message header: 1st or 4th command byte in header is incorrect	
36H	0BH	34H	RK Partner detects incorrect message length (total length)	

Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
37H	0CH	36H	RK Partner detects synchronization error: Message sequence is faulty	This error occurs with a cold restart of the own PLC or the partner. This is a normal startup response of the system and need not be corrected. This error may also occur during operation as a result of previous errors. Otherwise you can assume that the partner has responded incorrectly.
38H	0CH	2AH	RK No cold restart has yet been performed on the partner. With CP 544 as partner: A SYNCHRON DHB has not been executed since the power-up, or the mode selector is in the STOP position.	Carry out cold restart on partner PLC or set mode selector on CP to RUN position.
39H	0BH	12H	RK Partner signals "Job type illegal"	Incorrect response of partner since a system command has not been sent from the CP 544.
3AH	0BH	-	RK Unknown error number received in reply message	Check whether the error results from interferences or from a faulty response of the partner. Prove this using an interface test unit (FOXPG) inserted into the transmission line.

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Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
			Error in command message of partner. A reply message is sent to the partner with the defined error number in the 4th byte.	
			RK	
40H	-	10H	Error in 1st command byte: not 00H or FFH	Basic header error in partner. Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.
			RK	
41H	-	16H	Error in 3rd command byte: Command letter is not "A" or "0" or "E"	
			RK	
42H	-	16H	Error in 3rd command byte with continuation message: Command letter not as with 1st command message	
			RK	
43H	-	10H	Error in 4th command byte: Command letter incorrect	Basic header error in partner, or a command combination has been requested which is illegal with the CP 544. Check the permissible commands in the command tables. Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.

Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
44H	-	10H	RK Error in 4th command byte with continuation message: Command letter not as with 1st command message	Basic header error in partner. Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.
45H	-	14H	RK Error in 5th command byte: DB/DX No. illegal (e.g. 00)	The permissible DB/DX numbers, initial addresses or lengths are listed in the job tables.
46H	-	0CH	RK Error in 5th or 6th command byte: Initial address too high	
47H	-	34H	RK Errors in 7th and 8th command bytes: Illegal length	
48H	-	0CH	RK Errors in 9th and 10th command bytes: The specification of a coordination flag is illegal for this data type, or the bit number of the coordination flag is too high (permissible range 0 to 7).	Basic header error in partner. The job tables list when a coordination flag is permissible.
49H	-	0CH	RK Error in 10th command byte: CPU No. too large (permissible values 0, 1, 2, 3, 4, F)	Basic header error in partner.

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Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
4BH	-	34H	RK Send message was longer than expected, i.e. more data were received (possibly with continuation messages) than were specified in the message header.	Correction necessary in partner.
			OT The parameterized end characters have not occurred within the max. permissible length (modes 2 and 4).	Correct your user program or that of the partner.
4CH	-	34H	RK Send message was too short or < 128 bytes, i.e. fewer data were received (possibly with continuation messages) than specified in the message header.	Correction necessary in partner.
4DH	-	34H	RK Fetch message received with useful data	
			Further errors when processing the partner job:	
4EH	-	2AH	RK CP has received message whilst mode selector was in STOP position.	Set mode selector of CP to RUN position.

Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
			RK	
50H	-	-	Error when sending the (continuation) reply message, an associated procedure error number was entered immediately previously in the SYSTAT (error numbers E0 to E5, F8 to FF).	See remedy measures for the error number entered directly previously in the SYSTAT (SYSTAT nos. E0 to E5 and F8 to FF).
			RK	
51H	-	36H	Synchronization error of partner since - new (continuation) command message arrived although previous (continuation) reply message has not yet been sent by the CP 544 or - a normal command message has been received although a continuation command message was expected or - a continuation command message arrived although a command message was expected.	This error is signalled following the cold restart of the own PLC in the case of long messages or with the cold restart of the partner. This is a normal startup response of the system. The error may also occur during operation as a result of previous error statuses which have only been detected by the partner. Otherwise you can assume that the partner has responded incorrectly. The error may not occur with jobs < 128 bytes.

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Error number			**Error description**	**Remedy**
	RK 512 only			
SYSTAT	ANZW	REATEL		
			RK	
52H	-	32H	DB/DX disabled by coordination flag	In the own STEP 5 program: Reset the coordination flag again following the processing of the last transmitted data. In the partner program: Repeat the job. During initial system startup: Make sure that the coordination flags are distributed amongst the individual processors, CPs, IPs and the coordinator, that the jumper settings are correct and that the used coordination flags are reset in the restart OBs (OB 20, OB 21, OB 22).
			RK	
5EH	-	-	A correct message has been received with a length shorter than the header length in the (continuation) command message (< 4 bytes with continuation messages or reply messages; < 10 bytes with command messages). The message is ignored. Currently active jobs are not aborted.	Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.

Error number			Error description	Remedy
	RK 512 only			
SYSTAT	ANZW	REATEL		
			RK	
5FH	-	34H	A correct message with a length > 128 bytes was received. The message cannot be evaluated. The processed job is aborted.	Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.

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Error number		Error description	Remedy
	RK 512 only		
SYSTAT	ANZW		
C6H	-	RK 3964/R OT No parameters present, parameter memory empty or unknown contents	Load the interface parameters
C7H	-	RK 3964/R OT Illegal parameter, parameter memory faulty, submodule removed following parameterization	Check the parameters or replace the CP or the RAM submodule.
D8H	-	RK 3964/R Connection could not be established, the number of connection attempts has been exceeded.	Check the interface cable or the transmission parameters.
D9H	-	RK 3964/R Data could not be transmitted, the permissible number of repetitions has been exceeded.	
E0H	-	**Error in data transfer CP <--> partner:** RK 3964/R Transmission of first repetition: - An error has been detected when transmitting the message or the partner requests a repetition by means of a negative acknowledgement (NAK).	A repetition is not an error but it may indicate that interferences have occurred on the transmission line or that the partner responds incorrectly. If the message still cannot be transmitted following the maximum number of repetitions, an error no. is signalled which describes the error which occurred first.

Error number		Error description	Remedy
	RK 512 only		
SYSTAT	ANZW		
E1H	0EH	RK 3964/R Error during establishment of connection:, - NAK or any other character (except DLE or STX) was received after STX was sent or - the reply took place too early or - an initialization conflict has occurred.	Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.
E2H	0EH	RK 3964/R Acknowledgement delay time (QVZ) exceeded: a reply from the partner did not arrive within the acknowledgement delay time following transmission of STX.	Partner is too slow or not ready to receive or there is e.g. an interruption in the transmission line. Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.
E3H	-	RK 3964/R Abort by partner: One or more characters (including NAK) have been received by the partner during a current transmission.	Check whether the partner also indicates errors since it may be the case that not all transmitted data have arrived (e.g. interruption in transmission line) or the major interferences exist or there is a faulty response of the partner. Prove this by connecting interface test unit (FOXPG) into transmission line if applicable.
E4H	-	RK 3964/R Error at connection termination: - The message was rejected by the partner at the end by NAK or any other character (except DLE) or - the acknowledgement character (DLE) was received too early	

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Error number		Error description	Remedy
	RK 512 only		
SYSTAT	ANZW		
E5H	-	RK 3964/R Acknowledgement delay time exceeded at connection termination: No reply was received from the partner during the QVZ following clearance of the connection with DLE ETX.	Partner is too slow or faulty. Prove this using interface test unit (FOXPG) inserted into transmission line if applicable.
F0H	-	RK 3964/R First repetition expected: A fault was detected whilst receiving a message, and the CP 544 requested a repetition from the partner by means of a negative acknowledgement (NAK).	A repetition is not an error but it may indicate that interferences have occurred on the transmission line or that the partner responds incorrectly. If the message still cannot be transmitted following the maximum number of repetitions, an error no. is signalled which describes the error which occurred first.
F1H	-	RK 3964/R Error during establishment of connection: - One or more characters (apart from NAK or STX) were received in the idle state or - further characters were sent by the partner following a received STX without waiting for the reply DLE. Following power-up of partner: - The CP receives an undefined character whilst the partner is being switched on.	Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.

Error number		Error description	Remedy
	RK 512 only		
SYSTAT	ANZW		
		RK 3964/R	
F2H	-	Logic error during reception: A further character (apart from DLE, ETB, ETX) was received following the reception of DLE.	Check whether the partner always doubles DLE in the message header and in the data string or whether the clearance of the connection is made with DLE ETX. Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.
		RK 3964/R OT	
F3H	-	Character delay time (ZVZ) exceeded: - Two successive character were not received within the ZVZ or - 1st character following transmission of DLE when establishing the connection was not received within the ZVZ.	Partner is too slow or faulty. Prove this using interface test unit (FOXPG) inserted into transmission line if applicable.
		RK 3964R	
F4H	-	Error in block check character BCC (only with RK 512 with 3964R procedure, and with 3964R procedure): The internally generated value of the BCC does not agree with the BCC received by the partner at the end of the connection.	Check whether there is a large interference on the connection, in this case error codes FE may also be observed occasionally. Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.

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Error number		Error description	Remedy
	RK512 only		
SYSTAT	ANZW		
		RK 3964/R	
F5H	-	Repetition number of partner does not agree with the own setting of repetition attempts	Set the same number of repetitions on the partner as on the CP. Prove faulty response of partner using interface test unit (FOXPG) inserted into transmission line if applicable.
		RK 3964/R OT	RK 3964/R
F6H	-	A vacant receive buffer is not available: Following the reception of STX, an empty receive buffer was not available to the procedure for the establishment of the connection and a further wait time.	The error can only occur where there is a large interference in operation. Reason: brief overloading of protocol. Remove the fault by modifying the system design or rerouting the cables.
			OT
			Use the flow control.
		RK 3964/R	
F8H	-	Receive buffer is too short. End identifier could not be stored in the receive buffer.	Increase receive buffer.

Error number		Error description	Remedy
	RK 512 only		
SYSTAT	ANZW		
		RK 3964/R OT	
FEH	-	Transmission error: A transmission error (parity error, stop bit error, overflow error) has been detected. Repetitions are started if this occurred during transmission or reception. The error is signalled immediately if a faulty character is received in the idle state so that influences on the transmission line can be detected early.	Interferences on the transmission line cause message repetitions and thus reduce the throughput of useful data. The risk of an undetected error is increased. Change the system structure or reroute the cables. Check whether the baud rate, parity and number of stop bits are set equally on the two devices.
		RK 3964/R OT	
FFH	0FH	BREAK The connecting cable (receive line) to the partner is interrupted. This error number is repeated until the status is eliminated.	Reestablish the connection between the devices, or switch the partner on. Check in TTY mode that current flows in the idle state.

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8.1.2 Error Messages for SYSTAT, ANZW and REATEL, Arranged According to Numbers for ANZW

Error number		
RK 512 only		
ANZW	REATEL	SYSTAT
01H	0AH	01H
02H	14H/0CH	02H
03H	14H/0CH	03H
04H	0AH	04H
05H	0CH	05H
06H	0AH	06H, 10H–14H
07H	–	15H–18H, 1DH-1FH 20H-26H
09H	32H	30H
0AH	0AH, 0CH, 14H	31H–33H
0BH	10H, 12H 16H, 34H	2AH–2EH, 34H–36H, 39H, 3AH
0CH	36H, 2AH	27H–29H, 37H, 38H
0DH	–	2FH
0EH	–	E1H, E2H
0FH	–	FFH

8.1.3 Error Messages for SYSTAT, ANZW and REATEL, Arranged According to Numbers for REATEL

Error number		
RK 512 only		
REATEL	ANZW	SYSTAT
0AH	01H, 04H, 06H, 0AH	01H, 04H, 06H, 10H, 31H
0CH	02H, 03H, 05H, 0AH	02H, 03H, 05H, 32H, 46H, 48H, 49H
10H	0BH	35H, 40H, 43H, 44H
12H	0BH	39H
14H	02H, 03H, 0AH	02H, 03H, 33H, 45H
16H	0BH	34H, 41H, 42H
2AH	0CH	38H, 4EH
32H	09H	30H, 52H
34H	0BH	36H, 47H, 4BH, 4CH, 4DH, 5FH
36H	0CH	37H, 51H

8.2 Which Messages do you Receive from COM PP?

COM PP outputs text as necessary in the *message line* of a screen form. The texts belong to one of the following categories:

- Messages when loading the language-dependent text file (identification DAT)
- Error resulting from incorrect inputs (identification MF)
- Messages (identification MESS)
- Acknowledgements (identification ACK)
- Handling errors (identification ERR)
- Internal errors (identification IMF).

The texts themselves and their causes, meanings and effects are listed below. You are also informed of how to react to the various messages and to clear the error.

Message		**Explanation/troubleshooting**
DAT.001:	Problem reading desired DAT file → Default loaded	The desired text file (English, French, German) cannot be loaded. The corresponding *.DAT file must be present in the same directory as S5PXCPPX.CMD.
DAT.002:	Problem reading DAT file! Press F8!	None of the text files has been found. Check whether the *.DAT files are present in the same directory as S5PXCPPX.CMD. This error also occurs if the main memory on the PG is too small. Remove TSR programs if they are working under MS-DOS.
DAT.003:	Please wait...	This message is output when loading the COM PP.
DAT.004:	Loading DAT file...	This message is output when loading the DAT files.

Message	Explanation/troubleshooting
MF.001: Incorrect key	You have attempted to enter an illegal character in the input field marked by the cursor or you pressed the wrong function key.
MF.002: Incorrect input	The input in the field marked by the cursor is not between the permitted limits or is not one of the permitted alternatives. Press function key *F7* and read the information about this input field.

<table>
<tr><th>Message</th><th>Explanation/troubleshooting</th></tr>
<tr><td>MESS.001: Incorrect key</td><td>You have attempted to enter an illegal character in the input field marked by the cursor or you pressed the wrong function key.</td></tr>
<tr><td>MESS.002: Incorrect input</td><td>The input in the field marked by the cursor is not between the permitted limits or is not one of the permitted alternatives.
Press function key F7 and read the information about this input field.</td></tr>
<tr><td>MESS.003: DX1/DX2 found</td><td rowspan="6">These messages are displayed during the plausibility check. If the message "DX1/DX2/static parameter set/dynamic parameter set not found" appears, the program is incomplete.
You must then create the missing component.

The message "DX1/DX2 not found" is also displayed if you have initiated a cold restart but DX1/DX2 was not transferred to the interface.
First transfer DX1/DX2 to the corresponding interface.</td></tr>
<tr><td>MESS.004: DX1/DX2 not found</td></tr>
<tr><td>MESS.005: Static parameter set found</td></tr>
<tr><td>MESS.006: Static parameter set not found</td></tr>
<tr><td>MESS.007: Dynamic parameter set found</td></tr>
<tr><td>MESS.008: Dynamic parameter set not found</td></tr>
</table>

MESS.009: New file	This message appears when you select a new file.
MESS.010: Entered	Your input was checked and written to the external memory.
MESS.011: Job entered	A job belonging to a dynamic parameter set (e.g. SEND or FETCH) was checked and written to the external memory.
MESS.012: Job deleted	A job belonging to a dynamic parameter set (e.g. SEND or FETCH) was deleted but not written to the external memory.
MESS.013: Warning! Job faulty	Incorrect jobs have been found in the dynamic parameter set. The first error-free job is displayed. Page to job 1 and go through all the jobs step by step. Rewrite incorrect jobs.
MESS.014: No file of this type found on selected drive	A file of the type *ST.S5D (program file), *DR.INI (printer presets file), or *F1.INI (footer file) does not exist. Either enter a new program file name in the input field or create a new printer presets file or footer file using the STEP 5 package.
MESS.015: Limit reached	When editing the header or footer for the static parameter set, the limit of 554 characters including control characters and delimiters has been reached.
MESS.016: Insert function illegal	When editing the header or footer for the static parameter set, it is not possible to insert an extra line.
MESS.017: Printer not connected or not ready	Either there is no printer connected or the connected printer is not ready or not switched on.
MESS.018: Active	This message informs you that the PG is active and that you cannot make any entries at the moment. The message appears, e.g. when COM PP is loading a DAT file (texts).

MESS.019: Printing...	This message appears when the print function is active.
MESS.020: Printing aborted	This message appears when the print function was aborted with *F2*.
MESS.021: Printing finished	This message appears when the print function was completed correctly.
MESS.022: No memory space free. Press F8.	There is not enough memory in the PG or an internal system error has occurred. Exit COM PP and the S5 KOMI, then boot the PG and restart COM PP. If you are working with MS-DOS, remove any TSR programs.
MESS.023: Space not sufficient (max. data block length exceeded)	When assigning parameters to DX1/2, note that the static parameter set, the dynamic parameter sets and the coordination byte must be completely within the block boundaries in the DB.
MESS.024: Coordination bytes: limit value exceeded	The coordination bytes have different limits depending on whether they are in a DB, flag or S flag. Press function key *F7* and read the information about this input field.
MESS.025: Change the entry "Dynamic parameter set:" from "NO" to "YES"	You wanted to assign parameters for a dynamic parameter set. This is only possible, however, if you entered "Dynamic parameter sets: YES" when assigning parameters.
MESS.026: Dyn. param. set: last valid job with no. ###!	The maximum number of 188 programmable dynamic parameter sets can also be restricted by the particular location of the dynamic parameter sets and the static parameter set. COM PP calculates the last valid job.
MESS.027: Further jobs not possible acc. to DX1/2 parameter assignment	The maximum number of 188 programmable dynamic parameter sets can also be restricted by the particular location of the dynamic parameter sets and the static parameter set.

MESS.028: There are more than 256 files of this type	Only 256 files (program files, printer files) can be displayed in the selection window. Enter the required file name directly in the input field. If you are searching for a particular file which is not displayed in the selection window, leave COM and search in the operating system (DIR).
MESS.029: Transferred	This message appears following the successful transfer of data to the CP 544.
MESS.030: Deleted	This message appears following a delete operation on the CP 544.
MESS.031: Cold restart carried out	This message appears following a cold restart on an interface of the CP 544.
MESS.032: No new entries exist	You have repeatedly pressed the function key *F6* (READ) for the error output but no new error messages have been found.
MESS.033: No entries exist	You have pressed the function key *F6* (READ) for the error output but no error messages have been found. Alternately you have selected a path file which does not contain any paths.
MESS.034: BREAK present on receive line	You have pressed function key *F6* (READ) for the error output. A BREAK exists on the point-to-point link of the CP 544 (not on the CP-PG connection!). The listed error messages in the error output may be continuation errors resulting from the BREAK.
MESS.035: Start reached	You have pressed function key *F1* (PAGE BACKWARDS) or *F4* (CURSOR UP) or the corresponding cursor key for the error area output although you are already positioned at the beginning of the display area.
MESS.036: End reached	You have pressed function key *F2* (PAGE FORWARDS) or *F5* (CURSOR DOWN) or the corresponding cursor key for the error area output although you are already positioned at the end of the display area.

MESS.038: Transfer not executed	Transfer to DX1/DX2 not carried out (block faulty or transfer aborted by user).

ACK.001: Internal system error. Exit?	Exit COM PP by repeatedly pressing function key *F8*. Exit S5 KOMI as well and boot the PG. Then restart COM PP.
ACK.002: Internal system error. Exit?	
ACK.003: Screen form modified. Abort last entry?	This acknowledgement appears when you attempt to exit a screen form before importing your input. Press function key *F1* (YES), if you want to abort your input.
ACK.004: Continue?	Read the text in the info window. Press function key *F1* (YES) to execute the function (e.g. ESC or *F8*). Press function key *F3* (NO) and the last input is discarded and the COM PP remains in the current screen form.
ACK.005: Abort printing?	This message appears when you press function key *F2* (STOP PRINT) while printing out.
ACK.006: Link type changed. Enter?	A different link type from the one currently set is programmed in the .S5D file you have selected. Please remember that a different link type may also require changes or additions to the programmed data (static parameter set, dynamic parameter sets).

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<table>
<tr><td>ACK.007:</td><td>Link type changed. Stat. param. set must be generated again. Cont.?</td><td>The static parameter set already existed when the link type was changed. The static parameter set is now no longer suitable for the new link type and must be modified.
Press F1 (YES) to call the screen form for assigning parameters to the static parameter set. Press F3 (NO) to undo the modification to the link type.</td></tr>
<tr><td>ACK.008:</td><td>Stat. param. set longer. Overwrite data behind old stat. p. set?</td><td>After the static parameter set (at higher DW addresses) there may be data that have already been created with the DB editor or COM PP. If you change the link type, the mode of the static parameter set and the number or length of the header or footer (which together determine the length of the static parameter set), these data may be overwritten. COM PP detects this and displays this message.
If you press F1 (YES) the current parameter set overwrites the existing data in the data block. If you press F3 (NO) you remain in the current screen form and the data after the old unmodified static parameter set remain unchanged.</td></tr>
<tr><td>ACK.009:</td><td>Overwrite non-interpretable data in DB with stat. param. set?</td><td rowspan="2">The location you have selected for the static or dynamic parameter set is at an address where there are already data in the data block. These data cannot be interpreted as COM PP parameter sets. If necessary, you can check the DB using the DB editor.
If you press F1 (YES), the current parameter set overwrites the existing non-interpretable data. If you press F3 (NO), the data are not overwritten.</td></tr>
<tr><td>ACK.010:</td><td>Overwrite non-interpretable data in DB with dyn. param. set?</td></tr>
<tr><td>ACK.011:</td><td>Link type changed. Overwrite data in DB with stat. param. set?</td><td>A static parameter set already exists.
If you press F1 (YES), the old parameter set is overwritten. If you press F3 (NO), COM PP remains in the currently displayed screen form and the parameter set is not stored.</td></tr>
</table>

<table>
<tr><td>ACK.012:</td><td>Stat. param. set faulty. Must be generated again. Continue?</td><td rowspan="2">The data in the parameter set are incorrect and cannot be interpreted by COM PP. The data block may contain data you created previously with the DB editor or with COM PP.
Using the DB editor, check and if necessary change the location of the parameter set ("from DW") in the parameters in DX2.
If you press F1 (YES) you can create a new parameter set and overwrite the non-interpretable data. If you press F3 (NO), COM PP remains in the currently displayed screen form.</td></tr>
<tr><td>ACK.013:</td><td>Dyn. param. set faulty. Must be generated again. Continue?</td></tr>
<tr><td>ACK.014:</td><td>Link type changed. DX1/DX2 must be generated again. Continue?</td><td>A DX1/DX2 already exists. If you press F1 (YES) you can assign new parameters for DX1/DX2. If you press F3 (NO), COM PP remains in the currently displayed screen form.</td></tr>
<tr><td>ACK.015:</td><td>DX1/DX2 faulty. DX1/DX2 must be generated again. Continue?</td><td>The data from DW 0 onwards of DX1/DX2 are incorrect and cannot be interpreted by COM PP: You may have made a mistake when generating DX1/DX2 with the DB editor.
Check the DB with the DB editor. If you press F1 (YES), you can create a new DX1/DX2 and overwrite the non-interpretable data. If you press F3 (NO), COM PP remains in the currently displayed screen form.</td></tr>
<tr><td>ACK.016:</td><td>Link type changed. Overwrite existing DX1/DX2 ?</td><td>A DX1/DX2 already exists. If you press F1 (YES), the old DX1/DX2 is overwritten. If you press F3 (NO), COM PP remains in the currently displayed screen form and the old DX1/DX2 is retained.</td></tr>
<tr><td>ACK.017:</td><td>Overwrite non-interpretable data in DX1/DX2 ?</td><td>COM PP cannot interpret the data in DX1/DX2. Check the DB with the DB editor.
If you press F1 (YES), the DX1/DX2 currently displayed by the COM overwrites the existing but not-interpretable DX2. If you press F3 (NO), COM PP remains in the currently displayed screen form and the old DX1/DX2 is retained.</td></tr>
</table>

ACK.018:	Link type changed. Stat. p. set 2 must be generated again. Cont?	You have changed the link type to "open driver" and the static parameter set, part 2, must be recreated. If you press *F1* (YES), the screen form STAT. PARAMETER SET 2 (PRINTER) appears. If you press *F3* (NO), COM PP remains in the currently displayed screen form.
ACK.019:	Stat. param. set 2 faulty. Must be generated again. Continue?	The static parameter set, part 2, cannot be interpreted by COM PP. The data block may contain data you created previously with the DB editor or with COM PP. Check the DB with the DB editor. If you press *F1* (YES), you can create a new static parameter set, part 2, and overwrite the non-interpretable data. If you press *F3* (NO), COM PP remains in the currently displayed screen form.
ACK.020:	Job faulty. Must be generated again. Continue?	In the dynamic parameter set you pressed *F1, F2* (PAGE BACKW./FORW.) or *F4* (GO TO JOB) and COM PP has recognized that the next job is incorrect. If you press *F1* (YES), the screen form for the next job is displayed with the defaults. If you press *F3* (NO), COM PP remains in the current job. You can obtain other jobs by pressing *F4.*
ACK.021:	Quit COM?	With this acknowledgement you indicate whether or not you want to exit COM PP. If you press *F1* (YES), you exit COM PP and return to the S5 KOMI. If you press *F3* (NO), COM PP remains in the currently displayed screen form.

ACK.022:	Stat. param. set 1 not yet in external memory. Quit screen form?	The static parameter set, part 1, is only stored together with the static parameter set, part 2, on an external data medium (diskette) for the link type "open driver" in the mode "PRINTER OUTPUT". Press *F6* (ENTER) in the STAT. PARAMETER SET 2 (PRINTER) screen form. If you exit the screen with *F8* (RETURN), the static parameter set, part 1, is not written to diskette. If you press *F1* (YES), you exit the screen form and the static parameter set is not entered. If you press *F3* (NO), COM PP remains in the currently displayed screen form.
ACK.023:	SYSID file cannot be read or interpreted. Create?	The system name and the creation date are stored in the SYSID file. The file is required when writing the PROM. This message is output if the file cannot be read or interpreted by COM PP. If you acknowledge with "YES", the old SYSID file is deleted and a new one created.
ACK.024:	Comment not yet on external memory. Leave screen form?	The comment on the interface is only stored when importing the following screen form (3964/3964R PROCEDURE or OPEN DRIVER). The comment cannot be stored on its own.
ACK.025:	Interface already assigned parameters. Overwrite?	You have already assigned parameters to an interface. Press *F1* (YES) to overwrite. Press *F3* (NO) to retain.
ACK.026:	Parameter already exists on disk. Overwrite?	Parameters already exist on diskette. Press *F1* (YES) to overwrite. Press *F3* (NO) to retain.

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ERR.001: Internal error following read/write access to external memory	Exit COM PP by repeatedly pressing *F8* ! Exit S5 KOMI as well and boot your PG. Then start COM PP again. The programmed data may be lost (on diskette or hard disk). For this reason always make a back-up copy.
ERR.002: External memory (diskette) faulty or drive not available	The diskette drive is open, the diskette or drive is not correctly formatted or is defective. You have selected a drive which does not exist. Close the drive or format the diskette correctly. Create the drive if applicable.
ERR.003: External memory (diskette) write-protected	The diskette cannot be written. Remove the write-protect tab or use a different diskette.
ERR.004: File is write-protected	You cannot write the file you have selected. Change the attribute of the file (PCPM: SET XXXXXXST.S5D [RW]) or select a new file.
ERR.005: File cannot be interpreted (not a STEP 5 file)	The file you have selected does not have a STEP 5 format and cannot be read. Enter a different file name.
ERR.006: Diskette has been changed	During an editing session with COM PP, the diskette was changed. This is not permitted. Insert the original diskette in the drive again.
ERR.007: DX1/DX2 faulty	This message is displayed during the plausibility check. Set up a new DX1/DX2 with COM PP.
ERR.008: Printer parameters cannot be read	An error has occurred reading the printer file or the printer file does not exist. Set up a new printer file with the STEP 5 basic package keeping to the name convention *DR.INI.
ERR.009: Print to file not possible	There is not enough memory for the print to file function. Create space on the PG by deleting unnecessary files.

ERR.010: Static parameter set faulty	These messages appear during the plausibility check. Set up new parameter sets with COM PP.
ERR.011: Dynamic parameter set faulty	
ERR.012: External memory (diskette) full	There is not enough space on the diskette and the data cannot be stored. Exit COM PP and delete the files you no longer require.
ERR.013: Directory full	No more files can be created because the maximum number of files has been reached. Exit COM PP and delete the files you no longer require.
ERR.014: File does not exist	The file you have selected (e.g. footer file) does not exist.
ERR.015: File too big	The file cannot be read into COM PP.
ERR.016: Illegal ack. delay time (HELP: limit values. SELECT: min value).	The limit for the acknowledgement delay time has been exceeded. Remember that the minimum values vary with the transmission speed. Press *F7* to display the limit or *F3* to obtain the minimum value suitable for the transmission speed.
ERR.017: Illegal char. delay time (HELP: limit values. SELECT: min value)	The limit for the character delay time has been exceeded. Remember that the minimum values vary with the transmission speed. Press *F7* to display the limit or *F3* to obtain the minimum value suitable for the transmission speed.
ERR.018: Drive not available	You have selected a non-existent drive.

ERR.019: Static parameter set 1 faulty	These messages appear during the plausibility check. Set up the appropriate new parameter set.
ERR.020: Static parameter set 1 too short. Cannot be interpreted	
ERR.021: Static parameter set 2 faulty	
ERR.022: Static parameter set 2 too short. Cannot be interpreted	
ERR.023: Parameter set too long (max. data block address DW 2042 exceeded)	The parameter set cannot be stored. Change the mode of the static parameter set (select shorter mode) or shorten the header/footer or change your entry for "from DW" in the parameters for DX1/DX2.
ERR.024: No. of header/footer lines illegal (cannot be processed)	The header/footer editor cannot interpret the header/footer of the static parameter set (number of lines and delimiters do not correspond to the text).
ERR.025: DX1/DX2 too short. Cannot be interpreted	These messages appear during the plausibility check. Set up the appropriate new parameter set.
ERR.026: DX1/DX2 faulty	
ERR.027: Stat. param. set too short. Cannot be interpreted	
ERR.028: Dyn. param. set too short. Cannot be interpreted	
ERR.029: No. of header/footer lines in static parameter set 2 illegal	

ERR.030: Static parameter set and coordination bytes overlap.	When you assigned parameters, you specified the location of the receive mailbox and the parameter sets such that at least two memory areas are in the same data block and overlap each other. This error only occurs if the parameters have not been entered using the COM PP and were transferred to the CP using data handling blocks. Change the parameters.
ERR.031: Static parameter set and dynamic parameter set overlap	
ERR.034: Dynamic parameter set and coordination bytes overlap	
ERR.037: Static parameter set and receive mailbox overlap	
ERR.040: Receive mailbox and coordination bytes overlap	
ERR.041: Error reading external memory. Plausibility check not done.	When you exit a user program (return to the screen form "SELECTION") a plausibility check is made on the parameter sets. This means that all the data blocks involved must be read from external memory (diskette). If an error occurs when reading from diskette (e.g. diskette drive opened accidentally), the plausibility check cannot be performed.
ERR.042: Static parameter set overlaps mailboxes or coordination bytes	If the static parameter set and the data programmed in DX1/2 are in the same data block, the data may overlap if the static parameter set is extended. Change the location of the mailboxes, coordination bytes and parameter sets in DX1/DX2.
ERR.043: Internal system error	Exit COM PP by repeatedly pressing *F8* ! Exit S5 KOMI as well and boot your PG! Then start COM PP again.

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ERR.044: SYSID cannot be interpreted	The SYSID file (system identification) read by the CP cannot be interpreted by COM PP. Check that a CP 544 is inserted and that the PG-CP cable is connected. Check that the CP 544 and COM PP versions match. Repeat the last operation. Perhaps try by switching the CP off/on.
ERR.045: The interface parameters to be transferred do not yet exist	You wanted to transfer interface parameters (from the PG or CP) which do not yet exist.
ERR.046: PG interface cannot be initialized	Error when initialising the serial PG interface (possibly the cable to the CP was not connected previously and you have now connected it). Repeat the last operation (e.g. transmit, delete).
ERR.047: Communication error between PG and CP	A communication error has occurred between the PG and CP 544. The SYSID cannot be read. Repeat the last operation (e.g. transfer). Check that a CP 544 is inserted and that the PG-CP cable is connected.
ERR.048: No CP 544 plugged	The SYSID cannot be read by the CP or the SYSID read by the CP does not contain the identification "CP544". Check that a CP 544 is inserted and that the PG-CP cable is connected.
ERR.049: CP error. No test area received	You pressed *F6* (READ) during the error output but the corresponding test blocks could not be received by the PG. Switch off the CP and on again and repeat the operation.
ERR.050: CP memory is full	You wish to transfer data to the CP, but the CP or memory card has insufficient space. Use a larger memory card.

ERR.051: Block exists in EPROM	You wished to create, transmit or delete an interface on the CP. The EPROM cannot be overwritten or deleted, however.
ERR.052: Memory error in CP RAM	The CP is in an undefined state. Switch the CP off and on again (remove module from rack if applicable).
ERR.053: Function illegal in current CP status	Certain COM PP functions (test functions) are only permissible in specific CP states (STOP, RUN, TEST).
ERR.054: Compression of CP memory aborted	The CP 544 memory was being reorganized but could not be completed (e.g. because of brief voltage dip in power supply). The memory is nevertheless consistent and you can continue working.
ERR.055: User submodule not present in CP	This message is output if you wish to transfer reloadable drivers to the CP (only possible in next version of COM PP). Insert a memory card into the CP.
ERR.056: Error in user submodule of CP	This error may occur with a brief voltage dip. It may also mean that the memory card or the internal RAM of the CP is faulty. Try to repeat the last operation. Switch the CP off and on again (remove CP from rack). Replace the memory card if the error has not yet been cleared. The module may be faulty if you are not using a memory card or if the error occurs with the card replaced.
ERR.057: User submodule in CP is EPROM	You wanted to transfer/delete data on the CP. The user submodule is an EPROM, however, and cannot be overwritten. Insert a RAM user submodule.

ERR.058: Data block (DX1/DX2) cannot be loaded	The parameter set which you wished to transmit cannot be loaded onto the CP 544. The CP checks the parameter set (DX1/DX2) transmitted from the COM PP. This error should not actually occur since the COM PP itself carries out a test prior to the transfer. The COM PP carries out a test when selecting a program (screen form SELECTION). Return to this form and carry out the test. If you have generated the parameter set online, attempt to enter the parameters again. If this still does not work, the CP and COM PP versions do not correspond, or either the CP or the COM PP is faulty.
ERR.059: CP memory write-protected	You have inserted a memory card in the CP but have set the write-protect function.
ERR.060: Protocol error in CP - PG communication	A general error (protocol error) has occurred during the CP - PG transmission. Repeat the last operation. Check whether the cable is subject to external interferences.
ERR.061: Internal error in CP	The CP 544 is in an undefined status. Communication between the CP 544 and the PG is not possible. Switch the CP off and on again (remove briefly from rack). The CP is faulty if this is unsuccessful.
ERR.062: Timeout in CP - PG communication	The CP 544 does not reply within a defined acknowledgement time. Check the connection cable to the CP 544. Check whether the correct module is inserted and switched on. Leave the COM if applicable and recall it. Switch off the CP if applicable and then on again by pulling it briefly out of the rack.
ERR.063: Transmission error	A general error (in the bottom transmission layer) has occurred in the CP - PG transmission. Repeat the last operation. Check whether the cable is subject to external interferences.

ERR.064: AS interface in PG not ready	Serial interface of PG in undefined status (possibly the cable to the CP was not connected previously and you have now connected it). Repeat the last operation (e.g. transmit, delete).
ERR.065: External memory (diskette) full or directory full	Insufficient space on the diskette, or the maximum number of files has been exceeded. Exit COM PP and delete the files you no longer require.
ERR.066: Path selection unsuccessful. Path cancelled	The online connection from the COM PP to the CP 544 could not be established. Check that all modules and connections are configured correctly in your bus configuration. Try the last operation again.
ERR.067: Path does not match KOMI default setting	The defined path does not match the default setting. The default setting is specified outside the COM PP in the S5 KOMI (e.g. AS 511, SINEC L2). Select a matching path or modify the path in the package "BUS SELECTION".
ERR.068: Path does not exist in path file	You can only specify paths which are already present in the path file. COM PP displays all existing paths for the specified path file when you press F3 (SELECT).
ERR.069: H1-CP not configured	The online connection from the COM PP to the CP 544 could not be esatblished via SINEC H1. Your local H1-CP in the PG is not configured.

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IMF.001: Screen form not found	Exit COM PP by repeatedly pressing *F8*. The configured data may be lost (on the external memory). For this reason always make a back-up copy.
IMF.002: Field not found	
IMF.003: Illegal call	

9

What is a Typical Application of the CP 544?

Contents of Chapter 9

9 What is a Typical Application of the CP 544?

The following application example shows how you can actually use the CP 544 communications processor. The RK 512 computer link has been selected as the data transmission mode. The example is also interesting if you wish to use the 3964/3964R procedures or the open driver since it indicates the basic procedure when using the CP 544.

The application example is divided as follows:

- You will first be informed of the prerequisites necessary to implement the point-to-point link described
- The required hardware settings are then explained
- The next step describes how you can assign parameters to the CP 544 using the COM PP parameter assignment software
- You are finally shown how the associated STEP 5 program should appear for the CPU of the programmable controller.

9.1 Prerequisites

You require the following if you wish to implement the described application example:

Hardware

- Two CP 544 modules
- Two interface submodules (e.g. TTY)
- One connecting cable CP 544 ↔ CP 544 (TTY)
- One PG 7xx programmer
- One adapter cable PG ↔ CP 544
- Two S5-135U programmable controllers
- Two CPU 928 modules with RAM submodule
- One connecting cable PG ↔ CPU 928

and if possible:

- One digital input module (24 V, min. 8 channels)
- One digital output module (24 V, min. 8 channels)

and:

Software

- The S5-DOS parameterization package COM PP
- The STEP 5 basic package for the PG 7xx programmer (supplied with your programmer)
- Data handling blocks for the CPU 928.

9.2 Objective

The following tasks must be solved:

- Data are transmitted from a data block in one PLC to a data block in the other PLC
- The data are subsequently fetched from the data block of the second PLC and stored in a data block
- A flag word is then sent cyclically to a data word of the partner
- The acceptance of this cyclically sent data is inhibited by a coordination flag
- A PSEUDO-WRITE job is programmed to demonstrate the PSEUDO-READ/WRITE function and used to send an input byte to a data word of the partner
- Reading of the error message area in the SYSTAT is carried out
- Reading and adjustment of the CP 544 hardware clock are shown, and the synchronization of several CP hardware clocks explained.

The individual tasks are limited to that which is absolutely essential and are loosely based on one another.

The DIRECT jobs (i.e. the jobs which trigger job processing) are entered into the queue of the CP 544 which accommodates 20 jobs and processed in the order in which they are entered. Jobs which are already in the queue are not entered again. Since less than 20 DIRECT jobs are programmed in this application example, a triggered DIRECT job is always processed. Interlocking of jobs is therefore unnecessary in this application example.

9.3 Hardware

A point-to-point link is to be made between two SIMATIC S5 programmable controllers in this application example. The programmable controllers used are two S5-135Us with one CPU 928 each.

S5-135Us

Insert the two CPUs 928 into the provided slots of the two S5-135Us. Carry out an overall reset for the CPUs and then switch the mode selector to STOP.

1st CP 544

Set page frame number 2 on a CP 544, i.e. press down all switches in switch assembly S2 apart from position 1. Enable the communication flag bytes 0 to 31 on this CP 544 by setting all switches in switch assembly S4 upwards apart from position 0. Set the number of pages per interface to 1 by pressing down the switch at position 1 in switch assembly S5 and setting the switch at position 0 upwards. Insert this CP into a provided slot (see Section 2.5) in one of the S5-135Us.

2nd CP 544

Set the page frame number to 0 on the other CP (press down all switches in switch assembly S2) and disable all communication flags (set all switches in switch assembly S4 upwards). Set the number of pages per interface to 1 by pressing down the switch at position 1 in switch assembly S5 and setting the switch at position 0 upwards. Insert the CP 544 into a provided slot (see Section 2.5) in the other S5-135U.

Connecting cable

Connect the top device interfaces (SI 1) of the two CPU modules together using the associated connecting cable.

Input/output modules

Set the module address to 0 on the digital input module and the digital output module. The input byte IB 0 and the output byte QB 0 are available for this purpose. Insert the modules into any free slots in one of the S5-135Us.

Assignment of input byte IB 0:

Bit 0	Not used
Bit 1	Trigger SEND 1 PLC job (see Section 9.7)
Bit 2	Trigger FETCH 2 PLC job (see Section 9.8)
Bit 3	Trigger PSEUDO-WRITE PLC job (see Section 9.11)
Bit 4	Reset error message area in SYSTAT (see Section 9.12)
Bit 5	Trigger date/time synchronization (see Section 9.13.3)
Bit 6	Trigger date/time setting (see Section 9.13.2)
Bit 7	Reset coordination flag (see Section 9.10)

Assignment of output byte QB 0:

Bit 0	SYNCHRON parameterization error (see Section 9.7)
Bit 1	Error with SEND 1 PLC job (see Section 9.7)
Bit 2	Error with FETCH 2 PLC job (see Section 9.8)
Bit 3	Error with PSEUDO-WRITE job (see Section 9.11)
Bit 4	Error when reading SYSTAT error message area (see Section 9.12)
Bit 5	Error when reading CP 544 clock (see Section 9.13.1)
Bit 6	Error when setting CP 544 clock (see Section 9.13.2)
Bit 7	Error when synchronizing slave clocks (see Section 9.13.3)

If you do not have any input/output modules, use flag byte FY 0 instead of input byte IB 0. You can modify these flags using the STEP 5 online function FORCE VARIABLE. In the description below, the S5-135U which also contains the digital input/output modules is referred to as PLC 1, and the other S5-135U as PLC2.

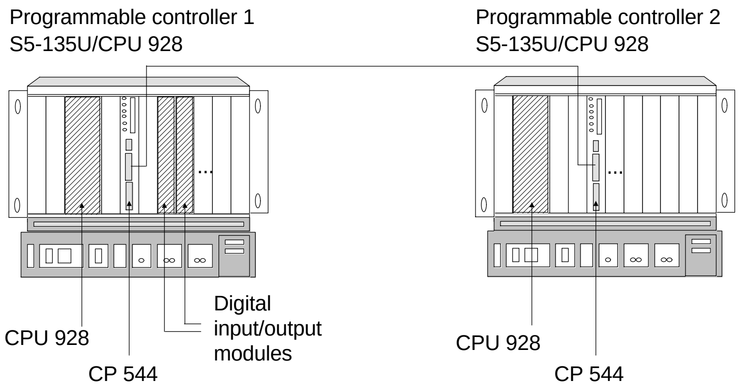


Fig. 9-1 System configuration in application example

Programmer

Connect the PG 7xx programmer to the PG interface of the CP 544 using the corresponding adapter cable.

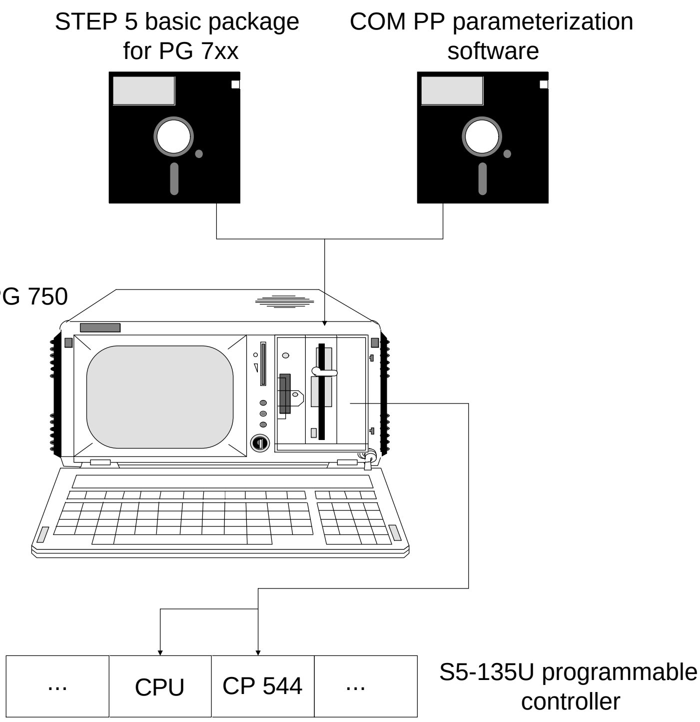


Fig. 9-2 Use of programmer for point-to-point link

9.4 COM PP Parameterization Package

The prerequisites for the generation of the parameter sets for the computer link are provided in this section.

9.4.1 Installation of COM PP on the PG 7xx

You require a PG 7xx programmer in which the STEP 5 basic package is already installed.

Select drive C: user level 0 by entering

0:

Copy the contents of the COM PP floppy onto the hard disk drive user level 0 using

PIP C:=A:*.*[R V]

(option: V = copy check, R = copy SYS files)

Declare the COM PP files as write-protected system files using

SET S5PXCPPX.CMD [SYS RO]
SET S5PDCPPX.CMD [SYS RO]
SET S5PECPPX.CMD [SYS RO]
SET S5PFCPPX.CMD [SYS RO]

You can now use COM PP in every user level.

Leave user level 0 using

n: (n = required user level)

9.4.2 Call COM PP

Now call the package selection form using

S5

Position the cursor to the line "COM PP" and select the COM PP parameter assignment software for the CP 544 using function key F1 (PACKAGE).

The COM PP startup form appears.

9.5 CP 544 Parameter Sets for PLC 1

Generate the parameter sets for the CP 544 using the COM PP parameter assignment software.

Following selection of the language, you are provided with the screen form "SELECTION". Enter the following values:

Parameterization of module	CP 544
Program file	C:RKCP01ST.S5D
SYSID file	C:RKCP01SD.INI
System name	Application example
Generation date	00.00.00 (actual date)
Interface	1
Path file	AP.INI
Path name	
Data to	FILE

Import the entered data.

Then access the screen form "CONFIGURATION" and enter the following parameters:

Type of link	RK 512 WITH 3964R WITH DEFAULT VALUES
Comment	Application example, generated by ....

Import the entered data.

9.5.1 Assign Parameters to Static Parameter Set

Enter the following parameters in the screen form "STATIC PARAMETER SET":

<table>
<tr><td>Transmission mode</td><td colspan="2">MODE 1: RK 512 WITH 3964 WITH DEFAULT VALUES</td></tr>
<tr><td>Baud rate</td><td colspan="2">9600 bps</td></tr>
<tr><td>Parity</td><td colspan="2">EVEN</td></tr>
<tr><td>Bits per character</td><td colspan="2">8</td></tr>
<tr><td>Stop bits</td><td colspan="2">1</td></tr>
<tr><td>Priority</td><td colspan="2">HIGH</td></tr>
<tr><td>Character delay time</td><td>22 * 10 ms</td><td rowspan="4">These parameters are automatically entered in the current mode.</td></tr>
<tr><td>Acknowledgement delay time</td><td>55 * 10 ms</td></tr>
<tr><td>Number of connection attempts</td><td>6</td></tr>
<tr><td>Number of repetitions</td><td>6</td></tr>
</table>

Import the entered data.

9.5.2 Transfer Parameters to CP 544 User Memory

Transfer the generated parameters to the CP 544 user memory (internal RAM or RAM user submodule) by means of the screen form "TRANSFER":

- first select the transmission direction and then
- specify the CP interface.

	Source	Destination
Data medium	FD	CP
Drive	B	
Interface	1	1
Program name	RKCP01ST.S5D	

You must restart the CP 544 following transmission of the parameters. Do this by pressing the function key "COLD RESTART" for the corresponding device interface. The LED TXD 1 on the front panel of the CP 544 must not subsequently light up permanently (see Section 2.10). The parameter settings are not correct or are incomplete if this is the case.

You have then carried out all preparations on the CP in PLC 1 for programming the RK 512 computer link function.

9.6 CP 544 Parameter Sets for PLC 2

The parameter settings of the computer link for the CP 544 in PLC 2 are identical to the parameter settings of the computer link for the CP 544 in PLC 1 apart from the setting of the priority in the static parameter set. You can therefore copy the file in which the parameters are stored. To do this, leave STEP 5 and copy at the operating system level. The command with PCP/M is e.g.:

```
PIP RKCP02ST.S5D = RKCP01ST.S5D
```

Subsequently change the priority to LOW using COM PP and transfer the modified file to the CP 544 in PLC 2.

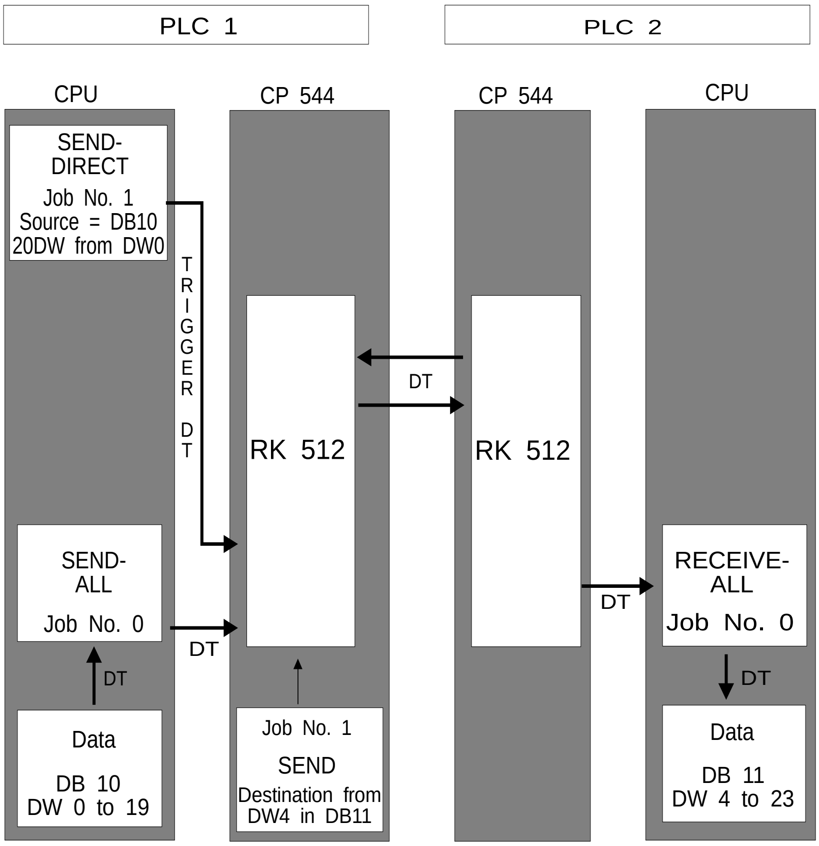
The parameter settings for the two CP 544 modules have then been completed and you can now commence with generation of the STEP 5 program.

9.7 SEND Job from Data Block to Data Block

Start with a SEND job from PLC 1 to PLC 2.

Task

20 data words are to be transferred from data block DB 10 (starting at data word DW 0) in the CPU 928 of PLC 1 to data block DB 11 (starting at data word DW 4) in the CPU 928 of PLC 2. The source and destination data can thus be completely different.
The following program structure is then required:



DT = data transfer

Fig. 9-3 Structure of a SEND job from DB to DB

The static parameters have already been loaded into the user memories of the two CPs 544 (see Section 9.5.2).

A job need only be programmed on the CP 544 in the active PLC. The active PLC is the one which triggers the data exchange. You need thus only program a SEND job for the CP 544 of PLC 1.

The SEND job is triggered by the CPU by calling the data handling block SEND-DIRECT with job number "n". Select job number 1. The associated job on the CP 544 has the same job number "n". This job contains information on the data destination in PLC 2.

The CP 544 then fetches the data by calling the data handling block SEND-ALL and transfers the data from the CPU/DB 10 to the CP 544 in PLC 2.

The CP 544 receives the data in PLC 2. By calling RECEIVE-ALL, it stores the data in the destination defined by PLC 1.

The SEND-ALL has the job number A-NR 0. It is called unconditionally in every program cycle and examines in the CP 544 (dual-port RAM) whether the CP requires data. If yes, the SEND-ALL fetches these from the defined source and transfers them to the CP 544. If data are not required, the function block is left and the cyclic program continued.

The RECEIVE-ALL has the job number A-NR 0. It is called unconditionally in every program cycle and examines in the CP 544 (dual-port RAM) whether the CP wishes to transfer data to the CPU. If yes, the RECEIVE-ALL stores these at the destination address defined by the CP 544. If data are not to be transferred, the function block is left and the cyclic program continued.

9.7.1 CP 544 Parameter Sets for PLC 1

The parameter settings of the computer link on the CP 544 in PLC 1 must be extended by the dynamic parameter set for job 1. You can access the screen form "DYNAMIC PARAMETER SET" in the COM PP by pressing the key "ENTER" in the screen form "CONFIGURATION". Enter the following parameters:

Job No.	1
Job	SEND
Data destination	DATA BLOCK
DB No.	11
Destination address from	4 dec.

You need not specify a CPU number since this is not multi-processor mode. A coordination flag need not be entered either. Import the entered data.

Subsequently transfer the dynamic parameter set to the CP and carry out a cold restart as described in Section 9.5.2.

9.7.2 STEP 5 Program for PLC 1

Call the S5 package LAD, CSF, STL, name your STEP 5 program file "B:RKAG01ST.S5D" and select STL. Transfer the data handling blocks for the CPU 928 into this program file. Connect the CPU 928 to the PG 7xx.

The STEP 5 program must:

- Synchronize the CPU and CP 544 during the PLC startup
- Trigger the SEND job
- Transfer the data from the CPU to the CP 544.

9.7.2.1 Starting the Program

You must call the data handling block SYNCHRON unconditionally in the restart organization blocks OB 20, OB 21 and OB 22.

SYNCHRON

The interface number SSNR for the device interface 1 (SI 1) is the same as the set page number "2". Select frame size "2". Data can then be transferred in portions of up to 32 bytes at once between the CPU and CP 544. Any other frame size can also be used.

If you wish to transfer more data than correspond to the set frame size, the CP 544 simply requests the remaining data with further SEND-ALL calls.

You can use the frame size to decide whether you wish to transfer large or small amounts of data per SEND-ALL (and RECEIVE-ALL) call. In the case of a small frame size, the data exchange is distributed amongst several cycles, and only requires a small portion of the cycle time. Large amounts of data can be transmitted at once using large frame sizes, but this requires a larger cycle time.

Use flag byte "FY 10" as the parameterization error byte PAFE.

Restart organization blocks OB 20, OB 21 and OB 22

The restart organization blocks OB 20, OB 21 and OB 22 thus appear as follows:

```
     : JU     FB125    SYNCHRONIZATION CP 544 ↔ CPU
NAME : SYNCHRON
SSNR :        KY0,2    INTERFACE NUMBER 2
BLGR :        KY0,2    FRAME SIZE: 2 (MAX. 32 BYTE)
PAFE :        FY10     PARAMETERIZATION ERROR BYTE
     :
     :        BE
```

A parameterization error is to be indicated at digital output Q 0.0. Since a process image, and thus digital inputs/outputs, cannot be processed in the restart organization blocks, the indication can only be made in the cyclic program (OB 1). If an error occurs here, check whether the interface number and page number are the same. If this is the case, the error indicates a hardware fault. A computer link cannot be carried out in this case.

9.7.2.2 Cyclic Program

At the beginning of the cyclic program, an indication is first made of whether a parameterization error has occurred during the restart.

SEND-DIRECT

The SEND job is triggered by a SEND-DIRECT call, i.e. a call of the data handling block SEND with a job number not equal to 0 (job number 1 in the example). The job number on the SEND-DIRECT must agree with that of the job in the CP 544. The job is to be executed if a positive edge appears at digital input I 0.1.

The interface number SSNR "2" and the job number A-NR "1" must be programmed. Select the status word ANZW "FW 11" and parameterization error byte PAFE "FY 15". The status word occupies two words. Flag word FW 11 indicates the job status and error messages, if any. The number of transmitted data per SEND-ALL call is indicated in flag word FW 13.

Information on the source of the data in the CPU must be made on the data handling block with the SEND job. The data source is to be a data block (source type QTYP "DB") with the number DBNR "10". The source start QANF is data word "0", and the source length QLAE is "20" data words.

The SEND job is triggered by the result of the logic operation 1. If the result of the logic operation with the call is 0, the status word is only updated.

The termination of the job with an error, or the occurrence of a parameterization error, is indicated at the digital output Q 0.1. In the event of an error, evaluate the error numbers in the parameterization error byte PAFE, the status word ANZW and the error message area in the SYSTAT (see also Section 9.12).

SEND-ALL

The job is triggered by the SEND-DIRECT call. The data are transmitted by the SEND-ALL call. The interface number must also be SSNR "2". The job number A-NR is "0". We shall select status word ANZW "FW 16" and parameterization error byte "FY 18". The status word is only one word long with the ALL function. The least significant byte (FY 17) indicates the number of the job for which the SEND-ALL is currently transmitting data from the CPU to the CP, i.e. job number 1 in our case.
The SEND-ALL can be called with any result of the logic operation.

Organization block OB 1

The corresponding program in the cyclic organization block OB 1 is shown below.

```
        : A     F 10.0   IF SYNCHRON PARAMETERIZATION
        : =     Q 0.0    ERROR HAS OCCURRED → SET
        :                OUTPUT
        :
        : AN    I 0.1    EDGE EVALUATION:
        : R     F 2.1    THE RESULT OF THE LOGIC
        : A     I 0.1    OPERATION RLO IS SET FOR A
        : AN    F 2.1    CYCLE IF THE SIGNAL AT
        : S     F 2.1    INPUT I 0.1 CHANGES FROM 0 TO 1 .
        :
        : JU    FB120    TRIGGER SEND JOB 1
NAME    : SEND
SSNR    :       KY0,2    INTERFACE NUMBER 2
A-NR    :       KY0,1    JOB NUMBER 1
ANZW    :       FW11     STATUS WORD
QTYP    :       KSDB     SOURCE TYPE DATA BLOCK
DBNR    :       KY0,10   SOURCE DATA BLOCK DB 10
QANF    :       KF+0     SOURCE START DATA WORD 0
QLAE    :       KF+20    SOURCE LENGTH 20 DATA WORDS
PAFE    :       FY15     PARAMETERIZATION ERROR BYTE
        :
        : 0     F 12.3   JOB 1 FINISHED WITH ERROR
        : 0     F 15.0   OR PARAMETERIZATION ERROR
        : =     Q 0.1    INDICATE AT OUTPUT Q 0.1
        :
        : JU    FB126
NAME    : SEND-A
SSNR    :       KY0,2    INTERFACE NUMBER 2
A-NR    :       KY0,0    JOB NUMBER 0 0
ANZW    :       FW16     STATUS WORD
PAFE    :       FY18     PARAMETERIZATION ERROR BYTE
        :
        : BE
```

9

Data block DB 10

Only the data source is now missing – data block DB 10. It should be at least 63 data words long so that its length is also sufficient for the other application examples. Assign the first 20 data words DW 0 to DW 19 with values not equal to 0.

Transfer the data handling blocks for the PLC 1 and OB 20, OB 21, OB 22, OB 1 and DB 10 to the user memory of your CPU. Carry out a cold restart on the CPU. The green LED (RUN display) must light up. The LED TXD 1 goes out on the CP.

9.7.3 CP 544 Parameter Sets for PLC 2

No modifications are made to the previous parameter settings of the computer link from Section 9.6 since a job is not required in the passive PLC 2, and thus no dynamic parameter set either.

Set the CP 544 to operating mode RUN. The red interface-specific LED display TXD 1 on the CP 544 continues to flash slowly. The parameter settings are incorrect or incomplete if this is not the case, or there is a CP 544 hardware error.

9.7.4 STEP 5 Program for PLC 2

Connect the CPU 928 to the PG 7xx.

Call the S5 package LAD, CSF, STL, name your STEP 5 program file for the PLC 2 "B:RKAG02ST.S5D" and select STL. Transfer the data handling blocks for the S5-135U into this program file.

The STEP 5 program must

- synchronize the CPU and CP 544 when restarting the PLC,
- transfer the received data from the CP 544 to the CPU.

9.7.4.1 Starting the Program

You must call the data handling block SYNCHRON unconditionally in the restart organization blocks OB 20, OB 21 and OB 22.

SYNCHRON

The interface number SSNR for the device interface 1 (SI 1) is the same as the set page frame number "0". We shall select the smallest frame size "1". Data can thus be transferred in portions of up to 16 bytes at once between the CPU and CP 544. Any other frame size can also be used.

If more than 16 bytes are transmitted, the remaining data are simply stored in the CPU with further RECEIVE-ALL calls.

You can use the frame size to define whether you wish to transfer large or small amounts of data per RECEIVE-ALL (and SEND-ALL) call. In the case of a small frame size, the data exchange is distributed amongst several cycles, and only requires a small portion of the cycle time. Large amounts of data can be transmitted at once using large frame sizes, but this requires a larger portion of the cycle time.

Use flag byte "FY 10" as the parameterization error byte PAFE.

Restart organization blocks OB 20, OB 21 and OB 22

The restart organization blocks OB 20, OB 21 and OB 22 thus appear as follows:

```
      : JU   FB125   SYNCHRONIZATION CP ↔ CPU
NAME  : SYNCHRON
SSNR  :      KY0,0   INTERFACE NUMBER 0
BLGR  :      KY0,1   FRAME SIZE 1 (MAX. 16 BYTE)
PAFE  :      FY10    PARAMETERIZATION ERROR BYTE
      :
      :      BE
```

A parameterization error is indicated by flag F 10.0. If an error occurs here, check whether the interface number and page frame number are the same. If this is the case, the error indicates a hardware fault. A computer link cannot be carried out following a parameterization error during the restart.

9.7.4.2 Cyclic Program

RECEIVE-ALL

The data transfer from the CP 544 to data block DB 11 is carried out by a RECEIVE-ALL call. The interface number SSNR must be "0". The job number A-NR is "0". Select status word ANZW "FW 11". The status word is only one word long for the ALL function. The coordination flag byte number of the job which has just sent data is indicated here in the least significant byte (FY 12) with the last RECEIVE-ALL for a job (see Section 9.10). Since a coordination flag has not been programmed in this example, DEH appears there for a call with the last RECEIVE-ALL. The parameterization error byte PAFE is flag byte "FY 13".

The data handling block RECEIVE-ALL can be called by any result of the logic operation (RLO).

Organization block OB 1

The corresponding program in the cyclic organization block OB 1 thus appears as follows:

```
      : JU    FB127    RECEIVE-ALL CALL
NAME  : RECEIVE
SSNR  :       KY0,0    INTERFACE NUMBER 0
A-NR  :       KY0,0    JOB NUMBER 0
ANZW  :       FW11     STATUS WORD
PAFE  :       FY13     PARAMETERIZATION ERROR BYTE
      :
      : BE
```

Data block DB 11

Only the data destination is now missing – data block DB 11. This must be at least 24 data words long. Transfer the S5-135U data handling blocks as well as OB 20, OB 21, OB 22, OB 1 and DB 11 into the user memory of your PLC 2.

Carry out a cold restart on the CPU. The green LED (RUN display) must continue to light up. The red LED TXD1 goes out on the CP.

9

9.7.5 Testing

Monitor the data words DW 4 to DW 23 of data block DB 11 in the PLC 2 using the PG 7xx online function FORCE VARIABLE. Then switch digital input I 0.1 on the PLC 1 from "0" to "1". The values from DB 10 in the PLC 1 now appear in DB 11 in the PLC 2.

If you do not have a digital input module, use the flag F 0.1 instead of input I 0.1. Set the flag using the PG 7xx online function FORCE VARIABLE (or reset it). Monitor the status word FW 11 and the parameterization error byte FY 15 using FORCE VARIABLE.

9.8 FETCH Job from Data Block to Data Block

The data which have been sent in Section 9.7 to the PLC 2 are fetched back from the PLC 2 into the PLC 1 again using a FETCH job.

Task

20 data words are to be fetched from data block DB 11 (starting at data word DW 4) in the PLC 2 and transferred to data block DB 10 (starting at data word DW 20) in the PLC 1. The source and destination data are again completely different. The following program structure is required:

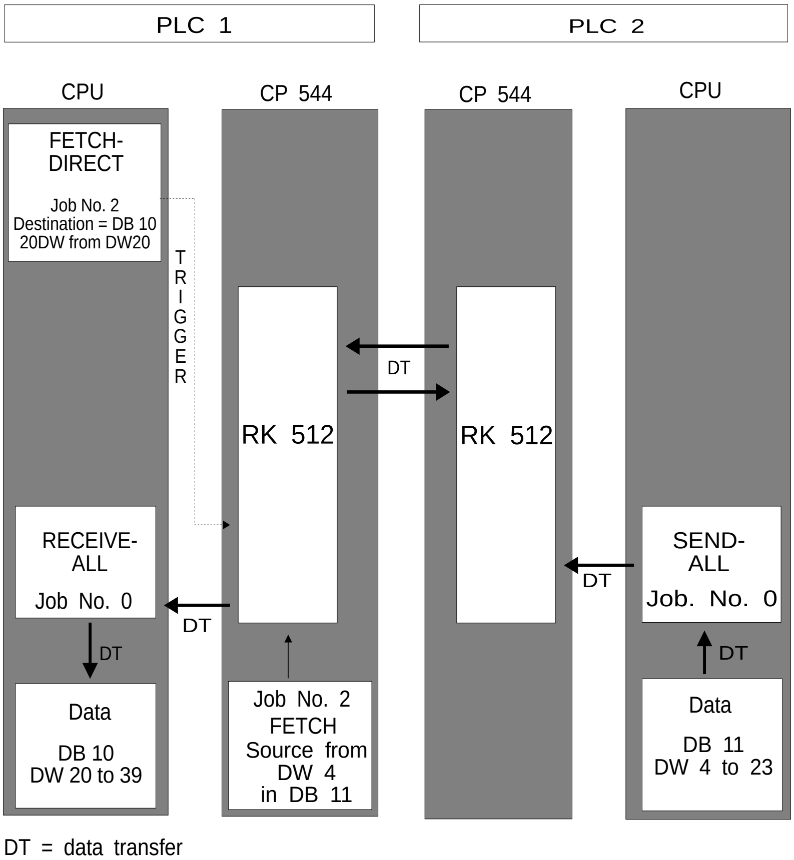


Fig. 9-4 Structure of a FETCH job from DB to DB

The static parameters have already been loaded into the user memories of the two CPs 544 (see Section 9.5.2).

A job need only be programmed on the CP 544 in the active PLC. The active PLC is the one which triggers the data exchange. You need thus only program a FETCH job for the CP 544 of PLC 1.

The FETCH job is triggered by the CPU by calling the data handling block FETCH-DIRECT with job number "n". We shall select job number 2.

The associated job on the CP 544 has the same job number "n". This job contains information on the data source in the PLC 2; information on the data destination in the PLC 1 is stored in the FETCH-DIRECT.

The CP 544 in PLC 1 sends a request message to the CP 544 in PLC 2 with information on where the data are to be fetched from. The CP 544 in PLC 2 fetches the requested data from data block DB 11 of the CPU by means of a SEND-ALL and transfers them to PLC 1. They are received there by the CP 544 and stored in data block DB 10 by a RECEIVE-ALL.

The SEND-ALL has the job number A-NR 0. It is called unconditionally in every program cycle and examines in the CP 544 (dual-port RAM) whether the CP requires data. If yes, the SEND-ALL fetches these from the source defined by the CP 544 and transfers them to the CP 544. If data are not required, the function block is left and the cyclic program continued.

The RECEIVE-ALL has the job number A-NR 0. It is called unconditionally in every program cycle and examines in the CP 544 (dual-port RAM) whether the CP wishes to transfer data to the CPU. If yes, the RECEIVE-ALL stores these at the destination defined by the CP 544. If data are not to be transferred, the function block is left and the cyclic program continued.

9.8.1 CP 544 Parameter Sets for PLC 1

The parameter settings of the computer link on the CP 544 in the PLC 1 must be extended by the dynamic parameter set for job 2. You can access the screen form "DYNAMIC PARAMETER SET" in the COM PP by pressing the key "ENTER" in the screen form "CONFIGURATION". Scroll to job number 2.
Enter the following parameters:

Job No.	2
Job	FETCH
Data source	DATA BLOCK
DB No.	11
Source address from	4 dec.

You need not specify a CPU number since this is not multi-processor mode. A coordination flag need not be entered either. Import the entered data.

Subsequently transfer the dynamic parameter set to the CP and carry out a cold restart as described in Section 9.5.2.

9

9.8.2 STEP 5 Program for PLC 1

The FETCH job is triggered by means of a FETCH-DIRECT call with a job number not equal to 0, job number 2 in our example. The job number on the FETCH-DIRECT block and that of the job in the CP 544 must agree. The job is to be executed if a positive edge occurs at the digital input I 0.2.

FETCH-DIRECT

The interface number SSNR "2" and the job number A-NR "2" must be programmed. Select the flag word "FW 20" as the status word ANZW and the flag byte "FY 24" as the parameterization error byte PAFE. The job status and any error messages are indicated in the status word.

Information on the data destination in the PLC 1 must be defined on the data handling block FETCH-DIRECT. The data destination should be the data block (destination type QTYP "DB") with the number DBNR "10". The destination start ZANF is data word "20", and the destination length ZLAE is "20" data words.

The FETCH job is triggered by the result of the logic operation 1. If the result of the logic operation with the call is 0, the status word is only updated.

The termination of the job with an error, or the occurrence of a parameterization error, is indicated at the digital output Q 0.2. In the event of an error, evaluate the error numbers in the parameterization error byte PAFE, the status word ANZW and the error message area in the SYSTAT (see also Section 9.12).

RECEIVE-ALL

The data sent by the PLC 2 are stored in the CPU 928 by the CP 544 of PLC 1 by means of RECEIVE-ALL. The interface number must also be SSNR "2". The job number A-NR is "0". Select status word ANZW "FW 25" and parameterization error byte PAFE "FY 27". The number of the job for which the RECEIVE-ALL transfers data from the

CP to the CPU is stored there in the least significant byte (FY 26). This is job number 2 in our example.

The RECEIVE-ALL can be called with any result of the logic operation (RLO).

Organization block OB 1

Call the program file "B:RKAG01ST.S5D" in the STEP 5 presets form and extend the organization block OB 1 by the following statements:

```
      : AN    I 0.2     EDGE EVALUATION:
      : R     F 2.2     THE RESULT OF THE LOGIC
      : A     I 0.2     OPERATION RLO is "1"
      : AN    F 2.2     FOR A CYCLE IF THE SIGNAL
      : S     F 2.2     AT INPUT I 0.2 CHANGES FROM 0 TO 1.
      :
      : JU    FB122     TRIGGER FETCH JOB 2
NAME  : FETCH
SSNR  :       KY0,2     INTERFACE NUMBER 2
A-NR  :       KY0,2     JOB NUMBER 2
ANZW  :       FW20      STATUS WORD
ZTYP  :       KSDB      DESTINATION TYPE DATA BLOCK
DBNR  :       KY0,10    DESTINATION DATA BLOCK DB 10
ZANF  :       KF+20     DESTINATION START DATA WORD 20
ZLAE  :       KF+20     DESTINATION LENGTH 20 DATA WORDS
PAFE  :       FY24      PARAMETERIZATION ERROR BYTE
      :
      : O     F 21.3    JOB 2 FINISHED WITH ERROR
      : O     F 24.0    OR PARAMETERIZATION ERROR
      : =     Q 0.2     INDICATE AT OUTPUT Q 0.2
      :
      : JU    FB127     RECEIVE-ALL CALL
NAME  : REC-A
SSNR  :       KY0,2     INTERFACE NUMBER 2
A-NR  :       KY0,0     JOB NUMBER 0
ANZW  :       FW25      STATUS WORD
PAFE  :       FY27      PARAMETERIZATION ERROR BYTE
```

Transfer the extended OB 1 to the user memory of your CPU 928.

Data block DB 10

Data block DB 10 has already been generated with a sufficient length in the previous example.

9.8.3 CP 544 Parameter Sets for PLC 2

No modifications are made to the previous parameter settings of the computer link from Section 9.6 since a job is not required in the passive PLC 2, and thus no dynamic parameter set either.

9.8.4 STEP 5 Program for PLC 2

SEND-ALL

The transfer of the data requested by PLC 1 from the CPU (data block DB 11) to the CP 544 in PLC 2 is carried out by a SEND-ALL call. The interface number SSNR must be "0". The job number A-NR is "0". Select status word ANZW "FW 14". The coordination flag byte number of the job for which the data are fetched is indicated there in the least significant byte (FY 15) with the last SEND-ALL for a job. Since a coordination flag has not been programmed in the FETCH job of the CP 544 in PLC 1 in our example, DEH appears there with the last SEND-ALL for a job.

Parameterization error byte PAFE is flag byte "FY 16".

Organization block OB 1

Connect the CPU of PLC 2 to the PG 7xx and call the program file "B:RKAG02ST.S5D" in the STEP 5 default form. Organization block OB 1 must be extended as follows:

```
       : JU    FB126    SEND-ALL CALL
NAME   : SEND
SSNR   :       KY0,0    INTERFACE NUMBER 0
A-NR   :       KY0,0    JOB NUMBER 0
ANZW   :       FW14     STATUS WORD
PAFE   :       FY16     PARAMETERIZATION ERROR BYTE
```

Transfer the extended OB 1 to the user memory of your PLC 2.

Data block DB 11

You have already generated the data block DB 11 in the previous example.

9

9.8.5 Testing

Monitor the data words DW 0 to DW 19 and DW 20 to DW 39 of data block DB 10 in PLC 1 using the PG 7xx online function FORCE VARIABLE.

Switch digital input I 0.1 and then input I 0.2 on PLC 1 from "0" to "1". 20 data words from data word DW 0 to DW 19 are then sent to the PLC 2, and then returned from there to data words DW 20 to DW 39. The values from data words DW 0 to DW 19 must now also be present in data words DW 20 to DW 39.

If you do not have digital input/output modules, use flags F 0.1 and F 0.2 instead of the inputs I 0.1 and I 0.2. Set the flags using the PG 7xx online function FORCE VARIABLE (or reset them). Output the status words FW 11 and FW 20 and the parameterization error bytes FY 15 and FY 24 using FORCE VARIABLE.

9.9 SEND Job "Flag to Data Block"

A SEND job is programmed in the opposite direction, i.e. from PLC 2 to PLC 1.

Task

Flag word 8, i.e. the flag bytes 8 and 9, is to be transferred from PLC 2 to data block DB 10, data word DW 40, in PLC 1 in every second program cycle.
The following program structure is required:

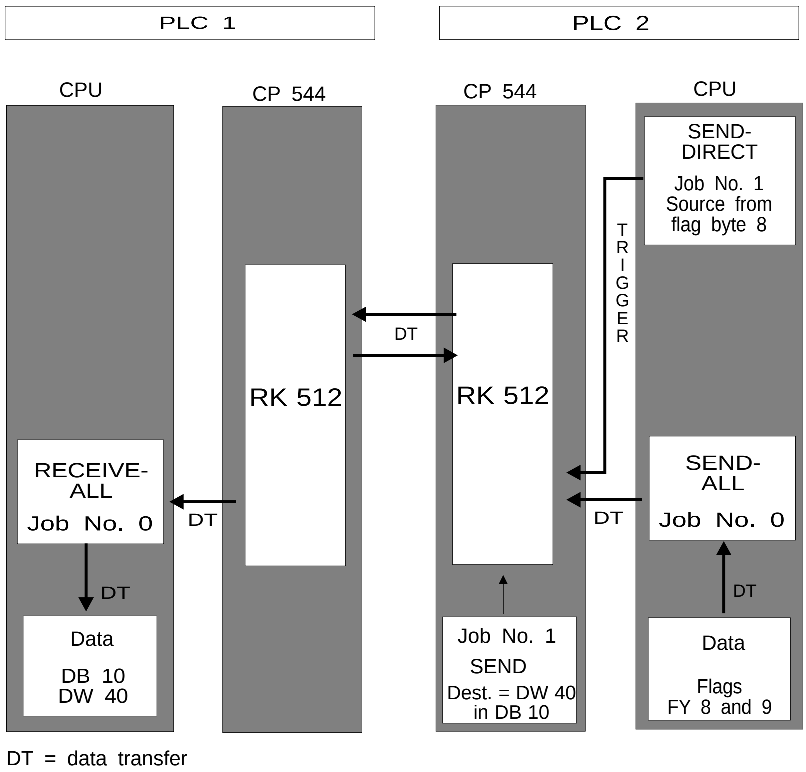


Fig. 9-5 Structure of a SEND job "Flag to DB"

The static parameters have already been loaded into the user memories of the two CPs 544 (see Section 9.5.2).

A job need only be programmed on the CP 544 in the active PLC. The active PLC is the one which triggers the data exchange. Thus a SEND job need only be programmed for the CP 544 of PLC 2.

The SEND job is triggered by the CPU by calling the data handling block SEND-DIRECT with job number "n". Select job no. "1". The associated job on the CP 544 has the same job number "n" . This job contains information on the data destination in PLC 1.

The CP 544 then fetches the data by calling the data handling block SEND-ALL and transfers the data from the CPU/FW 8 to the CP 544 in PLC 1. The CP 544 in PLC 1 receives the data and stores them in the destination defined by PLC 2 by calling the RECEIVE-ALL.

The SEND-ALL has the job no. A-NR 0. It is called unconditionally in every program cycle and examines in the CP 544 (dual-port RAM) whether the CP requires data. If yes, the SEND-ALL fetches the data from the defined source and transfers them to the CP 544. If data are not required, the function block is left and the cyclic program continued.

The RECEIVE-ALL in PLC 1 has the job number A-NR 0. It is called unconditionally in every program cycle and examines in the CP 544 (dual-port RAM) whether the CP wishes to transfer data to the CPU. If yes, the RECEIVE-ALL stores these at the address defined by the CP 544. If data are not to be transferred, the function block is left and the cyclic program continued.

The contents of the flag word FW 8 are to be incremented by 1 in each program cycle. The successful execution of the SEND job can thus be easily recognized in the PLC 1.

9.9.1 CP 544 Parameter Sets for PLC 1

The previous parameter settings of the computer link need not be changed since a job is not required in the passive PLC 1, and thus no dynamic parameter set either.

9.9.2 STEP 5 Program for PLC 1

The transfer of the data received by the CP 544 to the data block DB 10 is executed by the cyclically called RECEIVE-ALL. Since this, as well as the data block DB 10, has been programmed in the previous examples, the STEP 5 program in the CPU 928 in PLC 1 need not be changed.

Set the CPU to RUN. The green LED must now light up.

9.9.3 CP 544 Parameter Sets for PLC 2

The parameter settings of the computer link on the CP 544 in PLC 2 must be extended by the dynamic parameter set for job 1. You can access the screen form "DYNAMIC PARAMETER SET" in the COM PP by pressing the key "ENTER" in the screen form "CONFIGURATION".
Enter the following parameters:

Job No.	1
Job	SEND
Data destination	DATA BLOCK
DB No.	10
Destination address from	40 dec.

You need not specify a CPU number since this is not multi-processor mode. A coordination flag need not be entered either. Import the entered data.

Subsequently transfer the dynamic parameter set to the CP and carry out a cold restart as described in Section 9.5.2.

9.9.4 STEP 5 Program Extension for PLC 2

The SEND job is triggered by a SEND-DIRECT call, i.e. a call of the data handling block SEND with a job number not equal to 0, job number 1 in the example. The job number of the SEND-DIRECT and that of the job in the CP 544 must agree. The job is to be executed in every second program cycle.

SEND-DIRECT

Program the interface number SSNR as "0" and the job number A-NR as "1". Select the status word ANZW "FW 20" and the parameterization error byte PAFE "FY 25". The status word occupies two words.
The job status is indicated in flag word FW 20, as well as any error messages. The number of data transferred during the current SEND-ALL call is present in flag word FW 22.

Information on the source of the data in the CPU must be specified on the data handling block for the SEND job. The data source should be flag bytes (source type QTYP "FY"). The parameter with the data block number DBNR is therefore not evaluated. The source start QANF is flag byte "8" and the source length QLAE is 2 flag bytes.

The SEND job is triggered by a result of 1 for the logic operation. Only the status word is updated if the result of the logic operation is 0 when the call is made. Inverting the flag bit F 3.0 means that the RLO is 0 in one cycle and 1 in the next cycle.

Termination of the job with errors is indicated in bit 3 of the status word. The occurrence of a parameterization error is recognized in that bit 0 of the parameterization error byte is set. In the event of an error, an error evaluation program tailored to the application is usually called. Evaluate the error numbers in the status word ANZW, the error message area in the SYSTAT (see also Section 9.12) and the parameterization error byte PAFE.

SEND-ALL

The SEND-ALL job has already been programmed in the previous example.

Connect the PG 7xx to the CPU of PLC 2 and call the program file "B:RKAG02ST.S5D" in the STEP 5 presets screen form.

Organization block OB 1

Extend organization block OB 1 by the following statements:

```
         : L     FW8
         : L     KF+1
         : +F          INCREMENT CONTENTS OF FLAG WORD
         : T     FW8   BY 1 FOR EACH PROGRAM CYCLE
         :
         : AN    F 3.0 INVERT FLAG BYTE FOR EACH
         : =     F 3.0 PROGRAM CYCLE
         :
         : JU    FB120 TRIGGER SEND JOB 1
NAME     : SEND
SSNR     :       KY0,0 INTERFACE NUMBER 0
A-NR     :       KY0,1 JOB NUMBER 1
ANZW     :       FW20  STATUS WORD
QTYP     :       KSMB  SOURCE TYPE FLAG
DBNR     :       KY0,0 NOT EVALUATED
QANF     :       KF+8  SOURCE START FLAG BYTE 8
QLAE     :       KF+2  SOURCE LENGTH 2 FLAG BYTES
PAFE     :       FY24  PARAMETERIZATION ERROR BYTE
```

Transfer OB 1 to the user memory of your PLC 2.

9.9.5 Testing

Monitor the data word DW 40 of data block DB 10 in PLC 1 using the PG 7xx online function FORCE VARIABLE. The value in the data word must constantly be incremented.

9.10 Coordination Flags

You can enable or disable the data transfer between CPU and CP 544 using a coordination flag.

You must declare the coordination flags in the STEP 5 program as output communication flags and enable them on the CP 544 using switch S4 (see Section 2.1). The communication flags (and thus also the coordination flags of course) are part of the normal flag area.

Communication flags with CPU 928

The communication flags must be entered in data block DB 1 as communication flag outputs. (As soon as DB 1 is programmed, the digital input and output bytes must also be entered there.) The output communication flags of the CPU are updated in the dual-port RAM of the CP at the end of the cyclic program.

A SEND job (job number 1) is triggered by the PLC 2 in every second program cycle. It is transferred to data block DB 10, data word DW 40, in the PLC 1 by flag word FW 8. The job has already been programmed in Section 9.9 and thus need only be supplemented by specification of the coordination flag F 5.3. The contents of the flag word are incremented by one in each program cycle.

The program in PLC 1 recognizes in the status word of RECEIVE-ALL that data have arrived from a SEND job with the coordination flag byte number 5. The coordination flag F 5.3 is then set. The jobs with the same coordination flag data (same byte and bit numbers) are then rejected with error number 32H in the reply message, 09H in the status word and 30H in the SYSTAT, and data word DW 40 is thus protected from being overwritten.

You can reset the coordination flag again using digital input I 0.7, and thus permit acceptance of the SEND job.

9.10.1 CP 544 Parameter Sets for PLC 1

No changes need be made to the previous parameter settings of the computer link. A job is not required in PLC 1 anyway. The communication flag bytes 0 to 31 have already been enabled by switches (see Section 9.3).

9.10.2 STEP 5 Program for PLC 1

The transfer of the data received by the CP 544 to data block DB 10 is executed by the cyclically called RECEIVE-ALL. RECEIVE-ALL and data block DB 10 have already been programmed.

The coordination flag byte number appears in the least significant byte of the RECEIVE-ALL status word as soon as data have arrived from the SEND job of the PLC 2 (with job number 1). The coordination flag F 5.3 is set if the byte number is 5. SEND jobs of the PLC 2 are then rejected.

The coordination flag is reset again by a positive edge at digital input I 0.7, and the acceptance of the job is permitted again.

The coordination flag is immediately reset again following the next SEND job of PLC 2 (with job number 1).

Organization block OB 1

Extend organization block OB 1 as follows:

```
: L     FY26     COORDINATION FLAG BYTE NUMBER
: L     KF+5     FROM STATUS WORD OF RECEIVE-
: !=F            ALL EQUAL TO 5? IF YES,
: S     F 5.3    SET COORDINATION FLAG
:
:                THE DATA DESTINATION IS
:                PROTECTED FROM BEING
:                OVERWRITTEN AS LONG AS THE
:                COORDINATION FLAG REMAINS SET.
:                THE SEND JOB WITH COORDINATION
:                FLAG F 5.3 IS REJECTED.
:
:
: AN    I 0.7    EDGE EVALUATION:
: R     F 2.7    THE RESULT OF THE LOGIC
: A     I 0.7    OPERATION RLO IS SET FOR A
: AN    F 2.7    CYCLE IF THE SIGNAL CHANGES FROM
: S     F 2.7    0 TO 1 AT THE INPUT I 0.7.
:
: R     F 5.3    RESET COORDINATION FLAG WITH
                 0 → 1 EDGE AT INPUT I 0.7
```

Data block DB 1

The output communication flag byte 5, the input byte 0 and the output byte 0 must be entered in data block DB 1 using the STEP 5 program function INPUT (F1) – SCR FORM (F4):

```
DB 1        I/O ASSIGNMENT

DIGITAL INPUTS              : ,  0,  ,  ,  ,  , ...
DIGITAL OUTPUTS             : ,  0,  ,  ,  ,  , ...
IPC FLAG INPUTS             : ,    ,  ,  ,  ,  , ...
IPC FLAG OUTPUTS            : ,  5,  ,  ,  ,  , ...
TIMER FIELD LENGTH          : ,    ,
```

Transfer the extended OB 1 and DB 1 to the CPU 928.

9.10.3 CP 544 Parameter Sets in PLC 2

The parameter settings of the computer link on the CP 544 in PLC 2 must be extended by entering the coordination flag in the dynamic parameter set for job 1. You can access the screen form "DYNAMIC PARAMETER SET" in the COM PP by pressing the key "ENTER" in the screen form "CONFIGURATION". Select the previously programmed job 1 and extend it by the parameter

Coordination flag	5.3

You need not specify a CPU number since this is not multi-processor mode. Import the entered data.

Subsequently transfer the dynamic parameter set to the CP and carry out a cold restart as described in Section 9.5.2.

9.10.4 STEP 5 Program for PLC 2

The previous STEP 5 program is not changed. The SEND job with the job number 1 is triggered as previously (see Section 9.9).

Set the CPU to RUN. The green LED must now light up.

9.10.5 Testing

Monitor the data word DW 40 of data block DB 10 in the PLC 1 using the PG 7xx online function FORCE VARIABLE. It has a value which does not change.

Switch the input I 0.7 from 0 to 1. The value in data word DW 40 must change once and then remain constant since the coordination flag is reset again immediately after acceptance of the job.

Also monitor the status word FW 20 of the SEND job with job number 1 in PLC 2. KH = 0928 appears briefly in the status word when this coordination flag is set in the CPU 928, i.e. this SEND job is rejected by PLC 1. This means "Job completed with error 9H", DB or DX are disabled by coordination flags. Error number 30H appears in the error message area of the SYSTAT (see Section 9.12).

9.11 PSEUDO-WRITE Job "Input to Data Block"

The PSEUDO-READ/WRITE jobs enable the source and destination data of a job to be defined by the STEP 5 program and to be modified during execution of the program.

Task

Input byte IB 0 of PLC 1 is to be sent to data word DW 0 in data block DB 11 of PLC 2 by means of a PSEUDO-WRITE job.

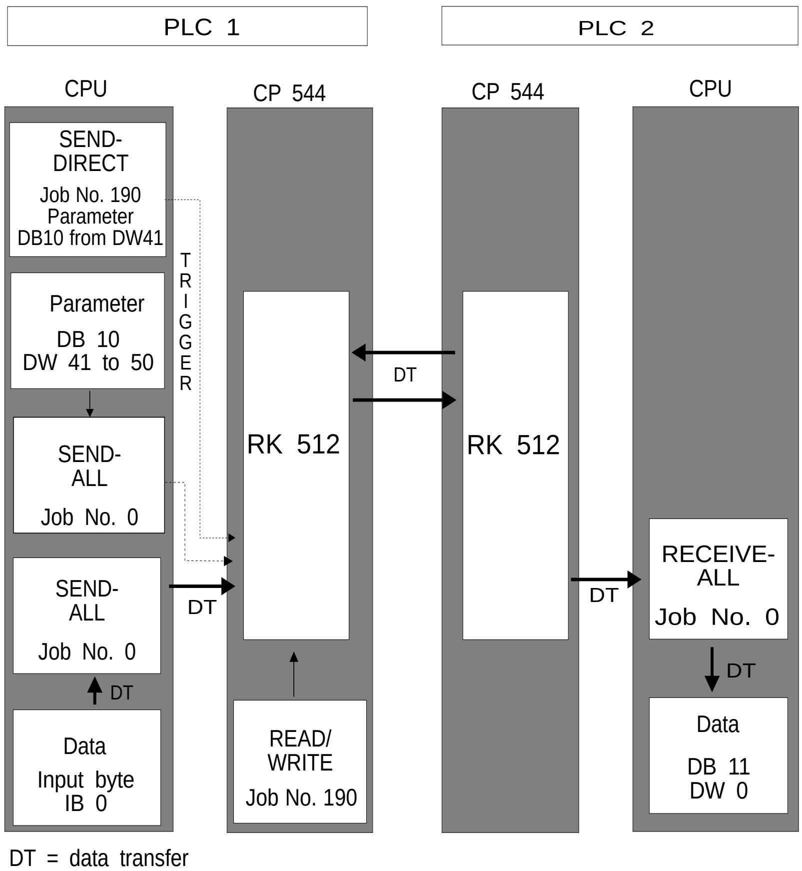


Fig. 9-6 Structure of a PSEUDO-WRITE job

The static parameters have already been loaded into the user memories of the two CPs 544 (see Section 9.5.2).

The special jobs 190 to 199 for the PSEUDO-READ and PSEUDO-WRITE jobs are always installed on the CP 544. These need not therefore be programmed by the user or transferred to the CP user memory. The job numbers 190 to 199 are reserved in the computer link for the PSEUDO-READ and PSEUDO-WRITE functions.

The job is triggered by the call SEND-DIRECT as for the PSEUDO-WRITE function. Select job number 190. The CP 544 first fetches the source and destination partners from the parameter data block by means of a SEND-ALL. The input byte IB 0 is subsequently fetched by a second SEND-ALL and transferred to the CP 544 in PLC 2.

The CP 544 in PLC 2 receives the data and stores them in the destination defined by the PLC 1 by means of the RECEIVE-ALL.

When transmitting only one byte into a data word, the CP 544 writes the data into the left data byte DL and overwrites the right data byte DR with 0.

The SEND-ALL has the job No. A-NR 0. It is called unconditionally in every program cycle and examines in the CP 544 (dual-port RAM) whether this requires data. If yes, the SEND-ALL fetches the data from the address specifed by the CP 544 and transfers them to the CP 544. If data are not required, the function block is left and the cyclic program continued.

The RECEIVE-ALL has the job number A-NR 0. It is called unconditionally in every program cycle and examines in the CP 544 (dual-port RAM) whether this wishes to transfer data to the CPU. If yes, the RECEIVE-ALL stores these at the address defined by the CP 544. If data are not to be transferred, the function block is left and the cyclic program continued.

9.11.1 CP 544 Parameter Sets for PLC 1

The job 190 is always present on the CP 544 and need not therefore be programmed.

Switch the CP 544 to RUN. The red LED display TXD 1 of device interface 1 (SI 1) must now flash slowly. The parameter settings are incorrect or incomplete if this is not the case, or there is a CP 544 hardware fault.

9.11.2 STEP 5 Program for PLC 1

The PSEUDO-WRITE job is to be triggered by the change in signal from "0" to "1" at digital input I 0.3.

SEND-DIRECT

The PSEUDO-WRITE job is triggered by a SEND-DIRECT call, i.e. calling of the data handling block SEND with a job number in the range 190 to 199. Select job number 190.

Interface number SSNR "2" and job number A-NR "190" must be programmed. Select status word ANZW "FW 30" and parameterization byte PAFE "FY 34". The status word occupies two words. The job status and any error messages are indicated in flag word FW 30. The number of transmitted data per SEND-ALL call is present in flag word FW 32.

The initial address of the transfer parameters must be specified for the PSEUDO-WRITE job. The parameters are to present in the data block (QTYP "DB") with the number DBNR "10" starting at data word QANF "41". The CP 544 automatically requests 10 data words as transfer parameters; the parameter QLAE is therefore not evaluated.

The SEND job is called unconditionally and triggered by the result of the logic operation (RLO) 1. Only the status word is updated if the RLO for the call is 0.

The termination of the job with errors or the occurrence of a parameterization error is indicated at digital output Q 0.3. In the event of an error, evaluate the error numbers in the status word ANZW, the parameterization error byte PAFE and the error message area of the SYSTAT (see Section 9.12).

Connect the PG 7xx to the CPU 928 and call the program file "B:RKAG01ST.S5D" in the STEP 5 presets form.

Organization block OB 1

Extend organization block OB 1 as follows:

```
      : AN    I 0.3     EDGE EVALUATION:
      : R     F 2.3     THE RESULT OF THE LOGIC
      : A     I 0.3     OPERATION RLO IS SET FOR A
      : AN    F 2.3     CYCLE IF THE SIGNAL CHANGES
      : S     F 2.3     FROM 0 TO 1 AT INPUT I 0.3.
      :
      : JU    FB120     TRIGGER SEND JOB 190
NAME  : SEND
SSNR  :       KY0,2     INTERFACE NUMBER 2
A-NR  :       KY0,190   JOB NUMBER 190
ANZW  :       FW30      STATUS WORD
QTYP  :       KSDB      SOURCE TYPE DATA BLOCK
DBNR  :       KY0,10    PARAMETER FROM DB 10
QANF  :       KF+41     START OF PARAM. BLOCK DW 41
QLAE  :       KF+0      NOT EVALUATED
PAFE  :       FY34      PARAMETERIZATION ERROR BYTE
      :
      : O     F 31.3    JOB 190 COMPLETED WITH ERROR
      : O     F 34.0    OR PARAMETERIZATION ERROR
      : =     Q 0.3     INDICATE AT OUTPUT Q 0.3
```

The SEND-ALL call required for transmission of the transfer parameters and the input byte has already been programmed.

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Data block DB 10

Program the source and destination in data block DB 10:

41	:	KS = IB	QTYP source type input byte
42	:	KY = 0,0	DBNR not required
43	:	KF = +0	QANF source start is input byte 0
44	:	KF = +1	QLAE source length is 1 byte
45	:	KS = DB	ZTYP destination type data block
46	:	KY = 0,11	DBNR destination data block is DB 11
47	:	KF = +0	ZANF destination start is DW 0
48	:	KF = +0	ZLAE irrelevant with SEND
49	:	KY = 255,255	No coordination flag
50	:	KF = +0	CPU number

Transfer the organization block OB 1 and data block DB 10 to the user memory of your PLC 1.

9.11.3 CP 544 Parameter Sets for PLC 2

There are no changes to the previous parameter settings for the computer link since a job is not required in the passive PLC 2, and thus a dynamic parameter set is not required either.

9.11.4 STEP 5 Program for PLC 2

The transfer of the data received by the CP 544 to the data block DB 11 is executed by the cyclically called RECEIVE-ALL. Since this, as well as the data block DB 11, has already been programmed, the STEP 5 program need not be changed.

Set the CPU to RUN. The green LED must now light up.

9.11.5 Testing

Monitor the data word DW 0 of data block DB 11 in PLC 2 using the PG 7xx online function FORCE VARIABLE.

Switch the digital input I 0.3 on PLC 1 from "0" to "1". The bit pattern of input byte IB 0 appears in the most significant part of data word DW 0 (left data byte DL = 0). The right data byte DR 0 is always overwritten with 0.

If you do not have digital input/output modules in PLC 1, use flag byte FY 0 instead of input byte IB 0. Set the flags using the PG 7xx online function FORCE VARIABLE (or reset them).

Monitor the status word FW 30 and the parameterization error byte FY 34 using FORCE VARIABLE.

9.12 Reading the Error Message Area in the SYSTAT

The SYSTAT is a memory area on the CP 544 which contains status information for each page separately.

Task

The error information is to be transferred to DW 51 and 52 in data block DB 10. The job is called unconditionally in each program cycle, but only executed if an error occurs. It must be called with the result of the logic operation RLO 1.

The PLC job RECEIVE-DIRECT 200 is reserved for reading the error message area. This job is executed directly, i.e. it is not entered into the queue of the CP 544 and does not require a RECEIVE-ALL. It is not necessary to program a job on the CP 544 either.

9.12.1 STEP 5 Program for PLC 1

RESET-DIRECT 200

The error message area of the addressed page is reset by calling the RESET-DIRECT 200 – in our example, device interface 1 of the CP 544 (SSNR = 2). The data words DW 51 and DW 52 in data block DB 10 – in which the error numbers are written by the RECEIVE-DIRECT 200 – must be reset separately.

The error message area is reset by a positive edge at digital input I 0.4.

Function block FB 100 Set the parameters for function block FB 100 as follows:

```
        : JU     FB124     RESET SYSTAT
NAME    : RESET
SSNR    :        KY0,2     INTERFACE NUMBER 2
A-NR    :        KY0,200   JOB NUMBER 200
PAFE    :        FY40      PARAMETERIZATION ERROR BYTE
        :
        :
        : Q      DB10      DELETE DATA WORDS DW 51
        : L      KF+0      AND DW 52 IN DATA BLOCK 10
        : T      DB 10
        : T      DW52
        : BE
```

9

Organization block OB 1

Extend organization block OB 1 by the following commands:

```
       : O     F 3.0
       : ON    F 3.0     GENERATE RLO = 1
       :
       : JU    FB121     READ SYSTAT
NAME   : RECEIVE
SSNR   :       KY0,2     INTERFACE NUMBER 2
A-NR   :       KY0,200   JOB NUMBER 200
ANZW   :       FW35      STATUS WORD
ZTYP   :       KSDB      THE DESTINATION IS A DATA BLOCK
DBNR   :       KY0,10    DATA BLOCK NUMBER DB 10
ZANF   :       KF+51     STARTING AT DATA WORD 51
ZLAE   :       KF+2      2 DATA WORDS
PAFE   :       FY39      PARAMETERIZATION ERROR BYTE
       :
       : O     F 36.3    JOB COMPLETED WITH ERROR
       : O     F 39.0    OR PARAMETERIZATION ERROR
       : =     Q 0.4     INDICATE AT OUTPUT Q 0.4
       :
       : AN    I 0.4     EDGE EVALUATION:
       : R     F 2.4     THE RESULT OF THE LOGIC
       : A     I 0.4     OPERATION RLO IS SET FOR A
       : AN    F 2.4     CYCLE IF THE SIGNAL CHANGES
       : S     F 2.4     FROM 0 TO 1 AT INPUT I 0.4.
       :
       : JC    FB100
NAME   : R-SYSTAT
```

Transfer organization block OB 1 and function block FB 100 to the user memory of the CPU 928.

9.12.2 Testing

Monitor data block DB 10, DW 51 and DW 52, using the PG 7xx online function FORCE VARIABLE, and disconnect the cable between the two CPs 544.

KH = 0EFF immediately appears in data word DW 51 and KH = FFFF in DW 52, i.e. BREAK. This error number is signalled repeatedly until the status has been eliminated. The error buffer in the SYSTAT therefore also overflows; bit 2 is set in the first byte. Transfer jobs are terminated with error FH in the associated ANZW.

Reestablish the connection between the two CPs 544. Reset the SYSTAT error message area by switching input I 0.4 from 0 to 1. Check the resetting using FORCE VARIABLE. Trigger the SEND job with the job number 1 at input I 0.1 in PLC 1.

Switch the mode selector of the CP 544 in PLC 2 to STOP and trigger the SEND job with job number 1 in PLC 1. KH = 0838 appears in data word DW 51 of DB 10, i.e. the error message that the partner CP has been switched to STOP.

9.13 Date/Time Jobs

The CP 544 has an internal hardware clock which continues to run even in the event of power failures because of the backup battery of the PLC subrack. It can be used as a date and time generator if necessary. It is easy to set and read this clock and to synchronize it with the hardware clocks of other CPs in the same PLC.

The PLC job number 218 is reserved on the CP 544 for reading and writing the date and time. This special job is executed directly, i.e. it is not entered into the CP 544 queue and does not require SEND-ALL or RECEIVE-ALL. Triggering of the job and the transfer are carried out in one call. You need not program a call on the CP 544.

The master status must be set in order to process date/time jobs. The master status on the CP 544 is reset when the power supply is switched on. It is not influenced by the function block SYNCHRON either. Setting of the master status is described in Sections 9.13.2 and 9.13.3.

9.13.1 Read Date/Time

Task

In the PLC 1, the current date and time values as well as the master status are to be transmitted cyclically by the CP 544 hardware clock to data block DB 10 starting at data word DW 53.

The transmission is to take place in every cycle. The end of the job is indicated by an error at output Q 0.5.

Organization block OB 1

Extend OB 1 by a corresponding PLC job trigger:

```
      : O     F 3.0
      : ON    F 3.0      GENERATE RLO = 1
      :
      : JU    FB121
NAME  : RECEIVE
SSNR  :       KY0,2      INTERFACE NUMBER 2
A-NR  :       KY0,218    JOB NUMBER 218
ANZW  :       FW41       STATUS WORD
ZTYP  :       KSDB       THE DESTINATION IS A DATA BLOCK
DBNR  :       KY0,10     DATA BLOCK NUMBER DB 10
ZANF  :       KF+53      STARTING AT DATA WORD 53
ZLAE  :       KF+5       5 DATA WORDS
PAFE  :       FY45       PARAMETERIZATION ERROR BYTE
      :
      : O     F 42.3     JOB COMPLETED WITH ERROR
      : O     F 45.0     OR PARAMETERIZATION ERROR
      : =     Q 0.5      INDICATED AT OUTPUT Q 0.5
```

Transfer the extended organization block OB 1 to the CPU 928.

9.13.1.1 Testing

Monitor data block DB 10 from DW 53 to DW 57 using the PG 7xx online function FORCE VARIABLE. The date and time are not entered because the master status is not set when the CP 544 is started up by switching on the power.

The job is terminated with an error in the status word (7H, SYSTAT = 1FH); nothing is entered in the destination data block.

9.13.2 Set Date/Time

Task

Enter the required value – e.g. 31. December 1992, 23 hours, 58 minutes and 30 seconds – in BCD format into data block DB 10 starting at data word DW 59. The CP 544 is to be the master clock. Therefore the master status (bit 8) must be set in data word DW 58 (see also Sections 9.13.1 and 9.13.3).

Data block DB 10

58	:KH = 0100	Master status
59	:KH = 0030	1/10 s / 1/100 s / seconds
60	:KH = 5823	Minutes / hours
61	:KH = 3112	Day / month
62	:KH = 9200	Year / --

The set function is to be triggered by a change in signal from "0" to "1" at input bit I 0.6. The termination of the job is to be indicated with an error at output Q 0.6.

Organization block OB 1

Extend OB 1 by the associated PLC job trigger:

```
      : AN   I 0.6     EDGE EVALUATION:
      : R    F 2.6     THE RESULT OF THE LOGIC
      : A    I 0.6     OPERATION RLO IS SET FOR A
      : AN   F 2.6     CYCLE IF THE SIGNAL CHANGES
      : S    F 2.6     FROM 0 TO 1 AT INPUT I 0.6.
      :
      : JU   FB120
NAME  : SEND
SSNR  :      KY0,2     INTERFACE NUMBER 2
A-NR  :      KY0,218   JOB NUMBER 218
ANZW  :      FW46      STATUS WORD
QTYP  :      KSDB      THE SOURCE IS A DATA BLOCK
DBNR  :      KY0,10    DATA BLOCK NUMBER DB 10
QANF  :      KF+58     STARTING AT DATA WORD 58
QLAE  :      KF+5      5 DATA WORDS
PAFE  :      FY50      PARAMETERIZATION ERROR BYTE
      :
      : O    F 47.3    JOB COMPLETED WITH ERROR
      : O    F 50.0    OR PARAMETERIZATION ERROR
      : =    Q 0.6     INDICATED AT OUTPUT Q 0.6
```

Transfer OB 1 and data block DB 10 to the user memory of the CPU 928.

9.13.2.1 Testing

Switch the digital input I 0.6 from "0" to "1". The master status, date and time of the CP 544 hardware clock are set to the value programmed in data block DB 10. You can check the success on the date and time values which are written cyclically into data words DW 53 to DW 57; the hundredths of a second, the tenths of a second, the seconds and the minutes must change continuously. The CP 544 indicates the change in year shortly afterwards.

9

9.13.3 Synchronization of Several CP Hardware Clocks

In order to synchronize the hardware clocks of several CP modules, the CPU must

- read the date and time from a CP declared as the master and
- transfer the time and date to the other communications processors declared as slaves.

The time is read using a RECEIVE-DIRECT 218 (see Section 9.13.1) and set using a SEND-DIRECT 218 (see Section 9.13.2).

Time master, time slave

A CP is declared as the time master by a SEND-DIRECT 218 if bit 8 is set in the first data word transmitted. The CP is declared as the slave if this bit is set to "0".

Transmit master status, date, time

Only the master status is influenced if only one data word is transmitted with the SEND-DIRECT 218 (QLAE = 1); the time remains unchanged. The master status, date and time are transmitted if 5 data words are transmitted with the SEND-DIRECT 218 (QLAE = 5). The hardware clock is set accordingly and starts immediately with the new value. As an example, two CP 544 modules are inserted in an S5-135U with CPU 928. These modules have the page numbers 0 and 2. The CP 544 with page number 2 has already been declared as the master and has the correct time.

The date, time and master status are read from the master clock (interface 2) in every program cycle using the command sequence from Section 9.13.1, and written into data block DB 10 starting at data word DW 53. The master status must be reset in data block 10, data word DW 53, before the date and time of the master clock can be transmitted to the slave clock (interface 0). Carry out the synchronization following a rising edge at input I 0.5.

A prerequisite for exact synchronization is that the time read from the master clock is transmitted to the slave clock in the same program cycle.

The trigger flag F 3.2 for interface 0 (SSNR 0) is set following the 0-1 edge at input I 0.5.

Successful reading

The set job (SEND-DIRECT 218) is only carried out if the associated trigger flag is set and if the read job (RECEIVE-DIRECT 218) has been carried out. You can recognize successful reading in that the master status which is reset in DB 10 DW 53 in each cycle is set immediately after calling the RECEIVE-DIRECT. The trigger flag of the slave clock is removed once the latter has been synchronized correctly (completed without errors).

Errors when reading

An error when reading the master clock is indicated at output Q 0.5, and an error when setting the slave clock at output Q 0.7. In the event of an error, evaluate the error numbers in the status word (ANZW) the parameterization error byte (PAFE) and the error message area of the SYSTAT for the respective interface (see Section 9.12).

Organization block OB 1

The program in organization block OB 1 for synchronizing the two CPs 544 is then as follows:

```
      : O    F 3.0
      : ON   F 3.0      RESULT OF LOGIC OPERATION RLO = 1
      :
      : JU   FB121
NAME  : RECEIVE
SSNR  :      KY0,2      INTERFACE NUMBER 2
A-NR  :      KY0,218    JOB NUMBER 218
ANZW  :      FW41       STATUS WORD
ZTYP  :      KSDB       THE DESTINATION IS A DATA BLOCK
DBNR  :      KY0,10     DATA BLOCK NUMBER DB 10
ZANF  :      KF+53      STARTING AT DATA WORD 53
ZLAE  :      KF+5       5 DATA WORDS
PAFE  :      FY45       PARAMETERIZATION ERROR BYTE
      :
      : O    F 42.3     JOB COMPLETED WITH ERROR
      : O    F 45.0     OR PARAMETERIZATION ERROR
      : =    Q 0.5      INDICATED AT OUTPUT Q 0.5
      :
      : Q    DB10
      : A    D 53.8     IF MASTER STATUS 1, SET
      : =    F 3.1      "READING SUCCESSFUL", RESET
      : R    D 53.8     MASTER STATUS
      :
      : AN   I 0.5      EDGE EVALUATION:
      : R    F 2.5      THE RESULT OF THE LOGIC OPERATION
      : A    I 0.5      RLO IS 1 FOR A CYCLE
      : AN   F 2.5      IF THE SIGNAL CHANGES FROM
      : S    F 2.5      0 to 1 AT INPUT I 0.5.
      :
      : S    F 3.2      SET TRIGGER FLAG SSNR TO 0
      :
```

```
      :
      : A    F 3.2     SET SLAVE CLOCK SSNR IF
      : A    F 3.1     TRIGGER FLAG IS SET AND
      : JU   FB120     DATE/TIME READ
NAME  : SEND
SSNR         KY0,0     INTERFACE NUMBER 0
A-NR         KY0,218   JOB NUMBER 218
ANZW         FW51      STATUS WORD
QTYP         KSDB      SOURCE IS A DATA BLOCK
DBNR         KY0,10    DATA BLOCK NUMBER DB 10
QANF         KF+53     STARTING AT DATA WORD 53
QLAE         KF+5      5 DATA WORDS
PAFE         FY55      PARAMETERIZATION ERROR BYTE
      : A    F 52.2    SETTING OF SSNR 0 COMPLETED
      : R    F 3.2     WITHOUT ERRORS, RESET
                       TRIGGER FLAG
      : O    F 52.3    JOB SSNR 0 COMPLETED WITH
      : O    F 55.0    ERRORS OR PARAMETERIZATION
                       ERROR
      : =    Q 0.7     INDICATED AT OUTPUT Q 0.7
```

The set values could also have been sent to interface numbers SSNR 1 and 5 since the CP 544 only has one hardware clock for both device interfaces.

9

10

Reference Section

Contents of Chapter 10

10 Reference Section

C

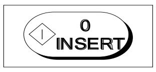
COM PP The COM PP parameterization software supports the parameter settings of point-to-point links for the two serial interfaces of the CP 544.

Input keys Working with COM PP is possible with S5-specific keys, function keys and cursor keys.

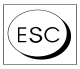
S5-specific keys The key description is based on the programmers of the PG 7xx range.

DELETE:
Deletes the character at the current cursor position.

EXPAND HORIZONTALLY:
Inserts a blank at the current cursor position.



INSERT key:
This key enters your input and has the same function as function key *F6*.

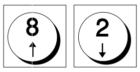


ESCAPE key:
With certain restrictions, this key has basically the same functions as function key *F8*. (You cannot exit acknowledgement menus with the *ESC* key.)

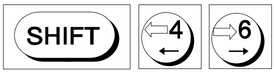
HELP key:
Triggers the help function and opens a help window.

Cursor keys

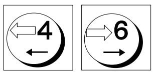
The key description is based on the programmers of the PG 7xx range.



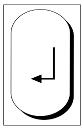
CURSOR up/down:
The cursor is positioned to the higher/lower input field.



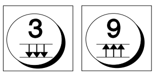
SHIFT CURSOR left/right:
The cursor is positioned to the previous/next input field.



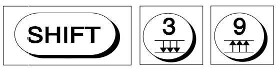
CURSOR left/right:
The cursor is positioned to the previous/next character in the input field. If the limit of the field is reached, the cursor moves to the previous/next field.



RETURN key:
Selects an entry in a selection window and closes the window.
Positions the cursor to the next input field (the cursor jumps from the last field of a screen form to the first field).



PAGE forwards/backwards:
You can page forwards/backwards. If there are insufficient data for a complete further page, the screen scrolls to the end. You can use these keys in selection windows.



You can jump to the end/start of a selection window.

Function keys

The eight function keys *F1* to *F8* are assigned a specific function in the softkey menu of the currently selected screen form. The function keys *F3*, *F6*, *F7* and *F8* usually have the following meanings:

F 3

SELECT:
Opens a selection window.

F 6

ENTER (same as INSERT key):
Closes a selection window, imports the data you have entered, and displays the next screen form.

F 7

HELP (same as HELP key):
Triggers the help function and then opens a help window.

F 8

RETURN (same as ESC key):
Exits the screen form, returns to the next higher level in the screen form hierarchy.

D

Data handling blocks

The two following tables list the numbers of the various data handling blocks in the different types of programmable controller, and which data handling blocks you can call in your STEP 5 program.

Block numbers

Table 10.1 Data handling blocks for the CP 544

DHB	**Function**	**S5-115U**	**S5-135U S5-155U**
SYNCHRON	Synchronizes the CP	FB 249	FB 125
SEND-DIRECT n	Starts the SEND job with job number n	FB 244	FB 120
SEND-ALL	Transfers the data from the CPU to the CP	FB 244 Job No.= 0	FB 126 or FB 120 Job No.= 0
FETCH-DIRECT n	Starts the FETCH job with job number n	FB 246	FB 122
RECEIVE-ALL	Transfers the data from the CP to the CPU	FB 245 Job No.= 0	FB 127 or FB 121 Job No.= 0
RECEIVE-DIRECT n	Starts the RECEIVE job with job number n	FB 245	FB 121
RESET-DIRECT n	Starts the RESET job with job number n	FB 248	FB 124
CONTROL	Copies the status of the respective job into the defined status word	FB 247	FB 123

Jobs

Table 10.2 Jobs for data transmission with the CP 544

Job	Data handling block	Job number	Entry into queue	Destination length in words *
Synchronize CP and CPU	SYNCHRON	–	No	-
Send data	SEND	0–188	Yes	-
Fetch data	FETCH	1–188	Yes	-
Receive data	RECEIVE	0	Yes	-
Read data (PSEUDO-READ)	FETCH	190–199	Yes	-
Write data (PSEUDO-WRITE)	SEND	190–199	Yes	-
Check job status	CONTROL	0–223	No	-
Parameterize device interface	SEND	189	Yes	-
Read device interface parameters	RECEIVE	189	Yes	0 to 2043
Read error message area of SYSTAT	RECEIVE	200	No	2
Delete error message area of SYSTAT	RESET	200	No	-
Read complete SYSTAT	RECEIVE	221	No	16
Scan status	RECEIVE	205	No	1
Start device interface	SEND	202	No	-
Stop device interface	RESET	202	No	-
Import mode-specific static parameters	SEND	203	Yes	-
Read hardware parameters	RECEIVE	204	No	16
Set time	SEND	218	No	-
Read time	RECEIVE	218	No	5
Read SYSID	RECEIVE	223	No	≥ 64

* Data only for special jobs

I

Installation guidelines

Only the most important EMC rules are listed here as installation guidelines. You can obtain further information on installation in your programmable controller manual.

The most important EMC rules

It is usually sufficient to observe a number of elementary rules in order to ensure electromagnetic compatibility (EMC). Please therefore observe the following 5 rules when installing your programmable controller.

Rule 1: Ensure when installing the programmable controllers that the inactive metal components are grounded with a good large-area contact.

- Connect all inactive metal components with a large contact and low impedance.
- For the screw connections on painted and anodized metal parts, use either special contact washers or remove the insulating protective layers.
- Do not use any aluminum parts if possible. Aluminum is easily oxidized and is thus less suitable for grounding purposes.
- Produce a central connection between the ground and the grounding electrode/protective ground system.

Rule 2: Ensure that the cables are routed correctly.

- Divide the cables into groups (power cables, power supply cables, signal cables, data cables).
- Always route the power cables and signal/data cables in separate ducts or bundles.
- Route signal and data cables as close as possible to grounded surfaces (e.g. supporting members, metal rails, cabinet panels).

Rule 3: Ensure that the cable shields are secured perfectly.

- Data lines must be shielded. The shield must be connected at both ends.
- Analog cables should be shielded. Connection of the shield at one end may be advantageous when transmitting signals with small amplitudes.
- Connect the cable shields directly on entry into the cabinet to a shield/protective ground rail with a large-area contact and secure the shields using cable clamps. Route the shield up to the module without an interruption, but do not connect it there again.
- Ensure that the shield/protective ground rail is connected to the cabinet with a low impedance.
- Use metal or metal-plated plug housings for shielded data cables.

Rule 4: Use special EMC measures for special applications.

- Provide all inductors with spark quenchers which are not controlled by SIMATIC-S5 modules.
- Use filament lamps for the cabinet illumination; avoid the use of fluorescent lamps.

Rule 5: Produce a uniform reference potential and ground all electrical equipment if possible.

- Take care when implementing the grounding measures. Grounding of the controller serves for protective and functional purposes.
- Connect system components and cabinets with central controllers and expansion units radially to the grounding electrode/protective ground system. This prevents the production of ground loops.
- If there are differences in potential between system components and cabinets, provide sufficiently dimensioned equipotential bonding conductors.

Interface submodules

The following interface submodules can be used in the CP 544:

Table 10.3 Interface submodules in the CP 544

Interface submodules	V.24 (RS 232)	TTY	RS 422 RS 485
Transmission mode	V 28	TTY	X.27 RS 485
Interface lines	V 24	RXD TXD	X.21 X.24
Floating	No	No *	Yes
Minimum baud rate	300 bps	300 bps	300 bps
Maximum baud rate	19.2 K	9.6 K	76.8 K

* Only floating on passive side

L

LED displays

Module-specific displays

Table 10.4 LED displays (module-specific)

LED RUN	**LED STOP**	**Meaning**
On (green)	Off	- CP is in RUN state. - The CP can process jobs arriving from the CPU and the partner.
Slow flashing	Off	- CP is in TEST state. - The CP can process jobs arriving from the CPU and the partner.
Off	On (red)	- CP is in STOP state. - Module in operation, but no more data transfer is taking place to the CPU via the S5 interface.
Off	Slow flashing	- CP in state "Error". - An error has occurred which means that further processing is not reliable. This state can only be left by switching off the power.

Interface-specific displays

Table 10.5 LED displays (interface-specific)

TXD 1, TXD 2	
On (red), permanent	Interface submodule inserted but no interface parameters present
On (red), fast flashing	Correct/incomplete parameters or incorrect interface submodule inserted
On (red), slow flashing	Parameters OK, but synchronization not yet carried out via backplane bus
On (green)	Job has been triggered
Off	Interface is in operation, active and passive jobs can be executed, or no interface submodule inserted
RXD 1, RXD 2	
On (green)	Job has been received

M

Mode selector switch

A mode selector is present on the front panel of the CP 544 with the three positions RUN/TEST/STOP.

RUN

If the mode selector is set to RUN (and if a SYNCHRON job has been executed without errors), the CP 544 processes jobs which arrive from the CPU and the partner.

TEST

The switch position TEST currently has no special meaning. The CP 544 responds as in switch position RUN.

10

STOP

The transfer of useful data on the serial transmission line is interrupted if the mode selector is set to STOP. Incoming jobs are rejected with an error message (see also Chapter 8).

Mode switchover

RUN/TEST → STOP

The transfer of useful data on the serial transmission line is interrupted. If a job is currently being processed, it is completed without an error message. Thus a longer period may expire until the STOP status is reached depending on the amount of data to be transmitted. Illumination of the LED on the front panel indicates this status.

STOP → RUN/TEST

The CP 544 recommences job processing. The LED on the front panel goes out.
Changing the switch position does not result in a cold restart of the CP 544!

P

Pin assignments

Front connector for PG interface:

1	Ground ($M_{ext.}$)
2	Receiver TTY -
3	
4	P24V
5	Identifier 1, TTL level
6	Transmitter TTY +
7	Transmitter TTY -
8	Ground ($M_{ext.}$)
9	Receiver TTY +
10	M 24 (current sources 20 mA -)
11	Current source +20 mA
12	0 V
13	Current source +20 mA
14	Identifier 2
15	

R

RS422-A/485 submodule

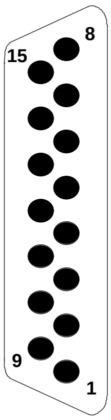
You can use the RS422-A/485 submodule in RS422-A mode with:

- RK 512 computer link,
- data transmission with the 3964/3964R procedures,
- data transmission with the open driver

but not if the CP 544 is used without a fan subassembly.

Pin assignments

The following table lists the pin assignments of the 15-way Sub-D plug on the front panel of the RS422-A/485 submodule:



Pin	Name acc. to CCITT X.24	Input/ output	Remarks
1	Shield		
2	T(A)	Output	
3	C(A)	Output	
4	R(A)	Input/, output	In full-duplex mode, data can only be received on this 2-wire line.
5	I(A)	Input	
6	S(A)	Input	
7	B(A)	Output	
8	GND		
9	T(B)	Output	
10	C(B)	Output	
11	R(B)	Input/, output	In full-duplex mode, data can only be received on this 2-wire line.
12	I(B)	Input	
13	S(B)	Input	
14	B(B)	Output	
15	X(B)	Input	

Jumper settings

When supplied, the jumpers on the RS422-A/485 submodule are inserted as shown below. You can therefore use the RS422-A/485 submodule immediately.

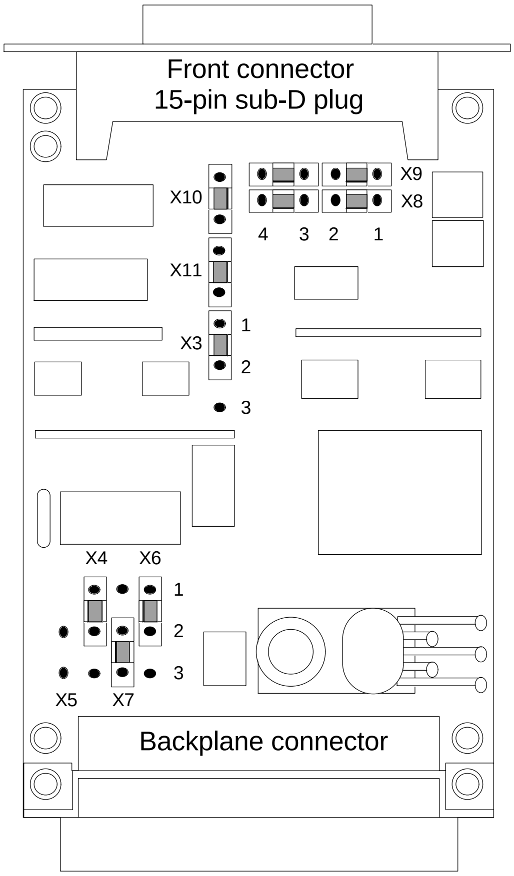
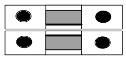


Fig. 10-1 RS422-A/485 submodule: jumper settings when supplied

Using jumpers X10 and X11, you can cancel the detection of the BREAK state via the twisted pair R.

Jumper	1 2	Setting
X10 X11		BREAK state on twisted pair R cancelled, the BREAK state cannot be detected reliably
X10 X11		Twisted pair R active, the BREAK state can be detected reliably

You must not change the other jumper settings.

10

Standard connecting cables for the RS422-A/485 submodule

There are standard connecting cables in various lengths for linking the RS422-A/485 submodule in the CP 544 to the partner. The following lengths are permissible depending on the baud rate:

- 1200 m up to 19200 bps
- 500 m at 38400 bps
- 250 m at 76800 bps

Refer to the ordering information in Chapter 11 for the order nos.

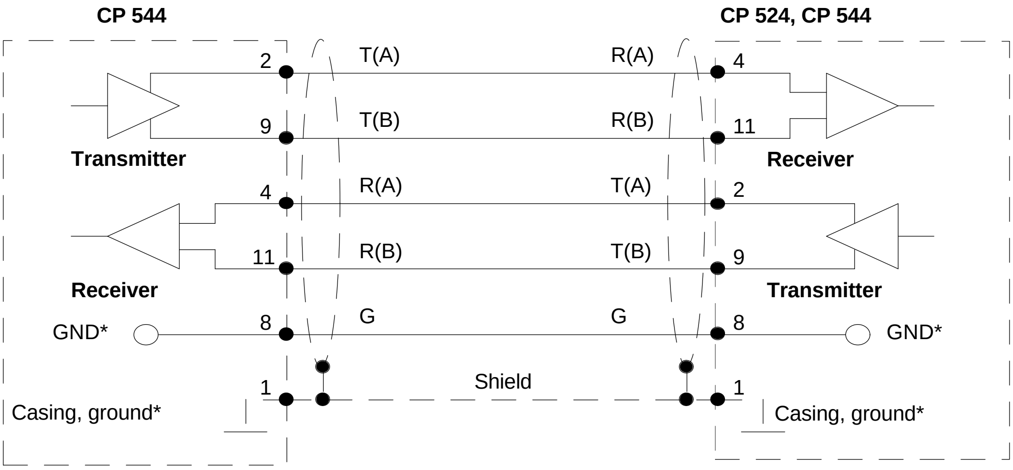


Fig. 10-2 RS422-A/485 submodule: connecting cable CP 544 - CP 524, CP 544

Note

* Never connect the casing ground and GND together, the submodules could otherwise be destroyed.

* GND must always be connected at both ends, otherwise destruction of the submodule is also possible.

Technical data

Important for USA and Canada

The following approvals have been assigned:

UL Listing Mark
Underwriters Laboratories (UL) according to Standard UL 508, Report E 85972

CSA Certification Mark Canadian Standard Association (CSA) according to Standard C 22.2 No. 142, Report LR 63533

Degree of protection Noise immunity, EMC Climatic ambient conditions Mechanical ambient conditions Power supply	All as for CP 544	
Transmission speed	300 to 76 800 bps	
Front connector	15-pin Sub-D plug	
Transmission cable	Shielded 4-wire cable (5-wire cable for RS422-A) with braided shield and metal connector casing, grounding necessary at both ends	
Cable length	Max. 1 200 m	
Current input	At 5 V	At 24 V
	Max 0.6 A	-
Power loss	Max. 3 W	
Dimensions (w x h x d)	16.3 mm x 60 mm x 102.7 mm	
Weight	Approx. 0.1 kg	

S

Switch settings

You can use the following switch settings on the CP to define the page frame numbers, the number of pages and the coordination flag area:

Table 10.6 Switch settings on the CP 544

<table>
<tr><td>Switch assembly S2</td><td>Setting of page frame number
The CP occupies up to 8 successive page numbers. You need only set the lowest page number, the following numbers result from the number of pages. To set the value, position the associated switch upwards. When supplied, all switches are pressed down (page number 0 set).</td></tr>
<tr><td>Switch assembly S4</td><td>Setting of coordination flags
Using S4 you can enable up to 8 blocks with 32 bytes each as communication flags by pressing the corresponding switches down. When supplied, all switches are positioned upwards (all coordination flags are disabled).

Position

0 = flag bytes 0 - 31
1 = flag bytes 32 - 63
2 = flag bytes 64 - 95
3 = flag bytes 96 - 127
4 = flag bytes 128 - 159
5 = flag bytes 160 - 191
6 = flag bytes 192 - 223
7 = flag bytes 224 - 255</td></tr>
<tr><td>Switch assembly S5</td><td>Setting of number of pages (1, 2 or 4 pages)
<table>
<tr><td>Position 1</td><td>Position 0</td><td></td></tr>
<tr><td>Down</td><td>Down or up</td><td>1 page per interface
(= delivery condition)</td></tr>
<tr><td>Up</td><td>Down</td><td>2 pages per interface</td></tr>
<tr><td>Up</td><td>Up</td><td>4 pages per interface</td></tr>
</table>
The other switches of S5 must be positioned upwards.</td></tr>
</table>

T

Technical data of CP 544

Important for USA and Canada

The following approvals have been assigned:

UL Listing Mark
Underwriters Laboratories (UL) according to Standard UL 508, Report E 85972

CSA Certification Mark
Canadian Standard Association (CSA) according to Standard C 22.2 No. 142, Report LR 63533

Device-specific data	
Design	Double Eurocard format, two ES 902 backplane connectors, series 2, 48-way, 1 slot wide
Front connector	15-pin Sub-D plug
Interface submodule connector (SI1,SI2)	48-way female connector, three-row
Memory submodule connector	68-pin male connector, two-row
Current consumption	Max. 0.9 A at 5 V (without submodules) Max. 30 µA at 2.7 V in backup mode Max. 120 mA at 24 V
Power loss	Max. 4.5 W (without submodules) Fan-free operation possible (exception: fan-free operation with the RS422-A/RS485 submodule 6ES5 752-0AA42)
Transmission speed of PG interface	Max. 9600 bps with 1000 m cable length
Supply voltages	5 V ± 5% 2.7 V + 30%/- 10% 24 V + 25%/- 15%
Weight	Approx. 0.5 kg
Dimensions (h x w x d)	20.32 x 233.4 x 160 mm

Device safety	
Device corresponds to	DIN VDE 0805 / EN 60 950 / IEC 950
Protection class	I
Degree of protection	IP 20 to DIN 40 050 / IEC 529
Noise resistance, electromagnetic compatibility (EMC)	
Noise suppression Limit class	TO VDE 0871 A
EMC resistance	To DIN VDE 0843
Conducted interference on signal lines	To IEC 801-4 (burst): 1 kV
Noise immunity to discharges of static electricity	To IEC 801-2 (ESD): 4 kV relay
Noise immunity to external fields	To IEC 801-3: 3 V/m
Climatic ambient conditions	
Temperature: Operation Storage/transport	Tested to DIN IEC 68-2-1/2 0 °C to +55 °C -40 °C to +70 °C
Temperature gradient: Operation Transport and storage	 Max. 10 K/h Max. 20 K/h
Relative humidity: Operation Transport and storage	 < 95% at 25 °C < 95% at 25 °C
Operating altitude	Max. 1500 m above sea level
Mechanical ambient conditions	
Oscillation Operation Transport	Tested to DIN IEC 68-2-6 10 - 58 Hz: amplitude 0.075 mm 58 - 500 Hz: amplitude 10 m/s^2, (1 g) 5 - 9 Hz: amplitude 3.5 mm 9 - 500 Hz: amplitude 10 m/s^2, (1 g)
Shock Operation	Tested to DIN IEC 68-2-27 Half-sine: 150 m/s^2 (15 g), 11 ms

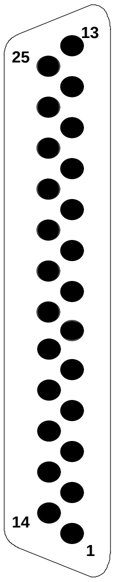
TTY submodule

You can use the TTY submodule with:

- RK 512 computer link,
- data transmission with the 3964/3964R procedures,
- data transmission with the open driver.

Pin assignments

The following table lists the pin assignments of the 25-way Sub-D plug on the front panel of the TTY submodule:



Pin	Name	Current direction	Remarks
1	Shield		
9	24 V external		This connection is switched between 24 V internal and 24 V external using jumper J 3.
10	+ TxD	←	
12	+ 20 mA	→	Current source, transmitter
13	+ RxD	←	
14	- RxD	→	
16	+ 20 mA	→	Current source, receiver
19	- TxD	→	
21	- 20 mA	←	Return circuit
24	- 20 mA	←	Return circuit

←: Input
→: Output

10

Jumper settings

When supplied, the jumpers on the TTY submodule are inserted as shown below. You can therefore use the TTY submodule immediately.

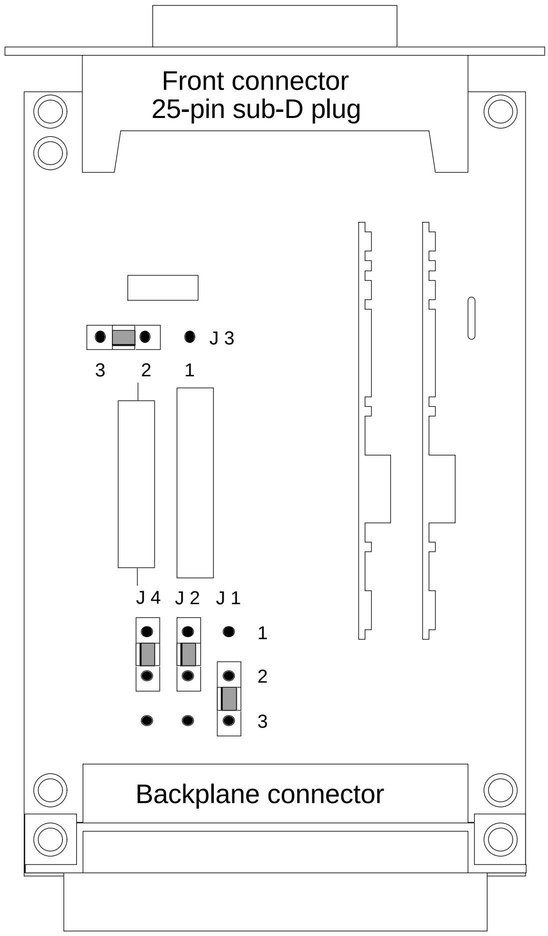
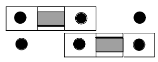
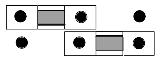
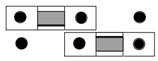


Fig. 10-3 TTY module: jumper settings when supplied

Using jumpers **J 1** and **J 2** you can switch over the polarity of the transmitted and received data.

	1 2 3	
J 1		Transmitted data negated Transmitted data with normal polarity
J 2		Received data with normal polarity Received data negated

Using jumper **J 3** you can switch over the 24-V source voltage for generating the current.

	1 2 3	
J 3		24 V applied to pin 9 of Cannon socket on front panel 24 V supplied via backplane connector (internal)

10

Standard connecting cables to the TTY submodule

There are standard connecting cables in various lengths up to 1000 m for the link from the TTY submodule in the CP 544 to the partner.

Refer to the ordering information in Chapter 11 for the order nos. and lengths.

Note

The following applies to all connecting cables:

Never connect the casing ground and GND together, the submodules could otherwise be destroyed.

GND must always be connected at both ends, otherwise destruction of the submodule is also possible.

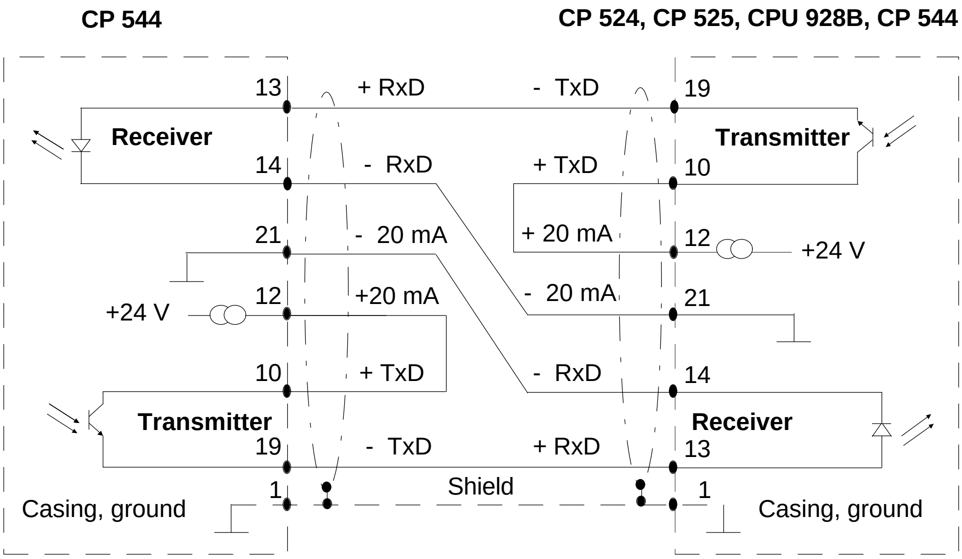


Fig. 10-4 TTY submodule: connecting cable CP 544 - CP 525, CP 524, CPU 928B, CP 544

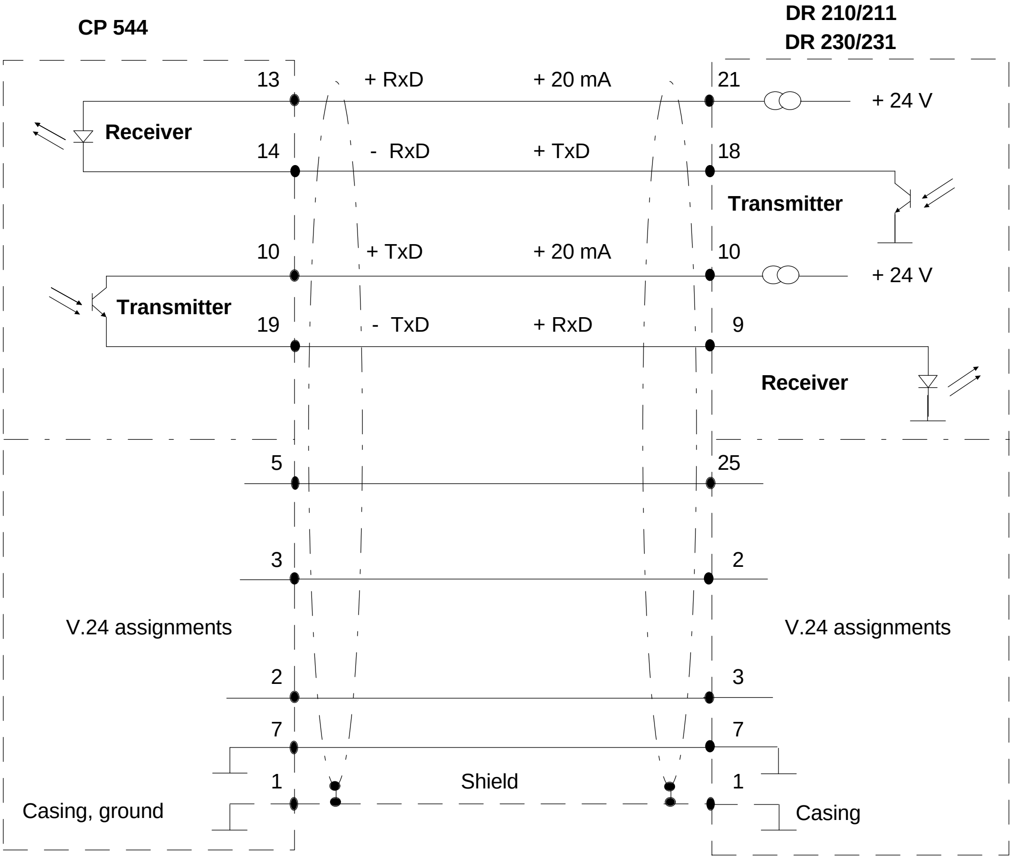


Fig. 10-5 TTY submodule: connecting cable CP 544 - DR 210/211, DR 230/231

You can use this connecting cable for both the TTY and V.24 submodules. Ensure that you have the same interface type in the CP 544 and in the printer.

No standard connecting cables are available for the link to the CP 523 and CP 521 communications processors.

Note that you must only use metal connector housings. The cable shield must be connected to the connector housing and the shield rail at both ends using a large-area contact.

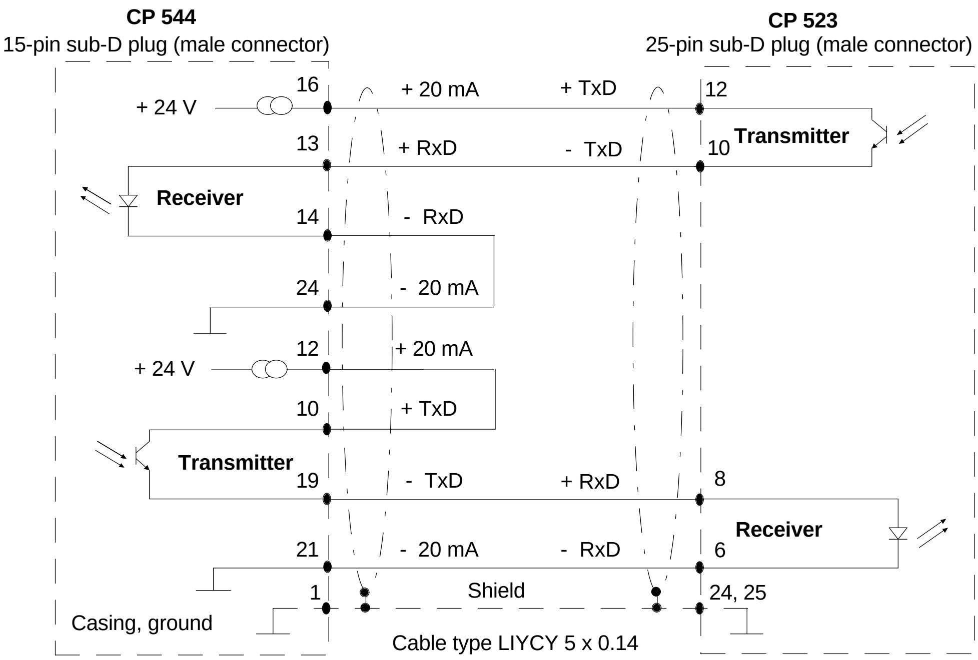


Fig. 10-6 TTY submodule: connecting cable CP 544 - CP 523

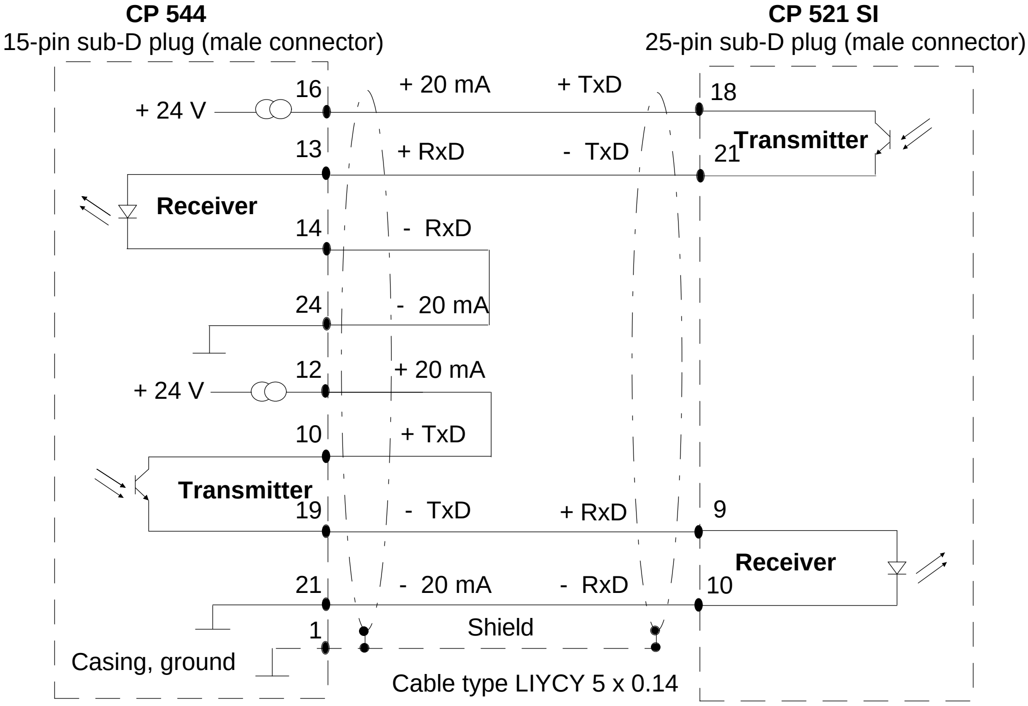


Fig. 10-7 TTY submodule: connecting cable CP 544 - CP 521 SI

Technical data

Important for USA and Canada

The following approvals have been assigned:

UL Listing Mark
Underwriters Laboratories (UL) according to
Standard UL 508, Report E 85972

CSA Certification Mark
Canadian Standard Association (CSA) according to
Standard C 22.2 No. 142, Report LR 63533

Degree of protection Noise immunity, EMC Climatic ambient conditions Mechanical ambient conditions Power supply	All as for CP 544	
Transmission speed	300 to 9 600 bps	
Front connector	25-pin Sub-D plug	
Transmission cable	Shielded 4-wire cable with braided shield and metal connector casing, grounding necessary at both ends	
Cable length	Max. 1 000 m	
Current input	At 5 V	At 24 V
	Max. 0.1 A	60 mA
Power loss	Max. 2 W	
Dimensions (w x h x d)	16.3 mm x 60 mm x 102.7 mm	
Weight	Approx. 0.1 kg	

V

V.24 submodule

You can use the V.24 submodule with:

- RK 512 computer link,
- data transmission with the 3964/3964R procedures,
- data transmission with the open driver.

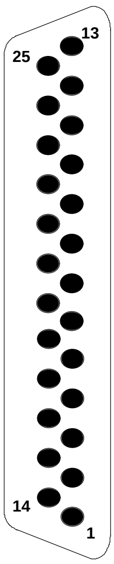
Making your own connecting cables

If you make your own connecting cables, remember that unused inputs on the partner may have to be connected to open-circuit potential.
For more information, refer to the appropriate device manuals and the CCITT recommendations V.24 and V.28.

Pin assignments

The following table lists the pin assignments of the 25-pin Sub-D plug on the front panel of the V.24 submodule.

The signal numbering complies with DIN 66020 (V.24/ RS 232C), the signal names are in accordance with the usual international abbreviations (RS 232C).



Pin	DIN 66020	CCITT V.24	Abbrevi-ation	Input/ output	Remarks
1			Shield		
2	D1	103	TxD	Output	
3	D2	104	RxD	Input	
4	S2	105	RTS	Output	
5	M2	106	CTS	Input	
6	M1	107	DSR	Input	
7	E2	102	GND		
8	M5	109	DCD	Input	
15	T2	114	TxC	Input	Only for synchronous data transmission (not available since no synchronous protocols are currently implemented)
17	T4	115	RxC	Input	
18	PS3	141		Output	Not supported
20	S1.2	108.2	DTR	Output	
22	M3	125	RI	Input	
23	S4	111		Output	
24	T1	113		Output	Only for synchronous data transmission (not available since no synchronous protocols are currently implemented)
25	PM1	142		Input	Not supported

Jumper settings

When supplied, the jumpers on the V.24 submodule are inserted as shown below. You can therefore use the V.24 submodule immediately.

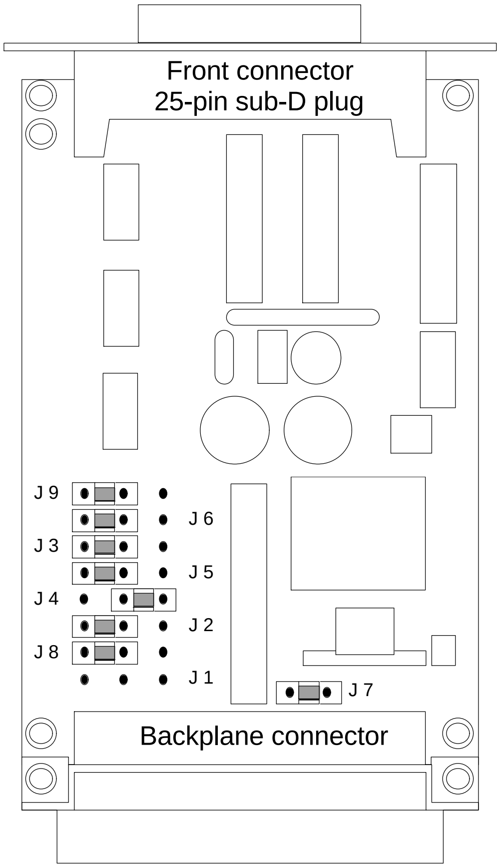
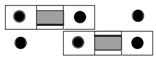


Fig. 10-8 V.24 submodule: jumper settings when supplied

Using jumpers **J 3** and **J 5** you can switch over the polarity of the transmitted and received data.

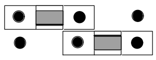
1 2 3

J 3



Transmitted data with normal polarity
Transmitted data negated

J 5

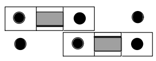


Received data with normal polarity
Received data negated

Using jumper **J 6** you can switch all V.24 receivers so that they can receive signals even if these are only in the positive voltage range.

1 2 3

J 6

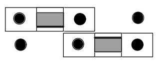


All received signals must have the V.24 signal level
All received signals can be in a positive range

Using jumper **J 9** you can connect CTS permanently to open-circuit potential or connect it through from the front connector.

1 2 3

J 9



CTS applied to open-circuit potential
CTS applied to pin 5

The transmitter is enabled if +12V are applied to input CTS.

Data are output by the transmitter if +12V are present at output RTS.

Standard connecting cables to the V.24 submodule

There are standard connecting cables in various lengths up to 16 m for the link from the V.24 submodule in the CP 544 to the partner.

Refer to the ordering information in Chapter 11 for the order nos. and lengths.

Note
The following applies to all connecting cables:
Never connect the casing ground and GND together, the submodules could otherwise be destroyed.
GND must always be connected at both ends, otherwise destruction of the submodule is also possible.

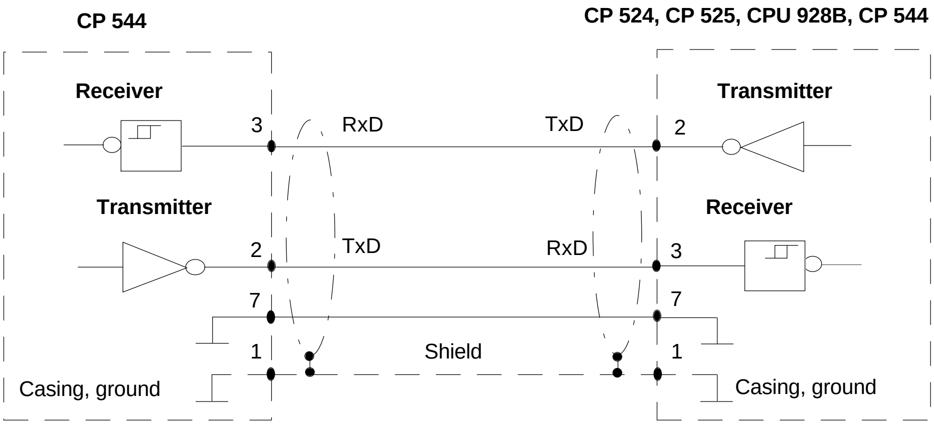


Fig. 10-9 V.24 submodule: connecting cable CP 544 - CP 525, CP 524, CPU 928B, CP 544

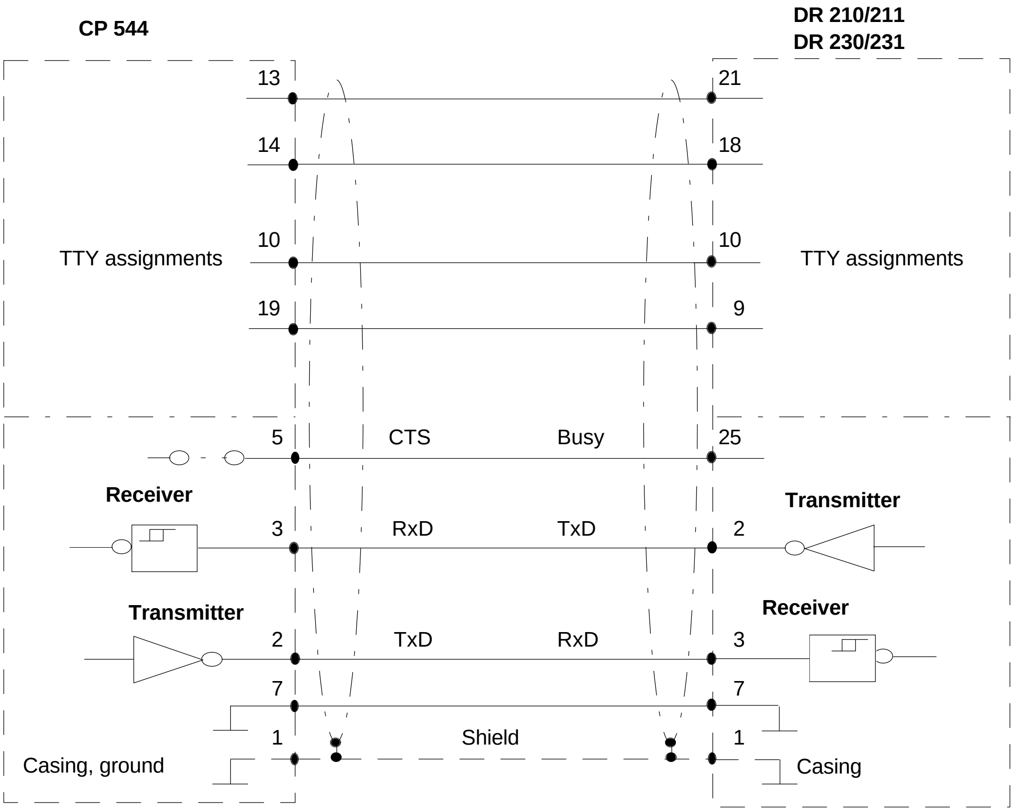


Fig. 10-10 V.24 submodule: connecting cable CP 544 - DR 210/211, DR 230/231

You can use the connecting cable CP 544 - DR 230/231 for both the V.24 and TTY submodules. Ensure that you have the same interface type in the CP 544 and in the printer.

No standard connecting cables are available for the link to the CP 523 and CP 521 communications processors.

Note that you must only use metal connector housings. The cable shield must be connected to the connector housing and the shield rail at both ends using a large-area contact.

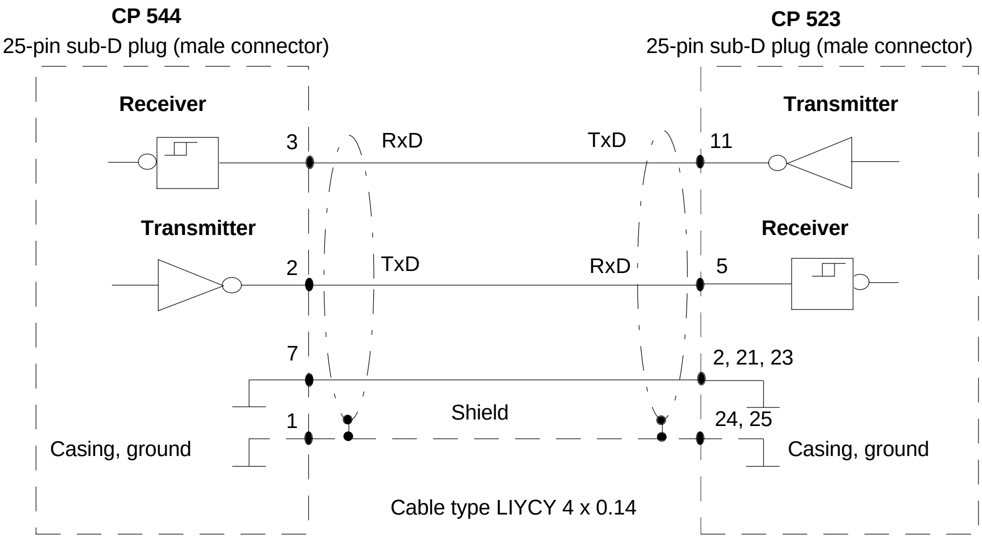


Fig. 10-11 V.24 submodule: connecting cable CP 544 - CP 523

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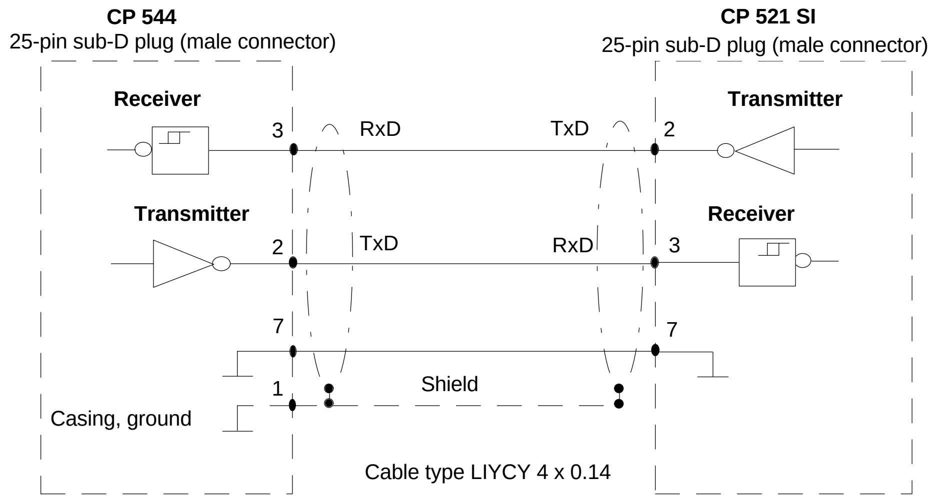

Fig. 10-12 V.24 submodule: connecting cable CP 544 - CP 321 SI

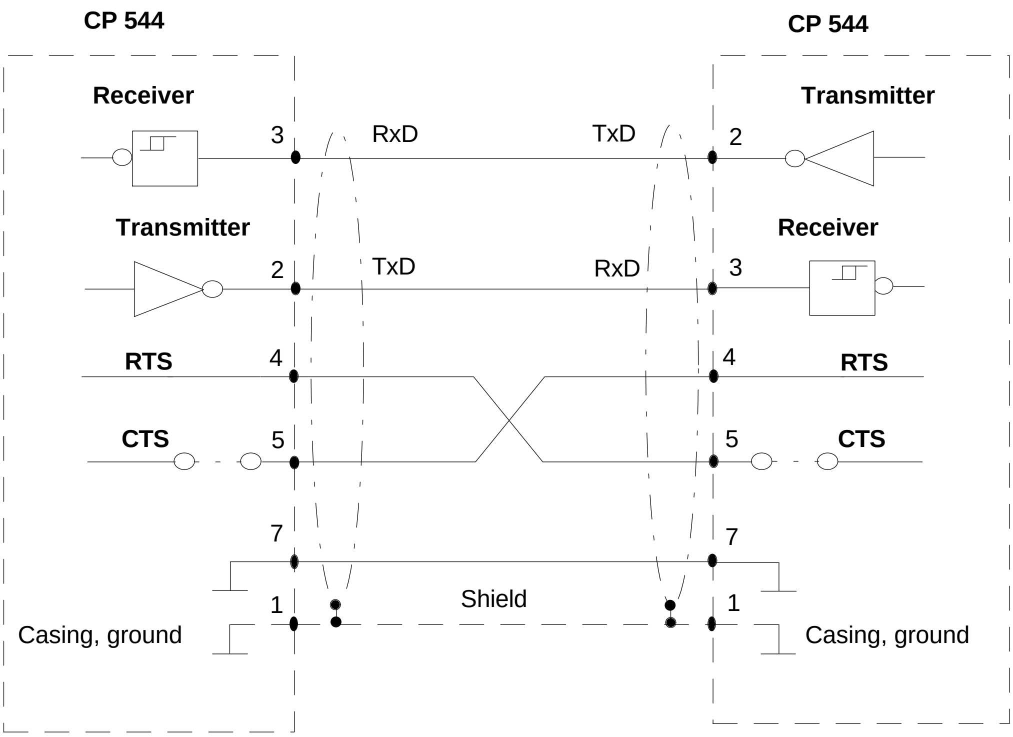

Fig. 10-13 Example of a connecting cable CP 544 - CP 544 for RTS/CTS flow control

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Technical data

Important for USA and Canada

The following approvals have been assigned:

UL Listing Mark
Underwriters Laboratories (UL) according to Standard UL 508, Report E 85972

CSA Certification Mark
Canadian Standard Association (CSA) according to Standard C 22.2 No. 142, Report LR 63533

Degree of protection Noise immunity, EMC Climatic ambient conditions Mechanical ambient conditions Power supply	All as for CP 544	
Transmission speed	300 to 19 200 bps	
Front connector	25-pin Sub-D plug	
Transmission cable	Shielded 4-wire cable with braided shield and metal connector casing, grounding necessary at both ends	
Cable length	Max. 16 m	
Current input	At 5 V	At 24 V
	Max. 0.3 A	-
Power loss	Max. 1.5 W	
Dimensions (w x h x d)	16.3 mm x 60 mm x 102.7 mm	
Weight	Approx. 0.1 kg	

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Appendix

In the appendix you can find

- Ordering information on products referred to in the manual
- A list of further reading
- A list of abbreviations
- A list of key words.

Ordering information

This section lists ordering information for the products mentioned and/or described in this manual. You can obtain the actual Order Nos. from the respective catalog.

CP 544	Module	6ES5 544-3UA11
COM PP	Parameterization software for CP 544 and CPU 928B, in three languages (G, E, F)	6ES5 895-4SP01
F-EPROM submodule	16 bit, 256 byte	6ES5 374-2FH21
RAM submodule	16 bit, 256 byte	6ES5 374-2AH21
Interface submodules	RS 422-A/485 submodule	6ES5 752-0AA42
	TTY submodule	6ES5 752-0AA12
	V.24 submodule	6ES5 752-0AA22
Adapter	CP 544 to PG	6ES5 734-4AG00
Standard connecting cables	CP 544 - CP 524/544 (RS 422-A/485)*	6ES5 725-7xxx0
	CP 544 - CP 525/524, CPU 928B, CP 544 (TTY)	6ES5 726-1xxx0
	CP 544 - DR 210/DR 211 DR 230/DR231 (TTY/V.24)	6ES5 726-5xxx0
	CP 544 - CP 525/524, CPU 928B, CP 544 (V.24)	6ES5 726-8xxx0

(xxx = SIMATIC length code, see catalog)

* Permissible lengths depend on the baud rate (see under RS422-A/485 submodule in the reference section)

Further Reading

/1/ Catalog ST 59: Programmers
SIMATIC S5

/2/ Catalog ST 52.3: S5-115U Programmable Controller
SIMATIC S5

/3/ Catalog ST 54.1: Programmable Controllers
S5-135U, S5-155U/H
SIMATIC S5

/4/ Catalog ST 57: Standard Function Blocks and
Driver Software for Programmable
Controllers of the U Range
SIMATIC S5

/5/ S5-115U Programmable Controller

Order No. 6ES5 998-0UF23

/6/ Standard Function Blocks, Handling Blocks
CPU 922, CPU 928, CPU 928B
S5-135U, S5-155U Programmable Controllers

Order No. C79000-G8576-C366

/7/ Handling Blocks, Standard Function Blocks
CPU 946/947
S5-155U Programmable Controller

Order No. C79000-G8563-C572

/8/ S5-155H Programmable Controller

Order No. 6ES5 998-3SR21

/9/ STEP 5

Order No. C79000-G8576-C140

Abbreviations

A

A-NR	Job number
ANZW	Status word
AS 512	Interface module 512 (IM 512)

B

BCC	Block check character
BLGR	Frame size

C

CC	Central controller
CP	Communications processor
CPU	Central processing unit

D

DB	Data block
DBNR	Data block number
DHB	Data handling block
DR	Drive (floppy disk)
DW	Data word
DX	Extended data block

E

EPROM submodule	Plug-in memory submodule

F

FB	Function block
FW	Flag word
FY	Flag byte

I

IPC	Interprocessor communication flag

O

OB	Organization block

P

PAFE	Parameterization error byte
PG	Programmer
PLC	Programmable controller

Q

QANF	Initial address of source
QLAE	Source length = number of source files
QTYP	Source type = type of data source
QVZ	Acknowledgement delay time

R

RAM submodule	Plug-in memory submodule
REATEL	Reply message
RK	Computer link
RLO	Result of logic operation

S

SI	Interface
SSNR	Interface number
SYSID	Identification area SYSID
SYSTAT	Error message area of the SYSTAT

T

TTY	Current-loop signals (20 mA)

Z

ZANF	Initial address of destination
ZLAE	Destination length = number of destination files
ZTYP	Destination type = type of data destination
ZVZ	Character delay time

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SIEMENS

Documentation Supplement

C79000-Q8576-C191-02

CP 544 **January 1995**
6ES5 998-2DB21, Release 01

This supplement contains additional information and corrections to the CP 544 and the CP 544 manual, release 01. The supplement should be considered more up-to-date than the manual if uncertainties arise.

Notes on the CP 544 Module (6ES5 544-3UA11)

CP 544, computer link, accessing AS and RS from the link partner is not performed correctly (fault corrected from release 3).

If the CP 544 receives a job from the link partner in which absolute addresses (AS) or system addresses (RS) greater than 255 are given as the source address (partner FETCH) or destination address (partner SEND), incorrect addresses in the range from 0 to 255 are read and written.

Remedy:
None (only AS and RS addresses which lie in the range from 0 to 255 may be accessed).

Notes on the CP 544B Module (6ES5 544-3UB11)

You can also run special drivers with the CP 544B. You will need version 3.0 of the COM PP software for this.

Loading special drivers

To be able to run the special drivers you must always use a user memory submodule (RAM or EPROM).

Deleting special drivers

If a special driver is already present on the CP on interface 1 or 2, it cannot simply be overwritten (error message: "Special driver cannot be overwritten because referenced in DX1/2").
You must delete the interface which the special driver is using in the selection screen DELETE CP. The other interface may also have to be deleted if it uses the same special driver.

Additions to the Manual

Handling block SEND, parameter QLAE

When sending n bytes of user data, state the number n of bytes of user data to be transferred as the parameter QLAE when calling the handling block SEND. Note that the parameter QLAE must either be specified in words (DB, DX, CA, TA, RS, AS) or in bytes (FA, IA, QA, PY) depending on the data type to be transferred.

New RS422-A/485 submodule for operation without fan (Section 1.1.4)

Operation without a fan is possible with the newly developed RS422-A/485 submodule with the order number 6ES5 752-0AA43.

Description of the LEDs TXD1, TXD2 (Section 2.10 and Reference Section)

The TXD LEDs also flash quickly when the parameters are complete, a cold restart has been performed and no submodule is plugged.

The correct description for "TXD LED off" is:

– Interface is in operation, active and passive jobs can be executed and the interface submodule is plugged

or

– No parameters are available and no interface submodule is plugged.

CP 544, computer link, accessing AS from partner CPUs with more than 64K address area (e.g. CPU 948, CPU 945) (Chapter 3)

Access (SEND or FETCH) to absolute addresses from partner CPUs with more than 64K address area is not allowed because only an address area with up to 64K words can be addressed with the computer link. This does not guarantee which 64K address area the data are written to or read from.

Handling blocks for 3964 procedures (Section 4.3.1.2) and open drivers (Section 5.3.1.2)

The handling block "PSEUDO-WRITE" may not be used for the 3964 procedures and the open driver.

Using the special jobs 189 and 203 (Section 6.3)

The special jobs 189 and 203 cannot be used if you have stored the parameters in an EPROM user memory submodule.

Assigning device interface parameters with SEND 189; incorrect description in manual (Section 6.3.8)

If the device interface is assigned parameters with the SEND 189, the 3964/3964R procedures and the open driver must also have their data word 6 and 7 filled out as follows as for the RK 512 computer link:

DW6:

5801 - DX No.1 (interface 1) or
5802 - DX No.2 (interface 2) or
0000 - If no receive mailbox is configured on the interface.

DW7:

02BC - From DW No. 2BC (700 decimal) onwards or
0000 - If no receive mailbox is configured on the interface.

Assigning parameters (Chapter 7)

You can assign parameters to the CP 544 offline in a file or online on the module itself (online parameter assignment is not possible on the CPU 928B and CPU 948). You should observe the following:

Data in the file:

After the parameters for a screen form have been entered, they are saved to the file with "ENTER". If you do not want to save the parameters, you can return to the previous screen form with the "RETURN" key.

Data on the module:

If you assign parameters on the module itself the data are saved to a temporary file with "ENTER" and only transferred to the CP when you have finished assigning parameters. You are then asked whether you want to abandon the parameters or transfer them to the CP.

Installing COM PP (Section 7.3)

If you are working on a programmer with MS-DOS and you want to store COM PP and the program file/special drivers on the same drive, you must store them in the same directory (path).

Status word (ANZW) (Section 8.1.1)

Contrary to the information in the manual, the status word (ANZW) can be used for all driver types.

Siemens AG
AUT 1282
D-76181 Karlsruhe
Federal Republic of Germany

From:

Your Name: . . . .
Your Title: . . . .
Company Name: . . . .
Street: . . . .
City, Zip Code: . . . .
Country: . . . .
Phone: . . . .

Please check any industry that applies to you:

- ❑ Automotive
- ❑ Chemical
- ❑ Electrical Machinery
- ❑ Food
- ❑ Instrument and Control
- ❑ Nonelectrical Machinery
- ❑ Petrochemical
- ❑ Pharmaceutical
- ❑ Plastic
- ❑ Pulp and Paper
- ❑ Textiles
- ❑ Transportation
- ❑ Other . . . .

Remarks Form
Your comments and recommendations will help us to improve the quality and usefulness of our publications. Please take the first available opportunity to fill out this questionnaire and return it to Siemens,

Please do not forget to state the title, order number, and release of your manual.

Title of Your Manual: ....

Order No. of Your Manual: .... Release: ......

Please give each of the following questions your own personal mark within the range from 1 (very good) to 5 (poor).

1. Do the contents meet your requirements? ☐
2. Is the information you need easy to find? ☐
3. Is the text easy to understand? ☐
4. Does the level of technical detail meet your requirements? ☐
5. Please rate the quality of the graphics/tables: ☐

Additional comments:

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