SIEMENS

SIMATIC S5

ET 200
Distributed I/O System

Manual

EWA 4NEB 780 6000-02c

Edition 04

Safety 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 are marked as follows according to the level of danger:

Danger

indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.

Warning

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Caution

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

Note

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

The device/system may only be set up and operated in conjunction with this manual.

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:

Warning

This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

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

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Automation and Drives (A&D)
Industrial Automation Systems (AS)
Postfach 4848, D- 90327 Nürnberg

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.

Important Information

Purpose of the manual

The information in this manual will enable you to:

- set up the PROFIBUS bus
- operate the IM 308-C as DP master and/or DP slave
- parameterize the standard function block FB IM308C for the IM 308-C
- operate the S5-95U with DP master interface on the PROFIBUS-DP
- start up the PROFIBUS.

This manual deals with the S5-95U programmable controller and supplements the system manual *S5-90U/S5-95U Programmable Controller.* It describes all the functions and features of the DP master interface of the S5-95U.

The COM PROFIBUS configuration software as of version V5.0 is not described in this manual. There is a separate manual for COM PROFIBUS. The *COM PROFIBUS* manual is available on the COM PROFIBUS CD-ROM.

Target group

This manual is aimed at readers who want to plan, set up and commission the ET 200 distributed I/O system with COM PROFIBUS. We assume that you have experience with or knowledge of how to handle the S5-95U, S5-115U, S5-135U and S5-155U programmable controllers, depending on the master you are using.

Scope of validity

This manual is valid for the following:

Module / software	Order number	As of release/ version
IM 308-C	6ES5 308-3UC11	6
S5-95U	6ES5 095-8ME01	3
COM PROFIBUS	6ES5 895-6SE.2	3.3
	6ES5 895-6SE03	5
RS 485 repeater	6ES7 972-0AA01-0XA0	1
PROFIBUS bus connectors	6ES7 972-0B.11-0XA0 6ES7 972-0B.40-0XA0 6ES7 972-0BA30-0XA0	1 1 1
FB IM308C (FB 192) with demo program	Available on the intranet (Siemens) or Internet	3

This manual describes all the modules approved at the time of issue. We reserve the right to enclose a Product Information Sheet containing up-to-date information with each new or revised module.

Changes since the previous version

The following things have changed since the previous version of the manual:

- COM PROFIBUS as of version V 5.0 is now an open configuration software package for DP masters and is marketed as a separate product. COM PROFIBUS is therefore no longer described in this manual. There is a separate manual for COM PROFIBUS, which is shipped together with COM PROFIBUS on CD-ROM.

  For a limited transitional period, COM PROFIBUS version 3.3 will be supplied in parallel with the new version 5.0. You will still find the description of COM PROFIBUS V 3.3 in Appendix G of this manual.
- The description of the optical PROFIBUS-DP network has been included.
- The PROFIBUS Terminator (active bus terminating element) has been added to the PROFIBUS network components.

Standards, certificates and approvals

The components described in this manual fulfill the requirements and criteria of IEC 1131, Part 2 and the requirements for CE marking. CSA, UL and FM certificates and approvals have been obtained. You will find detailed information on the certificates, approvals and standards in Section A.1.

The IM 308-C master interface module and the DP master interface of the S5-95U are based on the EN 50170, Volume 2, PROFIBUS standard.

Recycling and disposal

The ET 200 is low in contaminants and can thus be recycled.

To recycle and dispose of your old device in an environment-friendly manner, please contact:

Siemens Aktiengesellschaft
Anlagenbau und Technische Dienstleistungen
ATD ERC Essen Recycling/Remarketing
Frohnhauser Str. 69
45127 Essen

Phone: +49 201 / 816 1540 (hotline)
Fax: +49 201 / 816 1504

Other requisite manuals

You will find information on the S5-95U with DP-master interface and all other versions of the S5-95U in the system manual *S5-90U/S5-95U Programmable Controller.* At various points in this manual, you will find references to the system manual *S5-90U/S5-95U Programmable Controller.*

The description of the slaves does not form part of this manual. You can find the order numbers for the slave manuals in Catalog ST PI, PROFIBUS & AS-Interface, Components on the Field Bus.

COM PROFIBUS as of version 5.0 is not described in this manual. You can print out the *COM PROFIBUS* manual from the COM PROFIBUS CD-ROM (6ES5 895-6SE03) and insert it in Chapter 12 (which is a placeholder).

Quick access

A number of features in this manual will help you to obtain quick access to the information you require:

- At the start of the manual, you will find a general table of contents, plus a list of all the illustrations and a list of all the tables in the manual.
- On each page throughout the manual, the bold-face headings on the left summarize the contents of the individual passages.
- The Appendices are followed by a Glossary containing definitions of the important terms used in the manual.
- The manual closes with an index. The index is in alphabetical order and you can use it to find information on the topic of your choice.

Further support

If you have any questions of a technical nature, please get in touch with your contact at the Siemens office or agent responsible for dealing with you. You will find the address in the manuals for the DP masters (e.g. in the “Siemens Worldwide” appendix of the manual *S7-300 Programmable Controller; Hardware and Installation* manual, in catalogs and on CompuServe (`GO AUTFORUM`).

If you have questions about the load feeders, please get in touch with the contact people in your region for communication-capable low-voltage switchgear. You can obtain a list of contacts by fax on +49 8765/9302/781001.

If you need a type file or device master file, you can obtain this via modem on +49 (911) 737972 or via Internet:

- http://www.ad.siemens.de/csi_e/gsd

If you have questions or comments about the manual itself, please complete the reply card at the end of the manual and send it to the specified address. Please also give us your personal assessment of the manual on the reply card.

In order to make it easier for you to start working with the ET 200 distributed I/O system, we provide the ”KO-ET 200” workshop. If you are interested, please notify your regional training center or the central training center in Nuremberg, D (tel. +49 911 895 3154).

Constantly updated information

You can obtain constantly updated information about SIMATIC products:

- On the Internet at http://www.ad.siemens.de/
- By fax on +49 8765-93 00 50 00

In addition, SIMATIC Customer Support assists you with information and downloads that can be useful when using the SIMATIC products:

- On the Internet at http://www.ad.siemens.de/simatic-cs
- At the SIMATIC Customer Support mailbox on +49 (911) 895-7100

  To access the mailbox, use a modem with up to V.34 (28.8 kbps), whose parameters you set as follows: 8, N, 1, ANSI. Alternatively, dial in using ISDN (x.75, 64 kbps).

You can reach SIMATIC Customer Support by phone on +49 (911) 895-7000 and by fax on +49 (911) 895-7002. You can also make inquiries by e-mail on the Internet or by leaving a message at the above-mentioned mailbox (addresses: see above).

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System overview

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In this chapter

This chapter explains:

Goal

After reading this chapter, you should know what the ET 200 distributed I/O system is and you should be familiar with its principal components.

1.1 What is the ET 200 distributed I/O system?

What is ET 200?

When a conventional system is set up, the I/O modules are usually grouped together in the programmable controller.

If the inputs/outputs are distant from the programmable controller, the cabling may be complex and cumbersome, while reliability may be impaired by disruptive electromagnetic fields.

Under these circumstances, Siemens recommends the use of the ET 200 distributed I/O system. The controller CPU is located at a central point, the inputs and outputs are distributed so as to be at their most efficient, and the high- performance ET 200 bus system with its high data-transfer rates ensures excellent communication between the CPU and the I/O stations via the PROFIBUS.

What does ET 200 consist of?

The distributed I/O system consists of active (master) and passive (slave) stations interconnected by the PROFIBUS.

ET 200 also includes the COM PROFIBUS parameterization software which enables you to set up and commission the distributed configuration.

What is PROFIBUS?

PROFIBUS is a bus system designed for communication in small cellular networks as well as with field devices in accordance with the European standard EN 50 170.

PROFIBUS-DP is ideal for high-speed, cyclic communication when only small amounts of data are involved. Transmission rates of up to 12 Mbaud are possible.

PROFIBUS-FMS is intended for communication with complex field devices with an FMS interface as well as for small cellular networks (10 to 15 stations). Transmission rates of up to 1.5 Mbaud are possible.

PROFIBUS-DP and FMS: Both these protocols are based on the same bus components and can be operated together on a single line (Combimaster).

Reference standards for PROFIBUS

PROFIBUS is based on EN 50 170, Volume 2, PROFIBUS. A distinction is drawn between active stations (masters) and passive stations (slaves).

EN 50 170, Volume 2, PROFIBUS describes:

- the bus access and transfer protocol and the specifications for the necessary data transfer technology,
- the high-speed, cyclic exchange of data between the master and the slaves,
- the procedures for configuration and parameterization,
- how cyclic data exchange with the distributed I/Os functions, and
- the diagnostics options at your disposal.

What is a master?

A master is an active station on the PROFIBUS. This means that only a master can send data to other stations on the PROFIBUS and request data from them.

What is a slave?

A slave is a passive station on the PROFIBUS. This means that it can only exchange data with the master when requested to do so.

You can operate up to 124 slaves in the ET 200 distributed I/O system.

Parameterization with COM PROFIBUS

The COM PROFIBUS parameterization software is used for straightforward parameterization and initial operation of the ET 200 distributed I/O system.

COM PROFIBUS runs under MS-Windows® (V 3.1x or higher) or Windows 9x/NT, presenting a graphical user interface with tools for:

- straightforward parameterization of the master and slaves,
- transferring data to the master directly via the PROFIBUS (exporting),
- starting up the PROFIBUS with the aid of diagnostics functions and the states of the inputs/outputs,
- detailed documentation of parameterization.

COM PROFIBUS includes detailed online help, offering you any assistance you may need when working with the parameterization program.

Addressing the distributed I/Os

When you use the control program, you access the distributed inputs/outputs in just the same way as those of the central programmable controller (e.g. L PW/T PW).

If you use the IM 308-C master interface, FB IM308C is available for straightforward data interchange (FB 230 is provided for the S5-95U).

What does the PROFIBUS do?

The **PROFIBUS-DP** transfers data at a maximum rate of 12 Mbaud, so reaction times are short, while the **PROFIBUS-FMS** transfers at up to 1.5 Mbaud for medium reaction times.

You can use either shielded, two-wire cables or fiber optics to set up your PROFIBUS.

The maximum range with copper cabling is 10,000 meters; fiber optics extend the range to 90 km.

The bus connectors are of a design such that slaves can be linked to or disconnected from the bus without interrupting data traffic.

Reaction time of PROFIBUS-DP

The average reaction time of the PROFIBUS-DP is approx. 1 ms under the following conditions:

- one DP master on the bus (IM 308-C)
- up to 30 DP slaves with a total of 128 bytes inputs/128 bytes outputs
- 12 Mbaud transfer rate
- no transfer of diagnostics data and consistent areas

1.2 Expansion options of the ET 200 distributed I/O system

What is a bus segment?

The ET 200 distributed I/O system consists of at least one bus segment. If the ET 200 consists of only one bus segment, this segment has at least two stations, one of which is a master.

A bus segment can consist of up to 32 stations, all physically connected by a bus cable.

Maximum configuration of a bus segment

A bus segment consists of up to 32 stations. You must insert a terminating resistor at the start and end of the bus.

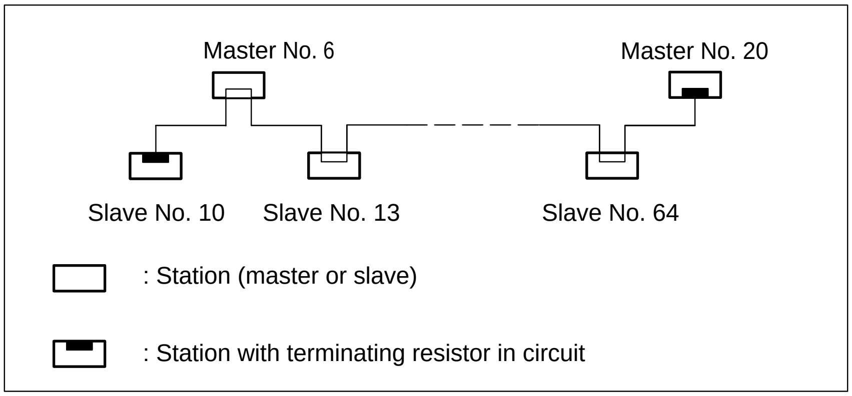


Figure 1-1 Structure of a bus segment

Cornerstone data for a bus segment

You can interconnect a maximum of 32 stations in a single bus segment.

The maximum physical length of a bus segment depends on the baud rate used (see Table 1-1).

Table 1-1 Permissible cable length of a bus segment as a function of baud rate

Baud rate	Max. cable length of a segment (in meters)
9.6 to 187.5 kbaud	1000
500 kbaud	400
1.5 Mbaud	200
3 to 12 Mbaud	100

Rules for more than one bus segment

You must insert RS 485 repeaters between the bus segments:

- if you want to have more than 32 stations connected to the bus, or
- if the maximum permissible cable length per segment is exceeded (see Table 1-1).

All the bus segments **together** must have at least one master and one slave.

Linking bus segments

The configuration below will serve by way of example:

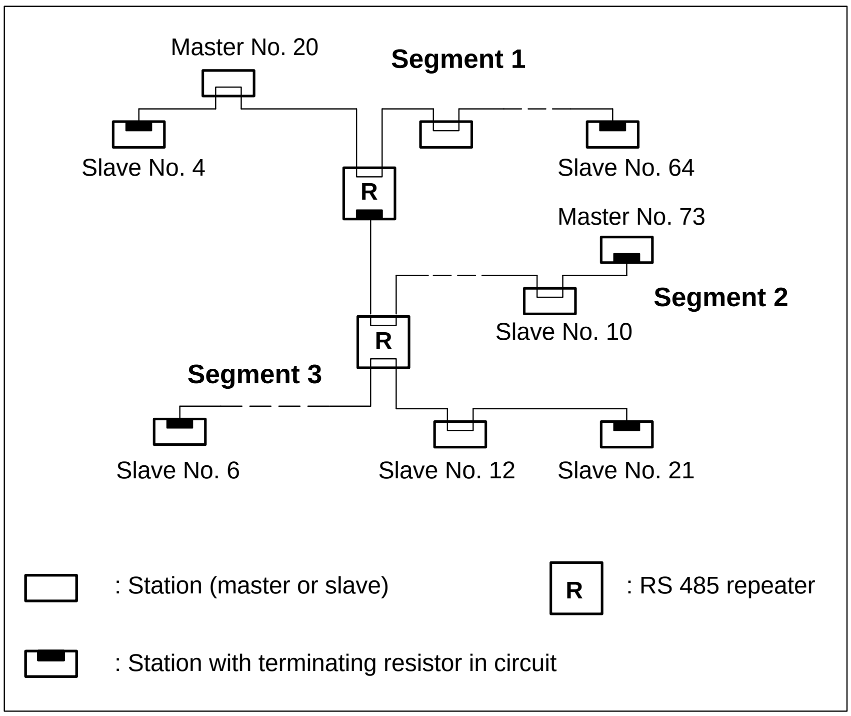


Figure 1-2 Linking bus segments with RS 485 repeaters

Cornerstone data for linking bus segments

In the ET 200 distributed I/O system, you can operate a maximum of 126 stations on a single bus. Of this total, a maximum of 124 can be DP slaves. The maximum number of slaves you can address with an IM 308-C is 122.

The maximum number of stations per bus segment diminishes with each RS 485 repeater inserted in the system (because of power consumption). This means as that soon as you include an RS 485 repeater in a segment, the segment in question can accommodate a maximum of only 31 other stations. Note that the number of RS 485 repeaters has **no** effect on the maximum number of stations connected to the bus.

Up to 10 bus segments can be connected in series. The distance between the two most widely separated stations must not exceed the appropriate value shown in the table below.

Table 1-2 Permissible cable length of a segment incorporating RS 485 repeaters

Baud rate	Max. cable length of a segment (in meters)	Max. distance between two most widely separated stations (in m)
9.6 to 187.5 kbaud	1,000	10,000
500 kbaud	400	4,000
1.5 Mbaud	200	2,000
3 to 12 Mbaud	100	1,000

1.3 Masters in the ET 200 distributed I/O system

Overview

In the distributed I/O system, the following can function as masters:

In SIMATIC S5 and COM PROFIBUS:

- S5-115U, S5-135U and S5-155U programmable controllers, each with
  - one IM 308-C as DP master up to 12 Mbaud (COM PROFIBUS V 1.0 or later versions), or
  - one IM 308-B as DP master up to 1.5 Mbaud (up to COM PROFIBUS V 4.x), or
  - one CP 5431 as Combimaster for PROFIBUS-FMS and PROFIBUS-DP
- S5-95U programmable controller with DP master interface (COM ET 200 V 2.0 or later versions),

In SIMATIC S7 and STEP 7:

- CPU 315-2 DP with integrated DP interface or the SIMATIC NET communications processor CP 342-5 in S7-300
- CPU 413-2 DP/414-2 DP/416-2 DP with integrated DP interface or the SIMATIC NET communications processor CP 443-5 in S7-400

In SIMATIC M7:

- IF 964-DP interface module in M7-300 and M7-400

or ...

- PG 720, PG 740, PG 760 programmers with integrated interface
- PG 720, PG 730, PG 740, PG 750, PG 760, PG 770 programmers or AT-PCs with the SIMATIC NET PC modules
  - CP 5412 (A2) as FMS/DP master
  - CP 5411 + SOFTNET for PROFIBUS as DP master
  - CP 5511 + SOFTNET for PROFIBUS as DP master
- PROFIBUS-DP master interface IM 180
- SIMATIC 505-FIM (Field Interface Module) for connecting a SIMATIC TI505
- IM 329-N for SINUMERIK 840C and SINUMERIK 805SM
- SIMADYN D digital control system
- CP 581 TM-L2 as interface to TELEPERM M
- Other Siemens or other-vendor masters.

1.3.1 IM 308-C master interface

Definition

The IM 308-C master interface links the PROFIBUS-DP to the CPUs in the S5-115U, S5-135U and S5-155U programmable controllers.

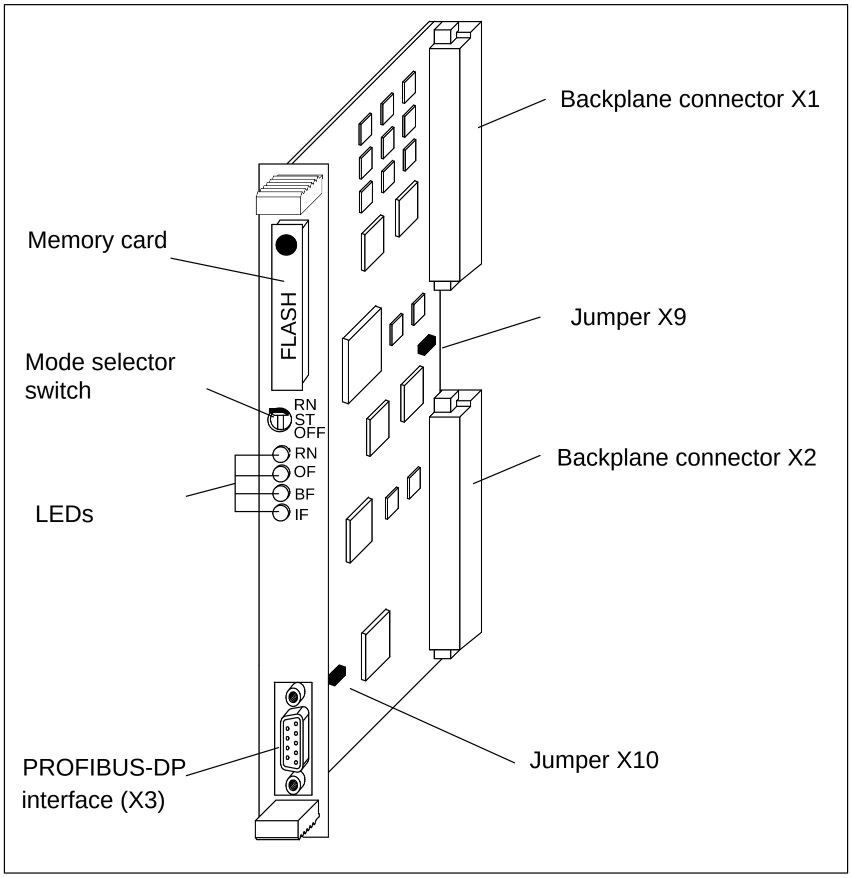


Figure 1-3 IM 308-C master interface

Functions

The IM 308-C offers:

- large address space (up to 13,300 bytes in all for inputs, outputs and diagnostics data, for addressing with FB IM308C)
- baud rates from 9.6 kbaud to 12 Mbaud
- FREEZE and SYNC control commands
- usable as DP master and/or DP slave

Additional information

See chapter 5 for a detailed description of the IM 308-C master interface.

1.3.2 S5-95U programmable controller with DP master interface

Definition

One version of the S5-95U has an integral interface for connecting the S5-95U as a DP master to the PROFIBUS-DP.

Mechanical design

The DP master interface is integrated in the S5-95U:

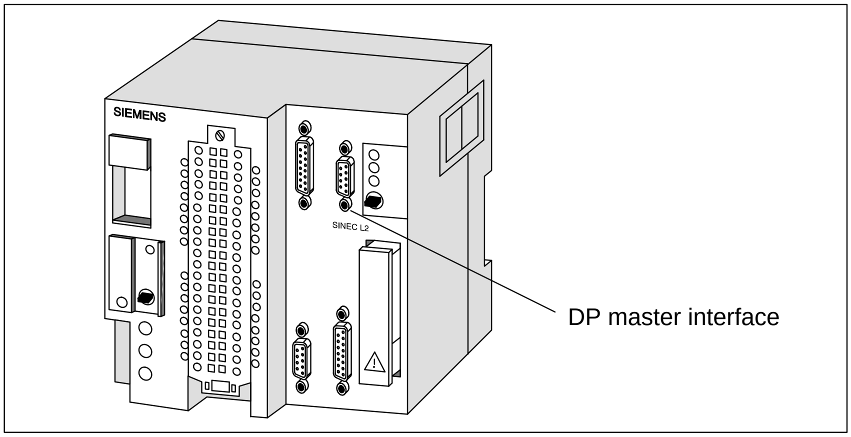


Figure 1-4 S5-95U programmable controller with DP master interface

Functions

The S5-95U with DP master interface offers:

- 256 bytes of address space (128 bytes inputs, 128 bytes outputs; linear addressing only).
- baud rates from 9.6 kbaud to 1.5 Mbaud.
- connection of up to 16 DP slaves.

Restrictions

The S5-95U with DP master interface **does not offer**:

- support for DP slaves that cannot be limited to a telegram length of 32 bytes. The S5-95U processes a maximum of 32 bytes of input data and 32 bytes of output data per DP slave.
- use as a shared-input master.
- selection of an error reporting mode.
- the ”overview diagnostics” function of COM PROFIBUS.

Additional information

The S5-95U with DP master interface is described in detail in chapter 9.

Information applicable to the S5-95U with DP master interface and to all other versions of the S5-95U is to be found in the system manual *S5-90U/S5-95U Programmable Controller.* See Appendix G for the order number of this manual.

1.4 Slaves in the ET 200 distributed I/O system

Overview

The following can be used as DP slaves in the distributed I/O system:

- Distributed I/O stations: ET 200B, ET 200C, ET 200M, ET 200S, ET 200X (up to 12 Mbaud) and ET 200U, ET 200L (up to 1.5 Mbaud)
- Progammable controllers/automation systems, such as:
  - S5-115U, S5-135U or S5-155U with IM 308-C as DP slave
  - S5-95U with DP slave interface (up to 1.5 Mbaud)
  - S7-300 with CPU 315-2 DP or CP 342-5 as DP slave
  - S7-400 with CP 443-5 as DP slave
- Interface to the actuator/sensor interface with the DP/AS-I link
- Text displays and operator panels for local operator control and monitoring
- MOBY identification systems
- Low- voltage switchgear
- Siemens or other-vendor field devices, such as drives, valve islands, etc.

FMS slaves may be, for example, the ET 200U or SIMOCODE, the motor protection and control unit.

ET 200B (DP slave)

The ET 200B is a small, compact I/O station. It is a slimline module and its degree of protection is IP 20. The ET 200B is particularly suitable for applications requiring a limited number of inputs/outputs or where space is at a premium.

The ET 200B distributed I/O station consists of the terminal block (TB) for the inhouse wiring and the electronics block (EB). The ET 200B connects to the PROFIBUS-DP field bus by means of bus connectors.

ET 200C (DP slave)

The ET 200C is a small, compact I/O station. The degree of protection is IP 66/67. On account of its sturdy design, the ET 200C is eminently suitable for use in harsh industrial environments.

The ET 200C distributed I/O station consists of a sturdy metal housing with integrated inputs/outputs and the interface for the PROFIBUS-DP field bus.

ET 200L (DP slave)

The ET 200L is a small, compact I/O station. The degree of protection is IP 20 and it is suitable for baud rates up to 1.5 Mbaud.

On account of its compact, slimline design, the ET 200L is eminently suitable for applications where space is at a premium or where only a limited number of inputs/outputs are required.

ET 200M (DP slave)

The ET 200M is a slave interface for the modules of the S7-300 line.

The ET 200M is eminently suitable for applications requiring a large number of locally installed inputs/outputs or modules from the S7-300 range.

The ET 200M consists of the IM 153 slave interface, the power supply unit and up to 8 modules from the S7-300 range.

ET 200U (DP slave and FMS slave)

The ET 200U is a slave interface module for the I/O modules of the S5-100U.

The ET 200U distributed I/O station is compatible with both PROFIBUS-**DP** and PROFIBUS-**FMS**.

The ET 200U is eminently suitable for applications requiring a large number of locally installed inputs/outputs or modules from the S5-100U I/O range (e.g. CPs and IPs).

The ET 200U consists of the IM 318-B or IM 318-C slave interface module plus modules from the S5 I/O range.

ET 200S (DP slave)

ET 200S is a fine-step modular I/O device that offers the highest possible degree of flexibility.

You can connect virtually any number and combination of I/O modules next to the interface module, which transfers the data to the DP master. This means you can configure the system exactly to suit local requirements.

ET 200X (DP slave)

The ET 200X is a small, modular I/O station. The degree of protection is IP 66/67.

On account of its modular design and its integrated load feeders, e.g. direct-on-line or reversing starters, the ET 200X is eminently suitable for use in harsh industrial environments where only a limited number of inputs/outputs are required.

DP/AS-I link (DP slave)

The DP/AS-I link connects the actuator-sensor interface to PROFIBUS-DP. Its degree of protection is high (IP 66/67), so the DP/AS-I link is ideal for use in harsh industrial environments.

S5-95U (DP slave)

One version of the S5-95U has an integrated interface for connecting the S5-95U as a DP slave to the PROFIBUS-DP.

The S5-95U with DP slave interface is suitable for applications which require local intelligent signal preprocessing.

IM 308-C (DP slave)

As of release status 3, the IM 308-C can be used as a DP slave in the S5-115U, S5-135U and S5-155U programmable controllers. This means, for example, that you can transfer data between two programmable controllers.

Additional information

You can find additional information about the above-mentioned products in the Catalog ST PI (PROFIBUS & AS Interface) Components on the Field Bus.

1.5 PROFIBUS field bus

Definition

The PROFIBUS interconnects all stations. The physical connection to these stations is effected by means of bus connectors (exception: RS 485 repeaters and programmer interface).

Characteristics

The characteristics of the PROFIBUS are as follows:

- reliable data transfer (hamming distance = 4, i.e. reliable detection of three simultaneously occurring errors in the telegram)
- high data-transfer rate with baud rates from 9.6 kbaud to 12 Mbaud or in the case of PROFIBUS-FMS medium data-transfer rates from 9.6 kbaud to 1.5 Mbaud
- supports up to 32 hosts parameterized with COM PROFIBUS. A host is a system or device that contains the master interface. An S5-115U, S5-135U or S5-155U programmable controller is the host for the IM 308-C.
- supports up to 126 stations connected to the bus, of which a maximum of 124 may be DP slaves (up to 16 DP slaves connecting to an S5-95U with DP master interface; up to 122 DP slaves connecting to an IM 308-C)
- supports up to 126 active stations (masters) connected to the bus. The number of masters is limited to 123 if they are all parameterized with COM PROFIBUS.
- each slave can be connected to or removed from the bus without any detrimental effect on the transfer of data (subject to certain rules as described in section 3.6)
- range up to 1 km without RS 485 repeaters
- range up to 10 km with RS 485 repeaters
- range up to 90 km with fiber-optic cables

1.6 COM PROFIBUS parameterization software

Definition

You require the COM PROFIBUS parameterization software in order to plan the layout of the distributed I/O system and to go operational when the system is installed.

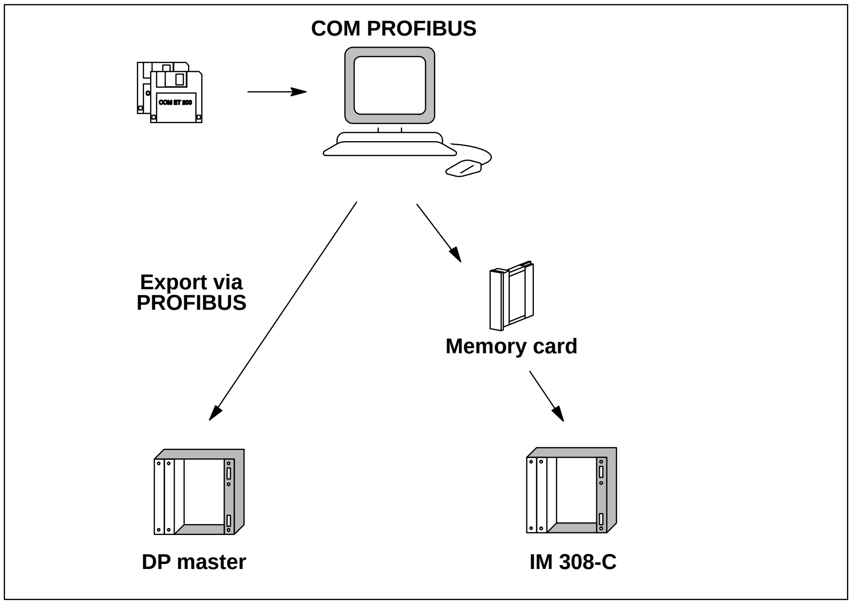


Figure 1-5 Purpose of the COM PROFIBUS parameterization software

Functions

COM PROFIBUS runs under MS-Windows® or Windows 95/NT, presenting a graphical user interface with tools for:

- straightforward parameterization of the bus configuration,
- transferring data directly to the master via the PROFIBUS (exporting),
- starting up the PROFIBUS with the aid of diagnostics functions and the states of the inputs/outputs,
- detailed documentation of parameterization.

COM PROFIBUS includes detailed online help, offering you any assistance you may need when working with the parameterization program.

Additional information

You will find a detailed description of COM PROFIBUS in the form of an electronic manual (PDF) on the COM PROFIBUS CD-ROM. You can print out the *COM PROFIBUS* manual from the CD-ROM and insert it in Chapter 12 (which is a placeholder) of this manual.

You will find the order number of the COM PROFIBUS CD-ROM in Appendix G.

1.7 Network components

Definition

You require network components

- to connect the bus to a station,
- to amplify the signal
- to convert the signal to a fiber-optic medium.
- to actively terminate the bus (e.g. PROFIBUS Terminator)

Connecting the bus

The following options exist for connecting the bus to the station ...
... For electrical networks (copper cable):

- Bus connectors with IP 20 protection (see section 1.7.1)
- Bus connectors with IP 66/67 protection (e.g. to the ET 200C)

... For optical networks (fiber-optic cables):

- Fiber-optic cable Simplex connectors with IP 20 protection (see Section 1.7.2)

Signal amplification

RS 485 repeaters are used to amplify the electric signal (see section 1.7.3). Optical link modules (OLMs) are used to amplify the optical signal up to 1.5 Mbaud.

Electrical/optical conversion

If you want to use the field bus for larger distances irrespective of the transmission rate, or if you do not want the data traffic on the bus to be impaired by external interference fields, use fiber-optic cables instead of copper cables.

There are two ways to convert electrical cables to fiber-optic cables:

- PROFIBUS nodes with a PROFIBUS-DP interface (RS 485) are connected to the optical network via an optical bus terminal (OBT) or via the optical module link (OLM).
- PROFIBUS nodes with an integrated fiber-optic cable interface (e.g. ET 200M (IM 153-2 FO), S7-400 (IM 467 FO)) can be integrated in the optical network directly.

The structure of optical networks with an optical link module (OLM) is described in detail in the manual *SIMATIC NET PROFIBUS Networks*. You will find the most important information on the structure of an optical PROFIBUS-DP network with PROFIBUS nodes that have an integrated fiber-optic cable interface in Section 3.8 of this manual.

1.7.1 Bus connector

Definition

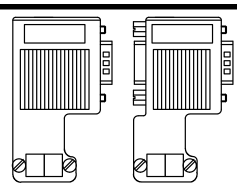
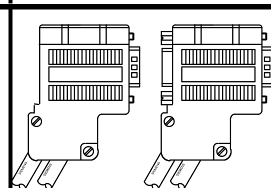
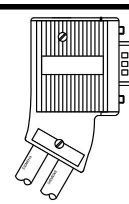
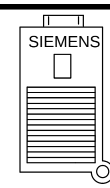
The bus connector connects the bus cable (copper cable) with the station.

The bus connector enables you to isolate a station (under certain circumstances) without interrupting the data traffic on the bus.

Mechanical design

There are various bus connectors with IP 20 protection, the different uses of which are indicated in Table 1-3. There are also special bus connector types with IP 65 protection. You will find a detailed description of the bus connectors in Chapter 3.

Table 1-3 Mechanical design of and applications for IP 20 bus connectors

Order numbers:	**6ES7 972-0BA11-0XA0** **6ES7 972-0BB11-0XA0**	**6ES7 972-0BA40-0XA0** **6ES7 972-0BB40-0XA0**	**6ES7** **0BA30-0XA0**	**6GK1** **500-0EA00**
Appearance:		 35° outgoing cable unit	 30° outgoing cable unit	
Recommended for:				
• IM 308-B	● (since release 6)	●	●	
• IM 308-C	●	●	●	
• S5-95U		●	●	
• S7-300	●	●	●	
• S7-400	●	●	●	
• M7-300	●	●	●	
• M7-400		●	●	
• CP 5412 (A2)				●
• CP 5411				●
• CP 5511				●
• CP 5611				●
• ET 200B	●	●	●	
• ET 200L	●	●	●	
• ET 200M	●	●	●	
• ET 200S	●	●	●	
• ET 200U	●	●	●	
• PG 720/720C		●	●	●
• PG 730		●	●	●
• PG 740		●	●	●
• PG 750		●	●	●
• PG 760		●	●	●

1.7.2 Fiber-optic cable Simplex connectors

Definition

Simplex connectors connect the fiber-optic cable to the integrated fiber-optic cable interface of the PROFIBUS device. In some Siemens modules (e.g. the IM 153-2 FO and the IM 467 FO), two Simplex connectors (one for the sender and one for the recipient) are inserted in the module via a special plug-in adapter.

Mechanical design

Two Simplex connectors (a sender and a recipient) and a plug-in adapter with the following features are required for a fiber-optic cable connection:

- IP 20 protection
- Transmission rates of 9.6 kbps to 12 Mbps

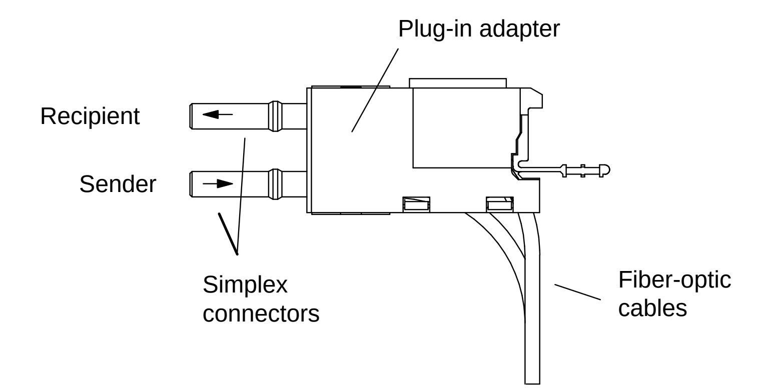


Figure 1-6 Simplex connectors and the special plug-in adapter for the IM 153-2 FO and IM 467 FO (assembled)

Additional information

You will find a detailed description of the fiber-optic cable connection system in Section 3.8.

1.7.3 RS 485 repeater

Definition

An RS 485 repeater regenerates data signals on the bus line (copper cable).

By inserting RS 485 repeaters, you can split the ET 200 distributed I/O system into a number of segments, thus bridging longer distances.

Mechanical design

The characteristics of the RS 485 repeaters with order numbers 6ES7 972-0AA01-0XA0 are as follows:

- degree of protection IP 20
- baud rates from 9.6 kbaud to 12 Mbaud
- repeater adapters for connecting waveguides

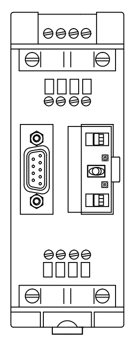


Figure 1-7 RS 485 repeater

Additional Information

The RS 485 repeater is described in detail in chapter 4.

1.7.4 PROFIBUS Terminator

Definition

A PROFIBUS Terminator forms an active bus terminating element. The essential benefit is that bus nodes can be disconnected, removed or replaced without data transfer being impaired.

Mechanical design

The PROFIBUS Terminator (order number: 6ES7 972-0DA00-0AA0) has the following features:

- IP 20 protection
- Transmission rates of 9.6 kbps to 12 Mbps
- Connectable cables: all SIMATIC NET PROFIBUS cables

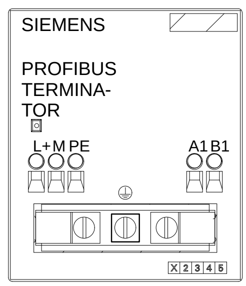


Figure 1-8 PROFIBUS Terminator

Additional information

You will find a detailed description of the PROFIBUS Terminator in Section 4.8.

Procedure – from planning to initial operation

2

In this chapter

This chapter offers an overview of the procedure in the ET 200 distributed I/O system. This chapter is intended primarily for readers who as yet have no experience with the ET 200.

It is in the nature of a quick reference for the rest of the manual, beginning with planning and continuing through cabling, parameterization with COM PROFIBUS, generation of the STEP 5 application program and on to initial operation.

Goal

After reading this chapter, you should be familiar with the outlines of the procedure for the distributed I/O system and know where to look for additional information in this manual.

2.1 Planning the layout

Overview

This section lists the important points for planning.

Layout, planning

The first thing to do when planning the layout is to draw up a site plan:

Table 2-1 Planning the layout

Step	Objective	Additional information
1	Distribute the inputs and outputs to the locations where they are required.	–
2	Assign the inputs and outputs to the appropriate slaves.	*Manuals on slaves*
3	Choose the master and protocol (PROFIBUS-DP or -FMS) which are best suited to achieving your particular goals.	–
4	Decide the locations of the slaves and the master.	*Manuals on slaves*
5	If you are using IM 308-C master interface(s), decide which slot(s) will accommodate the IM 308-C(s).	See section 5.3
6	Calculate the distances between the sites. These figures will determine:	
	• the maximum possible baud rate	See section 3.5
	• whether or not you require RS 485 repeaters (bus amplifiers)	See chapter 4
	• whether you require fiber-optic waveguides	*SIMATIC NET PROFIBUS Networks* manual

2.2 Structuring the ET 200 distributed I/O system

Overview

This section indicates the points that must be borne in mind with regard to the mechanical and electrical layout of the components.

Setting up the ET 200 system

To set up the ET 200 system:

Table 2-2 Setting up the ET 200

Step	Objective	Additional information
1	Begin by determining the positions of the cable ducts, and thus the spacing between the cables.	See section 3.1
2	Install the slaves and the master securely in their designated locations.	*Manuals on slaves*
3	IM 308-C: Insert the IM 308-C in the programmable controller.	See section 5.3
4	Connect the power supply, sensors and actuators to the slaves.	*Manuals on slaves*
5	Connect all nodes to the PROFIBUS-DP field bus:	
	• with bus connectors	See section 3.4
	• to RS 485 repeaters without bus connectors	See chapter 4
	• with special IP 66/67 bus connectors, for example for ET 200C, DP/AS-I link.	e. g. Manual *ET 200C Distributed I/O Station*

2.3 What to consider before parameterization with COM PROFIBUS

Overview

This section deals with the aspects you should consider before starting parameterization with COM PROFIBUS.

Considerations

Broadly speaking, there are two approaches to parameterization with COM PROFIBUS and to writing the application program:

- You can begin by parameterizing the configuration with COM PROFIBUS and allow COM PROFIBUS to automatically assign all station numbers and addresses in the STEP 5 application program. Thereafter, you can have the program print the system documentation and use this to set up your STEP 5 application program.

  Alternatively,
- Parameterization with COM PROFIBUS and writing of the STEP 5 application program are parallel. If you opt for this alternative, you must define the following before you start parameterization with COM PROFIBUS:

Decisions

Before starting parameterization with COM PROFIBUS, decide on the following:

Table 2-3 COM PROFIBUS and STEP 5 in parallel

Before starting parameterization with COM PROFIBUS, decide ...	**Additional information**
... which slave will have which PROFIBUS address.	–
... which addresses the slaves will use in the STEP 5 application program.	–
IM 308-C: The scope of the addresses determines which mode of addressing you select (linear, P-page addressing or Q-page addressing; plus function block FB IM308C).	See section 6.1
The system requirements determine whether you activate response monitoring for the slaves. The response monitoring setup determines whether the slave is switched to ”0” in a defined manner in the event of an error.	See section G.8.3
IM 308-C: You must define the error reporting mode for the IM 308-C: QVZ (acknowledgment delay), PEU (power fail in expansion unit) or none.	See section G.8.3

2.4 Parameterization with COM PROFIBUS

Overview

This section provides a brief outline of the procedure for parameterization with COM PROFIBUS.

Parameterizing the configuration

When you are ready to parameterize and save the configuration, proceed as follows:

Table 2-4 Parameterizing and saving the configuration

Step	Objective	Additional information
1	After starting COM PROFIBUS, assign the parameters to the individual components: • Bus • Host • Master and • DP slaves or FMS stations.	See *COM PROFIBUS* manual
2	After you have finished parameterizing the configuration, save all the parameters and transfer the data to the master.	See *COM PROFIBUS* manual
3	Finally, print the system documentation.	See *COM PROFIBUS* manual

2.5 Writing the STEP 5 application program

STEP 5 application program

You must know the following in order to write the STEP 5 application program:

Table 2-5 STEP 5 application program

You must know the following in order to write the STEP 5 application program ...	Additional information
... the addresses that the various DP slaves will have in the STEP 5 application program.	See *COM PROFIBUS* manual
... how to access the distributed inputs and outputs in the STEP 5 application program:	IM 308-C: see sections 6.1 and B.7 S5-95U: see section 10.1
... how to use FB IM308C for the IM 308-C.	See section 7
... how to interpret diagnostics messages.	IM 308-C: see section 6.2 S5-95U: see section 10.4
... what the FREEZE and SYNC control commands mean and how to send these commands to the DP slaves.	See section 6.5

2.6 Initial operation of the ET 200

Initial operation of the ET 200

The procedure for initial operation of the ET 200 distributed I/O system is as follows:

Table 2-6 Initial operation of the ET 200 (with IM 308-C)

Step	Objective	Additional in-formation
1	Use COM PROFIBUS or the FB IM308C to assign a valid PROFIBUS address to slaves that have to be assigned a PROFIBUS address by software means.	See Section 6.6 See the *COM PROFIBUS* manual
2	Test the individual slaves first with COM PROFIBUS.	See the *COM PROFIBUS* manual
3	Connect the individual stations to the bus, following the correct sequence.	See section 8.1
4	Via the AS 511 interface of the programmable control-ler, power up the ET 200 distributed I/O system.	*Manuals on pro-grammable con-trollers*
5	Using COM PROFIBUS, interpret the diagnostics messages on the PROFIBUS.	See *COM PROFI-BUS* manual

Routing cables; connecting and installing bus connectors

3

In this chapter

This chapter contains information on:

Goal

This chapter contains all the information that you must bear in mind with regard to routing cables.

After reading this chapter you will know how to connect the bus connectors and what you must bear in mind when routing the PROFIBUS cable.

3.1 Notes on routing cables

Overview

Certain rules and regulations apply to use of the ET 200 as a component in a higher-order system. These rules and regulations vary from application to application.

In this chapter

The various sections of this chapter contain information on the following topics:

3.1.1 General rules and regulations for operation of ET 200

Specific application

The rules and regulations for safety at work and accident prevention (e.g. machine-protection guidelines) must be observed in all instances.

EMERGENCY OFF facilities

IEC 204 EMERGENCY OFF facilities must remain effective in all operating modes of the plant or system.

System startup after certain events

The table below lists the points to bear in mind when a system starts up after certain events.

When ...	then ...
ET 200 restarts after voltage collapse or power failure	no dangerous operating statuses are permitted to occur. If necessary, an EMERGENCY OFF may have to be forced.
ET 200 starts up when the EMERGENCY OFF facility is reset	it must be impossible for an uncontrolled or undefined startup to occur.

Mains power

The important points are listed in the table below.

System feature	System requirement
Permanently installed system without all-pole mains disconnector	A mains disconnector or a fuse must be incorporated in the in-building wiring system.
Load power supply modules, power supply modules	The voltage range must be correct for the local mains supply.
All circuits	Fluctuations/variation of mains voltage from rated value must be within permissible tolerance (see technical data).

24 V DC supply

The points to bear in mind with regard to the 24 V supply are as follows:

<table>
<tr><th>With regard to ...</th><th colspan="2">it is important to ensure ...</th></tr>
<tr><td>buildings</td><td>exterior lightning protection</td><td rowspan="2">provide adequate lightning protection (see Section 3.2)</td></tr>
<tr><td>24 V DC supply lines, signal lines</td><td>interior lightning protection</td></tr>
<tr><td>24 V supply</td><td colspan="2">dependable electrical isolation of low voltage</td></tr>
</table>

Protection against external electrical effects

The points of importance with regard to protection against external electrical effects and faults are shown below.

With regard to ...	it is important to ensure ...
all facilities or systems incorporating the ET 200	that the facility or system is connected to the protective conductor so that destructive influences are diverted.
connecting lines and signal lines	that routing and installation are correct.
signal lines	that line or conductor breakage cannot cause the facility or system to assume an undefined state.

3.1.2 In-building cable routing

Introductory remarks

The EMC rules with regard to in-building cable routing (inside and outside cabinets) require certain clearances to be maintained between individual line groups. Table 3-1 shows the general rules with regard to spacing as they apply to cable selection.

How to read the table

If you want to know how two cables of different types should be routed, proceed as follows:

1. Find the first cable type in column 1 (cables for ...).
2. Find the second cable type in the corresponding section of column 2 (and cables for ...).
3. Read off the applicable guidelines in column 3 (route ...).

Table 3-1 In-building cable routing

<table>
<tr><th>Cables for ...</th><th>and cables for ...</th><th>route ...</th></tr>
<tr><td rowspan="3">• Bus signals, shielded (SINEC L1, PROFIBUS)
• Data signals, shielded (programmers, OPs, printers, counter inputs, etc.)
• Analog signals, shielded
• DC voltage ($\leq$ 60 V), unshielded
• Process signals ($\leq$ 25 V), shielded
• AC voltage ($\leq$ 25 V), unshielded
• Monitors (coaxial cabling)</td><td>• Bus signals, shielded (SINEC L1, PROFIBUS)
• Data signals, shielded (programmers, OPs, printers, counter inputs, etc.)
• Analog signals, shielded
• DC voltage ($\leq$ 60 V), unshielded
• Process signals ($\leq$ 25 V), shielded
• AC voltage ($\leq$ 25 V), unshielded
• Monitors (coaxial cabling)</td><td>in shared bundles or in shared cable ducts</td></tr>
<tr><td>• DC voltage ($>$ 60 V and $\leq$ 400 V), unshielded
• AC voltage ($>$ 25 V and $\leq$ 400 V), unshielded</td><td>in separate bundles or cable ducts (no minimum spacing required)</td></tr>
<tr><td>DC and AC voltages ($>$ 400 V), unshielded</td><td>• inside cabinets:
in separate bundles or cable ducts (no minimum spacing required)
• outside cabinets:
on separate cable racks with at least 10 cm spacing</td></tr>
</table>

Table 3-1 In-building cable routing, continued

Cables for ...	and cables for ...	route ...
• DC voltage (>60 V and ≤ 400 V), unshielded • AC voltage (>25 V and ≤ 400 V), unshielded	• Bus signals, shielded (SINEC L1, PROFIBUS) • Data signals, shielded (programmers, OPs, printers, counter signals etc.) • Analog signals, shielded • DC voltage (≤ 60 V), unshielded • Process signals (≤ 25 V), shielded • AC voltage (≤ 25 V), unshielded • Monitors (coaxial cabling)	in separate bundles or cable ducts (no minimum spacing necessary)
	• DC voltage (>60 V and ≤ 400 V), unshielded • AC voltage (>25 V and ≤ 400 V), unshielded	in shared bundles or cable ducts
	DC and AC voltages (>400 V), unshielded	• **Inside cabinets:** in separate bundles or cable ducts (no minimum spacing necessary) • **Outside cabinets:** on separate cable trays with at least 10 cm spacing
DC and AC voltages (>400 V), unshielded DC and AC voltages (>400 V), unshielded	• Bus signals, shielded (SINEC L1, PROFIBUS) • Data signals, shielded (programmers, OPs, printers, counter signals, etc.) • Analog signals, shielded • DC voltage (≤ 60 V), unshielded • Process signals (≤ 25 V), shielded • AC voltage (≤ 25 V), unshielded • Monitors (coaxial cabling) • DC voltage (>60 V and ≤ 400 V), unshielded • AC voltage (>25 V and ≤ 400 V), unshielded	• **Inside cabinets:** in separate bundles or cable ducts (no minimum spacing necessary) • **Outside cabinets:** on separate cable trays with min. 10 cm spacing
	DC and AC voltages (>400 V), unshielded	in shared bundles or cable ducts
SINEC H1	SINEC H1	in shared bundles or cable ducts
	Others	in separate bundles or cable ducts with at least 50 cm spacing

3.1.3 Outdoor cable routing

Cable routing rules for EMC

The rules that apply to in-building routing and EMC also apply outdoors. Outdoor cabling is also subject to the following rules:

- Lay cables on metal cable carriers.
- Galvanically connect the butting faces of cable-carrier sections.
- Ground the cable carriers.
- If necessary, ensure adequate potential equalization between the connected devices.
- Provide adequate lightning protection and grounding as applicable in your case (see below).

Additional information

Section 3.2 contains additional information on lightning protection for the ET 200 distributed I/O system. If you have any questions, do not hesitate to contact your local Siemens branch or a company specializing in lightning protection.

3.1.4 Potential equalization

When do differences in potential occur?

Differences in potential can occur, for example, when different mains supplies are used. Damage may be caused to the system as a result of potential differences between various system parts if:

- programmable controllers and inputs/outputs are connected by potential-bonded couplings,

  or

- cable shields are connected at both ends and grounded to different parts of a system.

Avoiding potential differences

It is important to install potential equalization lines in order to minimize potential differences and ensure the functionality of the electronic components.

When and why do you need potential equalization?

Potential equalization has the following advantages:

- Devices with a grounded interface may be destroyed as a result of potential differences.
- The shielding of the PROFIBUS cable must not be used for potential equalization. This is the case, however, with any parts of the system that are linked together via the cable shield, but connected to different grounding points.
- Potential equalization is a precondition of lightning protection.

Rules for potential equalization

Note the following points:

- The smaller the impedance of the potential equalization line, the higher the efficiency of potential equalization.
- If shielded signal cables are installed between certain parts of the system and connected at both ends to ground/protective conductors, it is important to ensure that the impedance of the additional potential equalization line is not in excess of 10 % of the shield impedance.
- Use connectors with large contact areas to connect the potential equalization conductors to the ground/protective conductor.
- Protect the potential equalization conductors against corrosion.
- Use potential equalization conductors made of copper or galvanized steel.
- Route the potential equalization conductors in such a way that the areas bounded by the potential conductor and the signal lines are as small as possible.
- Use equipotential bonding conductors made of copper or galvanized steel.

Note

Equipotental bonding conductors are not necessary if the parts of the system are connected to each other exclusively by means of fiber-optic cables.

3.1.5 Cable shielding

Definition

Shielding is a means of weakening (attenuating) magnetic, electric and electromagnetic interference fields.

Interference currents on cable shields are diverted to ground via the shield busbar, which forms a conductive connection with the housing. It is particularly important to ensure a low-ohmic connection to the protective conductor, as otherwise the interference currents themselves may become a source of interference.

Measures for cable shielding

Note the following points:

- If possible, use only cables with braided shields. The shield density should be more than 80 %.

  Avoid using cables with foil shielding, because tensile and compressive loads at the attachments can easily damage the foil. The result is a reduction in shield efficiency.

- Always connect the cable shields at both ends. It is only when the shielding is connected at both ends that interference suppression is effective at the high end of the frequency range.

  Exceptions: It may be better to connect the shield at one end only, if

  – for some reason it is not possible to install potential equalization lines,

  – analog signals (in the low mV or μA range) are transmitted, or

  – foil shielding (static shields) is used.

  Note, however, that if the shield is connected at one end only it can suppress only low-frequency interference.

- Connect the shield of the data line to the plug body.
- If the system is installed for stationary operation, it is advisable to remove the insulation from the shielded cable without interruption and connect the cable to the shielding/protective conductor busbar.

Note

If a potential difference occurs between the grounding points, an equalization current can flow through a shield connected at both ends.

In this case, install an additional potential equalization line.

Correct shield installation

Observe the following points:

- Use cable clamps made of metal to secure the braided shield.
- The enclosing clamps must hold a large part of the shield and make good contact (see Fig. 3-1).
- Connect the shield to a shield busbar immediately adjacent to the point where the cable enters the cabinet.

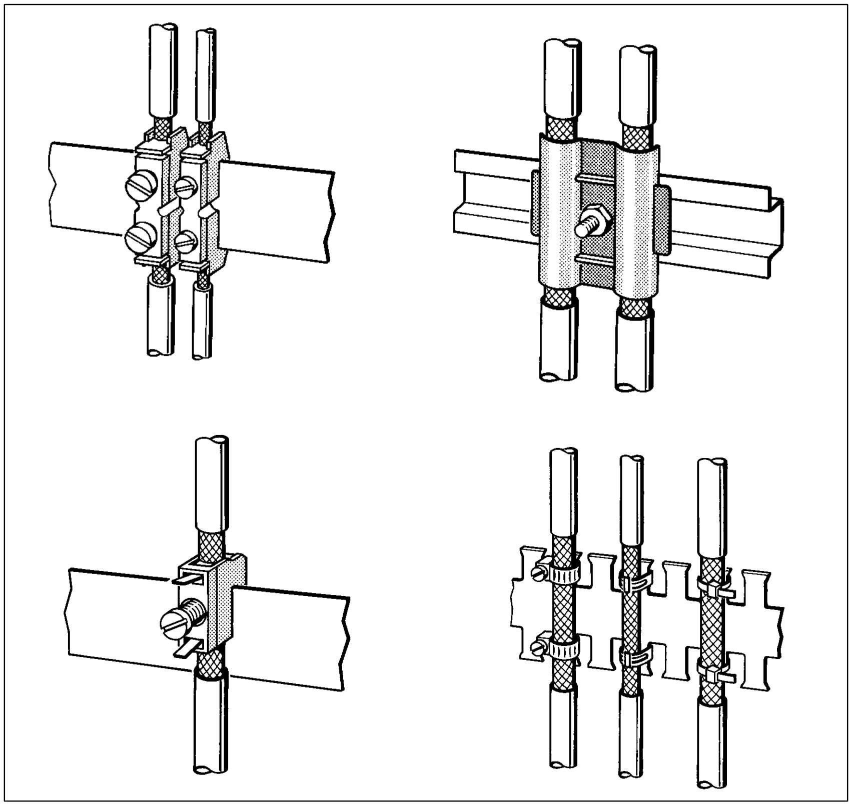


Figure 3-1 Securing shielded cables with cable clamps and cable ties (schematic diagram)

3.1.6 Measures to prevent interference voltages

Overview

Frequently, measures designed to suppress interference voltages are not adopted until the controller is in operation and reception of a traffic signal is found to be unsatisfactory. The outlay for post-installation measures (e.g. special contactors) can often be reduced to a significant extent if you observe the following points when configuring your control system.

Note the importance of the following:

- Suitable positioning of devices and routing of cables
- Grounding of all inactive metal components
- Shielding of devices and lines, and
- Special interference-suppression measures

Arrangement of devices and routing of cables

Adequate suppression of magnetic DC or AC fields in the low-frequency range (e.g. 50 Hz) is costly. In many cases, however, the problem can be solved by ensuring that the interference sink is sufficiently far away from the interference source.

Installation and grounding of inactive metal components

When the devices are installed, it is important to ensure that the inactive metal components are correctly grounded with connectors having large contact areas. Correct grounding establishes a uniform reference potential for the control system and reduces the effects on spurious interference.

Grounding means the conductive connection of all inactive metal components. The entirety of all interconnected inactive components is known as the machine ground.

Inactive metal components are all conductive parts electrically isolated from active parts by basic insulation at least and which can become charged only if a fault occurs.

Even if a fault occurs, the ground **may under no circumstances carry voltage that could cause injury** in the event of accidental contact. The ground must, therefore, be connected to the protective conductor. In order to avoid ground loops, a star pattern must be adopted when grounded objects (cabinets, parts of structures and machines) not immediately adjacent to each other are connected to the protective conductor system.

Note the following:

1. When connecting the inactive metal parts, exercise the same meticulous care and attention as with active parts.
2. Make sure that metal-to-metal connections are low-ohmic, i.e. use connectors that are efficiently conductive and which have large contact areas.
3. If painted or anodized metal parts are included in grounding, these insulating protective surface coatings must be penetrated. Use special contact washers or remove the surface coatings down to bare metal.
4. Protect the assembled connections against corrosion, e.g. by applying a coat of grease.
5. Use flexible grounding straps to connect moving grounded parts (e.g. doors of cabinets). The grounding straps should be short and have a large surface area, because the surface area is critical for the removal of high-frequency interference.

3.1.7 Special measures for interference-proof operation

Commutating capacitors for inductors

As a rule, the inductors driven by SIMATIC S5 (e.g. contactor/relay coils) do not require external commutating capacitors, because the requisite components are integrated in the modules.

You need to install commutating capacitors for inductors only:

- when SIMATIC S5 output circuits can be switched off by other integral contacts (e.g. relay contacts for EMERGENCY OFF). In this case, the commutating capacitors integrated in the modules are no longer effective;
- if the inductors are **not** driven by SIMATIC S5 modules.

Note: The supplier of the inductors will be able to tell you how to dimension the overvoltage-protection devices.

Circuit with DC-actuated coils

DC-actuated coils require diodes or Zener diodes.

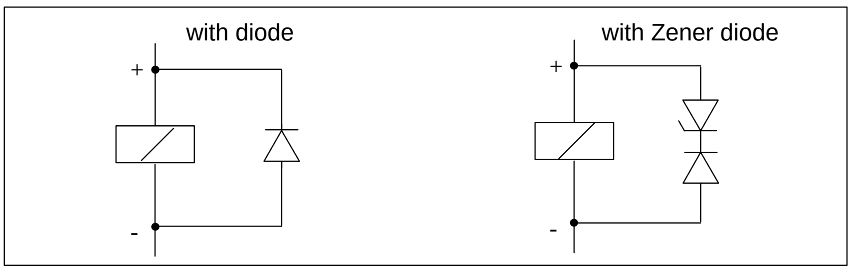


Figure 3-2 Circuits with DC-actuated coils

Circuit with diodes/Zener diodes

A circuit incorporating diodes/Zener diodes has the following properties:

- Shutdown overvoltages can be avoided completely
- High shutdown delay (6 to 9 times higher than without protective circuitry)

Circuit with AC-actuated coils

AC-actuated coils require varistors or RC elements.

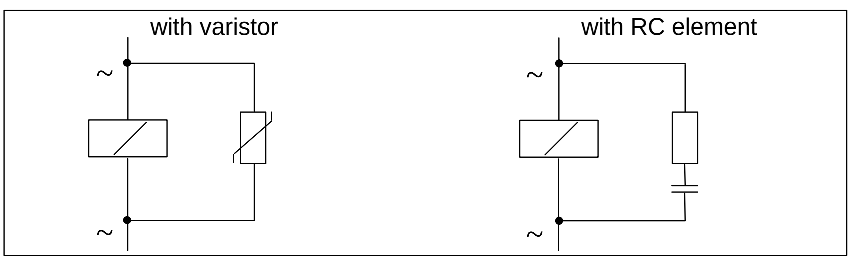


Figure 3-3 Circuits with AC-actuated coils

Circuit with varistor

A circuit incorporating a varistor has the following properties:

- The amplitude of the shutdown overvoltage is limited, but the overvoltage is not suppressed
- Overvoltage slope is uniform
- Shutdown delay is slight

Circuit with RC element

A circuit incorporating an RC element has the following properties:

- The amplitude and slope of the shutdown overvoltage are reduced
- Shutdown delay is slight

Programming units: connection to power supply

Each cabinet must feature a power point for connecting the programming units to the mains supply. These power points must receive their supply via the distribution board to which the protective conductor of the cabinet is connected.

Cabinet lighting

Use bulbs such as LINESTRA® bulbs for the cabinet lighting. Do not use fluorescent tubes, because they generate interference fields. If there is no alternative to fluorescent tubes, adopt the measures illustrated in Fig. 3-4.

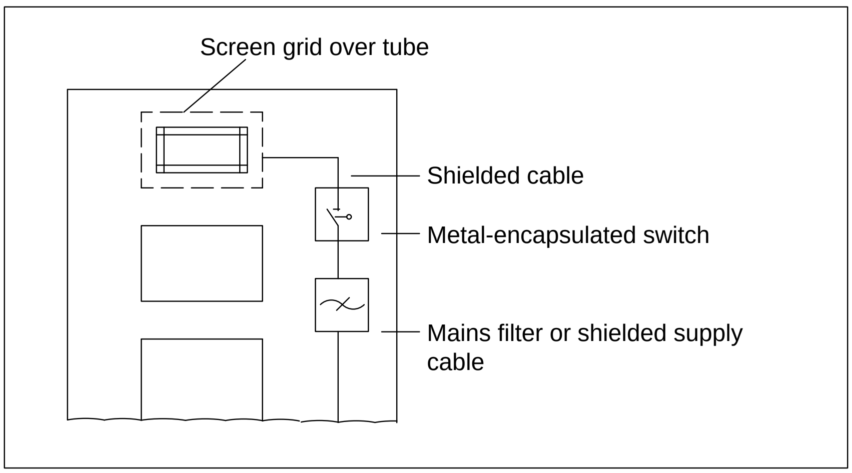


Figure 3-4 Measures for suppressing interference from fluorescent tubes in cabinets

3.2 Lightning protection and overvoltage protection

In this chapter

This chapter describes ways and means of protecting your automation system against overvoltage surge and lightning strike.

3.2.1 Why protect the automation system against overvoltage?

Introduction

Overvoltage is one of the most frequent causes of failure. These dangerous voltage surges can be caused by:

- switching operations in power-supply networks
- atmospheric discharges, or
- electrostatic discharges

In this context, it is important to understand the theory of overvoltage protection, in other words the concept of zoned lightning protection.

This chapter contains an outline of this concept, plus a discussion of the rules governing the measures to be adopted at the interfaces between the individual zones.

Note

This chapter merely indicates how to protect an **automation system** against overvoltage.

Bear in mind that complete protection against overvoltage can be ensured only if the entire structure which houses the system incorporates adequate overvoltage-protection measures. This is especially significant for structural measures intended for buildings in planning.

If you would like comprehensive information on overvoltage protection, we strongly recommend that you consult your Siemens contact partner or a company which specializes in lightning protection.

In-depth literature

The proposals advanced in this chapter are based on the concept of zoned lightning protection as described in IEC standard 1024-2 *Protection against LEMP.*

Principle of zoned lightning protection

The principle of zoned lightning protection requires that the volume (a factory building, for example) to be protected against overvoltage be subdivided into zones by the application of EMC criteria (see Fig. 3-5).

The individual lightning-protection zones are formed by

The external lightning protection of the building (field side)	Lightning-protection zone 0
The shielding of: • Buildings • Rooms and/or • Devices	 Lightning-protection zone 1 Lightning-protection zone 2 Lightning-protection zone 3

Lightning strikes and overvoltages

Direct lightning strikes occur in lightning-protection zone 0, producing high-energy electromagnetic fields that must be reduced or dissipated by suitable lightning-protection elements/measures as they pass from one zone to the next.

In lightning-protection zones 1 and higher, overvoltages may occur as the result of switching operations, coupling operations, etc.

Lightning-protection zones: schematic

Fig. 3-5 is a schematic showing the concept of lightning-protection zones as it applies to a free-standing building.

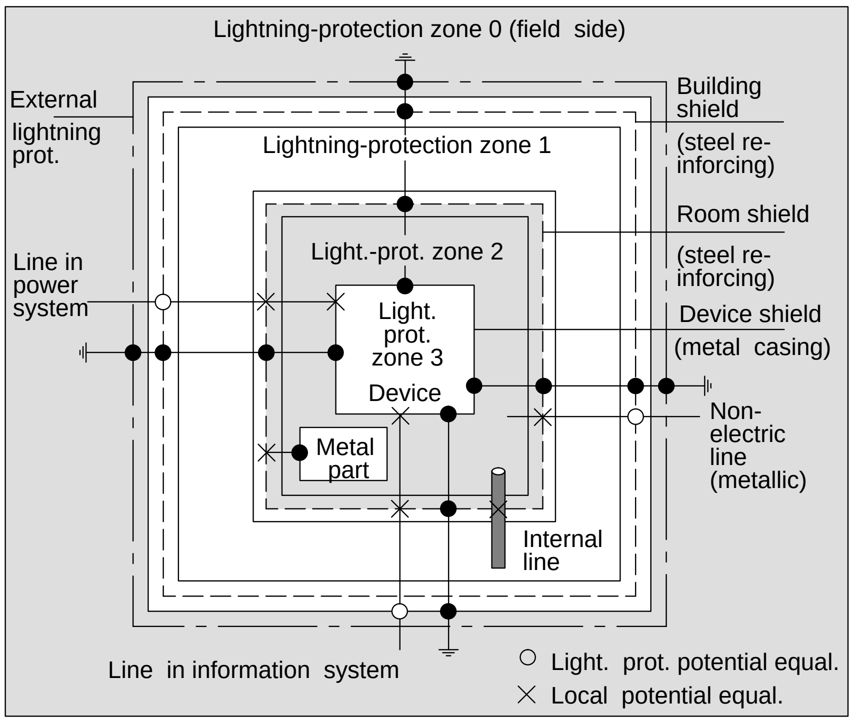


Figure 3-5 Lightning-protection zones of a building

Principle of the interfaces between the lightning-protection zones

At the interfaces between the lightning-protection zones, you must provide measures to prevent or hinder the passage of overvoltage surges.

The principle of establishing lightning-protection zones also requires that all lines capable of carrying the lightning pulse between the lightning-protection zones be included in the potential equalization system for lightning protection.

Lines capable of carrying the lightning pulse include:

- metal pipes (e.g. for water, gas and heat)
- cables in power systems (e.g. mains supply, 24 V supply)

  and
- cables in information systems (e.g. bus line)

3.2.2 How to protect the ET 200 distributed I/O system against overvoltage

Rules for the 0 ↔ 1 interface (potential equalization in lightning protection system)

Suitable measures for potential equalization in the lightning-protection system at the interface between lightning-protection zones 0 ↔ 1 are as follows:

- Use twisted metal straps or metal braids of sufficient current-carrying capacity as cable shields, e.g. NYCY or A2Y(K)Y, and ground these straps at both ends;

  or

- lay the cables in
  - continuously connected metal conduits grounded at both ends, or
  - in reinforced-concrete ducts with continuous reinforcing members, or
  - on enclosed cable trays made of metal and grounded at both ends.

  or

- use fiber-optic waveguides instead of lines which are capable of carrying the surge current.

Additional measures

If the measures outlined above cannot be implemented, it is essential to provide coarse protection at the 0 ↔ 1 interface in the form of suitable lightning diverters. The table below is an overview of the components you can use for this purpose.

Table 3-2 Overvoltage-protection components for coarse protection

Ser. No.	Lines for ...	... install the following at the 0 ↔ 1 interface:	Order No.
1	Three-phase TN-C system	3 pcs. DEHNport lightning diverter, phases L1/L2/L3 to PEN	900 100[1]
	Three-phase TN-S and TT systems	4 pcs. DEHNport lightning diverter, phases L1/L2/L3/N to PE	900 100[1]
	Alternating current TN-L, TN-S-, TT systems	2 pcs. DEHNport lightning diverter, phases L1+, N to PE	900 100[1]
2	24 V DC supply	1 pc. Blitzductor KT, Type AD 24 V	DSN: 919 253[2]
3	PROFIBUS bus line	up to 500 kbaud: 1 pc. Blitzductor KT, Type ARE 8 V	DSN: 919 232[2]
		over 500 kbaud: 1 pc. Blitzductor KT, Type AHFD 5 V	DSN: 919 270[2]
4	Inputs/outputs of digital modules		
	• 24 V DC	1 pc. Blitzductor KT, Type AD 24 V	DSN: 919 253[2]
	• 110/220 V AC	2 pc. DEHNguard 150 overvoltage diverter	900 603[1]
	Inputs/outputs of analog modules		
	• up to ± 12 V	1 pc. Blitzductor KT, Type ALE 15 V	DSN: 919 220[2]
	• up to ± 24 V	1 pc. Blitzductor KT, Type ALE 48 V	DSN: 919 227[2]
	• up to ± 48 V	1 pc. Blitzductor KT, Type ALE 60 V	DSN: 919 222[2]

1 Order components directly from: DEHN + Soehne, Elektrotechnische Fabrik, Hans-Dehn-Str. 1, D-92318 Neumarkt, Germany

2 Order numbers as per catalog *Service XV 10*. The order number of this catalog is E89700-S1034-X-A3.

Rules for the 1 ↔ 2 interfaces and higher (local potential equalization)

The rules for all lightning-protection zone interfaces 1 ↔ 2 and higher are as follows:

- Provide local potential equalization at each lightning-protection zone interface.
- At all lightning-protection zone interfaces, include all lines (e.g. metal pipes, etc.) in the local potential equalization measures.
- Include all metal fittings inside the lightning-protection zone in the local potential equalization system (e.g. metal components inside lightning protection zone 2 must be included in measures implemented at the 1 ↔ 2 interface).

Additional measures

We recommend the installation of fine protection:

- for all lightning-protection zone interfaces 1 ↔ 2 and higher and
- for all lines longer than 100 meters inside a lightning-protection zone.

Table 3-3 Fine protection of lines by means of overvoltage-protection components

Ser. No.	Lines for ...	... at the 1 ↔ 2 interface and higher, install:	Order No.
1	Three-phase TN-C system	3 pcs. DEHNguard 275 overvoltage diverter	900 600[1]
	Three-phase TN-S and TT systems	4 pcs. DEHNguard overvoltage diverter 275	900 600[1]
	Alternatiing current TN-L, TN-S, TT systems	2 pcs. DEHNguard 275 overvoltage diverter	900 600[1]
2	24 V DC supply	1 pc. Blitzductor KT, Type AD 24 V	DSN: 919 253 [2]
3	PROFIBUS bus line	up to 500 kbaud: 1 pc. Blitzductor KT, Type ARE 8 V	DSN: 919 232[2]
		over 500 kbaud: 1 pc. Blitzductor KT, Type AHFD 5 V	DSN: 919 270 [2]
4	Inputs/outputs of digital modules		
	• 24 V DC	1 pc. Blitzductor KT, Type AD 24 V	DSN: 919 253[2]
	• 110/220 V AC	2 pcs. DEHNguard 150 overvoltage diverter	900 603[1]
	Inputs/outputs of analog modules		
	• up to ± 12 V	1 pc. Type FDK 12 V OV terminal	DSN: 919 999[2]
	• up to ± 24 V	1 pc. Type FDK 24 V OV terminal	DSN: 919 998[2]
	• up to ± 48 V	1 pc. Type FDK 60 V OV terminal	DSN: 919 997[2]

1 Order components directly from: DEHN + Soehne, Elektrotechnische Fabrik, Hans-Dehn-Str. 1, 92318 Neumarkt, Germany

2 Order numbers as per catalog *Service XV 10*. The order number of this catalog is: E89700-S1034-X-A3.

3.2.3 Example illustrating lightning protection for the ET 200 distributed I/O system

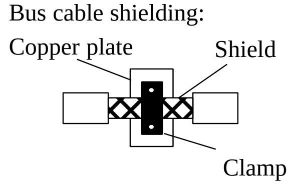
Introduction

This section contains an example illustrating how the ET 200 distributed I/O system can be protected against overvoltage surges.

Components for lightning protection

Table 3-4 refers to Fig. 3-6 and clarifies the items referred to by their serial numbers:

Table 3-4 Example of configuration with adequate lightning protection (legend for Fig. 3-6)

Ser. No. from Fig. 3-6	Component	Purpose
1	Lightning diverter to suit mains system; 2 to 4 pcs. DEHNport Order No.: 900 100[1]	Coarse protection against direct lightning strike and overvoltage at interface 0 ↔ 1
2	Overvoltage diverter, 2 pcs. DEHNguard 275 Order No.: 900 600[1]	Coarse protection against overvoltage at interface 1 ↔ 2
3	Digital modules • Blitzductor KT, Type AD 24 V SIMATIC Analog modules • Blitzductor KT, Type ARE 12 V	Fine protection against overvoltage at inputs and outputs of the DP slaves at interface 1 ↔ 2
4	In dropline • 1 pc. adapter type FS 9E-PB Order No.: DSN 924 017[2] • 1 pc. 35 mm top-hat rail with cable, type ÜSD-9-PB/S-KB Order No.: DSN 924 064[2]	Fine protection against overvoltage for RS 485 interfaces at interface 1 ↔ 2
5	Bus cable shielding: 	–
6	Potential equalization cable, 16 mm^2	–
7	Blitzduktor KT, type AHFD, for building transition Order No.: DSN 919 270[2]	Fine protection against overvoltages for RS 485 interfaces at interface 0 ↔ 1

1 Order components directly from: DEHN + Soehne, Elektrotechnische Fabrik, Hans-Dehn-Str. 1, 92318 Neumarkt, Germany

2 Order numbers as per catalog *Service XV 10*. The order number for this catalog is E89700-S1034-X-A3.

Sample configuration

Fig. 3-6 is an example showing how the distributed I/O system must be configured for effective protection against overvoltage surges:

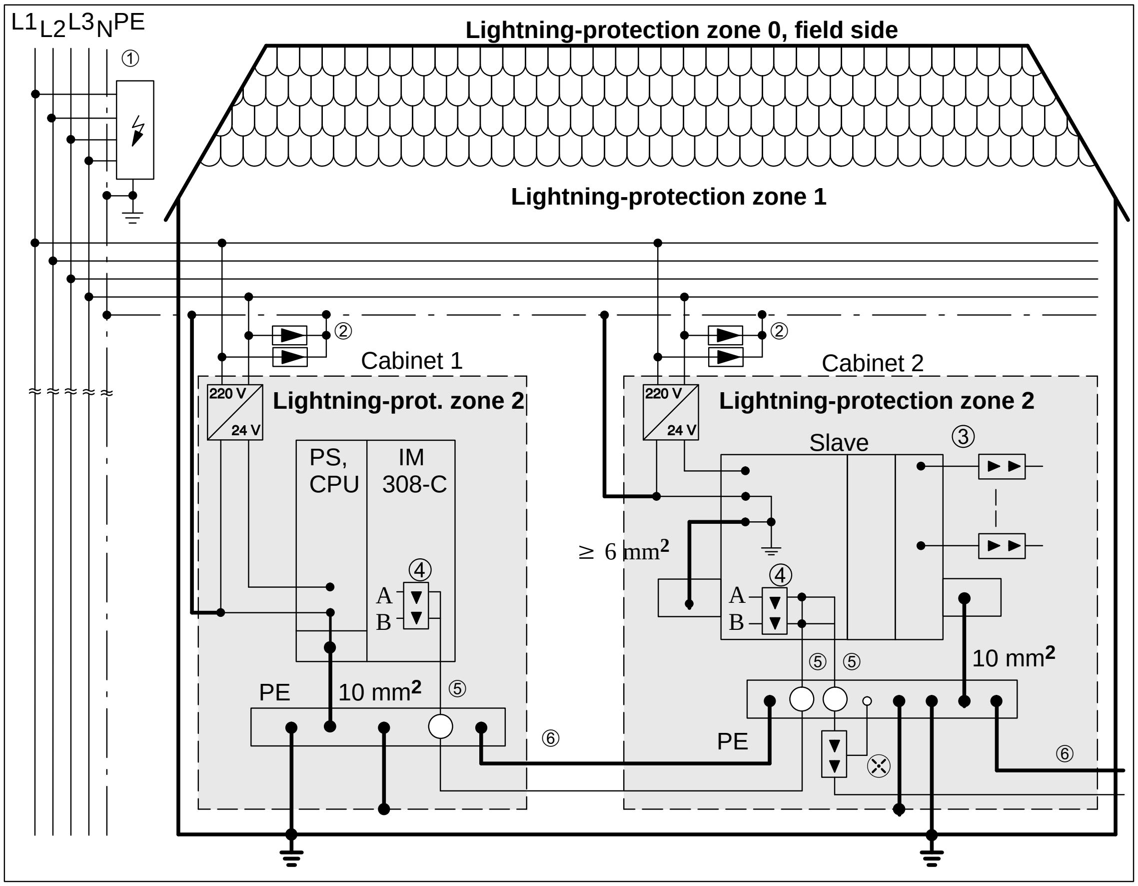


Figure 3-6 Example showing lightning protection for the ET 200 distributed I/O system

3.3 Characteristics of the bus cable

Characteristics of the bus cable

Use a two-conductor, twisted, shielded cable with the following characteristics as the bus cable:

Table 3-5 Characteristics of the PROFIBUS cable

Designation	Normal	Normal with PE sheath	Buried cable	Drum cable[1]	Normal cable with festoon [1]
Order number 6VX1 ...	830-0AH10	830-0BH10	830-3AH10	830-3BH10	830-3CH10
Attenuation at • 16 MHz • 4 MHz • 38.4 kHz • 9.6 kHz	< 45 dB/km < 22 dB/km < 5 dB/km < 3 dB/km			< 52 dB/km < 25 dB/km < 5 dB/km < 3 dB/km	
Characteristic impedance at • 9.6 kHz • 38.4 kHz • 3 to 20 MHz Rated value	270 ± 27 Ω 185 ± 18,5 Ω 150 ± 15 Ω 150 Ω				
Loop resistance	≤ 110 Ω/km		≤ 110 Ω/km	≤ 132 Ω/km	
Shield impedance	≤ 9.5 Ω/km		≤ 12 Ω/km	≤ 14 Ω/km	
Operating capacitance at 1 kHz	approx. 28.5 nF/km				
Operating voltage (rms value)	≤ 100 V				
Cable type (standard designation)	02Y (ST) CY 1 × 2 × 0.64/ 2.55- 150 KF 40 FR VI	02Y (ST) C2Y 1 × 2 × 0.64/ 2.55- 150 SW	02Y (ST) CY2Y 1 × 2 × 0.64/ 2.55- 150 KF 40 SW	02Y (ST) C11Y 1 × 2 × 0.64/ 2.55- 150 LI petrol	02Y (ST) C (ZG) 11Y 1 × 2 × 0.64/ 2.55- 150 LI petrol
Sheath • Material • Color • Diameter (in mm)	PVC violet 8.0 ± 0.4	PE black 8.0 ± 0.4	PE black 10.2 ± 0.4	PUR petrol 8.5 ± 0.4	PUR petrol 9.7 ± 0.4
Permissible ambient conditions • Operating temperature • Transport/storage temperature • Laying temperature	–40 °C to +60 °C –40 °C to +60 °C –5 °C to +50 °C			–40 °C to +60 °C –40 °C to +60 °C –5 °C to +60 °C	
Bending radius • Single bending • Multiple bending	± 75 mm ± 150 mm	± 40 mm ± 80 mm	± 75 mm ± 100 mm	± 45 mm ± 65 mm	± 50 mm ± 80 mm
Permissible tensile force	45 N			35 N	
Weight	59 kg/km	52 kg/km	90 kg/km	74 kg/km	74 kg/km
Use of halogen	Yes	No	Yes	No	No

Table 3-5 Characteristics of the PROFIBUS cable, continued

Designation	Normal	Normal with PE sheath	Buried cable	Drum cable[1]	Normal cable with festoon [1]
Behavior in fire	Flame-retardant to VDE 0472 T804, test type C	Flammable	Flammable	Flame-retardant to VDE 0472 T804, test type B	Flame-retardant to VDE 0472 T804, test type B
Resistance to oil	Conditional resistance to mineral oils and greases			Good resistance to mineral oils and greases	
Resistance to UV light	No	Yes	Yes	Yes	Yes

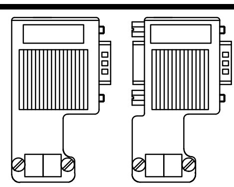
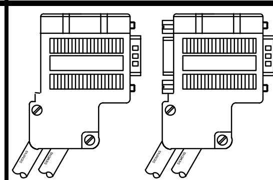
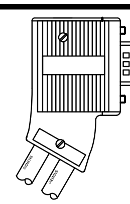
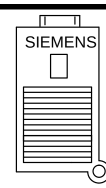
1 Segment lengths restricted

3.4 Applications and technical data of the bus connectors

Applications

You need bus connectors to connect the PROFIBUS to a station. There is a choice of IP 20 bus connectors; the uses of the various types are shown in Table 3-6.

Table 3-6 IP 20 bus connectors, configuration and applications

Order numbers:	**6ES7 972-0BA11-0XA0** **6ES7 972-0BB11-0XA0**	**6ES7 972-0BA40-0XA0** **6ES7 972-0BB40-0XA0**	**6ES7** **0BA30-0XA0**	**6GK1** **500-0EA00**
Appearance:		 35° outgoing cable unit	 30° outgoing cable unit	
Recommended for: • IM 308-B • IM 308-C • S5-95U	 ● (since release 6) ● 	 ● ● ●	 ● ● ●	
• S7-300 • S7-400 • M7-300 • M7-400	● ● ●	● ● ● ●	● ● ● ●	
• CP 5412 (A2) • CP 5411 • CP 5511 • CP 5611				● ● ● ●
• ET 200B • ET 200L • ET 200M • ET 200S • ET 200U	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	
• PG 720/720C • PG 730 • PG 740 • PG 750 • PG 760		● ● ● ● ●	● ● ● ● ●	● ● ● ● ●

Technical data The technical data of the various bus connectors is shown in the table below:

Table 3-7 IP 20 bus connectors, technical data

Order numbers	6ES7 972- ... 0BA11-0XA0 ... 0BB11-0XA0	6ES7 972- ... 0BA40-0XA0 ... 0BB0-0XA0	6ES7 972- 0BA30-0XA0	6GK1 500- 0EA00
Programmer socket	0BA11: no 0BB11: yes	0BA40: no 0BB40: yes	no	no
Max. baud rate	12 Mbaud	12 Mbaud	1.5 Mbaud	12 Mbaud
Terminating resistor	optionally activatable	optionally activatable	no	optionally activatable
Outgoing cable	vertical	inclined 35°	inclined 30°	axial
Interfaces • PROFIBUS station • PROFIBUS bus cable	9-pole sub-D socket 4 terminal blocks for wires up to 1.5 mm^2	9-pole sub-D socket 4 terminal blocks for wires up to 1.5 mm^2	9-pole sub-D socket 4 insulation-piercing connecting devices for wires 0.644 ± 0.04 mm	9-pole sub-D socket 4 terminal blocks for wires up to 1.5 mm^2
Connectable PROFIBUS cable diameter	8 ± 0.5 mm	8 ± 0.5 mm	8 ± 0.5 mm	8 ± 0.5 mm
Supply voltage (must be obtained from terminal device)	DC 4.75 to 5.25 V	DC 4.75 to 5.25 V	DC 4.75 to 5.25 V	DC 4.75 to 5.25 V
Current consumption	max. 5 mA	max. 5 mA	max. 5 mA	max. 5 mA
Permissible ambient conditions • Operating temperature • Transport/storage temperature • Relative humidity	 0 °C to +60 °C –25 °C to +80 °C max. 75 % at +25 °C	 0 °C to +60 °C –25 °C to +80 °C max. 75 % at +25 °C	 0 °C to +60 °C –25 °C to +80 °C max. 75 % at +25 °C	 0 °C to +55 °C –25 °C to +70 °C max. 95 % at +25 °C
Dimensions (in mm)	15.8 × 54 × 34	15.8 × 54 × 38	15 × 58 × 34	15 × 39 × 57
Weight	approx. 40 g	approx. 40 g	approx. 30 g	approx. 100 g

Bus connector not necessary

You do **not** require the IP 20 bus connectors for:

- IP 65 slaves (e.g. ET 200C)
- RS 485 repeaters

Disconnecting a station

Under certain circumstances, the bus connector enables you to disconnect a station from the bus without interrupting traffic on it.

Bus connector with programmer socket

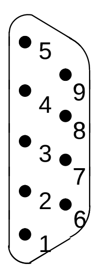
We recommend fitting at least one bus connector with a programmer socket in each bus segment. This will make it easier for you to start up with a programmer or a PC.

Pin assignment of sub-D connector

Table 3-8 shows the pin assignment of the 9-pole D-sub connector.

The assignment of pin nos. 1, 2, 7 and 9 corresponds to that of the connected device. Pins 4, 5 and 6 of the bus connector with order number 6ES7 972-0BA30 ... are not wired.

Table 3-8 Pin assignment of the 9-pole D-sub connector

View	Pin No.	Signal	Designation
	1	–	–
	2	–	–
	3	RxD/TxD-P	Data line B
	4	RTS	Request to send
	5	M5V2	Data reference potential (from station)
	6	P5V2	Supply plus (from station)
	7	–	–
	8	RxD/TxD-N	Data line A
	9	–	–

3.5 Connecting the bus cable to the bus connector

In section 3.5

This section contains:

Rules for laying cables

When you lay the bus cable, take great care to ensure that it is:

- not twisted
- not stretched and
- not compressed.

When laying the bus cable, moreover, you must observe the boundary conditions stated in section 3.3.

Maximum cable length

The maximum cable lengths as stated in the table below are guaranteed only for PROFIBUS bus cables.

Table 3-9 Permissible cable lengths for a segment using RS 485 repeaters

Baud rate	Maximum cable length of a segment (in meters)	Max. distance between 2 stations (in meters)
9.6 to 187.5 kbaud	1000	10,000
500 kbaud	400	4,000
1.5 Mbaud	200	2,000
3 to 12 Mbaud	100	1,000

Length of droplines

If you do not connect the bus cable directly to the bus connector (e.g. when using an PROFIBUS bus terminal), you must take the maximum permissible length of a dropline into account.

The maximum lengths for droplines per bus segment are shown in the table below.

At baud rates of 3 Mbaud and higher, connect the programmer or PCs by means of programmer droplines having the order number 6ES7 901-4BD00-0XA0. You can use multiple droplines with this order number in a bus configuration. Other droplines are not permitted.

Table 3-10 Length of droplines per segment

Baud rate	Max. length of droplines per segment	Number of stations with droplines measuring ...	
		1.5 m or 1.6 m	3 m
9.6 to 93.75 kbaud	96 m	32	32
187.5 kbaud	75 m	32	25
500 kbaud	30 m	20	10
1.5 Mbaud	10 m	6	3
3 to 12 Mbaud	–	–	–

3.5.1 Connecting bus cable to bus connectors with order number 6ES7 972-0B.11 ...

Appearance (6ES7 972-0B.11 ...)

The bus connector with the order number 6ES7 972-0B.11 ... is illustrated below:

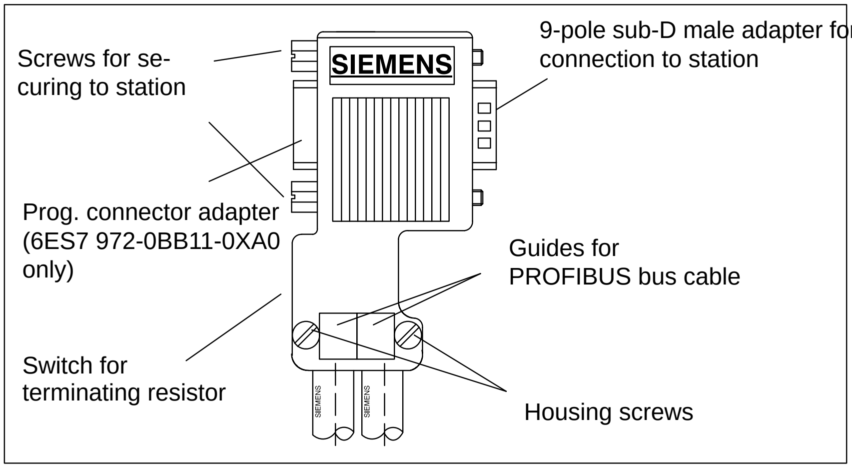


Figure 3-7 Bus connector with order number 6ES7 972-0B.11 ...

Preparing the bus cable

To connect the bus cable to a bus connector with order number 6ES7 972-0B.11 ... proceed as follows:

1. Strip the ends of the cable conductors as shown in Fig. 3-8.

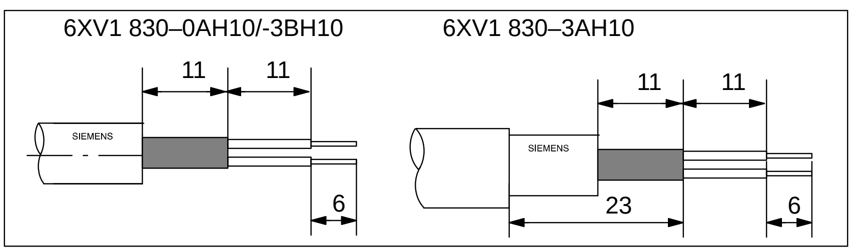
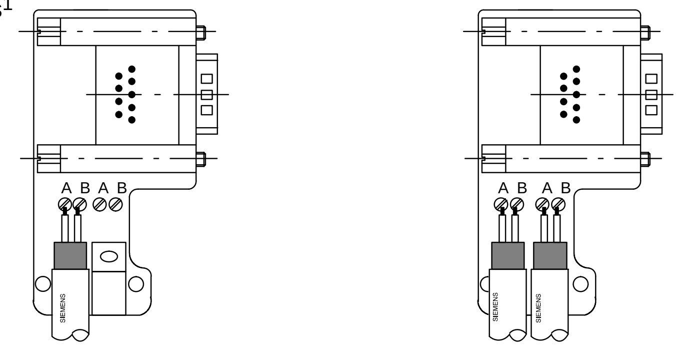


Figure 3-8 Length of stripped ends for connection to bus connector (6ES7 972-0B.11...)

2. To open the housing of the bus connector, slacken the securing screws and lift off the cover.
3. Insert the green and red conductors in the screw terminals as shown in Fig. 3-9.

   Make sure that you always connect the same conductors to the same terminal A or B (e.g. always connect the green conductor to terminal A and the red conductor to terminal B).

4. Press the cable sheath between the two retainers to hold the cable in position.
5. Tighten the screws to secure the conductors in their respective terminals.



[1]: The bus cable can be connected to either the left or right set of terminals!

Figure 3-9 Connecting bus cable to bus connectors with order number 6ES7 972-0B.11 ...

6. Screw the housing tight.

   Make sure that the naked cable shield is seated under the shield clamp.

3.5.2 Connecting bus cable to bus connectors with order number 6ES7 972-0BA30 ...

Appearance (6ES7 972-0BA30 ...)

Fig. 3-10 shows the bus connector with order number 6ES7 972-0BA30 ...:

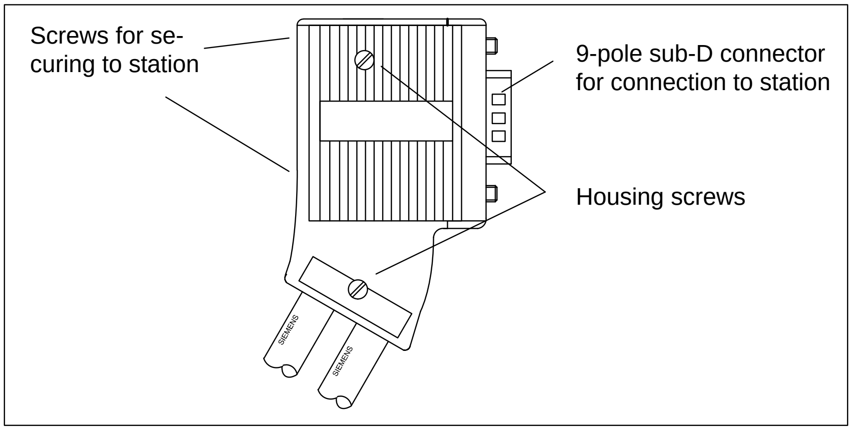


Figure 3-10 Appearance of the bus connector with order number 6ES7 972-0BA30 ...

Installing the bus cable

To connect the bus cable to a bus connector with order number 6ES7 972-0BA30 ..., proceed as follows:

1. Strip the ends of the bus cable as shown in Fig. 3-11.

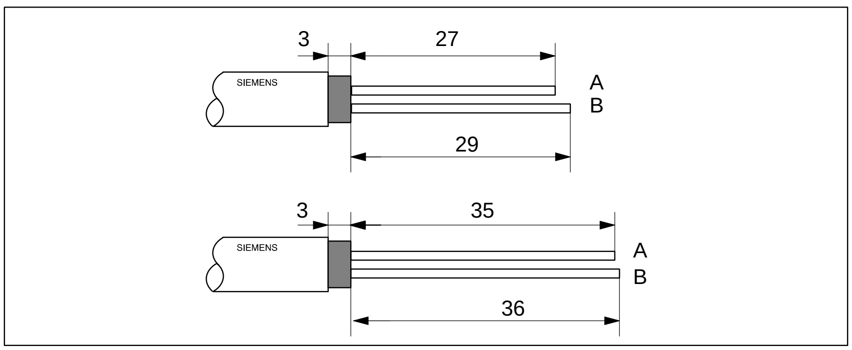


Figure 3-11 Length of stripped ends for connection to bus connector (6ES7 972-0BA30 ...)

2. Open the housing of the bus connector by slackening the housing screws and lifting off the cover.
3. Press the bus cable into the strain relief device. The cable shield must lay naked on the metal guide.

4. Insert the green and red conductors into the guides through the insulation-piercing connection devices as shown in Fig. 3-12.

   Make sure that you always connect the same conductors to the same terminal A or B (e.g. always connect the green conductor to terminal A and the red conductor to terminal B).

5. Press the red and green conductors gently into the insulation-piercing connection devices with your thumb.

6. Screw the cover on tightly again.

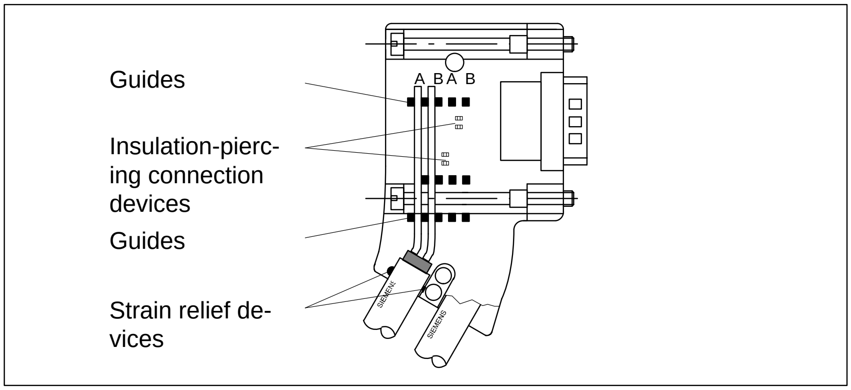


Figure 3-12 Connecting bus cable to bus connector (6ES7 972-0BA30 ...)

3.5.3 Connecting bus cable to bus connectors with order number 6ES7 972-0B.40 ...

Appearance (6ES7 972-0B.40 ...)

The bus connector with the order number 6ES7 972-0B.40 ... is illustrated below:

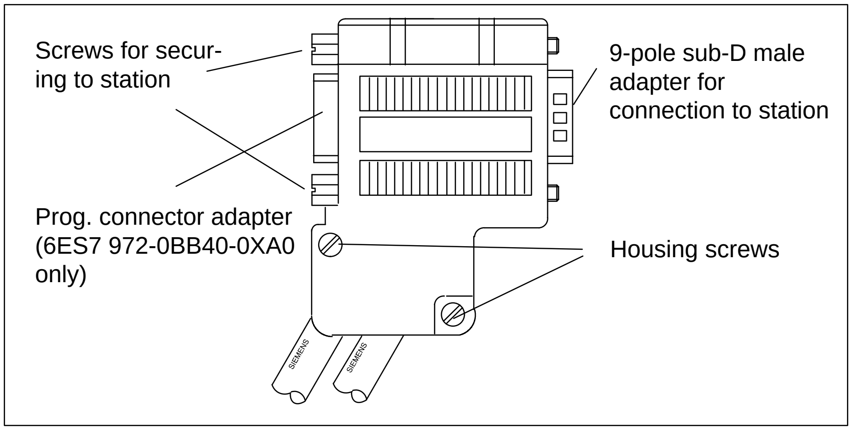


Figure 3-13 Bus connector with order number 6ES7 972-0B.40 ...

Installing the bus cable

To connect the bus cable to a bus connector with order number 6ES7 972-0B.40 ... proceed as follows:

1. Strip the ends of the cable conductors as shown in Fig. 3-14.

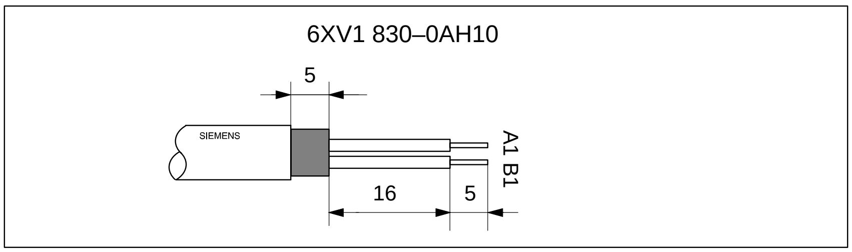
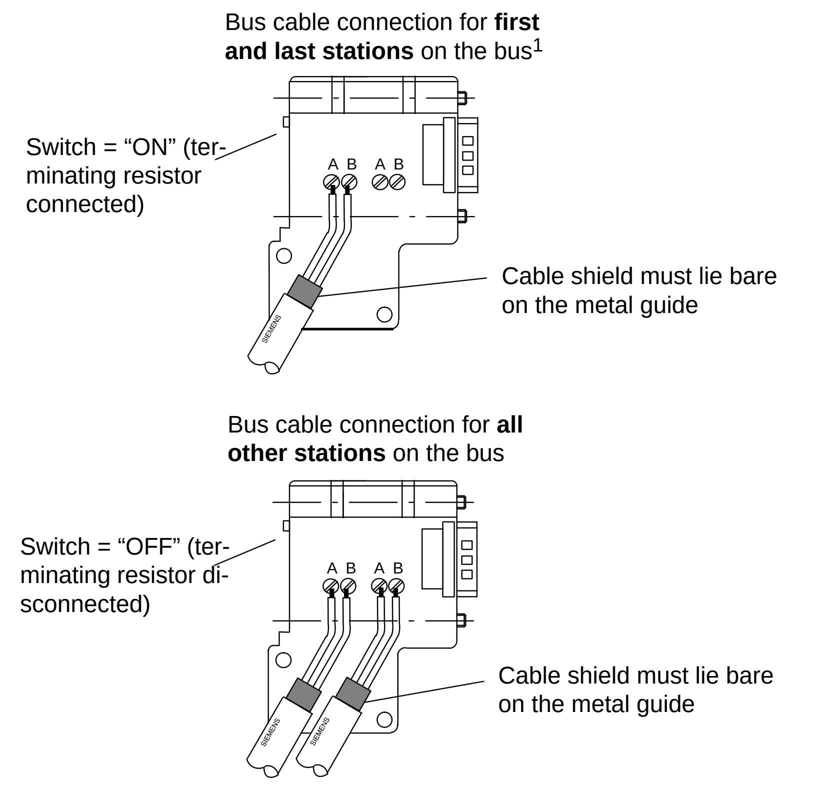


Figure 3-14 Length of stripped ends for connection to bus connector (6ES7 972-0B.40 ...)

2. To open the housing of the bus connector, slacken the securing screws and lift off the cover.
3. Insert the green and red conductors in the screw terminals as shown in Fig. 3-15.

   Make sure that you always connect the same conductors to the same terminal A or B (e.g. always connect the green conductor to terminal A and the red conductor to terminal B).
4. Press the cable sheath between the two retainers to hold the cable in position.

5. Tighten the screws to secure the conductors in their respective terminals.



[1]: The bus cable must always be connected on the left!

Figure 3-15 Connecting the bus cable to the bus connector (6ES7 972-0B.40 ...)

6. Screw the housing tight.

3.6 Connecting the bus connector to the module

Connecting the bus connector

The procedure for connecting the bus connector is as follows:

1. Push the bus connector into position on the module adapter.
2. Tighten the screws to secure the connector to the module.
3. If the bus connector is at the start or end of a segment, you must activate the terminating resistor (set switch to ”ON) (see Fig. 3-16).

   You can activate the terminating resistor for bus connectors with order number 6ES7 972-0B.11-... or 6ES7 972-0B.40-... .

Make sure that the stations with active terminating resistors are always energized throughout power-up and operation.

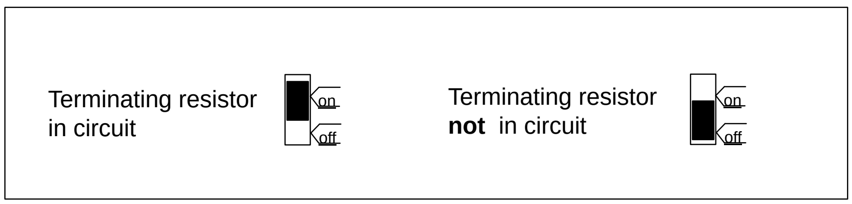


Figure 3-16 Bus connector (6ES7 972-0B.11-...): positions of switch for terminating resistor in circuit or not in circuit

Disconnecting bus connectors

If the bus cable is in a loop, you can disconnect bus connectors from the PROFIBUS-DP interface at any time without interrupting traffic on the bus.

Warning

Danger of disrupting data traffic on the bus.

Each bus segment must always have a terminating resistor at each end. Note that this requirement is not satisfied if the last slave with a bus connector is deenergized. The bus connector receives its power supply through the station, so the terminating resistor has no effect if the supply is shut off.

Take care to ensure an uninterrupted power supply to the stations in which the terminating resistors are in circuit.

Alternatively, you can use the PROFIBUS Terminator as an active bus terminating element (see Section 4.8).

3.7 PNO installation guideline (placeholder)

PNO installation guideline

Please comply with the *PROFIBUS-DP/FMS Installation Guideline* of the PROFIBUS-Nutzerorganistation (user organization) when using electrical networks. It describes important measures to be taken as regards the wiring, cabling and commissioning of PROFIBUS networks.

Publisher

PROFIBUS-Nutzerorganisation e. V.
Haid-und-Neu-Straße 7
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Tel: ++49 721 / 9658 590
Fax: ++49 721 / 9658 589
Internet: http//www.profibus.com

Guideline order number 2.111

3.8 PROFIBUS-DP network with fiber-optic cables

Overview

Electrical/optical conversion

If you want to use the field bus for larger distances irrespective of the transmission rate, or if the data traffic on the bus is not to be impaired by external interference fields, use fiber-optic cables rather than copper cables.

There are two ways to convert electrical cables to fiber-optic cables:

- PROFIBUS nodes with a PROFIBUS-DP interface (RS 485) are connected to the optical network via an Optical Bus Terminal (OBT) or via the Optical Link Module (OLM).
- PROFIBUS nodes with an integrated fiber-optic cable interface (e.g. ET 200M (IM 153-2 FO), S7-400 (IM 467 FO)) can be directly integrated in the optical network.

How to set up optical networks with the Optical Link Module (OLM) is described in detail in the *SIMATIC NET PROFIBUS Networks* manual. You will find below the most important information on setting up an optical PROFIBUS-DP network with PROFIBUS nodes that have an integrated fiber-optic cable interface.

Benefits and areas of application

Fiber-optic cables have the following advantages over electrical cables:

- Electrical isolation of the PROFIBUS-DP components
- Insensitivity to electromagnetic interference (EMC)
- No electromagnetic emission into the environment
- Thus no need for additional grounding and shielding measures
- No adherence to minimum clearances from other cables necessary for EMC
- No need for equipotential bonding conductors
- No need for lightning conductors
- Maximum permissible cable lengths independent of the transmission rate
- Easy installation of the fiber-optic cable connections of the PROFIBUS-DP components by means of standard fiber-optic cable connectors (Simplex connectors)

Optical PROFIBUS-DP network in partyline topology

The optical PROFIBUS-DP network with nodes that have an integrated fiber-optic cable interface has a **partyline topology**. The PROFIBUS nodes are interconnected in pairs by means of Duplex fiber-optic cables.

Up to 32 PROFIBUS nodes with a fiber-optic cable interface can be series-connected in an optical PROFIBUS-DP network. If a PROFIBUS node fails, as a result of the partyline topology none of the downstream DP slaves can be accessed by the DP master.

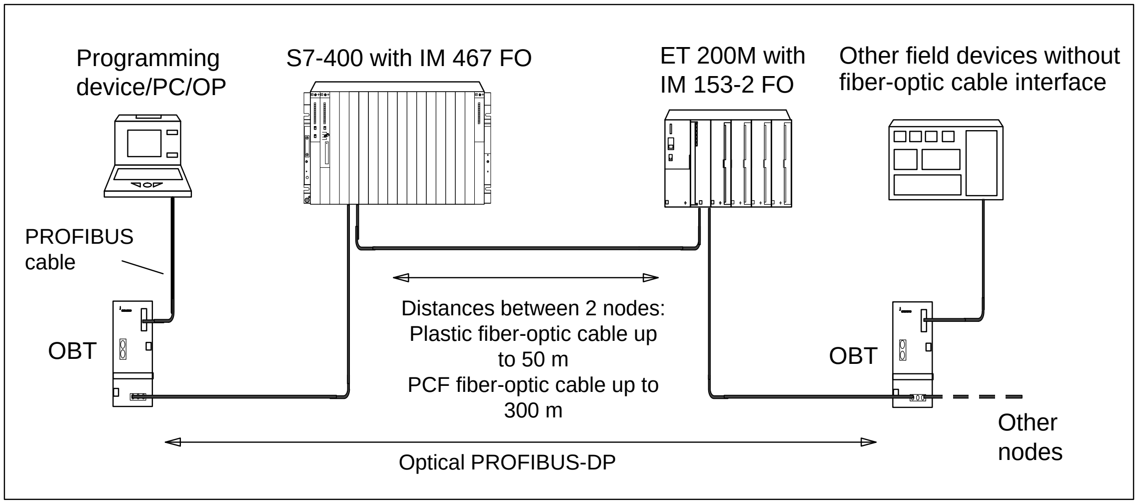


Figure 3-17 Optical PROFIBUS-DP network with nodes that have an integrated fiber-optic cable interface

Transmission rate

The following transmission rates are possible when the optical PROFIBUS-DP network is operated with a partyline topology:

9.6 kbps, 19.2 kbps, 45.45 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5 Mbps and 12 Mbps

PROFIBUS Optical Bus Terminal (OBT)

A PROFIBUS node can be connected to the optical PROFIBUS-DP network via a PROFIBUS Optical Bus Terminal (OBT) (6GK1 500-3AA00) without an integrated fiber-optic cable interface (e.g. programming devices (PGs) or operator panels (OPs), see Figure 3-17).

The programming device/PC is connected to the RS 485 interface of the OBT by means of the PROFIBUS cable. The OBT is integrated in the optical PROFIBUS-DP line by means of its fiber-optic cable interface.

3.8.1 Fiber-optic cables

Features of the fiber-optic cables

Use Siemens plastic and PCF fiber-optic cables with the following features:

Table 3-11 Features of the fiber-optic cables

Description	SIMATIC NET PROFIBUS		
	Plastic fiber-optic duplex conductor	**Plastic fiber-optic standard cable**	**PCF fiber-optic standard cable**
Standard designation	I–VY2P 980/1000 150A	I–VY4Y2P 980/1000 60A	I–VY2K 200/230 10A17+8B20
Area of application	Indoors with a low mechanical load, such as laboratory test assemblies or in cabinets: Cable lengths up to 50 m	Indoors: Cable lengths up to 50 m	Indoors: Cable lengths up to 300 m
Fiber type	Step-index fiber		
Core diameter	980 µm		200 µm
Core material	Polymethyl methacrylate (PMMA)		Quartz glass
Cladding outer diameter	1000 µm		230 µm
Cladding material	Fluorinated special polymer		
Inner sheath • Material • Color • Diameter	 PVC Gray 2.2 ± 0.01 mm	 PA Black and orange 2.2 ± 0.01 mm	 – (Without inner sheath)
Outer sheath • Material • Color	 –	 PVC Purple	 PVC Purple
Number of fibers	2		
Attenuation at wavelength	≤ 230 dB/km 660 nm		≤ 10 dB/km 660 nm
Cable grip	–	Kevlar fibers	Kevlar fibers
Maximum permissible tensile force • Short-term • Continuous	 ≤ 50 N Not suitable for continuous tensile load	 ≤ 100 N Not suitable for continuous tensile load	 ≤ 500 N ≤ 100 N (At cable grip only, ≤ 50 N at connector or single conductor)

Table 3-11 Features of the fiber-optic cables, continued

Description	SIMATIC NET PROFIBUS		
	Plastic fiber-optic duplex conductor	**Plastic fiber-optic standard cable**	**PCF fiber-optic standard cable**
Resistance to lateral pressure per 10 cm cable length (short-term)	≤ 35 N/ 10 cm	≤ 100 N/ 10 cm	≤ 750 N/ 10 cm
Bend radii • Single bend (without tensile force) • Multiple bends (with tensile force)	 ≥ 30 mm ≥ 50 mm (flat side only)	 ≥ 100 mm ≥ 150 mm	 ≥ 75 mm ≥ 75 mm
Permissible environmental conditions • Transport/storage temperature • Laying temperature • Operating temperature	 –30 °C to +70 °C 0 °C to +50 °C –30 °C to +70 °C	 –30 °C to +70 °C 0 °C to +50 °C –30 °C to +70 °C	 –30 °C to +70 °C –5 °C to +50 °C –20 °C to +70 °C
Resistance against • Mineral oil ASTM no. 2, grease or water • UV radiation	 Conditional[2] Not UV-resistant	 Conditional[1] Conditional[1]	 Conditional[1] Conditional[1]
Flame retardance	Flame retardant in accordance with the VW-1 flame test to UL 1581		
External dimensions	2.2 4.4 mm ± 0.01 mm	Diameter: 7.8 ± 0.3 mm	Diameter: 4.7 ± 0.3 mm
Weight	7.8 kg/km	65 kg/km	22 kg/km

1 Please ask your Siemens contact about specific applications.

Order numbers

You can order the fiber-optic cables specified in Table 3-11 as follows.

Table 3-12 Order numbers – fiber-optic cables

Fiber-optic cables	Form	Order number
SIMATIC NET PROFIBUS plastic fiber-optic, duplex conductor I–VY2P 980/1000 150A Plastic fiber-optic cable with 2 conductors and a PVC sheath, without connectors, for use in environments with low mechanical stress (e.g. in a cabinet or for test assemblies in the laboratory)	50 m ring	6XV1821–2AN50
SIMATIC NET PROFIBUS plastic fiber-optic, standard cable I–VY4Y2P 980/1000 160A Robust round cable with 2 plastic fiber-optic cable conductors, PVC outer sheath and PA inner sheath, without connectors, for use indoors	Meterware 50 m ring 100 m ring	6XV1821–0AH10 6XV1821–0AN50 6XV1821–0AT10

Table 3-12 Order numbers – fiber-optic cables, continued

Fiber-optic cables	Form	Order number
SIMATIC NET PROFIBUS PCF fiber-optic, standard cable	50 m	6XV1821–1CN50
I–VY2K 200/230 10A17 + 8B20	75 m	6XV1821–1CN75
PCF fiber-optic cable with 2 conductors, PVC outer sheath, fitted with 4 Simplex connectors, whip length 30 cm each, for distances up to 300 m	100 m	6XV1821–1CT10
	150 m	6XV1821–1CT15
(Other lengths on request)	200 m	6XV1821–1CT20
	250 m	6XV1821–1CT25
	300 m	6XV1821–1CT30

3.8.2 Simplex connectors and connector adapter

Definition

Simplex connectors allow you to connect the fiber-optic cable to the integrated fiber-optic cable interface on the PROFIBUS device. In some Siemens modules (e.g. IM 153-2 FO, IM 467 FO) two Simplex connectors (one for the sender and one for the receiver) are inserted in the module by means of a special connector adapter.

Prerequisite

The PROFIBUS device must be equipped with a fiber-optic cable interface, such as the ET 200M (IM153-2 FO) or the IM 467 FO for S7-400.

Structure

Two Simplex connectors (a sender and a receiver) and a connector adapter with the following attributes are required for a fiber-optic cable connection:

- IP 20 protection
- Transmission rates of 9.6 kbps to 12 Mbps

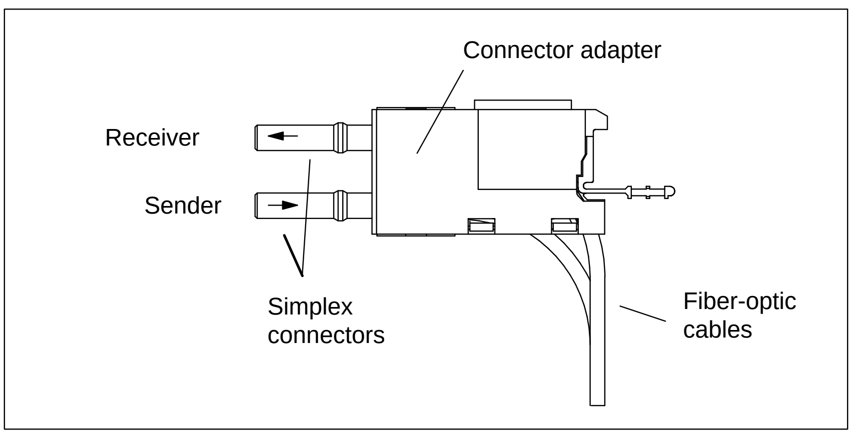


Figure 3-18 Simplex connectors and a special connector adapter for the IM 153-2 FO and IM 467 FO (installed)

Order numbers

You can order Simplex connectors and connector adapters as follows:

Table 3-13 Order numbers – Simplex connectors and connector adapters

Accessories	Order number
SIMATIC NET PROFIBUS plastic fiber-optic Simplex connector/polishing set 100 Simplex connectors and 5 polishing sets for fitting SIMATIC NET PROFIBUS plastic fiber-optic cables with connectors	6GK1901–0FB00–0AA0
Connector adapters Pack of 50 for fitting plastic Simplex connectors with the IM 467 FO and the IM 153-2 FO	6ES7195–1BE00–0XA0

3.8.3 Connecting a fiber-optic cable to the PROFIBUS device

Cable lengths

With fiber-optic cables, the length of the cable segment **does not depend** on the transmission rate.

Each bus node in the optical PROFIBUS-DP network has repeater functionality. The distances specified below are the distances between two neighboring PROFIBUS nodes in the partyline topology.

The maximum cable length between two PROFIBUS nodes depends on the type of the fiber-optic cable used.

Table 3-14 Permissible cable lengths on the optical PROFIBUS-DP network (partyline topology)

SIMATIC NET PROFIBUS fiber-optic cable	Maximum cable lengths between two nodes (in m)	Projected for 1 network (= 32 nodes) (in m)
Plastic fiber-optic duplex conductor	50	1,550
Plastic fiber-optic standard cable	50	1,550
PCF fiber-optic standard cable	300	9,300

Mixed use of plastic fiber-optic and PCF fiber-optic cable

To gain the maximum benefit from the different cable lengths you can mix the plastic and PCF fiber-optic cables.

For example, you can use plastic fiber-optic cable for connections between DP slaves locally (distances $<$ 50 m) and PCF fiber-optic cable for the connection between the DP master and the first DP slave in the partyline topology (distance $>$ 50 m).

Laying PCF fiber-optic cable

You can order PCF fiber-optic cables fitted with 2x2 connectors in specific lengths from Siemens.

Lengths and order numbers: See Table 3-12

Laying plastic fiber-optic cable

You can easily fit connectors to and install plastic fiber-optic cables yourself. Please read the following information on how to do this and on the rules for laying the cable.

Installation instructions for plastic fiber-optic cable (with photos)

You will find detailed installation instructions and a series of photographs on fitting plastic fiber-optic cables with Simplex connectors:

- In the appendix of the *SIMATIC NET PROFIBUS Networks* manual
- On the Internet
  - German: http://www.ad.siemens.de/csi/net
  - English: http://www.ad.siemens.de/csi_e/net

  Click SEARCH on this page, enter the number “574203” under “Entry-ID” and start the search function.
- Enclosed with the Simplex connector/polishing set (see Table 3-13)

Title: *Assembly instructions for SIMATIC NET PROFIBUS Plastic Fiber Optics with Simplex connectors*

Rules for laying cable

When you lay plastic fiber-optic cable, please adhere to the following rules:

- Use only the Siemens fiber-optic cables specified in Section 3.8.1
- Never exceed the maximum permissible stresses (tensile load, crushing, etc.) of the cable you are using specified in Table 3-11. Impermissible crushing can occur, for example, when screw clamps are used to fix the cable in place.
- Follow the steps specified in the installation instructions, and use only the tools specified there. Grind and polish the fiber ends carefully.

Note

Polishing the fiber ends of the fiber-optic cable, as described in the installation instructions, reduces attenuation by 2 dB.

- Grind and polish by pressing the connector only lightly against the abrasive paper or polishing foil in order to prevent the connector fusing with the fiber.
- Ensure that you maintain the bend radii specified in Table 3-11 during grinding and polishing, particularly when cables are supported for mechanical strain relief. In this case, ensure an adequate whip length.
- Ensure that there are no loops when cables are cut to length. Under tensile load, loops can cause kinks to form in the cable and thus damage it.
- Ensure that the outer and conductor sheathing of the cable and the fibers are not damaged. Scoring and scratches can let light escape and thus lead to higher attenuation values and line failure.
- Never insert dirty connectors or connectors with protruding fibers in the device sockets. This can destroy the optical sending and receiving elements.

Installing the connector adapter

The installation of the cut fiber-optic cable with connector on the PROFIBUS devices is module-specific, and it is therefore described in the manual for the PROFIBUS device with an integrated fiber-optic cable interface.

RS 485 repeaters: installing, connecting and operating

4

In this chapter

This chapter contains information on:

Goal

After reading this chapter, you will be able to identify the situations in which you must use the RS 485 repeater.

You will also be able to install and use the RS 485 repeaters with order number 6ES7 972-0AA01-0XA0.

4.1 The RS 485 repeater: scope of application

What is an RS 485 repeater?

An RS 485 repeater amplifies data signals on bus lines and is the link between individual bus segments.

Using the RS 485 repeater

You must use an RS 485 repeater, if:

- you want to connect more than 32 stations to the bus,
- you want to operate bus segments as non-grounded segments, or
- a segment exceeds the maximum permissible cable length (see Table 4-1).

Table 4-1 Maximum cable length of a segment

Baud rate	Max. cable length of a segment (in meters)
9.6 to 187.5 kbaud	1,000
500 kbaud	400
1.5 Mbaud	200
3 to 12 Mbaud	100

Rules

When you set up a bus with RS 485 repeaters, the following rules apply:

- You cannot connect more than nine RS 485 repeaters in a cascade.
- If you use RS 485 repeaters the maximum cable length between two nodes is subject to the limits stated in Table 4-2.

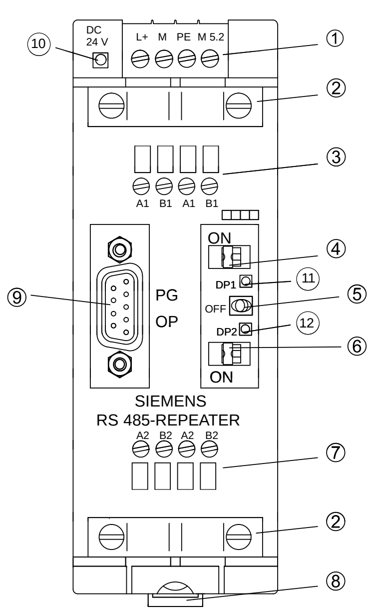
Table 4-2 Maximum cable length between two stations

Baud rate	Max. cable length between 2 stations (in meters) with RS 485 repeaters
9.6 to 187.5 kbaud	10,000
500 kbaud	4,000
1.5 Mbaud	2,000
3 to 12 Mbaud	1,000

4.2 Mechanical design of the RS 485 repeater

Mechanical design Table 4-3 shows the RS 485 repeater.

Table 4-3 Description and functions of the RS 485 repeater

Appearance of the repeater	No.	Function
	①	Terminal for power supply to the RS 485 repeater (pin M5.2 is the ground reference for measuring the voltage transient between A2 and B2).
	②	Shield clamp for strain relief and grounding the bus cable of bus segment 1 or bus segment 2
	③	Terminals for bus cable of bus segment 1
	④	Terminating resistor for bus segment 1
	⑤	Switch for OFF operating status (= separating bus segments, e.g. for commissioning)
	⑥	Terminating resistor for bus segment 2
	⑦	Terminals for bus cable of bus segment 2
	⑧	Locking mechanism for installing/removing the RS 485 repeater on/from the DIN rail
	⑨	Interface for the programming device (PG)/operator panel (OP) on bus segment 1
	⑩	24V power supply LED
	⑪	LED for bus segment 1
	⑫	LED for bus segment 2

Note

Terminal M5.2 of the power supply (see Table 4-3, No. ①) serves as a ground reference for signal measurements in the event of a fault and must not be wired.

Technical data

The table below shows the technical data of the RS 485 repeater:

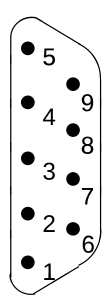
Table 4-4 Technical data of the RS 485 repeater

Technical data	
Power supply • Rated voltage • Ripple (static limit)	 24 V DC 20.4 V DC to 28.8 V DC
Current consumption at rated voltage • No consumer via programmer/OP interface • Consumer via programmer/OP interface (5 V/90 mA) • Consumer via programmer/OP interface (24 V/100 mA)	 200 mA 230 mA 300 mA
Galvanic isolation	yes, AC 500 V
Connection of wave guides	yes, via repeater adapters
Redundancy	no
Transmission rate (detected automatically by the repeater)	9.6 kbaud, 19.2 kbaud, 45.45 kbaud, 93.75 kbaud, 187.5 kbaud, 500 kbaud, 1.5 Mbaud, 3 Mbaud, 6 Mbaud, 12 Mbaud
Degree of protection	IP 20
Dimensions W × H × D (in mm)	45 × 128 × 67
Weight (including packaging)	350 g

Pin assignment of the sub-D adapter (programmer/OP interface)

The pin assignment of the 9-pin sub-D adapter is as follows:

Table 4-5 Pin assignment of the 9-pin sub-D adapter (programmer/OP interface)



View	Pin No.	Signal	Designation
	1	–	–
	2	M24V	Ground 24 V
	3	RxD/TxD-P	Data line B
	4	RTS	Request to send
	5	M5V2	Data reference potential (from station)
	6	P5V2	Supply plus (from station)
	7	P24V	24 V
	8	RxD/TxD-N	Data line A
	9	–	–

Block diagram

Fig. 4-1 is a block diagram of the RS 485 repeater:

- Bus segment 1 and bus segment 2 are galvanically isolated.
- Bus segment 2 and the programmer/OP interface are galvanically isolated.
- Signals are amplified
  - between bus segment 1 and bus segment 2
  - between programmer/OP interface and bus segment 2

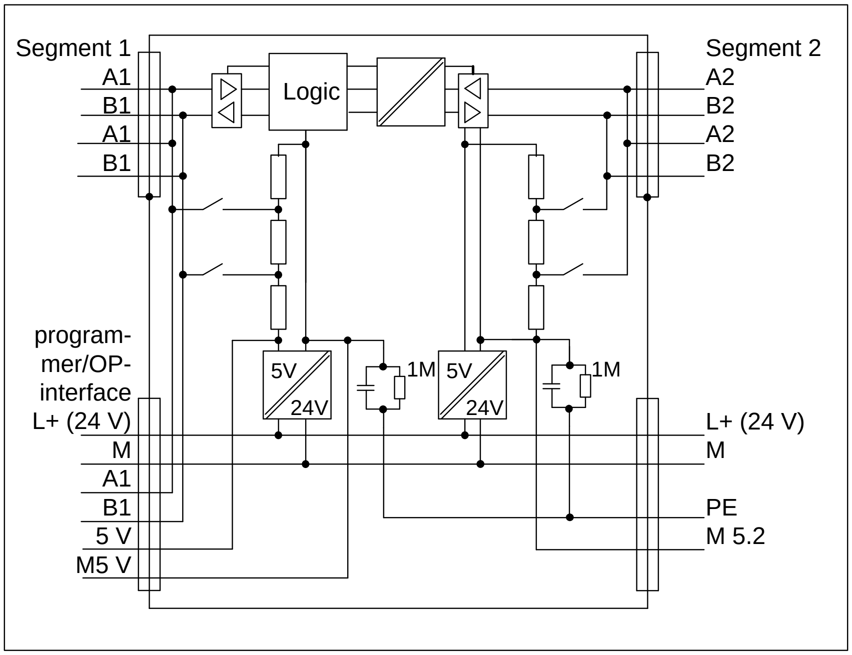


Figure 4-1 Block diagram of the RS 485 repeater

4.3 Configuration options with the RS 485 repeater

Overview

This section discusses the configuration options offered by the RS 485 repeater:

- Segment 1 and segment 2 terminating at the RS 485 repeater
- Segment 1 terminating at the RS 485 repeater and segment 2 looped through the RS 485 repeater,

  and

- Segment 1 and segment 2 looped through the RS 485 repeater.

Terminating resistor ON (in circuit) or OFF (not in circuit)

Fig. 4-2 shows the position of the selector switch for the terminating resistor:

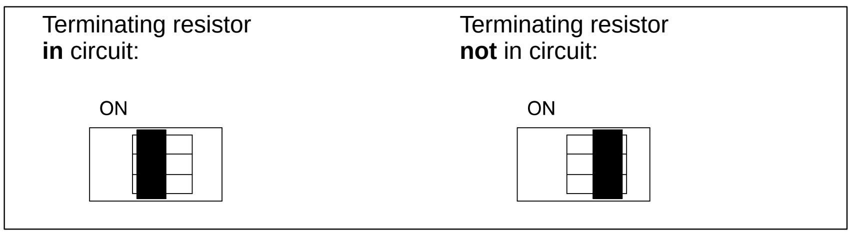


Figure 4-2 Setting of the terminating resistor

Segment 1 and 2 terminated

Fig. 4-3 shows the RS 485 repeater used to terminate two segments:

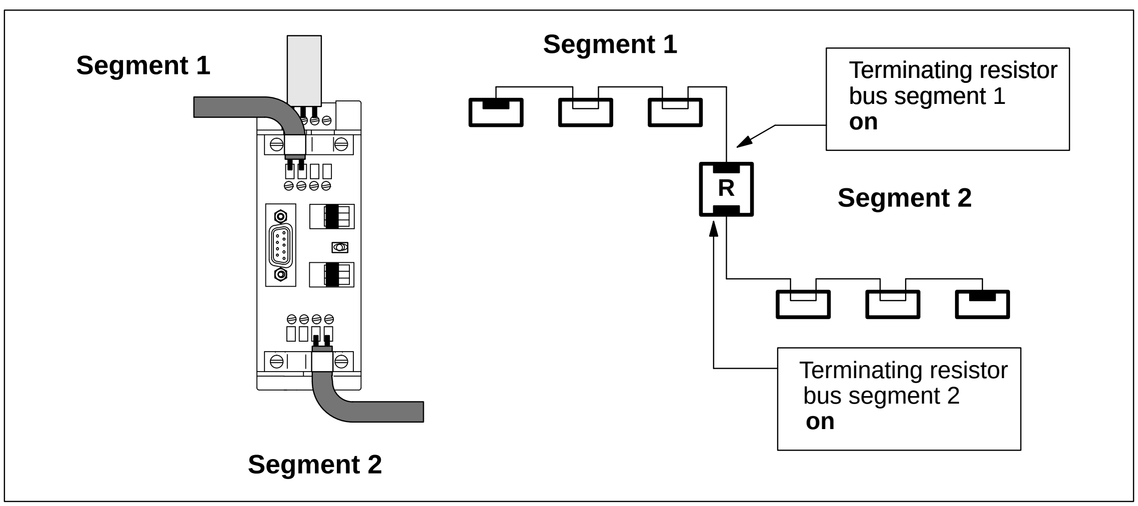


Figure 4-3 Two bus segments connected to the RS 485 repeater (1)

Segment 1 terminated, segment 2 looped through

In Fig. 4-4, one of the two segments connected to the RS 485 repeater is looped through and one is terminated:

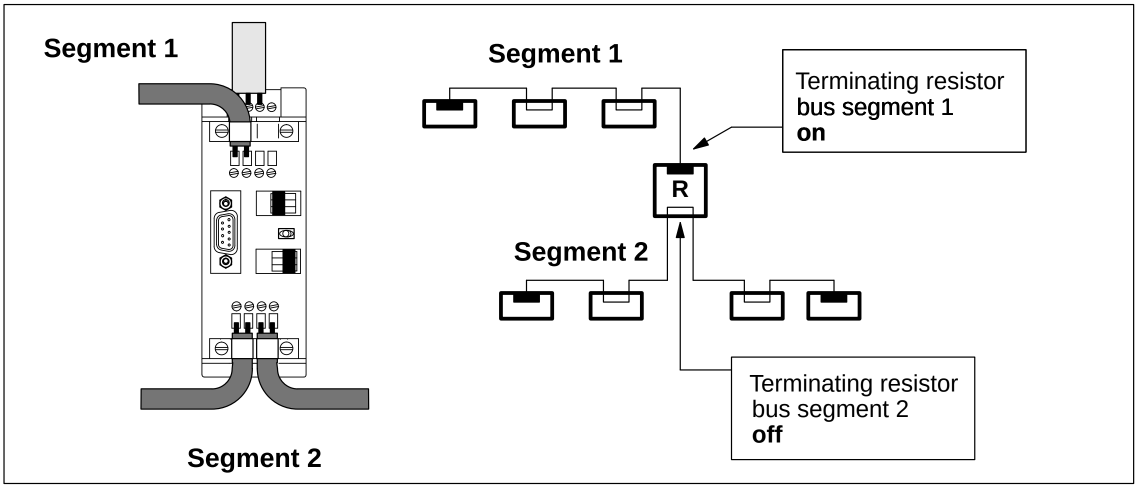


Figure 4-4 Two bus segments connected to the RS 485 repeater (2)

Segments 1 and 2 looped through

In Fig. 4-5, both segments connected to the RS 485 repeater are looped through:

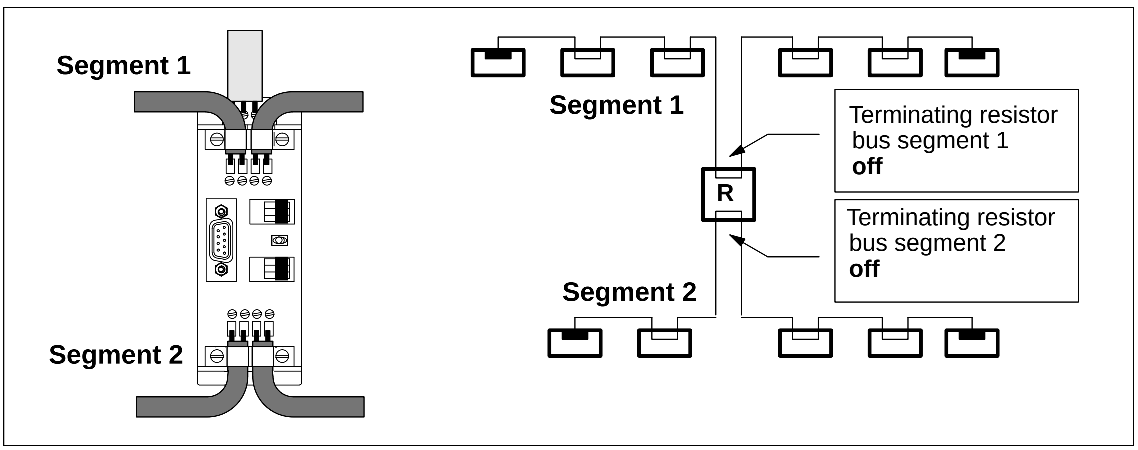


Figure 4-5 Two bus segments connected to the RS 485 repeater (3)

4.4 Installing and removing the RS 485 repeater

Overview

You can install the RS 485 repeater:

- on a special busbar for S7-300

  or

- on a standard-section busbar (order number 6ES5 710-8MA..)

Installation on busbar for S7-300

If you want to mount the RS 485 repeater on a special busbar for S7-300, you must first remove the clamp at the rear of the RS 485 repeater (see Fig. 4-6):

1. Insert the blade of a screwdriver under the lip of the latch (1) and
2. press the handle of the screwdriver toward the rear of the module (2).

   Hold the screwdriver in this position.

   Result: This releases the clamp from the RS 485 repeater.
3. Using your free hand, slip the clamp up as far as it will go (3) and disengage it from the module.

   Result: The clamp is released from the RS 485 repeater.
4. Place the RS 485 repeater in position on the busbar for S7-300 (4).
5. Push the bottom back as far as it will go (5).
6. Tighten the securing screw to between 80 and 110 Ncm (6).

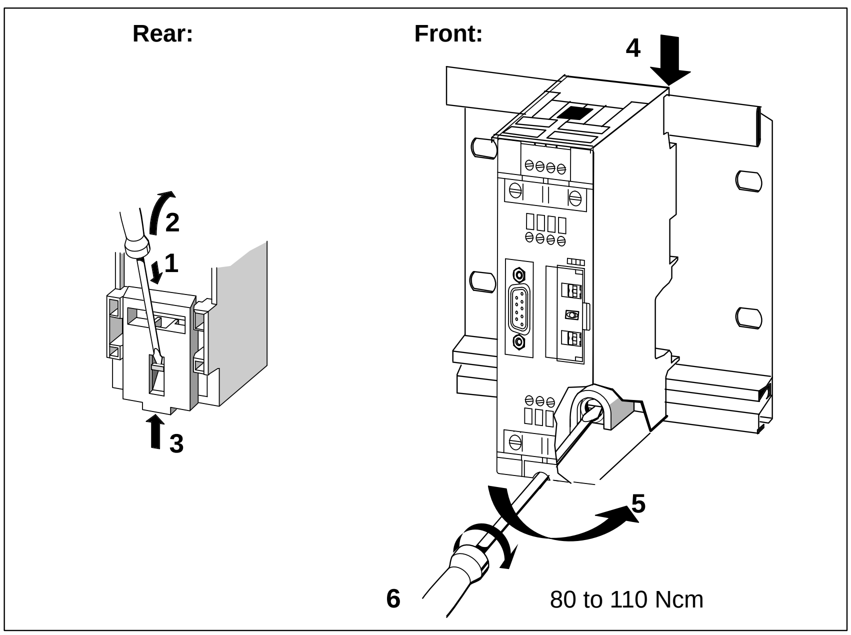


Figure 4-6 Mounting the RS 485 repeater on the busbar for S7-300

Releasing from busbar for S7-300

To release the RS 485 repeater from a busbar for S7-300:

1. Release the screw securing the RS 485 repeater (1) and
2. swing the RS 485 repeater up and away from the busbar (2).

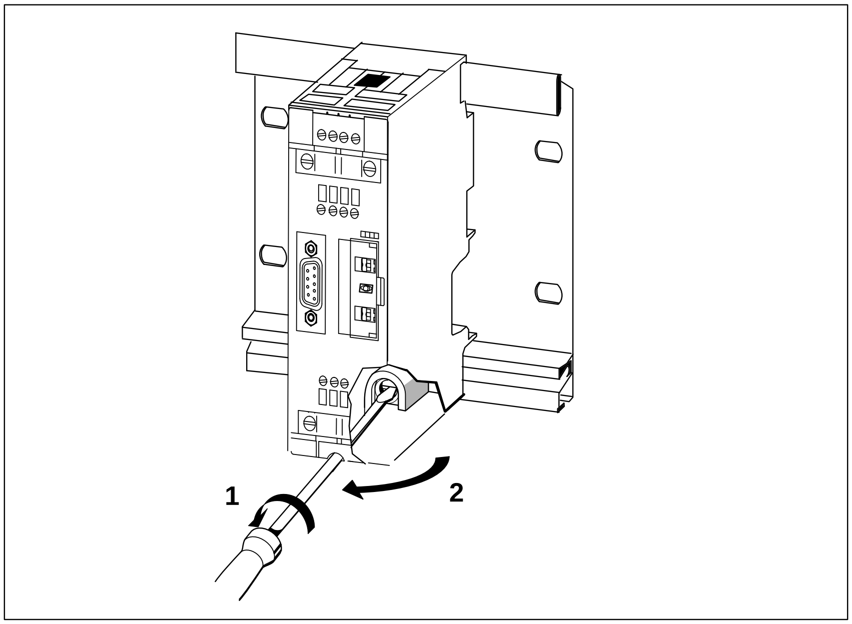


Figure 4-7 Removing the RS 485 repeater from the busbar for S7-300

Installation on standard-section busbar

If you want to mount the RS 485 repeater on a standard-section busbar, make sure that the clamp is in position on the rear of the RS 485 repeater:

1. Engage the RS 485 repeater on the standard-section busbar and
2. push it back until the clamp engages.

Releasing from standard-section busbar

To disengage the RS 485 repeater from the standard-section busbar:

1. Using a screwdriver, press the clamp at the bottom of the RS 485 repeater down and
2. swing the RS 485 repeater up and away from the busbar.

4.5 Non-grounded operation of the RS 485 repeater

Non-grounded operation

Non-grounded operation means that ground and PE are not connected.

If you use the RS 485 repeater in non-grounded mode, the bus segments can operate with potential isolation.

The way in which the RS 485 repeater influences potential on bus segments is illustrated in Fig. 4-8.

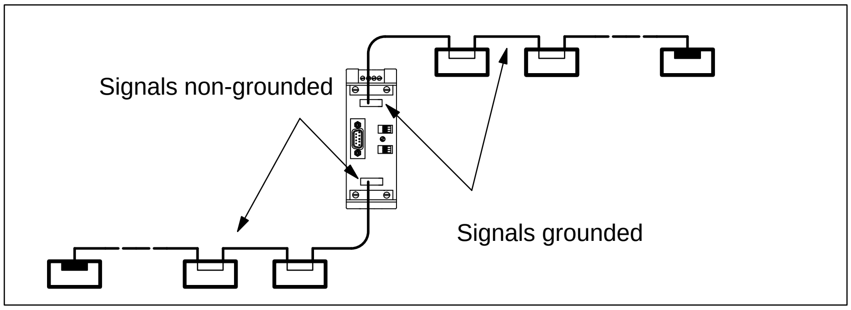


Figure 4-8 ET 200 bus segments operating as non-grounded segments

Installing RS 485 repeater for non-grounded operation

To ensure non-grounded operation of the RS 485 repeater, ensure that the power supply to this repeater is also non-grounded.

4.6 Connecting the voltage supply

Cable type

For the 24 V DC voltage supply, use flexible cables with a cross-section from 0.25 mm^2 to 2.5 mm^2 (AWG 26 to 14).

Rules for routing cables

See section 3.1 for details on cable routing (DC voltage $\leq$ 60 V, unshielded).

Connecting the power supply

To connect the power supply of the RS 485 repeater:

1. Strip the ends of the 24 V DC cable conductors.
2. Connect the cable to the terminals marked ”L+”, ”M” and ”PE”.

4.7 Connecting the bus cable

Cable type

The PROFIBUS bus cable must satisfy the requirements laid down in section 3.5.

Connecting the PROFIBUS bus cable

Connect the PROFIBUS bus cable to the RS 485 repeater as follows:

1. Cut the PROFIBUS bus cable to length.
2. Strip the ends of the PROFIBUS bus cable as shown in Fig. 4-9.

   Fold back the braided shield over the end of the cable sheath. This is necessary to ensure that the shield clamp can function as strain relief and as a terminal for the shield.

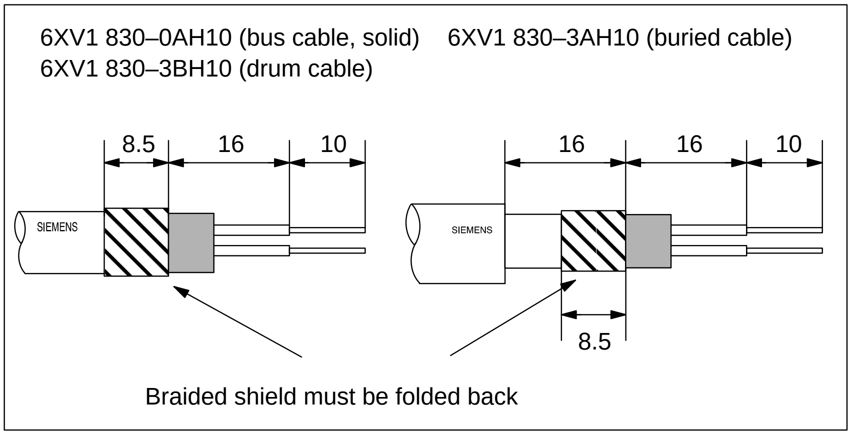


Figure 4-9 Length of stripped ends for connection to RS 485 repeater

3. Connect the PROFIBUS bus cable to the RS 485 repeater:

   Connect the same conductor (green/red for PROFIBUS bus cable) to the same connections, A or B (e.g., always connect the green conductor to terminal A and the red conductor to terminal B).
4. Tighten the shield clamps so that the naked shield is held firmly by the clamp.

4.8 PROFIBUS Terminator

What is a PROFIBUS Terminator?

The PROFIBUS Terminator forms an active bus terminating element. The essential benefit is that bus nodes can be disconnected, removed or replaced without data transfer being impaired. This applies particularly to the bus nodes at both ends of the bus cable, at which the terminating resistors have had to be connected and supplied up to now. The PROFIBUS Terminator can be installed on a DIN rail.

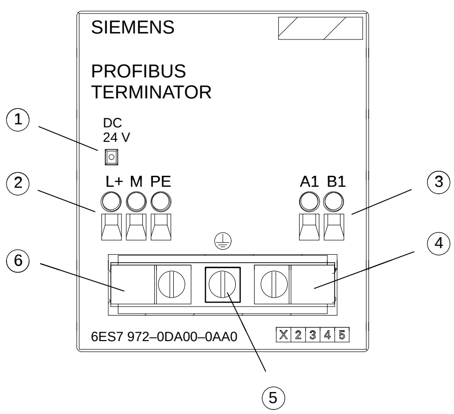
Order number

6ES7 972-0DA00-0AA0

Appearance of the PROFIBUS Terminator

Table 4-6 shows the appearance of the PROFIBUS Terminator:

Table 4-6 Description and functions of the PROFIBUS Terminator

Appearance of the PROFIBUS Terminator	No.	Function
	①	24 V power supply LED
	②	Connection for 24 V DC power supply
	③	PROFIBUS connection
	④	Shield clamp for grounding the shield braid and for strain relief on the bus cable
	⑤	Grounding screw
	⑥	Shield clamp for strain relief on the cable for the power supply

Technical specifications

Table 4-7 shows the technical specifications of the PROFIBUS Terminator:

Table 4-7 Technical specifications of the PROFIBUS Terminator

Technical specifications	
Power supply • Rated voltage • Ripple (static limit)	 24 V DC 20.4 V DC to 28.8 V DC
Power consumption at rated voltage	max. 25 mA
Isolation	Yes, 600 V DC
Transmission rate	9.6 kbps to 12 Mbps
Degree of protection	IP 20
Permissible ambient temperature	0° C to 60° C
Storage temperature	– 40° C to +70° C
Connectable cables; power supply • Flexible cables – With wire end ferrule – Without wire end ferrule • Rigid cables	Screw type; 0.25 mm^2 to 1.5 mm^2 0.14 mm^2 to 2.5 mm^2 0.14 mm^2 to 2.5 mm^2
Connectable cables; PROFIBUS	Screw type; all SIMATIC NET PROFIBUS cables
Dimensions W × H × D (in mm)	60 × 70 × 43
Weight (incl. packaging)	95 g

Cable type

The PROFIBUS bus cable must meet the requirements specified in Section 3.5.

Connecting a PROFIBUS bus cable

Connect the PROFIBUS bus cable to the PROFIBUS Terminator as follows:

1. Cut the PROFIBUS bus cable to the required length.
2. Strip the insulation from the PROFIBUS bus cable as in Figure 4-10.

   The shield braid must be folded back on the cable. If it is not, the shield point cannot subsequently be used for the purpose of strain relief or grounding the shield braid.

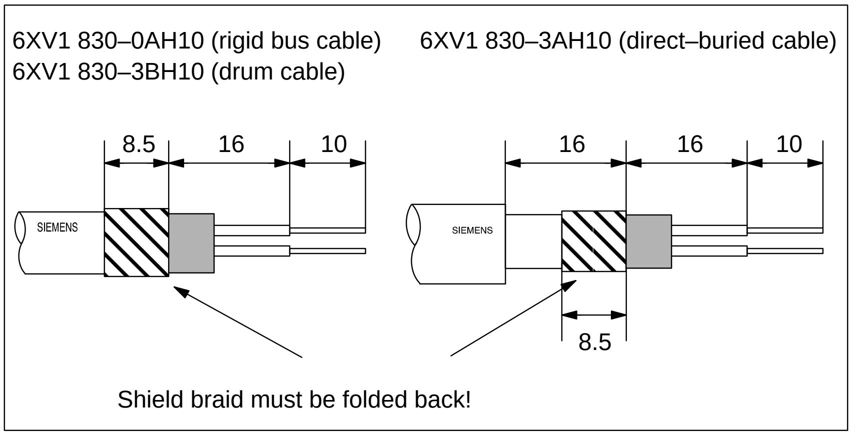


Figure 4-10 Stripping lengths for connection to the PROFIBUS Terminator

3. Connect the PROFIBUS bus cable to the PROFIBUS Terminator:

   Connect the same conductors (green/red for PROFIBUS bus cable) to the same connection A or B (thus, always connect connection A to green wire and connection B to red wire, for example).
4. Tighten the shield clamps so that the bare shield has contact under the shield clamp.

Note

Ensure when installing that no terminating resistor is connected to the bus connectors when the PROFIBUS bus system has 2 active PROFIBUS Terminators.

IM 308-C master interface and memory card – structure and functioning 5

In this chapter

In this chapter you will find all the information you need on:

Goal

After reading this chapter, you will know what to bear in mind when installing the IM 308-C.

5.1 Function and appearance of the IM 308-C

Purpose of the IM 308-C

The IM 308-C enables you to connect the distributed I/O stations to the S5-115U, S5-135U and S5-155U programmable controllers via the PROFI-BUS-DP bus.

Appearance of the IM 308-C

The IM 308-C is shown below:

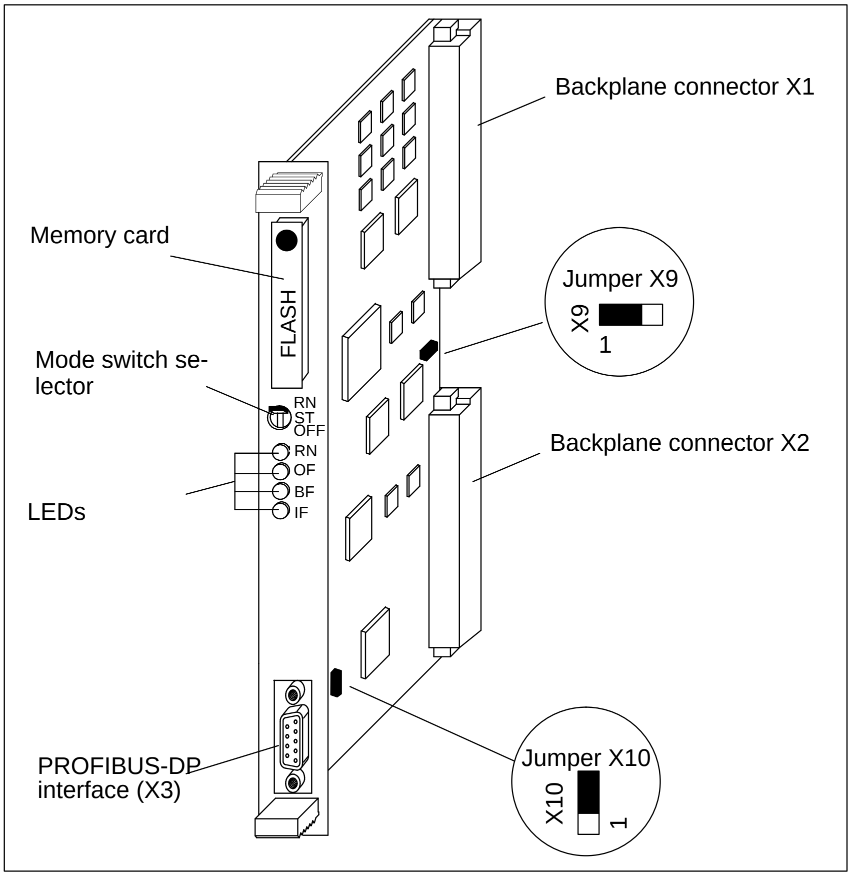


Figure 5-1 IM 308-C master interface

Controls and features

The controls and features of the master interface are as follows:

Table 5-1 Controls and features of the IM 308-C master interface

<table>
<tr><th>Designation</th><th colspan="2">Function</th></tr>
<tr><td>Backplane connectors X1 and X2</td><td colspan="2">Backplane connectors X1 and X2 enable communication between the IM 308-C and the CPU via the S5 I/O bus.</td></tr>
<tr><td>Memory card</td><td colspan="2">All important configuration data for the IM 308-C and the bus layout is stored on the memory card.</td></tr>
<tr><td rowspan="5">Mode selector switch</td><td colspan="2">The mode selector switch is a three-position switch:</td></tr>
<tr><td>IM 308-C as DP master:</td><td>IM 308-C as DP slave:</td></tr>
<tr><td>RN (RUN): normal operation; IM 308-C reads the inputs of the slaves and sets the outputs.</td><td>RN (RUN): normal operation; IM 308-C is DP slave and exchanges data with the DP master.</td></tr>
<tr><td>ST (STOP): IM 308-C does not exchange data with the slaves; it may, however, receive the token (send authorization) from another master on the bus and pass on the token.</td><td rowspan="2">ST (STOP) or OFF:
IM 308-C is DP slave and does not exchange data with the DP master. No exchange of data between the IM 308-C/DP slave and the slave CPU.
Depending on parameterization with COM PROFIBUS, QVZ or PEU is reported to the master CPU.
Bit 0, station status 1, is set;</td></tr>
<tr><td>OFF: IM 308-C does not exchange data with the slaves and cannot receive the token (send authorization) from another master on the bus.</td></tr>
<tr><td>LEDs</td><td colspan="2">The meanings of the LEDs are shown in Tables 5-2 and 5.3.</td></tr>
<tr><td>PROFIBUS-DP interface (X3)</td><td colspan="2">The bus connectors of the field bus connect to the IM 308-C via the PROFIBUS-DP.</td></tr>
<tr><td>Jumper X10</td><td colspan="2">PROFIBUS-DP grounded or not grounded (see section 5.3)</td></tr>
<tr><td>Jumper X9</td><td colspan="2">PEU signal switched (power fail in expansion unit) (see section 5.2)</td></tr>
</table>

Meaning of "BF"

The "BF" LED indicates bus-fault messages. It can indicate the following:

Table 5-2 Meanings of "BF" LED on the IM 308-C master interface

BF	Meaning	Remedy
Off	Data exchanged with all parameterized slaves	–
On	Bus fault [1] (physical fault)	Check: • whether there is a short-circuit on the data lines of the PROFIBUS (A and B) • the parameters set with COM PROFIBUS (different baud rates) • whether the DP master receives the token (HSA not correct in the bus parameters; the HSA is lower than the PROFIBUS address of the DP master)
Flashes	No exchange of data with at least one slave which is assigned to an IM 308-C as DP master	Check whether the bus cable is connected to the IM 308-C. Wait until the IM 308-C has powered up. If the LED does not cease flashing, check the DP slaves or interpret the diagnostics report for the DP slaves. Only if IM 308-C is DP slave: check whether the DP master addresses the IM 308-C/DP slave.

[1]: During power-up, the "RN", "OF" and "IF" LEDs light up along with the "BF" LED for approx. 0.5 seconds.

Meaning of ”RN”, ”OF” and ”IF”

The meanings of the LEDs RN (= RUN), OF (= OFF) and IF (= IM FAULT) are as follows:

Table 5-3 Meanings of the LEDs on the IM 308-C master interface

RN	OF	IF	Meaning	Remedy
On	On	On	IM 308-C is powering up (”BF” LED on).	–
On	Off	Off	**IM 308-C as DP master:** Status is RUN: IM 308-C reads the slave inputs and sets the outputs. The IM 308-C can receive the token from another master and pass it on.	–
			IM 308-C as DP slave: normal operation; IM 308-C as DP slave exchanges data with the DP master.	
Flashes	Off	Off	**IM 308-C as DP master:** IM 308-C parameterizes all slaves on the bus and checks their addressability. Status is CLEAR: Afterwards, the IM 308-C reads the inputs but sets all outputs to ”0”. The IM 308-C can receive the token from another master and pass it on.	–
			IM 308-C as DP slave: CPU outputs BASP; bit 7, byte 7 of the slave diagnostics is set.	–
Off	Flashes	Off	**IM 308-C as DP master:** Status is STOP: IM 308-C does not exchange data with the slaves. The IM 308-C can receive the token from another master and pass it on.	–
			IM 308-C as DP slave: IM 308-C as DP does not exchange data with the DP master. Depending on parameterization with COM PROFIBUS, QVZ, PEU or no error is reported at the slave CPU and the master CPU. Bit 0, station status 1, is set.	
Off	On	Off	**IM 308-C as DP master:** Status is OFF: IM 308-C does not exchange data with the slaves and can neither receive nor pass on the token.	–
			IM 308-C as DP slave: IM 308-C as DP slave does not exchange data with the DP master. No exchange of data between the IM 308-C/DP slave and the slave CPU	–

Table 5-3 Meanings of the LEDs on the IM 308-C master interface, continued

RN	OF	IF	Meaning	Remedy
Off	Off	On	No memory card or wrong memory card inserted, or	Insert a memory card with the correct order number. Read the notes in section 5.4.
			There is no master system on the memory card that was exported with COM PROFIBUS, or	Delete the memory card with COM PROFIBUS by means of **Service ▸Delete memory card**.
			Fault in the IM 308-C.	Withdraw and reinsert the IM 308-C. If the fault persists, replace the module or contact Siemens Support.
On	Off	On	Empty memory card in the IM 308-C, or IM 308-C waiting for a master system to be exported from COM PROFIBUS, or Master system is being exported to IM 308-C from COM PROFIBUS.	Check the memory card.
Off	On	On	IM 308-C waiting for master system exported from COM PROFIBUS to be activated (**Service ▸ Activate parameters**).	–
Flashes	Flashes	Off	Operating system is being loaded from memory card.	–
On	On	Off	Operating system has been loaded from memory card.	–
On	On	Flashes	An error has occurred in importing the operating system from memory card.	Repeat the import procedure. Check that the correct memory card is inserted.

5.2 Technical data of the IM 308-C

Block diagram

Fig. 5-2 is a block diagram of the IM 308-C:

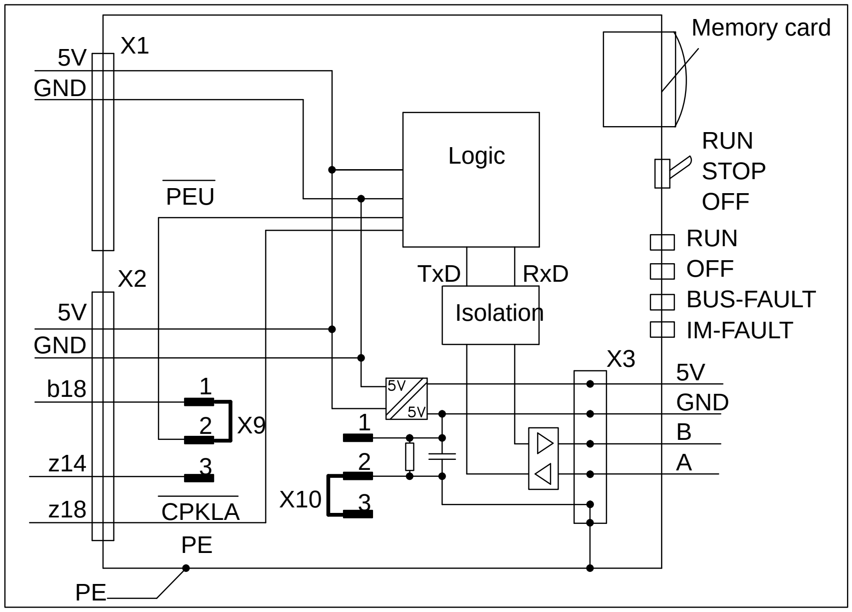


Figure 5-2 Block diagram of the IM 308-C

Technical data

The table below contains the technical data of the IM 308-C.

Table 5-4 Technical data of the IM 308-C

Technical data	
Rated voltage Current consumption (at 5 V) Output voltage X3 (external power source)	5 V (via S5 I/O bus) 0.7 A (typ. 0.4 A) 5 V / 90 mA (bus connector)
Voltage isolation	yes, between logic and PROFIBUS-DP
Jumper X10 • in position 1-2 • in position 2-3 (normal operation)	see section 5.3 PROFIBUS-DP interface grounded PROFIBUS-DP interface not grounded
Jumper X9 • in position 1-2 (normal operation) • in position 2-3	Switches over ”PEU signal ”PEU” signal at pin X2/B18 ”PEU” signal at pin X2/Z14
Status indicators Diagnostic functions	RUN: green LED OF: red LED BF (bus fault): red LED IF (IM fault): red LED
Heat loss	typ. 2.5 W
Dimensions W × H × D (in mm) Weight with memory card and boxed	20 × 243.4 × 173 approx. 350 g

5.3 Installing the IM 308-C

Setting the jumpers

You must set jumper X10 on the IM 308-C. Jumper X10 enables you to configure bus segments in such a way that they are not grounded:

- If you want to operate the PROFIBUS-DP as **grounded**, set the jumper to position ”1-2”.
- If you want to operate the PROFIBUS-DP as **non-grounded**, set the jumper to position ”2-3”.

Slots in the S5-115U system

The tables below show you where to insert the IM 308-C in the rack. The gray hatching indicates the slots in which you can insert the IM 308-C.

Table 5-5 Slots in the S5-115U system, CR 700-0 module rack

CR 700-0 module rack:						
PS	**CPU**	**0**	**1**	**2**	**3**	**IM**

Table 5-6 Slots in the S5-115U system

CR 700-2 module rack:									
PS	**CPU**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**IM**
CR 700-3 module rack:									
PS	**CPU**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**IM**

Slots in the S5-135U and S5-155U

The tables below show you where to insert the IM 308-C in the S5-135U and S5-155U systems. The gray hatching indicates the slots where you can insert the IM 308-C.

Table 5-7 Slots in the S5-135U/S5-155U system

S5-135U programmable controller:																				
3	**11**	**19**	**27**	**35**	**43**	**51**	**59**	**67**	**75**	**83**	**91**	**99**	**107**	**115**	**123**	**131**	**139**	**147**	**155**	**163**
S5-155U programmable controller:																				
3	**11**	**19**	**27**	**35**	**43**	**51**	**59**	**67**	**75**	**83**	**91**	**99**	**107**	**115**	**123**	**131**	**139**	**147**	**155**	**163**
S5-135U/155U programmable controller:																				
3	**11**	**19**	**27**	**35**	**43**	**51**	**59**	**67**	**75**	**83**	**91**	**99**	**107**	**115**	**123**	**131**	**139**	**147**	**155**	**163**

5.4 Installing the memory card

Purpose of the memory card

The memory card is used to store the following data:

- Configuration data generated with COM PROFIBUS,

  or

- The operating system to be imported to the IM 308-C.

Changing the memory card

If you want to change the memory card, proceed as follows:

1. Set the mode selector switch on the IM 308-C to ”ST”or ”OFF”
2. Switch off the power supply to the IM 308-C.
3. Pull the memory card.
4. Insert the new memory card.
5. Switch on the power supply to the IM 308-C.

5.5 Loading the operating system of the IM 308-C from the memory card

Usage

You only need to load a new operating system on the IM 308-C if you are working with COM PROFIBUS version 3.3 or lower **and** have installed a new version of COM PROFIBUS.

The operating system of the IM 308-C is stored in the ”\BESY308C” directory in COM PROFIBUS.

If you need to upgrade the operating system of the IM 308-C, you can refer to Siemens Information ”Kunden aktuell” for further details. If in doubt, please consult Siemens Support.

Exception

Since the IM 308-C release 3 is not hardware-compatible with release 2, and release 6 is not hardware-compatible with release 5, the IM 308-C of these releases can only be upgraded with the assistance of Siemens Support. You **cannot** upgrade to release 3 or release 6 by loading the new operating system from memory card.

Loading the operating system of the IM 308-C from memory card

If you want to load the operating system of the IM 308-C from memory card, proceed as follows (all order numbers are listed in Appendix G):

1. Insert the memory card
   – in the memory-card interface of the programmer, or;
   – in the E(E)PROM slot of the programmer with the associated programming adapter, or
   – in the external programmer connected to your PC.
2. Using the commands **File▶Export ▶ Operating system file**, export the operating system file to a memory card.
3. Select the operating system file (extension is .LFW) and confirm your choice by answering the query with ”OK”.

   Result: COM PROFIBUS exports the operating system for the IM 308-C to the memory card.
4. Insert the memory card into the IM 308-C.
5. Set the IM 308-C to the ”OFF” position.
6. Switch on the power supply for the IM 308-C.

   Result: The IM 308-C indicates the operating system version (on IM 308-C and memory card) by means of LEDs (see below, Table 5-8).
7. Set the IM 308-C mode selector switch to RN.

   Result: The IM 308-C automatically loads the operating system from the memory card. The ”RN” and ”OF” LEDs **flash**.

8. Wait until the ”RN” and ”OF” **remain on** for at least 5 seconds. The operating system has now been loaded.

   If the ”IF” LED lights up in this process, an error has occurred in loading. Repeat the entire procedure once, and check that the correct memory card is inserted.

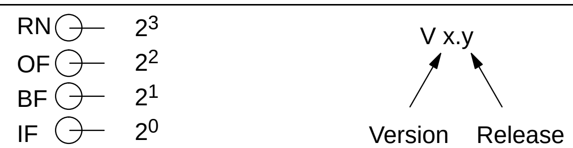
Code for operating-system version

Before the IM 308-C operating system is loaded from the memory card, the four LEDs on the IM 308-C output a flashing BCD code which indicates the current statuses of the operating system on the IM 308-C and on the memory card.

You can call up the code indicating which version of the operating system is currently available on the IM 308-C (see steps 1 through 6, Table 5-8), when the mode selector switch of the IM 308-C is in the ”OFF” position and you switch on the power supply.

The operating system version is not indicated if there is an empty memory card in the IM 308-C.

Table 5-8 Flashing code output by LEDs on IM 308-C when the operating system is loaded from memory card



Step	LED sequence	Duration
1	3 × in sequence from bottom to top	3 s
2	all LEDs are off	1 s
3	BCD code indicating the current operating-system version of the IM 308-C	4 s
4	all LEDs are off	1 s
5	BCD code indicating the current operating system release of the IM 308-C	4 s
6	all LEDs are off	1 s
7	3 × from top to bottom in sequence	3 s
8	all LEDs are off	1 s
9	BCD code indicating the operating-system version on the memory card	4 s
10	all LEDs are off	1 s
11	BCD code indicating the operating-system release on the memory card	4 s
12	all LEDs are off	1 s

5.6 IM 308-C as DP slave

In this section

Section 5.6 summarizes everything you need to know about operating the IM 308-C as DP slave.

The function of the mode selector switch and the meanings of the indicators are discussed above, in section 5.1.

IM 308-C as DP slave

You use the IM 308-C as a DP slave for fast data interchange between two programmable controllers. The module functions as a high-speed I/O link between the two programmable controllers.

Method of operation

Fig. 5-3 illustrates the method of operation of the IM 308-C when it is used as a DP slave.

- The DP master sends outputs to the IM 308-C as DP slave. The DP slave treats these outputs as inputs (DP slave inputs).
- The IM 308-C as DP slave sends the CPU outputs to the DP master (DP slave outputs). The DP master treats the DP slave outputs as inputs.
- You define the addresses and the scope of the DP slave inputs and outputs with COM PROFIBUS (see section G.8.8).

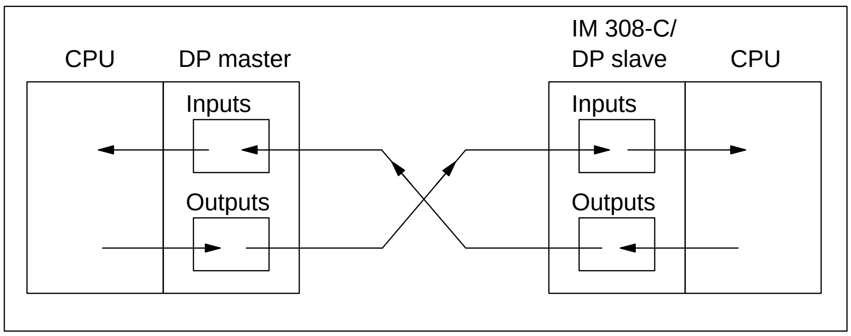


Figure 5-3 Method of operation, IM 308-C as DP slave

Characteristics

The characteristics of the IM 308-C as a DP slave are as follows:

- For each IM 308-C as DP slave, you can process up to 244 bytes of inputs and up to 244 bytes of outputs. You can find the maximum consistent data length for the IM 308-C as a DP slave in Table 6-1 in section 6.1.
- The same IM 308-C can be operated as:
  - DP master
  - DP slave
  - DP master and DP slave (precondition: there must be at least two DP masters on the bus)
- Using COM PROFIBUS, you can set a response monitoring time.

Preconditions

If you want to use the IM 308-C as a DP slave, you require COM PROFIBUS version 2.0 or later and an IM 308-C release 3 or higher. The IM 308-C running as DP slave requires a memory card containing parameters set with COM PROFIBUS.

Restrictions

You need a memory card in order to operate the IM 308-C as DP slave, so the following restrictions apply:

- The PROFIBUS address of the IM 308-C as DP slave is set by means of the memory card.
- The baud rate is set by means of the memory card and is invariable, i.e. unlike other DP slaves the IM 308-C does not auto-detect the baud rate.
- The IM 308-C as DP slave cannot process the FREEZE and SYNC control commands.

The slave CPU cannot read the slave diagnostics.

Structure of slave diagnostics

The structure of the slave diagnostics (bytes 0 to 5) is described in section 6.4. You can read the slave diagnostics via the DP master. The structure of the device-specific diagnostics of the IM 308-C as DP slave is as follows:

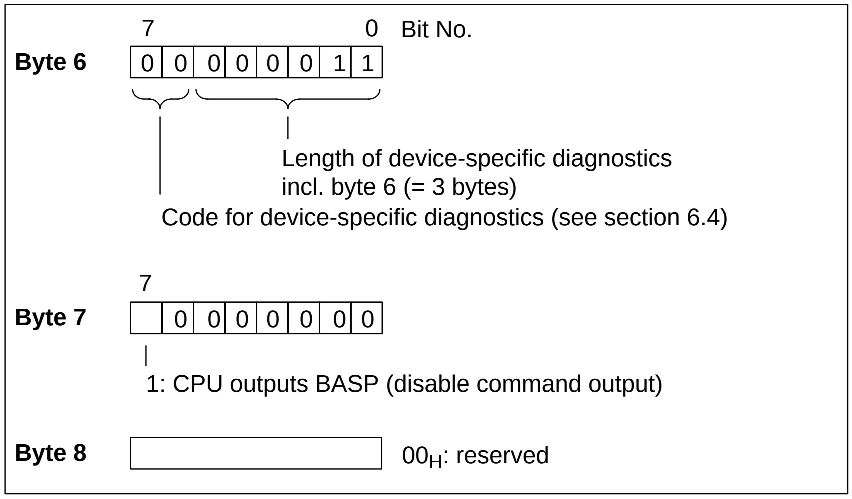


Figure 5-4 Structure of device-specific diagnostics of the IM 308-C as DP slave

Response monitoring

If the IM 308-C as DP slave cannot be addressed by the DP master and ”Response monitoring = YES” is configured in COM PROFIBUS, the IM 308-C goes to STOP when the response monitoring time elapses. Inputs of the IM 308-C as DP slave are set to ”0”.

IM 308-C – addressing, access to the distributed I/Os and diagnostics with STEP 5

6

In this chapter

This chapter contains information on:

Goal

After reading this chapter, you will be in possession of all the information you need in order to write the STEP 5 application program.

6.1 Addressing

In this section

Section 6.1 contains information on the following:

Configuration of the DB 1

The CPUs of the S5-135U and S5-155U series **require** you to generate a DB 1 if you access consistent data areas in the P area. The rules governing entries in the DB 1 are as follows:

CPU	Entries under ”Digital inputs / digital outputs”	Example
CPU 922	decrementing	20, 19, 18, 5, 4
CPU 928 (A/B)	incrementing	4, 5, 18, 19, 20
CPU 946/947	decrementing	20, 19, 18, 5, 4
CPU 948	decrementing	20, 19, 18, 5, 4

Data consistency and the IM 308-C

The table below shows the maximum data lengths for which data consistency is still guaranteed, depending on the addressing mode:

- **Without consistency:** ”byte” format and ”no module consistency”
- **With consistency:** ”word” format and ”no module consistency” or ”byte” or ”word” format and ”module consistency”

Table 6-1 Maximum data lengths and consistent areas in bytes for the IM 308-C

<table>
<tr><th rowspan="2"></th><th colspan="3">Without consistency</th><th colspan="3">With consistency</th></tr>
<tr><th colspan="2">Inputs</th><th>Outputs</th><th colspan="3">Inputs and outputs</th></tr>
<tr><td>Overall data length (in bytes)</td><td>≤ 122</td><td>> 122
≤ 244</td><td>≤ 244</td><td colspan="2">≤ 122</td><td>> 122
≤ 244</td></tr>
<tr><td>Maximum consistent area of an ID (in bytes)</td><td>1</td><td>1</td><td>1</td><td>> 1
≤ 16</td><td>> 16</td><td>> 1</td></tr>
<tr><td>Possible addressing modes</td><td>P area
Q area
DP window</td><td>DP window</td><td>P area
Q area
DP window</td><td>P area
Q area
DP window</td><td>DP window</td><td>DP window</td></tr>
</table>

CPU 944 and FB 250 and 251

The warning below applies to the use of the FB 250 and 251 function blocks and the CPU 944 in conjunction with ET 200:

Warning

There is a possibility of outputs of the distributed I/O being inadvertently reset.

The FB 250 and 251 function blocks with the CPU **do not** comply with the specified sequence for accessing the distributed I/O. This can cause an interruption in data traffic on the PROFIBUS-DP bus and a reset of the slave outputs. The IM 308-C may stop processing and the inputs/outputs are not updated.

To avoid this difficulty, do not use the FB 250 and 251 function blocks with the CPU 944 in the ET 200 distributed I/O system.

Address space used by IM 308-C

By default, the IM 308-C uses the address space (F)F800$_H$ to (F)F9FF$_H$ for addressing the distributed I/O. This address space is also required if you use only linear or page addressing.

Caution

Danger of double addressing!

The IM 308-C uses fully one or more of the address areas shown in Table 6-2 under DP window (default: (F)F800$_H$ to (F)F9FF$_H$).

No part of these address areas may be used by other modules such as CPs, IPs in the CP area, central I/O in the IM3/IM4 area or the WF 470 position-sensing module in the central programmable controller.

Address space used by ASM 401

Please note the following points if you are using the ASM 401 module:

Caution

Double addressing is allowed.

The ASM 401 module uses the entire page address range from (F)F400$_H$ to (F)FBFF$_H$ and therefore accesses the two DP windows (F)F800$_H$ to (F)F9FF$_H$ (**default**) and (F)FA00$_H$ to (F)FBFF$_H$.

If you use the ASM 401 module, you should set the DP address to (F)FC00$_H$ for the CPUs in the S5-115U series and to (F)FE00$_H$ for the CPUs in the S5-135U and S5-155U series.

RESTART

The ”RESTART” mode is not allowed for the CPUs in the S5-135U and S5-155U series!

QVZ during data access

If ”QVZ” occurs during a consistent data access, the data preceding this QVZ must not be interpreted. It will be inconsistent in relation to any data which is read after the QVZ.

Alarm processing

If you access a consistent data area, you must disable the process alarms beforehand with the ”AS” command and then enable them again after the data access.

Addressing in DP window

The 13300 bytes used for addressing in the DP window represent the maximum addressing volume – even if you use linear and page addressing in parallel. The maximum addressing volume depends on:

- the number of bytes required per slave for inputs, outputs and diagnostics data (rounded up to an even length), and
- the configured data consistency. If the consistency is $\leq$ 16 bytes, you must also add on the data length (rounded up to an even value) for each consistent ID and for each data-transfer direction (inputs/outputs).

Options for addressing

Your options for addressing the distributed I/O system are as follows:

- linear addressing (P and Q areas)
- page addressing (P and Q areas)

  or
- function block FB IM308C (FB 192) in the DP window.

Table 6-2 shows the inputs and outputs at your disposal and the applicable modes of addressing.

Table 6-2 Modes of addressing with the IM 308-C as DP master

Addressing	Address range[1]	Access through ...	Page selection address	Max. inputs / outputs	Restrictions
Linear P area	(F)F000$_H$ to (F)F0FF$_H$	PY 0 to PY 255	–	256 bytes for inputs / 256 bytes for outputs	If an output can be addressed in linear mode, it cannot be addressed through the FB IM308C.
Linear Q area	(F)F100$_H$ to (F)F1FF$_H$	QB 0 to QB 255	–	256 bytes for inputs / 256 bytes for outputs	
P page	(F)F0C0$_H$ to (F)F0FE$_H$	PY 192 to PY 254	PY 255 / (F)F0FF	per IM 308-C: 16 pages, 63 bytes = 1,008 bytes for inputs / 1,008 bytes for outputs max. 16 IM 308-C: 16,128 bytes / 16,128 bytes	If an output is addressed through pages, it cannot be addressed through the FB IM308C. PROFIBUS addresses 120 through 123 are not available
Q page	(F)F100$_H$ to (F)F1FE$_H$	QB 0 to QB 254	QB 255 / (F)F1FF	per IM 308-C: 16 pages, 255 bytes = 4,080 bytes for inputs / 4,080 bytes for outputs max. 16 IM 308-C: 65,280 bytes / 65,280 bytes	If an output is addressed through pages, it cannot be addressed through the FB IM308C. PROFIBUS addresses 120 through 123 are not available
DP window	(F)F800$_H$ to (F)F9FF$_H$ (**default**)	FB IM308C (FB 192)	–	Min. 6,650 bytes and max. 13,300 bytes in total for inputs, outputs and diagnostics data	–
	(F)FA00$_H$ to (F)FBFF$_H$				
	(F)FC00$_H$ to (F)FDFF$_H$				
	(F)FE00$_H$ to (F)FFFF$_H$**				

* If you use the address range starting at (F)FC00$_H$ for the CPU 948, you must deactivate the ”PESP” signal (jumper X 13).

** S5-135U and S5-155U only.

[1] Column indicates the address area of the IM 308-C for addressing. In the 945, 946/947 and 948 CPUs, this address is on memory page F.

6.1.1 Linear addressing

Definition

Linear addressing is possible in the P and Q areas of the CPU. Each input or output of a DP slave has one and only one address in the P or Q area, respectively (i.e. linear addressing).

Advantages

Linear addressing affords rapid access to the individual bytes of a DP slave.

You also have bit-serial access to input and output bytes 0 to 127 (63 with 941 CPU) via the process image (e.g. U E 1.0).

Restrictions

The following restrictions apply to linear addressing:

- If you address an output using linear addressing, you cannot also write to the output via the FB IM308C. The IM 308-C does not recognize the attempt to address this output via the FB IM308C.
- **CPUs 941 to 944:** The 941 to 944 CPUs build the process image word by word. This can mean that under certain circumstances, two DP slaves are addressed within a word. If you selected QVZ as the error reporting mode in COM PROFIBUS and you address via the process image, the following case may arise:

  There are two DP slaves in a word and one DP slave fails: the CPU generates QVZ for the second DP slave as well, despite the fact that this DP slave can still be addressed via the bus.

  The following rules therefore apply to the CPUs 941 to 944:

  – Align the start of address of a DP slave with an even address (e.g. 2, 4, 6, ...) and leave the odd address free. You can then use access via the process image as well.

  – Use load and transfer commands. The commands run byte-by-byte checks and can tell whether or not a byte exists.
- **CPUs 941 to 944:** If you select linear addressing for the Q area with CPUs 941 to 944, you cannot use L QB /T QB. Instead, you access the addresses through the standard function block FB 196.
- **S5-135U and S5-155U:** If an input/output module is inserted in the central programmable controller, you must not assign any P or Q addresses for the IM 308-C if they are also used by this input/output module!

  If you use the entire Q area for the IM 308-C, do not insert an input or output module in the central programmable controller (host).

  You can avoid the danger of inadvertent double assignments by reserving input and output areas when you enter the master parameters with COM PROFIBUS (see section G.8.3).

When should I use linear addressing?

Use linear addressing when you do not need more than 512 bytes for inputs and 512 bytes for outputs as the sum of all DP slaves in a host.

If you require more input or output bytes, use P-page addressing, Q-page addressing or the FB IM308C.

6.1.2 Page addressing

Definition of page addressing

In page addressing, 16 pages numbered from n to (n + 15) are created on each IM 308-C. The first page number n corresponds to the **number of the IM 308-C**. The number of the IM 308-C is a multiple of 16 and is entered in COM PROFIBUS as one of the master parameters.

In a maximum configuration, you can create 256 pages distributed across 8 IM 308-C master interfaces. The pages are assigned as follows:

Table 6-3 Assignment of pages to IM 308-C master interfaces

Pages with numbers ...	... are on the IM 308-C with the number:
0 to 15	0
16 to 31	16
32 to 47	32
...	...
224 to 239	224
240 to 255	240

Example

The number of the IM 308-C is ”48”; I-addr is ”02P192”.

Address
P area
Page

Calculate the page number as follows:

Page number = 48 + 2 = 50.

Definition of page selection address

Before you can use a page for data exchange, you must include the page in question in the address area of the CPU. To do so, you write the number of the desired page into the **page selection address** (PY 255 for P-page addressing, QB 255 for Q-page addressing).

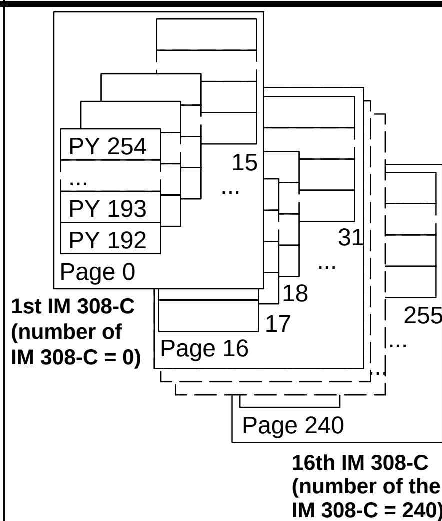
Example: page addressing

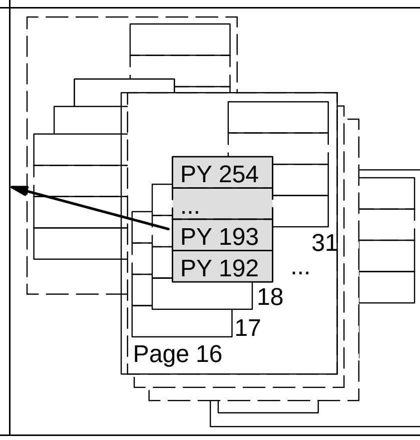
The table below shows how page addressing works. Note that the mode shown here by way of example illustrates P-page addressing.

In the example, the I/O byte PY 193 is read from the page having the page number 18. Page 18 is on the second IM 308-C, the number of which is 16.

Table 6-4 How page addressing works

Activity	Memory areas in the IM 308-Cs	Result

1. Write the number of the page to the read/written into the ”page selection address” byte.
`L KF +18`
`T PY 255`
		The page selection address is loaded into the IM 308-C via the I/O bus.
		The IM 308-C sets a pointer to page 18 and makes this page available for read/write.

2. You can now read or write the actual address, for example load I/O byte PY 193:
`L PY 193`
`T MB 100`
		You have direct access to a memory area of the IM 308-C.

P/Q-page addressing

P or Q addressing for distributed I/Os only functions in the ordinary I/O area. It is independent of page addressing for communications processors (CPs) and intelligent I/O modules (IPs) (address range: (F)F400$_H$ to (F)F7FF$_H$).

Definition of P-page addressing

In P-page addressing, part of the P area is replicated. The part in question is from PY 192 to PY 254.

You can use PY 0 to PY 191 to address the central I/O modules in the programmable controller.

Q-page addressing

In Q-page addressing, the Q area is replicated. The Q area extends from QB 0 to QB 254.

Using the Q area

You can use I/O bytes QB 0 to QB 254 for the I/O modules in the expansion unit and for distributed I/O.

Warning

There is a possibility of inputs or outputs receiving double assignments in the Q area.

If an input/output module is inserted in the central programmable controller, you must not assign any P or Q addresses with any page number for the IM 308-C if they are also used by this input/output module!

If you use the entire Q area for the IM 308-C, do not insert an input or output module in the central programmable controller (host).

You can avoid the danger of inadvertent double assignments by reserving input and output areas when setting the master parameters with COM PROFIBUS (see section G.8.3).

Restrictions

The following restrictions apply to page addressing:

- With P-page addressing, you cannot use PROFIBUS addresses 120 to 123. Only the PROFIBUS addresses from 1 to 119 are available.

  With Q-page addressing, you cannot use PROFIBUS addresses 108 to 123. Only the PROFIBUS addresses from 1 to 107 are available.
- If you use pages to address an output, you can no longer address the output via the FB IM308C. The IM 308-C does not recognize the attempt to access this output via the FB IM308C.
- Additional programming: (write page selection address and only then the I/O byte as such)

6.1.3 Addressing via the FB IM308C (FB 192) function block

Definition

If you opt for addressing through the FB IM308C (FB 192) you use the CP page area and the IM3/IM4 area to address the distributed inputs and outputs.

This address area is known as the DP window; by default, it occupies the address area (F)F800$_H$ to (F)F9FF$_H$.

See chapter 7 for an explanation of the parameters exported to the FB IM308C for the individual functions.

Advantages

The advantages of addressing via the FB IM308C are as follows:

- You can always address **in**puts through the FB IM308C, irrespective of whether or not you have assigned the address with COM PROFIBUS.
- The FB IM308C is ideal for addressing large data quantities as is the case with operator panels, IM 308-C as DP slave, drives, for example.
- Data can be saved directly to a data block or a bit memory address area – no linear addresses are lost.
- The FB IM308C permits mixed addressing. For example, if you have large data quantities you can address the first byte with linear addressing and address the remaining bytes via the FB IM308C. The maximum consistent area is then 16 bytes (see Table 6-1).

  In this case you use the first byte as coordination byte that for high-speed cyclic queries. When this coordination byte shows that the data in the remaining bytes has been updated, you can address them through the FB IM308C. This mechanism cuts down on runtime in the application program.
- If you want to address more than one IM 308-C in multiprocessor mode, you can assign a DP window to each IM 308-C. This significantly reduces the complexity of addressing.

Restrictions

If you use the FB IM308C, bear the following in mind:

- Access to inputs/outputs is faster when you use linear or page addressing than when you use the FB IM308C for addressing.
- If you have already addressed an **out**put with linear or page addressing, you cannot read or write this output through the FB IM308C. The IM 308-C does not recognize any attempt to set this output through the FB IM308C.

When should I use the FB IM308C?

Use the FB IM308C when the addressing volume of the DP slaves or the IM 308-C is such that linear addressing is no longer adequate.

6.1.4 Access commands for distributed I/O

Overview

You can access the addresses of the distributed I/O as follows:

- Via the process image or with load/transfer commands
- Via the standard function block FB IM308C

Process image or load/transfer commands

You cannot access inputs or outputs via the process image or load/transfer commands unless you assigned the inputs and outputs beforehand with COM PROFIBUS.

Appendix B contains a list of all the commands for the various CPUs and address areas. Appendix B also contains a list of rules that you must observe in order to maintain data consistency.

Mixed-mode addressing

You can mix the various modes of addressing to suit your application. Define ”Linear”, ”P-page” or ”Q-page” as the addressing mode in the ”Master parameters” dialog box in COM PROFIBUS. This mode then applies for all DP slaves assigned to the DP master in question.

If you mix the modes of addressing linearly or mix page addressing with FB IM308C, the following applies:

- **In**puts can be read either with the FB IM308C or by linear or page addressing.
- If you have addressed **out**puts using linear or page addressing, you cannot simultaneously use the FB IM308C to address these **out**puts.

6.2 Diagnostics with STEP 5

Overview

Diagnostics means identifying and pinpointing errors. You require the FB IM308C function block to read the diagnostics data.

Structure of diagnostics

Diagnostics consists of master diagnostics and slave diagnostics.

Master diagnostics comprises the diagnostics functions implemented in the DP master for the DP slaves of the master, and for the status of the DP master.

Slave diagnostics comprises detailed diagnostics messages for each DP slave.

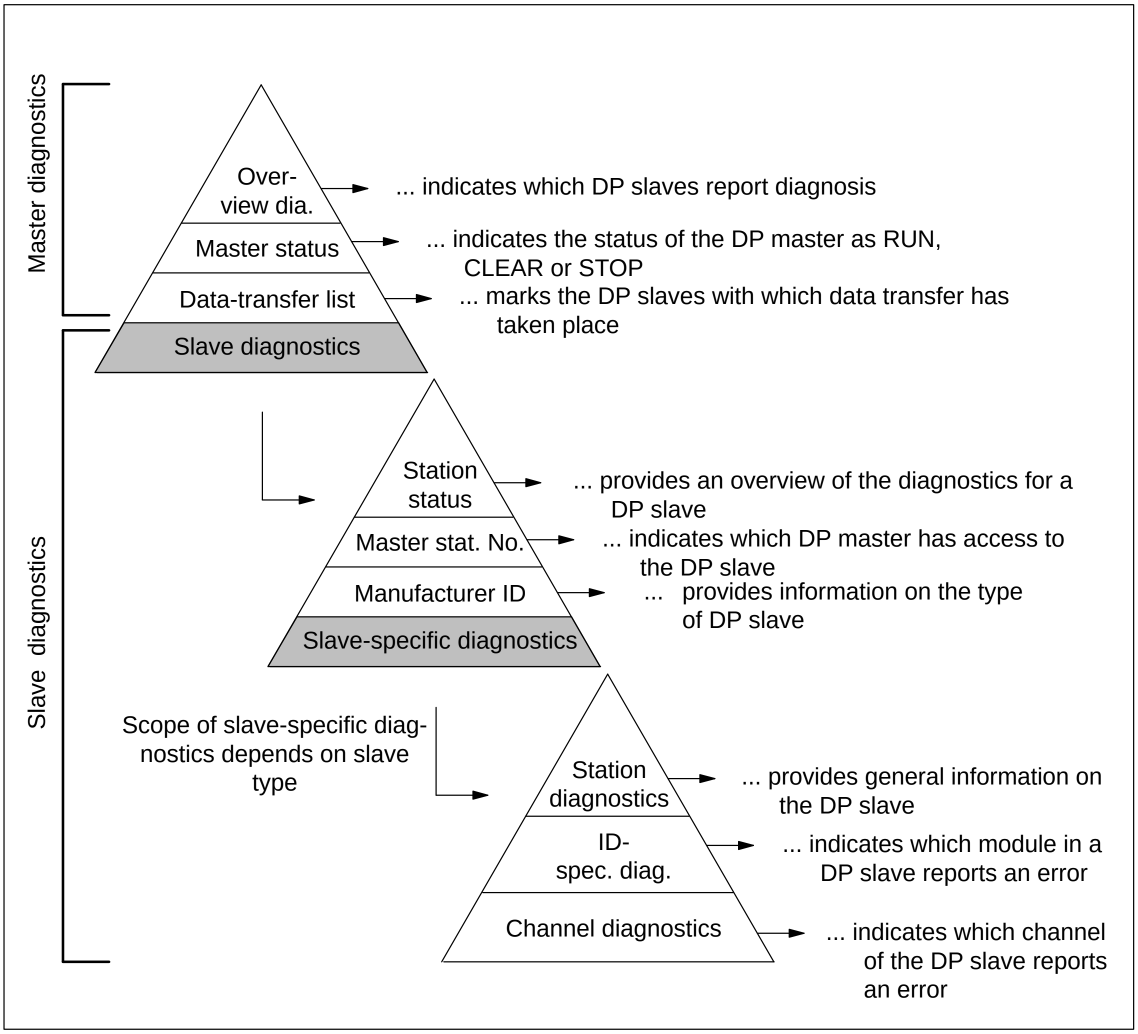


Figure 6-1 Diagnostics structure

6.3 Reading master diagnostics

Definition

Master diagnostics consists of 64 bytes structured as follows:

- **Overview diagnostics (16 bytes):** In overview diagnostics, you can check all DP slaves for which diagnostics data is available. The overview diagnostics is updated once every data cycle.

  On the basis of the overview diagnostics, you can trace the type of diagnostics message by checking the (see section 6.4):

  – station status and

  – depending on the type of the DP slave, station diagnostics, module diagnostics and/or channel diagnostics.

- **Master status (16 bytes):** The master status diagnostics byte indicates the operating mode of the master: RUN, CLEAR, STOP or OFF.
- **Data-transfer list (16 bytes):** The data-transfer list marks those DP slaves assigned to a DP master with which data has been exchanged within a time configurable under COM PROFIBUS (response monitoring). The contents of the data-transfer list are updated every third time after the minimum response monitoring time has elapsed.

The remaining 16 bytes are reserved.

Reading master diagnostics

To request master diagnostics, call the FB IM308C with the function FCT = MD. The values for the other parameters in this call are shown in section 7.

Result: The FB IM308C places the diagnostics data in the S5 memory area specified in the FB IM308C call (data block or bit memory address area).

Meaning of master diagnostics

Master diagnostics is structured as follows:

Table 6-5 Structure of master diagnostics

Byte	Meaning
0 to 15	Overview diagnostics: A ”1” means that the corresponding DP slave has reported diagnostics or that the DP slave cannot be addressed by the DP master.
16 to 31	Master status: Information on the operating modes of the IM 308-C and version releases.
32 to 47	Data-transfer list: A ”1” means that data has been exchanged with the station in question within a time calculated by COM PROFIBUS (minimum response monitoring time).
48 to 63	Reserved

Structure of master diagnostics

This table shows how master diagnostics is structured:

Table 6-6 Appearance of master diagnostics

<table>
<tr><th rowspan="2">Diagnostics</th><th rowspan="2">Byte</th><th colspan="8">Bit (corresponds to the DP slave with the PROFIBUS address:)</th><th rowspan="2">Data format rec.</th></tr>
<tr><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td rowspan="5">**Overview diagnostics**</td><td>0</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>–</td><td>KM</td></tr>
<tr><td>1</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>KM</td></tr>
<tr><td>...</td><td colspan="8">...</td><td>KM</td></tr>
<tr><td>14</td><td>119</td><td>118</td><td>117</td><td>116</td><td>115</td><td>114</td><td>113</td><td>112</td><td>KM</td></tr>
<tr><td>15</td><td>–</td><td>–</td><td>–</td><td>–</td><td>123</td><td>122</td><td>121</td><td>120</td><td>KM</td></tr>
<tr><td></td><td>**Byte**</td><td>**Value**</td><td colspan="7">**Meaning**</td><td></td></tr>
<tr><td rowspan="11">**Master status**</td><td rowspan="4">16</td><td>$C0_H$</td><td colspan="7">**RUN**: The IM 308-C reads the input data of the DP slaves cyclically and passes output data to the DP slaves. The IM 308-C can receive the token from another DP master and pass on the token.</td><td>KH</td></tr>
<tr><td>80_H</td><td colspan="7">**CLEAR**[1]: The IM 308-C reads the input data cyclically; output data is set to ”0”. The IM 308-C can receive the token from another DP master and pass on the token.</td><td>KH</td></tr>
<tr><td>40_H</td><td colspan="7">**STOP**: No data is exchanged between the IM 308-C and the DP slaves. The IM 308-C can receive the token from another DP master and pass on the token.</td><td>KH</td></tr>
<tr><td>00_H</td><td colspan="7">**OFF**: No data is exchanged between the IM 308-C and the DP slaves. The IM 308-C can neither receive nor pass on the token. This means that the OFF status cannot be passed on to other DP masters.</td><td>KH</td></tr>
<tr><td>17</td><td>80_H</td><td colspan="7">Manufacturer ID (high byte)</td><td>KH</td></tr>
<tr><td>18</td><td>$1C_H$</td><td colspan="7">Manufacturer ID (low byte)</td><td>KH</td></tr>
<tr><td>19</td><td>$\_\_{}_H$</td><td colspan="7">Hardware version DDLM/user interface (e. g. 21_H for V 2.1)</td><td>KH</td></tr>
<tr><td>20</td><td>$\_\_{}_H$</td><td colspan="7">Firmware version DDLM/user interface</td><td>KH</td></tr>
<tr><td>21</td><td>$\_\_{}_H$</td><td colspan="7">Hardware version user</td><td>KH</td></tr>
<tr><td>22</td><td>$\_\_{}_H$</td><td colspan="7">Firmware version user</td><td>KH</td></tr>
<tr><td>23 to 31</td><td>–</td><td colspan="7">Reserved</td><td>–</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">**Byte**</td><td colspan="8">**Bit (corresponds to the DP slave with the PROFIBUS address:)**</td><td rowspan="2"></td></tr>
<tr><td>**7**</td><td>**6**</td><td>**5**</td><td>**4**</td><td>**3**</td><td>**2**</td><td>**1**</td><td>**0**</td></tr>
<tr><td rowspan="5">**Data transfer list**</td><td>32</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>–</td><td>KM</td></tr>
<tr><td>33</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>KM</td></tr>
<tr><td>...</td><td colspan="8">...</td><td>KM</td></tr>
<tr><td>46</td><td>119</td><td>118</td><td>117</td><td>116</td><td>115</td><td>114</td><td>113</td><td>112</td><td>KM</td></tr>
<tr><td>47</td><td>–</td><td>–</td><td>–</td><td>–</td><td>123</td><td>122</td><td>121</td><td>120</td><td>KM</td></tr>
<tr><td></td><td>48 to 63</td><td colspan="8">Reserved</td><td>–</td></tr>
</table>

[1] The operating mode goes to CLEAR when the operating-mode selector switch of the IM 308-C is in the RUN position and the CPU operating mode is STOP (see section 8.2).

6.4 Reading slave diagnostics

Definition

Slave diagnostics comprises a maximum of 244 bytes and is structured as follows:

- Station status 1 through 3 (length: 3 bytes)

  Station status 1 through 3 reflects the status of a DP slave.

- Master PROFIBUS address (length: 1 byte)

  The master PROFIBUS address diagnostics byte contains the PROFIBUS address of the DP master which parameterized the DP slave.

- Manufacturer ID (length: 2 bytes)

  The manufacturer ID contains a code indicating the type of the DP slave.

- Station diagnostics (length depends on the type of the DP slave)

  Station diagnostics provides general information on the DP slave.

- Module diagnostics (length depends on the type of the DP slave)

  Module diagnostics indicates which module is defective and which slot it occupies.

- Channel diagnostics (length depends on the type of the DP slave)

  Channel diagnostics indicates which channel of a DP slave has an error message.

Reading slave diagnostics

To request slave diagnostics, you must call the FB IM308C with the function FCT = SD. See section 7 for the values of the remaining parameters.

Result: The FB IM308C places the slave-diagnostics data in the S5 memory area opened in the FB IM308C call (data block or marker area).

Diagnostics of shared-input slaves

With the exception of the diagnostics messages listed below, shared-input slave diagnostics can be analyzed only by the parameterization master:

The following diagnostics messages are updated cyclically by the shared-input master:

- Overview diagnostics (station powerfail only)
- Data transfer list
- Station status 1: bit 0, 1, 2, 5, 6, 7
- Station status 2: bit 0, 3, 7
- Master PROFIBUS address of the parameterization master
- Manufacturer ID

The status of all other bits in the diagnostics messages is frozen after startup in the shared-input master.

Static diagnostics for shared-input slaves

If a DP slave sets bit 1 in station status 2 (static diagnostics message), this bit is set only for the parameterization master and not for the shared-input master.

This can mean that if for example, an S5-95U with PROFIBUS-DP slave interface goes to STOP, the shared-input master cannot recognize this status. Consequently, the corresponding bits in the overview diagnostics and in the data transfer list are not updated.

Structure of slave diagnostics

Slave diagnostics is structured as follows:

Table 6-7 Structure of slave diagnostics

Byte	Meaning	Recommended data format
0	Station status 1	KM
1	Station status 2	KM
2	Station status 3	KM
3	Master PROFIBUS address	KF
4	Manufacturer ID (high byte)	KH
5	Manufacturer ID (low byte)	KH
6 ... 243	Other slave-specific diagnostics (station, module or channel diagnostics, depending on the DP slave, see sections 6.4.1 and 6.4.2)	KH

Structure of station status 1

Station status 1 provides information on the DP slave. The structure is as follows:

Table 6-8 Structure of station status 1

Bit	Meaning	Remedy
0	1: DP slave not addressable by DP master.	• Is PROFIBUS address of DP slave correct? • Bus connector correctly seated? • Voltage applied to DP slave? • RS 485 repeater correctly configured? • Reset DP slave
1	1: DP slave not ready for data exchange.	• Wait, because DP slave is powering up.
2	1: The configuration data sent by the DP master to the DP slave does not match the DP slave configuration.	• Is correct station type or correct DP slave configuration entered in COM PROFIBUS?
3	1: Station, module and/or channel diagnostics data is present (depends on type of DP slave).	• You can read the diagnostics data. For notes on the contents of the diagnostics data, see the manuals on the DP slaves and sections 6.4.1 and 6.4.2.
4	1: Function not supported, e.g. the control command FREEZE or SYNC.	• Check parameterization. Parameterization with COM PROFIBUS and the type file.
5	1: DP master cannot interpret response of slave.	• Check physical bus characteristics.
6	1: DP slave type does not match parameterization in COM PROFIBUS.	• Parameters entered correctly in COM PROFIBUS?
7	1: DP slave parameterized by a DP master other than that currently accessing the DP slave.	• Bit is always 1 if, for example, you are currently accessing the DP slave from the programmer or another DP master. The station number of the parameterization master is in the ”Master PROFIBUS address” diagnostics byte.

Structure of station status 2

Station status 2 provides additional information on the DP slave.

Table 6-9 Structure of station status 2

Bit	Meaning
0	1: DP slave must be re-parameterized.
1	1: A diagnostics message has been received. The DP slave cannot resume until the error has been rectified (static diagnostics message).
2	1: Bit is always ”1” if there is a DP slave with this PROFIBUS address.
3	1: Response monitoring is activated for this DP slave.
4	1: DP slave has received the ”FREEZE” control command. [1]
5	1: DP slave has received the ”SYNC” control command. [1]
6	0: Bit is always ”0”.
7	1: DP slave is deactivated, i.e. removed from current processing.

[1] Bit is not updated unless a second diagnostics message is modified.

Structure of station status 3

Bit 7 of station status 3 provides information on whether or not more diagnostics information is available. The DP slave sets this bit, for example, if there is more channel-specific diagnostics data than it can enter in its send buffer. The DP master sets this bit if the DP slave sends more diagnostics information than the master can store in its diagnostics buffer.

Structure of the master PROFIBUS address

The master PROFIBUS address consists of one byte:

Table 6-10 Structure of the master PROFIBUS address

Bit	Meaning
0 to 7	PROFIBUS address of the DP master which parameterized the DP slave and which has read and write access to the DP slave.

Structure of the manufacturer ID

See the manual on the DP slave for details of the manufacturer ID. The manufacturer ID consists of two bytes.

Slave diagnostics; continued

This part of slave diagnostics depends on the DP slave

6.4.1 Slave diagnostics for DP slaves

Overview

On the IM 308-C master interface, the diagnostics data is stored in accordance with EN 50 170, Volume 2, PROFIBUS.

The slave diagnostics data is stored separately for all slaves that do not comply with the above standard (see section 6.4.2).

Structure of slave diagnostics

The structure of slave diagnostics varies from slave to DP slave. Not every slave diagnostics message is valid for each DP slave.

The header always indicates the type of diagnosis in question. The header contains the type of slave diagnostics (station, module or channel diagnostics) plus the length of the diagnostics bytes.

The first header is always in byte 6 of the slave diagnostics.

Table 6-11 shows the structure of the header for slave diagnostics:

Table 6-11 Structure of the header for station, module or channel diagnostics

Bit	Value	Meaning
7, 6	0 0	Code for station diagnostics
	0 1	Code for module diagnostics
	1 0	Code for channel diagnostics
5 to 0	–	Length of diagnostics including header.

Contents of slave-specific diagnostics

The structure of the station, module and channel diagnostics is always specific to the DP slave. See the manual on the DP slave for the meanings of these diagnostics.

6.4.2 Slave-specific diagnostics for DP Siemens slaves.

Structure

The structure of the slave diagnostics for DP Siemens slaves varies from slave to slave:

Table 6-12 Structure of the slave-specific diagnostics for DP Siemens slaves

Byte	ET 200B (6ES5 ...)	ET 200C (6ES5 ...)	ET 200U (6ES5 ...)	ET 200K	SPM module
0	Station status 1				
1	Station status 2				
2	Station status 3				
3	Master PROFIBUS address				
4	Manufacturer ID (high byte)				
5	Manufacturer ID (low byte)				
6	Header, station diagnostics	Header, station diagnostics	Header, station diagnostics	Header, station diagnostics	Header, station diagnostics
7	Header, station diagnostics	0	Header, station diagnostics	0	0
8	0	0	Header, module diagnostics	0	0
9	0	Channels 7 ... 0	Modules 7 ... 0	Channels 7 ... 0	Channels 7 ... 0
10	0	0	Modules 15 ... 8	Channels 15 ... 8	Channels 15 ... 8
11	0	0	Modules 23 ... 16	Channels 23 ... 16	Channels 23 ... 16
12	0	0	Modules 31 ... 24	Channels 31 ... 24	Channels 31 ... 24

6.5 Sending the FREEZE and SYNC control commands

What is a control command?

The IM 308-C can send simultaneous commands to a group of DP slaves in order to synchronize them.

The FREEZE and SYNC control commands enable you to synchronize groups of DP slaves in response to events.

What is FREEZE?

When it receives the FREEZE control command from the DP master, the DP standard slave freezes the current status of the **inputs** and transfers these inputs cyclically to the DP master.

After every new FREEZE control command, the DP standard slave again freezes the status of the **inputs**.

The freeze remains in effect and the input data is not again updated until the DP master sends the UNFREEZE control command.

What is SYNC?

When it issues the SYNC control command to a DP standard slave, the DP master is instructing the DP standard slave to freeze the states of the **outputs** at their current value. When it subsequently receives telegrams, the DP standard slave stores the most recent output data, but the output status remains unchanged.

After every new SYNC control command, the DP standard slave sets the outputs which it last received.

Cyclic updating of the outputs does not resume until the DP master sends the UNSYNC control command.

Preconditions

The FREEZE and SYNC control commands are not effective unless you have structured the DP slaves in groups with the aid of COM PROFIBUS. You must know which DP slave is assigned to which group and you must be in possession of the group number before you can issue these control commands. You can check these numbers in the ”group membership” listing.

When you send a control command, you must use the FB IM308C to ascertain whether the control command has already been broadcast to all the DP slaves concerned. Only then can you continue processing the inputs/outputs in question.

Issuing control commands

In order to issue control commands to the groups of DP slaves, you must set FCT = GC and the GCGR parameter to suit the control command in question. See section 7 for the remaining parameters.

Result: In accordance with the parameter settings, the FB IM308C sends the control commands to the groups of DP slaves.

6.6 Assigning PROFIBUS addresses with FB IM308C

Application

For some DP standard slaves you set the PROFIBUS address by means of the software, e.g. for the ET 200C distributed I/O station or the DP/AS-I link.

Note that the FB IM308C can be used to change the PROFIBUS addresses of **DP standard slaves** only.

No application

DP slaves whose PROFIBUS addresses can **only** be set by means of switches set in the housing, or DP Siemens slaves: you cannot assign the PROFIBUS addresses by means of the software.

Assigning PROFIBUS addresses

To assign a PROFIBUS address to a DP slave, proceed as follows:

1. Configure the parameterization master IM 308-C and the DP standard slave with the new PROFIBUS address using COM PROFIBUS.

   Tip: Use the highest possible baud rate for the DP standard slave.

2. Connect the bus to the IM 308-C and to the target DP slave which is to receive a PROFIBUS address.
3. Connect the programmer to the AS 511 interface of the CPU and set up a configuration as shown in Fig. 6-2 :

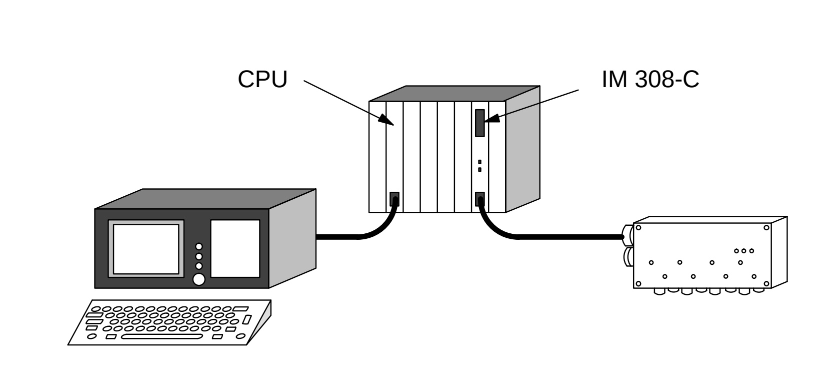


Figure 6-2 Using the FB IM308C to assign a PROFIBUS address to a DP slave

4. Switch the IM 308-C to STOP.
5. Start the STEP 5 program.

6. Call the FB IM308C with FCT = CS. See chapter 7 for details of all remaining parameters.

   If you are unaware of the original PROFIBUS address, program the FB IM308C with all PROFIBUS addresses as a loop.

   Result: The IM 308-C attempts to transfer the new PROFIBUS address to the DP slave. The ”BF” LED goes out when the DP slave accepts the PROFIBUS address. You should always check the ERR parameter of the FB IM308C in order to ascertain whether transfer was successful.

7. Evaluate the master diagnostics and check whether the DP standard slave has been removed from the overview diagnostics and entered in the data-transfer list.

IM 308-C set to RUN

If you want to change the PROFIBUS address of a DP standard slave while the IM 308-C is set to RUN, note the following:

- The new PROFIBUS address of the DP standard slave must be parameterized with COM PROFIBUS
- The old PROFIBUS address of the DP standard slave must **not** be parameterized with COM PROFIBUS
- No other DP master accessing the DP standard slave.

Example

The STEP 5 application program shown below is an example of how you can assign a PROFIBUS address to a DP slave with the FB IM308C:

```
STL                                              Explanation
OB 1

SEGMENT 1          0000
       :C      DB  70                            Open data block No. 70
       :
       :JU     FB 192
Name   :IM308C
DPAD   :       KH F800                           Default address area of IM 308-C
IMST   :       KY 0,126                          IM No.=0: old PROFIBUS address.=126
FCT    :       KC CS                             Function: Change PROFIBUS address
GCGR   :       KM 00000000 00000000
TYP    :       KY 0,60                           S5-Data block: DB 60
STAD   :       KF  +1                            As of data word 1
LENG   :       KF +4                             Minimum length = 4 bytes
ERR    :       DW   0                            Error code placed in DW 0 of the
       :                                         current data block
       :                                         (here DB 70)
       :BE
```

6.7 Addressing the ET 200 in multimaster mode and/or multiprocessor mode

Introduction

This section describes the meanings of the terms mono-master mode, multimaster mode and multiprocessor mode. The important points for each mode are also discussed.

Definition: mono-master mode

Monomaster mode means that there is one master in a host connected to the bus. There are no other masters operating on the bus.

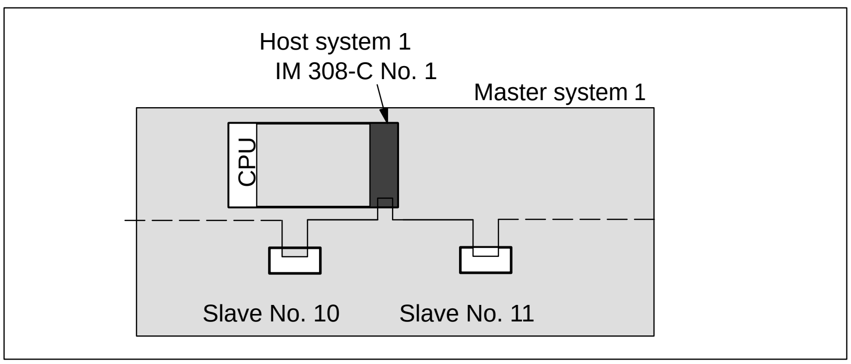


Figure 6-3 Monomaster mode

6.7.1 Multimaster mode

Definition

Multimaster mode means that there are at least two masters on the bus, for example an IM 308-C and a CP 5431 or two IM 308-C master interfaces.

If there are two IM 308-C master interfaces on the bus, they may be in the same host or in two different hosts.

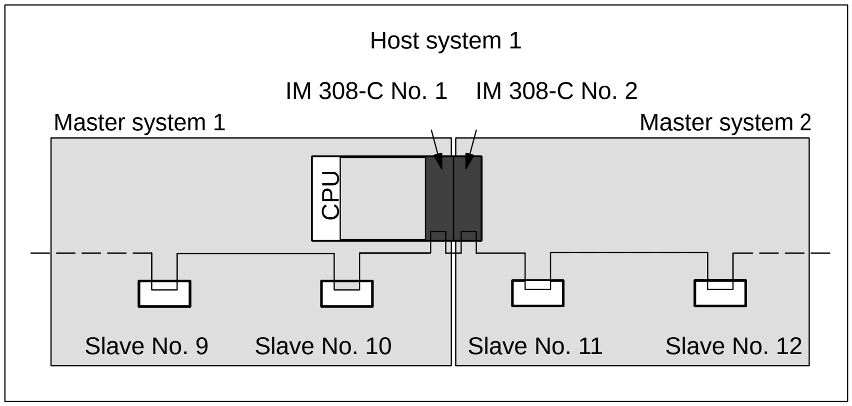


Figure 6-4 Multimaster mode

Rules

COM PROFIBUS supports the generation of multiple IM 308-C master interfaces on one bus:

- Enter the entire bus configuration before you start exporting the data to memory card.
- If you change the contents of one memory card, you must always re-transfer all the data to each memory card.
- You must leave a free PROFIBUS address between the PROFIBUS address of one master and that of the next master. This address is only allowed to be used by a slave.
- So as not to sacrifice performance, assign the DP masters consecutive PROFIBUS addresses that are as low as possible, e.g. 1, 3 and 5 for three DP masters.

  The highest PROFIBUS address (Highest Station Address, HSA) in the ”Bus parameters” dialog box should also be as low as possible.

6.7.2 Multiprocessor mode

Definition

Multiprocessor mode means that two, three or four CPUs access one or more IM 308-C master interfaces.

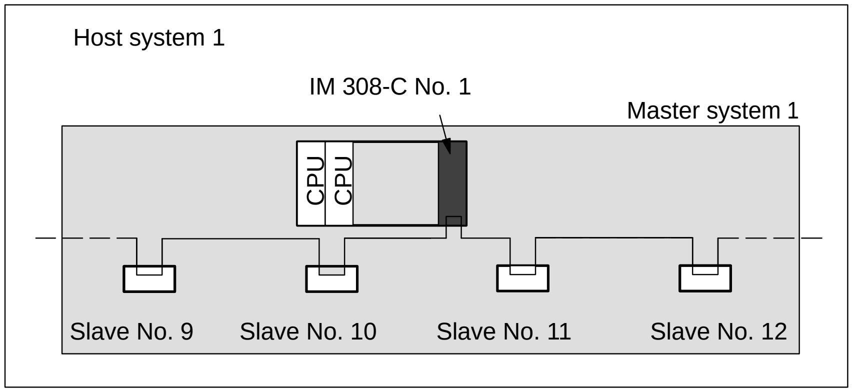


Figure 6-5 Multiprocessor mode

Rules

The following rules apply to multiprocessor mode:

- Multiprocessor mode is permissible only in conjunction with linear addressing (P- and Q-areas) or addressing through the FB IM308C.

  If you want to use page addressing nevertheless, the CPU accesses to the IM 308-C master interfaces must be coordinated with semaphores. This means that at any one time, only one CPU can access a page.
- Digital inputs/outputs can be processed by multiple CPUs.
- The FB IM308C can be called in multiprocessor mode. The maximum data consistency ensured is byte-by-byte.

  If you address an IM 308-C master interface from multiple CPUs via the FB IM308C, you must implement semaphore interlocks to ensure that only one CPU can address the FB IM308C at any given time.
- If you address in parallel using pages and via the FB IM308C, you can use two different semaphores – one for page addressing and one for the FB IM308C. Within a particular addressing mode, each CPU must process the same semaphore.

S5-135U and S5-155U

Note that the following rules apply if you operate a series S5-135U CPU in multiprocessor mode in conjunction with a series S5-155U CPU:

- Select the S5-135U as the host type in COM PROFIBUS.
- Make sure that there are no entries in the DB1 (digital inputs, digital outputs) for the series S5-155U. You must use direct load/transfer commands to enable the S5-155U CPU to access.
- The process image may contain addresses in the case of S5-135U.

IM 308-C – Using the standard function block FB IM308C (FB 192)

7

In this chapter

Chapter 7 contains information on:

Goal

After reading this chapter, you will be in possession of all the information you need in order to carry out the following tasks with the standard function block FB IM308C (FB 192).

- Reading the inputs/outputs of slaves and writing the outputs
- Interpreting diagnostics data
- Sending control commands
- Assigning a slave PROFIBUS address
- Parameterizing the FB IM308C indirectly

7.1 Functions of the FB IM308C (FB 192)

Application

The standard function block FB IM308C transfers data between a CPU memory area (marker area, data-block area) and the IM 308-C master interface. You can use the FB IM308C to:

- Read the inputs
- Read/write the outputs
- Read the diagnostics
- Send and monitor the FREEZE and SYNC control commands
- Change the PROFIBUS address (e.g. for the ET 200C DP standard slave).

Memory area on the CPU

The FB IM308C supports the following memory areas, always presuming that they are supported by the CPU:

- Data blocks DB
- Extended data blocks DX (945, 928, 946/947, 948 CPUs only)
- Marker area M
- Extended marker area S (945, 928B, 946/947, 948 CPUs only)

Control commands

You can use the FB IM308C to send a combination of the following control commands to one or more groups of DP slaves:

- FREEZE (freeze inputs of the DP slaves)
- UNFREEZE (cancel the FREEZE command)
- SYNC (simultaneously output and freeze the output states of the DP slaves)
- UNSYNC (cancel the SYNC command)
- Check whether a control command issued beforehand has been completed

Changing PROFIBUS address

You can use the FB IM308C in conjunction with the STEP 5 program to assign PROFIBUS addresses to DP standard slaves (e.g. for the ET 200C distributed I/O station).

Parameterization

You can directly or indirectly parameterize the function block FB IM308C. If you prefer indirect parameterization, you require a parameter data block.

Calling the FB IM308C

In the simplest form, the FB IM308C is called in cyclic program processing.

If you call the FB IM308C in process-alarm or time-alarm processing, you must make provision in the STEP 5 application program for ensuring that the FB IM308C does not interrupt itself. To this end, you must block the alarms for calling the FB IM308C and release them again after the FB IM308C call has been implemented.

Note

If the FB IM308C accesses a DP slave for which the error-reporting mode is ”QVZ” (time-out), and this DP slave is not available, QVZ is not reported. Instead, the corresponding error message is placed in the ”ERR” parameter of the FB IM308C.

FB IM308C in multiprocessor mode

The FB IM308C can be called in multiprocessor mode.

If you address an IM 308-C master interface from multiple CPUs via the FB IM308C, you must implement semaphore interlocks to ensure that only one CPU can address the FB IM308C at any given time.

For notes on multiprocessor operation, see section 6.7.2.

FB IM308C and DP/AS-I link

You can issue read/write jobs to the DP/AS-I link via the FB IM308C. To do so, you must parameterize the FB IM308C indirectly. You can find a description of the FB IM308C for the DP/AS link in section D.1.

7.2 Technical data and installation of the FB IM308C (FB 192)

Form of delivery

COM PROFIBUS up to V3.3:

The FB IM308C is shipped together with COM PROFIBUS. The files are contained in the ”\CSTEP5” directory and have the following designations:

Table 7-1 File designations for FB IM308C

File	Valid for	Library number
S5ET50ST.S5D	CPU 941 to CPU 944	P71200-S5192-A3
S5ET55ST.S5D	CPU 945	P71200-S3192-A3
S5ET23ST.S5D	CPU 922, 928, CPU 928B	P71200-S8192-A3
S5ET60ST.S5D	CPU 946/947, CPU 948	P71200-S6192-A3

The diskette also contains a demo program with a description of all the functions of the FB IM308C.

COM PROFIBUS as of V 5.0:

The FB IM308C is no longer shipped with COM PROFIBUS. You can obtain a current version of the FB IM308C on the Internet or intranet:

On the intranet (Siemens)
German: http://www.m30x.nbg.scn.de/extern/spiegeln/support/html_00
English: http://www.m30x.nbg.scn.de/extern/spiegeln/support/html_76

On the Internet
German: http://www.ad.siemens.de/support/html_00
English: http://www.ad.siemens.de/support/html_76

Versions of FB IM308C

You can use the FB IM308C with the library number **...-A3** only with the IM 308-C (as of release 6).

If you are using an FB IM308C with the library number **...-A2**, you cannot use the functions described in the *ET 200 Distributed I/O System* manual for issuing a SYNC or FREEZE command (see Section 6.5) or the functions with the DP/AS-I Link (see Section D.1).

If you have installed a version of COM PROFIBUS whose installation disk contains an FB IM308C with the library number **..-A2**, you can obtain a current update of the FB IM308C with the library number **...-A3** on the Internet or intranet.

Address space occupied by the FB IM308C

By default, the IM 308-C occupies the address space $(F)F800_H$ to $(F)F9FF_H$ for addressing distributed I/O. These 512 bytes of address space is the block also accessed by the FB IM308C. This address space is also required if you use only linear or page addressing.

Do not change this address space (DP window) unless absolutely necessary, for example if there is a second IM 308-C in the programmable controller. You can change the address space in COM PROFIBUS under the options for master parameters.

Caution

Danger of double addressing

The IM 308-C uses fully one or more of the address areas shown in Table 6-2 under DP window (default: $(F)F800_H$ to $(F)F9FF_H$).

No part of these address areas may be used by other modules such as CPs, IPs in the CP area, central I/O in the IM3/IM4 area or the WF 470 position-sensing module in the central programmable controller.

Technical data

Table 7-2 shows the technical data of the FB IM308C:

Table 7-2 Technical data of the FB IM308C

Technical data	CPU 941 to CPU 944	CPU 945	CPU 922 CPU 928A/B	CPU 946/947 CPU 948
Module number	192			
Module name	IM 308C			
Library number P71200-S	5192-A3	3192-A3	8192-A3	6192-A3
Call length	10			
Module length	1077	918	879	820
Layering depth	0	1	1	1
Assignment in marker area	MB 200 to MB 255			
Assignment in data area	Parameter data block (DW 0 to DW 12). The parameter data block is required only for indirect parameterization.			

Runtimes

Table 7-3 shows the runtimes which occur when the FB IM308C is called.

These runtimes apply when the FB IM308C can access the IM 308-C master interface when called. If the FB IM308C does not have access, the runtime is extended by a maximum of 5 milliseconds. This can occur if a function is repeated at a short interval for a DP slave. If the same function is pending for another DP slave, the runtime is not increased.

Table 7-3 Runtimes for the FB IM308-C

Function	Length (bytes)	Runtimes depending on CPU (in ms)									
		941B	942B	943B	944B	945	922	928A	928B	946/947	948
GC	–	4.1	4.1	3.7	0.9	0.17	6.5	2.8	1.1	0.6	0.15
CC, CW, DR	–	2.1	2.1	2.0	0.7	0.10	5.0	2.2	0.7	0.5	0.11
CS	4	5.0	5.0	4.4	1.3	0.20	8.6	4.5	1.7	0.8	0.20
WO, DW	4	4.4	4.4	4.1	0.9	0.16	6.6	2.9	1.3	0.7	0.19
	100	8.9	8.9	8.6	1.2	0.35	7.1	3.4	1.8	0.9	0.35
	200	13.9	13.9	13.4	1.5	0.54	7.6	3.8	2.2	1.1	0.51
RO, RI, MD, SD, CR	4	3.4	3.4	2.9	0.8	0.13	5.9	2.8	1.0	0.6	0.15
	100	8.3	8.3	7.8	1.1	0.31	6.4	3.2	1.4	0.8	0.33
	200	13.5	13.5	13.1	1.4	0.50	7.1	3.6	1.9	1.1	0.50

7.3 Calling the standard function block FB IM308C and block parameters (FB 192)

In section 7.3

Section 7.3 contains:

Calling the FB IM308C

The call for the FB IM308C is as follows:

```
      :SPA FB 192                  FB 192
NAME  :IM308 C                 ┌─────────────────────┐
DPAD:                          │      IM308C         │
IMST  :                      ──┤ DPAD          ERR   ├──
FCT   :                      ──┤ IMST                │
GCGR  :                      ──┤  FCT                │
TYP   :                      ──┤ GCGR                │
STAD  :                      ──┤  TYP                │
LENG  :                      ──┤ STAD                │
ERR   :                      ──┤ LENG                │
                             ──┤                     │
                               └─────────────────────┘
```

Figure 7-1 Appearance of the FB IM308C call in the STL or in KOP/FUP

FB IM308C access to the IM 308-C during RESET

While the IM 308-C is carrying out a reset (all four LEDs come on briefly), the FB IM308C cannot access the IM 308-C. A reset is carried out after power on, when a downloaded parameter set is activated and when the IM 308-C is switched to OFF.

Block Parameters

The table below shows the meanings of the block parameters which you must transfer to the FB IM308C in the STEP 5 application program. You can call the FB IM308C with either directly or indirectly entered parameters.

Note

LENG parameter: Always specify the joker length for the LENG parameter for ”read slave diagnosis” (FCT = SD).

If the length specified is too great, this can lead to an error message in the case of a variable device-specific slave diagnosis, for example.

Table 7-4 Meanings of the block parameters of the FB IM308C

Name	Mode	Type	Designation	Permissible assignment
DPAD	D	KH	Address area of the IM 308-C (DP window, **DP** window **ad**dress)	KH = F800; (default)[1]
IMST	D	KY	Number of the **IM** 308-C, **PROFIBUS address** of DP slave	KY = x, y;
				x: Number of the IM 308-C (see section 6.1.2) x = 0, 16, 32, 48, 64, 80, 96, 112, 128, 144, ..., 240;
				y: PROFIBUS address of the DP slave y = 1 ... 123 (if FCT = WO, RO, RI, SD) y = 1 ... 126 (if FCT = CS) y = irrelevant (if FCT = MD, GC, CC)
FCT	D	KC	Function of the FB IM308C (for details see Table 7-5)	WO = Write outputs RO = Read outputs RI = Read inputs MD = Read master diagnostics SD = Read slave diagnostics GC = Global control (control command) CC = Check global control (check control command) CS = Change station number (change PROFIBUS address) XX = Switch to indirect parameterization
GCGR	D	KM	Control commands (**G**lobal **C**ontrol), **Gr**oup selection (for details see Table 7-8)	KM = xxxxxxxx yyyyyyyy; (relevant only if FCT = GC, CC)
				xxxxxxxx: Choice of control command
				yyyyyyyy: Choice of DP slaves as target group for control commands
TYP	D	KY	Type of STEP 5 memory area	KY = x, y;
				x = 0: Data block type DB x = 1: Data block type DX x = 2: Flag area M x = 3: Flag area S
				y = 10 to 255; DB or DX number (relevant only if x = 0 or x = 1)
STAD	D	KF	Start of STEP 5 memory area (**St**art **Ad**dress)	KF = +x;
				x: Number of the first data word (if TYP: x = 0 or x = 1) x: First flag byte[2] (if TYP: x = 2 or x = 3)
LENG	D	KF	Number of bytes to be transferred (**Leng**th)	KF = +x;
				x: Number of bytes for transfer if FCT = DW or CR: x = 1 to 240 if FCT ≠ CS: x = 1 to 244 [3]or x = –1 ; joker length[4] if FCT = CS: x = 4 to 244
ERR	A	W	Error word (**Err**or)	Data, flag or output word [5]

1 Do not change the default setting of the ”DPAD” parameter unless you selected ”Multiprocessor mode” in the master parameters under COM PROFIBUS and changed the address of the DP window to a value other than F800.
2 Do not use scratch flags (MB 200 to MB 255.
3 The area to be transferred must be entirely within the permissible area or data block.
4 For the joker length, the FB IM308C transfers all permissible bytes. If the source or target area is not long enough, the FB IM308C does not transfer data and outputs an error message in the ERR parameter.
5 The data word is in the data block opened before the FB IM308C was called. If this data block does not exist, the programmable controller goes to ”STOP”. Only the range from MW 0 to MW 199 is allowed to be used for flags.

7.3.1 FCT parameter: function of the FB IM308C (FB 192)

Meaning of the FCT parameter

Use the ”FCT” parameter to define which function the FB IM308C will execute. The primary functions are:

- WO: Write outputs of a DP slave (up to 244 bytes at once)
- RI: Read inputs of a DP slave (up to 244 bytes at once)
- MD: Read master diagnostics
- SD: Read slave diagnostics

Assignment of the FCT parameter

Table 7-5 lists the settings of the FCT parameters and their significance. The two columns on the right show

- which parameters you must set (other relevant parameters) and
- which defaults you can leave, because the parameters in question are irrelevant.

Table 7-5 Meaning of the FCT parameter for IM 308-C as DP master

FCT =	Meaning	Description	Other relevant parameters	Irrelevant parameters
WO	**W**rite **O**utputs	The FB IM308C transfers the number of bytes specified in the LENG parameter from the S5 source area to the DP slave.	IMST, TYP, STAD, LENG, DPAD	GCGR
RI	**R**ead **I**nputs	The FB IM308C transfers the number of bytes specified in the LENG parameter from the DP slave (inputs) to the S5 target area.	IMST, TYP, STAD, LENG, DPAD	GCGR
MD	Read **M**aster **D**iagnostics	The FB IM308C transfers the master diagnostics of the specified IM 308-C to the S5 target area.	IMST, TYP, STAD, LENG, DPAD	GCGR
SD	Read **S**lave **D**iagnostics	The FB IM308C transfers the slave diagnostics of the specified DP slave to the S5 target area.	IMST, TYP, STAD, LENG, DPAD	GCGR
RO	**R**ead **O**utputs	The FB IM308C transfers the number of bytes specified in the LENG parameter from the DP slave (outputs) to the S5 target area.	IMST, TYP, STAD, LENG, DPAD	GCGR
GC	**G**lobal **C**ontrol	The FB IM308C triggers the control command (Global Control) specified in the GCGR parameter.	IMST, GCGR, DPAD	TYP, STAD, LENG,
CC	**C**heck Global **C**ontrol	The FB IM308C checks whether the control command specified in the GCGR parameter is still being processed. While ERR = DC_H is output, the inputs affected by the control command cannot be read and the outputs cannot be set.	IMST, GCGR, DPAD	TYP, STAD, LENG

Table 7-5 Meaning of the FCT parameter for IM 308-C as DP master, continued

FCT =	Meaning	Description	Other relevant parameters	Irrelevant parameters
CS	**C**hange **S**tation Number	The FB IM308C transfers a new PROFIBUS address to the DP slave specified in the IMST parameter. The new PROFIBUS address is specified in the S5 source area.	IMST, TYP, STAD, LENG, DPAD	GCGR
XX	Switch to indirect parameterization	The FB IM308C fetches the requisite parameterization data from the data block opened in the FB IM308C call.	–	

Warning

Outputs on the DP slaves may be set inadvertently.

If P-page addressing is selected, PROFIBUS addresess 120 to 123 are illegal. With Q-page addressing, PROFIBUS addresses 108 to 123 are illegal. If these PROFIBUS addresses do not exist on the bus, they cannot be addressed through the FB IM308C.

RO function

The RO function of the FB IM308C is only possible on slaves configured by COM PROFIBUS for the IM 308-C. Only output values are read that have been written with the WO function by means of the FB IM308C. The outputs are not read directly by the slave.

S5 memory area with WO, RO, RI

This table shows how the S5 memory area is structured subsequent to FCT = WO, RO or RI:

Table 7-6 Structure of the S5 memory area after FCT = WO, RO or RI

DB/DX	M/S	Content
DL n	Byte n	Input/output byte 0
DR n	Byte (n + 1)	Input/output byte 1
DL (n + 1)	Byte (n + 2)	Input/output byte 2
DR (n + 1)	Byte (n + 3)	Input/output byte 3
...	...	...
DL (n + 121)	Byte (n + 242)	Input/output byte 242
DR (n + 121)	Byte (n + 243)	Input/output byte 243

S5 memory area with CS

This table shows how the S5 memory area must be structured for FCT = CS (change PROFIBUS address):

Table 7-7 Structure of the S5 memory area for FCT = CS

DB/DX	M/S	Content
DL n	Byte n	New PROFIBUS address
DR n	Byte (n + 1)	free
DL (n + 1)	Byte (n + 2)	free
DR (n + 1)	Byte (n + 3)	00_H: Permit PROFIBUS address change [1]
DL (n + 2)	Byte (n + 4)	User-specific data (byte 0)
DR (n + 2)	Byte (n + 5)	User-specific data (byte 1)
...	...	
DL (n + 121)	Byte (n + 242)	User-specific data (byte 238)
DR (n + 121)	Byte (n + 243)	User-specific data (byte 239)

1 This parameter indicates whether the PROFIBUS address can be changed again at a subsequent time. If you select FF_H, the PROFIBUS address cannot be changed again unless the DP slave is removed from the system in the interim.

7.3.2 GCGR parameter: sending control commands

Assignment of the GCGR parameter

The FB IM308C does not read the GCGR parameter unless a control command is sent with FCT = GC or CC. You define the group memberships of the DP slaves with COM PROFIBUS.

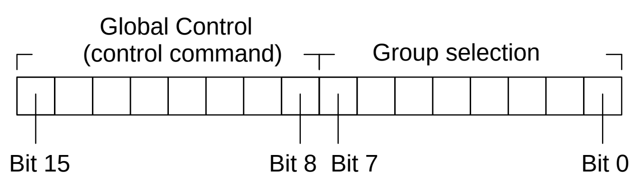
If FREEZE and UNFREEZE are set simultaneously, only UNFREEZE is executed. The same applies to simultaneous SYNC and UNSYNC.

Note

”00” is not permissible as the group selection byte.

Table 7-8 Assignment of the GCGR parameter

GCGR parameter



Bit	Meaning of control command (Global Control)	Bit	Meaning (group selection)
15	Reserved	7	1: Group 8 selected.
14	Reserved	6	1: Group 7 selected.
13	1: SYNC is executed. 0: No meaning	5	1: Group 6 selected.
12	1: UNSYNC is executed. 0: No meaning	4	1: Group 5 selected.
11	1: FREEZE is executed. 0: No meaning	3	1: Group 4 selected.
10	1: UNFREEZE is executed. 0: No meaning	2	1: Group 3 selected.
9	Reserved	1	1: Group 2 selected.
8	Reserved	0	1: Group 1 selected.

GCGR parameter, bits 15, 14, 9 and 8

Bits 15, 14, 9 and 8 are reserved for the GCGR parameter of the FB IM308C. If one of the bits is set for the GC and CC functions in spite of this, the IM 308-C may go into IM fault mode. Although the module will restart without problems after a subsequent power off and power on, this incorrect parameter assignment should be avoided in order to prevent system failure.

When is the control command valid?

When the control command is issued with the FB IM308C, it takes approximately one bus cycle (approx. $1 \times T_{TR}$, target rotation time; calculated by COM PROFIBUS in bus parameters) before the control command is broadcast to all DP slaves concerned.

You must use FCT = CC to check whether the control command sent in the GCGR parameter has already been broadcast to all the DP slaves concerned.

While ERR = DC_H persists, the inputs affected by the control command cannot be read or the outputs set.

Caution

If you process the inputs or outputs affected by a control command before the command has been broadcast along the bus to the DP slaves, incorrect values may be read or set.

Consequently, always check beforehand with FCT = CC to ascertain whether the control command you sent has already been processed by the DP slaves.

7.3.3 ERR parameter: interpreting the response and errors of the FB IM308C (FB 192)

ERR parameter

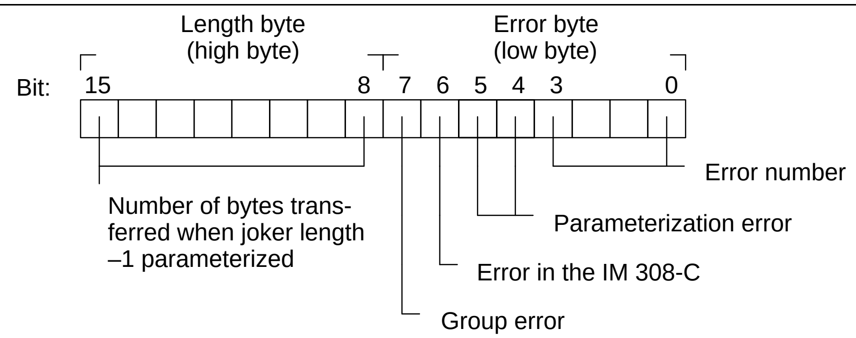
If an error occurs while the FB IM308C is running, the ERR parameter contains information indicating the cause of the error. If no error occurs, the group error bit in the ERR parameter is = 0.

Note

The ERR parameter must be re-evaluated after each FB IM308C call.

Table 7-9 Assignment of the ERR parameter

ERR parameter or battery 1



Bits	Meaning	
15 ... 8	The length byte indicates the number of bytes transferred by the FB IM308C. The length byte is always updated when the FB IM308C is called with LENG = –1 (joker length). When the length byte is updated, the group error bit is not set.	
7 ... 0	Error byte: Information about an error (see Table 7-10) The following bits have a special meaning:	
	Bit 7: Group error[1]	1: Error
	Bit 6: Error in the IM 308-C	1: Error
	Bits 4 and 5: Parameterization error	1: Parameterization error (at least one of the parameters for the FB IM308C call is invalid)
	Bits 0 to 3: Error numbers 1 to F	See Table 7-10

1 If the ”No error occurred” query is displayed, it is sufficient to query bit 7 (group error).

FB IM308C and QVZ

If the FB IM308C accesses a DP slave for which the error-reporting mode is ”QVZ” and the slave in question is not accessible, ”QVZ” is not reported: instead, the corresponding error message is placed in the ”ERR” parameter of the FB IM308C.

Exception: If you switch the IM 308-C from STOP to OFF at this time, the CPU reports ”QVZ” for a short time.

Error numbers in the ERR parameter

Table 7-10 shows the meanings of the ERR parameter.

Table 7-10 Meanings of the error numbers in the ERR parameter

LOW byte of ERR		Meaning	Remedy
Hex.	**Dec.**		
01_H	1	The previous data has not yet been transferred to the slave, or the slave has not received any new data since the last time it was read.	–
02_H	2	Slave failed, only in ”None” or ”PEU” error mode	–
04_H	4	Incorrect mode	Switch the master to RUN mode.
$A1_H$	161	Illegal CPU **type**, FB IM308C not executable in this CPU	Use the FB IM308C from the S5ETxxST.S5D file which belongs to the CPU (see Table 7-1).
$A2_H$	162	Number of the IM 308-C invalid (**IM**ST parameter)	The number of the IM 308-C must be one of the following values: 0, 16, 32, 48, 64, 80, 96, 112, 128, 144, 160, 176, 192, 208, 224 or 240.
$A3_H$	163	PROFIBUS address of the DP slave invalid (IM**ST** parameter)	The PROFIBUS address must be within the range 1 to 123.
$A4_H$	164	LENG parameter invalid	The LENG parameter must be either ”–1” (joker length) or in the range 0 to 240 or 1 to 244 or 4 to 244, depending on the function.
$A5_H$	165	TYP parameter invalid	The parameter value must be in the range 0 to 3.
$A6_H$	166	GCGR parameter invalid	The low byte of the GCGR parameter must be a value not equal to 0.
$A7_H$	167	TYP parameter invalid; the S marker memory area is valid only for the following CPUs: • CPU 945 • CPU 928B • CPU 946/947 and CPU 948	Select a different memory area, e.g. marker M.
$A8_H$	168	TYP parameter invalid; the extended data block area is valid only for the following CPUs: • CPU 945 • CPU 928A, CPU 928B • CPU 946/947 and CPU 948	Select a different memory area, e.g. data block DB.

Table 7-10 Meanings of the error numbers in the ERR parameter, continued

<table>
<tr><th colspan="2">LOW byte of ERR</th><th rowspan="2">Meaning</th><th rowspan="2">Remedy</th></tr>
<tr><th>Hex.</th><th>Dec.</th></tr>
<tr><td>$A9_H$</td><td>169</td><td>TYP parameter invalid; specified data block DB/DX does not exist.</td><td>Create the specified source/target data block.</td></tr>
<tr><td>AA_H</td><td>170</td><td>TYP parameter invalid; specified data block DB/DX is too small.</td><td>The specified source/target data block must exist in the application memory and must be long enough:
• LENG $\neq$ –1:
Minimum length (words) = STAD + LENG/2 – 1
• LENG = 1:
Minimum length depends on the configuration of the DP slave;
STAD $\leq$ Minimum length (words) $\leq$ STAD + 122</td></tr>
<tr><td>AB_H</td><td>171</td><td>TYP parameter invalid: specified flag memory area M/S too short.</td><td>The data to be transferred must fit entirely into the following area:
• Valid area for flags:
0 $\leq$ MB $\leq$ 199
• Valid area for S flags:
0 $\leq$ SY $\leq$ 1023 (CPU 928B)
0 $\leq$ SY $\leq$ 4095 (CPU 945, CPU 946/947, CPU 948)</td></tr>
<tr><td>AC_H</td><td>172</td><td>FCT parameter invalid; FB IM308C does not recognize specified function</td><td>A valid function must be parameterized in KC format.</td></tr>
<tr><td>AD_H</td><td>173</td><td>STAD parameter invalid</td><td>The validity range of the STAD parameter is as follows:
• Valid range for flags:
0 $\leq$ STAD $\leq$ 199
• Valid range for S flags:
0 $\leq$ STAD $\leq$ 1023 (CPU 928B)
0 $\leq$ STAD $\leq$ 4095 (CPU 945, CPU 946/947, CPU 948)</td></tr>
<tr><td>AE_H</td><td>174</td><td>A slave has failed or is not parameterized, no inputs/outputs have been parameterized, or
the FB IM308C has gone to STOP</td><td>Interpret the slave diagnostics data.</td></tr>
<tr><td>AF_H</td><td>175</td><td>LENG parameter too large. The IM 308-C does not have the desired number of data bytes for the specified DP slave.</td><td>Reduce LENG or select LENG = –1 (joker length).</td></tr>
<tr><td>$B0_H$</td><td>176</td><td>QVZ error; IM 308-C does not react.</td><td>Check the IM 308-C (for reasons for QVZ, see section 8.2).</td></tr>
<tr><td>$B1_H$</td><td>177</td><td>TYP parameter invalid; the specified DB/DX No. is invalid.</td><td>Select DB/DX No. $\geq$ 10.</td></tr>
<tr><td>$B2_H$</td><td>178</td><td>DPAD parameter invalid</td><td>The following are the only permissible addresses for this parameter: F600, F800, FA00, FC00, FE00.</td></tr>
</table>

Table 7-10 Meanings of the error numbers in the ERR parameter, continued

LOW byte of ERR		Meaning	Remedy
Hex.	Dec.		
$C1_H$	193	Error message from IM 308-C: The requested command has already been executed; the IM 308-C is out of resources.	Only one CS or two GC commands possible at any given time.
$C2_H$	194	Error message from IM 308-C: The IM 308-C is in wrong mode.	A control command can be executed only with the IM 308-C in the RUN or CLEAR mode.
$C3_H$	195	Error message from IM 308-C: No appropriate group configured. Error in the GCGR parameter setting	A control command can be executed only if an appropriate group has been configured with COM PROFIBUS. Check syntax and content of the control command.
$C5_H$	197	Error message from IM 308-C: PROFIBUS address is not configured.	Before a PROFIBUS address can be changed, the corresponding PROFIBUS address must be configured with COM PROFIBUS.
$C6_H$	198	Error message from IM 308-C: DP slave not responding to PROFIBUS address change. (PROFIBUS address does not exist).	The DP slave must be physically present and connected to the PROFIBUS-DP bus.
$C7_H$	199	Error message from IM 308-C: DP slave not responding correctly to PROFIBUS address change.	DP slave has responded with incorrect data; the CS command has not been processed by the DP slave. Repeat the function FCT = CS. If the error message persists, check the DP slave.
$C8_H$	200	Error message from IM 308-C: DP slave not responding correctly to PROFIBUS address change.	DP slave has responded with incorrect data; the CS command has not been processed by the DP slave. Repeat the function FCT = CS. If the error message persists, check the DP slave.
$C9_H$	201	Error message from IM 308-C: DP slave not responding correctly to PROFIBUS address change.	DP slave has responded with incorrect data; the CS command has not been processed by the DP slave. Repeat the function FCT = CS. If the error message persists, check the DP slave.
CA_H	202	Error message from IM 308-C: DP slave not responding correctly to PROFIBUS address change.	DP slave unable to implement PROFIBUS address change; corresponding SAP not available to DP slave.
DC_H	220	Control command still being processed.	The control command specified in the GCGR parameter is still being processed. Do not process the input/outputs affected by this command. Repeat the FCT = CC.
DD_H	221	The IM 308-C reports that diagnostics message is not consistent.	If you require consistent diagnostics data, call the FB IM308C again. If you do not require consistent diagnostics data, you can read the inconsistent diagnostics data from the specified target area.

Table 7-10 Meanings of the error numbers in the ERR parameter, continued

LOW byte of ERR		Meaning	Remedy
Hex.	**Dec.**		
DE_H	222	The IM 308-C is busy transferring data to the DP slaves. Requested function could not be executed.	Repeat the function call.
DF_H	223	No feedback from IM 308-C.	The IM 308-C failed to send a feedback message to the FB IM308C after function implementation. **or** IM 308-C did not return a feedback message to the FB IM308C within 5 ms. Increase the baud rate.

7.4 Indirect parameterization

Indirect parameterization

With indirect parameterization (FCT = XX), the FB IM308C takes the parameterization data from a parameterization data block and not from the block parameters.

You must open the parameter data block before calling the FB IM308C.

If the parameter data block is too short or if none exists, the programmable controller goes to STOP. All subsequent errors are intercepted by the FB IM308C and output in the parameter data block.

The parameter data block must be structured as follows: you can find a description of the block parameters in section 7.3.

Table 7-11 Structure of the parameter data block for the FB IM308C

Data word	Parameter	Recommended data format
DW 0	Reserved	KH
DW 1	DPAD	KH
DW 2	IMST	KY
DW 3	FCT	KC
DW 4	GCGR	KM
DW 5	TYP	KY
DW 6	STAD	KF
DW 7	LENG	KF
DW 8	ERR	KY
DW 9[1]	–	–
DW 10[1]	–	–
DW 11[1]	–	–
DW 12[1]	–	–

[1]: Data words DW 9 to DW 12 are required for the DP/AS-I link (see Appendix D.1). Even if you do not address the DP/AS-I link with the FB IM308C, the parameter data block must always include data words DW 0 to DW 12.

IM 308-C – Starting ET 200

8

In this chapter

This chapter contains all you need to know about startup, shutdown and failure of the ET 200 distributed I/O system when the IM 308-C master interfaces are in use.

S5-95U as DP master

If you use an S5-95U as DP master, skip chapter 8 and proceed to chapter 11.

Goal

After reading this chapter, you will have all the information you need to start up the ET 200 distributed I/O system with IM 308-C master interfaces as DP masters.

8.1 Starting and operating the ET 200

Preconditions

We assume:

- that you have already inserted the memory card(s) in the corresponding IM 308-C master interface(s) (see section 5.4)

  It is an essential precondition of starting up the CPU that a memory card with a parameterized master system be inserted. If there is no memory card with a parameterized master system, the CPU will not boot.
- that you have exported the data for each master system to the master (see section G.11)
- that you have checked the configuration of the distributed I/O system.

Note

If the status of the IM 308-C is CLEAR, outputs are set to ”0” but the inputs are still read.

If the CPU issues BASP (command output lock) while the status of the IM 308-C is CLEAR, the inputs are updated continuously but data consistency is not ensured for the inputs.

Normal IM 308-C start

If there is not yet a master system on the memory card of the IM 308-C and you want to export the master system online via the PROFIBUS using COM PROFIBUS, the following default parameters are set on the IM 308-C:

- PROFIBUS address: 1
- Baud rate: 19.2 kbaud

The ”RN” and ”IF” LEDs light up, i.e. the IM 308-C has started up with an empty memory card and is now waiting for you to export a master system with COM PROFIBUS.

Starting the ET 200 (switching on)

When you are ready to start the ET 200 distributed I/O system:

1. Test the wiring to the sensors and actuators of the individual DP slaves using the ”Status of inputs/outputs” service function of COM PROFIBUS.

   Result: After testing the DP slaves, you are sure that each DP slave is fully operational.

2. Connect all DP slaves and DP masters with the PROFIBUS bus cable.
3. Switch on the power supply units of the DP slaves.
4. Set the STOP/RUN switches of the DP slaves (if fitted) to RUN.
5. Set the mode selector switches of the IM 308-C from OFF or ST to RN.
6. Switch on the power supply of the hosts.

   Result: The IM 308-C powers up (BF (Bus Fault) LED flashes) and loads the slave parameters entered in COM PROFIBUS to the DP slaves.

   After loading the slaves, the IM 308-C compares the configuration parameterized with COM PROFIBUS with the actual configuration.

   The ”BF” LED on each of the DP slaves connected to the bus must go out. When data is exchanged between all the parameterized DP slaves and the IM 308-C, the ”BF” LED on the IM 308-C goes out as well.
7. Use COM PROFIBUS or the FB IM308C to check the diagnostics messages (FCT = MD). These messages will tell you whether or not data exchange with the CP slaves is functioning correctly.
8. Restart the CPU.
9. Via COM PROFIBUS or the AS 511 interface of the programmable controller, you can display the statuses of the inputs/outputs of the DP slaves.

Warning

If you use the STATUS/CONTROL function to address consistent data areas via the AS 511 interface, communication on the PROFIBUS may be interrupted (outputs of DP slaves without response monitoring may be frozen).

Remedy: Switch the power supply of the IM 308-C off and then on again.

To avoid this difficulty, do not use the STATUS/CONTROL function to address consistent data areas.

8.2 Response of the ET 200 distributed I/O system

Overview

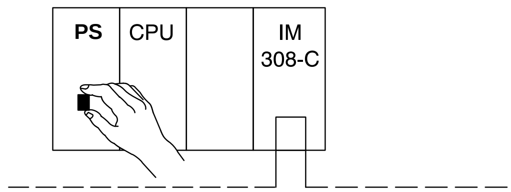
The reactions of the distributed I/O system to certain events are described in this section:

8.2.1 Reaction when power supply is switched on

Switching on the power supply

The table below shows you how the ET 200 distributed I/O system responds when you switch on the power supply to the host.

Table 8-1 Reaction when power supply is switched on



Preconditions			Reactions when power supply is switched on		
CPU	**IM 308-C**	**Error-reporting mode**	**CPU**	**DP slave**	**Diagnostics**
STOP/ RUN	OFF	–	CPU power-up is released. You cannot access the inputs/outputs of the distributed I/O system.	Outputs retain their status.	–
STOP/ RUN	ST	QVZ[1]	CPU power-up is released. You cannot access the inputs/outputs of the distributed I/O system.	Outputs retain their status.	Only the master diagnostics can be read.
		PEU[1]	CPU power-up is released. Inputs are set to ”0”, outputs cannot be accessed for write. PEU remains set until all DP slaves with error-reporting mode = PEU are addressable.		
		None	CPU power-up is released. You cannot access the inputs/outputs of the distributed I/O system.		
STOP/ RUN	RN	QVZ[1]	CPU does not run up until all DP slaves are addressable or until power-up delay has expired. After power-up, all DP slave inputs are set to the current values.	**CPU in STOP**: Outputs are set to ”0”. **CPU in RUN**: Outputs are updated once the CPU has powered up.	Master and slave diagnostics can be read.
		PEU[1]	CPU does not run up until all DP slaves are addressable or until power-up delay has expired. PEU remains set until all DP slaves with error-reporting mode = PEU are addressable. After power-up, all DP slave inputs are set to the current values.		
		None	CPU powers up. The inputs of the DP slaves are set to the current values.		

[1]: At least one DP slave must be configured for this error-reporting mode.

CPU and IM 308-C power-up

Fig. 8-1 illustrates CPU and IM 308-C power-up when the power supply is switched on. The CPU and IM 308-C switches are already set to RUN/RN and the error-reporting mode is ”QVZ” (acknowledgment delay).

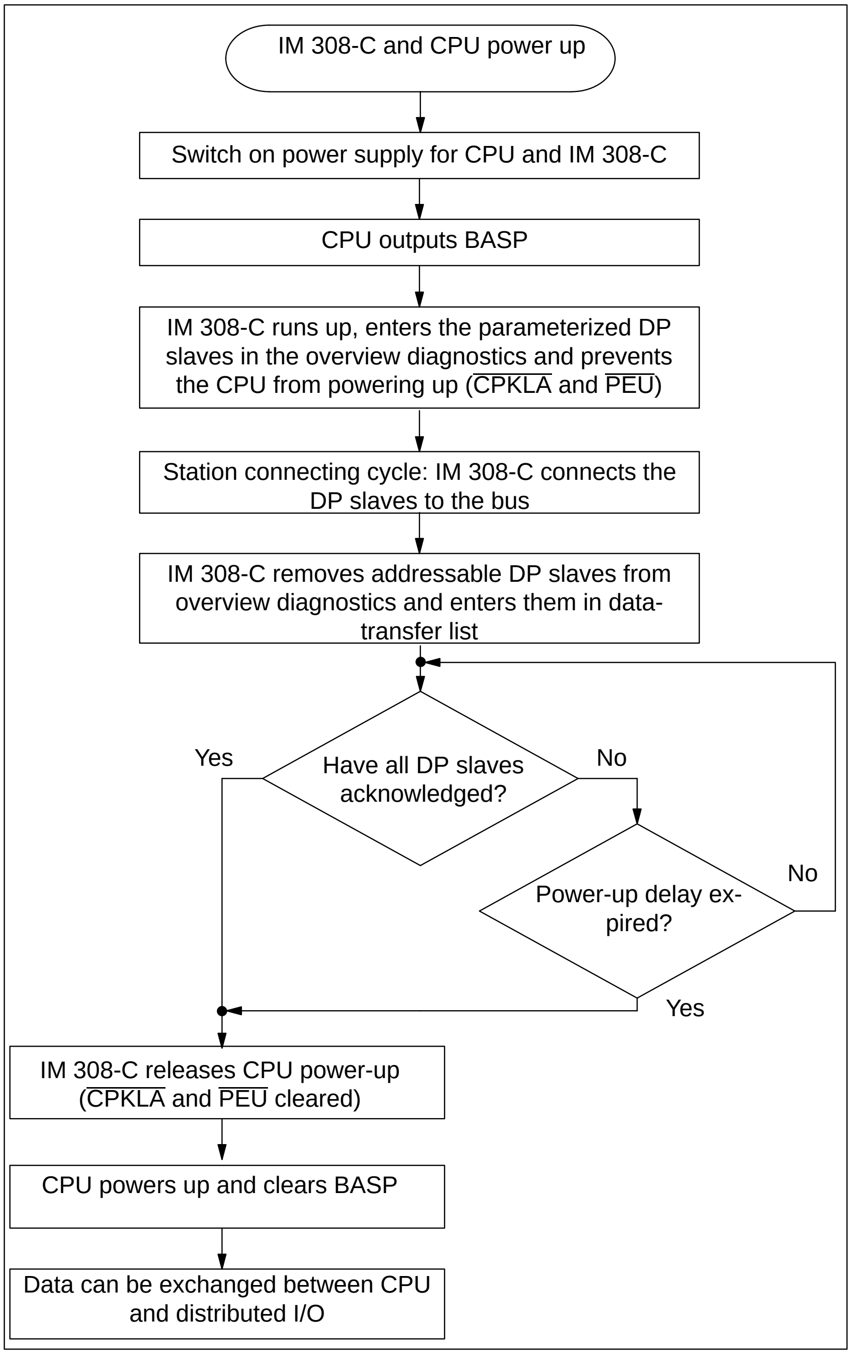


Figure 8-1 IM 308-C and CPU power-up

8.2.2 Reaction when IM 308-C is switched to OFF, ST or RN

Operating modes of the IM 308-C

Table 8-2 illustrates the meanings of the various operating modes of the IM 308-C. Table 8-3 references these operating modes.

Note

When the IM 308-C changes its operating mode, there is a possibility that consistency may be lost in data transferred while the change is in progress.

Table 8-2 Operating modes of the IM 308-C

<table>
<tr><th rowspan="2">Operating mode</th><th colspan="2">LEDs of the IM 308-C</th><th rowspan="2">Meaning for the DP slaves</th><th rowspan="2">Meaning for the token ring</th></tr>
<tr><th>RN</th><th>OF</th></tr>
<tr><td>RUN[1]</td><td>on</td><td>off</td><td>The IM 308-C reads all inputs and sets the outputs (normal operation).</td><td rowspan="3">The IM 308-C can receive the token from another DP master and pass on the token.</td></tr>
<tr><td>CLEAR[2]</td><td>flashing</td><td>off</td><td>The IM 308-C reads all inputs, but sets all outputs to ”0”.</td></tr>
<tr><td>STOP</td><td>off</td><td>flashing</td><td>The IM 308-C does not exchange data with the DP slaves.</td></tr>
<tr><td>OFF</td><td>off</td><td>on</td><td>The IM 308-C does not exchange data with the DP slaves.</td><td>The IM 308-C cannot receive the to-ken or pass it on.</td></tr>
</table>

[1]: The mode selector switch position RN is not identical with the RUN mode.
[2]: You can access the CLEAR mode when the mode selector switch on the IM 308-C is in the RN position and the CPU is in STOP.

Reaction of the IM 308-C

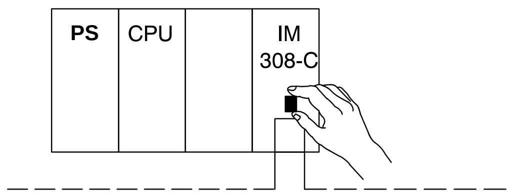
Table 8-3 indicates the reaction when the mode selector switch of the active DP master on the bus is set to OFF, ST or RN.

Precondition: It is assumed that all DP slaves connected to the bus are addressable. If this is not the case, you must also make provision for the reactions occurring when bus communication is interrupted or when a DP slave fails (see section 8.2.4).

Note

If you have selected ”PEU” as the error-reporting mode and the IM 308-C is OFF, ”QVZ” (acknowledgment delay) is reported instead of ”PEU” (power-fail on expansion unit).

Table 8-3 Reaction when IM 308-C is switched to OFF, ST or RN



Preconditions			Reactions		
CPU	**IM 308-C**	**Error-reporting mode**	**CPU**	**IM 308-C[1]**	**DP slaves**
STOP / RUN	St → Off	–	No access to the inputs/outputs of the distributed I/O system.	OFF	Status of outputs is sustained.
STOP / RUN	Off → St	QVZ[2]	No access to the inputs/outputs of the distributed I/O system.	STOP	Status of outputs is sustained.
		PEU[2]/None	Inputs are set to ”0”, outputs cannot be set.		
STOP / RUN	RN → ST	QVZ[2]	No access to the inputs/outputs of the distributed I/O system.	STOP	Outputs are set to ”0”.
		PEU[2]/ None	Inputs are set to ”0”, outputs cannot be set.		
STOP	ST → RN	–	Inputs of the DP slave set to current values.	CLEAR	Outputs are set to ”0”.
RUN	ST → RN	–	Inputs of the DP slave set to current values.	RUN	Outputs are set to current values.

1 The modes of the IM 308-C are as defined in Table 8-2.
2 At least one DP slave must be configured for this error-reporting mode.

8.2.3 Reaction when CPU is switched to STOP or RUN

CPU reaction

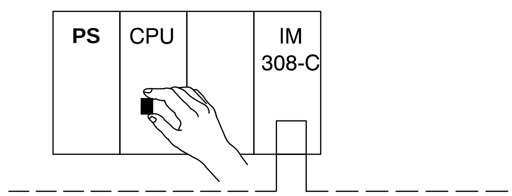
The table below shows the reactions when the mode selector switch of the CPU is set to STOP or RUN while the bus is in operation.

Precondition: It is assumed that all DP slaves connected to the bus are addressable. If this is not the case, you must also make provision for the reactions occurring when bus communication is interrupted or when a DP slave fails (see section 8.2.4).

Note

If you switch the CPU to STOP or the CPU goes to STOP, the data transferred while the STOP is in progress is no longer consistent.

Table 8-4 Reaction when CPU is switched to STOP or RUN



Preconditions			Reactions		
CPU	**IM 308-C**	**Error-reporting mode**	**CPU**	**IM 308-C** [1]	**DP slaves**
RUN → STOP STOP → RUN	OFF	–	If you switch the CPU to STOP or the CPU goes to STOP, the data transferred while the STOP is in progress is no longer consistent.	OFF	Status of outputs is sustained.
RUN → STOP STOP → RUN	ST	QVZ[2]	If you switch the CPU to STOP or the CPU goes to STOP, the data transferred while the STOP is in progress is no longer consistent.	STOP	Status of outputs is sustained.
		PEU[2]/ None	Inputs are set to ”0”, outputs cannot be set.		
RUN → STOP	RN	–	Inputs of the DP slave set to current values	CLEAR	Outputs are set to ”0”.
STOP → RUN	RN	–	Inputs of the DP slave set to current values.	RUN	Outputs are set to current values.

1 The modes of the IM 308-C are as defined in Table 8-2.
2 At least one DP slave must be configured for this error-reporting mode.

8.2.4 Reaction to interruption of bus communication or failure of the DP slave

Overview

The reaction to an interruption in bus communication or the failure of one or more DP slaves depends on the error mode you selected with COM PROFIBUS. The various possibilities are shown in the table below.

Note

If bus communication with a DP slave is interrupted, the DP slave fails or, for example, the bus connector of the IM 308-C is pulled, there is a possibility of the most recently received data losing its consistency.

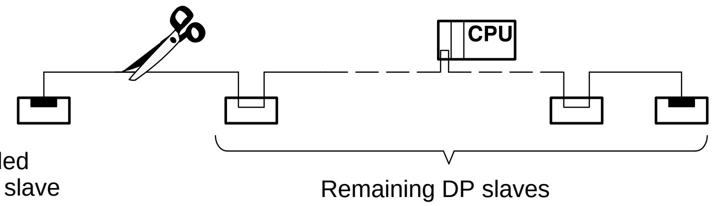
The same applies when bus communication is reestablished or the DP slave is again addressable.

Remedy: If you require consistent data, you must re-address the data.

QVZ (acknowledgment delay)

QVZ (acknowledgment delay) occurs when an addressable memory area on the IM 308-C fails to return the READY signal (acknowledgment) within a certain time after being addressed by the CPU.

Table 8-5 Reaction to interruption of bus communication or failure of a DP slave (with QVZ)



Failed DP slave(s)[1]: Response monitoring	Reaction of CPU:	Reaction of failed DP slave(s): The inputs in the CPU are set to ”0”. The outputs of the DP slaves are ...	Reaction of remaining DP slaves: The inputs in the CPU are updated as before. The outputs on the DP slaves are ...
No	RUN[2]	frozen.	updated as before
Yes	RUN[2]	set to ”0” when response time expires.	updated as before.
No	STOP	frozen.	set to ”0”. **Exception:** If the CPU belongs to the S5-115 7UB.. series, the outputs in the process image up to byte 79 are set to ”0” and frozen as of byte 80.
Yes	STOP	set to ”0” when response time expires.	set to ”0”.

1 QVZ (acknowledgment delay) is triggered by default for the CPU. The reaction of the CPU to QVZ depends, for example, on whether OBs 23 and 24 have been programmed and on the setting selected in the DX0 for the S5-135U CPUs.

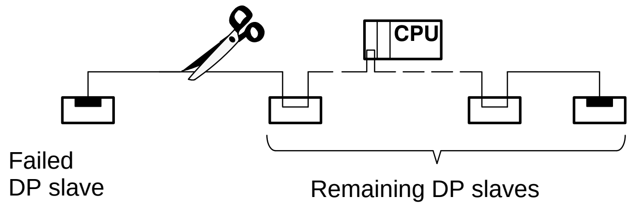
2 The ”QVZ” LED lights up.

PEU (powerfail in expansion unit)

The I/O system reacts by issuing the PEU signal (powerfail in expansion unit),

- if a power failure occurs in an expansion unit
- if a DP slave fails and PEU was selected as the error-reporting mode in COM PROFIBUS.

Table 8-6 Reaction to interruption of bus communication or failure of a DP slave (with PEU)



Failed DP slave(s): Response monitoring	**Reaction of CPU**	**Reaction of failed DP slave(s): The inputs in the CPU are set to ”0”. The outputs of the DP slaves are ...**	**Reaction of the remaining DP slaves: The inputs in the CPU are updated as before. The outputs on the DP slaves are ...**
No	**S5-115U**:		
	• No OB 35 programmed: CPU goes to and remains in STOP.	frozen.	set to ”0”.
	• OB 35 programmed (applicable to 945 CPUs only): CPU remains in RUN and performs OB 35 while PEU is pending.	frozen.	frozen.
	S5-135U, S5-155U: CPU goes to STOP [1]	frozen.	set to ”0”.
Yes	**S5-115U:**		
	• No OB 35 programmed: CPU goes and remains in STOP.	set to ”0” when response monitoring time expires.	set to ”0”.
	• OB 35 programmed (applicable to 945 CPUs only): CPU remains in RUN and performs OB 35 while PEU is pending.	set to ”0” when response monitoring time expires.	frozen.
	S5-135U, S5-155U: CPU goes to STOP [1]	set to ”0” when response monitoring time expires.	set to ”0”.

1 Once PEU is cleared, the CPU powers up again via OB 22 (automatic restart).

Error-reporting mode ”none”

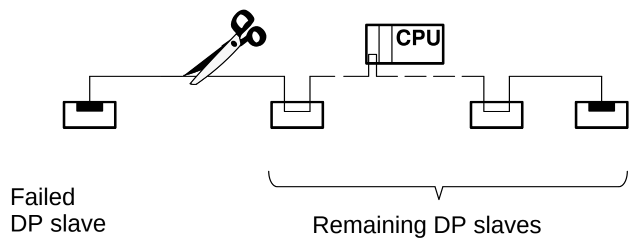
If you selected ”none” as the error-reporting mode in COM PROFIBUS, ET 200 responds as follows:

Caution

If you selected ”none” as the error-reporting mode, you can only detect an error in the distributed I/O in the application program by means of diagnostics analysis with the IM308C.

Consequently, we strongly recommend that ”none” be selected as the error-reporting mode only for initial operation.

Table 8-7 Reaction to interruption of bus communication or failure of a DP slave (error-reporting mode ”none”)



Failed DP slave(s): Response monitoring	Reaction of CPU	Reaction of failed DP slave(s): Inputs in the CPU are set to ”0”, outputs on the DP slave are ...	Reaction of remaining DP slaves: The inputs in the CPU are updated as before. The outputs on the DP slaves are ...
No	CPU remains in RUN	frozen.	updated as before.
Yes	CPU remains in RUN	set to ”0” when response monitoring time expires.	updated as before.

8.2.5 Reaction when bus interruption is rectified or DP slave is again addressable

Reaction

The table below shows the reactions when bus communication is reestablished or a failed DP slave is again addressable. The reactions depend on the error-reporting mode selected.

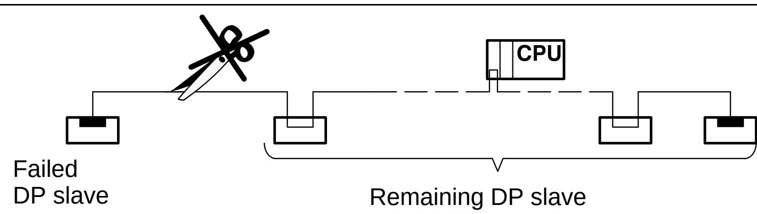
Note

If bus communication with a DP slave is interrupted, the DP slave fails or, for example, the bus connector of the IM 308-C is pulled, there is a possibility of the most recently received data losing its consistency.

The same applies when bus communication is reestablished or the DP slave is again addressable.

Remedy: If you require consistent data, you must re-address the data.

Table 8-8 Reaction when bus interruption is rectified or DP slave is again addressable



Failed DP slave(s):		**Reaction of failed DP slave(s):**		**Reaction of remaining DP slaves:**
Response monitoring	**Error-reporting mode**	**The inputs in the CPU are set to ”0”. The outputs of the DP slaves are ...**		**The inputs in the CPU are updated as before. The outputs on the DP slaves are ...**
		Response monitoring time expired:	**Response monitoring time not yet expired:**	
No	QVZ[1]/ None	... set to the last value prior to the interruption and then updated.		... updated as before.
No	PEU[1]	... set to the last value prior to the interruption and then updated.		... updated as again.
Yes	QVZ[1]/ None	... updated as again.	... set to the last value prior to the interruption and then updated.	... updated as before.
Yes	PEU[1]	... updated as again.	... set to the last value prior to the interruption and then updated.	... updated as again.

[1]: At least one DP slave must be configured for this error-reporting mode.

8.3 Switching off ET 200 and reaction to power failure

Switching off the ET 200

The procedure for shutting down the ET 200 distributed I/O system is always as follows:

1. Set the STOP/RUN switch of the CPU to STOP.
2. Set the mode selector switch of the IM 308-C from RN to ST or OFF.
3. Switch off the power supply of the host.
4. Switch off the power supply to the DP slaves and
5. Set the STOP/RUN switch on each DP slave (if fitted) to STOP.

Warning

If response monitoring for DP slaves is deactivated and only the power supply for the host is switched off, outputs may be inadvertently set.

In this case, set the IM 308-C to ST before switching off the power supply of the host, or always proceed in accordance with the shutdown sequence outlined above.

What do I do if the power supply fails?

If you selected ”QVZ = Yes” as the error-reporting mode in COM PROFIBUS, the CPU may refuse to restart when power is reapplied after a total power failure. The reasons are as follows:

- If the power supply to the slaves fails just before that of the DP master, the CPU with QVZ goes to STOP.
- When mains power is reapplied, the CPU remains in STOP on account of QVZ.

Remedy: Your options are as follows:

- Restart the CPU

  or

- program the appropriate OBs for QVZ, e.g. OB 23/24

  or

- select ”PEU” as the error-reporting mode instead of ”QVZ”

  or

- buffer the power supplies to the DP slaves in such a way that the CPU always goes down before the DP slaves if a total power failure occurs.

Design and method of operation of the S5-95U with DP master interface

9

In this chapter

This chapter contains information on:

Goal

After reading this chapter you will have basic knowledge of the design and method of operation of the S5-95U with DP master interface.

9.1 Design of the S5-95U

Front view of the S5-95U

This is a front view of the S5-95U, showing all the indicators, controls and interfaces.

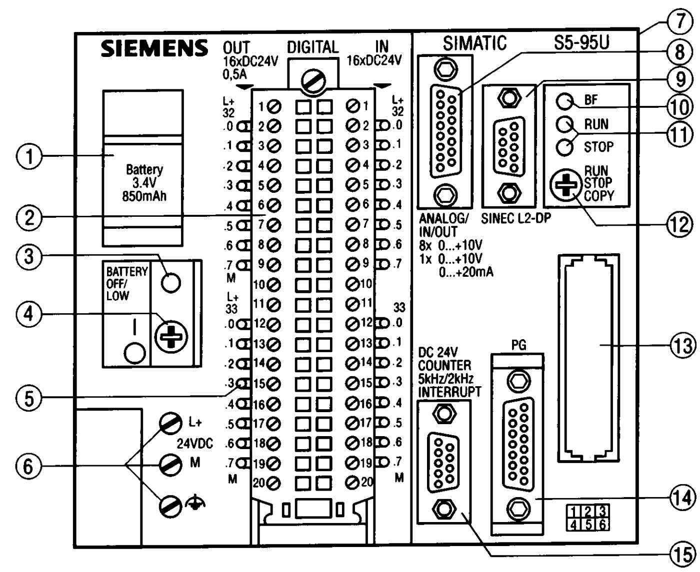


Figure 9-1 Front view of the S5-95U with DP master interface

Indicators, controls and interfaces

The table below explains the indicators, controls and interfaces of the S5-95U with DP master interface.

Table 9-1 The indicators, controls and interfaces of the S5-95U

Callout in Fig. 9-1	Designation	Purpose
1	Battery compartment	Receives the backup battery The backup battery keeps the internal memory retentive when there is a power failure or when the S5-95U is switched off.
2	Front connector	The front connector is the terminal block for the signal lines of the digital inputs (I 32.0 to I 33.7) and outputs (O 32.0 to O 33.7) and it establishes the connection to the S5-95U.
3	Battery low indicator	If this LED lights up, the backup battery is discharged.
4	ON/OFF switch	Switches the S5-95U on or off.

Table 9-1 The indicators, controls and interfaces of the S5-95U, continued

Callout in Fig. 9-1	Designation	Purpose
5	LEDs for digital inputs/outputs	LED lights up when the signal state of the digital input/output is ”1”.
6	Terminals for power supply	These terminals connect the S5-95U to the power supply unit.
7	Jack for I/O modules	If you want to add I/O modules to the S5-95U, connect the ribbon cable of a bus module to this jack.
8	Port for analog inputs and analog output	Port for the D-sub connector with the signal lines of the analog inputs (IW 40 to IW 54) and the analog output (OW 40).
9	PROFIBUS-DP interface	The PROFIBUS-DP interface connects the field bus to the S5-95U by means of a bus connector.
10	LED ”BF”	See Table 9-2.
11	Mode indicator	Green LED on: S5-95U is in RUN Red LED on: S5-95U is in STOP For details, see Table 9-2
12	Mode selector switch	**Meaning for PROFIBUS-DP** **RUN:** normal operation; S5-95U cyclically reads the input data of the DP slaves and sends output data to the DP slaves. The S5-95U can receive the token from another DP master and pass on the token. **STOP:** The S5-95U cannot exchange data with the DP slaves, but it can receive the token (send authorization) from another DP master on the bus and pass on the token. All outputs of the DP slaves are set to ”0”. The inputs of the S5-95U are reset. For a detailed description of the mode selector switch in the S5-95U without PROFIBUS-DP, see the system manual *S5-90U/S5-95U Programmable Controller.*
13	Slot for memory module	Accommodates the memory module (32 K EEPROM) All important configuration data for the bus layout and the STEP 5 application program is stored on the 32 K EEPROM.
14	Interface for programmer, PC, OP or SINEC L1	This interface enables you to connect a programmer, TD, OP or the S5-95U as a slave to the SINEC-L1 bus.
15	Port for alarm and counter inputs	Port for the D-sub connector with the signal lines of the alarm inputs (I 34.1 to I 34.3) and counter inputs (IW 36, IW 38).

Significance of the LEDs

The significance of the ”BF”, ”RUN” and ”STOP” LEDs is as follows:

Table 9-2 Significance of the ”BF”, ”RUN” and ”STOP” LEDs of the S5-95U

BF LED	RUN LED	STOP LED	Meaning	Remedy
Off	On	Off	All parameterized DP slaves are addressable	–
Flashes	On	Off	At least one DP slave cannot be addressed	Check the DP slaves and analyze the slave diagnostics.
On	Off	On	Bus short-circuit or terminating resistors missing or parameterization error (invalid HSA)	Check the bus cable and the bus configuration or Check whether the DP master receives the token (highest station address not correct in the bus parameters; the HSA is lower than the PROFIBUS address of a DP master). After rectifying the error, switch the power supply to the S5-95U off and then on again.
Off	On	On	Power-up delay (see section G.8.2) or OB 21/OB 22	–
Off	Off	Flickering	DP parameters being transferred in S5-95U between control and communications processors or STEP 5 application program being saved or read (Copy button pressed)	–

9.2 Pin assignment of the DP master interface

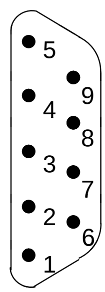
Purpose of the interface

The DP master interface enables you to connect distributed I/Os to the S5-95U via the PROFIBUS-DP bus.

Assignment

The DP master interface is a 9-pole D-sub port in compliance with the PRO-FIBUS-DP draft standard.

Table 9-3 Pin assignment of the DP master interface on the S5-95U

View	Pin No.	Signal	Designation
	1	–	Function ground
	2	–	–
	3	RxD/TxD-P	Data line B
	4	RTS	Request to send
	5	M5V2	Data reference potential (from station)
	6	P5V2	Supply plus (from station)
	7	–	–
	8	RxD/TxD-N	Data line A
	9	–	Internal assignment

Parallel operation

Parallel operation of the DP master interface and programmer interface (e.g. SINEC L1 on programmer interface) is possible.

9.3 Exchange of data between S5-95U and DP slaves

Exchange of data

The S5-95U and the DP slaves exchange data through the agency of the control and communications processors in the S5-95U.

The link to PROFIBUS-DP is established via the DP master interface.

Functions of the control processor

The functions discharged by the control processor of the S5-95U with regard to communication via PROFIBUS-DP are as follows:

- Load DP parameter set from 32 K EEPROM/ save to 32 K EEPROM
- Ready output data for the DP slaves in the STEP 5 application program
- Process the master and slave diagnostics in the STEP 5 application program (diagnostics fetched by FB 230)
- Process input data in the STEP 5 application program and pass on to the I/O of the S5-95U

Functions of the communications processor

The communications processor of the S5-95U handles the data traffic via the PROFIBUS-DP parallel to the control processor. Its functions are as follows:

- Accept the token (send authorization) from a DP master and pass on the token to another DP master
- Parameterize DP slaves (send parameterization data to DP slaves)
- Copy input data from the receive buffer of the communications processor to the address space in the S5-95U (control processor)
- Copy output data from the address space of the S5-95U (control processor) to the send buffer of the communications processor

Operating principle

This illustration shows the principle of data exchange as implemented in the S5-95U.

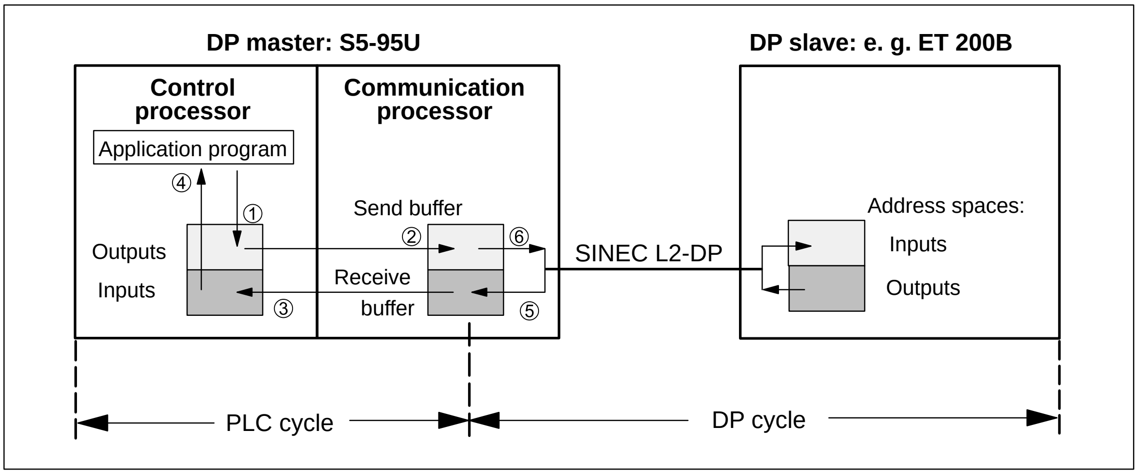


Figure 9-2 Principle of data exchange between S5-95U and DP slave

PLC cycle

The application program writes the output data into the appropriate address space of the S5-95U ①.

The exchange of data between the control processor and the control processor takes place at the cycle checkpoint of the S5-95U.

At the cycle checkpoint, the communications processor copies:

- the output data from the address space to its send buffer ②

  and simultaneously

- the input data to the corresponding address space of the S5-95U ③.

The input data can be processed in the application program ④.

DP cycle

The S5-95U receives data from the DP slaves. This data is written to the receive buffer of the communications processor ⑤. At the same time, the output data is sent to the DP slaves ⑥.

The exchange of data between the DP master and DP slaves takes place cyclically and is independent of the cycle checkpoint of the S5-95U.

9.4 Technical data of the S5-95U

Technical data

The technical data of the S5-95U with DP master interface is listed in the table below. General technical data applicable to all versions of the S5-95U is to be found in the system manual S5-90U/S5-95U Programmable Controller.

Table 9-4 Technical data of the S5-95U with DP master interface

Technical data	
Extension of alarm reaction time	0.5 ms
Maximum PLC cycle load time in PROFIBUS-DP operation (per program cycle)	0.5 ms
Internal power supply	
Input voltage	rated: DC 24 V
	permissible range: 20 to 30 V
Current consumption at 24 V	for the PLC: typ. 280 mA
	full config. ext. I/O: typ. 1.2 mA
Output voltage	U1 (for ext. I/O): + 9 V
	U2 (for programmer/PROFIBUS-DP interface): + 5.2 V
Output current	from U1: ≤ 1 A
	from U2 total: ≤ 0.65 A
	from U2 for PROFIBUS interface: ≤ 0.1 A
Short-circuit protection for U1, U2 (programmer)	yes, electronic
Short-circuit/overvoltage protection	yes, fuse
for U2 (PROFIBUS-DP interface)	250 mA, fast-blow
Potential isolation	no
Protection	class I

Table 9-4 Technical data of the S5-95U with DP master interface, continued

Technical data	
Special PROFIBUS-DP data	
Number of S5-95Us as DP masters on the PROFIBUS-DP	max. 124 DP masters
Number of DP slaves per S5-95U as DP master	max. 16 DP slaves
Baud rates	9.6 kbaud to 1.5 Mbaud
Address volume for PROFIBUS-DP	128 bytes for outputs 128 bytes for inputs 2 bytes overview diagnostics
Integrated organization blocks	OB 1, OB 3, OB 13, OB 21, OB 22, OB 31, OB 34, OB 251
Integrated function blocks	FB 230, FB 240, FB 241, FB 242, FB 243, FB 250, FB 251

9.5 Installing S5-95U and 32 K EEPROM

Installing S5-95U

You install the S5-95U with DP master interface in just the same way as any other S5-95U version. The installation procedure for the S5-95U is described in detail in the system manual *S5-90U/S5-95U Programmable Controller*, Chapter 3.

32 K EEPROM for S5-95U

If you use the S5-95U as DP master, you need a special memory module, an EEPROM with 32 Kbytes capacity, included in the scope of supply of the S5-95U with DP master interface.

On the 32 K EEPROM, 19.9 Kbytes are reserved for the STEP 5 application program and 12 Kbytes are reserved for the configuration data (compressed data).

In case you have to re-order the 32 K EEPROM, you will find the order number in Appendix G.

Purpose of the 32 K EEPROM

The 32 K EEPROM is used as the storage medium for:

- the configuration data parameterized beforehand with COM PROFIBUS
- the STEP 5 application program (including block headers of the integrated FBs)

Installing/ changing the 32 K EEPROM

The procedure for installing/replacing the 32 K EEPROM is as follows:

1. Set the S5-95U to STOP.
2. Set the ON/OFF switch on the S5-95U to ”O”.
3. Remove the original EEPROM, if applicable.
4. Insert the new EEPROM.
5. Set the ON/OFF switch on the S5-95U to ”I”.
6. Reset the S5-95U to RUN.

9.6 Saving to 32 K EEPROM in the S5-95U (File ▸ Export ▸ DP master)

32 K EEPROM for S5-95U

If you have the S5-95U as DP master, you use a special memory module, an EEPROM with a capacity of 32 Kbytes, supplied with the S5-95U with DP master interface.

In case you have to re-order the 32 K EEPROM, you will find the order number in Appendix G.

Preconditions

To export data directly to the S5-95U:

- The online functions of COM PROFIBUS must be installed (see COM PROFIBUS manual)
- The programmer/PC must be connected either to the PROFIBUS or directly to the DP master
- The 32 K EEPROM must be installed on the S5-95U (see section 9.5)

Note

The data of a master system cannot be saved by inserting the 32 K EEPROM in the EEPROM slot of the programmer or an external programming unit.

You can only save the data of a master system in the S5-95U when the 32 K EEPROM is inserted in the S5-95U.

Saving data to S5-95U

You can only export the data you have parameterized with COM PROFIBUS to the S5-95U via the PROFIBUS-DP. The S5-95U automatically sets the baud rate to 19.2 kbaud and the PROFIBUS address to ”1” after a general reset (battery removed and POWER DOWN/POWER UP or programmer command).

Tip: Save the application program on the 32 K EEPROM before you carry out a general reset. In this case, the S5-95U will load the application program after the POWER DOWN/POWER UP.

Saving configuration data to 32 K EEPROM

The procedure for saving the configuration data to the 32 K EEPROM is as follows:

1. Set the S5-95U to STOP.
2. In COM PROFIBUS, select **File ▸ Export ▸ DP Master**.

3. Enter the current baud rate of the DP master (default after general reset = 19.2 kbaud). The current baud rate is available in EB 63 (value 05_H is not used):

Table 9-5 Contents of EB 63 (baud rate)

EB 63	**Baud rate**
00_H	9.6 kbaud
01_H	19.2 kbaud
02_H	93.75 kbaud
03_H	187.5 kbaud
04_H	500 kbaud
06_H	1,500 kbaud

4. Enter the current station number of the DP master (default after general reset = STN1). The current station number is available as a hexadecimal value in EB 62.

   Result: COM PROFIBUS exports the configuration data to the S5-95U. It then asks whether you want to activate the exported configuration data immediately in the S5-95U.

5. If there is only one S5-95U on the PROFIBUS, activate the exported configuration data immediately.

   If there are two or more DP masters on the PROFIBUS, answer ”No” to the prompt instead. Export all the parameterization data to the DP masters first, then activate it with **Service ▸ Activate Parameters**.

   Result: If the configuration data is exported successfully, it is stored in compressed form in the 32 K EEPROM (STOP LED flickers).

   If the configuration data is not exported successfully, the S5-95U resumes with the old bus parameters of the 32 K EEPROM. If the 32 K EEPROM is blank, the default values are used.

   If the export of the configuration data to the S5-95U is interrupted – e.g. if the bus connector is withdrawn or an error occurs on the bus – you must POWER DOWN/POWER UP.

6. Reset the S5-95U from STOP to RUN. After a STOP-RUN transition, the S5-95U operates with the new configuration data.

General reset of the 32 K EEPROM

If you perform a general reset (with a programmer command or by removing the backup battery and using DB 1 parameter ”LNPG n”; see section 10.3), only the configuration data on the 32 K EEPROM is deleted. The STEP 5 application program is deleted from the 32 K EEPROM if you then press the ”Copy” button.

S5-95U – addressing, accessing the distributed I/O and diagnostics with STEP 5 10

In this chapter

This chapter contains information on:

IM 308-C as DP master

If you have an IM 308-C as DP master, skip chapter 10 and read chapter 6 instead.

Goal

After reading this chapter, you will be in possession of all the information you need in order to write the STEP 5 application program.

10.1 Address areas and options for addressing

Address areas

Table 10-1 shows which address areas can be used in the S5-95U for distributed I/O, how access is implemented in the STEP 5 application program and how many inputs/outputs are available.

Table 10-1 Addressing with S5-95U as DP master

Address area (absolute address)	Access by ...	Max. inputs/outputs
6338_H to 6339_H	PY 56 to PY 57	2-byte overview diagnostics
6340_H to $637F_H$	PY 64 to PY 127	64 bytes for inputs
5700_H to $573F_H$	PY 128 to PY 191	64 bytes for inputs
$63C0_H$ to $63FF_H$	PY 64 to PY 127	64 bytes for outputs
5780_H to $57BF_H$	PY 128 to PY 191	64 bytes for outputs

Caution

Danger of double address assignments.

Input/output bytes 64 to 127 are used by the local I/O (e.g. analog input/output modules, slots 0 to 7) as well as the distributed I/O (DP slaves).

If you use local I/O (e.g. analog input/output modules), you must reserve the address areas with COM PROFIBUS in the host parameters (see Table G-8, section G.8.2).

Addressing options

If you use the S5-95U as DP master, linear addressing is the only option. You must assign one and only one address to each input/output of a DP slave.

Defining addressing

”Linear” is predefined as a master parameter in COM PROFIBUS. This mode applies to all DP slaves assigned to the DP master.

10.2 Accessing the distributed I/O

Access to addresses

Once you have assigned the inputs and outputs of the distributed I/O with COM PROFIBUS, you can use the STEP 5 application program to access the inputs and outputs of the distributed I/O:

- access addresses ≤ 127 via the process image
- access addresses ≥ 128 via load and transfer operations

Access operations

The P-area is at your disposal for linear addressing. Table 10-2 shows the operations you can use.

Table 10-2 Linear addressing with S5-95U as DP master

P area	I/O address	Address for direct access	Access operations

Inputs	56 to 57	6338_H to 6339_H	`U E x.y / UN E x.y`
			`O E x.y / ON E x.y`
			`L EB x  L EW x`

	64 to 127	6340_H to $637F_H$	`U E x.y / UN E x.y`
			`O E x.y / ON E x.y`
			`L EB x  L EW x`

	128 to 191	5700_H to $573F_H$	`L PY x  L PW x` `LIR  TNB`

Outputs	64 to 127	$63C0_H$ to $63FF_H$	`S A x.y  R A x.y`
			`= A x.y`
			`T AB x  T AW x`

	128 to 191	5780_H to $57BF_H$	`T PY x  T PW x` `TIR  TNB`

Data consistency

There are two consistent areas, I/O address 64 to 127 and 128 to 191. If these areas overlap in a DP slave the result is data inconsistency: overlap must therefore be avoided. The S5-95U recognizes data consistency for a DP slave. If you specify module-granular consistency for a DP slave, the S5-95U still treats the data consistently for the DP slave as such.

Nesting depth

If you exceed the maximum nesting depth (8) for the S5-95U, the CPU goes to STOP with STUEB. At the same time, the data transfer via the PROFI-BUS-DP master interface is terminated; the S5-95U is removed from the to-ken ring.

Remedy: Modify the STEP 5 application program and then POWER DOWN/POWER UP the system.

10.3 Parameterizing the S5-95U (DP master) in DB 1

Parameters in DB 1

You must set the ”LNPG” parameter (= general reset with programmer only) in DB 1 for the S5-95U as DP master (release 3 and later versions).

```
  0:    KC ='DB1 OBA: AI 0 ; OBI:    ';
 12:    KC ='  ; OBC: CAP N CBP '
 24:    KC ='N      ;#SL1: SLN 1 SF '
 36:    KC ='DB2  DW0   EF DB3 DW0  '
 48:    KC ='  KBE MB100      KBS MB1'
 60:    KC ='01      PGN 1  ;# SDP: N'
 72:    KC ='T 128 PBUS N ; TFB: OB13'
 84:    KC =' 100    ; #CLP: STW MW10'
 96:    KC ='2        CLK D85 DW0   '
108:    KC ='  SET 3  01.10.91 12:00:'
120:    KC ='00    OHS 000000:00:00  '
132:    KC ='  TIS 3 01.10. 12:00:00 '
144:    KC ='   STP Y SAV Y  CF 00   '
156:    KC =' ; #  DPM: LNPG n ; END '
168:
```

You can find the meanings of these default parameters in the system manual *S5-90U/S5-95U Programmable Controllers*

Parameter for S5-95U as DP master

Figure 10-1 DB 1 with default parameters

Meaning of ”LNPG”

You can use the ”LNPG” parameter (= general reset with programmer only) to specify whether or not the S5-95U – and thus also the master system transferred with COM PROFIBUS – is completely reset if the power supply fails and is subsequently restored, but there is no battery.

Note: The general reset does not affect the STEP 5 application program on the EEPROM.

Table 10-3 Meaning of the ”LNPG” parameter in DB 1 of the S5-95U

Parameter	Argument	Meaning
LNPG	n	= No; if the power supply fails and is subsequently restored, but there is no battery, the S5-95U is completely reset. (default)
	y	= Yes; if the power supply fails and is subsequently restored, but there is no battery, the S5-95U is **not** completely reset, i.e. a general reset of the S5-95U is only possible in conjunction with the programmer. The parameters entered in the master system remain stored. DB 1 must be copied to the EEPROM with the COPY key before the ”LNPG” parameter takes effect.

Procedure

A default DB 1 is integrated in the operating system of the S5-95U. To edit this DB 1, proceed as follows:

1. Load the default DB 1 onto your programmer (transfer function, source: programmable controller, destination: FD (programmer)).
2. Search for the ”LNPG” parameter and overwrite the ”n” with a ”y” if necessary.

   When you edit DB 1, it is essential to follow the rules for parameterizing this data block as described in the system manual *S5-90U/S5-95U Programmable Controllers,* section 9.4.
3. Transfer the new DB 1 to the S5-95U. In doing so, you overwrite the default DB 1.
4. Trigger a STOP-RUN transition. The S5-95U thus accepts the changed parameters.
5. Copy DB 1 to the EEPROM by means of the COPY key. Not until you do this does the ”LNPG” parameter take effect.

10.4 Diagnostics in the STEP 5 application program of the S5-95U

Overview

Diagnostics means identifying and pinpointing errors. You require the integrated function block FB 230 of the S5-95U to read the diagnostics data.

Structure of diagnostics

Diagnostics consists of overview diagnostics and slave diagnostics.

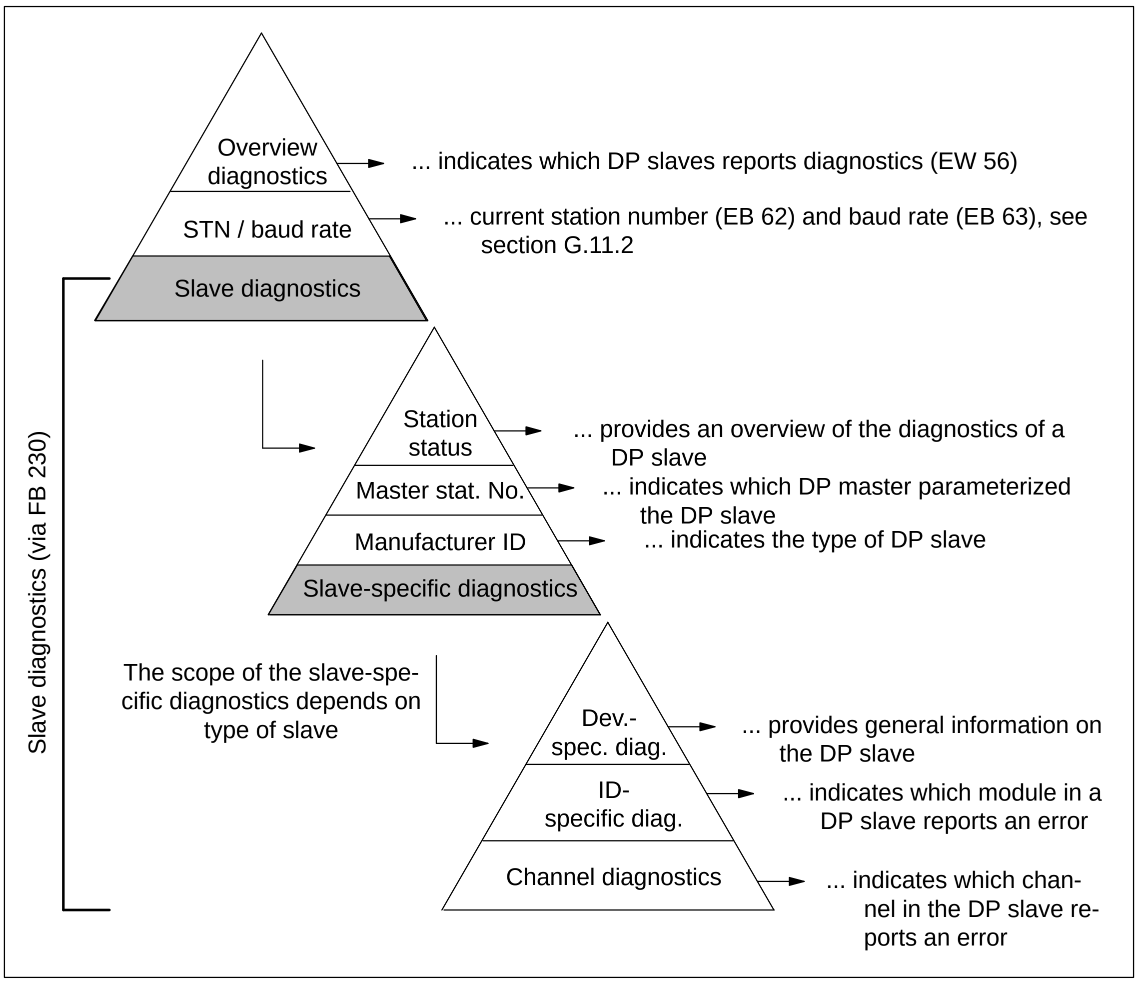


Figure 10-2 Structure of diagnostics

10.4.1 Requesting overview diagnostics

Overview diagnostics

In diagnostics word EW 56, each bit is assigned to a DP slave. A ”1” means that the DP slave in question has reported diagnostics or that the DP slave cannot be addressed by the DP master.

Structure of overview diagnostics

The table below shows the structure of overview diagnostics:

Table 10-4 Overview diagnostics

Diagnostics	Input byte	Bits correspond to the DP slaves with lowest to highest PROFIBUS addresses: (lowest PROFIBUS address: E 56.0 highest PROFIBUS address with 16 DP slaves: E 57.7)								Format of data received
		7	**6**	**5**	**4**	**3**	**2**	**1**	**0**	
Overview diagnostics	56	7	6	5	4	3	2	1	0	KM
	57	15	14	13	12	11	10	9	8	KM

Interpreting overview diagnostics

Query the EW 56 in the STEP 5 application program and call the FB 230. When you call the FB 230, the bits in EW 56 are reset.

In order to avoid resetting the bits in EW 56, you can start an additional FB in each cycle which updates the slave diagnostics data, even if EW 56 is reset by the FB 230 (see section D.2).

Example

The STEP 5 application program below shows how overview diagnostics can be interpreted.

```
AWL                                          Explanation
        .
        .                                    custom application program
        .
        : L  KM    00000000 00000000
        : L  EW    56                        load diagnostics word EW 56
        : !=F                                no station with errors?
        : BEB
        : SPB      FB230                     if errors, then request station diag-
                                             nostics with FB 230
```

What to do next

On the basis of the overview diagnostics, you can see what kind of diagnostics message you have to deal with. You should now analyze the slave diagnostics.

10.4.2 Requesting slave diagnostics

Definition

Slave diagnostics comprises a maximum of 34 bytes and is structured as follows:

- Number of the slave station that has submitted diagnostics data (1 byte)
- Number of diagnostics bytes (1 byte)
- Station status 1 to 3 (length: 3 bytes)

  Station status 1 to 3 reflects the status of a DP slave.
- Master-PROFIBUS address (length: 1 byte)

  The diagnostics byte for the master PROFIBUS address contains the PROFIBUS address of the DP master which parameterized the DP slave.
- Manufacturer ID (length: 2 bytes)

  The manufacturer ID contains a code with describes the type of the DP slave.
- Device-specific diagnostics (length depends on the type of DP slave)

  The device-specific diagnostics provides general information on the DP slave.
- ID-specific diagnostics (length depends on the type of DP slave)

  The ID-specific diagnostics indicates which module in which slot is faulty.
- Channel diagnostics (length depends on the type of DP slave)

  Channel diagnostics indicates which channel of a DP slave has an error message.

Requesting slave diagnostics

To request slave diagnostics, you must call the FB 230 in the STEP 5 application program.

Result: The FB 230 places the slave diagnostics data in a data block that you created beforehand in the STEP 5 application program.

Structure of slave diagnostics

Slave diagnostics is structured as follows:

Table 10-5 Structure of slave diagnostics (S5-95U)

DW	Meaning, DL	Meaning, DR
0	Number of the slave station, which submitted diagnostics data	Number of diagnostics bytes
1	Station status 1	Station status 2
2	Station status 3	Master PROFIBUS address
3	Manufacturer ID	
4 to 16	Other slave-specific diagnostics (device-specific, ID-specific or channel diagnostics, always depending on the DP slave, see sections 6.4.1 and 6.4.2)	

Station status and master PROFIBUS address

The structure of the bytes for station statuses 1 to 3 and the master PROFIBUS address is based on EN 50 170, Volume 2, PROFIBUS and is independent of the DP master used.

The meanings of the bits are explained in section 6.4, Tables 6-8, 6-9 and 6-10.

10.4.3 Standard function block FB 230

Function of the FB 230

You must call the FB 230 in the STEP 5 application program in order to request slave diagnostics.

Calling the FB 230 resets EW 56 (overview diagnostics). In order to avoid resetting the bits in EW 56, you can start an additional FB in each cycle which updates the slave diagnostics data, even if EW 56 is reset by the FB 230 (see section D.2).

Calling the FB 230

In the simplest case, the FB 230 is called in cyclic program processing.

If you call the FB 230 in the process alarm or the time alarm processing, you must implement measures in the STEP 5 application program to ensure that the FB 230 does not interrupt itself. You do this by disabling the alarms before each FB 230 call and enabling the alarms again once the FB 230 has been called.

Creating the DB

Before you call the FB 230 in the STEP 5 application program, you must create the data block for the diagnostics data: note that this data block must be at least 17 data words in length.

See sections 10.4.2 and 6.4 for details of the structure of slave diagnostics.

Block parameters

The table below shows the meanings of the block parameters which you must send to the FB 230 in the STEP 5 application program. You can call the FB 230 with direct or indirect parameterization.

Table 10-6 Meanings of the block parameters of the FB 230

Name	Mode	Type	Designation	Valid assignment
S_NR	D	KY	PROFIBUS address of the DP slave from which you request diagnostics data	KY = x, y x = 0: Direct parameterization y = 0 to 15: STN acc. to Table 10-4 y > 15 Lowest station that has reported diagnosis or x<>0: Indirect parameterization y: Irrelevant if parameterization is indirect
DB_NR	D	KY	Target data block for storing the diagnostics data	KY = x, y **If parameterization is direct:** x = 2 to 255 DB No. y = 0 to 255 DW No. Diagnostics data is written to the data block starting at the DW you specify. **If parameterization is indirect:** x = 2 to 255 DB No. y = 0 to 255 DW No. The PROFIBUS address and the DB No. of the target data block for the diagnostics data are written, starting at the DW you specify. The high byte of the PROFIBUS address parameter must have the value ”0”.

Example of an FB 230 call

This STEP 5 application program is an example illustrating how you can request slave diagnostics with the FB 230 for the following DP slaves: STN 5, STN 20, STN 110, STN 123.

STL	Explanation
: U E 56.0	If station with lowest number (here STN 5) is errored,
: SPB FB230	then call the FB 230
Name : S_DIAG	
S_NR : KY0,0	Direct parameterization, station with lowest PROFIBUS address (here STN 5) on the PROFIBUS-DP
DBNR : KY230,0	Slave diagnostics data (18 DW) is written to DB 230 starting at DW 0
: U E 56.2	If station with 3rd lowest PROFIBUS address (here STN 110) is errored,
: SPB FB230	then call the FB 230
Name : S_DIAG	
S_NR : KY1,y	1 = indirect parameterization, y = irrelevant
DBNR : KY11,10	Parameters stored in DB 11 starting at DW 10
	Contents of DB 11
	DW 10 = 0002_H --> 02_H = 3rd lowest station
	↓
	must be 00_H!
	DW 11 = $0C0A_H$ --> $0C_H$ = 12 --> DB 12
	$0A_H$ = 10 --> DW 10
	--> slave diagnostics data of station 110
	(= 3rd lowest station) stored in DB 12 starting at DW 10

Technical data

The technical data of the FB 230 is listed in the table below:

Table 10-7 Technical data of the FB 230

Technical data	FB 230
Library number P71200-S	1230-A1
Length of call	4 data words
Block length	17 data words
Nesting depth	1
Runtime in ms	< 6.5 ms

10.5 Monomaster and multimaster modes with S5-95U as DP master

Monomaster mode

Monomaster mode means that there is one DP master on the bus. No other DP master is operating elsewhere on the bus.

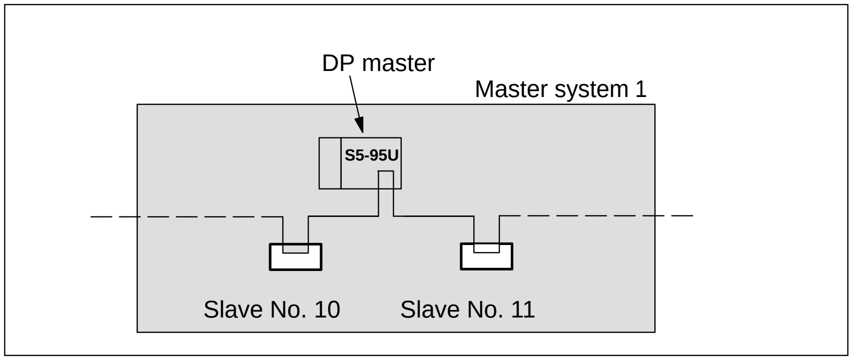


Figure 10-3 S5-95U – monomaster mode

Multimaster mode

Multimaster mode means that there are at least two masters on the bus, for example an S5-95U and an IM 308-C, or two S5-95Us.

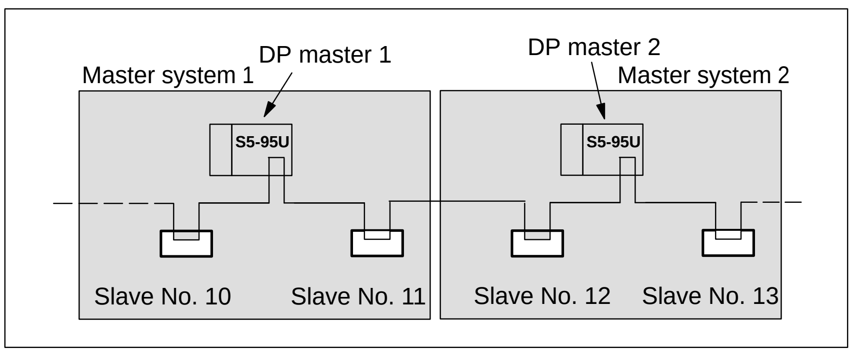


Figure 10-4 S5-95U – multimaster mode

Rules

COM PROFIBUS supports you in multimaster mode:

- Enter the entire bus configuration before you start exporting the data to an S5-95U (see section G.11.2).
- You must leave a free PROFIBUS address between the PROFIBUS address of one master and that of the next master. This address is only allowed to be used by a slave.
- If you change the bus parameters in one program file, you must always re-transfer all bus parameters to each DP master.
- If you operate the S5-95U with DP master interface on the bus with several masters (multimaster mode), you are not allowed to connect the S5-95U to the PROFIBUS-DP bus until all the bus parameters (e.g. the baud rate) match the existing bus. The functionality of the PROFIBUS interface may otherwise be restricted (reduced performance or failure of the bus system).

S5-95U – Starting ET 200

11

In this chapter

This chapter contains all you need to know about startup, shutdown and failure of the ET 200 distributed I/O system when the S5-95U programmable controllers are in use as DP masters.

IM 308-C as DP master

If you use the IM 308-C as DP master, skip chapter 11 and read chapter 8 instead.

Goal

After reading this chapter, you will have all the information you need to start up the ET 200 distributed I/O system with S5-95U as DP masters.

11.1 Starting and operating the ET 200

Preconditions

We assume:

- that you have installed a backup battery in each S5-95U with DP master interface or parameterized ”LNPG y” in DB 1 (see section 10.3).
- that you have inserted the 32 K EEPROM(s) in the S5-95Us with DP master interface (see section 9.5).
- that you have used COM PROFIBUS to transfer the data of each master system to the appropriate DP master.
- that you have checked the configuration of the distributed I/O system.

Starting the ET 200 (switching on)

When you are ready to start the ET 200 distributed I/O system:

1. Test the wiring to the sensors and actuators of the individual DP slaves using COM PROFIBUS and the ”Status” service function.

   Result: After testing the DP slaves, you are sure that each DP slave is fully operational.

2. Connect all DP slaves and DP masters with the PROFIBUS bus cable.
3. Switch on the power supply units of the DP slaves.
4. Set the STOP/RUN switches of the DP slaves (if fitted) to RUN.
5. Switch on the power supply of the S5-95U with DP master interface.
6. Set the ON/OFF switch on the S5-95U to ”I”.
7. Switch the S5-95U programmable controllers with DP master interface from STOP to RUN.

   Result: The S5-95Us power up. On the S5-95Us and the connected DP slaves the ”BF” LEDs go out. Data exchange is possible between all parameterized DP slaves and the S5-95U.

   Fig. 11-1 is a flowchart illustrating the power-up sequence of the S5-95U on the bus.

8. Use the FB 230 or COM PROFIBUS to check the diagnostics messages. These messages will tell you whether or not data exchange with the DP slaves is functioning correctly.
9. Via the programmer interface of the S5-95U, you can execute the status/control function for all DP slaves the addresses of which are contained in the process image, or you can display the statuses of the inputs/outputs of the DP slaves with COM PROFIBUS.

11.2 Power-up of the S5-95U on the bus

Preconditions for power-up

We assume:

- that you have started the S5-95U without using the DP master interface (see system manual *S5-90U/S5-95U Programmable Controller*, Chapter 4).
- that you have correctly wired the DP slaves.
- that you have connected all DP slaves and DP masters with the PROFIBUS bus cable.
- that you have switched on the power supply of the DP slaves.
- that – where applicable – you have already set the DP slaves to RUN.
- that you have installed a battery in the S5-95U or selected ”LNPG y” in DB 1 of the S5-95U. If you have not installed a battery and if you have parameterized ”LNPG n” in DB 1 of the S5-95U, a general reset of the S5-95U will be initiated after a power failure.

Power-up of the S5-95U

Fig. 11-1 is a flowchart explaining how the S5-95U with DP master interface powers up.

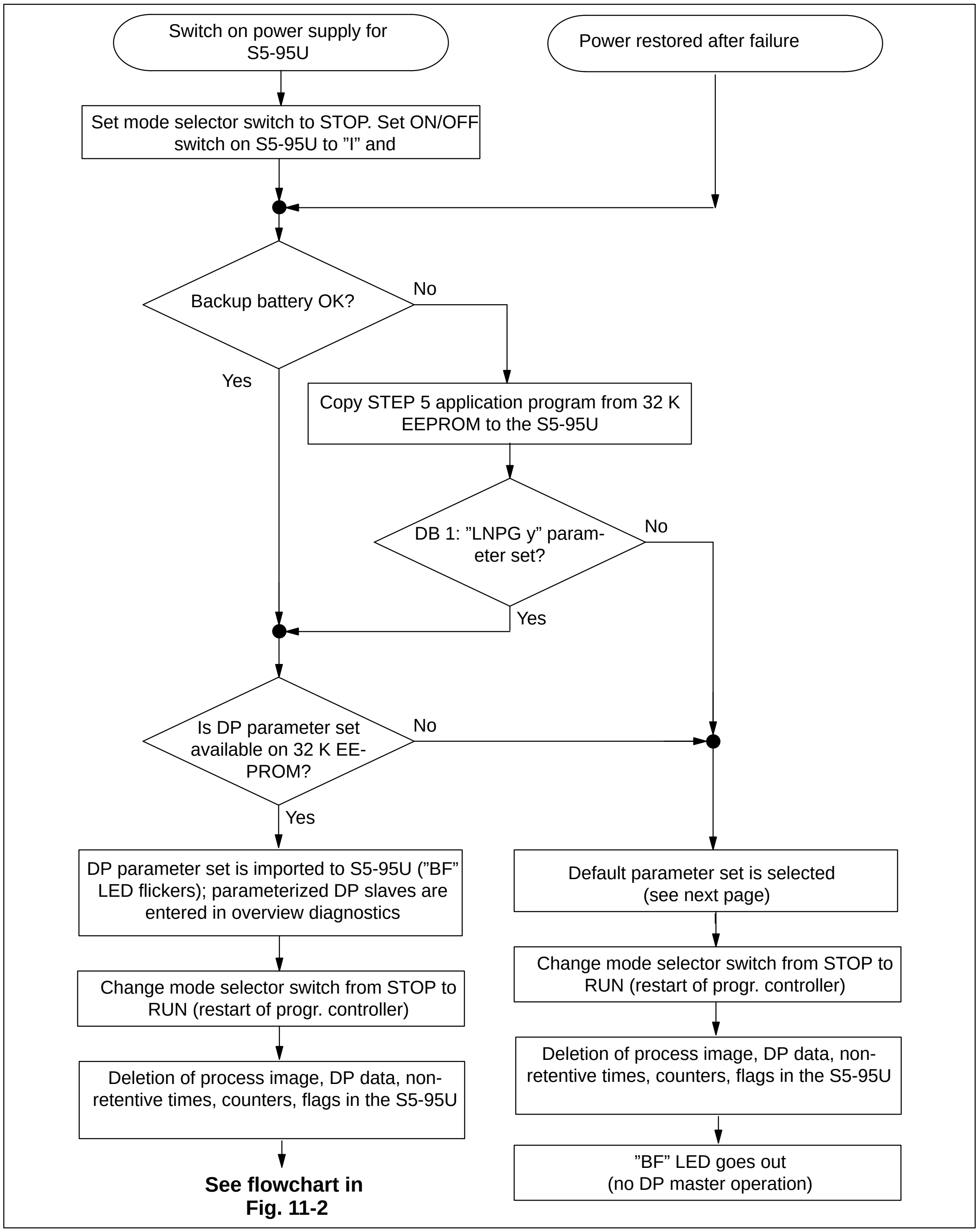


Figure 11-1 Power-up of the S5-95U with DP master interface (1)

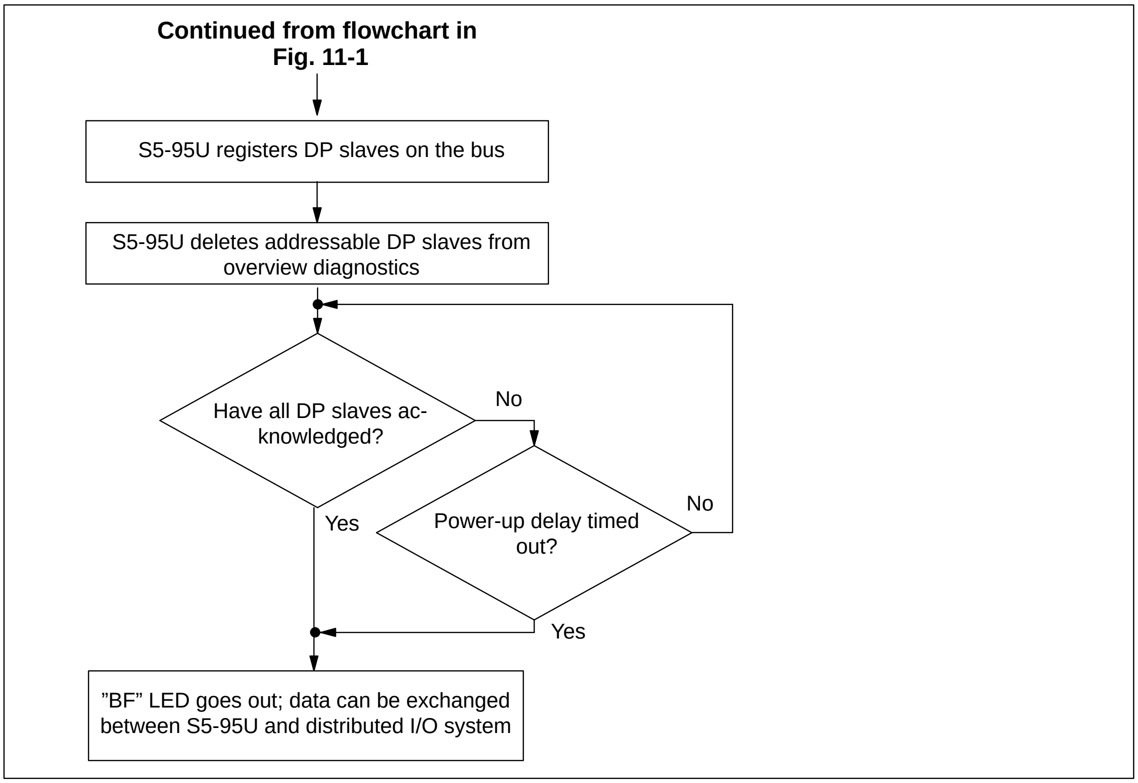


Figure 11-2 Power-up of the S5-95U with DP master interface (2)

Default parameter set

The S5-95U uses the default parameter set if it fails to find a DP parameter set on the 32 K EEPROM (see Fig. 11-1). The settings in the default parameter set are as follows:

- PROFIBUS address = 1
- Baud rate = 19.2 kbaud
- No DP slave parameterized
- Highest active PROFIBUS address = 126

The baud rate and the PROFIBUS address of the station are stored in EW 62 (see section G.11.2).

Message in operating system datum

Operating system datum 17 of the S5-95U (absolute address $5D22_H$) contains the following information on the DP parameter set:

- 00_H = Default parameter set is valid
- 01_H = DP parameter set loaded from 32 K EEPROM is valid

For more information on other system data in the S5-95U, see the system manual *S5-90U/S5-95U Programmable Controller.*

11.3 Response of the ET 200 distributed I/O system

Overview

The reactions of the distributed I/O system with S5-95U as DP master to certain events are described in this section:

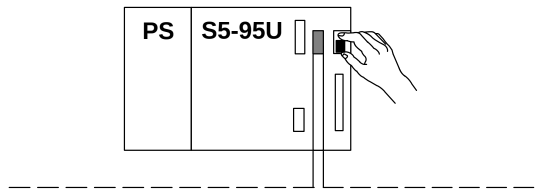
Section	Topic	Page
11.3.1	Reaction to switching the S5-95U for the first time from STOP to RUN (programmable controller startup)	11-7
11.3.2	Reaction after power failure in the S5-95U (restoration of mains power)	11-8
11.3.3	Reaction when, with the bus running, you switch the S5-95U to STOP or RUN	11-9
11.3.4	Reaction to interruption of bus communication or failure of the DP slave	11-10
11.3.5	Reaction when bus interruption is rectified or when the DP slave is again addressable	11-11

11.3.1 Reaction to switching the S5-95U for the first time from STOP to RUN (programmable controller startup)

Switching on power supply and S5-95U

The table below shows you how the ET 200 distributed I/O system responds when you switch on the power supply of the S5-95U and the S5-95U for the first time.

Table 11-1 Reaction to switching the S5-95U for the first time from STOP to RUN



Preconditions	Reactions	
S5-95U as DP master	**S5-95U as DP master**	**DP slaves**
STOP	You cannot access the inputs/outputs of the distributed I/O system.	Outputs are set to ”0”.
STOP → RUN	Diagnostics data, DP inputs and outputs are cleared. Diagnostics data and DP inputs are updated. DP outputs are written. DP outputs are set to defaults (if you programmed the startup OB 21). You can access the inputs/outputs of the distributed I/O system.	Inputs are read Outputs are up-dated

11.3.2 Reaction after power failure in the S5-95U (restoration of mains power)

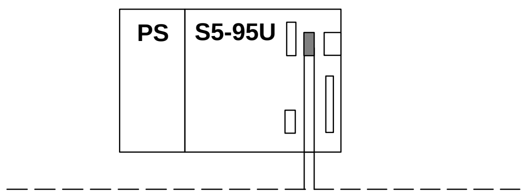
Restoration of mains power

The status of the S5-95U when mains power failed was RUN and when mains power is restored the status is again RUN.

Response of bus system

The table below shows you how the ET 200 distributed I/O system responds to the restoration of mains power.

Table 11-2 Reaction after power failure in the S5-95U (restoration of mains power)



Preconditions		Reactions	
S5-95U as DP Master		S5-95U as DP Master	DP Slaves
Restoration of mains power	Backup battery present, or DB 1 parameter ”LNPG y”	Diagnostics data, DP inputs and outputs are cleared. Diagnostics data and DP inputs are updated. DP outputs are written. You can access the inputs/outputs of the distributed I/O system.	Inputs are read Outputs are updated
	No backup battery, and DB 1 parameter ”LNPG n”	Distributed I/O system configuration is lost (for selection of default parameter set see section 11.2).	–

11.3.3 Reaction when, with the bus running, you switch the S5-95U to STOP or RUN

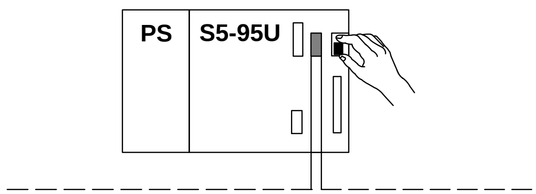
Precondition

All DP slaves on the bus are addressable. If not, you must make provision for the reactions to interruption of bus communication and failure of a DP slave (see section 11.3.4).

Response of bus system

The table below shows you how the system responds if, with the bus running, the mode selector switch of the S5-95U is actuated to switch to STOP or RUN.

Table 11-3 Reaction when, with the bus running, you switch the S5-95U to STOP or RUN



Preconditions	Reactions	
S5-95U as DP master	**S5-95U as DP master**	**DP slaves**
RUN → STOP	You cannot access the inputs/outputs of the distributed I/O system.	Outputs are set to ”0”.
STOP → RUN	You can access the inputs/outputs of the distributed I/O system.	Inputs are read Outputs are up-dated

11.3.4 Reaction to interruption of bus communication or DP slave failure

Error-reporting mode ”none”

Unlike the IM 308-C, the S5-95U as DP master does not support an error-reporting mode (neither PEU nor QVZ).

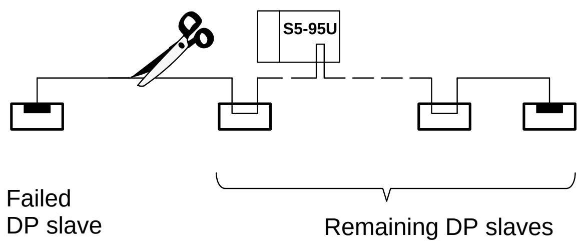
Caution

In the application program, you can detect an error in the distributed I/O system only by analyzing the overview diagnostics or the slave diagnostics with the FB 230.

Response of bus system

This table shows the reaction to an interruption in bus communication or the failure of one or more DP slaves.

Table 11-4 Reaction to interruption of bus communication or failure of a DP slave



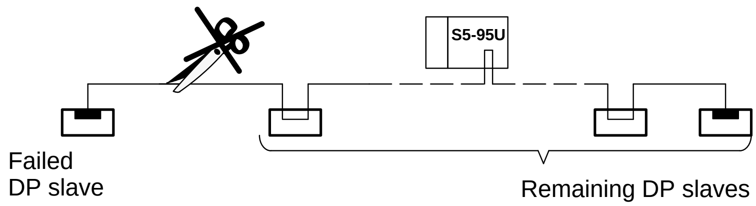
Failed DP slave(s): Response monitoring	Reaction of the S5-95U as DP master	Reaction of the S5-95U and the failed DP slave(s):	Reaction of the S5-95U and the remaining DP slaves:
No	S5-95U remains in RUN	**S5-95U:** Inputs in the S5-95U are set to ”0” Outputs in the S5-95U are updated internally **DP slave:** Outputs are frozen	**S5-95U:** Inputs and outputs in the S5-95U are updated as before. **DP slaves:** Outputs are updated as before.
Yes	S5-95U remains in RUN	**S5-95U:** Inputs in the S5-95U are set to ”0” Outputs in the S5-95U are updated internally **DP slave:** Outputs are set to ”0” when the response monitoring time times out.	**S5-95U:** Inputs and outputs in the S5-95U are updated as before. **DP slaves:** Outputs are updated as before.

11.3.5 Reaction when bus interruption is rectified or the DP slave is again addressable

Reaction

The table below shows the reactions when bus communication is reestablished or a failed DP slave is again addressable.

Table 11-5 Reaction when bus interruption is rectified or DP slave is again addressable



Failed DP slave(s): **Response monitoring**	**Reaction of the failed DP slave(s):**	**The inputs in the S5-95U are updated as before.** **Reaction of the remaining DP slaves:**
Yes	DP slave is re-parameterized and configured, then outputs on the DP slaves are updated	Outputs on the DP slaves are updated as before

11.4 Switching off ET 200

Switching off ET 200

The procedure for shutting down the ET 200 distributed I/O system is always as follows:

1. SET the STOP/RUN switch of the S5-95U with DP master interface to STOP.
2. Set the ON/OFF switch on the S5-95U to ”O”.
3. Switch off the power supply of the S5-95U.
4. Switch off the power supply to the DP slaves and
5. Set the STOP/RUN switch on each DP slave (if fitted) to STOP.

11.5 Failure response of the S5-95U

Monitoring mechanism

The S5-95U has an integral failure-monitoring system which notifies the communication processor of:

- cycle monitoring time overshoot
- control processor failure

Monitoring time for control processor

When the DP master interface runs up, the communication processor in the S5-95U starts a monitoring time of 0.5 s.

When this monitoring time times out, the communication processor recognizes a failure of the control processor. The S5-95U goes to STOP.

Monitoring time characteristics

The monitoring time is cleared when the S5-95U goes from RUN to STOP.

The monitoring time is started when the S5-95U goes from STOP to RUN.

The monitoring time is retriggered at the cycle checkpoint of the S5-95U and when the OB 31 is called.

COM PROFIBUS manual (placeholder for manual on CD-ROM) 12

COM PROFIBUS documentation

There is an integrated online help system in COM PROFIBUS that contains all the information you require in order to work with COM PROFIBUS.

If you are carrying out configuration with COM PROFIBUS as of version 5.0 for the first time, and if you want to familiarize yourself with how to work with COM PROFIBUS, we recommend that you refer to the *COM PROFIBUS* manual.

The *COM PROFIBUS* manual explains the most important functions of COM PROFIBUS V 5.0 or higher and includes complete configuration examples to illustrate them.

Accessing the manual

The *COM PROFIBUS* manual is available only in electronic from (PDF) on the COM PROFIBUS CD-ROM.

You can read the electronic manual on screen or print it out from the COM PROFIBUS CD-ROM and insert it in Chapter 12 of this manual.

You will find the order number of the COM PROFIBUS CD-ROM in Appendix G.

COM PROFIBUS V 3.3

For a limited transitional period COM PROFIBUS V 3.3 will be supplied in parallel with the new version V 5.0. You will still find the description of COM PROFIBUS V 3.3 in Appendix G of this manual.

General technical data

A

In this chapter

This chapter contains the general technical data for the bus connectors and the RS 485 repeaters with order numbers 6ES7 972-0AA00-0XA0 as described in this manual.

The standards complied with by the above-mentioned components and the values the components achieve in testing are listed in the general technical data, along with the criteria for testing.

Not in this chapter

This chapter does **not** contain the general technical data relating to

- the IM 308-C master interface,
- the S5-95U with DP master interface
- the PROFIBUS card

The IM 308-C is in compliance with the general technical data for the S5-115U, S5-135U and S5-155U programmable controllers.

The general technical data for the S5-95U is in the system manual *S5-90U/S5-95U Programmable Controller.* This information is applicable to all versions of the S5-95U.

The PROFIBUS card is in compliance with the general technical data for the programmers/PCs.

Goal

After reading this chapter, you will be familiar with the environmental conditions in which the ET 200 can be used.

A.1 Standards and certifications

Introduction

This chapter contains the following information about the ET 200:

- The most important standards for which the ET 200 satisfies the criteria
- The certifications available for the ET 200.

PROFIBUS standard

The ET 200 distributed I/O system is based on the EN 50 170, Volume 2, PROFIBUS standard.

IEC 1131

The ET 200 distributed I/O system fulfills the requirements and criteria of the IEC 1131, Part 2 standard.

CE mark

Our products meet the requirements and protection objectives of the following EC Directives and comply with the harmonized European standards (EN) that have been published in the Official Gazettes of the European Community for programmable logic controllers:

- 89/336/EEC ”Electromagnetic compatibility” (EMC Directive)
- 72/23/EEC ”Electrical Equipment for Use Within Fixed Voltage Ranges” (Low-Voltage Directive)

The EC declarations of conformity are being kept available for the cognizant authorities at:

Siemens Aktiengesellschaft
Bereich Automatisierungstechnik
A&D AS E4
Postfach 1963
D-92209 Amberg

EMC Directive

SIMATIC products are designed for use in industrial environments.

SIMATIC products issued with an individual approval can also be used in residential environments (private housing or small-scale trades and commercial premises). You must obtain this special approval from an appropriate authority or certificate-issuing agency, for example in Germany from the Federal Office of Posts and Telecommunications or one of its branches.

Operating environment	Requirement	
	Emitted interference	Interference immunity
Industrial	EN 50081-2 : 1993	EN 50082-2 : 1995
Residential	Individual approval	EN 50082-1 : 1992

UL certification

UL Recognition Mark
Underwriters Laboratories (UL) in accordance with
Standard UL 508, File No. 116536

CSA certification

CSA Certification Mark
Canadian Standard Association (CSA) in accordance with
Standard C 22.2 No. 142, File No. LR 48323

FM approval

Factory Mutual Approval Standard Class Number 3611, Class I, Division 2, Groups A, B, C, D.

Warning

Personal injury and material damage may be incurred.

Personal injury and material damage may be incurred in hazardous areas if you disconnect plug and socket connections while the ET 200 is operating.

Always deenergize the ET 200 in hazardous areas before disconnecting plug and socket connections.

A.2 Electromagnetic compatibility

Definition

Electromagnetic compatibility (EMC) is the ability of an electrical device to function satisfactorily in its electromagnetic environment without affecting this environment.

The bus connectors and the RS 485 repeaters described in this manual comply with the statutory requirements for EMC.

The details of interference immunity and RFI suppression are listed below.

Pulse interference

Table A-1 lists the details of electromagnetic compatibility with regard to pulse interference.

Table A-1 Electromagnetic compatibility with regard to pulse interference

Pulse interference	Tested with	Corresponding to severity
Electrostatic discharge to IEC 801-2 (DIN VDE 0843, Part 2)	8 kV	3 (air discharge)
	4 kV	2 (contact discharge)
Burst pulses (rapid, transient interference) to IEC 801-4 (DIN VDE 0843, Part 4)	2 kV (feeder line) 2 kV (signal line)	3
Single high-energy pulse (surge) to IEC 801-5 (DIN VDE 0839, Part 10)		
• Asymmetric link	2 kV (feeder line) 2 kV (signal line/data line)	3
• Symmetric link	1 kV (feeder line) 1 kV (signal line/data line)	

Sinusoidal interference

RF radiation onto the device to ENV 50140 (corresponds to IEC 801-3):

- Electromagnetic RF field, amplitude-modulated
  - from 80 to 1000 MHz
  - 10 V/m
  - 80 % AM (1 kHz)
- Electromagnetic RF field, pulse-modulated
  - 900 ± 5 MHz
  - 10 V/m
  - 50 % ED
  - 200 Hz repetition frequency
- RF coupling on signal and data lines, etc. to ENV 50141 (corresponds to IEC 801-6), radio frequency, asymmetrical, amplitude-modulated
  - from 0.15 to 80 MHz
  - 10 V rms, unmodulated
  - 80 % AM (1 kHz)
  - 150 Ω source impedance

RF emissions

RFI suppression to EN 55011: Limit class A, Group 1.

A.3 Transport and storage conditions

Transport and storage conditions

The bus connectors and RS 485 repeaters described in this manual comply with the requirements of IEC 1131, Part 2. The figures below are applicable to modules transported and stored in their original packaging.

Condition	Permissible range
Free fall	≤ 1 m
Temperature	from –40 °C to +70 °C
Barometric pressure	from 1080 to 660 hPa (corresponding to altitudes from –1000 to 3000 m)
Relative humidity	from 5 to 95 %, without condensation

Bus connectors

The storage temperature for the bus connectors is determined by other conditions. They are specified in Table 3-7 in section 3.4.

A.4 Mechanical and climatic conditions for operation

Ambient operating conditions

The bus connectors and RS 485 repeaters described in this manual are designed for stationary use in sheltered locations. Ambient operating conditions to IEC 1131-2.

Where the modules should not be used

Unless additional protective measures are implemented, the bus connectors and RS 485 repeaters should **not** be used:

- where they would be exposed to a high proportion of ionizing radiation
- where operating conditions are harsh, for example due to:
  - dust
  - aggressive vapors or gases
- in systems which require special monitoring, for example:
  - elevators
  - electrical systems in high-risk zones

Installation in cabinets counts as an additional protective measure.

Climatic conditions

The bus connectors and RS 485 repeaters are suitable for use under the following climatic conditions:

Ambient conditions	Ranges	Remarks
Temperature	from 0 to 60 °C	–
	from 0 to 55 °C	for bus connectors with Order No. 6ES7 972-0B.20-0XA0
Relative humidity	from 5 to 95 %	without condensation, corresponds to relative humidity (RH) category 2 to IEC 1131-2
Barometric pressure	from 1080 to 795 hPa	corresponds to an altitude from -1000 to 2000 m
Pollutant concentration	SO_2: < 0.5 ppm; Relative humidity (RH) < 60 %, no condensation	Test: 10 ppm; 4 days
	H_2S: < 0.1 ppm; Relative humidity (RH) < 60 %, no condensation	Test: 1 ppm; 4 days

Mechanical conditions

The mechanical conditions are listed in the table below as sinusoidal vibrations.

Frequency range (Hz)	Continuous	Occasional
$10 \leq f < 57$	0.0375 mm amplitude	0.075 mm amplitude
$57 \leq f \leq 150$	0.5 g constant acceleration	1 g constant acceleration

Reducing vibration

If the modules are subjected to severe shocks or vibrations, you must implement suitable measures to reduce the acceleration or amplitude.

We recommend installation on suitable dampers (e.g. rubber-metal elements).

Tests for mechanical conditions

Table A-2 lists the nature and scope of the tests to establish the mechanical conditions.

Table A-2 Tests of mechanical conditions

Test of ...	Standard	Remarks
Vibrations	Vibration testing to IEC 68, Part 2-6 (sinusoidal)	Type of vibration: frequency transients with a rate of change of 1 octave/minute. 10 Hz $\leq f <$ 57 Hz, const. amplitude 0.075 mm 57 Hz $\leq f \leq$ 150 Hz, const. acceleration 1 g Duration: 10 frequency transients per axis in each of the 3 normal axes
Shock	Shock testing to IEC 68, Part 2-27	Nature of shock: semi-sinusoidal Severity of shock: 15 g peak, 11 ms duration Direction: 2 shocks along each of the 3 normal axes

A.5 Insulation tests, protection class and degree of protection

Test voltages

The insulation strength was verified by application of the following test voltages to VDE 0160:

Circuits with nominal voltage U_e to other circuits and earth	Nominal voltage (test voltage)
$0\ V < U_e \leq 50\ V$	AC 350 V
$50\ V < U_e \leq 100\ V$	AC 700 V
$100\ V < U_e \leq 150\ V$	AC 1,300 V
$150\ V < U_e \leq 300\ V$	AC 2,200 V

Protection class

Class I to IEC 536 (VDE 0106, Part 1), i.e. requires connection of protective conductor to busbar.

Ingress of foreign matter and water

Degree of protection IP 20 to IEC 529, i.e. proof against contact with standard test fingers.

In addition: Proof against ingress of foreign matter of diameter in excess of 12.5 mm.

Not specially protected against the ingress of water.

Access commands for the S5-115U, S5-135U and S5-155U programmable controllers

B

In this chapter

This chapter details the various access commands. The commands are listed separately for each programmable controller and cover:

- linear addressing
- P-page addressing and
- Q-page addressing

Goal

This is a ready-reference chapter. It tells you which access commands are available for which CPUs and what you must bear in mind with regard to the individual commands.

B.1 General information about addressing consistent data

What is consistency?

The term ”consistent data” refers to all areas containing more than one byte of data that belongs together, e.g. a single word constitutes a consistent area of 2 bytes.

Consistent data is processed, for example, by analog modules, CPs, IPs in an ET 200U, or by the S5-95U with PROFIBUS-DP interface.

Example: The following are consistent on account of their contents:

- the high byte and the low byte of an analog value (word consistency)
- the job number and the associated parameters of this job, e.g. in a CPU job addressing a CP (consistency across 4 words)

Rules

Observe these rules for consistent data handling:

Note

- If you process consistent data, define the addresses in the range from PY 128 to PY 255 or in the Q area.
- Access byte-consistent areas using byte commands, and word-consistent areas using word commands.
- If the addresses are located in the range from PY 128 to PY 255 or in the Q area, you should always access the consistent area decrementally, e.g. first PY 5 and then PY 4, PY 3 and PY 2.
- Always access **all** the bytes or words in a consistent area.
- Always try to create consistent data areas that are as small as possible. If you have two digital bytes, for example, you should address them as individual bytes and not as a word.
- If you want to access any address in the P or Q area from an alarm processing level, you must disable the alarms and then enable them again prior to each consistent data access.

B.2 Access commands for the CPUs 941 to 943

Linear addressing

When you use linear addressing for the 941 to 944 CPUs, you can access the P area and – via FB 196/197 – the Q area:

The FB 196/197 requires the IM 308-C release 2 or higher.

Table B-1 Linear addressing with 941 to 943 CPUs

Inputs		
I/O address	**Address for direct access**	**Access commands**

941 CPU (P area):
0 to 63
942 to 944 CPUs
(P area):
0 to 127
	$F000_H$ to $F03F_H$
	
	$F000_H$ to $F07F_H$
		`A I x.y / AN I x.y`
		`O I x.y / ON I x.y`
		`L IB x`
		`L IW x`
		`L PY x`

941 to 944 CPUs: (P area) 128 to 255	$F080_H$ to $F0FF_H$	`L PY x` `L PW x*`
0 to 255 (Q area)	$F100_H$ to $F1FF_H$	`FB 196/197`
Outputs		
I/O address	**Address for direct access**	**Access commands**

941 CPU (P area):
0 to 63
942 to 944 CPUs
(P area):
0 to 127
	$F000_H$ to $F03F_H$
	
	$F000_H$ to $F07F_H$
		`S Q x.y  R Q x.y`
		`= Q x.y`
		`T QB x  T QW x`
		`T PY x`

941 to 944 CPUs: (P area) 128 to 255	$F080_H$ to $F0FF_H$	`T PY x` `T PW x*`
0 to 255 (Q area)	$F100_H$ to $F1FF_H$	`FB 196/197`

*: Word-consistent data only

P-page addressing

If you choose P-page addressing, you must use PY 255 ($F0FF_H$) as the page selection address.

Table B-2 P-page addressing with the 941 to 943 CPUs

Inputs P_n, P_{n+1} ,... , P_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
192 to 254	$F0C0_H$ to $F0FE_H$	`L PY x  L PW x*`
Outputs P_n, P_{n+1} , ... , P_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
192 to 254	$F0C0_H$ to $F0FE_H$	`T PY x  T PW x*`

*: Word-consistent data only

Q-page addressing

If you choose Q-page addressing, you must use QB 255 ($F1FF_H$) as the page selection address and then address the Q area via the FB 196/197.

The FB 196/197 requires IM 308-C release 2 or higher.

Other access commands

Other access commands can be used only under certain conditions. These conditions are listed in section B.7.1.

B.3 Access commands for the 944 CPU

Linear addressing

When you use linear addressing for the 944 CPU, you can access the P area and – via FB 196/197 – the Q area:

Table B-3 Linear addressing with 944 CPU

Inputs		
I/O address	**Address for direct access**	**Access commands**

CPU 941 (P area):
0 to 63
 	
CPU 942 to 944
(P area):
0 to 127
	$F000_H$ to $F03F_H$
	
	$F000_H$ to $F07F_H$
		`U E x.y / UN E x.y`
		`O E x.y / ON E x.y`
		`L EB x`
		`L EW x`
		`L PY x`
		`L PW x`
		`LIR  TNB`

CPU 941 to 944:
(P area)
128 to 255
	$F080_H$ to $F0FF_H$	`L PY x`
		`L PW x`
		`LIR  TNB`

0 to 255 (Q area)	$F100_H$ to $F1FF_H$	`FB 196/197`
Outputs		
I/O address	**Address for direct access**	**Access commands**

CPU 941 (P area):
0 to 63
CPU 942 to 944
(P area):
0 to 127
	$F000_H$ to $F03F_H$
	
	$F000_H$ to $F07F_H$
		`S A x.y  R A x.y`
		`= A x.y`
		`T AB x  T AW x`
		`T PY x`
		`T PW x`
		`TIR  TNB`

CPU 941 to 944:
(P area)
128 to 255
	$F080_H$ to $F0FF_H$	`T PY x`
		`T PW x`
		`TIR  TNB`

0 to 255 (Q area)	$F100_H$ to $F1FF_H$	`FB 196/197`

P-page addressing

If you choose P-page addressing, you must use PY 255 ($F0FF_H$) as the page selection address.

Table B-4 P-page addressing with the 944 CPU

Inputs P_n, P_{n+1} ,... , P_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**

192 to 254	$F0C0_H$ to $F0FE_H$	`L PY x`
		`L PW x`
		`LIR`
		`TNB`

Outputs P_n, P_{n+1} , ... , P_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**

192 to 254	$F0C0_H$ to $F0FE_H$	`T PY x`
		`T PW x`
		`TIR`
		`TNB`

Q-page addressing

If you choose Q-page addressing, you must use QB 255 ($F1FF_H$) as the page selection address and then address the Q area via the FB 196/197.

The FB 196/197 requires IM 308-C release 2 or higher.

B.4 Access commands for the 945 CPU

Linear addressing

When you use linear addressing for the 945 CPU, you can access both the P area and the Q area:

Table B-5 Linear addressing with the 945 CPU

Inputs		
I/O address	**Address for direct access**	**Access commands**

0 to 127
(P area)
	$0F000_H$ to $0F07F_H$	`A I x.y / AN I x.y`
		`O I x.y / ON I x.y`
		`L IB x  L IW x`
		`L ID x  L PY x`

128 to 255 (P area)	$0F080_H$ to $0F0FF_H$	`L PY x  L PW x`*
0 to 255 (Q area)	$0F100_H$ to $0F1FF_H$	`L QB x  L QW x`*
Outputs		
I/O address	**Address for direct access**	**Access commands**

0 to 127
(P area)
	$0F000_H$ to $0F07F_H$	`S Q x.y  R Q x.y`
		`= Q x.y`
		`T QB x  T QW x`
		`T QD x  T PY x`

128 to 255 (P area)	$0F080_H$ to $0F0FF_H$	`T PY x  T PW x`*
0 to 255 (Q area)	$0F100_H$ to $0F1FF_H$	`T QB x  T QW x`*

*: Word-consistent data only

P-page addressing

If you choose P-page addressing, you must use PY 255 ($F0FF_H$) as the page selection address.

Table B-6 P-page addressing with the 945 CPU

Inputs P_n, P_{n+1} , ..., P_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
192 to 254	$F0C0_H$ to $F0FE_H$	`L PY x  L PW x`*
Outputs P_n, P_{n+1} , ..., P_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
192 to 254	$F0C0_H$ to $F0FE_H$	`T PY x  T PW x`*

*: Word-consistent data only

Q-page addressing

If you choose Q-page addressing, you must use QB 255 ($F1FF_H$) as the page selection address.

Table B-7 Q-page addressing with the 945 CPU

Inputs Q_n, Q_{n+1} , ..., Q_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
0 to 254	$0F100_H$ to $0F1FE_H$	`L QB x  L QW x`*
Outputs Q_n, Q_{n+1} , ..., Q_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
0 to 254	$0F100_H$ to $0F1FE_H$	`T QB x  T QW x`*

*: Word-consistent data only

Other access commands

Other access commands can be used only under certain conditions. These conditions are listed in section B.7.3.

B.5 Access commands for the S5-135U

Linear addressing

When you use linear addressing, you can access both the P area and the Q area.

Table B-8 Linear addressing with the S5-135U

Inputs		
I/O address	**Address for direct access**	**Access commands**
0 to 127 (P area)	$0F000_H$ to $0F07F_H$	**A I x.y / AN I x.y** **O I x.y / ON I x.y** **L IB x L IW x** **L ID x** **L PY x**
128 to 255 (P area)	$0F080_H$ to $0F0FF_H$	**L PY x L PW x***
0 to 255 (Q area)	$0F100_H$ to $0F1FF_H$	**L QB x L QW x***
Outputs		
I/O address	**Address for direct access**	**Access commands**
0 to 127 (P area)	$0F000_H$ to $0F07F_H$	**S Q x.y** **R Q x.y** **= Q x.y** **T QB x T QW x** **T QD x** **T PY x**
128 to 255 (P area)	$0F080_H$ to $0F0FF_H$	**T PY x T PW x***
0 to 255 (Q area)	$0F100_H$ to $0F1FF_H$	**T QB x T QW x***

*: Word-consistent data only

P-page addressing

If you choose P-page addressing, you must use PY 255 ($F0FF_H$) as the page selection address.

Table B-9 P-page addressing with the S5-135U

Inputs P_n, P_{n+1} , ..., P_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
192 to 254	$F0C0_H$ to $F0FE_H$	`L PY x` `L PW x`*
Outputs P_n, P_{n+1} , ..., P_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
192 to 254	$F0C0_H$ to $F0FE_H$	`T PY x` `T PW x`*

Q-page addressing

If you choose Q-page addressing, you must use QB 255 ($F1FF_H$) as the page selection address.

Table B-10 Q-page addressing with the S5-135U

Inputs Q_n, Q_{n+1} , ..., Q_{n+15} (n = 0, 16, 32 , ..., 240)		
I/O address	**Address for direct access**	**Access commands**
0 to 254	$0F100_H$ to $0F1FE_H$	`L QB x` `L QW x`*
Outputs Q_n, Q_{n+1} , ..., Q_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
0 to 254	$0F100_H$ to $0F1FE_H$	`T QB x` `T QW x`*

*: Word-consistent data only

Other access commands

Other access commands can be used only under certain conditions. These conditions are listed in section B.7.4 for the 922 CPU and in section B.7.5 for the 928 CPU.

B.6 Access commands for the S5-155U

Linear addressing

When you use linear addressing, you can access both the P area and the Q area:

Table B-11 Linear addressing with the S5-155U

Inputs		
I/O address	**Address for direct access**	**Access commands**

0 to 127
(P area)
	$0F000_H$ to $0F07F_H$	`A I x.y / AN I x.y`
		`O I x.y / ON I x.y`
		`L IB x  L IW x`
		`L ID x`
		`L PY x`

128 to 255 (P area)	$0F080_H$ to $0F0FF_H$	`L PY x  L PW x`*
0 to 255 (Q area)	$0F100_H$ to $0F1FF_H$	`L QB x  L QW x`*
Outputs		
I/O address	**Address for direct access**	**Access commands**

0 to 127
(P area)
	$0F000_H$ to $0F07F_H$	`S Q x.y  R Q x.y`
		`= Q x.y`
		`T QB x  T QW x`
		`T QD x`
		`T PY x`

128 to 255 (P area)	$0F080_H$ to $0F0FF_H$	`T PY x  T PW x`*
0 to 255 (Q area)	$0F100_H$ to $0F1FF_H$	`T QB x  T QW x`*

*: Word-consistent data only

P-page addressing

Use PY 255 as the page selection address.

Table B-12 P-page addressing with the S5-155U

Inputs P_n, P_{n+1} , ..., P_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
192 to 254	$F0C0_H$ to $F0FE_H$	`L PY x` `L PW x`*
Outputs P_n, P_{n+1} , ..., P_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
192 to 254	$F0C0_H$ to $F0FE_H$	`T PY x` `T PW x`*

*: Word-consistent data only

Q-page addressing

Use QB 255 as the page selection address.

Table B-13 Q-page addressing with the S5-155U

Inputs Q_n, Q_{n+1} , ..., Q_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
0 to 254	$0F100_H$ to $0F1FE_H$	`L QB x` `L QW x`*
Outputs Q_n, Q_{n+1} , ..., Q_{n+15} (n = 0, 16, 32, ..., 240)		
I/O address	**Address for direct access**	**Access commands**
0 to 254	$0F100_H$ to $0F1FE_H$	`T QB x` `T QW x`*

*: Word-consistent data only

Other access commands

Other access commands can be used only under certain conditions. These conditions are listed in section B.7.6.

B.7 Structure of the consistent data areas for the S5-115U, S5-135U and S5-155U programmable controllers

Overview

This section describes the rules you must observe in order to maintain data consistency in direct access to the distributed I/O system.

Structure of the ID

COM PROFIBUS enables you to define IDs to select the consistency for a module.

When parameterizing a DP slave such as the ET 200U or the S5-95U, enter the ID in COM PROFIBUS by selecting **Configure** ▸ **Slave Parameters** ▸ **Configure**▸ ID.

The ”ID” dialog box is opened:

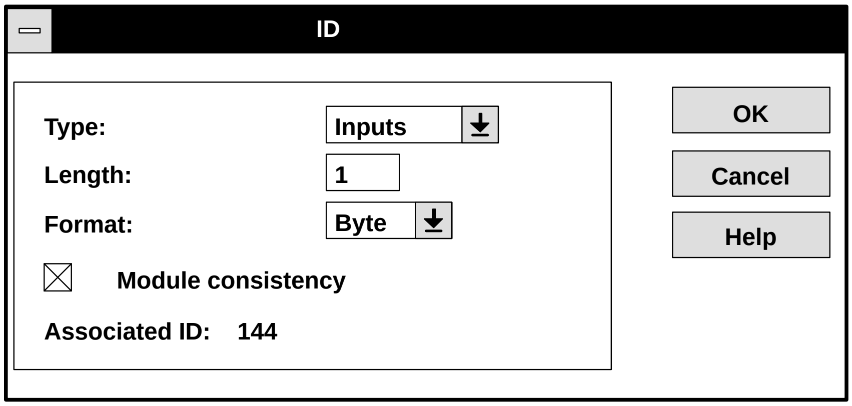


Figure B-1 ID

Sections B.7.1 to B.7.6 refer to this ”ID” dialog box in COM PROFIBUS.

What is important with regard to consistency?

Observe these rules for consistent data access:

Note

- Data consistency is switched on and off on the IM 308-C.
- Data consistency is switched off only by a certain byte (switch-off byte, indicated by gray hatching in the illustrations below).
- Data consistency is switched on by any other byte in the consistent area (switch-on byte, no hatching in the illustrations below).
- If data consistency is switched on when one or more bytes in a consistent area are read or written, the IM 308-C waits until data consistency is switched off again (switch-off byte).

  If, for example, you do **not** write consistently to a consistent output area, it is possible that these outputs will not be set.
- If you want to read or write only one byte in the consistent area and this byte is not the switch-off byte, you must always read or write the switch-off byte as well to ensure that data consistency is switched off again.
- During access to a consistent area (input or output area), no other I/O address outside this area may be accessed because if it were, the IM 308-C could no longer process the data consistently.

Word-by-word access to consistent data area

The following rules apply to word-by-word access to consistent areas:

Note

- If you access these modules only through the process image (PII, PIO), the data is always consistent.
- If you use load/transfer commands for direct access to consistent areas, observe the following access rules:
  - Access consistent data only word-by-word (address must be an even number)
  - Always read or write the job number or control word (CPs and IPs) last, in other words read the **parameters first and then the job number.** This means you should always start by accessing the word which contains the switch-off byte.

Byte-by-byte access to consistent data area

The following rules apply to byte-by-byte access to consistent areas:

Note

- If you access these modules only through the process image (PII, PIO), the data is always consistent.
- If you use load/transfer commands for direct access to consistent areas, you must always access the ”switch-off byte” **last**. You will find the correct ”switch-off byte” in Sections B.7.1 to B.7.3. This depends on the type of the CPU, the type of consistency and the address area (0 to 127 in the P area or addresses outside this area).

Sections B.7.1 to B.7.6

In these sections:

- n is always an even number, e. g. 0, 2, 4, 6, ...
- m/2 is always an integer, e. g. 1, 2, 3, ...

Switch-on and switch-off bytes

Bytes with which you switch on consistency (switch-on bytes) are always shown as white fields below. Bytes with which you switch off consistency (switch-off bytes) are shown as gray-hatched fields.

(white field)	With this byte consistency is **switched on.**
(gray field)	With this byte consistency is **switched off.**

B.7.1 S5-115U: CPUs 941, 942, 943

Word consistency over one word

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-14 Word consistency over one word

Format: **Word**

☐ **Module consistency**

Byte	P area: 0 to 127	P area: 128 to 255	Q area: 0 to 255
n			
n + 1			
access commands	`L PW x/T PW x`	`L PW x/T PW x`	`FB 196/197`

Byte consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-15 Byte consistency over m bytes (total length)

Length: **[m]**

Format: **Byte**

☒ **Module consistency**

Byte	P area: 0 to 127	P area: 128 to 255	Q area: 0 to 255
n			
n + 1			
...			
n + m–1[1]			
access commands	`L PY x/T PY x`	`TNB`	`FB 196/197`

[1] m corresponds to the length in bytes you defined in the ”ID” dialog box.

Word consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-16 Word consistency over m/2 words (total length)

Length: **[m/2]**

Format: **Word**

☒ **Module consistency**

Byte	P area: 0 to 127	P area: 128 to 255	Q area: 0 to 255
n			
n + 1			
...			
n + m–1[1]			
access commands	`L PW x/T PW x`	`L PW x/T PW x`	`FB 196/197`

[1] m corresponds to the length in bytes you defined in the ”ID” dialog box.

B.7.2 S5-115U: 944 CPU

Word consistency over one word

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-17 Word consistency over one word

	Format: Word ⤓ ☐ **Module consistency**		
Byte	**P area: 0 to 127**	**P area: 128 to 255**	**Q area: 0 to 255**
n			
n + 1			
access commands	`L PW x/T PW x` `TNB`	`L PW x/T PW x` `TNB`	`FB 196/197` `TNB`

Byte consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-18 Byte consistency over m bytes (total length)

	Length: [m] **Format:** Byte ⤓ ☒ **Module consistency**		
Byte	**P area: 0 to 127**	**P area: 128 to 255**	**Q area: 0 to 255**
n			
n + 1			
...			
n + m–1[1]			
access commands	`TNB`	`TNB`	`FB 196/197` `TNB`

[1] m corresponds to the length in bytes you defined in the ”ID” dialog box.

Word consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-19 Word consistency over m/2 words (total length)

Length: [m/2]

Format: Word

☒ **Module consistency**

Byte	P area: 0 to 127	P area: 128 to 255	Q area: 0 to 255
n			
n + 1			
...			
n + m–1[1]			
access commands	`L PW x/T PW x` `TNB`	`L PW x/T PW x` `TNB`	`FB 196/197` `TNB`

[1] m corresponds to the length in bytes you defined in the ”ID” dialog box.

B.7.3 S5-115U: CPU 945

Word consistency over one word

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-20 Word consistency over one word

Format: Word ⭳ ☐ Module consistency			
Byte	**P area: 0 to 127**	**P area: 128 to 255**	**Q area: 0 to 255**
n			
n + 1			
access commands	`L PW x/T PW x TNW`	`L PW x/T PW x TNW`	`L QW x/T QW x TNW`

Byte consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-21 Byte consistency over m bytes (total length)

Length: [m] Format: Byte ⭳ ☒ Module consistency			
Byte	**P area: 0 to 127**	**P area: 128 to 255**	**Q area: 0 to 255**
n			
n + 1			
...			
n + m–1[1]			
access commands	`L PY x/T PY x`	`TNB`	`TNB`

[1] m corresponds to the length in bytes you defined in the ”ID” dialog box.

Word consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-22 Word consistency over m/2 words (total length)

Length: [m/2]

Format: Word

☒ **Module consistency**

Byte	P area: 0 to 127	P area: 128 to 255	Q area: 0 to 255
n			
n + 1			
...			
n + m–1[1]			
access commands	`L PW x/T PW x`	`L PW x/T PW x TNW`	`L QW x/T QW x TNW`

[1] m corresponds to the length in bytes you defined in the ”ID” dialog box.

B.7.4 S5-135U: CPU 922

Word consistency over one word

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-23 Word consistency over one word

Format: Word

☐ **Module consistency**

Byte	P area: 0 to 127	P area: 128 to 255	Q area: 0 to 255
n			
n + 1			

Byte consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-24 Byte consistency over m bytes (total length)

Length: [m]

Format: Byte

☒ **Module consistency**

Byte	P area: 0 to 127	P area: 128 to 255	Q area: 0 to 255
n			
n + 1			
...			
n + m–1[1]			

1 m corresponds to the length in bytes you defined in the ”ID” dialog box.

Word consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-25 Word consistency over m/2 words (total length)

Length: [m/2]

Format: Word

☒ **Module consistency**

Byte	P area: 0 to 127	P area: 128 to 255	Q area: 0 to 255
n			
n + 1			
...			
n + m–1[1]			

[1] m corresponds to the length in bytes you defined in the ”ID” dialog box.

B.7.5 S5-135U: CPU 928

Word consistency over one word

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-26 Word consistency over one word

Format: **Word**

☐ **Module consistency**

Byte	**P area: 0 to 127**	**P area: 128 to 255**	**Q area: 0 to 255**
n			
n + 1			

Byte consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-27 Byte consistency over m bytes (total length)

Length: **[m]**

Format: **Byte**

☒ **Module consistency**

Byte	**P area: 0 to 127**	**P area: 128 to 255**	**Q area: 0 to 255**
n			
n + 1			
...			
n + m–1[1]			

[1] m corresponds to the length in bytes you defined in the ”ID” dialog box.

Word consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-28 Word consistency over m/2 words (total length)

Length: **[m/2]**

Format: **Word**

☒ **Module consistency**

Byte	P area: 0 to 127	P area: 128 to 255	Q area: 0 to 255
n			
n + 1			
...			
n + m–1[1]			

[1] m corresponds to the length in bytes you defined in the ”ID” dialog box.

B.7.6 S5-155U: CPUs 946/947, 948

Word consistency over one word

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-29 Word consistency over one word

	Format: Word		
	☐ **Module consistency**		
Byte	**P area: 0 to 127**	**P area: 128 to 255**	**Q area: 0 to 255**
n			
n + 1			
access commands	`L PW x/T PW x`	`L PW x/T PW x`	`L QW x/T QW x`

Byte consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-30 Byte consistency over m bytes (total length)

	Length: [m]		
	Format: Byte		
	☒ **Module consistency**		
Byte	**P area: 0 to 127**	**P area: 128 to 255**	**Q area: 0 to 255**
n			
n + 1			
...			
n + m–1 [1]			
access commands	`L PY x/T PY x`	`TNB`	`TNB`

[1] m corresponds to the length in bytes you defined in the ”ID” dialog box.

Word consistency over module

The following is based on the ”ID” dialog box in COM PROFIBUS:

Table B-31 Word consistency over m/2 words (total length)

Length: **[m/2]**

Format: **Word**

☒ **Module consistency**

Byte	P area: 0 to 127	P area: 128 to 255	Q area: 0 to 255
n			
n + 1			
...			
n + m–1[1]			
access commands	`L PW x/T PW x`	`L PW x/T PW x`	`L QW x/T QW x`

1 m corresponds to the length in bytes you defined in the ”ID” dialog box.

Reaction times in the ET 200 distributed I/O system

C

Reaction time calculation

COM PROFIBUS automatically calculates the average reaction time when you parameterize the ET 200. If you have not installed COM PROFIBUS, the information contained in this chapter provides a summary of the reaction times and tells you how to determine them.

In this chapter

This chapter contains information on the following:

Basis

The information in this section is based on the ”PROFIBUS-DP” bus profile. The computations of reaction times do not take delays such as those caused by diagnostics telegrams into account.

Goal

After reading this chapter, you will be familiar with the reaction times and mechanisms of the ET 200 distributed I/O system.

You will also be in a position to dimension time-critical bus segments.

C.1 Reaction times with IM 308-C as DP master

Reaction times in ET 200

Fig. C-1 shows the reaction times of the ET 200 distributed I/O system. The aggregate reaction time is the mean reaction time which elapses between the switching of an input and the associated switching of an output:

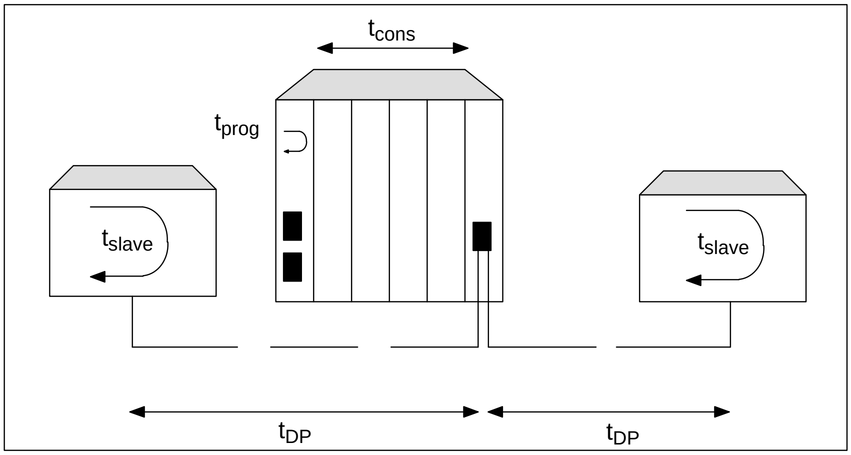


Figure C-1 Reaction times in the ET 200 distributed I/O system

Importance

Table C-1 shows the relative importance of the reaction times introduced in the above illustration. The individual reaction times are described in detail below.

Table C-1 Importance of reaction times in the ET 200 distributed I/O system

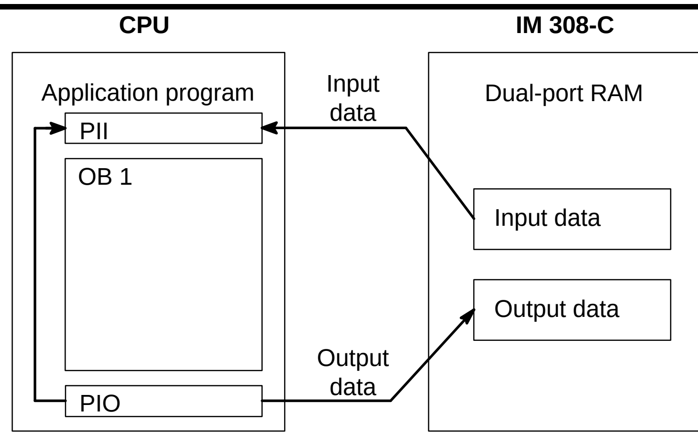
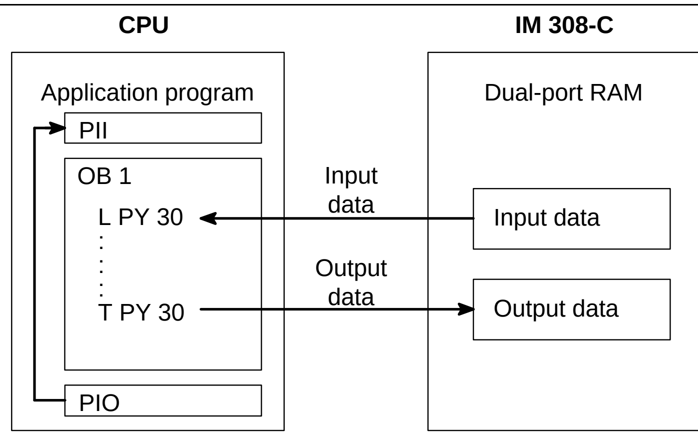
Ser. No.	Reaction time	Abbreviation	Importance
1	... of application program in the CPU	t_{prog}	• Important for access to process image, otherwise negligible
2	... between IM 308-C and CPU	t_{cons}	• Depends on length of application program
3	... on the PROFIBUS-DP bus	t_{DP}	• Important if bus configuration is large, baud rate is low and/or data telegrams are extensive
4	... within the slave	t_{slave}	• ET 200U, S5-95U: very important • ET 200B, ET 200C: less important

C.1.1 Reaction time t_{prog}

Definition

$t_{p\ rog}$ is the reaction time of the application program in the CPU. There are two cases for t_{prog}:

Table C-2 Reaction time t_{prog}

Reaction time	Caused by	Importance
t_{prog} for accessing process image	 At the start of the application program cycle, the process image of the inputs is transferred from the IM 308-C to the PII. At the end of the application program cycle, the process image of the outputs is transferred from the PIO to the IM 308-C. If you access the process image, t_{prog} equals the duration of the application program.	Very important
t_{prog} for direct access (load/transfer commands)	 If you access the dual-port RAM of the IM 308-C directly using load/transfer commands, reaction time t_{prog} is negligible.	Negligible

C.1.2 Reaction time t_{cons}

Definition

t_{cons} is the reaction time for data transfer between CPU and IM 308-C. t_{cons} can be up to 0.08 ms long.

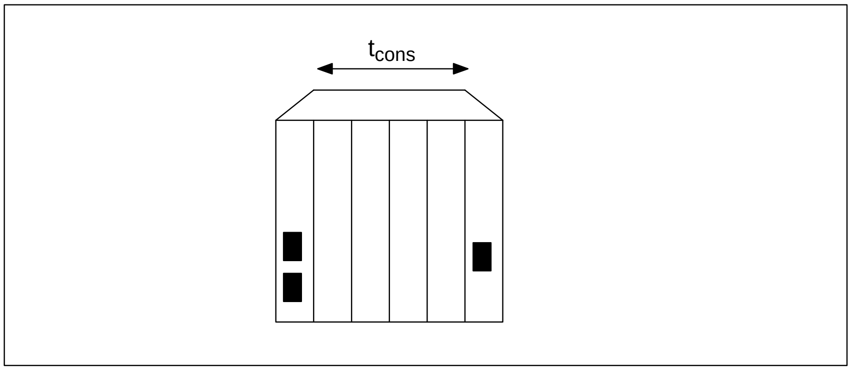


Figure C-2 Reaction time t_{cons}

C.2 Reaction times with S5-95U as DP master

Reaction times in ET 200

Fig. C-1 shows the reaction times of the ET 200 distributed I/O system. The aggregate reaction time is the mean reaction time which elapses between the switching of an input and the associated switching of an output:

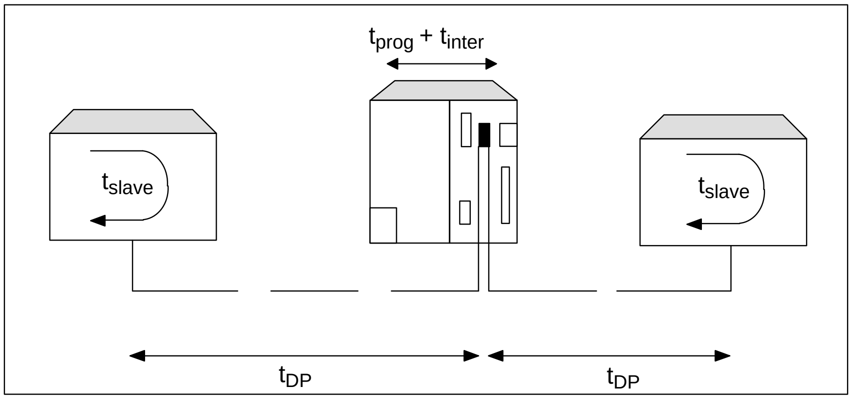


Figure C-3 Reaction times in the ET 200 distributed I/O system (S5-95U)

Importance

Table C-1 shows the relative importance of the reaction times introduced in the above illustration. The individual reaction times are described in detail below.

Table C-3 Importance of reaction times in the ET 200 distributed I/O system (S5-95U)

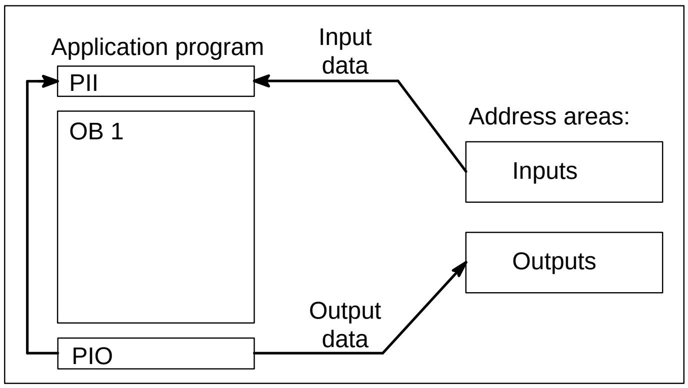
Ser. No.	Reaction time	Abbreviation	Importance
1	... of application program in the CPU	t_{prog}	• Important for access to process image, otherwise negligible
2	... between control processor and communication processor in the S5-95U	t_{inter}	• Occurs in every DP data transfer between the processors in the S5-95U
3	... on the PROFIBUS-DP bus	t_{DP}	• Important if bus configuration is large, baud rate is low and/or data telegrams are extensive
4	... within the slave	t_{slave}	• ET 200U, S5-95U: very important • ET 200B, ET 200C: less important

C.2.1 Reaction time t_{prog}

Definition

t_{prog} is the reaction time of the application program in the CPU. t_{prog} is negligible if you access directly (load/transfer commands).

Table C-4 Reaction time t_{prog} (S5-95U)

Reaction time	Caused by	Importance
t_{prog} for accessing process image	**S5-95U**  At the start of the application program cycle, the process image of the inputs is transferred to the PII. At the end of the application program cycle, the process image of the outputs is transferred from the PIO to the outputs address area. If you access the process image, t_{prog} equals the duration of the application program. For calculating cycle time and reaction time, see the system manual *S5-90U/S5-95U Programmable Controller*, chapter 6)	very important

C.2.2 Reaction time t_{inter}

Definition

t_{inter} is the interrupt delay time for the DP data transfer between the control processor and the communication processor in the S5-95U. t_{inter} has a **constant value of 0.5 ms** and occurs in every data transfer between the control processor and the communication processor.

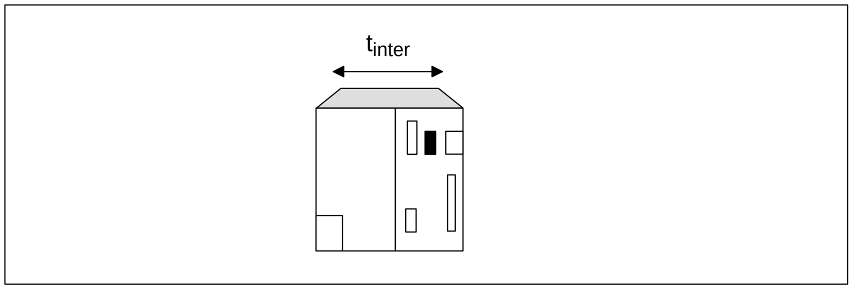


Figure C-4 Reaction time t_{inter} (S5-95U)

C.3 Reaction time t_{DP}

Definition

t_{DP} is the reaction time on the PROFIBUS-DP bus between master and slave.

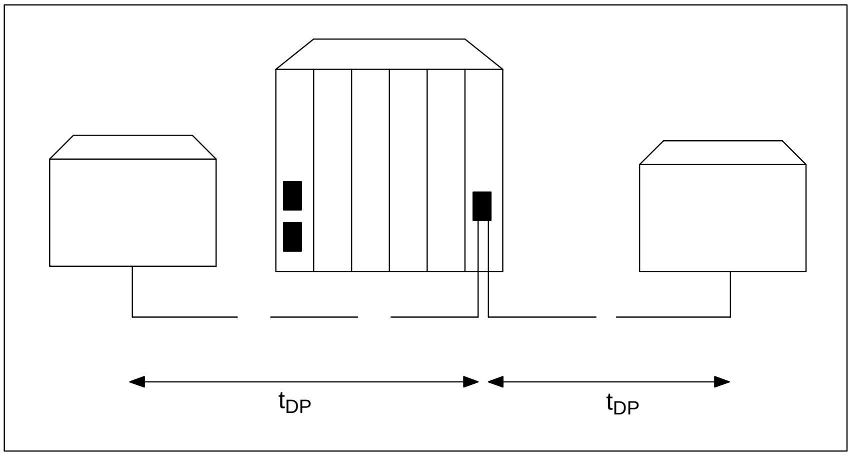


Figure C-5 Reaction time t_{DP}

Importance

t_{DP} depends on the following factors:

Table C-5 Factors influencing reaction time t_{DP}

Factor	Reaction time t_{DP} is low:
Baud rate	High baud rate, e.g. > 500 kbaud
Number of DP slaves	Few DP slaves assigned to a master

C.4 Reaction time t_{slave}

Definition

t_{slave} is the reaction time within the DP slave.

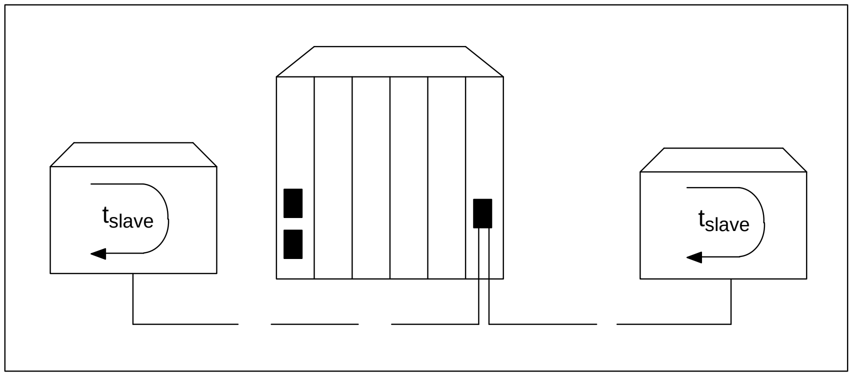


Figure C-6 Reaction time t_{slave}

Negligible ...

t_{slave} is **negligible** for the DP slaves:

- ET 200B (with low input/output delay) and
- ET 200C (with low input/output delay).

Important ...

t_{slave} is **very important** for the DP slaves:

- ET 200U and
- S5-95U with PROFIBUS-DP interface
- ET 200B and ET 200C with high input/output delay

Table C-6 Factors which favor reaction time t_{slave}

Factor	favoring a low reaction time t_{slave} in ET 200U and S5-95U:
Configuration of DP slaves	• Uniform distribution of inputs and outputs on a DP slave • All DP slaves of similar configuration; if necessary, divide the I/O modules of an ET 200U to two ET 200Us

t_{slave} for IM 308-C/DP slave

The delay t_{slave} for the IM 308-C as DP slave (see section C.1) is:

$t_{slave} = t_{prog} + t_{cons}$

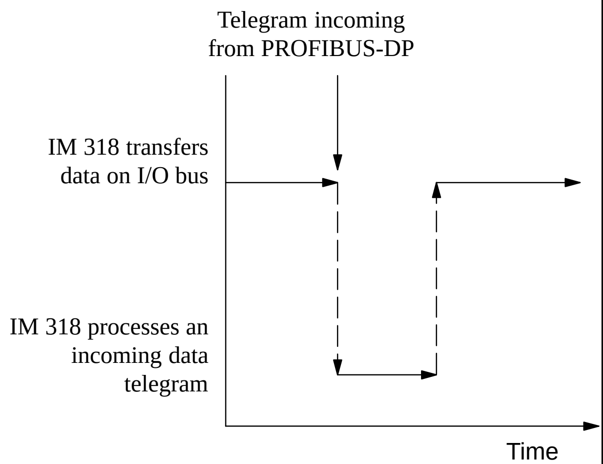
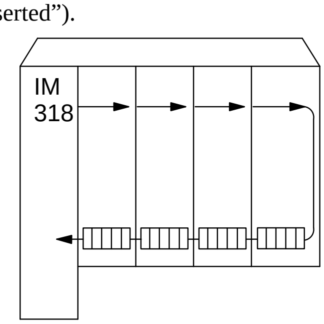
t_{slave} for S5-95U

t_{slave} is the reaction time in the DP slave. The way in which this reaction time affects the S5-95U programmable controller with PROFIBUS-DP interface is described in detail in the system manual *S5-90U/S5-95U Programmable Controller*, chapter 6 (”Calculating the cycle and reaction times”).

t_{slave} for ET 200U

t_{slave} is the reaction time in the DP slave. As regards the ET 200U distributed I/O stations, three different reaction times must be taken into account:

Table C-7 Reaction times in the ET 200U

Reaction times in the ET 200U	Caused by:	Importance
$t_{IM\ 318}$ of a data telegram in the ET 200U	When the IM 318 receives a data telegram from the DP master, it must interrupt serial data transfer on the I/O bus. During the interrupt, the IM 318 processes the data telegram.  	$t_{IM\ 318}$ is short when • baud rate is high • output bytes are few, and • input bytes are few (only at baud rates > 187.5 kbaud)
$t_{I/Obus}$ between IM 318 and I/O modules	Data is transferred between the input/output modules and the IM 318 on the serial I/O bus. The length of this reaction time $t_{I/Obus}$ depends on the number of I/O modules inserted (or more precisely on the number of ”bytes inserted”).  	Important as number of I/O modules increases
$t_{I/O}$	The input/output modules have specific reaction times. For input modules, $t_{I/O}$ is the time between a signal change at the input and the status change on the I/O bus. For output modules, $t_{I/O}$ is the time between a status change on the I/O bus and the signal change at the output. For details of the reaction times of the input/output modules, see the manual *ET 200U Distributed I/O Station*.	Important for analog modules

C.5 Example illustrating how to calculate reaction times for the ET 200 distributed I/O system

Overview

This section contains a worked example illustrating how to calculate the reaction times t_{prog}, t_{cons}, t_{DP} and t_{slave} in the ET 200 distributed I/O system with IM 308-C as DP master.

Section	Topic	Page
C.5.1	Calculating t_{prog} and t_{cons}	C-13
C.5.2	Calculating t_{DP}	C-14
C.5.3	Calculating t_{slave}	C-15
C.5.4	Calculating reaction time t_R	C-17

Sample configuration

The illustration below shows a sample configuration with an IM 308-C as DP master and a variety of DP slaves:

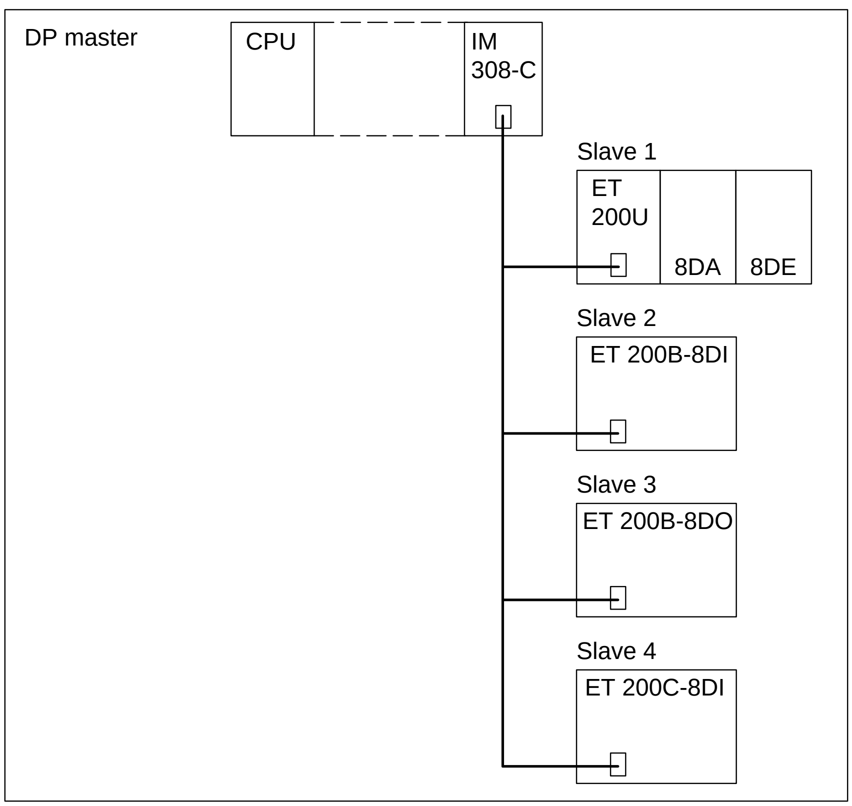


Figure C-7 Example of a bus configuration

An input of the ET 200B-8DI must set an output on the ET 200U. The baud rate is 500 kbaud.

C.5.1 Calculating t_{prog} and t_{cons}

t_{prog}

t_{prog} is dependent on the STEP 5 application program.

Let us suppose that the process image only is accessed and that the length of the application program is 100 ms:

t_{prog} = 100 ms

t_{cons}

Only the process image is accessed (see above, ”Calculating t_{prog}”), so t_{cons} is negligible.

t_{cons} = 0 ms

C.5.2 Calculating t_{DP}

Components of t_{DP}

The reaction time t_{DP} comprises the following components. The constants A, B and T_{byte} depend on the baud rate (see Table C-8).

t_{DP} = constant A
+ (constant B + (number of I/O bytes × T_{byte})) [slave 1]
+ (constant B + (number of I/O bytes × T_{byte})) [slave 2]
+ (constant B + (number of I/O bytes × T_{byte})) [slave 3]
+ (constant B + (number of I/O bytes × T_{byte})) [slave 4]
+ ...
+ (constant B + (number of I/O bytes × T_{byte})) [slave n]

Table C-8 Constants for various baud rates

Baud rate	Constant A (in ms)	Constant B (in ms)	T_{byte} (ms)
9.6 kbaud	64.5	25.6	1.15
19.2 kbaud	32.3	12.8	0.573
93.75 kbaud	6.6	2.62	0.118
187.5 kbaud	3.3	1.31	0.059
500 kbaud	1.6	0.49	0.022
1.5 Mbaud	0.67	0.164	0.00733
3 Mbaud	0.436	0.085	0.00367
6 Mbaud	0.27	0.044	0.00183
12 Mbaud	0.191	0.024	0.00092

Calculating t_{DP}

The reaction time t_{DP} comprises the following components:

t_{DP} = 1.6 ms
+ (0.49 ms + 2 × 0.022 ms) [slave 1]
+ (0.49 ms + 1 × 0.022 ms) [slave 2]
+ (0.49 ms + 1 × 0.022 ms) [slave 3]
+ (0.49 ms + 1 × 0.022 ms) [slave 4]

t_{DP} = 3.67 ms

Note

If there is at least one ET 200U distributed I/O station or S5-95U with DP slave interface on the PROFIBUS-DP bus, t_{DP} is at least 2 ms. Consequently, you must substitute 2 ms for any calculated result that is less than 2 ms.

C.5.3 Calculating t_{slave}

Calculating t_{slave}

The configuration includes three different slaves:

Slave	t_{slave}
ET 200B	0 ms
ET 200C	0 ms
ET 200U	$t_{IM\ 318} + t_{I/Obus} + t_{I/O}$
IM 308-C/DP-Slave	$t_{prog} + t_{cons}$

Let us calculate t_{slave} for the ET 200U. t_{slave} for the ET 200U is the sum of three different reaction times, namely $t_{IM\ 318}$, $t_{I/O\ bus}$ and $t_{I/O}$:

Calculating $t_{IM\ 318}$

$t_{IM\ 318}$ is the reaction time in the ET 200U caused by a data telegram.

Table C-9 Basic values at different baud rates for calculating the reaction time $t_{IM\ 318}$ of the ET 200U

Baud rate	Basic value (ms)	T_{byteO} (ms)	T_{byteI} (ms)
9.6 kbaud	2.3	1.16	0.0036
19.2 kbaud	1.18	0.58	0.0036
93.75 kbaud	0.273	0.122	0.0036
187.5 kbaud	0.154	0.063	0.0036
500.0 kbaud	0.081	0.026	0.0036
1.5 Mbaud (0 output byte) 1.5 Mbaud (1 output byte) 1.5 Mbaud (2 output bytes) 1.5 Mbaud (> 2 output bytes)	0.0594 0.069 0.073 0.043	0.0 0.0 0.0 0.011	0.0036 0.0036 0.0036 0.0036

Insert the values from Table C-9 to calculate $t_{IM\ 318}$:

		Basic value	=	0.081 ms
				+
1	×	0.026 ms	=	0.026 ms
(Number of output bytes)		(T_{byteO})		+
1	×	0.0036 ms	=	0.0036 ms
(Number of input bytes)		(T_{byteI})		=
		$t_{IM\ 318}$	≅	0.03 ms

Calculating $t_{I/Obus}$

$t_{I/Obus}$ is the duration of the transfer between the IM 318 and the I/O modules via the I/O bus.

Table C-10 Constants for calculating $t_{I/Obus}$ for ET 200U

Reaction time constant (ms)		**Constant ("bytes inserted") (ms)**	
ET 200U (Siemens DP)	**ET 200U (standard DP)**	**ET 200U (Siemens DP)**	**ET 200U (standard DP)**
0.151	0.251	0.089	0.120

Calculate $t_{I/Obus}$ by inserting the values from the table above:

Reaction time constant			=	0.151 ms +
0 (Number of analog modules, CPs, IPs)	×	0.014 ms (constant)	=	0.0 ms +
2 ("Number of bytes inserted")	×	0.089 ms ("bytes inserted" constant)	=	0.178 ms +
0 (Number of empty slots)	×	0.039 ms (constant)	=	0.0 ms =
		$t_{I/Obus}$	≅	0.33 ms

Calculating $t_{I/O}$

The manual *ET 200U Distributed I/O Station* provides us with an average figure of 5 ms:

$t_{I/O}$ = 5 ms

Final calculation

The figures already obtained can now be used to calculate t_{slave} for the ET 200U:

$t_{slave,\ ET\ 200U} = t_{IM\ 318} + t_{I/Obus} + t_{I/O} = 0.03\ ms + 0.33\ ms + 5\ ms$

$t_{slave,\ ET\ 200U} = 5.36\ ms$

C.5.4 Calculating reaction time t_R

What is reaction time t_R?

The reaction time t_R is the time which elapses between the switching of an input on a DP slave and the corresponding switching of an output.

Components of the reaction time t_R

The reaction time t_R is calculated on the basis of the reaction times determined beforehand. The ET 200 distributed I/O system operates on the basis of an asynchronous communication mechanism, so two cases can be distinguished:

- Typical reaction time and
- Worst-case reaction time

Table C-11 lists the multiplication factors for the reaction times:

Table C-11 Multiplication factors for the reaction times

Medium	Reaction time	Factor (typical)	Factor (worst case)
DP slave (input) t_{slave}	$t_{I/O}$	$\times$ 1	$\times$ 1
	$t_{I/Obus}$	$\times$ 1	$\times$ 1
	$t_{IM\ 318}$	$\times$ 1	$\times$ $(1+t_{I/O\ bus}/t_{DP})$
DP master and PROFIBUS-DP bus	t_{DP}	$\times$ 0.5	$\times$ 1
	t_{cons}	$\times$ 1	$\times$ 2
	t_{prog}	$\times$ 1.5	$\times$ 2
	t_{DP}	$\times$ 0.5	$\times$ 1
DP slave (output) t_{slave}	$t_{IM\ 318}$	$\times$ 1	$\times$ $(1+t_{I/O\ bus}/t_{DP})$
	$t_{I/Obus}$	$\times$ 1	$\times$ 2
	$t_{I/O}$	$\times$ 1	$\times$ 1

t_R =

Calculating the typical reaction time t_R

The reaction time t_R for a typical situation is calculated below. The values used are those calculated in the worked example in the preceding section.

Table C-12 Calculating the typical reaction time

Medium	Reaction time	Time (ms)	Factor (typical)	Final value (ms)
DP slave (input) t_{slave}	$t_{I/O}$	0.0	× 1	0.0
	$t_{I/Obus}$	0.0	× 1	0.0
	$t_{IM\ 318}$	0.0	× 1	0.0
DP master and PROFIBUS-DP bus	t_{DP}	3.67	× 0.5	1.835
	t_{cons}	0.0	× 2	0.0
	t_{prog}	100.0	× 1.5	150.0
	t_{DP}	3.67	× 0.5	1.835
DP slave (output) t_{slave}	$t_{IM\ 318}$	0.03	× 1	0.03
	$t_{I/Obus}$	0.33	× 1	0.33
	$t_{I/O}$	5.0	× 1	5.0

t_R =	159.03

Calculating the worst-case reaction time t_R

The worst-case reaction time t_R is calculated below:

Table C-13 Calculating the worst-case reaction time t_R

Medium	Reaction time	Time (ms)	Factor (typical)	Final value (ms)
DP slave (input) t_{slave}	$t_{I/O}$	0.0	× 1	0.0
	$t_{I/Obus}$	0.0	× 1	0.0
	$t_{IM\ 318}$	0.0	× $(1+t_{I/O\ bus}/t_{DP})$	0.0
DP master and PROFIBUS-DP bus	t_{DP}	3.67	× 1	3.67
	t_{cons}	0.0	× 2	0.0
	t_{prog}	100.0	× 2	200.0
	t_{DP}	3.67	× 1	3.67
DP slave (output) t_{slave}	$t_{IM\ 318}$	0.03	× $(1+t_{I/O\ bus}/t_{DP})$	0.03
	$t_{I/Obus}$	0.33	× 2	0.66
	$t_{I/O}$	5.0	× 1	5.0

t_R =	213.03

Result of reaction time t_R

When an input on the ET 200B-8DI sets an output on the ET 200U, the typical reaction time is approx. 159 ms. The worst-case reaction time is approx. 213 ms.

Fig. C-8 shows how the PROFIBUS-DP field bus contributes to the reaction time.

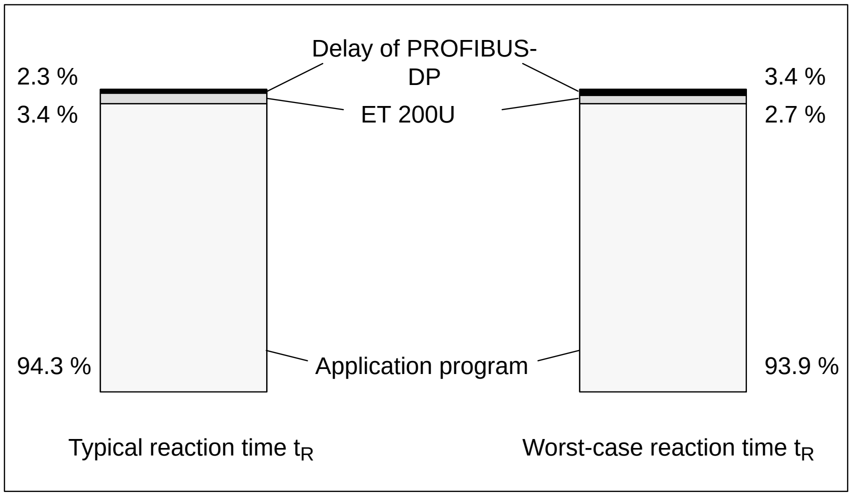


Figure C-8 Contribution of PROFIBUS-DP to the reaction time

C.6 Special cases which may prolong the reaction time t_R

Overview

The preceding section dealt with the principles of calculating reaction time t_R under normal circumstances (mono-master mode, ET 200U not in slow mode, steady-state operation).

This section shows how the reaction time t_R changes when:

- the bus configuration is loaded (station connecting cycle)
- diagnostic data is transferred from the slave (diagnostics cycle)
- there is more than one DP master on the PROFIBUS-DP bus (token-passing cycle)

  or

- the ET 200U is operating in slow mode.

C.6.1 How is data exchanged?

Overview of data exchange

Fig. C-9 illustrates how the DP master and the DP slaves exchange data. In the **station connecting cycle**, the DP master ascertains which stations are available on the bus. If a station has failed, the IM 308-C detects this state in the station connecting cycle.

In the **data cycle**, the IM 308-C sends output data to the slaves and receives input data.

In the **diagnostics cycle**, the DP slaves that have experienced a change in their diagnostic message report this change to the IM 308-C.

The DP master then passes the token (send authorization) to the next DP master (if there is more than one in the system) = **token passing**.

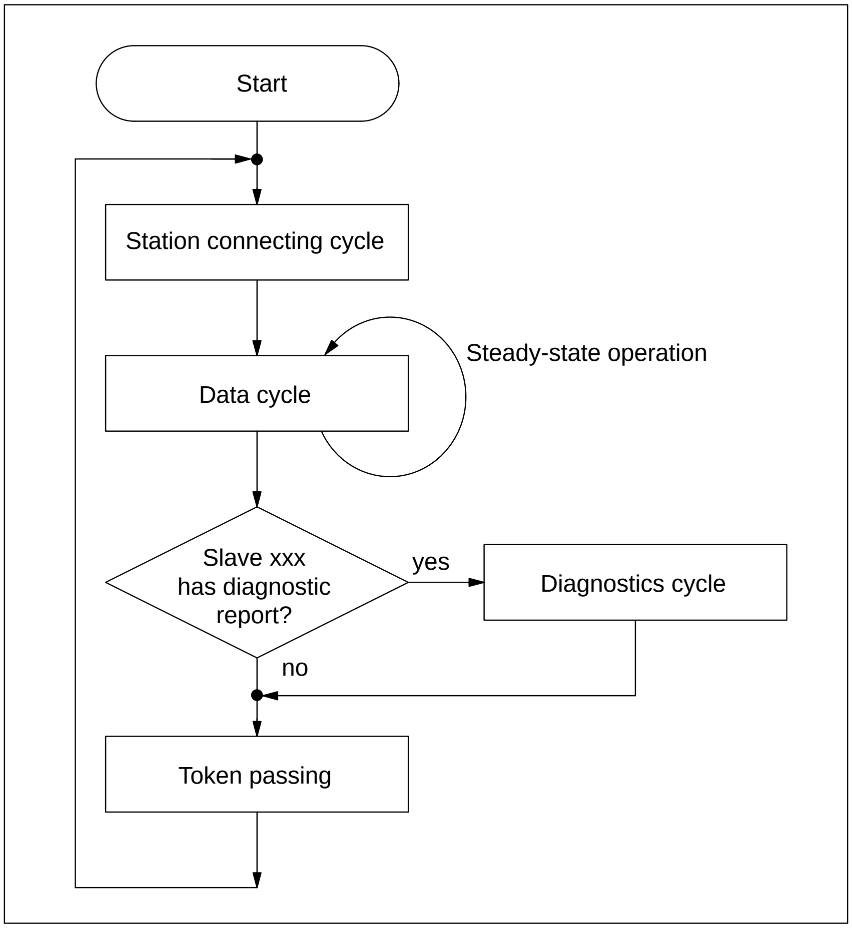


Figure C-9 Block diagram illustrating exchange of data between DP master and DP slave

Power-up phase/ steady-state operation

As regards the exchange of data between DP master and DP slave, a distinction is drawn between the **power-up phase** and **steady-state operation**.

- Power-up phase: The DP master runs the program shown in Fig. C-10 once, starting with the station connecting cycle. This is followed by steady-state operation.
- Steady-state operation: The DP master runs the program repeatedly, the only change being the station connecting cycle. The station connecting cycle is repeated only in the event of an error.

The individual program parts are described below, along with the effects they have on the reaction time t_R.

Contribution of the station connecting cycle to t_R

Table C-14 lists the events which cause the DP master to run the station connecting cycle. The table also shows how this response affects the reaction time.

Table C-14 Reaction times in the station connecting cycle

Event	Response of IM 308-C in station connecting cycle
The DP master runs up (power-up phase)	The DP master checks whether all DP slaves configured with COM PROFIBUS are addressable (= power-up phase). In the subsequent data cycle, the DP master takes into account only those DP slaves which it identified as addressable.
The DP master is in steady-state operation.	If a DP slave is not accessible or could not be addressed in the power-up phase, the DP master runs the station connecting cycle for the non-addressable DP slave.

Data cycle

In the data cycle the DP master sends output data to the DP slaves and receives their input data.

Only those DP slaves which were identified as addressable in the station connecting cycle are taken into account in the data cycle.

The reaction time t_R corresponds to the actual reaction time (see section C.5) when only the data cycle is run (in error-free operation).

Conditions for diagnostics cycle

A diagnostics cycle takes place only if the diagnostic report of at least one DP slave has changed.

What is a token?

If there is more than one DP master on the PROFIBUS-DP bus (i.e. two or more DP masters), at any given time only one DP master can have permission to access the bus.

Access permission (the token) is passed to each DP master in turn. In the periods in which it does not have the token, a DP master cannot address its DP slaves.

How does token passing work?

Fig. C-10 illustrates how the token is passed from one master to another (Steps 1 to 4 are repeated again and again). The same principle applies for any multimaster configuration.

1. Master No. 1 has the token and thus can address its slaves. Master No. 2 cannot access its slaves.
2. Master No. 1 passes the token to master No. 2. At this point neither master can access its slaves.
3. Master No. 2 has the token and thus can address its slaves. Master No. 1 cannot access its slaves.
4. Master No. 2 passes the token to master No. 1. At this point neither master can access its slaves.

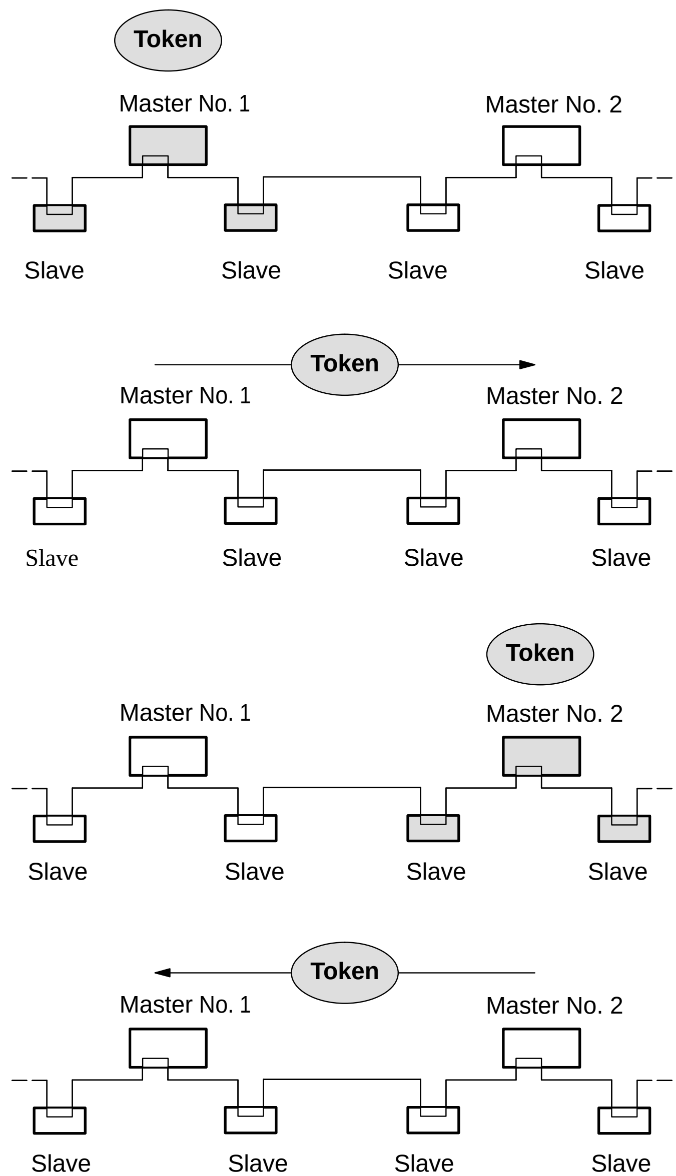


Figure C-10 Token passing between two masters

Contribution of token passing to t_R

In a multimaster configuration, the reaction time is prolonged by

$t_{R(token)} = t_{R(master\ 1)} + t_{R(master\ 2)} + ... + t_{R(master\ n)}$ where:

$t_{R\ master\ 1}$	Reaction time of DP master 1
$t_{R\ master\ 2}$	Reaction time of DP master 2
$t_{R\ master\ n}$	Reaction time of DP master having the highest PROFIBUS address
$t_{R(token)}$	Reaction time for the entire ET 200 distributed I/O system **Note:** The upper limit for $t_{R(token)}$ is set by COM PROFIBUS. $t_{R(token)}$ corresponds to the target rotation time T_{tr} in COM PROFIBUS

The reaction time t_R is calculated in a worked example in section C.5.4. Bear in mind that the reaction time of a master does not include the reaction time of its slaves. The only components which make up the reaction time of the master are t_{DP}, t_{cons} and t_{prog}.

C.6.2 ET 200U operating in slow mode

When does the ET 200U operate in slow mode?

If, for example, the IP 265 is inserted in the ET 200U, the ET 200U must operate in slow mode. The reaction time $t_{I/Obus}$ is prolonged accordingly.

Worked example

This example refers to section C.5. Let us assume that the ET 200U contains an IP 265 instead of an 8DI.

$t_{I/Obus}$ is calculated as follows:

Reaction time constant			=	1.064 ms
				+
1	×	0.014 ms	=	0.014 ms
(Number of analog modules, CPs, IPs)				+
9	×	0.186 ms	=	1.674 ms
(”Number of bytes inserted”)				=
0	×	0.087 ms	=	0 ms
(Number of empty slots)				=
		$t_{I/O\ bus}$ (slow mode)	≅	2.75 ms

D Demo programs

In this chapter

This chapter contains demo programs that would otherwise interrupt the flow of the manual if they were included in the sections to which they actually belong:

D.1 Accessing the DP/AS-I link with FB IM 308-C (FB 192)

In section D.1

Section D.1contains:

Preconditions

You require the following functions of FB IM308C for the DP/AS-I link only (release 3 and later versions).

Important note

Please note the following special feature of the CPU 945:

Note

If FB IM308C is used with the CPU 945, the first job to be processed is not run. The error flag $00B0_H$ (QVZ) entered in DW 8 must be ignored.

All subsequent jobs are of course processed and run in the normal way.

D.1.1 Calling FB IM308C (FB 192) (DP/AS-I link only)

Calling FB IM308C

With FB IM308C you can access the DP/AS-I link via the IM 308-C. You must parameterize FB IM308C indirectly in order to do so, i.e. all the required parameters must be saved in a data block (y).

The call for FB IM308C is shown below. You can find a detailed description of the block parameters in section 7.3.

STL	Meaning
`       :A      DB      y`	Opens data block y
`       :SPA    FB      192`	Calls FB 192
`Name   :IM308C`	
`DPAD   :       KH0000`	
`IMST   :       KY0,0`	
`FCT    :       KCXX`	XX: Indirect parameterization
`GCGR   :       KM 00000000 00000000`	
`TYP    :       KY0,0`	
`STAD   :       KF+0`	
`LEN    :       KF+0`	
`ERR    :       DW 0`	

Data block (y)

If FB IM308C is parameterized indirectly (FCT = XX), DB y has the following structure, starting at data word 0:

Table D-1 Data block (y)

Data word	Parameter	DL	DR
DW 0	---	Reserved	
DW 1	DPAD	Address range of IM 308-C (e.g. F800$_H$)	
DW 2	IMST	Number of IM 308-C	PROFIBUS address of DP slave
DW 3	FCT	Function of FB IM308C	
DW 4	GCGR	Reserved	
DW 5	TYP	Type of STEP 5 memory area	
DW 6	STAD	Start of STEP 5 memory area	
DW 7	LENG	No. of bytes transferred	
DW 8	ERR	Error word of FB IM308C	
DW 9	---	Slot number of DP/AS-I link	Data record number
DW 10	---	Reserved	
DW 11	---	Error code 1	Error code 2
DW 12	---	Reserved	

FCT parameter

The functions of the DP/AS-I link can only be activated by indirect parameterization. The FCT parameter (DW 3) entered in the data block is used to activate them.

Table D-2 FCT parameter

FCT	Description
DW	Initiates a write job and writes data (Data_Write)
CW	Reads the acknowledgment for the previously initiated write job (Check_Write)
DR	Initiates a read job (Data_Read)
CR	Reads the data and acknowledgment of the previously initiated read job (Check_Read)

Note

You should observe the following rules in order to ensure that the read and write jobs are processed correctly.

- A check job (CW) is necessary after every write job (DW).
- A check job (CR) is necessary after every read job (DR).

FCT = DW parameter

You can use this function to change the address of an AS-I slave or to write parameters to the AS-I slaves. The FCT = DW function can only be activated by indirect parameterization. The data block which is used has the following structure:

Table D-3 FCT = DW parameter

Data word	Parameter	DL	DR
DW 0	---	Not relevant	
DW 1	DPAD	Address range of IM 308-C (e.g. $F800_H$)	
DW 2	IMST	Number of IM 308-C	PROFIBUS address of DP slave Range 1 ... 123 (not checked at present)
DW 3	FCT	Function of FB IM308C: in this case **DW**	
DW 4	GCGR	Not relevant	
DW 5	TYP	Type of S5 memory area	
DW 6	STAD	Not relevant	
DW 7	LENG	Length of S5 memory area in bytes: in this case $\mathbf{03_H}$	
DW 8	ERR	Error word of FB IM308C	
DW 9	---	Slot number: in this case $\mathbf{04_H}$	Data record number: in this case $\mathbf{84_H}$
DW 10	---	Not relevant	
DW 11	---	Error code 1	Error code 2
DW 12	---	Not relevant	

Allocation of S5 memory area

If you have selected FCT = DW, you must allocate the S5 memory area as follows:

Table D-4 Allocation of the S5 memory area if FCT = DW

DB/DX	M/S	Change operating address	Write parameters
DL (n)	Bytes (n)	OPCODE: 02_H	OPCODE: 03_H
DR (n)	Bytes (n + 1)	PARAMETER1: 00 to $1F_H$ Source address	PARAMETER1: 01 to $1F_H$ Slave address
DL (n + 1)	Bytes (n + 2)	PARAMETER2: 00 to $1F_H$ Destination address	PARAMETER2: 0 to $0F_H$ Parameter for AS-I slave

FCT = CW parameter

This function reads the acknowledgments for the previously initiated FCT = DW function. The acknowledgments indicate how the FCT = DW function was terminated (DW 8: ERR parameter of FB IM308C; DW 11: error codes 1 and 2).

The FCT = CW function can only be activated by indirect parameterization. The data block which is used has the following structure:

Table D-5 FCT = CW parameter

Data word	Parameter	DL	DR
DW 0	---	Not relevant	
DW 1	DPAD	Address range of IM 308-C (e.g. $F800_H$)	
DW 2	IMST	Number of IM 308-C	PROFIBUS address of DP slave Range 1 ... 123 (not checked at present)
DW 3	FCT	Function of FB IM308C: in this case **CW**	
DW 4	GCGR	Not relevant	
DW 5	TYP	Not relevant	
DW 6	STAD	Not relevant	
DW 7	LENG	Not relevant	
DW 8	ERR	Acknowledgment: error word of FB IM308C	
DW 9	---	Not relevant	
DW 10	---	Not relevant	
DW 11	---	Acknowledgment: error code 1	Acknowledgment: error code 2
DW 12	---	Not relevant	

Note

If you change the address of an AS-I slave with the FCT = CW function, the original data of the AS-I slave remains valid (i.e. it is not reset).

FCT = DR parameter

This function reads the parameters of the DP/AS-I link. The FCT = DR function can only be activated by indirect parameterization. The data block which is used has the following structure:

Table D-6 FCT = DR parameter

Data word	Parameter	DL	DR
DW 0	---	Not relevant	
DW 1	DPAD	Address range of IM 308-C (e.g. $F800_H$)	
DW 2	IMST	Number of IM 308-C	PROFIBUS address of DP slave Range 1 ... 123 (not checked at present)
DW 3	FCT	Function of FB IM308C: in this case **DR**	
DW 4	GCGR	Not relevant	
DW 5	TYP	Not relevant	
DW 6	STAD	Not relevant	
DW 7	LENG	Length of S5 memory area in bytes: in this case $\mathbf{19_H}$	
DW 8	ERR	Error word of FB IM308C	
DW 9	---	Slot number: in this case $\mathbf{04_H}$	Data record number: in this case $\mathbf{84_H}$
DW 10	---	Not relevant	
DW 11	---	Acknowledgment: error code 1	Acknowledgment: error code 2
DW 12	---	Not relevant	

FCT = CR parameter

This function shows the parameter echo, the version ID and the acknowledgments for the DP/AS-I link following the previously initiated FCT = DR function. The acknowledgments indicate how the FCT = DR function was terminated (DW 8: ERR parameter of FB IM308C; DW 11: error codes 1 and 2).

The FCT = CR function can only be activated by indirect parameterization. The data block which is used has the following structure:

Table D-7 FCT = CR parameter

Data word	Parameter	DL	DR
DW 0	---	Not relevant	
DW 1	DPAD	Address range of IM 308-C (e.g. $F800_H$)	
DW 2	IMST	Number of IM 308-C	PROFIBUS address of DP slave Range 1 ... 123 (not checked at present) Note: 00H or 123 causes an error message (see DW8)
DW 3	FCT	Function of FB IM308C: in this case **CR**	
DW 4	GCGR	Reserved	
DW 5	TYP	Type of STEP 5 memory area	
DW 6	STAD	Start of STEP 5 memory area	
DW 7	LENG	Length of S5 memory area in bytes: in this case $\mathbf{19_H}$	
DW 8	ERR	Acknowledgment: error word of FB IM308C	
DW 9	---	Not relevant	
DW 10	---	Not relevant	
DW 11	---	Acknowledgment: error code 1	Acknowledgment: error code 2
DW 12	---	Reserved	

Data in S5 memory area

The table below shows the allocation of the S5 memory area. The first 16 bytes represent the parameter echo; each nibble corresponds to one slave. In the following nine bytes firmware version and the release date of the DP/AS-I Link are specified in ASCII code.

Table D-8 Allocation of the S5 memory area if FCT = CR

DB/DX	M/S	Parameter echo of AS-I slaves (4 bits each)
DW n	Bytes n / n+1	Irrelevant / slave 1 / slave 2 / slave 3
DW n+1	Bytes n+2 / n+3	Slave 4 / slave 5 / slave 6 / slave 7
DW n+2	Bytes n+4 / n+5	Slave 8 / slave 9 / slave 10 / slave 11
:	:	:
DW n+7	Bytes n+15 / n+16	Slave 28 / slave 29 / slave 30 / slave 31
		Version and release of DP/AS-I link
DW n+8	Bytes n+17 / n+18	$5A30_H$ = Z0 (firmware **Z0**2 of 31.07.96)
DW n+9	Bytes n+19 / n+20	3233_H = 23 (firmware Z0**2** of **3**1.07.96)
DW n+10	Bytes n+21 / n+22	3130_H = 10 (FW Z02 of 3**1.0**7.96)
DW n+11	Bytes n+23 / n+24	3739_H = 79 (FW Z02 of 31.0**7.9**6)
DL n+12	Bytes n+25	36_H = 6 (FW Z02 of 31.07.9**6**)

D.1.2 Interpreting the error messages of FBIM308C (FB 192) (DP/AS-I link only)

ERR parameter

If an error occurs when FB IM308C is processed, information about its cause can be found in DW 8. Please refer to section 7.3.3 for a detailed description of the ERR parameter and the associated error numbers.

If you use the functions of the FB IM308C with the DP-AS-I link, the meanings of the subsequent error numbers of the ERR parameter differ from those specified in Section 7.3.3.

ERR error byte		Meaning	What to do
Hex.	Dec.		
$C1_H$	193	At least one of the additionally required parameters (DW 9 of the parameter DB or the OPCODE in the S5 memory area) is impermissible.	Check the error codes 1 and 2 in DW 11 of the parameter DB in the table in Section D.1.2. There you will find detailed information on the incorrect parameter.
$C3_H$	195	The DP slave has failed.	Use the "read slave diagnosis" (SD) function of the FB IM308C to read the diagnosis of the DP slave.
$C6_H$	198	The desired function could not be executed.	Check the error codes 1 and 2 in DW 11 of the parameter DB in the table in Section D.1.2. There you will find detailed information on the error.

Error code 1 parameter

The left byte of data word DW 11 contains error code 1. Here you can find general information about any read or write errors that have occurred. The following error numbers are output:

- DF_H: An error has occurred during a write job (Data_Write)
- DE_H: An error has occurred during a read job (Data_Read)
- 01_H: A previous job is still running; repeat the last job

Error code 2 parameter

The right byte of data word DW 11 contains error code 2. You can find more detailed information about any errors that have occurred here.

Table D-9 Meaning of the error code 2 parameter

Byte 0		Meaning	Remedy
Hex.	Dec.		
01_H	001	AS-I slave not activated	---
02_H	002	No source slave	Input error; enter correct value
03_H	003	AS-I slave with address 0 already exists	---
04_H	004	Destination slave already exists	---
05_H	005	Cannot delete source address	---
06_H	006	Cannot program source address with new address	---
07_H	007		
08_H	008	Cannot write new parameters	Input error; enter correct value
09_H	009	No meaning	---
$0A_H$	010	No meaning	---
$0B_H$	011	Job number unknown	Input error; enter correct value
$0C_H$	012	Data record unknown	Input error; enter correct value
$0D_H$	013	Opcode of AS-I Manager unknown	Input error; enter correct value
$0E_H$	014	Telegram too long or too short	Enter correct number of bytes
$0F_H$	015	Automatic programming active	Repeat job
10_H	016	Argument too long; source address = destination address	Input error; enter correct argument

D.2 S5-95U: demo FB 30 for saving the overview diagnostics

Demo FB: application

When FB 30 is called, the bits in EW 56 (overview diagnostics) are reset. You thus cannot tell from EW 56 whether the slave is functioning again (see section 10.4.1).

The demo FB 30 shown below (”SLAVEINF”) can be used instead of EW 56 to determine a possible slave failure.

Purpose of the demo FB 30

If a slave can no longer be addressed, the corresponding bit in the ”**INF**” parameter is set in accordance with the overview diagnostics (EW 56). As soon as the slave can be addressed again, the corresponding bit in the ”**INF**” parameter is reset.

Sequence of the demo FB 30

The demo FB 30 (”SLAVEINF”) is described below. Proceed as follows:

1. Call FB 230 during cyclic program processing (see Table D-10).

   Result: The slave diagnostics of all slaves are contained in DB 230 (see Table D-11).

2. Now call the demo FB 30 (”SLAVEINF”) (see Table D-12). The contents of the demo FB 30 are shown in Table D-13.

   Result: The overview diagnostics are contained in MW 230 (”**INF**” parameter) and have the same structure as in EW 56.

Calling FB 230

FB 230 is called during cyclic program processing. The following STEP 5 application program shows how FB 230 is called with four DP slaves:

Table D-10 FB 230 call for the demo FB (”SLAVEINF”)

STL	Description
: U E 56.0	Lowest station
: SPB FB230	
S_NR : KY0,0	
DBNR : KY230,0	Slave diagnostics saved in DB 230, starting at DW 0
: U E 56.1	2nd lowest station
: SPB FB230	
S_NR : KY0,1	
DBNR : KY230,20	Slave diagnostics saved in DB 230, starting at DW 20
: U E 56.2	3rd lowest station
: SPB FB230	
S_NR : KY0,2	
DBNR : KY230,40	Slave diagnostics saved in DB 230, starting at DW 40
: U E 56.3	4th lowest station
: SPB FB230	
S_NR : KY0,3	
DBNR : KY230,60	Slave diagnostics saved in DB 230, starting at DW 60

Contents of DB 230 230

DB 230 contains the slave diagnostics of the slaves you fetched via FB 230. In this case it has the following contents:

Table D-11 Contents of DB 230

Data word	DL	DR
DW 0	PROFIBUS address of DP slave (lowest DP slave)	Number of diagnostic bytes
DW 1	Station status 1	Station status 2
DW 2	...	...
...	...	...
DW 20	PROFIBUS address of DP slave (2nd lowest DP slave)	Number of diagnostic bytes
DW 21	Station status 1	Station status 2
DW 22	...	...
...	...	...
DW 40	PROFIBUS address of DP slave (3rd lowest DP slave)	Number of diagnostic bytes
DW 41	Station status 1	Station status 2
DW 42	...	...
...	...	...
DW 60	PROFIBUS address of DP slave (4th lowest DP slave)	Number of diagnostic bytes
DW 61	Station status 1	Station status 2
DW 62	...	...
...	...	...

Calling the demo FB 30 (”SLAVEINF”)

The following example shows how the demo FB 30 (”SLAVEINF”) is called during cyclic program processing.

Table D-12 Call for the demo FB 30 (”SLAVEINF”)

```
STL                         Meaning
OB 1
       : L KF 230           Loads DB number
       : TMB 10             Saves DB number in MB 10
       : SPA FB 30          Branches to FB 30 SLAVEINF

DBNR   :     MB 10          MB 10 ––> KF 230
INF    :     MW 230         Overview diagnostics contained in MW 230; compare EW 56
ST01   :     DL 1           Station status 1 of lowest station
ST02   :     DL 21          Station status 1 of 2nd lowest station
ST03   :     DL 41          Station status 1 of 3rd lowest station
ST04   :     DL 61          Station status 1 of 4th lowest station
```

Contents of the demo FB 30 ("SLAVEINF")

The following demo FB 30 ("SLAVEINF") was written for four slaves, but can be adapted if necessary for any other number of slaves.

Table D-13 Contents of the demo FB 30 ("SLAVEINF")

STL	Meaning
Network 1 0000	
Name :SLAVEINF	
Des :DBNR E/A/D/B/T/Z: B	
Des :INF E/A/D/B/T/Z: E BI/BY/W/D: W	
Des :ST01 E/A/D/B/T/Z: E I/BY/W/D: BY	
Des :ST02 E/A/D/B/T/Z: E BI/BY/W/D: BY	
Des :ST03 E/A/D/B/T/Z: E BI/BY/W/D: BY	
Des :ST04 E/A/D/B/T/Z: EI/BY/W/D: BY	
:	
:	
:B =DBNR	A DBxx (xx => number)
:	Check for lowest slave
:L =ST01	Station status 1 of lowest slave (see
:	E 56.0)
:L KH 0001	corresponds to => slave cannot be ad-
:	dressed (=> slave failure)
:!=F	If slave failure => branch
:SPB =M001	
:L =INF	If no slave failure => reset
:L KH FEFF	bit 0 of INF parameter
:UW	via UW link
:T =INF	
:	
:L =ST02	Check for 2nd lowest slave (see E
:L KH 0001	56.1)
:!=F	
:SPB =M002	
:L =INF	
:L KH FDFF	
:UW	
:T =INF	
:	
:L =ST03	Check for 3rd lowest slave
:L KH 0001	
:!=F	
:SPB =M003	
:L =INF	
:L KH FBFF	
:UW	
:T =INF	
:	
:L =ST04	Check for 4th lowest slave
:L KH 0001	
:!=F	
:SPB =M004	
:L =INF	
:L KH F7FF	
:UW	
:T =INF	
:	
:	
:BEA	etc. for all other slaves
:	

Table D-13 Contents of the demo FB 30 (”SLAVEINF”), continued

```
M001   :L    =INF                          Failure: lowest slave
       :L    KH 0100                       Set bit 8 of INF parameter via OW
       :OW                                 link
       :T    =INF
       :BEA

M002   :L    =INF                          Failure: 2nd lowest slave
       :L    KH 0200                       Set bit 9 of INF parameter via OW
       :OW                                 link
       :T    =INF
       :BEA

M003   :L    =INF                          Failure: 3rd lowest slave
       :L    KH 0400                       Set bit 9 of INF parameter via OW
       :OW                                 link
       :T    =INF
       :BEA

M004   :L    =INF                          Failure: 4th lowest slave
       :L    KH 0800                       Set bit 11 of INF parameter via OW
       :OW                                 link
       :T    =INF
       :BE                                 etc. for all other slaves
```

Example

The interpretation with FB 30 ("SLAVEINF") is shown below with the aid of an example.

Assumptions:

- Four stations with the following PROFIBUS addresses: 5, 20, 110, 123.
- Station 110 has failed.

The overview diagnostics (EW 56) thus have the following appearance:

Table D-14 Overview diagnostics

Input byte	**Bit position**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
56	0	0	0	0	0	1	0	0
57	0	0	0	0	0	0	0	0

[1] Bits correspond to the DP slaves ranging from the lowest to the highest PROFIBUS address: (lowest PROFIBUS address: EB 56.0; highest PROFIBUS address with 16 slaves: EB 57.7).

1. You can fetch the slave diagnostics via FB 230 and save them in DB 230, starting at DW 40, for station 110 (--> EB 56 = 00_H).
2. You can evaluate the slave diagnostics with the aid of FB 30 ("SLAVEINF")and set the corresponding bits in the "INF" parameter (MW 230).

Result: MW 230 now has the following appearance (cf. Table 10-4, EW 56):

Table D-15 MW 230

Flag word 230	**Bit position**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
MB 230	0	0	0	0	0	1	0	0
MB 231	0	0	0	0	0	0	0	0

This tells you that the 3rd lowest station (station 110) has failed.

Dimensional drawings

E

In this chapter

This chapter contains dimensional drawings of all the components described in this manual.

The dimensional drawing of the S5-95U programmable controller is in the system manual *S5-95U Programmable Controller.*

E.1 Dimensional drawing of the IM 308-C master interface

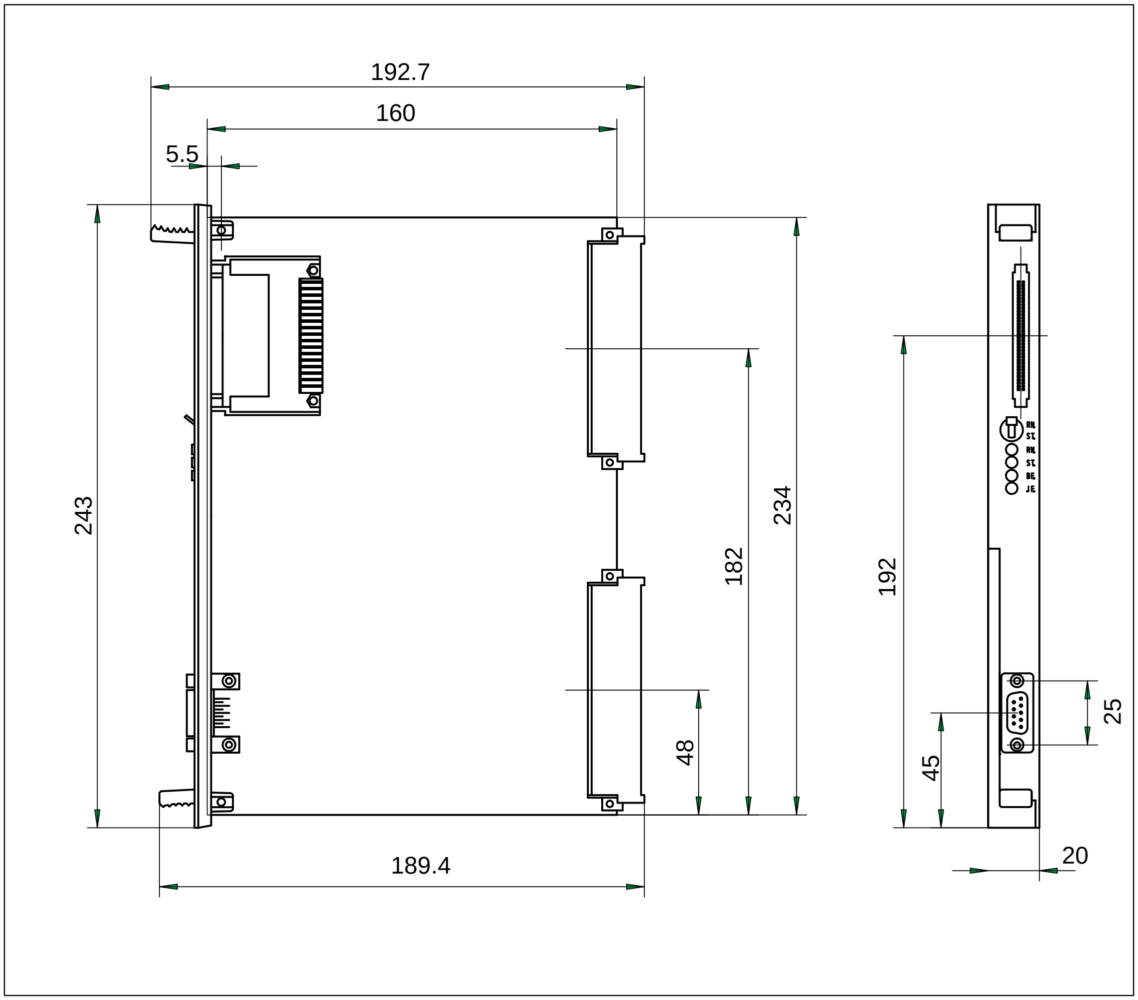


Figure E-1 Dimensional drawing of the IM 308-C master interface

E.2 Dimensional drawings of the bus connector

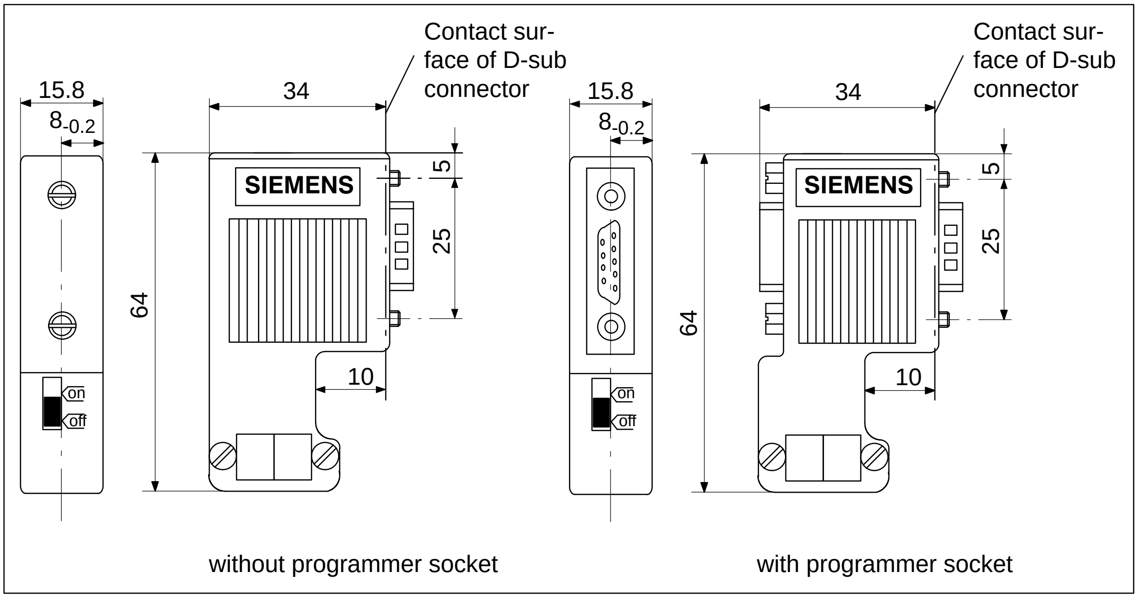


Figure E-2 IP 20 bus connector (6ES7 972-0B.11-0XA0)

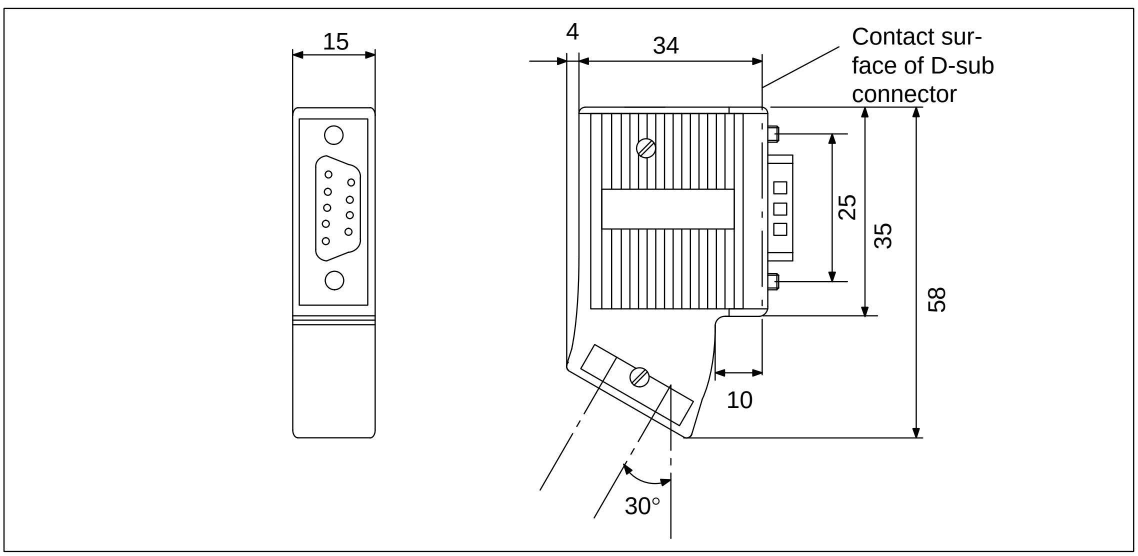


Figure E-3 IP 20 bus connector (6ES7 972-0BA30-0XA0)

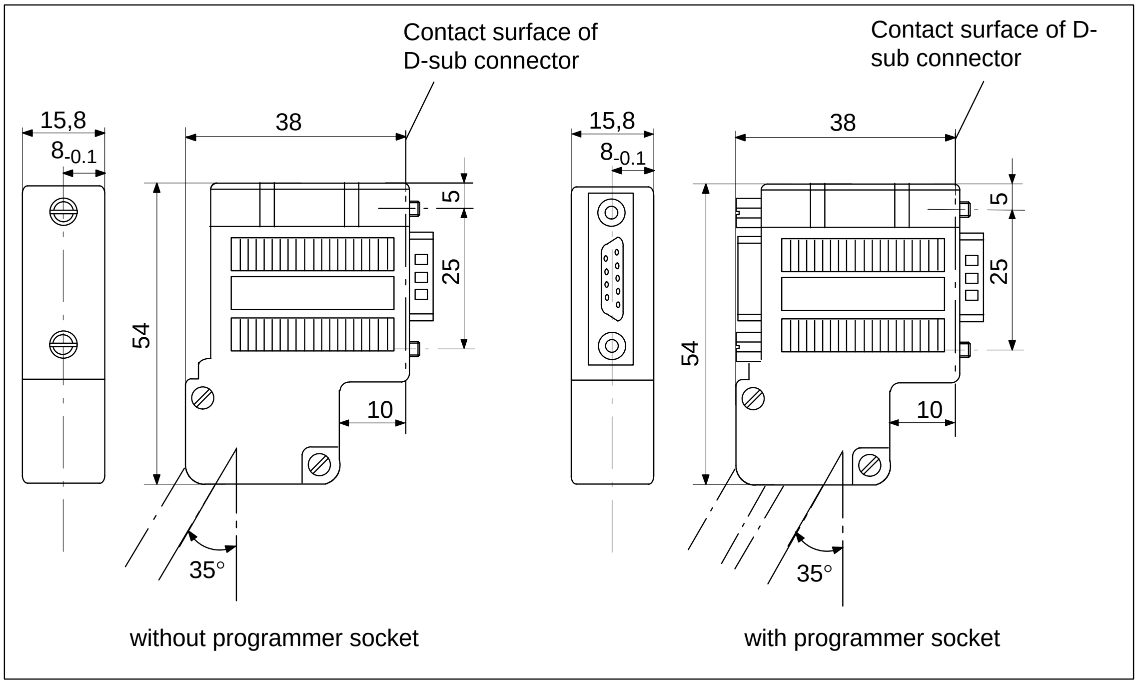


Figure E-4 IP 20 bus connector (6ES7 972-0B.40-0XA0)

E.3 Dimensional drawings of the RS 485 repeater

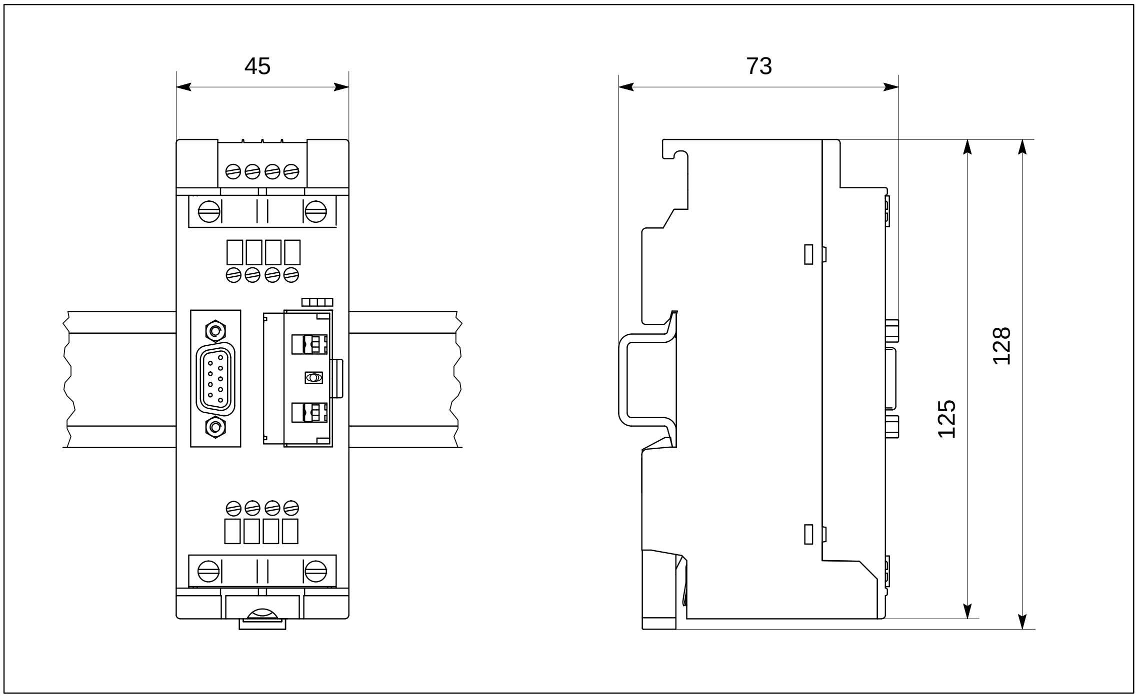


Figure E-5 RS 485 repeater on standard-section busbar

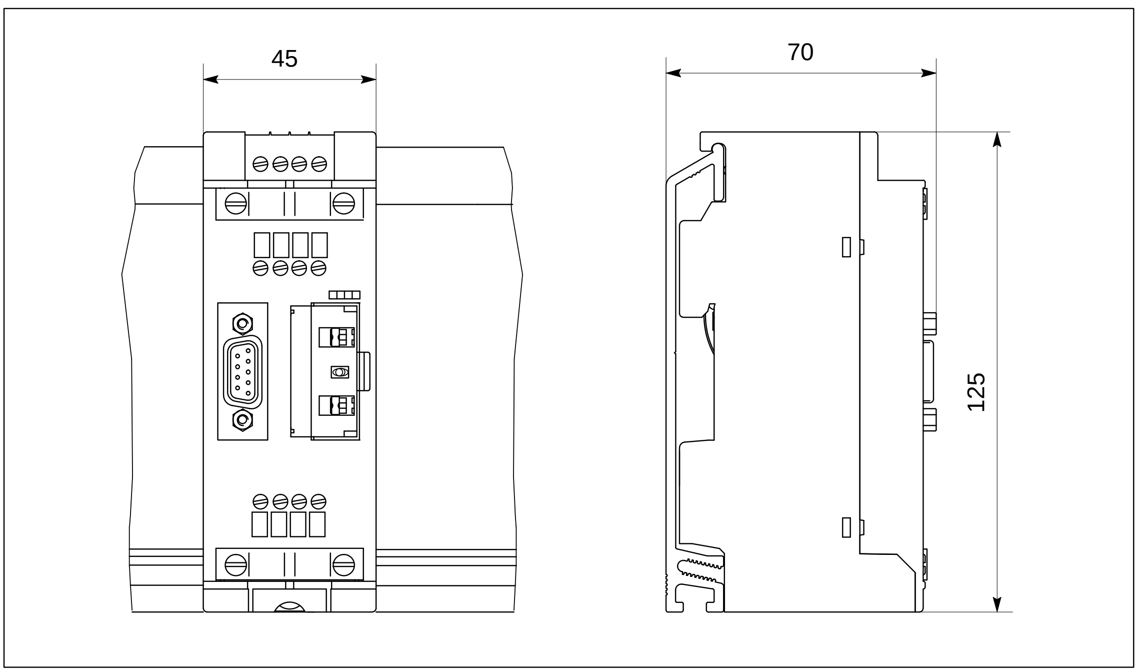


Figure E-6 RS 485 repeater on busbar for S7-300

E.4 Dimensional drawing of the PROFIBUS Terminator

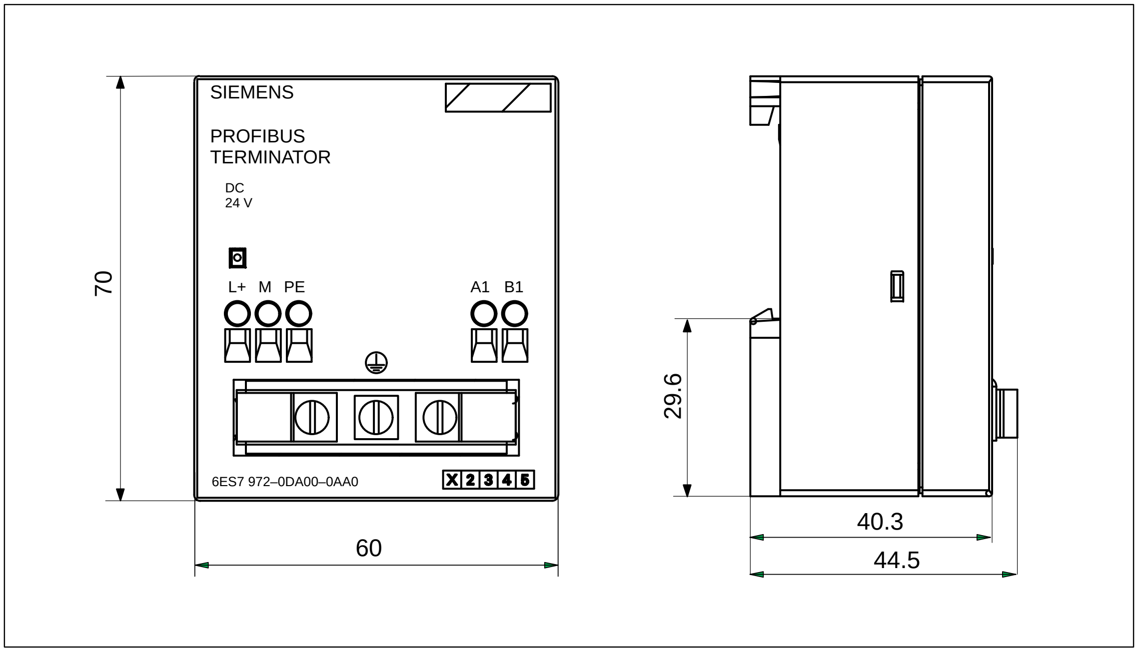


Figure E-7 PROFIBUS Terminator

Order numbers

F

Order numbers

Table F-1 lists all the components, complete with order numbers, that you can order as options for the ET 200 distributed I/O system.

Note

You can find additional order numbers in Catalog ST PI, PROFIBUS & AS Interface, Components on the Field Bus. Your SIEMENS partner will be glad to help you.

Table F-1 Order numbers

Part	Order number	Comment
COM PROFIBUS, as of V 5.0 (including the *COM PROFIBUS* manual (PDF))	6ES5 895-6SE03	–
COM PROFIBUS V 3.3	6ES5 895-6SE.2	–
IM 308-C (including memory card)	6ES5 308-3UC11	–
Memory card for IM 308-C (flash EPROM)		
• 256 KB	6ES5 374-1FH21	No longer available
• 256 KB	6ES5 374-1KH21*	–
• 512 KB	6ES5 374-1FJ21	No longer available
• 1 MB	6ES5 374-1KK21*	–
Programming adapter for the memory card	6ES5 985-2MC11	–
S5-95U programmable controller with DP master interface (including 32 K-EEPROM)	6ES5 095-8ME01	–
32 K-EEPROM for S5-95U with DP master interface	6ES5 375-0LC61	–

Table F-1 Order numbers, continued

Part	Order number	Comment
Bus connector		
• Up to 12 Mbps	6ES7 972-0BA10-0XA0	Without programming port
• Up to 12 Mbps	6ES7 972-0BB10-0XA0	With programming port
• Up to 12 Mbps, 30° outgoing cable unit	6ES7 972-0BA30-0XA0	Without programming port
• Up to 12 Mbps, 35° outgoing cable unit	6ES7 972-0BA40-0XA0	Without programming port
• Up to 12 Mbps, 35° outgoing cable unit	6ES7 972-0BB40-0XA0	With programming port
RS 485 repeater in IP 20	6ES7 972-0AA01-0XA0	–
PROFIBUS Terminator	6ES7 972-0DA00-0AA0	–
Bus cable		–
• Bus line	6XV1 830-0AH10	
• Bus line with PE sheath	6XV1 830-0BH10	
• Direct-buried cable	6XV1 830-3AH10	
• Trailing cable	6XV1 830-3BH10	
• Bus line with festoon attachment	6XV1 830-3CH10	
E(E)PROM programming device for parallel interface (LPT1)		–
• E(E)PROM programming device	6ES5 696-3AA11	
• STEP 5/ST PC package, external PROM programmer	S79200-A0567-F088	
• Connecting cable (1.5 m in length)	C79195-A3863-H150	

Table F-1 Order numbers, continued

Part	Order number	Comment
Manuals		–
• System Manual *S5-90U/S5-95U Programmable Controller*	6ES5 998-8MA.2	
• *SINEC CP 5412 (A2)*	6GK1 971-5CA00-0AA.	
• *SINEC L2-DP Interface of the S5-95U Programmable Controller* (DP slave)	6ES5 998-8MD.1	
• *ET 200B Distributed I/O Device*	6ES5 998-4ET.1	
• *ET 200C Distributed I/O Device*	6ES5 998-3EC.1	
• *ET 200L Distributed I/O Device*	6ES7 130-1AA00-8.A0	
• *ET 200M Distributed I/O Device*	6ES7 153-1AA00-8.A0	
• *ET 200U Distributed I/O Device*	6ES5 998-5ET.1	
• *ET 200S Distributed I/O Device*	6ES7 151-1AA00-8.A0	
• *ET 200X Distributed I/O Device*	6ES7 198-8FA00-8.A0	
• *DP/AS-I Link*	6ES7-156-0AA00-8.A0	
• *ET 200 Handheld*	6ES5 998-7ET.1	
• *SIMATIC NET PROFIBUS Networks*	6GK1 970-5CA10-0AA.	
Repeater adapter	6GK1 510-1AA00	–
PROFIBUS RS 485 bus terminal	6GK1 500-0A.00	–
Optical link modules for fiber-optic cables	6GK1 502-3AB00 6GK1 502-4AB00	–

* This memory card is also shipped with the IM 308-C (6ES5 308-3UC11).

COM PROFIBUS V3.3 or lower

G

In this chapter

You only need to read this chapter if you are working with COM PROFIBUS V3.0 to V3.3. You will find the documentation for COM PROFIBUS V 5.0 on the COM PROFIBUS CD-ROM (see also Section 12).

For a limited transitional period, COM PROFIBUS V3.3 will be shipped in parallel with the new COM PROFIBUS V 5.0.

This chapter contains a full description for COM PROFIBUS V3.0 to V3.3.

Purpose of the chapter

Once you have read this chapter:

- You will know how to install COM PROFIBUS on your programming device or PC and how to work with COM PROFIBUS.
- You will be able to enter the entire configuration of an ET 200 distributed I/O system in COM PROFIBUS.

G.1 Differences between COM PROFIBUS V3.0 to V3.3 and important information on the online functions

COM PROFIBUS: from V3.2 to V3.3

COM PROFIBUS V3.3 has the following new functions and features that were not available in V3.2:

- The “control” function is now available for the station type ET 200L-SC, ET 200L-SC IM-SC.
- You can use the **Help ▸ Info via DP card** menu command to check the installed DP card and any associated ressources.
- The CP 5412 (A2) now supports automatic transmission rate detection.
- The CP 5412 (A2) as DP master supports the “Overview diagnostics” online function.

COM PROFIBUS: from V3.1 to V3.2

COM PROFIBUS V3.2 has the following new functions and features that were not available in V3.1:

- Under the Windows 95 operating system, the online functions are also possible using the CP5611 adapter (PCI). This adapter handles all PROFIBUS transmission rates up to 12 Mbps.
- Before each online function is started, COM PROFIBUS determines the current transmission rate on the PROFIBUS and sets it. You no longer need to know in advance the current transmission rate of a bus system you want to diagnose using the programming device/PC.
  Restrictions:
  - The CP 5412 (A2) does not support automatic transmission rate detection.
  - The MPI cards can detect transmission rates of up to 1.5 Mbps, but note that under COM PROFIBUS the MPI cards can only be run up to a maximum of 500 kbps.
- Stations of the type ET 200L-SC IM-SC can also be configured.
- If you have started one of the online functions (overview diagnosis, slave diagnosis, status of the DP slave inputs/outputs), you can use the F1 key to obtain context-sensitive help.
- In the ”Master parameters” dialog box, you can activate the AUTOCLEAR functionality for SIMATIC NET PC modules. In AUTOCLEAR mode, the CP 5412 (A2) or Softnet DP automatically switches to CLEAR mode (the DP system is powered down) if a malfunction occurs in one or more DP slaves during the productive phase.

  In CLEAR mode, the DP master sends data with a value of 0h to the DP slaves in the output direction. The DP master does not exit this mode independently; the user has to explicitly initiate a return to OPERATE mode.

COM PROFIBUS: from V3.0 to V3.1 – Brief Overview –

COM PROFIBUS V3.1 has the following new functions and featuresthat were not available in V3.0:

- The full functionality of the online status and error diagnostic functions (overview diagnostics, slave diagnostics, status of the DP slave inputs/ outputs) can be used.
- The new online function “Control” allows you to set the outputs of the DP slaves (see next page).
- The **File ▸ Export ▸ ASCII file** and **File ▸ Import ▸ ASCII file** menu commands allow the configuration of a master system to be saved and loaded in ASCII format.
- Device master files can be created for connecting DP slaves of the ET 200 family to DP masters that are not configured using COM PROFIBUS (see next page).
- Additional parameters are offered in the “Bus parameters” dialog box for optimizing bus and response times: “Number of repeaters”, “Number of OLMs” (optical link modules), “Line length (CU)” and “Line length (FO)”.
- A baud rate of 45.45 kbaud can be parameterized for PROFIBUS-PA (DP/ PQ coupler).
- All online functions are also supported for the CP 5412 (A2) in DP mode.
- When working with the CP 5412 (A2), you can use the “Overview” button in the “Master parameters” dialog box to display an overview of all the configured FMS connections together with the most important parameters.
- When working with the CP 5412 (A2), you can use the “Cyclical frames” button in the “Groups and their properties” dialog box to configure the cyclical sending of the FREEZE and SYNC control commands.
- S5 function blocks for the analog modules of an ET 200M are shipped with this version of COM PROFIBUS. After installation you will find the S5 functions together with a detailed description (readme.doc) in the COM PROFIBUS directory **`...\ANALOG`**.

Controlling the Outputs

As of version 3.1 of COM PROFIBUS you can control the outputs of the DP slaves on the PROFIBUS-DP from the programming device/PC.
Proceed as follows:

1. Select the DP slave in the graphical editing window.
2. Choose the **Service ▸ Status/control** menu command or the **Status/control** command from the pop-up menu for the slave (by clicking the slave with the right mouse button).
3. Suppress the status display of the slave inputs/outputs by clicking  on the COM PROFIBUS toolbar.
4. Specify new control values in the white fields of the ”Outputs” column in the table.
5. Start the control of the outputs with the new control values by clicking . Communication between the slave and the master (class 1) is interrupted. The programming device/PC (master class 2) with COM PROFIBUS is the master for this period.
6. You click  to switch from control back to the current status display of the inputs/outputs. The connection to the master (class 1) is re-established.

Note: If there is no master (class 1) on the bus, “Status” is not possible.

Note: The “Control” function is **not** available for the PROFIBUS card “MPI_ISA_Karte” and for the station types DP/AS-I Link and ET 200L-SC.

Creating a Device-Master File

As of version 3.1 of COM PROFIBUS, you can create device master files for connecting DP slaves of the ET 200 family to DP masters of other manufacturers.

Principle: You use COM PROFIBUS to configure the DP slave in the usual way. COM PROFIBUS creates a device master file on the basis of the configuration data. The device master file contains the configuration data of the DP slave optionally in the form of a compact station or a modular station. You copy the device master file to the device master directory of the other manufacturer’s configuration tool. This gives the configuration tool a DP slave with fixed parameterization; the only thing left to do is address assignment.

Proceed as follows:

1. Choose the **File ▸ New** menu command.
2. Select ”Default master” as the master station type in the “Master host selection” dialog box.

   Result: The graphical editing window appears with a default as the master.
3. Configure the DP slaves in this window in the same way as you do for a full configuration with COM PROFIBUS (except for addressing).
4. Select a DP slave in the window.
5. Choose the **File ▸ Create device master file** menu command.
6. In the ”Create device master file” dialog box, specify the device name, the identifier format type and the modularity of the station and then confirm you entries.

Note

Select only an identifier format type and station modularity that can be interpreted by the non-Siemens configuration tool or DP master (non-Siemens master).

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7. In the ”Save as” dialog box, specify the directory and name of the device master file and then confirm your entries.

Result: COM PROFIBUS stores the device master files in the ...\PROGDAT directory.

”Create GSD File” Dialog and Examples

Two check boxes in the ”Create GSD File” dialog box (below) allow you to specify the identifier format type and modularity in which the configuration is entered in the device master file.

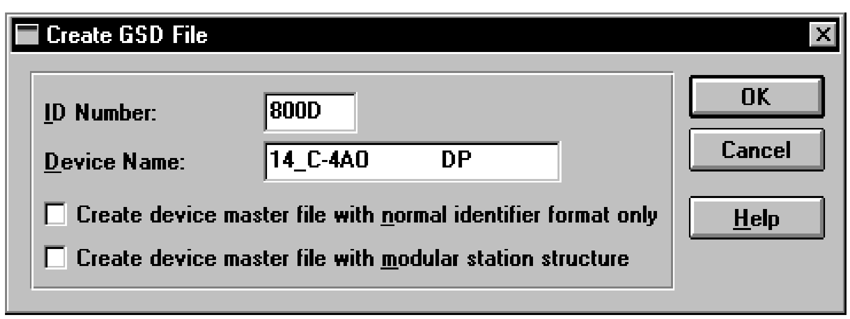

Figure G-1 ”Create GSD File” Dialog Box

Variant 1: Configuration in normal identifier format and compact station

☒ Create device master file with normal identifier format only
☐ Create device master file with modular station structure

Example of entry in device master file (ET 200M (IM153-1) with 16DE and 4AA):

... Module=”Cfg–Data” 0x00, 0x00, 0x00, 0x11, 0x63 EndModule ...	S7 header (3 bytes), 16DI, 4AO

Variant 2: Configuration in special identifier format and compact station

☐ Create device master file with normal identifier format only
☐ Create device master file with modular station structure

Example of entry in device master file (ET 200M (IM153-1) with 16DE and 4AA):

... Module=”Cfg–Data” 0x04, 0x00, 0x00, 0xAD, 0xC4, 0x04, 0x00, 0x00, 0x8B, 0x41, 0x04, 0x00, 0x00, 0x8F, 0xC0, 0x43, 0x01, 0x00, 0x9F, 0xC2, 0x83, 0x43, 0x00, 0x25, 0xE0 EndModule ...	S7 header (15 bytes), 16DI, 4AO

Variant 3: Configuration in normal identifier format and modular station

☒ Create device master file with normal identifier format only
☒ Create device master file with modular station structure

Example of entry in device master file (ET 200M (IM153-1) with 16DE and 4AA):

...	
Module=”Module 1” 0x00	S7 header
EndModule	
Module=”Module 2” 0x00	S7 header
EndModule	
Module=”Module 3” 0x00	S7 header
EndModule	
Module=”Module 4” 0x11	16DI
EndModule	
Module=”Module 5” 0x63	4AO
EndModule	
...	

Variant 4: Configuration in special identifier format and modular station

☐ Create device master file with normal identifier format only
☒ Create device master file with modular station structure

Example of entry in device master file (ET 200M (IM153-1) with 16DE and 4AA):

`...`	
`Module="Module 1" 0x04, 0x00, 0x00, 0xAD, 0xC4`	S header
`EndModule`	
`Module="Module 2" 0x04, 0x00, 0x00, 0x8B, 0x41`	S7 header
`EndModule`	
`Module="Module 3" 0x04, 0x00, 0x00, 0x8F, 0xC0`	S7 header
`EndModule`	
`Module="Module 4" 0x43, 0x01, 0x00, 0x9F, 0xC2`	16DI
`EndModule`	
`Module="Module 5" 0x83, 0x43, 0x00, 0x25, 0xE0`	4AO
`EndModule`	
`...`	

PROFIBUS Monitor

PROFIBUS Monitor is also shipped with COM PROFIBUS. PROFIBUS Monitor appears after installation in the COM PROFIBUS program group. It is supplied free of charge, and no claims can therefore be made if it is not bug-free.

There is no description of PROFIBUS Monitor in the *ET 200 Distributed I/O Device* manual. There is a detailed description of its functions in the *Monitor.wri* file, which you will find next to the PROFIBUS Monitor icon in the program group.

The CP 5412 (A2) does **not** support the PROFIBUS Monitor shipped with COM PROFIBUS.

COM PROFIBUS, online functions

When you enter the DP parameters, please note the following in connection with the online functions of COM PROFIBUS:

- The online functions are not supported by COM PROFIBUS under MS Windows NT. They can be run under MS Windows 3.x or MS Windows 95 on the basis of the CP 5411, the CP 5412 (A2), the CP 5511 and the MPI cards (integrated MPI interface for Siemens programmers, MPI_ISO card).
- The CP 5511 cannot be withdrawn during online operation.
- All open MS-DOS applications must be closed before you activate an online function in Windows 95. Otherwise, there is a danger that interrupts will be lost and COM PROFIBUS will crash.
- When you select the overview diagnostics, the set program file must coincide with the current master parameters. If not, the information which is displayed will not match the actual bus configuration.
- When you select the **Import ▸ DP master** function, the bus profile you have defined and the baud rate of the DP card must coincide with the actual bus parameters. If not, you will not be able to set up a connection to the selected station.

  If you encounter any errors in connection with the baud rate or the bus profile, the reaction times on the programmer/PC may be as much as several minutes.
  Tip: You can shorten this time by disconnecting the PROFIBUS cable from the programmer/PC.
- If a sequence error is indicated for the **Export ▸ DP master** or **Import ▸ DP master** function, you must wait for a standard period of at least 65 s before attempting to activate the function again.
- You must close all online applications before you exit COM PROFIBUS.
- Permanent virus checks may impair the online functions.

Creating program files with COM PROFIBUS < V3.2

If you use COM PROFIBUS V3.3 to edit a program file created using COM PROFIBUS < V3.2, the following host type errors occur when the program file is read in:

Setting in V3.0	Corruption in V3.1	Corruption in V3.2/3.3
CPU 928A	CPU 928	CPU 928
CPU 928B	CPU 946/947	CPU 946/947
CPU 946/947	CPU 948	CPU 948
CPU 948	CPU 948	SINUMERIK 840C

In this case, proceed as follows:

1. Open the program file in COM PROFIBUS V3.3.
2. Choose the **Configure ▸ Host parameters** menu command.
3. Click the ”Host type” button in the “Host parameters” dialog box.
4. Select the correct host type, and then click “OK”.
5. If your bus configuration consists of a number of masters on different hosts, carry out steps 2. to 4. for each host.

Program files created using V3.1 are no longer corrupted as of V3.2.

G.2 Scope of applications and preconditions for using the COM PROFIBUS parameterization software

Why you need COM PROFIBUS

You need the COM PROFIBUS parameterization software:

- to parameterize the bus configuration, the hosts, the masters and the slaves
- to read the data from a memory card/master or write data to a memory card/master, and
- to start up the bus configuration
- to generate detailed system documentation

Preconditions for working with COM PROFIBUS

COM PROFIBUS runs under the MS-Windows GUI. We assume that you are familiar with MS-Windows.

Preconditions for using COM PROFIBUS

in order to use the full functionality of COM PROFIBUS, you require:

- The MS-DOS operating system, V 5.0 or higher
- The MS-Windows GUI (V 3.1x or higher) or Windows 95
- At least 8 Mbytes free RAM
- Approx. 10 Mbytes free space on hard disk
- 386 CPU or faster

DP online functions of the PC/programmer

You can use your PC or programmer online on the PROFIBUS with COM PROFIBUS V3.0 or higher, in other words the PC/programmer takes part in data communication on the PROFIBUS as an active bus station with PROFIBUS address 0.

You need the online functions for the service functions of COM PROFIBUS (e.g. diagnostics) as well as for transferring a master system directly to the master via PROFIBUS.

Preconditions for using the DP online functions

You require one of the PROFIBUS cards for PCs/programmers shown in Table G-1 in order to use the online functions of COM PROFIBUS or the diagnostic functions.

Detailed installation instructions are enclosed with the PROFIBUS cards. You must use the programming adapter with order number 6ES7 901-4BD00-0XA0, for example, to connect the programmer/PC to the PROFIBUS. You do not need to take account of any spur capacitances with this programming adapter (see section 3.5).

In the majority of situations, the PROFIBUS cards work correctly with the default setups. If this is not the case, please check the following setups, to make sure there are no conflicts with other plug-in cards.

Table G-1 Possible setups on the PROFIBUS card for the online functions of COM PROFIBUS

Card type	**Card setups for COM stored in the following section of the <...\kernel\comet.ini> file:**	**Permissible interrupts (IRQ)**	**Required address range in the memory area below 1 Mbyte:**	**Memory area which must be excluded with emm386.exe in config.sys file**	**Memory area which must be excluded in Windows system.ini file in [386enh] section**
Integrated MPI interface (Siemens programmers only)	[MPI_1]	Possible IRQs: 5, 10, 11, 12, 15 Default: **11**	Length 100h Default address: **0xCC000** [1]	Occupied memory area Default: **X=CC00-CCFF**	Occupied memory area Default: **EMMEXCLUDE= CC00-CCFF**
MPI_ISA card	[MP1_1]	Possible IRQs: 5, 10, 11, 12, 15 Default: **11**	Length 100h Default address: **0xDC000**	Occupied memory area Default: **X=DC00-DCFF**	Occupied memory area Default: **EMMEXCLUDE= DC00-DCFF**
CP5411 card	[DPI_1]	Possible IRQs: 5, 10, 11, 12, 15 Default: **11**	No	No	No
CP5511 card (PCMCIA) [2]	[DPP_1]	This card is started up automatically when the Card and Socket Services are installed.			

1 The set address can be checked and altered if necessary using the BIOS Setup program.

2 The Card and Socket Services, which are essential for operation, do not form part of the scope of supply of COM PROFIBUS. Please call the hotline to order the Card and Socket Services for Siemens programmers.
You can find more information about the CP5511 card in the file called ”\kernel\online.wri” in the COM PROFIBUS directory, providing you have installed the online functions with the CP5511 card.

Note

Please note that with COM PROFIBUS the MPI cards (integrated MPI interface, MPI-ISA card) can only be operated up to a transmission rate of 500 kbaud.

G.3 Starting COM PROFIBUS

Making a backup copy

Before you install COM PROFIBUS, you should use MS-DOS, the File Manager under MS-Windows or the Explorer under Windows 95 to create a backup copy of the system disks.

Thereafter, you use only the backup copy.

Installing COM PROFIBUS

To install COM PROFIBUS:

1. Insert the first disk of the COM PROFIBUS set in a disk drive, e.g. drive A.
2. Start the File Manager under MS-Windows or the Explorer under Windows 95.
3. Select the ”SETUP.EXE” command on the COM PROFIBUS disk, e.g. on drive A.

   Result: The COM PROFIBUS installation program is started.
4. Choose another directory if you do not want to use the default directory, then click ”Install”.
5. Select the program components that you require and confirm them by clicking ”OK”.
6. Specify the program group in which you want to install COM PROFIBUS, e.g. ”Siemens COM PROFIBUS”.
7. Follow the instructions provided by COM PROFIBUS to install the software.

   Result: COM PROFIBUS is installed on your PC or programmer.
8. Check that the pointer to the STEP7/S7BIN directory has been written correctly into your ”AUTOEXEC.BAT”. If the entry is not correct, add the following line to your ”AUTOEXEC.BAT”:

   ```
   path = [drive]:\STEP7\S7BIN ;
   ```

   e.g. for drive C:

   ```
   path = C:\STEP7\S7BIN
   ```
9. Reboot your programmer or PC.
10. If you intend using the memory card functions, make sure that the memory card driver is loaded when MS-WINDOWS starts (WINSTART.BAT).

Installing the DP online functions

Pay attention to the following points when you install the online functions of COM PROFIBUS:

- If you forget to install the online functions, you can also load them later on without having to repeat the complete installation procedure. To do so, simply select the ”Add Online Functions” option.
- The online functions take up a lot of space in your RAM. Do not install them unless you actually need them!
- If you install the online functions by mistake, you can uninstall them again without having to repeat the complete procedure. To do so, simply start the <setup.exe> program and mark ”Add Online Functions” under Options. You can then specify ”Application Without Online Functions” during the installation procedure.
- Please also read the additional information about using your particular PROFIBUS card in the programmer/PC which is contained in section G.2.

Starting COM PROFIBUS

To start COM PROFIBUS:

1. Select the ”Siemens COM PROFIBUS” group in the Program Manager (default name), and
2. Double-click on the icon for COM PROFIBUS.

G.4 Graphical user interface of COM PROFIBUS

Overview

The COM PROFIBUS GUI incorporates the following standard elements (for example):

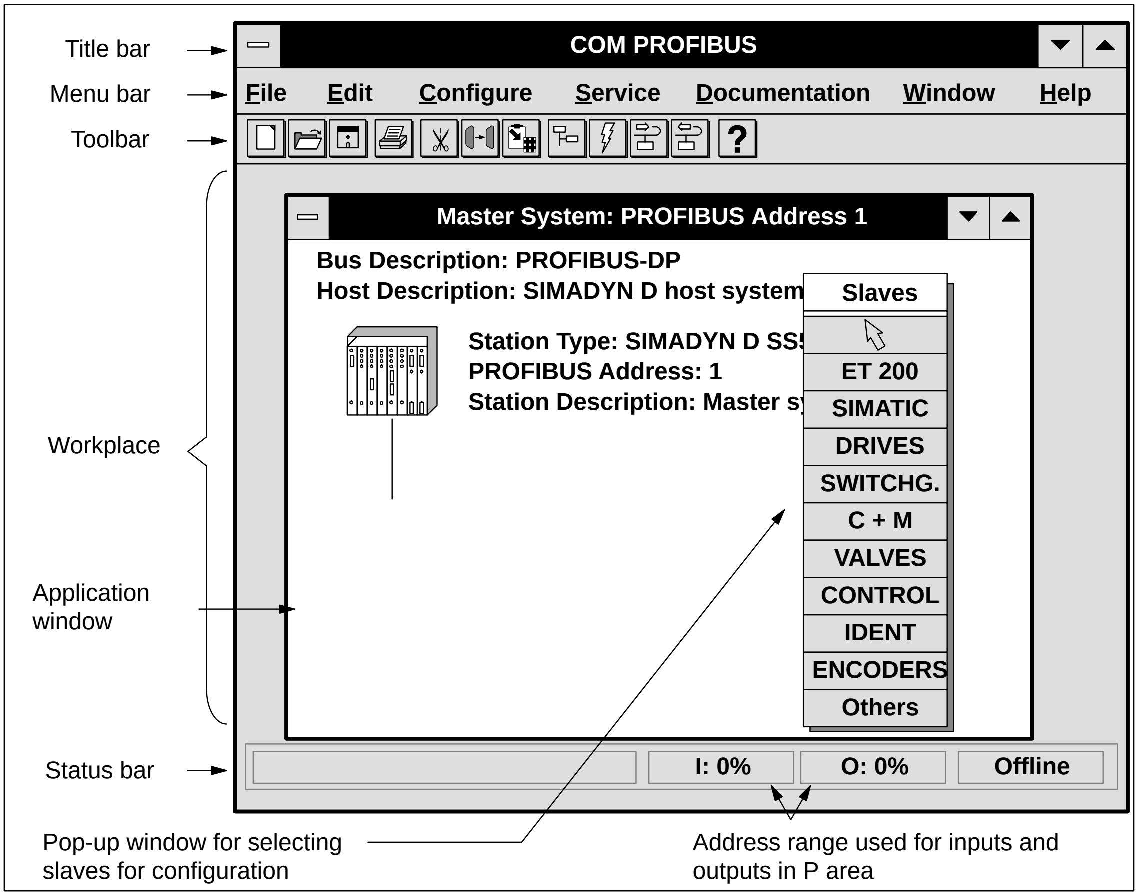

Figure G-2 Screen elements of COM PROFIBUS

Title bar

The title bar always contains the name of the application, in this case ”COM PROFIBUS”.

Status bar

The status bar contains outline information indicating the currently active command, the current activity of COM PROFIBUS or notes referring to operator inputs.

The status bar also indicates the amount of address space already assigned for inputs and outputs.

Menu bar

The menu bar contains the names of the various pull-down menus. By opening a pull-down menu, you can call certain functions:

Table G-2 The functions in the pull-down menus

Menu	Commands in menu
File	Open, save and close program files Read (import) master systems from a memory card, a DP master or a binary file Save (export) master systems to a memory card, a DP master, a binary file or an NCM file Export the operating system file to a memory card for IM 308-C Re-import device master files and type files Print system documentation
Edit	Cut, copy, paste and delete selected DP slaves or FMS stations
Configure	Enter bus, host, master and DP slave parameters or FMS station parameters Generate a new master system, a new DP slave or a new FMS station Change from DP parameterization to FMS parameterization and vice versa Arrange DP slaves in groups
Service	Display the overview and slave diagnostics Status of the slave inputs/outputs Change the PROFIBUS address of a slave using PROFIBUS Activate a parameter record after exporting it to the DP master Set the parameters on the PROFIBUS card Display the data cycle times Switch the programmer/PC offline from PROFIBUS Delete memory cards
Documentation	Print system documentation
Window	Change to a different window
Help	Online help

Mouse

The mouse buttons have the following functions in COM PROFIBUS:

Table G-3 Functions of the mouse buttons

Function	Meaning
Click left mouse button once	Select
Click left mouse button twice	Open window for selection
Click right mouse button and hold down	Pop-up menu with most important functions

Toolbar

The toolbar contains icons that you can use to select commands without working through the menus:

Table G-4 Meanings of icons

Icon	Menu command	Description	Icon	Menu command	Description
	File ▶ New	Creates a new file		Edit ▶ Copy	Copies the selected DP slave(s)/FMS station(s) **withou**t S5 addresses
	File ▶ Open	Opens an existing program file of COM PROFIBUS		Configure ▶ New master system	Opens a new master system with PROFIBUS address query for the master
	File ▶ Save	Saves the configuration in the current program file		File ▶ Export ▶ Memory card	Exports the current program file to a memory card
	Print	Prints system documentation for the open documentation window		File ▶ Export▶ DP master	Exports master system to DP master
	Edit ▶ Cut	Cuts out the selected DP slave(s)/FMS station(s)		File ▶ Import ▶ DP master	Imports master systems from the DP master to the open program file
	Edit ▶ Copy	Copies the selected DP slave(s)/FMS station(s) **with** S5 addresses		Help ▶ Contents	Opens online help

Application window

Working in an application window, you construct the bus using icons. Each application window contains a master to which you assign slaves graphically.

By double-clicking on the icon or designation, you automatically switch to the dialog box for entering the individual parameters. The gray highlighting in Fig. G-3 indicates the active areas:

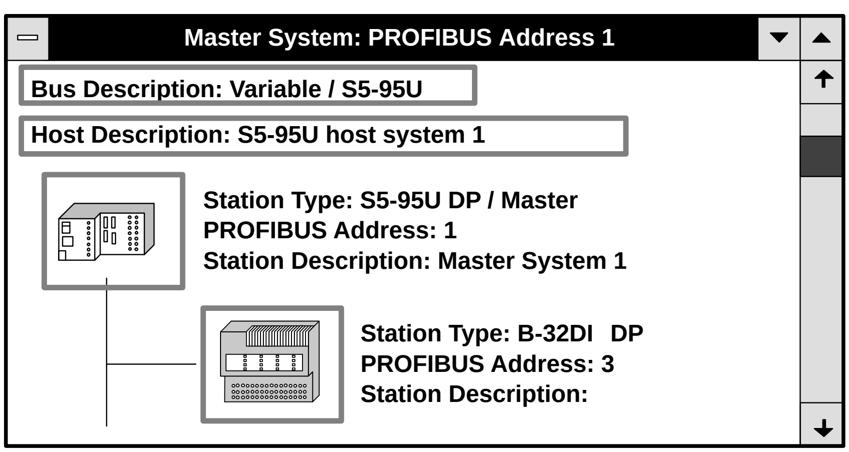

Figure G-3 Example of an application window

G.5 Example of how to parameterize a DP configuration with COM PROFIBUS

Overview

This section contains a short example showing how to parameterize a configuration with COM PROFIBUS:

- Start COM PROFIBUS
- Enter the bus parameters
- Enter the host parameters
- Enter the master parameters
- Enter the slave parameters for the ET 200B and the ET 200M
- Print the system documentation
- Save the configuration and export it to the DP master

  and
- Display the status of the inputs/outputs.

Parameterization example for an FMS configuration

You can find a similar parameterization example for an FMS configuration in section G.6.

Sample configuration

Fig. G-4 contains an example showing how a configuration is parameterized with COM PROFIBUS:

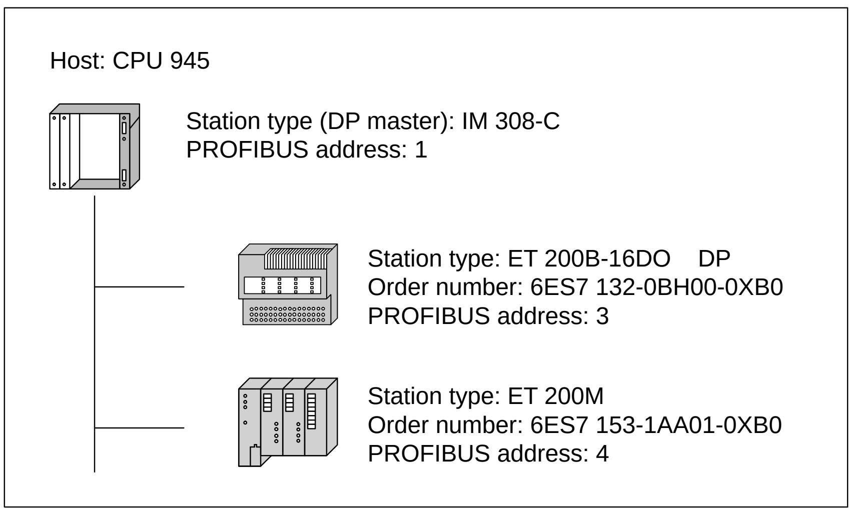

Figure G-4 Sample configuration

Starting COM PROFIBUS

To work with COM PROFIBUS:

1. Start MS-Windows and
2. Double-click on the icon for COM PROFIBUS.

   Result: COM PROFIBUS starts.
3. Select **File** ▸ **New** and
4. Select the master and the associated host.

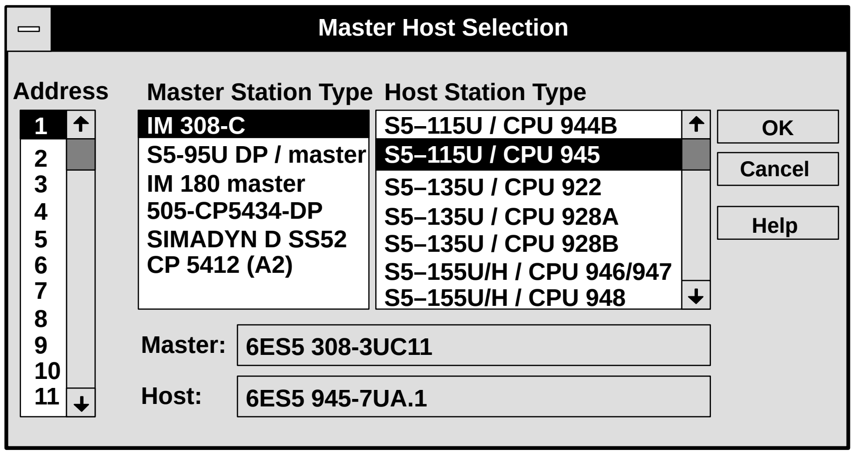

Figure G-5 Example of the ”Master Host Selection” window

5. Press ”OK” to confirm.

   Result: COM PROFIBUS creates a window containing icons for the master system having PROFIBUS address ”1”.

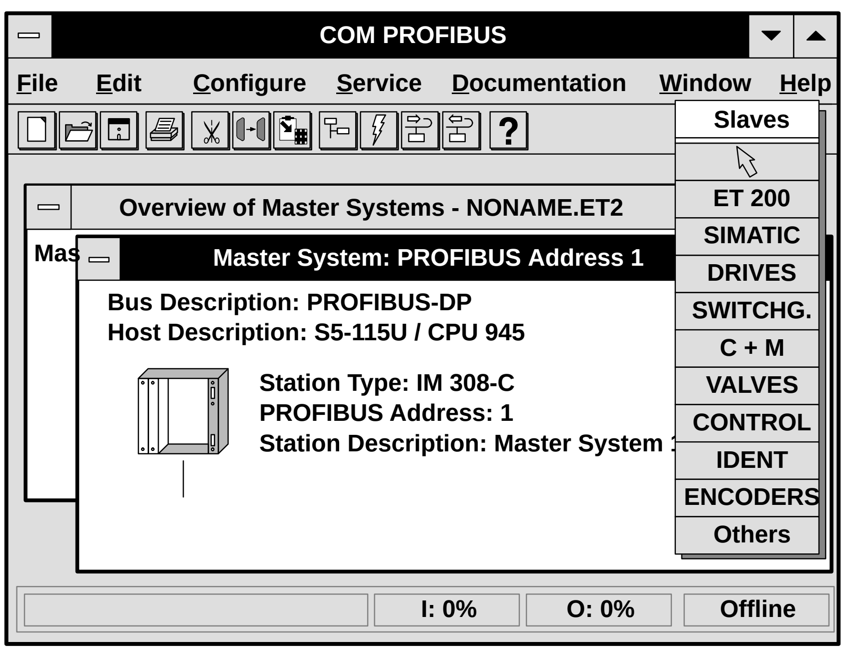

Figure G-6 Example showing how the master system is displayed on screen

Entering bus parameters

To enter the parameters for the bus:

1. In the application window, double-click on ”Bus Description”.

   Result: The ”Bus Parameters” dialog box is opened.

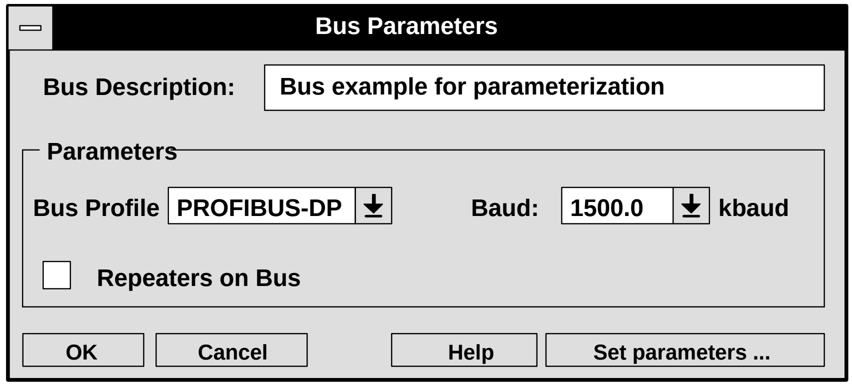

Figure G-7 Example of the ”Bus Parameters” dialog box

2. Confirm the ”PROFIBUS-DP” bus profile and the baud rate of 1500 kbaud by pressing the ”OK” button.

   Result: The bus parameters you entered are saved and you are returned to the application window.

Entering host parameters

To enter the designation for the host:

1. In the application window, double-click on ”Host Description”.

   Result: The ”Host Parameters” dialog box is opened.

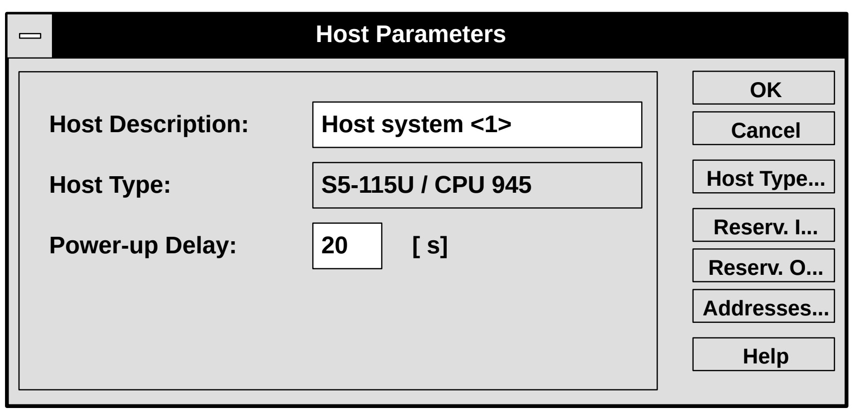

Figure G-8 Example of the ”Host Parameters” dialog box

2. Make your entries as appropriate and confirm by pressing ”OK”.

   Result: The host parameters you entered are saved and you are returned to the application window.

Entering master parameters

To extend the parameters for the master:

1. In the application window, double-click on the icon for the master.

   Result: The ”Master Parameters” dialog box is opened.

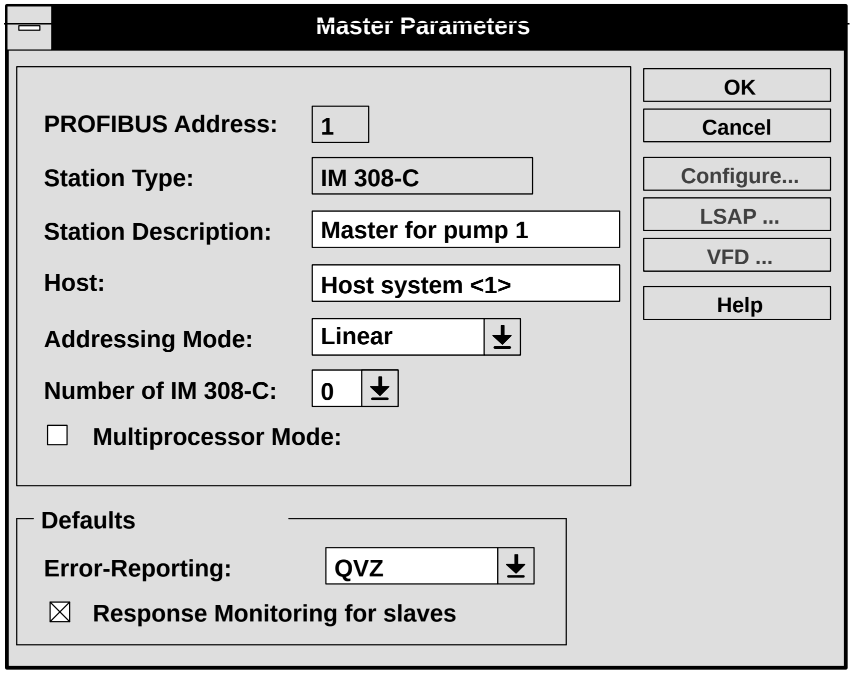

Figure G-9 Example of the ”Master Parameters” dialog box

2. Select the values as shown above and press the ”OK” button to confirm.

   Result: The master parameters you entered are saved and you are returned to the application window.

Entering slave parameters for ET 200B

To configure the ET 200B distributed I/O station:

1. In the ”Slaves” window, click on the icon for the ET 200 and by holding down the left mouse button, drag it to the bottom of the bus.

   Result: A selection list allowing you to choose the PROFIBUS address of the slave is opened.

2. Select ”3” and press the ”OK” button to confirm.

   Result: The ”Slave Parameters” dialog box is opened.

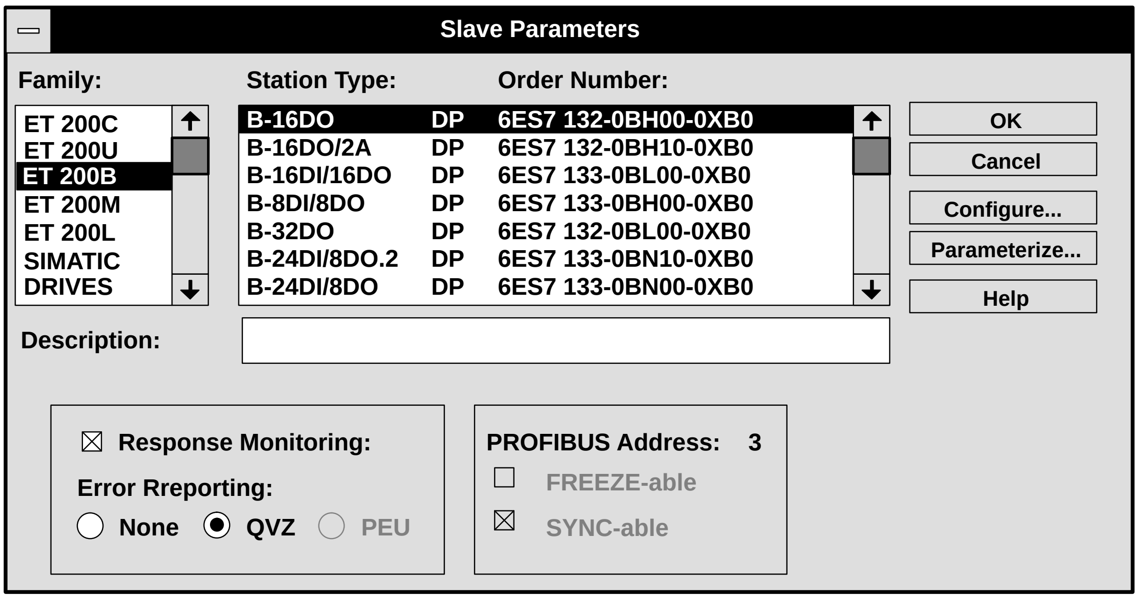

Figure G-10 Example of the ”Slave Parameters ET 200B” dialog box

3. Select ”ET 200B” as the family and the ET 200B-16DO with order number 6ES7 132-0BH00-0XB0 as the station type, and enter a designation. Press the ”OK” button to confirm.

   Result: The master system in the application window is extended accordingly.

Entering slave parameters for ET 200M

To configure the ET 200M distributed I/O station

1. In the ”Slaves” window, click on the icon for ET 200 and by holding down the left mouse button, drag it to the bottom of the bus.

   Result: A selection list allowing you to choose the PROFIBUS address of the slave is opened.

2. Select a PROFIBUS address, e.g. ”4”, and press the ”OK” button to confirm.

   Result: The ”Slave Parameters” dialog box is opened.

3. Select the ET 200M with order number 6ES7 153-1AA01-0XB0 as the station type and click on the ”Configure...” button to switch to the ”Configure” dialog box

   Result: The ”Configure ET 200M” dialog box is opened.

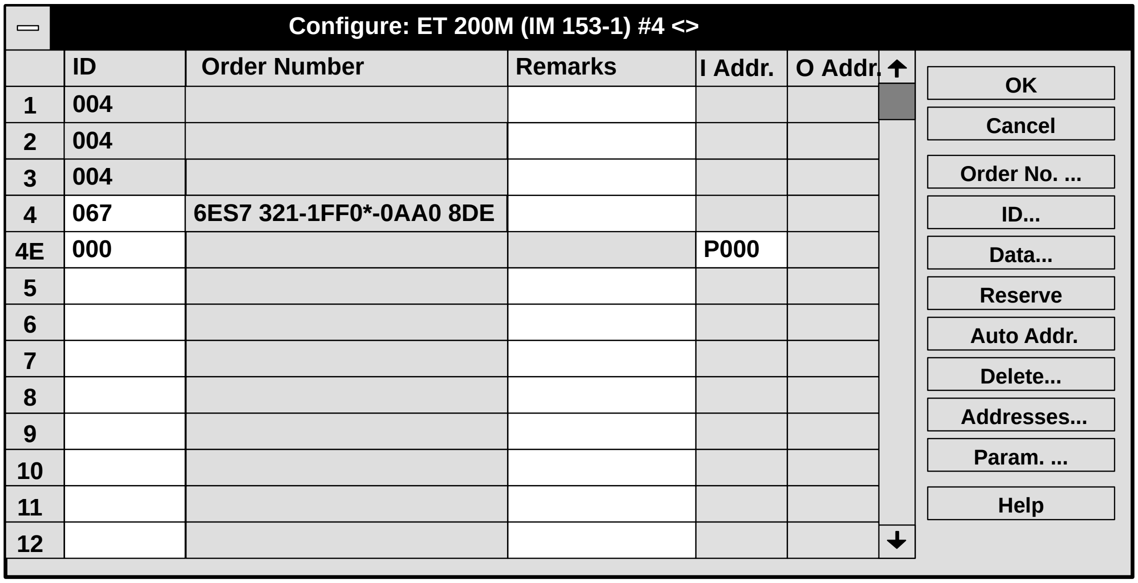

Figure G-11 Example of the ”Configure ET 200M” dialog box

4. Click on the first white field in the ”ID” column and then on ”Order Number” in order to enter a signal module of the ET 200M.

   Result: A pick list of all signal modules with order numbers appears.

5. Select, for example, a digital input module 8DE with order number 6ES7 321-1FF0*-0AA0 and press the ”OK” button to confirm.

   Result: The digital input module is entered in the ”Configure ET 200M” dialog box.

6. Close the list of signal modules by clicking on ”Close”.

7. Click the empty field under ”I Addr.” and then press the ”Auto Addr.” button.

   Result: The start of the address area for the digital input module is automatically defined.

   You can also overwrite the empty field under ”I Addr.” with any address of your choice.

8. Press ”OK” twice to confirm.

9. In the ”Slaves” window, deselect station selection by pressing the ↖ button.

All the important parameters have now been entered.

Saving the file

It is now time to save the data with COM PROFIBUS.

1. Save the entire configuration in a program file by selecting **File ▸ Save as**.
2. Enter a file name and confirm it by pressing the ”OK” button.

Printing the system documentation

You can print documents that will show you, for example, which STEP 5 address is assigned to which DP slave. This entails printing the station-oriented address assignments with **Documentation ▸ Station- oriented address assignment**.

Exporting data to the DP master

The last step is to save the data with COM PROFIBUS and export it to the DP master. You must have installed the online functions (see section G.3) in order to use the **File ▸ Export ▸ DP master** function.

1. Switch the IM 308-C to STOP.
2. Connect the PC/programmer (with the PROFIBUS card) to the PROFIBUS DP interface of the IM 308-C using the programming adapter.
3. Insert the memory card in the IM 308-C if it is not already inserted.
4. In COM PROFIBUS, click on the master system that you want to export to the IM 308-C.
5. Select **File ▸ Export ▸ DP master**.
6. Enter the currently active baud rate and the PROFIBUS address of the IM 308-C and confirm them by pressing ”OK”.

   Result: The data of the master system is exported to the memory card that is installed in the IM 308-C. The switch position you selected on the IM 308-C remains set.

   COM PROFIBUS then asks whether you want to activate the parameter record immediately or later on.
7. Activate the master system you exported to the IM 308-C.

   Result: The IM 308-C works with the new parameterization data.

Status of the inputs/outputs

You can display the status of the inputs/outputs with COM PROFIBUS, providing you have installed the online functions (see section G.3).

1. Load the master system you exported to the DP master with COM PROFIBUS.
2. Click on the slave whose input/output states you want to display.
3. Select **Service ▸ Status**.

   Result: COM PROFIBUS displays the status of the selected slave.

G.6 Example of how to parameterize an FMS configuration with COM PROFIBUS

Overview

This section contains a short example showing how to parameterize an FMS master system with COM PROFIBUS.

Sample configuration

Fig. G-12 contains an example showing how an FMS master system is parameterized with COM PROFIBUS:

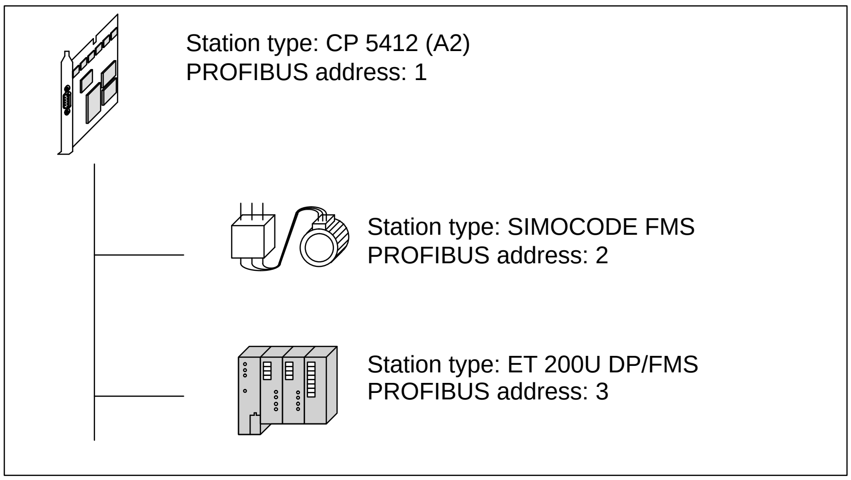

Figure G-12 Sample configuration

Starting COM PROFIBUS

To work with COM PROFIBUS:

1. Start MS-Windows and
2. Double-click on the icon for COM PROFIBUS.

   Result: COM PROFIBUS starts.
3. Select **File** ▸ **New** and
4. Select the master.

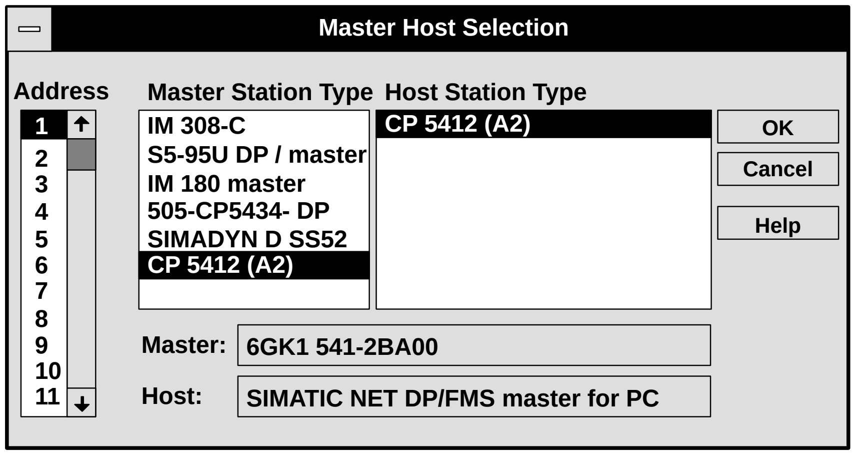

Figure G-13 Example of the ”Master Host Selection” window

5. Press ”OK” to confirm.

   Result: COM PROFIBUS creates a window containing icons for the FMS master system having PROFIBUS address ”1”.

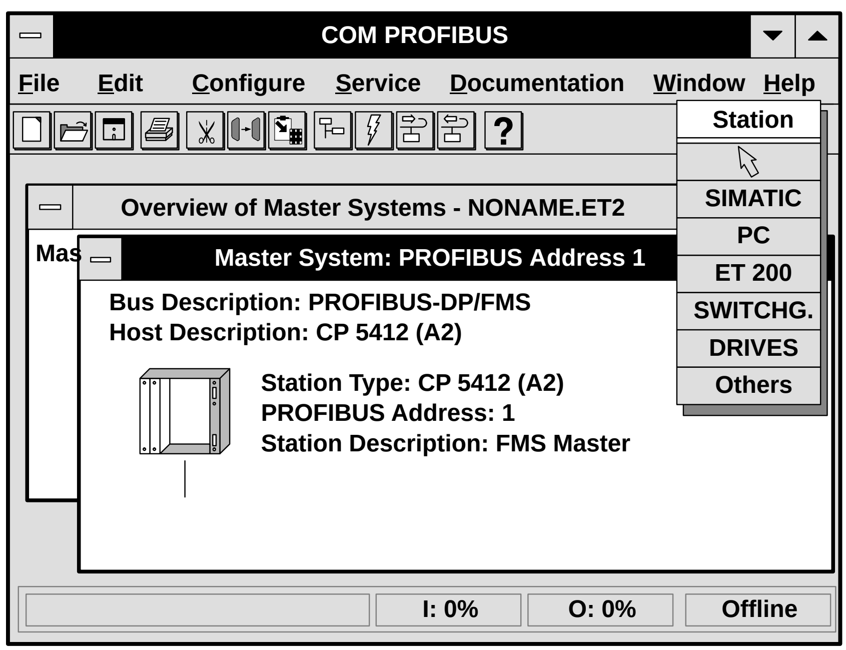

Figure G-14 Example showing how the FMS master system is displayed on screen

Bus parameters

To enter the parameters for the bus:

1. In the application window, double-click on ”Bus Description”.

   Result: The ”Bus Parameters” dialog box is opened. COM PROFIBUS has automatically selected ”DP/FMS” as the bus profile because you chose the FMS master.

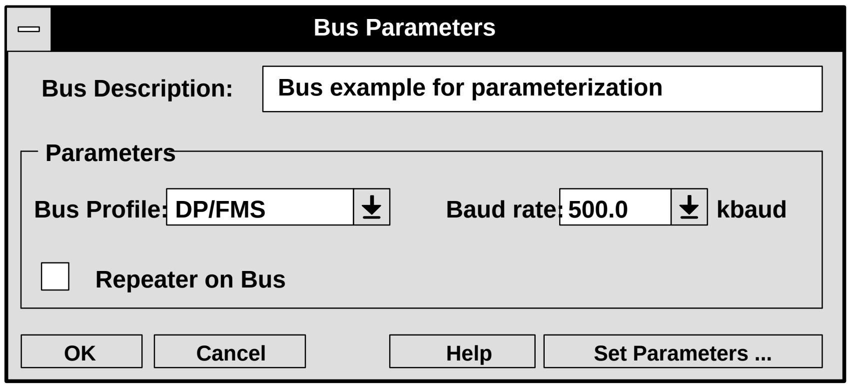

Figure G-15 Example of the ”Bus Parameters” dialog box

2. Select a baud rate of ”500” kbaud and confirm it by pressing the ”OK” button.

   Result: The bus parameters you entered are saved and you are returned to the application window.

Host parameters

The host parameters are irrelevant for SIMATIC NET PC modules.

Master parameters

The master parameters are irrelevant for this example, which entails entering an FMS master system.

FMS connections for SIMOCODE

To configure the FMS connections to the FMS SIMOCODE device:

1. In the ”Station” window, click on the icon for ”SWITCHG.” and by holding down the left mouse button, drag it to the bottom of the bus.

   Result: A selection list allowing you to choose the PROFIBUS address of the station is opened.

2. Select ”2” and press the ”OK” button to confirm.

   Result: The ”FMS Station Properties” dialog box is opened.

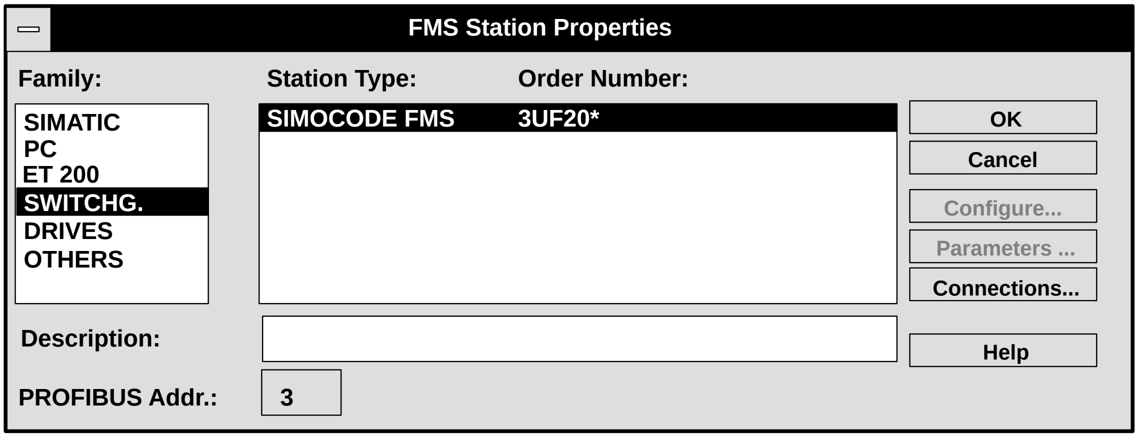

Figure G-16 Example of the ”FMS Station Properties SIMOCODE” dialog box

3. Branch to ”Connections”, the next dialog box, by clicking ”Connections ...”.

   Result: The ”Edit FMS Connections” dialog box is opened.

4. Click ”New”.

   Result: COM PROFIBUS enters the default connections.

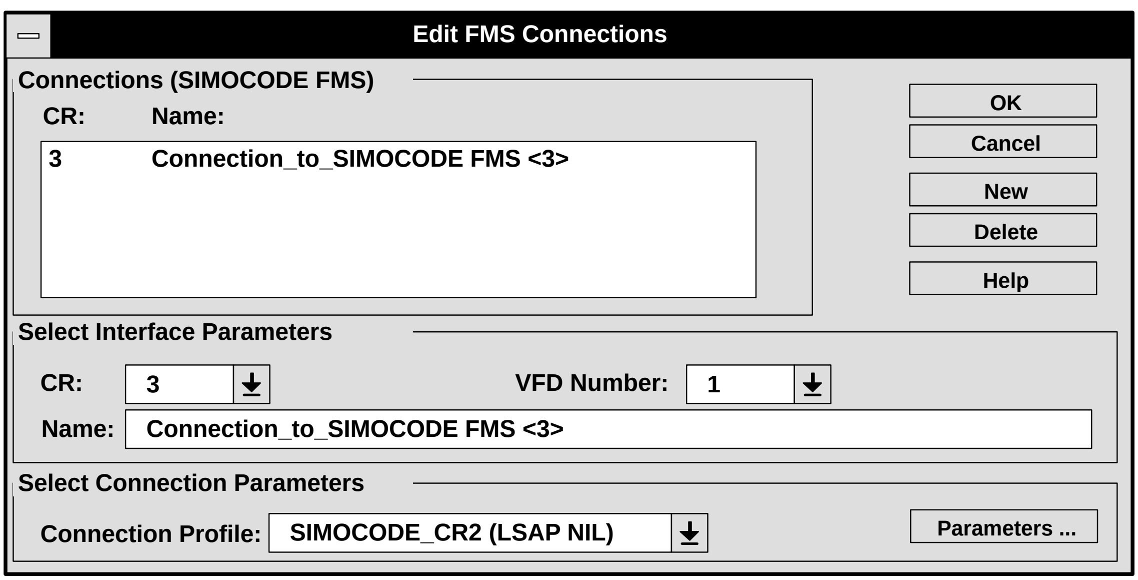

Figure G-17 Example of the ”Edit FMS Connections” dialog box

5. Confirm the FMS connections by pressing the ”OK” button, then confirm the FMS station parameters by pressing ”OK” again.

FMS connections to ET 200U

To configure the FMS connections to the FMS ET 200U device:

1. In the ”Station” window, click on the icon for ”ET 200” and by holding down the left mouse button, drag it to the bottom of the bus.

   Result: A selection list allowing you to choose the PROFIBUS address of the station is opened.

2. Select ”3” and press the ”OK” button to confirm.

   Result: The ”FMS Station Properties” dialog box is opened.

3. Select the ET 200U (FMS) and branch to ”Connections”, the next dialog box, by clicking ”Connections ...”.

   Result: The ”Edit FMS Connections” dialog box is opened.

4. Click ”New”.

   Result: COM PROFIBUS enters the default connections.

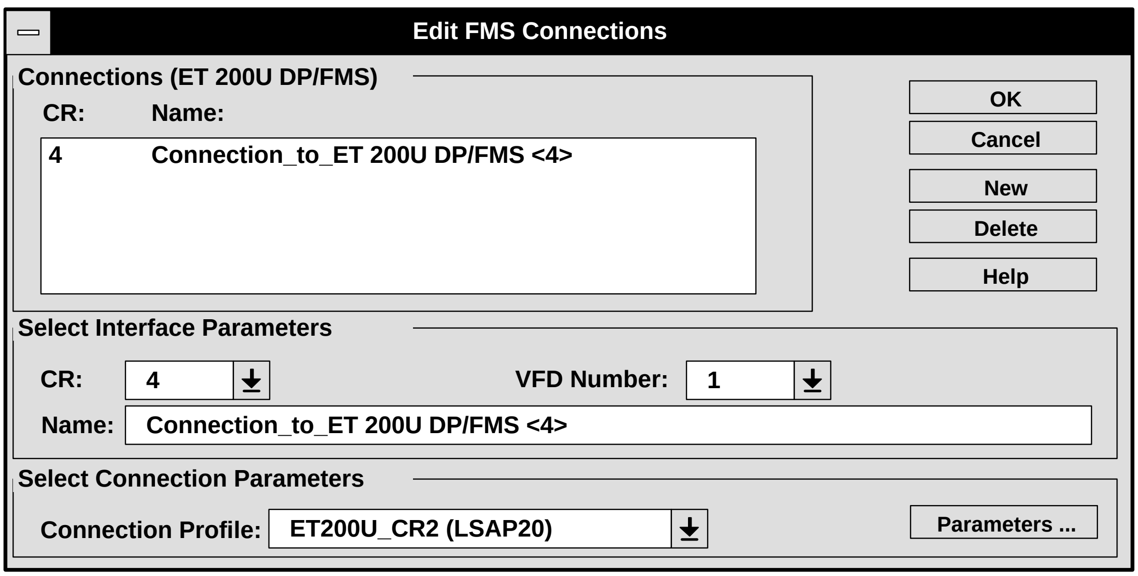

Figure G-18 Example of the ”Edit FMS Connections” dialog box

5. Confirm the FMS connections by pressing the ”OK” button, then confirm the FMS station parameters by pressing ”OK” again.

   All the parameters for the FMS stations have now been entered.

Saving the file

It is now time to save the data with COM PROFIBUS.

1. Save the entire configuration in a program file with **File** ▸ **Save as**.
2. Enter a file name and confirm it by pressing the ”OK” button.

Printing the system documentation

You can print documents that will show you an overview of the FMS master system. This entails printing the station list with **Documentation** ▸ **Station list**.

Saving in a binary database

You require a binary database in NCM format for the CP 5412 (A2):

1. Select **File** ▸ **Export** ▸ **NCM file** and enter a name for the NCM database.

   Result: COM PROFIBUS converts the configuration you have generated and creates, amongst other things, a non-resident, binary database (NCM file) with an .LDB extension.

2. Load the binary database on the CP 5412 (A2) using the SIMATIC NET Setup program.

G.7 Creating and opening a program file; importing data

Definitions

COM PROFIBUS recognizes files of different types:

Table G-5 File types in COM PROFIBUS

Name	Meaning	Extension
Program file	In a program file, you save the entire bus configuration, i.e. all the components physically interconnected by a bus cable. **Note:** The name format for program files generated with COM ET 200 V1.0 to V4.x is: ??????ET.200. Directory: \PROGDAT	.ET2
Binary file	In a binary file, you save the configuration of a master system. The contents of a binary file correspond to the data stored in the master. Create a binary file if, after exporting data to the master, you want to store it on the PC as well.	.2BF
NCM file	In an NCM file, you save the configuration of a master system for SIMATIC NET PC modules. You then load the NCM file on the module using SIMATIC NET tools. Directory: \NCM	.LDB
Type file for DP slaves	A type file contains all the parameters of a DP slave. COM PROFIBUS requires a type file or a device master file for each station type, in order to link the stations. Non-language-specific type files are designated ???????X.200, while type files in English bear names with the format ???????E.200. Directory for DP slaves: \TYPDAT5X **Note:** Type files used under COM ET 200 V1.0 to V4.x are in the \KONVER4X directory. You require these type files only if you want to convert program files generated with COM ET 200 V1.0 to V4.x.	.200
Type file for FMS stations	A type file contains all the parameters of an FMS station. COM PROFIBUS requires a type file for each station type, in order to link the stations. Directory for FMS stations: \FMSTYPES	.FMS
Type file for master/host	A type file for master/host contains the parameters of the master and the host. Directory: \MASTERS	.2MH
Device master file for DP slaves	A device master file contains all the parameters of a DP slave in accordance with EN 50 170, Volume 2, PROFIBUS. **Note:** If COM PROFIBUS contains both the type file and the device master file under a particular manufacturer ID, it only ever imports the device master file. The type file is no longer relevant! (Exception: old parameterizations which were created using type files.) Directory: \GSD	.GSD .GSX
Operating-system file	The operating-system file contains the IM 308-C operating system which belongs to COM PROFIBUS. Once the operating-system file has been exported to a memory card, it can then be imported to the IM 308-C. Directory: \BESY308C	.LFW

Creating a file

You create a new program file when you

1. Start COM PROFIBUS and
2. In COM PROFIBUS, select **File** ▸ **New**.
3. Enter the parameters in the ”Master host selection” dialog box and
4. Press ”OK” to confirm.

Result: A new program file is created with the description ”noname.et2”.

In addition, a window bearing the title ”Master system: PROFIBUS address X” is opened and you can start the parameterization of a slave belonging to this master system.

Opening a program file

There are two ways of opening an existing program file:

- Click on the icon for **File** ▸ **Open**

  or

- Using **File** ▸ **Open**, select an existing program file.

Importing data

There are various ways of loading or importing the data of a master system with COM PROFIBUS, depending on the master:

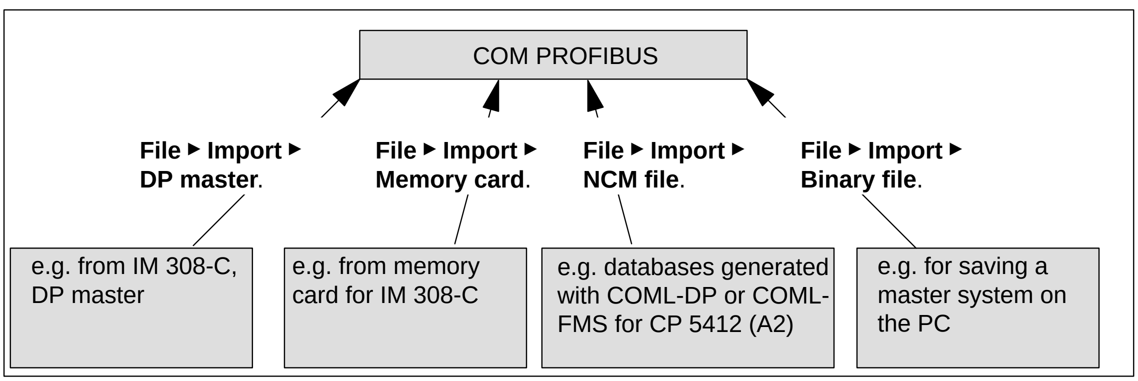

Figure G-19 Alternative ways of importing master systems

Note

You cannot reconstruct the entire bus system configuration and store it in a single program file until you have loaded **all** the master systems that together make up this configuration (from the DP master, the memory card, the NCM file and the binary file).

Importing data from DP master

If you want to import data directly from the DP master:

- The programmer/PC must be connected to the DP master either via PROFIBUS or directly (see Table G-1, section G.2)
- A master system must already have been exported to the master previously
- The memory card must be connected if the DP master is the IM 308-C
- The 32 K EEPROM must be installed in the S5-95U if the S5-95U is the DP master.

To load the data, select **File ▸ Import ▸ DP Master**.

Result: The data of a master system is available in the program file opened by these commands.

Importing data from memory card

If you want to import data from a memory card:

- Your programmer must have a memory card interface, **or**

  Your programmer must have an E(E)PROM slot with the appropriate programming adapter, **or**

  Your PC must have an external programming unit.

  The order numbers are listed in Appendix G.
- The memory card drivers must already be loaded when MS-WINDOWS or Windows 95 is started
- The memory card must be connected to the memory card interface of the programmer or the PC.

To load the data, select **File ▸ Import ▸ Memory card**.

Result: The data of a master system is available in the program file opened by these commands.

Importing data from an NCM file

Using the **File ▸ Import ▸ NCM File** function, you can load databases in COM PROFIBUS that you have generated using the SIMATIC NET PC parameterization tools, e.g. COML-DP or COML-FMS.

Importing data from a binary file

You need the ”Import data from binary file” function only if the original program file was previously saved as a binary file and is now lost.

If you want to import data from a binary file

1. Select **File ▸ Import ▸ Binary File**:
2. Select a file with a ”.2BF” extension.

Result: The binary file is converted into a format compatible with COM PROFIBUS and imported. The contents of a binary file correspond to a master system. The data of the binary file is available in the program file opened by these commands.

G.8 Parameterizing the configuration of a master system with COM PROFIBUS

In this section G.7

Section G.7 contains information on:

Starting point

If you have opened a new program file and entered the parameter settings in the ”Master host selection” dialog box, COM PROFIBUS has already created a window for the new master system (see section G.7) and the master is depicted in this window as an icon.

It is advisable to set the bus, host and master parameters before setting the slave parameters, because otherwise it is not easy to change certain settings.

Building the DP configuration (principle)

Build your configuration in the application window as follows:

1. Begin by entering the parameters for the bus, the host and the DP master. See sections G.8.1 to G.8.3 for details.
2. After entering the parameters, in the ”Slaves” window click on the slave that you want to parameterize, e.g. ET 200 (①).

   Result: The icon for slave you selected is ”attached” to the mouse pointer.

3. Click on the line representing the bus to insert the slave (②).

   Result: COM PROFIBUS prompts you for the PROFIBUS address of this slave.

4. Select a PROFIBUS address and confirm it by pressing the ”OK” button.

   Result: The ”Slave Parameters” dialog box is opened.

5. Enter the slave parameters. See sections G.8.4 and G.8.5 for details. Repeat steps 2 to 4 until you have entered all the slaves for this master system.

Note

Any slaves that have not yet been configured appear in italics in the application window.

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6. Deselect the slave by clicking on the arrow in the ”Slaves” pop-up window (③).

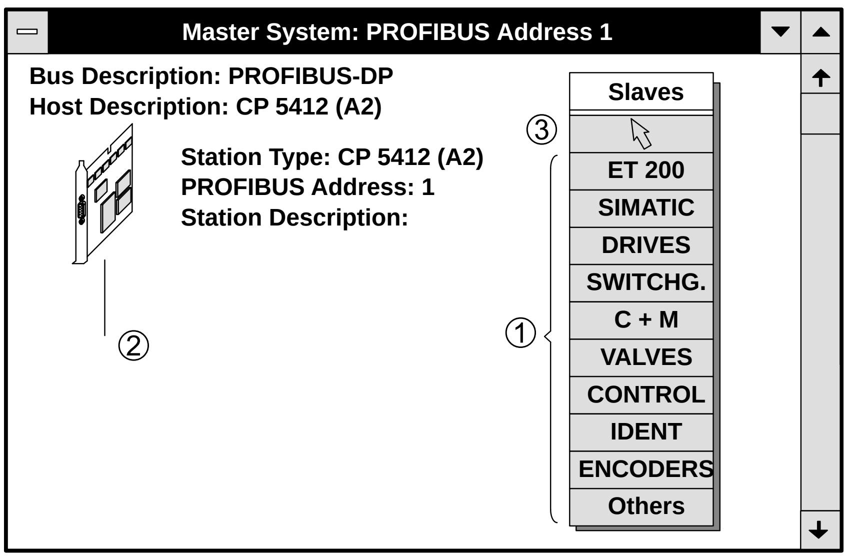


Figure G-20 Application window

Building the FMS configuration

If you enter an FMS configuration instead of a DP configuration, the above input rules apply analogously.

You can find more information about entering a PROFIBUS FMS configuration in section G.8.6.

G.8.1 Entering bus parameters

Definition

You use the bus parameters to define:

- The description for the bus system
- The bus profile for transmitting data on the bus
- The baud rate
- Whether the bus incorporates an RS 485 repeater
- The duration of the response monitoring time.

Meanings

The meanings of the individual bus parameters are shown in Table G-6:

Table G-6 Meanings of bus parameters

Description	Meaning	Default
Bus description	Assign a name to the bus system. Max. length: 40 characters.	–
Bus profile[1]	In the ”Bus profile” field, you can select certain bus and reaction times: • **PROFIBUS-DP**, if there are only DP masters on the bus and they comply with EN 50 170, Volume 2, PROFIBUS. • **DP/FMS**, if there is at least one FMS master on the bus or in order to parameterize an FMS master system. • **DP with IM 308-B**, if there is at least one IM 308-B or one CP 5480-DP (version 2) on the bus, but no FMS master. • **DP with S5-95U**, if you have an S7-95U as DP master. The defaults apply to the S5-95U (DP master). • **Variable**, if the bus or reaction times have to be varied to suit your specific configuration (with ”Set parameters ...”).	PROFIBUS-DP
Baud rate	Set a baud rate between 9.6 kbaud and 12000 kbaud. Bear in mind that some slaves are restricted to a maximum of 1500 kbaud (e.g. ET 200U).	1,500 kbaud
Repeaters on bus	Use this parameter to tell COM PROFIBUS whether the bus is extended by RS 485 repeaters (order number 6ES5 ... or 6GK1 ... only) or fiber-optic amplifiers (e.g. OLMs or active star hubs). If the bus is extended, the hamming distance is reduced from 4 to 2 at baud rates of 3000 kbaud or higher.	No
Set parameters ...	In the ”Set parameters” dialog box, you can define among other things: • The response monitoring time (response monitoring/T_{tr}) for all DP slaves on the bus as a function of the target token runtime. If, for example, you select a factor of 1.25, the response monitoring time is 1.25 times the target token runtime. • Delta Ttr, if, for example, you have to make provision for another, other-vendor master (see section G.9).	–

[1]: RESET the slaves not incorporated in the bus after a bus-profile change.

Entering bus parameters

To enter the bus parameters:

1. Select **Configure ▸ Bus Parameters** or

   Double-click on ”Bus Desription” or

   Select the bus parameters with the right mouse button.

   Result: The ”Bus Parameters” dialog box is opened.
2. Set the bus parameters. Click on ”Help” for more information.
3. If necessary, go to ”Set Parameters ...”:
   – If you want to view the bus times calculated by COM PROFIBUS,
   – If you want to customize the bus times to suit your configuration,
   – If you want to increase the response monitoring time, or
   – If you must make provision for the token runtime of another master not entered with COM PROFIBUS (see section G.9).
4. Confirm the bus parameters and close the dialog box by pressing ”OK”.

Customizing bus times to suit your configuration

If you select ”DP with S5-95U” as the bus profile for the DP master or DP slaves, you must change the bus times. The rule of thumb is:

- Always set the slowest bus time of all bus stations.
- Set the following bus times:

Table G-7 Bus times that must be set for a ”DP with S5-95U” bus profile

Bus time	Also known as
T_{ID2}	SDT2
T_{RDY}	SDT1
T_{SET}	SET
T_{SL}	ST
T_{TR}	TRT

G.8.2 Entering host parameters

Definition

A host is a system or device containing one or more masters.

If there is no higher-level system for the master, e.g. in the case of an S5-95U with a DP master interface or a SIMATIC NET PC module, the master is considered to be its own host.

If the host and the master are identical, COM PROFIBUS automatically masks out any parameters that are irrelevant. You define the following host parameters:

- The description of the host
- The host type
- The reservation of input and output addresses for the central I/O modules in the programmable controller, and
- The length of the power-up delay

Meanings

The meanings of the individual host parameters are shown in Table G-8:

Table G-8 Meanings of host parameters

Description	Meaning	Default
Host description	Assign a name to the host system. Max. length: 40 characters.	–
Host type	The host type is the CPU to which the master is assigned.	–
Power-up delay	The CPU power-up is delayed for this length of time, so that the master can address all the slaves configured with COM PROFIBUS. Note, however, that the time specified here is the upper limit for the delay. When the timer times out, CPU power-up continues even if the master did not succeed in addressing all the slaves configured with COM PROFIBUS. **IM 308-C only:** If the IM 308-C is used as DP master, the reaction of the CPU is dependent on the selected error-reporting mode (see section 8.2).	20 s
Reserv. I... Reserv. O...	These parameters enable you to reserve input and output address areas that can then be used for central/local I/O modules in the programmable controller or for another master in a programmable controller. If you use page addressing, the input and output address areas are reserved on each page! In this way, you can avoid the danger of having the same S5 addresses used for distributed I/O and for I/O modules in the central or expansion units.	–
Addresses	The ”Addresses” button provides you with an overview of the available address space, the occupied address space and the reserved address space.	–

Entering host parameters

To enter the host parameters:

1. Select **Configure ▸ Host Parameters**, or

   Double-click on ”Host Description”, or

   Select the host parameters with the right mouse button.

   Result: The ”Host Parameters” dialog box is opened.

2. Set the host parameters. Click on ”Help” for more information.

3. Confirm the host parameters and close the dialog box by pressing the ”OK” button.

G.8.3 Entering master parameters

Definition

Not all master parameters are relevant for all masters. COM PROFIBUS masks out any irrelevant master parameters automatically. You define the following master parameters, among others:

- The description of the master
- The host to which the master is assigned
- How the distributed I/O is addressed
- Whether the master is addressed by the CPU in multiprocessor mode, and
- Which error messages will be generated (QVZ or PEU and response monitoring of slaves)

FMS master system

If you parameterize an FMS master system, the only relevant parameters are the PROFIBUS address, the station type and the station description.

Meanings

The meanings of the individual master parameters are shown in Table G-9:

Table G-9 Meanings of master parameters

Description	Meaning	Default
PROFIBUS address	The PROFIBUS address is a bus-wide unique number which you assign to the master.	(Assigned PROFIBUS address)
Station type	Type of the master	IM 308-C
Station description	Assign a name to the master system. Max. length: 40 characters.	–
In host	Select the name of the host which contains the master with the ”In host” parameter.	–
Addressing	If the master is assigned to a CPU and if you have not yet assigned addresses to the slaves, you can select the type of addressing (IM 308-C: see section 10.1; S5-95U: see section 10.1).	Linear
Number of IM 308-C	**IM 308-C only:** You require the number of the IM 308-C for page addressing or addressing via FB IM308C (see section 6.1).	(Lowest unassigned number of the IM 308-C)
Multiprocessor mode	**IM 308-C only:** You must check the box for multiprocessor mode: • If you want to use several CPUs and masters with a single host, or • If the address space occupied by FB IM308C has already been used for CPs and IPs in the programmable controller. COM PROFIBUS prompts for the first address in the range that FB IM308C should use to address the distributed I/O (DP window) (see section 7).	–

Table G-9 Meanings of master parameters, continued

Description	Meaning	Default
Error-reporting mode	**IM 308-C only:** The error-reporting modes, namely PEU (power-fail in expansion unit), QVZ (acknowledgment delay) and ”None”, enable you to define how the CPU should react to an error in the distributed I/O system (see section 8.2). PEU, QVZ and ”None” are described in detail in section 8.2. If you select PEU or QVZ, the setting is valid for all slaves assigned to the master. Note, however, that you can deactivate PEU or QVZ for individual slaves, for example during initial operation (slave parameters). **Caution** If you set the error-reporting mode to ”None”, diagnosis with FB IM308C is the only way that you can detect an error in the distributed I/O system from within the application program! Consequently, we strongly recommend that the error-reporting mode be set to ”None” only for initial operation.	QVZ
Response monitoring	**PROFIBUS-DP:** Response monitoring enables you to define how the DP slave reacts to a master error or a break in the data traffic on the bus. If the DP slave is not addressed within the response monitoring time you define, it goes to the safe condition (all outputs are set to ”0”). If you set response monitoring to ”Yes” (by checking the box), the setting applies to all DP slaves assigned to the master. Note, however, that you can switch off response monitoring for individual slaves, for example during initial operation (slave parameters). **Danger** If you switch off response monitoring, there is a possibility that the outputs of a particular slave may not be set to ”0” if an error occurs! Consequently, we strongly recommend that response monitoring be switched off only for initial operation. See section 8.2 for a detailed description of response monitoring for the IM 308-C and section 11.3 for the S5-95U.	Yes
Configure ...	If the master is also used as a slave, you can open the ”Configure slave” dialog box by clicking this button (see section G.8.7).	
LSAPs ...	If CP 5412 (A2), the SIMATIC NET PC module, is used as FMS and/or DP master, you can open the ”Reserve LSAPs ...” dialog box by clicking on this button. Enter the LSAP disable list there.	–
VFDs ...	If CP 5412 (A2), the SIMATIC NET PC module, is used as FMS master, you can open the ”Edit VFDs ...” dialog box in order to parameterize the VFDs by clicking on this button.	–

LSAPs ... (CP 5412 (A2) only)

Local service access points (LSAPs), which are not allowed to be used by another protocol at the same time, are defined at the FDL interface. You must therefore disable the LSAPs that are reserved for the FDL interface in the ”Reserve LSAPs ...” dialog box.

1. Click on the ”Reserve LSAPs ...” button in the ”Master Parameters” dialog box.

   Result: The ”Reserve LSAPs” dialog box is opened.

   All the LSAPs which are already used by the PROFIBUS DP and the PROFIBUS FMS are grayed and can no longer be selected.
2. Reserve the LSAPs for FDL.
3. Confirm the reserved LSAPs and close the dialog box by pressing the ”OK” button.

VFDs ... (CP 5412 (A2) only)

COM PROFIBUS automatically creates a virtual field device (VFD) as default whenever you parameterize an FMS master.

You can edit this VFD as necessary in the ”Edit VFDs” dialog box.

Entering master parameters

To enter the master parameters:

1. Select **Configure ▸ Master Parameters**, or

   Double-click on the icon for the master, or

   Select the master parameters with the right mouse button.

   Result: The ”Master Parameters” dialog box is opened.
2. Set the master parameters. Click on ”Help” for more information.
3. Confirm the master parameters and close the dialog box by pressing ”OK”.

G.8.4 DP slave: entering slave parameters

Definition

The slave parameters enable you to define:

- The family and type of the DP slave
- The description of the DP slave
- The configuration and addresses of the DP slave (Configure ...)
- The structure of a parameterization telegram, if necessary (Parameterize ...),

  and
- Whether or not the error-reporting mode selected for the DP master or response monitoring is to be switched off for this DP slave.

Meanings

The meanings of the individual DP slave parameters are shown in Table G-10:

Table G-10 Meanings of DP slave parameters

Description	Meaning	Default
Family	Family of the distributed I/O station, e.g. ET 200B, SIMATIC, valves, etc.	–
Station type	Enter the station type of the DP slave exactly as shown, for example, by the order number or the label on the DP slave.	–
Description	Assign a name to the distributed I/O station. Max. length: 40 characters.	–
Response monitoring	You can switch response monitoring on or off for each individual DP slave. **Danger** If you switch off response monitoring, there is a possibility that the outputs of a particular slave may not be set to ”0” if an error occurs! Consequently, we strongly recommend that response monitoring be switched off only for initial operation.	Yes
Error-reporting mode	You can switch the error-reporting mode PEU or QVZ on or off for each slave. The switch for setting the error-reporting mode for all DP slaves assigned to a DP master is in the ”Master Parameters” dialog box (see sections G.8.3 and 8.2).	QVZ
PROFIBUS address	The PROFIBUS address is a bus-wide unique number for the DP slave.	(Assigned PROFIBUS address)
FREEZE-able SYNC-able	The ”FREEZE-able” and ”SYNC-able” parameters indicate whether the DP slave can receive and respond to the FREEZE and SYNC control commands respectively.	–

Table G-10 Meanings of DP slave parameters, continued

Description	Meaning	Default
Configure ...	In the ”Configure ...” dialog box: • Define the size of the input/output areas for a DP slave and/or • Assign S5 addresses to these input/output areas. E.g. define the signal modules and their initial addresses for the ET 200M or assign an address to an ET 200B.	–
Parameterize ...	In the ”Parameterize ...” dialog box you define the contents of the parameterization telegram, if the DP slave type requires this. You define, for example, areas or diagnostic enabling for analog DP slaves. See the manual for the DP slave for details of the ”Parameterize ...” dialog box. COM PROFIBUS uses the values in the ”Parameterize ...” dialog box to generate the parameterization telegram which the DP master sends to the DP slave on powering up.	–

Entering slave parameters

There are several ways of entering slave parameters:

- Via the menu bar:

  Select **Configure ▸ Slave Parameters** and confirm the desired slave PROFIBUS address by pressing the ”OK” button.

  Result: The ”Slave Parameters” dialog box is opened.

- Via the ”Slaves” window:

  In the ”Slaves” window, click on the icon for the appropriate DP slave and attach it to the bottom of the bus by clicking the mouse button. Confirm the desired slave PROFIBUS address by pressing the ”OK” button.

  Result: The ”Slave Parameters” dialog box is opened.

- Via the icon for the DP slave (if the slave is already displayed in the application window):

  Double-click on the icon for the slave or select the slave parameters by clicking the right mouse button.

  Result: The ”Slave Parameters” dialog box is opened.

Note

You can switch to the ”Configure” and ”Parameterize” dialog boxes for the DP slave directly from the graphical parameterization mode.

- To open the ”Configure” dialog box: press and hold down the ”Shift” key and double-click on the icon for the DP slave.
- To open the ”Parameterize” dialog box: press and hold down the ”Ctrl” key and double-click on the icon for the DP slave.

G.8.5 FMS station: entering FMS station parameters

Definition

The FMS station properties enable you to define:

- The family and type of the FMS station
- The description of the FMS station
- The FMS connections to the selected station.

Meanings:

The meanings of the individual FMS station properties are shown in Table G-11:

Table G-11 Meanings of FMS station properties

Description	Meaning	Default
Family	Family of the FMS station, e.g. SIMATIC	–
Station type	Enter the station type of the FMS station exactly as shown, for example, by the order number or the label on the FMS station.	–
Description	Assign a name to the FMS station. Max. length: 40 characters.	–
PROFIBUS address	The PROFIBUS address is a bus-wide unique number for the FMS station.	(Assigned PROFIBUS address)
Connections ...	In the ”Connections ...” dialog box, you can define the FMS connections to the selected station.	–

Selecting FMS station properties

There are several ways of entering FMS station properties:

- Via the menu bar:

  Select **Configure ▸ FMS Station Properties** and confirm the desired PROFIBUS address by pressing the ”OK” button.

  Result: The ”FMS Station Properties” dialog box is opened.

- Via the ”Stations” window:

  In the ”Stations” window, click on the icon for the appropriate FMS station and attach it to the bottom of the bus by clicking the mouse button. Confirm the desired PROFIBUS address by pressing the ”OK” button.

  Result: The ”FMS Station Properties” dialog box is opened.

- Via the icon for the FMS station (if the FMS station is already displayed in the application window):

  Double-click on the icon for the FMS station or select the FMS station properties by clicking the right mouse button.

  Result: The ”FMS Station Properties” dialog box is opened.

Entering FMS station properties

Proceed as follows to enter the FMS station properties for an FMS station:

1. Set the FMS station properties. Click on ”Help” for more information.
2. Press the ”Connections ...” button to switch to the ”Connections” dialog box and enter the FMS connections for the selected FMS station (see Table G-12).

   Result: The ”Edit FMS Connections” dialog box is opened.
3. Select a new connection with the ”New” button.

   Result: COM PROFIBUS enters the default connections.

Table G-12 Meanings of the connections of an FMS station

Description	Meaning	Default
CR[1]	The communications relation reference (CR) is the number of an FMS connection. Value range: 3 to 128	
VFD number[1]	The communications relation is assigned to a valid virtual field device (VFD) via its VFD number. You assigned the VFD number to the master with the master parameters. Value range: 1 to 5	
Name	Assign a name to the communications relation. Max. length: 32 characters.	–
Connection profile	Connection profiles group together the specific communications parameters of an FMS station (e.g. fixed FMS connections for pre-parameterized FMS devices, such as the SIMOCODE). Value range: The available profiles are dependent on the selected FMS device.	Default
Parameters ...	In the ”Parameters ...” dialog box which follows, you can define communications parameters for the selected connection profile: • The type of communications relation, e.g. MMAZ • The local and remote service access points (LSAPs) • The services supported by the master acting as a client • The service supported by the master acting as the server • Details such as PDU sizes, maximum number of simultaneous services, etc. You can normally use the default values directly.	–

1 The CR and the VFD number are the interface parameters which are visible at the SIMATIC NET FMS communications interface.

4. Edit the FMS connections and confirm them by pressing the ”OK” button.
5. Confirm the FMS station properties and close the dialog box by pressing ”OK”.

G.8.6 Using PROFIBUS-DP and PROFIBUS-FMS simultaneously

Definition

According to EN 50 170, Volume 2, PROFIBUS, it is possible to use PROFIBUS-DP and PROFIBUS-FMS simultaneously on a shared, physical bus line.

The SIMATIC NET communications processor CP 5412 (A2) permits simultaneous operation of PROFIBUS-DP and PROFIBUS-FMS.

Procedure

Proceed as follows to parameterize simultaneous operation of PROFIBUS-DP and PROFIBUS-FMS with COM PROFIBUS:

1. Create a new master system using **File** ▸ **New**.
2. Select the CP 5412 (A2) as master in the ”Master Host Selection” dialog box and confirm it by pressing ”OK”.
3. Select the DP and/or FMS protocols that you want to use for the CP 5412 (A2) and confirm them by pressing ”OK”.

   Result: COM PROFIBUS starts a separate master system for each protocol at the same PROFIBUS address. The stations you must parameterize depend on the master system you are currently using, i.e. you parameterize the DP slaves in the DP master system or the FMS stations in the FMS master system.

   More information about parameterizing the DP slaves can be found in section G.8.4 and about parameterizing the FMS stations in section G.8.5.

Note

Even if originally you only decided to use a DP master system, you can create an FMS master system at any time with **Configure** ▸ **FMS Parameterization.**

The same applies analogously if at first you only selected an FMS master system. In this case, you can create a DP master system with **Configure** ▸ **DP Parameterization**.

G.8.7 Creating a new master system

Definition

Each master plus the stations assigned to it constitutes a master system.

You have to create a new master system if you have at least two masters connected to a physical bus.

If you parameterize a slave that can also be a master, COM PROFIBUS automatically creates a new master system for this slave (e.g. the IM 308-C/DP slave).

Creating a new master system

To create a new master system:

1. Select **Configure ▸ New Master System** or click the appropriate icon.
2. Enter the parameters in the "Master Host Selection" dialog box and confirm them by pressing "OK".

   Result: A new field appears containing the master you just created. You can now proceed in the same way as with the first master system and assemble your new master system using graphical icons.

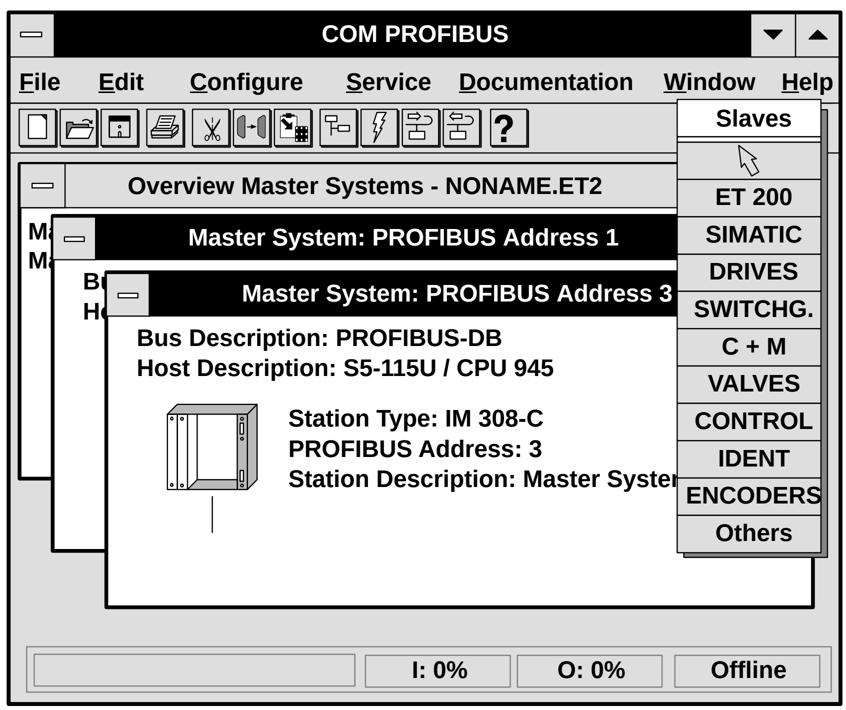


Figure G-21 Creating a new master system

G.8.8 Configuring the IM 308-C as a DP slave

Definition

As of release 3, the IM 308-C can be operated as:

- DP master
- DP slave

  or
- DP master and DP slave.

You can find all you need to know about operating the IM 308-C as a DP slave in section 5.6.

Displaying the master and slave in the application window

If a master is operated as a slave, COM PROFIBUS automatically creates a master system for the slave. Meanings:

– **m:** IM 308-C operates as DP master only

– **s:** IM 308-C operates as DP slave only

– **m + s:** IM 308-C operates as DP master and DP slave.

Starting point 1 (DP slave only)

The IM 308-C only operates as a DP slave and not as DP master:

Note

What happens if the IM 308-C operates as a DP slave in a master system whose master is not entered with COM PROFIBUS?

Simply create a master system with any master, e.g. a CP 5412 (A2), and parameterize the IM 308-C as a DP slave in this master system.

COM PROFIBUS automatically creates a separate master system for the IM 308-C/DP slave, which you can then export to the IM 308-C.

Procedure for starting point 1

The procedure for configuring an IM 308-C as a DP slave only is as follows:

1. Select the IM 308-C/slave as a DP slave (e.g. by selecting **Configure ▸ Slave Parameters**).
2. Select a PROFIBUS address and press the ”OK” button to confirm.

   Result: The ”Slave Parameters” dialog box is opened.
3. Select ”SIMATIC” as the family and ”IM 308-C DP Slave” as the station type.
4. Press the **Configure ...** button to switch to the ”Master Host Selection” dialog box.
5. Select the host station type and press the ”OK” button to confirm.

   Result: The ”Configure: IM 308-C/Slave” dialog box is opened.
6. Press the ”ID” button and enter the input and output data quantities and the addresses. Remember:
   - Inputs: input data of the DP slave CPU
= outputs of the DP master
Outputs: output data of the DP slave CPU
= inputs of the DP master
   - The maximum block size is 16 words.
7. Press the ”OK” button twice to confirm:

   Result: COM PROFIBUS automatically creates a new master system for the IM 308-C as a DP slave.
8. Switch to the master system in which the IM 308-C/DP slave is the DP master (the master system is indicated by an ”s”).
9. Edit the host and master parameters of the IM 308-C/DP slave.
10. Once you have completed all the entries for the bus configuration, export the data of this master system for the IM 308-C/DP slave to the IM 308-C.

Starting point 2 (DP master and DP slave)

The IM 308-C operates as master and as a slave. You have already parameterized the IM 308-C as master, and entered all the host and master parameters, and now want to parameterize it as a slave.

Procedure for starting point 2

If you have already parameterized the IM 308-C as master, proceed as follows to parameterize it as a slave:

1. Switch to the master system in which you want the IM 308-C to be addressed as a DP slave.
2. Select **Configure ▸ New Slave** in this master system.
3. Enter the PROFIBUS address of the IM 308-C as master manually.
4. Confirm it by pressing ”OK” and ”Yes”.

   Result: COM PROFIBUS opens the ”Slave Parameters” dialog box for the IM 308-C as a DP slave.
5. Press the **Configure ...** button to switch to the ”Configure IM 308-C DP Slave” dialog box.

   Result: The ”Configure: IM 308-C/Slave” dialog box is opened.
6. Press the ”ID” button and enter the input and output data quantities and the addresses. Remember:

   – Inputs: input data of the DP slave CPU
     = outputs of the DP master
     Outputs: output data of the DP slave CPU
     = inputs of the DP master

   – The maximum block size is 16 words.
7. Press the ”OK” button twice to confirm:

   Result: COM PROFIBUS automatically creates a new master system for the IM 308-C as a DP slave (indicated by ”m + s”).
8. Once you have completed all the entries for the bus configuration, export the data of this master system for the IM 308-C/DP slave to the IM 308-C.

G.8.9 Assigning DP slaves to groups

Definition

If you want to send the FREEZE or SYNC control commands to DP slaves, you must arrange the DP slaves in groups.

Each group consists of at least one DP slave. Note, however, that each DP slave can belong to several different groups.

You can form a maximum of 8 groups in each master system.

Precondition

The DP master must be able to send the FREEZE and SYNC control commands and the DP slave must be able to process them.

Defining group membership

To assign the DP slaves to groups:

1. Select **Configure ▸ Group Membership**.

   Result: The ”Groups and their Properties” dialog box is opened.

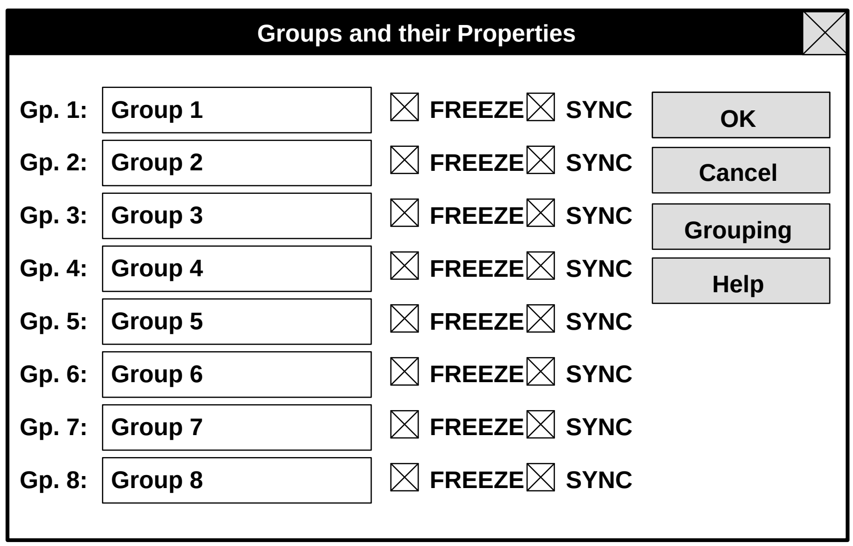


Figure G-22 Groups and their Properties

2. In this dialog box, define whether the groups can process FREEZE and/or SYNC commands, and
3. Click on the ”Grouping ...” button in the next dialog box and define which DP slaves with which PROFIBUS addresses belong to which group. Define the group members by double-clicking on the empty fields.
4. Confirm your entries by pressing the ”OK” button.

   Result: The DP slaves are now assigned to between one and eight groups. You require the group numbers when you send control commands in the STEP 5 application program with FB IM308C.

G.8.10 IM 308-C: Assigning a shared-input master

Definition

In addition to the parameterization master, other DP masters can be granted **read** access to each DP slave with inputs. These DP masters are known as shared-input masters.

The DP slaves accessed by shared-input masters are known as shared-input slaves.

Preconditions

Another DP master requiring read access to a DP slave must satisfy the following preconditions:

Before you assign the DP slave to a shared-input master:

- You must have already **completely** parameterized the DP slave in a master system and defined all the slave parameters (see section G.8.4)
- You must have already created a new master system (see section G.8.7)

Assigning a shared-input master

To assign a DP slave to a shared-input master, proceed as follows:

1. Select a DP slave from the toolbar, and
2. In the master system which contains the shared-input master, point to the bottom of the bus and click the mouse button.

   Result: A pop-up menu of PROFIBUS addresses appears.
3. Manually enter the PROFIBUS address of the DP slave to which the shared-input master is to be granted read access and confirm it by pressing the ”OK” button twice.

   Result: The DP slave is masked out or grayed. The shared-input master has read access only to the inputs of this DP slave.

G.9 Making provision for masters other than those entered with COM PROFIBUS

Definition

If the bus includes masters **other** than those entered with COM PROFIBUS, you must make provision for these in the target token runtime.

Note

If you have parameterized all the masters that together make up a bus system with COM PROFIBUS, the system automatically calculates the total target token runtime. In this case, you do not need to make provision for any additional target token runtimes.

Making provision for other-vendor masters

To make provision for other-vendor masters (i.e. not entered with COM PROFIBUS) in the target token runtime, proceed as follows:

1. Parameterize both the master systems completely. A target token runtime T_{TR} results for each master system:
   - $T_{TR}1$: calculated with COM PROFIBUS
   - $T_{TR}2$: calculated with another software tool

   The sum of the two target token runtimes T_{TR} corresponds to the actual target token runtime.
2. Select **Configure ▸ Bus Parameters** in COM PROFIBUS and then click on the **Set Parameters** button.

   Result: The ”Bus Parameter Settings” dialog box is opened.
3. Make a note of the target token runtime T_{TR} calculated by COM PROFIBUS.
4. Set the ”Delta T_{tr}” parameter to the time in bit-time units. This setting is the target token runtime you calculated for the other-vendor master.

   Result: When you click the ”Calculate” button, COM PROFIBUS calculates the new target token runtime T_{tr} in bit-time units.
5. In the other-vendor master system, add the target token runtime you noted in 3. to the target token runtime of this other-vendor system.

Subsequent changes

If you want to make changes after you have already customized the target token runtime, proceed as follows:

1. Cancel out the additive target token runtimes again in **all** the master systems.
2. Repeat steps 1 to 5 above in order to calculate the new target token runtime.

G.10 Device master files

Introduction

Each PROFIBUS device requires a device master file or a type file so that it can be mounted in COM PROFIBUS. All new devices are described by means of device master files. COM PROFIBUS loads the data needed for old devices from type files.

If there is both a device master file and a type file, COM PROFIBUS uses the device master file automatically.

What is a device master file?

A device master file contains all the DP slave descriptions in a standard format in accordance with EN 50 170, Volume 2, PROFIBUS.

Device master files are stored in the directory called ”\GSD”.

What is a DP type file?

COM PROFIBUS reads the data required for old DP slaves from the DP type file. A DP type file describes a slave with regard to the number of inputs and outputs, the number of diagnostic bytes, FREEZE/SYNC-ability, possible parameter values and so on.

COM PROFIBUS can only process those DP type files which are in the ”TYPDAT5X” directory. Non-language-specific type files are identified by an ”*X.200” extension, while English-language type files are identified by an ”*E.200” extension.

What is an FMS type file?

COM PROFIBUS reads the data required for old FMS stations from the FMS type file. An FMS type file describes the parameters of an FMS station (e.g. the value ranges for the FMS connection parameters).

COM PROFIBUS can only process those FMS type files which are in the ”FMSTYPES” directory. Non-language-specific type files are identified by an ”*X.FMS” extension, while English-language type files are identified by an ”*E.FMS” extension.

Reading a device master file/type file

If you copy new device master files or new DP type files into the appropriate directory while COM PROFIBUS is running, you must then update the directory with **File ▸ Read Device Master Files**.

Opening a device master file/DP type file

To open and read an existing device master file/DP type file:

1. Select **File ▸ Open Device Master File**.

   Result: A list box appears containing the names of all the device master files/type files.

2. Select the file name of your choice and confirm it by pressing the ”OK” button.

   Result: A window containing the filled-in device master file/type file appears on the screen.

G.11 Saving and exporting the configuration parameterized with COM PROFIBUS

In section G.11

Section G.11 contains information on:

Options for saving/exporting

You have several options for saving and exporting data with COM PROFIBUS.

Table G-13 Saving the configuration parameterized with COM PROFIBUS

If you ...	Use the commands ...	Meaning
save the entire configuration	**File** ▸ **Save** or **File** ▸ **Save file as ...**	COM PROFIBUS saves the entire bus configuration in a program file.
export the configuration of a master system to the memory card for the IM 308-C	**File** ▸ **Export** ▸ **Memory Card**	COM PROFIBUS exports the configuration of the master system to the memory card (see section G.11.3)
want to save the configuration of a master system on the programmer/PC as well	**File** ▸ **Export** ▸ **Binary File**	COM PROFIBUS saves the configuration of the master system in a binary file having the extension ”*.2BF”
export the configuration of a master system directly to the DP master (e.g. to an IM 308-C or S5-95U/DP master)	**File** ▸ **Export** ▸ **DP Master**	COM PROFIBUS exports the configuration of the master system to the DP master (see sections G.11.1 and 9.6)
export the configuration of a master system to SIMATIC NET PC modules	**File** ▸ **Export** ▸ **NCM File**	COM PROFIBUS saves the configuration of a master system as an NCM file. You can then export this file (binary database) to SIMATIC NET PC modules using SIMATIC NET tools.

Saving more than one master system

COM PROFIBUS exports the data of only **one** master system to the master or to a binary file. This has the following consequences if you have more than one master system:

- If your bus configuration consists of more than one master system and you want to modify the parameters of one of these systems, you must also re-parameterize the other masters. If not, you may encounter errors or the bus system may not work at all (e.g. because the response monitoring time has been changed).
- If you want to reconstruct the entire configuration of a program file, you must re-import **all** the associated binary files or the master systems of **all** masters.

G.11.1 Saving to DP master (File ▸ Export ▸ DP master)

Example 1: No master system on the DP master

There is no master system on the DP master as yet. To export data to the DP master (e.g. to the IM 308-C):

- The online functions of COM PROFIBUS must be installed (see section G.2).
- The programmer/PC must be connected either to the PROFIBUS or directly to the DP master (see Table G-1, section G.2).
- There must be no other stations on the PROFIBUS with PROFIBUS address 1, and no other baud rates must be set, because the default parameters are saved on the DP master (IM 308-C: baud rate = 19.2 kbaud and PROFIBUS address = 1).
- The memory card must be inserted in the IM 308-C as DP master. If the memory card contains data not generated with COM PROFIBUS, delete the memory card in COM PROFIBUS with **Service ▸ Delete Memory Card**.

Example 1: Exporting the master system

To export the master system to the master:

1. In COM PROFIBUS, select **File ▸ Export ▸ DP Master**.
2. Enter the baud rate and the PROFIBUS address of the DP master and confirm them by pressing the ”OK” button (**IM 308-C:** baud rate = 19.2 kbaud; PROFIBUS address = 1).

   Result: COM PROFIBUS exports the parameters to the DP master (IM 308-C: ”RN” and ”IF” LEDs lit: the operating mode of the IM 308-C does not change).

   After the parameters have been exported, they are saved in the DP master, but the DP master resumes with the old parameters (IM 308-C: ”ST” and ”IF” LEDs lit).
3. COM PROFIBUS then asks you whether you want to activate the exported parameters immediately in the DP master:

   If there is only one DP master on the PROFIBUS, activate the parameters by clicking on ”Yes”.

   If there are two or more DP masters on the PROFIBUS, answer ”No” to the prompt instead. Export all the parameterization data to the DP masters first, then activate it with **Service ▸ Activate Parameters**.

   Result: The DP master(s) work(s) with the new parameters.

Note

The IM 308-C always works with the last parameters to have been exported if the system is powered down and powered up again!

Example 2: Overwriting a master system on the DP master

There is already a master system on the DP master and you want to overwrite it. To export data to the DP master (e.g. to the IM 308-C):

- The online functions of COM PROFIBUS must be installed (see section G.2)
- The programmer/PC must be connected either to the PROFIBUS or directly to the DP master (see Table G-1, section G.2)

Example 2: Exporting the master system

To export the master system to the master:

1. In COM PROFIBUS, select **File ▸Export ▸DP Master**.
2. Enter the current baud rate and the PROFIBUS address of the DP master and confirm them by pressing the ”OK” button.

   Result: COM PROFIBUS exports the parameters to the DP master (IM 308-C: ”RN” and ”IF” LEDs lit: the operating mode of the IM 308-C does not change).

   After the parameters have been exported, they are saved in the DP master, but the DP master resumes with the old parameters (IM 308-C: ”ST” and ”IF” LEDs lit).
3. COM PROFIBUS then asks you whether you want to activate the exported parameters immediately in the DP master:

   If there is only one DP master on the PROFIBUS, activate the parameters by clicking on ”Yes”.

   If there are two or more DP masters on the PROFIBUS, answer ”No” to the prompt instead. Export all the parameterization data to the DP masters first, then activate it with **Service ▸ Activate Parameters**.

   Result: The DP master(s) work(s) with the new parameters.

Note

The IM 308-C always works with the last parameters to have been exported if the system is powered down and powered up again!

G.11.2 Saving to 32 K EEPROM in the S5-95U (File ▶ Export ▶ DP master)

32 K EEPROM for S5-95U

If you have the S5-95U as DP master, you use a special memory module, an EEPROM with a capacity of 32 Kbytes, supplied with the S5-95U with DP master interface.

In case you have to re-order the 32 K EEPROM, you will find the order number in Appendix G.

Preconditions

To export data directly to the S5-95U:

- The online functions of COM PROFIBUS must be installed (see section G.2)
- The programmer/PC must be connected either to the PROFIBUS or directly to the DP master (see Table G-1, section G.2)
- The 32 K EEPROM must be installed on the S5-95U (see section 9.5)

Note

The data of a master system cannot be saved by inserting the 32 K EEPROM in the EEPROM slot of the programmer or an external programming unit.

You can only save the data of a master system in the S5-95U when the 32 K EEPROM is inserted in the S5-95U.

Saving data to S5-95U

You can only export the data you have parameterized with COM PROFIBUS to the S5-95U via the PROFIBUS-DP. The S5-95U automatically sets the baud rate to 19.2 kbaud and the PROFIBUS address to ”1” after a general reset (battery removed and POWER DOWN/POWER UP or programmer command).

Tip: Save the application program on the 32 K EEPROM before you carry out a general reset. In this case, the S5-95U will load the application program after the POWER DOWN/POWER UP.

Saving configuration data to 32 K EEPROM

The procedure for saving the configuration data to the 32 K EEPROM is as follows:

1. Set the S5-95U to STOP.
2. In COM PROFIBUS, select **File ▸ Export ▸ DP Master**.
3. Enter the current baud rate of the DP master (default after general reset = 19.2 kbaud). The current baud rate is available in EB 63 (value 05_H is not used):

Table G-14 Contents of EB 63 (baud rate)

EB 63	Baud rate
00_H	9.6 kbaud
01_H	19.2 kbaud
02_H	93.75 kbaud
03_H	187.5 kbaud
04_H	500 kbaud
06_H	1500 kbaud

4. Enter the current station number of the DP master (default after general reset = STN1). The current station number is available as a hexadecimal value in EB 62.

   Result: COM PROFIBUS exports the configuration data to the S5-95U. It then asks whether you want to activate the exported configuration data immediately in the S5-95U.

5. If there is only one S5-95U on the PROFIBUS, activate the exported configuration data immediately.

   If there are two or more DP masters on the PROFIBUS, answer ”No” to the prompt instead. Export all the parameterization data to the DP masters first, then activate it with **Service ▸ Activate Parameters**.

   Result: If the configuration data is exported successfully, it is stored in compressed form in the 32 K EEPROM (STOP LED flickers).

   If the configuration data is not exported successfully, the S5-95U resumes with the old bus parameters of the 32 K EEPROM. If the 32 K EEPROM is blank, the default values are used.

   If the export of the configuration data to the S5-95U is interrupted – e.g. if the bus connector is withdrawn or an error occurs on the bus – you must POWER DOWN/POWER UP.

6. Reset the S5-95U from STOP to RUN. After a STOP-RUN transition, the S5-95U operates with the new configuration data.

General reset of the 32 K EEPROM

If you perform a general reset (with a programmer command or by removing the backup battery and using DB 1 parameter ”LNPG n”; see section 10.3), only the configuration data on the 32 K EEPROM is deleted. The STEP 5 application program is deleted from the 32 K EEPROM if you then press the ”Copy” button.

G.11.3 Saving to memory card for IM 308-C (File ▸ Export ▸ Memory Card)

Preconditions for use of memory card

To export data to a memory card:

- Your programmer must have a memory card interface, or
- Your programmer must have an (E)EPROM slot with the appropriate programming adapter, or
- Your PC must have an external programming unit.

The order numbers are listed in Appendix F.

Saving to memory card

To save the data of a master system to a memory card:

1. Insert the memory card in the slot in the programmer or programming unit, and
2. In COM PROFIBUS, select **File ▸ Export ▸ Memory Card**.

   Result: The configuration data is saved on the memory card. You can insert the memory card in the IM 308-C.

G.11.4 Saving as a binary database in NCM format for SIMATIC NET PC modules (File ▶ Export ▶ NCM file)

Applications

You require binary databases in NCM format for SIMATIC NET PC modules. The procedure for exporting the master system configured with COM PROFIBUS to a SIMATIC NET PC module is as follows:

1. Generate the database for the SIMATIC NET PC module (.LDB) using the **File ▶ Export ▶ NCM file** command.
2. Choose a name for the NCM database and give it an ".LDB" extension.
3. Follow the instructions provided by COM PROFIBUS and confirm your inputs by pressing the "OK" button.

   Result: COM PROFIBUS converts the configuration you have generated and creates the following files:

   – NCM file, loadable binary database (.LDB)

   – Error file (.ERR)
4. Load the binary database (NCM file) onto the SIMATIC NET PC module using the SIMATIC NET Setup program (please also refer to the Installation Manual for the FMS-5412, DP-5412 or SOFTNET for PROFIBUS).

G.12 Documenting and printing the parameterized configuration

Overview

COM PROFIBUS can generate the following lists to document the parameterized configuration:

Table G-15 Documenting the parameterized configuration

Documentation ...	Contains ...
List of all bus parameters	... baud rate, bus profile and bus times, etc.
Station list	... all stations on the bus, in order of their PROFIBUS addresses, with description and master or host assignment.
Overview of hosts and master systems	... host configuration, masters assigned to the host and PROFIBUS addresses of the DP slaves/FMS stations assigned to the master.
Assignment of DP slaves to groups[1]	... slaves in groups and the group properties (FREEZE, SYNC).
Station-oriented address assignment[1]	... the STEP 5 addresses assigned to a DP slave.
Area-oriented address assignment[1]	... how the STEP 5 address space is divided among the various DP slaves.
Overview of connections (FMS)[2]	... FMS connections parameterized for an FMS station.
List of all station types and associated device master files	... the device master files/type files in a directory known to COM PROFIBUS, with the device master file/type file to station type assignments.

1 These documentation lists are only available for a DP system.
2 This documentation list is only available for an FMS system.

View documentation

To view the area-oriented address assignments, for example, select **Documentation ▸ Area-oriented Address Assignment**.

What can I print?

You can print all the lists that are named in the ”Documentation” box.

How do I print?

To print a list:

1. Click on the list of your choice in the system documentation box (e.g. overview of host and master systems), and
2. Click on the print icon or select **File ▸ Print**.
3. Confirm your choice by pressing the ”OK” button.

G.13 PROFIBUS-DP: service functions with COM PROFIBUS

Overview

COM PROFIBUS incorporates the following service functions:

- Overview diagnostics (not when S5-95U is DP master)
- Slave diagnostics
- Status of slave inputs and outputs
- Changing the PROFIBUS address of a slave
- Activating parameters that have been exported to the DP master
- Bus parameters of the PROFIBUS card
- Data cycle times
- Programmer/PC offline on the PROFIBUS
- Deleting the memory card

Preconditions

It is a precondition of using the service functions that your programmer/PC is active as master on the PROFIBUS via a PROFIBUS interface. You can find these preconditions for the online functions in section G.2.

Definition of diagnostics

The **overview diagnostics** indicate which slave has reported a diagnosis – in other words detected an error.

The **slave diagnostics** provide more detailed information about the slave with regard to

- The station status of the slave
- The master PROFIBUS address
- The device-specific, ID-specific and channel-specific diagnostics, depending on the slave type

View overview diagnostics

You can view the overview diagnostics as follows:

1. Switch to the master system whose overview diagnostics you want to view.
2. Select **Service ▸ Overview Diagnostics** or click on the master with the right mouse button.

   Result: The ”Overview Diagnostics” dialog box is opened. Its meaning is as follows:

Table G-16 Meaning of the ”Overview Diagnostics” dialog box

PROFIBUS address	Meaning
M	PROFIBUS address of the master
X	A slave which is parameterized , but not assigned to this master system
Empty field	No diagnostics reported by a slave which is assigned to this master system
!! (empty field)	Diagnostics reported by a slave
OFF (empty field)	No data communication between master and slave.

View slave diagnostics

You have several ways of viewing the slave diagnostics:

- If the mouse is pointing to an empty field for a slave in the ”Overview Diagnostics” dialog box, you can display the slave diagnostics either by clicking the right mouse button or by double-clicking (not if S5-95U is DP master)

  or

- Click on the appropriate slave and select **Service ▸ Slave Diagnostics**

  or

- Click on the appropriate slave with the right mouse button and select **Slave Diagnostics**.

Result: COM PROFIBUS opens the ”Slave Diagnostics” box.

Status of inputs and outputs

With Version 3.0 of COM PROFIBUS, you can display the status of the inputs and outputs of the slaves on the PROFIBUS.

You have several ways of viewing the status of a slave:

1. Click on the appropriate slave and select **Service ▸ Status**

   or

   Click on the appropriate slave with the right mouse button and select **Status**.

   Result: COM PROFIBUS opens the ”Status” box

2. Using the right mouse button in the ”Format” column, select the field containing the format in which you want the inputs and outputs to be displayed.

   Result: COM PROFIBUS updates the status of the inputs and outputs online.

Preconditions of changing the PROFIBUS address

The following preconditions must be fulfilled in order to change the PROFIBUS address with COM PROFIBUS:

- It must be possible to change the PROFIBUS address of the slave using the software. This is not the case with slaves whose PROFIBUS address can **only** be set directly with a switch on the housing.
- The slave must behave like a DP slave in accordance with EN 50 170, Volume 2, PROFIBUS.
- The slave must not be in the process of communicating with the DP master.

Changing the PROFIBUS address

To change the PROFIBUS address:

1. Select **Service ▸ Change PROFIBUS Address**.

   Result: COM PROFIBUS opens the ”Change PROFIBUS Address” box.

2. Enter the old and new PROFIBUS addresses.
3. Specify whether or not the new PROFIBUS address can be changed later on. If not, you will only be able to change the PROFIBUS address after a general reset.
4. Confirm your inputs by pressing the ”OK” button.

   Result: COM PROFIBUS assigns a new PROFIBUS address to the slave. This new PROFIBUS address takes effect for the slave immediately.

Activating parameters

If you have exported the data of a master system to the DP master directly using the **File ▸ Export ▸ DP Master** function, the new parameters are not valid immediately.

After the data has been exported, COM PROFIBUS asks you whether you want to activate the exported parameters immediately in the DP master. If there is only one DP master on the PROFIBUS, activate the parameters immediately.

If there are two or more DP masters on the PROFIBUS, answer ”No” to the prompt instead. Export all the parameterization data to the DP masters first, then activate it with **Service ▸ Activate Parameters**. You can thus activate the parameters synchronously.

Bus parameters of the PROFIBUS card

Using **Service ▸ Bus Parameters DP Card** you can define the bus profile and the baud rate of the PROFIBUS card.

Data cycle times

Using **Service ▸ Data Cycle Times** you can tell COM PROFIBUS to output the data cycle times, such as the response monitoring time for the configuration you have entered.

Offline

If you want to use a programmer/PC offline on the PROFIBUS, e.g. in order to display diagnostic messages or states, and at the same time disconnect the programmer/PC from the PROFIBUS in a defined manner, select **Service ▸ Offline**.

Deleting the memory card

If you want to delete the memory card for the IM 308-C, select **Service ▸ Delete Memory Card**.

Glossary

Baud rate

The speed of data transmission, expressed as the number of bits transferred per second (baud rate = bit rate).

Baud rates from 9.6 kbaud to 12 Mbaud are possible on the PROFIBUS-DP, while the PROFIBUS-FMS permits rates from 9.6 kbaud to 1.5 Mbaud.

Binary file

If, after transferring data to the DP master, you wish to save this data on the programmer/PC as well, you must create a binary file. The binary file contains all the bus, slave and master parameters of a master system configured with COM PROFIBUS.

Bus

Common transmission path interconnecting all nodes; the bus has two defined terminating points.

The bus for the ET 200 system is a two-conductor cable or a fiber-optic waveguide.

Bus connector

Physical connection between a station and the bus.

Bus connectors for ET 200 are available with and without an interface for the programmer and with IP 20 and IP 65 protection ratings.

Bus segment

→Segment

Bus system

The set of all stations physically connected by a bus cable forms a bus system.

CLEAR

An operating mode of the DP master. The DP master reads the input data cyclically, the outputs remain set to ”0”.

The DP master participates in the token ring.

Combimaster

A master that can function either as a DP master or as an FMS master.

Communications relationship

With the PROFIBUS-FMS, a communications relationship is a logical link between two stations on the bus.

Communications relationship reference (KR)

A communications relationship exists between two stations that communicate with one another via the PROFIBUS-FMS. Each station on the bus has at least one communications relationship. Each relationship has a unique number (known as a communications relationship reference). A communications relationship reference corresponds to an ”internal address” of the bus station on layer 7.

Configuring

The act of parameterizing individual modules in a distributed I/O system and/or assigning addresses.

Consistent data

Data which, on account of its content, belongs together and cannot be separated is known as consistent data.

The values of analog modules, for example, must always be treated as consistent data, i.e. the value of an analog module must not be falsified by being read at two different times.

Control command

The IM 308-C can send commands simultaneously to a group of DP slaves in order to synchronize the DP slaves.

The control commands → FREEZE and → SYNC enable event-driven synchronization of the DP slaves.

Cyclic processing

The regular addressing of the slaves by the master.

The master (e.g. the IM 308-C) reads the input data of the slaves and sends output data to the slaves.

Cyclic processing corresponds to the RUN and CLEAR operating modes of the DP master.

Device master data

Device master data contains DP slave descriptions in a standard format. It is easier to parameterize the master and the DP slave using the device master data.

Diagnostics

The detection, location, classification, indication and evaluation of errors, faults and messages.

Diagnostics supports monitoring functions that execute automatically during system operation, thus enhancing the availability of the system by helping to minimize startup times and idle times.

ET 200 supports a number of diagnostics options, from an overview of the DP slaves that have generated diagnostic reports to monitoring of individual channels.

Distributed I/O station

An I/O unit not installed in the central device. A distributed I/O station can be located at a considerable distance from the CPU. Distributed I/O stations include:

- ET 200B, ET 200C, ET 200L, ET 200M, ET 200U
- DP/AS-I link
- S5-95U with PROFIBUS-DP interface
- other DP slaves from Siemens or other-vendor products

The PROFIBUS-DP bus connects the distributed I/O stations to the IM 308-C master interface or the S5-95U with DP master interface.

DP master

A → master which functions in accordance with EN 50 170, Volume 2, PROFIBUS with the DP protocol is known as a DP master.

DP Siemens

The bus protocol developed by Siemens. With the cooperation of the PROFIBUS User Forum, this bus protocol has been extended into an open, vendor-independent system. The extended bus protocol has been ratified as European Standard EN 50 170, Volume 2, PROFIBUS (→ DP standard).

DP slave

A → slave operating on the PROFIBUS with the PROFIBUS-DP protocol and functioning in accordance with EN 50 170, Volume 2, PROFIBUS is known as a DP slave.

DP standard

The bus protocol of the ET 200 distributed I/O system, as defined in EN 50 170, Volume 2, PROFIBUS.

DP window

The DP window is the address space addressed by the FB IM308C on the IM 308-C. Multiple DP windows are available for addressing the distributed I/O system, beginning with address (F)F800$_H$, (F)FA00$_H$, (F)FC00$_H$ and (F)FE00$_H$.

When you use DP windows, you must ensure that the address space is not also occupied either totally or in part by CPs and IPs in the central programmable controller.

Earth

The conductive soil where the potential at all points can be assumed to be zero.

ET 200

ET 200 distributed I/O system with the PROFIBUS-DP protocol is a bus for connecting distributed I/O stations to the S5-115U, S5-135U and S5-155U programmable controllers or other suitable master. The ET 200 is characterized by fast reaction times, as only small volumes of data (bytes) are transferred.

ET 200 is based on the European Standard EN 50 170, Volume 2, PROFIBUS.

ET 200 operates on the master/slave principle. The DP master can be, for example, the IM 308-C master interface, the S5-95U with DP master interface or a programmer/PC with a SIMATIC NET PC module.

The DP slaves can be, for example, the ET 200B, ET 200C, ET 200L, ET 200M or ET 200U distributed I/O stations, the S5-95U programmable controller with PROFIBUS-DP slave interface, other Siemens DP slaves or other-vendor slaves.

Export

A COM PROFIBUS command for saving data on a memory card or in a binary file.

External power supply

Power supply unit for I/O modules.

FDL

Field bus data link; layer 2 of PROFIBUS

Floating

On a floating I/O module the reference potentials of the control and load circuits are galvanically isolated from each other. The input and output circuits are not grouped, in other words they have no common reference potential (1-to-1 grouping). Not to be confused with ”isolated”.

FMS connection

An FMS connection is a → communications relationship between two FMS stations.

FMS master

A → master which functions in accordance with EN 50 170, Volume 2, PROFIBUS with the FMS protocol is known as an FMS master.

FMS service

The master can exchange data with FMS services.

There are confirmed and unconfirmed FMS services. In the case of confirmed FMS services (e.g. MSAZ), the slave sends an acknowledgment back to the master to confirm that the services have been received. With unconfirmed FMS services (e.g. broadcast), the slave does not send an acknowledgment to the master.

FMS slave

A → slave operating on the PROFIBUS with the PROFIBUS-FMS protocol and functioning in accordance with EN 50 170, Volume 2, PROFIBUS is known as an FMS slave.

FMS station

An FMS station is an FMS master or an FMS slave.

FREEZE

A control command issued by the DP master to a group of DP standard slaves.

When it receives the FREEZE control command, the DP slave freezes the current state of the **inputs** and transfers them cyclically to the DP master.

The DP standard slave freezes the status of the **inputs** every time it receives a FREEZE command.

The DP standard slave does not transfer the data cyclically to the DP master until the DP master sends the UNFREEZE control command.

The FREEZE command requires that the DP standard slaves be assigned to a → group in COM PROFIBUS. ET 200 supports the FB IM308C for the FREEZE command.

Gap factor

Gap-update factor. The distance between the own PROFIBUS address of the DP master and the next PROFIBUS address is known as the gap. The gap update factor, in turn, indicates the number of token runs that must be performed before the DP master checks whether there is another DP master in the gap.

If, for example, the gap updating factor is 3, each DP master checks after 3 token runs whether there is another DP master between its own PROFIBUS address and that of the next DP master.

Ground electrode

One or mode conductive parts making good contact with the ground.

Grounding

Connecting an electrically conductive part to the ground electrode by means of a grounding system.

Group

You must assign the DP slaves to groups and send the FREEZE and SYNC control commands to the groups.

Multiple DP slaves can be assigned to a group. A given DP slave can be assigned to more than one group, but can belong to only one → master system.

Grouping

On grouped modules, multiple input and output circuits share a common connection. The common connection may carry either the (L-) potential (M-grouping) or the (L+) potential (P-grouping).

Group membership

Membership of a bus node to a → group.

Host

A host is a system or device containing at least one DP master, for example the programmable controller with the CPU is the host and the IM 308-C is the DP master.

ID

A unique code identifying the S5-100U I/O modules in the ET 200U distributed I/O station. These unique codes are assigned to the S5-100U I/O modules under COM PROFIBUS.

IM 308-C

A DP master for the ET 200 distributed I/O system. The IM 308-C can be used together with COM PROFIBUS and can be inserted in the S5-115U, S5-135U and S5-155U programmable controllers.

Import

A command in COM PROFIBUS for reading a configuration from a DP master, a memory card or a binary file.

IP 20

DIN 40050 degree of protection: protection against finger contact and ingress of solid bodies measuring in excess of 12 mm in diameter.

IP 65

DIN 40050 degree of protection: complete protection against contact, protection against the ingress of dust and protection against jets of water from all directions.

IP 66

DIN 40050 degree of protection: complete protection against contact, protection against the ingress of dust and protection against the ingress of heavy seas or powerful jets of water.

IP 67

DIN 40050 degree of protection: complete protection against contact, protection against the ingress of dust and protection against damaging ingress of water under pressure when immersed.

Isolated

On an isolated I/O module the reference potentials of control and load circuits are galvanically isolated, e.g. by optocouplers, relay contacts or transformers. Input and output circuits may be grouped. Not to be confused with ”floating”.

Isolation monitoring

Facility for monitoring the isolation resistance of a system.

LSAP

A link service access point is a layer 2 access point (address).

Lightning arrester — A device capable of wholly or partially diverting a lightning pulse without losing its integrity.

Lightning-protection potential equalization — Comprises those parts of the internal lighting-protection system required to reduce the potential differentials caused by a lightning pulse, i.e. the potential-equalization busbars, potential-equalization conductors, clamps, connectors, air-gap suppressers, lightning arresters and overvoltage arresters.

Loop resistance — Total resistance of the feed and return.

Machine ground — The entirety of all interconnected inactive parts of a device. The machine ground cannot carry a hazardous contact voltage even in the event of a fault.

Master — When in possession of the token, the master may send data to other nodes and request data from other nodes.

Master interface — Module for distributed I/O. The distributed inputs/outputs are connected to the programmable controller via the IM 208-C master interface.

Master PROFIBUS address — The ”master PROFIBUS address” parameter of the PROFIBUS-DP contains the PROFIBUS address of the master to which a DP slave is assigned and which has parameterized the DP slave.

Master/slave procedure — Bus access procedure in which only one node is the master and all other nodes are slaves.

Master system — The master plus all the slaves to which it has read and write access form a master system.

Max. retry limit — A bus parameter defining the maximum number of call retries addressed to a DP slave.

max_T_{SDR} — A bus parameter defining the maximum protocol processing time of the responding node (Station Delay Responder).

min_T_{SDR} — A bus parameter defining the minimum protocol processing time of the responding node (Station Delay Responder).

Mode selector switch — The mode selector switch is on the IM 308-C master interface. It is a three-position switch for the modes → RUN, → STOP and → OFF.

Non-floating

On a non-floating I/O module the reference potentials of control and load circuits are electrically connected.

Non-grounded configuration

Configuration without a galvanic connection to ground. In most instances an RC element is used to divert interference currents.

Offline

When the programmer is connected to the bus by the bus cable but is not active as master, it is said to be offline on the bus.

Online

When the programmer is active as DP master on the bus, it is said to be online on the bus.

Overvoltage arrester

Device for limiting overvoltages from remote strikes or induction effects (or switching operations). The currents diverted by overvoltage arresters are significantly lower than lightning pulses with regard to peak values, charges and specific energy.

Parameterization

Parameterization is the defining of an ET 200 configuration with all specific parameters in COM PROFIBUS.

Parameterization master

Each DP slave has one parameterization master. In the power-up procedure, the parameterization master transfers the parameters to the DP slave, it has read and write access to the DP slave and may modify the configuration of a DP slave.

The FREEZE and SYNC control commands, for example, can be sent to the DP slave only by the parameterization master.

The opposite of the parameterization master is the → shared-input master.

Parameterizing

The act of transferring the slave parameters from the master to the slave.

PDU

→ Protocol data unit

Process image

A process image of all inputs (= PII) or all outputs (= PIO) at a given time. You can access the process image in the control program.

PROFIBUS

PROcess FIeld BUS, European process and field bus standard defined in the PROFIBUS standard (EN 50 170, Volume 2, PROFIBUS).

The standard defines functional, electrical and mechanical characteristics for a bit-serial field bus system.

PROFIBUS is a bus system which links PROFIBUS-compatible programmable controllers and field devices on cell and field level. PROFIBUS runs the protocols DP (= distributed I/O system), FMS (= field bus message specification), PA (= process automation) and TF (= technological functions).

PROFIBUS address

Each station must be assigned a unique PROFIBUS address for identification.

The programmer or the ET 200 Handheld has the PROFIBUS address ”0”.

DP masters and DP slaves are assigned PROFIBUS addresses in the range 1 to 123, with the following exceptions:

PROFIBUS-DP

The PROFIBUS bus system with the DP protocol. DP stands for distributed I/O system.

The primary function of PROFIBUS-DP is to sustain the high-speed cyclic exchange of data between the central DP master and the distributed I/O stations.

PROFIBUS-FMS

The PROFIBUS bus system with the FMS protocol. FMS stands for field bus message specification.

Protocol data unit

The information which is exchanged between two stations on the bus is packed in a PDU (= protocol data unit).

Reaction time

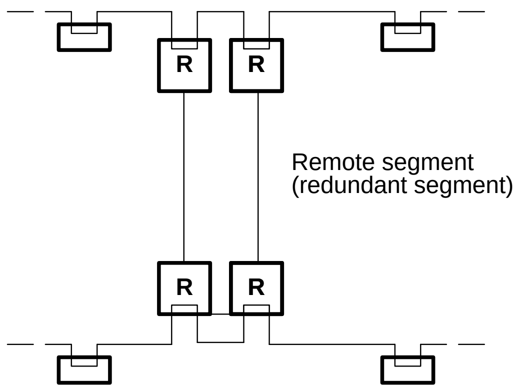
The reaction time is the average time which elapses between the change of an input and the corresponding change of an output.

Redundancy

The provision of duplicates for the sake of reliability. If one component fails the duplicate assumes the role of the original.

Redundant remote operation

The duplication of a bus line monitored at both ends by two 485 repeaters in remote mode:



Reference potential

Potential to which the voltages of the circuits are referenced and the datum for measurement of these voltages.

Response monitoring

A slave parameter in COM PROFIBUS. If a DP slave is not addressed within the response monitoring time, it goes to safe condition, i.e. the DP slave sets its output to ”0”.

Response monitoring can be switched on or off for each individual DP slave.

RS 485 repeater

Device for amplifying bus signals and linking → segments over large distances.

RUN

An operating mode of the master.

The DP master cyclically reads the input data of the slaves and sends output data to the slaves. The master is participating in the token ring.

Segment

The bus line between two terminating resistors constitutes a segment. A segment includes 0 to 32 → stations. Segments can be linked by → RS 485 repeaters.

Shared-input master

Other DP masters can have **read** access to a DP slave assigned to a parameterization master. The other DP masters are known as shared-input masters.

In COM PROFIBUS masks, DP slaves assigned to a shared-input master appear gray.

Shield impedance

AC impedance of the cable shield. Shield impedance is a characteristic of the cable used and is usually specified by the manufacturer.

Short-circuit

A conductive path established by a fault between two conductors that are normally energized in operation when the fault circuit thus created does not include a working resistance.

SIMATIC NET PC modules

SIMATIC NET PC modules are used to link the PC to bus systems, e.g. PROFIBUS or Industrial Ethernet.

SINEC L2

SINEC L2 is the name of the Siemens → PROFIBUS.

Slave

A slave can exchange data with a → master only when requested to do so by the master.

Slaves are, for example, all DP slaves such as ET 200B, ET 200C, etc.

SOFTNET for PROFIBUS

SOFTNET for PROFIBUS is the protocol software for the CP 5411, CP 5511 and CP 5611 SINEC NET PC modules.

Standard-section busbar

Metal busbar of a section standardized in EN 50 022.

Standard-section busbars are used to secure the devices in the SIMATIC family, for example S5-100U I/O modules, ET 200B, etc.

Station

Device which can send, receive or amplify data on the bus, e.g. master, slave, RS 485 repeater, star hub.

Station number

→ PROFIBUS address

STOP

Operating mode of the master. No data is exchanged between master and slaves. The master participates in the token ring.

Suppresser

Component designed to reduce induced voltages. Induced voltages occur when circuits with inductors are switched off.

SYNC

A control command addressed by the DP master to a group of DP standard slaves.

The DP master issues the SYNC control command to force the receiving DP slaves to freeze the states of their **outputs** at their current values. The DP standard slaves store the output data for subsequent telegrams, but the output states remain unchanged.

After every SYNC control command, the DP standard slave sets the outputs which it had saved as output data.

The outputs are not cyclically updated until the DP master sends the UNSYNC control command.

The DP standard slave must be assigned to a → group in order to implement the SYNC control command. ET 200 supports the FB IM308C for the SYNC control command.

Terminating resistor

A resistance for matching to the impedance of the bus cable; invariably, a terminating resistor must be installed at each end of the bus cable or segment.

In the ET 200, the terminating resistors are activated/deactivated in the → bus connectors.

T_{ID1}

A bus parameter; idle time 1 is the idle time which elapses after receipt of a response.

T_{ID2}

A bus parameter; idle time 2 is the idle time which elapses after sending of a call without response.

Token

A telegram representing the send authorization in a network. The token signals the states ”seized” and ”free”. The token is passed from master to master.

Token ring

Each master physically interconnected by a bus receives the token and passes it to the next master in turn. The masters participate in what is known as a token ring.

Token runtime

The time that elapses between the receipt of two consecutive → tokens.

T_{QUI}

Quiet time for modulator; the time for switching from send to receive. The quiet time for modulator allows for the operation of switching off the transmitter and switching on the receiver.

T_{RDY}

Ready time for acknowledgment or response.

T_{SET} Setup time. The setup time is the time that may elapse between reception of a telegram and the associated reaction.

T_{SL} Slot time. The slot time is the maximum time the transmitter allows for a response from the station it addresses.

T_{TR} Target rotation time. Each master compares the target rotation time with the actual token runtime. The difference is the factor which determines the time that the DP master can use to send its data telegrams to the slaves.

UNFREEZE → FREEZE

UNSYNC → SYNC

VFD A VFD (virtual field device) is a map of a real field device, the purpose of which is to obtain a standard view of any device.

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Federal Republic of Germany

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