SIEMENS

SIMATIC

Bus links
DP/PA coupler, DP/PA link, Y-link and active field distributors

Operating Instructions

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Security information

1

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

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https://www.siemens.com/industrialsecurity.

Preface

2

Purpose of the operating instructions

These operating instructions provide you with important information for configuring, installing, wiring and commissioning the following gateways for PROFIBUS:

- Couplers and links between PROFIBUS DP and PROFIBUS PA or PROFIBUS DP.
- Active field distributors for PROFIBUS PA

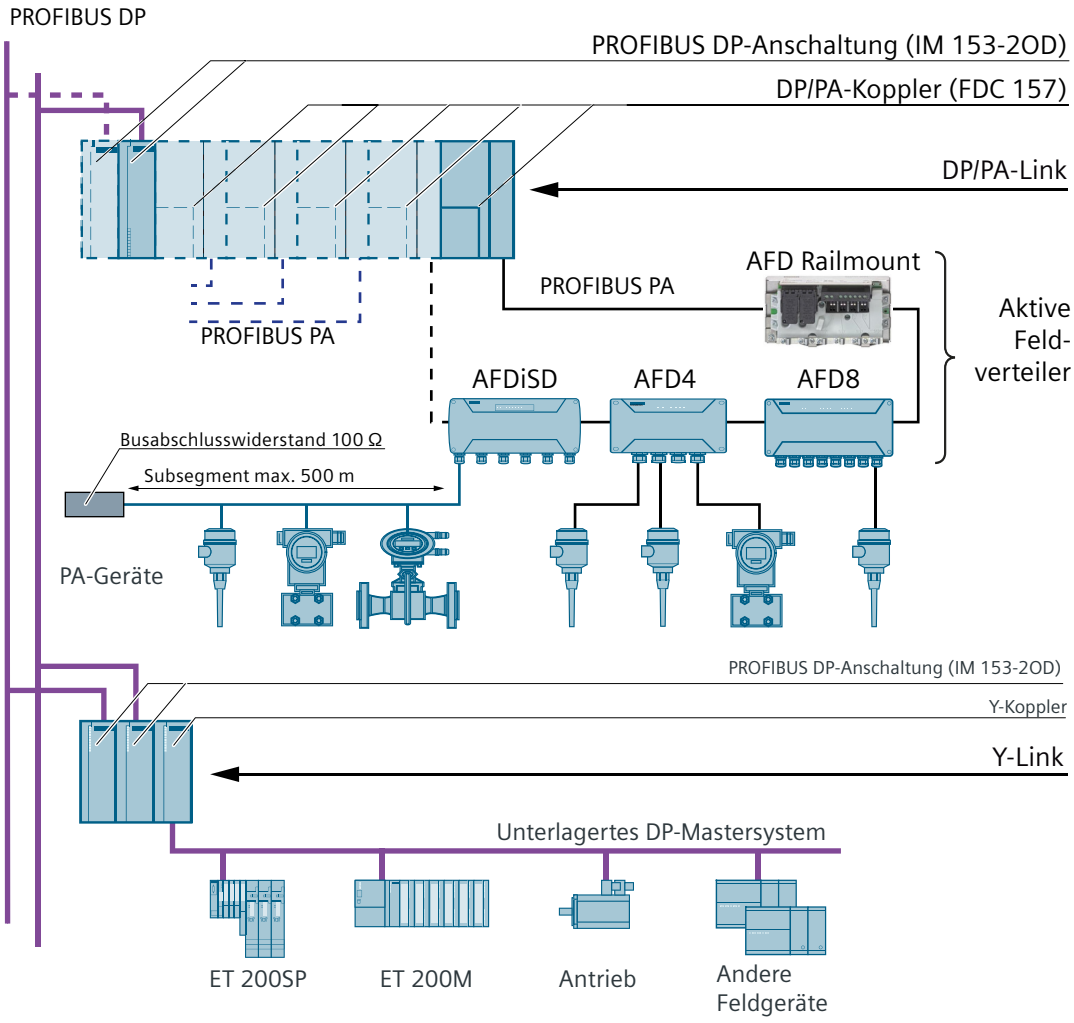


Figure 2-1 Overview of the components

Connection of PA field devices to PROFINET IO

To connect PA field devices to PROFINET IO, use the SIMATIC CFU PA instead of the DP/PA link. You can find information on this in the commissioning manual: SIMATIC Distributed I/O SIMATIC Compact Field Unit (CFU) (https://support.industry.siemens.com/cs/ww/en/view/109776629)

Range of validity of these operating instructions

These operating instructions apply to the following products:

Table 2-1 Article numbers for the hardware components of the gateways

Component	Product	Article number
Interface module		
• IM 153-2OD	PROFIBUS DP interface module for extended temperature range	6ES7153-2BA70-0XB0
DP/PA coupler		
• FDC 157	DP/PA coupler	6ES7157-0AC85-0XA0
• FDC 157-0 Ex [ia]	DP/PA coupler Ex [ia]	6ES7157-0AD82-0XA0
Y-coupler		
• Y-coupler	Connects PROFIBUS DP redundant to PROFIBUS DP single (only possible in the Y-Link)	6ES7197-1LB00-0XA0
Bus modules		
• BM PS/IM	Bus module to accommodate one power supply PS and one interface module IM	6ES7195-7HA00-0XA0
• BM PS/IM SIPLUS extreme	Bus module for extended ambient conditions to accommodate one power supply PS and one interface module IM	6AG1195-7HA00-2XA0
• BM IM/IM	Bus module to accommodate two interface modules IM	6ES7195-7HD10-0XA0
• BM IM/IM Outdoor	Bus module for extended ambient conditions to accommodate two interface modules IM	6ES7195-7HD80-0XA0
• BM FDC	Bus module to accommodate one DP/PA coupler	6ES7195-7HF80-0XA0
• BM FDC/FDC (redundant)	Bus module to accommodate two DP/PA couplers (redundant)	6ES7195-7HG80-0XA0
• BM Y-coupler	Bus module to accommodate one Y-coupler	6ES7654-7HY00-0XA0
Active field distributors		
• AFDiSD (**A**ctive **F**ield **D**istributor **I**ntrinsic **S**afety with extended Fieldbus **D**iagnostic)	Active field distributor with extended fieldbus diagnostics for up to 6 PA field devices	6ES7655-5DX60-1BB0
• AFD4	Active field distributor for up to 4 PA field devices	6ES7157-0AG81-0XA0
• AFD4 (FM)	Active field distributor with FM approval for up to 4 PA field devices	6ES7655-5DX40-1AA1
• AFD4 Railmount	Active field distributor for up to 4 PA field devices, installation in enclosure required	6ES7655-5DX40-2AA0
• AFD8	Active field distributor for up to 8 PA field devices	6ES7157-0AG82-0XA0

For information on current components, the required software, and compatibility with predecessor components, refer to the section:

Compatibility overview (Page 279)

These operating instructions contain a description of the components that was valid at the time the operating instructions were published. We reserve the right to include product information with information updates with new components and components with a new product version.

Basic knowledge required

General knowledge in the field of automation technology and basic knowledge of PCS 7 or STEP 7 are required to understand the documentation.

Knowledge of the use of computers or PC-like tools such as programming devices with a Windows operating system is required.

When using the AFDiSD, you require knowledge of the fundamentals of explosion protection, of the labeling of explosion-protected equipment and of the legal fundamentals concerning explosion protection.

Active field distributors in hazardous areas (Page 62)

Changes compared to the previous version

Compared to previous versions of these operating instructions, the following changes have been made:

- Compared to the previous version, Edition 08/2015:
  - Adaptation to available products
  - Update of certificates
- Compared to the previous version, Edition 07/2011:
  - Replacement components included (information on this can be found in the section "Compatibility overview (Page 279)".
- Compared to previous version, Edition 10/2006:
  - Integration of the product information 09/2008 and 11/2009

Position in the overall information structure

Depending on the hardware used you require the following manuals in addition to these operating instructions:

- The manual for the implemented DP master, including the following special information:
  - Configuring and commissioning of a DP master system
  - Description of the DP master
- The manual SIMATIC NET, PROFIBUS network manual (https://support.industry.siemens.com/cs/ww/en/view/35222591)

- The operating instructions SIMATIC S7-300 CPU 31xC and CPU 31x: Installation (https://support.industry.siemens.com/cs/ww/en/view/36305386)
- The manual Automation Systems S7-300, ET 200M Ex I/O modules (https://support.industry.siemens.com/cs/ww/en/view/1096709), including in particular information on the topics intrinsic safety and explosion protection.
- System manual Principles of Explosion Protection (https://support.industry.siemens.com/cs/ww/en/view/12521844)

You can find additional information on explosion protection in the corresponding directives and standards.

Also note the supplementary product information for the following products:

Guide

These operating instructions are divided into the following topics:

- Product overview and description of the components
- Install, connect and commission
- Operation and diagnostics
- Technical specifications
- Appendices
- Glossary

2.1 Additional information

Recycling and disposal

The described components are ecologically compatible, and thus suitable for recycling. Contact a certified disposal service company for electronic scrap for environmentally sustainable recycling and disposal of your old devices.

Additional support

If you have any questions relating to the products described in these operating instructions and do not find the answers in this document, please contact your local Siemens representative (http://support.industry.siemens.com/aspa_app/).

A guide to the technical documentation for the various SIMATIC products and systems is available on the Internet. (http://www.siemens.com/simatic-docu)

The online catalog and order system is available on the Internet (http://www.siemens.com/automation/mall).

Training center

Siemens offers a series of courses that will help you getting started with the components and the SIMATIC S7 automation system. Please contact your regional training center or the central training center in D-90327, Nuremberg, Germany (https://www.siemens.com/sitrain).

Technical support

You can contact Technical Support for all Industry Automation products by means of the Internet Web form for the Support Request. (https://support.industry.siemens.com/My/ww/en/requests)

You can find additional information on our technical support on the Internet (https://support.industry.siemens.com/cs/us/en/).

Service & Support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base on the Internet (https://support.industry.siemens.com/cs/us/en/).

There you will find:

- Our Newsletter, which constantly provides you with the latest information about your products.
- The right documents for you in Service & Support.
- Worldwide forum in which users and experts exchange ideas.
- Your local contact for Automation & Drives from our contact database.
- Information about on-site service, repairs, spare parts, and much more.

See also

Compatibility overview (Page 279)
Active field distributors in hazardous areas (Page 62)

2.2 2D matrix code (QR code / EAN code)

The 2D matrix code on the product is a coded representation of the product-specific article number.

Access to product-related information

For reading the 2D matrix code, SIEMENS offers an app for mobile use.
Information about the app and the download can be found on the Internet: "Mobile use via app (https://support.industry.siemens.com/cs/ww/en/sc/2067)".

The app provides direct access to the technical forum and product-related posts, such as:

- FAQs
- Application examples
- Manuals
- Certificates
- Product notices
- Catalogs
- and many more

Description of the components

3

3.1 What are distributed I/O devices?

Observe the PNO PROFIBUS engineering guideline:

PROFIBUS User Organization (https://www.profibus.com/downloads)

Distributed I/O Devices - Field of Application

When a system is configured, the inputs and outputs from and/or to the process are often integrated centrally in the automation system.

In the case of greater distances of the inputs and outputs from the automation system the wiring may be very extensive and confusing. Electromagnetic interference may be impair reliability.

Distributed I/O is suitable for use with systems of this kind.

- The PROFIBUS DP master is located in a central position.
- The distributed I/O devices (inputs and outputs) work at their decentral locations.
- With its high transmission rates the high power PROFIBUS DP ensures that the control system CPU and the distributed I/O devices communicate smoothly.

What is PROFIBUS DP?

PROFIBUS DP is an open bus system according to IEC 61784-1:2002 Ed1 CP 3/1. The transmission protocol used (DP stands for Distributed Peripherals or Distributed I/O) enables very fast, cyclic data exchange between the controller CPU and the distributed I/O devices.

Physical design of PROFIBUS DP:

- Electrical network based on a shielded two-wire cable
- Optical network based on a fiber-optic cable (FOC)

What is PROFIBUS PA?

PROFIBUS PA is an open bus system according to IEC 61784-1:2002 Ed1 CP 3/2. The transmission technology is a communication-compatible extension of PROFIBUS DP. PROFIBUS PA permits communication with the automation system and enables the connection of suitable devices in the hazardous area (e.g. Ex transmitters, Ex actuators).

In PROFIBUS PA the field devices can be supplied simultaneously via the data cable.

Gateway from PROFIBUS DP to PROFIBUS PA

The following standards are taken into account for the gateway from PROFIBUS DP to PROFIBUS PA:

- PROFIBUS DP (IEC 61784-1:2002 Ed1 CP 3/1)
- PROFIBUS PA (IEC 61784-1:2002 Ed1 CP 3/2)

3.2 Network components

Bus link

A bus link is a combination of PROFIBUS DP interface module (IM 153-2OD) and a specific coupler.
Typical combinations are DP/PA link and Y-link.

Active field distributors

Active field distributors distribute the PROFIBUS PA via spur lines to PA field devices (e.g. measuring devices, sensors, actuators)

- AFD4 / AFD4 (FM / AFD 4 Railmount: Connection of up to 4 PA field devices)
- AFD8: Connection of up to 8 PA field devices
- AFDiSD: Use in hazardous areas possible, 6 connectors for PA-field devices (for detailed information on the number of PA-field devices see: "Active field distributor AFDiSD (Page 35)" - Special properties of the AFDiSD)

DP/PA coupler

A DP/PA coupler creates a gateway between the PROFIBUS DP and PROFIBUS PA.

DP/PA couplers are used as stand-alone devices or as a DP/PA link in connection with a PROFIBUS DP interface module.

Y-coupler

The Y-coupler is used exclusively in connection with a redundant PROFIBUS DP interface module. The Y-coupler forms the Y-link together with the redundant PROFIBUS DP interface module.

In the Y-link, the coupler creates a gateway between a redundant PROFIBUS DP and a non-redundant PROFIBUS DP.

PROFIBUS DP interface module (IM 153-2OD)

A PROFIBUS DP interface module is used to connect components to the PROFIBUS DP.
As a head module, the PROFIBUS DP interface module is an integral component in the following setups:

- Station of ET 200M
- DP/PA link
- Y-link

DP/PA link

A DP/PA link creates a gateway between the PROFIBUS DP and up to 5 PROFIBUS PA segments. The DP/PA link consists of one or, in a redundant configuration, two PROFIBUS DP interface modules and up to five DP/PA couplers.

Y-link

The Y-link creates a gateway between a redundant PROFIBUS DP and a non-redundant PROFIBUS DP.
The Y-link consists of a redundant PROFIBUS DP interface module and a Y-coupler.

3.3 DP/PA coupler

Definition

A DP/PA coupler creates a gateway between the PROFIBUS DP and PROFIBUS PA.

DP/PA couplers are used as stand-alone devices or as a DP/PA link in connection with a PROFIBUS DP interface module.

Operating principle

The DP/PA coupler is a DP slave on the higher-level DP master system. This DP slave acts as a proxy for the nodes (PA field devices) connected to the lower-level bus system.

The DP/PA coupler forms an independent, lower-level bus system in which the communication is decoupled from the higher-level DP master system.

Product variants of the DP/PA coupler

The following DP/PA couplers are available:

- **DP/PA coupler FDC 157-0**
  DP/PA coupler with extended field bus diagnostics
- **DP/PA coupler Ex [ia]**
  Can be used as PROFIBUS node in equipment category 3G in Zone 2 hazardous areas.
  DP/PA coupler for use with equipment in hazardous areas:
  You may connect intrinsically safe, electrical equipment of the following device categories to the intrinsically safe PROFIBUS PA:
  - Equipment category 1G, 2G and 3G for Zone 0, 1 and 2
  - Equipment category 1D, 2D and 3D for Zone 20, 21 and 22

The following figure shows an example of the integration of the DP/PA couplers in the system.

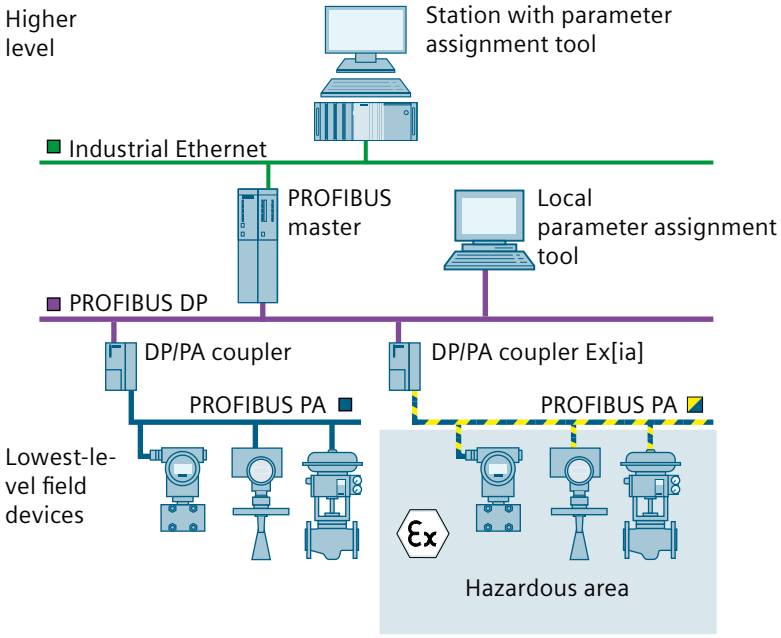


Figure 3-1 Integration of the DP/PA couplers in the system landscape

See also

Use cases for DP/PA link (Page 47)

Technical specifications DP/PA coupler FDC 157 (6ES7157-0AC85-0XA0) (Page 258)

Technical specifications DP/PA coupler Ex [ia] (6ES7157-0AD82-0XA0) (Page 260)

Commissioning DP/PA couplers (Page 132)

3.4 Y coupler

Definition

The Y-coupler is used exclusively in connection with a redundant PROFIBUS DP interface module. The Y-coupler forms the Y-link together with the redundant PROFIBUS DP interface module.

In the Y-link, the coupler creates a gateway between a redundant PROFIBUS DP and a non-redundant PROFIBUS DP.

Operating principle

The Y-link forms an independent, lower-level bus system whose communication is decoupled from the higher-level DP master system.

Use of the Y-link (Page 55)

3.5 Configuration and function of a bus link

3.5.1 PROFIBUS DP interface module

Definition

The PROFIBUS DP interface module is a module for connection of distributed I/O to the PROFIBUS DP.

The PROFIBUS DP interface module is used to communicate between the CPU and the connected components via the bus system.

Use case

The PROFIBUS DP interface module IM 153-2OD is designed for the use in the following installation variants:

- Operating as head station of a ET200M station
  - On a non-redundant DP master system
  - On a redundant DP master system, for example on an S7-400H
- Operation in the DP/PA link
  - On a non-redundant DP master system
  - On a redundant DP master system, for example on an S7-400H
- Operation in the Y-link
  - On a redundant DP master system, for example on an S7-400H

Replacement for predecessor models:
You can find information on this in the section "Compatibility overview (Page 279)".

Note

Configuration

The operating mode of the PROFIBUS DP interface module must be configured:

- As DP/PA link or Y-link
  Configuration of a DP/PA link with IM153-2 OD interface module and corresponding definition in the configuration dialog:
  Select the PROFIBUS DP interface module "IM 153-2 OD" from the hardware catalog under "PROFIBUS DP", directory "DP/PA link".
  - A DP/PA link is configured as an interface module for PROFIBUS-PA
  - A Y-link is configured as an interface module for PROFIBUS DP
- As head station of an ET200M station:
  - Configuration of an ET 200M with IM153-2OD interface module
    Select the PROFIBUS DP interface module "IM 153-2 OD" from the hardware catalog under "Distributed I/O", directory "ET 200M".
  - Configuration of additional I/O modules is possible

Configuring as DP/PA link or Y-Link

- Select the PROFIBUS DP interface module "IM 153-2 OD" from the hardware catalog under "PROFIBUS DP", directory "DP/PA link".
  The article number of the PROFIBUS DP interface module appears at the bottom line of the display window.
- When configuring the DP/PA link with the GSD Tool:
  - You can download the GSD Tool free of charge from the Internet (https://support.industry.siemens.com/cs/ww/en/view/26562190).
  - You must select the predecessor model "2BA82".
    - Configuring DP/PA link (Page 304)
    - How to configure Y link (Page 308)

Note

Operation in the DP/PA link

In the DP/PA link, the PROFIBUS DP interface module communicates with the respective coupler via the S7 backplane bus. The PROFIBUS DP connections of the coupler are not connected to the PROFIBUS DP.

Properties

Property	Note
Transmission rates	9.6 kbps to 12 Mbps for the higher-level DP master system
Redundancy mode	Bumpless changeover of the active channel

Property	Note
System modifications during operation	Supported in operating modes: • S7 standard mode • Redundancy mode
Diagnostics	• Via LEDs • Via the user program
Use as DPV0 or DPV1 slave	Depending on the higher-level DP master: DPV0 and DPV1 modes (Page 59)
Routing	Routing of frames of the slave initiative

Routing of frames of the slave initiative

The PROFIBUS DP interface module "IM 153-2 OD" supports routing of frames of the slave initiative. Here, the frames of devices behind a link are forwarded to the higher-level controller.

This routing is used, for example, when operating SINAMICS drives behind the Y-link, if the trace function is used with the STARTER commissioning tool.

3.5.2 DP/PA link

Definition

A DP/PA link creates a gateway between the PROFIBUS DP and up to 5 PROFIBUS PA segments. The DP/PA link consists of one or, in a redundant configuration, two PROFIBUS DP interface modules and up to five DP/PA couplers.

Operating principle

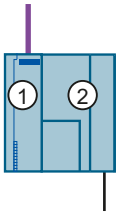
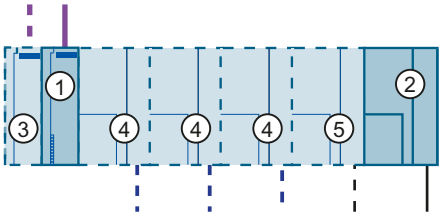
- The DP/PA link is a DP slave on the higher-level DP master system. This DP slave acts as a proxy for the nodes (PA field devices) connected to the lower-level bus system.
- The DP/PA link forms an independent, lower-level bus system in which the communication is decoupled from the higher-level DP master system.
- Using multiple DP/PA couplers in the DP/PA link serves to increase the current-carrying capacity and availability of the PA master system.
- All DP/PA couplers contained in the setup of the DP/PA-link form **one** common bus system with the connected PA field devices.

Hardware components of the DP/PA link

Information about the hardware components of the DP/PA link installation variant:

Components (Page 290)

Installation

Schematic	Component	
 DP/PA link minimum	①	PROFIBUS DP interface module • IM 153-2OD
	②	DP/PA coupler types: • FDC 157-0 or • FDC 157-Ex [ia]
	Information on bus modules: Components (Page 290)	
 DP/PA link with maximum extensions	③	Optional: Redundant PROFIBUS DP interface module • ① + ③ = 2x IM 153-2OD = Redundant DP/PA link
	④⑤	Optional up to 4 additional DP/PA couplers: • FDC 157-0 or • FDC 157-Ex [ia] ⑤ + ② ring redundancy possible[1)]
	Information on bus modules: Components (Page 290)	

1) Ring redundancy only for the last two DP/PA couplers and only possible with FDC 157-0

See also

Use cases for DP/PA link (Page 47)

Use cases for the DP/PA coupler (Page 42)

3.5.3 Y link

Definition

The Y-link creates a gateway between a redundant PROFIBUS DP and a non-redundant PROFIBUS DP.

The Y-link consists of a redundant PROFIBUS DP interface module and a Y-coupler.

Operating principle

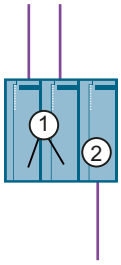
- The Y-link is a DP slave on the higher-level DP master system and acts as a proxy for the nodes (DP slaves) connected to the lower-level bus system.
- The Y-link forms an independent, lower-level bus system whose communication is decoupled from the higher-level DP master system.

Hardware components of the Y-link

Information about the hardware components of the Y-link:

Components (Page 290)

Installation

Schematic	Component	
 Y-link	①	PROFIBUS DP interface module (redundant) • 2 IM 153-2OD modules
	②	Y-coupler
	Information on bus modules: Components (Page 290)	

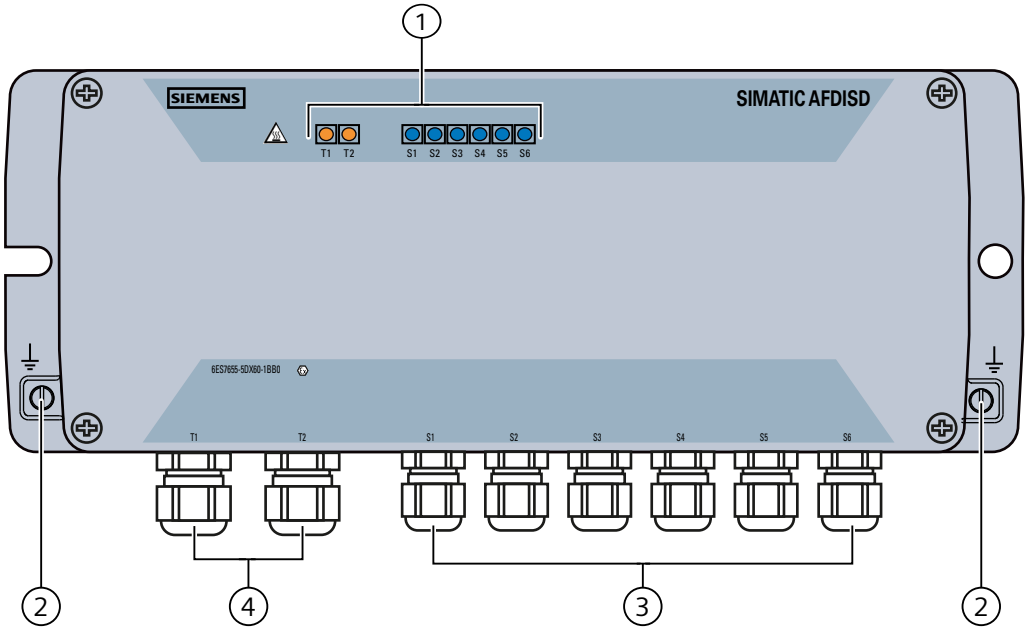
3.6 Active field distributors

3.6.1 Active field distributor AFDiSD

Use cases

The AFDiSD active field distributor (Active Field Distributor intrinsically Safe with extended fieldbus Diagnostics) can be used in operating environments according to Ex Zone 1/21 and 2/22.

- Through its intrinsically safe, short-circuit-proof spur line connections, the AFDiSD can integrate intrinsically safe PROFIBUS PA field devices into one fieldbus segment (line/ring).
- The use of a DP/PA coupler pair and field distributors enables redundant operation on a PA segment in ring redundancy.
- Optionally, the AFDiSD has an extended fieldbus diagnostics for PROFIBUS PA (available in the SIMATIC PCS 7 process control system, for example).
  Refer to the documentation "SIMATIC; Bus link; Extended fieldbus diagnostics in PROFIBUS PA (https://support.industry.siemens.com/cs/ww/en/view/88994694)".



No.	Description
1	LED displays
2	Ground terminals
3	Cable glands for the PA spur lines S1 to S6
4	Cable glands for the PA main line T1, T2

Special properties of the AFDiSD

NOTICE
Impairment of function of the field devices Ensure that the field devices connected via the AFDiSD comply with IEC 61158-2: 2007, Edition 4.0. Note the technical specifications in the manufacturer's documentation.

The AFDiSD has the following additional features:

- The AFDiSD can be used in equipment category 2G / 2D up to hazardous area Zone 1 / 21.
- Intrinsically safe connections allow connection to intrinsically safe PA field devices in the following areas:
  - Ex Zone 0, 1, 2:
    PA field devices of the equipment category 1G, 2G, 3G
  - Zone 20, 21, 22 hazardous area
    PA field devices of equipment category 1D, 2D, 3D
- The spur line connection S1 can optionally be operated as:
  - PA spur line
    or
  - PA subsegment with multiple field devices up to 500 m length
- The following limitations apply to the number of field devices:
  - Maximum 31 devices in a PA segment
  - At spur line connection S1 max. 60 mA
  - At spur line connection S2 to S6 maximum 40 mA per PA spur line
  - Total current of all connected field devices is a maximum of 180 mA

Note

FISCO certification and EFD

In the following cases only one field device is permitted at the S1 spur line connection:

- Design with required FISCO certification
- Application of the extended fieldbus diagnostics (EFD)

Functions

- Connection of field devices for PROFIBUS PA in line or ring topology
- Automatic bus termination
- Isolation of faulty PA segments
- Connection of isolated PA segments after fault rectification
- Extending a PA segment during operation

- FISCO field barrier with electrical isolation between main and spur lines
- Short-circuit-proof, intrinsically safe spur lines with bounce protection

Properties

- 2 M20 cable glands for the PA main lines
- 6 M16 cable glands for up to 6 field devices
- Connection of the PA main lines and the PA spur lines via screw terminals
- Power supply via the PA main lines
- Terminals with reverse polarity protection
- IP30 covers for the connections of the PA main lines
- Diagnostics via LED displays
- Screw connection to subsurface
- Direct grounding via terminal bar inside
- Degree of protection IP66
- Ground terminals outside

Integrated repeater function of the AFDiSD

The AFDiSD has an integrated repeater function:

- Maximum length of PA spur lines 120 m, regardless of the number of field devices connected to the PA segment via PA spur lines (> 1 m), according to IEC 61158-2.
- A length of up to 500 m is possible for the S1 spur line. A bus terminating resistor for the subsegment is required for the following lengths depending on the location of the field devices:
  - Field device in Zone 0 / Zone 1 / Zone 20 / Zone 21
    for length of the spur line S1 > 60 m
  - Field device in Zone 2 / Zone 22
    for length of the spur line S1 > 120 m
- Length of the PA main line up to 1900 m, not including the sum of the PA spur lines:
  The repeater function allows you to examine the PA spur lines separately from the PA main line. This enables significantly greater network spans than in the case of devices without a repeater function.
- Galvanic separation and bi-directional signal reproduction ensure reaction-free transmission between PA main lines and PA spur lines. This significantly increases the resistance of the PA segment to interference.

Diagnostics

Time assignment of signal changes and detection of events of the AFDiSD must be performed by external systems.

Mode selector of the AFDiSD

The mode selector is located (in top view) to the left of the IP30 covers.

- Selector position = "C" (default)
  Compatibility to AFDiS selected:
  If compatibility to AFDiS is required by the AFDiSD, compatible mode must be set.
- Selector position = "D"
  If you want to use the extended fieldbus diagnostics, see the documentation SIMATIC; Bus link; Extended fieldbus diagnostics in PROFIBUS PA (https://support.industry.siemens.com/cs/ww/en/view/88994694).

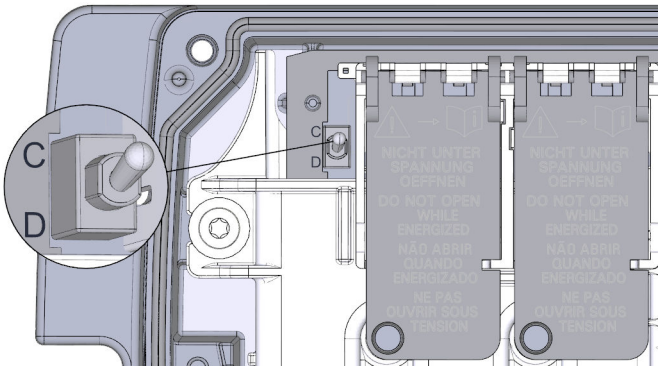


Figure 3-2 Mode selector compatible mode

3.6.2 Active field distributor AFD4 / AFD4 (FM) / AFD4 Railmount / AFD8

Use cases

Field devices, e.g. measuring instruments, sensors, actuators, can be connected to the active field distributors AFD4 / AFD4 (FM) / AFD4 Railmount / AFD8.

The use of a DP/PA coupler pair and field distributors enables redundant operation on a PA segment in ring redundancy.

The number of field devices in the PA segment is limited to 31 devices.

Functions

- Connection of field devices for fieldbus in line or ring topology
- Automatic bus termination
- Automatic isolation of faulty PA segments
- Automatic connection of isolated PA segments after fault rectification
- Extending a PA segment during operation
- Short-circuit-proof PA spur lines

Cable glands

AFD4:

- 2 M16 cable glands for the PA main lines
- 2 M16 cable glands for the PA spur lines to a maximum of 4 field devices

Note
AFD4 Railmount

Product variant of the AFD4 without enclosure (no cable glands)

AFD4 (FM):

- 2 M20 blanking plugs for the PA main lines
- 4 M16 blanking plugs for the PA spur lines to a maximum of 4 field devices

AFD8:

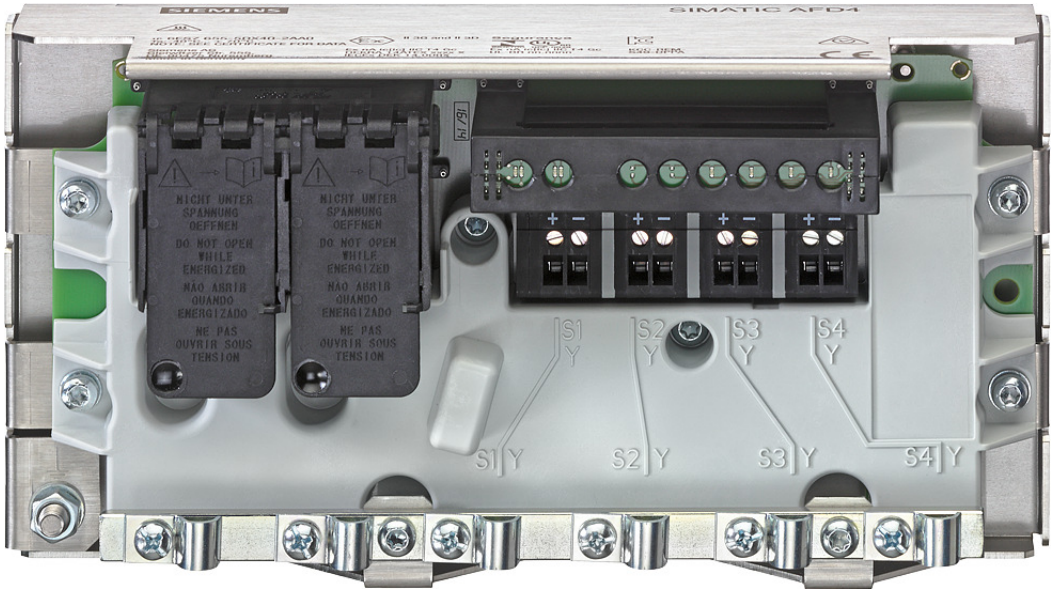
- 2 M16 cable glands for the PA main lines
- 8 M16 cable glands for the PA spur lines to a maximum of 4 field devices

Properties

- Connection of the PA main line and the PA spur lines via screw terminals
- Power supply via the PA main lines
- Terminals with reverse polarity protection
- IP30 covers for the connections of the PA main lines
- Debounce logic reduces interference when connecting and disconnecting the PA spur lines
- Diagnostics via LED displays
- Screw connection to subsurface
- Conformal coating of the assembled circuit board
- IP66 degree of protection (except AFD4 Railmount - IP20)
- Ground terminal outside
- Length of the cables
  Line and star-type topology (Page 300)

Specific conditions for the AFD4 Railmount

- The AFD4 Railmount is a product variant of the AFD4 active field distributor, however, without an enclosure.
  The degree of protection of the AFD4 Railmount is IP20.
  Compared to the AFD4, the AFD4 Railmount is supplied without an aluminum die-cast enclosure. The elimination of the die-cast aluminum enclosure improves flexibility in enclosure selection.
- The AFD4 Railmount is suitable for mounting on rail (DIN rail TH 35 according to EN60715).
- The AFD4 Railmount must be mounted in an enclosure that meets the requirements of your installation, e.g. stainless steel, die-cast aluminum or plastic enclosure.



NOTICE
Active field distributor AFD4 Railmount (in hazardous area)
The device can be used as a bus node in equipment category 3G in Zone 2 hazardous areas.
Only intrinsically safe electrical devices of equipment category 3G for Zone 2 may be connected to the spur lines S1 to S4.
Observe the following information: Standards and approvals for AFD4 Railmount active field distributors (Page 246)

See also

Mounting AFD4 / AFD4 (FM) / AFD8 (Page 100)

DP/PA coupler in ring redundancy and connected active field distributors (Page 44)

Application planning

4

4.1 Overview

Observe the PNO PROFIBUS engineering guideline:
PROFIBUS User Organization (https://www.profibus.com/downloads)

- The DP/PA coupler can be operated stand-alone (also redundant).
- The Y-coupler is used exclusively in connection with a redundant PROFIBUS DP interface module. The Y-coupler forms the Y-link together with the redundant PROFIBUS DP interface module.
- The PROFIBUS DP interface module IM 153-2OD is designed for the use in the following installation variants:
  - Operating as head station of a ET200M station
    You can find the installation variants that are possible in the operating instructions for the ET 200M Distributed I/O Device (http://support.automation.siemens.com/WW/view/en/1142798).
  - PROFIBUS DP interface module for bus links
    - DP/PA link with maximum 5 DP/PA couplers
    - Y-link with one Y-coupler
- The active field distributors can be operated on any PA bus system.
  A network structure with media redundancy is made possible with a redundant DP/PA coupler (coupler pair with ring redundancy) and active field distributors.

Replacement for predecessor models:
You can find information on this in the section "Compatibility overview (Page 279)".

Note

Information about the example graphics

To preserve clarity, the following graphics containing the symbols for the AFD4 / AFD4 (FM) / AFD8 / AFDiSD field distributors show the main lines from the side and without cable glands.

Installation in the outdoor area

The permissibility of use in outdoor areas depends on the components.
You can find information on this in the section: Components (Page 290)

References

You can find detailed information about the functions and properties of these PROFIBUS DP interface modules in the following sections:

- Functions (Page 169)
- Compatibility overview (Page 279)

4.2 Use of the DP/PA couplers (stand-alone and redundant)

4.2.1 Use cases for the DP/PA coupler

Introduction

The following DP/PA couplers are available:

- DP/PA coupler FDC 157-0
- DP/PA coupler Ex [ia]

Properties

- Technical specifications DP/PA coupler FDC 157 (6ES7157-0AC85-0XA0) (Page 258)
- Technical specifications DP/PA coupler Ex [ia] (6ES7157-0AD82-0XA0) (Page 260)

The DP/PA couplers have the following properties:

Product variant	DP/PA coupler FDC 157-0	DP/PA coupler Ex [ia] *
Transmission	Changeover of the transmission hardware between RS485 and symmetrical bus hardware according to IEC 61784-1:2002 Ed1 CP 3/2	
PROFIBUS DP		
• Transmission rate	45.45 kbps	
• PROFIBUS address	DP slave PROFIBUS address 1 to 125 adjustable via DIL switch	-
PROFIBUS PA		
• Transmission rate	31.25 Kbps	
• Supply	Integrated supply unit	Integrated intrinsically safe supply unit for PROFIBUS PA interface and integrated barrier
• Intrinsic safety	-	Intrinsic safety for the lower-level PROFIBUS PA
• Bus termination	Automatic isolation of faulty subsegments including automatic bus termination	
• Availability	For a coupler pair at the end of the installation: Redundancy mode adjustable via DIL switch • Increased current carrying capacity of the PA segment • Increased availability through ring redundancy Repair and extension on the bus segment possible during operation	-
	• For a coupler pair at the end of the installation: • Repair and extension on the bus segment possible during operation	-
• Field devices in the PA segment	The number of field devices in the PA segment is limited to 31 devices.	
• Spur lines	Additional information on this: Line and star-type topology (Page 300)	

Product variant	**DP/PA coupler FDC 157-0**	**DP/PA coupler Ex [ia] ***
Diagnostics	Diagnostics via LED displays	
	Diagnostics of the PROFIBUS PA: • **User data of the DP/PA coupler** – Current value – Optional with ring redundancy: Voltage value • Local lifelist • Wire break / short-circuit	-
Ambient conditions	Extended ambient conditions *	

* For installation in Zone 2: The device may only be used in areas with a pollution degree of not more than 2 according to IEC 60664-1. The device must be installed in a suitable housing that provides a degree of protection of at least IP54 according to IEC 60079-7.

Use cases

The following table shows the use cases of the DP/PA couplers and the available functions.

Table 4-1 Use cases for the DP/PA coupler

Use cases	**Functions**	
	DP/PA coupler FDC 157-0	**DP/PA coupler Ex [ia]**
DP/PA coupler in stand-alone operation (Page 44)	YES	Yes *
DP/PA coupler pair for ring redundancy (Page 44) (bus module BM FDC/FDC required)	YES	NO
Use of the DP/PA coupler in the DP/PA link Use cases for DP/PA link (Page 47) Information on bus modules: Components (Page 290)	YES	Yes *

* No diagnostic functions via PROFIBUS DP and no ring redundancy

Configuration

Without configuration, you can use the DP/PA coupler in stand-alone operation.
You must ensure the following for stand-alone operation:

- The DP master is set to a transmission rate of 45.45 kbps.
- The PA field devices are configured and their parameters are assigned.

If you want to use one of the following functions, configuration of a DP/PA coupler FDC 157-0 is required:

- Ring redundancy
- Diagnostics of the PROFIBUS PA

4.2.2 DP/PA coupler in stand-alone operation

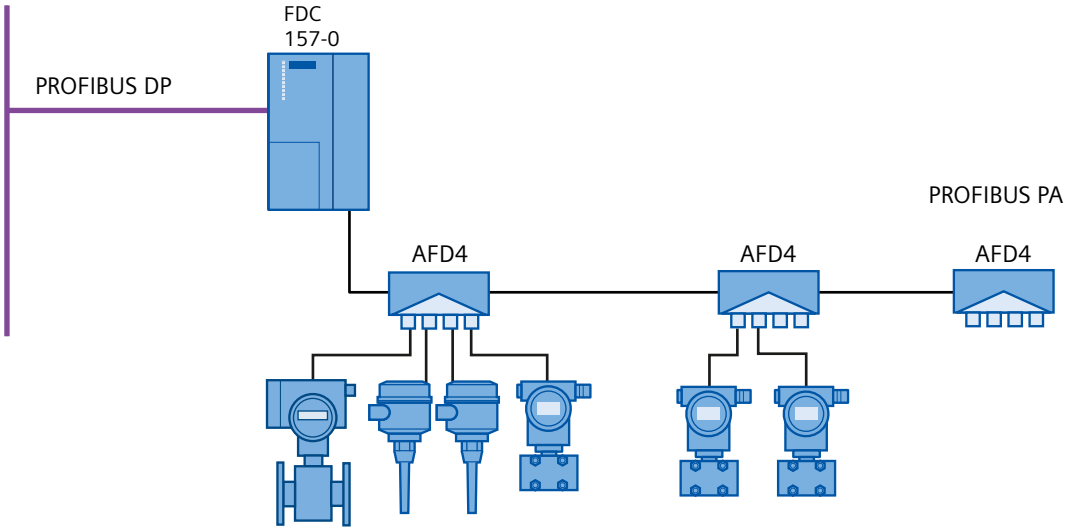


Figure 4-1 Example: DP/PA coupler in stand-alone operation with active field distributors.

Hardware components of the DP/PA coupler

Table 4-2 DP/PA coupler

Function	Product	Article numbers
DP/PA coupler	• FDC 157 or • FDC 157-Ex [ia]	Table A-4 Article numbers for the hardware components of the gateways (Page 290)

4.2.3 DP/PA coupler in ring redundancy and connected active field distributors

FDC 157-0 as coupler pair for ring redundancy

You can use the FDC 157-0 DP/PA coupler to set up a ring redundancy for the redundant connection of components on PROFIBUS PA.

Two DP/PA couplers are installed and set as a coupler pair. Together with the components on PROFIBUS PA, the ring redundancy enables a network with media redundancy.

Note

Power supply

- A DP/PA coupler supplies the PA segment.
  You can find information about the behavior in the following table, "Ring redundancy: Component behavior in the event of faults".
- Recommendation: The two DP/PA couplers should be connected to separate power supplies to increase the availability in redundancy mode.

The number of field devices in the PA segment is limited to 31 devices.

Installation with ring redundancy

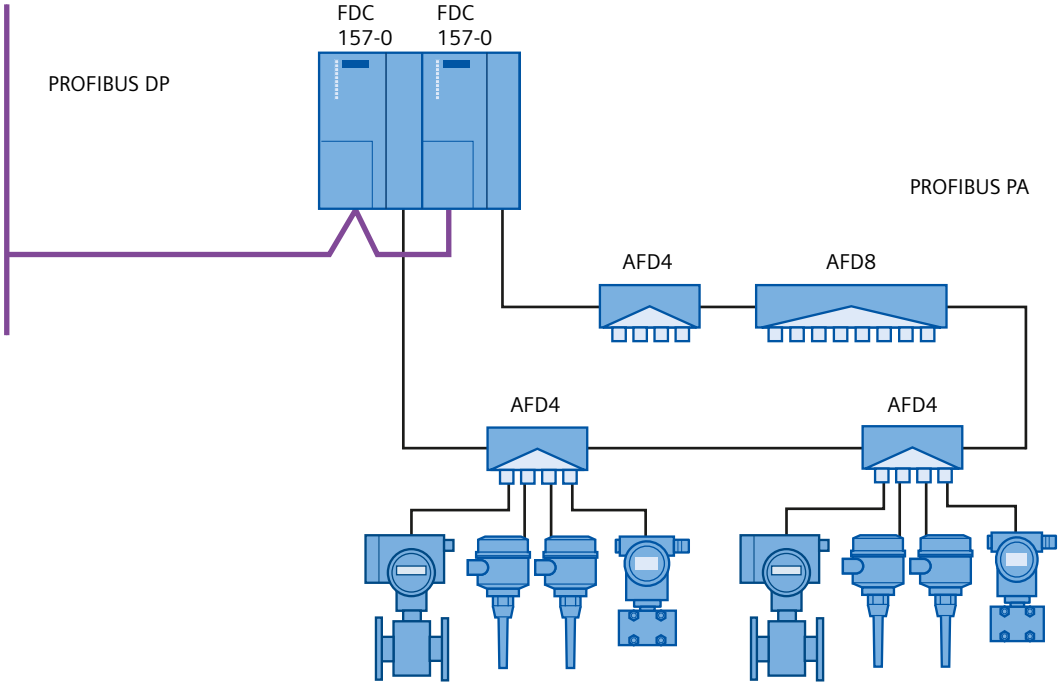


Figure 4-2 Example: Ring redundancy and media redundancy (by configuration with AFD4 and AFD8 active field distributors).

Note

Installation

Ring redundancy has been approved for use with Siemens network components.

Hardware components of the DP/PA coupler with ring redundancy

Table 4-3 Redundant DP/PA coupler

Function	Product	Article number
DP/PA coupler	2 x FDC 157	Table A-4 Article numbers for the hardware components of the gateways (Page 290)

Note

Installation in the DP/PA link

Use cases for DP/PA link (Page 47)

- If you want to integrate the ring redundancy in the DP/PA link, only the last two DP/PA couplers are the redundant coupler pair required for the ring redundancy.
- The coupler pair is installed on the BM FDC/FDC bus module.

Ring redundancy: Component behavior in the event of faults

The typical installation with active field distributors in the PA segment behaves as follows in the event of faults:

Table 4-4 Ring redundancy: Component behavior in the event of faults

Components Fault	Coupler pair	Active field distributors	PA field devices	PA segment
Failure of the active supplying DP/PA coupler	• Changeover to partner coupler. • Partner coupler takes over the supply of the PA segment.	OK	OK	OK
Short-circuit or wire break on the PA main line	• The active feeding DP/PA coupler supplies both parts of the separated PA segment. • The partner coupler becomes actively conductive.	Isolate and terminate adjacent active field distributors.	OK	PA segment is disconnected but continues to be supplied.
Short-circuit on the spur line	OK	• Current limiting of the active field distributor becomes active. • Active field distributor reports failure on spur line Sn: Green LED flashes	• Uninvolved field devices remain OK. • Field device on the affected spur line fails.	OK

4.3 Use of the DP/PA link

4.3.1 Use cases for DP/PA link

Use case

You set up the DP/PA link by connecting at least one PROFIBUS DP interface module together with at least one DP/PA coupler.

The DP/PA link is intended for the following use cases:

- S7 standard mode on S7-300 or S7-400
- DP standard master mode
- Redundancy mode, for example on S7-400H
- Use as DPV0 or DPV1 slave: DPV0 and DPV1 modes (Page 59)

The DP/PA link can contain a maximum of 5 DP/PA couplers in one installation.

The following explanations apply in part to the S7 standard mode and to DP standard master mode. In such cases the term "non-redundant mode" is used.

You can find information about the configuration of the PROFIBUS PA in the section "Maximum configuration of PROFIBUS PA with DP/PA link (Page 299)".

Note

Installation notes

- In the DP/PA link, the S7 backplane bus connects the PROFIBUS DP interface module to the DP/PA coupler.
  This eliminates the need to connect the PROFIBUS DP connections from the DP/PA coupler via cable.
- Impermissible installation:
  - Cascading of DP/PA links
  - Y-coupler in the DP/PA link

Table 4-5 Use cases for the DP/PA coupler

Use cases	Functions	
	DP/PA coupler FDC 157-0	DP/PA coupler Ex [ia]
DP/PA link without redundant couplers (Page 51)	YES	Yes *
DP/PA link with DP/PA coupler for ring redundancy (Page 52)	YES	NO
Redundant DP/PA link (Page 54)	YES	Yes *

* No ring redundancy and no diagnostic function

Configuration options and restrictions

A DP master system can be extended by at least one PROFIBUS PA segment using DP/PA links as follows:

Property	Values	Note
Number of DP/PA links on a DP master system	Max. 126 bus nodes are permissible in a DP master system.	
Number of DP/PA couplers in the DP/PA link	Max. 5	
Number of nodes in the PA master system	Max. 64 Max. 31 PA devices per physical PROFIBUS PA segment	The total number of **slots** is limited in each case to (236 minus the number of PA field devices). The maximum number of PA field devices that can be connected for each physical PROFIBUS PA segment or each DP/PA coupler is limited by the maximum output current of the DP/PA coupler and the I/O data to be transmitted.
Maximum length of frames: • Configuration data • Parameter assignment data • Diagnostic data • I/O data	244 bytes each	The following frames of the DP/PA link are derived from the frame contents of the lower-level PA field devices: • The configuration frame • The user data frames

Configuration

A DP/PA link can be configured with *STEP 7* V5.4 or higher.

Parameter assignment for the PA field devices

The PA field device parameters are assigned using a suitable tool, such as *SIMATIC PDM*, from a PG / PC that is connected to the higher level PROFIBUS DP. For more detailed information please refer to the documentation of your parameter assignment tool.

User data of the DP/PA link

The DP user data frame of the DP/PA link depends on the number of configured PA field devices.

- It comprises the data blocks of the configured PA field devices arranged one after the other.
- The data blocks are sorted in ascending order of PA address.

According to *PROFIBUS PA Profile for Process Control Devices, General Requirements* each process variable is accompanied by one status byte that contains a statement about the status of the process variable.

Failure and return of a PA field device

- If a PA field device fails, the associated input data including the status byte are reset in the user data frame of the DP/PA link first. The corresponding information is then entered into the diagnostics frame.
- After return of the PA field device, corresponding information is entered in the diagnostics frame. Almost simultaneously, the valid input data of the PA field device is available again in the user data frame of the DP/PA link. The status byte displays the valid data.

Note

Recommendation:
In order to quickly detect the status of the PA field devices, the status bytes should generally be evaluated in the user program.

When you use the Avanced Process Library for configuring with a process control system, this is automatically taken into account.

Update times of the process image in single and redundancy mode

Both in single mode and redundant mode, the update time of the process image in the module is determined by the following times:

- Update time of the lower-level bus system (PROFIBUS PA)
- Internal update time of the module

The update time of the lower-level bus system depends on the configuration (transmission rate, number of slaves, number of I/O data). It is determined by the TargetRotationTime Ttr. The Ttr is hereby calculated and specified in STEP 7.

In single mode, the internal processing of the process image is also included. This is 15 ms.

- Update time = 15 ms + Ttr

In redundant mode, three or four times the Ttr must also be expected, in addition to the time for detecting a PrmCMD of 30 ms (includes internal update time).

- Update time without configuration change (CFC) = 30 ms + 3* Ttr
- Update time without configuration change (CFC) = 30 ms + 4* Ttr

Changeover time to PROFIBUS PA during operation with redundant PROFIBUS DP interface module

At a master-to-reserve changeover or failure of the active PROFIBUS DP interface module, the PA field devices operate via the reserve PROFIBUS DP interface module.

The changeover is bumpless, i.e. during the changeover the states of the inputs and outputs are maintained.

The changeover time is defined as the time between the activation of the reserve PROFIBUS DP interface module and the availability of new input data.

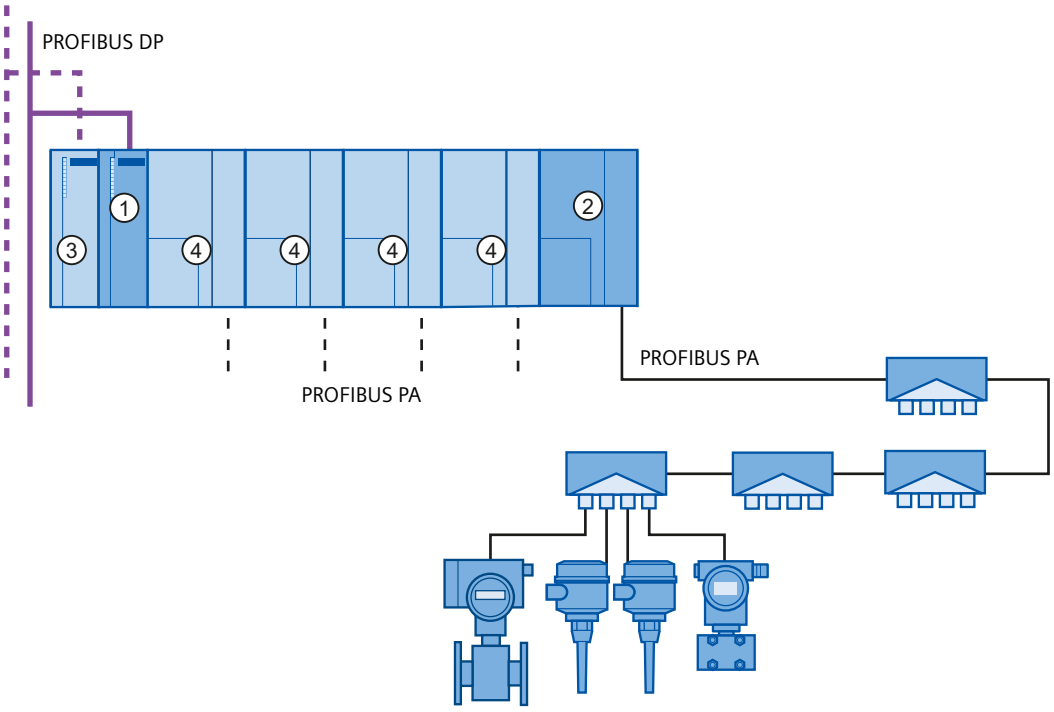
Condition / Requirement	Changeover time
Changeover time with unchanged PA configuration	• Typical: 70 ms + number of PA field devices x 51 ms • Max.: 820 ms + number of PA field devices x 50 ms
Changeover time if configuration is changed during operation	• Typical: 80 ms + number of PA field devices x 67 ms * • Max.: 800 ms + number of PA field devices x 130 ms *
* With unchanged PA field device addresses	

Communication connections from the PG / PC to the PA field devices

Up to 10 communication connections to PA field devices from a PG / PC are possible simultaneously via the DP/PA coupler.

4.3.2 DP/PA link without redundant couplers

Basic installation



① **PROFIBUS DP interface module (IM 153-2OD)**

② + ④ **② DP/PA coupler**

+ ④ Optional: Maximum 4 additional DP/PA couplers

= Total of a maximum of 5 DP/PA couplers:

- DP/PA coupler FDC 157-0
- DP/PA coupler Ex [ia]

Note on optional ring redundancy

If the last two DP/PA couplers are type FDC 157-0, ring redundancy is possible.

③ Optional: Extension to redundant DP/PA link with PROFIBUS DP interface module possible

Figure 4-3 Basic installation of the DP/PA link and active field distributors

Hardware components of the DP/PA link

Information on the components of the installation variant:

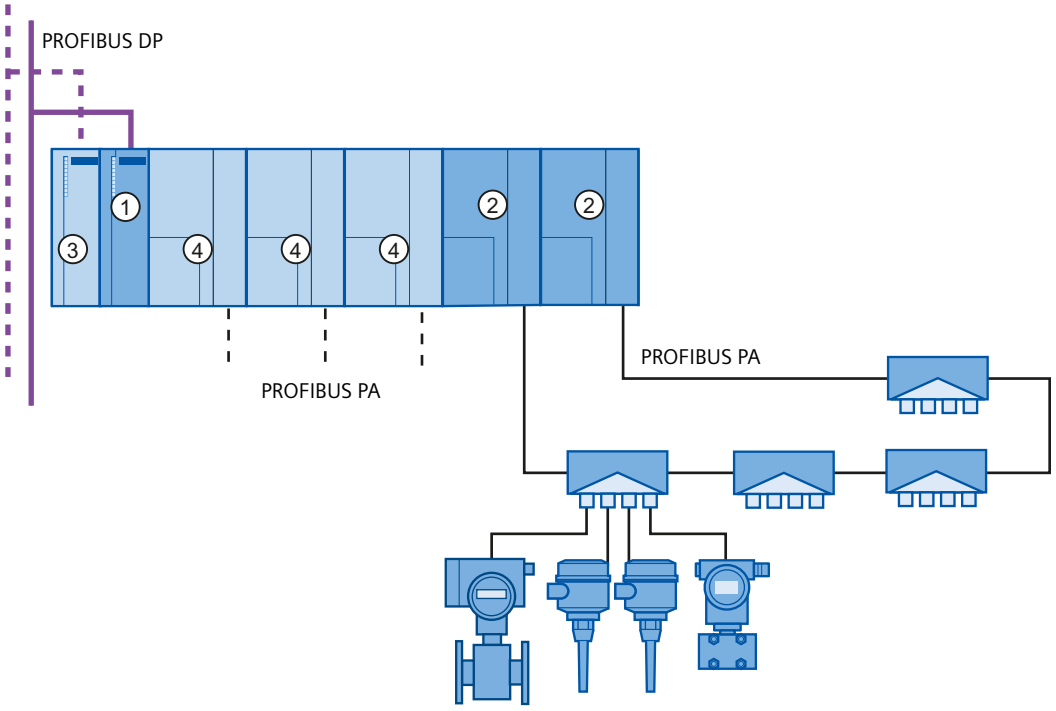
- Variant 1: Table A-5 Article numbers: DP/PA link without bus modules and power supply (Page 291)
- Variant 2: Table A-6 Article numbers: DP/PA link with bus modules and power supply (Page 291)
- Variant 3: Table A-7 Article numbers: DP/PA link with bus modules without power supply (Page 291)

See also

Components (Page 290)

4.3.3 DP/PA link with DP/PA coupler for ring redundancy

Basic installation



① **PROFIBUS DP interface module (IM 153-2OD)**

②+④ ②**Coupler pair consisting of 2x DP/PA coupler FDC 157-0**
The last two DP/PA couplers FDC 157-0 are operated as a coupler pair (ring redundancy).

④ Optional maximum of 3 additional DP/PA couplers:

- DP/PA coupler FDC 157-0
- DP/PA coupler Ex [ia]

= Total of maximum of 5 DP/PA couplers

③ Optional: Extension to redundant DP/PA link with PROFIBUS DP interface module possible

Figure 4-4 Basic installation of the DP/PA link with DP/PA coupler for ring redundancy and active field distributors in the media-redundant PROFIBUS PA ring

Hardware components of the DP/PA link

Information on the components of the installation variant:

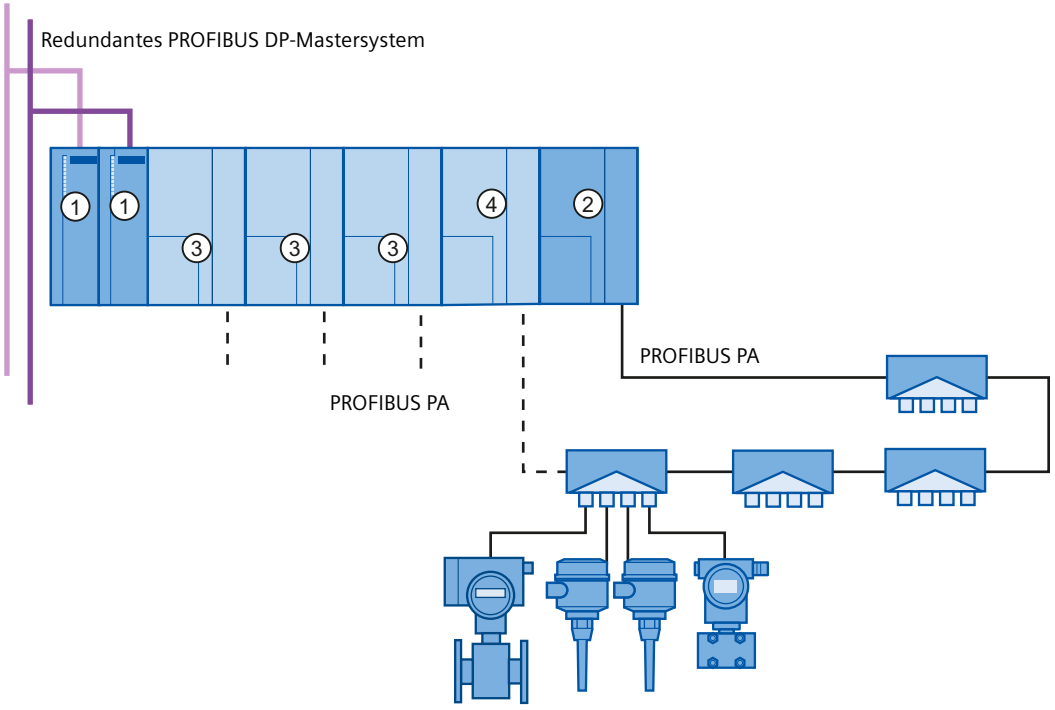
- Variant 1: Table A-5 Article numbers: DP/PA link without bus modules and power supply (Page 291)
- Variant 2: Table A-6 Article numbers: DP/PA link with bus modules and power supply (Page 291)
- Variant 3: Table A-7 Article numbers: DP/PA link with bus modules without power supply (Page 291)

See also

Components (Page 290)

4.3.4 Redundant DP/PA link

Basic installation



① **2 x PROFIBUS DP interface module (IM 153-2OD)**

② + ③ + ④ **② DP/PA coupler**
Optional: ③ + ④ DP/PA couplers
= Total of a maximum of 5 DP/PA couplers (② + ③ + ④):

- DP/PA coupler FDC 157-0
- DP/PA coupler Ex [ia]

Note on optional ring redundancy
If the last two DP/PA couplers ② + ④ are type FDC 157-0, ring redundancy is possible.

Figure 4-5 Basic installation of the redundant DP/PA link and active field distributors.

Hardware components of the redundant DP/PA link

Information on the components of the installation variant:

Table A-8 Article numbers: Redundant DP/PA link (Page 292)

See also

Components (Page 290)

4.4 Use of the Y-link

4.4.1 Y coupler

Configuration

The Y-coupler is an integral part of the Y-link and is not configured separately.

Configuration options and restrictions

Technical specifications Y coupler (6ES7197-1LB00-0XA0) (Page 262)

Property	Note
Devices on the Y-coupler	Connection of DP standard slaves
Power supply	The Y-coupler is supplied via the backplane bus.
Transmission rate	45.45 kbps to 12 Mbps
Termination of the lower-level DP master system	Active terminating resistor (bus terminator)

4.4.2 Use of the Y-link

Use case

The Y-link creates a gateway between a redundant PROFIBUS DP and a non-redundant PROFIBUS DP.
The Y-link consists of a redundant PROFIBUS DP interface module and a Y-coupler.

The following figure shows the integration of the Y-link into the system.

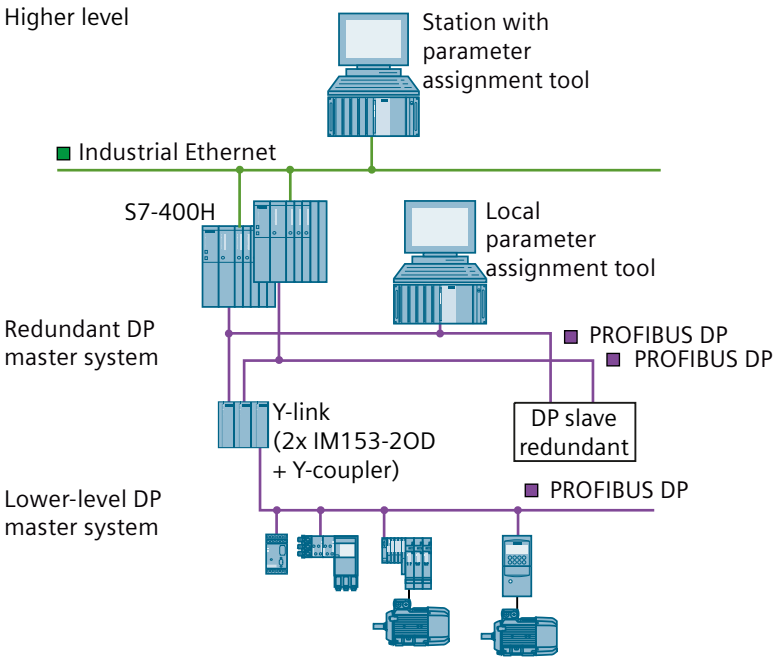


Figure 4-6 Integration of the Y-link into the system landscape

The Y-link is intended for the following applications:

- Redundancy mode, for example on S7-400H
- Use as DPV0 or DPV1 slave: DPV0 and DPV1 modes (Page 59)

Note

Installation notes

- In the Y-link, the S7 backplane bus connects the PROFIBUS DP interface module to the Y-link.
- Impermissible installation:
  - Cascading Y-links
  - DP/PA links in the Y-link

Configuration options and restrictions

A redundant DP master system can be extended by a singular PROFIBUS segment by Y-links as follows:

Property	Values	Note
Number of Y-links on a DP master system	Max. 126 bus nodes are permissible in a DP master system.	
Number of Y-couplers in the Y-link	1	Only **one** Y-coupler can be operated in each Y-link.
Number of nodes in the lower-level DP master system	Max. 64	The sum of the **slots** is limited in each case (236 minus the number of DP slaves).

Property	Values	Note
Maximum length of frames: • Configuration data • Parameter assignment data • Diagnostic data • I/O data	244 bytes each	The following message frames of the Y-link are derived from the frame contents of the lower-level PA field devices: • The configuration frame • The user data frames
Direct data exchange and isochronous mode	-	Not possible in the lower-level DP master system

Configuration

The Y-link can be configured with *STEP 7* V5.4 or higher.

When *STEP 7* calculates the bus parameters, the connected nodes on the lower-level DP master system as well as the Y-link itself are taken into account.

Operating mode of the DP slave

The parameters of the operating mode of the DP slaves in the lower-level DP master system are assigned from the S7 400H via the Y-link.

User data of the Y-link

The DP user data frame of the Y-link depends on the number of configured DP slaves.

- It comprises the data blocks of the configured DP slaves arranged one after the other.
- The data blocks are sorted in ascending order of DP address.

Failure and return of a DP slave

- If a DP slave fails, the associated input data in the user data frame of the Y-link is reset first. The corresponding information is then entered into the diagnostics frame.
- After return of the DP slave, corresponding information is entered in the diagnostics frame. Almost at the same time, the valid input data of the DP slave is available again in the user data frame of the Y-link.

Diagnostics data of the DP slaves

The processing of the diagnostic frames of DP slaves depends on the setting of the operating mode of the PROFIBUS DP interface module:
DPV0 and DPV1 modes (Page 59)

Communication connections from the PG / PC to the DP slaves

Up to 10 communication connections to DP slaves from a PG / PC can be established simultaneously via the Y-link.

Communication connections can only be passed on from the S7-400H to the lower-level DP master system. After a changeover of the active channel from one PROFIBUS DP interface

module to the other, all communication connections from the PG / PC to the DP slaves are maintained.

4.5 DPV0 and DPV1 modes

The "DPV0" and "DPV1" modes define the range of functions for communication between devices on the PROFIBUS.
For devices with the full range of functions, it is usually possible that they can select the communication mode.

- "DPV0" mode: S7-compatible
- "DPV1" mode: Extended function range

The engineering tool (e.g. STEP 7) reads the required information from the device description and offers the operating modes available for a device for selection during configuration.

DPV0

"DPV0" mode designates a mode for communication between devices on the PROFIBUS.
The mode includes the basic functions of the PROFIBUS DP communication protocol:

- Cyclic data exchange between control system and slaves.
- Configuration via GSD files
- Diagnostics

DPV1

"DPV1" mode is a further development of the original PROFIBUS standard *IEC 61784-1:2002 Ed1 CP 3/1*.
DPV1 identifies a mode for communication between devices on PROFIBUS.

The mode extends the functions of the PROFIBUS DP communication protocol compared to "DPV0" mode. The changes are specified in the IEC 61158 standard:

- Acyclic data exchange between control system and slaves.
- Integration into engineering systems via EDD or FDT / DTM
- Transferable PLC software function blocks (IEC 61131 3)
- Fail-safe communication (PROFIsafe)
- Interrupts (hardware interrupt, status interrupt, update interrupt, manufacturer-specific interrupt, diagnostic interrupt, plug interrupt, pull interrupt)

Operating mode of devices

The following applies to a device (IM 153-2OD, DP/PA link, Y-Link, DP/PA coupler) as DP slave on the lower-level bus system:

- **Device in "DPV0" mode:**
  If the following conditions for operation of slaves in "DPV1" mode are not fulfilled, the DP slave can only be operated in "DPV0" mode.
- **Device in "DPV1" mode:**
  DP slaves must be integrated and configured with GSD rev. ≥ 5.
  The device description must contain and support the following entries:
  - *Prm_Block_Structure_supp=1*
  - *PrmCmd_supp=1*
  - *Slave_Redundancy_supp=1*

Setting the operating mode

To use "DPV1" mode, the following components must be operated in "DPV1" mode in a DP master system.

- Device as DP slave (IM 153-2OD, DP/PA link, Y-Link, DP/PA coupler)
- The components of the DP master system that are on a higher level than the device

---

Note

Request to DPV1 slave at the redundant DP/PA link or Y-Link

A DPV1 slave on the lower-level system must be able to continue to operate bumplessly after a changeover of the higher-level bus system.

Only then can the extended functions of the DP slave be used in "DPV1" mode (e.g. extended diagnostics).

In *STEP 7* HW Config, the operating mode can be selected in the object properties of the DP master:

- "DPV0" (S7-compatible)
- "DPV1"

Data from devices on the lower-level bus system of a Y-Link

With *STEP 7*, the diagnostic frames of the lower-level devices, for example, can be displayed in the online view of HW Config.

- If a DPV0 slave or a non-interrupt capable DPV1 slave reports diagnostic information on the lower-level master system, the PROFIBUS DP interface module triggers a diagnostic interrupt on the higher-level DP master system ("proxy diagnostic interrupt").
- If an interrupt-capable DPV1 slave triggers an interrupt on the lower-level master system, this interrupt is passed on by the PROFIBUS DP interface module to the higher-level DP master system.

Additional information on the evaluation of the data of the PROFIBUS DP interface module: "Interrupts (Page 212)".

The devices on a Y-Link or DP/PA link can only be operated in "DPV1" mode if the following applies:

Higher-level system, e.g. PROFIBUS interface of the automation system CPU: DP master in "DPV1" mode.

- Subordinate system, e.g. PROFIBUS DP interface module of the DP/PA link: DP slave in "DPV1" mode
  - Subordinate system, e.g. PROFIBUS PA field device: DP slave in "DPV1" mode

DP mode	**Field device DPV0-compatible**	**Field device DPV1-compatible**	**PROFIBUS DP interface module in "DPV0" mode**	**PROFIBUS DP interface module in "DPV1" mode**
PLC and PROFIBUS DP interface module in operating mode "DPV0".	Everything in "DPV0" mode	No evaluation of DPV1-specific information	No evaluation of DPV1-specific information	-
PLC and PROFIBUS DP interface module in "DPV1" mode	Interpretable information is evaluated (e.g. insertion, removal)	All information is evaluated Interrupts can be acknowledged.	-	
PLC and field device in "DPV0" mode	Everything in "DPV0" mode	-		
AS and field device in "DPV1" mode	-	AS and field device in "DPV1" mode		

4.6 Active field distributors in hazardous areas

4.6.1 Fundamentals of hazardous areas and intrinsic safety

Use of AFDiSD in hazardous areas

⚠ DANGER

Explosion hazard

In mixed operation with (AFD4, AFD4 (FM), AFD4 Railmount, AFD8, AFDiSD) active field distributors, always disconnect the DP/PA couplers from the power supply before replacing AFDiSD active field distributors.

Properties of zones

Hazardous areas are classified into zones. The zones are distinguished according to the probability of the existence of an explosive atmosphere.

The AFDiSD active field distributor can be used in hazardous areas up to Zone 1 / 21.

You can connect intrinsically safe PA field devices to the AFDiSD, which may be located in hazardous areas up to Zone 0 / 20. The PA field devices must be certified for operation in the corresponding hazardous areas.

You can find an overview of the zone divisions in the following table:

Table 4-6 Classification of zones

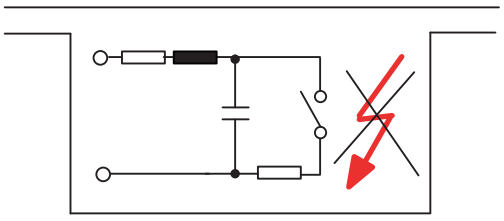
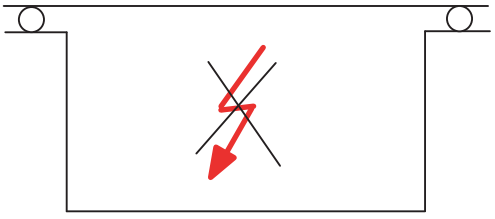
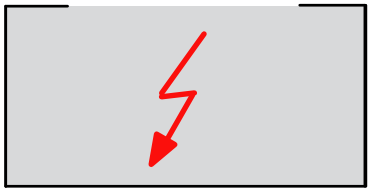
Hazardous areas	Explosion hazard	Example
Zone 0/ 20	Long-term, frequent or permanent presence of explosive gas or dust atmosphere	Within containers.
Zone 1/ 21	Infrequent presence of potentially explosive gas or dust atmosphere	In the area of openings for filling and emptying.
Zone 2/ 22	Rare or short-term presence of potentially explosive gas or dust atmosphere	Areas bordering Zone 1 / 21

For additional information, refer to the Fundamentals of Explosion Protection (http://support.automation.siemens.com/WW/view/en/12521844) system manual.

Constructive ignition protection types on the AFDiSD

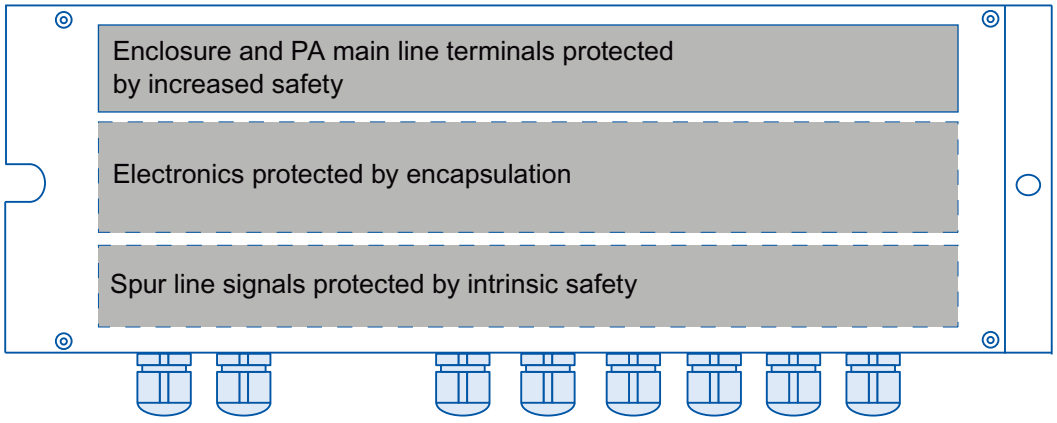
The types of protection include design and electrical measures relating to the equipment to achieve explosion protection in the hazardous areas. The following types of protection are used on the AFDiSD:

Table 4-7 Types of protection

Type of protection	Meaning	Representation
Intrinsic safety i	All voltages, currents, inductances and capacitances occurring are limited by electrical measures (intrinsically safe) - sparks or thermal effects capable of causing ignition cannot occur. The AFDiSD spur line connections have an intrinsically safe design [ia].	
Increased Safety enclosure e	The enclosure and the main line terminals of the AFDiSD have the type of protection *Increased Safety* Ex e. This type of ignition protection is an additional measure to prevent high temperatures, sparks and arcing from forming with a higher degree of certainty.	
Encapsulation "m"	The internal electronics of the AFDiSD are embedded in a potting compound. This means that an explosive atmosphere surrounding the equipment cannot be ignited either by sparks or by impermissible heating.	

Marking of the AFDiSD

Equipment for operation in hazardous areas is marked with an identifier indicating the hazardous environments in which the equipment can be used. The AFDiSD has the following safety measures, among others:



Certificates for the AFDiSD active field distributor

The EC type examination certificates and EC certificates of conformity for the AFDiSD active field distributor are available at Service & Support on the Internet (https://support.industry.siemens.com/cs/ww/en/ps/cert).

Verification of intrinsic safety

The active field distributor limits the energy in hazardous areas on the spur line to the intrinsically safe PA field devices and electrically isolates them from the PA main line.

All spur lines have Ex [ia] type of protection and can therefore be installed in Zone 0/20. In addition to the following requirements, no further verification of the intrinsic safety in accordance with the FISCO model is required:

- PROFIBUS PA bus cable for the PA main lines and for the spur lines to the intrinsically safe PA field devices

  Note

  PROFIBUS PA bus cable

  The recommended PROFIBUS PA bus cable (PB FC Process Cable - Article number: 6XV1830-5AH10) is for reference and is not mandatory. However, if the FISCO model is to be used, the selected cable must comply with FISCO guidelines (capacitances, inductances).

  When connecting flexible cables, the wires must be protected with ferrules.

- Maximum spur line cable length 120 m or subsegment cable length 500 m at connection S1.

4.6.2 Grounding

Equipotential bonding

You must set up an equipotential bonding EB in hazardous areas. This must be in accordance with IEC 60079-14.

Shields of the PROFIBUS PA bus lines must be connected to the equipotential bonding "EB".

The best EMC protection for the AFDiSD active field distributor is achieved by direct grounding.

Direct grounding

The shield of the PROFIBUS PA bus cables is grounded directly in both the hazardous area and in the safe area. This is possible when the equipotential bonding PA extends from the DP/PA coupler (in the safe zone) all the way to the field devices (in the hazardous area), which means a corresponding equipotential bonding cable was laid.

Note

Direct grounding on the AFDiSD field distributor

The braided shield of the cable for PROFIBUS PA must be placed under the shielding clamps.

Capacitive shield grounding is not supported due to the intrinsically safe PROFIBUS PA bus cables.

Example of direct grounding

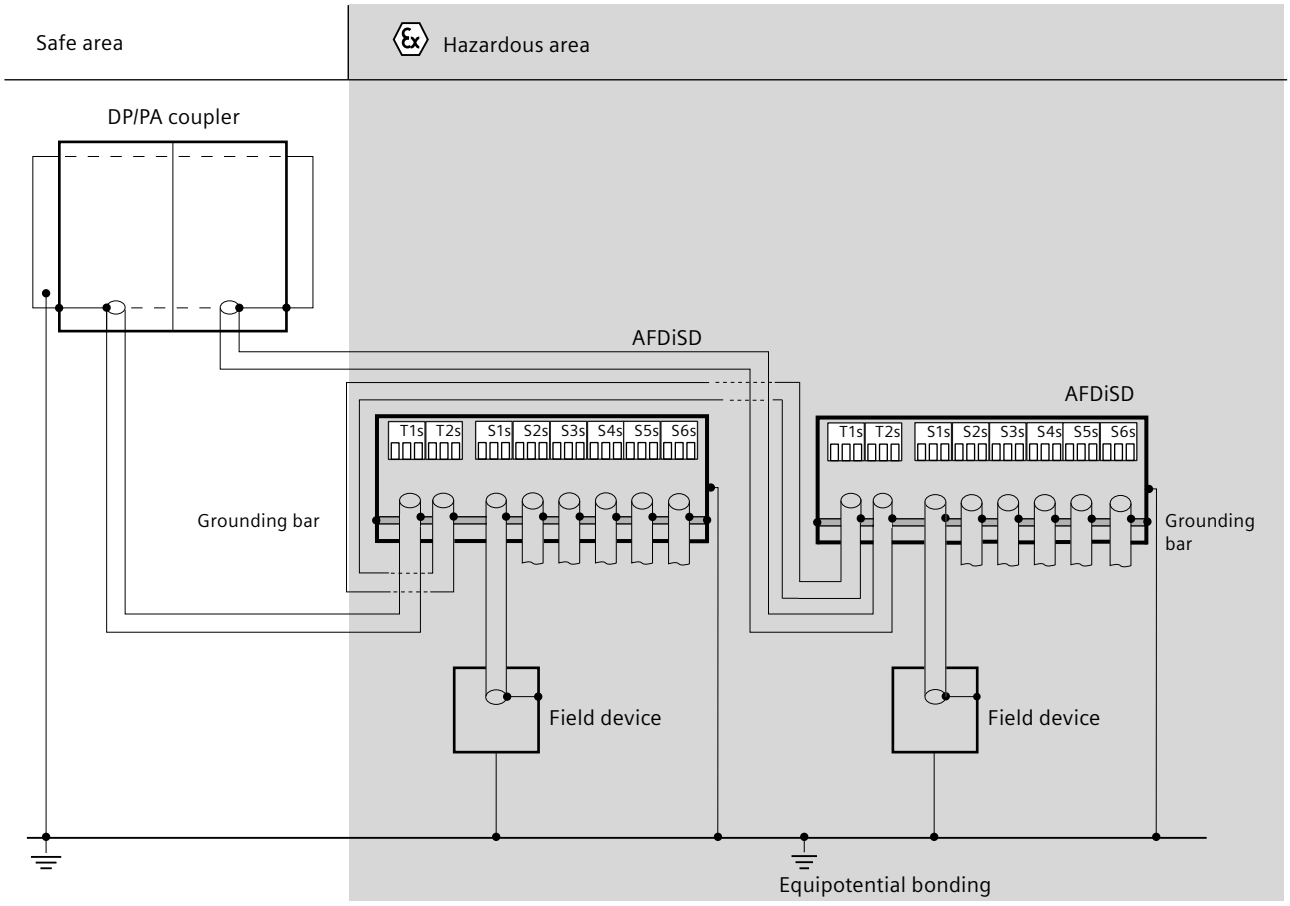


Figure 4-7 Example: Direct grounding

See also

Principles of Explosion Protection (https://support.industry.siemens.com/cs/ww/en/view/12521844)

profibus.com (http://www.profibus.com)

4.6.3 DP/PA coupler with active field distributors

DP/PA coupler with active field distributors

The DP/PA coupler with diagnostic function is a gateway between PROFIBUS DP and PROFIBUS PA.

Active field distributors connect the field devices to the main line and ensure a robust field distribution.

The following types of active field distributors are available for selection:

- AFD4
- AFD4 (FM)
- AFD4 Railmount
- AFD8
- AFDiSD (with extended field bus diagnostics)

A DP/PA coupler pair allows ring redundancy when active field distributors are connected.

The number of field devices in the PA segment is limited to 31 devices.

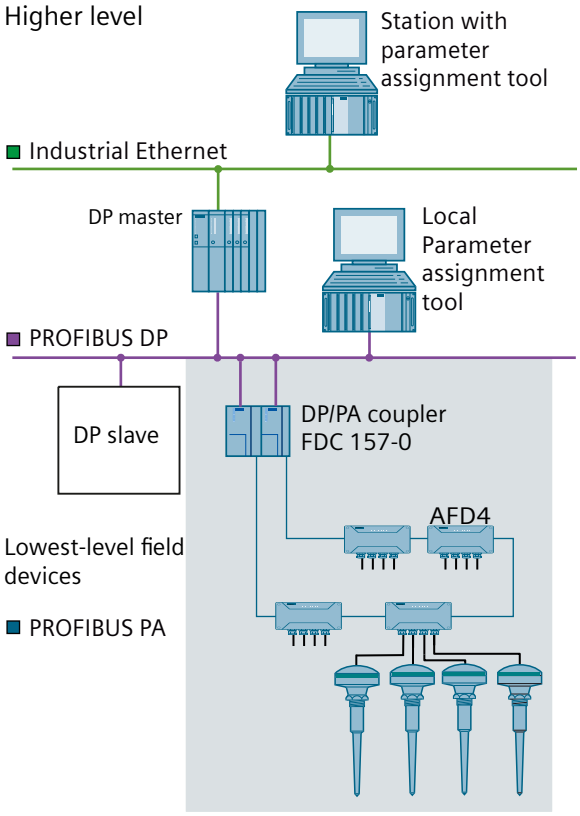


Figure 4-8 Example: DP/PA coupler pair with active field distributor (AFD4)

DP/PA coupler with AFDiSD

The AFDiSD field distributor can be mounted in the hazardous area Zone 1 / 21. Intrinsically safe PA field devices can be connected to the AFDiSD. These intrinsically safe PA field devices may be located in hazardous areas up to Zone 0 / 20. The number of field devices in the PA segment is limited to 31 devices.

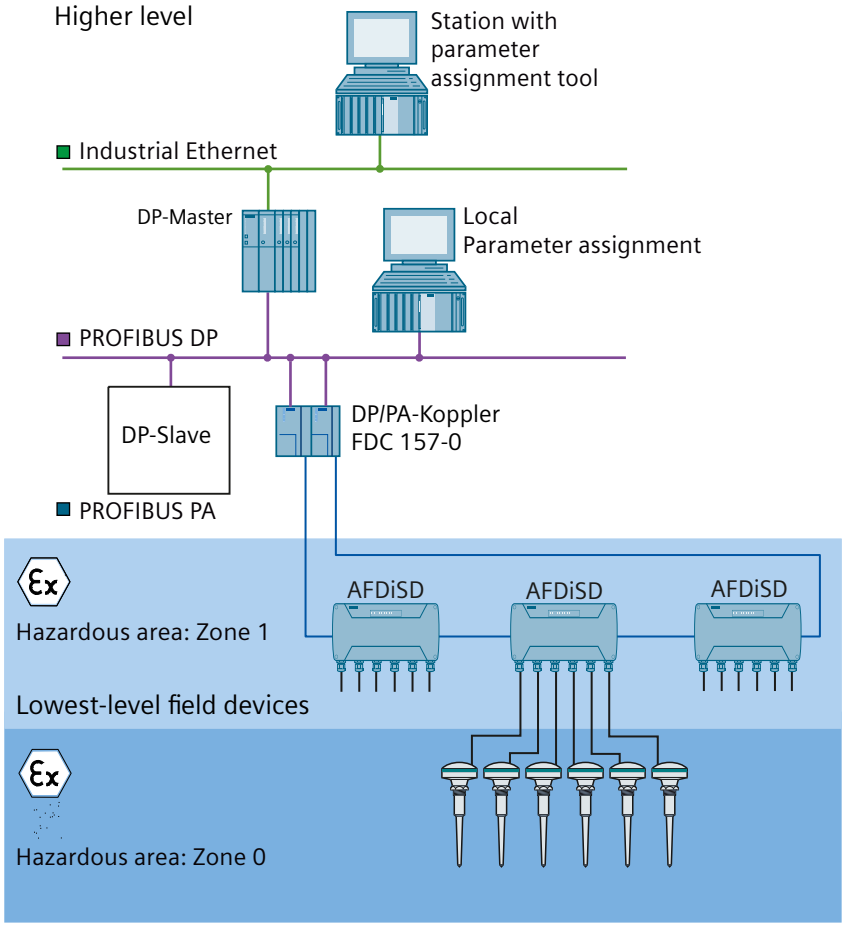


Figure 4-9 DP/PA coupler FDC 157-0 with AFDiSD

4.6.4 Installation with AFDiSD

Introduction

The AFDiSD active field distributor is designed for hazardous areas. It supplies up to six spur lines or five spur lines and a subsegment with multiple field devices with a length of up to 500 meters.

To achieve the maximum availability for each port, connect only one device to each port.

You can find additional information on the special properties of the AFDiSD in the section "Active field distributor AFDiSD (Page 35)".

AFDiSD active field distributor with subsegment in hazardous area

The following graphic shows an example of the installation of a DP/PA system with several field distributors.

- The subsegment of an AFDiSD with its connected devices extends into Zone 0 / Zone 20.
- The subsegment must be terminated with a bus terminating resistor to avoid signal reflections.

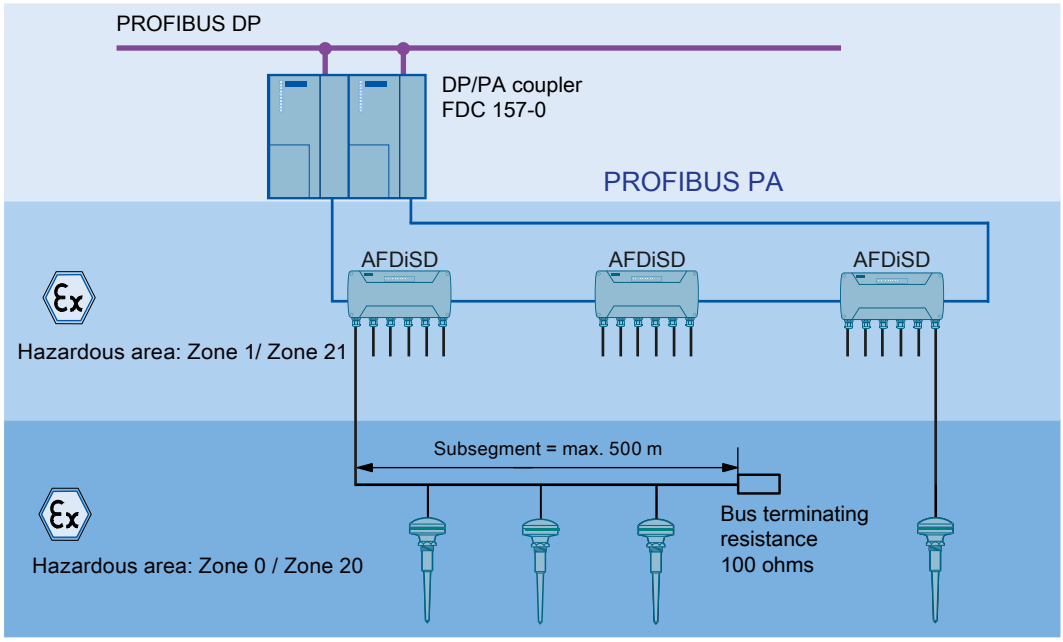


Figure 4-10 AFDiSD with subsegment in hazardous area

Note

Exceeding the permissible ambient temperature

If you are concerned that the permissible ambient temperature of the AFDiSD may be exceeded, you should monitor the ambient temperature and take any countermeasures necessary (cooling the environment).

4.6.5 Installation with active field distributors AFD4 / AFD4 (FM) / AFD4 Railmount / AFD8

Installation with ring redundancy

The graphic below provides an example of the installation with ring redundancy.

Note
AFD4 Railmount

Read the installation instructions for the AFD4 Railmount.

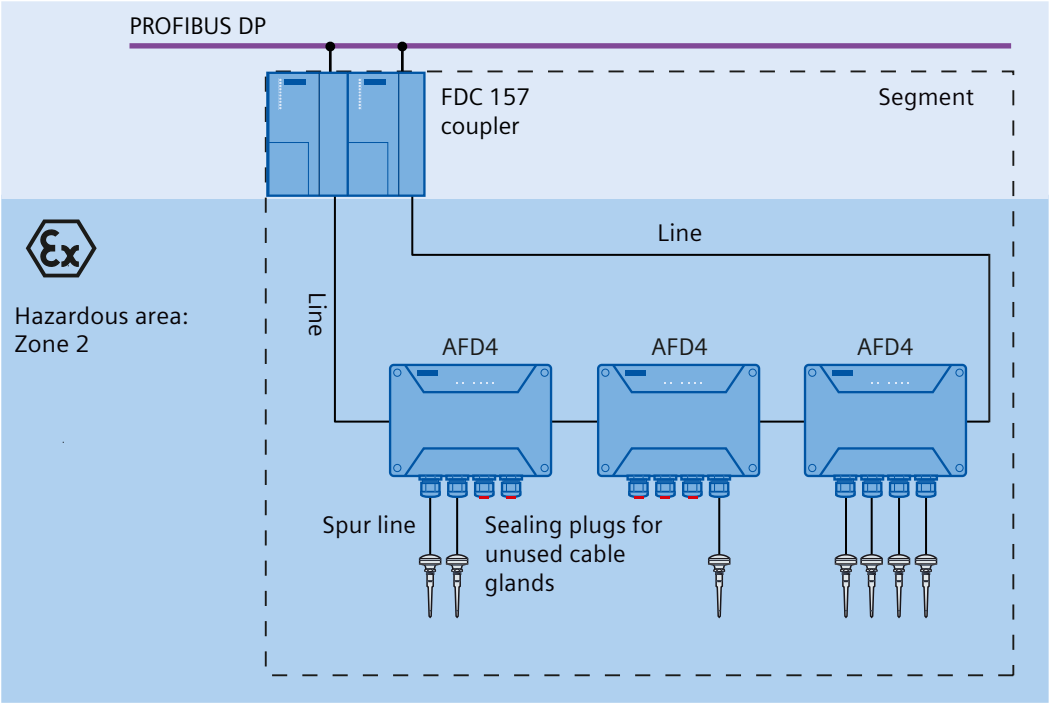


Figure 4-11 Example: Installation with ring redundancy with AFD4 field distributors

Note
Installation

Ring redundancy has been tested and approved for use with SIEMENS network components.

Topology

More information on this: Line and star-type topology (Page 300)

4.6.6 Safety instructions for connecting the AFDiSD

Safety information

DANGER

Explosion hazard

When laying cables and wiring, ensure that you adhere to the installation and setup regulations according to EN 60079-14 and any regulations specific to your country.

You can find information on how to install the PROFIBUS PA in the "Technical Guideline PROFIBUS PA, User and Installation Guideline". Available from PROFIBUS User Organization (http://www.profibus.com).

DANGER

Explosion hazard

Ignitable sparks may be generated during connection.
Therefore, use a **non-magnetic** screwdriver when connecting the cables!

DANGER

Explosion hazard

A tensile load on the cable glands of AFDiSD can impair the degree of protection and is not permitted.

Ensure that the installed cables are fixed at the cable entry!

WARNING

Risk to intrinsic safety

If the wrong connection is made on the AFDiSD (PA main line <--> spur lines) or the cables are incorrectly connected to the PA field devices, the intrinsic safety is put at risk:

Only connect Ex i circuits (intrinsically-safe PA field devices) to the spur lines!

Check the wiring to the PA field devices.

Schematic view of the interior and IP30 cover

The connections of the PA main lines inside the enclosure of the AFDiSD are sealed with an IP30 cover. Opening the IP30 cover switches off the voltage supply to the terminals and the feed lines.

Depending on the zone in which the AFDiSD is located, you are permitted to open the IP30 cover during operation for a visual inspection.

DANGER

Explosion hazard in Zone 1

In the **Zone 1** hazardous area you are not permitted to open the IP30 cover during operation.

Before opening the IP30 cover, disconnect the voltage supply to the relevant FDC 157 couplers.

In the hazardous area **Zone 2**, you are permitted to open the IP30 cover during operation.

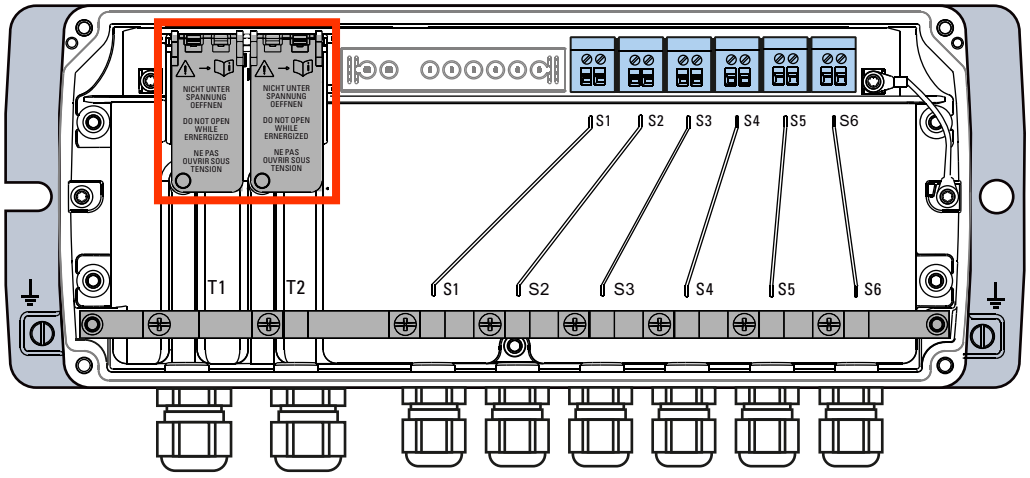


Figure 4-12 AFDiSD with IP30 covers

Additional information on this: Mechanical lock of the IP30 cover (Page 78)

Zone 1: Disconnecting the main line / connecting the main line to AFDiSD

DANGER

Explosion hazard

In the hazardous area **Zone 1** it is not permitted to disconnect the main line to an AFDiSD during operation.

Before you start the work, disconnect the FDC 157 coupler(s) from the voltage.

Zone 2: Disconnecting the main line / connecting the main line to AFDiSD

DANGER

Explosion hazard

In the **Zone 2** hazardous area, it is prohibited to disconnect the main line to an AFDiSD during operation, if it is **directly** connected to a FDC 157 coupler.

Before you start the work, disconnect the FDC 157 coupler(s) from the voltage.

In hazardous area **Zone 2**, it is permissible to disconnect a main line to an AFDiSD during operation if it connects two AFDiSD.

Zone 2: Disconnecting the main line / Connecting the main line to FDC 157 coupler

DANGER

Explosion hazard

In the **Zone 2** hazardous area, it is prohibited to disconnect the lines from a FDC 157 coupler during operation.

Disconnect the FDC 157 couplers from the power supply before starting work.

Rules for connecting main lines

The following examples illustrate the rules you must follow when connecting main lines. The main lines T1 and T2 are shown from the side and in color for better clarity.

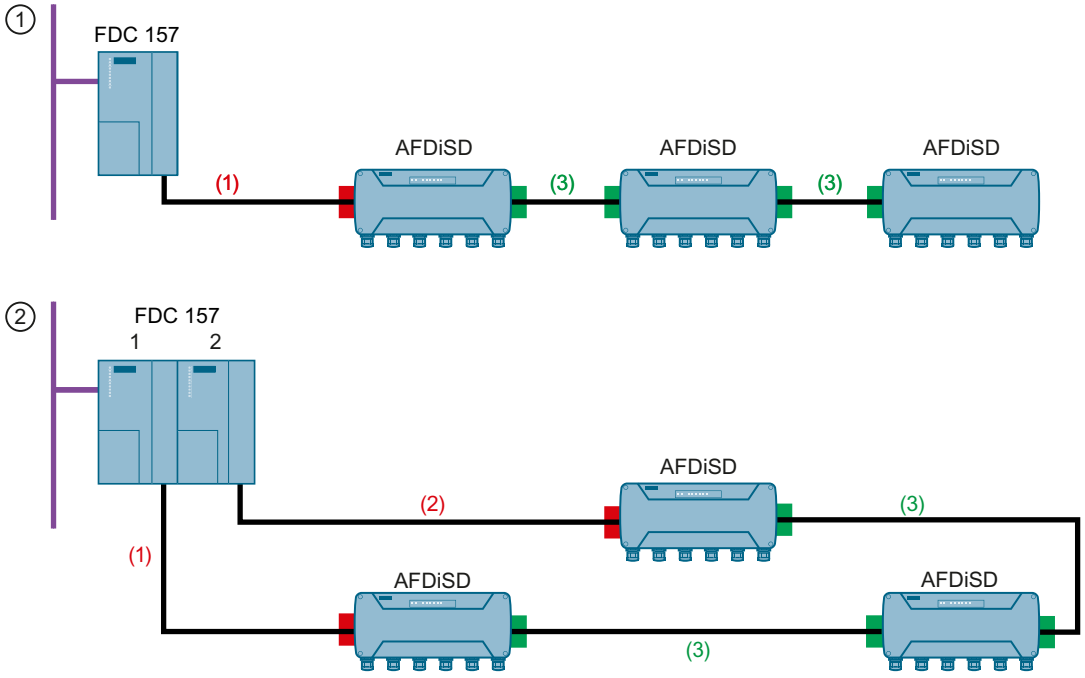


Figure 4-13 Rules for connecting main lines in hazardous areas

Rules

When connecting main lines in a Zone 2 hazardous area, comply with the following rules:

No.	Rule
①	De-energize FDC when disconnecting the line (1) on the AFDiSD
②	De-energize FDC 1 when disconnecting the line (1) on the AFDiSD
	De-energize FDC 2 when disconnecting the line (2) on the AFDiSD

The following applies to all configurations:

- Connection of the lines (3) is possible during operation (marked green in the figure above)
- The spur lines (in the figure: schematic representation) can always be connected during operation.

Marking main lines

Note

Mark the main lines that you are not permitted to disconnect during operation on the field distributors.

Mark the main lines on the AFDiSD in your system that come directly from the FDC 157 coupler.

4.6.7 Safety information for connecting the AFD4 / AFD4 (FM) / AFD4 Railmount / AFD8

Safety information

Note

When laying cables and wiring, adhere to the installation regulations in accordance with EN 60079-14 and any regulations specific to your country.

You can find information on how to install the PROFIBUS PA in the "Technical Guideline PROFIBUS PA, User and Installation Guideline". Available from PROFIBUS User Organization (http://www.profibus.com).

⚠ DANGER

Explosion hazard

Sparks may occur when connecting in some circumstances.

Therefore, use a **non-magnetic** screwdriver when connecting the cables.

⚠ DANGER

Explosion hazard

A tensile load on the cable glands of AFD4, AFD4 (FM), AFD8 can impair the degree of protection and is not permitted.

Ensure that the installed cables are fixed at the cable entry!

Schematic view of the interior and IP30 cover for AFD4 / AFD4 (FM) / AFD8

The connections of the main lines inside the enclosure of the AFD4 / AFD4 (FM) / AFD8 are sealed with an IP30 cover. Opening the IP30 cover switches off the voltage supply to the terminals and the feed lines.

In the hazardous area **Zone 2**, you are permitted to open the IP30 cover during operation for visual inspection.

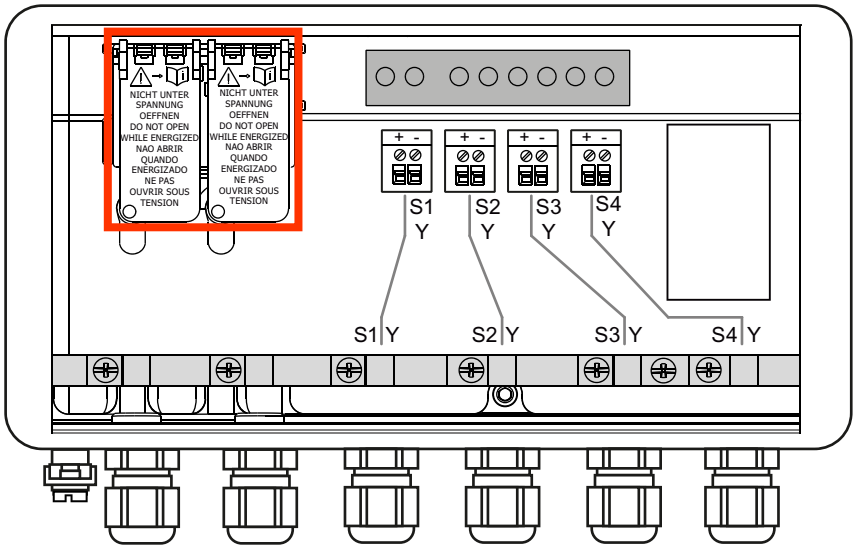


Figure 4-14 Schematic diagram AFD4 interior view

Additional information on this: Mechanical lock of the IP30 cover (Page 78)

Zone 2: Disconnecting the main line / connecting the main line to AFD4 / AFD4 (FM) / AFD8

DANGER

Explosion hazard

In the **Zone 2** hazardous area, it is prohibited to disconnect the main line from an AFD4 / AFD4 (FM) / AFD8 during operation if it is **directly** connected to a FDC 157 coupler.

Before you start the work, disconnect the FDC 157 coupler(s) from the voltage.

In hazardous area **Zone 2**, you are permitted to disconnect a main line from an AFD4 / AFD4 (FM) / AFD8 during operation if it connects two AFD4 / AFD4 (FM) / AFD8.

Rules for connecting main lines

The following examples illustrate the rules you must follow when connecting main lines. The main lines T1 and T2 are shown from the side and in color for better clarity.

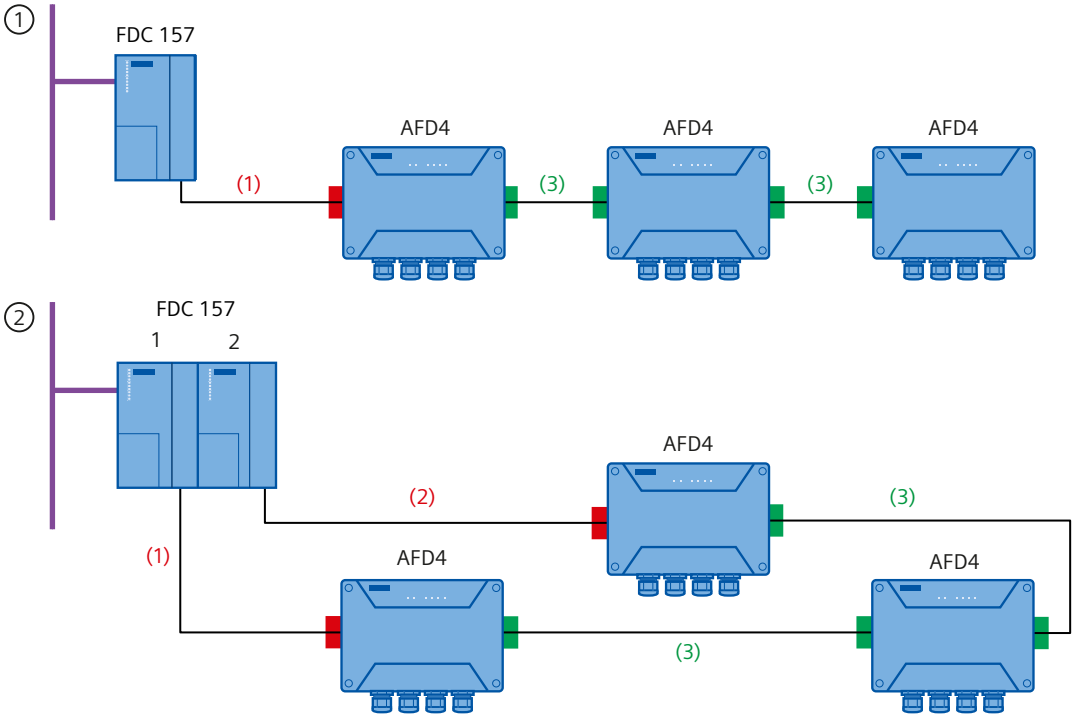


Figure 4-15 Rules for connecting main lines

Rules

When connecting main lines in a Zone 2 hazardous area, comply with the following rules:

No.	Rule
①	De-energize FDC when disconnecting the line (1) on the AFD4 / AFD4 (FM) / AFD8
②	De-energize FDC 1 when disconnecting the line (1) on the AFD4 / AFD4 (FM) / AFD8
	De-energize FDC 2 when disconnecting the line (2) on the AFD4 / AFD4 (FM) / AFD8

The following applies to all configurations:

- The lines (3) can be connected during operation
  (each highlighted in green in the figure)
- S<n> (n = 1 ... 4/8)
  The spur lines can always be connected during operation.

Marking main lines

Note

Mark the main lines that you are not permitted to disconnect during operation on the field distributors.

Mark the main lines on the AFD4 / AFD4 (FM) / AFD8 in your system that come directly from the FDC coupler.

4.6.8 Mechanical lock of the IP30 cover

Protection by locking

Protect your active field distributors against unauthorized or accidental opening by a sufficiently secured IP30 cover.

You can thread a wire of **non-electrically conductive material** through the sealing tabs on each IP30 cover and then have the following options, for example:

- Attach a seal
- Tightly knot the two ends of the wire
  Ensure that the seal/knot does not damage the IP30 covers when putting the enclosure lid on and tightening the screws.

Position of the sealing tabs on the active field distributor.

The sealing tabs of the IP30 cover are located to the left of the left IP30 cover and to the right of the right IP30 cover of the AFDiSD active field distributor:

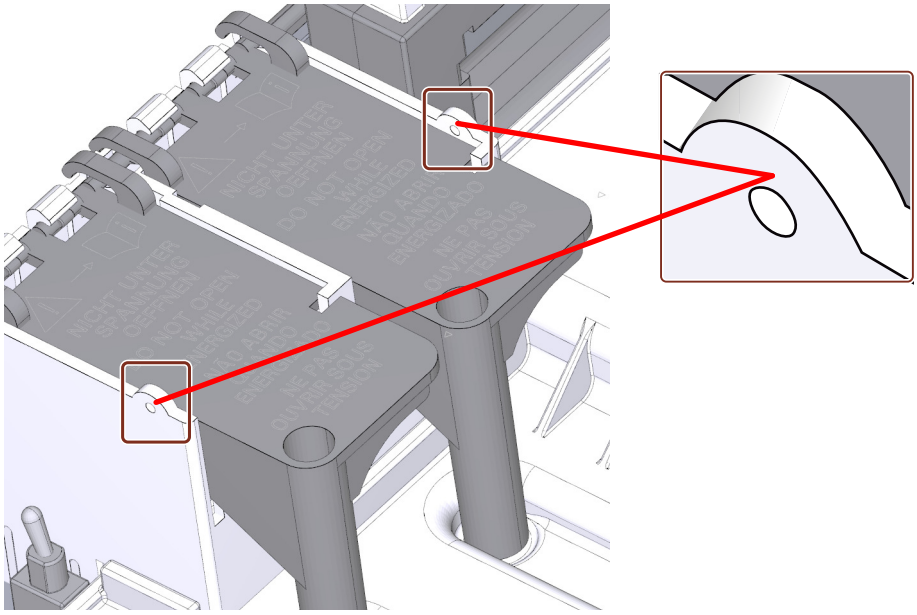


Figure 4-16 Sealing tabs of the IP30 cover of the AFDiSD active field distributor

The sealing tabs of the IP30 cover are located to the right of the IP30 cover on the following active field distributors:

- AFD4
- AFD4
- AFD4 Railmount
- AFD8

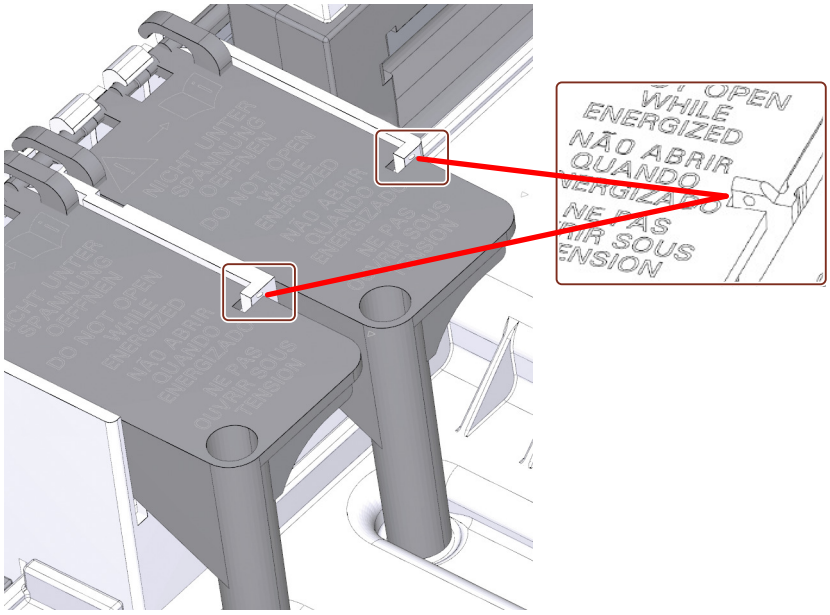


Figure 4-17 Sealing tabs of the IP30 cover on the active field distributor AFD4 / AFD4 (FM) / AFD4 Railmount / AFD8.

Mounting

5

5.1 Mounting rules

Follow the PNO PROFIBUS mounting guideline:

PROFIBUS User Organization (https://www.profibus.com/downloads)

Mounting position

The following modules can be installed vertically or horizontally:

- PROFIBUS DP interface module IM 153-2OD
- DP/PA coupler
- Y-coupler

WARNING

Open equipment

The devices are open equipment. This means that they may only be mounted in enclosures, cabinets, or electrical service rooms that can only be accessed by using a key or a tool. Only authorized personnel may have access to the enclosures, cabinets or electrical service rooms.

Mounting system

The modules are mounted on rails for the S7 assembly system. Free space of 40 mm must be maintained above and below the modules for trouble-free mounting.

You can find additional information on the setup and mounting in the operating instructions SIMATIC ET 200M Distributed I/O Device (https://support.industry.siemens.com/cs/ww/en/view/1142798).

Installation location

The DP/PA coupler (FDC 157-0 and FDC 157 Ex [ia]) or the DP/PA link with DP/PA coupler Ex [ia] can be operated in Zone 2 hazardous areas if they are installed in a suitable enclosure.

When using the DP/PA coupler Ex [ia], the PROFIBUS PA bus line may lead from the safe area to an area with Zone 0 / 20.

⚠ DANGER

Approval

For the DP/PA coupler FDC 157 Ex [ia] 6ES7157-0AD82-0XA0, the intrinsically safe PROFIBUS PA is approved for the following intrinsically safe electrical equipment:

- Equipment category 1G, 2G and 3G for Zones 0, 1, and 2
- Equipment category 1D, 2D and 3D for Zone 20, 21 and 22

You may use the DP/PA coupler FDC 157 Ex [ia] as a PROFIBUS node in equipment category 3G in the Zone 2 hazardous area (or in the safe area).

If you want to use the DP/PA coupler FDC 157 Ex [ia] in Zone 22, you must mount it in an approved enclosure certified for these zones.

Enclosure for Zone 2

The DP/PA coupler FDC 157 Ex [ia] or the DP/PA link with DP/PA coupler FDC 157 Ex [ia] must be mounted in a enclosure with at least IP 54 degree of protection. A manufacturer's declaration for Zone 2 must be submitted for the enclosure (in accordance with EN 60079-0).

Use the following cable glands:

- Power supply and PROFIBUS DP Ex i: Cable gland with manufacturer's declaration for Zone 2
- PROFIBUS PA Ex i: Degree of protection Ex i

⚠ DANGER

Explosion hazard

Sparks capable of ignition or impermissible surface temperatures may possibly form during installation work.

Never install under explosive conditions!

Switch off the voltage supply to the plant and adhere to the safety regulations.

5.2 Mounting the DP/PA coupler

5.2.1 Mounting DP/PA coupler for non-redundant mode

Required components

- Rail for the S7 mounting system
- DP/PA coupler

Installing a DP/PA coupler

Note

If you operate several DP/PA couplers in a rack in stand-alone operation without ring redundancy, you are not allowed to connect the DP/PA couplers via bus connectors or bus modules.

1. Hang the DP/PA coupler on the S7 rail and swing it down.
2. Screw down the DP/PA coupler.

Removing a DP/PA coupler

To remove the DP/PA coupler, proceed in the reverse order.

If the device is already in operation, switch off the power supply prior to removing it.

5.2.2 Mounting the DP/PA coupler for redundancy mode

Installation with bus modules

For operation with ring redundancy, connect two DP/PA couplers FDC 157-0 to a coupler pair.

Required components

- Rail for installation with active bus modules ("Rail for module replacement in runtime")
- For ring redundancy:
  - Bus module BM FDC/FDC (redundant)
    If the setup consists only of the coupler pair, the DP/PA coupler can be coupled via bus connectors.
  - Two FDC 157-0 DP/PA couplers (a maximum of one coupler pair is possible in an setup)

Installing bus modules and modules

1. Hang the *BM FDC* bus modules first, then the *BM FDC/FDC (redundant)* bus module on the mounting rail and press them into the rail.
2. Slide the bus modules together, so that the module connections have contact.
3. Insert the DP/PA couplers into the bus modules. Use the guides on the side of the bus modules for this.
4. Screw down the modules. This also fixes the bus modules to the rail.

Removing bus modules and modules

To remove the DP/PA coupler, proceed in the reverse order.

If the device is already in operation, switch off the power supply prior to removing it.

5.2.3 Setting addresses and redundancy mode

Introduction

You activate the diagnostic functions of the DP/PA coupler FDC 157-0 via the PROFIBUS address.

You activate the "Ring redundancy" mode at the DP/PA coupler pair and in the configuration.

Rules for operation as a visible device on PROFIBUS DP

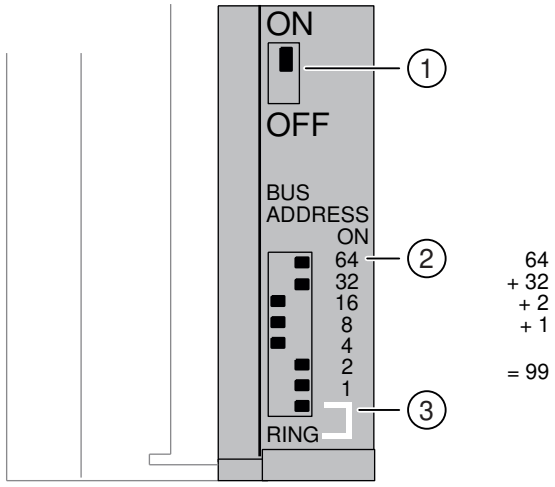
- Permitted PROFIBUS addresses: 1 to 123.
  The addresses 124 and 125 are reserved for internal services.
- Each PROFIBUS address may only be assigned once in the DP master system.
- The PROFIBUS addresses of both DP/PA couplers must be different.
- The PROFIBUS addresses that are set at the DP/PA coupler and in the configuration software must be identical.
- The redundancy mode that is set at the DP/PA coupler pair and in the configuration software must match.
- For ring redundancy, a lower PA address must be set for the left FDC 157 ("Coupler 1") than for the right FDC 157 ("Coupler 2").

Required tools

Screwdriver 3 mm blade width

Setting the PROFIBUS address and redundancy mode

1. Open the front door of the DP/PA coupler.
2. Use a screwdriver to set the required PROFIBUS address via the DIP switches. The PROFIBUS address is the sum of the values of all of switches that are in the "ON" position (switch set to the right).
3. Set the redundancy mode to ring redundancy using the DIP switch.
4. Close the front door of the DP/PA coupler.

Figure	Switch function	
	①	PA bus termination switch • ON: Bus terminating resistor switched on (default setting) • OFF: Bus terminating resistor switched off
	②	Set the PROFIBUS address.
	③	Redundancy mode • **ON: Ring redundancy** • OFF: Coupler redundancy (**default setting**)

Changing the PROFIBUS address

You can change the PROFIBUS address setting at any time. However, the DP/PA coupler does not apply the new setting until the 24 VDC supply has been switched off / on.

5.2.4 Removing and inserting DP/PA couplers

Introduction

Removing and inserting a DP/PA coupler during operation with ring redundancy is possible. The PA field devices connected to the redundant coupler pair remain in operation.

⚠ **WARNING**
Explosion hazard Ensure that there are no explosive conditions in the area of the DP/PA coupler.

Requirement

To remove a DP/PA coupler during operation, the following requirements must be fulfilled:

- The ACT LED of the DP/PA coupler must not be lit. Multiple PA field devices can fail otherwise.
- The power supply of the DP/PA coupler FDC 157-0 must be disconnected.

Removing and inserting modules

Note

Removing a DP/PA coupler

Removing a DP/PA coupler is only allowed in the de-energized state.

Disconnect the power supply of a DP/PA coupler before removing it.

Note

Failure of a DP/PA coupler FDC 157-0

If you remove a DP/PA coupler FDC 157-0 under voltage, the overvoltage protection may respond permanently. You can reset this shutdown by switching off the supply system for at least 10 s.

Before removing a DP/PA coupler FDC 157-0, disconnect its power supply.

5.3 Mounting the DP/PA link

5.3.1 Mounting the DP/PA link for non-redundant mode

Required components

- Rail for the S7 mounting system
- PROFIBUS DP interface module (IM 153-2OD)
- 1 to 5 DP/PA couplers
- Bus module BM PS/IM or BM IM/IM
- Bus modules BM FDC

If the module exchange is not required during operation, the DP/PA couplers can be coupled via one bus connector each.
A bus connector is included in the delivery of the DP/PA coupler.

Typical installation of the DP/PA link

The following figure shows the typical installation of the DP/PA link with two DP/PA couplers and PS 307 power supply with open front doors.

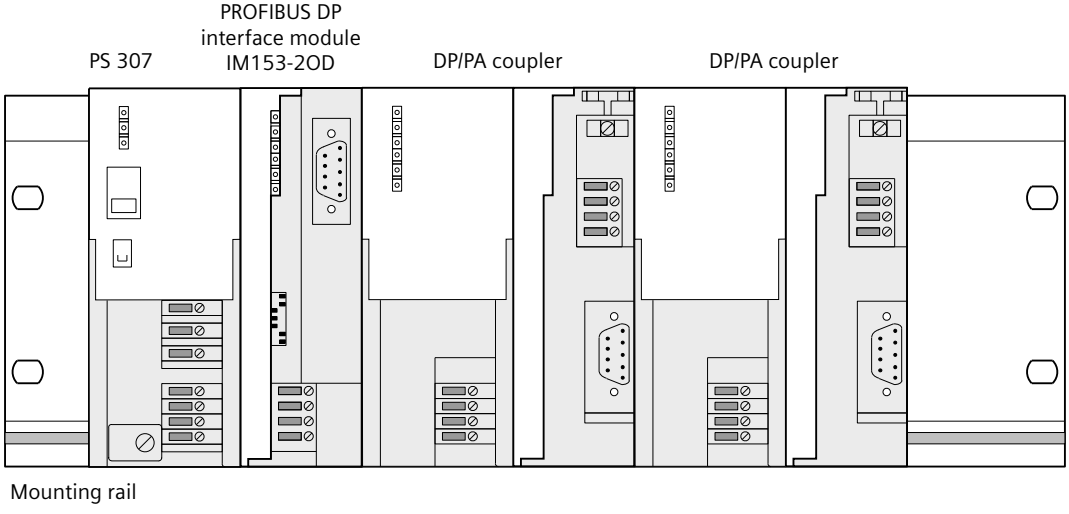


Figure 5-1 Typical installation of the DP/PA link for non-redundant mode

Installing the DP/PA link

Note

Changing a configuration

If the DP/PA link is already in operation, switch off the power supply before changing the configuration.

1. Hang the BM PS/IM or BM IM/IM bus module with the lower edge onto the S7 mounting rail, press it into the S7 mounting rail and slide it into the desired position.
   With the recommended mounting rails, this is to the left up to the engagement position.
2. Hang the next bus module (BM FDC) onto the mounting rail and press it into the mounting rail. Slide it against the left bus module so that the module connection makes contact.
3. Hang the modules onto the mounting rail and swivel them down. Use the guides on the side of the bus modules for this. When screwing the modules tight, fasten the bus module to the mounting rail at the same time.
4. Plug the bus module cover onto the last bus module. If no module is plugged into a slot, plug the backplane bus cover into the unoccupied slot as well.

Note

Mounting with bus connectors

Before mounting a DP/PA coupler and the module to be mounted on the left (starting with the PROFIBUS DP interface module), observe the following:
(does not apply when mounting the last DP/PA coupler)

1. Plug in a bus connector to the right of the module to be mounted on the left.
2. Only then hang the module to be mounted on the left onto the S7 mounting rail and swivel the modules down.

Removing / inserting a DP/PA coupler

If you want to pull or plug DP/PA couplers during operation, the DP/PA link must be assembled with bus modules.

Removing a DP/PA link

If the DP/PA link is already in operation, switch off the power supplies before disassembly.

To disassemble the DP/PA link with bus connectors, proceed in reverse order. Start with the DP/PA coupler mounted to the far right.

See also

Accessories for PROFIBUS DP (Page 293)

Accessories for PROFIBUS PA (Page 294)

5.3.2 Mounting the DP/PA link for redundant operation

Installation with bus modules

The DP/PA link must be installed with bus modules for redundant mode.

Required components

- Rail for installation with active bus modules ("Rail for module replacement in runtime")
- 2 x IM 153-2OD
- Bus module BM IM/IM
- 1 to 5 DP/PA couplers
- One BM FDC/FDC bus module for each DP/PA coupler

Typical installation

The following figure shows the typical installation of a DP/PA link for redundancy mode with two PS 307 power supplies with open front doors.

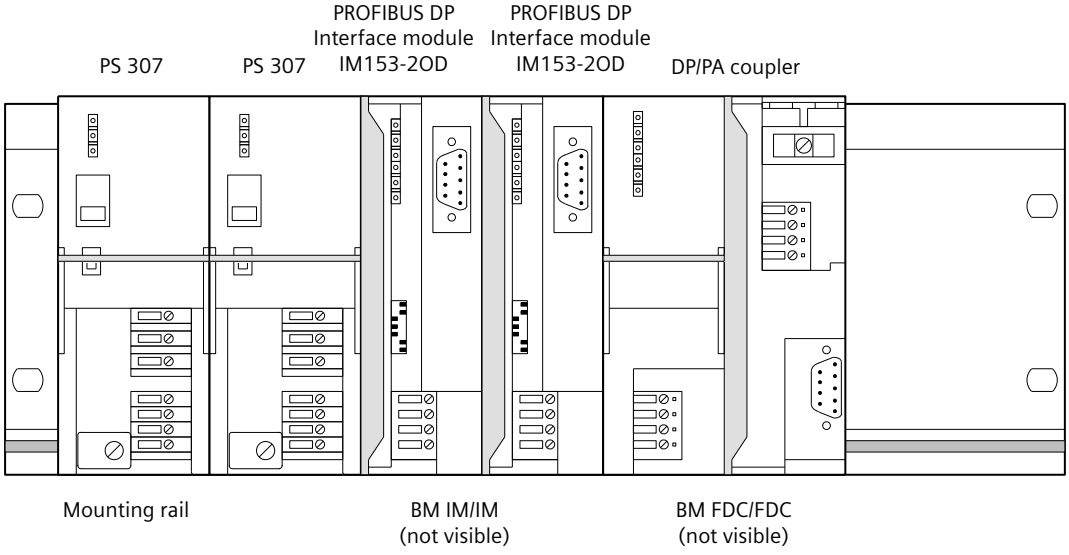
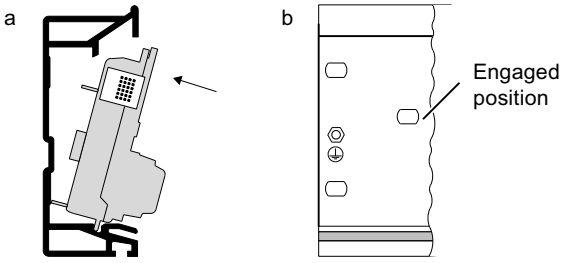


Figure 5-2 Typical installation of the DP/PA link for redundancy mode

Installing bus modules and modules

1. Hook the lower edge of the BM IM/IM bus module into the rail, press it into the rail (a) and slide it to the left up to the engagement position (b).
   If you are using the 530 mm rail and position the BM IM/IM in the engaged position on the right, you can install two additional PS 307; 2A or one PS 307; 5A to the left of the bus module.



2. Hang the BM FDC/FDC bus modules on the rail and press them into the rail.
3. Push the bus modules together so that the module connections are in contact.
4. Insert the two PROFIBUS DP interface modules into the BM IM/IM bus module.
5. Insert the DP/PA couplers into the BM FDC/FDC bus modules. Use the guides on the side of the bus modules for this.
6. Screw down the modules. This also fixes the bus modules to the rail.

Removing and inserting modules

Removal and insertion of modules during operation is possible on S7-400H in redundant mode. The following particularities must be noted for this:

- Removal and insertion of a PROFIBUS DP interface module is only allowed in the de-energized state. The power supply of the PROFIBUS DP interface module must be switched off for this. To avoid a failure of the lower-level master system, the DP/PA link should be installed with independently switchable power supplies for the two PROFIBUS DP interface modules (e.g. by using two power supplies).
- There is no restriction on removing and inserting the DP/PA coupler, but it causes the nodes connected to it to fail.

Removing bus modules and modules

To remove the DP/PA link, proceed in the reverse order.

If the device is already in operation, switch off the power supply prior to removing it.

See also

Accessories for PROFIBUS DP (Page 293)

Accessories for PROFIBUS PA (Page 294)

5.3.3 Setting addresses and redundancy mode

Definition

For the purpose of unique identification on PROFIBUS DP, each node must be given a PROFIBUS address.

Rules for operation as a visible device on PROFIBUS DP

The following rules apply to the PROFIBUS address of the PROFIBUS DP interface module in the higher-level DP master system:

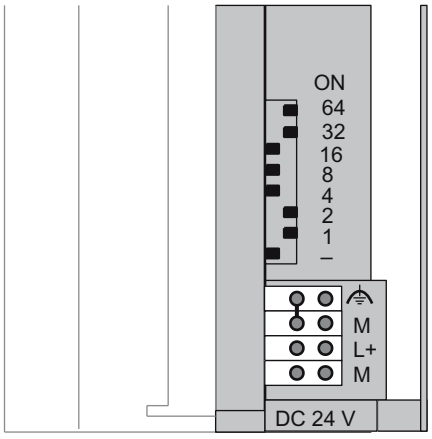
- Permitted PROFIBUS addresses: 1 to 123.
  The addresses 124 and 125 are reserved for internal services.
- Each PROFIBUS address may only be assigned once in the DP master system.
- In redundant mode, the same PROFIBUS address must be set for both PROFIBUS DP interface modules.
- The configured and set PROFIBUS addresses of the PROFIBUS DP interface modules must match.
- For ring redundancy, a lower PA address must be set for the left FDC 157 ("Coupler 1") than for the right FDC 157 ("Coupler 2").

Required tools

Screwdriver 3 mm blade width

Procedure

1. Open the front door of the PROFIBUS DP interface module.
2. Use a screwdriver to set the required PROFIBUS address via the DIP switches. The PROFIBUS address is the sum of the values of all of switches that are in the "ON" position (switch set to the right).

Figure	Switch function
	Set the PROFIBUS address. Example: 64 32 2 1 ----- PROFIBUS address 99

Changing the PROFIBUS address

You can change the PROFIBUS address setting at any time. However, the PROFIBUS DP interface module does not adopt the new setting until the 24 V DC supply has been switched off / on.

5.3.4 Setting the PROFIBUS PA address and redundancy mode

Introduction

Note

PROFIBUS addresses of the DP/PA couplers

Couplers of the type "**DP/PA coupler Ex [ia]**" are always invisible (transparent PROFIBUS DP device).

If PROFIBUS address 0 is set at a DP/PA coupler in the DP/PA link, the DP/PA coupler itself is invisible (transparent PROFIBUS DP device).

You activate the diagnostic functions of the DP/PA coupler FDC 157-0 via the PROFIBUS PA address.

You activate the "Ring redundancy" mode at the DP/PA coupler pair and in the configuration.

Rules for operation as a visible device on PROFIBUS DP

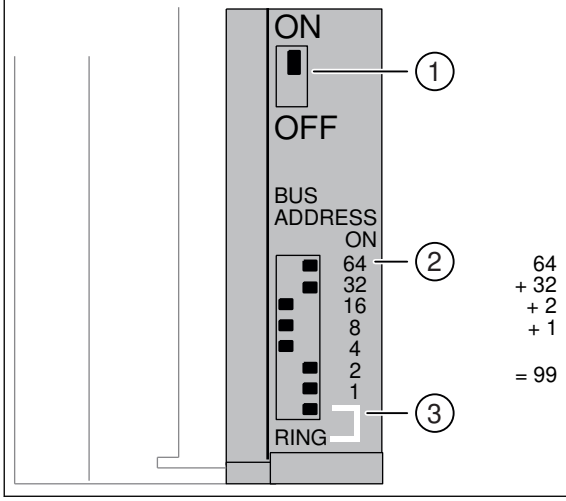
- The PROFIBUS addresses from 1 to 123 are permitted.
  - Each PROFIBUS address may only be assigned once in a PROFIBUS master system.
  - The PROFIBUS addresses 124 and 125 are reserved for internal services.
- For ring redundancy, the PA address of the left FDC 157 ("Coupler 1") must be lower than the PA address of the right FDC 157 ("Coupler 2").
- The PROFIBUS addresses of both DP/PA couplers must be different.
- The PROFIBUS addresses that are set at the DP/PA coupler and in the configuration software must be identical.
- The redundancy mode that is set at the DP/PA coupler pair and in the configuration software must match.

Required tools

Screwdriver 3 mm blade width

Setting the PROFIBUS address and redundant mode

1. Open the front door of the DP/PA coupler.
2. Use a screwdriver to set the required PROFIBUS address via the DIP switches. The PROFIBUS address is the sum of the values of all of switches that are in the "ON" position (switch set to the right).
3. Set the redundancy mode to ring redundancy using the DIP switch.
4. Close the front door of the DP/PA coupler.

Figure	Switch function	
	①	PA bus termination switch • ON: Bus terminating resistor switched on (default setting) • OFF: Bus terminating resistor switched off
	②	Set the PROFIBUS address.
	③	Redundancy mode • **ON: Ring redundancy** • OFF: Coupler redundancy (**default setting**)

Changing the PROFIBUS address

You can change the PROFIBUS address setting at any time. However, the DP/PA coupler does not apply the new setting until the 24 VDC supply has been switched off / on.

5.4 Installing the Y-Link

5.4.1 Mounting the Y link

Installation with bus modules

The Y-link must always be configured with bus modules.

Required components

- Rail for installation with active bus modules ("Rail for module replacement in runtime")
- 2x PROFIBUS DP interface module (IM 153-2OD)
- Bus module BM IM/IM
- Y-coupler
- Bus module BM Y-coupler

Typical installation

The following figure shows the typical design of a Y-Link with two PS 307 power supplies with the front doors open.

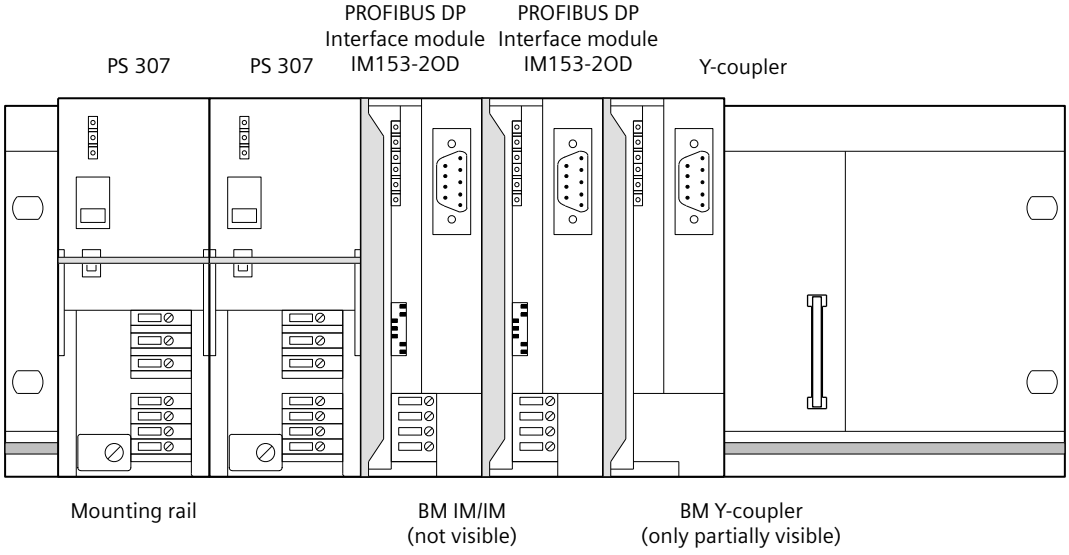
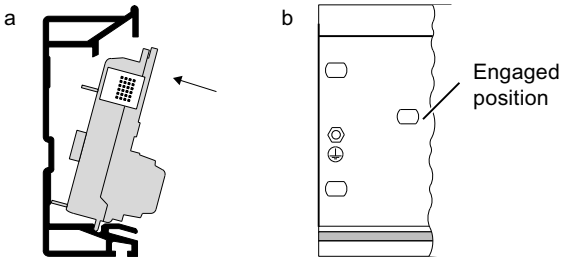


Figure 5-3 Typical installation of the Y-link

Installing bus modules and modules

1. Hook the lower edge of the BM IM/IM bus module into the rail, press it into the rail (a) and slide it to the left up to the engagement position (b).
   If you are using the 530 mm rail and position the BM IM/IM in the engaged position on the right, you can install two additional PS 307; 2A or one PS 307; 5A to the left of the bus module.



2. Hang the BM Y-coupler bus module on the rail and press it down into the rail.
3. Push the bus modules together so that the module connections are in contact.
4. Insert the two PROFIBUS DP interface modules into the BM IM/IM bus module.
5. Insert the Y-coupler into the BM Y-coupler bus module. Use the guides on the side of the bus modules for this.
6. Screw down the modules. This also fixes the bus modules to the rail.

Removing and inserting modules

Removal and insertion of modules during operation is possible on S7-400H in redundant mode. The following particularities must be noted for this:

- Removal and insertion of a PROFIBUS DP interface module is only allowed in the de-energized state. For this purpose, the 24 V DC supply of the PROFIBUS DP interface module must be switched off. To avoid a failure of the lower-level master system, the Y-link should be set up with independently switchable power supplies for the two PROFIBUS DP interface modules (e.g. by using two power supply modules).
- There is no restriction on removing and inserting the Y-coupler, but it causes the nodes connected to it to fail.

Removing bus modules and modules

To remove the Y-link, proceed in the reverse order.

If the device is already in operation, then turn off the 24 V DC supplies before disassembly.

See also

Accessories for PROFIBUS DP (Page 293)

5.4.2 Setting addresses and redundancy mode

Definition

For the purpose of unique identification on PROFIBUS DP, each node must be given a PROFIBUS address.

Rules for operation as a visible device on PROFIBUS DP

The following rules apply to the PROFIBUS address of the PROFIBUS DP interface module in the higher-level DP master system:

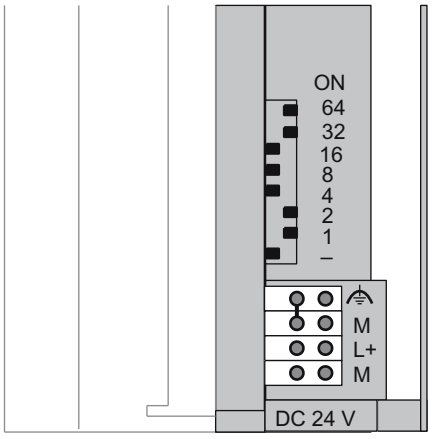
- Permitted PROFIBUS addresses: 1 to 123.
  The addresses 124 and 125 are reserved for internal services.
- Each PROFIBUS address may only be assigned once in the DP master system.
- In redundant mode, the same PROFIBUS address must be set for both PROFIBUS DP interface modules.
- The configured and set PROFIBUS addresses of the PROFIBUS DP interface modules must match.
- For ring redundancy, a lower PA address must be set for the left FDC 157 ("Coupler 1") than for the right FDC 157 ("Coupler 2").

Required tools

Screwdriver 3 mm blade width

Procedure

1. Open the front door of the PROFIBUS DP interface module.
2. Use a screwdriver to set the required PROFIBUS address via the DIP switches. The PROFIBUS address is the sum of the values of all of switches that are in the "ON" position (switch set to the right).

Figure	Switch function
	Set the PROFIBUS address. Example: 64 32 2 1 ----- PROFIBUS address 99

Changing the PROFIBUS address

You can change the PROFIBUS address setting at any time. However, the PROFIBUS DP interface module does not adopt the new setting until the 24 V DC supply has been switched off / on.

5.5 Mounting active field distributors

5.5.1 Mounting AFDiSD

Safety information

DANGER

Explosion hazard in Zone 21 / 22

During mounting, observe the guidelines according to EN 60079-14.

If you install the AFDiSD in areas with dust (Zone 21, Zone 22), then you must also adhere to EN 61241-14.

DANGER

Explosion hazard

Sparks capable of ignition or impermissible surface temperatures may possibly form during installation work.

Never install when an explosive atmosphere is present!

CAUTION

Risk of injury due to the heavy weight of the AFDiSD

The AFDiSD weights 4.5 kg. During mounting, hold the device firmly in your hand.

Mounting position

Only mount the AFDiSD active field distributor with the connections facing downwards.

NOTICE

Damage to property

A tensile load on the cable gland is not permitted. Ensure that the installed cables are fixed at the cable entry.

Requirement

- The subsurface must be flat and vibration-free and be able to support the weight.
- Select appropriate fixing accessories for the subsurface
- Space of at least 60 mm below the modules for the connections of the PA main lines and spur lines.

Required tools

- 2 fixing screws M8; dowels depending on the substrate
- Screwdriver suitable for the screws used

Mounting AFDiSD

Screw the enclosure base to the substructure with 2 fixing screws (connections facing downwards). The torque depends on the fixing screws used. You can find the drill hole spacing on the back of the enclosure base.

Additional information

For additional information, see *Installation in hazardous areas* in the Principles of Explosion Protection (https://support.industry.siemens.com/cs/ww/en/view/12521844) system manual.

See also

Mounting AFD4 / AFD4 (FM) / AFD8 (Page 100)

5.5.2 Mounting AFD4 / AFD4 (FM) / AFD8

Mounting position

The AFD4 /AFD4 (FM)/ AFD8 active field distributors are preferably screwed to a flat surface with the connections facing downwards.

Requirement

- The subsurface must be flat and vibration-free and be able to support the weight.
- Select appropriate fixing accessories for the subsurface
- There should be a clearance of at least 60 mm below the modules for the connection of main lines and spur lines.
- You can find the drill hole spacing on the back of the enclosure base (see Technical specifications).

Required tools

- Phillips screwdriver, size 4
- 4 M6 fixing screws; dowels depending on the subsurface
- Screwdriver suitable for the fixing screws used

Procedure

⚠ WARNING
Risk of injury! There is risk of injury due to heavy weight of the field distributor. During mounting, hold the device firmly in your hand.

1. Loosen the 4 screws of the enclosure cover with a Phillips screwdriver.
2. Screw the lower part of the enclosure tightly to the substrate with 4 fixing screws. The torque depends on the fixing screws used.
3. Screw the enclosure cover onto the upper part of the enclosure with the 4 Phillips-recess screws.
   Torque 2.4 Nm

See also

Mounting AFDiSD (Page 99)

5.5.3 Mounting AFD4 Railmount

NOTICE
Explosion hazard Sparks capable of ignition or impermissible surface temperatures may possibly form during installation work. Never carry out the installation under explosive conditions!

NOTICE
Risk of injury due to weight of AFD4 Railmount. The weight of AFD4 Railmount is 1 kg.

Installation

When mounting, observe national and international installation and assembly regulations according to EN 60079-14 as well as country-specific regulations.

Mount the AFD4 Railmount on a mounting rail (DIN rail TH 35 according to EN 60715).

1. Hang the AFD4 Railmount on the rail.
2. Swivel the AFD4 Railmount backwards until it snaps into place on the rail.

Fastening components

Fastening required for vibration and shock loads:
If there is a vibration and shock load, you must mount a mechanical fixation on the rail on both sides of the assembly (e.g. WAGO 249-117, https://www.wago.com/de/zubehoer/schraubenlose-endklammer/p/249-117 or similar). This measure prevents the AFD4 Railmount from slipping sideways.

Special conditions

1. Devices must be installed in a suitable enclosure.
   The enclosure must provide at least IP 54 degree of protection (according to EN 60529). The ambient conditions in which the device is installed are to be taken into account. A manufacturer's declaration for Zone 2 must be submitted for the enclosure (in accordance with EN 60079-0).
2. In situations where the temperature on the cable or at the cable entry of this enclosure exceeds 70 °C or where the temperature on the wire branching point exceeds 80 °C under operating conditions, the temperature specifications of the cables must match the actually measured temperatures.
3. The cable entries used must comply with the required IP degree of protection and section 6.2 (in accordance with EN 60079-0).

Connecting

6

6.1 General Rules and Regulations for Operation

Introduction

As an integral component of plants or systems, the described modules must adhere to specific rules and regulations depending on the area of use.

This section gives an overview of the most important rules you have to obey for safe integration in a plant or system.

Specific use case

Observe the safety and accident prevention regulations applying to specific applications, for example, the machinery protection guidelines.

EMERGENCY-OFF devices

In all operating modes of the plant or system, EMERGENCY-OFF devices that conform to IEC 60204 *Safety of machinery – electrical equipment of machines* must remain effective.

System startup after certain events

The table below shows what you have to observe for the startup of a plant after specific events.

For ...	...
• Startup following a voltage dip or failure • Startup after bus communication has been interrupted	No dangerous states may result. EMERGENCY STOP may be required!
• Startup after unlocking the EMERGMENCY STOP mechanism. • Startup without the DP master addressing the slaves	Must not result in an uncontrolled or undefined startup.

Power supply (24 V DC)

The following table shows what you need to observe for the power supply.

For ...	You must give heed to ...	
Buildings	External lightning protection	Make provision for lightning protection (for example lightning arresters)
24 VDC supply lines, signaling lines	Internal lightning protection	
Power supply	Safe extra-low voltage with safe electrical isolation (SELV)	

Protection from external electrical influences

The table below shows how you must protect your system against electrical interference or faults.

For ...	You must ensure that ...
All plants or systems in which the modules are integrated	The plant or system is connected to the protective conductor so that the electromagnetic interference is discharged.
Connecting cables, signaling and bus lines	The arrangement of the wiring and installation are correct
Signal and bus lines	Cable or wire breaks do not cause undefined plant or system states.

Braided shield of the PROFIBUS cable

The braided shield of the PROFIBUS cable must be placed on a grounded shield bus.

- Affix the braided shields with metal cable clamps
- The clamp must clasp around a large portion of the shield and provide good contact.
- Attach the screen to a shield bus directly after the point where the cable enters the cabinet.

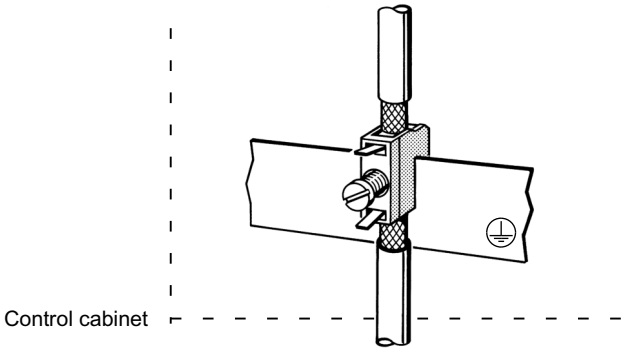


Figure 6-1 Braided shield of the PROFIBUS cable on a grounded shield bus

6.2 Connecting power supply to the redundant DP/PA coupler

PROFIBUS DP interface modules or DP/PA couplers in redundancy mode

The PROFIBUS DP interface modules or DP/PA couplers should be connected to separate power supplies to increase the availability in redundancy mode.

6.3 Electrical isolation and grounding

Introduction

You can wire the power supply to the described modules as a grounded installation and as a floating installation, depending on the requirements of your system installation.

Properties of the PROFIBUS DP interface module

- S7 backplane bus and power supply are galvanically connected
- PROFIBUS DP is galvanically isolated from the power supply and S7 backplane bus

Properties of the DP/PA coupler

- PROFIBUS DP and PROFIBUS PA are galvanically isolated from the power supply of the DP/PA coupler
- PROFIBUS DP and PROFIBUS PA are electrically isolated from one another

Properties of the Y-coupler

- The PROFIBUS DP master system is electrically isolated from the S7 backplane

6.3.1 Grounding AFD4 / AFD4 (FM) / AFD4 Railmount / AFD8

Requirement

- Active field distributor is mounted.

Required accessories

- Grounding cable, at least 4.0 mm^2

Grounding active field distributors AFD4 / AFD4 (FM) / AFD4 Railmount / AFD8

1. Strip the insulation of the grounding cable to 8 mm.
2. Attach the grounding cable to the ground terminal of the field distributor. Torque 2.0 Nm.
3. Connect the grounding cable to the equipotential bonding PA in accordance with EN 60079-14.

⚠ DANGER

Explosion hazard

Sparks may occur when connecting in some circumstances.

Never perform the work under explosive conditions!

Note

Read the safety information in the section Safety information for connecting (Page 75).

6.3.2 Grounding AFDiSD

Required accessories

- Grounding cable, at least 4.0 mm^2

Grounding an AFDiSD active field distributor

1. Strip the insulation of the grounding cable to 8 mm.
2. Attach the grounding cable to the right or left ground terminal of the AFDiSD.

⚠ DANGER

Active field distributor AFDiSD

Connect the grounding cable to the equipotential bonding terminal in accordance with EN 60079-14.

6.3.3 Operating with grounded supply

Definition: Grounded infeed

In the case of grounded infeeds, the neutral conductor of the supply system is grounded. A single ground fault between a live conductor and ground or a grounded part of the installation results in the protective devices being tripped.

Components and protective measures

Various components and protective measures are specified for assembling a full installation. The type of components and the degree to which the protective measures are mandatory depend on which DIN VDE regulation applies to your system installation.

- Main switch: DIN VDE 0100 part 460
- Disconnector: DIN VDE 0113 part 1

Operation with grounded infeed

The figure below shows the position of the modules in the overall installation with infeed from a TN-S system. For installation with grounded reference potential, any interference currents that occur are discharged to the protective conductor.

Comment: The arrangement of the power supply connections represented here does not correspond to the actual arrangement on the modules; it was selected for the purpose of clarity.

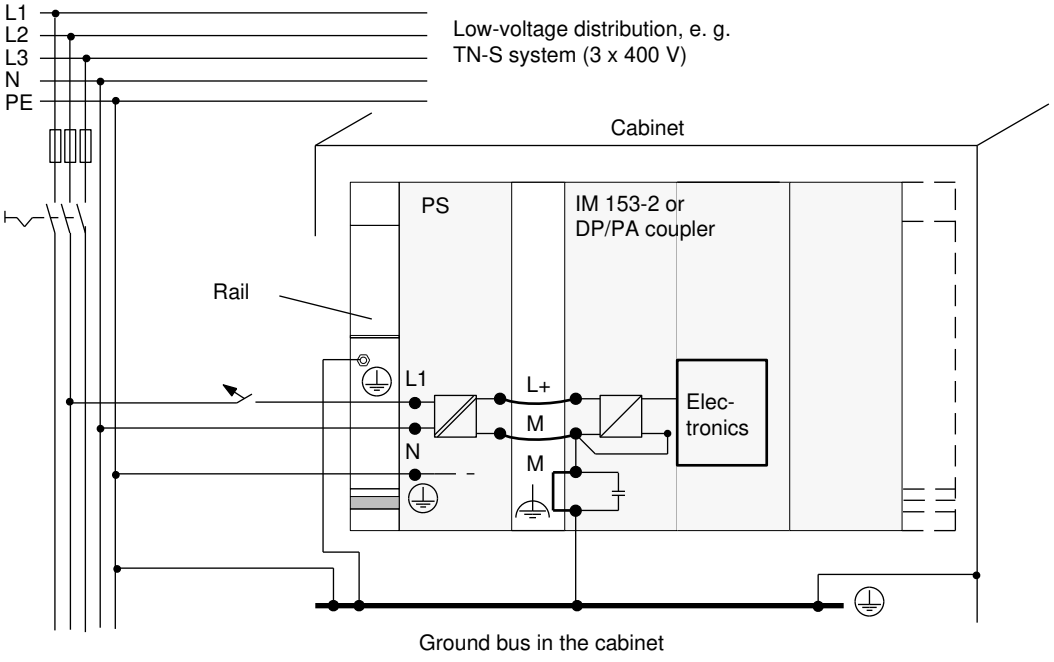


Figure 6-2 Installation with grounded infeed

6.3.4 Operation with ungrounded reference potential

Application

In extensive systems (e.g. in the chemical industry or in power plants), there may be a requirement to operate the modules with ungrounded reference potential, e.g. due to ground fault monitoring.

Discharging interference currents

When operating with ungrounded reference potential, interference currents that occur are discharged to the protective conductor via RC networks, which are integrated in the PROFIBUS DP interface module and in the DP/PA coupler (see figure below).

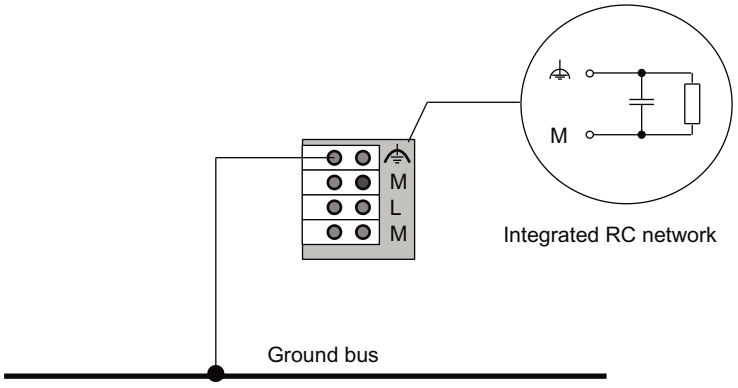


Figure 6-3 Installation with ungrounded reference potential

Power supply

If PROFIBUS DP interface module and DP/PA coupler FDC 157-0 are operated on the same power supply, the following applies:

- No galvanic isolation between power supply and backplane bus
  This is caused by the potential bond of the PROFIBUS DP interface module between power supply and backplane bus.
- The galvanic isolation can be implemented by connecting the devices to mutually isolated power supplies.

Note

Note that in the ungrounded installation with common supply, in parallel to the 10 Mohm resistance between the device ground and earth in the PROFIBUS DP interface module, there is an additional resistance of 1 Mohm in the DP/PA coupler FDC 157-0 (6ES7157-0AC85-0XA0).

6.3.5 Grounding

Equipotential bonding PA

In hazardous areas, you need to implement equipotential bonding PA according to IEC 60079-14.

Connect the equipotential bonding PA to the shielding of the bus lines.

The best EMC protection is achieved with direct grounding for active field distributors.

Direct grounding

The shielding of the bus lines is grounded directly in the hazardous area and in the safe area. This is possible if the equipotential bonding PA runs from the FDC 157 couplers (in the safe area) to the field devices (in hazardous areas), which means if a corresponding equipotential bonding conductor is installed.

Note

Direct grounding

The braided shielding of the connection cables must be guided under the shielding clamps of the active field distributors.

Example: Direct grounding of AFD4 / AFD4 (FM)

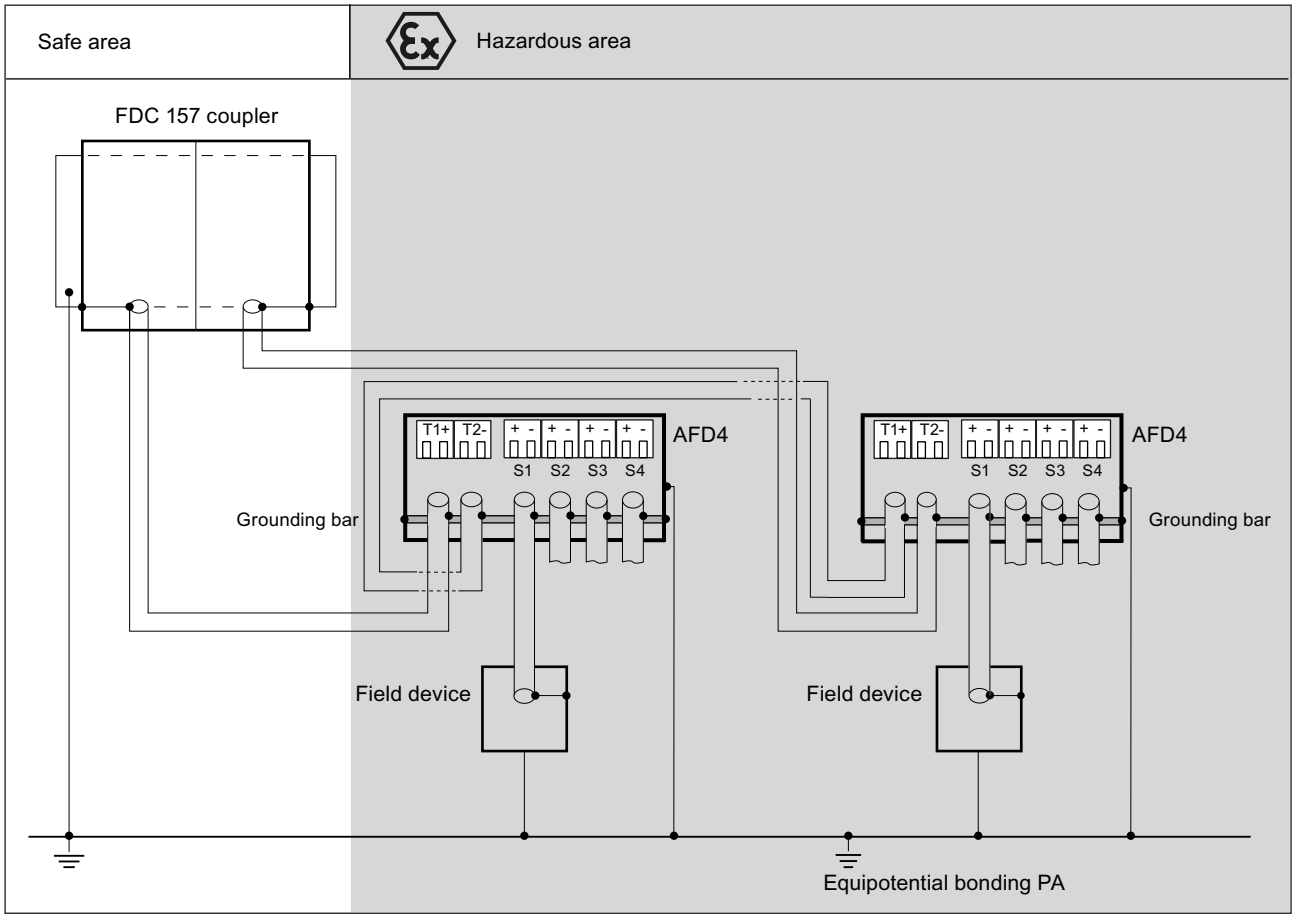


Figure 6-4 Example: Direct grounding of AFD4 / AFD4 (FM)

6.4 Connecting DP/PA couplers

6.4.1 Wiring the DP/PA coupler for stand-alone mode

Connections of the DP/PA coupler

The following figure shows all connections from and to the DP/PA coupler you must establish for stand-alone operation:

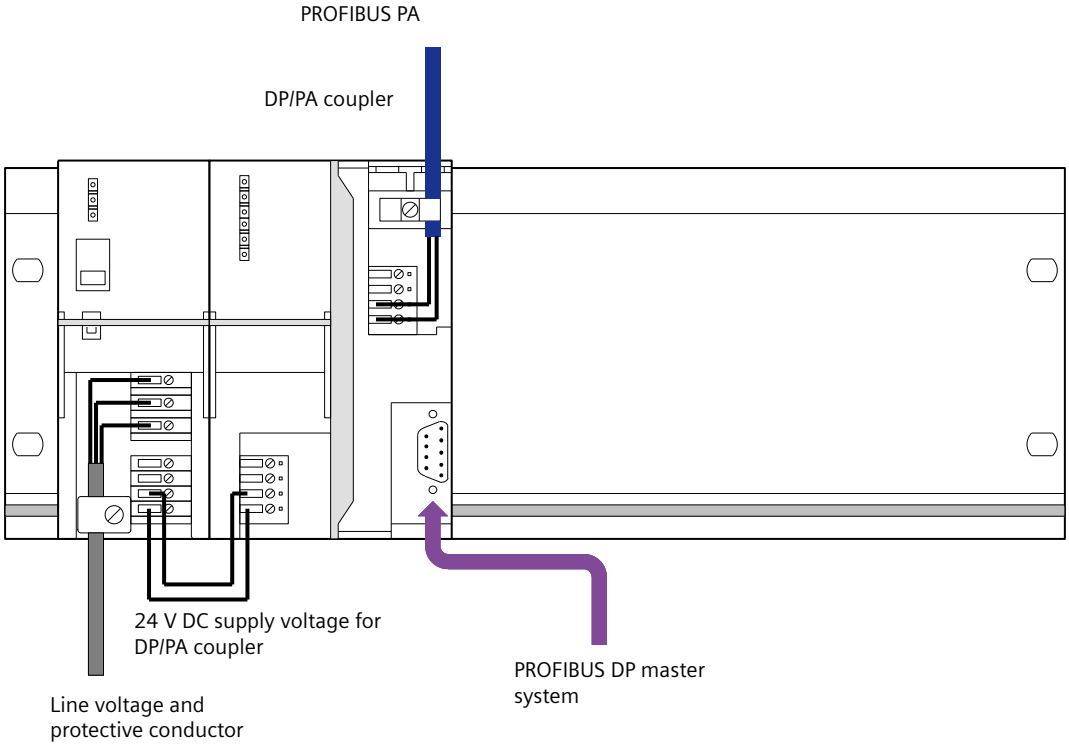


Figure 6-5 Connections of the DP/PA coupler for stand-alone operation.

Connecting the DP/PA link for ring redundancy (Page 114)

6.4.2 Connecting DP/PA couplers for ring redundancy

Connections of DP/PA couplers for ring redundancy

The following figure shows all connections you have to make to operate the DP/PA coupler for ring redundancy.

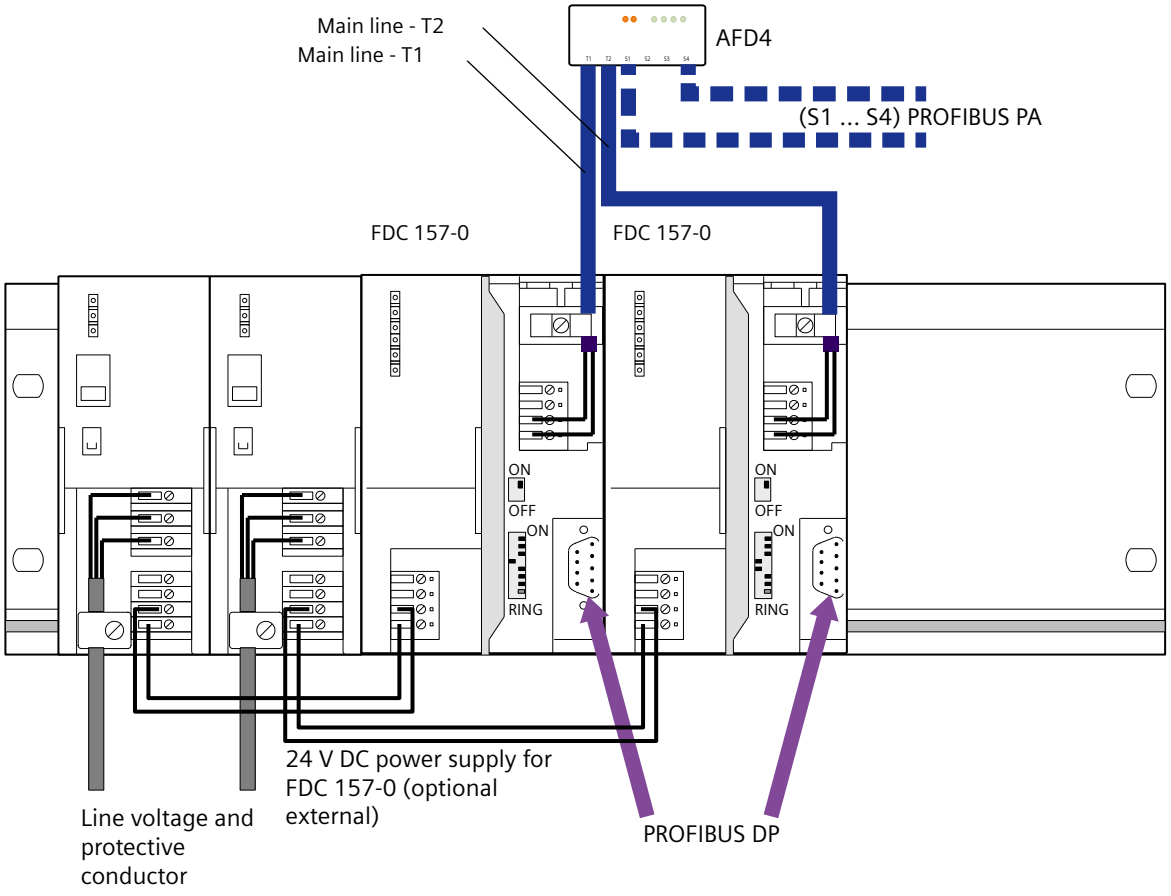


Figure 6-6 Connections of DP/PA couplers for ring redundancy

Additional information

Connecting the DP/PA link for ring redundancy (Page 114)

6.5 Connecting the DP/PA link

6.5.1 Wiring the DP/PA link for non-redundant mode

Connections of the DP/PA link

The following figure shows all connections from and to the DP/PA link you must establish for non-redundant mode:

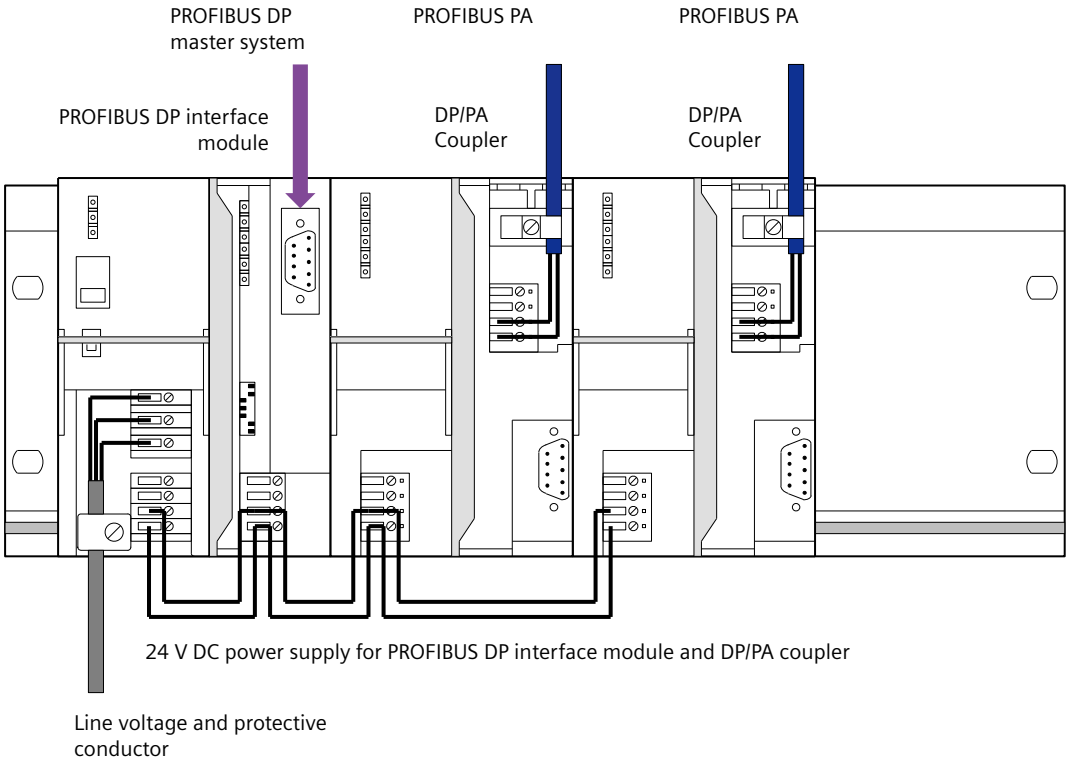


Figure 6-7 Connections of the DP/PA link for non-redundant mode.

Power supply

In the DP/PA link, power supplies are required for the PROFIBUS DP interface module and for each DP/PA coupler.

6.5.2 Connecting the DP/PA link for ring redundancy

Connections of DP/PA couplers for ring redundancy

The following picture shows all connections you must establish to operate the DP/PA coupler for ring redundancy in a redundant DP/PA link.

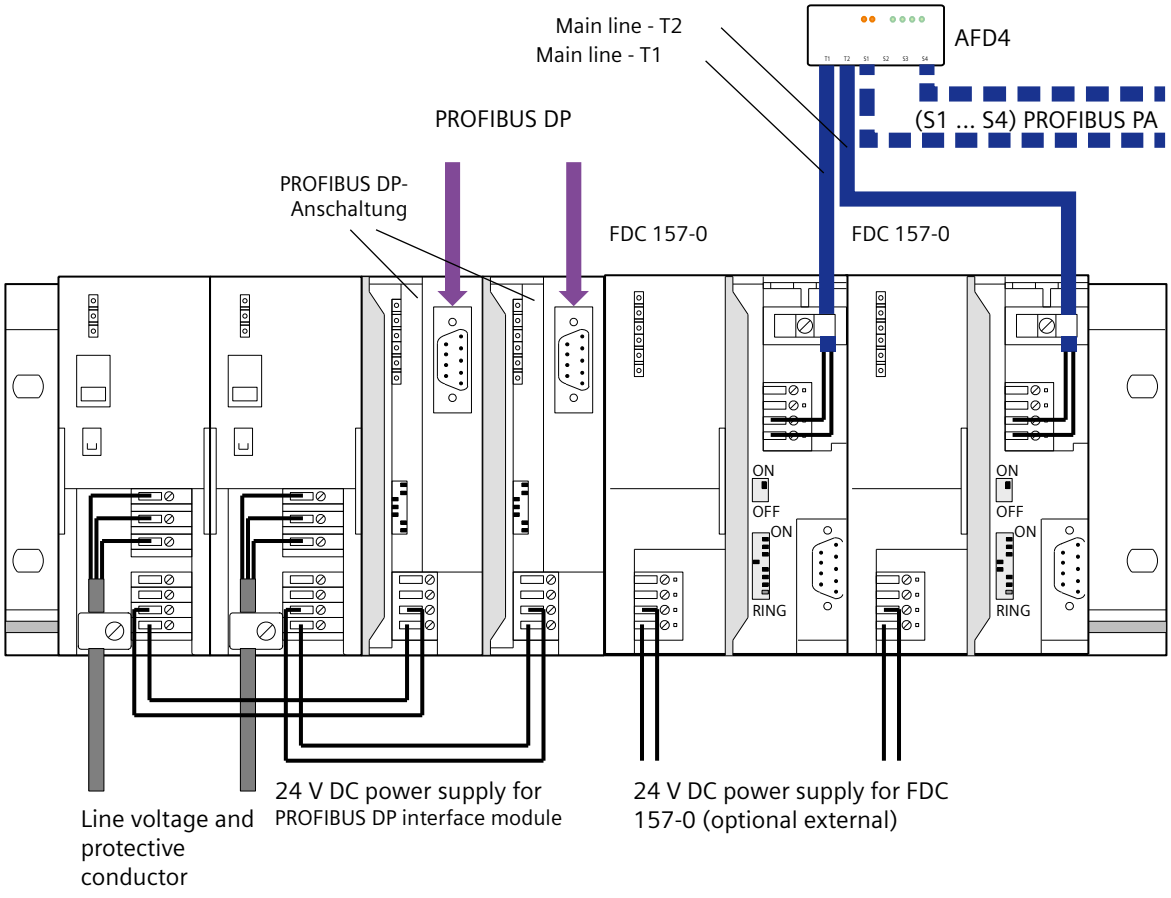


Figure 6-8 Connections of DP/PA couplers for ring redundancy in a redundant DP/PA link

Power supply

In the DP/PA link, power supplies are required for both PROFIBUS DP interface modules and for each DP/PA coupler.

PROFIBUS DP

In the DP/PA link, PROFIBUS DP connections to the S7-400H are required on both PROFIBUS DP interface modules.

See also

DP/PA coupler in ring redundancy and connected active field distributors (Page 44)

Connecting DP/PA couplers for ring redundancy (Page 112)

Connecting an active field distributor (Page 121)

6.6 Connecting Y link

Connections of the Y-link

The figure below shows all the connections you must establish from and to the Y-link:

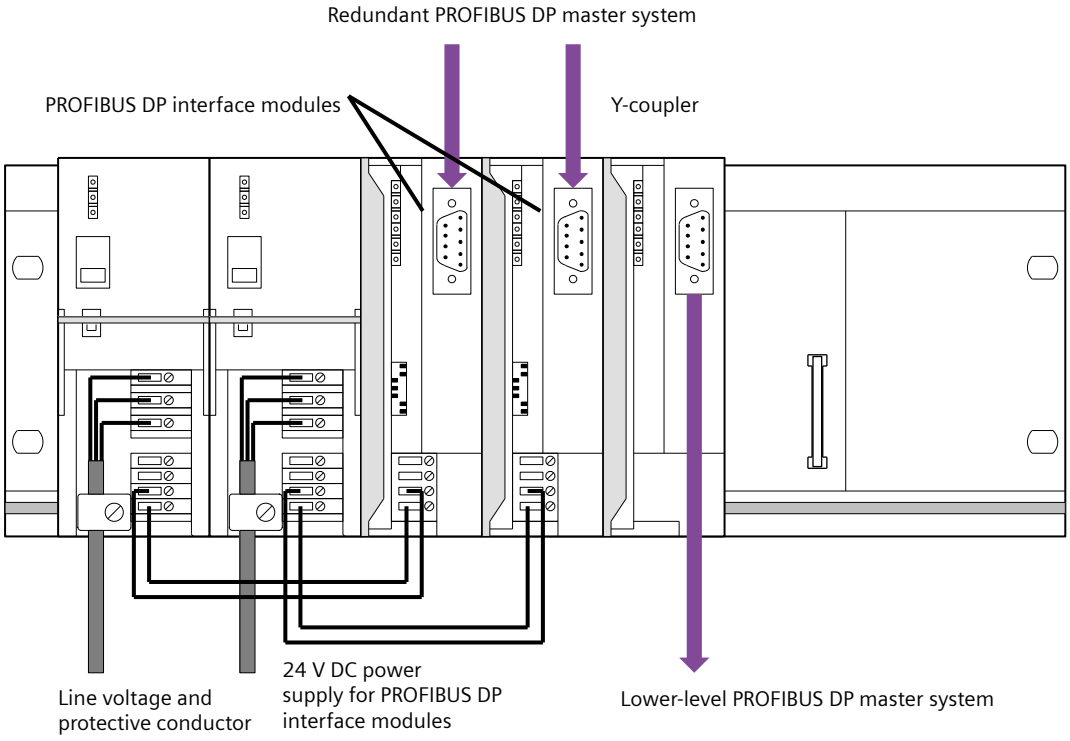


Figure 6-9 Connections of the Y-link

Power supply

In the Y-link, power supplies are required for both PROFIBUS DP interface modules.

PROFIBUS DP

The following PROFBUS DP connections are required in the Y-link:

- To the S7-400H at both PROFIBUS DP interface modules
- To the lower-level DP master system on the Y-coupler

Bus terminating resistors

The Y-coupler has no integrated bus terminating resistors. If the Y-coupler is arranged at the beginning or end of a bus segment, you must also connect in the bus terminating resistors on the bus connector.

6.7 Connecting the power supply

Introduction

The power supply is connected in the same way for all the described modules.

Required tools

You require a screwdriver with a 3 mm-wide blade to connect the power supply.

Power supply unit

You must only use SELV-type power supply units with protective extra-low voltage with safe electrical isolation (≤ DC 60 V).

The required power of the power supply used depends on the current consumption of the connected components.

Connection for power supply

The 4-pin screw terminal for the power supply is located behind the front door at the bottom. The terminals have the following meaning:

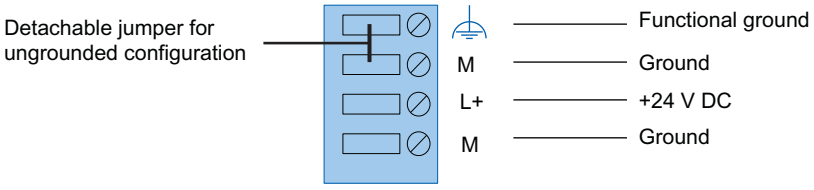


Figure 6-10 Contacts for the power supply

The maximum cross-section of the connection is 2.5 mm^2. There is no strain relief.

See also

Wiring the DP/PA coupler for stand-alone mode (Page 111)

Wiring the DP/PA link for non-redundant mode (Page 113)

Connecting Y link (Page 116)

6.8 Connecting PROFIBUS DP

Introduction

PROFIBUS DP is connected in the same way for all the described modules.

Required tools

You require a screwdriver with 3 mm-wide blade to fasten the bus connector plug on the PROFIBUS DP interface module.

Bus cable and connector

Use only the specified accessories for PROFIBUS DP.

Procedure

Connect the PROFIBUS DP as follows:

1. Insert the bus connector into the PROFIBUS socket.
2. Tighten the fixing screws of the bus connector.

Additional information

All the information required for handling bus cables and connectors can be found in the ET 200 Distributed I/O System manual (http://support.automation.siemens.com/WW/view/en/1142470).

6.9 DP/PA coupler: Connecting PROFIBUS PA

Important notes

The following content is binding for the PROFIBUS°PA installation:

- Investigation of intrinsic safety for field bus systems; PTB Report W-53, Braunschweig, March 1993 (only applicable for installation in a hazardous area).
- *PROFIBUS PA Commissioning Guide, Notes on using the IEC 61158-2 technology for PROFIBUS*, (German art. no. 2.091, English art. no. 2.092)
  PROFIBUS-Nutzerorganisation e. V. (http://www.profibus.com)
- Installation regulations in accordance with IEC 60079-14: Installing electrical installations in hazardous areas

Required tools

You require a screwdriver with a 3 mm-wide blade to connect the PROFIBUS PA.

To prepare the cable/wiring we recommend the tool PROFIBUS FastConnect.

Bus cable

Use the specified bus cable for PROFIBUS PA.

PROFIBUS PA connection

The 4-pin screw terminal for the PROFIBUS PA connection is located at the DP/PA coupler under the right front door at the top. The terminals have the following meaning:

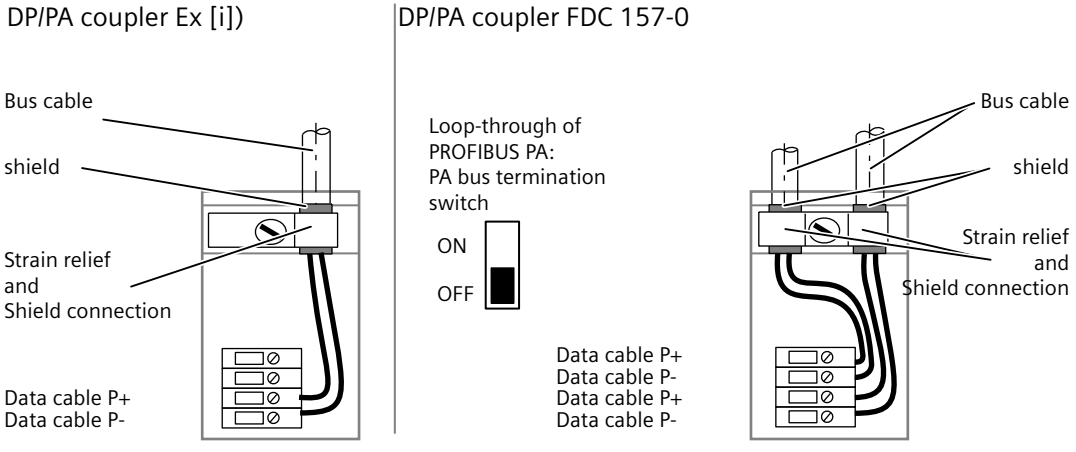


Figure 6-11 PROFIBUS PA connection

PA bus termination switch

You can loop-through the PROFIBUS PA at DP/PA couplers with a PA bus termination switch. The PA bus termination switch is available on the following DP/PA couplers:

- DP/PA coupler FDC 157-0
- DP/PA coupler Ex [i])

Note

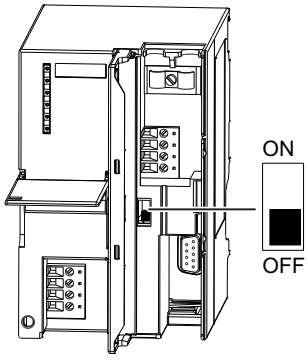
The PA bus termination switch has no function during operation of the DP/PA couplers with ring redundancy.

Note

DP/PA coupler for EX area (DP/PA coupler Ex [ia])

In this DP/PA coupler, the bus terminating resistor cannot be switched off.

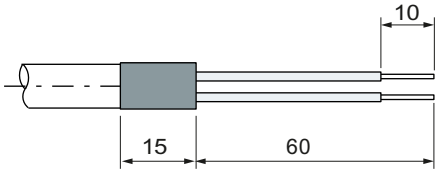
Therefore, this DP/PA coupler must be located at the beginning or end of a PA segment.

DP/PA couplers	PA bus termination switch	
	ON	The bus terminating resistors are activated. PROFIBUS PA must not be looped through.
	OFF	The bus terminating resistors are deactivated. You can loop PROFIBUS PA through and connect bus terminating resistors at both ends of the PA segment.

Procedure

Connect the PROFIBUS PA as follows:

1. Strip the insulation from the bus cable as depicted and pull the braided shield over the insulation.



2. Clamp the shield of the bus cable below the strain relief and screw down the strain relief.
3. Fix the wires of the bus cable into the screw-type terminals P+ and P-.
   Ensure that the wires have the correct polarity.

6.10 Connecting an active field distributor

6.10.1 Preparing a PROFIBUS PA cable

Required tools

- Phillips screwdriver, size 4
- Open ring wrench
  - M16 cable gland: 17mm
  - M20 cable gland: 21 mm
- Screwdriver 3 mm
- Small knife, wire cutter or FC stripping tool

Dimensions for preparing the PA cables

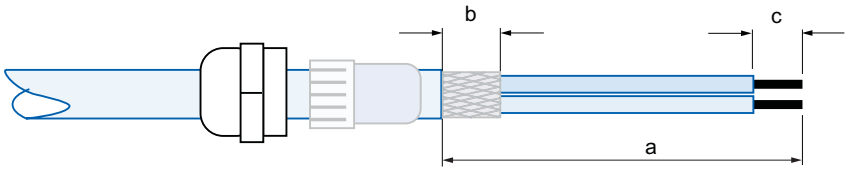
Table 6-1 Stripping lengths for PA cable

Component		Stripping length (outer jacket)	Length of the remaining braided shield	Stripping the connection wires
		Length a in the figure	Length b in the figure	Length c in the figure
• **AFD4** • **AFD4 (FM)** • **AFD4 (Rail-mount)** • **AFD8**	Main line T1, T2	90 mm	10 mm	8 mm
	Spur lines S<n> (n= 1 to 4/8)	70 mm	10 mm	8 mm
AFDiSD	Main line T1, T2	105 mm	10 mm	8 mm
	Spur lines S1 ... S3	120 mm	10 mm	8 mm
	Spur lines S4 ... S6	105 mm	10 mm	8 mm

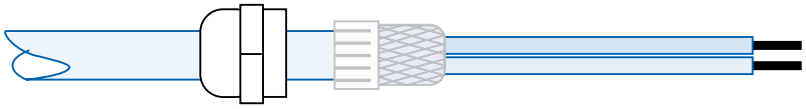
Procedure

1. Remove the cable gland from the field distributor with the open-end wrench.
2. Thread the pressure screw and the inside part of the gland with sealing ring onto the unprepared PA cable.

3. Strip the insultation from the PA cable as shown in the figure.



4. Push the braided shield over the inner part of the gland. To ensure electrical contact with the enclosure, the braided shield must encompass the inner part over a large area.



6.10.2 AFDiSD: Connecting PROFIBUS PA

Introduction

The PROFIBUS PA cables are introduced into the enclosure via cable glands.

- The PA main line via T1 and T2.
- The spur lines to the field devices via S1 to S6

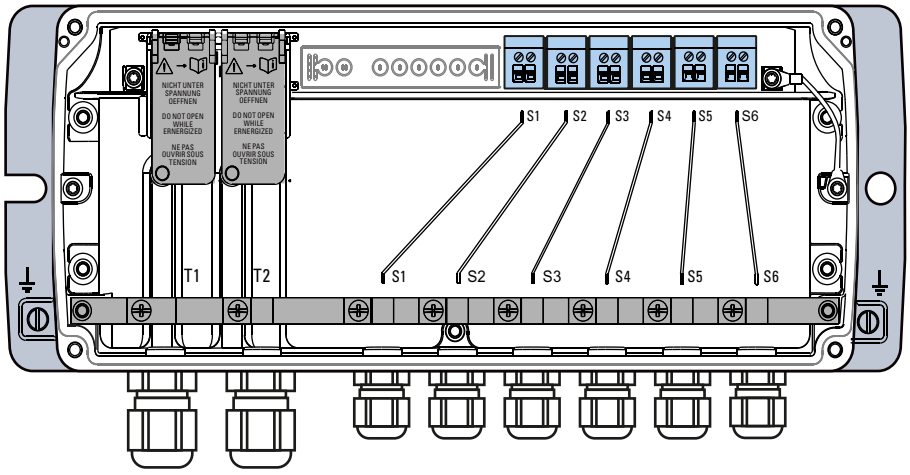


Figure 6-12 Interior view of AFDiSD

Terminal assignment

Connect the wires of the PROFIBUS PA cable to the terminal block in the active field distributor via the screw-type terminals.

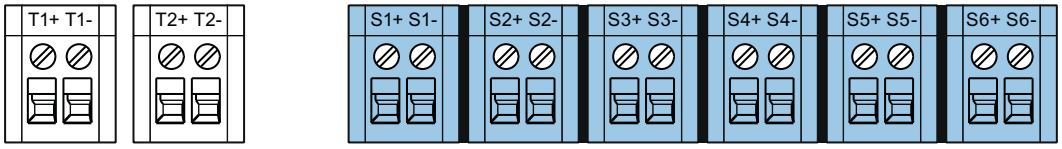


Figure 6-13 Terminal assignment on the active field distributor AFDiSD

Connection		Terminal	Assignment
T1, T2	Main line	+	Data cable (red)
		-	Data cable (green)
S1[1] to S6	Spur line to the field devices	+	Data cable (red)
		-	Data cable (green)
Shield / bar		Direct grounding for T1/T2; S1 to S6	
[1] S1 either for a subsegment with a length of up to 500 m or for a spur line; line termination with bus terminating resistor			

Basic procedure

Note

Installation note

Correctly closed, the enclosure offers an IP66 degree of protection. The mechanical design ensures Ex eb protection of the device.

Ensure that Ex eb certified cable glands and Ex eb compliant field wiring connections are used.

For cable entries and Ex tb degree of protection, ensure that the sealing ring is approved for the temperature range used and is fitted correctly.

To avoid damage, ensure that the specified tightening torques are observed during installation work.

- Observe the installation instructions in accordance with EN 60079-14 and country-specific regulations when laying the cables and wiring.
- When wiring you must ensure strict separation of intrinsically safe and non-intrinsically safe cables. Install them in separate cable ducts.
- Only intrinsically safe field devices that conform to the FISCO model may be connected to S1 to S6.
- As the bus cable, use cable type A, for example PB FC Process Cable (blue), 6XV1 830-5EH10.

1. Prepare the bus cable.
   (See section "Preparing a PROFIBUS PA cable (Page 121)")
2. Connect bus cable:
   – Open field distributor.
   – Connect main lines and spur lines to the terminal blocks.
3. Close field distributor

Requirement

- Active field distributor is mounted.

Note

Before connecting the PROFIBUS PA, read the section "Safety information for connecting"!

Note

Cable gland

For cable entries and Ex tc degree of protection, ensure that the sealing ring is approved for the temperature range used.

Required tools

- Phillips screwdriver, size 4
- Open ring wrench 19 mm
- Screwdriver 3 mm
- Small knife, wire cutter or FC stripping tool

Required accessories

- PROFIBUS PA cable (cable type A)
- Sealing plugs for unused terminals

Preparing the bus cable

You can find information on this in section "Preparing a PROFIBUS PA cable (Page 121)".

Direct grounding: Connecting the PROFIBUS PA cable to S1 to S6

1. Open field distributor: Remove the 4 screws of the enclosure cover using a Phillips screwdriver.
2. For direct grounding, feed the braided shield of the bus cables under the shield clamps and tighten the screw.

3. Connect the wires to the terminal block in accordance with the pin assignment.
   Torque 0.35 Nm.
4. Tighten the screw cap of the cable gland.
   Torque 1.3 Nm.

Direct grounding: Connecting the bus cable to T1/T2

⚠ WARNING

Hazardous area - Zone 1

During operation, never connect the PA main cable to the AFDiSD.
Switch off all supply voltages of the bus segment before connecting PROFIBUS PA to the AFDiSD!

1. Route the cable for the main line through the cable gland T1/T2 under the shield clamp and tighten the screw.
2. Open the IP30 cover T1/T2.
3. Connect the wires to the terminal block T1/T2 according to the terminal assignment.
   Ensure that the polarity of the wires is correct.
   Torque 0.35 Nm
4. Close the IP30 covers until you hear them engage.
5. Tighten the screw caps of all cable glands.
   Torque 1.5 Nm

Note

Impairment of the degree of protection

The degree of protection can be impaired if you overtighten the screw cap.

Close field distributor

1. Place the enclosure cover on the enclosure base and tighten the 4 screws.
   Torque 2.4 Nm.

Sealing unused cable glands

NOTICE

Impairment of the degree of protection

IP66 degree of protection is not guaranteed if terminals are not occupied.

Seal unused connections with a **sealing plug**. The screw caps with the yellow dust protection caps are not sufficient protection.

See also

Grounding (Page 65)
Components (Page 290)

6.10.3 AFD4 / AFD4 (FM) / AFD8: Connecting PROFIBUS PA

Introduction

The bus cables of the AFD4 / AFD4 (FM) / AFD8 field distributors are fed into the enclosure via cable glands:

- The main line via T1 and T2
- The spur lines to the field devices via S1 to S4 / S8

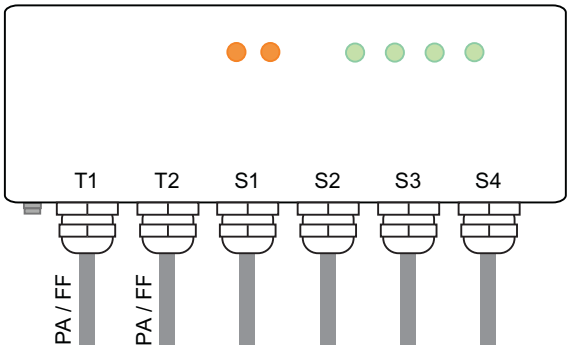


Figure 6-14 Connections of AFD4

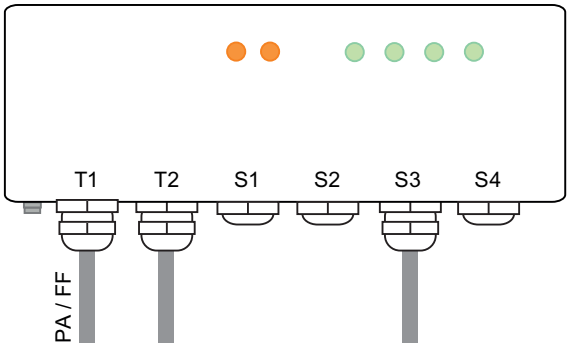


Figure 6-15 Connections of AFD4 (FM)

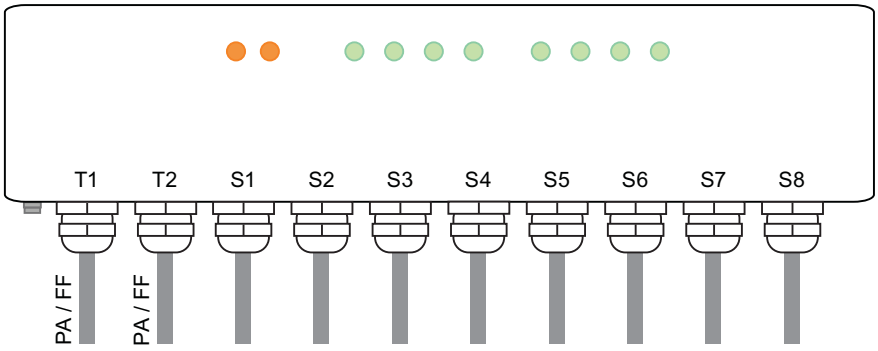


Figure 6-16 Connections of AFD8

Terminal assignment

Connect the wires of the bus cables to the terminal block using the screw-type terminals.

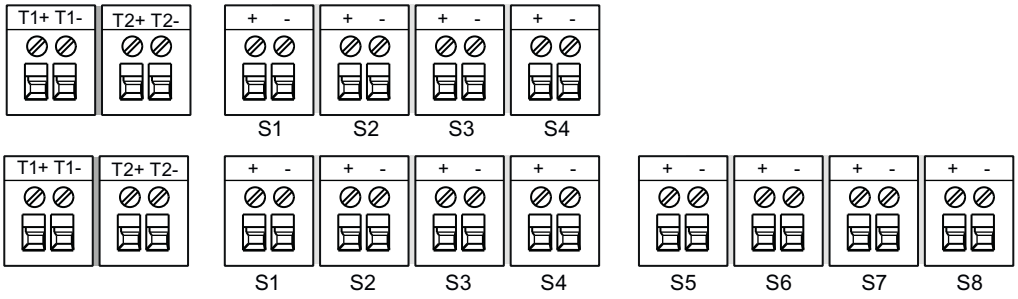


Figure 6-17 Terminal block AFD4 / AFD4 (FM) / AFD8

Table 6-2 Terminal assignment on the active field distributor AFD4 / AFD4 (FM) / AFD8

Connection		Terminal	Assignment
T1, T2	Main line	+	Data cable (red)
		-	Data cable (green)
S<n> (n= 1 to 4/8)	Spur line to the field devices	+	Data cable (red)
		-	Data cable (green)

Basic procedure

1. Prepare the bus cable.
2. Connect the bus cable:
   - Open field distributor.
   - Connect the wires to the terminal block.
   - Close the field distributor.

Preparing the bus cable

You can find information on this in section "Preparing a PROFIBUS PA cable (Page 121)".

Preparation of the AFD4 (FM)

Note

Replace blanking caps with UL- or CSA-approved lead-throughs for connection of additional field devices.

The customer must use a screwed gland and a cable as specified for the application according to NEC and CEC. The installation must conform to the relevant requirements of the National Electrical Code® (ANSI/NFPA-70 (NEC®).

Requirement

- Active field distributor is mounted and grounded.

Required tools

- Phillips screwdriver, size 4
- Open ring wrench 20 mm
- Screwdriver 3 mm
- Small knife, wire cutter or FC stripping tool

Required accessories

- Bus cable (cable type A)
- Sealing plugs for unused connections (10), 6ES7157-0AG80-1XA1

Commissioning systems with active field distributors AFD4 / AFD4 (FM) / AFD8

NOTICE
Failure of the bus system If the event of an error, the bus system may fail completely or partially. Before you commission a system with ring redundancy, check the redundancy function by causing a line interruption/short-circuit or by opening the IP30 covers on each AFD4 / AFD4 (FM) / AFD8 (opening the IP30 covers is also interpreted as an error).

Extending systems with active field distributors AFD4 / AFD4 (FM) / AFD8

NOTICE
Fault on the main line due to connection of spur lines If a plant is already in operation, first connect the spur lines to the field devices followed by the main lines. This sequence reduces interference on the main line.

Connecting the bus cables

1. Open field distributor: Loosen the 4 screws of the enclosure cover with a Phillips screwdriver.
2. Guide the bus cables through the cable glands according to the terminal assignment
3. For direct grounding, run the braided shield of the bus cables under the shielding clamps.

4. Connect the wires to the terminal block. Ensure that the wires have the correct polarity. Torque 0.35 Nm.
5. Tighten the screw caps of all cable glands. Torque 1.3 Nm.

NOTICE
Impairment of the degree of protection The degree of protection may be impaired if you tighten the screw caps too tight or not enough.

Close field distributor

1. Place the enclosure cover on the enclosure base and tighten the 4 screws. Torque 2.4 Nm.

Sealing unused cable glands

NOTICE
Impairment of the degree of protection IP66 degree of protection is not guaranteed if terminals are not occupied. Seal unused cable glands with sealing plugs, order number 6ES7157-0AG80-1XA1. This is the only way to ensure degree of protection IP66.

6.10.4 Connecting an AFD4 Railmount

NOTICE
Explosion hazard Sparks capable of ignition or impermissible surface temperatures may possibly form during installation work. Never carry out the installation under explosive conditions!

Wiring

- When laying cables and wiring, adhere to the installation regulations in accordance with EN 60079-14 and any regulations specific to your country.
- When wiring you must ensure strict separation of intrinsically safe and non-intrinsically safe cables. Install them in separate cable ducts.
- Use cable type A, for example *PB FC Process Cable* (blue), 6XV1830-5EH10, as the bus cable.

Commissioning

7

7.1 Commissioning in general

- Adhere to national regulations when commissioning.
- During functional checks, you must observe the guidelines according to EN 60079-17. This standard contains the provisions of international standard IEC 60079-17.
- Observe the PNO PROFIBUS Commissioning Guideline:
  PROFIBUS User Organization (https://www.profibus.com/downloads)
- A DPV1 slave may only be commissioned in connection with a DPV1 master.
  You can find additional information in the section "DPV0 and DPV1 modes (Page 59)".

7.2 Commissioning DP/PA couplers

In this section, you will learn about the steps required for commissioning DP/PA couplers. These steps are described in detail in the following subsections.

Requirements

Before you commission the DP/PA couplers, the following requirements must be fulfilled:

- DP/PA couplers are fully assembled and wired.
- PROFIBUS DP is fully assembled and ready for operation.
- PROFIBUS PA is fully assembled and ready for operation.

Commissioning DP/PA couplers (principle)

Basic procedure:

1. DP/PA coupler FDC 157-0 only:
   Read section "Configuring with STEP 7 (Page 133)".
2. Switch on the power supply for the DP/PA couplers.
3. Download the configuration to the PLC.

Use cases for DP/PA coupler FDC 157-0

The following table shows the use cases and the available functions for the DP/PA coupler and the required settings. The settings on the DP/PA coupler pair are required for ring redundancy.

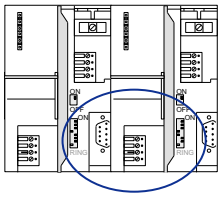
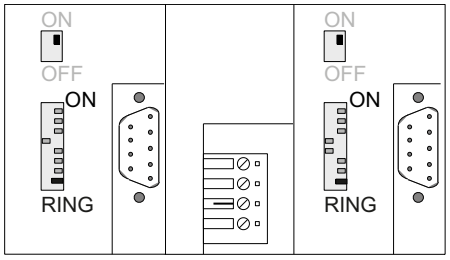


Table 7-1 Use cases and required settings

Use cases (stand-alone or in the DP/PA link)	Functions	Setting on the DP/PA coupler / DP/PA coupler pair	Settings in the configuration
• Non-redundant mode of a DP/PA coupler [1] • Operation of a DP/PA coupler pair with ring redundancy	Diagnostic function deactivated [2]	PROFIBUS address = 0	PROFIBUS address = 0
	• Diagnostic function activated • Ring redundancy activated	PROFIBUS address > 0 (1 to 123)[3]	PROFIBUS address > 0 (1 to 123)[3]

Use cases (stand-alone or in the DP/PA link)	Functions	Setting on the DP/PA coupler / DP/PA coupler pair	Settings in the configuration
Operation of a DP/PA coupler pair with ring redundancy	Ring redundancy activated	 RING ON	Redundancy mode: Ring redundancy

[1] Pay attention to the compatibility of the current components with predecessor components (see section "Compatibility overview (Page 279)").
[2] DP/PA coupler in the DP/PA link transparent.
[3] The addresses 124 and 125 are reserved for internal services.

7.2.1 Configuring with STEP 7

Introduction

You may use the DP/PA couplers in stand-alone operation without configuration. You must ensure the following for stand-alone operation:

- The DP master is set to a transmission rate of 45.45 kbps.
- The PA field devices are configured and their parameters are assigned.

If you want to use one of the following functions, configuration of a DP/PA coupler FDC 157-0 is required:

- Ring redundancy
- Diagnostic functions

In STEP 7 Version 5.4 and higher and PCS 7 Version 7.0 and higher, the HSP for the configuration of a DP/PA coupler is integrated.

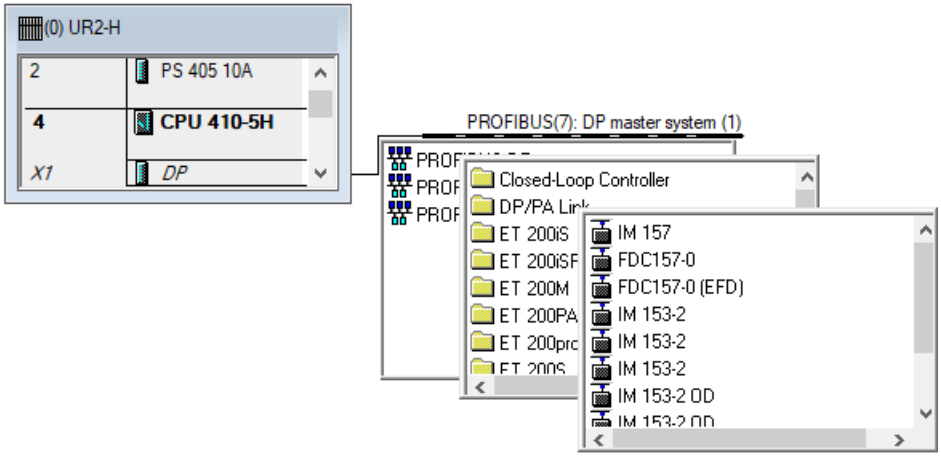
Requirement

- The DP/PA link is configured in *STEP 7* for the configuration example.
- The SIMATIC station is open in HW Config.
- The required PROFIBUS DP master system has been created at the SIMATIC station.

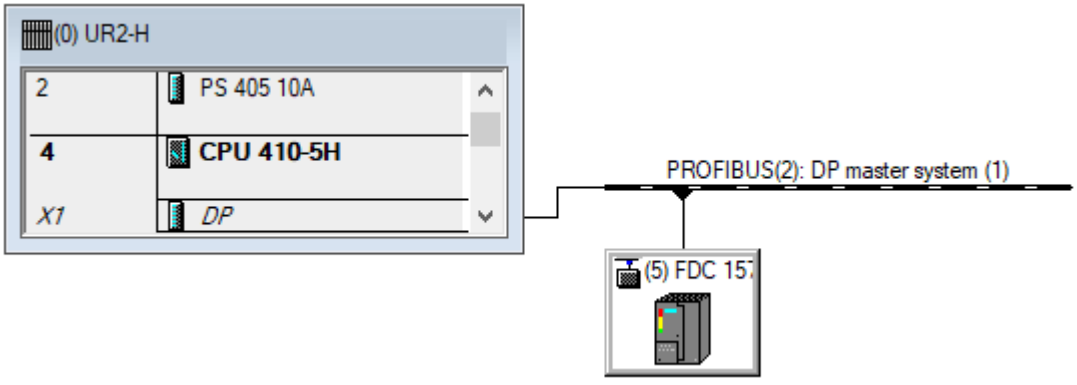
Configuring DP/PA coupler FDC 157-0 with STEP 7 (STEP 7 V5.4 and higher)

1. Select the PROFIBUS DP master system in which you want to insert the DP/PA coupler.
2. Select "Insert Object" in the shortcut menu.
   A selection menu opens.

3. Select the following entries:
   PROFIBUS DP > DP/PA Link > ....
   - FDC 157-0
     or
   - if the extended fieldbus diagnostics, EFD, is to be used:
     FDC157-0 (EFD)



4. Change the suggested address of the DP/PA coupler if necessary.
5. Assign the DP/PA coupler parameters and confirm with OK.



6. If the DP/PA coupler is used in redundancy mode, then configure the partner DP/PA coupler. To do this repeat steps 2 to 4.

Note

Using the DP/PA coupler in redundancy mode (ring redundancy)

If you use ring redundancy, the following is required:

- Activate the ring redundancy in the properties of each DP/PA coupler of the coupler pair.
- Check in Network settings / Profile of the properties of the PA master system, to see if Retry =3.
  or
- Set a user-defined profile with a Retry limit of 3.

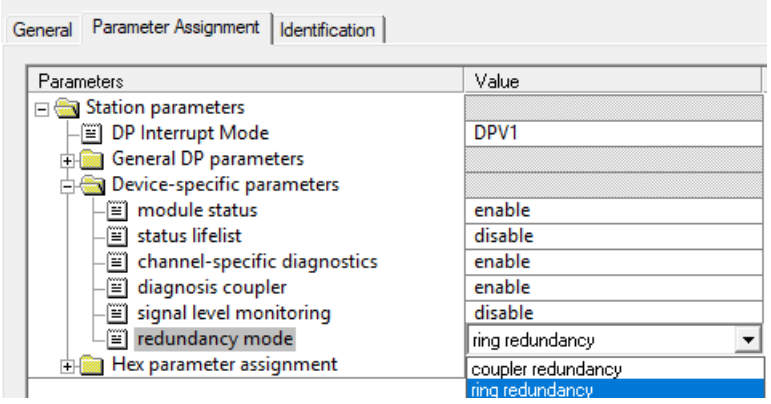


Figure 7-1 Ring redundancy

7. Save the configuration and download the configuration to the DP master.

Note

PROFIBUS address

Also set the PROFIBUS addresses via the DIP switches on the respective DP/PA coupler.

Additional information

You can find additional information on configuring the PA field devices in the manual Help for SIMATIC PDM (http://support.automation.siemens.com/WW/view/en/21407212).

See also

Configuring the PROFIBUS PA master system (Page 143)

7.2.2 Parameters for the diagnostic selection of the DP/PA coupler

Device-specific parameters

You can set the following parameters for the DP/PA coupler FDC 157-0:

Parameter	Value range	Default setting	Scope
Module status	• Disable • Enable	Enable	Module
Status lifelist	• Disable • Enable	Disable	Module
Channel-related diagnostics	• Disable • Enable	Enable	Module
Coupler diagnostics	• Disable • Enable	Enable	Module
Signal level monitoring	• Disable • Enable	Disable	Module

See also

User data of the DP/PA coupler (Page 179)

Structure of the current value and voltage value (Page 181)

7.3 Commissioning the DP/PA link

In this section, you will learn which steps you have to take to commission the DP/PA link. These steps are explained in detail in the individual subsections.

Requirements

Before you commission the DP/PA link, the following requirements must be fulfilled:

- You have completely installed and wired the DP/PA link.
- You have completely installed PROFIBUS DP. PROFIBUS DP is ready for operation.
- You have completely installed PROFIBUS PA. PROFIBUS PA is ready for operation.

Commissioning the DP/PA link (principle)

1. Configure the DP/PA link.
2. Set the PROFIBUS address of the PROFIBUS DP interface module.
   You can find information on this in the section "Setting addresses and redundancy mode (Page 91)".
3. Switch on the power supply for the DP/PA link.
4. Download the configuration to the PLC.

Configuring the DP/PA link

- The DP/PA link is configured with *STEP 7* for S7 standard mode and for redundancy mode.
  You can find information on this in the section "Configuring for S7 standard or redundant mode (Page 137)".
- For DP standard master mode, the DP/PA link is configured with a suitable program via a GSD file.
  You can find information on this in the section "Configuring DP/PA couplers for DP standard master mode (Page 303)".

In the DP/PA link, the DP/PA coupler communicates with the PROFIBUS DP interface module via the S7 backplane bus.

- The PROFIBUS DP connections of the DP/PA coupler are not connected to the PROFIBUS DP.
- Configuration of the DP/PA couplers is not required.

7.3.1 Configuring for S7 standard or redundant mode

Overview

The DP/PA link is configured with *STEP 7* for S7 standard mode and for redundancy mode.

7.3.1.1 Configuring DP/PA link

Requirement

- The DP/PA link is configured in *STEP 7* for the configuration example.
- The SIMATIC station is open in HW Config (or the SIMATIC H station for redundancy mode).
- The required PROFIBUS DP master system has been created at the SIMATIC station or SIMATIC H station.

Configuring the DP/PA link

1. Select the PROFIBUS DP master system in which you want to insert the DP/PA link.
2. Select the PROFIBUS DP interface module depending on the DP master system or redundant DP master system (for redundancy mode):
   - IM 153-2 OD (6ES7153-2BA70-0XB0)
     or
   - if the extended fieldbus diagnostics, EFD, is to be used:
     IM 153-2 OD EFD (6ES7153-2BA70-0XB0)

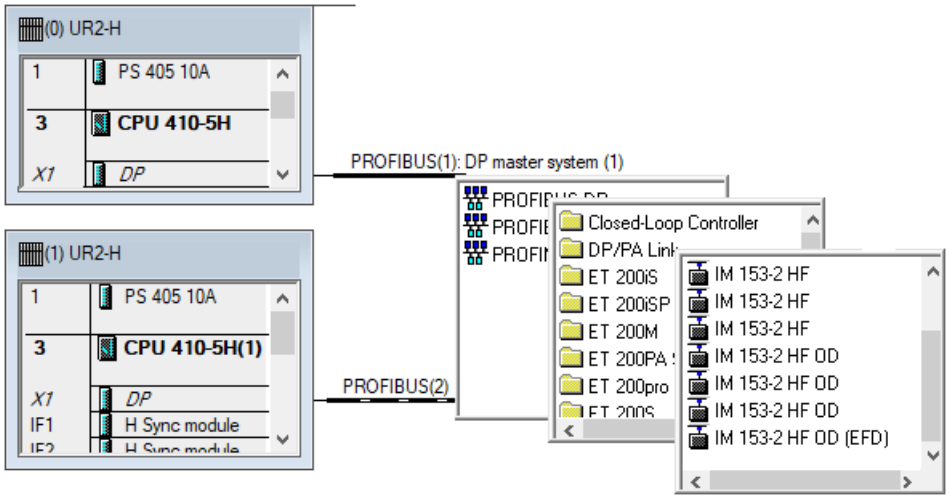


Figure 7-2 Creating a HW Config coupler

3. If needed, change the suggested address of the PROFIBUS DP interface module in the higher-level DP master system.
   Result: After closing this dialog, a dialog is displayed for selection of the lower-level master system.
4. Select PROFIBUS PA and confirm with OK.

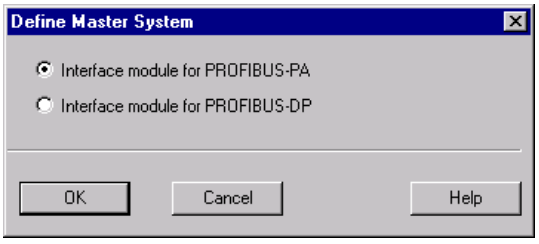


Figure 7-3 Dialog for selecting the lower-level master system (PROFIBUS PA)

Changeover time in redundancy mode

WARNING

Injury to persons may result

When upgrading or migrating the configuration software, you must observe the following:
As of *STEP 7 V5.2*, the bus parameters have changed compared to previous versions.
When using the PROFIBUS DP interface module as redundant DP slave, longer changeover times may occur in the H-system.

Result

The DP/PA link is inserted with the lower-level PA master system into the higher-level DP master system.
The transmission speed of the lower-level PA master system is preset to 45.45 Kbps.

Configuration on a SIMATIC H station with redundant PROFIBUS DP master system:
The redundant PROFIBUS DP interface module automatically connects to both PROFIBUS DP master systems of the SIMATIC H station only if the redundant PROFIBUS DP interface module is selected in step 2.

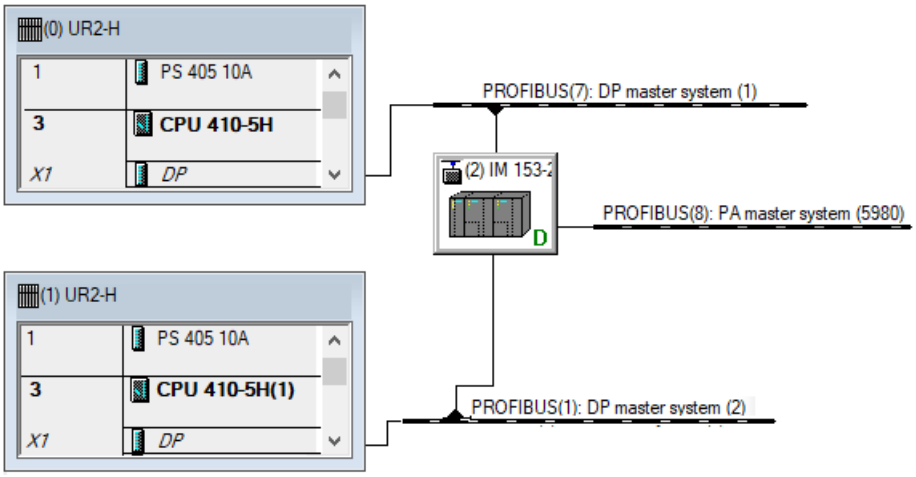


Figure 7-4 Example with redundant PROFIBUS DP interface module

See also

Configuring a DP/PA coupler in the DP/PA link (Page 140)

7.3.1.2 Configuring a DP/PA coupler in the DP/PA link

Introduction

You configure the following components for the redundancy functions supported by the DP/PA coupler FDC 157-0:

- For redundancy on the PROFIBUS DP side
  - A redundant DP master system
  - A redundant DP/PA link with IM 153-2OD PROFIBUS DP interface module connected to the redundant DP master system
- For the ring redundancy on the PA side
  - A PA master system
  - Two DP/PA couplers on the PA master system

Requirement

- For the configuration example, a DP/PA link is configured in *STEP 7*.
- The SIMATIC station or SIMATIC H station is open in HW Config.
- The DP/PA link with PROFIBUS DP interface module and PROFIBUS PA master system is created.
  Configuring DP/PA link (Page 138)

Configuring a DP/PA coupler in the DP/PA link

1. Select the PROFIBUS PA master system in which you want to insert the DP/PA coupler.
2. Select "Insert Object" in the shortcut menu.
   A selection menu opens.
3. Select the following entries:
   PROFIBUS DP > DP/PA Link > ....
   - FDC157-0
   - or
   - if the extended fieldbus diagnostics, EFD, is to be used:
     FDC157-0 (EFD)
4. Change the suggested address of the DP/PA coupler if necessary.
5. Assign the DP/PA coupler parameters and confirm with OK.

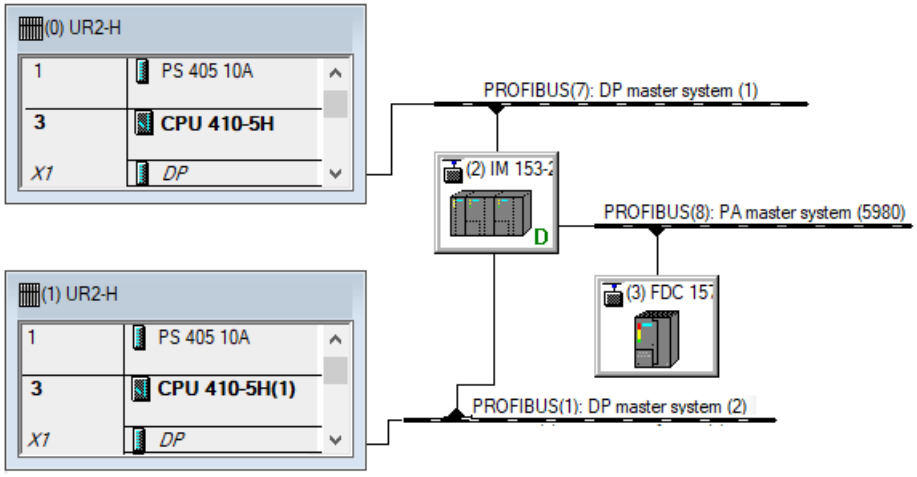


Figure 7-5 HW Config: Minimal configuration of a S7-400H for DP/PA link with redundant PROFIBUS DP interface module

6. If you insert additional DP/PA couplers in the DP/PA link, repeat steps 3 to 5 for this.
7. If DP/PA couplers are to be used in redundancy mode, configure the last two DP/PA couplers of the FDC157-0 type with ring redundancy.

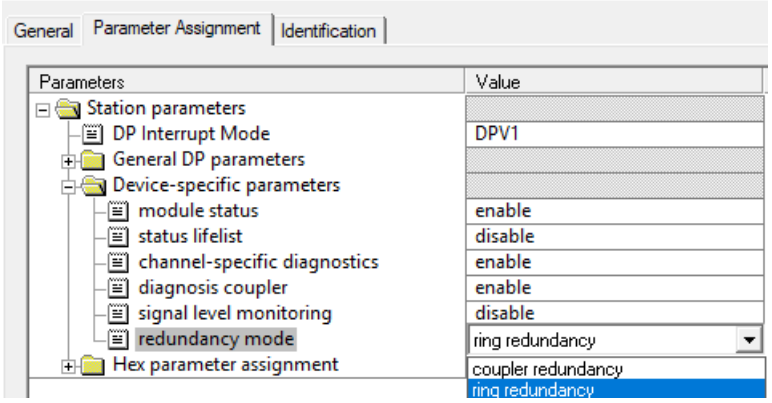


Figure 7-6 Ring redundancy

Note

Using the DP/PA coupler in redundancy mode (ring redundancy)

If you use ring redundancy, the following is required:

- Activate ring redundancy in the properties of each DP/PA coupler of the coupler pair.
- Check in Network settings / Profile of the properties of the PA master system, to see if Retry =3.
  or
- set a user-defined profile with a retry limit of 3.

Operating mode

Note

Only the following configuration ensures that the DP/PA coupler can bumplessly switch to the other side of the DP/PA link if there is a switchover at the higher-level DP master system.

If the DP/PA coupler FDC 157-0 is to operate as a DP slave with diagnostic function, the following settings are required in HW Config:

- In the object properties of the DP interfaces of the H-CPU, select the **DP master** mode and DP mode **DPV1**.
- In the object properties of the DP/PA coupler, select DP interrupt mode **DPV1** in the station parameters.

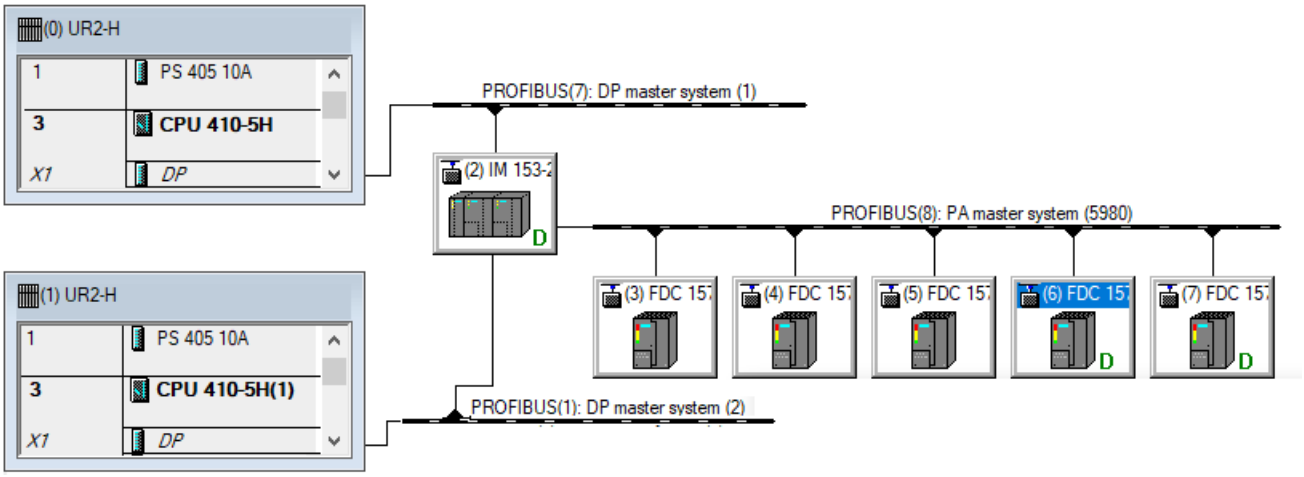


Figure 7-7 HW Config: Configuration of an S7-400H with DP/PA link and DP/PA couplers FDC 157-0

7.3.1.3 Configuring the PROFIBUS PA master system

Introduction

The field devices can be integrated in *SIMATIC PDM* or in *HW Config (STEP 7 and PCS 7)*.

PROFIBUS addresses in the PA master system

- In S7 standard mode, the PROFIBUS DP interface module uses address 2.
- In redundancy mode, the two PROFIBUS DP interface modules use addresses 1 and 2. Address 125 is blocked for PA field devices in addition.

The first possible address for a PA field device is 3 in both cases.

Requirements for configuring the PA field devices

- **Configuring with SIMATIC PDM**
  Configuring of the field devices is only possible if suitable device descriptions are integrated in SIMATIC PDM for the field devices. The Device Integration Manager is the SIMATIC PDM function for integrating device descriptions.
- **Configuring with HW Config**
  Import the GSD files of the PA field devices into HW Config using the menu command **Options > Install new GSD**.

Configuring

- **Configuring with SIMATIC PDM**
- **Configuring with HW Config**
  Drag the desired PA field devices from the hardware catalog to the PA master system that is shown after the PROFIBUS DP interface module.

Result

During configuration of the PA field devices, HW Config checks that the configuration limits are adhered to and, if exceeded, displays a corresponding error message.

Assignment of the PA field devices

If you use several DP/PA couplers in one link, topological assignment of the PA field devices in HW Config is not possible. However, you can review the assignment online via the local lifelist.

Processing of PA field devices in the user program

The process data of the PA field devices should only be accessed in the user program via the process images.

7.4 Commissioning the Y-link

In this section, you will learn about the steps required for commissioning the Y-link. These steps are explained in detail in the individual subsections.

Requirements

Before you commission the Y-link, the following requirements must be fulfilled:

- You have fully installed and wired the Y-link.
- You have fully installed the H-system and the redundant DP master system. PROFIBUS DP is ready for operation.
- You have fully installed the lower-level DP master system and connected it to the Y-coupler. PROFIBUS DP is ready for operation.

Commissioning a Y-link (principle)

1. Configure the Y-link.
2. Configure the lower-level DP slaves.
3. Switch on the voltage supply for the Y-link.
4. Set the PROFIBUS address of the PROFIBUS DP interface module.
   You can find information on this in the section "Setting addresses and redundancy mode (Page 91)".
5. Download the configuration to the PLC.

Configuring the Y-link

- For the redundancy mode, the Y-link is configured with *STEP 7*.
  You can find information on this in the section "Configuring the Y-link (Page 145)".
- For DP standard master mode, the Y-link is configured with a suitable program via a GSD file.
  You can find information on this in the section "Y-link for DP standard master mode (Page 308)".

In the Y-link, the Y-coupler communicates with the PROFIBUS DP interface module via the S7 backplane bus.

- The PROFIBUS DP connections of the Y-coupler are not connected to the PROFIBUS DP.
- Configuration of the Y-coupler is not required.

7.4.1 Configuring the Y-link

Overview of Contents

The Y link is configure using *STEP 7* for the redundancy mode.

7.4.1.1 How to configure Y link

Configuring Y-link

The Y-link is configure in *STEP 7*.

1. Start *STEP 7* and open your SIMATIC H-station in HW Config.
2. Select the PROFIBUS DP master system in which you want to insert the Y-link.
3. Select "Insert Object" in the shortcut menu.
   A selection menu opens.
4. Select the PROFIBUS DP interface module for the redundant DP master system (for redundancy mode):
   - IM 153-2OD (6ES7153-2BA70-0XB0)
     or
   - if the extended fieldbus diagnostics, EFD, is to be used: "IM 153-2 HF OD EFD (6ES7153-2BA70-0XB0)"

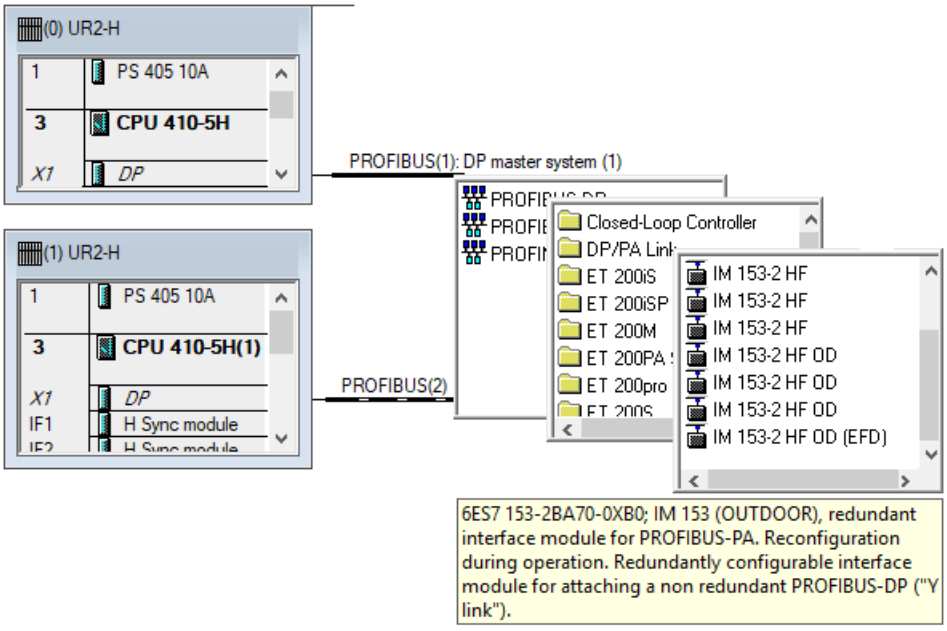


Figure 7-8 Creating a HW Config Y-link

5. Select PROFIBUS DP and confirm with OK.

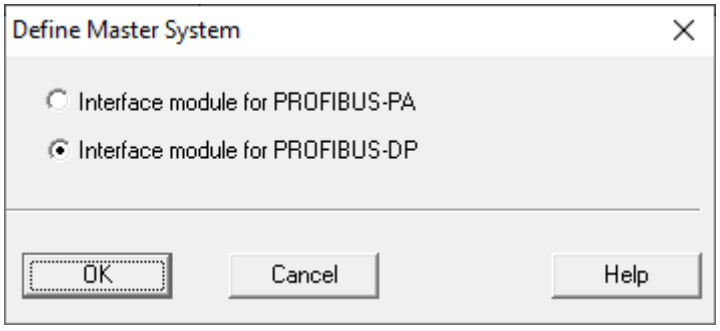


Figure 7-9 Dialog for selecting the lower-level master system (PROFIBUS DP)

Result: The Y-link is inserted into the redundant DP system. The transmission rate of the lower-level DP master system is preset to 1.5 Mbps.

6. If you want to change the transmission rate of the lower-level DP master system, double-click on it.
Result: The dialog with the properties for the lower-level master system is displayed.
   - Select the "Properties..." button.
Result: The "Properties PROFIBUS" dialog is displayed.
   - Select a transmission rate from 45.45 Kbps to 12 Mbps on the "Network settings" tab and confirm with OK.

Changeover time

WARNING

Injury to persons may result

When upgrading or migrating the configuration software, you must observe the following:
As of *STEP 7 V5.2*, the bus parameters have changed compared to previous versions.
When using the PROFIBUS DP interface module as redundant DP slave, longer changeover times may occur in the H-system.

Example configuration of a Y-link

Configuration on a SIMATIC H station with redundant PROFIBUS DP master system:
The redundant PROFIBUS DP interface module automatically connects to both PROFIBUS DP master systems of the SIMATIC H station only if the redundant PROFIBUS DP interface module is selected in step 2.

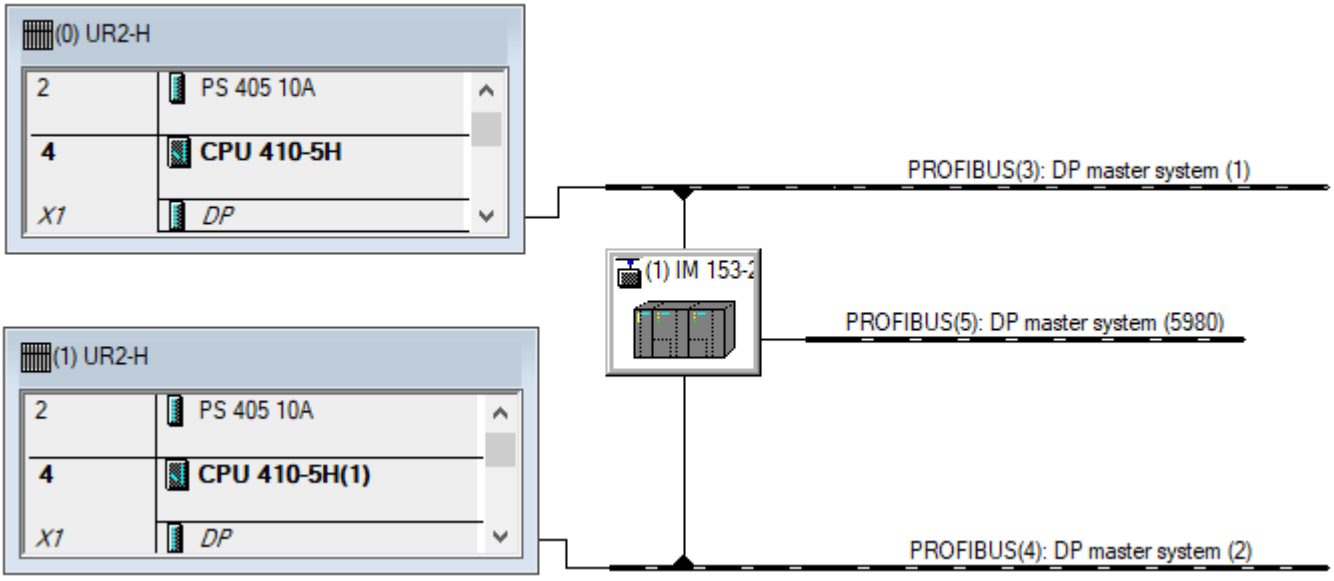


Figure 7-10 HW Config: Minimum configuration of an S7-400H with Y-link

7.4.1.2 Configuring underlying DP slaves

Configuring lower-level DP slaves

The lower-level DP slaves are configured in *STEP 7*.

1. If you have not done so, start *STEP 7* and open your SIMATIC H-station in HW Config.
2. If the required DP slaves cannot be configured directly, import the relevant GSD files using the **Options > Install new GSD** menu command.
   Result: The DP slaves are displayed in the hardware catalog in the directory **PROFIBUS DP > Other field devices**.
3. Drag the required DP slaves from the subdirectories of **PROFIBUS DP** of the hardware catalog to the lower-level DP master system.
4. Configure the DP slaves using *STEP 7*.

Result

During configuration of the lower-level DP slaves, HW Config checks that the configuration limits are adhered to and, if exceeded, displays a corresponding error message.

PROFIBUS address of the PROFIBUS DP interface modules in the lower-level DP master system

In the lower-level DP master system, the two PROFIBUS DP interface modules use addresses 1 and 2. Additionally, address 125 is locked for DP slaves. The first possible address for a lower-level DP slave is 3.

Processing of the DP slaves in the user program

The process data of the DP slaves should only be accessed in the user program via the process images.

7.5 AFDiSD: Activating extended fieldbus diagnostics

If you position the switch marked in the following figure to "D", you can activate extended fieldbus diagnostics of the SIMATIC AFDiSD using the integrated Commissioning Wizard. 50 SIMATIC PDM TAGs are booked per segment for this.

In switch position "C", the SIMATIC AFDiSD behaves fully compatible to the SIMATIC AFDiS as a replacement part.

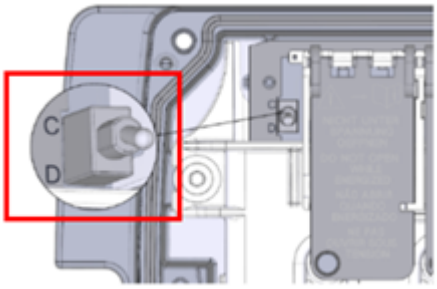


Figure 7-11 Activating extended fieldbus diagnostics

Operation of the bus link (DP/PA link or Y-link) 8

Terms

The following explanations apply in part to both the DP/PA link with its PA field devices and the Y-link with its lower-level DP slaves. In such instances, the following terminology will be used for the sake of clarity:

- "Bus link" stands for DP/PA link and Y-link.
- "Slaves" stands for PA field devices and lower-level DP slaves.
- "Lower-level master system" stands for PA master system and lower-level DP master system.

8.1 Start-up delay

Definition

During startup, the bus link incorporates the slaves of the lower-level master system into the data cycle. The slave parameters are assigned, the slaves are configured and the inputs of the slaves are read.

To ensure a reproducible startup and to prevent unintentional switching of outputs, the bus link outputs CLEAR frames on the lower-level master system during this phase, i.e. the outputs of the slaves are put into a safe state.

Configured startup behavior

The startup behavior depends on the configured startup behavior with regard to the system installation.

Table 8-1 Configured startup behavior

Configured startup behavior	Output data is output by the link if ...
Startup: When preset configuration ≠ actual configuration	• All slaves are configured and slave parameters are assigned, or • The startup delay has elapsed and fewer slaves have been configured or slave parameters have been assigned than configured.
Startup: When preset configuration = actual configuration	• All of the slaves are configured and all slave parameters are assigned. Note: If not all slaves are configured or not all slave parameters are assigned within the startup delay time, the bus link repeats the startup automatically.

The status of the startup delay can be evaluated in the "Status Message" diagnostic block of the diagnostics frame.

8.2 Behavior after certain events in the redundancy mode

Behavior of the PROFIBUS DP interface module

The following table shows the behavior of the PROFIBUS DP interface module after certain events in redundancy mode.

Table 8-2 Behavior after certain events in the redundancy mode

Event	Response
Master-reserve changeover with a modified configuration	The bus link is changed over bumplessly from the active channel to the previously passive channel.
Failure of a CPU	If this causes the active channel of the redundant DP master system to also fail: see failure of the active channel. Otherwise: see failure of the passive channel.
Failure of the active channel.	The bus link is changed over bumplessly from the active channel to the previously passive channel. The failed channel is indicated on the associated PROFIBUS DP interface module by the "BF 1" LED.
Failure of the passive channel	No effect on the bus link. The failed channel is indicated on the associated PROFIBUS DP interface module by the "BF 1" LED.
Failure of a PROFIBUS DP interface module	A diagnostic message is generated in the system. If the active PROFIBUS DP interface module fails, there is bumpless changeover to the previously passive channel.

8.3 Startup characteristics

Requirement for the startup of the PROFIBUS DP interface module

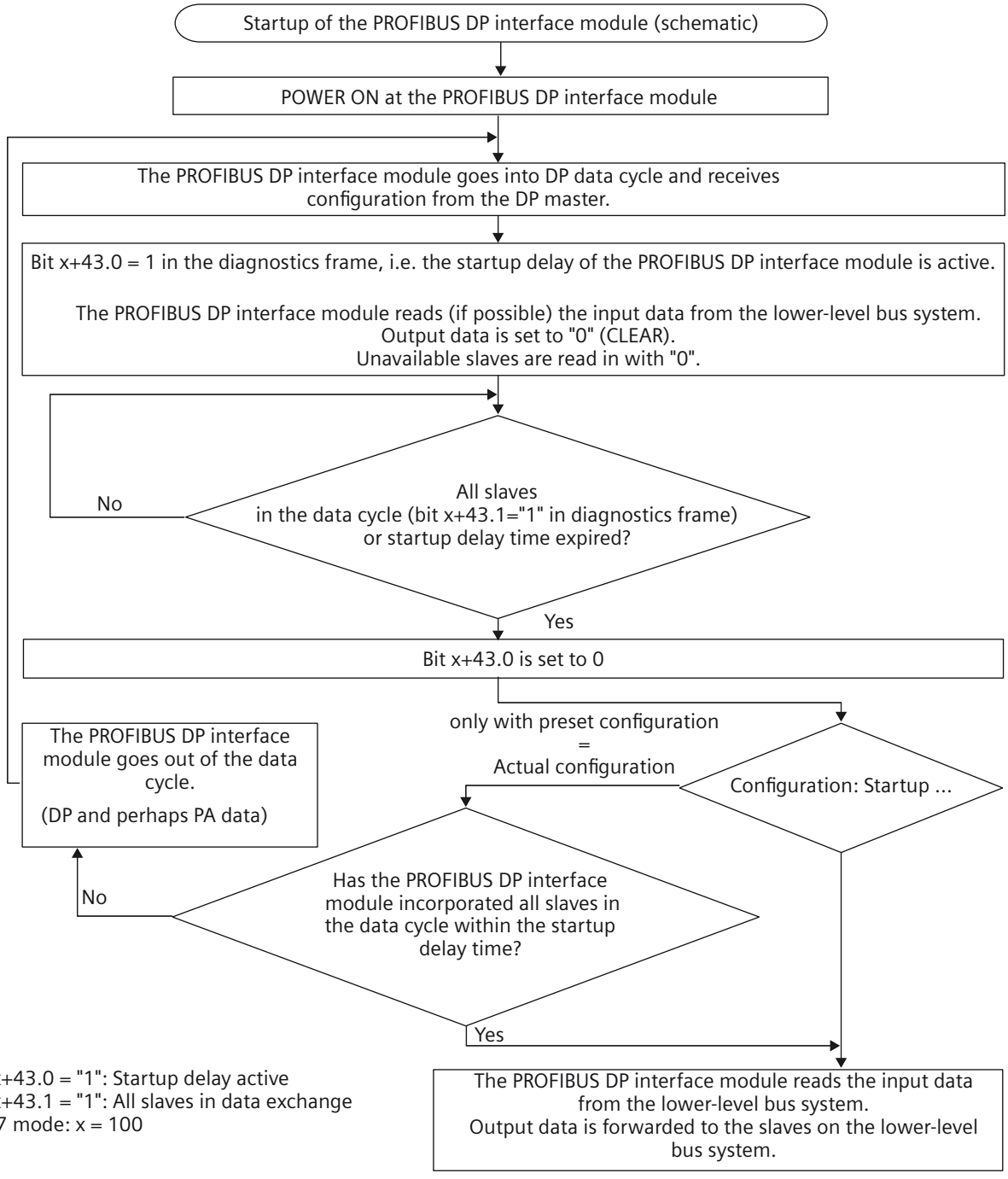
- A valid PROFIBUS address is set at the PROFIBUS DP interface module.
- The DP master on the higher level PROFIBUS DP is in operation.
- The bus link is configured correctly.

The further startup behavior of the bus link depends on whether the PROFIBUS DP interface module is operating in non-redundant mode or in redundancy mode.

8.3.1 Startup characteristics of the DP/PA link in non-redundant mode

Startup behavior

The flow chart below shows the startup behavior of the PROFIBUS DP interface module after POWER ON.



Bit x+43.0 = "1": Startup delay active
Bit x+43.1 = "1": All slaves in data exchange
In S7 mode: x = 100

Figure 8-1 Startup behavior of the PROFIBUS DP interface module after POWER ON

8.3.2 Startup characteristics in redundancy mode

Startup diagram of the PROFIBUS DP interface module on S7 400H

During startup, the two PROFIBUS DP interface modules are addressed independent of one other:

- Each DP master configures its PROFIBUS DP interface module and assigns the module parameters (independent of the other DP master) and sends the corresponding configuration.
- When there is no fault present, the PROFIBUS DP interface module that is connected to the subsystem of the master CPU is activated.
- As soon as the other DP master has also configured its PROFIBUS DP interface module and assigned the module parameters without errors and has completely sent the configuration, the PROFIBUS DP interface module is available as a reserve.
  The PROFIBUS DP interface module on the subsystem of the reserve CPU is passive. If the active PROFIBUS DP interface module fails, it is able to continue processing the slaves.

The following figure shows a simplified representation of the independent behavior of the two PROFIBUS DP interface modules.

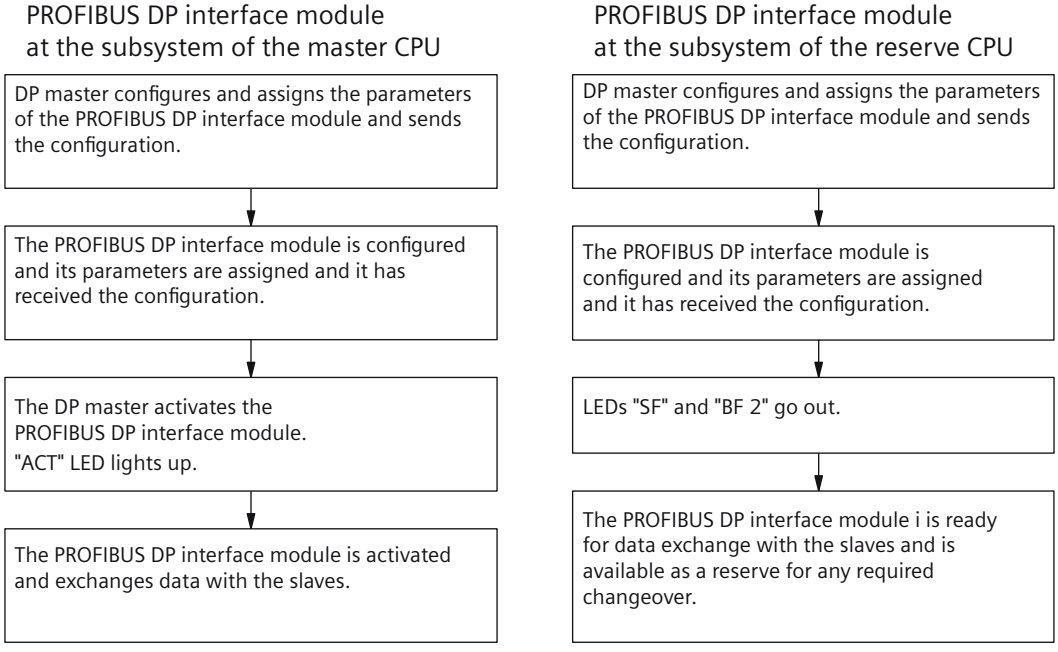


Figure 8-2 Startup behavior of the two PROFIBUS DP interface modules in redundancy mode

Startup of the PROFIBUS DP interface modules with flying redundancy

For flying redundancy, configuration and parameter assignment is carried out for only one PROFIBUS DP interface module. Configuration and parameter assignment of the second PROFIBUS DP interface module is not carried out, but itis nevertheless ready for a changeover.

Maintenance and service

9

9.1 Exchange PROFIBUS DP interface module of a DP/PA link or Y-link

Replacing the PROFIBUS DP interface module

Carry out the following steps to replace a PROFIBUS DP interface module:

1. Disconnect the power supply of the PROFIBUS DP interface module.
2. Disconnect the bus connector from the PROFIBUS DP interface of the PROFIBUS DP interface module.
3. Replace the PROFIBUS DP interface module.
4. Plug the bus connector plug onto the PROFIBUS DP interface of the new PROFIBUS DP interface module.
5. Connect the power supply of the new PROFIBUS DP interface module.

In case of redundancy

Note

If you replace the active PROFIBUS DP interface module ("ACT" LED on), the bus link only continues to run undisturbed in the following cases:

- The BF LED on the passive PROFIBUS DP interface module is not on or flashing and the SF LED is not flashing at a flash rate of 0.5 Hz.
- In a flying redundancy system it is apparent from the master diagnostics that both IMs are accessible. In this case, the BF LED can flash.

Have you replaced an active PROFIBUS DP interface module ("ACT" LED on)?	**Have you replaced a passive PROFIBUS DP interface module ("ACT" LED off)?**
Then a changeover was made in the link to the other PROFIBUS DP interface module and this also maintains the data traffic to its DP master.	No change in data traffic: The active PROFIBUS DP interface module has maintained the data traffic to its DP master.
Does the new PROFIBUS DP interface module have a different product version than the other one that was not replaced?	
If, after replacement, the PROFIBUS DP interface module just replaced goes to "STOP" (all LEDs are flashing), the release versions are not compatible. In this case you must switch off the link and upgrade both PROFIBUS DP interface modules or use a compatible release. Please contact your Siemens representative.	

9.2 Replacing DP/PA couplers

Requirement

If you replace a DP/PA coupler FDC 157-0, its ACT LED must not light up. Multiple PA field devices can fail otherwise.

Replacing a DP/PA coupler

To replace a defective DP/PA coupler, take the following steps:

1. Disconnect the power supply of the defective module.
2. Disconnect the PROFIBUS PA connection of the defective module.
3. Unplug the bus connector from the PROFIBUS DP interface of the defective module.
4. Replace the defective module.
5. If you use the diagnostic function of the DP/PA coupler FDC 157-0:
   Set the PROFIBUS address via the DIP switches.
6. If you use the redundancy mode of the DP/PA coupler FDC 157-0:
   Set the redundancy via the DIP switch.
7. Connect PROFIBUS PA to the new DP/PA coupler.
8. Plug the bus connector into the PROFIBUS DP interface of the new module.
9. Connect the power supply of the new module.

Converting the DP/PA coupler installation to ring redundancy

To use the ring redundancy, you can extend an existing DP/PA coupler installation, provided that you ensure the following:

- There is a maximum of 4 DP/PA couplers in the existing DP/PA coupler installation.
- If there are additional DP/PA couplers in the installation besides the DP/PA coupler pair:
  The redundant DP/PA coupler pair is mounted to the right of the remaining DP/PA couplers (max. 3).
- You use the bus module BM FDC/FDC or 2x BM FDC for the redundant DP/PA coupler pair.

9.3 Firmware update

9.3.1 When should you perform a firmware update for the PROFIBUS DP interface module?

After (compatible) function extensions or after performance improvements, you should upgrade (update) the PROFIBUS DP interface module to the latest firmware version.

9.3.2 Firmware update of the PROFIBUS DP interface module

Where can you obtain the most recent firmware version?

The latest firmware versions are available from your Siemens representative or on the Internet for the following interface modules:

Operating system updates for IM 153-2OD (http://support.automation.siemens.com/WW/view/en/29230295)

Note

Firmware update of the DP/PA link with enabled extended fieldbus diagnostics (EFD)

When using the interface module (6ES7153-2BA70-0XB0) in a DP/PA link with enabled extended fieldbus diagnostics (EFD), there may be some extremely rare circumstances under which communication to the PROFIBUS PA field instrumentation may fail.

We therefore recommended that you update a firmware V6.1.7 or older to the latest version in Stop mode; otherwise, process data on the lower-level field devices may be lost during the update.

Run a risk analysis for affected plants and a necessary firmware update of a firmware V6.1.7 or older to the latest version during operation. Please contact our technical support if you have any further questions.

Tip:

- Make a note of your current firmware version before you start the update.
- If you encounter problems with the new firmware, you can also download the previous (current) firmware from the Internet and transfer it to the interface module again.

Principle

There are two ways to update the module:

- directly via PROFIBUS DP
- from the PG / PC via PROFIBUS DP and CPU

After a successful update, the previous firmware version of the PROFIBUS DP interface module must be covered by a sticker with the updated firmware version.

With the PROFIBUS DP interface module, it is possible to update the firmware of both PROFIBUS DP interface modules during redundancy mode. Updating takes place with the support of *STEP 7* and has no retroactive effect on the current application. The firmware in a redundant system is (directly) updated by the PG / PC via PROFIBUS DP.

Requirements for updating via PROFIBUS DP

- The PROFIBUS DP interface module of the station to be updated can be accessed online.
- The files with the current (new) firmware version must be available in the file system of your PG / PC.

To **update a redundant system** there are two additional requirements:

- Both PROFIBUS DP interface modules are of the same type and are configured as such.
- The BUS link with redundant PROFIBUS DP interface module is operated on
  - S7-400H
  - Any redundant DP masters with GSD rev. 5 or higher

Example installation

Update directly via PROFIBUS DP

The PG / PC with the update files is connected directly to the PROFIBUS interface of the PROFIBUS DP interface module (see figure below).

In SIMATIC Manager, select the menu command **PLC > Accessible devices**. Select the desired PROFIBUS DP interface module in the displayed list and select the menu command **PLC > PROFIBUS > Update Firmware**. The remaining procedure is described in the *STEP 7* online help.



Figure 9-1 Update directly via PROFIBUS DP (PG / PC is directly connected to the PROFIBUS DP interface module)

Restart after update

In the*STEP 7* user interface it is possible to set whether

- The PROFIBUS DP interface module automatically performs a reset after a successful update in order to start up with the newly loaded firmware.

  CAUTION

  STOP of CPU possible

  If the "Activate firmware after download" check box is selected, there will be a brief link failure. If you have not made any provisions for this situation, the update will cause a CPU STOP as a result of rack failure.

- The PROFIBUS DP interface module must be reset by switching off the supply voltage before the PROFIBUS DP interface module starts up with the new firmware after the power is switched on again.

If the update was completed successfully, the startup of the PROFIBUS DP interface module takes **approx. 60 seconds** longer during the first, subsequent reset or switch-off / switch-on of the supply voltage than during the normal startup.
All additional startups take the usual time.

Update not successful

If the update fails, the PROFIBUS DP interface module always starts up with the current ("old") firmware after switch-off / switch-off of the supply voltage.

See also

Update IM153-2 (http://support.automation.siemens.com/WW/view/en/15350678)

9.4 Maintenance

Maintenance

The transmission behavior of the couplers (DP/PA couplers and Y-couplers), the active field distributors and the PROFIBUS DP interface module is stable over long periods of time, regular maintenance is not required.

9.5 Special considerations in hazardous areas

9.5.1 Maintaining and cleaning the AFDiSD

Permitted activities in hazardous areas

The following table describes the maintenance activities that are permitted on the AFDiSD during operation.

⚠ WARNING

Hazardous areas

- Zone 1 and Zone 2:
  You may briefly open the enclosure of the AFDiSD for the permitted maintenance work.
- Zone 21 and Zone 22:
  You must **not** open the enclosure of the AFDiSD in areas with dust.

Table 9-1 Permitted activities in hazardous areas

Activities	Zone 1, Zone 2	Zone 21, Zone 22
Maintenance during operation (visual inspections)	Permitted	**Warning:** In areas with dust, the enclosure of the AFDiSD must **not** be opened for this activity.
Cleaning	Permitted	Not permitted

Maintenance during operation

Take into account local and international standards in the maintenance intervals.

Maintenance of the AFDiSD is essentially limited to **visual inspections**. The AFDiSD may be in operation during these inspections.

Zone 1, Zone 2	Zone 21, Zone 22
Check that the cable entries and ground terminal of the enclosure are sealed and intact.	Check that the cable entries and ground terminal of the enclosure are sealed and intact. **Warning:** The enclosure of the AFDiSD must not be opened.
Check whether there is any water or dust inside the enclosure. Check the cause.	--
Check that the wiring is secure (terminals, cables). Observe the safety information in section Safety instructions for connecting the AFDiSD (Page 71).	–

Cleaning

⚠ WARNING

Hazardous areas - Zones 21 and 22

The dust layer on the enclosure of the AFDiSD must not exceed a thickness of 5 mm.

Remove the dust layer on and at the enclosure at regular intervals!
Ensure there is no risk of explosion during cleaning!
To do this, disconnect the unit from the voltage.

Note

Perform a functional check of the AFDiSD after cleaning.

See also

AFDiSD: Connecting PROFIBUS PA (Page 122)

9.5.2 Maintaining and cleaning AFD4 / AFD4 (FM) / AFD8

Permitted activities in hazardous areas

The following table describes the maintenance activities that are permitted on the AFD4 / AFD4 (FM) / AFD8 during operation.

⚠ DANGER

Explosion hazard

- Zone 1 and Zone 2:
  You may **briefly** open the enclosure of the AFD4 / AFD4 (FM) / AFD8 for the permitted maintenance work.
- Zone 22:
  You **must not** open the enclosure of the AFD4 / AFD4 (FM) / AFD8 in areas with dust.

Table 9-2 Permitted activities in hazardous areas

Activities	Zone 1, Zone 2	Zone 22
Maintenance during operation (visual inspections)	Permitted	**Warning:** In areas with dust, the enclosure of the AFD4 / AFD4 (FM) / AFD8 must **not** be opened for this activity.
Cleaning	Permitted	Not permitted

Maintenance during operation

Take into account local and international standards in the maintenance intervals.

Maintenance of the AFD4 / AFD4 (FM) / AFD8 is essentially limited to **visual inspections**. The AFD4 / AFD4 (FM) / AFD8 may be in operation during these inspections.

Zone 1, Zone 2	Zone 22
Check that the cable entries and the ground terminal of the enclosure are sealed and intact.	Check that the cable entries and the ground terminal of the enclosure are sealed and intact. **Warning:** The enclosure of the AFD4 / AFD4 (FM) / AFD8 must not be opened.
Check whether there is any water or dust inside the enclosure. Check the cause.	–
Check that the wiring is secure (terminals, cables). Read the safety information in the section Safety information for connecting (Page 75).	–

Cleaning

⚠ WARNING

Hazardous areas - Zone 22

The dust layer on the enclosure of the AFD4 / AFD4 (FM) / AFD8 must not exceed a thickness of 5 mm.
Remove the dust layer on the enclosure at regular intervals!

Note

After cleaning, perform a function check of the AFD4 / AFD4 (FM) / AFD8 .

9.5.3 Replacing and expanding an AFDiSD

⚠ DANGER

Explosion hazard

In mixed operation, disconnect the DP/PA couplers from the power supply before replacing active AFDiSD field distributors.

⚠ DANGER

Explosion hazard

Observe the safety information in section "Safety instructions for connecting the AFDiSD (Page 71)".

Replacing / expanding an active AFDiSD field distributor

Perform the following steps to replace the active field distributor:

1. Loosen the 4 screws of the enclosure cover with a Phillips screwdriver.
2. Loosen the screw caps of the cable glands.
3. Disconnect the cables of all field devices at the terminals Sn.
4. Open the covers of the IP30 and disconnect the main lines at terminals T1 and T2.
5. Detach the grounding cable from the ground terminal of the field distributor.
6. Replace the module.
7. Attach the grounding cable to the ground terminal with a torque of 2.0 Nm.
8. Connect the field devices to the new field distributor.
9. Connect the main lines T1 and T2 and close the IP30 covers until they audibly snap into place.
10. Screw the screw caps of the cable glands on tightly with 1.3 Nm.
11. Place the enclosure cover on the base and tighten the 4 screws with the washers on the enclosure with a torque of 2.4 Nm.

Additional information

Section "AFDiSD: Connecting PROFIBUS PA (Page 122)"

9.5.4 Replacing / expanding AFD4 / AFD4 (FM) / AFD8

⚠ DANGER

Explosion hazard

In mixed operation, disconnect the DP/PA couplers from the power supply before replacing AFD4 / AFD4 (FM) / AFD8 active field distributors.

Note

Read the safety information in the section Safety information for connecting (Page 75).

Replacing / expanding the AFD4 / AFD4 (FM) / AFD8 active field distributor

Note

AFD4 (FM)

Where you want to connect devices, replace the blanking plugs inserted in the delivery condition with FM-approved glands.

Cable glands, metric, with sealing ring:

- M16 x 1.5: L = 8-10 mm
- M20 x 1.5: L = 8-10 mm

Observe the tightening torque specified by the manufacturer of the glands.

⚠ DANGER

Explosion hazard

In the Zone 2 hazardous area, it is prohibited to disconnect the main line from an AFD4 / AFD4 (FM) / AFD8 during operation if it is directly connected to a FDC 157 coupler.

Before you start the work, disconnect the FDC 157 coupler(s) from the voltage.

In the **Zone 2** hazardous area, you are permitted to disconnect a main line to an AFD4 / AFD4 (FM) / AFD8 during operation if it connects two AFD4 / AFD4 (FM) / AFD8.

Perform the following steps to replace an active field distributor:

1. Loosen the 4 screws of the enclosure cover with a Phillips screwdriver.
2. Loosen the screw caps of the cable glands.
3. Disconnect the cables of all field devices at the terminals Sn.
4. Open the covers of the IP30 and disconnect the main lines at terminals T1 and T2.
5. Detach the grounding cable from the ground terminal of the field distributor.
6. Replace the module.
7. Attach the grounding cable to the ground terminal with a torque of 2.0 Nm.
8. Connect the field devices to the new field distributor.
9. Connect the main lines T1 and T2 and close the IP30 covers until they audibly snap into place.
10. Screw the screw caps of the cable glands on tightly with 1.3 Nm.
11. Place the enclosure cover on the base and tighten the 4 screws with the washers on the enclosure with a torque of 2.4 Nm.

Additional information

Section "AFD4 / AFD4 (FM) / AFD8: Connecting PROFIBUS PA (Page 127)"

Functions

10

10.1 PROFIBUS DP interface module

10.1.1 Time synchronization on the underlying master system

Properties

PROFIBUS DP interface module IM 153-2OD (6ES7153-2BA70-0XB0) supports time-of-day synchronization on the lower-level master system.

- The PROFIBUS DP interface module sends the current time to the lower-level master system if
  - Time-of-day synchronization takes place on the higher level PROFIBUS DP,
  - There is a valid configuration for the lower-level master system in the PROFIBUS DP interface module and
  - The lower-level master system is operating.
- Synchronization on the lower-level master system takes place at the synchronization interval that is set on the higher level PROFIBUS DP.
- Compared to the time received on the higher level PROFIBUS DP, accuracy deteriorates slightly. Accuracy within 10 ms is always guaranteed.

Operating steps for activation

You activate the time-of-day synchronization on the lower-level master system by performing the following steps:

1. Complete the higher level PROFIBUS DP with a time-of-day master.
2. Activate the time-of-day synchronization in the Properties of the DP master.

Note

In the H-system, you must insert a time-of-day master in both higher level PROFIBUS DP systems and activate the time-of-day synchronization in the properties of the DP master.

Time-of-day synchronization then takes place in the lower-level master system.

Time-of-day format

The time-of-day is distributed to the lower-level system in the ISP format.

The complete ISP frame is transferred in exactly the same format as the PROFIBUS DP interface module receives it from the higher-level PROFIBUS DP.

The structure of the frame and the sequence are described in:
InterOperable Systems™ Project, Fieldbus Specification, System Management Services Rev. 3.0 dated 19.10.1993 (compiled by ISP Foundation)

10.1.2 Redundancy of the PROFIBUS DP interface module

Usage

You can operate the PROFIBUS DP interface module IM 153-2OD redundantly

- On SIMATIC S7-400H
- According to the standard
  Specification Slave Redundancy V1.2, Nov. 2004 of the PROFIBUS-Nutzerorganisation;
  Order No: 2.212
  - System Redundancy (SR)
  - Flying Redundancy (FR)

Requirements

- Installation on active bus modules (6ES7195-7HD10-0XA0; 6ES7195-7HD80-0XA0)
- 2 x PROFIBUS DP interface module on bus module BM IM/IM
  For the active bus modules and interface modules used, the arrangement rules on the Internet (http://support.automation.siemens.com/WW/view/en/23372259) apply.
- System redundancy (SR) is possible
- Flying Redundancy (FR) is possible
  - The redundant master system must be installed according to the requirements for H-systems.
  - For configuring Flying Redundancy, the current version of the Java GSD creation tool is required.

  Note

  STEP 7 provides no support for configuring an H-system with flying redundancy.

- The SYNC/FREEZE function must not be activated in redundant operation.

  Note

  If the SYNC / FREEZE is activated in a redundant system nevertheless, the user bears the responsibility for the behavior of the H-system (for example at changeovers).

- The PROFIBUS DP interface module can only be used in a redundant system on DP masters that support the "Fail-safe" parameter. On DP masters that do not support this parameter, the PROFIBUS DP interface module does not start up and the BF LED flashes.
  Tip: You can tell from the GSD file of the DP master whether it supports "Fail-safe".

S7-400H as DP Master

You require *STEP 7* V5.0 or higher and the *SIMATIC S7 H-Systems* software package to configure the S7-400H system. With *STEP 7* V5.3 and higher, you no longer need *SIMATIC S7 H-Systems* additionally.

DP master 1 and DP master 2:

- Execute the same user program.
- Have the same parameter assignment and configuration for the PROFIBUS DP interface module.

Availability in redundancy mode

NOTICE
Power supply of the PROFIBUS DP interface module Use a separate power supply for each PROFIBUS DP interface module. This increases the availability of the bus link.

See also

Compatibility with predecessor modules (Page 281)

10.1.3 Reading and writing data records

Procedure for reading and writing data records

Depending on the operating mode of the DP master (S7-compatible or DPV1), data records of the PROFIBUS DP interface module IM 153-2OD and the lower-level slaves can be read and written with different procedures.

- Reading data records with SFC 59 "RD_REC" or SFB 52 "RDREC"
- Writing data records with SFC 58 "WR_REC" or SFB 53 "WRREC"
- Reading and writing data records with a PG / PC via communication connections, for example with *SIMATIC PDM*

Table 10-1 Procedure for reading and writing data records

	S7-compatible DP master	**DPV1 master**
Data records of the PROFIBUS DP interface module	• SFC 59 "RD_REC" • Reading with PG / PC	• SFC 59 "RD_REC", SFB 52 "RDREC" • SFC 58 "WR_REC", SFB 53 "WRREC" • Writing / reading with PG / PC
Data records of lower-level slaves	• SFC 58 "WR_REC" • SFC 59 "RD_REC" • Writing / reading with PG / PC	• SFC 59 "RD_REC", SFB 52 "RDREC" • SFC 58 "WR_REC", SFB 53 "WRREC" • Writing / reading with PG / PC

Data records of the PROFIBUS DP interface module

Depending on the operating mode of the DP master (S7-compatible or DPV1), the PROFIBUS DP interface module supports reading and writing of the following data records:

Table 10-2 Procedure for reading and writing data records

Data records of the PROFIBUS DP interface module	**S7-compatible DP master**	**DPV1 master**
Data records 0 and 1 (diagnostic data, read only)	YES	YES
Data records 255 ... (I&M data)	No	YES

Parameters for SFC 58 "WR_REC" and SFC 59 "RD_REC"

You can find the values required for the call parameters LADDR and REC_NUM and possible error information in the return value RET_VAL in the table below.

Table 10-3 Call parameters for SFC 58 "WR_REC" and SFC 59 "RD_REC"

	LADDR	**REC_NUM**	**Access**
Diagnostic data of the PROFIBUS DP interface module	Diagnostic address of the PROFIBUS DP interface module	0 or 1	Read only
I&M data of the PROFIBUS DP interface module	Diagnostic address of the PROFIBUS DP interface module	255 ...	Read / write
Buffered diagnostic data of a lower-level slave (from the PROFIBUS DP interface module) [1]	Diagnostic address of the PROFIBUS DP interface module	PROFIBUS address of the lower-level slave	Read only
Random data record of a lower-level DPV1 slave	Logical address of the lower-level slave or the lower-level module [3]	Data record number[2]	Read / write [2]

[1] Only on the DPV1 master and only for configured slaves

[2] Depending on the type of the lower-level slave or lower-level module

[3] Data record of slot 0 ⇒ Specify diagnostic address
Data record of slot 1 ⇒ Specify address of slot 1
Data record of slot 2 ⇒ Specify address of slot 2
and so on.

Error information of the PROFIBUS DP interface module

Table 10-4 Error information of the PROFIBUS DP interface module

RET_VAL (W#16#...)	Description
0000	No error
80B6	The slave or module refuses to read / write a data record or does not recognize this data record. ⇒ Set mode of the DP master to DPV1
80BB	Requested service is not supported
80BC	Node not available
80BD	Data record number incorrect

The other functions of the SFC 58 "WR_REC", SFC 59 "RD_REC", SFB 52 "RDREC" and SFB 53 "WRREC" are described in the *STEP 7* online help.

10.1.4 Identification and maintenance data (I&M data)

Definition and properties

Identification and maintenance data (I&M) is information stored in a module that supports you in

- Checking the system configuration
- Locating hardware modifications in a system
- Troubleshooting in a system

Identification data (I-data) is information on the module, such as order number and serial number, some of which are printed on the module enclosure. I-data is manufacturer information about the module and is read-only.

Maintenance data (M-data) is system-dependent information, such as the installation location and installation date. M-data is created during configuration and written to the module.

Modules can be uniquely identified online with the I&M data.
This data is available on the DP/PA link and Y-link.

Note

Only one DP master may access the I&M data of a DP/PA link or Y-link at any given time.

Reading and writing the I&M data with *STEP 7*

In *STEP 7*, the I&M data is displayed on the "Module information – IM 153-2OD" and "DP slave properties" tabs (see online help for *STEP 7*).

The M-data of modules can be entered in HW Config (for example in a dialog box during configuration).

The I&M data is accessed in accordance with the IEC 61158-6 standard.

In the H-system the interface module from which the I&M data is to be read must be accessible online.

Reading and writing the I&M data without *STEP 7*

If you want to make use of I&M data without using *STEP 7*, you must access the data as specified in the PROFIBUS Guideline – Order No. 3.502, Version 1.1 of May 2003.

In the H-system, you must address the interface module (slot 245 or 246) from which the I&M data is to be read. Slot 245 designates the left-hand interface module, slot 246 the right-hand interface module on the BM IM/IM.

Example for reading the I&M data

The user can selectively access certain I&M data via **Read data record**. This requires a two-stage access:

1. A directory is stored in data record 248 containing the data record numbers belonging to the various
   indices (see table below).

Table 10-5 Configuration of DS 248 for DP/PA link or Y-link

Content	Length (bytes)	Coding (hex)
Header information		
ID of content directory	2	00 01
Index of content directory	2	00 00
Length of subsequent blocks in bytes	2	00 08
Number of blocks	2	00 05
Block information for I&M data		
SZL-ID	2	F1 11
Relevant data record number	2	00 EA
Length of data record	2	00 40
Index	2	00 01
SZL-ID	2	F1 11
Relevant data record number	2	00 EB
Length of data record	2	00 40
Index	2	00 02
SZL-ID	2	F1 11
Relevant data record number	2	00 EC
Length of data record	2	00 40
Index	2	00 03
SZL-ID	2	F1 11
Relevant data record number	2	00 ED
Length of data record	2	00 40
Index	2	00 04

Content	Length (bytes)	Coding (hex)
8 bytes of block information for additional data record objects		
	Σ: 48	

2. The section
of the I&M data that is assigned to the respective index is to be found under the associated data record number (see table below: *Structure of the I&M data*).

All data records with I&M data have a length of 64 bytes.

The data records are structured according to the principle shown in the following table.

Table 10-6 Basic structure of data records with I&M data

Content	Length (bytes)	Coding (hex)
Header information		
SZL-ID	2	F1 11
Index	2	00 0x
Length of the I&M data	2	00 38
Number of blocks with I&M data	2	00 01
I&M data		
Index	2	00 0x
I&M data for the respective index (see table below)	54	

Structure of the I&M data

The data structures of the I&M data correspond to the specifications of the PROFIBUS Guideline – Order No. 3.502, Version 1.1 of May 2003.

Table 10-7 Structure of the I&M data

I&M data	Access	Default setting	Explanation
Identification data 0: Index 1 (data record 234)			
MANUFACTURER_ID	Read (2 bytes)	2A hex (= 42 dec)	The name of the manufacturer is stored here. (42 dec = SIEMENS AG)
ORDER_ID	Read (20 bytes)	Depending on the module	The order number of the module is stored here.
SERIAL_NUMBER	Read (16 bytes)	Depending on the module	The serial number of the module is stored here. This facilitates unique identification of the module.
HARDWARE_REVISION	Read (2 bytes)	Depending on the module	The revision level of the module is stored here. Is increased when the revision level or firmware of the module changes.
SOFTWARE_REVISION	Read (4 bytes)	Firmware version	Gives information on the firmware version of the module If the firmware version number is increased, then the revision level of the module (HARDWARE_REVISION) is also increased.
REVISION_COUNTER	Read (2 bytes)	0000 hex	Reserved
PROFILE_ID	Read (2 bytes)	F600 hex	Generic Device
PROFILE_SPECIFIC_TYPE	Read (2 bytes)	0005 hex	On interface modules

I&M data	Access	Default setting	Explanation
IM_VERSION	Read (2 bytes)	0101 hex	Gives information on the version of the I&M data. (0101 hex = Version 1.1)
IM_SUPPORTED	Read (2 bytes)	000E hex	Gives information on the existing I&M data. (Index 2 bis 4)
Maintenance data 1: Index 2 (data record 235)			
TAG_FUNCTION	Read / write (32 bytes)	–	Enter a system-wide unique identification for the module here.
TAG_LOCATION	read / write (22 bytes)	–	Enter the installation location of the module here.
Maintenance data 2: Index 3 (data record 236)			
INSTALLATION_DATE	Read / write (16 bytes)	–	Enter the installation date and, if necessary, the associated time for the module here.
RESERVED	Read / write (38 bytes)	–	Reserved
Maintenance data 3: Index 4 (data record 237)			
DESCRIPTOR	Read / write (54 bytes)	–	Enter a comment on the module here.

Changes compared to the previous I&A data

The previous I&A data were extended to include some content in the identification data in accordance with the PROFIBUS Guideline. The mechanism for accessing I&M data was supplemented in accordance with the PROFIBUS Guideline.

See also

Reading and writing the identification and maintenance data (I&M data) (Page 178)

10.1.5 System modification during operation.

10.1.5.1 System modification in S7 standard mode

Procedure

Perform the following steps to add a complete new DP/PA link including the lower-level PA master system to an existing system while it is operating.

1. Mount the new DP/PA link.
2. Connect the power supply of all modules.
3. Connect PROFIBUS PA to the new DP/PA couplers.
4. Plug the bus connector of the DP master system into the PROFIBUS DP interface module of the new PROFIBUS DP interface module.

The entire sequence of a system modification and the requirements that must be met for it are described in detail in the function manual *Modifying the system during operation via CiR*.

You can find the manual on the Internet at this address (http://support.automation.siemens.com)

Search for Entry ID 14044916.

10.1.5.2 System modification in redundancy mode

Procedure

Perform the following steps to add a complete new DP/PA link or Y-link including the lower-level master system to an existing system while it is operating.

1. Mount the new link.
2. Connect the power supply of all modules.
3. **DP/PA link only**
   Connect PROFIBUS PA to the new DP/PA couplers.
   Y-link only
   Plug the bus connector of the DP master system onto the PROFIBUS DP interface of the new Y-coupler.
4. Plug the bus connector plug of the active channel of the redundant DP master system into the PROFIBUS DP interface of one of the two PROFIBUS DP interface modules.
5. Plug the bus connector plug of the passive channel into the PROFIBUS DP interface module of the other PROFIBUS DP interface module.

This process is summarized in the "Modification of hardware" step in section *System modifications during operation* of manual *S7-400H, Fault-tolerant Systems*. It gives a detailed description of the entire sequence of a system modification.

You can find the manual on the Internet at this address (http://support.automation.siemens.com)

Search for Entry ID 1186523.

10.2 DP/PA coupler FDC 157-0

10.2.1 Reading and writing the identification and maintenance data (I&M data)

Procedure for reading I&M data

You can read and write the identification data in one of the following ways:

- With STEP 7
- Via user interfaces
- Via communication connections
- With the upload / download mechanism

Reading and writing the I&M data with STEP 7

HW Config shows the I&M data in the "Module information - DP/PA coupler" and "DP slave properties" tabs.

The I&M data is accessed in accordance with the IEC 61158-6 standard.

Reading and writing the I&M data with STEP 7

Writing I&M data with a PG / PC via communication connections, for example with *SIMATIC PDM*

Write the parameters and I&M data using the following menu commands:

- **File > Full upload to PG / PC**
- **Device > Full download to device**.

Reading and writing the I&M data via user interfaces

To do this, load the data records 231 to 234 of the DP/PA coupler. Data record 231 is read-only.

- Read data records with SFC 59 "RD_REC" or SFB 52 "RDREC".
- Write data records with SFC 58 "WR_REC" or SFB 53 "WRREC".

Reading and writing the I&M data with the upload / download mechanism

Use the data record 255 of the DP/PA coupler for this.

The I&M data is accessed in accordance with the standard *PROFIBUS Guideline, Profile Guidelines Part 1: Identification & Maintenance Functions*, March 2005.

Additional information

Documentation Help on SIMATIC PDM (https://support.industry.siemens.com/cs/fr/en/view/109754984)

10.2.2 Reading the local LifeList

Local lifelist

The local lifelist reproduces the status of the PA field devices on the PA segment.

PA field devices connected to the DP/PA link are only visible in the local lifelist if the PA field devices are configured.

Reading the local lifelist

To read the local lifelist, you have the following options:

- The local lifelist is displayed in graphical form using SIMATIC PDM.
- Via user interfaces:
  Read data records with SFC 59 "RD_REC" or SFB 52 "RDREC".
  To do this, load data record 50 of the DP/PA coupler.
- Via the PROFIBUS DP slave diagnostics
  Every change to the PA segment results in a PROFIBUS DP diagnostic information.

Note

Update of the local lifelist

The update of the local lifelist depends on the number of PA field devices. It can take up to approx. 1 minute to update and build the list.

Additional information

You can find additional information on SIMATIC PDM on the Internet (www.siemens.com/simatic-pdm).

10.2.3 Reading out the current value and the voltage value

10.2.3.1 User data of the DP/PA coupler

User data of the DP/PA coupler

The DP/PA coupler with diagnostic function has only input data. For the PA segment, these contain:

- Current value
- Optional with ring redundancy. Voltage value on the PROFIBUS PA

The variables are represented in IEEE754 format with a byte quality code according to PROFIBUS PA profile. This is the float format according to IEEE Standard 754 Short Real Number (floating point format).

Reading the current values and voltage values

To read the current values and voltage values you have the following options:

- PROFIBUS DP (PII of the CPU)
- Read data records with SFC 59 "RD_REC" or SFB 52 "RDREC".
  Load data record 56 of the DP/PA coupler for this.
- Read data records with PG / PC via communication connections, e.g. with SIMATIC PDM.

Structure of user data frame

DANGER

Status byte (x+4) in the user data frame of the DP/PA coupler - message of a PA redundancy error

The DP/PA coupler FDC 157 (6ES7157-0AC85-0XA0) reports back a PA redundancy error with status code "68_H" (instead of "24_H" at 0AC83).

4 bytes and 1 status byte are required for the representation of a variable in IEEE754 format. The status byte provides information about the validity of the measured value.

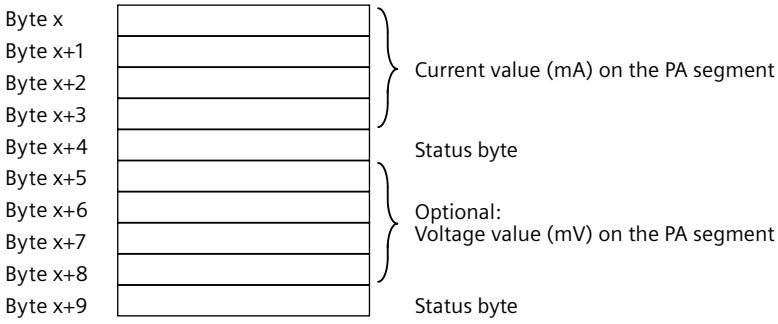


Figure 10-1 Structure of user data frame

Note

Input data

- Only the PA current value is supplied in stand-alone mode or active.
- Only the actively infeeding DP/PA coupler supplies a valid PA current value on slot 1 in redundant installation.
- If you insert slot 2 in HW Config, then the passive DP/PA coupler supplies a valid PA voltage value.

You can find additional information on this in the section "Structure of the current value and voltage value (Page 181)".

Voltage measurement on the PA segment

Only the installation with ring redundancy allows voltage measurement on the PA segment.

Required configuration:

- The configuration of slot 2 for voltage measurement on the PA segment is required.

Measuring points:

- The maximum PA voltage of approx. 31 V is always present at the actively infeeding DP/PA coupler.
- The measuring point for the PA voltage is the line end of the PA segment, i.e. at the passive DP/PA coupler.

10.2.3.2 Structure of the current value and voltage value

Measured values in IEEE format (byte x to byte x+3)

The following shows the representation of a measured value in IEEE format and the conversion to a decimal value.

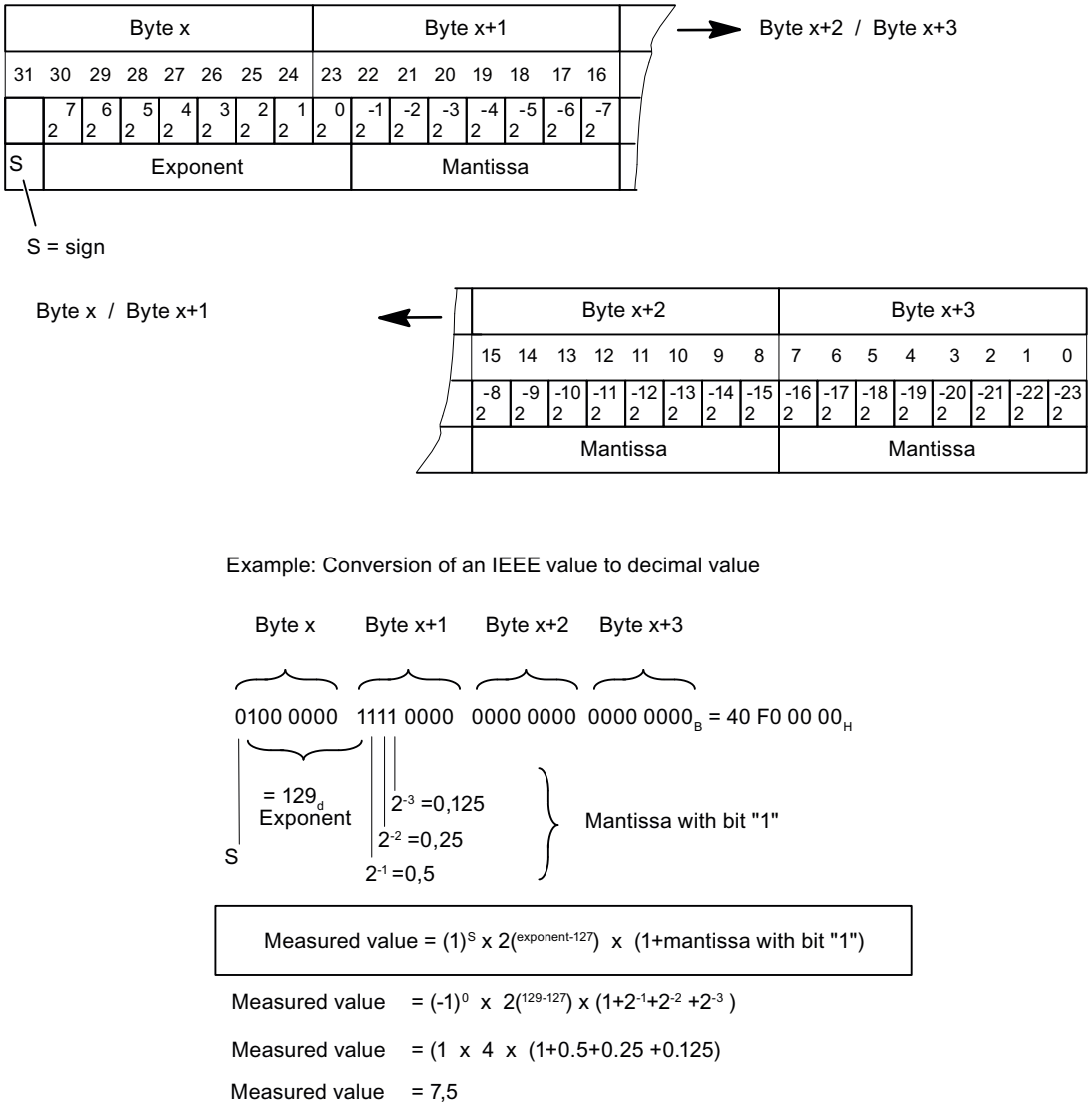
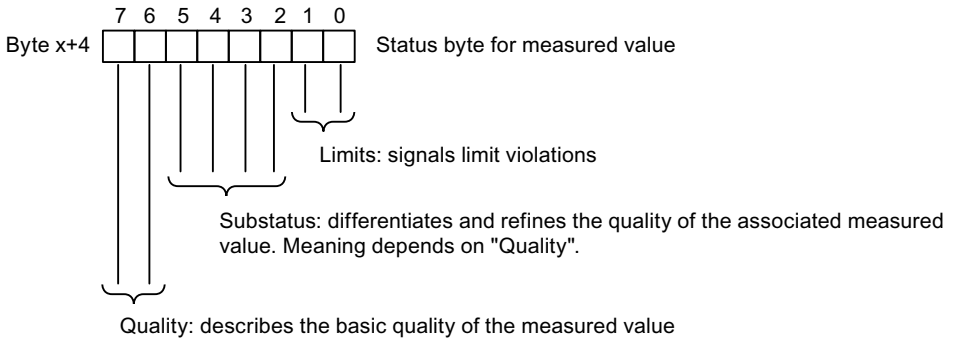


Figure 10-2 Conversion of IEEE-format in decimal value

Structure of IEEE status byte (byte x+4)

The structure of the status byte corresponds to the PROFIBUS PA profile. The following status codes are used at the DP/PA coupler:



Status codes:

00 0000 00 (0_H)	Bad, non-specific
00 1000 11 ($4F_H$)	Uncertain (initial value), (value not measured)
00 1001 00 (24_H)	Bad (maintenance alarm), (short-circuit, wire break, DP/PA coupler defective, poor signal level)
00 1001 01 (25_H)	Bad (maintenance alarm), low limit violation
00 1001 10 (26_H)	Bad (maintenance alarm), high limit violation
01 1010 00 (68_H)	Uncertain (maintenance demanded), PA redundancy error, parameter assignment error, Redundancy mode wrong partner
01 1010 01 (69_H)	Uncertain (maintenance demanded), low limit violation
01 1010 10 ($6A_H$)	Uncertain (maintenance demanded), high limit violation
10 0000 00 (80_H)	Good, ok (no error)
10 0000 01 (81_H)	Good, low limit violation
10 0000 10 (82_H)	Good, high limit violation

Figure 10-3 Structure of IEEE status byte

⚠ DANGER

Status byte (x+4) in the user data frame of the DP/PA coupler - message of a PA redundancy error

The DP/PA coupler (FDC 157 (6ES7157-0AC85-0XA0)) reports back a PA redundancy error with status code "68_H" (instead of "24_H" at 0AC83).

Note

Maintenance alarm / maintenance demanded

The status codes linked to "Maintenance alarm" or "Maintenance demanded" are only delivered if the diagnostics are enabled at the DP/PA coupler.

The status codes influence the corresponding bits in the PA status of the diagnostic frame.

Limits

The following limits are preset:

- PA current: Low / high limit: 0 mA / 1000 mA
- PA voltage: Low / high limit: 15.5 V / 35 V

You may change the limits via data record 128 of the DP/PA coupler.

When an error occurs when writing the data record, operation continues with limits that are not current or with the default limits. The data record is acknowledged negatively.

10.2.4 Data records

You need this information if you go beyond the standard applications of STEP 7 and SIMATIC PDM.

Requirements

The DP/PA coupler provides data records to the user that are addressed using slot 0 or 1.

The PROFIBUS DP data records are based on the *PROFIBUS PA profile*.

The profile is available from PROFIBUS International (PI) on the Internet at:

Internet (http://www.profibus.com)

Data records on slot 0

Table 10-8 Data records of the DP/PA coupler in slot 0

Data record no.	Read / Write	Size in bytes	Description
1	r	14	PA diagnostics (diagnostics frame bytes 1 to 14)
18	r	32	TAG, determined from I&M list 1.
24	r	16	Software revision
26	r	2	Device Man ID, determined from I&M list 0.
27	r	16	Device ID
50	r	16	Local lifelist (1 bit status per station)
	1 bit per PA field device, the offset corresponds to the station number: • Coding 0: PA field device not available. • Coding 1: PA field device present at local PA segment.		
56	r	10	Mapping of the input data
	See *User data frame*. 10 bytes of input data are also supplied in a configuration with only one slot: PA current and PA voltage.		
60	r	Max. 72	Mapping the diagnostics frame
	See *Diagnostics frame*.		
61	r	8	Mapping the PA redundancy status
	See *PA redundancy status*.		

Data record no.	Read / Write	Size in bytes	Description
62	r	16	See *Diagnostic data record*.
128	r/w	12	Parameter assignment of the limits for PA current and PA voltage
231	r/w	64	I&M list 0 (rating plate)
232	r/w	64	I&M list 1 (TAG)
233	r/w	64	I&M list 2 (date)
234	r/w	64	I&M list 3 (descriptor)
	The data structures of the I&M data correspond to the specifications of the PROFIBUS Guideline – Order No. 3.502, Version 1.1 of May 2003.		
255	r/w	68	Upload / Download mechanism for I&M objects
	This data record is structured according to the following standard: PROFIBUS Profile Guidelines Part 1: Identification & Maintenance Functions.		

Data records on slot 1

Table 10-9 Data records of the DP/PA coupler in slot 1

Data record no.	Read / Write	Size in bytes	Description
0	r	12	Header (device management)
1	r	8	Composite List Directory Entries (device management)

Reading and writing data records

To read and write data records, use the following SFCs:

- Read data record with SFC 59 "RD_REC" or SFB 52 "REC".
- Write data record with SFC 58 "WR_REC" or SFB 53 "WR_REC".

Additional information

For more detailed information on SFCs, refer to the *System Software for S7-300/400 System and Standard Functions* manual.

Internet (http://support.automation.siemens.com/WW/view/en/1214574)

See also

Identification and maintenance data (I&M data) (Page 173)

10.2.5 Diagnostic record 62

Structure of diagnostics record 62

Bytes 0 to 5 of data record 62 contain the standard diagnostics, bytes 6 to 15 the PA status.

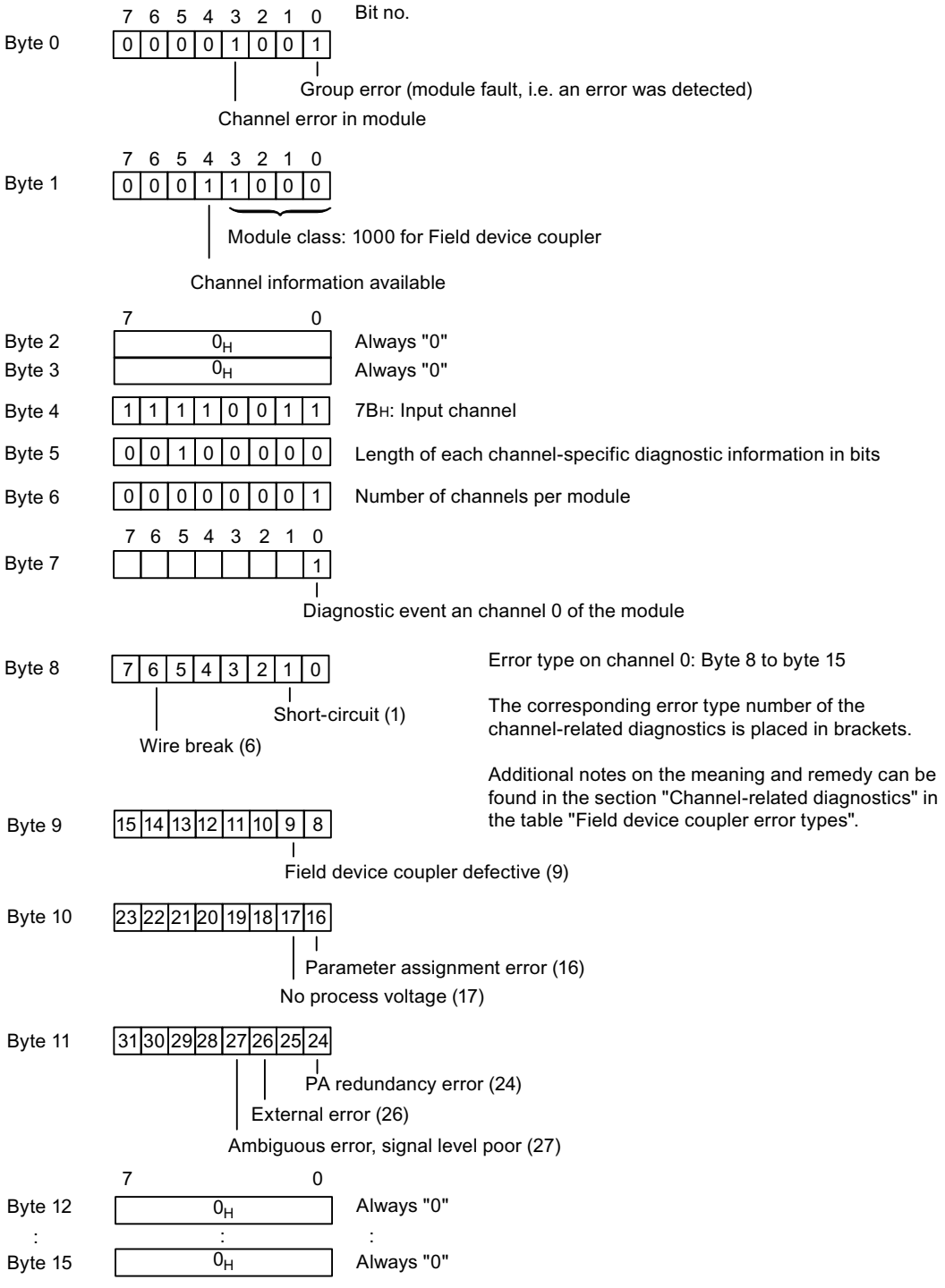


Figure 10-4 Structure of diagnostics record 62

10.2.6 Address space of the inputs

Introduction

The address range of the process image input (PII) that is occupied is dependent on the configuration, i.e. on the selection of the corresponding entry in the configuring software.

Assignment of the process image input (PII)

The DP/PA coupler FDC 157-0 has 5 or optionally 10 bytes of input data.

These contain the current value on the PA segment and optionally the PA voltage in IEEE754 format (32-bit floating point number) with a byte quality code according to the PROFIBUS PA profile.

Structure of the configuration frame

The DP/PA coupler has a slot modeling as modular slave.

- Slot 0 is the proxy for the entire slave
- Slot 1 is always available
- Slot 2 can be configured (optional)

Module	I/O data in bytes	Consistency	DP ID
Slot 1	5 / 0	Byte over entire length	94_H
Slot 2	5 / 0	Byte over entire length	94_H

Interrupt, error and system messages 11

11.1 Diagnostics by means of LED displays

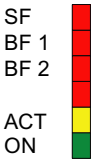
11.1.1 LED displays of the PROFIBUS DP interface module

Introduction

PA field devices and DP slaves communicate on the same basis. The following simplified terminology is therefore used in this section:

- "Slaves" stands for PA field devices and lower-level DP slaves.
- "Lower-level master system" stands for PA master system and lower-level DP master system.

Status and error messages of the PROFIBUS DP interface module IM 153-2OD (6ES7153-2BA70-0XB0)



SF Batch error (red)
BF 1 Bus fault higher-level PROFIBUS DP (red)
BF 2 Bus fault lower-level PROFIBUS (red)
ACT IM 153-2 has an active channel (yellow)
ON 24 V power supply IM 153-2 (green)

Figure 11-1 **LEDs of the PROFIBUS DP interface module**

Table 11-1 Status and error messages

LEDs					Meaning	Remedy
SF	**BF 1**	**BF 2**	**ACT**	**ON**		
Off	Off	Off	Off	Off	• There is no voltage at the PROFIBUS DP interface module. • Applied supply voltage is not within permissible range. • Hardware fault of the PROFIBUS DP interface module	• Switch on the power supply. • Check the voltage applied. • Replace the PROFIBUS DP interface module.
*	*	*	*	On	Supply voltage is applied to the PROFIBUS DP interface module.	–
On	On	On	On	On	All LEDs are switched on for approx. 1 s. The PROFIBUS DP interface module is starting up.	–

LEDs					Meaning	Remedy
SF	**BF 1**	**BF 2**	**ACT**	**ON**		
Off	Off	Off	Off	On	In non-redundant mode: The PROFIBUS DP interface module exchanges data with the DP master and the lower-level slaves.	–
					In redundancy mode: The PROFIBUS DP interface module is passive and ready for changeover.	–
Off	Off	Off	On	On	In redundancy mode only: The PROFIBUS DP interface module is active and exchanging data with the DP master and the lower-level slaves.	–
Off	Off	Flashes rapidly	*	On	The startup delay is active at the PROFIBUS DP interface module.	If the PROFIBUS DP interface module does not start up within 20 s, check the configuration to see if startup when preset configuration ≠ actual configuration is enabled.
*	Off	On	Off	On	In non-redundant mode: Missing configuration of the PROFIBUS DP interface module.	Check whether the CPU or the DP master is in the RUN mode.
					In redundancy mode: The PROFIBUS DP interface module is passive and not yet ready for changeover.	Check whether the H-system is in the redundant system state.**
*	On	*	Off	On	No connection to the DP master. Possible causes: • The bus communication to the PROFIBUS DP interface module is interrupted. • The DP master is not in operation.	• Check if the bus connector is correctly inserted. • Check if the bus cable to the DP master is broken. • Switch the 24 V DC switch for the power supply on/off.
*	Flashes	*	Off	On	There is no data exchange between DP master and PROFIBUS DP interface module.	• Check the configuration. • Check the PROFIBUS address.
On	Off	Off	Off	On	In non-redundancy mode: All slaves are exchanging data. At least one slave has reported an error. or Impermissible PROFIBUS address	Evaluate the diagnostics of the PROFIBUS DP interface module and check the reported slaves. PA link only: Check the status bytes in the slave user data. Read the slave device status with a configuration tool (e.g. *SIMATIC PDM*). or Set a valid PROFIBUS address for the PROFIBUS DP interface module.
					In redundancy mode: The PROFIBUS DP interface module is passive and ready for changeover. There is an error on the active PROFIBUS DP interface module.	Evaluate the LED display on the active PROFIBUS DP interface module.

LEDs					Meaning	Remedy
SF	**BF 1**	**BF 2**	**ACT**	**ON**		
On	Off	Off	On	On	In redundancy mode only: The PROFIBUS DP interface module is active. All slaves are exchanging data. At least one slave has reported an error.	Evaluate the diagnostics of the PROFIBUS DP interface module and check the reported slaves. Evaluate the diagnostics of the lower-level slaves using the online view of HW Config. PA link only: Check the status bytes in the slave user data. Read the slave device status with a configuration tool (e.g. *SIMATIC PDM*).
On	Off	Flashes	*	On	The specified configuration of the link does not correspond to the actual configuration. or The PROFIBUS DP interface module has no cyclic data exchange with at least one configured slave.	Check the configuration and installation of the link. or Evaluate the diagnostics of the PROFIBUS DP interface module and check the reported slaves (connection, address, parameter assignment, configuration).
Flashes	Flashes	Flashes	Flashes	Flashes	The PROFIBUS DP interface module is not compatible with the redundant PROFIBUS DP interface module in the current operating mode.	You can find information about compatibility between the versions of the PROFIBUS DP interface module in the section *Compatibility with predecessor modules*.
* Not relevant ** After the transition to the redundant system state, the "SF" LED flashes for another 20 seconds.						

LED display when an existing configuration is deleted

If you delete an existing configuration for the PROFIBUS DP interface module IM 153-2OD (6ES7153-2BA70-0XB0) by resetting the interface module, the following LED display appears:

LEDs					Meaning	Remedy
SF	**BF 1**	**BF 2**	**ACT**	**ON**		
Off	Flashes	Off	Off	Off	Occurs only if the PROFIBUS address (DIP switch) is "0" when power ON. Temporary state while default configuration data in retentive memory is restored.	-

See also

Compatibility with predecessor modules (Page 281)

11.1.2 LED displays of the DP/PA coupler FDC 157-0

Status and error messages of the DP/PA coupler FDC 157-0 (6ES7157-0AC85-0XA0)



Group error (red)
Bus error (red)
Bus monitoring PROFIBUS DP (yellow)
Bus monitoring lower-level bus system (yellow)
DP/PA coupler activated, feeding / transmitting (yellow) - only with coupler redundancy
24 V power supply DP/PA coupler (green)

Figure 11-2 **LEDs of the DP/PA coupler FDC 157-0**

For the specifications in the following table, the field devices are located on PROFIBUS PA. The corresponding bus-specific communication must be set.

Table 11-2 Status and error messages

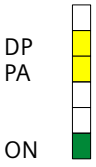
LEDs						Meaning	Remedy
SF	**BF**	**M**	**FB**	**ACT**	**ON**		
Off	Off	Off	Off	Off	Off	• No voltage is applied to the FDC 157. • Error in the FDC 157.	• Switch on the power supply. • Check the voltage applied. • Replace the FDC 157.
*	*	*	*	*	Flashes	Overload of the fieldbus	Check the number and total current of connected field devices.
*	*	*	*	On	On	FDC 157 mounted on redundant bus module and active.	-
*	*	*	*	Off	On	FDC 157 mounted on redundant bus module and passive, or not on redundant bus module.	-
*	*	Off	*	*	On	PROFIBUS DP interface module is not running / not available Causes: • PROFIBUS DP interface module is not running. • Bus modules are not connected correctly. • Connector to backplane bus is faulty.	• Check whether the PROFIBUS DP interface module is available and running. • Check if the bus modules are correctly connected.
*	*	Flashes	*	*	On	PROFIBUS DP interface module available, fieldbus communication from PROFIBUS DP interface module to fieldbus is working.	-

LEDs						Meaning	Remedy
SF	**BF**	**M**	**FB**	**ACT**	**ON**		
*	On	Flashes	*	*	On	Diagnostic communication between PROFIBUS DP interface module and FDC 157 is not working. Causes: • PROFIBUS DP interface module not running • No PROFIBUS DP interface module available.	• See above (PROFIBUS DP interface module not running / not available). • Ensure that the PROFIBUS DP interface module is being used.
*	Flashes	Flashes	*	*	On	Diagnostic communication between PROFIBUS DP interface module and FDC 157 is established.	-
*	Off	Flashes	*	*	On	Diagnostic communication between PROFIBUS DP interface module and FDC 157 is functioning.	-
*	*	Flashes	Off	Off	On	Fieldbus communication is not functioning. Causes: • FDC 157 is not active in redundancy mode • No field devices connected. • Fieldbus cable damaged or not connected.	• Check the other FDC 157, which must be active - at least one FDC 157 must be active in redundancy mode. • Check whether field devices are connected. • Check the cables and terminals.
*	*	Flashes	Off	On	On	FDC 157 active, but fieldbus communication is not functioning. Causes: • No field devices connected. • Fieldbus cable damaged or not connected.	• Check whether field devices are connected. • Check the cables and terminals.
*	Off	Flashes	Flashes	*	On	Fault-free operation: Fieldbus communication and diagnostic communication between PROFIBUS DP interface module and FDC 157 is functioning (with coupler redundancy on active FDC 157).	-

LEDs						Meaning	Remedy
SF	**BF**	**M**	**FB**	**ACT**	**ON**		
On	*	*	*	*	*	• Deviations from configuration • External or internal errors, such as short-circuit, wire break, voltage error	• Check the redundant/non-redundant configuration; set the redundancy mode correctly on the FDC 157 (DIP switch) • Check connections and cables between FDC 157 and the next AFD. • Replace the FDC 157.
Off	On	Off	On	On	On	Incorrect terminating resistor	• Set the fieldbus termination switch correctly. • Install a bus termination on both ends of the bus cable.

11.1.3 LED displays of the DP/PA coupler FDC 157 EX [ia]

Status and error messages of the DP/PA coupler FDC 157 Ex [ia] (6ES7157-0AD82-0XA0)



DP Bus monitoring PROFIBUS DP (yellow)
PA Bus monitoring PROFIBUS PA (yellow)
ON 24 V power supply DP/PA coupler (green)

Figure 11-3 **LEDs of the DP/PA coupler**

Table 11-3 Status and error messages

LEDs			Meaning	Remedy
DP	**PA**	**ON**		
*	*	On	Voltage is applied to the DP/PA coupler. The DP/PA coupler is ready for operation.	-
*	*	Off	There is no voltage applied to the DP/PA coupler, or Error in the DP/PA coupler.	Check the 24 V voltage supply of the DP/PA coupler, or Contact your Siemens representative.
*	*	Flashes	PROFIBUS PA overloaded	Check the number and total current of connected PA field devices.
Flashes	*	On	PROFIBUS DP frames are being received.	-

LEDs			Meaning	Remedy
DP	**PA**	**ON**		
Off	*	On	PROFIBUS DP frames are not being received Causes: • The DP master is not in operation. • Bus cable is damaged. • Bus modules are not connected correctly. • Connector to backplane bus is defective	• Check if the bus connector is correctly inserted. • Check if the bus cable to the DP master is broken. • Check if the bus modules are correctly connected. • Check the 24 V voltage supply of the DP/PA coupler,
*	Flashes	On	PROFIBUS PA frames are being received	-
*	Off	On	PROFIBUS PA frames are not being received, for example • The voltage on PROFIBUS PA is not within the permissible range (short-circuit, overload). • No response from a PA field device. The PA field device is possibly not being addressed.	• Check the PA field devices on the PROFIBUS PA. • Check if the bus segments are terminated properly.
* Not relevant				

11.1.4 LED displays of the Y coupler

Status messages of the Y-coupler (6ES7197-1LB00-0XA0)

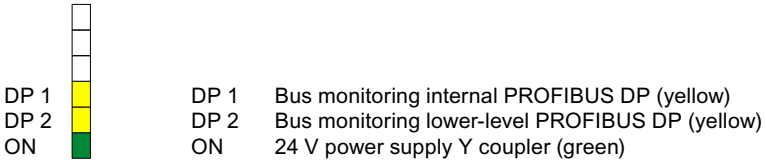


Figure 11-4 **LED of the Y-coupler**

Table 11-4 Status messages

LEDs			Meaning	Remedy
DP 1	**DP 2**	**ON**		
Off	Off	Off	No voltage is applied to the Y-coupler	Switch on the power supply of the IM 153-2. If the LED ON does not light up when the power supply of the IM 153-2 is switched on: Replace IM 153-2 because the internal power supply is defective.
Off	Off	On	Voltage is applied to the Y-coupler The Y-coupler is ready for operation. No data is being exchanged between the internal and the lower-level DP master system.	• Check that the bus connector is correctly inserted. • Check if the bus cable to the lower-level DP master system is interrupted. • Check if the bus modules are correctly connected.
On	Off	On	Frames from the lower-level DP master system are not being received, for example: • The connection to the lower-level DP master system is interrupted. • DP slaves are not responding.	• Check whether the lower-level DP master system is connected correctly (the bus connector is plugged in and the two bus terminal resistors are connected in if necessary). • Check the connected DP slaves.
*	On	On	Data exchange taking place between internal and lower-level DP master system (at high transmission rate).	-
On	*	On		
*	Flashes	On	Data exchange is taking place between internal and lower-level DP master system (at low transmission rate).	-
Flashes	*			
* Not relevant				

11.1.5 LED displays of the active field distributor AFDiSD

Status and error messages of the active field distributor AFDiSD (6ES7655-5DX60-1BB0)



Figure 11-5 **LEDs of the active field distributor AFDiSD**

Table 11-5 Status and error messages

LED T1, T2	LED S1 to S6	Meaning	Remedy
green		PA main line connected. Bus termination inactive.	-
orange		Automatic bus termination active. Cause: • e.g. last AFD or AFDiSD in the line • Short-circuit or no-load operation on the corresponding segment of the PA main line (T1 or T2)	-
Flashes orange		IP30 cover of the main line terminal is open.	Close the IP30 cover until you hear it engage.
Off		Wires of a PA main line swapped	Correct the wiring.
	Off	No field device is connected to the corresponding spur line.	-
	Blue	Field device is connected.	-
	Flashes slowly	Short-circuit on the PA spur line	Eliminate the cause of the error.
	Flashes rapidly	Debounce function active (3 s after changes to the spur lines, for example, before or after a short-circuit)	Wait for 3 s. One of the statuses "off", "blue" or "slow flashing" appears.
	Everything flashing quickly	"**Find AFDiSD**" function is in progress: All LEDs of the spur lines to the field devices (S1 to S6) flash for 5 s. (Extended function of AFDiSD compared to its predecessor model AFDiS)	-

11.1.6 LED displays of the active field distributor AFD4 / AFD4 (FM) / AFD4 Railmount / AFD8

Status and error messages of the active field distributor AFD4 / AFD4 (FM) / AFD8

Name	Article number
SIMATIC AFD4	6ES7157-0AG81-0XA0
SIMATIC AFD4 (FM)	6ES7655-5DX40-1AA1
SIMATIC AFD4 Railmount	6ES7655-5DX40-2AA0
SIMATIC AFD8	6ES7157-0AG82-0XA0

SIMATIC AFD4
SIMATIC AFD4 (FM)
SIMATIC AFD4 Railmount



SIMATIC AFD8



Figure 11-6 LED displays of the active field distributors

Table 11-6 Status and error messages

LED T1, T2	**LED S1 ... S<n>[1)]**	**Meaning**	**Remedy**
green		• Main line is connected. • Bus termination is inactive.	–
orange		Automatic bus termination is active. Cause: • E.g. last active field distributor in the line • Short-circuit or no-load operation on the corresponding segment of the main line (T1 or T2)	–
Flashes orange		Cover of the main line terminal is open.	Close the cover.
Off		Wires of a main line are reversed.	Correct the wiring.
	Off	No field device is connected to the corresponding spur line.	–
	green	A field device is connected to the corresponding spur line.	–
	Flashes slowly	Short-circuit on the spur line	Eliminate the cause of the error.
	Flashes rapidly	Debounce function is active (5 s after changes to the spur lines, for example, before or after a short-circuit)	Wait for 5 s. One of the statuses "off", "blue" or "slow flashing" appears.

<n>[1] Depending on the number of fieldbus connections "AFD4 / AFD4 (FM) / AFD4 Railmount (n=4)" or "AFD8 (n=8)".

11.2 S7 system diagnostics a PROFIBUS DP interface module

Terminology conventions

The following explanations apply in part to both the DP/PA link with its PA field devices and the Y-link with its lower-level DP slaves. In such instances, the following terminology will be used for the sake of clarity:

- "Link" stands for DP/PA link and Y-link.
- "Slaves" stands for PA field devices and lower-level DP slaves.
- "Lower-level master system" stands for PA master system and lower-level DP master system.

Slave diagnostics

The slave diagnostics behaves according to IEC 61784-1:2002 Ed1 CP 3/1. Depending on the DP master it can be read out with *STEP 7*, *SIMATIC PDM* or other configuration tools.

With *STEP 7* the diagnostics frames of the lower-level DP slaves can be displayed in the online view of HW Config.

Additional information

For additional information, refer to the *STEP 7* online help topic "How to diagnose hardware"

Refer to the *SIMATIC Software; Programming with STEP 7 V5.x* manual for additional options for reading out diagnostic information.

You can find the manual on the Internet at this address (http://support.automation.siemens.com):

Search for Entry ID 18652056.

11.2.1 Structure of slave diagnostics

Influencing factors

The structure of the slave diagnostics depends on the operating mode of the PROFIBUS DP interface module:

- S7 standard mode
- Redundancy mode on an S7-400H
- DP standard master mode

Diagnostic blocks in S7 standard mode and in redundancy mode

The table below shows the lengths of the diagnostics blocks and the offset in the diagnostics frame.

Table 11-7 Length and offset of the diagnostic blocks in S7 standard mode and in redundancy mode

Diagnostic block	Length in bytes	Offset in non-redundant mode	Offset in redundancy mode
Standard diagnostics	6	0	0
Identifier-related diagnostics	31	6	6
Module status	63	37	37
Status message	60	100	100
H-status	8	-	160
Interrupt section	(Max. 63 *)	(160 *)	(168 *)
Total length		160 (max. 223 *)	168 (max. 231 *)
* Only if interrupts are reported			

Diagnostic blocks in DP standard master mode

When the PROFIBUS DP interface module is configured using a GSD file revision 4 or higher, it is possible to select for each diagnostics block (with the exception of standard diagnostics) whether or not it is available. The sequence of the diagnostic blocks is fixed. The offset of the individual diagnostic blocks in the diagnostics frame depends on which diagnostic blocks are selected.

The table below shows the length of the diagnostic blocks and examples of the offset in the diagnostics frame with specific configurations.

Table 11-8 Length and offset of the diagnostic blocks in DP standard master mode

Diagnostic block	Length in bytes	Example 1		Example 2	
Selected	Offset	Selected	Offset		
Standard diagnostics	6	Always	0	Always	0
Identifier-related diagnostics	31	X	6	-	-
Module status	63	X	37	X	6
Status message	60	-	-	-	-
Interrupt section	(Max. 63 *)	-	-	X	(69 *)
Total length	160 (max. 223 *)	100		69 (max. 132 *)	
* Only if interrupts are reported					

11.2.2 Reading out the diagnostics of underlying slaves

Introduction

The diagnostic data of lower-level diagnostics-capable slaves buffered in the PROFIBUS DP interface module can be read via the SFC 59 "RD_REC".

Requirements

The link must be operated on a DPV1 master.

Parameters for SFC 59 "RD_REC"

The following table provides you with the necessary values for the call parameters of SFC 59 "RD_REC".

Table 11-9 Call parameters for SFC 59 "RD_REC"

Parameters	Value, meaning
IOID	B#16#54 (I/O input IOI)
LADDR	Diagnostic address of the PROFIBUS DP interface module from HW Config.
RECNUM	Node number of the slave whose diagnostic information is to be read

Any error information in the return value RET_VAL can be found in the section *Reading and writing data records*.

11.2.3 Structure of the diagnostic blocks

11.2.3.1 Default diagnosis

The following information is valid for the PROFIBUS DP interface module IM 153-2OD.

Structure of the standard diagnostics

The standard diagnostics consists of 6 bytes and is subdivided as follows:

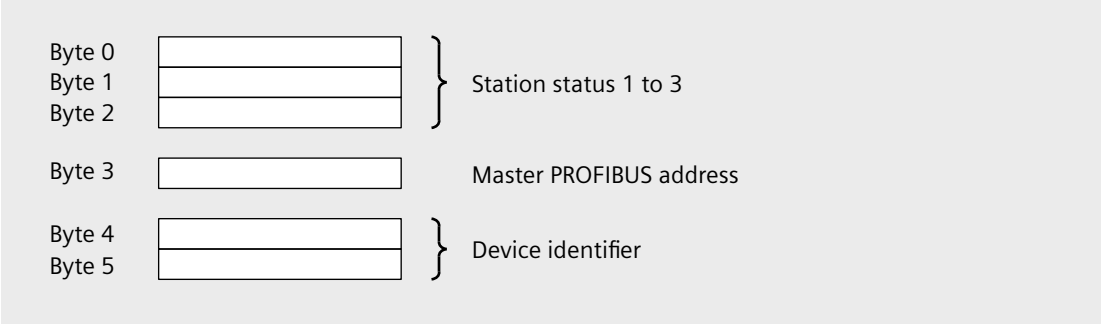


Figure 11-7 Structure of the standard diagnostics

Station status 1 to 3

Station status 1 to 3 provides an overview of the status of the PROFIBUS DP interface module.

Table 11-10 Structure of station status 1

Bit	Meaning	Cause / remedy
0	1: The PROFIBUS DP interface module cannot be addressed by the DP master.	• Correct PROFIBUS address set at the PROFIBUS DP interface module? • Are the bus connectors connected? • Voltage on the PROFIBUS DP interface module?
1	1: The PROFIBUS DP interface module is not yet ready for data exchange.	• Wait, because the PROFIBUS DP interface module is in the startup phase.
2	1: The configuration data sent from the DP master to the PROFIBUS DP interface module does not match the configuration of the PROFIBUS DP interface module.	• Is correct station type or correct configuration of the PROFIBUS DP interface module entered in the configuration software?
3	1: External diagnostics available. (Group diagnostics display)	• Evaluate the identifier-related diagnostics, the module status and / or the status message. As soon as all errors have been eliminated, bit 3 is reset. The bit is set again when there is a new diagnostic message in the bytes of the aforementioned diagnostics.
4	1: The requested function is not supported by the PROFIBUS DP interface module.	• Check the configuration.
5	1: DP master cannot interpret the response of the PROFIBUS DP interface module.	• Check the bus configuration.

Bit	Meaning	Cause / remedy
6	1: The configured station type does not match the PROFIBUS DP interface module.	• Correct station type entered in the configuration software?
7	1: The PROFIBUS DP interface module parameters have been assigned by another DP master (not by the DP master that currently has access to the PROFIBUS DP interface module).	• Bit is always "1" if, for example, you are currently accessing the PROFIBUS DP interface module with the PG or another DP master. The PROFIBUS address of the DP master that has assigned the PROFIBUS DP interface module parameters is located in the "Master PROFIBUS address" diagnostic byte.

Table 11-11 Structure of station status 2

Bit	Meaning
0	1: The PROFIBUS DP interface module parameters must be reassigned.
1	0: The bit is always set to "0."
2	1: The bit is always set to "1" if the PROFIBUS DP interface module with this PROFIBUS address is available.
3	1: The watchdog function is activated for the PROFIBUS DP interface module.
4	0: The bit is always set to "0."
5	0: The bit is always set to "0."
6	0: The bit is always set to "0."
7	1: The PROFIBUS DP interface module is deactivated, i.e. it is removed from current processing.

Table 11-12 Structure of station status 3

Bit	Meaning
0 to 7	0: Bits are always set to "0."

Master PROFIBUS address

Byte 3 of the standard diagnostics contains the PROFIBUS address of the DP master that has assigned the PROFIBUS DP interface module parameters and that has read and write access to the PROFIBUS DP interface module.

Device identifier

The device identifier is a code that uniquely identifies the type of DP slave (PROFIBUS ID number).

Table 11-13 Structure of the device identifier

Byte 4	Byte 5	Description
80_H	$1E_H$	PROFIBUS DP interface module IM 153-2OD

11.2.3.2 Identifier-related diagnostics

Definition

Identifier-related diagnostics specify the slots of the PROFIBUS DP interface module for which diagnostic information is available.

Terms: slave, module and slot

A slave is a bus node that is addressed via its own PROFIBUS address. It can physically or logically consist of one or more modules. The slaves and their modules are depicted in the identifier-related diagnostics in virtual slots:

- A non-modular slave always occupies two slots.
  The first slot represents a "virtual head module" and the second a "virtual module".
- A modular slave consisting of x modules occupies (x+1) slots.
  The first slot is assigned to the head module, the subsequent slots are assigned to the individual modules in ascending order.

Example of slot assignment

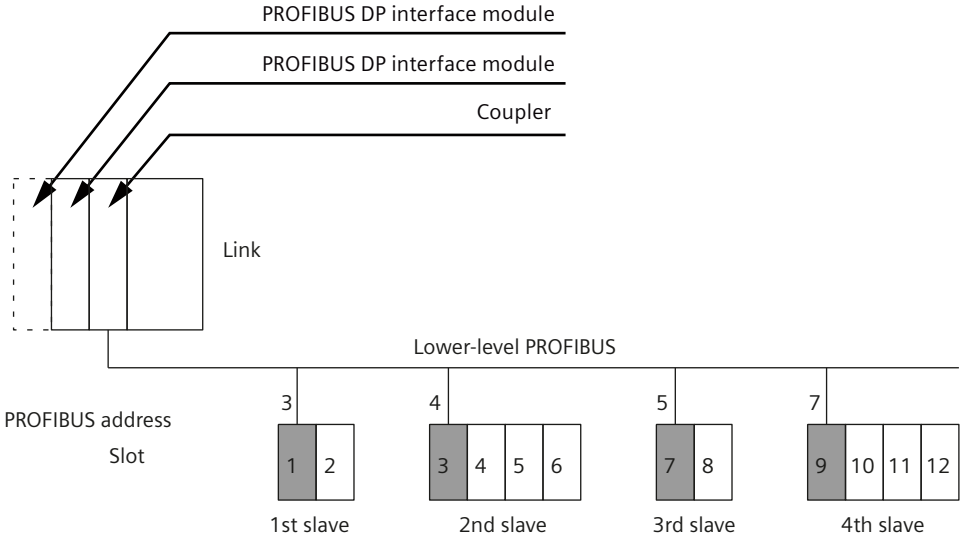


Figure 11-8 Example of slot assignment

Structure of the identifier-related diagnostics

The identifier-related diagnostics comprises 31 bytes.

Each slot of a slave occupies one bit. The slaves are arranged in ascending order according to their PROFIBUS addresses.

One bit is set:

- if the associated slave for the slot concerned delivers identifier-related diagnostics, or
- if the associated configured slave is not exchanging data with the DP master.

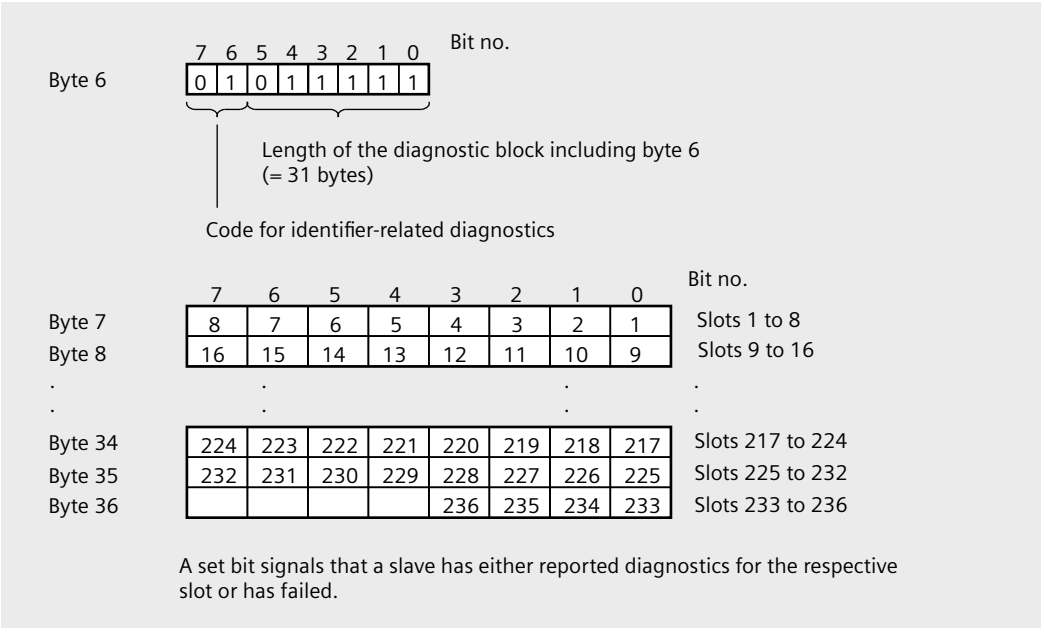


Figure 11-9 Structure of the identifier-related diagnostics

11.2.3.3 Module status

The following information is valid for the PROFIBUS DP interface module IM 153-2OD.

Definition

The module status is part of the device-related diagnostics and reports the status of the configure modules.

Structure of the module status

The modules status comprises 63 bytes.

The start address x is the equal to 37 for the S7 standard mode and redundancy mode, in DP standard master mode it depends on the diagnostic blocks that are present.

The status for each slot is coded by 2 bits in the module status.

The following applies to the entry in the module status:

- If a lower-level slave delivers its own module status in its diagnostics, this status is copied to the appropriate location.
- If a lower-level slave delivers identifier-related diagnostics but no module status, the status 01_B "Module error" is entered for an identifier with error.
- If a lower-level slave delivers neither its own module status nor identifier-related diagnostics, the status is entered as follows:
  - In case of error-free operation: 00_B "Module OK"
  - In case of configuration errors: 10_B "Wrong module"
  - If the slave is missing 11_B "No module"
  - In case of other errors (for example "Prm_Fault"): 01_B "Module error"

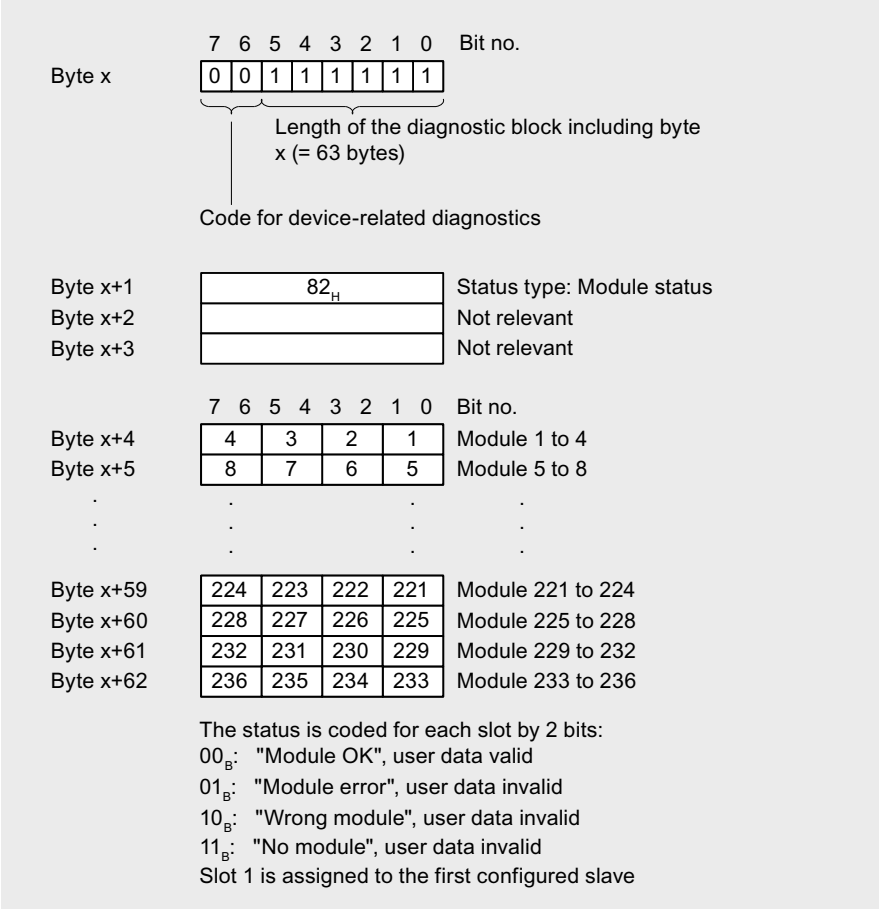


Figure 11-10 Structure of the module status

See also

Structure of slave diagnostics (Page 199)

11.2.3.4 Status message

The following information is valid for the PROFIBUS DP interface module IM 153-2OD.

Definition

The status message is part of the device-related diagnostics and delivers, among other things, the following information:

- Lower-level slaves that have reported diagnostics
- Lower-level slaves that are exchanging data
- Status of the PROFIBUS DP interface module as master of the lower-level PROFIBUS

Structure of the status message

The status message comprises 60 bytes.

The start address x is equal to 100 for the S7 standard mode and redundancy mode, in DP standard master mode it depends on the diagnostic blocks that are present.

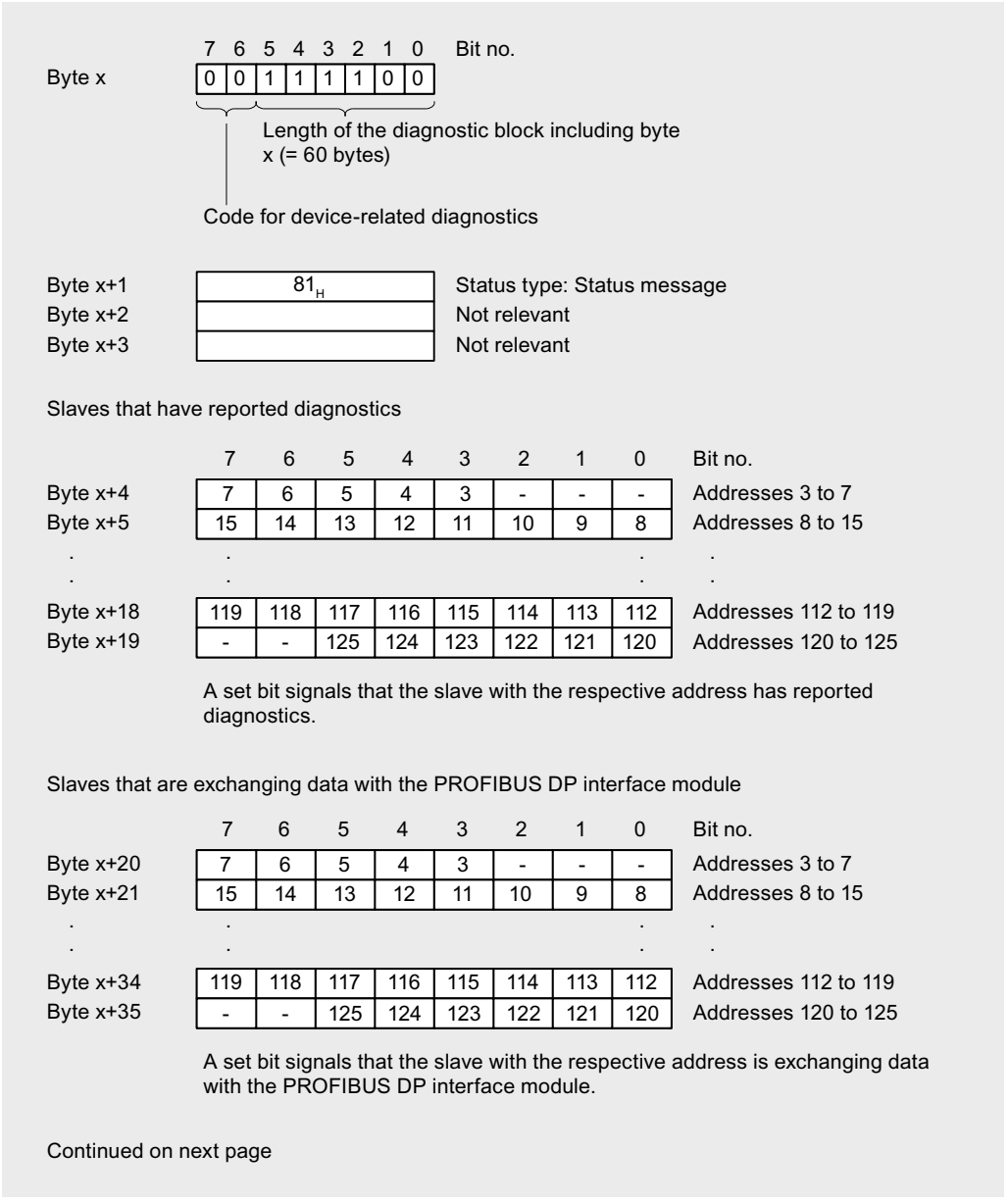
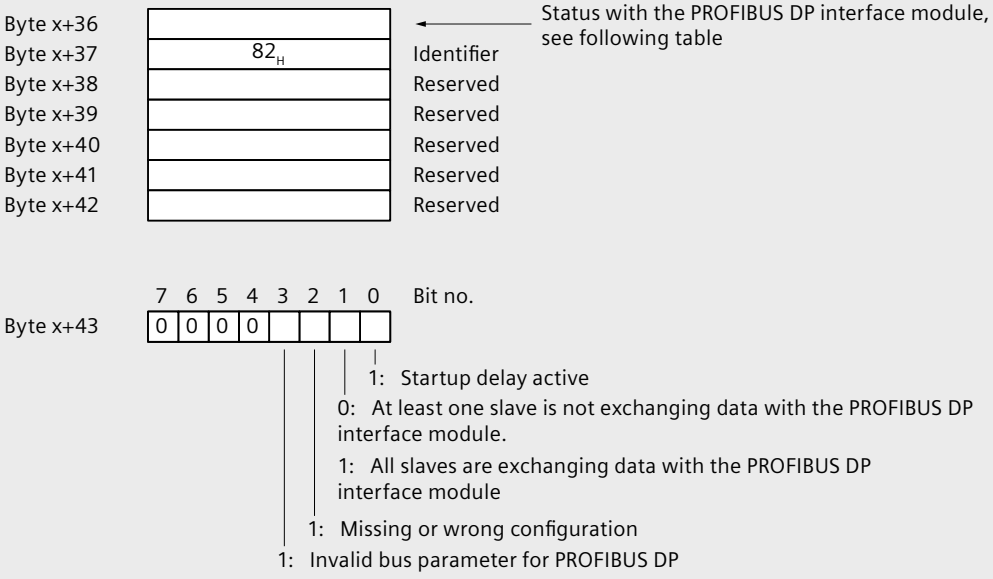


Figure 11-11 Structure of the status message

Continued from previous page

Status with the PROFIBUS DP interface module



Channel diagnostics overview

	7	6	5	4	3	2	1	0	Bit no.
Byte x+44	7	6	5	4	3	-	-	-	Addresses 3 to 7
Byte x+45	15	14	13	12	11	10	9	8	Addresses 8 to 15
.	.							.	.
.	.							.	.
Byte x+58	119	118	117	116	115	114	113	112	Addresses 112 to 119
Byte x+59	-	-	125	124	123	122	121	120	Addresses 120 to 125

A set bit signals that the slave with the respective address has reported channel-related diagnostics.

Figure 11-12 Structure of the status message, continued

Table 11-14 Meaning of byte x+36 in the status message

Byte x+36	Status	Meaning
00_H	OFF	There is no data exchange between the PROFIBUS DP interface module and the lower-level slaves. The PROFIBUS DP interface module can neither receive nor forward the token.
40_H	STOP	There is no data exchange between the PROFIBUS DP interface module and the lower-level slaves. The PROFIBUS DP interface module can receive and forward the token.
80_H	CLEAR	The PROFIBUS DP interface module reads the input data cyclically. Output data are held in a safe state or set to "0". The PROFIBUS DP interface module can receive and forward the token.
$C0_H$	RUN (OPERATE)	The PROFIBUS DP interface module cyclically reads the input data and forwards the output data to the slaves. The PROFIBUS DP interface module can receive and forward the token.

See also

Structure of slave diagnostics (Page 199)

11.2.3.5 H status

The following information is valid for the PROFIBUS DP interface module IM 153-2OD.

Definition

The PROFIBUS DP interface module only provides the H-status,

- if it is connected to the redundant DP system of an S7-400H or
- if it is being operated redundantly in accordance with the standard.

The H-status provides information about the status of the active and the passive PROFIBUS DP interface module. The H-status consists of 8 bytes.

Structure of the H-status

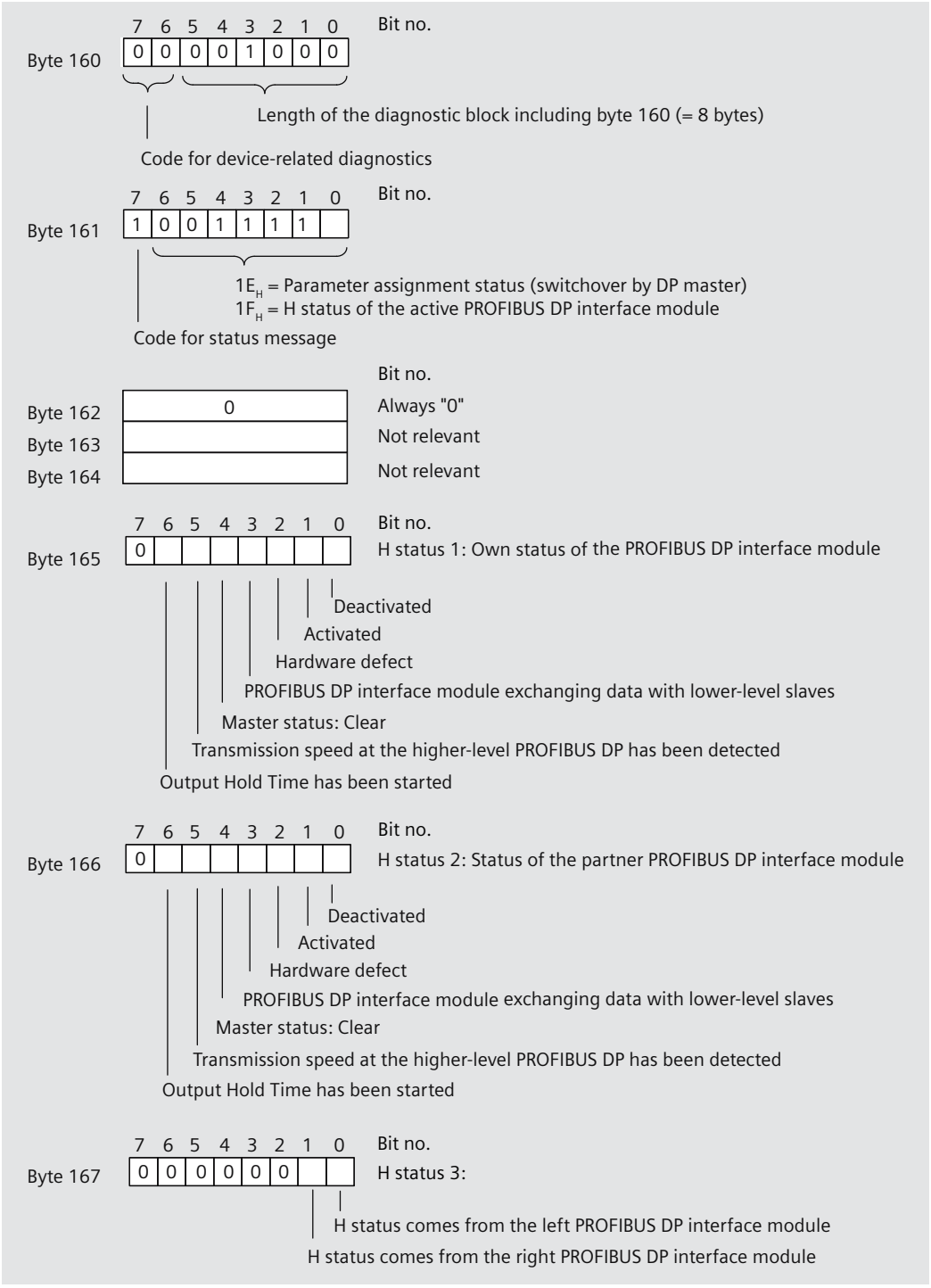


Figure 11-13 Structure of the H-status of the PROFIBUS DP interface module in redundancy mode

11.2.3.6 Interrupts

The following information is valid for the PROFIBUS DP interface module IM 153-2OD.

Definition

The interrupt section provides information on the type of interrupt and the cause leading to the interrupt being triggered. The interrupt section is only transmitted if there is an interrupt.

Structure of the interrupt section

The structure of the interrupt section depends on the DP master on which the PROFIBUS DP interface module is operated:

- In "DPV1" mode on the DP master, the interrupt section comprises maximum 63 bytes.
- On a redundant S7 master that is **not** DPV1-capable, the interrupt section comprises 20 bytes.

Structure of the interrupt section on the redundant S7 master (operating mode: S7-compatible)

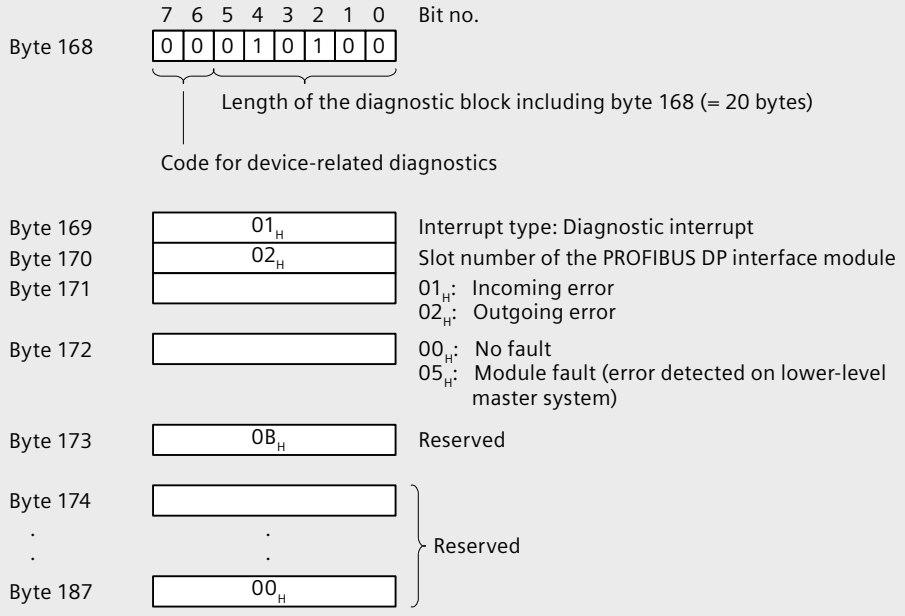


Figure 11-14 Structure of the interrupt section on the redundant S7 masters that is not DPV1-capable.

Structure of the interrupt section on the DP master in "DPV1" mode.

The interrupt section consists of an interrupt header and the additional interrupt information. The interrupt header always comprises 4 bytes. The structure of the additional interrupt information depends on the interrupt type; the maximum length is 59 bytes.

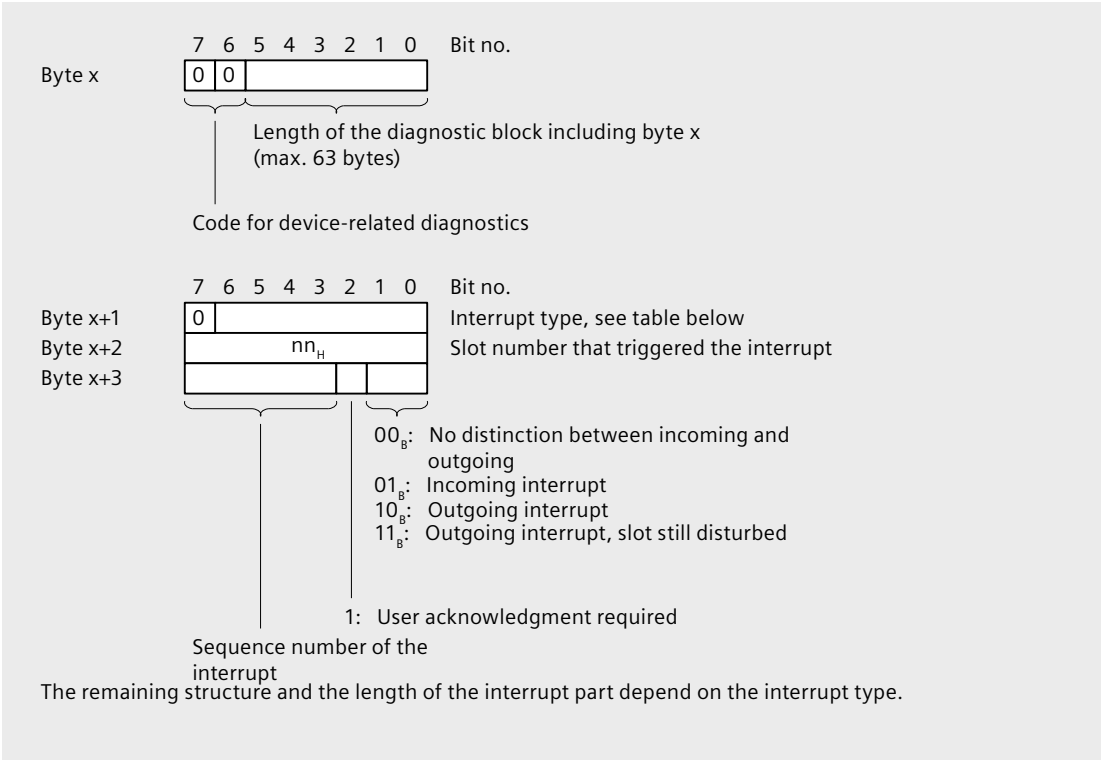


Figure 11-15 Structure of the interrupt header on the DP master in "DPV1" mode.

The start address x is equal to 168 in redundancy mode and equal to 160 in DP standard master mode.

Interrupt type

Table 11-15 Interrupt type (bytes x+1 in the interrupt section)

Byte x+1	Interrupt type	Byte x+1	Interrupt type
00_H	Reserved	05_H	Status interrupt *
01_H	Diagnostic interrupt	06_H	Update interrupt *
02_H	Hardware interrupt *	07_H to $1F_H$	Reserved
03_H	Removal interrupt	20_H to $7E_H$	Manufacturer-specific interrupt *
04_H	Insertion interrupt	$7F_H$	Reserved

* These interrupt types only occur if they are generated by a lower-level DPV1 slave and passed on by the PROFIBUS DP interface module (interrupt routing, see below).

Diagnostic interrupt

If a DPV0 slave or a non-interrupt capable DPV1 slave reports diagnostic information on the lower-level master system, the PROFIBUS DP interface module triggers a diagnostic interrupt on the higher-level DP master system ("proxy diagnostic interrupt").

The diagnostics frame of the slave is stored in the additional interrupt information. If this frame is longer than 59 bytes, the information starting from the 60th byte is discarded. In addition to this, bit 7.(Ext_Diag_Overflow) is set in the third forwarded byte (byte x+6).

The diagnostics of an interrupt-capable DPV1 slave operated in DPV1 mode does not cause a diagnostic interrupt.

Removal / insertion interrupt

After failure or return of a slave on the lower-level master system, the PROFIBUS DP interface module triggers a removal or insertion interrupt on the higher-level DP master system.

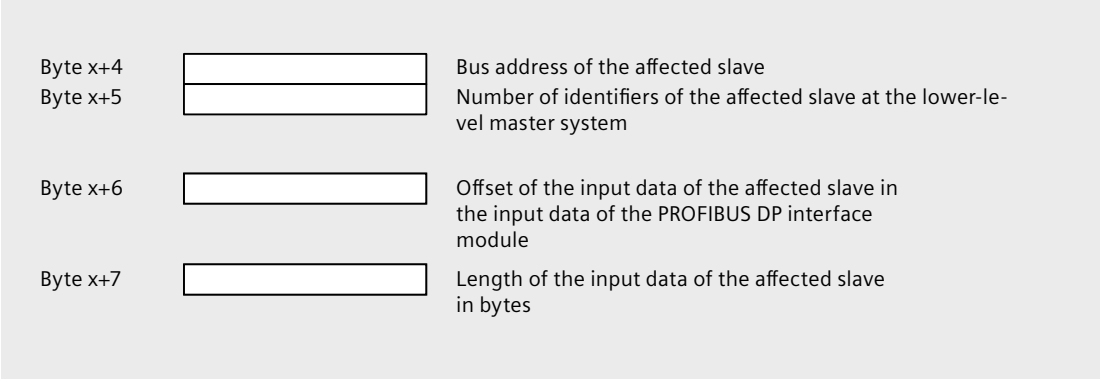


Figure 11-16 Structure of the additional interrupt information for removal / insertion interrupt

The start address x is equal to 168 in redundancy mode and equal to 160 in DP standard master mode.

In the case of modular slaves the additional interrupt information relates to the entire slave and not to the individual modules.

Removal / insertion interrupts are only reported after the startup delay has expired. Removal interrupts that occurred up to then are then added, insertion interrupts are discarded.

Interrupt routing

If an interrupt-capable DPV1 slave triggers an interrupt on the lower-level master system, this is passed on by the PROFIBUS DP interface module to the higher-level DP master system.

Interrupt header and additional interrupt information of the slave are stored in the interrupt section of the PROFIBUS DP interface module. With the exception of slot numbers and sequence numbers, this information remains unchanged.

11.2.4 Example of a diagnosis in redundant mode

Introduction

This example shows the call of typical diagnostics of the active PROFIBUS DP interface module in redundancy mode.

11.2.4.1 Example

Assumption

The following assumptions apply to the example:

- Both PROFIBUS DP interface modules have the same diagnostic address $3FE_H$.
- The lower-level PROFIBUS master system consists of 4 configured slaves
- Slaves have the addresses: 4, 8, 12 and 20
- Structure of the slaves:
  - Slave 4 is a non-modular slave
  - Slave 8 consists of a head module and 6 modules
  - Slave 12 consists of a head module and 2 modules
  - Slave 20 consists of a head module and 3 modules
- All configured slaves are exchanging data with the active PROFIBUS DP interface module.
- Slave 8 reports diagnostic information:
  - Modules 1 and 3 report diagnostic information
  - Module 1 reports a limit violation
  - Module 3 reports an incorrect configuration

11.2.4.2 Reading the diagnostics in the user program

Call of SFC 13

In OB 1, you call SFC 13 (DPNRM_DG) and read the diagnostic data from the PROFUBUS DP interface module.

Table 11-16 Call of SFC 13 (DPNRM_DG) in OB 1

STL

```
CALL SFC 13                              // Request for reading the diagnostic data
 REQ :=TRUE                             // Diagnostic address of the PROFUBUS DP interface
module
 LADDR :=W#16#3FE                        // RET_VAL of SFC 13
 RET_VAL :=MW0                           // Data mailbox for diagnostics in DB 10
 RECORD :=P#DB10.DBX 0.0 BYTE 190        // Read operation runs over several OB 1 cycles
 BUSY :=M2.0
```

With this call, the diagnostic data is stored in DB 10.

Appearance of DB 10

Create the following structure for DB 10:

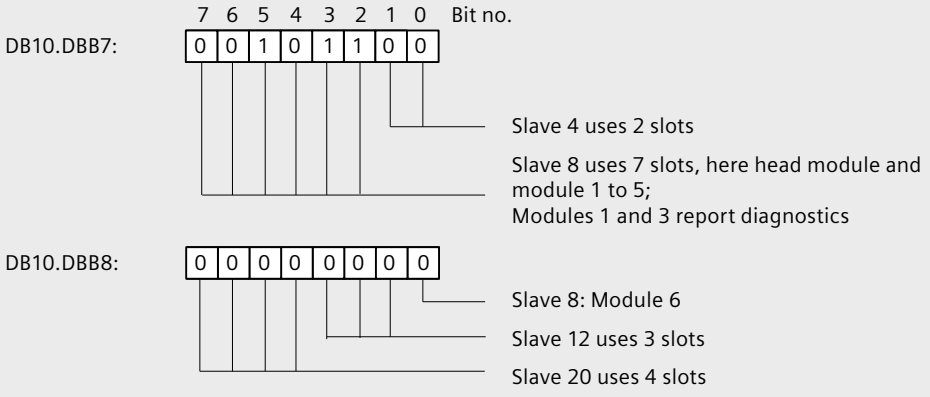
Address	Name	Type	Start value	Comment
0.0		STRUCT		
+0.0	Norm_Diag	ARRAY[1..6]		Standard diagnostics
*1.0		BYTE		
+6.0	Kenn_Diag	ARRAY[1..31]		Identifier-related diagnostics
*1.0		BYTE		
+38.0	Modul_Diag	ARRAY[1..63]		Module status
*1.0		BYTE		
+102.0	Status_Message	ARRAY[1..60]		Status message
*1.0		BYTE		
+162.0	H_Status	ARRAY[1..8]		H-status
*1.0		BYTE		
+170.0	Interrupt section	ARRAY[1..20]		Interrupts
*1.0		BYTE		
=190.0		END_STRUCT		

11.2.4.3 Evaluating the diagnostics data

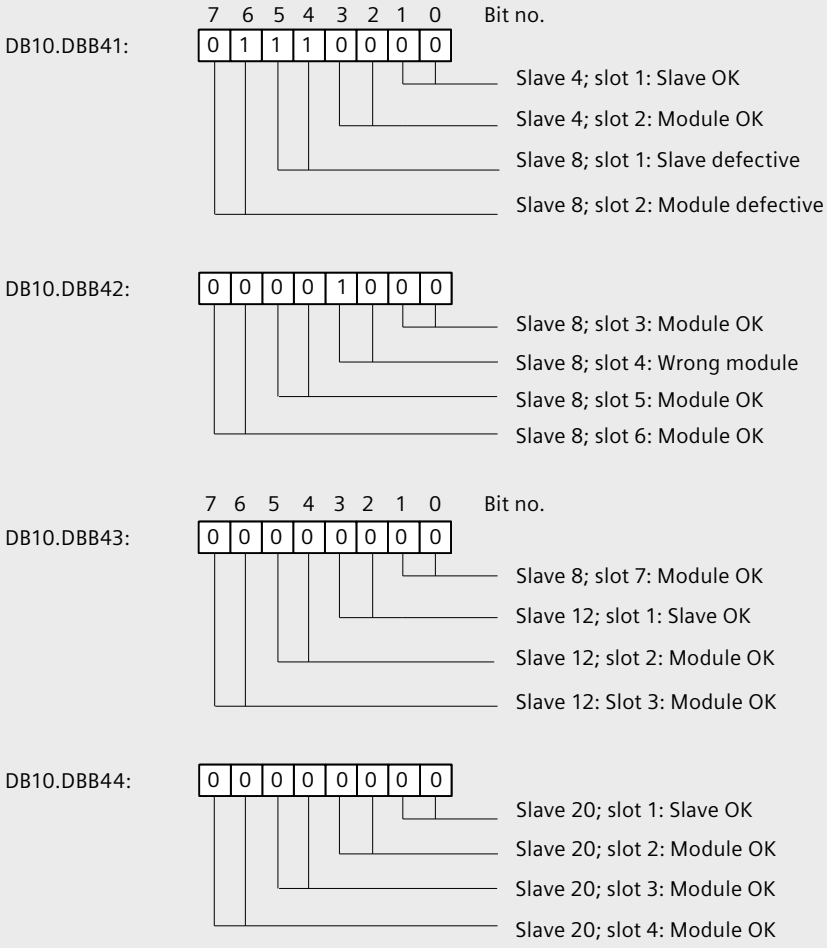
Diagnostic data in DB 10

The relevant diagnostic data in DB 10 has the following meaning:

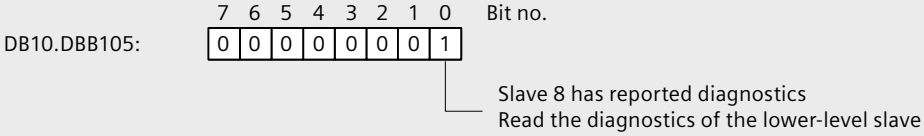
Identifier-related diagnostics (overview of the slots of the slaves with diagnostics)



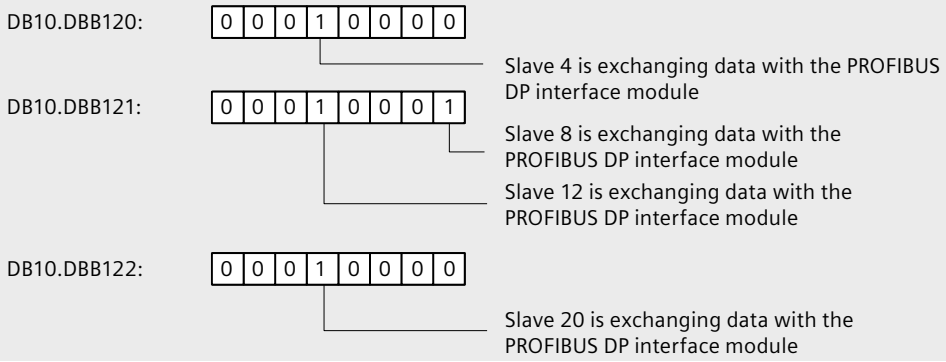
What is the status of the configured slots (modules)?



Which slaves report diagnostics?



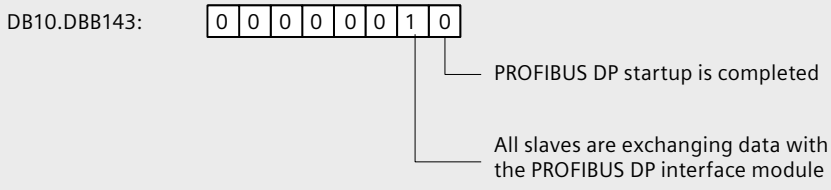
Which configured slaves are exchanging data with the DP master?



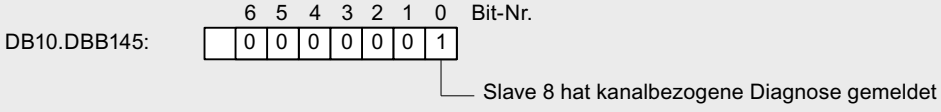
What is the status of the DP master?

DB10.DBB136:	1 0 0 0 0 0 0 0	PROFIBUS DP interface module (DP master) is in RUN (OPERATE)
DB10.DBB137:	1 0 0 0 0 0 1 0	Identifier for configured order number 82 BCD
DB10.DBB138:	0 0 0 0 0 0 0 0	Reserved
DB10.DBB139:	0 0 0 0 0 0 0 0	Reserved
DB10.DBB140:	0 0 0 0 0 0 0 0	Reserved
DB10.DBB141:	0 0 1 1 0 0 0 0	Hardware version of the PROFIBUS DP interface module
DB10.DBB142:	0 1 0 0 0 0 0 0	Firmware version of the PROFIBUS DP interface module

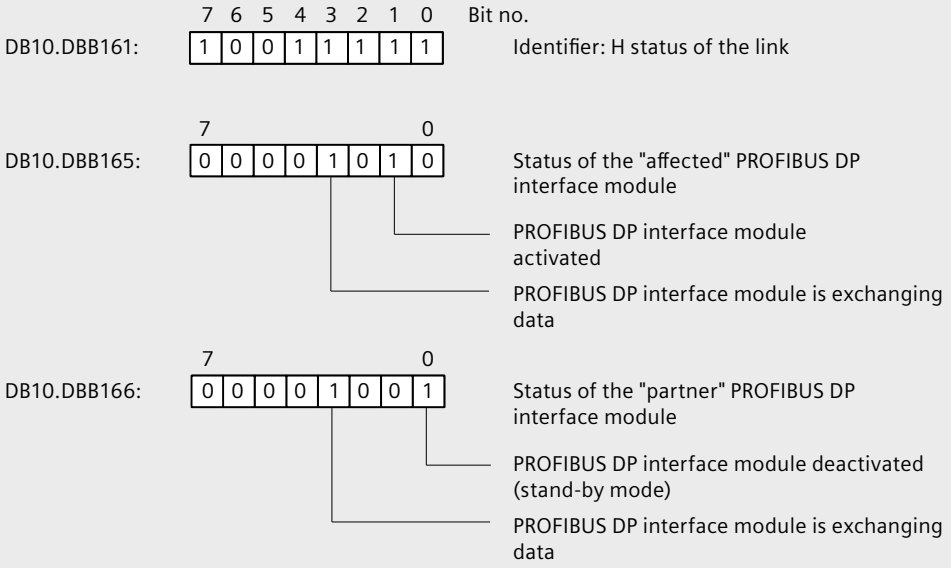
What is the status of the lower-level DP master system?



Welche Slaves melden kanalbezogene Diagnose?



What is the status of the two PROFIBUS DP interface modules?



The SIMATIC H-station always reads only the active PROFIBUS DP interface module. Hence a change of active channel does not affect the H-status.

11.3 S7 system diagnostics a DP/PA coupler FDC 157-0

11.3.1 Structure of slave diagnostics

Structure of slave diagnostics

The figure below shows the structure of the slave diagnostics.

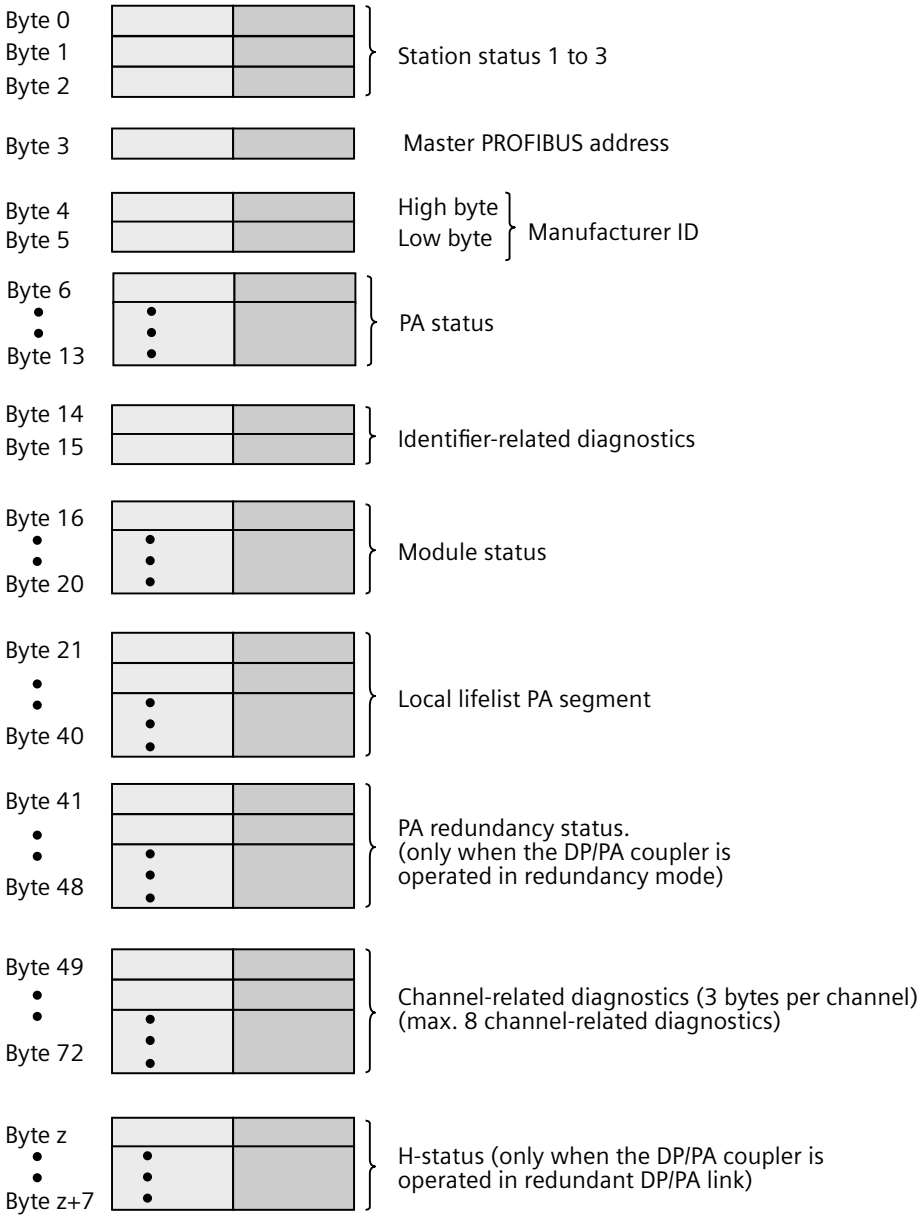


Figure 11-17 Structure of slave diagnostics

Rule

When using the GSD file for configuration, you can disable or enable the following diagnostics:

- Module status; default setting: Enable
- Channel-related diagnostics; default setting: Enable
- Local lifelist PA segment; default: Disable

If you disable the diagnostics, they are removed from the diagnostics frame.

11.3.2 Structure of the diagnostic blocks

11.3.2.1 Station statuses 1 to 3

Definition

The stations status 1 to 3 provides an overview of the status of a DP slave.

Station Status 1

Table 11-17 Structure of station status 1 (Byte 0)

Bit	Meaning	Cause / Remedy
0	1: The DP slave cannot be addressed by the DP master. The bit on the DP slave is always set to "0".	• Is the correct PROFIBUS address set on the DP slave? • Are the bus connectors connected? • Voltage at DP slave? • RS-485 repeater set correctly? • Has there been a RESET on the DP slave (off/on)?
1	1: The DP slave is not yet ready to exchange data.	• Wait for the DP slave to complete its startup.
2	1: The configuration data sent to the DP slave from the DP master does not match the configuration of the DP slave.	The DP slave is O.K., but the configuration does not match the current configuration of the DP slave. Compare the preset and actual configurations. Note: If the last slot is not used, install the slot cover. The cover is available in the bus termination module.

Bit	Meaning	Cause / Remedy
3	1: External diagnosis available.	Evaluate the channel-related diagnostic information, the module status and/or the channel-related diagnostic information. As soon as all errors have been eliminated, bit 3 will be reset. The bit is set again when there is a new diagnostic message in the bytes of the aforementioned diagnostics.
4	1: The DP slave does not supports the requested function (for example, changing the PROFIBUS address using the software).	Check the configuration.
5	1: The DP master cannot interpret the response from the DP slave.	Check the bus configuration.
6	1: Faulty DP parameter assignment message (wrong slave type, parameter).	Correct the preset and actual configurations.
7	1: The DP slave has not been parameterized by the DP master that currently has access to the DP slave.	The bit is always set to 1, for example, if you access the DP slave with the programming device or another DP master. The "master PROFIBUS address" diagnostic byte contains the PROFIBUS address of the DP master that assigned parameters to the DP slave.

Station Status 2

Table 11-18 Structure of station status 2 (Byte 1)

Bit	Meaning
0	1: The DP slave must be assigned new parameters.
1	1: There is a diagnostic message. The DP slave freezes its functions until the fault has been corrected (static diagnostic message).
2	1: The bit is always set to "1" at the DP slave.
3	1: Response monitoring is enabled for this DP slave.
4	1: The DP slave has received the "FREEZE" control command.
5	1: The DP slave has received a "SYNC" control command.*
6	0: The bit is always set to "0."
7	1: The bit is always set to "0." Note: When reading the station status from the DP master, the bit is 1 if the DP slave was deactivated in the DP master, i.e. it was isolated from the current process.

Station Status 3

Table 11-19 Structure of station status 3 (Byte 2)

Bit	Meaning
0 to 6	0: Bits are always set to "0."
7	1: There are more channel-related diagnostic messages than can be shown in the diagnostics frame

11.3.2.2 Master PROFIBUS address

Master PROFIBUS address

The diagnostic byte master PROFIBUS address contains the PROFIBUS address of the DP master:

- Assigned parameters to the DP slave and
- has read / write access to the DP slave

The master PROFIBUS address is in byte 3 of the slave diagnostic information.

11.3.2.3 Manufacturer ID

Definition

The manufacturer ID contains a code that describes the DP slave type.

Manufacturer ID

Byte 4	Byte 5	Description
81_H	31_H	DP/PA coupler with diagnostics function

11.3.2.4 PA status

Setup of the PA status

The PA status for the DP/PA coupler is setup as follows:

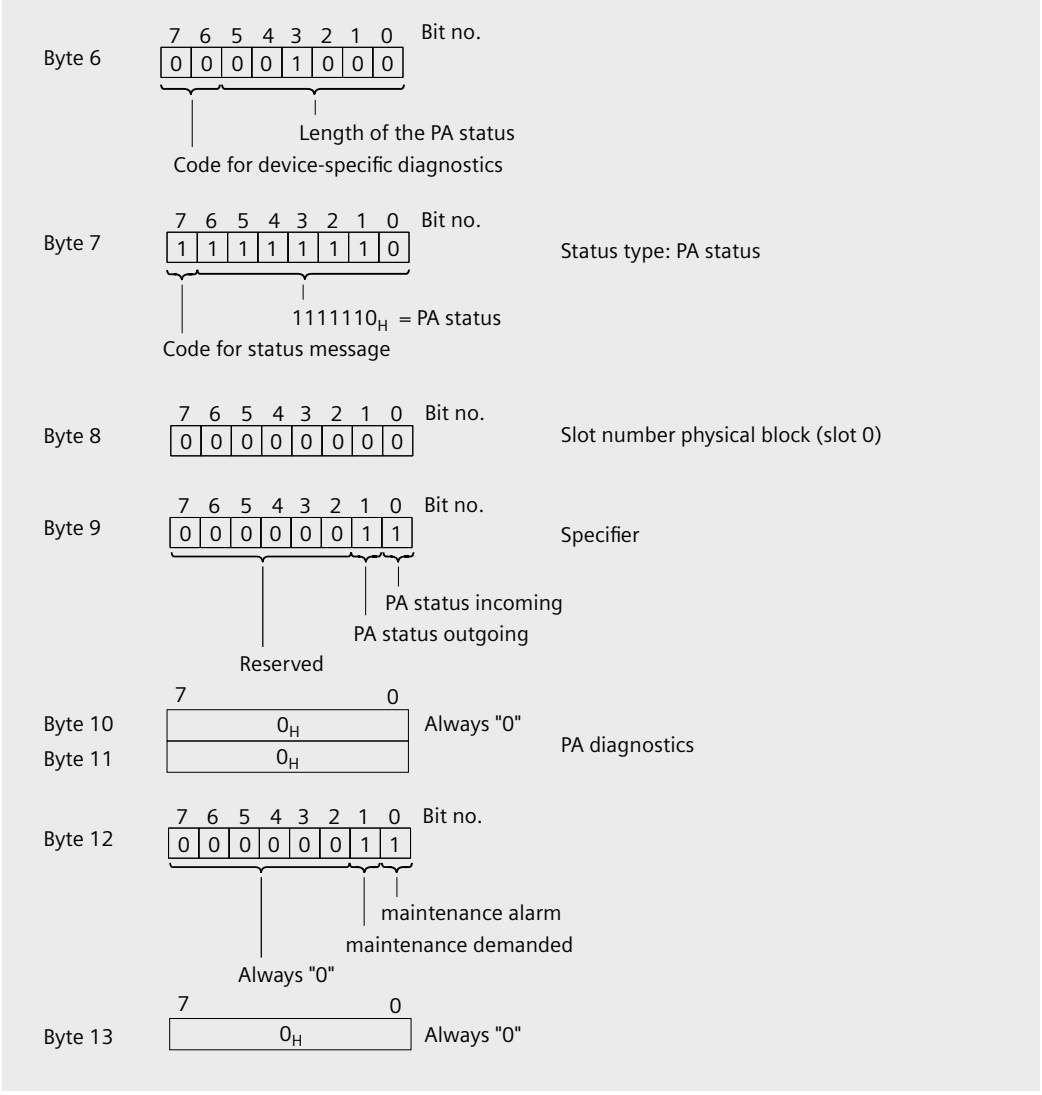


Figure 11-18 Setup of the PA status

Note

Maintenance alarm / maintenance demanded

The "maintenance alarm" or "maintenance demanded" bits are set according to the IEEE status byte.

11.3.2.5 Identifier-related diagnostics

Definition

The identifier-related diagnostics states whether the DP/PA coupler reports an error or not. Identifier-related diagnostics starts at byte 6 and is 2 bytes long.

Structure of the identifier-related diagnostics

The identifier-related diagnostics for the DP/PA coupler is structured as follows:

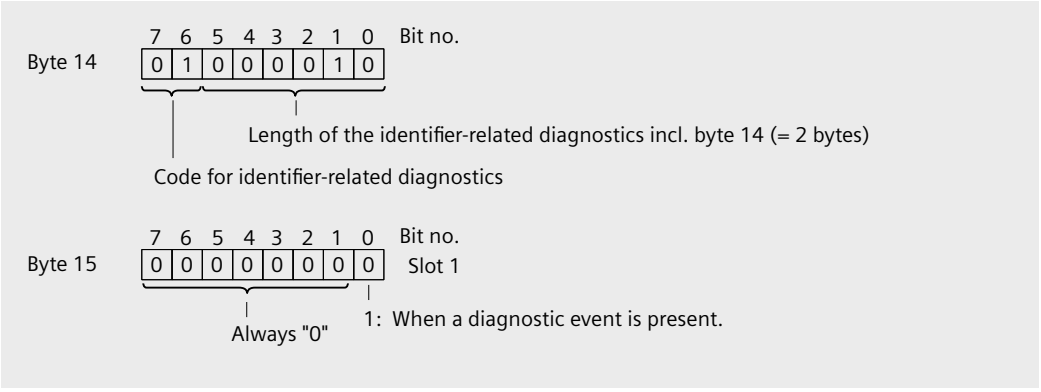


Figure 11-19 Structure of the identifier-related diagnostics

11.3.2.6 Module status

Definition

The module status indicates the status of the configured modules and expands on the module diagnosis as regards the configuration. The module status starts after the identifier-related diagnostic data and consists of 5 bytes.

Structure of the module status

The module status for the DP/PA coupler is setup as follows:

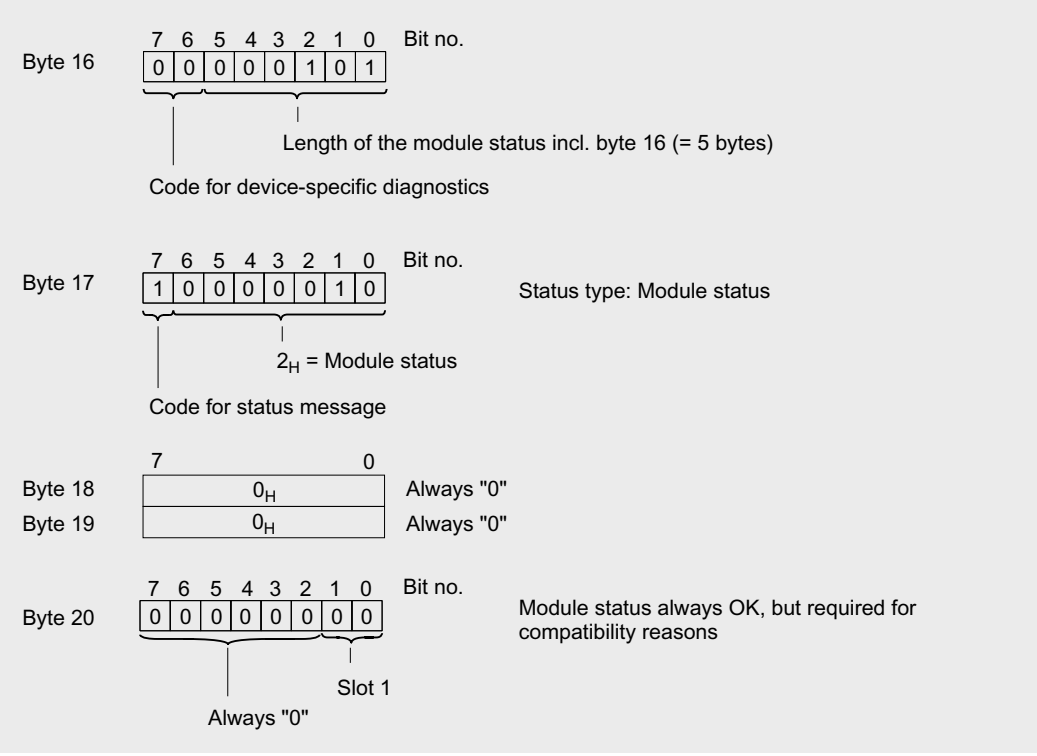


Figure 11-20 Structure of the module status

Rule

Note

Operation of the DP/PA coupler in the DP/PA link

To obtain the complete diagnostic information via the DP/PA link, you must enable the module status in the configuration when operating the DP/PA coupler in the DP/PA link.

11.3.2.7 Local LifeList

Definition

The local lifelist shows the status of the configured PA field devices on the PA segment. The local lifelist starts after the module status and consists of 20 bytes.

Structure of the local lifelist

The local lifelist of the DP/PA coupler is structured as follows:

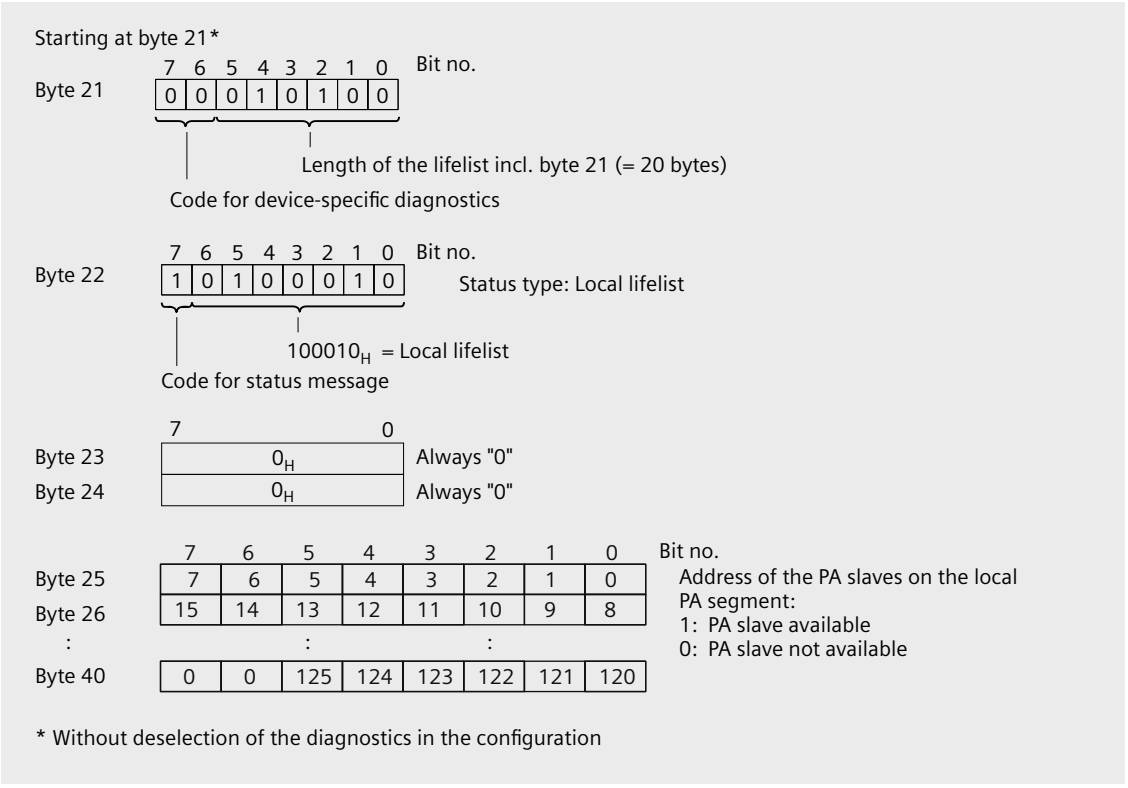


Figure 11-21 Structure of the local lifelist

Reading the local lifelist

The local lifelist is disabled in the default setting of the configuration. To read it out, you must enable the "Local Lifelist PA Line" parameter for the PA segment.

You can read the local lifelist via data record 50 of the DP/PA coupler.

See also

Structure of slave diagnostics (Page 221)

Reading the local LifeList (Page 179)

Data records (Page 184)

11.3.2.8 PA redundancy status

Definition

The PA redundancy status represents the status of the configured DP/PA couplers. A prerequisite is the use of bus module BM FDC/FDC (redundant). The PA redundancy status consists of 8 bytes.

Structure of the PA redundancy status

The PA redundancy status for DP/PA couplers is structured as follows:

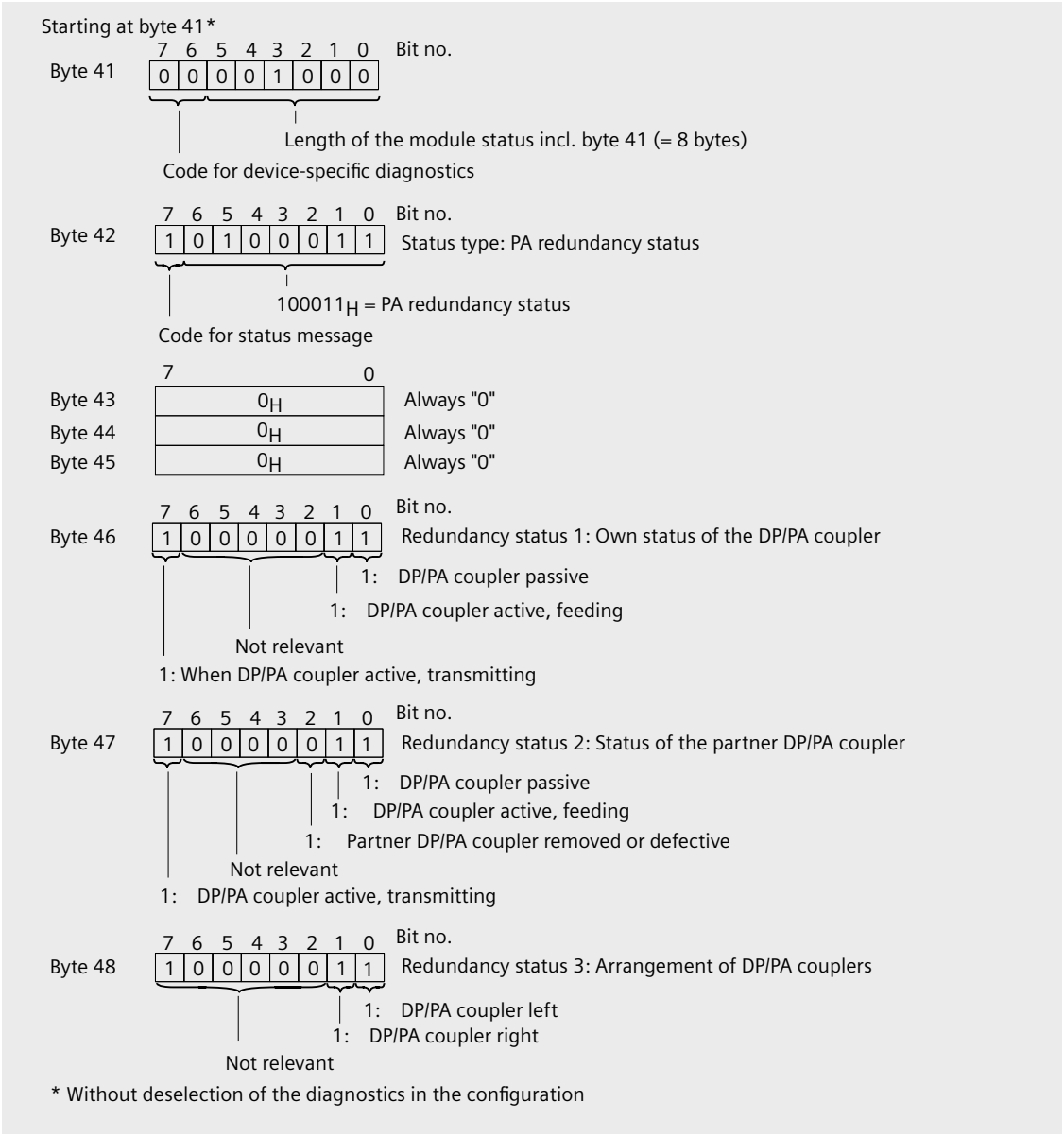


Figure 11-22 Structure of the PA redundancy status

Reading out the PA redundancy status with data record 61

The PA redundancy status can also be read out with SIMATIC PDM. If DP/PA couplers are not being used redundantly, the bytes redundancy status 1 to 3 are thereby "0".

11.3.2.9 Channel-related diagnostics

Definition

Channel-related diagnostics provides information about channel faults in modules. It represents the details of the identifier-related diagnostics. For each channel-related diagnostics, 3 bytes are added according to the IEC 61784 1:2002 Ed1 CP 3/1 standard.

The channel-related diagnostics do not affect the module status.

Structure of the channel-related diagnostics

The number of channel-related diagnostics is limited to 8. All channel diagnostics are reported via slot 1 with ID number 0.

Note

Messages that relate to PA redundancy, e.g. "Partner DP/PA coupler removed or defective", are reported via the PA redundancy status.

The channel-related diagnostics for the DP/PA coupler is structured as follows:

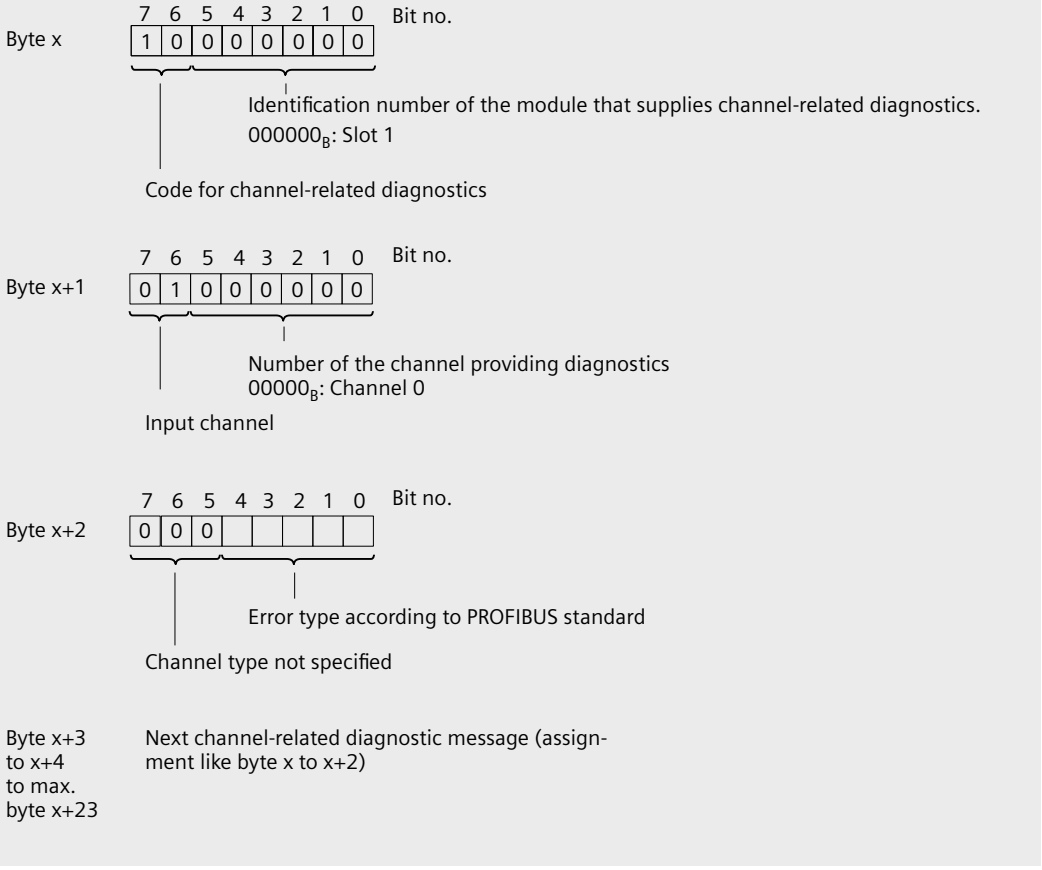


Figure 11-23 Structure of the channel-related diagnostics

DP/PA coupler FDC 157-0 error types

Table 11-20 DP/PA coupler FDC 157-0 error types

Error type		Error text	Meaning	Remedy
00001_B	1_D	Short-circuit	PA segment short-circuited	• Eliminate the error on the PA segment. • Check the process wiring.
00110_B	6_D	Wire break	PA segment interrupted	Eliminate the error on the PA segment.
01001_B	9_D	Coupler defective	-	Replace the DP/PA coupler.
10000_B	16_D	Parameter assignment error	Configured redundancy mode and redundancy mode set at the DP/PA coupler do not match.	Check the configured redundancy mode or the redundancy mode set at the DP/PA coupler.
10001_B	17_D	Process voltage missing.	• 24 V supply voltage on PS power supply is missing or too low. • Power Supply PS is faulty. • Partner coupler feeds logic.	• Check the supply voltage on the Power Supply PS. • Check the process wiring.
11000_B	24_D	PA redundancy error	• Wire break or short-circuit between two active field distributors. • Failure of a DP/PA coupler.	• Check the process wiring between the active field distributors. • Check the DP/PA coupler.
11010_B	26_D	External error	DP/PA couplers in redundancy mode: The redundancy modes of the DP/PA coupler pair do not match.	• Check the set redundancy mode at the DP/PA coupler. • Check the redundancy mode in the configuration.
11011_B	27_D	Signal level poor (default setting: disabled)	Warning that the signal level on the PA segment is in the limit range.	Check the cable length of the PA segment and the process wiring.

See also

PA redundancy status (Page 228)

Diagnostic record 62 (Page 186)

Data records (Page 184)

11.3.2.10 H status

H-status (only for redundant DP/PA link)

The H-status enables trouble-free operation on the PA segment, even at a changeover on the higher-level PROFIBUS DP segment. It is irrelevant for the user.

Technical specifications

12

12.1 General technical data

What are general technical specifications?

The technical specifications contain:

- The standards and test values that observe and fulfil the described components.
- The test criteria used to test the described components.

12.1.1 Standards and Approvals

The components described in the manual meet the following standards and approvals.

Exceptions:

- DP/PA coupler Ex [ia] Deviations from the standards and approvals listed here can be found in the corresponding sections.
- Active field distributors: The valid standards and approvals can be found in the corresponding sections.

Note

Currently valid approvals can be found on the nameplate of the relevant module.

CE approval

CE

The components described meet the requirements and protection goals of the following EC directives and comply with the harmonized European Standards (EN) published for programmable logic controllers in the official gazettes of the European Union:

- 2014/30/EU
- 2014/34/EU

The EC Declarations of Conformity are available to the relevant authorities at the following address:

Siemens AG
D-76181 Karlsruhe

https://support.industry.siemens.com (https://support.industry.siemens.com)

ATEX approval



II 3 G Ex ec II T4/T5/T6 Gc

DEKRA 14ATEX0026 X

according to

- EN IEC 60079-0
  Explosive atmospheres - Part 0: Equipment - General requirements
- EN 60079-7
  Explosive atmospheres – Part 7: Equipment protection by increased safety "e"

⚠ WARNING

Personal injury and property damage may occur.

In hazardous areas, personal injury and property damage may occur if plug connections are disconnected during operation.

In hazardous areas, always de-energize all components before disconnecting plug connections.

IECEx approval

Ex ec II T4/T5/T6 Gc

IECEx DEK 14.0082X

according to

- IEC 60079-0 Explosive atmospheres - Part 0: Equipment - General requirements
- IEC 60079-7 Explosive atmospheres - Part 7: Equipment protection by increased safety "e"

UKCA approval

UK CA

DEKRA 21UKEX0019 X

Importer UK:

Siemens plc

Manchester M20 2UR

CCC approval



Certificate: 2020322310002912

- Ex nA IIC T4/T5/T6 Gc

According to the following standards:

- GB 3836.1 (Explosive atmospheres - Part 1: Equipment - General requirements)
- GB 3836.8 (Explosive atmospheres - Part 8: Equipment protection by type of protection "n")

UL / CSA approval



Underwriters Laboratories Inc. in accordance with

Ordinary locations

- UL 508 (Industrial Control Equipment)
- CSA C22.2 No. 142 (Process Control Equipment)

Hazardous locations

- UL 1604 or ANSI/ISA-12.12.01
- CSA C22.2 No. 213

APPROVED for use in
Class I, Division 2, Group A, B, C, D Tx;
Class I, Zone 2, Group IIC Tx

FM approval



Factory Mutual Research (FM) in accordance with

Approval Standard Class Number 3611, 3600, 3810 (ANSI/ISA 82.02.01)

Approved for use in Class I, Division 2, Group A, B, C, D Tx;

Class I, Zone 2, Group IIC Tx

Approval for Australia and New Zealand



The components described meet the requirements of the AS/NZS CISPR 16 standard.

IEC 61131

The described components meet the requirements and criteria of the IEC 61131-2 standard (Industrial-process measurement and control - Programmable controllers - Part 2: Equipment requirements and tests).

PROFIBUS standard

The described components are based on the IEC 61158 Type 3.

PROFIBUS PA

The DP/PA couplers meet the requirements and criteria of the PROFIBUS PA guideline.

Use in industry

SIMATIC products are designed for industrial applications.

Table 12-1 Use in industry

Area of application	Requirements for	
	Interference emission	**Interference immunity**
Industry	EN 61000-6-4:2007 + A1:2011	EN 61000-6-2: 2005

Use in residential areas

When operating any of the components mentioned above in residential areas, you must ensure that RF interference emission does not exceed Limit Class B to EN 61000-6-3.

Suitable measures for achieving RF interference Limit Class B include, for example:

- Installation of grounded switching cabinets / switchboxes
- Use of noise filters in the supply lines

12.1.2 Standards and approvals of the BM IM/IM bus module

The BM IM/IM bus module complies with the following standards and approvals:

CCC approval

Certificate: 2020312304000839

REFNO. CNCA-C23-01:2019

The product(s) is verified and certified according to
CNCA-C23-01: 2019 *China Compulsory Certification Implementation Rule on Explosion Protected Electrical Product*
and
CNEX-C2301-2019 *Guideline of China Compulsory Certification Implementation Rule on Explosion Protected Electrical Product.*

- Ex nA IIC T4/T5/T6 Gc

According to the following standards:

- GB 3836.1 (Explosive atmospheres - Part 1: Equipment - General requirements)
- GB 3836.8 (Explosive atmospheres - Part 8: Equipment protection by type of protection "n")

12.1.3 Standards and approvals of the BM IM/IM Outdoor bus module

The BM IM/IM bus module complies with the following standards and approvals:

CCC approval

Certificate:

- 2020312304000916 (CCC-CNEX)
- 2020312304000838 (CCC-CNEX)
- 2020312304000839 (CCC-CNEX)

The product(s) is verified and certified according to
CNCA-C23-01: 2019 *China Compulsory Certification Implementation Rule on Explosion Protected Electrical Product*
and
CNEX-C2301-2019 *Guideline of China Compulsory Certification Implementation Rule on Explosion Protected Electrical Product.*

- Ex nA IIC T4/T5/T6 Gc

According to the following standards:

- GB 3836.1 (Explosive atmospheres - Part 1: Equipment - General requirements)
- GB 3836.8 (Explosive atmospheres - Part 8: Equipment protection by type of protection "n")

CCC approval (NEPSI)

Certificate: 2020322310003111

The product(s) is verified and certified according to
'CNCA-C23-01: 2019 *China Compulsory Certification Implementation Rule on Explosion Protected Electrical Product*
and
CNEX-C2301-2019 *Guideline of China Compulsory Certification Implementation Rule on Explosion Protected Electrical Product.*

- Ex nA IIC T4/T5/T6 Ge

According to the following standards:

- GB 3836.1 (Explosive atmospheres - Part 1: Equipment - General requirements)
- GB 3836.8 (Explosive atmospheres - Part 8: Equipment protection by type of protection "n")

12.1.4 Standards and approvals of the DP/PA coupler Ex

The DP/PA coupler Ex [ia] complies with the following standards and approvals:

CE approval

The components described meet the requirements and protection goals of the following EC directives and comply with the harmonized European Standards (EN) published for programmable logic controllers in the official gazettes of the European Union:

- 2014/30/EU
- 2014/34/EU

The EC Declarations of Conformity are available to the relevant authorities at the following address:

Siemens AG

D-76181 Karlsruhe

https://support.industry.siemens.com (https://support.industry.siemens.com)

ATEX approval





II 3 G (1) G Ex ec [ia Ga] IIC T4 Gc
II 3 G (1) D Ex ec [ia IIIC Da] IIC T4 Gc

KEMA 03ATEX1416 X

according to

- EN IEC 60079-0
  Explosive atmospheres - Part 0: Equipment - General requirements
- EN 60079-7
  Explosive atmospheres – Part 7: Equipment protection by increased safety "e"
- EN 60079-11
  Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"

WARNING
Injury to persons may result. In hazardous areas, personal injury and property damage may occur if plug connections are disconnected during operation. In hazardous areas, always de-energize all components before disconnecting plug connections.

UKCA approval



DEKRA 21UKEX0104 X

Importer UK:

Siemens plc

Manchester M20 2UR

CCC approval (Ex NEPSI)



Certificate: 2020322310003151

- Ex nA [ia Ga] IIC T4 Gc
- Ex nA [iaD] IIC T4 Gc

According to the following standards:

- GB 3836.1 (Explosive atmospheres - Part 1: Equipment - General requirements)
- GB 3836.4 (Explosive atmospheres - Part 4: Equipment protection by intrinsic safety "i")
- GB 3836.8 (Explosive atmospheres - Part 8: Equipment protection by type of protection "n")
- GB 12476.1 (Electrical apparatus for use in the presence of combustible dust - Part 1: General requirements)
- GB 12476.4 (Electrical apparatus for use in the presence of combustible dust - Part 4: Protection by intrinsic safety "iD")

Approval for the Eurasian Customs Union

EAC (Eurasian Conformity)

Customs Union of Russia, Belarus and Kazakhstan

Declaration of conformity with the technical requirements of the Customs Union (TR CU).

CERTIFICATE RU C-DE.МЮ62.B.03830
Series RU No.: 03998226

UL / CSA approval

HAZ. LOC.

Underwriters Laboratories Inc. in accordance with

Ordinary locations

- UL 508 (Industrial Control Equipment)
- CAN/CSA C22.2 No. 14 (Process Control Equipment)

Hazardous locations

- UL 1604, Third Edition
- UL 913, Fifth Edition
- UL 60079-0, UL 60079-11, UL 60079-15
- CAN/CSA C22.2 No. 213
- CAN/CSA C22.2 No. 157
- E60079-0, E60079-11, E60079-15

APPROVED for use in
Class I, Division 2, Group A, B, C, D T4
Class I, Zone 1, Group IIC
AIS Class I, Division 1, Group A, B, C, D
AIS Class II, Division 1, Group E, F, G
AIS Class III, Division 1
[AEx ib/ia] IIC, Class I, Zone 0, 1, 2, Group IIC

FM approval



Factory Mutual Research (FM) in accordance with

Approval Standard Class Numbers 3600, 3610, 3611, 3810

Class I, Division 2, Group A, B, C, D T4
Class I, Zone 1, Group IIC
AIS Class I, Division 1, Group A, B, C, D
AIS Class II, Division 1, Group E, F, G
AIS Class III, Division 1
[AEx ib/ia] IIC, Class I, Zone 0, 1, 2, Group IIC

12.1.5 Standards and approvals of active field distributor AFDiSD

CE approval



The components described meet the requirements and protection goals of the following EC directives and comply with the harmonized European Standards (EN) published for programmable logic controllers in the Official Journals of the European Union:

- 2014/30/EU
- 2014/34/EU

The EC Declarations of Conformity are available to the relevant authorities at the following address:

Siemens AG
D-76181 Karlsruhe

https://support.industry.siemens.com (https://support.industry.siemens.com)

ATEX approval



II 2 G (1) G Ex eb ib mb [ia IIC Ga] IIC T4 Gb
II 2 G (1) D Ex eb ib mb [ia IIIC Da] IIC T4 Gb



II 3 G (1) G Ex ec ic mc [ia IIC Ga] IIC T4 Gc
II 3 G (1) D Ex ec ic mc [ia IIIC Da] IIC T4 Gc

II 2 D Ex tb IIIC T80 °C Db

Ta = - 40 °C ... + 70 °C
DEKRA 14ATEX0044 X

⚠ WARNING
Personal injury and material damage can occur.
In hazardous areas, personal injury and property damage may occur if plug connections are disconnected during operation.
In hazardous areas, always de-energize all components before disconnecting plug connections.

IECEx approval

IECEx DEK 14.0008

UKCA approval

DEKRA 21UKEX0102 X

Importer UK:

Siemens plc

Manchester M20 2UR

INMETRO approval

UL-BR 15.0858X

Korea approval

KC registration number: KCC-REM-S49-DPPA

Note that this device complies with Class A limits for emission of radio frequency interference. This device can be used in all areas, except residential areas.

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정 외의 지역에서 사용하는 것을 목적으로 합니다.

Approval for the Eurasian Customs Union

EAC (Eurasian Conformity)

Customs Union of Russia, Belarus and Kazakhstan

Declaration of conformity with the technical requirements of the Customs Union (TR CU).

CERTIFICATE RU C-DE.МЮ62.B.03830
Series RU No.: 03998226

CCC approval (NEPSI)

Certificate: 2020322310003045

- Ex e ib mb [ia Ga] IIC T4 Gb, Ex e ib mb [iaD] IIC T4 Gb
- Ex nA ie [ia Ga] IIC T4 Ge, Ex nA ic [iaD] IIC T4 Ge
- Ex tD A21 IP66 T80 "C

According to the following standards:

- GB 3836.1 (Explosive atmospheres - Part 1: Equipment - General requirements)
- GB 3836.3 (Explosive atmospheres - Part 3: Equipment protection by increased safety e)
- GB 3836.4 (Explosive atmospheres - Part 4: Equipment protection by intrinsic safety "i")
- GB 3836.8 (Explosive atmospheres - Part 8: Equipment protection by type of protection "n")
- GB 3836.9 (Electrical apparatus for explosive gas atmospheres - Part 9: Encapsulation "m")
- GB 12476.1 (Electrical apparatus for use in the presence of combustible dust - Part 1: General requirements)
- GB 12476.4 (Electrical apparatus for use in the presence of combustible dust - Part 4: Protection by intrinsic safety "iD")
- GB 12476.5 (Electrical apparatus for use in the presence of combustible dust - Part 5: Protection by enclosures "tD")

Use in industry

SIMATIC products are designed for industrial applications.

Table 12-2 Use in industry

Area of application	Noise emission requirements	Noise immunity requirements
Industry	EN 61000-6-4: 2007 + A1:2011	EN 61000-6-2: 2005

12.1.6 Standards and approvals of AFD4 and AFD8 active field distributors

CE approval

The components described meet the requirements and protection goals of the following EC directives and comply with the harmonized European Standards (EN) published for programmable logic controllers in the official gazettes of the European Union:

- 2014/30/EU
- 2014/34/EU

The EC Declarations of Conformity are available to the relevant authorities at the following address:

Siemens AG
D-76181 Karlsruhe

https://support.industry.siemens.com (https://support.industry.siemens.com)

ATEX approval

Device	Certificate
AFD4 / AFD8	II 3G Ex ec ic [ic] IIC T4 Gc II 3D Ex tc [ic] IIIC T80°C Dc IP66

DEKRA 12ATEX0222 X

Ta = -40 °C...+70 °C

according to

- EN IEC 60079-0
  Explosive atmospheres - Part 0: Equipment - General requirements
- EN 60079-7
  Explosive atmospheres – Part 7: Equipment protection by increased safety "e"
- AFD4 and AFD8 only:
  EN 60079-11
  Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"
- EN 60079-31
  Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure "t"

WARNING

Personal injury and property damage may occur.

In hazardous areas, personal injury and property damage may occur if plug connections are disconnected during operation.

In hazardous areas, always de-energize all components before disconnecting plug connections.

The exceptions are described in the section Safety information for connecting the AFD4 / AFD4 (FM) / AFD4 Railmount / AFD8 (Page 75).

IECEx approval

IECEx DEK 12.0069X

UKCA approval

DEKRA 21UKEX0021 X

Importer UK:

Siemens plc

Manchester M20 2UR

CCC approval

Certificate: 2020322310003116

- Ex nA ic [ic] IIC T4 Ge

According to the following standards:

- GB 3836.1 (Explosive atmospheres - Part 1: Equipment - General requirements)
- GB 3836.4 (Explosive atmospheres - Part 4: Equipment protection by intrinsic safety "i")
- GB 3836.8 (Explosive atmospheres - Part 8: Equipment protection by type of protection "n")
- GB 12476.1 (Electrical apparatus for use in the presence of combustible dust - Part 1: General requirements)
- GB 12476.4 (Electrical apparatus for use in the presence of combustible dust - Part 4: Protection by intrinsic safety "iD")
- GB 12476.5 (Electrical apparatus for use in the presence of combustible dust - Part 5: Protection by enclosures "tD")

Approval for the Eurasian Customs Union

EAC (Eurasian Conformity)

Customs Union of Russia, Belarus and Kazakhstan

Declaration of conformity with the technical requirements of the Customs Union (TR CU).

CERTIFICATE RU C-DE.МЮ62.B.03830
Series RU No.: 03998226

INMETRO approval

UL-BR 13.0746X

Korea approval

KC registration number: KCC-REM-S49-DPPA

Note that this device complies with Class A limits for emission of radio frequency interference. This device can be used in all areas, except residential areas.

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정 외의 지역에서 사용하는 것을 목적으로 합니다.

Approval for Australia and New Zealand

The AFD4 and AFD8 active field distributors meet the requirements of the standards IEC 61000-6-2, IEC 61000-6-4.

Use in industry

SIMATIC products are designed for industrial applications.

Table 12-3 Use in industry

Area of application	Requirements for	
	Interference emission	Interference immunity
Industry	EN 61000-6-4: 2007+ A1:2011	EN 61000-6-2: 2005

12.1.7 Standards and approvals of the AFD4 (FM) active field distributor

FM approval



Factory Mutual Research (FM) in accordance with

- Approval Standard Class Number 3611, 3600, 3810
- ANSI/ISA 82.02.01 (IEC 61010-1)
- CSA C22.2 No. 213
- CSA 22.2 No. 1010.1

APPROVED for use in

Class I, II, III Division 2, Groups A, B, C, D, E, F, G T4;
Class I, Zone 2, Group IIC T4; Zone 22, AEx tc; IIIC T 80 °C
IP 66 Type 4X

Installation notes

1. The AFD4 (FM) (Article number = 6ES7655-5DX40-1AA1) is only suitable for installation in DIV. 2 / Zone 2 locations, and is not suitable for installation in DIV. 1 / Zone 1 or Zone 0 hazardous (classified) locations.
2. AFD4 (FM) and all other approved devices in the fieldbus system must be installed in accordance with the manufacturer's instructions.
3. Replace blank out panels (caps) by UL or CSA approved lead-throughs for connection of more field devices. Customer has to use a gland and cable "listed for the application" based on the NEC and CEC. Installations shall comply with the relevant requirements of the National Electrical Code® (ANSI/NFPA-70 (NEC®), where applicable.
4. WARNING FOR APPLICATIONS IN DIV. 2 / ZONE 2 (CLASSIFIED) LOCATIONS: EXPLOSION HAZARD. EXCEPT FOR SPUR LINES (FIELD DEVICES), DO NOT CONNECT OR DISCONNECT ANY TRUNK LINE UNLESS THE AREA IS KNOWN TO BE NONHAZARDOUS.

See also

https://support.industry.siemens.com (https://support.industry.siemens.com)

12.1.8 Standards and approvals for AFD4 Railmount active field distributors

CE approval

The described components meet the requirements and protection goals of the following EC directives and comply with the harmonized European Standards (EN), published for programmable logic controllers in the official gazettes of the European Union:

The EC Declarations of Conformity are available to the relevant authorities at the following address:

Siemens AG
D-76181 Karlsruhe

https://support.industry.siemens.com (https://support.industry.siemens.com)

ATEX approval

II 3G Ex eC ic [ic] IIC T4 Gc
DEKRA 12ATEX0222 X

Ta = -40 °C...+70 °C

according to

- EN IEC 60079-0
  Explosive atmospheres - Part 0: Equipment - General requirements
- EN 60079-7
  Explosive atmospheres – Part 7: Equipment protection by increased safety "e"
- EN 60079-11
  Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"
- EN 60079-31
  Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure "t"

WARNING

Personal injury and property damage may occur.

In hazardous areas, personal injury and property damage may occur if plug connections are disconnected during operation.

In hazardous areas, always de-energize all components before disconnecting plug connections.

The exceptions are described in the section Safety information for connecting (Page 75).

IECEx approval

IECEx DEK 12.0069X

UKCA approval

DEKRA 21UKEX0021 X

Importer UK:

Siemens plc

Manchester M20 2UR

CCC approval

Certificate: 2020322310003116

- Ex nA ic [ic] IIC T4 Ge

According to the following standards:

- GB 3836.1 (Explosive atmospheres - Part 1: Equipment - General requirements)
- GB 3836.4 (Explosive atmospheres - Part 4: Equipment protection by intrinsic safety "i")
- GB 3836.8 (Explosive atmospheres - Part 8: Equipment protection by type of protection "n")
- GB 12476.1 (Electrical apparatus for use in the presence of combustible dust - Part 1: General requirements)
- GB 12476.4 (Electrical apparatus for use in the presence of combustible dust - Part 4: Protection by intrinsic safety "iD")
- GB 12476.5 (Electrical apparatus for use in the presence of combustible dust - Part 5: Protection by enclosures "tD")

Approval for the Eurasian Customs Union

EAC (Eurasian Conformity)

Customs Union of Russia, Belarus and Kazakhstan

Declaration of conformity with the technical requirements of the Customs Union (TR CU).

CERTIFICATE RU C-DE.МЮ62.B.03830
Series RU No.: 03998226

INMETRO approval

UL-BR 13.0746X

KCC - Korea approval

KC registration number: KCC-REM-S49-DPPA

Note that this device complies with Class A limits for emission of radio frequency interference. This device can be used in all areas, except residential areas.

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정 외의 지역에서 사용하는 것을 목적으로 합니다.

Approval for Australia and New Zealand

The AFD4 Railmount active field distributor meets the requirements of IEC 61000-6-2, IEC 61000-6-4.

FM approval

Approval Standard Class Number 3611, 3600, 3810 ANSI/ISA 82.02.01 (IEC 61010-1)
CSA C22.2 No. 213; CSA 22.2 No. 1010.1
APPROVED for use in
Class I, Division 2, Groups A, B, C, D, T4;
Class I, Zone 2, Group IIC T4

Use as bus node

CAUTION

Equipment category and zone

The AFD4 Railmount active field distributor with the above approvals can be used as a bus node in equipment category 3G in Zone 2 hazardous areas.

Only intrinsically safe electrical field devices of equipment category 3G for Zone 2 may be connected to the spur lines S1 to S4.

Use in industry

SIMATIC products are designed for industrial applications.

Table 12-4 Use in industry

Area of application	Requirements for	
	Interference emission	Interference immunity
Industry	EN 61000-6-4: 2007+ A1:2011	EN 61000-6-2: 2005

12.1.9 Use in zone 2 potentially explosive areas

Refer to the product information:*Use of subassemblies / modules in a zone 2 Hazardous Area*.

The product information is available for download from the Internet (http://support.automation.siemens.com/WW/view/en/19692172).

12.1.10 Electromagnetic compatibility

Introduction

This chapter provides you with information on the immunity to interference of the described components as well as on radio interference suppression.

The described components meet, among others, the requirements of the EMC legislation of the European single market.

Definition: EMC

Electromagnetic compatibility (EMC) is the capacity of an electrical installation to function satisfactorily in its electromagnetic environment without affecting that environment.

Pulse-shaped Interference

The table below shows the electromagnetic compatibility of the described components with regard to pulse-shaped interference. The prerequisite for this is that the system complies with the relevant requirements and guidelines relating to electrical equipment.

Table 12-5 Pulse-shaped Interference

Pulse-shaped disturbance	Tested at	Corresponds to severity
Electrostatic discharge according to IEC 61000-4-2	8 kV 6 kV	3 (air discharge) 3 (contact discharge)
Burst impulses (fast transient interference) according to IEC 61000-4-4	2 KV (power supply lines) 2 kV (signal cable)	3
High-energy current surge according to IEC 61000-4-5 External protective circuitry required (Refer to Instruction Manual SIMATIC S7-300 CPU 31xC and CPU 31x: Installation (http://support.automation.siemens.com/WW/view/en/36305386), chapter *Lightning and surge voltage protection*) No external protective element is required for the PA bus.		
• Asymmetric interference	2 kV (supply line) 2 kV (signal cable/data line)	3
• Symmetric interference	1 kV (supply line) 1 kV (signal line / data line)	

Sinusoidal disturbance

EMC performance of the described components in relation to sinusoidal disturbance variables:

- RF radiation to IEC 61000-4-3
  Electromagnetic RF field, amplitude modulated
  - 80 MHz to 1000 MHz / 1.4 GHz to 2 GHz
  - 10 V/m
  - Modulated with 80% AM (1 kHz)
- RF coupling to IEC 61000-4-6
  - 0.15 to 80 MHz
  - Amplitude of unmodulated carrier: 10 V_{eff}
  - Modulated with 80% AM (1 kHz)
  - 150 Ω source impedance

Emission of Radio Interferences

Noise emission of electromagnetic fields according to EN 61000-6-4: limit value class A, group 1

from 30 to 230 MHz	< 40 dB (µV/m)Q
from 230 to 1000 MHz	< 47 dB (µV/m)Q
measured at a distance of 10 m	

Noise emission via supply lines in accordance with EN 61000-6-4: limit value class A, group 1

from 0.15 to 0.5 MHz	< 79 dB (µV)Q < 66 dB (µV) M
from 0.5 to 5 MHz	< 73 dB (µV)Q < 60 dB (µV) M
from 5 to 30 MHz	< 73 dB (µV)Q < 60 dB (µV) M

12.1.11 Shipping and storage conditions

Transport and Storage of Modules

With regard to their transport and storage conditions, the described components exceed the requirements according to IEC 61131, Part 2. The following specifications apply to modules transported and stored in the original packaging.

Table 12-6 Transport and storage conditions

Type of condition	Permitted range
Free fall (in transport packaging)	≤ 0.3 m
Temperature	from -40 °C to + 70 °C
Atmospheric pressure	from 1080 to 660 hPa (corresponds to an altitude of -1000 to 3500 m)
Relative humidity	of 10 to 95 %, without condensation
Sinusoidal vibrations according to IEC 60068-2-6	5 to 9 Hz: 3.5 mm 9 to 150 Hz: 9.8 m/s^2
Shock according to IEC 60068-2-29	250 m/s^2, 6 ms, 1000 shocks

12.1.12 Mechanical and climatic ambient conditions for operation

Conditions of use

The described components are designed for use in a fixed, sheltered location. The operating conditions exceed the requirements of IEC 61131 Part 2.

The described components meet the conditions of application of the climate class 3K22 according to EN IEC 60721-3-3.

In the associated die-cast aluminum enclosure, the devices meet the chemical resistance of class C3 according to ISO 9223.

Use with additional measures

Additional measures for the described components are required:

- At locations with a high degree of ionizing radiation
- In difficult operating conditions, caused for example, by:
  - Accumulation of dust (does not apply to devices in the associated die-cast aluminum enclosure)
  - Corrosive vapors or gases
  - Strong electric or magnetic fields
- In installations requiring special monitoring, for example:
  - Elevators
  - Electrical plants in potentially hazardous areas

An additional measure can be installation in a cabinet or in an enclosure, for instance.

Mechanical environmental conditions

The mechanical ambient conditions for the described components are specified in the table below for sinusoidal vibrations.

Table 12-7 Mechanical environmental conditions

Frequency range in Hz	Continuous	Infrequently
10 ≤ f ≤ 58	0.0375 mm amplitude	0.075 mm amplitude
58 ≤ f ≤ 150	0.5*g* constant acceleration	1*g* constant acceleration

Reduction of vibrations

If the described components are subject to big shocks or vibrations appropriate measures must be taken to reduce the acceleration or the amplitude.

We recommend fixing the described components on damping materials, for example on rubber-metal anti-vibration mountings.

Checking mechanical ambient conditions

The following table provides information on the type and scope of checks regarding mechanical ambient conditions.

Table 12-8 Checking Mechanical Environmental Conditions

Checking for	Test standard	Comments
Vibrations	Vibration test in compliance with IEC 60068 Part 2-6 Part (sine)	Type of vibration: Frequency sweeps with a sweep rate of 1 octave/ minute. 5 Hz ≤ f ≤ 9 Hz, constant amplitude 3.5 mm 9 Hz ≤ f ≤ 150 Hz, constant acceleration 1*g* Period of oscillation: 10 frequency sweeps per axis in each of the 3 axis which are vertical to each other.
Shock	Shock test in accordance with IEC 60068 Part 2-29	Type of shock: half-sine Strength of shock: 15*g* peak value, 11 ms duration Shock direction: 3 shocks each in +/- direction in each of the 3 axes that are vertical to each other

Climatic environmental conditions

The described components can be used in the following climatic ambient conditions:

Table 12-9 Temperature: Horizontal mounting Vertical mounting

Permissible range	Comments	Article number
• From 0 °C to 60 °C (horizontal mounting position) • From 0 °C to 40 °C (vertical mounting position)	IM 153-2 OD [1)]	6ES7153-2BA70-0XB0
	Y-coupler	6ES7197-1LB00-0XA0
	Bus module BM IM/IM	6ES7195-7HD10-0XA0
	Bus module BM Y-coupler	6ES7654-7HY00-0XA0
• From -25 °C to 60 °C (horizontal mounting position) • From -25 °C to 40 °C (vertical mounting position)	IM 153-2 OD	6ES7153-2BA70-0XB0
	DP/PA coupler FDC157-0	6ES7157-0AC85-0XA0
	DP/PA coupler Ex [ia]	6ES7157-0AD82-0XA0
	Bus module BM IM/IM	6ES7195-7HD80-0XA0
	Bus module BM FDC	6ES7195-7HF80-0XA0
	Bus module BM FDC/FDC (redundant)	6ES7195-7HG80-0XA0

1) The temperature range applies to the combination of components.

Table 12-10 Temperature: Any type of installation

Permissible range	Comments	Article number
• From -25 °C to 70 °C	• Active field distributor AFD4 • Active field distributor AFD4 Railmount • Active field distributor AFD8	
• From -40 °C to 70 °C	• Active field distributor AFD4 Railmount • Active field distributor AFD4 FM • Active field distributor AFD4 • Active field distributor AFD8 • Active field distributor AFDiSD	

Table 12-11 Relative humidity

Permissible range	Comments [1)]	Article number
From 10 % to 95 %	With condensation: • Active field distributor AFD4 FM • Active field distributor AFD4 • Active field distributor AFD8 • Active field distributor AFDiSD	

1) Without condensation, corresponds to relative humidity (RH) pollution degree 2 according to IEC 61131 Part 2

Table 12-12 Atmospheric pressure

Permissible range	Comments	Article number
from 1080 to 795 MHz	corresponds to a height of -1000 to 2000 m	

Table 12-13 Contaminant concentration

Permissible range	Comments	Article number
• SO_2: < 0.5 ppm; • RH < 60 %, no condensation • H_2S: < 0.1 ppm; • RH < 60 %, no condensation	• Test: 10 ppm; 4 days • Test: 1 ppm; 4 days	

12.1.13 Specifications for insulation tests, protection class and degree of protection

Test voltages

The insulation stability is tested with the following voltages during product testing:

Table 12-14 Test voltages

Circuits with a rated voltage of U_e relative to other circuits or ground	Test voltage
0 V < U_e ≤ 50 V	DC 600 V, 1 s

Protection class

Protection class I in compliance with IEC 61140; this means that a grounding terminal to the rail is required!

Protection against foreign bodies and water

Degree of protection IP 20 according to IEC 60529; that is protection against contact with standard probes.

There is no protection from penetration by water.

12.1.14 Rated voltage

Rated voltage for operation

The described components work with a rated voltage of 24 V DC.
The tolerance range extends from 20.4 V DC to 28.8 V DC.

Exception: active field distributors AFD4 / AFD4 (FM) / AFD4 Railmount / AFD8 / AFDiSD:

The active field distributors operate from a nominal voltage of 16 V DC.
The tolerance range extends from 16 to 32 V DC.

12.2 Technical specifications PROFIBUS DP interface module IM 153-2OD (6ES7153-2BA70-0XB0)

Technical specifications IM 153-2 (6ES7153-2BA70-0XB0)

Article number	6ES7153-2BA70-0XB0
General information	
Product type designation	IM 153-2 OD
Firmware version	V6.1
Vendor identification (VendorID)	801Eh
Supply voltage	
Rated value (DC)	24 V
permissible range, lower limit (DC)	20.4 V
permissible range, upper limit (DC)	28.8 V
external protection for power supply lines (recommendation)	2,5 A
Mains buffering	
• Mains/voltage failure stored energy time	5 ms
Input current	
Current consumption, max.	650 mA
Inrush current, typ.	3 A
I^2t	0.1 $A^2 \cdot s$
Output current	
for backplane bus (5 V DC), max.	1.5 A
Power loss	
Power loss, typ.	5.5 W
Address area	
Addressing volume	
• Inputs	244 byte
• Outputs	244 byte
Hardware configuration	
Number of modules per DP slave interface, max.	12
Time stamping	
Accuracy	1 ms; 1 ms at up to 8 modules; 10 ms at up to 12 modules
Number of message buffers	15
Messages per message buffer	20
Number of stampable digital inputs, max.	128; Max. 128 signals/station; max. 32 signals/slot
Time format	RFC 1119
Time resolution	0.466 ns
Time interval for transmitting the message buffer if a message is present	1 000 ms
Time stamp on signal change	rising / falling edge as signal entering or exiting
Interfaces	
Transmission procedure	RS 485

Article number	6ES7153-2BA70-0XB0
Transmission rate, max.	12 Mbit/s
1. Interface	
automatic detection of transmission rate	Yes
Interface types	
• Output current of the interface, max.	70 mA
• Design of the connection	9-pin sub D socket
PROFIBUS DP slave	
• GSD file	SI05801E.GSG
• automatic baud rate search	Yes
Protocols	
Bus protocol/transmission protocol	PROFIBUS DP to EN 50170
PROFIBUS DP	
• Number of node addresses, max.	1 to 125 permitted
Services	
– SYNC capability	Yes
– FREEZE capability	Yes
– Direct data exchange (slave-to-slave communication)	Yes; as publisher with all IO, as subscriber with F-IO only
Potential separation	
Potential separation exists	Yes
Isolation	
Isolation tested with	Isolation voltage 500 V
Degree and class of protection	
IP degree of protection	IP20
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-25 °C
• horizontal installation, max.	60 °C
• vertical installation, min.	-25 °C
• vertical installation, max.	40 °C
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	3 000 m
Configuration	
Configuration software	
• STEP 7	Yes; STEP 7 / COM PROFIBUS / non-Siemens tools via GSD file
Dimensions	
Width	40 mm
Height	125 mm
Depth	117 mm
Weights	
Weight, approx.	360 g

12.3 Technical specifications DP/PA coupler FDC 157 (6ES7157-0AC85-0XA0)

Technical specifications FDC 157 (6ES7157-0AC85-0XA0)

Article number	6ES7157-0AC85-0XA0
General information	
Product description	Field Device Coupler for PROFIBUS PA and Foundation Fieldbus
Supply voltage	
Rated value (DC)	24 V
permissible range, lower limit (DC)	20.4 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Overvoltage protection	Yes
Mains buffering	
• Mains/voltage failure stored energy time	5 ms
Input current	
Current consumption, max.	2.3 A; At 24 V DC
Power loss	
Power loss, typ.	13.4 W
Interfaces	
PROFIBUS DP	
• Transmission rate, max.	45.45 kbit/s
• Design of electrical connection	9-pin sub D
PROFIBUS PA	
• Transmission rate, max.	31.25 kbit/s
• Number of connectable PA field devices	31
• Current output to PA field devices, max.	1 A
Protocols	
PROFIBUS DP	Yes
PROFIBUS PA	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes; Group error (red)
Alarms	Yes
Diagnostics function	Yes
Diagnostics indication LED	
• Bus activity DP (yellow)	Yes
• Bus activity PA (yellow)	Yes
• Bus fault BF (red)	Yes
• Group error SF (red)	Yes
• Monitoring 24 V voltage supply ON (green)	Yes
Potential separation	

Article number	6ES7157-0AC85-0XA0
between backplane bus and all other circuit components	Yes
between PROFIBUS DP and all other circuit components	Yes
between PROFIBUS PA and all other circuit components	Yes
between supply and all other circuits	Yes
Isolation	
Isolation tested with	600 V DC
Degree and class of protection	
IP degree of protection	IP20
Ambient conditions	
Ambient temperature during operation	
• min.	-25 °C
• max.	60 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	70 °C
Relative humidity	
• Operation, max.	95 %
Dimensions	
Width	80 mm
Height	125 mm
Depth	130 mm
Weights	
Weight, approx.	550 g

12.4 Technical specifications DP/PA coupler Ex [ia] (6ES7157-0AD82-0XA0)

Technical specifications of the DP/PA coupler Ex [ia]

Article number	6ES7157-0AD82-0XA0
General information	
Product description	FDC157 Ex [ia]
Supply voltage	
Rated value (DC)	24 V
permissible range, lower limit (DC)	20.4 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes
Mains buffering	
• Mains/voltage failure stored energy time	5 ms
Input current	
Current consumption, max.	400 mA
Power loss	
Power loss, typ.	7 W
Interfaces	
PROFIBUS DP	
• Transmission rate, max.	45.45 kbit/s
• Design of electrical connection	9-pin sub D
PROFIBUS PA	
• Transmission rate, max.	31.25 kbit/s
• Number of connectable PA field devices	31
• Current output to PA field devices, max.	110 mA
Protocols	
PROFIBUS DP	Yes
PROFIBUS PA	Yes
Interrupts/diagnostics/status information	
Status indicator	No
Diagnostics function	Yes
Diagnostics indication LED	
• Bus activity DP (yellow)	Yes
• Bus activity PA (yellow)	Yes
• Monitoring 24 V voltage supply ON (green)	Yes
Ex(i) characteristics	
maximum values for connecting terminals for gas group IIC	
• Uo (no-load voltage), max.	15 V
• Io (short-circuit current), max.	247 mA
• Po (power output), max.	1.95 W

Article number	6ES7157-0AD82-0XA0
• Um (voltage at non-intrinsically safe connecting terminals), max.	250 V; AC
Potential separation	
between PROFIBUS DP and all other circuit components	Yes
between PROFIBUS PA and all other circuit components	Yes
Isolation	
Isolation tested with	500 V AC
Degree and class of protection	
IP degree of protection	IP20
Ambient conditions	
Ambient temperature during operation	
• min.	-25 °C
• max.	60 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	70 °C
Relative humidity	
• Operation, max.	95 %
Dimensions	
Width	80 mm
Height	125 mm
Depth	130 mm
Weights	
Weight, approx.	550 g

12.5 Technical specifications Y coupler (6ES7197-1LB00-0XA0)

Technical specifications of the Y-coupler

Article number	6ES7197-1LB00-0XA0
Supply voltage	
Design of the power supply	via bus module
permissible range, lower limit (DC)	20.4 V
permissible range, upper limit (DC)	28.8 V
Input current	
Current consumption, max.	300 mA
Power loss	
Power loss, typ.	1 W
Interfaces	
PROFIBUS DP	
Properties of the lower-level DP master system	
– Transmission rate, max.	12 Mbit/s; 45.45 kbit/s to 12 Mbit/s
– Termination of lower-level DP master system	active terminating resistor (Bus Terminator)
– Use of OLM/OBT	Yes
– Use of RS 485 repeaters, max.	9
– Number of DP slaves, max.	31; 64 when using RS 485 repeaters or OLM/OBT
Requirements for DP master system	
– Length of parameter assignment telegram	244 byte
Protocols	
PROFIBUS DP	Yes
AS-Interface	No
Interrupts/diagnostics/status information	
Status indicator	No
Alarms	No
Diagnostics function	Yes
Potential separation	
to lower-level DP master system	Yes
Degree and class of protection	
IP degree of protection	IP20
Dimensions	
Width	40 mm
Height	125 mm
Depth	130 mm
Weights	
Weight, approx.	200 g

12.6 Technical specifications of active field distributor AFDiSD (6ES7655-5DX60-1BB0)

Technical specifications of the AFDiSD

Article number	6ES7655-5DX60-1BB0
General information	
Product function	
• Repeater function	Yes
Supply voltage	
Design of the power supply	via fieldbus
permissible range, lower limit (DC)	16 V
permissible range, upper limit (DC)	32 V
Reverse polarity protection	Yes; only in conjunction with FDC 157
Overvoltage protection	Yes; only in conjunction with FDC 157
Input current	
Current consumption, max.	400 mA; at 20 V input voltage
Current consumption in the case of short-circuit at all spur lines	100 mA; at 24 V input voltage
Power loss	
Power loss, typ.	1.4 W; minimum - typ. specification not possible because load-dependent
Power loss, max.	5.9 W
Interfaces	
PROFIBUS PA	
• Transmission rate, max.	31.25 kbit/s
• Number of connectable PA field devices	6
• Current output to PA field devices, max.	260 mA; max. 180 mA total current of all field devices for operation in the permissible operating voltage range from 16 V to 32 V
• permissible current per spur line	40 mA; first spur line 60 mA
Protocols	
PROFIBUS DP	No
PROFIBUS PA	Yes
AS-Interface	No
FOUNDATION Fieldbus H1	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	No
Diagnostics function	Yes
Diagnostics indication LED	
• Main line status	Yes
• Main line failure	Yes
• Spur line status/fault	Yes
• automatic bus termination	Yes

Article number	**6ES7655-5DX60-1BB0**
Potential separation	
between main line and spur lines	Yes
Isolation	
Isolation tested with	2 550 V DC
Degree and class of protection	
IP degree of protection	IP66
Standards, approvals, certificates	
Use in hazardous areas	
• ATEX Zone 1	Yes
• ATEX Zone 21	Yes
• ATEX Zone 2	Yes
• ATEX Zone 22	Yes
• FM Class I Zone 1	No
• FM Class I Zone 2, Division 2	No
Ambient conditions	
Ambient temperature during operation	
• min.	-40 °C
• max.	70 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	70 °C
Relative humidity	
• Operation, max.	95 %
connection method / header	
connection method / main cable / header	
• Number of main lines	2
• Design of terminals	Screw terminal block
• Type of connection (enclosure cable gland)	M20
• Type of cable	Type A
• Cable diameter, min.	6 mm
• Cable diameter, max.	13 mm
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• automatic bus termination	Yes
• permissible main line current	1 A
connection method / spur line / header	
• Number of spur lines	6
• Design of terminals	Screw terminal block
• Type of connection (enclosure cable gland)	M16
• Type of cable	Type A
• Cable diameter, min.	4 mm

Article number	6ES7655-5DX60-1BB0
• Cable diameter, max.	9 mm
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• total current output to field devices, max.	260 mA; max. 180 mA total current of all field devices for operation in the permissible operating voltage range from 16 V to 32 V
• Number of connectable field devices	6
• Current limitation per field device, max.	40 mA; 60 mA on S1
• No-load voltage, max.	15.3 V
• short-circuit proof	Yes
• Short-circuit current (test current); max.	6 mA
• intrinsically safe according to FISCO model	Yes
• Debounce logic	Yes
Dimensions	
Width	380 mm
Height	85 mm
Depth	170 mm
Weights	
Weight, approx.	4 500 g

See also

LED displays of the active field distributor AFDiSD (Page 196)

Active field distributor AFDiSD (Page 35)

12.7 Technical specifications of active field distributors AFD4 (6ES7157-0AG81-0XA0)

Technical specifications of AFD4

Article number	6ES7157-0AG81-0XA0
General information	
Product function	
• Repeater function	No
Supply voltage	
permissible range, lower limit (DC)	16 V
permissible range, upper limit (DC)	32 V
Reverse polarity protection	Yes; only in conjunction with FDC 157
Overvoltage protection	No
Input current	
Current consumption (in no-load operation), typ.	24 mA; 54 mA at the end of the cable
Current consumption, max.	264 mA
Power loss	
Power loss, typ.	384 mW
Power loss, max.	3.2 W
Interfaces	
PROFIBUS PA	
• Transmission rate, max.	31.25 kbit/s
• Number of connectable PA field devices	4
• Current output to PA field devices, max.	240 mA
• permissible current per spur line	60 mA
Protocols	
PROFIBUS DP	No
PROFIBUS PA	Yes
AS-Interface	No
FOUNDATION Fieldbus H1	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	No
Diagnostics function	Yes
Diagnostics indication LED	
• Main line status	Yes
• Main line failure	Yes
• Spur line status/fault	Yes
• automatic bus termination	Yes
Potential separation	
between main line and spur lines	No
Degree and class of protection	
IP degree of protection	IP66

Article number	6ES7157-0AG81-0XA0
Standards, approvals, certificates	
Use in hazardous areas	
• ATEX Zone 1	No
• ATEX Zone 21	No
• ATEX Zone 2	Yes
• ATEX Zone 22	Yes
• FM Class I Zone 1	No
• FM Class I Zone 2, Division 2	Yes
Ambient conditions	
Ambient temperature during operation	
• min.	-40 °C
• max.	70 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	85 °C
Relative humidity	
• Operation, max.	95 %
connection method / header	
connection method / main cable / header	
• Number of main lines	2
• Design of terminals	Screw terminal block
• Type of connection (enclosure cable gland)	M16
• Type of cable	Type A
• Cable diameter, min.	4 mm
• Cable diameter, max.	9 mm
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• automatic bus termination	Yes
• permissible main line current	1 A
connection method / spur line / header	
• Number of spur lines	4
• Design of terminals	Screw terminal block
• Type of connection (enclosure cable gland)	M16
• Type of cable	Type A
• Cable diameter, min.	4 mm
• Cable diameter, max.	9 mm
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• total current output to field devices, max.	240 mA
• Number of connectable field devices	4
• Current limitation per field device, max.	60 mA

Article number	**6ES7157-0AG81-0XA0**
• No-load voltage, max.	30 V
• Short-circuit current (test current); max.	6 mA
• intrinsically safe according to FISCO model	No
• Debounce logic	Yes
Dimensions	
Width	220 mm
Height	120 mm; without screw glands
Depth	83 mm
Weights	
Weight, approx.	2 000 g

12.8 Technical specifications for active field distributor AFD4 (FM) (6ES7655-5DX40-1AA1)

Technical specifications of the AFD4 (FM)

Article number	6ES7655-5DX40-1AA1
General information	
Product function	
• Repeater function	No
Supply voltage	
permissible range, lower limit (DC)	16 V
permissible range, upper limit (DC)	32 V
Input current	
Current consumption (in no-load operation), typ.	24 mA; 54 mA at the end of the cable
Power loss	
Power loss, typ.	384 mW
Power loss, max.	3.2 W
Interfaces	
PROFIBUS PA	
• Transmission rate, max.	31.25 kbit/s
• Number of connectable PA field devices	4
• Current output to PA field devices, max.	240 mA
• permissible current per spur line	60 mA
Protocols	
PROFIBUS DP	No
PROFIBUS PA	Yes
AS-Interface	No
FOUNDATION Fieldbus H1	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	No
Diagnostics function	Yes
Diagnostics indication LED	
• Main line status	Yes
• Spur line status/fault	Yes
• automatic bus termination	Yes
Potential separation	
between main line and spur lines	No
Degree and class of protection	
IP degree of protection	IP66
Standards, approvals, certificates	
Use in hazardous areas	
• ATEX Zone 1	No
• ATEX Zone 21	No

Article number	**6ES7655-5DX40-1AA1**
• ATEX Zone 2	Yes
• ATEX Zone 22	Yes
• FM Class I Zone 1	No
• FM Class I Zone 2, Division 2	Yes
Ambient conditions	
Ambient temperature during operation	
• min.	-40 °C
• max.	70 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	85 °C
connection method / header	
connection method / main cable / header	
• Number of main lines	2
• Design of terminals	Screw terminal block
• Type of connection (enclosure cable gland)	M20
• Type of cable	Type A
• Cable diameter, min.	6 mm
• Cable diameter, max.	13 mm
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• automatic bus termination	Yes
• permissible main line current	1 A
connection method / spur line / header	
• Number of spur lines	4
• Design of terminals	Screw terminal block
• Type of connection (enclosure cable gland)	M16
• Type of cable	Type A
• Cable diameter, min.	4 mm
• Cable diameter, max.	9 mm
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• total current output to field devices, max.	240 mA
• Number of connectable field devices	4
• Current limitation per field device, max.	60 mA
• No-load voltage, max.	30 V
• Short-circuit current (test current); max.	6 mA
• intrinsically safe according to FISCO model	No
• Debounce logic	Yes
Dimensions	
Width	220 mm

Article number	6ES7655-5DX40-1AA1
Height	120 mm
Depth	83 mm
Weights	
Weight, approx.	2 000 g

12.9 Technical specifications of active field distributor AFD4 Railmount (6ES7 655-5DX40-2AA0)

Technical specifications of the AFD4 Railmount

Article number	6ES7655-5DX40-2AA0
General information	
Product function	
• Repeater function	No
Supply voltage	
permissible range, lower limit (DC)	16 V
permissible range, upper limit (DC)	32 V
Input current	
Current consumption (in no-load operation), typ.	24 mA; 54 mA at the end of the cable
Power loss	
Power loss, typ.	384 mW
Power loss, max.	3.2 W
Interfaces	
PROFIBUS PA	
• Transmission rate, max.	31.25 kbit/s
• Number of connectable PA field devices	4
• Current output to PA field devices, max.	240 mA
• permissible current per spur line	60 mA
Protocols	
PROFIBUS PA	Yes
FOUNDATION Fieldbus H1	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	No
Diagnostics function	Yes
Diagnostics indication LED	
• Main line status	Yes
• Spur line status/fault	Yes
• automatic bus termination	Yes
Potential separation	
between main line and spur lines	No
Degree and class of protection	
IP degree of protection	IP20
Standards, approvals, certificates	
Use in hazardous areas	
• ATEX Zone 1	No
• ATEX Zone 21	No
• ATEX Zone 2	Yes
• ATEX Zone 22	Yes

Article number	6ES7655-5DX40-2AA0
• FM Class I Zone 1	No
• FM Class I Zone 2, Division 2	Yes
Ambient conditions	
Ambient temperature during operation	
• min.	-40 °C
• max.	70 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	70 °C
connection method / header	
connection method / main cable / header	
• Number of main lines	2
• Design of terminals	Screw terminal block
• Type of cable	Type A
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• automatic bus termination	Yes
• permissible main line current	1 A
connection method / spur line / header	
• Number of spur lines	4
• Type of cable	Type A
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• total current output to field devices, max.	240 mA
• Number of connectable field devices	4
• Current limitation per field device, max.	60 mA
• Short-circuit current (test current); max.	6 mA
• intrinsically safe according to FISCO model	No
• Debounce logic	Yes
Dimensions	
Width	220 mm
Height	120 mm
Depth	83 mm
Weights	
Weight, approx.	1 000 g

Note

Data for selecting the field devices

Field devices with certification for fieldbus (according to IEC 61158-2, Edition 5.5, 2010-07) must be connected,

Field devices are located within the of Zone 2 hazardous area.

12.10 Technical specifications of active field distributors AFD8 (6ES7157-0AG82-0XA0)

Technical specifications of AFD8

Article number	6ES7157-0AG82-0XA0
General information	
Product function	
• Repeater function	No
Supply voltage	
permissible range, lower limit (DC)	16 V
permissible range, upper limit (DC)	32 V
Reverse polarity protection	Yes; only in conjunction with FDC 157
Overvoltage protection	No
Input current	
Current consumption (in no-load operation), typ.	34 mA; 64 mA at the end of the cable
Current consumption, max.	514 mA
Power loss	
Power loss, typ.	544 mW
Power loss, max.	4.1 W
Interfaces	
PROFIBUS PA	
• Transmission rate, max.	31.25 kbit/s
• Number of connectable PA field devices	8
• Current output to PA field devices, max.	480 mA
• permissible current per spur line	60 mA
Protocols	
PROFIBUS DP	No
PROFIBUS PA	Yes
AS-Interface	No
FOUNDATION Fieldbus H1	Yes
Interrupts/diagnostics/status information	
Status indicator	Yes
Alarms	No
Diagnostics function	Yes
Diagnostics indication LED	
• Main line status	Yes
• Main line failure	Yes
• Spur line status/fault	Yes
• automatic bus termination	Yes
Potential separation	
between main line and spur lines	No
Degree and class of protection	
IP degree of protection	IP66

Article number	**6ES7157-0AG82-0XA0**
Standards, approvals, certificates	
Use in hazardous areas	
• ATEX Zone 1	No
• ATEX Zone 21	No
• ATEX Zone 2	Yes
• ATEX Zone 22	Yes
• FM Class I Zone 1	No
• FM Class I Zone 2, Division 2	Yes
Ambient conditions	
Ambient temperature during operation	
• min.	-40 °C
• max.	70 °C
Ambient temperature during storage/transportation	
• min.	-40 °C
• max.	85 °C
Relative humidity	
• Operation, max.	95 %
connection method / header	
connection method / main cable / header	
• Number of main lines	2
• Design of terminals	Screw terminal block
• Type of connection (enclosure cable gland)	M16
• Type of cable	Type A
• Cable diameter, min.	4 mm
• Cable diameter, max.	9 mm
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• automatic bus termination	Yes
• permissible main line current	1 A
connection method / spur line / header	
• Number of spur lines	8
• Design of terminals	Screw terminal block
• Type of connection (enclosure cable gland)	M16
• Type of cable	Type A
• Cable diameter, min.	4 mm
• Cable diameter, max.	9 mm
• Conductor cross-section, min.	0.2 mm²
• Conductor cross-section, max.	2.5 mm²
• total current output to field devices, max.	480 mA
• Number of connectable field devices	8
• Current limitation per field device, max.	60 mA

Article number	6ES7157-0AG82-0XA0
• Short-circuit current (test current); max.	6 mA
• intrinsically safe according to FISCO model	No
• Debounce logic	Yes
Dimensions	
Width	360 mm
Height	120 mm; without screw glands
Depth	83 mm
Weights	
Weight, approx.	3 000 g

Appendix

A

A.1 Compatibility overview

A.1.1 Compatibility overview

The following table shows the following information:

- Article numbers of the current components
- Required software for the configuration
- Compatibility of current components with predecessor components

PROFIBUS DP interface module

Table A-1 PROFIBUS DP interface module

Current component	Required software (minimum required software version)	Replacement part for compatible predecessor component	Functionally compatible	Replacement part compatible	Supplementary notes
IM 153-2OD (Outdoor): 6ES7153-2BA70-0XB0 (Observe the following information when used redundantly)	New configuration: • PCS neo as of V3.1 • SIMATIC PCS 7 V7.0 and higher • STEP 7 V5.5 SP4 and HSP246, or higher. HW Config: "PROFIBUS DP > DP/PA-Link > IM 153-2 OD	• IM 153-2 (Outdoor): – 6ES7153-2BA82-0XB0 – 6ES7153-2BA81-0XB0	Yes	Yes	• Use in the Y-link • Use in the DP/PA link

Note

Redundant use

The operation of the IM 153-2OD (6ES7153-2BA70-0XB0) as IM 157 (6ES7157-0AA81-0XA0) in redundant mode on the BM IM/IM bus module (6ES7195-7HE80-0XA0) is no longer supported.

Approved bus modules for redundant use

- BM IM/IM (6ES7195-7HD10-0XA0)
- BM IM/IM Outdoor (6ES7195-7HD80-0XA0)

In case of redundancy, both PROFIBUS DP interface modules and the bus module must be replaced.

DP/PA coupler

Table A-2 DP/PA coupler

Current component	Required software (minimum required software version)	Replacement part for compatible predecessor component	Functionally compatible	Replacement part compatible	Supplementary notes
DP/PA coupler FDC 157: 6ES7157-0AC85-0XA0	• STEP 7 V5.3 SP3 and HSP0095, or higher • SIMATIC PCS 7 V7.0 and higher • PCS neo as of V3.1 • New configuration: STEP 7 V5.5 SP4 and HSP253, or higher. HW Config: "PROFIBUS DP > DP/PA-Link > FDC157-0 (EFD) Diagnostics can be configured	Field device coupler FDC 157 6ES7157-0AC83-0XA0	Yes	Yes	
DP/PA coupler FDC Ex [ia]: 6ES7157-0AD82-0XA0	• STEP 7 V5.3 SP3 and HSP0095, or higher • SIMATIC PCS 7 V7.0 and higher	DP/PA coupler, Ex-Version: 6ES7157-0AD81-0XA0	Yes	Yes	

⚠ DANGER

Message of PA redundancy error

The DP/PA coupler FDC 157 (6ES7157-0AC85-0XA0) reports back a PA redundancy error with status code "68_H" (instead of "24_H" at 0AC83).

Active field distributors

Table A-3 AFDiSD

Current component	Required software (minimum required software version)	Replacement part for compatible predecessor component	Functionally compatible	Replacement part compatible	Supplementary notes
AFDiS (Active Field Distributor intrinsic Safety): 6ES7655-5DX60-1BB0	• STEP 7 V5.4 SP3 and HSP0095, or higher • SIMATIC PCS 7 V7.1.SP4 or higher • PCS neo as of V3.1 Diagnostics can be configured	AFDiS (Active Field Distributor intrinsic Safety): 6ES7157-0AG83-0XA0	Yes	Yes	• "Find AFDiSD" function (see "LED displays of the active field distributor AFDiSD (Page 196)") • Mode selector of the AFDiSD (see "Active field distributor AFDiSD (Page 35)")

A.1.2 Compatibility with predecessor modules

Compatibility DP/PA coupler FDC 157-0

The DP/PA coupler FDC 157-0 with article number 6E7157-0AC85-0XA0 replaces the DP/PA coupler with article number 6E7157-0AC8**3**-0; 6E7157-0AC8**2**-0XA0. The bus module does not need to be replaced.

The PROFIBUS address 0 is set on the DP/PA coupler FDC 157-0 in delivery state. The diagnostic function is deactivated by this, the DP/PA coupler is transparent. This means that it is compatible with the predecessor module as a replacement part. Configuration is not required.

Note

Diagnostic function

If you want to use the diagnostic functions of the DP/PA coupler FDC 157-0 in existing systems, set the PROFIBUS address > 0 on the DP/PA coupler and in the configuration.

Note

Redundancy mode

If you want to use the DP/PA coupler FDC 157-0 with ring redundancy, you must use the bus module BM FDC/FDC (redundant).

Bus module BM FDC/FDC (redundant)

The bus module BM FDC/FDC (redundant) with order number 6ES7195-7HG80-0XA0 can only be used together with the DP/PA coupler FDC 157-0 with order number 6ES7157-0AC85-0XA0.

Compatibility of the PROFIBUS DP interface modules: IM 153-2 and IM 157

Information about compatible revision levels of the PROFIBUS DP interface modules IM 153-2 and IM 157 is available on the Internet (http://support.automation.siemens.com/WW/view/en/23372259).

Compatibility of the Y-coupler

The Y-coupler 6ES7197-1LB00-0XA0 **cannot** be used as a replacement part for Y-coupler 6ES7654-0YK00-0AB0.

A.2 Dimension drawings

A.2.1 Active field distributor AFDiSD

Dimension drawings AFDiSD (6ES7655-5DX60-1BB0)

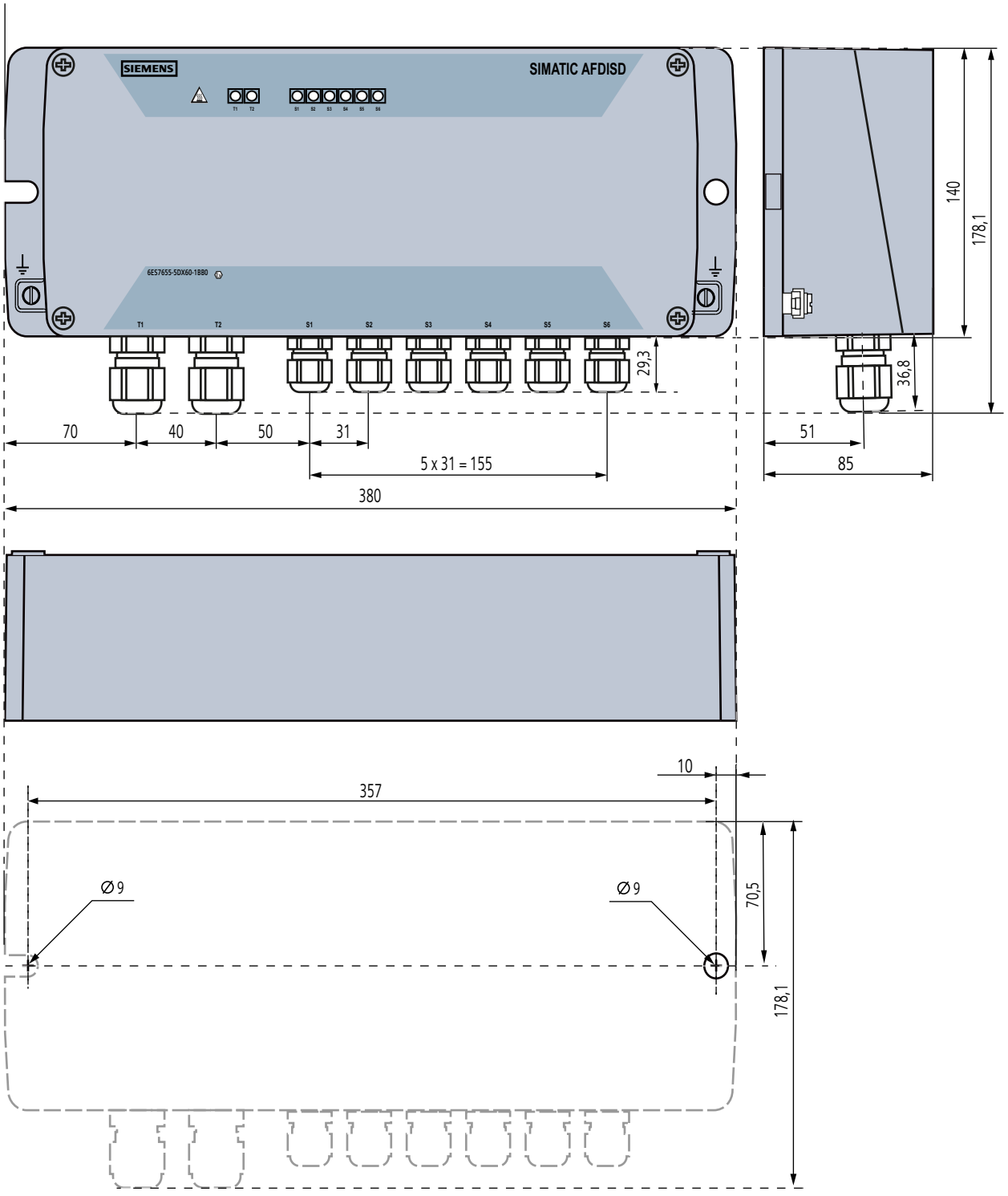


Figure A-1 AFDiSD dimension drawing

A.2.2 Active field distributor AFD4

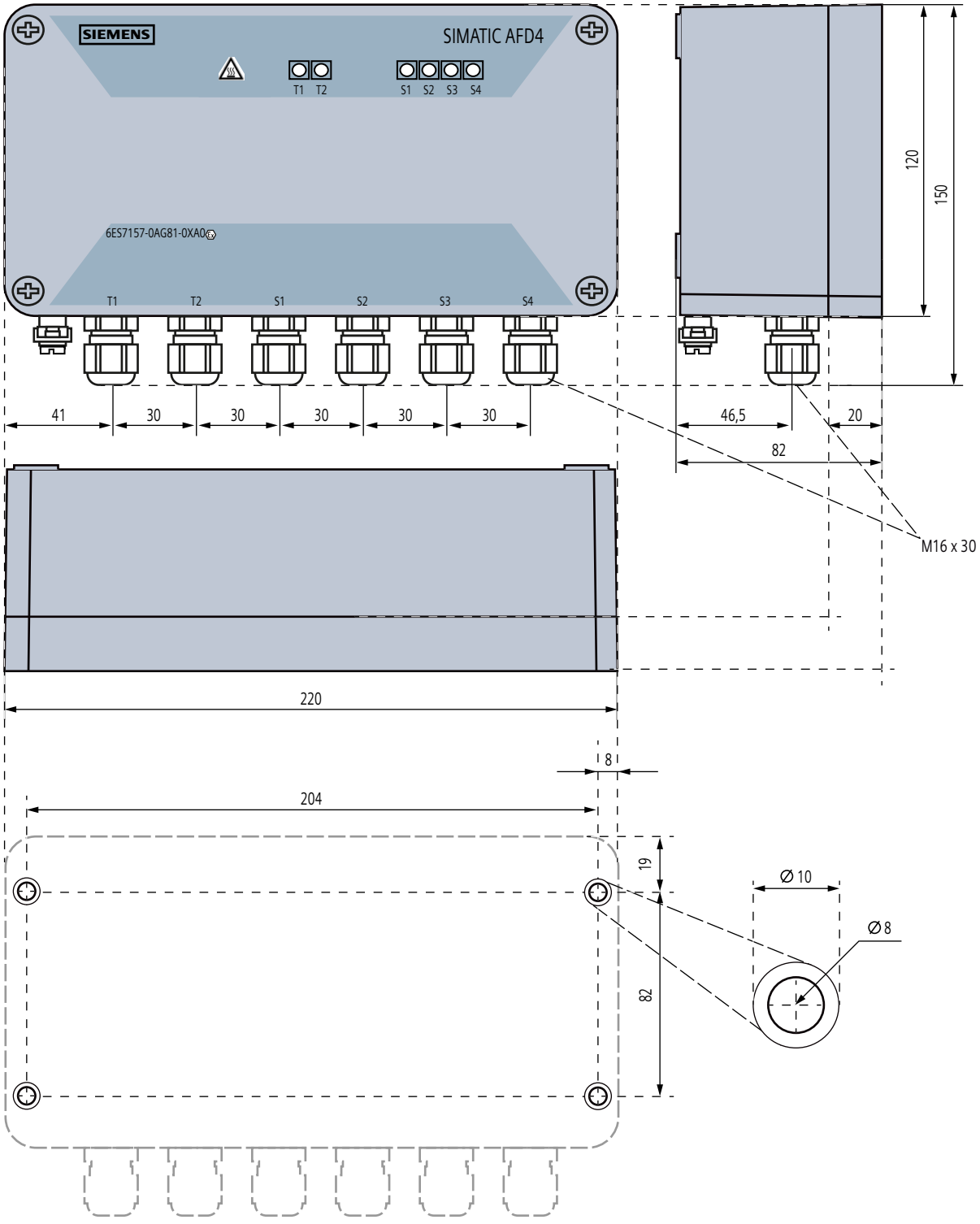


Figure A-2 AFD4 dimension drawing

A.2.3 Active field distributor AFD4 (FM)

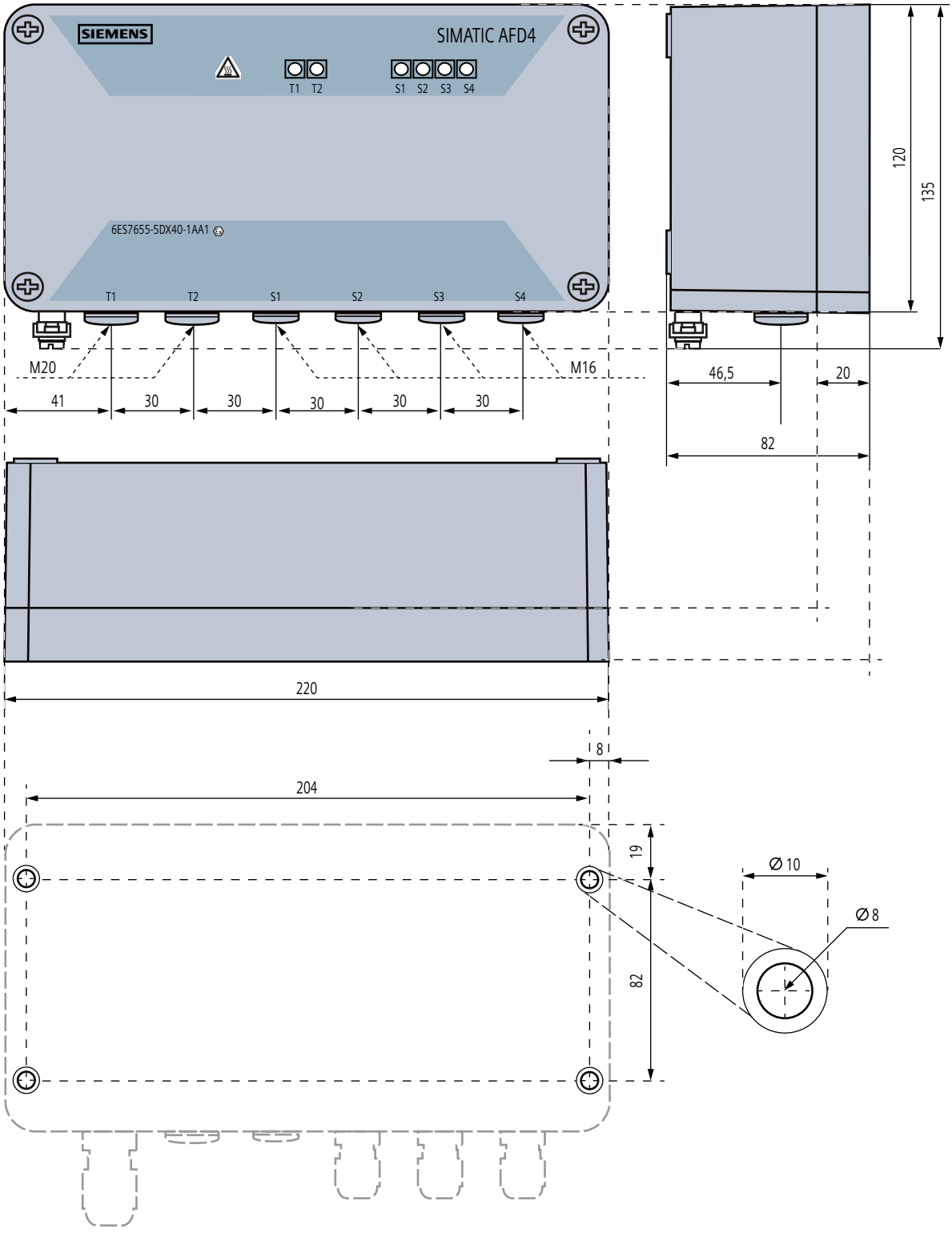


Figure A-3 AFD4 (FM) dimension drawing

A.2.4 Active field distributor AFD4 Railmount

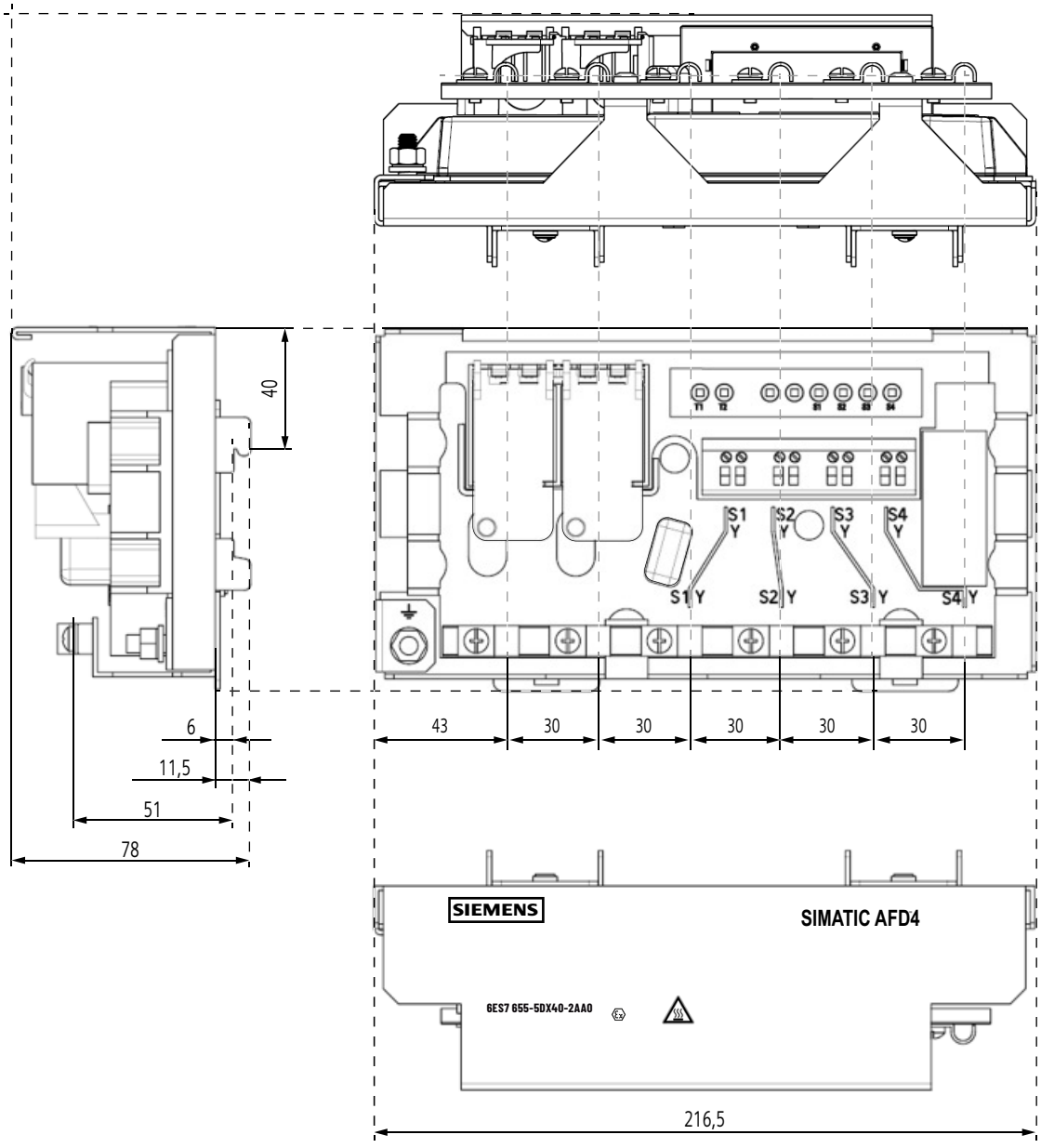


Figure A-4 AFD4 Railmount dimension drawing

A.2.5 Active field distributor AFD8

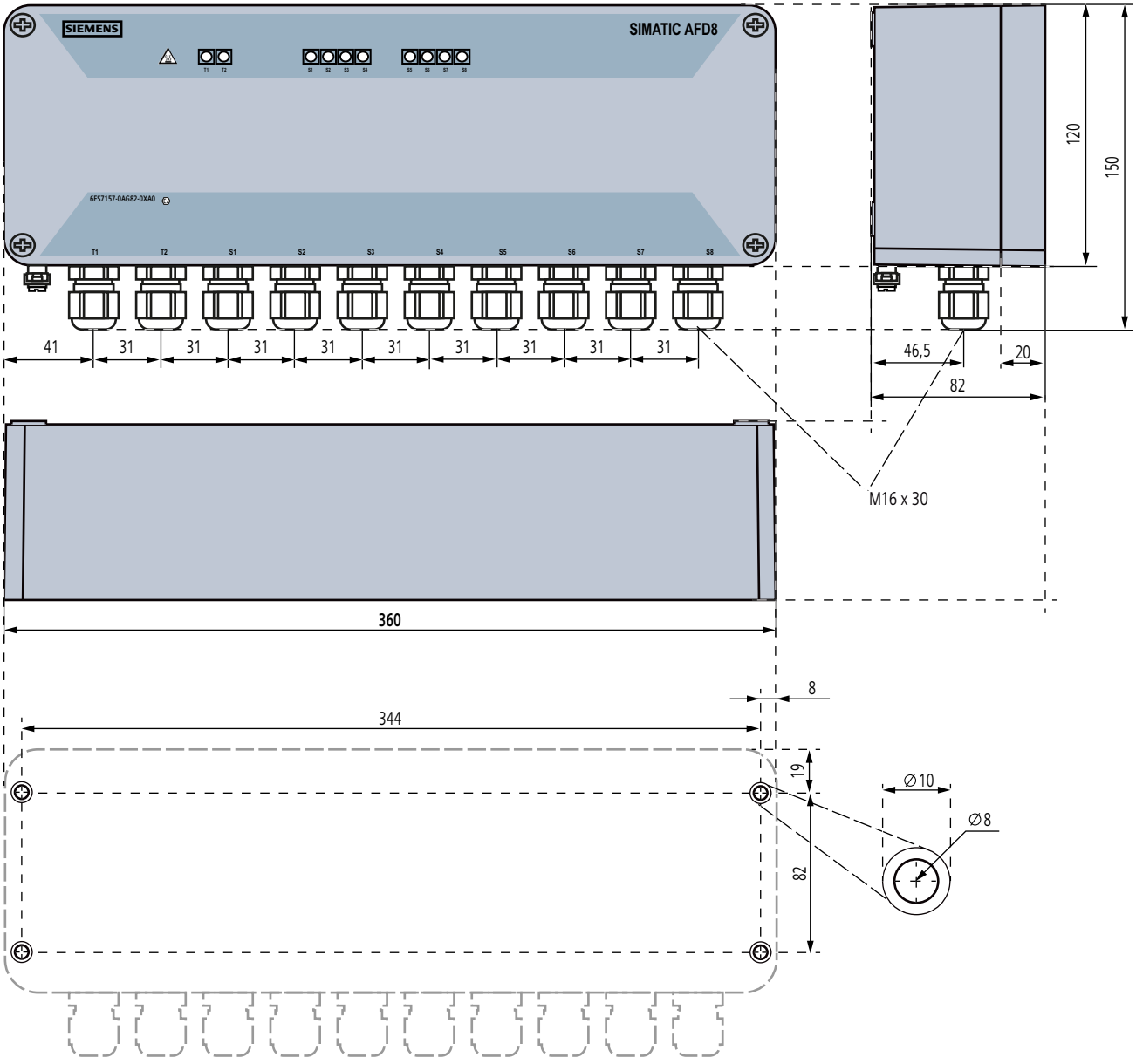


Figure A-5 AFD8 dimension drawing

A.3 Article numbers

A.3.1 Components

Components

Table A-4 Article numbers for the hardware components of the gateways

Hardware components	Product	Article number	Outdoor use
Interface module			
• IM 153-2OD	PROFIBUS DP interface module for extended temperature range supports the "Extended fieldbus diagnostics (EFD)" function	6ES7153-2BA70-0XB0	YES
DP/PA couplers			
• FDC 157	DP/PA couplers	6ES7157-0AC85-0XA0	YES
• FDC 157-Ex [ia]	DP/PA coupler Ex	6ES7157-0AD82-0XA0	YES
Y-coupler			
• Y-coupler	Via DP redundant after DP single)	6ES7197-1LB00-0XA0	No
Bus modules			
• BM PS/IM	Bus module to accommodate one PS power supply and one PROFIBUS DP interface module.	6ES7195-7HA00-0XA0	No
• BM PS/IM SIPLUS extreme	Bus module for extended ambient conditions to accommodate one PS power supply and one PROFIBUS DP interface module.	6AG1195-7HA00-2XA0	YES
• BM IM/IM	Bus module to accommodate two PROFIBUS DP interface modules	6ES7195-7HD10-0XA0	No
• BM IM/IM Outdoor	Bus module for extended ambient conditions to accommodate two PROFIBUS DP interface modules	6ES7195-7HD80-0XA0	YES
• BM FDC	Bus module to accommodate one DP/PA coupler	6ES7195-7HF80-0XA0	YES
• BM FDC/FDC (redundant)	Bus module to accommodate two DP/PA couplers (redundant)	6ES7195-7HG80-0XA0	YES
• BM Y-coupler	Bus module to accommodate one Y-coupler	6ES7654-7HY00-0XA0	No
Active field distributor			
• AFDiSD (**A**ctive **F**ield **D**istributor **i**ntrinsic **S**afety with extended Fieldbus-**D**iagnostic)	Active field distributor with extended fieldbus diagnostics for up to 6 PA field devices	6ES7655-5DX60-1BB0	YES
• AFD4	Active field distributor for up to 4 PA field devices	6ES7157-0AG81-0XA0	YES
• AFD4 (FM)	Active field distributor with FM approval for up to 4 PA field devices	6ES7655-5DX40-1AA1	YES

Hardware components	Product	Article number	Outdoor use
• AFD4 Railmount	Active field distributor for up to 4 PA field devices, installation in enclosure required	6ES7655-5DX40-2AA0	No
• AFD8	Active field distributor for up to 8 PA field devices	6ES7157-0AG82-0XA0	YES

Table A-5 Article numbers: DP/PA link without bus modules and power supply

Installation note	Product	Article number	Outdoor use [1]
Connection of couplers via bus connector	1 x IM 153-2OD	• 6ES7153-2BA70-0XB0	YES
	• FDC 157 or • FDC 157-Ex [ia]	• 6ES7157-0AC85-0XA0 or • 6ES7157-0AD82-0XA0	

Table A-6 Article numbers: DP/PA link with bus modules and power supply

Installation note	Product	Article number	Outdoor use [1]
Max. 5 DP/PA couplers - take into consideration the required number of bus modules BM FDC, etc.	• 1 x IM 153-2OD	• 6ES7153-2BA70-0XB0	-
	• 1 x power supply PS 307	• 6ES7307-1...	No
	• 1 x bus module PS/IM	• 6ES7195-7HA00-0XA0	-
	• FDC 157	• 6ES7157-0AC85-0XA0	-
	• BM FDC or • BM FDC/FDC (redundant)	• 6ES7195-7HF80-0XA0 or • 6ES7195-7HG80-0XA0	- -

[1] Only the component that enables (YES) or prevents (No) outdoor use is marked for the installation variant.

Table A-7 Article numbers: DP/PA link with bus modules without power supply

Installation note	Product	Article number	Outdoor use [1]
Max. 5 DP/PA coupler - take into consideration the required number of bus modules BM FDC, etc.)	• 1 x IM 153-2OD	• 6ES7153-2BA70-0XB0	-
	• 1 x bus module PS/IM (or BM PS/IM SIPLUS extreme)	• 6ES7195-7HA00-0XA0 • 6AG1195-7HA00-2XA0	• No • YES
	• FDC 157 or • FDC 157-Ex [ia]	• 6ES7157-0AC85-0XA0 or • 6ES7157-0AD82-0XA0	- -
	• BM FDC or • BM FDC/FDC (redundant)	• 6ES7195-7HF80-0XA0 or • 6ES7195-7HG80-0XA0	- -

[1] Only the component that enables (YES) or prevents (No) outdoor use is marked for the installation variant.

Table A-8 Article numbers: Redundant DP/PA link

Installation variant	Product	Article number	Outdoor use [1]
Redundant DP/PA link (Max. 5 DP/PA coupler - take into consideration the required number of bus modules BM FDC, etc.)	• 2 x IM 153-2OD	• 6ES7153-2BA70-0XB0	-
	• 1 x BM IM/IM (or BM IM/IM Outdoor)	• 6ES7195-7HD10-0XA0 • 6ES7195-7HD80-0XA0	• No • YES
	• FDC 157 or • FDC 157-Ex [ia]	• 6ES7157-0AC85-0XA0 or • 6ES7157-0AD82-0XA0	- -
	• BM FDC or • BM FDC/FDC (redundant)	• 6ES7195-7HF80-0XA0 or • 6ES7195-7HG80-0XA0	- -

[1] Only the component that enables (YES) or prevents (No) outdoor use is marked for the installation variant.

Table A-9 Article numbers for Y-link

Hardware components	Products		Article number	Outdoor use
Complete package Y-link: • 2 x PROFIBUS DP interface module IM 153-2OD • 1 x bus module BM IM/IM • 1 x Y-coupler • 1 x bus module BM Y-coupler	Complete package for installation of a Y-link consisting of the following products:		6ES7197-1LA12-0XA0	No
	2 x IM 153-2OD	6ES7153-2BA70-0XB0		
	1 x BM IM/IM	6ES7195-7HD80-0XA0		
	1 x Y-coupler	6ES7197-1LB00-0XA0		
	1 x BM Y-coupler	6ES7654-7HY00-0XA0		

Table A-10 Article numbers for accessories for installation

Component	Article number
Mounting rail for the "Module replacement in runtime" function • 482.6 mm • 530 mm • 620 mm • 2000 mm	 6ES7195-1GA00-0XA0 6ES7195-1GF30-0XA0 6ES7195-1GG30-0XA0 6ES7195-1GC00-0XA0
Bus connector for S7 mounting rail (included with each DP/PA coupler)	6ES7390-0AA00-0AA0
Covers (included are 4 backplane bus covers and 1 bus module cover)	6ES7195-1JA00-0XA0
Sealing plugs for unused connections on the AFDiSD (10 pieces)	6ES7157-0AG80-1XA1

Table A-11 Accessories of WISKA:

Component / thread	WISKA type designation	WISKA order designation
SPRINT ATEX cable glands		
• **M 16x1,5** (AFDiSD)	ESKE/1-i 16 (old designation: ESKE-i 16)	10103372 (old designation: 10064411)
• **M 20x1,5** (AFDiSD)	ESKE/1-e 20 (old designation: ESKE-2 20)	10103365 (old designation: 10064402)
• **M 16x1,5** (AFD4/8)	ESKE/1-e 16 (old designation: ESKE-e 16)	10103364 (old designation: 10064401)
Screw plugs		
• **M 16x1,5**	EVSG 16	10061831
• **M 20x1,5**	EVSG 20	10061832
Connection thread sealing rings		
• **M 16x1,5**	EADR 16	10062802
• **M 20x1,5**	EADR 20	10062803

See also

https://www.wiska.com/ (https://www.wiska.com/en/143/cat/1917/cable-glands/)

A.3.2 Accessories for PROFIBUS DP

Accessories for PROFIBUS DP

Table A-12 Article numbers for accessories for PROFIBUS DP

Accessories	Article number
PROFIBUS DP bus connector (up to 12 Mbps)	
• without PG socket	6ES7972-0BA12-0XA0
• with PG socket	6ES7972-0BB12-0XA0
PROFIBUS DP bus connector FastConnect	
• without PG socket	6ES7972-0BA50-0XA0
• with PG socket	6ES7972-0BB50-0XA0
PROFIBUS DP bus cable	
• Normal (flexible)	6XV1830-0AH10
• Trailing cable (solid)	6XV1830-3BH10
PROFIBUS DP terminator	6ES7972-0DA00-0XA0

A.3.3 Accessories for PROFIBUS PA

Accessories for PROFIBUS PA

Table A-13 Article numbers for accessories for PROFIBUS PA

Accessories	Article number
PROFIBUS PA bus cable (cable type A)	6XV1830-5AH10

Configuration with the SpliTConnect connector system

Create the configuration with the SpliTConnect connector system. The SpliTConnect connection system permits an easy-to-install configuration of PROFIBUS PA segments conforming to IEC 61784-1:2002 Ed1 CP 3/2 with field device connection points in intrinsically safe and non-intrinsically safe areas. The SpliTConnect connector system consists of the following components:

Accessories	Description	Article number
SpliTConnect Tap	T-connector for PA field device	6GK1905-0AA00
SpliTConnect M12 Outlet	Connecting element for M12 connection	6GK1905-0AB10
SpliTConnect Coupler	Connecting element between the taps	6GK1905-0AC00
SpliTConnect M12 Terminator (Ex)	Terminating resistor for hazardous areas	6GK1905-0AD00
SpliTConnect M12 Terminator	Terminating resistor for non-hazardous areas	6GK1905-0AE00
SpliTConnect M12 Jack	Connecting element for M12 connection	6GK1905-0AF00

Bus terminating element

The SpliTConnect tap can also be extended as a bus terminating element.

Wiring with the (FastConnect) fast installation cable

Wire the PROFIBUS PA segments with the fast installation cable (FastConnect cable):

Accessories	Description	Article number
FC PROFIBUS PA (blue)	Fast installation cable	6XV1830-5EH10
FC PROFIBUS PA (black)		6XV1830-5FH10

Stripping

Strip the FastConnect cables with the FastConnect stripping tool. You can remove the outer covering and the braided shield with millimeter accuracy in a single step with the FastConnect stripping tool.

Accessories	Description	Article number
FastConnect Stripping Tool	Stripping tool	6GK1905-6AA00
Blade Cassettes	Spare blade cassettes	6GK1905-6AB00

Additional information

For additional information, refer to *Catalog IK PI*.

A.4 Basics about PROFIBUS PA

PROFIBUS PA

PROFIBUS PA is the PROFIBUS for **P**rocess **A**utomation (PA) and is based on IEC 61784-1:2002 Ed1 CP 3/2 for transmission technology and protocol and on the PA profile.

PROFIBUS PA	=	PROFIBUS DP communication protocol + Synchronous transmission technology + Power supply of the PA field devices

Connectable field devices

You can connect all field devices suitable for PROFIBUS PA to the DP/PA link.

- Measuring transducers, valves, actuators etc.
- Networked via a serial bus system
- For use in the chemicals industry and process engineering
- With field device infeed via the data cable
- Also for applications in hazardous areas (protection type Ex [ia])

A.4.1 Intrinsic safety

Intrinsic safety

The principle behind the intrinsically safe protection type is that a certain minimum ignition energy is necessary for ignition of a potentially explosive atmosphere. In an intrinsically safe electric circuit this minimum ignition energy is not present, neither in normal operation nor under error conditions. The intrinsic safety of an electric circuit is achieved by limiting current and voltage for prevention of sparks and high temperatures as possible sources of ignition. As a result of this, the intrinsically safe protection type is limited to electric circuits relatively low power.

Spark ignition

"Spark ignition" is excluded because sparks that can normally occur due to short-circuit or ground fault or when an electric circuit is opened or closed during normal operation are excluded by the limiting of current and voltage and the prevention of large inductances.

Heat ignition

Heat ignition is not possible during normal operation and under error conditions because excessive heating of the equipment and cables in the intrinsically safe electric circuit is excluded.

Additional information

For additional information on the topics intrinsic safety and explosion protection please refer to:

- Automation Systems S7-300, ET 200M Ex I/O Modules manual (http://support.automation.siemens.com/WW/view/en/1096709)
- *Investigation of intrinsic safety for field bus systems*; PTB Report W-53, Braunschweig, March 1993
- *PROFIBUS PA Commissioning Guide*, Notes on using the IEC 61158-2 technology for PROFIBUS, (German art. no. 2.091, English art. no. 2.092)
  PROFIBUS-Nutzerorganisation e. V. (http://www.profibus.com)

A.4.2 Field device supply via PROFIBUS PA

Operating principle

When using the DP/PA link, the field devices can be supplied via the PROFIBUS PA data line.

Configuration

The total current of all field devices must not exceed the maximum output current of the DP/PA coupler. The maximum output current therefore limits the number of field devices that can be connected to the PROFIBUS PA.

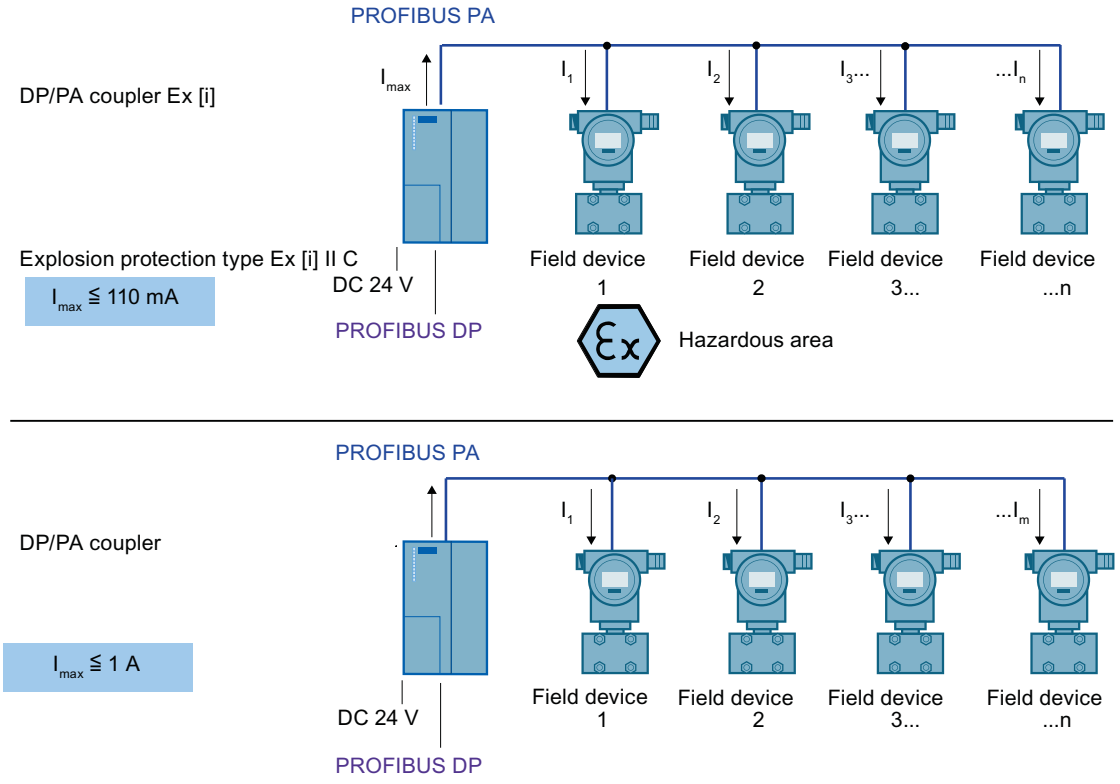


Figure A-6 Remote field device infeed

Extension

You must use an additional DP/PA coupler if you exceed the maximum output current of the DP/PA coupler.

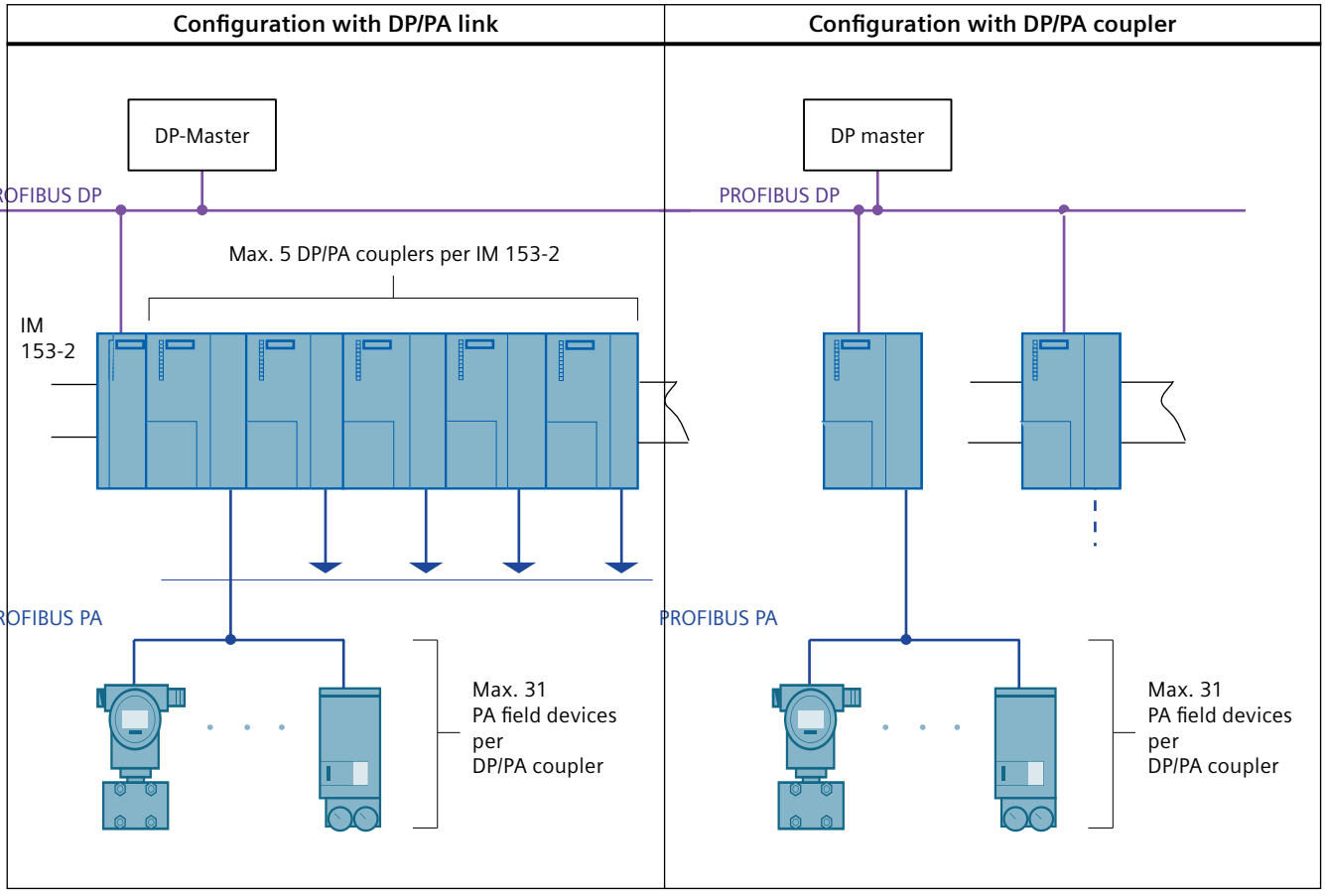
See also

Maximum configuration of PROFIBUS PA with DP/PA link (Page 299)

A.4.3 Maximum configuration of PROFIBUS PA with DP/PA link

Maximum configuration

The figure below describes the maximum configuration in a PROFIBUS PA system with one DP master:



Rules

The following rules apply to the maximum configuration of PROFIBUS PA:

- Only **one active supply unit** (= DP/PA coupler) may be connected to a physical PROFIBUS PA segment.
- A maximum of 31 PA field devices may be present in a physical PROFIBUS PA segment.
- A maximum of 64 PA field devices may be connected to one DP/PA link.
  The maximum number of PA field devices that can be connected for each physical PROFIBUS PA segment or each DP/PA coupler is limited by the maximum output current of the DP/PA coupler and the I/O data to be transmitted.

A.4.4 Line and star-type topology

Topology

The topology of PROFIBUS PA may be in line or star form.

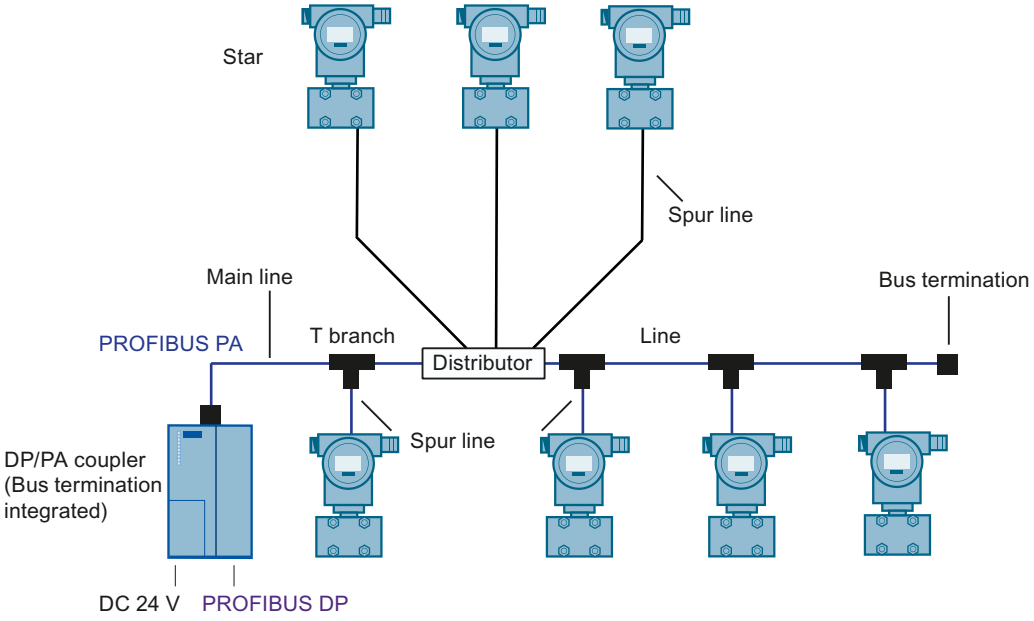


Figure A-7 Line and star topology

Extent of network

For a standard PROFIBUS PA cable (cable type A according to PNO) and when maximum current is drawn from DP/PA couplers, the maximum length of the main line and the spur lines is as follows:

- 560 m for DP/PA coupler FDC 157-0
- 920 m for DP/PA coupler Ex [ia] for hazardous areas

Note

In the case of low total power consumption and distributed arrangement of the PA field devices, longer cable lengths are possible.

Bus termination for PROFIBUS PA

For problem-free operation, the end of a PROFIBUS PA line must be provided with a bus termination (see figure under topology).

Configuration: RC element connected in series (R = 100 Ω ± 2 %; C = 1 µF ± 20 %)

Spur line

The maximum permissible length of a spur line can be found in the following table. Please pay attention to the maximum length of the total cable.

Table A-14 Spur line at DP/PA coupler

Number of spur lines	Length of a spur line	
	DP/PA coupler FDC 157-0	DP/PA coupler Ex [ia]
1 to 12	Max. 120 m	Max. 60 m
13 to 14	Max. 90 m	Max. 60 m
15 to 18	Max. 60 m	Max. 60 m
19 to 24	Max. 30 m	Max. 30 m
24 to 31	max. 1 m	max. 1 m

See also

Accessories for PROFIBUS DP (Page 293)

Accessories for PROFIBUS PA (Page 294)

A.5 Abbreviations

Abbreviation	Meaning
AFD	Active Field Distributor
FDC	Field Device Coupler (DP/PA coupler)
PA	Process automation
PA	Equipotential bonding
S	Spur; Connection for field devices (spur line)
T	Trunk; connection of the main line between the DP/PA couplers and active field distributors

Connection to non-STEP 7 systems via GSD files

B

B.1 Configuring DP/PA couplers for DP standard master mode

B.1.1 GSD files

For DP standard master mode, the PA link and the PA field devices are configured with a suitable program using a GSD file.

GSD files

For each DP slave (PA field device) that you configure on the lower-level bus system of the DP/PA link, module identifiers must be entered in the respective GSD file. The software tool "GSD-Tool for IM 157 / IM 153-2" is available for this. You can download the software tool free of charge from the Internet (http://support.automation.siemens.com/WW/view/en/26562190).

The GSD files for the PA field devices offered by Siemens AG can also be found at this Internet address. Enter the search term "gsd" and select the "Downloads" search area.

Creating a GSD file

Download the GSD Tool from the aforementioned Internet address and follow the accompanying instructions.

Note

Disclaimer

Siemens AG assumes no liability for damage arising from using the GSD Tool; in particular not for personal injury, property damage or financial losses that are linked as consequential damages directly or indirectly in connection with the use of the GSD Tool.

We offer no support for use of the GSD Tool.

The GSD Tool creates the following GSD file for the DP/PA link from the GSD files of the PA field devices being used that you have added: sip58052.gsd for the PROFIBUS DP interface module.

See also

GSD files for PA field devices (http://support.automation.siemens.com/WW/view/en/1581624)

B.1.2 Configuring DP/PA link

Requirement

The GSD file for the DP/PA link with the lower-level PA field devices is created.

- When creating the GSD file for the DP/PA link, the GSD files of the PA field devices were in the working directory of the GSD Tool.
- Additional information and conditions:
  GSD Tool (http://support.automation.siemens.com/WW/view/en/26562190)

Note

Creating a GSD file for PROFIBUS DP interface module IM 153-2OD

In the GSD Tool, select:

1. Create new GSD file
2. PA link
3. GSD Revision 5
4. IM153-2: 6ES7 153-2BAx1-0XB0 or 6ES7 153-2BAx2-0XB0
5. Generate GSD file

Procedure

Configure the DP/PA link with a suitable configuration tool like any other DP slave on PROFIBUS DP.

To do this, load the complete GSD file for the DP/PA link into your configuration tool.

Note

When configuring with GSD file

If a DP/PA link with PROFIBUS DP interface module IM 153-2OD does not start, check the creation of the GSD file.

Reason:
In the DP/PA link, the "MLFB" user parameter is set by default to "6ES7 153-2BA01(2)-0XB0" or "6ES7 153-2BA81(2)-0XB0".

Remedy:
To use the PROFIBUS DP interface module IM 153-2OD (6ES7 153-2BA70-0XA0), you must select the compatible predecessor module:

Change the user parameter "MLFB" to "6ES7153 2BA82 0XB0".

Parameter assignment and configuration frame

The frame length for parameter assignment depends on the number of PA field devices in use and may amount to a maximum of 223 bytes.

The frame length for configuration depends on the number of PA field devices in use and may amount to a maximum of 244 bytes.

The structure of the parameter assignment and configuration frames is available for download from the Internet (http://support.automation.siemens.com/WW/view/en/13406349).

Restrictions

Functions such as reading the configuration before initial parameter assignment of the DP/PA link are dependent on the components used.

B.1.3 How to configure PROFIBUS PA field devices

Requirement

The product designations for the required PA field devices must have been entered in the GSD file of the IM 153-2.

Note

For redundant operation, the only PA field devices that may be configured are those that have the entries "Begin of Device" or "Begin of Device h supported" in their GSD file.

Configuration principle

To configure the PA link, select the manufacturer information of the PA field devices in your configuration tool (product and module designation, if applicable). The specifications for the PA field devices must be entered in ascending order of their addresses.

An example of a configuration is shown in the figure below.

Procedure

1. Go to the DP slave configuration in your configuration tool.
2. Enter the manufacturer identification (for example SIEMENS SITRANS P) for the first PA field device in the "Order number" or "Module" field and apply this to the first slot. Set the PROFIBUS address for the PA field device.
   Repeat this procedure for all PA field devices in use.
3. Finish the input and complete the configuration. The further procedure (for example saving, compiling, etc.) is identical to other DP slaves.

PROFIBUS address of the IM 153-2 in the PA master system

In the PA master system, IM 153-2 uses address 2. The first possible address for PA field devices is 3.

Deployable transmitters

Transmitters may be used that accept a 10-byte parameter assignment frame.

Configuring with *COM PROFIBUS*

For SIMATIC S5, PA field devices are integrated as standard slaves via their GSD files in *COM PROFIBUS* (V3.1 and higher).

1. Copy the GSD file of the IM 153-2 to the *COM PROFIBUS* directory: **...COMPBxx\GSD**.
2. Start *COM PROFIBUS* and select the **File > Read in GSD file** menu command.
   Result: The IM 153-2 is displayed in the hardware catalog during slave configuration.
3. Configure the PA field devices with *COM PROFIBUS*

Example: View of configuration in *COM PROFIBUS*

The following figure shows an example of the view of a configuration for the PA link with *COM PROFIBUS*.

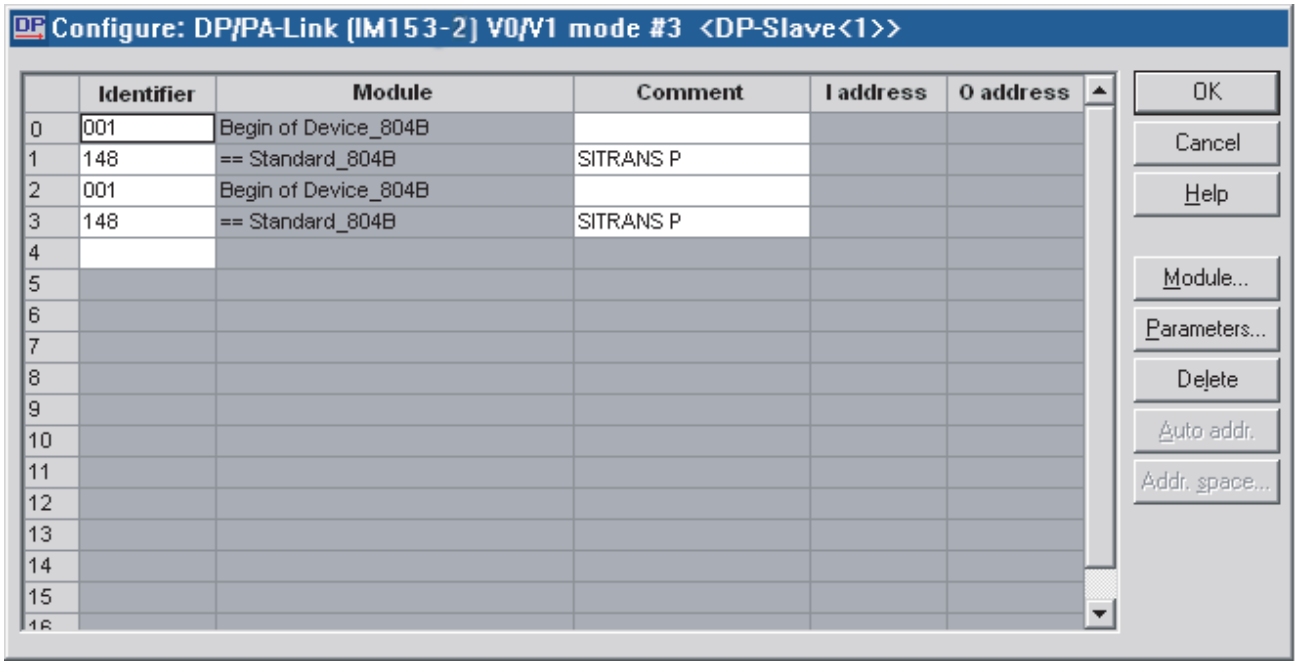


Figure B-1 Example of a configuration with *COM PROFIBUS*

Entering a PROFIBUS address

1. In the "Module" column, select the "Begin of Device" of the respective PA field device and select the "Parameter..." button.
2. In the "Value" column, enter the desired PROFIBUS address and confirm with "OK".

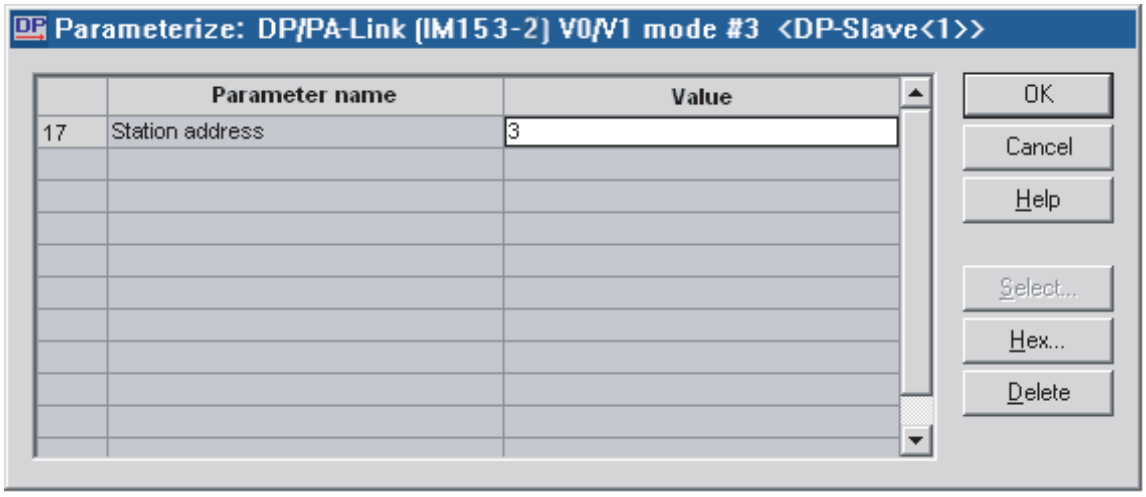


Figure B-2 Entering the PROFIBUS address

B.2 Y-link for DP standard master mode

B.2.1 GSD files

For DP standard master mode, the Y-link and the DP slaves are configured via GSD files, for example with *COM PROFIBUS*.

GSD files

Module identifiers must be entered in the respective GSD file for each DP slave that you configure on the lower-level bus system of the Y-link. The software tool "GSD-Tool for IM 157 / IM 153-2" is available for this. You can download the software tool free of charge from the Internet (http://support.automation.siemens.com/WW/view/en/26562190).

The GSD files for the DP slaves offered by Siemens AG can also be found at this Internet address. Enter the search term "gsd" and select the "Downloads" search area.

Creating a GSD file

Download the GSD Tool from the aforementioned Internet address and follow the accompanying instructions.

Note

Disclaimer

Siemens AG assumes no liability for damage arising from using the GSD Tool; in particular not for personal injury, property damage or financial losses that are linked as consequential damages directly or indirectly in connection with the use of the GSD Tool.

We offer no support for use of the GSD Tool.

The GSD Tool creates the following GSD file from the added GSD files of the DP slaves to be used for the Y-link: sip58052.gsd for the PROFIBUS DP interface module.

B.2.2 How to configure Y link

Requirement

The GSD file for the Y-link with the lower-level DP slaves is created.

- When creating the GSD file for the Y-link, the GSD files of the DP slaves were in the working directory of the GSD Tool.
- Additional information and conditions:
  GSD Tool (http://support.automation.siemens.com/WW/view/en/26562190)

Note

Creating a GSD file for PROFIBUS DP interface module IM 153-2OD

In the GSD Tool, select:

1. Create new GSD file
2. Y-link
3. GSD Revision 5
4. IM153-2: 6ES7 153-2BAx1-0XB0 or 6ES7 153-2BAx2-0XB0
5. Generate GSD file

Procedure

Configure the Y-link using your configuration tool (for example *COM PROFIBUS*) just like any other DP slave on PROFIBUS DP.

For this purpose download the complete GSD file for the Y-link to your configuration tool.

Note

When configuring with GSD file

If a Y-link with PROFIBUS DP interface module with IM 153-2OD does not start up, check the creation of the GSD file.

Reason:
In the Y-link, the "MLFB" user parameter is set by default to "6ES7 153-2BA01(2)-0XB0" or "6ES7 153-2BA81(2)-0XB0".

Remedy:
To use the PROFIBUS DP interface module IM 153-2OD (6ES7 153-2BA70-0XA0), you must select the compatible predecessor module:

Change the user parameter "MLFB" to "6ES7153 2BA82 0XB0".

Parameter assignment and configuration frame

The frame length for parameter assignment depends on the number of PA field devices in use and may amount to a maximum of 223 bytes.

The frame length for configuration depends on the number and maximum configuration of the DP slaves in use and may amount to a maximum of 244 bytes.

The structure of the parameter assignment and configuration frames is available for download from the Internet (http://support.automation.siemens.com/WW/view/en/13406349).

Restrictions

Functions that depend on reading the configuration prior to initial parameter assignment of the Y-link are not supported. For this reason, the CP 5431 cannot be used as DP master, for example. It is also not possible to modify variables with *COM PROFIBUS* before the parameter assignment of the Y-link.

B.2.3 Configuring underlying DP slaves

Requirement

The product designations for the required DP slaves must have been entered in the GSD file of the IM 153-2.

Note

For the redundancy mode only those DP slaves may be configured that have the entries "Begin of Device" or "Begin of Device h supported" in their GSD file.

Configuration principle

To configure the Y link select the manufacturer's specifications for the SP slaves in your configuration tool (Product and, where applicable, module designation). The specifications for the DP slaves must be entered in ascending order corresponding to their addresses.

An example of a configuration is shown in the figure below.

Procedure

1. In your configuration tool move to the DP slave configuration.
2. Enter the manufacturer designation (for example SIEMENS ET 200S (IM151 BASIC) for the first DP slave in the "Order number" or "Module" field and apply this in the first slot. Set the PROFIBUS address for the DP slave.
   Repeat this procedure for all of the DP slaves in use.
3. Terminate the entries and complete the configuration. The further procedure (for example saving, compiling, ...) is identical to other DP slaves.

PROFIBUS address of the IM 153-2 in the underlying DP master system

In the underlying DP master system the two IM 153-2 use the addresses 1 and 2. In addition, the address 125 is blocked for DP slaves. The first possible address for an underlying DP slave is 3.

Configuring with *COM PROFIBUS*

For SIMATIC S5 the DP slaves are integrated via their GSD files as a standard slave in *COM PROFIBUS* (V3.1 and later).

1. Copy the GSD file of the IM 153-2 into the*COM PROFIBUS* directory: **...COMPBxx\GSD**.
2. Start *COM PROFIBUS* and select the **File > Read in GSD file** menu command.
   Result: The IM 153-2 is displayed in the hardware catalog during slave configuration.
3. Configure the DP slaves using *COM PROFIBUS*.

Example: View of configuration in *COM PROFIBUS*

The figure below shows an example of the view of a configuration for the Y link using *COM PROFIBUS*.

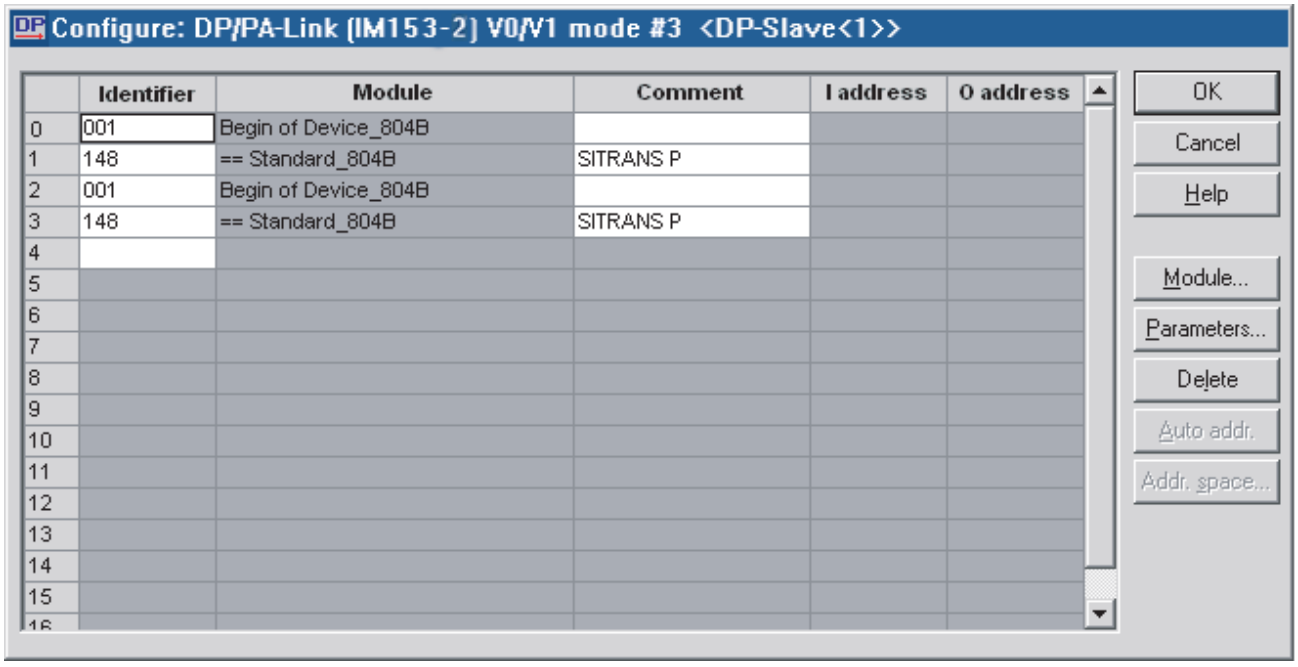


Figure B-3 Example of a configuration with *COM PROFIBUS*

How to enter a PROFIBUS address

1. In the "Module" column select the "Begin of Device" of the relevant DP slave and select the "Parameter..."button.
2. In the "Value" column enter the desired PROFIBUS address and confirm with "OK".

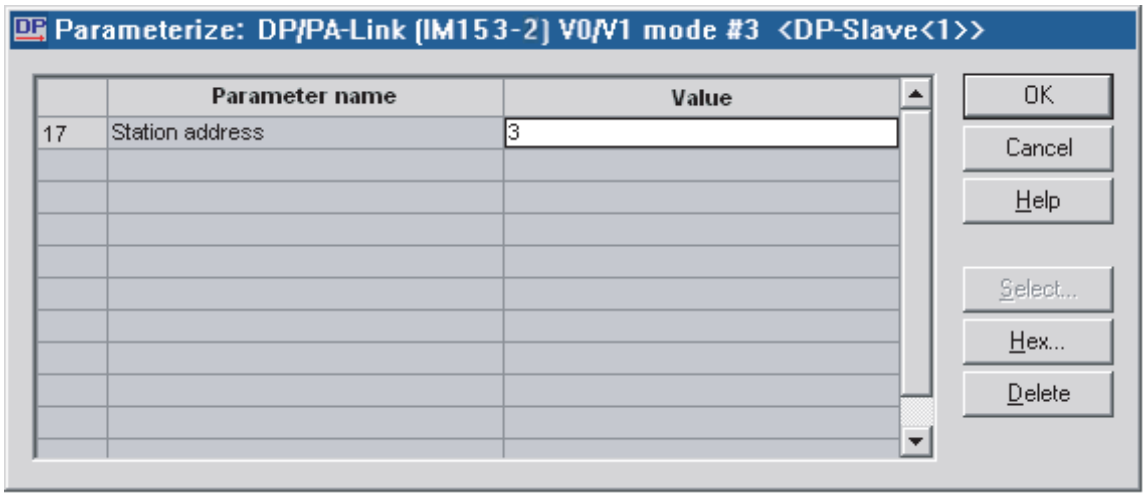


Figure B-4 Entering the PROFIBUS address

Glossary

Active field distributors

Active field distributors distribute the PROFIBUS PA via spur lines to PA field devices (e.g. measuring devices, sensors, actuators)

- AFD4 / AFD4 (FM / AFD 4 Railmount: Connection of up to 4 PA field devices)
- AFD8: Connection of up to 8 PA field devices
- AFDiSD: Use in hazardous areas possible, 6 connectors for PA-field devices (for detailed information on the number of PA-field devices see: "" - Special properties of the AFDiSD)

Address

The address of a node is used for localizing it in the network. It must be unique throughout the network.

Automation system

An automation system is a programmable control system, consisting of at least one CPU, various input and output modules as well as operating and monitoring devices.

Bus

A common transmission route to which all nodes are connected; it has two defined ends.

Bus connector

Physical connection between bus node and bus cable.

Bus link

A bus link is a combination of PROFIBUS DP interface module (IM 153-2OD) and a specific coupler.
Typical combinations are DP/PA link and Y-link.

Coupler

The DP/PA coupler connects a PROFIBUS PA segment to a PROFIBUS DP segment. PROFIBUS PA and PROFIBUS DP are coupled to one another in terms of data but are separated in terms of the transmission hardware.

Diagnostic interrupt

Diagnostics-capable modules report system errors they have detected to the central CPU by means of diagnostic interrupts.

In SIMATIC S7: When an error (e.g. wire break) is detected or disappears, provided the interrupt is enabled, the module initiates a diagnostic interrupt. The CPU interrupts the processing of the user program and lower priority classes and processes the diagnostic interrupt block (OB 82).

In SIMATIC S5: The diagnostic interrupt is shown within the device-related diagnostics You can identify errors, such as wire break, by cyclically scanning the diagnostic bits.

Diagnostics

Diagnostics is the detection, localization, classification, display and further evaluation of errors, faults and messages.

Diagnostics provides monitoring functions that run automatically while the plant is in operation. This increases the availability of plants by reducing commissioning times and downtimes.

DP master

A master that behaves in conformity with IEC 61784-1:2002 Ed1 CP 3/1 is termed a DP master.

DP slave

A slave that is operated on the PROFIBUS bus with the PROFIBUS DP protocol and that behaves in conformity with IEC 61784-1:2002 Ed1 CP 3/1 is termed a DP slave.

DP standard

Bus protocol of the distributed I/O system in accordance with IEC 61784-1:2002 Ed1 CP 3/1

DP/PA coupler

See Field bus coupler

DP/PA link

A DP/PA link creates a gateway between the PROFIBUS DP and up to 5 PROFIBUS PA segments. The DP/PA link consists of one or, in a redundant configuration, two PROFIBUS DP interface modules and up to five DP/PA couplers.

DPV0

"DPV0" mode designates a mode for communication between devices on the PROFIBUS. The mode includes the basic functions of the PROFIBUS DP communication protocol:

- Cyclic data exchange between control system and slaves.
- Configuration via GSD files
- Diagnostics

DPV1

"DPV1" mode is a further development of the original PROFIBUS standard *IEC 61784-1:2002 Ed1 CP 3/1*.
DPV1 identifies a mode for communication between devices on PROFIBUS.

The mode extends the functions of the PROFIBUS DP communication protocol compared to "DPV0" mode. The changes are specified in the IEC 61158 standard:

- Acyclic data exchange between control system and slaves.
- Integration into engineering systems via EDD or FDT / DTM
- Transferable PLC software function blocks (IEC 61131 3)
- Fail-safe communication (PROFIsafe)
- Interrupts (hardware interrupt, status interrupt, update interrupt, manufacturer-specific interrupt, diagnostic interrupt, plug interrupt, pull interrupt)

Electromagnetic compatibility

Electromagnetic compatibility is the capacity of electrical equipment to function faultlessly in a specified environment without affecting the environment in an inadmissible manner.

Equipment, associated

Electrical equipment that contains both intrinsically safe and non-intrinsically safe electric circuits and is installed so that the non-intrinsically safe electric circuits cannot impede the intrinsically safe ones.

Equipment, electrical

All components, electric circuits or parts of electric circuits that are normally found in a single enclosure.

Equipment, intrinsically safe, electrical

A piece of electrical equipment in which all electric circuits are intrinsically safe.

Equipotential bonding

Electrical connection (equipotential bonding conductor) that brings the bodies of electrical equipment and external conductive bodies to an equal or almost equal potential level to prevent interfering or dangerous voltages between these bodies.

Fieldbus

The fieldbus is a serial bus system for the distributed connection of field devices to an automation system.

Floating

Having no conductive connection to ground

Ground

The conductive earth whose electrical potential can be set equal to zero at any point.

Ground refers to the entirety of all interconnected inactive parts of a piece of equipment that cannot possess a dangerous touch voltage, even in the event of a malfunction.

Ground

The conductive earth whose electrical potential can be set equal to zero at any point.

Ground refers to the entirety of all interconnected inactive parts of a piece of equipment that cannot possess a dangerous touch voltage, even in the event of a malfunction.

Ground terminal PE

Terminal marking for electrical equipment used in hazardous areas and to which the equipotential bonding is connected.

Grounding

Grounding means connecting an electrically conductive part to a grounding system by means of the ground electrode.

GSD file

All slave-specific properties are stored in a General Station Description file (GSD file). The format of the GSD file is to be found in the PROFIBUS guideline: Specification for PROFIBUS Device Description and Device Integration Vol.1: GSD V4.1, 07/2001 of the PROFIBUS-Nutzerorganisation (PNO).

Hazardous area (Ex area)

Area in which a potentially explosive gas atmosphere is present or expected in such quantities that special measures with regard to the design, installation and use of equipment are required.

H-system

High-availability system consisting of at least two CPUs or two separate devices, such as PCs (master / reserve). The user program is processed identically in the master and in the reserve devices.

HW Config

Integral part of *STEP 7* for configuring hardware.

Identification and maintenance data

Identification data (I-data) is information about the module, some of which are printed onto the module enclosure. I-data is read-only.

Maintenance data (M-data) is plant-dependent information such as installation location, installation date, etc. M-data is created during configuration and written to the module.

Identification and maintenance data (I&M) is information stored in a module that supports you in

- Checking the system configuration
- Locating hardware modifications in a system
- Troubleshooting in a system

Modules can be uniquely identified online with the I&M data.

Master

When a master is in possession of the token, it can send data to other nodes and request data from other nodes (= active node). DP masters are, for example, the CPU 315-2 DP or the IM 308-C.

Parameter assignment

Parameter assignment is the transfer of slave parameters from master to the slave.

PNO

PROFIBUS user organization

Power supply unit

A power supply unit supplies power to the field devices and the process I/O connected to them.

PROFIBUS

PROcess FIeld BUS, process and fieldbus standard as defined in the fieldbus standard (IEC 61784-1:2002 Ed1 CPF 3 PROFIBUS and PROFINET). It specifies functional, electrical, and mechanical properties for a bit-serial fieldbus system.

PROFIBUS is available with the protocols: DP (=Distributed I/O) and FMS (= Field bus Message Specification)

PROFIBUS address

For the purpose of unique identification on PROFIBUS DP, each node must be given a PROFIBUS address.

PC / PG or the ET 200 Handheld have the PROFIBUS address "0".

DP master and DP slaves have a PROFIBUS address from the 1 to 125 range.

PROFIBUS DP interface module (IM 153-2OD)

A PROFIBUS DP interface module is used to connect components to the PROFIBUS DP.
As a head module, the PROFIBUS DP interface module is an integral component in the following setups:

- Station of ET 200M
- DP/PA link
- Y-link

PROFIBUS DP

PROFIBUS bus system with the DP protocol. DP stands for "dezentrale Peripherie" in German (distributed I/O in English).

PROFIBUS PA

PA stands for Process Automation and increases the range of usage of the PROFIBUS DP family to include the field of process engineering. Process engineering refers to both the intrinsically safe sectors of the chemicals industry and to the non-intrinsically safe sectors, such as nuclear power plant automation, the food industry and waste water technology.

Redundant systems

Redundant systems are characterized by the multiple (redundant) presence of important automation components. If a redundant component fails there the processing of the program is not interrupted.

Reference potential

The potential from which the voltages of the circuits involved are examined and/or measured.

Segment

A segment or bus segment is a self-contained section of a serial bus system.

SELV

Safety extra low voltage (SELV) is voltage < AC 30 V / DC 60 V that is generated via a safety transformer, accumulator etc.

SIMATIC PDM

SIMATIC PDM (Process Device Manager) is a universal tool that is not manufacturer-specific and is used for configuring, parameter assignment, commissioning and diagnostics of intelligent process devices. *SIMATIC PDM* makes it possible to configure a large variety of process devices with a single software on a standardized user interface.

Supply unit

A supply unit supplies power to the line.

Terminating resistor

A terminating resistor is a resistor for termination of the the data transmission line to prevent reflections.

Time-of-day synchronization

Time-of-day synchronization ensures that all clocks run synchronously. A master clock distributes the time in a configurable cycle to all other components in the automation system that have a clock. The components use this distributed time to set their own clocks.

TN-S system

In a TN-S system, the neutral conductor (N) and protective conductor (PE) are routed separately from each other. The neutral conductor is connected to the grounded protective conductor at a central point, and only there. The protective conductor can be grounded any number of times.

Token

In network technology a token refers to a bit pattern that is passed from one bus node to another, enabling that node to access the bus.

Total current

Total current of all PA field devices

Transmission rate

The transmission rate specifies the number of bits transmitted per second.

Type of protection

The special measures applied to electrical equipment to prevent the ignition of a potentially explosive ambient atmosphere.

Update

After (compatible) function extensions or after performance improvements, you should upgrade (update) the firmware of the components to the latest firmware version.

Y-coupler

The Y-coupler is used exclusively in connection with a redundant PROFIBUS DP interface module. The Y-coupler forms the Y-link together with the redundant PROFIBUS DP interface module.

In the Y-link, the coupler creates a gateway between a redundant PROFIBUS DP and a non-redundant PROFIBUS DP.

Y-link

The Y-link creates a gateway between a redundant PROFIBUS DP and a non-redundant PROFIBUS DP.
The Y-link consists of a redundant PROFIBUS DP interface module and a Y-coupler.

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