SIEMENS

SIMATIC

Distributed I/O ET 200iSP

Operating Instructions

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

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

CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

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Preface

Purpose of the manual

The information in this manual enables you to operate the ET 200iSP distributed I/O device as a DP slave via an RS 485 IS coupler on the PROFIBUS DP RS 485 IS.

Basic knowledge required

This manual presumes a general knowledge in the field of automation engineering.

The following qualifications are also required:

Table 1 Qualified personnel

Activities	Qualifications
Setting up the ET 200iSP	• Basic technical training • Knowledge of safety regulations regarding the workplace
Wiring the ET 200iSP	• Basic practical training in electro-engineering • Knowledge of the relevant electrotechnical safety regulations • Knowledge of methods of installing explosion-proof electrical equipment • Knowledge of safety regulations regarding the workplace
Commissioning the ET 200iSP	• Knowledge of all electrical and functional parameters and properties of the ET 200iSP • Knowledge of the functions and commissioning of PROFIBUS-DP • Knowledge of the connected encoders, actuators, and HART field devices • Knowledge of the safety regulations regarding the workplace, particularly regarding procedures in hazardous areas

Range of validity of this manual

This manual is valid for the distributed I/O station ET 200iSP.

Changes since with the previous edition

This manual contains the following changes/additions compared to the previous version:

- Terminal modules TM-PS-A UC and TM-PS-B UC
- Power supply PS 120/230 VAC

Approvals

Refer to Chapter Standards and certifications (Page 195)

CE mark

Refer to Chapter Standards and certifications (Page 195)

Labeling for Australia (C-tick mark)

Refer to Chapter Standards and certifications (Page 195)

Standards

Refer to Chapter Standards and certifications (Page 195)

Position in the information landscape

In the Chapter Order numbers (Page 347) you´ll find a listing of additional sources of information on the SIMATIC S7 and the ET 200 distributed I/O system.

Guide

This manual describes the hardware of the ET 200iSP distributed I/O station. It consists of introductory chapters and reference chapters (technical specifications).

- Installing and wiring the ET 200iSP distributed I/O station
- Commissioning and diagnostics of the ET 200iSP distributed I/O station
- Components of the ET 200iSP distributed I/O station
- Order numbers

Special notes

The EC-type-examination certificate and EC certificate of conformity for the ET 200iSP distributed I/O device are available from Service & Support on the Internet (http://www.siemens.com/automation/service&support)

Recycling and disposal

Due to the fact that it is low in contaminants, the ET 200iSP distributed I/O station is recyclable. For ecologically compatible recycling and disposal of your old device, contact a certificated disposal service for electronic scrap.

Additional support

Please contact your local Siemens representative and offices if you have any questions about the products described in this manual and do not find the right answers.

You will find information on who to contact on the Internet (http://www.siemens.com/automation/partner)

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

The online catalog and the online ordering systems are available on the Internet.

Training Center

We offer a range of courses to help you get started with the ET 200iSP distributed I/O station and the SIMATIC S7 automation system. For details, please contact your local Training Center or the Central Training Center in Nuremberg, D -90327 Germany.
Further information is available on the Internet (http://www.sitrain.com)

Technical support

You can contact the Technical Support for all the A&D products by means of the Web form Internet (http://www.siemens.de/automation/support-request) for the support request.

You can find additional information about our Technical Support on the Web (http://www.siemens.com/automation/service).

Service & Support on the Internet

In addition to our documentation pool, we offer our complete online knowledge base on the Internet (http://www.siemens.com/automation/service&support).

There you will find:

- The newsletter, which constantly provides you with up-to-date information on your products.
- The documentation you need, by using our Service & Support search engine.
- A forum where users and experts from all over the world exchange experiences.
- Your local Automation & Drives representative.
- Information about on-site services, repairs, spare parts, and lots more.

Table of contents

1 Product overview

1.1 Distributed I/O stations

Distributed I/O stations - Area of application

When a system is set up, it is common for the inputs to and outputs from the process to be incorporated centrally in the automation system.

If the inputs/outputs are located at greater distances from the automation system, the wiring can become very extensive and complex, and electromagnetic interferences can impair reliability.

In such systems, it is often advisable to use distributed I/O stations:

- The controller CPU is located centrally.
- the I/O devices are distributed on site
- The powerful PROFIBUS DP with its high data transmission rates ensures smooth communication between the controller CPU and the I/O devices.
- Less installation effort since less cables are required.

PROFIBUS DP

PROFIBUS DP is an open bus system based on *IEC 61784-1:2002 Ed1 CP 3/1* with the "DP" transmission protocol (DP stands for distributed peripheral I/O).

Physically, PROFIBUS DP is either an electrical network based on a shielded two-wire cable or an optical network based on a fiber-optic cable.

The "DP" protocol allows fast, cyclic data exchange between the control CPU and the distributed I/O devices.

PROFIBUS RS 485-IS

In contrast to PROFIBUS DP, PROFIBUS DP RS 485-IS is intrinsically safe (protection type - intrinsically safe i). The RS 485 IS coupler ensures intrinsic safety and acts as a safety barrier. You can find addtional information on PROFIBUS RS 485-IS in the "PROFIBUS RS485-IS User and Installation Guideline (http://www.profibus.com)"

DP master and DP slaves

The link between the control CPU and the distributed I/O devices is the DP master. The DP master exchanges data with the distributed I/O devices via PROFIBUS DP and monitors the PROFIBUS DP.

The distributed I/O devices (= DP slaves) prepare the sensor and actuator data on-site so that they can be transmitted to the controller CPU via PROFIBUS DP.

Devices that can be connected to PROFIBUS-DP devices

An extremely wide range of devices can be connected on the PROFIBUS DP as a DP master or as DP slaves, provided their behavior complies with *IEC 61784-1:2002 Ed1 CP 3/1*. These include the devices of the following product families:

- SIMATIC S7/M7/C7
- SIMATIC programming devices/PCs
- SIMATIC HMI (operator panel (OP), operator station (OS), and text display (TD) operator control and monitoring devices)
- Distributed I/O stations
- Devices from other manufacturers

Structure of a PROFIBUS DP network

The figure below illustrates a typical PROFIBUS DP network structure. The DP master is integrated in the relevant device, for example the S7-400 as a PROFIBUS DP interface. The ET 200iSP distributed I/O stations are connected to the DP masters via PROFIBUS DP and PROFIBUS RS 485-IS.

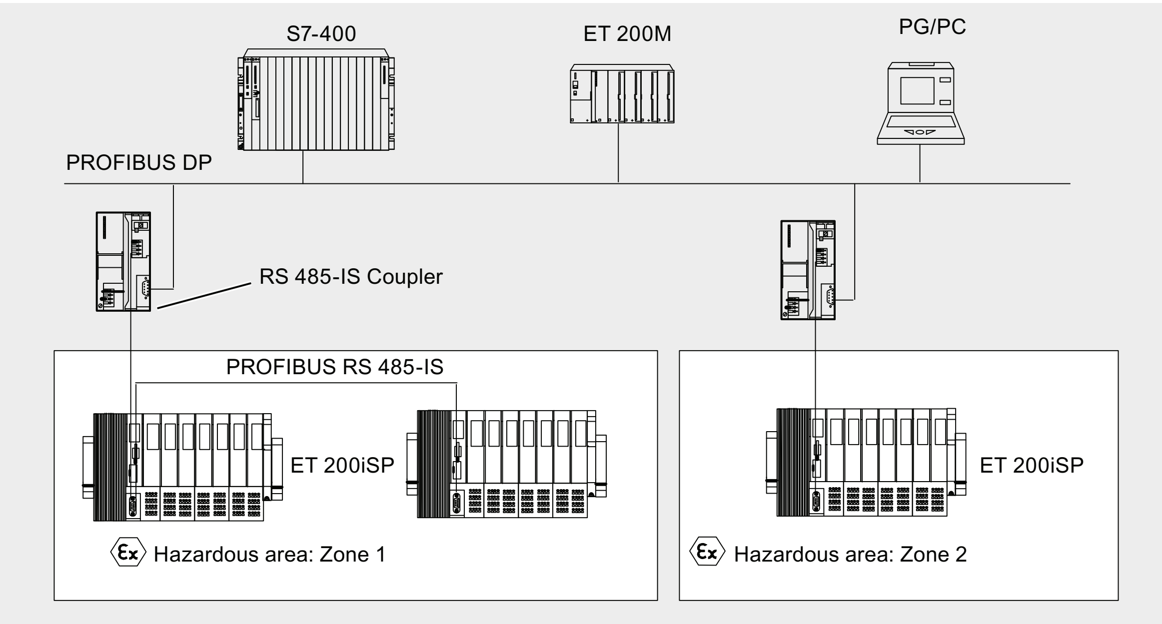


Figure 1-1 Typical structure of a PROFIBUS DP network

1.2 ET 200iSP Distributed I/O Station

Definition

The ET 200iSP distributed I/O station is a highly modular and intrinsically safe DP slave with degree of protection IP 30.

Area of application

The ET 200iSP distributed I/O station can be operated in potentially explosive atmospheres characterized by gas and dust:

Approval	ET 200iSP Station*	Inputs and outputs
ATEX IECEx	Zone 1, Zone 21	up to Zone 0, Zone 20 **
	Zone 2, Zone 22	up to Zone 0, Zone 20 **
* In combination with an appropriate enclosure ** for electronic module 2 DO Relay UC60V/2A: up to Zone 1, Zone 21		

The ET 200iSP distributed I/O station can, of course, also be used in the safety area.

You can insert almost any combination of ET 200iSP I/O modules directly next to the interface module that transfers the data to the DP master. This means you can adapt the configuration to suit your on-site requirements.

Every ET 200iSP consists of a power supply module, an interface module, and a maximum of 32 electronic modules (for example digital electronics modules). Remember not to exceed the maximum current consumption.

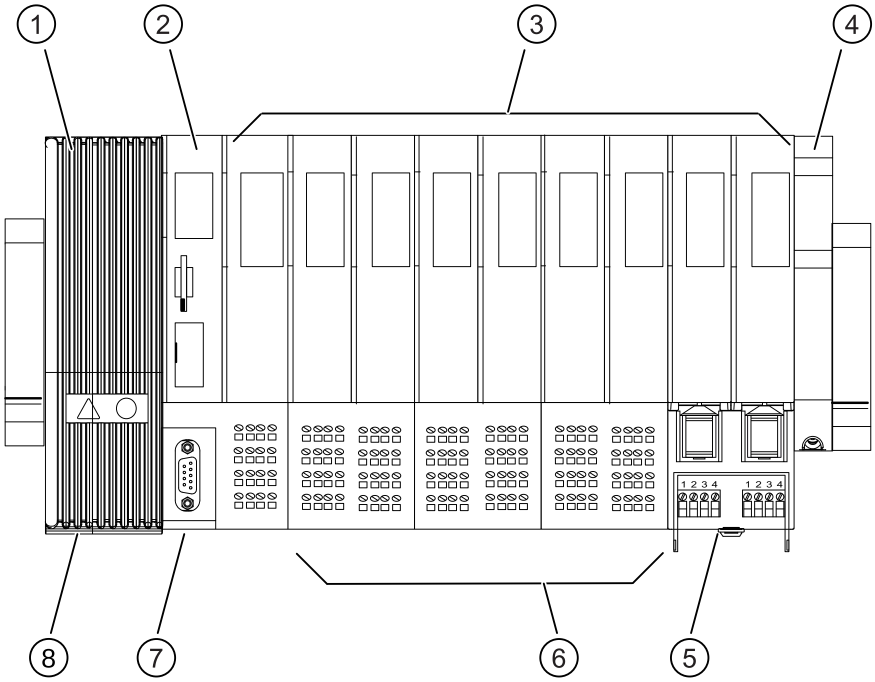
Terminal modules and electronic modules

In principle, the ET 200iSP distributed I/O station consists of various passive terminal modules onto which you plug the power supply and the electronic modules.

The ET 200iSP is connected to PROFIBUS RS 485-IS by means of a connector on terminal module TM-IM/EM. Every ET 200iSP is a DP slave on the PROFIBUS RS 485-IS.

View

The figure below shows an example of an ET 200iSP configuration.



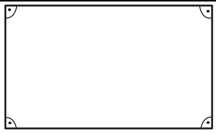
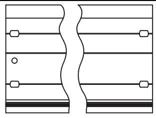
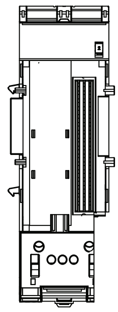
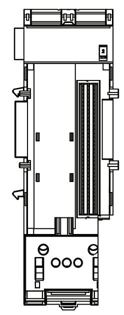
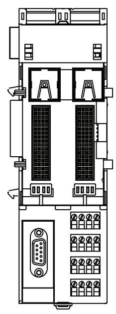
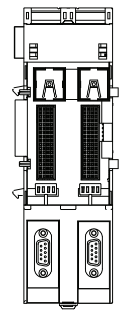
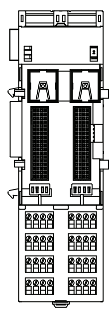
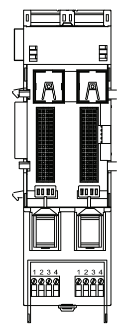
① Power supply PS
② Interface module IM 152
③ Electronic modules
④ Terminating module
⑤ Terminal module TM-RM/RM
⑥ TM-EM/EM terminal modules
⑦ TM-IM/EM terminal module
⑧ Terminal module TM-PS-A/ TM-PS-A UC

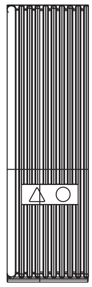
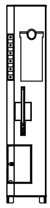
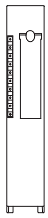
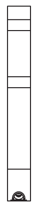
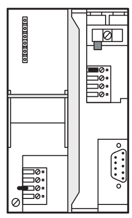
Figure 1-2 View of the ET 200iSP distributed I/O station

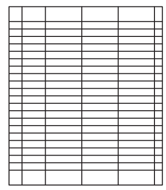
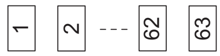
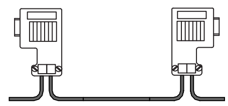
Components of the ET 200iSP

The following table provides an overview of the most important components of the ET 200iSP.

Table 1- 1 Components of the ET 200iSP

Component	Function	Image
Enclosure	...is an additional measure to further increase safety avoiding the production of high temperatures, sparks and electric arcs.	
Mounting rail	...is the rack for the ET 200iSP. You install the ET 200iSP on the mounting rail.	
Terminal module	...carries the wiring and accommodates the power supply module, interface module, and the electronic modules. Terminal modules are available in the following variants: • TM-PS-A for the power supply PS 24 VDC • TM-PS-B for the redundant power supply PS 24 VDC • TM-PS-A UC for the power supply PS 120/230 VAC and PS 24 VDC (Product version 6 and higher) • TM-PS-B UC for the redundent PS 120/230 VAC and PS 24 VDC redundant power supply (Product version 6 and higher) • TM-IM/EM for the interface module • TM-IM/IM for the redundant interface module • TM-EM/EM for the electronic modules • TM-RM/RM for the electronic module 2DO Relay UC60V/2A	TM-PS-A/ TM-PS-A UC  TM-PS-B/ TM-PS-B UC  TM-IM/EM  TM-IM/IM  TM-EM/EM  TM-RM/RM 

Component	Function	Image
Power supply PS	...is plugged into terminal module TM-PS-A / TM-PS-A UC or TM-PS-B / TM-PS-B UC. The power supply module supplies the electronic circuits and sensors with voltage. • PS 24 VDC power supply to TM-PS-A/ TM-PS-B • Power supply PS 120/230 VAC and PS 24 VDC (Product version 6 and higher) to TM-PS-A UC/ TM-PS-B UC	
Interface module	...is plugged onto the terminal module. The interface module connects the ET 200iSP with the DP master and conditions the data for the inserted electronic modules.	
Electronic module	...is inserted onto the terminal module and determines the function: • Digital electronic modules for NAMUR sensors, digital output, relay module • Analog electronic modules with current and resistance measurement circuit, thermoresistor and thermocouples, analog output • Reserve module • Watchdog module	
Terminating module	...completes the ET 200iSP.	
RS 485-IS Coupler	...couples PROFIBUS DP to PROFIBUS RS 485-IS.	

Component	Function	Image
Labeling sheet (DIN A4, perforated, foil)	...for machine labeling or printing 80 strips per labeling sheet	
Slot number labels	...are used for identifying the slots on the terminal module.	
PROFIBUS cable with bus connector	...interconnects the PROFIBUS RS 485-IS nodes or connects the RS 485-IS coupler to ET 200iSP. PROFIBUS connector RS 485-IS, including switched terminating resistor	

Features and benefits of the ET 200iSP

Table 1- 2 Features and benefits

Properties	Benefits
Structure	
Modular structure based on 4- or 8-channel electronic modules	• Station design optimized to contain costs • Reduced configuration and documentation effort • Space savings due to the ability to string modules together in any order
Extensive range of electronic modules	Broad area of application
Permanent wiring due to the separation of mechanical and electronic components	• Prewiring possible • Hot swapping of modules while the ET 200iSP is operating when at least two electronic modules are present.
Integrated power bus	Reduced effort required for wiring
Connection system	
Screw or spring terminals	Use of most suitable terminating technique
Intrinsically safe inputs and outputs complying with Ex ia IIC	Intrinsically safe sensors, actuators and HART field devices up to Zone 0/ 20 can be connected
Automatic coding of the I/O modules	Quick and reliable module replacement
Large label	Adequate space for clear identification
Disabling all digital outputs of a module by an intrinsically safe switching signal	Control of the outputs independent of the process image

Properties	Benefits
Functionality	
Changing parameter settings and expansion during operation	No restart of the ET 200iSP necessary
Time stamping, flutter monitoring, pulse stretching	Efficient monitoring of the inputs
Counting and frequency measurement	Options for use in technological applications
Identification data I&M	Unique identification/assignment of the modules used (for example, for validation, quality assurance)
Analog value display in S7 format	
IEEE tags	Analog modules with HART support up to four IEEE tags in IEEE754 format
Redundancy of IM 152 (V2.0 and higher)	• on S7-DP masters (e.g. S7-400H) • with software redundancy
Redundancy of the power supply PS	with TM-PS-A/ TM-PS-A UC

DP master

All ET 200iSP modules support communication with DP masters that are compliant with *IEC 61784-1:2002 Ed1 CP 3/1* and operate with "DP" transmission protocol (DP stands for distributed peripherals or distributed I/O).

1.3 ET 200iSP in the Hazardous Area

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 ET 200iSP can be used in the Zone 1/ 21, Zone 2/ 22 hazardous areas, and in the safe area.

ET 200iSP supports the connection of intrinsically safe sensors, actuators and HART field devices located in Zone 0/20 and in the safe area. The sensors, actuators, and HART field devices must be certified for operation in the corresponding hazardous areas.

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

Table 1- 3 Classification of zones

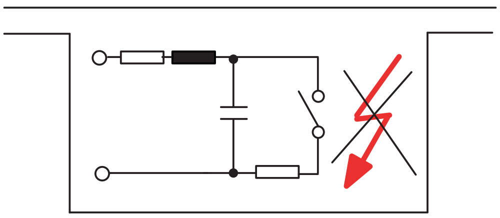
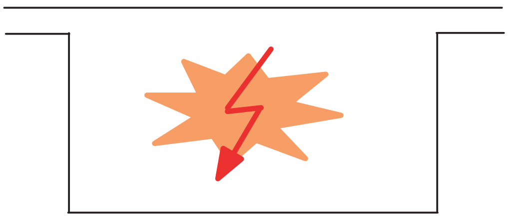
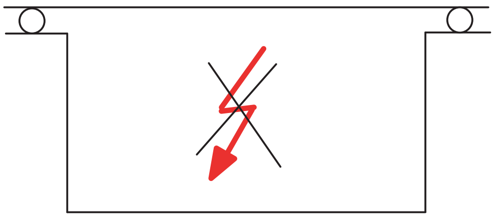
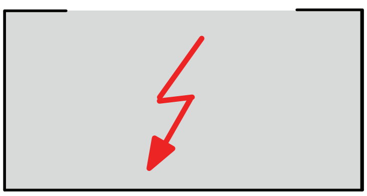
Hazardous areas	Explosion hazard	Example
Zone 0/ 20	Long-term, frequent or permanent presence of explosive gas or dust atmosphere	Within containers.
Zone 1/ 21	Infrequent presence of potentially explosive gas or dust atmosphere	In the region of openings for filling and emptying.
Zone 2/ 22	Rare or short-term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

For more information, refer to the "Principles of explosion protection (http://support.automation.siemens.com/WW/view/en/12521844)" manual.

Types of protection of the ET 200iSP

The types of protection include design and electrical measures relating to the equipment to achieve explosion protection in the hazardous areas.

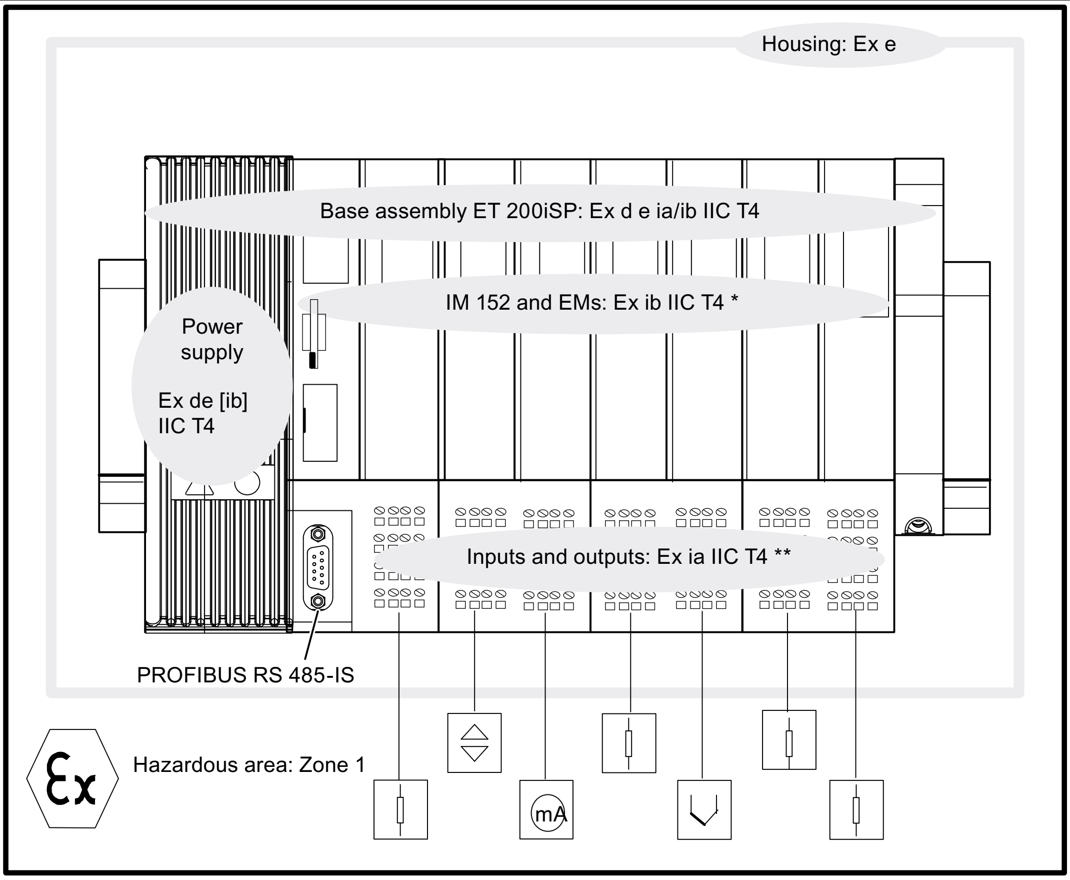
Table 1- 4 Types of protection

Type of Protection	Meaning	Representation
Intrinsic safety i	All voltages, currents, inductance and capacitance occurring are limited by electrical measures (intrinsically safe) - sparks or thermal effects capable of causing ignition cannot occur.	
Explosion-proof enclosure d	The power supply module is installed in a stable (explosion-proof) enclosure. If the explosive atmosphere within the enclosure ignites, the enclosure will withstand the explosion and contain the explosion within the module.	
Increased-safety enclosure e	In the Zone 1 hazardous area, the ET 200iSP must be installed in an additional enclosure. The enclosure must have the increased safety e type of protection. This type of protection involves additional measures to avoid the occurrence of high temperatures, sparks and arc-over. In the Zone 2 hazardous area, this type of protection is unnecessary. Here, the ET 200iSP must simply be installed in an enclosure suitable for zone 2 with at least degree of protection IP 54.	
Encapsulation "m"	In electronic module 2 DO Relay UC60V/2A, the internal relay is embedded in a sealing compound. This means that an explosive atmosphere surrounding the equipment can be ignited neither by sparks nor by unacceptable heating.	

Identification codes of the ET 200iSP

Equipment for operation in hazardous areas is marked with an identifier indicating the hazardous environments in which the equipment can be used. The ET 200iSP has the following marks:

Table 1- 5 Markings of the ET 200iSP



Meaning:	
Ex:	Explosion protection marking
ia:	Type of protection intrinsic safety (up to zone 0)
ib:	Type of protection intrinsic safety (up to zone 1)
d:	Type of protection explosion-proof enclosure
e:	Type of protection increased safety
IIC:	Explosion group for hydrogen
T4:	Temperature Class: Maximum permitted surface temperature 135 °C
* Electronic module 2 DO Relay UC60V/2A: Ex eibmb IIC T4 ** Terminal module TM-RM/RM: Ex deib IIC T4	

Certifications of the ET 200iSP distributed I/O station

The EC-type-examination certificate and EC certificate of conformity for the ET 200iSP distributed I/O station are available on the Internet: "Service & Support (http://www.siemens.com/automation/service&support)"

1.4 Figure Integration in the Control System

PCS 7

PCS 7 is a powerful process control system. With PCS 7, the ET 200iSP is directly attached to the control system.

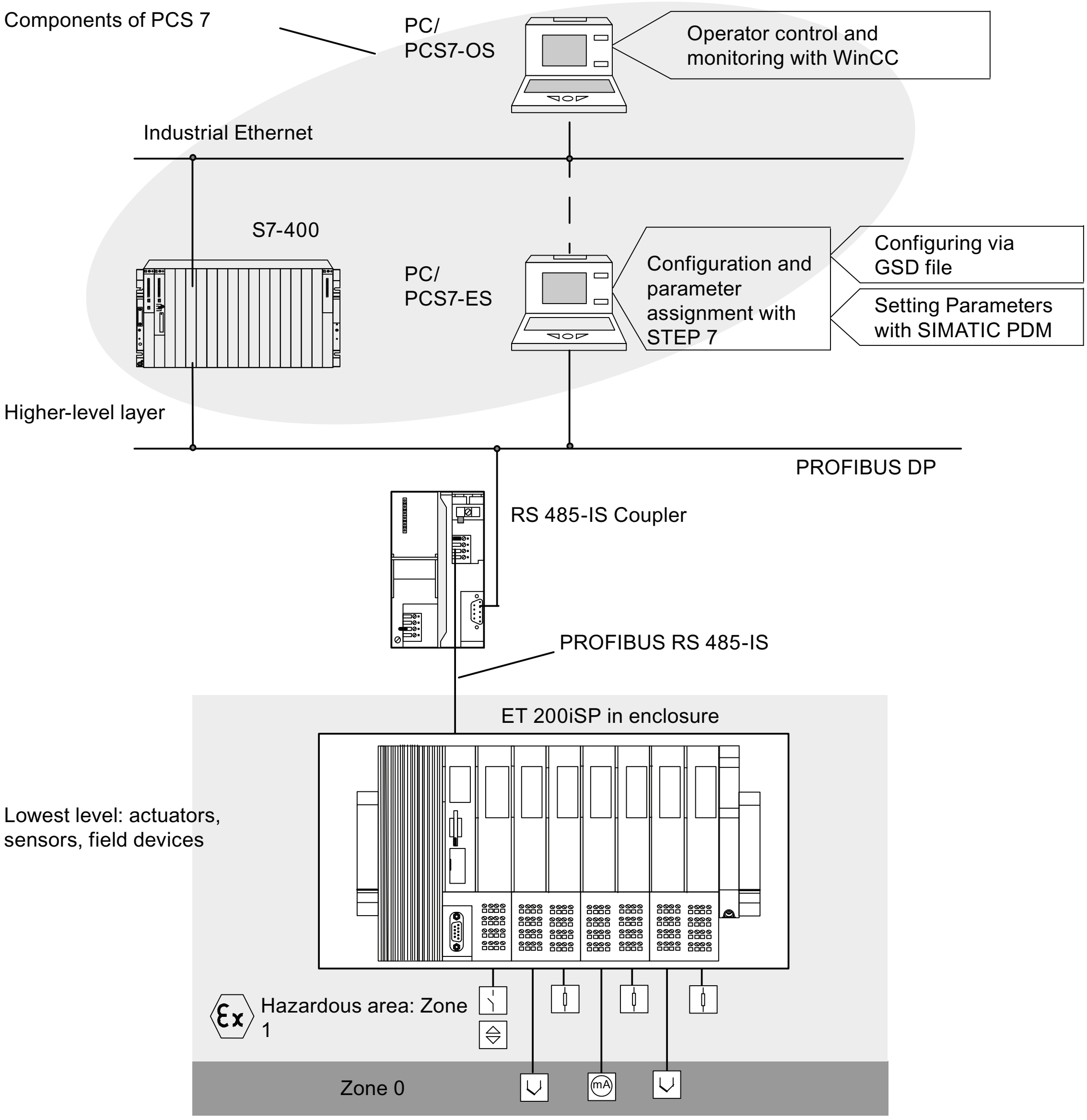


Figure 1-3 Integration in the Control System

2 Commissioning guideline

2.1 Introduction

Introduction

This manual guides you step-by-step through a concrete example until you have created a functioning application. While working through the example, you will learn the basic hardware and software functions of your ET 200iSP.

2.2 Prerequisites

Prerequisites

The following requirements must be met:

- You must be familiar with the basics of electrical and electronic engineering and the procedures relating to potentially explosive atmospheres and have experience working with computers and Microsoft(R) Windows(TM) 2000/ XP.
- STEP 7 (version 5.3 Service Pack 1 or higher and the current HW update) or PCS 7 (version 6.1 or higher) is completely installed on your programming device and you have a basic knowledge of STEP 7. You may also use older versions of STEP 7.
- If you implement this example in a hazardous area, you must adhere to all the rules and regulations explained and listed in this manual.

Note

Always observe the guidelines according to EN 60 079-17 when performing operation checks. This standard also contains the directives of international standard IEC 60 079-17.

DANGER

When laying cables and wiring in hazardous areas, make sure that you adhere to the installation regulations complying with EN 60 079-14 and any regulations specific to your country.

When operating the ET 200iSP in areas with combustible dust, you need to observe EN 61241-14 as well.

WARNING

When used in plants or systems, the ET 200iSP is subject to special rules and regulations depending on the area of application.

Please note the current safety regulations for the prevention of accidents, e.g. IEC 204 (EMERGENCY-OFF equipment).

You risk severe injuries or damage to machines and equipment if you ignore these directives.

See also

Basics of commissioning and diagnostics (Page 133)

2.3 Materials and Tools Required to Set Up the Example

Required materials and tools

Table 2- 1 Required materials and tools

Quantity	Article	Order Number (Siemens)
1	SIMATIC S7-300, mounting rail L=160 mm (for RS 485-IS coupler)	6ES7390-1AB60-0AA0
2	SIMATIC S7-300, mounting rail L=480 mm (for ET 200iSP)	6ES7390-1AE80-0AA0
1	Enclosure for ET 200iSP with degree of protection Ex e (for use of ET 200iSP in the zone 1 potentially explosive area)	Contact your Siemens representative
1	TM-PS-A terminal module	6ES7193-7DA10-0AA0
1	Terminal module TM-IM/EM with terminating module	6ES7193-7AA00-0AA0
2	Terminal module TM-EM/EM	6ES7193-7CA00-0AA0
1	Interface module IM 152	6ES7152-1AA00-0AB0
1	Power supply PS 24 VDC	6ES7138-7EA01-0AA0
2	8 DI NAMUR	6ES7131-7RF00-0AB0
3	4 DO DC17,4/27mA SHUT DOWN "H"	6ES7132-7RD11-0AB0
1	RS 485-IS Coupler	6ES7972-0AC80-0XA0
2	PROFIBUS bus connector (for master and RS 485-IS coupler)	6ES7972-0BB50-0XA0
1	PROFIBUS bus connector RS 485-IS up to 1.5 MBaud incl. terminating resistor	6ES7972-0DA60-0XA0
1	PROFIBUS-DP cable	for example, 6XV1830-0EH10
2	NAMUR sensor	for example, BERO 3RG 4612-1NA00
1	1-wire On button	normal suppliers
3	LEDs with series resistor	normal suppliers
1	Universal rack	6ES7400-1TA01-0AA0
1	Power supply module PS S7-400	6ES7407-0DA02-0AA0
1	CPU CPU S7-416-3 DP	6ES7416-3XR05-0AB0

Quantity	Article	Order Number (Siemens)
1	Programming device (PG) with PROFIBUS DP interface, installed STEP 7 software (Version 5.3, Service pack 1 or higher and the current HW update), communications processor CP 5611 and PG cable	various
1	Screwdriver with 3 mm blade	normal suppliers
1	Screwdriver with 4,5 mm blade	normal suppliers
1	Cutting tool for the mounting rails	normal suppliers
1	Cable cutters and wire stripping tools	normal suppliers
1	Tool for crimping wire-end ferrules	normal suppliers
1	Cable for grounding DIN rails with 10 mm cross-section with terminal end to fit M6, length to suit local situation	normal suppliers
1	Cable lug for M6	normal suppliers
1	Flexible wire with 1 mm² cross section with suitable ferrules with insulation collar, length 6 mm	normal suppliers

2.4 Overview of the Configuration

Overview

Overview of the sample configuration (wiring and power sources not illustrated)

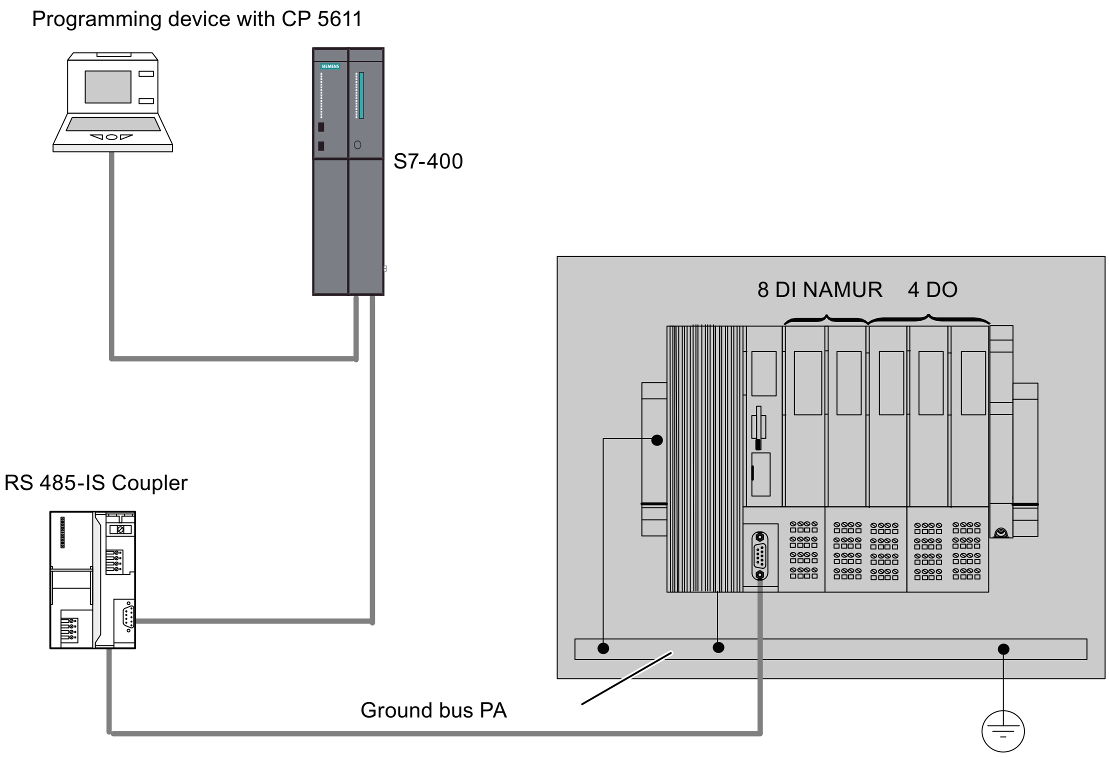


Figure 2-1 Overview of the sample configuration

2.5 Installing the the Sample Configuration

2.5.1 Installing the ET 200iSP

Setting up the ET 200iSP

1. Install the mounting rail (480 mm) in the Ex e enclosure that you have previously secured to a firm base.
2. Install the modules starting at the left-hand end of the rail. Begin with terminal module TM-PS-A (fit onto top of rail - push in at the bottom - fasten with two screws). Continue with the remaining modules (fit onto top of rail - push in at the bottom - push to the left). Insert the modules in the following order:
   – TM-PS-A terminal module
   – TM-IM/EM terminal module
   – 2 x terminal module TM-EM/EM
   – Terminating module

2.5.2 Installing the S7-400

Installing the S7-400

1. Install the rack on a stable surface. Refer to Operating Instructions

   Automation System S7-400: Hardware and Installation (http://support.automation.siemens.com/WW/view/en/1117849)
2. On the left of the rack, start by installing the separete modules (hang in - swivel into position - screw on tightly). Insert the modules in the following order:
   – Power supply module PS
   – Central module CPU 416-3 DP

2.5.3 Installing the RS 485-IS Coupler

Installing the RS 485-IS Coupler

1. Install the mounting rail (160 mm) on a stable surface.
2. Hang the RS 485-IS coupler onto the rail and then swivel it in.

Note

Install the RS 485-IS coupler in an enclosure outside of the Ex area.

2.6 Wiring the Sample Configuration

Wiring the TM-PS-A

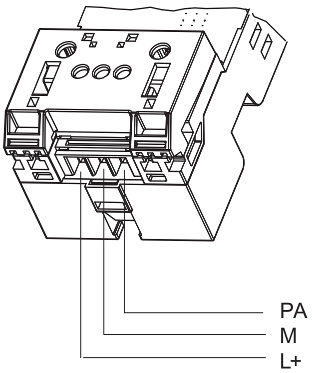


Figure 2-2 Wiring the TM-PS-A

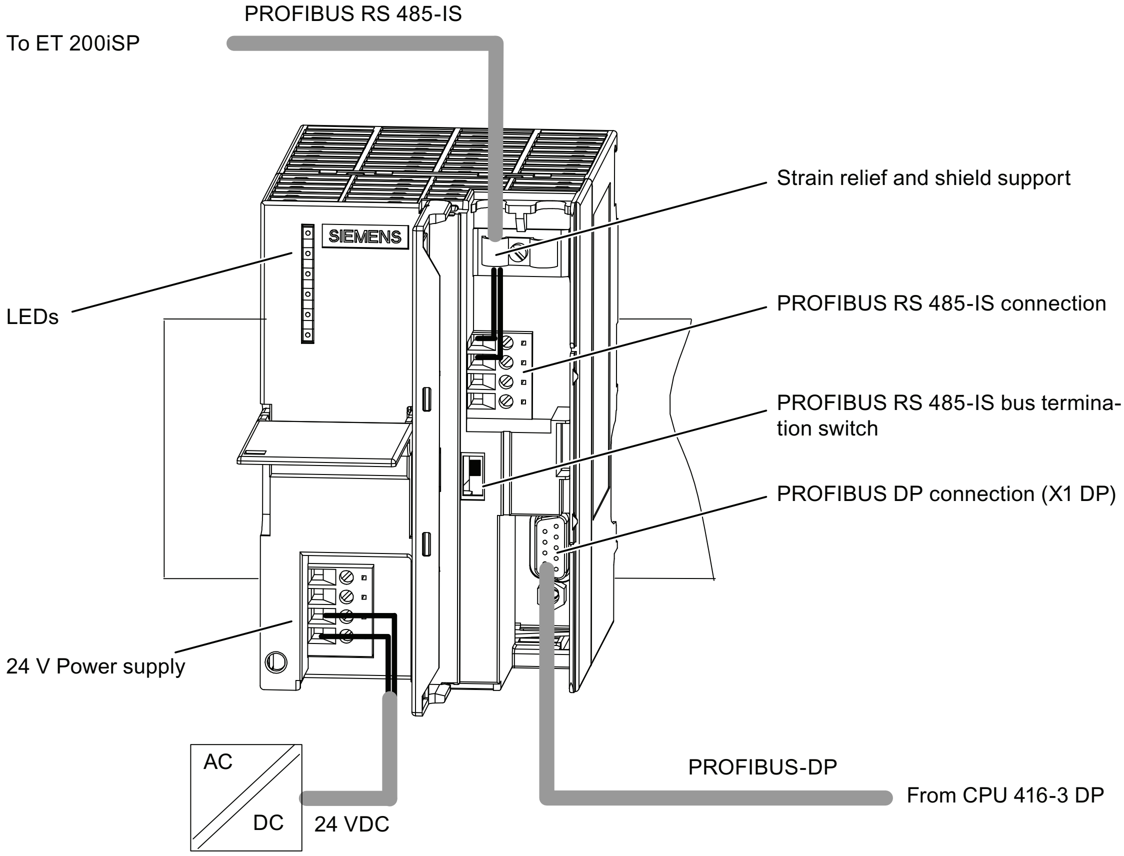
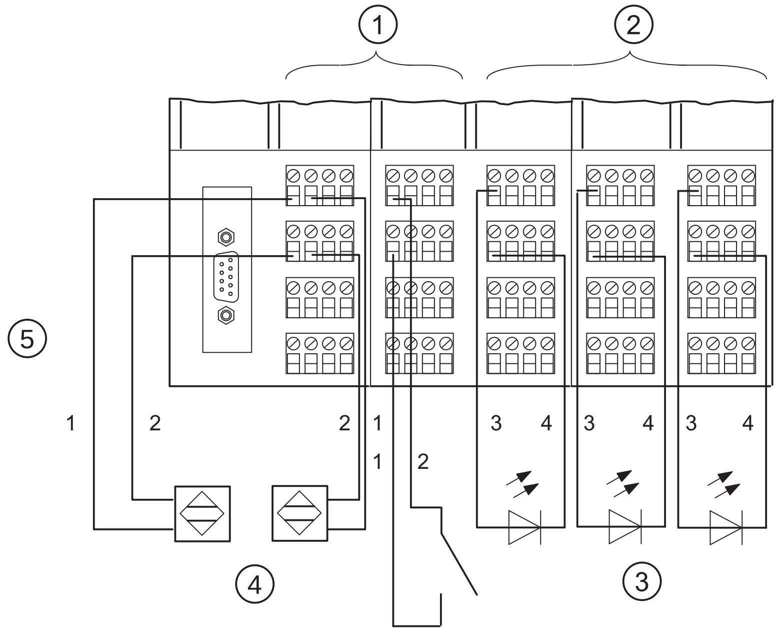


Figure 2-3 Wiring the RS 485-IS Coupler

Connect the following:

1. The programming device (PG) and the CPU 416-3 DP (interface: X1 MPI) with a programming device cable.
2. The mounting rail of the S7-400, including the grounding conductor.
3. The mounting rail of the ET 200iSP and the power supply PS with the equipotential bonding PA. Use the grounding bolts to secure to the mounting rail.
4. The CPU 416-3 DP (interface: X2 DP) with the RS 485-IS coupler, as shown above using a PROFIBUS DP cable (PROFIBUS connector 6ES7972-0BB50-0XA0).
5. The interface IM 152 with the RS-485-IS coupler, as shown earlier. Use a PROFIBUS DP cable (PROFIBUS connector 6ES7972-0BB50-0XA0).
6. The TM PS-A, the RS 485-IS Coupler and the power supply module PS S7-400 with the power supply.

Wire the ET 200iSP as shown below:



① 2 x 8 DI NAMUR
② 3 x 4 DO DC 17, 4/27 mA
③ LEDs
④ NAMUR sensor
⑤ Terminals

Figure 2-4 Wiring ET 200iSP modules

2.7 Inserting the interface module and the electronics modules

Inserting Modules

Insert the modules in the following order:

- Power supply PS 24 VDC
- Interface module IM 152
- 2 x 8 DI NAMUR
- 3 x 4 DO DC17.4V/27mA

See also

Installing Terminal Modules for the Interface Module and Electronics Modules (Page 94)

2.8 Setting the PROFIBUS address

Setting the PROFIBUS address

Set PROFIBUS address 3 on the interface module IM 152.

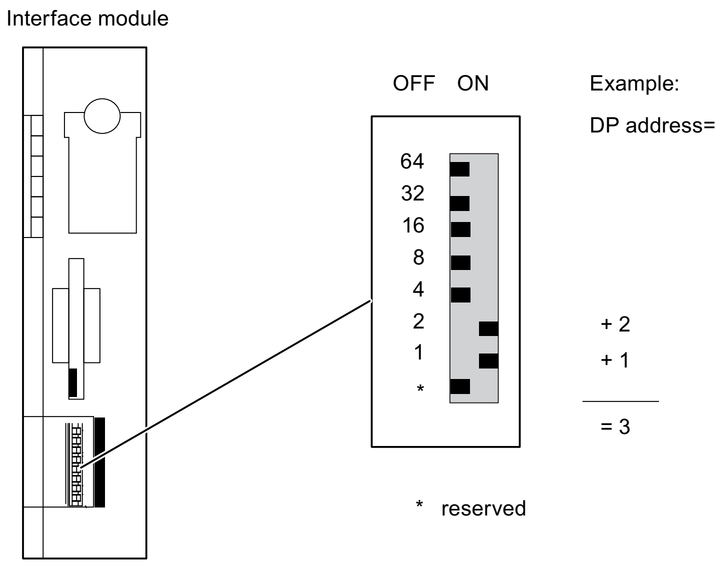


Figure 2-5 Setting PROFIBUS address 3

See also

Setting the PROFIBUS address (Page 130)

2.9 Configuring the Example

2.9.1 Configuring S7-400

Step 1

Open STEP 7.

Step 2

If the New Project Wizard opens, close it with Cancel.

Step 3

Go to the main menu of the SIMATIC Manager and select File > New. A dialog box opens in which you enter "ET 200iS" as the name and then close the dialog with OK.

Step 4

Select Insert > Station and then click SIMATIC 400 Station in the list. An icon with the name SIMATIC 400(1) appears in the right-hand pane of the project window.

Step 5

Now double-click on the icon of the SIMATIC 400 station in the SIMATIC Manager. An icon labeled "Hardware" now appears in the right-hand pane of the window. Double-click on this icon. HW Config opens.

Step 6

If no catalog with components is displayed on the right-hand side of the window, activate the display by selecting View > Catalog in the menu.

Expand the SIMATIC 400 folder and RACK-400 folder until you see UR1. Double-click on this icon.

Step 7

Select slot 1 (it changes to blue) and then return to the catalog and open the folders SIMATIC 400, PS 400 and Standard PS 400 until you can see PS 407 4A. Double-click on this icon. The power supply module now occupies slot 1.

Step 8

Next, select slot 3, then go to SIMATIC 400 via CPU 400, CPU 416-3 DP, and 6ES7416-3XR05-0AB0. A double-click opens a window titled "Properties-PROFIBUS interface DP". Acknowledge this with OK. The CPU is entered in slot 2.

Step 9

In the lower left-hand window, locate the row labeled DP and select it. Right-click on the row and select **Object Properties**. The "Properties DP" dialog opens. Click the **Properties** button and in the next dialog, click **New**. A new DP subnet operating at 1.5 Mbps is created. Now confirm by clicking **OK** three times in succession.

Step 10

In the main menu, you can save the changes with **Station > Save and Compile**.

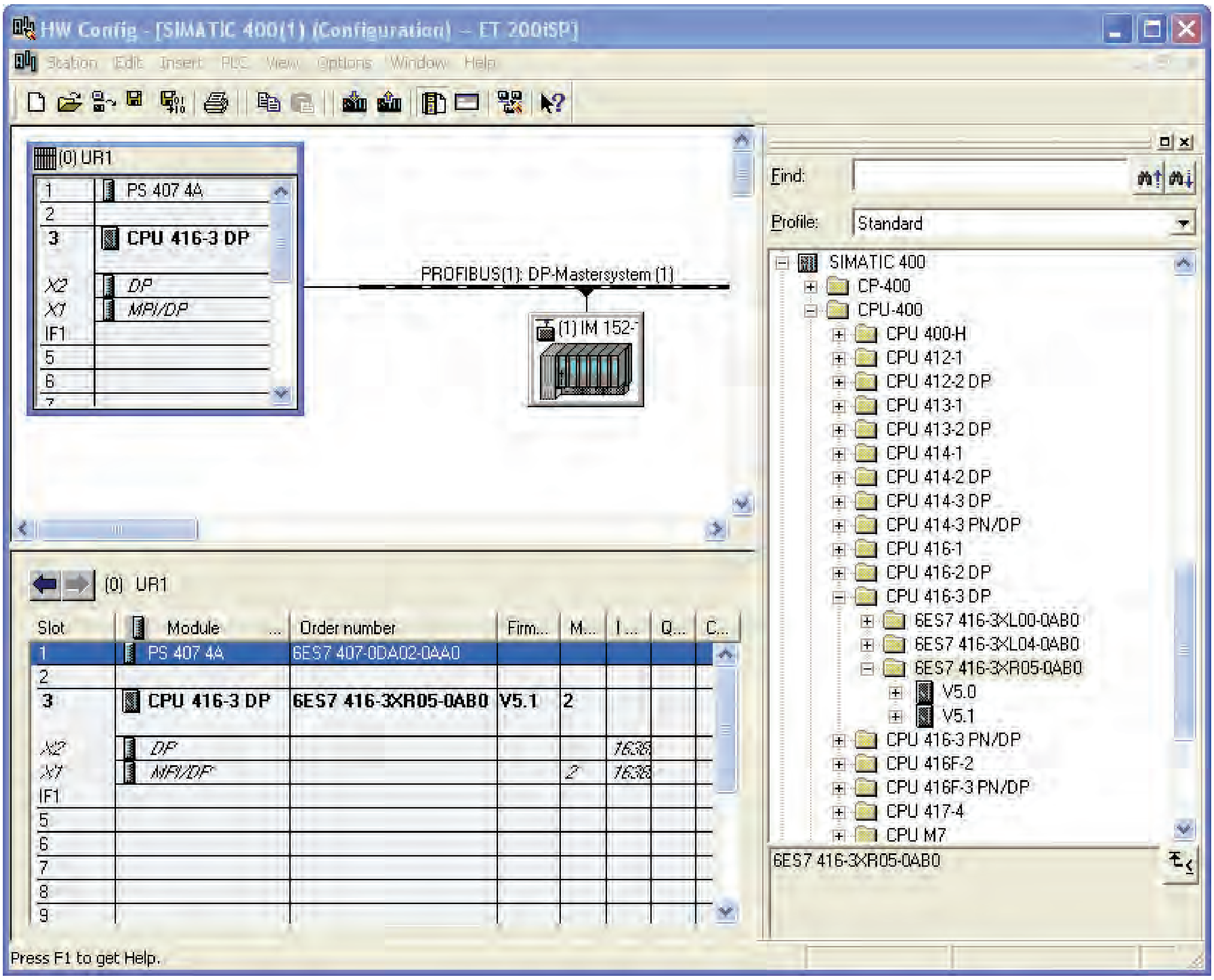


Figure 2-6 Configuring the S7-400

2.9.2 Configuring and assigning parameters for the ET 200iSP

Step 1

In the upper left-hand window of HW Config, click on the stylized PROFIBUS to select it. Next, go to the catalog and open PROFIBUS DP and ET 200iSP so that you can see IM 152. Double-click this icon to insert an ET 200iSP station. In the dialog box that opens, change the address to 3 and confirm with **OK**. At the bottom left, you can now see the new slots with an IM 152 in slot 2.

Step 2

Since slot 3 must remain free, select slot 4 and starting from there insert two NAMUR 8 DI modules and three 4 DO DC17.4V27mA modules.

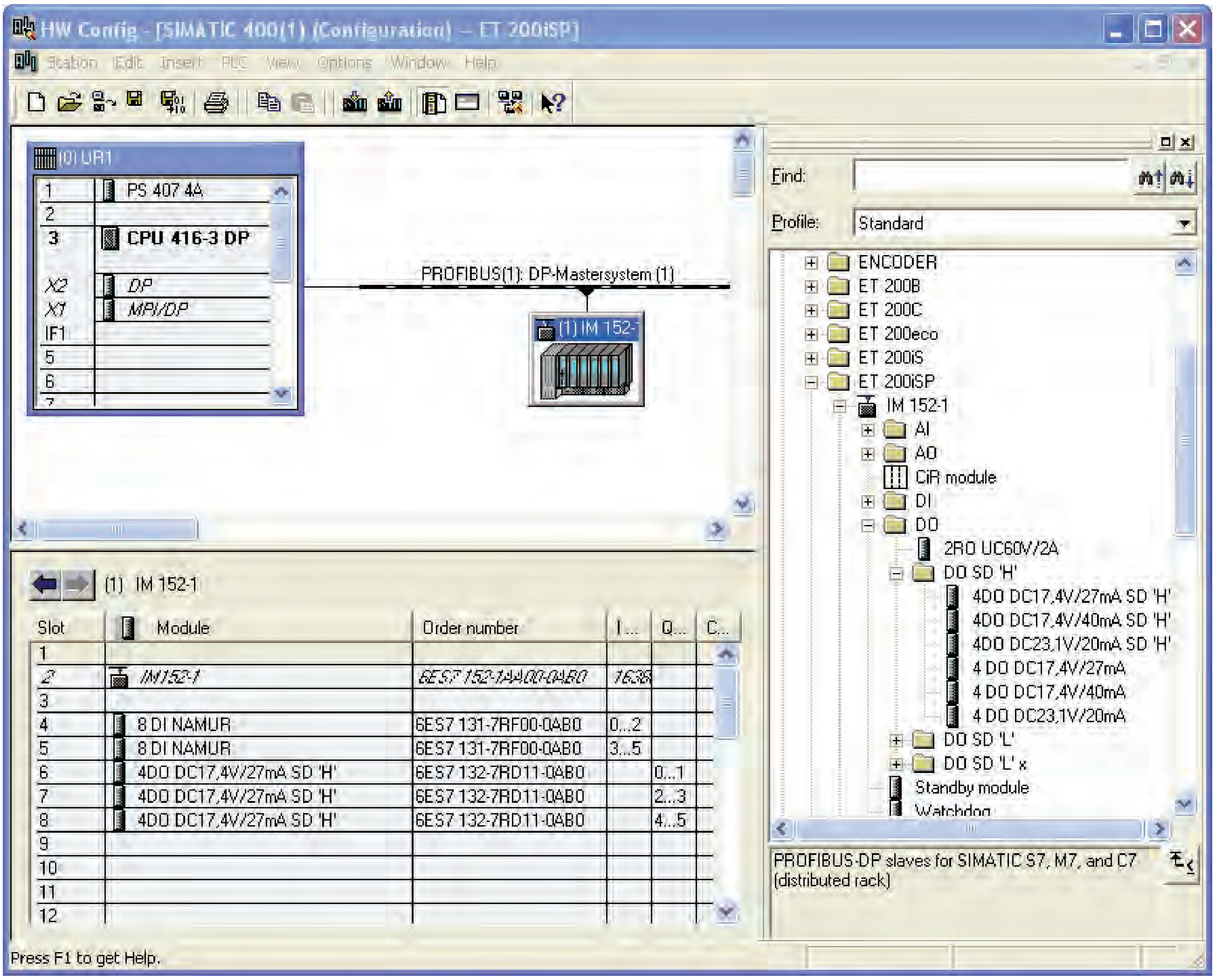


Figure 2-7 Configuring and Assigning Parameters for the ET 200iSP

Step 3

Double-click on the first module in the configuration table (slot 4: 8 DI NAMUR) and select the "Parameters" tab.

At channels 0 and 1 change the sensor type to "NAMUR sensor." Select "disabled" for all other channels.

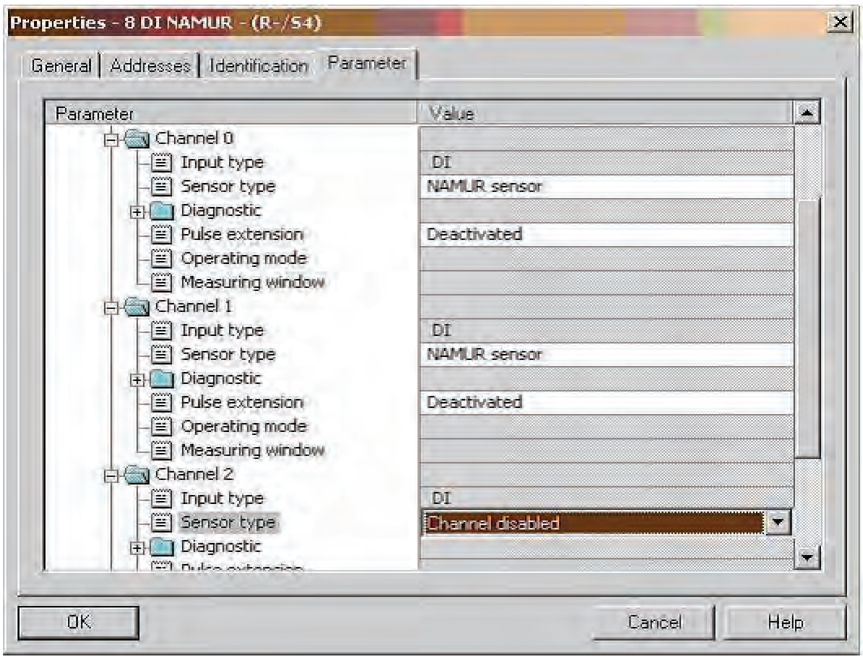


Figure 2-8 Disabling ET 200iSP Channels

Step 4

Follow the same procedure as described in item 3 for each of the ET 200iSP modules, and make the changes as outlined in the table below.

Table 2- 2 Changes

Module	Slot	Type	Channel 0	Channel 1	Channel 2- 7
1	4	8 x DI NAMUR	NAMUR sensor	NAMUR sensor	Sensor type: disabled
2	5	8 x DI NAMUR	NAMUR sensor	Sensor type: Channel disabled	Sensor type: disabled
3	6	4 x DO	No change	No change	---
4	7	4 x DO	No change	No change	---
5	8	4 x DO	No change	No change	---

Step 5

Save the configuration with **File > Save** and download it to the CPU with**PLC > Download**.

2.10 Programming the Sample Configuration

Principle of operation

The state of the sensors connected to inputs I512.0 , I513.0 and I514.0 is looked up and analyzed. I512.0 increments an internal counter and I513.0 decrements it. Input I514.0 resets the counter to zero.

Depending on the counter value, outputs Q512.0, Q513.0 and Q514.0 are set or deleted. Q512.0 is set when the count is 0. At a count < 3, Q514.0 is set and at ≥ 3, Q513.0 is set.

Programming

Change to the component view with **View > Component View**.

Open the following in succession: SIMATIC 400(1), CPU 416-3 DP, S7 Program(1) and blocks until you can see the block OB1. Double-click on OB1 and confirm the dialog with **OK**.

Enter the following STL program:

STL	Explanation
A I 514.0	If button 514.0 is active,
R C 0	set counter to 0
A I 512.0	If BERO 512.0 is active,
CU C 0	increment by 1
A I 513.0	If BERO 513.0 is active,
CD C 0	decrement by 1
AN C 0	Is counter = 0 ?
= Q 512.0	YES, then output 512.0 is active
L C 0	Load counter in ACCU
L 3	Load 3 in ACCU
>=I	Is counter => 3 ?
= Q 513.0	YES, then output 513.0 is active
<I	Is counter < 3 ?
= Q 514.0	Yes, then output 514.0 is active

Save the program with **File > Save** and download it to the CPU with**PLC > Download**.

2.11 Putting the Example into Operation

Commissioning

Turn on the power supply of the ET 200iSP.

Watch the status LEDs on the S7-400 and the ET 200iSP:

- CPU 416-3 DP is lit

  RUN: lit

  All other LEDs: off
- ET 200iSP

  SF: off

  BF: off

  ON: lit

  PS ON: lit

2.12 Evaluating the diagnostics

Evaluating the diagnostics

If an error occurs, OB82 is started. Evaluate the startup information in OB82.

Tip: Call SFC13 in OB82 and evaluate the diagnostic frame from the Chapter Commissioning and Diagnostics (Page 133).

2.13 Removing and inserting of modules

Removing and inserting digital electronics module 8 DI NAMUR

1. Remove the first of the three electronics modules 8 DI NAMUR from the terminal module during operation.
2. Monitor the status LEDs on the IM 152:
   – SF: lit -> diagnostic message exists.
   – BF: off
   – ON: lit
   – PS ON: lit

   Result: The ET 200iSP continues to operate problem-free.
3. Evaluate the diagnostic message:

   Result:
   – Station status 1 (byte 0): Bit 3 is set -> External diagnostics
   – ID-related diagnostics: Bit 3 in byte 7 is set -> slot 4
   – Module status: Byte 16.7 / 16.6: 11_B -> no module
4. Re-insert the unplugged electronics module in the terminal module.

   Result:
   – Status LEDs IM 152:

     SF: off

     BF: off

     ON: lit

     PS ON: lit
   – The diagnostic message is deleted.

2.14 Wire break of NAMUR encoder on digital input module

Procedure

1. Remove the wire from terminal 1 of the **first** 8 DI NAMUR electronic module.
2. Observe the status LEDs.
   – Status LED IM 152:
     SF: on -> diagnostic message exists
   – Status LEDs electronic module 8 DI NAMUR:
     SF: on -> diagnostic message exists
     3: off/on
3. Evaluate the diagnostic message
   Result:
   – Station status 1 (byte 0): Bit 3 is set -> External diagnostics
   – ID-related diagnostics: Byte 7.3 is set -> slot 4
   – Channel-related diagnostics:
     Byte 25: 10000011_B -> slot 4
     Byte 26: 01000000_B -> channel 0
     Byte 27: 00110_B -> wire break
4. Connect the wire to the BERO again in terminal 1 and evaluate the diagnostics again:
   – Status LED IM 152
     SF: off
   – Status LEDs electronic module 8 DI NAMUR:
     SF: off
     3: off/on
   – The diagnostic message is deleted.

Configuration options 3

3.1 Modular system

Modular system

With the ET 200iSP, modular means: You can adapt the configuration to your application with 4 and 8 channel electronic modules.

Example

The following schematic shows an example of a possible configuration of the ET 200iSP distributed I/O station:

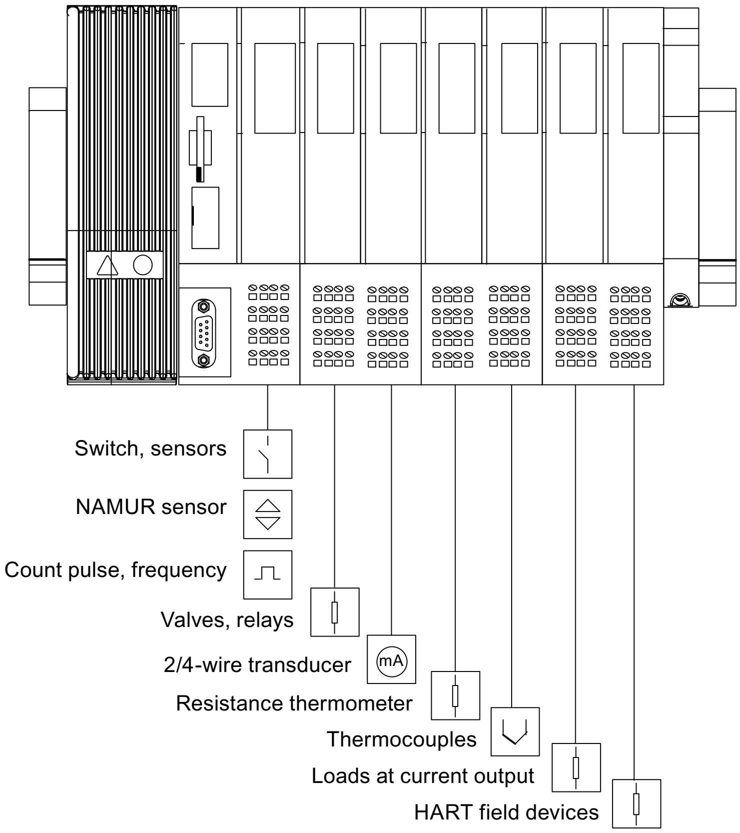


Figure 3-1 Example of an ET 200iSP configuration

3.2 Electronics modules suitable for your application

Which electronic module does what?

In the following table, you will find a guide to the applications of the electronic modules of the ET 200iSP distributed I/O station.

Table 3- 1 Electronic modules to suit your application

Application		Electronic modules
Evaluating NAMUR sensors Evaluation of connected, unconnected mechanical contacts Acquisition of counted pulses Measuring frequencies	8 input channels	8 DI NAMUR
Switching solenoid valves, d.c. relays, indicator lamps, actuators	4 output channels Deactivation via High active, intrinsically safe switching signal	4 DO DC23.1V/20mA SHUT DOWN "H" 4 DO DC17.4V/27mA SHUT DOWN "H" 4 DO DC17.4V/40mA SHUT DOWN "H"
	4 output channels Deactivation via Low active, intrinsically safe switching signal	4 DO DC23.1V/20mA SHUT DOWN "L" 4 DO DC17.4V/27mA SHUT DOWN "L" 4 DO DC17.4V/40mA SHUT DOWN "L"
	2 output channels up to 60 VDC/up to 60 VAC	2 DO Relay UC60V/2A
Measuring currents with two-wire measuring transducers (standard applications) Measuring currents with HART field devices (2-wire transducers) HART communication	4 input channels Input range • 4 to 20 mA • HART	4 AI I 2WIRE HART
Measuring currents with 4-wire measuring transducers (standard applications) Measuring currents with HART field devices (4-wire transducers) HART communication	4 input channels Input ranges • 0 to 20 mA • 4 to 20 mA • HART	4 AI I 4WIRE HART
Measuring temperatures with resistance thermometers Measuring resistance	4 input channels Input ranges • Pt 100, Ni 100 • 600 ohms	4 AI RTD

Application		Electronic modules
Measuring temperatures with thermocouples Measuring thermal e.m.f.	4 input channels Input ranges • ±80 mV • Type J, K, T, U, E, L, N, R, S, B	4 AI TC
Output of currents with HART field devices HART communication Outputting of currents	4 output channels Output ranges • 0 mA to 20 mA • 4 mA to 20 mA • HART	4 AO I HART

3.3 Electronics modules suitable for the terminal modules

Selecting the terminal modules

The table below provides

- an aid for selecting individual terminal modules and
- a slot assignment on the terminal modules.

Table 3- 2 Modules and terminal modules

Modules	Terminal modules									
	TM-PS-A TM-PS-B	TM-PS-A UC TM-PS-B UC	TM-IM/IM		TM-IM/EM 60S TM-IM/EM 60C		TM-EM/EM 60S TM-EM/EM 60C		TM-RM/RM 60S	
Order No. 6ES7193-	7DA10-0AA0 7DB10-0AA0	7DA20-0AA0 7DB20-0AA0	7AB00-0AA0		7AA00-0AA0 7AA10-0AA0		7CA00-0AA0 7CA10-0AA0		7CB00-0AA0	
Power supply PS 24 VDC (up to product version 5)	x									
Power supply PS 24 VDC (up to product version 6)	x	x								
Power supply PS 120/230 VAC		x								
Interface module IM 152			x	x	x					
8 DI NAMUR						x	x	x		
4 DO 23.1 VDC/20mA						x	x	x		
4 DO 17.4 VDC/27mA						x	x	x		
4 DO 17.4 VDC/40mA						x	x	x		
2 DO Relay UC60V/2A									x	x
4 AI I 2WIRE HART						x	x	x		

Modules	Terminal modules									
4 AI I 4WIRE HART						x	x	x		
4 AI RTD						x	x	x		
4 AI TC						x	x	x		
4 AO I HART						x	x	x		
Reserve module						x	x	x	x [1]	x [1]
WATCHDOG						x	x	x		
[1] product version 3 or higher of the reserve module										

3.4 Configuration Options in Zones

General rules

Regardless of the configuration of the ET 200iSP in hazardous areas or in the safe area, the following rules apply:

The ET 200iSP distributed IO station can only be operated on the intrinsically safe PROFIBUS RS 485-IS:

1. An RS 485-IS coupler (field bus isolating transformer) is always required
2. Identification of PROFIBUS DP as Ex i (not only for potentially explosive areas)
3. Marking of the cables/wires to the actuators and sensors as EEx i (for example, using the color light blue).

> ⚠ **WARNING**
>
> All devices connected to PROFIBUS RS 485-IS must be intrinsically safe.
>
> Do not connect voltage measuring devices, oscillographs, and bus testers to PROFIBUS RS 485-IS.

Rules for configuring the ET 200iSP in Zone 1:

If you use the ET 200iSP in zone 1, you must adhere to the following rules:

1. Installation of ET 200iSP in a metallic enclosure (see Chapter "Installation rules (Page 81)") with type of protection Ex e (increased safety). (see Appendix "Order numbers (Page 347)").
2. Isolation of PROFIBUS DP by means of RS 485-IS coupler (see Appendix "Order Numbers (Page 347)"). The RS 485-IS Coupler ensures protection class Ex i of PROFIBUS DP in potentially explosive areas. You can install the RS 485-IS Coupler in zone 2 potentially explosive areas or in safe areas.
3. You can use standard PROFIBUS DP cables (see Appendix "Order Numbers (Page 347)") in potentially explosive areas. You must, however, mark these as "Ex i bus cable" (for example, with a blue band/blue shrink-on sleeve at the ends or mark the cable with a blue color).

4. Connect the PROFIBUS RS 485-IS bus cable to the IM 152 using the PROFIBUS RS 485-IS connector (see Appendix "Order numbers (Page 347)").
5. Terminate the PROFIBUS RS 485-IS with the PROFIBUS RS 485-IS connector: (see Appendix "Order Numbers (Page 347)"). The transmission rate determines the maximum length of PROFIBUS RS 485-IS (refer to product information RS 485-IS coupler (http://support.automation.siemens.com/WW/view/en/29306413)).

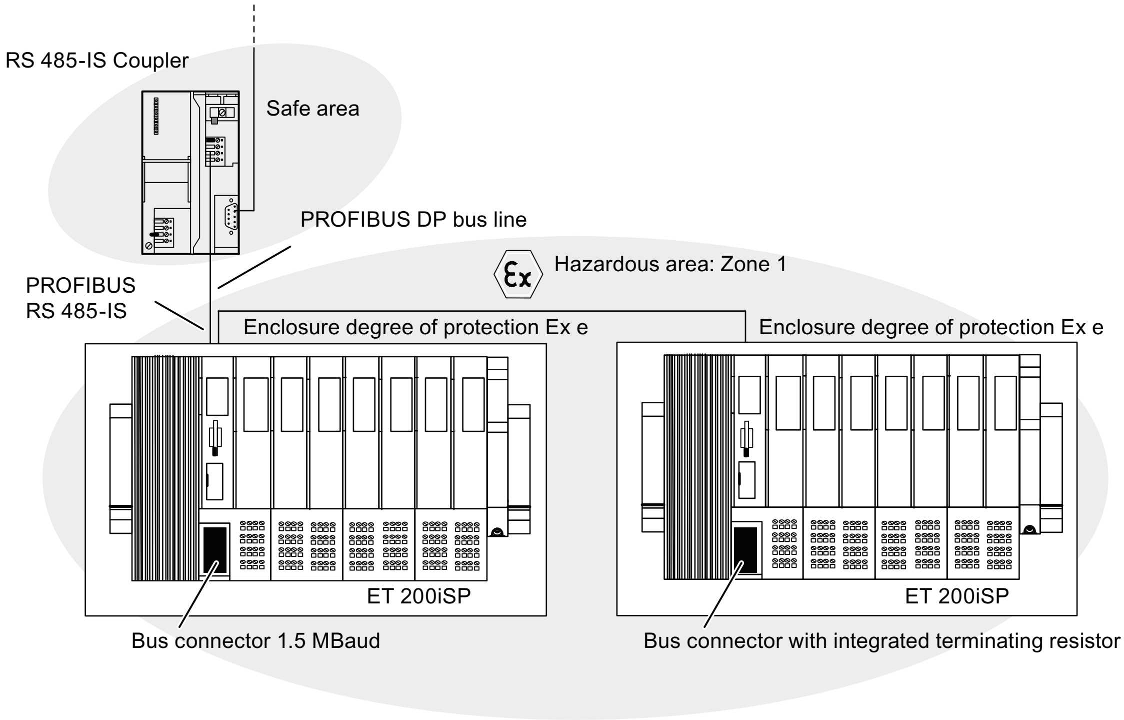


Figure 3-2 Configuration Options for the ET 200iSP in Zone 1

Rules for configuring the ET 200iSP in Zone 21:

If you use the ET 200iSP in zone 21, you must adhere to the following rules:

1. Install the ET 200iSP in a metallic, dust-proof (certified) enclosure (refer to Chapter "Rules for installation (Page 81)") with at least degree of protection IP 6x (according to guideline 94/9/EU for category 2D). Additional requirements (such as surface temperature) can be found in the certification document for the specific enclosure (refer to appendix "Order numbers (Page 347)").
2. See points 2 to 5: *Rules for Configuring the ET 200iSP in Zone 1*

Rules for configuring the ET 200iSP in Zone 2:

If you use the ET 200iSP in zone 2, you must adhere to the following rules:

1. Installation of the ET 200iSP in a metallic enclosure (refer to Chapter "Rules for installation (Page 81)") with at least degree of protection IP 54. The enclosure must have a manufacturer certification for zone 2 (complying with EN 60079-15: Protection from mechanical damage; degree of protection IP 54; avoidance of ignition due to electrostatic charge). (see Appendix "Order Numbers (Page 347)").
2. See points 2 to 5: *Rules for Configuring the ET 200iSP in Zone 1*

Rules for Configuring the ET 200iSP in Zone 22:

If you use the ET 200iSP in zone 22, you must adhere to the following rules:

1. Install the ET 200iSP in a metallic, dust-proof enclosure (refer to Chapter "Rules for installation (Page 81)") with at least degree of protection IP 5x (according to directive 94/9/EU for category 3D). Additional requirements (such as surface temperature) can be found in the certification document for the specific enclosure (refer to appendix "Order numbers (Page 347)").
2. See points 2 to 5: *Rules for Configuring the ET 200iSP in Zone 1*

DANGER

If the Zone 22 potentially explosive area is subject to conductive dust (for example, metal dust), the rules for zone 21 apply.

Rules for configuring the ET 200iSP in the safe area:

If you use the ET 200iSP in a safe area, you must adhere to the following rules:

1. Installation of the ET 200iSP in a metallic enclosure with degree of protection IP 20.
2. See points 2, 4 and 5: *Rules for Configuring the ET 200iSP in Zone 1*

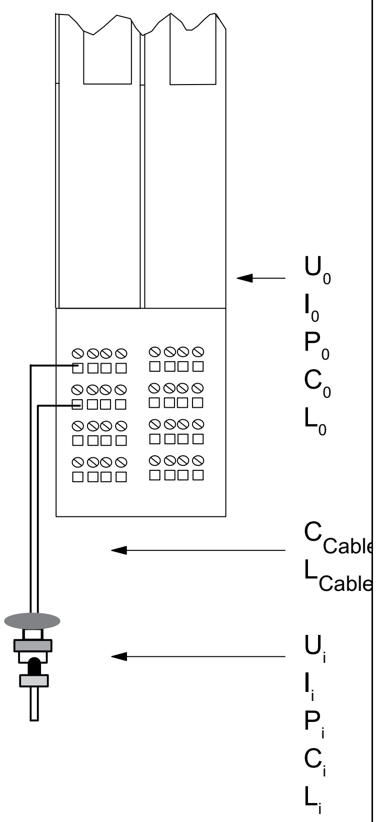
Rules for the configuration of sensors, actuators, and HART field devices in hazardous areas.

The verification of intrinsic safety for each field circuit must be made according to the regulations stipulated by the relevant standards for configuration, selection and installation.

A simple, intrinsically safe circuit results from attaching a sensor, actuator or HART field device to an input or output of an electronic module.

The following table describes the conditions for checking the maximum safe values for a simple, intrinsically safe circuit:

Table 3- 3 Rules for configuration

Relevant Standard / Conditions for Electrical Parameters		Usable Sensors and Actuators
Standard: EN 60 079-14 The following applies to the electrical parameters: • $U_0 \leq U_i$ • $I_0 \leq I_i$ • $P_0 \leq P_i$ • $C_0 \geq C_i + C_{cable}$ • $L_0 \geq L_i + L_{cable}$		The maximum safe values of the sensors and actuators must be adapted to the maximum values of the electronic modules. You will find these maximum values • in the Ex certification of the sensors and actuators • in the technical specifications of the electronic modules of the ET 200iSP
ET 200iSP modules Sensors Actuators HART field devices		U_0 max. output voltage I_0 max. output current P_0 max. output power C_0 max. external capacity L_0 max. external inductance C_{cable} max. capacitance wire/cable L_{cable} max. inductance U_i max. input voltage I_i max. input current P_i max. input power C_i max. inner capacitance L_i max. inner inductance

Safety information

Note

Always configure the system in accordance with EN 60 079-14 directives.

WARNING

Connecting an intrinsically safe sensor, actuator, or HART field device to the input/output of an electronic module must produce an intrinsically safe circuit! Always check for resultant safety values when you select the sensors, actuators and HART field devices for an electronic module.

See also

Operating the ET200iSP with older CPUs (Page 61)

Order numbers (Page 347)

3.5 Use of the ET 200iSP in category M2 of equipment-group I (mining)

Requirements

The following conditions must be fulfilled if the ET 200iSP is used in device group I (underground mining operations and their overground systems) Category M2:

CAUTION

To avoid ignitable sparks, the power supply PS and the mounting rail of the ET 200iSP must be packaged in shock-proof packaging for transportation and storage (e.g. for servicing) and immediately removed from the potentially explosive area.

The enclosure in which the ET 200iSP is installed must be approved for device group I, category M2.

Observe all other requirements concerning use of the ET 200iSP in the potentially explosive area.

3.6 Restricted Number of Connectable Electronics Modules

Number of electronic modules

Each ET 200iSP station consists of a maximum of 32 electronic modules. These include digital and analog electronic modules.

The actual number of electronic modules can be limited by the effective current output of the power supply PS. It is not permitted to violate this limit value (maximum permitted current).

In the following situation, **unrestricted** use and combination of the modules in the ET 200iSP are possible:

ET 200iSP up to 16 electronic modules

Verify any configuration containing a **higher number** of electronic modules (up to 32), or an **EM 4 DO 17.4 VDC/40mA**, with the help of the **calculation table (see below).**

Calculation table

With the calculation table, you can check the operational current consumption of the ET 200iSP.

Note

ET 200iSP always conforms with safety-relevant current consumption limits (limit value < 15 A, see EC Prototype Test Certification KEMA 04ATEX2242). With all configurations, the number of modules is restricted only by the effective current output (refer to following table) or the maximum number of modules (32).

Structure	Power supply		Maximum operational current output
Normal operation	PS 24 VDC[1]		5A
	PS 120/230 VAC[2]		
Redundancy	PS 24 VDC[1]	PS 24 VDC[1]	
	PS 120/230 VAC[2]	PS 120/230 VAC[2]	
	PS 24 VDC[3]	PS 120/230 VAC[2]	

1 Product version 3 and higher:

2 Maximum effective current output 5A at 170 VAC to 264 VAC (up to 60°C) or at 85 VAC to 132 VAC (up to 50°C). Refer to technical specifications in the Chapter Power Supply PS 120/230 VAC.

3 Product version 5 and higher:

Procedure

Check the **operational current consumption** of your ET 200iSP configuration. The limit value specified in the table column *=operational current consumption in mA* must **not be exceeded**.

1. Multiply the operational current per module by the number of modules, then enter the values in the *= operational current consumption in mA* column.
2. Add all modules and enter the value in the *Total Modules* box (maximum of 32 electronic modules).
3. Add the operational current consumption and enter the value in the *Total Current Consumption* box.
4. Compare the calculated totals with the specified limits.

Table 3- 4 Calculation table for current output

Electronic modules	**x Number of modules**	**Operational current per module in mA**	**= Operational current consumption in mA**
Power supply PS 24 VDC/ PS 120/230 VAC	x	15 mA	=
IM 152	x	30 mA	=
8 DI NAMUR	x	80 mA	=
4 DO DC23.1V/20mA SHUT DOWN "H"	x	290 mA	=
4 DO DC17.4V/27mA SHUT DOWN "H"	x	260 mA	=
4 DO DC17.4V/40mA SHUT DOWN "H"	x	380 mA	=
4 DO DC23.1V/20mA SHUT DOWN "L"	x	290 mA	=
4 DO DC17.4V/27mA SHUT DOWN "L"	x	260 mA	=
4 DO DC17.4V/40mA SHUT DOWN "L"	x	380 mA	=
2 DO Relay UC60V/2A	x	100 mA	=
4 AI I 2WIRE HART	x	280 mA	=
4 AI I 4WIRE HART	x	27 mA	=
4 AI RTD	x	19 mA	=
4 AI TC	x	17 mA	=
4 AO I HART	x	295 mA	=
Reserved	x	---	---
WATCHDOG	x	2 mA x DO **	
	Total Modules =		Total Current Consumption =
	max. 32*		**< max. effective current output*** **
* Without power supply PS and IM 152 ** Operational current consumption of WATCHDOG module = 2 mA x number of connected digital output modules *** Refer to above table for values			

Example

An ET 200iSP consists, for example, of the following electronic modules:

- 1 power supply module PS 24 VDC
- 5 x 8 DI NAMUR modules,
- 5 modules 4 DO DC17.4V/27mA SHUT DOWN "H"
- 2 modules 4 DO DC23.1V/20mA SHUT DOWN "H"
- 3 x 4 DI I 2 WIRE HART modules
- 5 x 4 DI I 4WIRE HART modules
- 5 x 4 DI RTD modules
- 4 x 4 DI TC modules
- 3 x 4 AO I HART modules

With 32 electronic modules, the current consumption (< 5000 mA) must be checked:

Table 3- 5 Calculation table for current output

Electronic modules	x Number of modules	Operational current per module in mA	= Operational current consumption in mA
Power supply PS 24 VDC/ PS 120/230 VAC	x 1	15 mA	= 15 mA
IM 152	x 1	30 mA	= 30 mA
8 DI NAMUR	x 5	80 mA	= 400 mA
4 DO DC23.1V/20mA SHUT DOWN "H"	x 2	290 mA	= 580 mA
4 DO DC17.4V/27mA SHUT DOWN "H"	x 5	260 mA	= 1300 mA
4 DO DC17.4V/40mA SHUT DOWN "H"	x ---	380 mA	= ---
4 DO DC23.1V/20mA SHUT DOWN "L"	x ---	290 mA	= ---
4 DO DC17.4V/27mA SHUT DOWN "L"	x ---	260 mA	= ---
4 DO DC17.4V/40mA SHUT DOWN "L"	x ---	380 mA	= ---
2 DO Relay UC60V/2A	x ---	100 mA	= ---
4 AI I 2WIRE HART	x 3	280 mA	= 840 mA
4 AI I 4WIRE HART	x 5	27 mA	= 135 mA
4 AI RTD	x 5	19 mA	= 95 mA
4 AI TC	x 4	17 mA	= 68 mA
4 AO I HART	x 3	295 mA	= 885 mA
Reserved	x ---	---	---
WATCHDOG	x ---	2 mA x DO **	= ---
	Total Modules =		Total Current Consumption = 4348 mA
	max. 32*		< 5000 mA

* Without power supply PS and IM 152
** Operational current consumption of WATCHDOG module = 2 mA x number of connected digital output modules

---

Note

The limit values are adhered to in the example.

Result: ET 200iSP station can be operated with this configuration.

Calculation of ET 200iSP power loss

You can calculate the power loss of the ET 200iSP using the following formula:

$P_{Vtotal} = x*5W + 1.2*\sum P_{V\_Type\_I/O}$

Explanation:

x*5W = basic power loss of power supply (x = 1 for standard configuration, x = 2 for redundant configuration or increase in performance)

$1,2*\sum P_{V\_Type\_I/O}$ = typical power loss of input and output modules, including the resulting P_V in the power supply.

3.7 Maximum configuration of the ET 200iSP

Number of ET 200iSP Stations

You may operate up to 31 ET 200iSP stations on one segment of PROFIBUS RS 485-IS (via RS 485-IS Coupler).

Power consumption of ET 200iSP with full configuration

Refer to technical specifications Power supply PS 24 VDC (Page 223) and technical specifications Power supply PS 120/230 VAC (Page 226).

Width of ET 200iSP

The maximum configuration width ET 200iSP (power supply + interface module + 32 electronic modules + terminating module) is:

- 1.095 m (with one power supply and one IM 152)
- 1.185 m (with two power supplies and two IM 152)

Address space

The interface module supports maximum 244 input and 244 output bytes. There are DP masters that do not control the entire address space.

3.8 Power Supply of the ET 200iSP

Power supply PS

Connect the voltage supply of ET 200iSP to terminal module TM-PS-A/ TM-PS-A UC of the power supply. The power supply provides the required output voltages for the ET 200iSP. The output voltages are electrically isolated from the supply voltage.

- Power supply PS 24 VDC: 24 VDC
- Power supply PS 120/230 VAC: 85 - 264 VAC

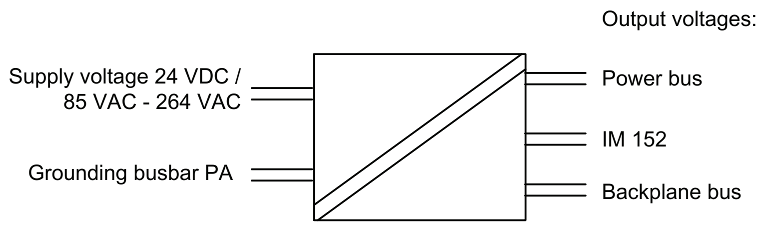


Figure 3-3 Power supply PS

Note

Protect the power supply with a 6 A automatic circuit breakers and tripping characteristic C (for each ET 200iSP station).

3.9 Direct data exchange

Prerequisites

The ET 200iSP can be used as publisher for direct data exchange (cross communication). This requires no configuration.

The DP master you are using must, of course, also support direct data exchange. You will find information on this in the description of the DP master.

Principle of operation

Direct data exchange is characterized by PROFIBUS DP nodes which "listen" on the bus and know which data a DP slave returns to its DP master. With this mechanism, the "listener" (recipient) can access changes to the input data of remote DP slaves directly.

During configuration in STEP 7, you use the peripheral input addresses to specify the address area of the recipient in which the required data of the publisher will be read.

Example

The schematic below illustrates the direct data exchange "relationships" that you can configure with an ET 200iSP as publisher and which nodes can "listen in" as potential recipients.

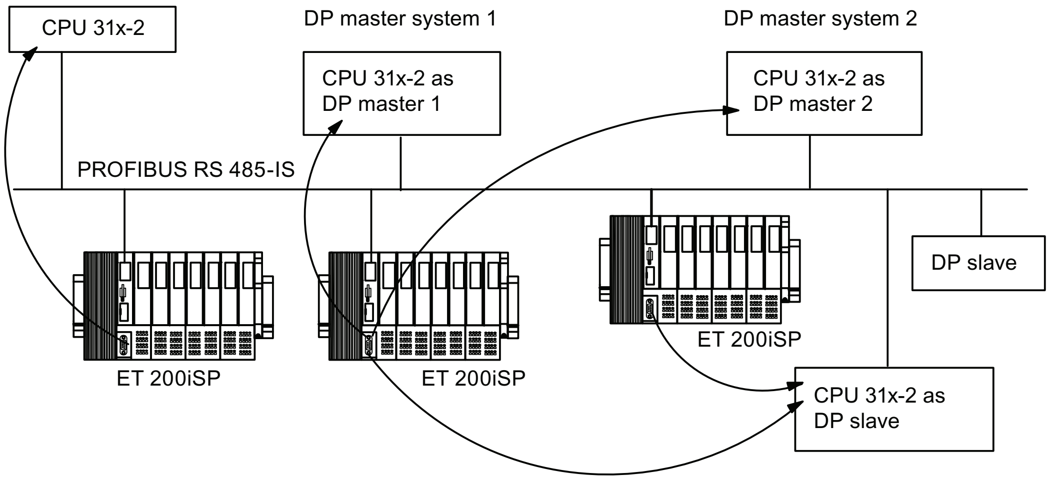


Figure 3-4 Example of Direct Data Exchange

3.10 Identification data I&M

Properties

I data: Information about the module that is normally printed on the enclosure of the module. I data is read-only.

M data: System-specific information such as the installation location and date. M data is generated during configuration and written to the module.

Identification data (I&M) this information stored on a module that supports you when

- Troubleshooting in a system
- Checking the system configuration
- Locating hardware changes in a system

Reading and writing the identification data with STEP 7

HW Config shows the I&M in the "Module status - IM 152" and "Properties - DP Slave" tabs. For information, refer to the STEP 7 Online Help.

Reading and writing the I&M with SIMATIC PDM

With SIMATIC PDM you can read the parameters and I&M by choosing the File > Complete Download to PG/PC menu command and write them by choosing the Device > Complete Download to Device menu command.

Reading the I&M with SFB52

The standard function block SFB 52 can be used to read the data records of a DP slave. To read the I&M, download the data records 231 to 234 (see table below).

Note

At present, the I&M data record objects cannot be read or written to by means of data record DS 255.

Identification data I&M

Table 3- 6 Identification data I&M

I&M	Access	Default	Explanation
I data 0: Index 1 (data record 231)			
MANUFACTOR_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)	Dependent on the module	Order number of the module
SERIAL_NUMBER	read (16 bytes)	Depends on the product version	The serial number of the module is stored here. This makes unique identification of the module possible.
HW_REVISION	read (2 bytes)	Depends on the product version	This provides information on the product version of the module. This is incremented when the product version and/or the firmware of the module changes.
SW_REVISION	read (4 bytes)	Depends on the product version	Provides information on the firmware version of the module. If the firmware version is incremented, then the product version (HW_REVISION) of the module is incremented as well.
REVISIONS_COUNTER	read (2 bytes)	---	Provides information on the assigned changes on the module. After each change, the REVISION_ COUNTER is incremented.
PROFILE_ID[1]	read (2 bytes)	Not applicable	
PROFILE_SPECIFIC_TYPE[1]	read (2 bytes)	Not applicable	
IM_VERSION[1]	read (2 bytes)	10 hex	Provides information on the version of the I&M (10 hex = Version 1.0).
IM_SUPPORTED[1]	read (2 bytes)	3E hex	Provides information on available I&M data (index 1 to 4).
M data 1: Index 2 (data record 232)			
TAG_FUNCTION	read / write (32 bytes)	---	Enter a system-wide unique identifier for the module here.
TAG_LOCATION	read / write (22 bytes)	---	Enter the installation location of the module here.

I&M	Access	Default	Explanation
M data 2: Index 3 (data record 233)			
DEVICE_INSTALL_ DATE	read / write (16 bytes)	---	Enter the installation date of the module here.
M data 3: Index 4 (data record 234)			
DESCRIPTOR	read / write (54 bytes)	---	Enter a comment on the module here.
[1] The display of this I&M depends on the engineering software.			

See also

Project Engineering with GSD File and SIMATIC PDM (Page 138)

3.11 Redundancy of the Power Supply

Properties

With the ET 200iSP, you can configure a redundant power supply PS. When one power supply PS fails, the system fails over to the second power supply PS without interruption.

Requirements

- Terminal module TM-PS-A/ TM-PS-A UC
- Terminal module TM-PS-B/ TM-PS-B UC
- 2 x Power Supply PS
- IM 152 (V2.0 and higher)

Combination options of the power supply PS with TM-PS-A and TM-PS-B

TM-PS-A	TM-PS-B
PS 24 VDC*	PS 24 VDC*

* All product versions

Combination options of the power supply PS with TM-PS-A UC and TM-PS-B UC

TM-PS-A UC	TM-PS-B UC
PS 24 VDC*	PS 24 VDC*
PS 120/230 VAC**	PS 120/230 VAC**
PS 24 VDC*	PS 120/230 VAC**

* Product version 6 and higher

** Maximum output current, refer to technical specifications in the Chapter *Power Supply PS 120/230 VAC*

Combination options of the power supply PS with TM-PS-A and TM-PS-B UC or TM-PS-A UC and TM-PS-B

TM-PS-A	TM-PS-B UC
PS 24 VDC*	PS 120/230 VAC**

TM-PS-A UC	TM-PS-B
PS 120/230 VAC**	PS 24 VDC*

* Product version 5 and higher

** Maximum output current, refer to technical specifications in the Chapter *Power Supply PS 120/230 VAC*

Installation and Wiring

1. Begin the installation with the TM-PS-A/ TM-PS-A UC.
2. Install the TM-PS-B/ TM-PS-B UC to the right of the TM-PS-A/ TM-PS-A UC.
3. Now complete the ET 200iSP configuration.
4. Connect a separate power supply to each TM.
5. Finally, fit the TMs with Power Supply PS 1 and PS 2.

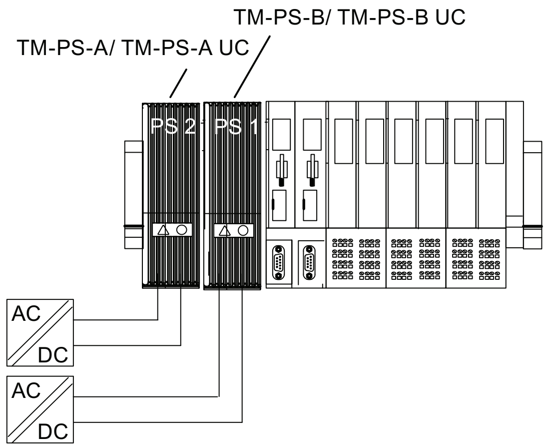


Figure 3-5 Redundancy of the Power Supply (example)

Parameter Assignment

Only those parameters that are relevant for the redundancy of the power supply are explained below. These are part of the parameters of the IM 152 interface module.

Table 3- 7 Parameters for redundancy of the Power Supply PS

Parameters	Setting	Description
Self-diagnostics	enabled	---
Redundant Power Supply diagnostics	Redundant Power Supply	Diagnostics in the event of failure of Power Supply PS 1 or PS 2

See also

Power supply PS 120/230 VAC (Page 226)

Power supply PS 24 VDC (Page 223)

3.12 System configuration in RUN (CiR)

3.12.1 System modification in a non-redundant system

Properties

There are plants that must not be closed down while they are running. This may be due to the complexity of the automated process or because of the costs involved in restarting. A modification or removal of system components may nonetheless be necessary.

Certain system configurations and parameters can be modified in RUN by means of the CiR function. To make the modifications, the process is halted for a brief time. The process inputs retain their last value during this time period.

The configuration of the ET 200iSP can be modified during operation with CiR.

You will find a detailed description of this function and the settings for it in the function manual Modifying the System during Operation via CiR (http://support.automation.siemens.com/WW/view/en/14044916).

What points should you note when planning the ET 200iSP stations?

- Construct the ET 200iSP station entirely using terminal modules and a terminating module.
- Add components to the ET 200iSP outwards from the interface module, starting with the necessary electronic modules. Fill the remaining slots with the reserve modules as far as the terminating module. All the reserve modules must be inserted and there must be no gaps.
- You must not configure these reserve modules.

Rules for making changes to the system while it is in use

- Replace the reserve modules with the planned electronic modules. Start with the first reserve module in the lowest slot (to the right of the last electronic module). This may create a gap, i.e. only replace a reserve module with the electronic module.
- If you have fitted a slot cover on the last free slot, it is not expandable.
- Note that terminal modules TM-RM/RM are required for electronic modules 2DO Relay UC60V/2A.

Changing the parameter settings in RUN mode

Note the operator steps used for reassigning paramters in the function manual Modifying the system during operation via CiR (http://support.automation.siemens.com/WW/view/en/14044916).

Reaction of the I/O to parameter reassignment in RUN

When changing the parameter settings for certain modules (see table), make sure that there is no diagnostic event pending for this module (for example wire break) prior to changing the settings otherwise diagnostic events exiting the state may no longer be signaled in some situations. The effect is that the LEDs on the CPU, IM, or module stay lit even though the reconfigured module is operating properly. If, this situation nevertheless arises, the module must be removed and reinserted.

Table 3- 8 Behavior of the inputs/outputs

<table>
<tr><th>Electronic module</th><th>Behavior of the inputs/outputs</th><th>Points to note when changing parameter settings</th></tr>
<tr><td>8 DI NAMUR</td><td>They return the process value that applied before the parameters were set. Inputs not affected return their last valid value (with value status).</td><td rowspan="4">SF LED is lit.
If a diagnostic event was reported before you started to reassign parameters, the SF LEDs (on the CPU, IM or module) may be lit even though the module is operating properly and the diagnostic event has been cleared.
• Only make new parameters settings when there is no diagnostic event pending, or
• Remove and insert module.</td></tr>
<tr><td>4 DO DC23.1V/20mA SHUT DOWN "H"/ "L"
4 DO DC17.4V/27mA SHUT DOWN "H"/ "L"
4 DO DC17.4V/40mA SHUT DOWN "H"/ "L"
2 DO Relay UC60V/2A</td><td>They output the output value that applied before the parameters were set. Unaffected outputs return their last valid value.</td></tr>
<tr><td>4 AI I 2WIRE HART
4 AI I 4WIRE HART
4 AI RTD
4 AI TC</td><td>They return the process value that applied before the parameters were set. Inputs not affected return their last valid value.</td></tr>
<tr><td>4 AO I HART</td><td>They output the output value that applied before the parameters were set. Unaffected outputs return their last valid value.</td></tr>
</table>

3.12.2 System modification in a redundant system

Properties

Information on using this function in the redundant structure can be found in the S7-400H automation system, fault-tolerance systems (http://support.automation.siemens.com/WW/view/en/1186523) manual and in the online help for the H option package for *STEP 7*.

Requirements

- as of STEP 7 V5.3 SP2 with HW update 0042 (version V3.0)
- PCS7 will be released with the next service packs for PCS7 V6.1, V7.0 and V7.1.

What points should you note when planning the ET 200iSP stations?

- Construct the ET 200iSP station entirely using terminal modules and a terminating module.
- Add components to the ET 200iSP with the necessary electronic modules. Fill the remaining slots with the reserve modules. All the reserve modules must be inserted and there must be no gaps.
- You do not have to configure reserve modules.

Rules for making changes to the system while it is in use

- If you are modifying the real hardware configuration, there may be only one gap each. When removing the electronic modules, replace the electronics modules by reserve modules; when adding electronic modules, replace the installed reserve modules with electronic modules.
- If you have fitted a slot cover on the last free slot, it is not expandable.
- Note that terminal modules TM-RM/RM are required for electronic modules 2DO Relay UC60V/2A.

Example: Replacement of configured electronic modules

1. Replace the electronic modules or reserve modules with gaps in the configuration (HW config).
2. Execute the Save and Compile menu command.
3. Download the station configuration to the H station in RUN mode.
4. Change the real hardware configuration: Remove and install one module at a time (for example, remove slot 5 --> install slot 5). **Note: two empty slots are not permitted.**
5. Replace the gaps in the configuration (HW config) with the new electronic modules.
6. Execute the Save and Compile menu command.
7. Download the station configuration to the H station in RUN mode.

Result

The system modification was successfully completed.

3.13 Operating the ET200iSP with older CPUs

Operating the ET200iSP with older CPUs

The following CPUs cannot be operated in DPV1 mode. The ET 200iSP must be integrated via the GSD file for projects with these CPUs. Parameters are to be assigned with SIMATIC PDM.

Table 3- 9 Operating the ET200iSP with older CPUs

CPU	Order Number	HW Version	FW Version
CPU 412-1	6ES7412-1XF03-0AB0	8	V3.1.3
CPU 412-2	6ES7412-2XG00-0AB0	8	V3.1.3
CPU 413-1	6ES7413 1XG02-0AB0	9	
CPU 413-2	6ES7413 2XG02-0AB0	9	
CPU 414-1	6ES7414-1XG02-0AB0	9	
CPU 414-2 with 128 kB	6ES7414-2XG03-0AB0	8	V3.1.3
CPU 414-2 with 384 kB	6ES7414-2XJ01-0AB0	9	
CPU 414-3	6ES7414-3XJ00-0AB0	8	V3.1.3
CPU 414-4H	6ES7414-4HJ00-0AB0	1	V3.1.3
CPU 416-1	6ES7416-1XJ02-0AB0	9	
CPU 416-2 with 800 kB	6ES7416-2XK02-0AB0	8	V3.1.3
CPU 416F-2	6ES7416-2FK02-0AB0	2	V3.1.3
CPU 416-2 mit 1,6MB	6ES7416-2XL01-0AB0	9	
CPU 416-3	6ES7416-3XL00-0AB0	8	V3.1.3
CPU 417-4	6ES7417-4XL00-0AB0	6	V3.1.3
CPU 417-4H	6ES7417-4HL01-0AB0	1	V3.1.3
Sync module	6ES7960-1AA00-0XA0	3	
CPU 416-2 DP ISA Lite	6ES7616-2PG01-0AB4	1	
CPU 416-2 DP ISA	6ES7616-2PK01-0AB4	2	
CPU 412-2 DP PCI	6ES7612-2QH00-0AB4	1	V3.1.0
CPU 416-2 DP PCI	6ES7616-2QL00-0AB4	1	V3.1.0

3.14 Year of Production of the Module

Year of production

The year of production is included in the serial number (4th position). The serial number is on the type plate.

Example of a serial number:

Digit	1	2	3	4	5	6	7	8	9	10	11
Serial number	S		V	P	S	9	1	2	3	4	5 6

Year of production:

S	2004
T	2005
U	2006
V	2007
W	2008
X	2009
A	2010
B	2011
C	2012
D	2013

Figure 3-6 Year of production

3.15 Time stamping

3.15.1 Fundamentals of Time Stamping

Properties

Time stamping is possible with the IM 152

- in customer applications using FB 62 (FB TIMESTMP)
  (see also the STEP 7 Online Help).
- with the PCS 7 system solution accurate to 20 ms

  For a detailed description of the time sampling and the time-of-day synchronization, consult the *PCS 7* function manual "10 ms time stamping".

Principle of operation

A modified input signal is assigned a time stamp and stored in a buffer (data record). If time stamped signals exists or a data record is full, a hardware interrupt is generated to the DP master. The buffer is evaluated with "Read data record". Special messages are generated for events that influence the time stamping (communication with the DP master interrupted, frame failure of time master, ...).

Parameter Assignment

With the parameter assignment you define which IM 152 user data will be monitored. For the time stamping these are digital inputs that are monitoring for signal changes.

Parameters	Setting	Description
Time stamping	• disabled • enabled	Activate the time staming for the channels of the electronics module 8 DI NAMUR.
Edge evaluation incoming event	• rising edge • falling edge	Determine the type of signal change that will be time-stamped.

3.15.2 Time stamps accurate to 20 ms

Introduction

The time stamping of binary signal changes is supported in the PCS 7 system by all hardware and software components: from the ET 200iSP over the S7-400 right to the OS.

Prerequisites

- Set a synchronization interval of 20 ms for the master and ET 200iSP.
- For time stamping, you require the 8 DI NAMUR electronics module with the "8DI NAMUR" configuration. Time stamping is not possible with any other configuration of the 8DI NAMUR electronics module.

How time stamping works

You can configure the monitoring of digital inputs for signal changes in HW Config. The following can be monitored: "Signal entering/leaving state" (as "rising or falling edge"). The IM 152 stamps these changed input signals with the current time of day and saves them as message lists. A message list is a data record with a maximum of 20 messages about time-stamped signal changes. The IM 152 can store up to 15 data records.

After a certain time and if messages exist or when a data record is full, the IM 152 triggers a hardware interrupt on the DP master (S7-400). The CPU then reads the data record and passes on the message lists to WinCC on an OS using the driver block FB90 "IM_DRV".

Example of time stamping

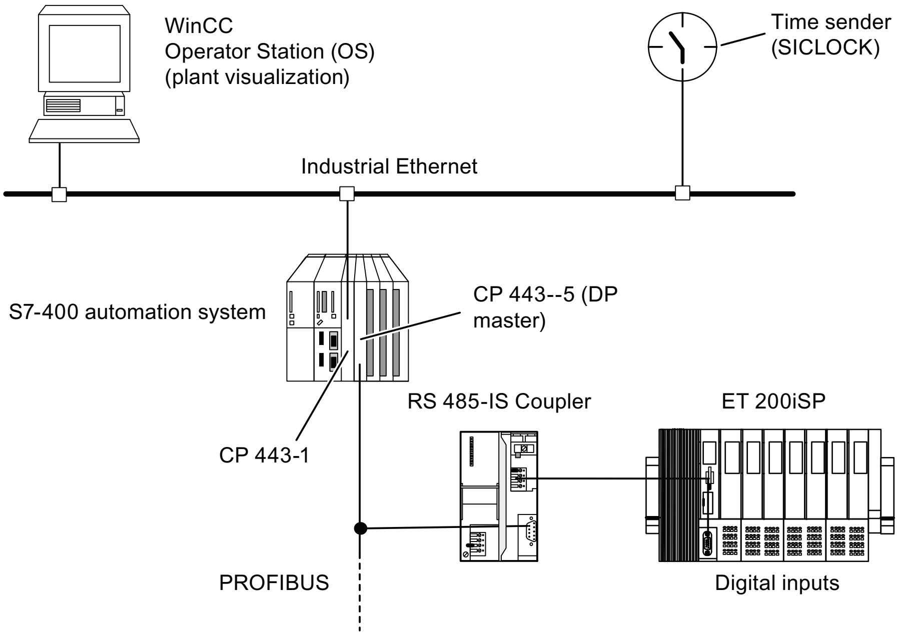


Figure 3-7 Example of time stamping and edge evaluation

How time stamping functions in the redundant system

Both IM°152 save the messages of the time-stamped signals. After a changeover from the active to the passive IM 152 the "new" active IM 152 can relay the current messages to WinCC.

During the switch between the two IM 152 the signal changes are not time-stamped. In WinCC you can recognize in which time span not time stamping occurred.

Example of time stamping in redundant system

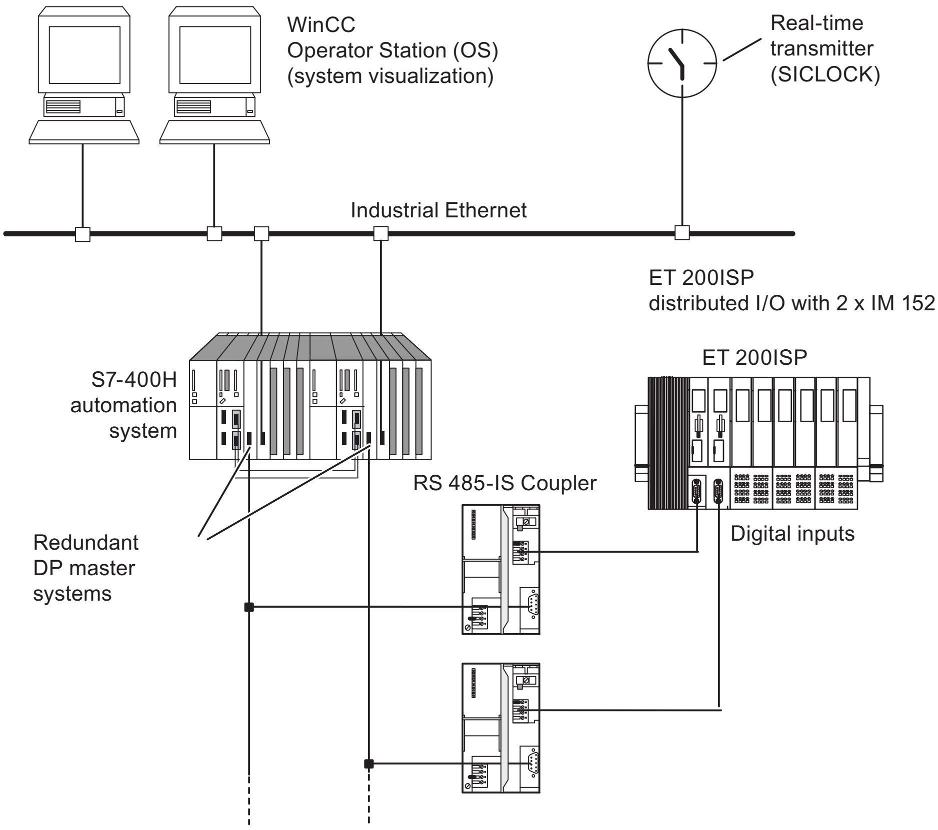


Figure 3-8 Sample configuration with 2 IM 152s for redundancy in an H-system

3.15.3 Time synchronization with a flexible time interval

Description

The synchronization interval can be set in the configuration tool.

The longer the synchronization interval is set, the lower the accuracy of the time stamping.

3.16 Counting

3.16.1 Properties

Counting functions

The 8 DI NAMUR electronics module has configurable counting functions:

- 2 x 16-bit up counters (standard counting function) or
- 2 x 16-bit down counters (standard counting function) or
- 1 x 32-bit down counter (cascading counter function)
- Setting a setpoint with the POI
- GATE function
- You can configure the control signals of the counters:
  - "2 Count/ 6DI NAMUR" configuration: Two counters are configured. The control signals of the counters are stored in the POI (process output image).
  - "2 Count/ 6 Control" configuration: Two counters are configured. The control signals of the counters are stored in the POI (process output image). They are also controlled by the digital inputs of the 8 DI NAMUR.
- You configure the counters of the 8 DI NAMUR electronic module and assign the parameters in the engineering software, for example, HW Config.

3.16.2 Principle of operation

16-bit up counters (standard counting function)

The counting range is always 0 to 65,535.

With each count pulse at the digital input, the count is incremented by 1. Once the count limit is reached, the counter is reset to 0 and it counts up again from this value.

If there is counter overflow, the corresponding output is set in the PII.

A positive edge of the *Reset output* control signal resets the output in the PII. This does not affect the current count value.

In 16-bit up counting operations, the system does not set any outputs in the POI. These are always reset.

The positive edge of the *Reset counter* control signal sets the counter to 0 and resets the set counter output.

The *GATE* control signal pauses the counting on a positive edge. Count pulses are processed at the digital input again, but only at the negative edge. The *Reset counter* control signal is also effective when *GATE* is active.

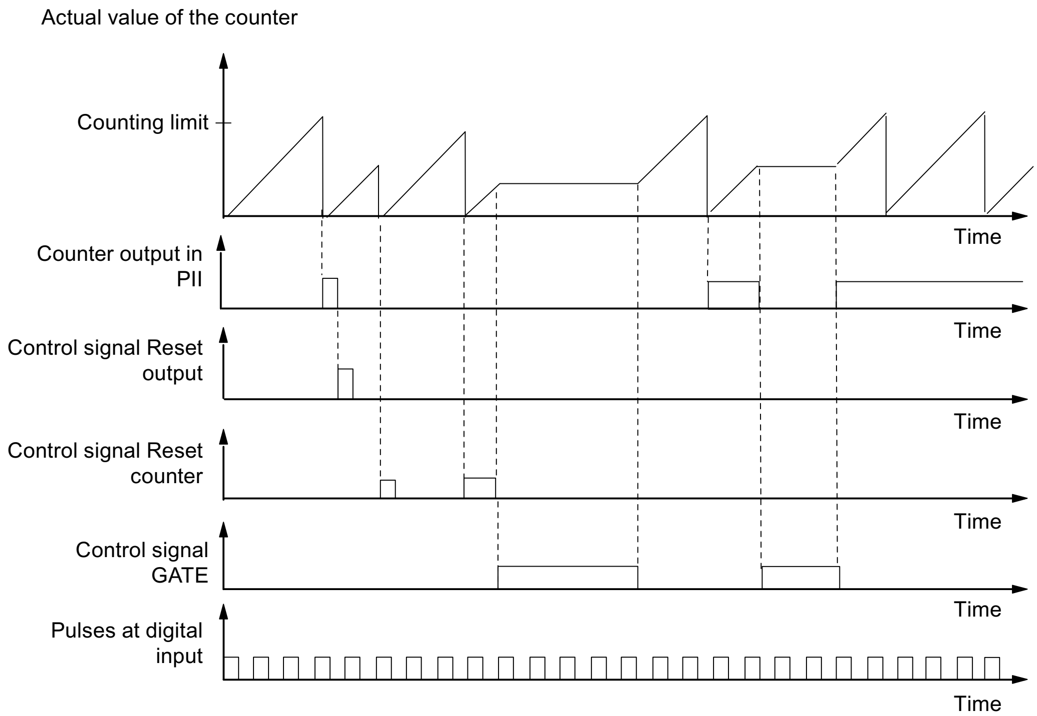


Figure 3-9 Principle of operation of the 16-bit up counter

16-bit down counters (periodic counting function)

The maximum counting range is always 65,535 to 0.

When the counter is started, the actual value is set to the selected setpoint. Each counted pulse reduced the actual value by 1. Once the actual value reaches 0, the corresponding output in the PII is turned on and the actual value is set to the selected setpoint. The counter then counts down from this value.

The positive edge of the *Reset counter* control signal resets the selected setpoint and the corresponding output in the PII.

A positive edge of the *Reset output* control signal resets the output in the PII. This does not affect the current count value.

The *GATE* control signal pauses the counting on a positive edge. At the same time, the assigned output in the PII is reset. Count pulses are processed at the digital input again, but only at the negative edge. The *Reset output* and *Reset counter*control signals are also effective when *GATE* is active.

The setpoint of the counter is set and changed using the POI. The setpoint is adopted on a positive edge of the *Reset counter* control signal or when the counter has reached zero.

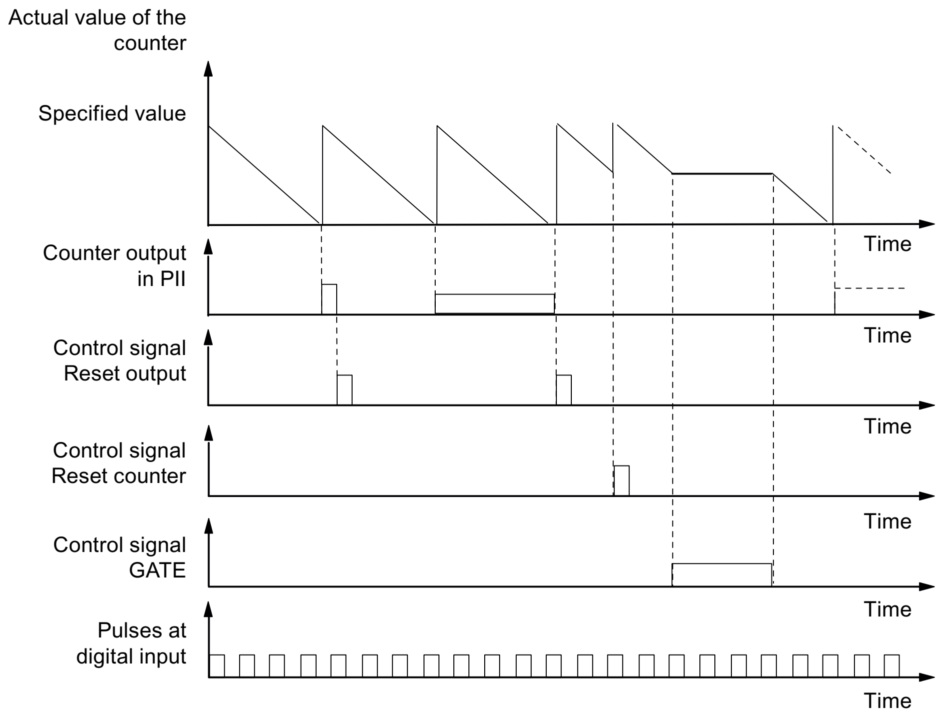


Figure 3-10 Principle of operation of the 16-bit down counter

32-bit down counter (cascading counter function)

The maximum counting range is always 4294967295 to 0.

The principle of operation is identical to that of the 16-bit down counter. Channel 1 has no function.

3.16.3 Configuring counters

Procedure in HW Config

Drag the required configuration "2 Count/ 6 DI NAMUR" or "2 Count/ 6 Control" from the hardware catalog to the configuration table with the mouse or set the configuration with the parameters.

"2 Count/ 6 DI NAMUR" configuration:

- Assignment of the digital inputs on electronic module 8 DI NAMUR

  Additional information on pin assignment is available in the Digital electronics module 8 DI NAMUR (Page 239).

Table 3- 10 Assignment of the digital inputs for 2 Count/ 6 DI NAMUR

Digital input	Terminal	Assignment
Channel 0	1, 2	Counter 1
Channel 1	5, 6	Counter 2 (does not apply to 32-bit down counters)
Channel 2	9, 10	Digital input 2
Channel 3	13, 14	Digital input 3
Channel 4	3, 4	Digital input 4
Channel 5	7, 8	Digital input 5
Channel 6	11, 12	Digital input 6
Channel 7	15, 16	Digital input 7

- Assignment of the process input image (PII)

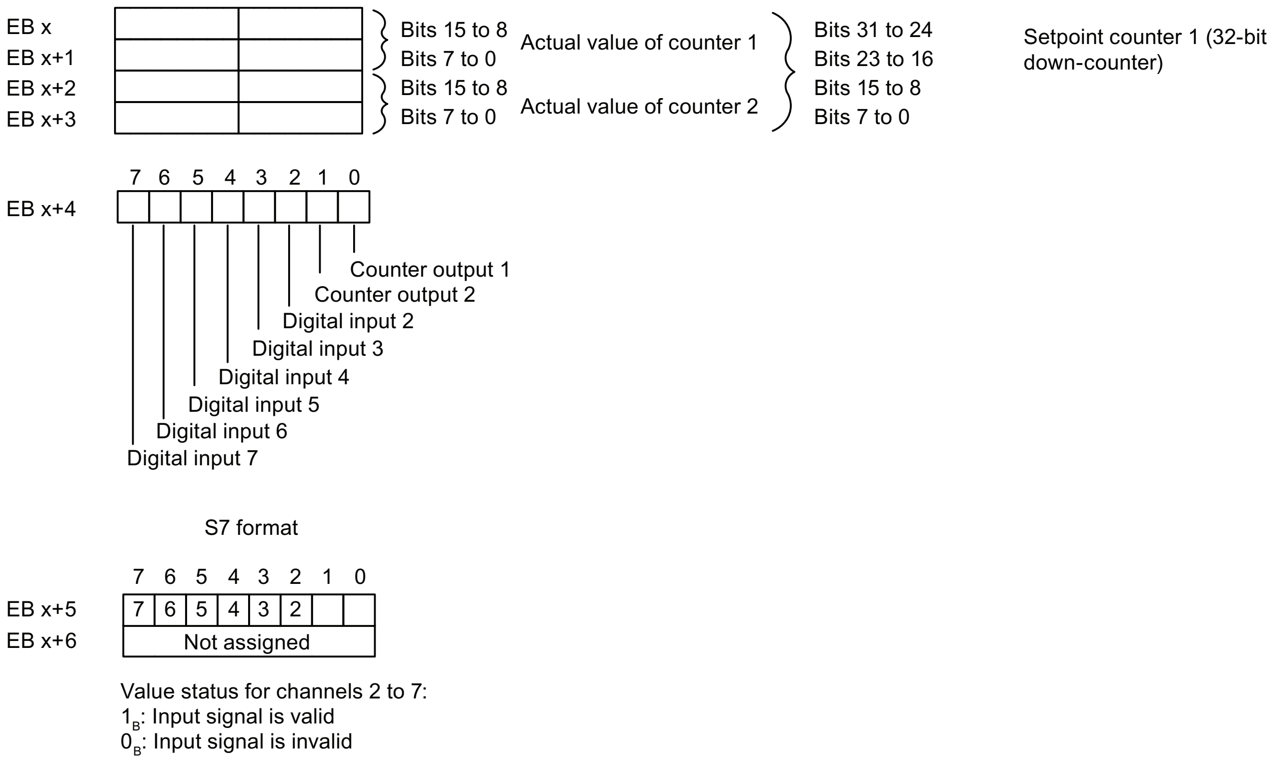


Figure 3-11 PII with "2 Count/ 6 DI NAMUR" configuration

- Assignment of the process output image (POI)

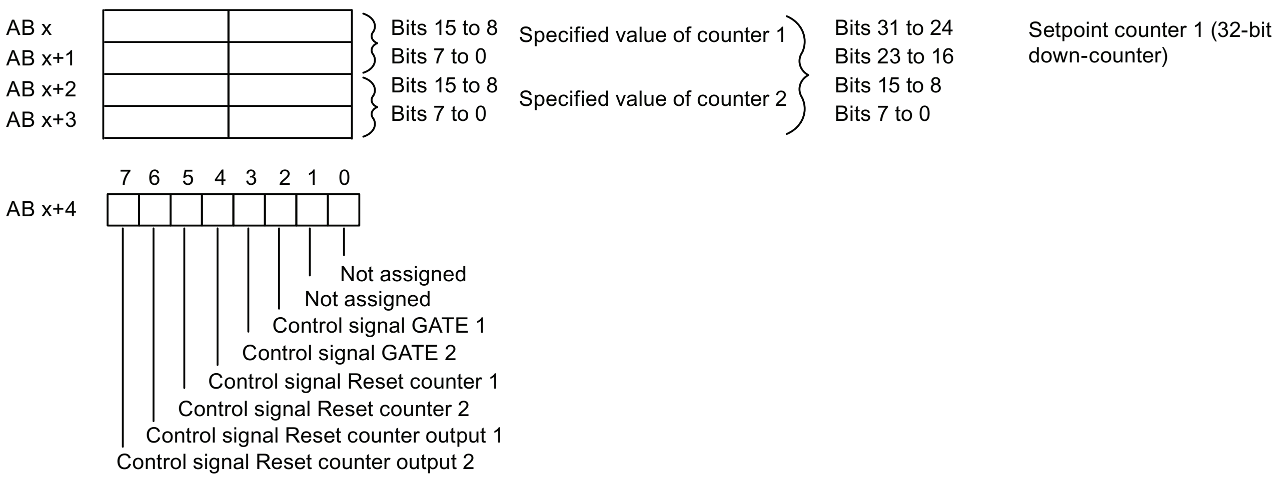


Figure 3-12 POI with "2 Count/ 6 DI NAMUR" configuration

"2 Count/ 6 Control" configuration

With this configuration, you can also control the counters over the digital inputs.

- Assignment of the digital inputs on electronic module 8 DI NAMUR

  For further information on input assignments, refer to the technical data for electronic module 8 DI NAMUR.

Table 3- 11 Assignment of the digital inputs for 2 Count/ 6 Control

Digital input	Terminal	Assignment
Channel 0	1, 2	Counter 1
Channel 1	5, 6	Counter 2 (does not apply to 32-bit down counters)
Channel 2	9, 10	control signal *GATE 1*
Channel 3	13, 14	control signal *GATE 2*
Channel 4	3, 4	control signal *Reset counter 1*
Channel 5	7, 8	control signal *Reset counter 2*
Channel 6	11, 12	control signal *Reset counter output 1*
Channel 7	15, 16	control signal *Reset counter output 2*

- Assignment of the process input image (PII)

  The assignment is identical to that of the "2 Count/ 6 DI NAMUR" configuration.
- Assignment of the process output image (POI)

  The assignment is identical to that of the "2 Count/ 6 DI NAMUR" configuration.

3.16.4 Assigning parameters to counters

Procedure in HW Config

Double-click on electronic module 8 DI NAMUR in the configuration table and start parameter assignment.

Parameters

Only those parameters that are relevant for the counters are explained below. These belong to the parameters of electronic module 8 DI NAMUR and depend on the selected configuration:

Table 3- 12 Parameters for the counters

Parameters	Setting	Description
Sensor type counter inputs	• Channel disabled • NAMUR sensor • Single contact, no load resistance	Select the sensor for the respective counter of channels 0 or 1.
Mode for counter 1	• Standard counting function • Periodic counting function • Cascaded counting function	Select the mode for counter 1.
Mode for counter 2	• Standard counting function • Periodic counting function • Cascaded counting function	Select the mode for counter 2. This parameter is not relevant if you have set the "Mode for counter 1" parameter to "Cascaded counter function".

3.17 Metering frequencies

3.17.1 Properties

Properties

The electronic module 8 DI NAMUR allows the frequencies to be measured on channel 0 and 1:

- 2 frequency meters from 1 Hz to 5 kHz
- Configurable metering window (GATE)
- The signals of the frequency meter are read in by means of the digital inputs of the electronic module.
- You configure the counters of the 8 DI NAMUR electronic module and assign the parameters in the configuration software, for example, HW Config.
- Configuration "2 Trace/ 6DI NAMUR": This configuration makes available 2 frequency meters.

3.17.2 Principle of operation

Frequency measurement

The signal frequencies are identified from the input signals of channel 0 or 1 of the electronic module. To calculate the frequency the signals are measured within a configurable gate.

The frequency is displayed as 16-bit value in fixed-point format and transferred to the PII.

The frequency meter calculates the frequency according to the follow formula:

$$\text{Frequency [Hz]} = \frac{\text{Number of rising edges at digital input}}{\text{Measuring window [s]}}$$

Exceeding the input frequency

If the input frequency exceeds 5kHz, $7FFF_H$ is reported as actual value. If the input frequency is above approx. 8 kHz it is no longer possible to display correct actual values.

3.17.3 Configuring frequency meters

Procedure in HW Config

Drag the configuration "2 Trace/ 6 DI NAMUR" from the hardware catalog to the configuration table with the mouse or set the configuration with the parameters.

"2 Trace/ 6 DI NAMUR" configuration:

- Assignment of the digital inputs on the 8 DI NAMUR electronic module

  For further information on input assignments, refer to the technical data for the 8 DI NAMUR electronic module.

Table 3- 13 Assignment of the digital inputs for 2 Trace/ 6 DI NAMUR

Digital input	Terminal	Assignment
Channel 0	1, 2	Frequency counter 1
Channel 1	5, 6	Frequency counter 2
Channel 2	9, 10	Digital input 2
Channel 3	13, 14	Digital input 3
Channel 4	3, 4	Digital input 4
Channel 5	7, 8	Digital input 5
Channel 6	11, 12	Digital input 6
Channel 7	15, 16	Digital input 7

- Assignment of the process input image (PII)

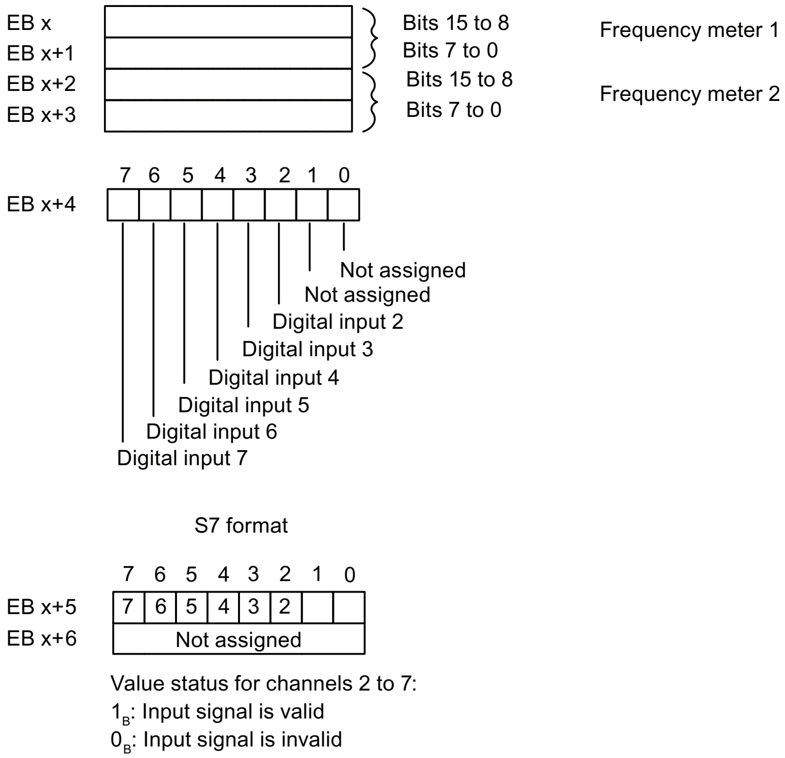


Figure 3-13 PII with "2 Trace/ 6 DI NAMUR" Configuration

- Assignment of the process output image (POI)

  The POI is not assigned.

3.17.4 Assigning parameters for the frequency meters

Procedure in HW Config

Double-click on electronic module 8 DI NAMUR in the configuration table and start parameter assignment.

Parameters

Only those parameters that are relevant for the frequency meters are explained below. These are part of the parameters of electronic module 8 DI NAMUR.

Table 3- 14 Parameters for the frequency meters

Parameters	Setting	Description
Sensor type frequency inputs	• Channel disabled • NAMUR sensor • Single contact, no load resistance	Select the sensor for the relevant frequency meter for channel 0 or 1.
Measuring window (GATE)	• 50 ms • 200 ms • 1 s	Select the required measuring window for channel 0 or 1. To achieve the highest possible accuracy when metering frequencies, remember the following rules: • High frequencies (> 4 kHz): Set a low measuring window (50 ms) • Variable/medium frequencies: set medium measuring window (200 ms) • Low frequencies (< 1 kHz): Set a high measuring window (1 s)

3.18 Redundancy with IM 152

3.18.1 Introduction

Properties

You can operate the ET 200iSP in redundant mode on S7-DP masters (for example, S7-400H)

Power Supply of the ET 200iSP

To ensure consistently high availability during redundant operation with 2 IM 152 interface modules, it is also recommended that you configure the ET 200iSP with a redundant power supply PS.

See also

Redundancy of the Power Supply (Page 56)

3.18.2 Redundancy with S7 DP Masters

Principle of operation

Redundancy on an H-system provides the highest availability. If an interface module fails, the system switches over to the redundant interface module without interruption.

Prerequisites

- H-system (e.g. S7-400H)
- Terminal module TM-IM/IM
- 2 x IM 152 (V2.0 and higher)
- 2 x RS 485-IS coupler
- *STEP 7* software package and *SIMATIC S7 H systems*
- In a redundant system, the IM 152 can only be implemented on DP masters that support the "Fail-Safe" parameter. On DP masters that do not support this parameter, the IM 152 does not start up, and the BF LED flashes.

  Tip: The GSD file of the DP master indicates whether it supports this "Fail-Safe" parameter.

  WARNING

  The SYNC/FREEZE function must not be activated during redundant operation. Violation of this condition can result in invalid process values.

  Cross-segment synchronization of SYNC/FREEZE commands does not take place during redundant operation.

Installation and wiring

The H-system is completely set up, configured, and parameterized.

1. Install the ET 200iSP with terminal module TM-IM/IM.
2. Connect a PROFIBUS RS 485-IS to each bus connector. Each PROFIBUS RS 485-IS requires a separate RS 485-IS coupler.
3. Fit the TM-IM/IM with two IM 152 interface modules (V2.0 or higher).

Configuration and parameter assignment

1. In the "Hardware Catalog" of HW Config, select a suitable DP master interface and place it in both module racks. In the properties dialog that appears automatically, create PROFIBUS DP networks with the same parameters for both DP master interfaces.
2. For each DP master system, insert a DP master system. Result: STEP 7 will automatically produce a redundant system.
3. Drag **one** IM 152 (V2.0 and higher) from the "Hardware Catalog" to a PROFIBUS DP in the station window. Result: STEP 7 will automatically create the connection to both PROFIBUS DPs.
4. Open the properties window of the IM 152 and activate both PROFIBUS DP connections in the "Redundancy" tab: "PROFIBUS" and "PROFIBUS-Red".
5. Save the configuration and download it to the CPU.

Sample configuration of a redundant DP-master system and IM 152

The following figure shows a sample configuration on an S7-400H. For a detailed description of H-systems, refer to the manual *S7-400H Automation System, Introduction to the system*.

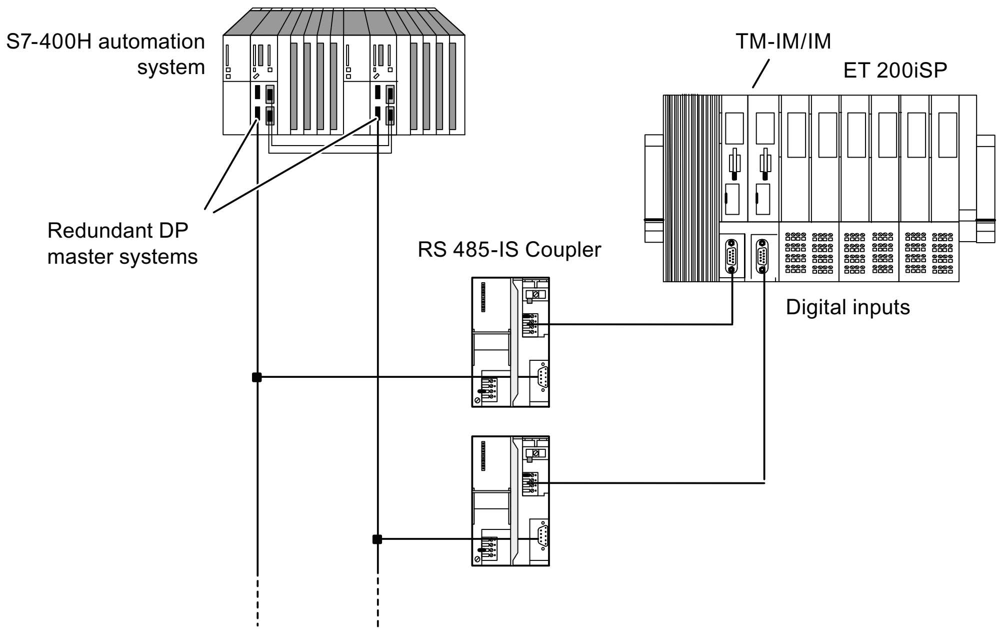


Figure 3-14 Redundancy with 2 x IM 152 modules in an H-system

S7-400H as DP master

You need *STEP 7* V 5.0 or higher and the *SIMATIC S7 H-Systems* software package to configure the S7-400H system.

DP master 1 and DP master 2 ...

- execute the same user program.
- have the same parameter assignment and configuration for the IM 152.

Installing 4

4.1 Installation rules

Safety information

⚠ DANGER

During installation, make sure that you keep to the stipulations in EN 60079-14. The conditions for the electrical parameters in the standard apply to simple electrical circuits. Refer to Chapter Configuration Options in Zones (Page 44).

When operating the ET 200iSP in areas with combustible dust (Zone 21, Zone 22), you must also comply with EN 61241-14.

⚠ DANGER

In some circumstances, sparks capable of ignition or unacceptable surface temperatures can occur during installation.

Never install when an explosive atmosphere is present!

The following activities/jobs are forbidden when the ET 200iSP is operating and the power supply is applied to the terminal module TM-PS-A/ TM-PS-A UC:

- Isolation/disconnection of the power supply on the terminal module TM-PS-A/ TM-PS-A UC.
- Releasing the securing screw of the terminating module.
- Uninstalling the terminating module and any other modifications that affect the configuration of the terminal modules.

Mounting dimensions

Table 4- 1 Mounting dimensions

Dimensions		
Mounting width	Terminal module with power supply module	60 mm
	Terminal module with interface module/electronic module	60 mm
	Terminal module with electronic modules	60 mm
	Terminating module	20 mm
Mounting height	Terminal module with power supply module	190 mm
	Terminal module with interface module/electronic module	190 mm
	Terminal modules with electronic modules	190 mm
	Terminating module	155 mm
Mounting depth	ET 200iSP on S7-300 mounting rail	167 mm

Requirements for enclosure selection

As of the product versions of the ET 200iSP modules listed in the following table, it is no longer mandatory to use a metallic enclosure.

Note

The product version is located on the front of each module.

Table 4- 2 Product versions of ET 200iSP modules for "open installation"

Module	Order No.	As of product version
Power supply PS 24 VDC	6ES7138-7EA01-0AA0	03
Power supply PS 120/230 VAC	6ES7138-7EC00-0AA0	01
Interface module IM 152-1	6ES7152-1AA00-0AB0	05
8 DI NAMUR	6ES7131-7RF00-0AB0	04
4 DO DC23.1V/20mA SHUT DOWN "H"	6ES7132-7RD01-0AB0	02
4 DO DC17.4V/27mA SHUT DOWN "H"	6ES7132-7RD11-0AB0	02
4 DO DC17.4V/40mA SHUT DOWN "H"	6ES7132-7RD21-0AB0	02
4 DO DC23.1V/20mA SHUT DOWN "L"	6ES7132-7GD00-0AB0	02
4 DO DC17.4V/27mA SHUT DOWN "L"	6ES7132-7GD10-0AB0	02
4 DO DC17.4V/40mA SHUT DOWN "L"	6ES7132-7GD20-0AB0	02
2 DO Relay UC60V/2A	6ES7132-7HB00-0AB0	01
4 AI I 2WIRE HART	6ES7134-7TD00-0AB0	05
4 AI I 4WIRE HART	6ES7134-7TD50-0AB0	05
4 AI RTD	6ES7134-7SD50-0AB0	03
4 AI TC	6ES7134-7SD00-0AB0	03
4 AO I HART	6ES7135-7TD00-0AB0	06
RESERVE	6ES7138-7AA00-0AA0	02
WATCHDOG	6ES7138-7BB00-0AA0	01
Terminal module TM-PS-A	6ES7193-7DA10-0AA0	02
Terminal module TM-PS-A UC	6ES7193-7DA20-0AA0	01
Terminal module TM-PS-B	6ES7193-7DB10-0AA0	02
Terminal module TM-PS-B UC	6ES7193-7DB20-0AA0	01
Terminal module TM-IM/EM 60S	6ES7193-7AA00-0AA0	03
Terminal module TM-IM/EM 60C	6ES7193-7AA10-0AA0	03
Terminal module TM-IM/IM	6ES7193-7AB00-0AA0	03
Terminal module TM-EM/EM 60S	6ES7193-7CA00-0AA0	04
Terminal module TM-EM/EM 60C	6ES7193-7CA10-0AA0	04
Terminal module TM-RM/RM	6ES7193-7CB00-0AA0	01

Enclosure for the ET 200iSP in Zone 1

The ET 200iSP must be installed in an enclosure with degree of protection Ex e (increased safety). Refer to "Order Numbers (Page 44)" appendix.

Use the following cable glands:

- Power supply, electronic module 2 DO Relay UC60V/2A: Degree of protection Ex e
- PROFIBUS RS 485-IS, Input and outputs Ex i: Degree of protection Ex i

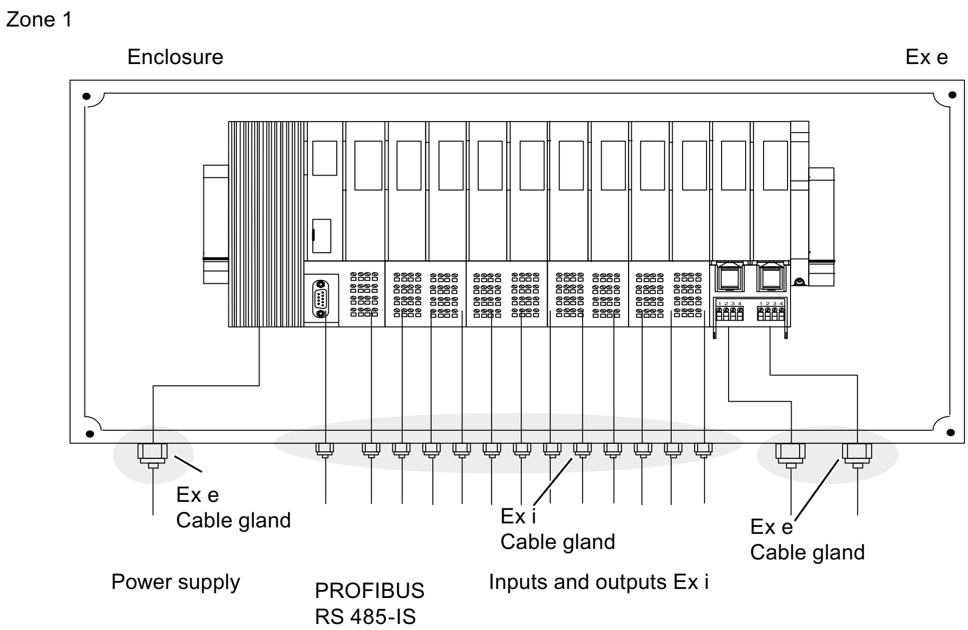


Figure 4-1 Enclosure for the ET 200iSP in Zone 1

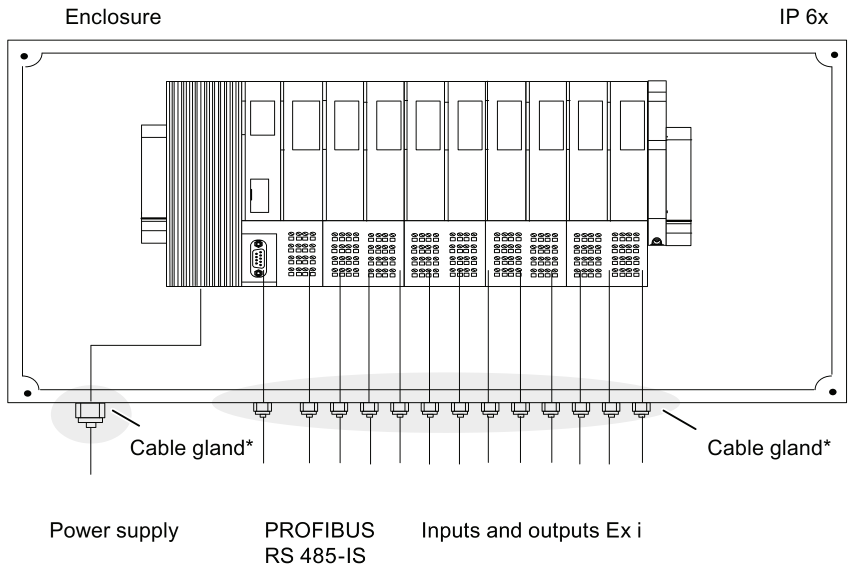
Enclosure for the ET 200iSP in Zone 21

The ET 200iSP must be installed in a dust-proof (certified) enclosure with degree of protection IP 6x
(according to directive 94/9/EC for category 2D). Further requirements (surface temperature, for example) can be found in the certification document for the enclosure. Refer to "Order Numbers (Page 347)" appendix.

Remove dust deposits from the enclosure and its immediate environment at regular intervals; in other words, always install the enclosure in a location with easy access for cleaning.

Use the following cable glands:

- Power supply: Cable gland with manufacturer's certification for Zone 21.
- PROFIBUS RS 485-IS, Input and outputs Ex i: Cable gland with manufacturer's certification for Zone 21.



* A manufacturer declaration for Zone 21 must be available.

Figure 4-2 Enclosure for the ET 200iSP in Zone 21

Enclosure for the ET 200iSP in Zone 2

The ET 200iSP must be installed in an enclosure with at least degree of protection IP 54. A manufacturer declaration for zone 2 must be available for the enclosure (in accordance with EN 60079-15). Refer to "Order Numbers" appendix.

Use the following cable glands:

- Power supply and PROFIBUS RS 485-IS: Cable gland with manufacturer's certification for zone 2.
- Inputs and outputs Ex i: Degree of protection Ex i.

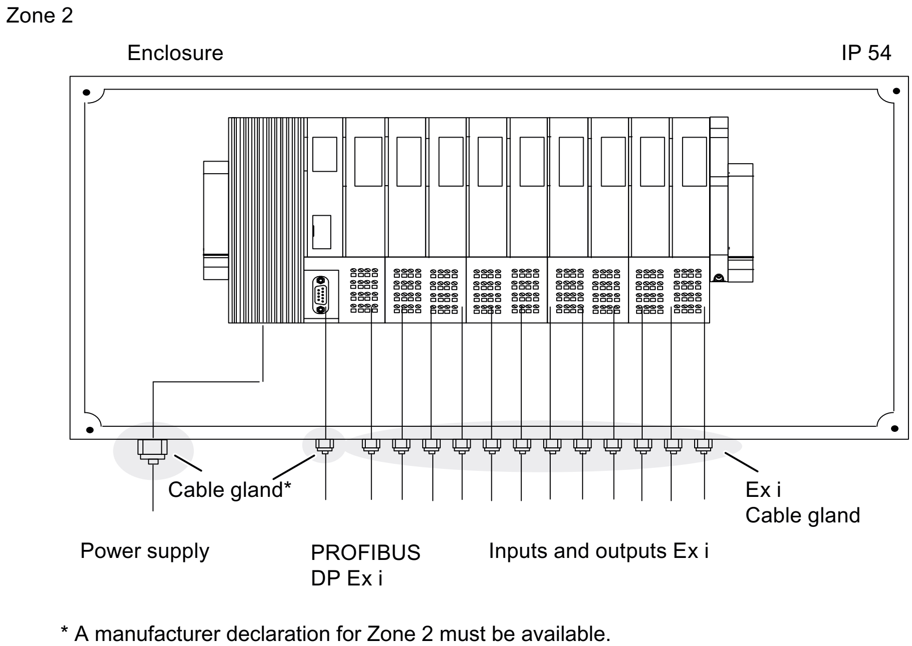


Figure 4-3 Enclosure for the ET 200iSP in Zone 2

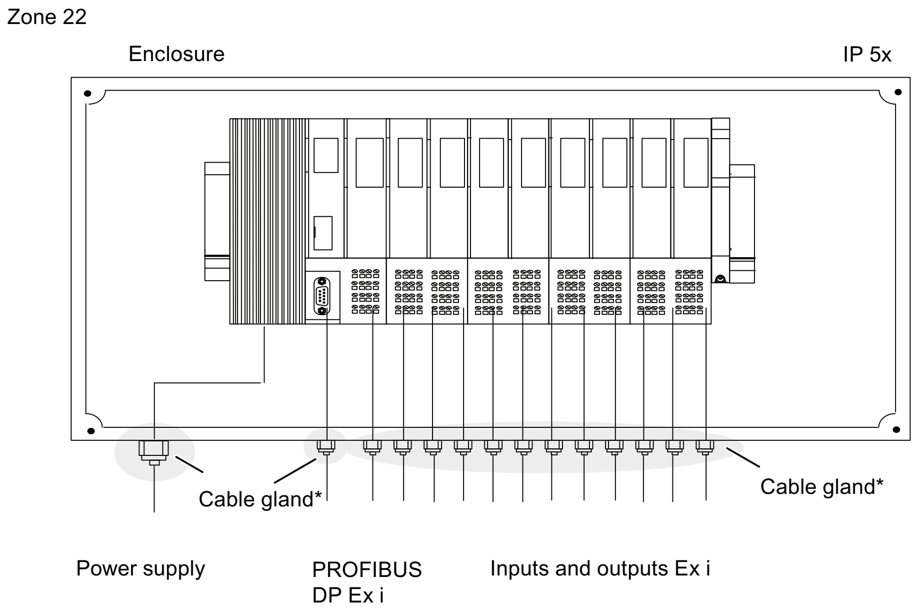
Enclosure for the ET 200iSP in Zone 22

The ET 200iSP must be installed in a dust-protected enclosure with degree of protection IP 5x (according to directive 94/9/EC for category 3D). Further requirements (surface temperature, for example) can be found in the certification document for the enclosure. Refer to "Order Numbers" appendix.

Remove dust deposits from the enclosure and its immediate environment at regular intervals; in other words, always install the enclosure in a location with easy access for cleaning.

Use the following cable glands:

- Power supply and PROFIBUS RS 485-IS: Cable gland with manufacturer's certification for Zone 22.
- Inputs and outputs Ex i: Cable gland with manufacturer's certification for Zone 22.



* A manufacturer declaration for Zone 22 must be available.

Figure 4-4 Enclosure for the ET 200iSP in Zone 22

Enclosure for ET 200iSP in the Safe Area

The ET 200iSP must be installed in an enclosure with at least degree of protection IP 20.

Mounting position

The ideal installation position is horizontal on a vertical surface. Any other installation position is also possible; however, there are limitations with regard to ambient temperature.

Minimum clearances to the enclosure for installation, wiring, and ventilation

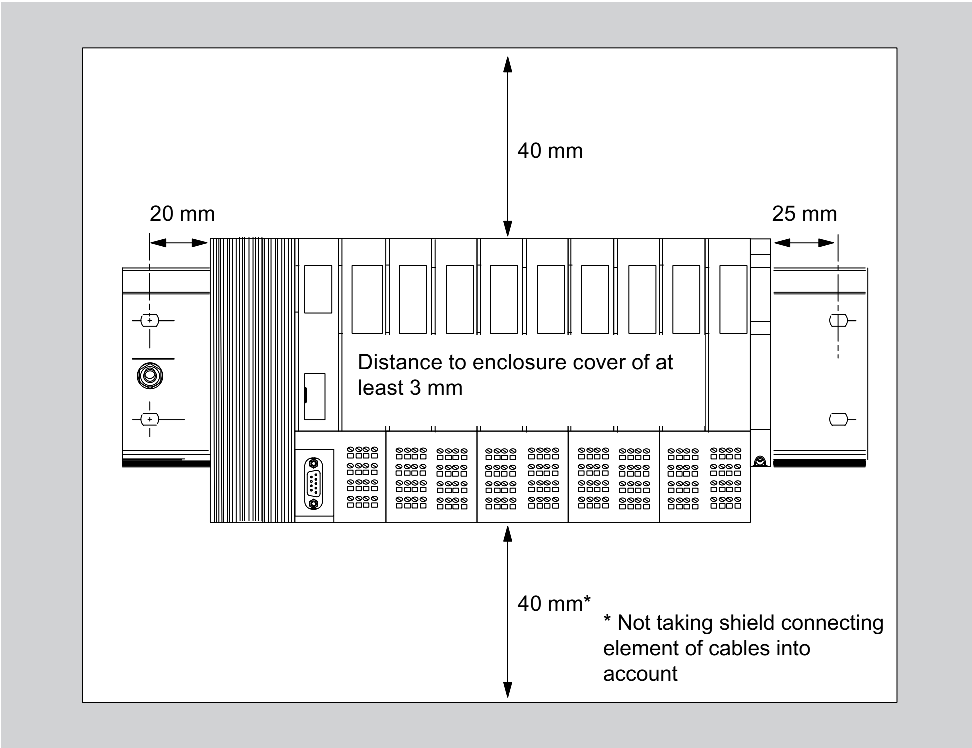
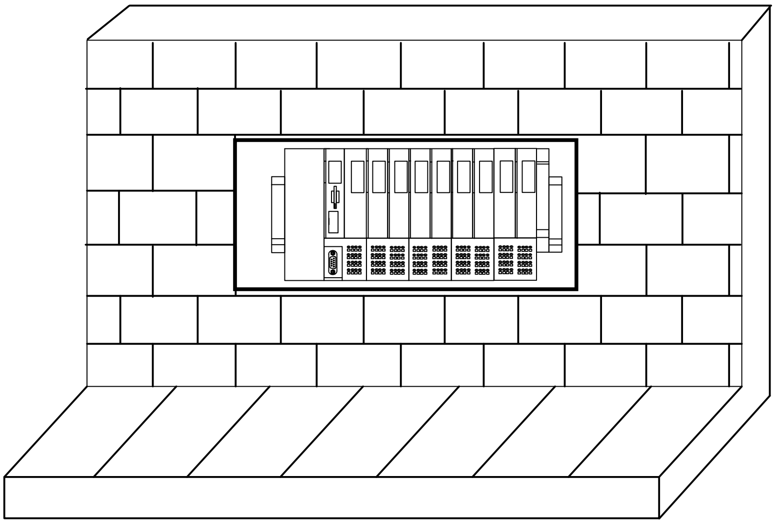


Figure 4-5 Minimum clearances to the enclosure

Ambient temperature	Mounting positions
• Power supply PS 24 VDC: – from -20 to 70°C • Power supply PS 120/230 VAC: At 120 VAC – From -20 to 70°C (3A) – From -20 to 60°C (4A) – From -20 to 50°C (5A) • Power supply PS 120/230 VAC: At 230 VAC – From -20 to 70°C (4A) – From -20 to 60°C (5A)	For horizontal installation of the ET 200iSP on a vertical wall 
• Power supply PS 24 VDC: – From -20 to 40°C (up to product version 2 of power supply PS) – From -20 to 50°C (product version 3 and higher of power supply PS) • Power supply PS 120/230 VAC – from -20 to 50°C	For all other mounting positions of the ET 200iSP

Rules for installation

During installation, make sure that you keep to the following rules:

- The mechanical design of the ET 200iSP starts with the terminal module TM-PS-A/ TM-PS-A UC. Start with the installation of the terminal module approx. 10 mm right of the grounding pin, in order that the mounting location on the mounting rail can be optimally used.
- The terminal module TM-PS-A/ TM-PS-A UC is followed by the terminal module TM-IM/EM.
- These are followed by the terminal modules TM-EM/EM and TM-RM/RM.
- The ET 200iSP is completed by the terminating module. The terminating module accompanies the terminal module TM-IM/EM and/or TM-IM/IM. If your ET 200iSP configuration leaves you with a gap in the last slot, you must install the slot cover or a reserve module in this slot.
  - Install a slot cover if the ET 200iSP will not be expanded in the future. The slot cover is integrated in the terminating module.
    Replacing the slot cover with an electronic module during operation will cause a station failure of the ET 200iSP.
  - Install a reserve module if you want to use the free slot for a future expansion (by means of an electronic module).
- The maximum configuration of the ET 200iSP distributed I/O station is one power supply, one interface module and 32 electronic modules. Remember not to exceed the maximum current consumption.

Note

Due to integrated coding, the terminal modules can only be installed in the order described.

4.2 Installing the mounting rail

Properties

The ET 200iSP distributed I/O station is mounted on a rail for S7 installation technology (Refer to appendix "Order Numbers (Page 347)"). These rails are ready to install and have 4 holes for the securing screws and a grounding bolt.

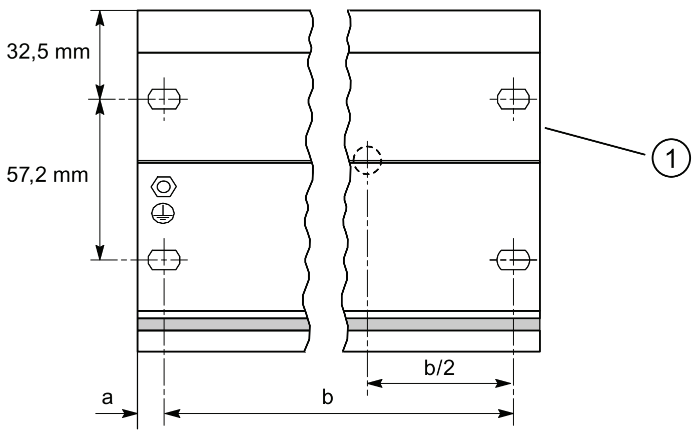
The following configuration is recommended for optimal use of the rail when mounting the terminal modules.

Dimensions for the securing holes

The following table contains the dimensions for the holes for securing mounting rails.

Table 4- 3 Diagram for securing mounting rails

"Standard" Mounting Rail



①	Mark for additional bore hole for applications with increased vibration and shock stress.		
Length of the mounting rail	**Distance a**	**Distance b**	**Maximum number of terminal modules[1]within distance b**
482.6 mm	8.3 mm	466 mm	6
530 mm	15 mm	500 mm	7
585 mm	8.5 mm	568 mm	8
830 mm	15 mm	800 mm	12
885 mm	8.5 mm	868 mm	13
[1]Width of terminal modules: 60 mm			

Required tools

Wrench or screwdriver suitable for selected securing screws.

Required accessories

To secure the mounting rail, you can use the following types of screws:

Table 4- 4 Securing screws

For	You can use...	Explanation
Outer securing screws	M6 cylinder head screw in accordance with ISO 1207 / ISO 1580 (DIN 84 / DIN 85)	Select the screw length to suit the situation. You also require 6.4 washers to ISO 7092 (DIN 433)
	Hexagon head screw M6 to ISO 4017 (DIN 4017)	

Installing the mounting rail

1. Mount the rail in the cabinet so that you have sufficient space for installation and heat dissipation of the modules (*maintain the minimum clearance to the casing*).
2. If necessary, mark the fixing holes on the base of the enclosure, then drill the holes with diameter of 6.5 mm $^{\pm 0.2}$.
3. Screw the mounting rail to the base surface of the cabinet (screw size M6).

Note

Make sure there is a low-resistance connection between the mounting rail and the base of the cabinet.

If the ET 200iSP is subject to increased vibration or shock, it is advisable to bolt down the mounting rail with an additional screw, at the center position between the two outer bores (with b/2). The securing screws require an additional M6 hole at b/2 on the mounting rail (see table above).

4.3 Installing the terminal module for power supply PS

Properties

- The terminal module TM-PS-A/ TM-PS-A UC is used to accommodate the power supply PS.
- The terminal module TM-PS-B/ TM-PS-B UC is used to accommodate a second, power supply PS of the ET 200iSP as redundant unit.
- The terminal modules TM-PS-A/ TM-PS-A UC and TM-PS-B/ TM-PS-B UC must be prewired (without power supply PS).
- All other terminal modules are installed to the right of the terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC.

Requirements

The mounting rail is installed.

Required tools

4.5 mm screwdriver (cylindrical design)

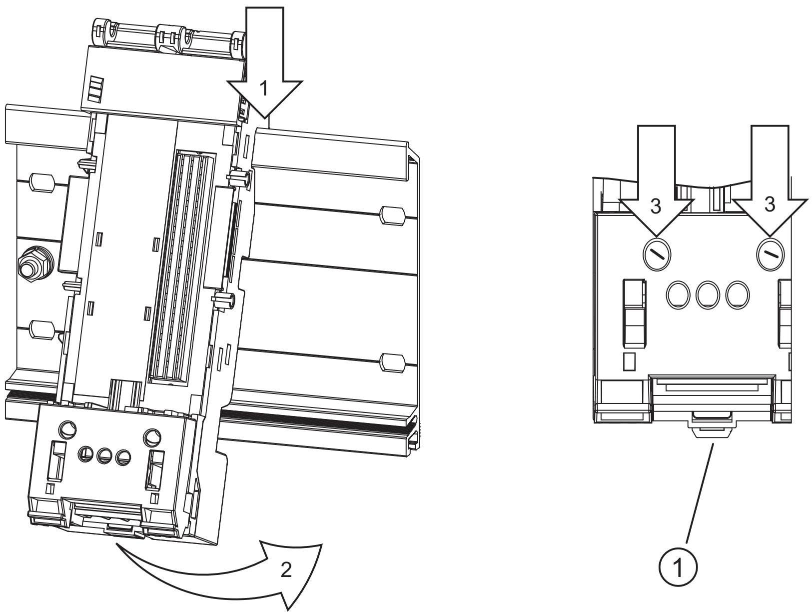
Installing terminal module TM-PS-A/ TM-PS-A UC

1. Fit the terminal module onto the rail.
2. Push in the terminal module at the bottom until you can hear the catch lock.
3. Screw the terminal module to the mounting rail (2 screws - torque 0.8 to 1.1 Nm). Use a screwdriver with a 4.5 mm wide blade.

Note

To avoid the ET 200iSP slipping to the side, the terminal module must be secured mechanically (see point 3). The 2 securing screws are located on the front at the bottom of the terminal module.

An inserted power supply PS can only be uninstalled if both securing screws are tightened.



① Catch

Figure 4-6 Installing terminal module TM-PS-A/ TM-PS-A UC

Installing terminal module TM-PS-B/ TM-PS-B UC (second power supply PS)

1. Hang terminal module TM-PS-B/ TM-PS-B UC to the right of the TM-PS-A/ TM-PS-A UC on the mounting rail.
2. Swivel the TM-PS-B/ TM-PS-B UC back until you can hear the catch lock.
3. Push the TM-PS-B/ TM-PS-B UC to the left until you hear it engage on the first terminal module TM-PS-A/ TM-PS-A UC.
4. Bolt the terminal module to the mounting rail. Refer to *Installing terminal module TM-PS-A/ TM-PS-A UC*.

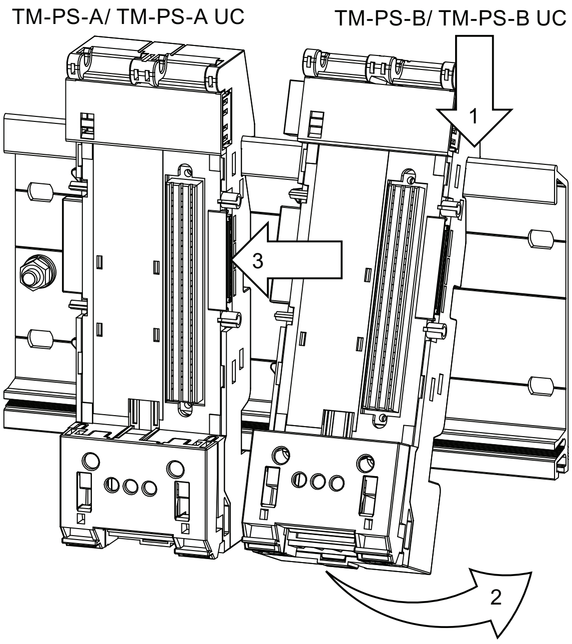


Figure 4-7 Installing terminal module TM-PS-B/ TM-PS-B UC

Removing the terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC.

The terminal module is wired up and there are further terminal modules to the right of it

1. Switch off the power supply of the terminal module TM-PS-A/ TM-PS-A UC and, if present, on the TM-PS-B/ TM-PS-B UC.
2. Use a screwdriiver to disconnect the cables from terminal module TM-PS-A/ TM-PS-A UC.
3. Release the two securing screws of the terminal module.
4. Using the screwdriver as a lever, force the slider on terminal module TM-PS-A/ TM-PS-A UC to its bottom end stop, then slide the terminal module to the left.

Note

The slider is located below the terminal module (see figure above).

5. While pulling on the slider, swivel the terminal module off the mounting rail.
6. Repeat steps 2 to 5 for terminal module TM-PS-B/ TM-PS-B UC, if present.

4.4 Installing Terminal Modules for the Interface Module and Electronics Modules

Properties

- The terminal modules are used to accommodate the interface module and the electronic modules
  – TM-IM/EM: The terminal module for the interface module and electronic module is located directly next to the right of terminal module TM-PS-A/ TM-PS-A UC.
  – TM-IM/IM: Terminal module for 2 interface modules (IM 152 redundancy), located to the right of TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC.
  – TM-EM/EM: Terminal module for the electronic modules, located to the right of terminal module TM-IM/EM or TM-IM/IM.
  – TM-RM/RM: Terminal module for digital output module 2 DO Relay UC60V/2A, located to the right of terminal module TM-IM/EM or TM-IM/IM.
- The terminal modules can be prewired (without electronic modules).

Requirements

The mounting rail is installed.

Required tools

4.5 mm screwdriver

Installing terminal modules TM-IM/EM, TM-IM/IM, TM-EM/EM, and T-RM/RM

1. Fit the terminal module onto the rail.
2. Push in the terminal module at the bottom until you can hear the catch lock.
3. Push the terminal module to the left until you hear it lock into the previous terminal module.

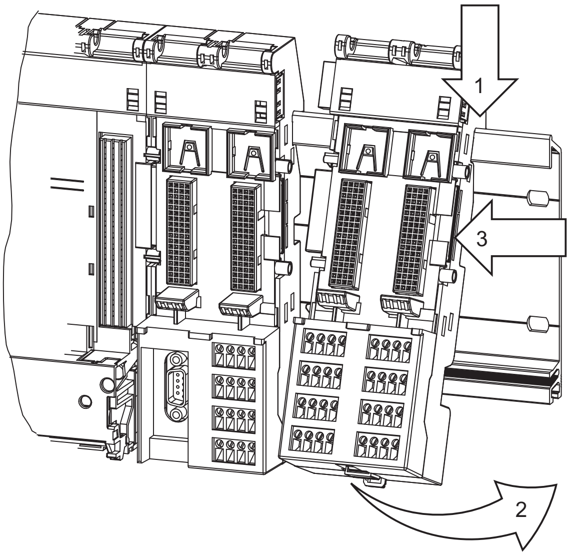


Figure 4-8 Installing terminal modules TM-IM/EM and TM-EM/EM

Uninstalling terminal modules TM-IM/EM, TM-IM/IM, TM-EM/EM, and TM-RM/RM

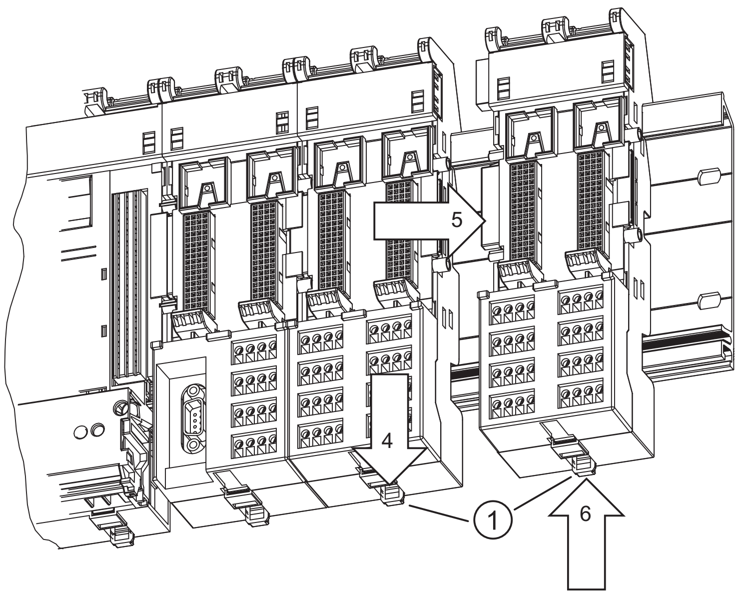
The terminal module is wired and other terminal modules are situated to the right.

To uninstall starting from the right, proceed as follows:

1. Switch off the supply voltage on the power supply PS or uninstall the power supply PS.
2. Use a screwdriver (3.5 mm) to detach the wiring at the terminal module.
3. Use a screwdriver (4.5 mm) to loosen the lock screws on the terminating module.
4. Use the screwdriver to lever the catch on the previous (left) terminal module down to the stop.
5. At the same time push the terminating module to the right.
6. Keeping the catch pressed down, swivel the terminating module out of the mounting rail.
7. Repeat steps 4 to 6 for each additional terminal module.

Note

You can also uninstall the distributed I/O stations starting from left (to right).



① Catch

Figure 4-9 Uninstalling terminal module TM-EM/EM, starting from the right

4.5 Installing the Terminating Module and the Slot Cover

Properties

- The ET 200iSP distributed I/O station is terminated with the terminating module at the right hand end of the ET 200iSP. Unless you have inserted a terminating module, the ET 200iSP is not ready for operation (EMC is not ensured). While the ET 200iSP will start up, removal of an electronic module will cause a station failure.
- Removal of an electronic module causes a station failure of the ET 200iSP.
- To secure the ET 200iSP mechanically, you must screw the terminating module to the mounting rail.
- If your ET 200iSP configuration leaves you with a gap in the last slot, you must install a reserve module or the slot cover in this slot.
  - Install a slot cover if the ET 200iSP will not be expanded in the future. The slot cover is integrated in the terminating module.
    Replacing the slot cover with an electronic module during operation will cause a station failure of the ET 200iSP.
  - Install a reserve module if you want to use the free slot for a future expansion (by means of an electronic module).
- The terminating module accompanies terminal modules TM-IM/EM and TM-IM/IM.

Prerequisites

The last terminal module of the ET 200iSP has been installed.

Required tools

4.5 mm screwdriver

Installing the terminating module

1. Hook the terminating module onto the mounting rail to the right of the last terminal module.
2. Pivot the terminating module backwards onto the mounting rail.
3. Move the terminating module to the left until you hear it latch onto the last terminal module.
4. Screw the terminating module to the mounting rail (1 screw - torque 0.8 to 1.1 Nm). Use a screwdriver with a 4.5 mm wide blade.

Note

To avoid the ET 200iSP slipping to the side, the terminating module must be secured mechanically (see point 4). The securing screw is located on the front on the terminating module.

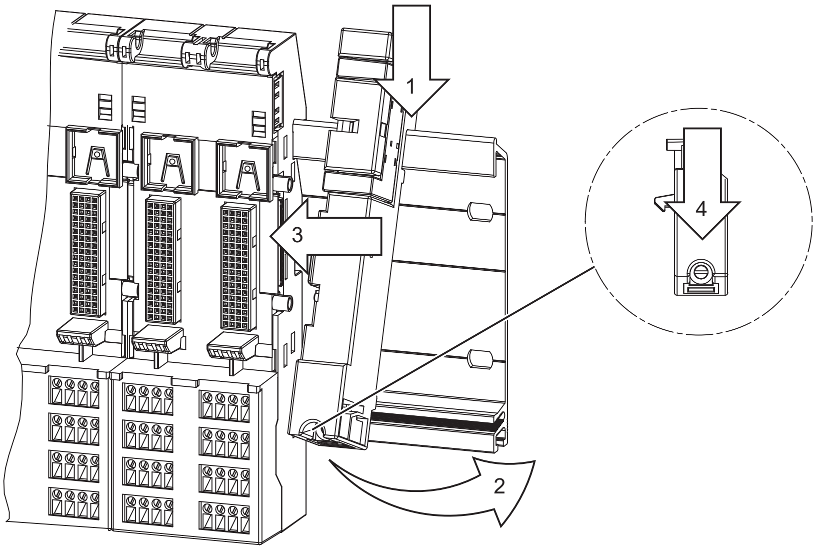


Figure 4-10 Installing the terminating module

Uninstalling terminating module

1. Switch off the supply voltage on the power supply PS or uninstall the power supply PS.
2. Remove the lock screw of the terminal module.
3. Use the screwdriver to push the catch on the last terminal module down to the stop and slide the terminating module to the right.
4. Swivel the terminating module out of the mounting rail.

Installing the slot cover

1. Use the screwdriver to lever the slot cover out of the terminating module. The slot cover is fixed in bracket on the right of the terminating module.
2. Insert this on the last slot of ET 200iSP.

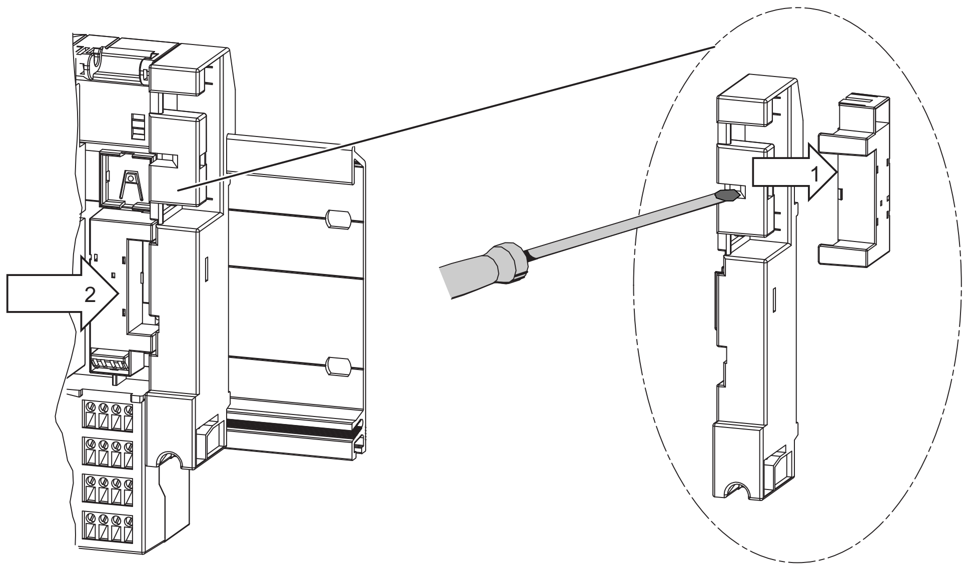


Figure 4-11 Installing the slot cover

Removing the slot cover

1. Push the screwdrivers into the lower opening on the slot cover and lever this out of the terminal module.
2. Press the Slot Cover into the bracket on the terminating module.

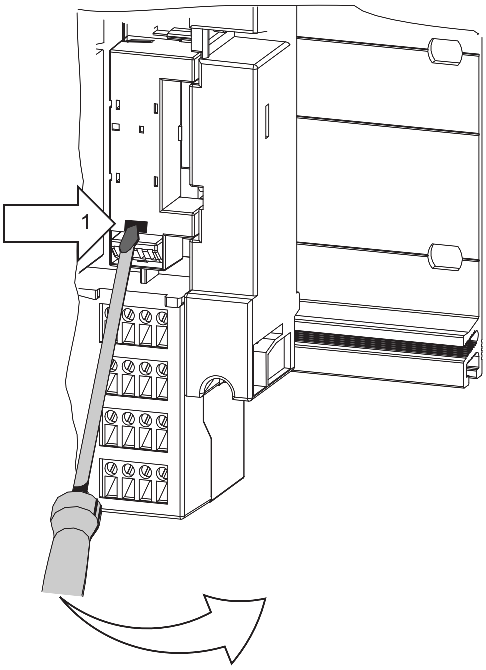


Figure 4-12 Installing the slot cover

4.6 Installing the Slot Number Labels

Properties

The slot number plates identify the individual electronic modules with a slot (1 to 34).

Requirements

- The terminal modules are installed.
- There must not be any electronic modules inserted when you apply the slot number plates.
- Position terminal module TM-PS-A/ TM-PS-A UC: One plate at the top left

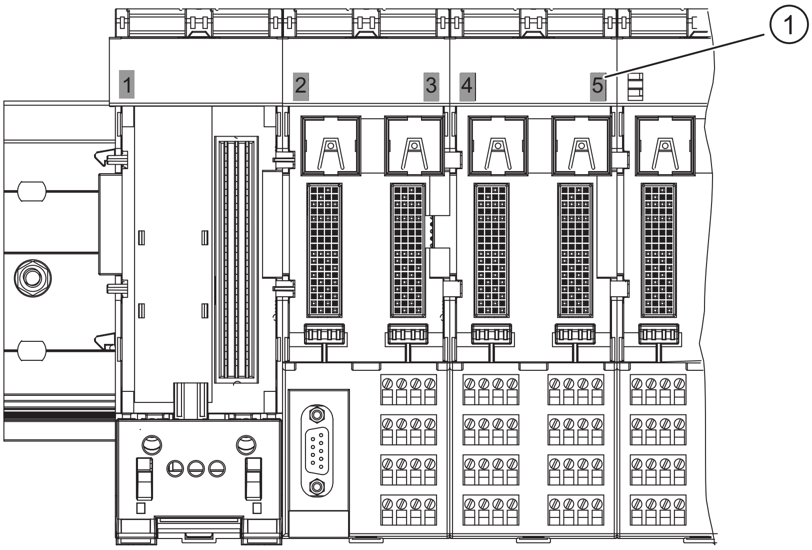
  Position of terminal modules TM-IM/EM, TM-EM/EM, and TM-RM/RM: One plate at the top left and right.

Required tools

3.5 mm screwdriver (for removal only)

Installing the slot number plates

1. Break off the slot number plates (1 to 34) from the strip.
2. Use your finger to press the slot number plates into the terminal module.



① Slot number plates

Figure 4-13 Installing the slot number plates

Removing slot number plates

1. Remove the electronic module from the terminal module.
2. Using the screwdriver, lever the slot number plate carefully from below out of the bracket.

Wiring 5

5.1 General Rules and Regulations for Wiring

Introduction

As a component in plants or systems, the distributed I/O station ET 200iSP is subject to special rules and regulations depending on its application. This chapter provides you with an overview of the most important rules when integrating the ET 200iSP distributed I/O system in a plant or system.

Specific application

Observe the accident prevention guidelines for specific applications, such as machine directive. When laying cables and lines, observe the installation regulations in EN 60 079-14, as well as country-specific regulations. When operating the ET 200iSP in areas with combustible dust (Zone 21, Zone 22), you must also comply with EN 61241-14.

EMERGENCY STOP mechanisms in the safe area

Emergency stop devices as defined in IEC 204 (corresponds to DIN VDE 113) must remain effective in all operating modes of the plant or system.

Startup of the system after certain events

The following table describes points to remember when your plant starts up following certain events:

Table 5- 1 Startup of the system after certain events

If...	then...
Startup after power dips or failure, Startup of ET 200iSP after bus communication was interrupted,	no dangerous states must result. If necessary, force an EMERGENCY STOP!
Startup after releasing the EMERGENCY STOP mechanism,	There must not be an uncontrolled or undefined startup.

Line voltage in the safe area

The following table describes points to remember relating to the line voltage:

Table 5- 2 Line voltage in the safe area

With ...	Requirements
A fixed installation or systems without all-pole disconnector	A disconnector or a fuse must exist in the building installation.
Load power supplies, power supply modules	The set rated voltage range must correspond to the local line voltage.
All circuits of the ET 200iSP distributed I/O station	Any fluctuation/deviation in the supply voltage from the rated value must be within the permitted tolerance (refer to "General technical specifications (Page 195)").

24 VDC supply in safe area

The following table shows what you have to note with the 24 VDC supply:

Table 5- 3 24 VDC supply in the safe area

<table>
<tr><th>With ...</th><th colspan="2">you must note the following...</th></tr>
<tr><td>Buildings</td><td>exterior lightning protection</td><td rowspan="2">Provide lightning protection measures (e.g. overvoltage suppressor)</td></tr>
<tr><td>24 VDC supply lines, signal lines</td><td>Interior lightning protection</td></tr>
<tr><td>24 VDC supply</td><td colspan="2">Safety isolation</td></tr>
</table>

Protection against exterior electric effects

The following table shows what you have to note to protect against electric effects or faults:

Table 5- 4 Protection against exterior electric effects

With ...	you must note the following...
All systems in which ET 200iSP is installed	That the system for discharging electromagnetic faults is connected to a PE conductor.
Supply, signal and bus lines	The wiring arrangement and installation must be correct.
Signal and bus lines	that a cable or wire break cannot lead to undefined system states.

5.2 Operating the ET 200iSP with equipotential bonding

Components and protective measures

When setting up a system, various components and protective devices are mandatory. The types of components and the degree to which the protective measures are mandatory depend on the DIN VDE regulation that applies to your plant setup. The table below relates to the schematic that follows.

Table 5- 5 24 VDC supply in the safe area

Compare	Relates to figure	DIN VDE 0100	DIN VDE 0113
Shutdown device for controllers, transducers and actuators	(1)	...Part 460: Main switch	...Part 1: Disconnector
Short-circuit and overload protection	(2)	...Part 725: Single-pole protection of circuits	...Part 1: With a grounded secondary circuit: single-pole protection

Safety isolation

Reliable electrical isolation is required with modules that are powered with voltages ≤ 60 V DC or ≤ 250 V AC, in other words, the power supply of the ET 200iSP must be reliably electrically isolated.

ET 200iSP with ungrounded reference potential

With the ET 200iSP, the reference potential M of the power supply relative to the protective conductor is ungrounded.

ET 200iSP within the overall configuration

The following schematic shows the ET 200iSP distributed I/O station within the overall configuration in the Zone 1 hazardous area (power supply and grounding concept) when powered from a TN-S system.

- Overall configuration with power supply PS 24 VDC

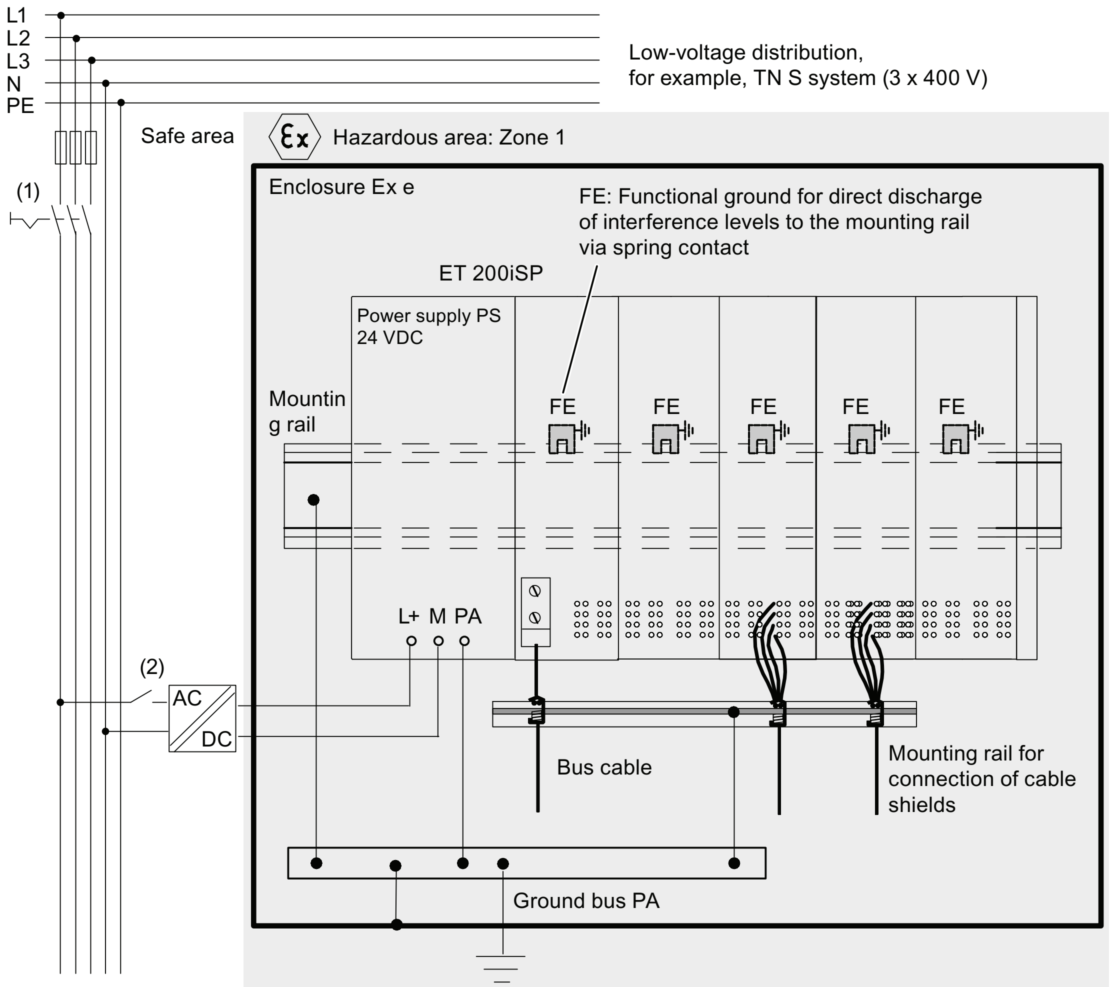


Figure 5-1 Operating the ET 200iSP and PS 24 VDC with equipotential bonding

- Overall configuration with power supply PS 120/230 VAC

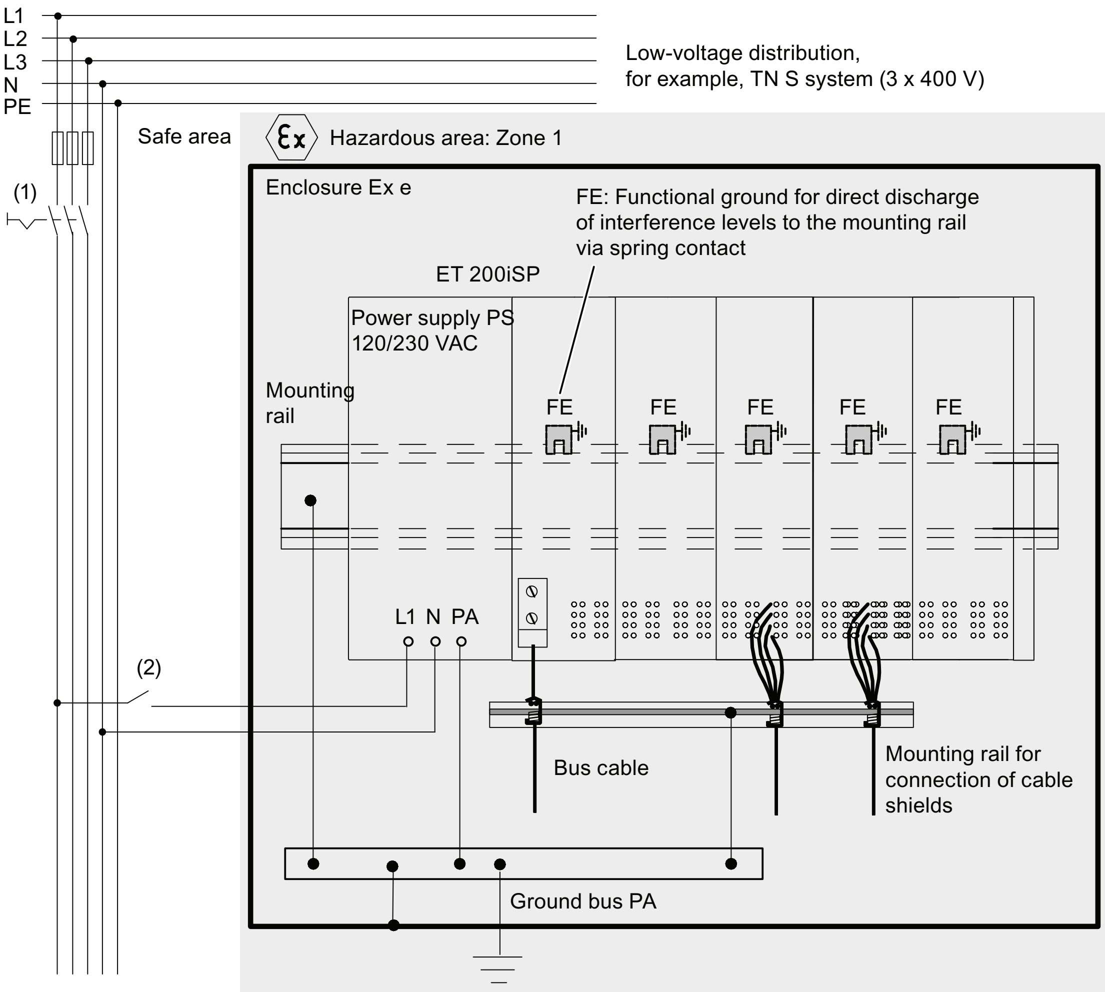


Figure 5-2 Operating the ET 200iSP and PS 120/230 VAC with equipotential bonding

Equipotential bonding EB

Connect the following to the equipotential bonding EB

- The mounting rail of the ET 200iSP system (with the grounding bolts Ex e)
- The terminal module TM-PS-A/ TM-PS-A UC by means of the connection terminal EB
- The terminal module TM-PS-A/ TM-PS-A UC by means of the connection terminal EB
- Mounting rail for mounting the cable shields (with an Ex e-terminal)

> **DANGER**
>
> It is not permitted to connection the equipotential bonding EB to the PE conductor of the supply system.

According to EN 60 079-14, equipotential bonding is mandatory in hazardous areas.

For more information on the equipotential bonding system, refer to the System Manual "Principles of explosion protection (http://support.automation.siemens.com/WW/view/en/12521844)".

5.3 Electrical Design of the ET 200iSP

Electrical isolation

In the ET 200iSP, isolation exists between:

- The load circuits/process and all other circuitry of the ET 200iSP
- The PROFIBUS DP interface in the interface module and all other circuit components
- Power supply (auxiliary power) and all output voltages

The following schematic shows the various potentials with the ET 200iSP. The figure shows only the most important components:

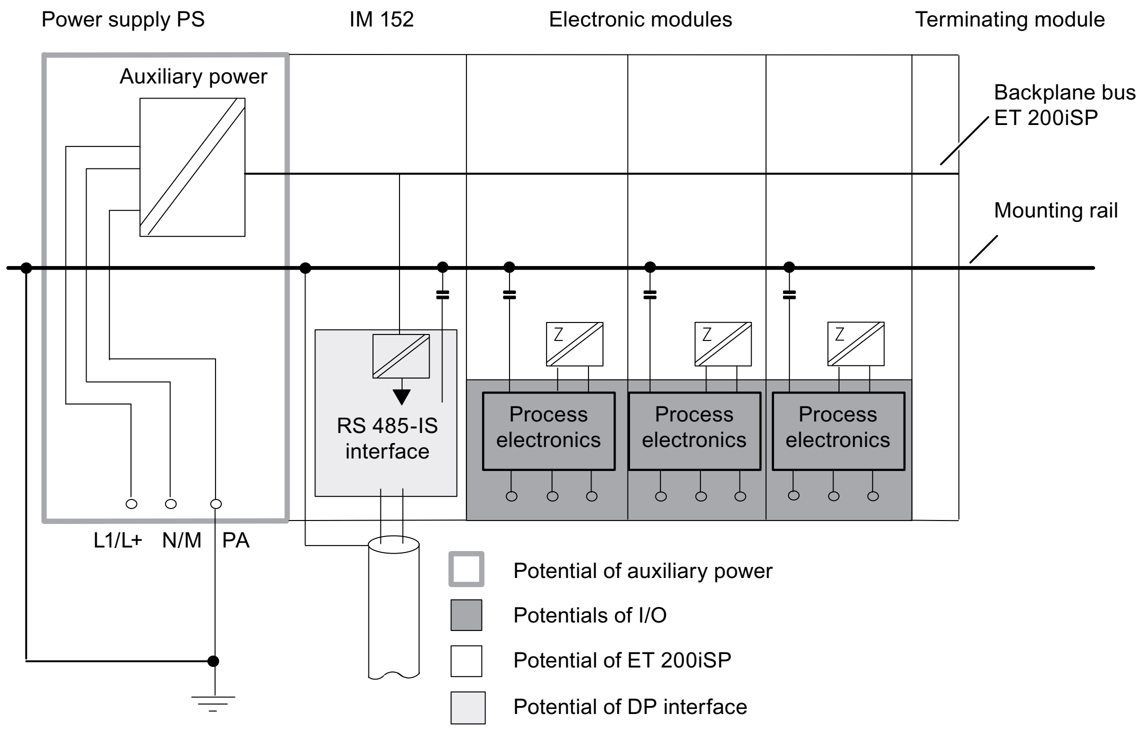


Figure 5-3 Potentials with the ET 200iSP

5.4 Wiring the ET 200iSP

5.4.1 Wiring Rules for the ET 200iSP

DANGER

When laying cables and wiring, make sure that you adhere to the installation regulations complying with EN 60 079-14 and any regulations specific to your country.

When operating the ET 200iSP in areas with combustible dust (Zone 21, Zone 22), you must also comply with EN 61241-14.

DANGER

Connecting an intrinsically safe sensor, actuator, or HART field device to the input/output of an electronic module must produce an intrinsically safe circuit! For this reason:

When you select the encoder, actuator or HART field device to be connected to the electronic module, the resulting safety-related values must be checked!

The inductance and capacitance of the cable must also be taken into account! Refer to Configuration Options in Zones (Page 44).

WARNING

If the wrong electronic module is used or the terminals are connected incorrectly to the sensors, actuators or HART field devices, the intrinsic safety is put at risk:

Connect only Ex i circuits to the intrinsically safe inputs and outputs of the electronic modules.

Check the wiring between the electronic modules and sensors, actuators, and HART field devices.

Wiring rules

Table 5- 6 Wiring rules for the ET 200iSP

Wiring rules for ...		TM-PS-A/ TM-PS-A UC, TM-PS-B/ TM-PS-B UC	TM-IM/EM, TM-EM/EM (spring and screw terminals)
Connectable wire cross-sections for solid wires		0.5 to 4 mm²	0.14 to 2.5 mA
Connectable wire cross-sections for flexible wires	Without end sleeve	0.5 to 2.5 mm²	0.14 to 2.5 mA
	with wire end ferrules	0.5 to 2.5 mm²	0.14 to 1.5 mA
Number of conductors per terminal		1 wire	1 or combination of 2 wires up to 1.5 mm (total) in a common wire-end ferrule
Length of insulation to be stripped		11 mm	
End sleeves in accordance with DIN 46228	without insulation collar	Form A, up to 12 mm long	Form A, up to 12 mm long
	With insulation collar 0.25 to 1.5 mm	Form E, up to 12 mm long	Form E, up to 12 mm long
Tightening torque		0.5 - 0.7 Nm	

5.4.2 Wiring Terminal Modules with Screw Terminals

Properties

- In terminal modules with screw terminals, the individual wires are screwed into the terminal.
- Wire-end ferrules are not necessary.

Prerequisites

Observe the wiring rules.

Required tool

3.5 mm screwdriver

Procedure

1. Strip insulation from the wires.
2. Insert the individual wires into the terminal.
3. Tighten the screw. Result: The wire is clamped into the terminal module.

5.4.3 Wiring terminal modules with spring terminals

Properties

In terminal modules with spring terminals, the individual wires are affixed by inserting them into the terminal.

Requirements

Observe the wiring rules.

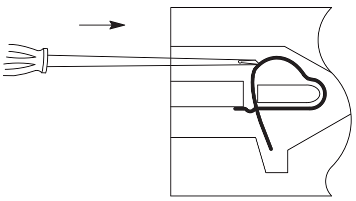
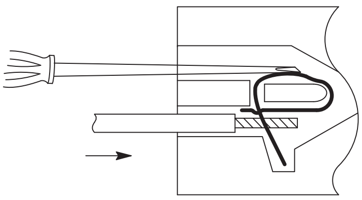
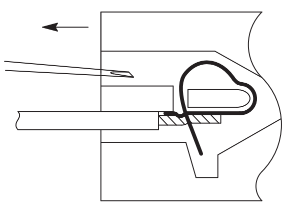
Required tools

3.5 mm screwdriver

Procedure

1. Strip insulation from the wires.
2. Insert the screwdriver into the upper (square) opening of the terminal and press it into the opening.
3. Insert the wire into the lower (round) opening of the terminal to the end stop.
4. Remove the screwdriver.

Table 5- 7 Wiring the spring terminal

	Insert screwdriver
	Insert cable up to stop in spring-type terminal
	Pull out screwdriver; cable clamps to contact

5.4.4 Grounding the mounting rail

Properties

The DIN rail of the distributed I/O station must be connected to the ground bus (equipotential bonding).

Requirements

- Perform the wiring with the power supply turned off .
- Securing the ground cable to the Ex e grounding bolt of the mounting rail
- To avoid any interference, the cross-section of the grounding conductor for the mounting rail must be greater than the cross-section of the grounding conductor on the terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC.

Required tools

- 10 mm wrench
- Insulation stripper
- Cable lug pliers

Procedure

1. Strip the insulation from the grounding conductor. Attach an M6 (ring) cable lug to the grounding conductor.

   The grounding cable must have a cross-section of at least 4 mm^2.
2. Terminate the grounding conductor at the grounding bolt (M6 nut, washer, and spring washer) located on the mounting rail on the left of the TM-PS-A/ TM-PS-A UC. The tightening torque is 2 to 2.5 Nm.
3. Secure the other end to the ground bus PA.

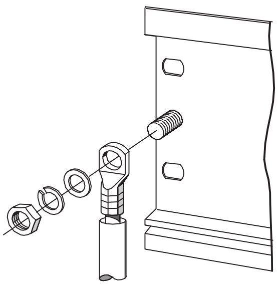


Figure 5-4 Grounding the mounting rail

5.4.5 Wiring terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC

Safety instructions for power supply PS 24 VDC

DANGER

Threat to explosion protection in the Zone 1 and Zone 21 potentially explosive area:

In Zone 1/ Zone 21, always switch off power before you disconnect the PS 24 VDC power supply cable on terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC. In zone 21, you may only open the enclosure of the ET 200iSP when no explosive dust is present!

DANGER

Threat to explosion protection in the Zone 2 and Zone 22 potentially explosive area:

In Zone 2/ Zone 22, in cases subject to explosion hazard, always switch off power before you disconnect the PS 24 VDC power supply cable on terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC.

If there is no risk of explosion, the PS 24 VDC power supply cables can be disconnected from terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC in Zone 2/ Zone 22 while power is on.

Safety instructions for the power supply PS 120/230 VAC

DANGER

In Zone 1/ Zone 21, Zone 2/ Zone 22 and in the safe area, always switch off power before you disconnect the PS 120/230 VAC power supply cable on terminal module TM-PS-A UC or TM-PS-B UC. In zone 21, you may only open the enclosure of the ET 200iSP when no explosive dust is present!

Properties

Connect the ET 200iSP power supply to the terminal module TM-PS-A/ TM-PS-A UC.

Connect the power supply for redundancy to the terminal module TM-PS-B/ TM-PS-B UC.

The active Power Supply PS supplies interface module IM 152 and all electronic modules with the required voltage.

Requirements

- Wire the terminal module with the power supply turned off.
- Observe the wiring rules.

Required tools

- 3.5 mm screwdriver
- Insulation stripper

Procedure

1. Strip the wires for the power supply to the ET 200iSP.
2. Pull the slide down as far as the end stop until it clicks into place.

   You can only pull the slide down when the two securing screws on the terminal module are screw to the mounting rail.
3. Secure the individual wires using the 3.5 mm screwdriver.

Note

The grounding cable (equipotential bonding) must have a cross-section of at least 4 mm². Connect the other end of the grounding cable Pa with the grounding busbar PA.

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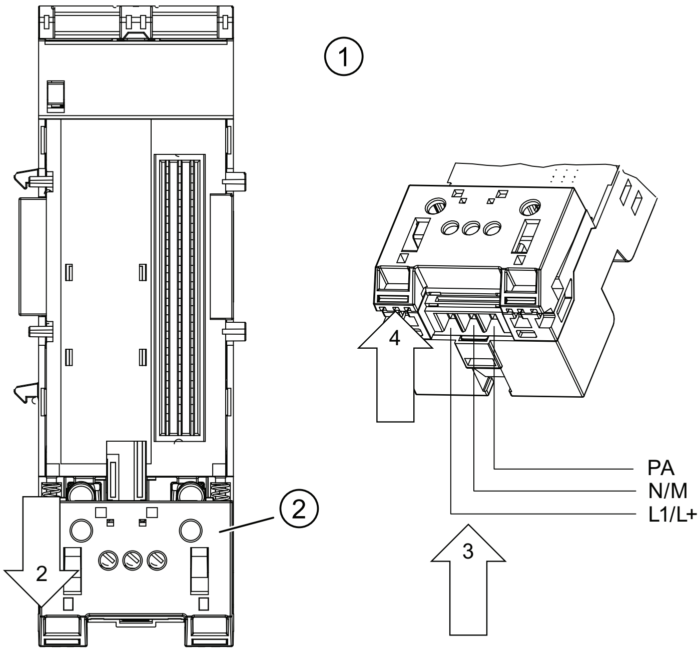
4. Lift the slide until this move upwards of its own accord.



① Terminal module TM-PS-A/ TM-PS-A UC
② Catch

Figure 5-5 Connecting the Power Supply and Grounding Conductor PA to the TM-PS-A/ TM-PS-A UC.

Note

When wiring the TM-PS-A UC/ TM-PS-B UC, make sure to connect the phase L1 and the neutral conductor N properly. This is necessary to ensure a trouble-free operation of the ET 200iSP.

5.4.6 Wiring Terminal Modules TM-IM/EM and TM-IM/IM

Properties

Connect the PROFIBUS RS 485-IS connector to terminal module TM-IM/EM. The connector is on the left-hand side of the module. Terminal module TM-IM/EM also forms the interface to the actuators and sensors. The connectors are on the right-hand side of the module.

Connect the bus connector to terminal module TM-IM/IM for redundant operation of the two IM 152s.

Prerequisites for Zone 1 and Zone 21

Keep to the following rules in zone 1 and zone 21:

1. Use the RS 485-IS coupler (see appendix "Order Numbers (Page 347)").
2. If you want to loop the PROFIBUS RS 485-IS through to the next ET 200iSP, use the PROFIBUS connector RS 485-IS (order no. 6ES7972-0DA60-0XA0). To loop the module through, connect the bus cable to the second cable outlet of the bus connector.
3. Terminate PROFIBUS RS 485-IS with the PROFIBUS connector RS 485-IS. The PROFIBUS connector RS 485-IS (6ES7972-0DA60-0XA0) is equipped with an integrated terminating resistor.
4. Use the bus cable specified in Appendix "Order Numbers" for PROFIBUS RS 485-IS and mark the bus cable as an "Ex i bus cable". If you use a color as the identifier, you must select light blue.
5. The shield of the bus cable must be connected to one of the following locations providing a sure ground connection PA:
   – Either at the transition of the bus cable from the safe area to the hazardous area
   – or in the safe area directly at the RS 485-IS coupler. In this case, the shield must be installed like an active circuit; in other words, protection against accidental touch must also exist for the shield of the bus cable (IP 20).

Prerequisites for Zone 2 and Zone 22

Keep to the following rules in zone 2:

- See points 1 to 5: *Prerequisites for Zone 1 and Zone 21*

Prerequisites for safe area

- See points 1 to 4: *Prerequisites for Zone 1 and Zone 21*

Wiring terminal module TM-IM/EM

Connecting PROFIBUS RS 485-IS (left module)

1. Insert the bus connector on the PROFIBUS RS 485-IS connection.

Note

The cable shield of the bus cable is connected in service to the terminal module TM-IM/EM by means of a spring-type terminal with the mounting rail and consequently with the equipotential bonding PA.

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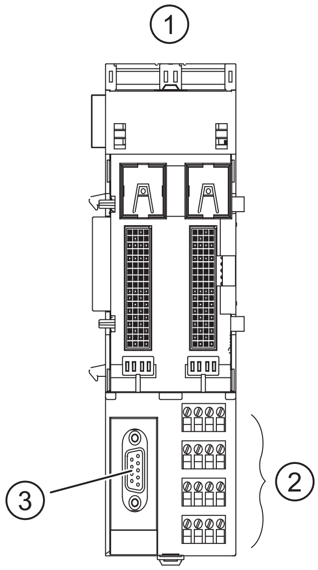
2. Use the 3.5 mm screwdriver to tighten the lockscrews of the bus connection (torque: 0.5 to 0.7 Nm).
3. Label the bus cable as "Ex i bus cable".



① Terminal module TM-IM/EM
② Connector for the electronic module:
channel 0 to 3, or
channel 0 to 7
③ Connection for IM 152:
PROFIBUS RS 485-IS

Figure 5-6 Wiring terminal module TM-IM/EM (PROFIBUS RS 485-IS)

For pin configuration, refer to the Chapter "Terminal module TM-IM/EM 60S and TM-IM/EM 60C (Page 210)".

Note

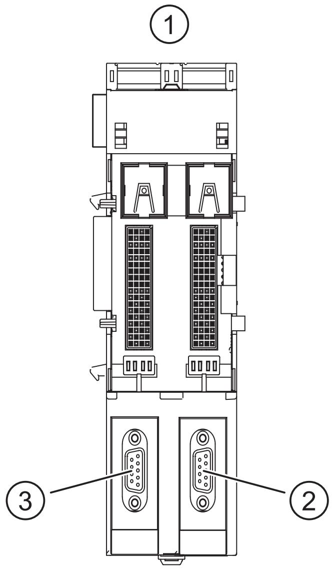
PROFIBUS RS 485-IS of ET 200iSP in intrinsically safe owing to the RS 485-IS coupler. It is therefore permitted to remove and insert the bus connector during running operation in Zone 1 and Zone 2. In Zone 21 and Zone 22 it is only permitted to open the enclosure of the ET 200iSP if no combustible dust is present.

Connecting sensors and actuators (right-hand module)

Refer to the Chapter "Wiring terminal module TM-EM/EM (Page 118)".

Wiring terminal module TM-IM/IM

Connect the two bus connectors for the redundant IMs. The procedure for TM-IM/EM is described under *Connecting PROFIBUS RS 485-IS (left-hand module)*. Repeat the same steps for the right-hand module.



① Terminal module TM-IM/IM
② Connection for IM 152 (b): PROFIBUS RS 485-IS
③ Connection for IM 152 (a): PROFIBUS RS 485-IS

Figure 5-7 Wiring terminal module TM-IM/IM (PROFIBUS RS 485-IS)

For pin configuration, refer to the Chapter "Terminal module TM-IM/IM (Page 214)".

5.4.7 Wiring Terminal Modules TM-EM/EM

Properties

Terminal module TM-EM/EM forms the interface to the sensors and actuators.

Requirements

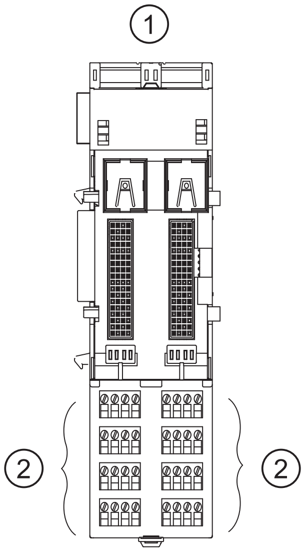
Observe the wiring rules.

Required tools

3.5 mm screwdriver

Procedure

1. Strip the insulation from the wires to the sensors / actuators.
2. Secure the individual wires in the screw or spring terminals.



① Terminal module TM-EM/EM
② Connector for the electronic module:
channel 0 to 3, or
channel 0 to 7

Figure 5-8 Wiring the terminal module TM-EM/EM

Pin assignment, see Chapter "Terminal modules TM-EM/EM 60S and TM-EM/EM 60C (Page 217)".

Note

The inputs and outputs of the ET 200iSP distributed I/O station are intrinsically safe. Disconnecting wires to the sensors, actuators, and HART field devices on the terminal module TM-EM/EM is permitted during operation in zone 1 and zone 2. In zone 21 and zone 22, you may only open the enclosure of the ET 200iSP when no explosive dust is present!

5.4.8 Wiring terminal module TM-RM/RM

DANGER

Threat to explosion protection in the Zone 1 and Zone 21 potentially explosive area:

In Zone 1/ Zone 21, always switch off the rated load voltage (relay contacts) before you disconnect the wires for actuators on terminal module TM-RM/RM. In zone 21, you may only open the enclosure of the ET 200iSP when no explosive dust is present!

DANGER

Threat to explosion protection in the Zone 2 and Zone 22 potentially explosive area:

In Zone 2/Zone 22, if an explosion hazard exists always switch off the rated load voltage (relay contacts) before you disconnect the wires for actuators on terminal module TM-RM/RM.

If an explosion hazard does not exist, you may disconnect the wires for the actuators on terminal module TM-RM/RM in Zone 2/ Zone 22 while the rated load voltage is switched on.

Properties

Terminal module TM-RM/RM forms the interface to the actuators of the electronic module 2 DO Relay UC60V/2A. The terminals of terminal module TM-RM/RM are designed with increased safety Ex e type of protection.

Requirements

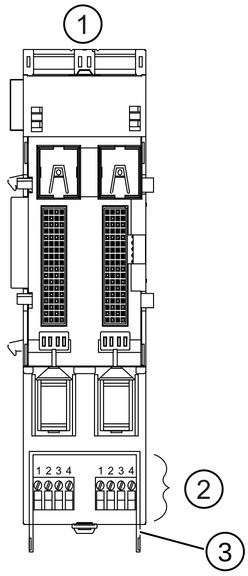
- Switch off the rated load voltage before you wire the terminal module.
- Observe the wiring rules.

Required tools

- 3.5 mm screwdriver
- Insulation stripper

Procedure

1. Open the terminal cover.
2. Strip the insulation from the wires to the sensors / actuators.
3. Secure the individual wires in the screw-type terminal Ex e.
4. Close the terminal cover.



① Terminal module TM-RM/RM
② Connection for electronic module 2 DO Relay UC60V/2A channels 0 and 1
③ Terminal cover

Figure 5-9 Wiring terminal module TM-RM/RM

For pin configuration, refer to Chapter "Terminal module TM-RM/RM 60S".

5.4.9 Connecting cable shields

Properties

The cable shields of the analog electronic modules must be connected to the ground bus (equipotential bonding) of the enclosure.

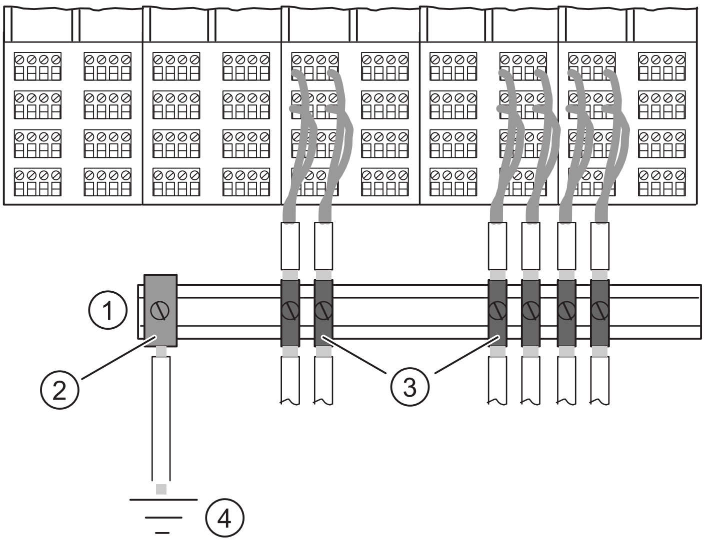
Prerequisites

- Tim-plated or galvanized standard mounting rail complying with EN 50022 (35 x 15/ 35 x 7.5) and fittings
- Shield terminals (6ES5728-8MA11)
- Securing the ground cable to the standard mounting rail:
  - Zone 1 or zone 21: Ex e terminal. Use the terminal WP 16/E, from Weidmüller (see appendix "Order numbers (Page 347)").
  - Zone 2, zone 22 or safe area: Normal terminal
- 4.5 mm screwdriver
- Insulation stripper

Procedure

The following procedure describes an example of how to contact the shield. You can also use the enclosure features to connect the shield.

1. Install the standard mounting rail ET 200iSP in the enclosure (clearance to the ET 200iSP: approx. 40 mm).
2. Strip the installation from the cable in the area of the standard mounting rail (approx. 40 mm).
3. Secure the cable to the standard mounting rail with the shield clamp (torque: 0.8 to 1.2 Nm). Make sure that the shield clamp contacts only the cable shield.
4. Repeat steps 2 and 3 if you need to connect other cable shields.



① Standard mounting rail for shield support
② Ex e terminal
③ Shield terminals
④ Ground bus PA

Figure 5-10 Connecting cable shields

Connecting standard mounting rail with ground bus PA

1. Strip the cable for the ground connection (from 4 to 16 mm²) and fasten to the standard mounting rail using the ground terminal (torque: 2 to 2.5 Nm).
2. Connect the other end to the ground bus PA.

5.4.10 How to Connect a TC Sensor Module

Properties

The TC sensor module can be used for the internal compensation of the reference junction temperature. This ships with the 4AI TC.

Prerequisites

The TC sensor module can only be connected to terminal modules with screw terminals.

Required tool

3.5 mm screwdriver

Procedure

1. Insert the TC sensor module into the third terminal row of the terminal module: Terminals in 3, 7, 11; pin in terminal 15.
2. Tighten the TC sensor module using a 3.5 mm screwdriver. Tighten the screws of terminals 3, 7 and 11.

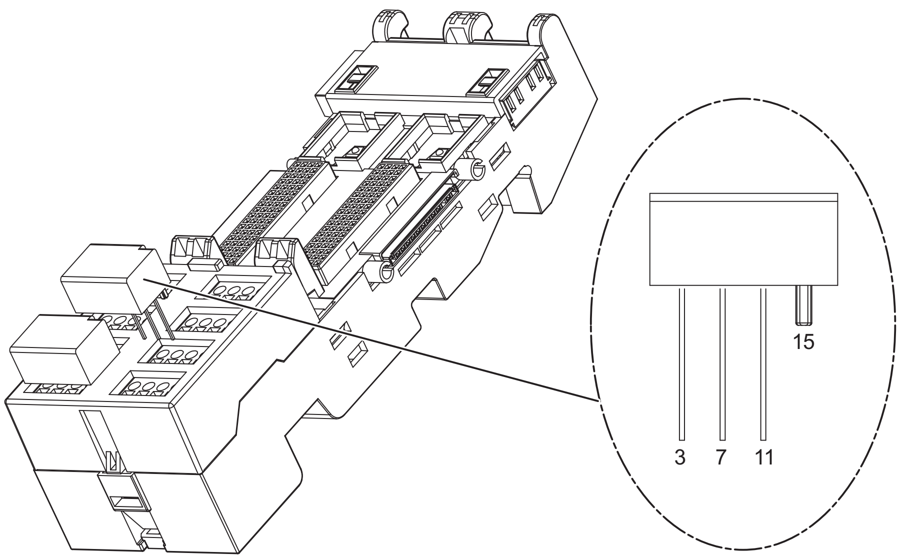


Figure 5-11 TC sensor module

5.5 Inserting and labeling the power supply, interface module, and electronic modules

5.5.1 Requirements

Properties

- The modules installed on the relevant terminal modules.
- Using a labeling strip, you can identify the interface module and the electronic modules.
- When you first insert an interface or electronic module, the coding element engages into the terminal module. This prevents the wrong module being inserted.

  The interface module and the electronic modules are self-coding.

Prerequisites

Keep to the wiring rules.

Required tools

4.5 mm screwdriver

5.5.2 Inserting power supply PS

Installing the power supply PS

1. Hang the power supply into the top of the bearing of terminal module TM-PS-A/ TM-PS-A UC.
2. Push in the bottom of power supply until it engages on the terminal module.
3. If your configuration has a power supply for redundancy, repeat steps 1 and 2 on terminal module TM-PS-B/ TM-PS-B UC.

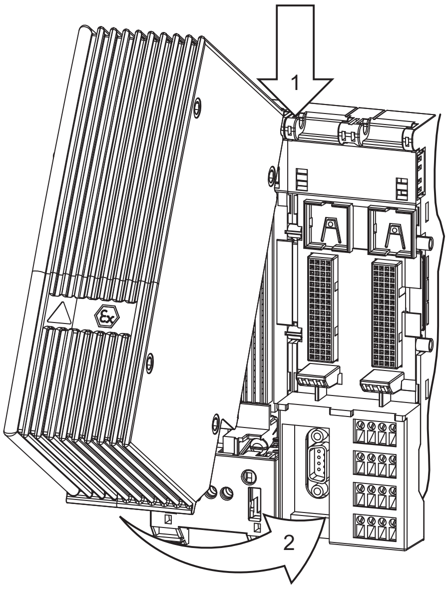


Figure 5-12 Installing the power supply PS

> **DANGER**
>
> **Danger of crushing!**
>
> Despite its small size the power supply PS is heavy, 2.7 kg, because it is compact. Therefore, please make sure to hold it firmly in the hand.

Uninstalling the power supply PS

1. Use the 4.5 mm screwdriver to trip the catch on the underside of the terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC and pull this downward until it latches in.
2. Swivel the Power Supply out of the mounting position of the terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC.

> **CAUTION**
>
> During operation, the enclosure of the power supply can reach a temperature of up to 90 °C. There is a danger of burning!

5.5.3 Inserting and labeling the interface module and electronic modules

Installing and labeling the interface module and electronic module

1. Hang the interface or electronic module in the top section of the storage part of the terminal module.
2. Swivel the interface or electronic module downward until it latches on the terminal module.
3. Label the module using the label strips provided.
4. Then insert the label strips in the interface or electronic module.

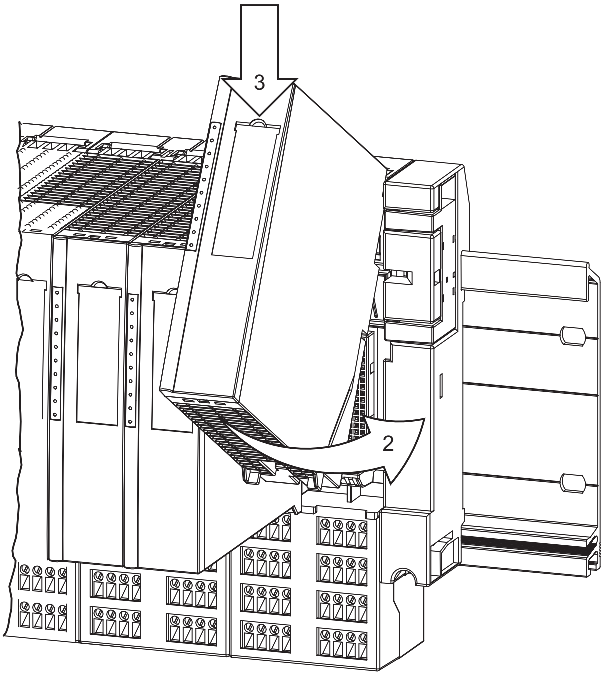


Figure 5-13 Installing and labeling interface and electronic modules

WARNING
Make sure that the terminal and electronic module are properly allocated for their application.

Note

If any gaps (of an electronic module) develop due to the ET 200iSP configuration, the following rules apply:

- The gap is at the last slot of the ET 200iSP: insert the slot cover (or a reserve module) in this gap.
- The gap is at a different slot (for electronic modules): insert a reserve module in this gap.

Uninstalling interface module and electronic modules

1. Use the screwdriver to operate the catch on the underside of the interface or electronic module.
2. Swivel this upward.
3. Remove the module from the storage space of the terminal module.

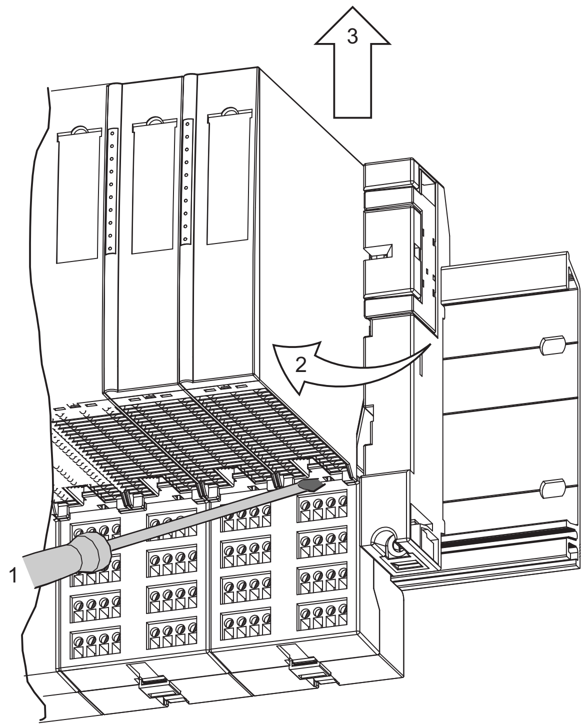


Figure 5-14 Uninstalling interface and electronic modules

Replacing a defective interface or electronic module

You have already uninstalled the interface or electronic module:

1. remove the removable part of the coding element from the new interface or electronic module. The coding element is located on the underside of the interface or electronic module.
2. Install the new interface or electronic module (same type) on the terminal module, checking for an audible latching sound.
3. Label the new interface or electronic module.

Note

Check the coding element before you install the new interface or electronic module.

Changing the Type of Electronic Module

You have already removed the electronic module:

1. Use the screwdriver to press the coding element out of the terminal module.
2. Insert this coding element on the used electronic module.
3. Install the new electronic module (different type) on the terminal module, checking for an audible latching sound.
4. Label the new electronic module.

DANGER

Making changes to the coding can lead to dangerous states in your system. In such cases you have to check the installation and adjust it where necessary. In doing so also note the safety data of the electronic module.

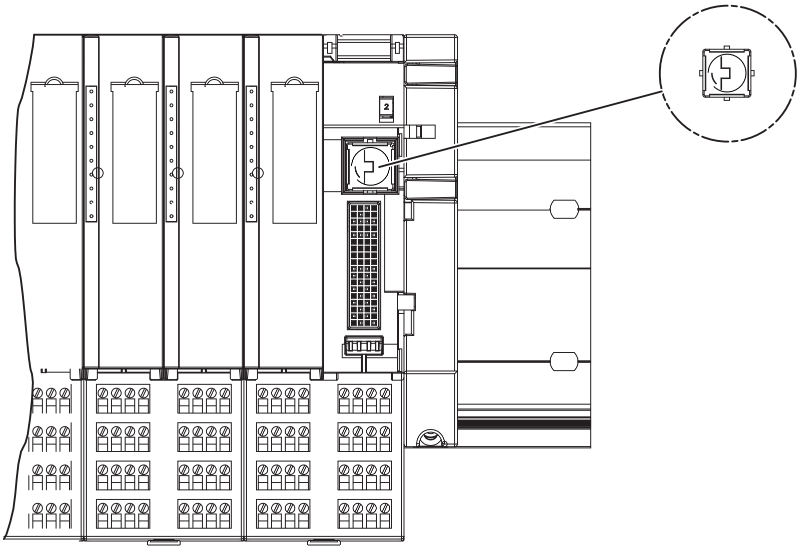


Figure 5-15 Replacing an electronic module with a different type

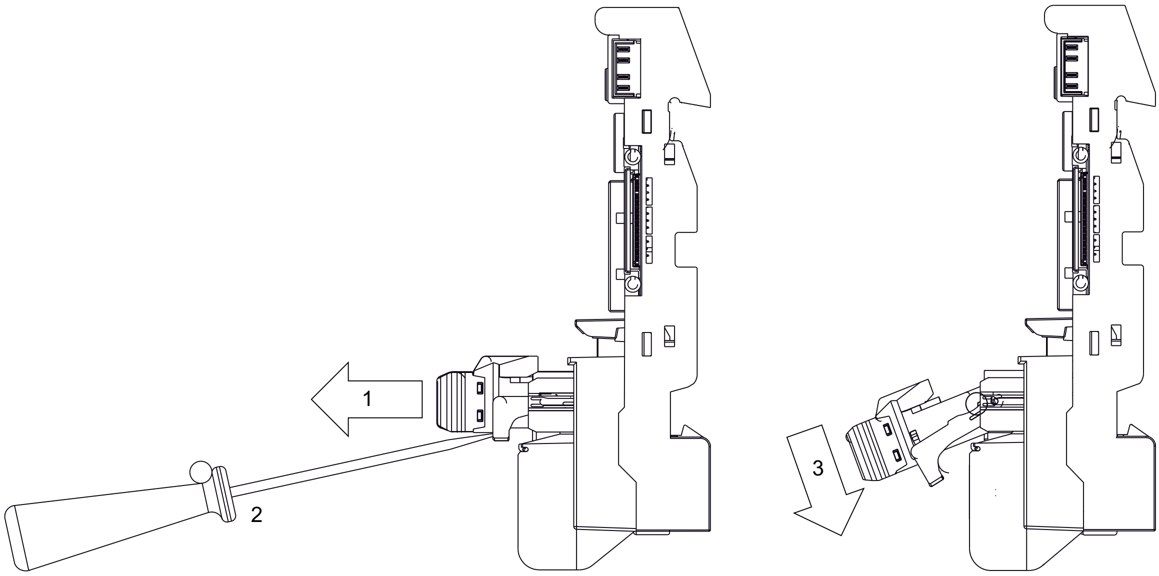
See also

Modular system (Page 41)

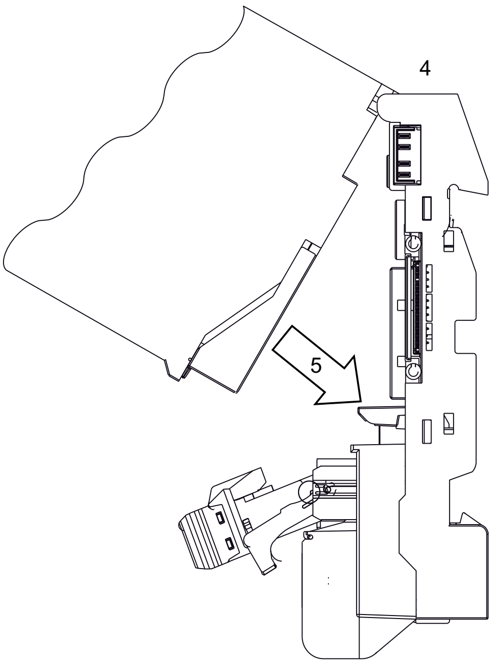
5.5.4 Inserting and labeling electronic modules 2 DO Relay UC60V/2A

Inserting and labeling electronic modules 2 DO Relay UC60V/2A

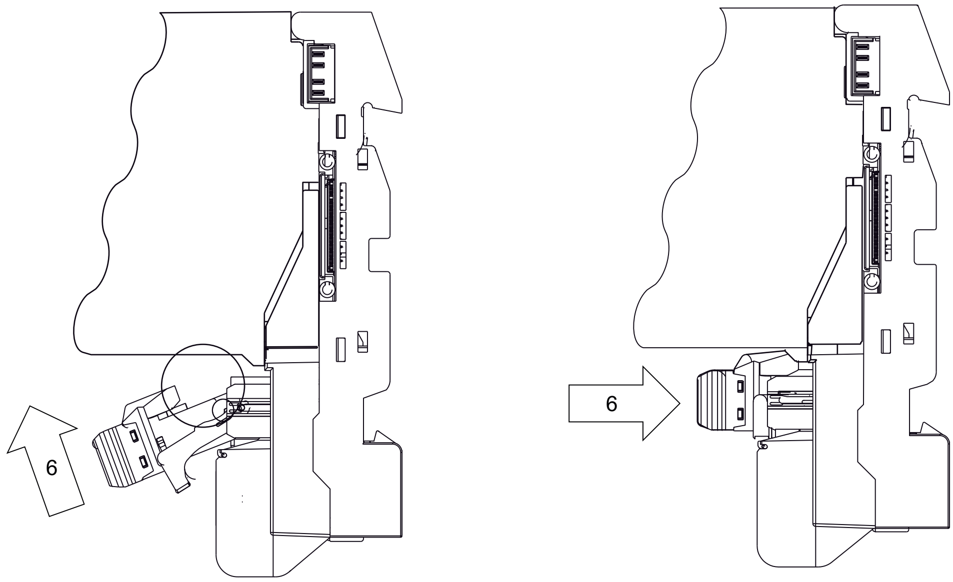
1. Remove the Ex d isolating plug up to the end stop.
2. Use a screwdriver to loosen the locking lever from the latch and swivel the lever down.
3. Pull the Ex d isolating plug further forward up to the end stop. In this position, it folds downward.



4. Hang the top of electronic module 2 DO Relay UC60V/2A in the bearing position of the terminal module.
5. Push in the bottom of the electronic module 2 DO Relay UC60V/2A power supply until it engages on the terminal module.



6. Swivel the Ex d isolating plug back into the horizontal position and push it back to the end stop. Pay attention that the locking lever is flush with the plug and is engaged.



7. Label the electronic module using the labeling strips provided and reinsert the labeling strips into the electronic module.

Note

If a gap (of an electronic module 2 DO Relay UC60V/2A) develops due to the ET 200iSP configuration, the following rules apply:

- The gap is at the last slot of the ET 200iSP: insert the slot cover (or a reserve module as of product version 3 or later) in this gap.
- The gap is at a different slot (for electronic module 2 DO Relay UC60/2A): insert a reserve module (as of product version 3) in this gap.

Uninstalling electronic modules 2 DO Relay UC60V/2A

1. Follow steps 1 to 3, see "Digital electronic module 2 DO Relay UC60V/2A (Page 259)" installing and labeling
2. Use the screwdriver to operate the catch on the underside of the electronic module.
3. Swivel this upward.
4. Remove the module from the storage space of the terminal module.

Replacing a defective electronic module

You have already uninstalled the electronic module:

1. remove the removable part of the coding element from the new electronic module. The coding element is located on the underside of the electronic module.
2. Install the new electronic module (same type) on the terminal module, checking for an audible latching sound.
3. Follow steps 4 to 7, see "Digital electronic module 2 DO Relay UC60V/2A (Page 259)" installing and labeling

---

Note

Check the coding element before you install the new interface or electronic module.

5.6 Setting the PROFIBUS address

Properties

With the PROFIBUS DP address, you define under which address the distributed I/O station ET 200iSP is addressed on the PROFIBUS RS 485-IS.

Requirements

- The PROFIBUS DP address for the ET 200iSP is set on the interface module by means of DIP switch. The DIP switch is located on the front of the interface module, protected by a swivel cover.
- Permitted PROFIBUS DP addresses are 1 to 125
- Each address can be assigned only once on the PROFIBUS.

Required tool

3.5 mm screwdriver

Setting PROFIBUS DP Addresses

1. To open, swivel the cover to the right.
2. Use the screwdriver to set the desired PROFIBUS DP address by means of the DIP switch.
3. Close the cover.

Changing the PROFIBUS DP Address

1. Use the screwdriver to set the PROFIBUS DP address "0" by means of the DIP switch.
2. Switch the supply voltage of the ET 200iSP on and off on the Power Supply. The deletion operation is finished when the BF LED flashes (0.5 Hz, duration approx. 10 s).

   The ET 200iSP saves the parameters retentively in the Flash memory of the IM 152. Therefore you should delete the retentive stored parameters during the initial commissioning or after the modification of the system.
3. Now set the new PROFIBUS DP address by means of the DIP switch and again switch the power voltage on and off at the Power Supply.

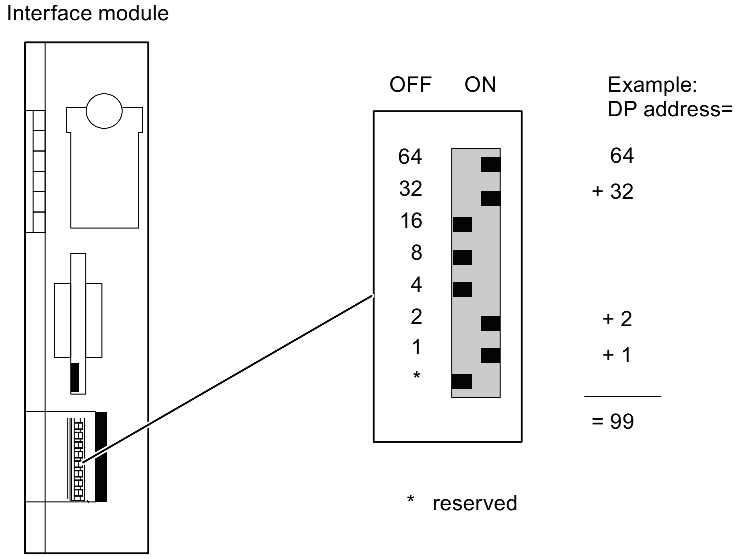


Figure 5-16   Setting the PROFIBUS DP address

Note

If you change the PROFIBUS DP address without previously erasing the retentive parameters in the Flash memory, the ET 200iSP does not respond with either the new or to the old address on the PROFIBUS DP.

Commissioning and Diagnostics

6

6.1 Basics of commissioning and diagnostics

Principle of Configuration

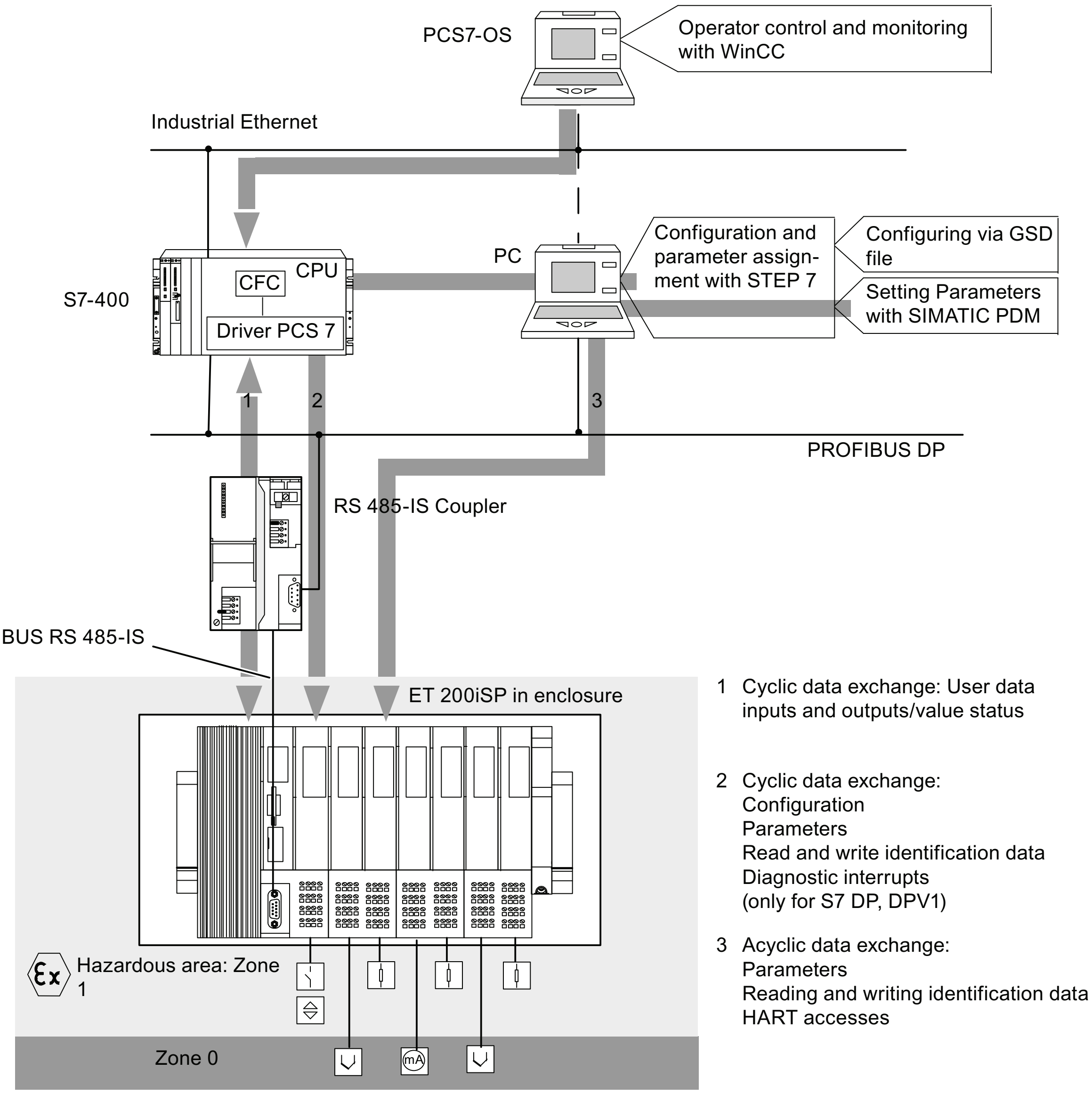


Figure 6-1 Principle of project engineering

Configuration

Configuration involves configuring and setting parameters for the ET 200iSP with a programming device (PG).

Configuring

When you configure your project, you set only the basic characteristics of the DP slave (for example, network parameters, module selection in HW Config). You configure the ET 200iSP with

- STEP 7
- COM PROFIBUS or with suitable configuration software (using the GSD file).

Parameter Assignment

When you make the parameter assignments, you set the parameters of the ET 200iSP and the HART field devices.

- With STEP 7, you make the parameter settings for the ET 200iSP in HW Config.
- Outside STEP 7, you set the parameters for the ET 200iSP and the HART field devices with SIMATIC PDM. SIMATIC PDM must be installed as a standalone version.
- All modules have basic parameter settings when they leave the factory (refer to the parameter defaults). After you turn on the power supply for the ET 200iSP, the modules are initially in a safe state:
  - Digital inputs: input values 0, value status 0
  - Digital outputs: no current or voltage (no substitute values)
  - Analog inputs: input value $7FFF_H$
  - Analog outputs: no current or voltage (no substitute values)
  - All parameters (that you can set with SIMATIC PDM): Disabled

    Once parameters are assigned correctly (using HW Config or SIMATIC PDM), they are saved to non-volatile memory in the modules. The next time you turn on the power on the power supply PS, the parameters will be adopted.

    The retentively stored parameters will be deleted if you set the PROFIBUS address to "0" and then switch the power supply off and on at the power supply PS.

Cyclic Data Transfer Via PROFIBUS DP

Data is exchanged between the CPU (for example, S7-400) and the ET 200iSP.

The cyclic user data of the inputs and outputs, including the value status of the inputs, are transferred.

For plant visualization, this data can be prepared by the PCS 7 driver and CFC (Continuous Function Chart) on the CPU and then displayed on the OS with WinCC.

Acyclic Data Transfer Via PROFIBUS DP

Acyclic data exchange takes place between the ET 200iSP and the PG / PC (SIMATIC PDM). The ET 200iSP receives its parameters using acyclic data exchange. Identification data is also transferred and displayed in SIMATIC PDM.

- Diagnostics and alarms (with S7 DP slave and DPV1 slave)
- Data records

DPV0, S7 DP, or DPV1 slave

The ET 200iSP can be operated as a DPV0, S7 DP or DPV1 slave. The following table compares the functions.

Table 6- 1 Comparison of DPV0, S7 DP and DPV1

Function		DPV0 slave	S7 DP slave	DPV1 slave	Comment
Parameter assignment and configuration with GSD file		X	---	X	
Configuration and parameter assignment with HW Config		X[1]	X	X[1]	
Cyclic data exchange		X	X	X	
Acyclic data traffic (read/write data record) • Free access to parameters on the field device • Reassignment of parameters of the application process	Class 1 services (parameter assignment master, e.g. PLC)	---	X	X	
	Class 2 services (for example, PD/OP)	X	X	X	
Diagnostics					One interrupt can be reported per diagnostic frame. For DPV1 and S7 DP slaves, an interrupt consists of a slave diagnostic accompanied by an acknowledgment mechanism not included in DPV0.
• ID-related diagnostics		X	X	X	
• Module status		X	X	X	
• Channel-related diagnostics		X	X	X	
Interrupts					
• Diagnostic interrupt		---	X[2]	X	
• Hardware interrupt		---	X[2]	X	
• Remove/insert interrupt		---	X	X	
• Update interrupt		---	---	X	
• Time stamping		---	X	X	

[1]If you configure the ET 200iSP using the GSD file (in HW Config), you will need SIMATIC PDM for parameter assignment.

[2]For the S7 DP slave, diagnostic and process interrupts are only reported when the CPU is in RUN mode.

Software requirements

Table 6- 2 Software requirements

Configuration software used	Version	Explanations
STEP 7	STEP 7 V5.3, Service Pack 1 or higher, and current HW update	The ET 200iSP is available in the hardware catalog of HW Config. You configure and assign parameters for the ET 200iSP in HW Config.
STEP 7 and SIMATIC PDM (SIMATIC PDM is integrated; it is also available as a stand-alone version)	STEP 7 version 4.02 or higher	You need the GSD file for the ET 200iSP and configure with HW Config...
	SIMATIC PDM version 6.0 or higher	... and set parameters with SIMATIC PDM
PCS 7 (includes, among other things STEP 7 and SIMATIC PDM)	Version 6.1 or higher	Refer to the documentation on PCS 7
COM PROFIBUS and SIMATIC PDM (SIMATIC PDM is integrated; it is also available as a stand-alone version)	COM PROFIBUS Version 5.0 or higher	You need the GSD file for the ET 200iSP and configure with COM PROFIBUS...
	SIMATIC PDM version 5.2 or later	... and set parameters with SIMATIC PDM
Other configuration software and SIMATIC PDM (SIMATIC PDM is integrated; it is also available as a stand-alone version)	Other project engineering software (version, see manufacturer)	You need the GSD file of the ET 200iSP and configure with a suitable engineering tool...
	SIMATIC PDM version 5.2 or later	... and set parameters with SIMATIC PDM

Note

If you are configuring the ET 200iSP in STEP 7 using the GSD file, you will need SIMATIC PDM for parameter assignment.

6.2 Project engineering with STEP 7

Properties

- The ET 200iSP is included in the hardware catalog of STEP 7.
- Diagnostic interrupts, process interrupts, remove/insert interrupts (S7-400 only) and time stamping are supported.

Requirements

The required software has been installed on the PG/ PC or PCS 7-ES.

Procedure for Configuration and Parameter Assignment

1. Start SIMATIC Manager.
2. Configure the ET 200iSP with HW Config.
   – Create a new project
   – Drag modules from the hardware catalog to the configuration table
3. Configure the time stamping (option).
4. Double-click on the first module of the ET 200iSP in the configuration table and set the parameters.
5. Set the parameters for the remaining ET 200iSP modules.
6. Save the configuration, or download it to the DP master.

6.3 Project Engineering with GSD File and SIMATIC PDM

Properties

ET 200iSP is integrated as a DPV0 or DPV1 slave.

Prerequisites

- The required software has been installed on the PG/ PC or PCS 7-ES.
- You need GSD file SI028110.GSE. These can be downloaded from the Internet at Service & Support (http://www.siemens.com/automation/service&support)
  The GSD file is integrated into the configuration software as described below:

> **Note**
>
> The GSD file for the ET 200iSP is based on Revision 4. Result: Not all parameters are available in COM PROFIBUS.
>
> Make sure that your configuration tool supports GSD files with Revision 4 so that all parameters will be available.

STEP 7 version 4.02 or higher	COM PROFIBUS Version 5.0 or higher
1. Start STEP 7, open HW Config, then select **Options > Install new GSD file**. 2. From the next dialog box, select the GSD file you want to install and confirm with OK. Result: The ET 200iSP appears in the PROFIBUS-DP directory of the hardware catalog.	1. Copy the GSD file from the ET 200iS to the COM PROFIBUS directory: **...COMPB5\GSD** (default). Copy the bit map file to the **...COMPB5\BITMAPS** directory. 2. Start COM PROFIBUS, then select **File > Read in GSD file**. Result: The ET 200iSP is displayed in the hardware catalog during the slave configuration.

- To work online with SIMATIC PDM, you require a PROFIBUS-DP interface, such as CP5611 (6GK1561-1AA00). The CP must be set to the PROFIBUS-DP interface (in SIMATIC Manager: menu command **Options > Set PG/ PC Interface**).

> **WARNING**
>
> If you are configuring with the GSD file and SIMATIC PDM, create your project in two steps:
>
> 1. Step: Configuring by means of GSD file
>
> 2. Step: Setting Parameters with SIMATIC PDM
>
> Note that configuration (step 1) is consistent with the parameter assignment with SIMATIC PDM (step 2). The assignment of the slots from step 1 must match the parameters generated with SIMATIC PDM (step 2).

Procedure for configuring

STEP 7 version 4.02 or higher	COM PROFIBUS version 5.0 or higher or another project engineering software
1. Start SIMATIC Manager. 2. Integrate the GSD file into HW Config (see requirements). 3. Configure the ET 200iSP with HW Config. – Create a new project – Drag modules from the hardware catalog to the configuration table 4. Save the configuration, or download it to the DP master.	1. Start COM PROFIBUS or the project engineering software. 2. Integrate the GSD file into COM PROFIBUS or into the engineering software (see requirements). 3. Configure the ET 200iSP with COM PROFIBUS / your project engineering software. 4. Save the configuration and download the configuration to the DP master.

Procedure for assigning parameters to electronic modules

1. Start SIMATIC Manager.
2. Select the process device network view as the standard view with the menu command Options > Settings > View > Process Network View.
3. Create a new project with the menu command File > New. The "New" dialog opens in which you enter the required project name and confirm with "OK".
4. Now select the Networks icon, right-click and select Insert New Object > PC and Insert New Object > PROFIBUS DP Network.
5. In the left-hand pane of the window, select the PC icon. An icon labeled DP Interface now appears in the right-hand pane of the window. Right-click on this icon and select "Object Properties". In the next dialog, select "PROFIBUS-DP Networks" under networks and confirm with "OK".
6. Now select the icon labeled "PROFIBUS DP Network", right-click and select Insert new object > Remote I/O. Make the following entries in the dialog that opens:
   Name: Name of the ET 200iSP station (for example, ET 200iSP).
   Address: PROFIBUS address you set on the interface module.
   Number of "Remote I/O" objects: Number of ET 200iSP stations for which you are setting parameters.
   Confirm with "OK". Result: The ET 200iSP station is now displayed in the right-hand pane of the window.
7. Now select the remote I/O object you created in the previous step (ET 200iSP), right-click and select the Insert New Object > Remote I/O Module menu command. Make the following entries in the dialog that opens:
   Name: Name of the module (for example, 8 DI NAMUR).
   Address: Slot of the first electronic module in the ET 200iSP station (4).
   Number of "Remote I/O Objects: Number of electronic modules in the ET 200iSP station.
   Confirm with "OK". Result: The electronic modules are now displayed in the right-hand pane of the window.
8. Select the first remote I/O object (electronic module in the left pane of the SIMATIC Manager), right-click and select the Open Objects menu command. In the next dialog, "SIMATIC PDM Select Device", select SIEMENS > ET 200iSP > Modules and confirm with "OK".

9. From the next dialog box, select "Specialist" as the user and confirm with "OK." In this mode, you can assign parameters. Result: SIMATIC PDM is started.
10. Once SIMATIC PDM has started, select the relevant electronic module as the "module type". Then click in one of the gray fields to update the window. Result: The parameters and I&M of the electronic module are displayed.
11. Now set the parameters of the electronic module. Save the changes with the **File > Save** menu command and download the parameters to the electronic module with the **Device > Download to Device** menu command. Close SIMATIC PDM.
12. Follow the same procedure as described in points 8 through 11 for each of the ET 200iSP objects (electronic modules).

Procedure for assigning parameters to the interface module

1. Select the first remote I/O object (ET 200iSP in the left pane of the SIMATIC Manager), right-click and select the Open Objects menu command. In the next dialog, "SIMATIC PDM Select Device", select **SIEMENS > ET 200iSP > Head-end Station** and confirm with "OK".
2. From the next dialog box, select "Specialist" as the user and confirm with "OK." In this mode, you can assign parameters. Result: SIMATIC PDM is started.
3. Now set the parameters of the interface module. Save the changes with the **File > Save** menu command and download the parameters to the interface module with the **Device > Download to Device** menu command. Close SIMATIC PDM.

How to set parameters for all modules of the ET 200iSP

1. Select the first remote I/O object (ET 200iSP in the left pane of the SIMATIC Manager), right-click and select the Open Objects menu command. In the next dialog, "SIMATIC PDM Select Device", select **SIEMENS > ET 200iSP > Head-end Station** and confirm with "OK".
2. In the next dialog, select "Specialist" as the user and confirm with "OK".
3. Upload all parameters of the modules (menu command **File > Complete Upload to PG/PC**).
4. Set the parameters for all required modules. In the left-hand pane of the SIMATIC PDM window, you can select all the modules of the ET 200iSP.
5. Save the changes (menu command **File > Save**) so that the file is updated.
6. Download all parameters to the modules (menu command **Device > Complete Download to Device**). Close SIMATIC PDM.

Reference

For more detailed information on parameter assignment, refer to the documentation and online help of SIMATIC PDM.

6.4 Assigning Parameters for the ET 200iSP during Operation using SIMATIC PDM

Properties

- Using the parameter assignment function, you can also assign module parameters during operation with SIMATIC PDM. Each new parameter setting that is correct is adopted by the module and stored in non-volatile memory.
- Bad parameters are ignored. The module then retains the previous parameter settings.
- If the modules are restarted (after turning the supply voltage of the ET 200iSP off ---> on), the current parameter assignment in the non-volatile memory of the modules is applied (SF LED of the modules is off).
- Adopting the retentive parameter settings on modules takes place regardless of the communication between the ET 200iSP and the DP master.
- The outputs of the modules are controlled by the class 1 DP master.

Requirements

SIMATIC PDM Version 6.0 or higher (integrated or stand-alone version)

Procedure for Reassigning Parameters

1. Start SIMATIC PDM.
2. Open the project.
3. Change the view in the SIMATIC Manager: Menu Command **View > Process Network View**.
4. Select the desired ET 200iSP module in the left part of the window. Press the right mouse button and select from the Open Objects menu. Result: SIMATIC PDM is started.
5. Load the parameter and/or I & M of the module in the PG/PC.
6. Change the parameters and/or I & M.
7. Save the changes and load the parameters and/or identification data in the module.
8. Control step: Load the parameters and/or I & M of the module in the PG/PC and check the re-assignment of the parameters.

Reference

For further information on assigning parameters, refer to the SIMATIC PDM Documentation and Online Help.

6.5 Diagnostics Using the Process Image Input Table

Properties

In addition to the diagnostic information available with the LEDs and module/DP diagnostics, the module also provides information about the validity of every input signal - the value status. The value status is entered in the process image along with the input signal.

Value Status of the Digital Input Modules

The value status is additional binary information in a digital input signal. It is entered in the process image input table at the same time as the process signal and provides information on the validity of the input signal.

The value status is influenced by the wire break check / short-circuit, chatter monitoring, pulse stretching and validation check of changeover contacts.

- S7 format with value status
  - Input signal is valid: "1_B"
  - Input signal is invalid: "0_B"

Value status from the analog input modules

The input values of the analog input modules are stored in the process image of the inputs. For a measured value, the following value status is entered as input value:

- S7 format
  - Input signal is valid: No value status
  - Input signal is invalid: "$7FFF_H$" (bit 0 to 15 of the analog value)

Assignment of the inputs and value status in the PII

Each channel of the module is assigned a value status in the process image of the inputs. You can find the assignment at "Address space of the inputs and outputs (Page 361)".

Evaluation of the value status in PCS 7

The value status is evaluated by means of the PCS 7 channel driver.

1. The PCS 7 channel drivers reads the value status from the process image of the inputs...
2. ... and forms the quality code for PCS 7 from this.

Reference

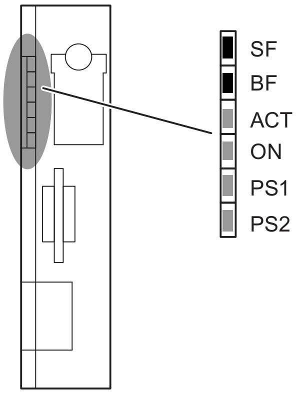
For a detailed description of the evaluation and processing of the relevant input signals, refer to the PCS 7 documentation (http://support.automation.siemens.com/WW/view/en/10806846/130000).

See also

Digital input module (Page 361)

6.6 Status and error LEDs on the ET 200iSP

Interface module IM 152



SF Group error (red)
BF Bus fault (red)
ACT Active IM with redundancy (yellow)
ON Supply voltage (green)
PS1 Power Supply PS 1 status (green, right-hand PS)
PS2 Power Supply PS 2 status (green, left-hand PS)

Status and Error LEDs on the IM 152

- LED PS1: On --> power supply is switched on at power supply 1
- LED PS2: On --> for power supply PS when redundancy is configured: power supply is switched on at Power Supply 2

Table 6- 3 Status and Error LEDs on the IM 152

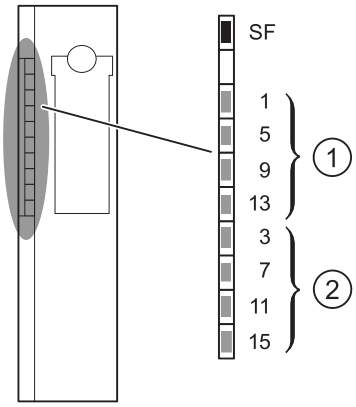
LEDs				Meaning	Remedy
SF	BF	ACT	ON		
off	off	off	off	No voltage is applied. Power supply PS or IM 152 defective.	Turn on the power on power supply PS. Replace the power supply PS or the IM 152.
on	on	on	on	Hardware test after power on.	---
off	off	*	on	Data exchange between the ET 200iSP and the DP master. Preset and actual configuration are consistent, no diagnostics.	---

LEDs				Meaning	Remedy
SF	BF	ACT	ON		
on	off	*	on	Data exchange between the ET 200iSP and the DP master, at least one diagnostic event and/or one inconsistency in the preset and actual configuration is present.	Check the process wiring. Check the electronic modules. Check the preset and actual configuration (wrong or missing module).
*	on	*	on	No connection with the DP master (transmission rate detection). Cause: Bus communication over PROFIBUS DP has been interrupted.	Check the bus (is the bus connector inserted correctly). Check the terminating resistor and the RS 485-IS coupler.
*	flashes	*	on	IM 152 is not configured properly - no data exchange is occurring between the DP master and the ET 200iSP. Causes: Bad PROFIBUS DP address. Inconsistent preset and actual configuration. Problems on PROFIBUS DP.	Check the project engineering (PROFIBUS DP address). Check the preset and actual configuration (wrong or missing module). Check the bus configuration (bus connector, terminating resistor, RS 485-IS coupler).
on	off	*	on	Illegal PROFIBUS DP address. Causes: PROFIBUS DP address 126 or 127 set. PROFIBUS DP address changed, without deleting retentive data.	Set a valid PROFIBUS DP address on the IM 152. If you have changed the PROFIBUS DP address, delete the retentive data.
on	on	*	off	Deleting the retentive data (turning on with PROFIBUS DP address "0").	---
off	flashes at 0.5 Hz	*	off	Retentive data is deleted, turn off.	Set the required PROFIBUS DP address before turning on again.
*	off	on	on	The IM 152 is exchanging data with the DP master and the electronic modules of the ET 200iSP. If redundancy is configured, this IM 152 is the **active** interface module of the ET 200iSP.	---
*	off	off	on	The IM 152 is receiving power. If redundancy is configured, this IM 152 is the **passive** interface module, i.e. no data is exchanged with the electronic modules.	---
flashes at 0.5 Hz **	off	off	on	If redundancy is configured, this IM 152 is the **passive** interface module and is not ready for a bumpless switchover (for example, the associated CPU is in STOP mode).	Bring the H-system to the redundant state.
flashes at 2 Hz	flashes at 2 Hz	flashes at 2 Hz	flashes at 2 Hz	The IM 152 is in the safe state.	Remove and insert the IM 152. If the flashing code continues to occur, you must send in the IM 152.

* Not applicable

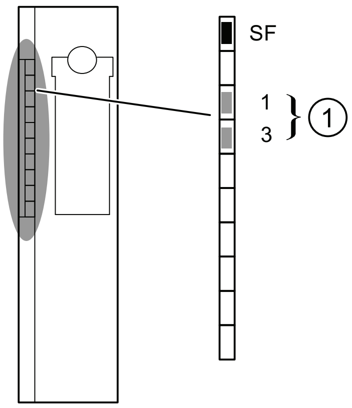
** After the transition to redundant operation, the SF LED continues to flash for another 20 s.

Digital electronic modules



SF Group error (red)
① Status for input/output status (green)
② Status for the input status (green)

Digital electronic module 2 DO Relay

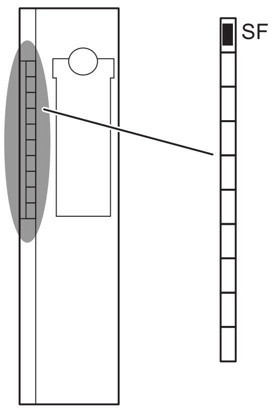


Status and Error LEDs on the Digital Electronic Modules

Table 6- 4 Status and Error LEDs on the Digital Electronic Modules

LEDs									Meaning	Remedy
SF	1	5	9	13	3	7	11	15		
on									Wrong module present or diagnostic message.	Analyze the diagnostic information.
	on								Input DI_0 or counter output 1 or output DO_0 activated	
		on							Input DI_1 or counter output 2 or output DO_1 activated	
			on						Input DI_2 or GATE 1 or output DO_2 activated	
				on					Input DI_3 or GATE 2 or output DO_3 activated	
					on				Input DI_4 or Reset counter 1 activated	
						on			Input DI_5 or Reset counter 2 activated	
							on		Input DI_6 or Reset output 1 activated	
								on	Input DI_7 or Reset output 2 activated	

Analog electronic modules



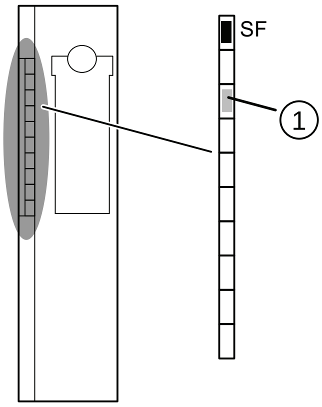
SF Group error (red)

Status and error LEDs on the analog electronic modules

Table 6- 5 Status and error LEDs on the analog electronic modules

LEDs	Meaning	Remedy
SF		
on	Wrong module present or diagnostic message.	Analyze the diagnostic information.

Watchdog module



SF Group error (red)
① Bit 0: Status (green)

Status and error LEDs on the Watchdog module

Table 6- 6 Status and error LEDs on the Watchdog module

LEDs		Meaning	Remedy
SF	Bit 0		
on		Wrong module present or diagnostic message.	Analyze the diagnostic information.
	flashes	The LED flashes at the assigned frequency (toggle: 0.1 Hz; 0.5 Hz; 1 Hz; 2 Hz)	---
	on	Output signal (bit 0 active)	---

6.7 Commissioning and starting up the ET 200iSP

6.7.1 Safety Information

Safety Information

Note

During commissioning, keep to national regulations.

Always observe the guidelines according to EN 60 079-17 when performing operation checks. This standard also contains the directives of international standard IEC 60 079-17.

Performing tests

Note

You must provide for the safety of your facility. Before a system undergoes final commissioning, you should perform a complete function test and the necessary safety tests.

Incorporate foreseeable errors when planning the tests. This will enable you to avoid endangering persons or property during operation.

6.7.2 Requirements for commissioning

Requirements

Table 6- 7 Requirements for commissioning

Step	Prior Activity	See...
1	ET 200iSP is installed	Chapter "Installing (Page 81)"
2	PROFIBUS address is set on the ET 200iSP	Chapter "Wiring (Page 103)"
3	ET 200iSP is wired up	Chapter "Wiring (Page 103)"
4	Zone 1, zone 21, zone 2 and zone 22: Additional check of the installation and wiring of the ET 200iSP, connections, enclosure, and supply lines.	
5	The project engineering of the ET 200iSP is completed (configuration and parameter assignment)	Chapter "Basics of commissioning and diagnostics (Page 133)"
6	The power supply for the DP master is on	*Manual to the DP master*
7	DP master switched to RUN operating state	*Manual to the DP master*

See also

General Rules and Regulations for Wiring (Page 103)

6.7.3 Commissioning the ET 200iSP

Commissioning the ET 200iSP

Table 6- 8 Commissioning the ET 200iSP

Step	Procedure	See
1	Turn on the power supply for the ET 200iSP.	Chapter "Wiring (Page 103)"
2	Watch the STATUS LEDs on the ET 200iSP and on the DP master.	• Chapter "Basics of commissioning and diagnostics (Page 133)" • *Manual to the DP master*

Note

The ET 200iSP supports the default startup.

The following conditions then apply:

- Transferred parameters are saved and used after the switching on the supply voltage on the Power Supply PS.
- The configuration can be performed with the General Identification Format according to the PROFIBUS standard.

See also

General Rules and Regulations for Wiring (Page 103)

6.7.4 Figure Starting up the ET 200iSP

Starting up the ET 200iSP

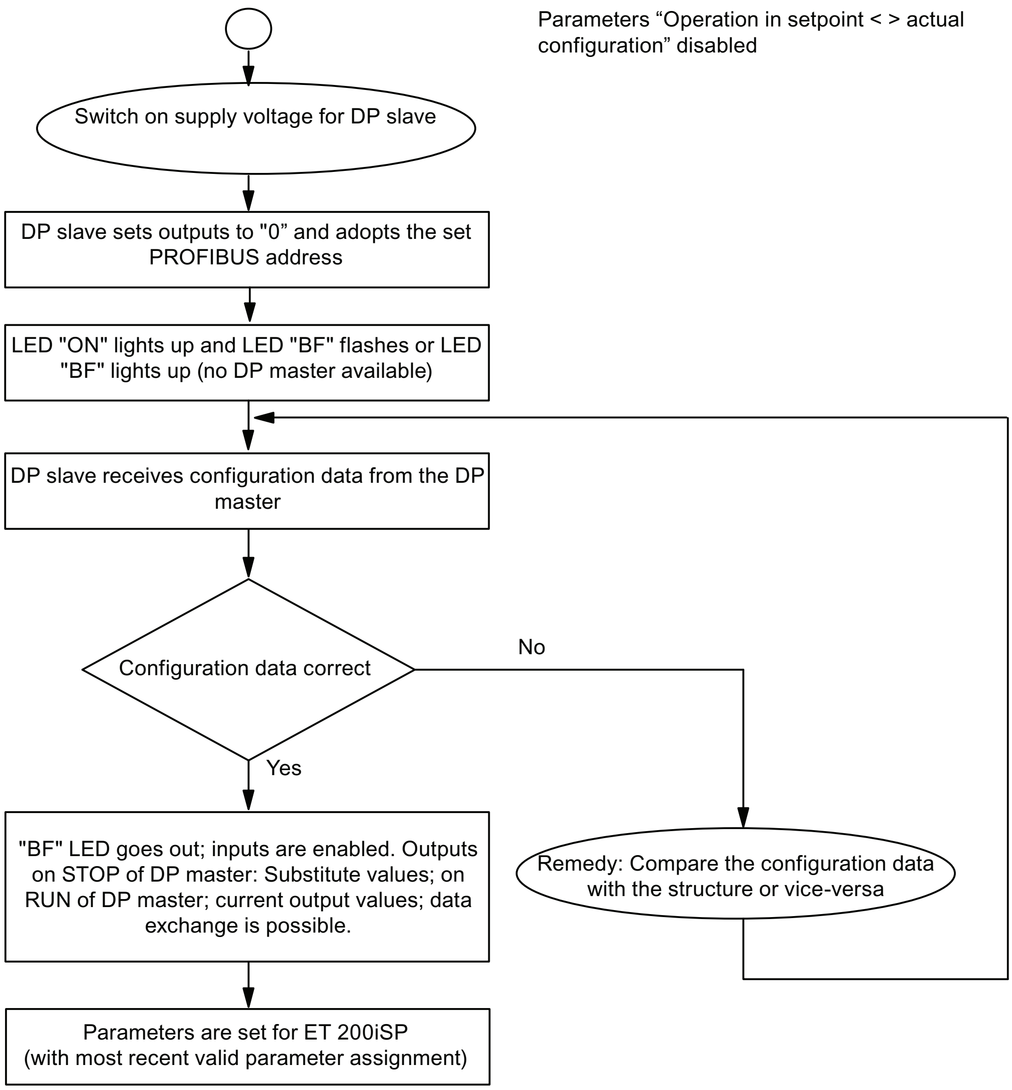


Figure 6-2 Starting up the ET 200iSP

6.7.5 Startup of the ET 200iSP with IM 152 redundancy

Principle of operation

In a redundant configuration, the two inserted IM 152 modules start up independently. The following flowchart illustrates the startup of the IM 152 (a). For the IM 152 (b), the following flow chart applies with the designations reversed accordingly.

ET 200iSP

<table>
<tr><td>TM-PS-A/
TM-PS-A UC</td><td colspan="2">TM-IM/IM</td><td colspan="2">TM-EM/EM</td><td colspan="2">TM-EM/EM</td></tr>
<tr><td>PS</td><td>IM 152
(a)</td><td>IM 152
(b)</td><td>EM</td><td>EM</td><td>EM</td><td>EM</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
</table>

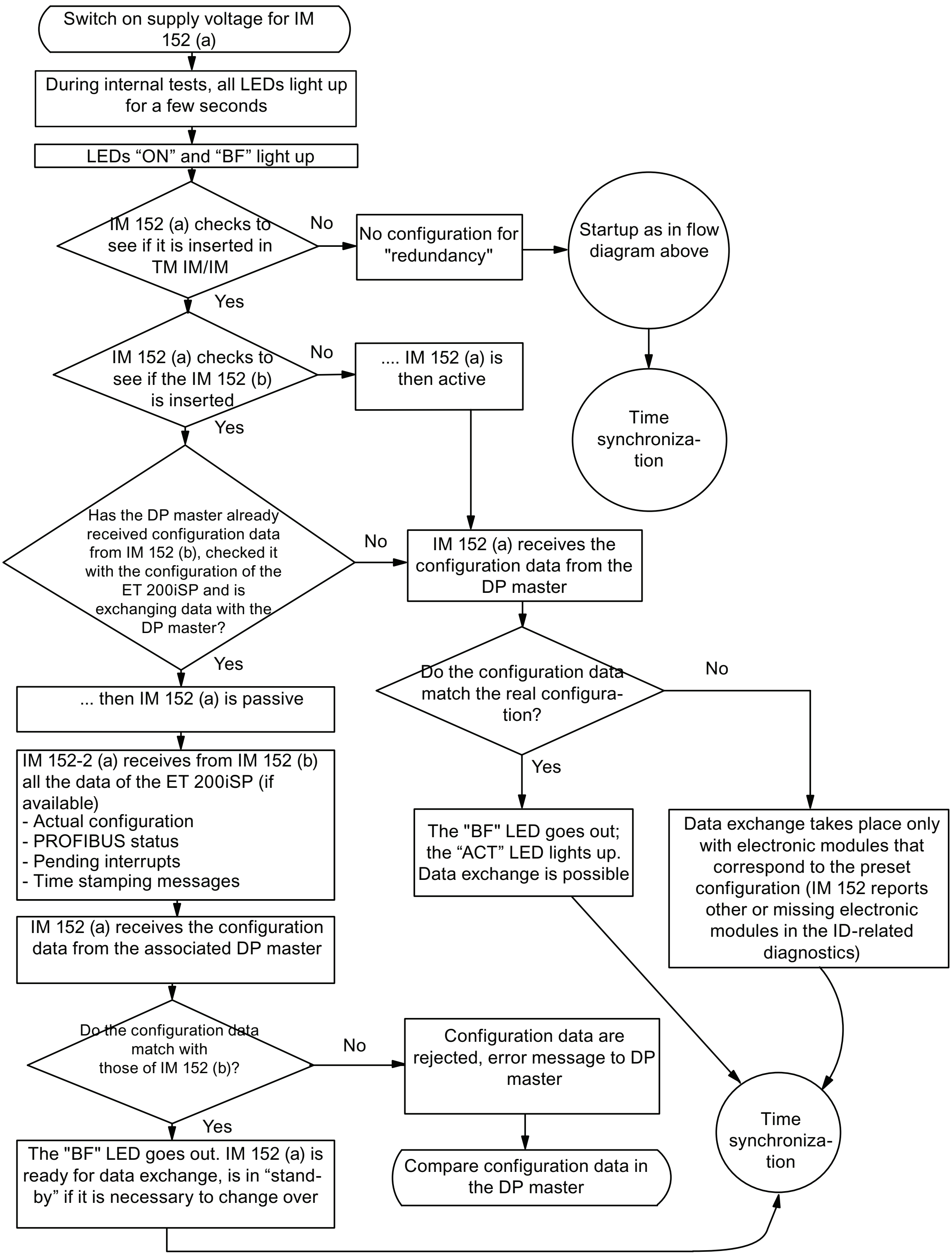


Figure 6-3 Startup of the ET 200iSP with IM 152 redundancy

6.7.6 Startup for time synchronization / time stamping of signal changes

Principle of operation

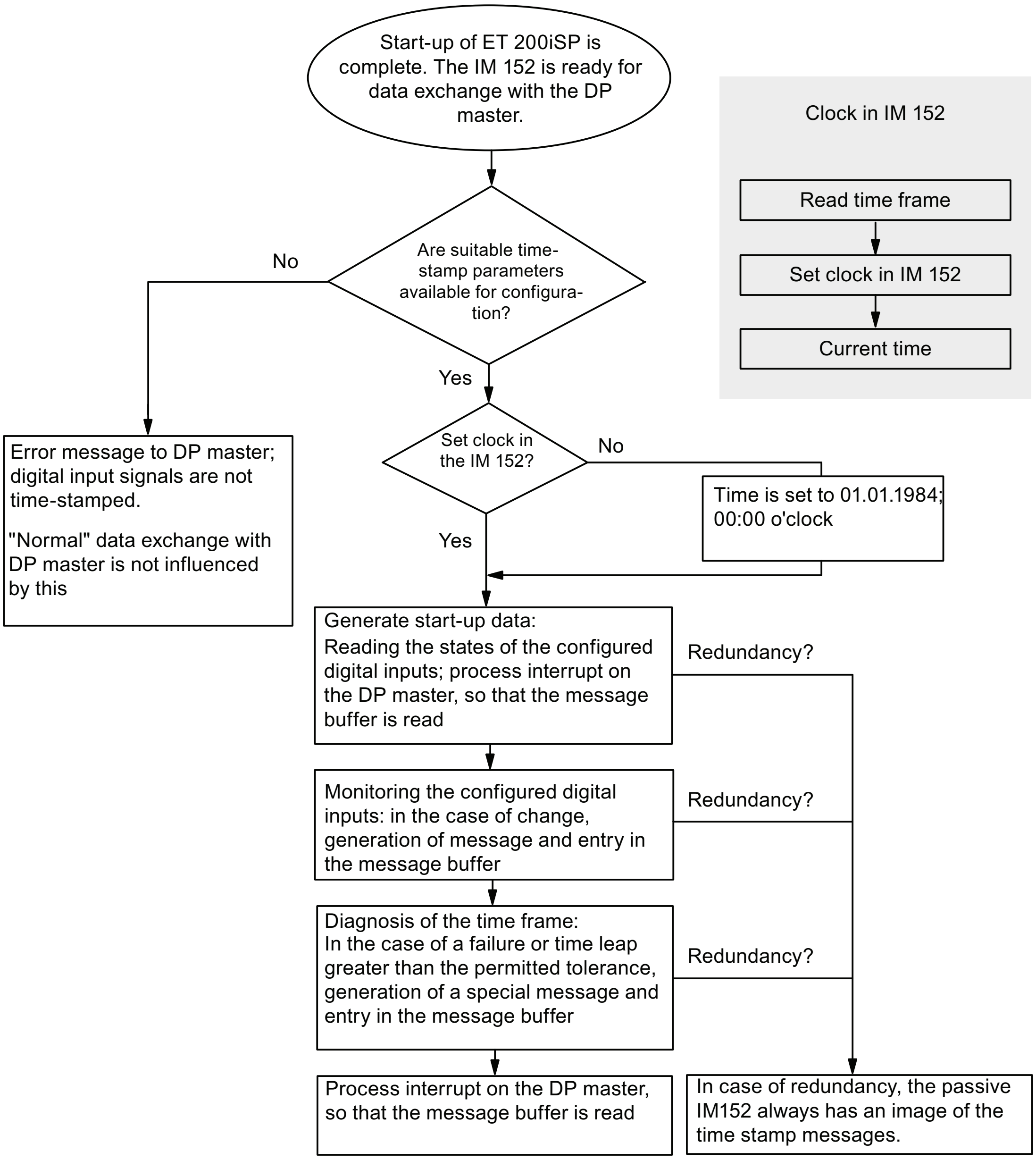


Figure 6-4 Startup for time synchronization/time stamping

6.8 Diagnostics with STEP 7

6.8.1 Introduction

Introduction

The slave diagnostics behaves according the *IEC 61784-1:2002 Ed1 CP 3/1* standard. In dependence on the DP master it can be read out using STEP 7 for all DP slaves that behave according to the standard.

The readout and the configuration of the slave diagnostics is described in the follow sections.

6.8.2 Reading out the diagnostics

Options for reading out the diagnostics

Table 6- 9 Reading out diagnostic information with STEP 7

Automation system with DP master	Block or tab in STEP 7	Application	See...
SIMATIC S7	"DP Slave Diagnostics" tab	Slave diagnostics in plain text on the STEP 7 user interface	"Hardware diagnostics" in the STEP 7 Online Help
	SFC13 "DPNRM_DG"	Reading out slave diagnostic information (storing in the data area of the user program)	Structure, see chapter Structure of the slave diagnostics (Page 160); SFC see reference manual System and standard functions (http://support.automation.siemens.com/WW/view/en/1214574)
	SFC 59 "RD_REC"	Reading out data records (DS0/1) of the S7 diagnostics (save in data area of user program)	

Example of Reading Out the S7 Diagnostics using SFC 13 "DPNRM_DG"

This is an example of how to use the SFC 13 to read out the slave diagnostics for a DP slave in the STEP 7 user program.

Assumptions

The following assumptions apply for this STEP 7 user program:

- The diagnostics address of the ET 200iSP is 1022 ($3FE_H$).
- The slave diagnostics should be stored in the DB 82: from address 0.0, length 96 bytes.
- The slave diagnostics comprises 96 bytes.

STEP 7 User Program

STL	Explanation
`Call SFC 13`	
`REQ :=TRUE`	Read request
`LADDR :=W#16#3FE`	Diagnostics address of the ET 200iSP
`RET_VAL :=MW 0`	RET_VAL from SFC 13
`RECORD :=P#DB82.DBX 0.0 BYTE 96`	Data compartment for the diagnostics in DB 82
`BUSY :=M2.0`	Read process runs over several OB1 cycles

6.8.3 Diagnostic messages of the electronic modules

Introduction

You can set parameters for the diagnostic messages of the following modules:

- Digital input modules
- Digital output modules
- Analog input modules
- Analog output modules

Digital input modules

Table 6- 10 Digital input modules

Diagnostic message	Applicability	Can be set
Short-circuit	Channel	Yes
Wire break	Channel	Yes
Error	Module	No
External fault	Channel	No

Digital output modules

Table 6- 11 Digital output modules

Diagnostic message	Applicability	Can be set
Short-circuit	Channel	Yes
Wire break	Channel	Yes
Error	Module	No
Actuator disconnection	Channel	Yes[1]
[1] Enabling the actuator disconnection by means of the group diagnostics parameter		

Digital output module 2 DO Relay UC60V/2A

Table 6- 12 Digital output module 2 DO Relay UC60V/2A

Diagnostic message	Applicability	Can be set
Error	Module	No

Analog input modules

Table 6- 13 Analog input modules

Diagnostic message	Applicability	Can be set
Short circuit[1]	Channel	Yes
Wire break	Channel	Yes
Upper measuring range exceeded	Channel	Yes
Lower measuring range exceeded	Channel	Yes
Error	Module	No
Reference channel error	Module	No
[1] Not possible with 4 AI TC and with 4 AI I 4WIRE HART		

Analog output modules

Table 6- 14 Analog output modules

diagnostic message[1]	Applicability	Can be set
Short-circuit	Channel	Yes
Wire break	Channel	Yes
Error	Module	No
[1] Diagnostic message only with currents > 1 mA.		

Watchdog module

Table 6- 15 Watchdog module

Diagnostic message	Applicability	Can be set
Error	Module	No

Actions after diagnostic message in STEP 7 or DPV1 Operation

Each diagnostic message leads to the following actions:

- In S7 or DPV1 operation, diagnostics are reported as diagnostic interrupts.
- In DPV1 operation, diagnostics are also reported when CPU is in STOP state.
- After a diagnostic message this is
  - entered in the diagnostic frame as diagnostic interrupt block (always only one alarm)
  - stored in the diagnostics buffer of the CPU
  - entered in the channel related diagnostics
- The SF LED on the IM 152 is lit.
- The OB82 is called. If there is no OB82, the CPU goes to STOP operating state.
- Acknowledgement of the diagnostic interrupt (after which new alarm is possible)

Actions after a diagnostic message in DPV0 operation

The error is entered in the diagnostic frame in the channel-related diagnostics:

- The SF LED on the IM 152 is lit.
- Several diagnostic messages are possible at the same time.

Causes of Error and Troubleshooting

The causes of error and the troubleshooting of the diagnostic messages are described in the Chapter "Channel-related diagnostics (Page 167)".

6.8.4 Evaluating interrupts from the ET 200iSP (S7-DP slave/ DPV1 slave)

Introduction

Certain errors cause the DP slave to trigger an interrupt. Depending on the DP master you are using, the evaluation of the interrupt follows different procedures.

Evaluating Interrupts with an S7 DP Master or DPV1 Master

Requirements: You have configured the ET 200iSP with STEP 7 (Version 5.3 Service Pack 1 or higher), i.e., interrupts are only supported if you integrate the ET 200iSP as an S7-DP slave or DPV1 slave.

When interrupts are generated the CPU of the DP master automatically calls the interrupt OBs (see Programming Manual System software for S7-300/S7-400, program draft (http://support.automation.siemens.com/WW/view/en/1136533)).

Evaluating interrupts with other DP master

If you operate ET 200iSP with a different DP master or as DP standard slave, no interrupts are generated.

Triggering of a diagnostic interrupt

With an incoming or outgoing event (wire break, for example) the module triggers a diagnostic interrupt upon "Release: Diagnostic Interrupt".

The CPU interrupts the processing of the user program and processes the diagnostics block OB82. The event that led to the triggering of the interrupt is entered in the start information of the OB82.

Triggering of a Hardware Interrupt

In the event of a hardware interrupt the CPU interrupts the processing of the user program and processes the hardware interrupt block OB40.

The channel of the module that triggered the hardware interrupt is entered in the start information of the OB40 in the tag OB40_POINT_ADDR. The following Fig. shows the assignment to the bits of the local data doubleword 8.

- Analog input modules

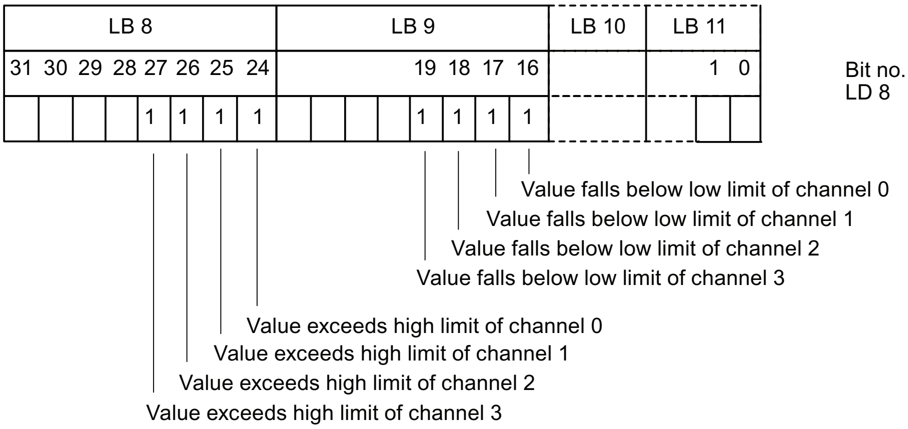


Figure 6-5 Interrupts from analog input modules

Note

For a description of the OB40, refer to the *System and Standard Functions* reference manual. System and standard functions (http://support.automation.siemens.com/WW/view/en/1214574)

Triggering of a remove/insert interrupt

Remove/insert interrupts are only supported by S7-400 or in DPV1 operation.

The CPU (S7-400) interrupts the processing of the user program and processes the diagnostic block OB83. The event which led to the triggering of the interrupt is entered in the start information of the OB83.

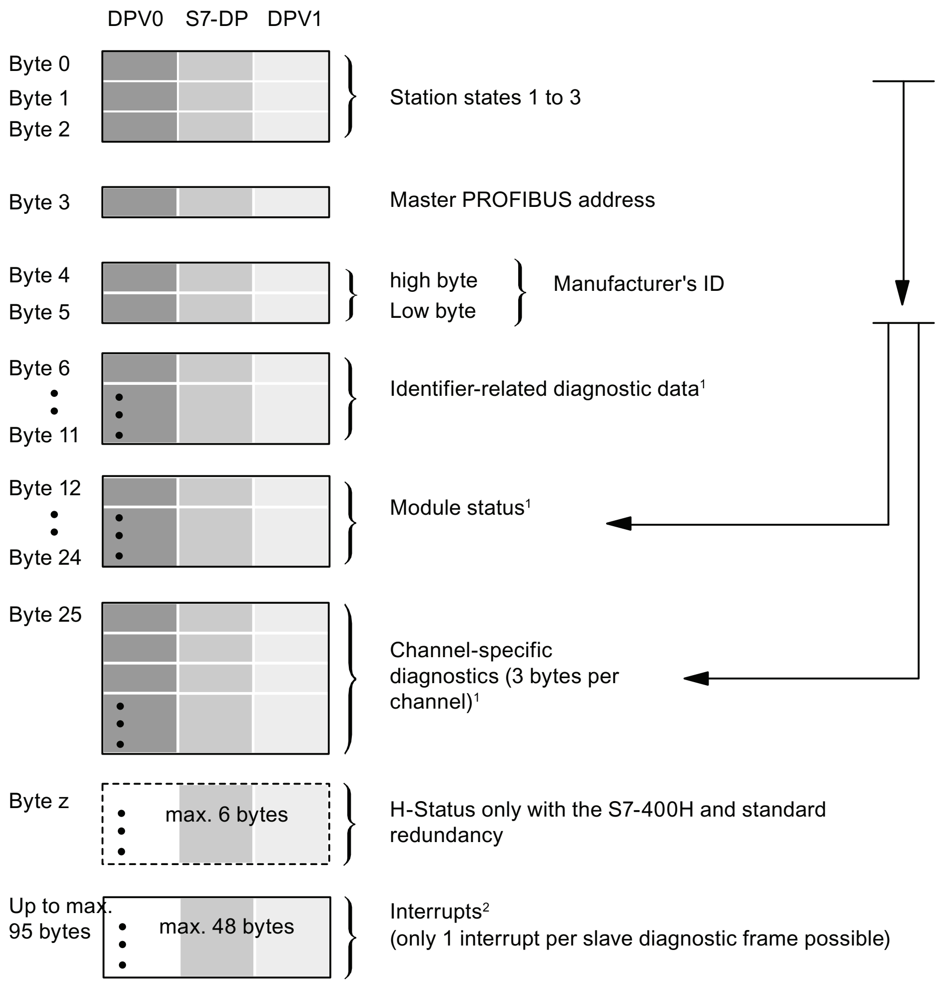
Triggering of an Update Interrupt

Update interrupts are only supported in DPV1 operation.

The CPU interrupts the processing of the user program and processes the diagnostic block OB56. The event which led to the triggering of the interrupt is entered in the start information of the OB56.

6.8.5 Structure of the slave diagnostics

Structure of the Slave Diagnostic Information



[1] If you use the GSD file for configuring, you can deselect this diagnostic function.

[2] Interrupts are only supported if you configure the ET 200iSP as an S7 DP slave or DPV1 slave using STEP 7.

Figure 6-6 Structure of the Slave Diagnostic Information

See also

Station statuses 1 to 3 (Page 161)
Master PROFIBUS address (Page 163)
ID-related diagnostics (Page 164)
Manufacturer's ID (Page 163)
Channel-related diagnostics (Page 167)
H-Status (only with the S7-400H and standard redundancy) (Page 170)
Interrupts (Page 171)

6.8.6 Station statuses 1 to 3

Definition

Stations status 1 to 3 provides an overview of the status of a DP slave.

Station status 1

Table 6- 16 Structure of station status 1 (Byte 0)

Bit	Meaning	Cause/remedy
0	1: The DP slave cannot be accessed by the DP master. The bit on the DP slave is always "0".	• Correct PROFIBUS address set on the DP slave? • Bus connector connected? • Voltage on the DP slave? • RS 485 reporter properly set? • RESET (switching off/on) performed on DP slave?
1	1: DP slave is not ready for data exchange.	• Wait, as DP is currently starting up.
2	1: The configuration data sent by the DP master to the DP slave does not match the configuration of the DP slave.	DP slave is OK, but the configuration does not match the actual configuration of the slave. Compare the preset configuration with the actual configuration. Note: If the last slot is not occupied, a slot cover must be installed! This is in the terminating module.
3	1: There is external diagnostic information.	Evaluate the identifier-related, the module status and/or the channel-related diagnostics. When all errors are eliminated, bit 3 is reset. The bit is reset if there is a new diagnostic message in the bytes of the previously mentioned diagnostics.

Bit	Meaning	Cause/remedy
4	1: The required function is not supported by the DP slave (modifying the PROFIBUS address via software, for example).	Check the configuration.
5	1: DP master in not able to interpret the answer of the DP slave.	Check the bus configuration.
6	1: The DP coniguration frame is not correct (incorrect slave type, paramters)	Correct the preset and actual configuration.
7	1: The DP slave was configured by a different DP master (not the master that currently has access to the DP slave).	Bit is always 1 if you, for example, use the programming device or a different DP master to access the DP slave. The PROFIBUS address of the DP master which configured the DP slave is located in the "Master-PROFIBUS address" diagnostic byte".

Station status 2

Table 6- 17 Structure of station status 2 (Byte 1)

Bit	Meaning
0	1: The DP slave has to be re-configured.
1	1: there is a diagnostic message. The DP slave will not function until the error is elminated (static diagnostic message).
2	1: The bit in the DP slave is always at "1".
3	1: The watchdog is activated on this DP slave.
4	1: The DP slave has received the "FREEZE" control command.
5	1: The DP slave has received the "SYNC" control command.
6	0: Bit is always at "0".
7	1: Bit is always at "0". Note: The bit is "1" when the station status is read by the DP master, if the DP slave was deactivated in the DP master, in other words it has been removed from current processing.

Station status 3

Table 6- 18 Structure of station status 3 (Byte 2)

Bit	Meaning
0 to 6	0: Bits are always at "0".
7	1: There are more channel-related diagnostic messages than can be shown in the diagnostic frame (diagnostic overflow).

6.8.7 Master PROFIBUS address

Definition

The master PROFIBUS address diagnostic byte contains the PROFIBUS address of the DP master that:

- Assigned parameters to the DP slave and
- Has read and write access to the DP slave

The master PROFIBUS address is in byte 3 of the slave diagnostics.

DP slave not assigned parameters by the DP master (class 1)

If the value FF_H is entered as the master PROFIBUS address in byte 3, the DP slave was not assigned parameters by the DP master.

No cyclic data exchange takes place.

6.8.8 Manufacturer's ID

Definition

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

Manufacturer's ID

Table 6- 19 Structure of the manufacturer's ID

Byte 4	Byte 5	Manufacturer ID for
81	10	IM 152

6.8.9 ID-related diagnostics

Analyzing the slave diagnostics

The figure below shows a systematic approach to evaluating slave diagnostics. You start with ID-related diagnostics.

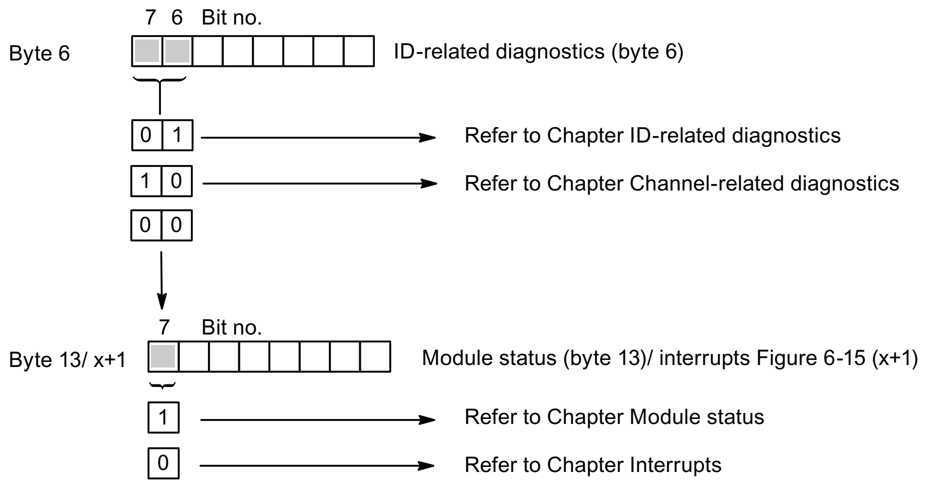


Figure 6-7 Analyzing the slave diagnostics

Definition

The ID-related diagnostic information indicates whether or not modules of the ET 200iSP have faults. ID-related diagnostic information starts at byte 6 and is 6 bytes long.

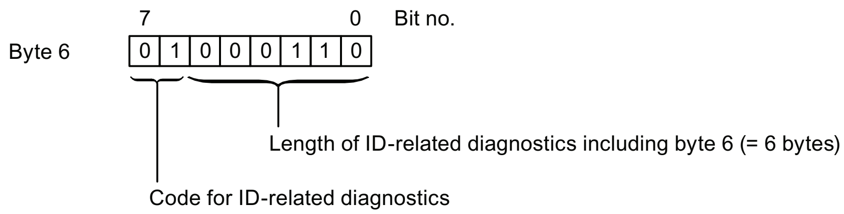
ID-related diagnostics

The bits in slots 2, 4 through 35 (bytes 7 through 11) of the modules are set if one of the following situations occurs:

- A module is removed.
- A module is inserted that was not configured.
- An inserted module cannot be accessed.
- A module reports a diagnostics event.

Unused slots have the value "0" entered.

The ID-related diagnostic information for the ET 200iSP has the following structure:



	7	6	5	4	3	2	1	0	
Byte 7	8	7	6	5	4		2		Entries for IM 152 on slot 2 and modules on slots 4 to 8
Byte 8	16	15	14	13	12	11	10	9	Entries for modules on slot 9 to 16
Byte 9	24	23	22	21	20	19	18	17	Entries for modules on slot 17 to 24
Byte 10	32	31	30	29	28	27	26	25	Entries for modules on slot 25 to 32
Byte 11						35	34	33	Entries for modules on slot 33 to 35

Key for “Entry for module on slot x”:

Bit is set if
- A module is removed.
- A module is inserted that was not configured.
- An inserted module cannot be accessed.
- A module reports a diagnostics event.
Unused slots have the value "0" entered.

Figure 6-8 Structure of the ID-related diagnositic information for ET 200iSP

See also

Channel-related diagnostics (Page 167)

Module Status (Page 166)

Interrupts (Page 171)

6.8.10 Module Status

Definition

The module status indicates the status of the configured modules and provides more detailed information than ID-related diagnostics in terms of the configuration or indicates a module fault. The module status begins after the ID-related diagnostics and comprises 13 bytes.

Module Status

The module status for the ET 200iSP is structured as follows:

	7	6	5	4	3	2	1	0	Bit no.
Byte 12	0	0	0	0	1	1	0	1	

Bits 7–6: Code for device-specific diagnostics
Bits 5–0: Length of the module status including byte 12 (= 13 bytes)

	7	6	5	4	3	2	1	0	Bit no.
Byte 13	1	0	0	0	0	0	1	0	Status type: Module Status

Bit 7: Code for status message
Bits 6–0: 2_H = module status

	7 … 0	
Byte 14	0_H	Always "0"
Byte 15	0_H	Always "0"

	7 6	5 4	3 2	1 0	Bit no.
Byte 16	4				Slot 4
Byte 17	8	7	6	5	Slots 5 to 8
Byte 18	12	11	10	9	Slots 9 to 12
Byte 19	16	15	14	13	Slots 13 to 16
Byte 20	20	19	18	17	Slots 17 to 20
Byte 21	24	23	22	21	Slots 21 to 24
Byte 22	28	27	26	25	Slots 25 to 28
Byte 23	32	31	30	29	Slots 29 to 32
Byte 24		35	34	33	Slots 33 to 35

Key for “Entry for module on slot x”:

00_B: Module ok; valid data
01_B: Module error; invalid data
10_B: Incorrect module; invalid data
11_B: No module (or module failure); invalid data

	5	4	Bit no.
Example: Slot 35	1	0	→ 10_B: Incorrect module; invalid data

Figure 6-9 Module status of the ET 200iSP

6.8.11 Channel-related diagnostics

Definition

Channel-related diagnostics provides information on channel faults of modules and provides more detail than ID-related diagnostics.

For each channel-related diagnostic information, 3 bytes are added as per *IEC 61784-1:2002 Ed1 CP 3/1*.

The channel-related diagnostic information follows the module status.

Channel-related diagnostics does not affect the module status.

Important: The group diagnostics must be switched on for each module.

Channel-related diagnostics

The maximum number of channel-related diagnostics is restricted by the maximum overall length of the slave diagnostics of 96 bytes with IM 152. The length of the slave diagnostics depends on the number of the currently existing channel-related diagnostics. If there are more channel-related diagnostics present than the slave diagnostics can show, bit 7 is set to "Diagnostics Overflow" in the station status 3.

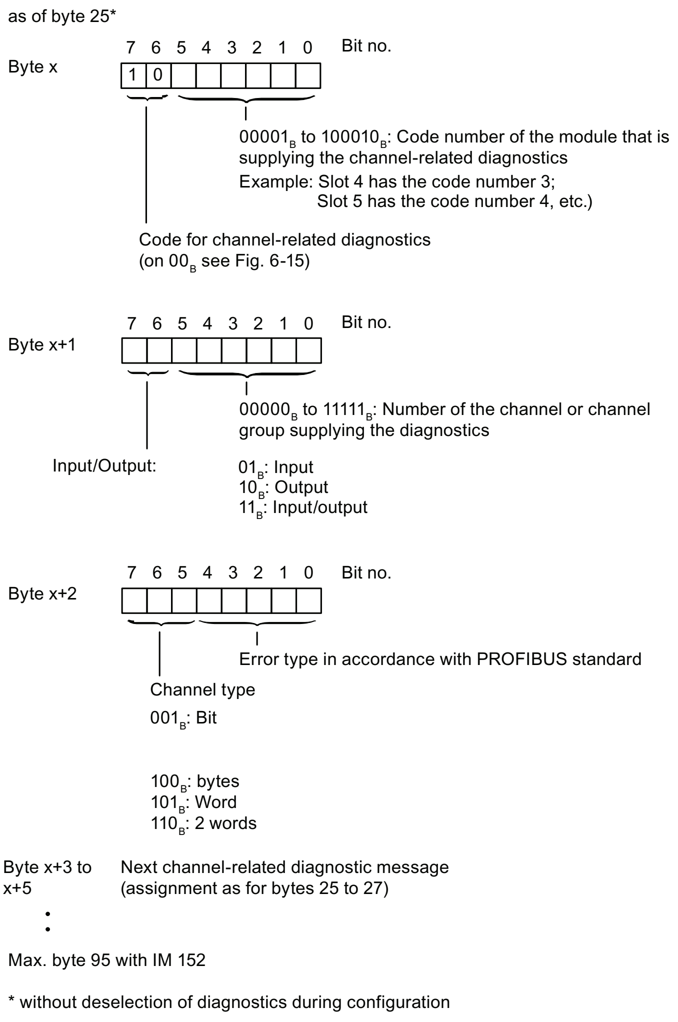


Figure 6-10 Structure of the channel-related diagnostics

Electronic Module Error Types

Table 6- 20 Electronic Module Error Types

Error type		Error text	Meaning	Remedy
00001_B	1_D	Short-circuit	• Sensor line short circuited to P potential • Sensor line short circuited to M potential • Output line short circuited to P potential • Output line short circuited to M potential	Correction of the process wiring
			Encoder is defect	Exchange the encoder
			Incorrect encoder type configured	Correction of the configuration
			Output overloaded	Eliminate overload
00010_B	2_D	Undervoltage (HART diagnostics)	HART analog output current set (HART diagnostics)	---
00100_B	4_D	Overload (HART diagnostics)	HART analog output current saturated (HART diagnostics)	---
00110_B	6_D	Wire break	• Signal line to an encoder interrupted • Signal line to an actuator interrupted • Encoder supply line interrupted	Correction of the process interconnection
			Error on the external circuit (resistance)	Eliminate errors
			Encoder is defect	Exchange the encoder
			Incorrect encoder type configured	Correction of the configuration
			Input/output channel is unused (open)	Deactivation of the "Diagnostic Group Diagnostics" parameter for this output channel
			Load impedance is too large	Use actuator with lower load impedance
00111_B	7_D	Upper limit exceeded	Value lies above the overrange	• Correction tuning of module/actuator • Modify measuring range by means of configuration
01000_B	8_D	Lower limit exceeded	Value lies below the underrange	• Correction tuning of module/actuator • Modify measuring range by means of configuration
01001_B	9_D	Error	Encoder signal flutters	Eliminate cause of error
			Hardware error in the module	Exchange of the module
			EMC interference	Eliminate cause of error
10001_B	17_D	Encoder- or load voltage missing	• No or too little supply voltage on Power Supply PS • Power Supply PS is faulty	• Check the supply voltage on the Power Supply PS • Exchange the Power Supply PS

Error type		Error text	Meaning	Remedy
10011_B	19_D	HART communication error (HART diagnostics)	• HARD field device is not responding • Timing error	• Check the process wiring • Correction of the configuration
10101_B	21_D	Reference channel error	• internal reference junction: TC sensor module defective or not available. • external reference junction (RTD): Parameters do not point to the RTD module	• Exchanging or connecting the TC Sensor Module • Correction of the configuration
10110_B	22_D	HART other statuses available (HART warning)	---	---
10111_B	23_D	reserved for HART (HART warning)	---	---
11000_B	24_D	Actuator disconnection	Intrinsically safe switch signal switched on at 4 DO	---
11010_B	26_D	External fault	• Encoder error • Encoder supply faulty • Changeover contact error • Actuator error • HART field device error	• Replacement of encoder/actuator/HART field device • Correction of the process wiring
11011_B	27_D	HART configuration modified (HART warning)	---	---
11101_B	29_D	HART primary variable outside the limits (HART diagnostics)	---	---
11110_B	30_D	HART auxiliary variable outside the limits (HART diagnostics)	---	---

Note

Control response

A control response is implemented for assigning parameters in the electronic modules of the ET 200iSP.

If the electronic module receives a faulty parameter, this is rejected. The electronic then continues to operate with its already valid parameters (the default parameters from the initial parameter assignment). No "parameter error" diagnostic messsage is output.

The update interrupt function can be used to check the changed parameters of the electronic module. Refer to chapter "Interrupts (Page 171) ".

No update interrupt is generated in the case of faulty parameters.

6.8.12 H-Status (only with the S7-400H and standard redundancy)

H-status

The IM 152 supplies the H-status only if it is running on an S7-400H DP master or is operated redundantly according to the standard.

In the structure of the slave diagnostics, the H-status is represented by an additional block, typically following the manufacturer's ID.

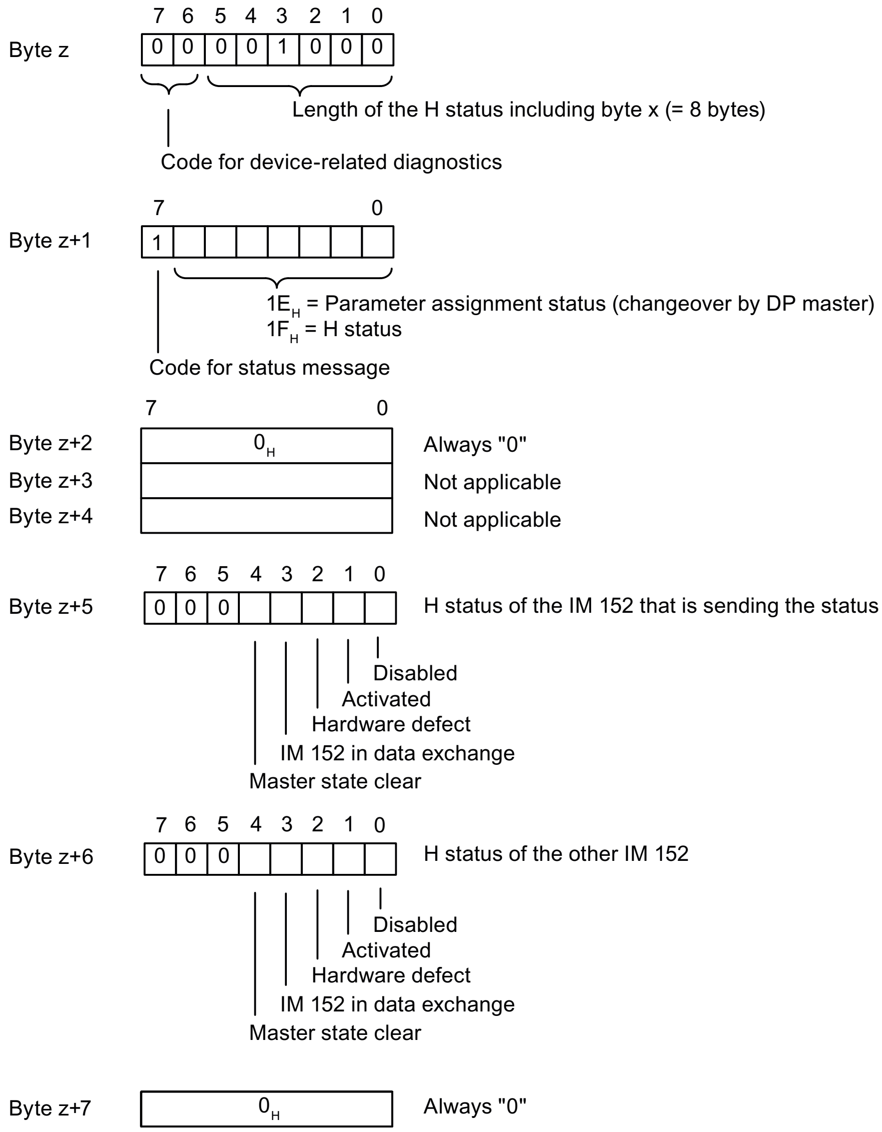


Figure 6-11 Structure of the H-Status of the IM 152 (for S7-400H only)

6.8.13 Interrupts

Definition

The interrupt section of the slave diagnosis provides information on the interrupt type and the cause that led to the triggering of the interrupt. The interrupt section consists of a maximum of 48 bytes.

Position in the diagnostic frame

The interrupt section is located after the channel-related diagnostic information or after the ID-related diagnostic information (with STEP 7)

Example: If there are three items of channel-related diagnostic information, the interrupt section starts at byte 34.

If an interrupt occurs, the channel-specific diagnostic information is shortened to allow space for the interrupt information.

Contents

The content of the interrupt function depends on the interrupt type:

With diagnostic interrupts, a 4-byte interrupt header and up to 44 bytes of additional interrupt information (diagnostic data record 1) are sent for SIMATIC S7.

With hardware interrupts, the length consists of a 4-byte interrupt header and 4 bytes of additional interrupt information.

For remove/insert interrupts, the length consists of 4 bytes of interrupt header and 5 bytes of supplementary interrupt information.

For update interrupts, the length consists of 4 bytes of interrupt header and 2 bytes of supplementary interrupt information.

The following pages describe the significance of these bytes.

Interrupts

The interrupt section for the ET 200iSP is structured as follows:

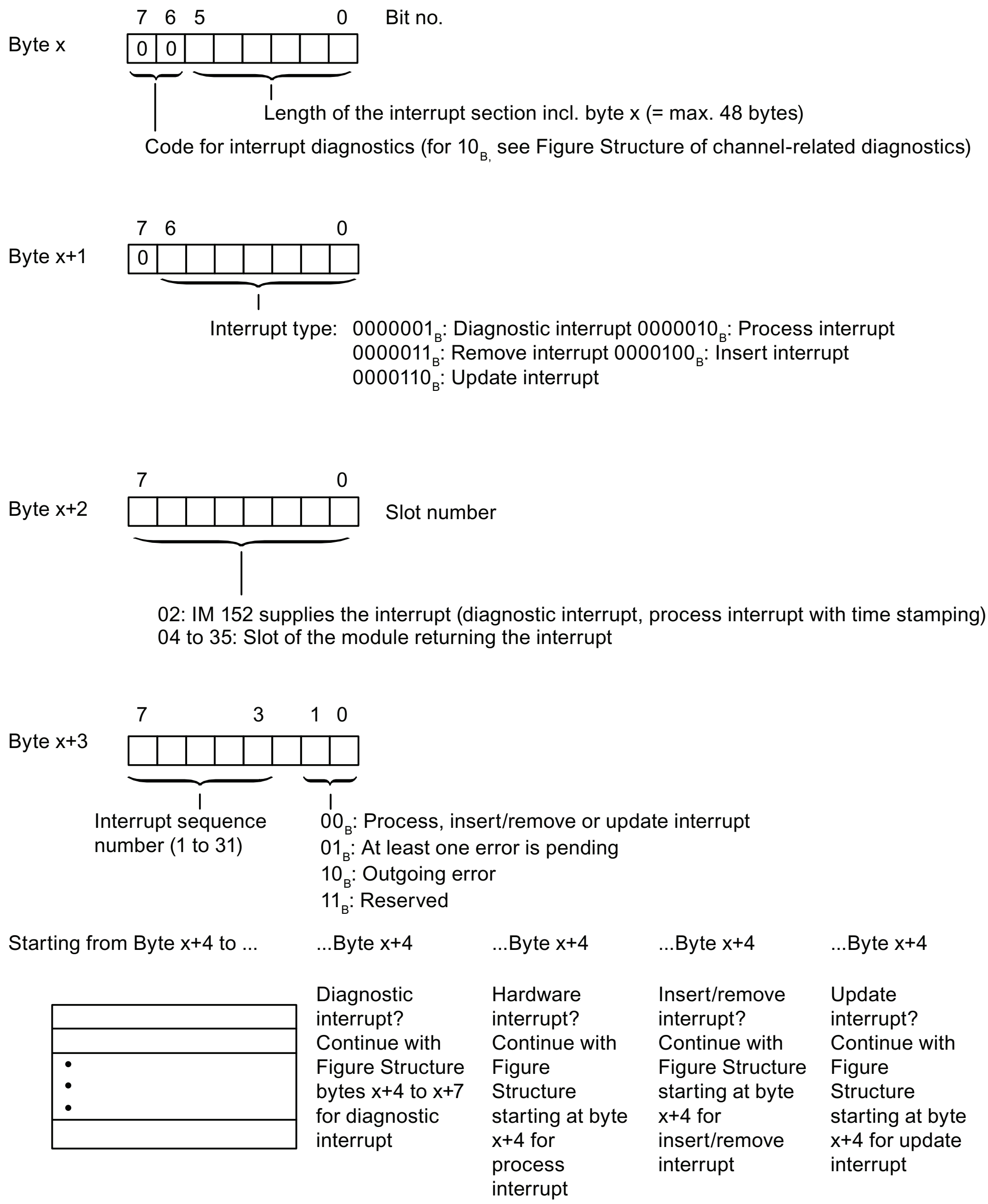


Figure 6-12 Structure of the interrupt status of the interrupt section

Diagnostic interrupt, byte x+4 to x+7

The bytes x+4 to x+7 correspond to the diagnostics data record 0 in STEP 7.

The bytes from x+8 to x+43 correspond to the diagnostics data record 1 in STEP 7.

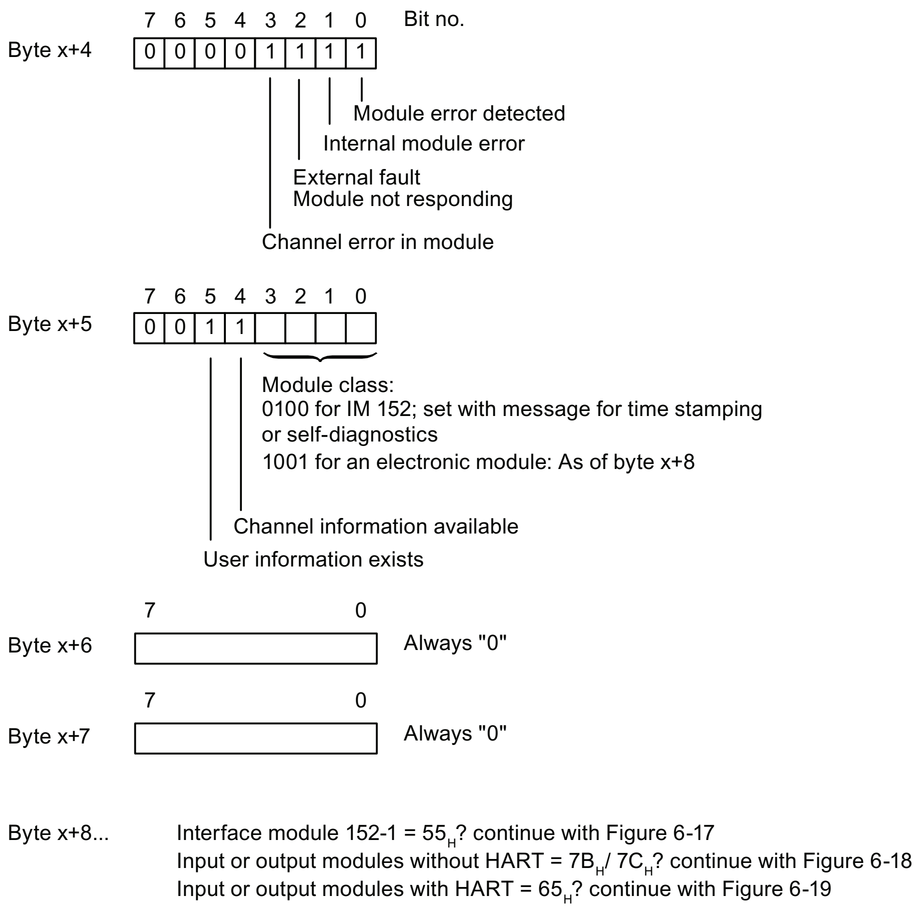


Figure 6-13 Structure of bytes x+4 to x+7 for diagnostic interrupt

Diagnostic interrupt from interface module IM 152

Byte x+8		55_H: Self-diagnosis
Byte x+9		Length of each channel-specific diagnostic in bits
Byte x+10		Number of channels per module
Byte x+11	7 6 5 4 3 2 1 0 — bit 1 = 1, bit 0 = 1	Bit 0: Diagnostic event at channel 0 of the module; Bit 1: Diagnostic event at channel 1 of the module (with redundancy)
Byte x+12	7 6 5 4 3 2 1 0	Bit 3: Power supply 1 error (17); Bit 5: Power supply 2 error (17)
Byte x+13	15 14 13 12 11 10 9 8	
Byte x+14	23 22 21 20 19 18 17 16	Bit 21: MMC content not permitted (26)
Byte x+15	31 30 29 28 27 26 25 24	
Byte x+16	39 38 37 36 35 34 33 32	
Byte x+17	47 46 45 44 43 42 41 40	
Byte x+18	55 54 53 52 51 50 49 48	
Byte x+19	63 62 61 60 59 58 57 56	

Error type on channel 0: Byte x+12 to x+19

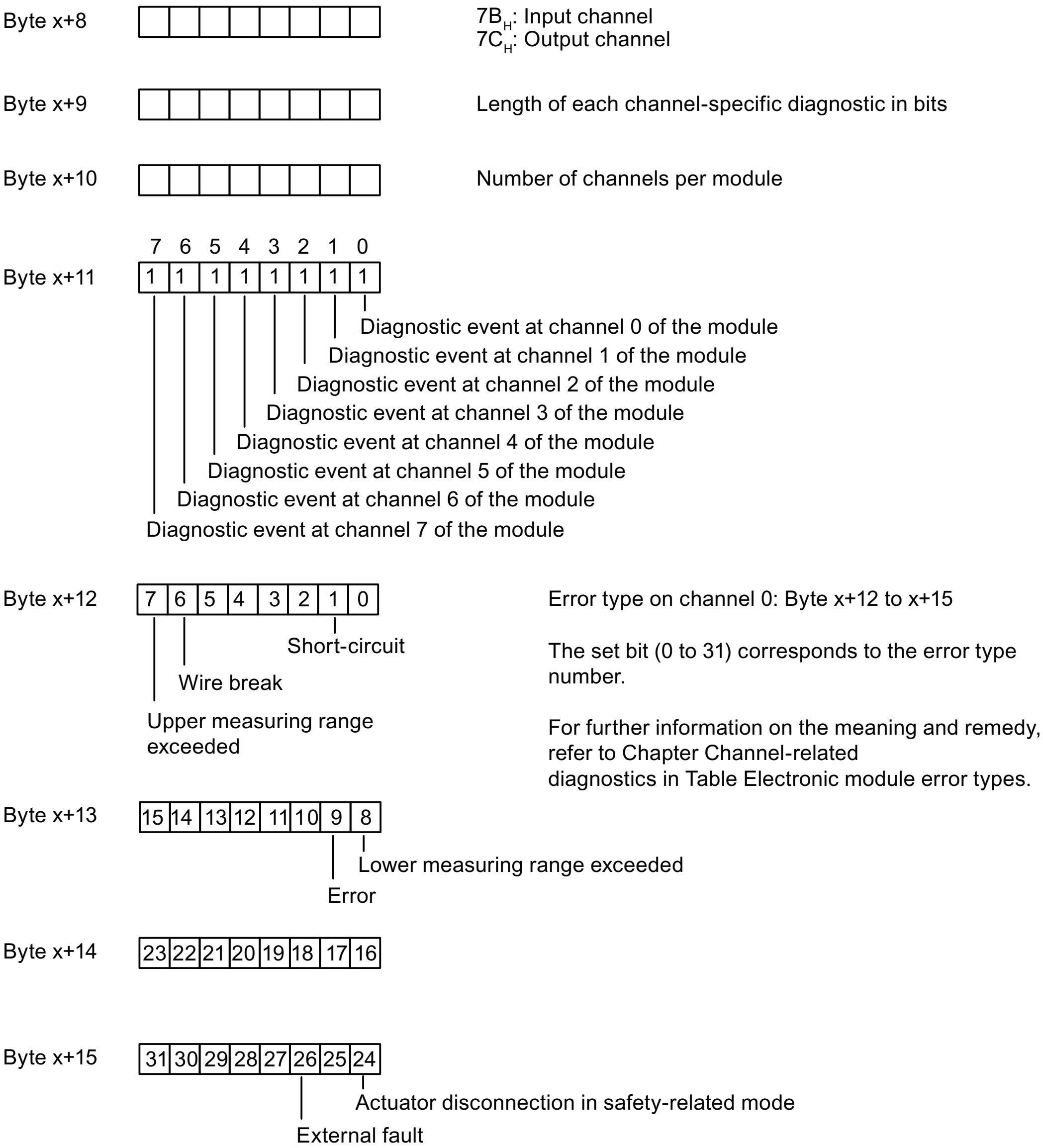
The associated error type number of channel-related diagnostics is placed in parentheses.

For further information on the meaning and remedy, refer to Chapter Channel-related diagnostics in Table Electronic module error types.

Byte x+20 to x+27 — Error type on channel 1: Refer to byte x+12 to x+19: Only available in case of redundancy of IM 152

Figure 6-14 Structure starting at byte x+8 for diagnostic interrupt from interface module

Diagnostic interrupt from input or output modules without HART



Byte x+16 to x+19	Error type on channel 1: Refer to byte x+12 to x+15
Byte x+20 to x+23	Error type on channel 2: Refer to byte x+12 to x+15
Byte x+24 to x+27	Error type on channel 3: Refer to byte x+12 to x+15
Byte x+28 to x+31	Error type on channel 4: Refer to byte x+12 to x+15
Byte x+32 to x+35	Error type on channel 5: Refer to byte x+12 to x+15
Byte x+36 to x+39	Error type on channel 6: Refer to byte x+12 to x+15
Byte x+40 to x+43	Error type on channel 7: Refer to byte x+12 to x+15

Figure 6-15 Structure starting at byte x+8 for diagnostic interrupt (input or output module without HART)

Diagnostic interrupt from input or output modules with HART

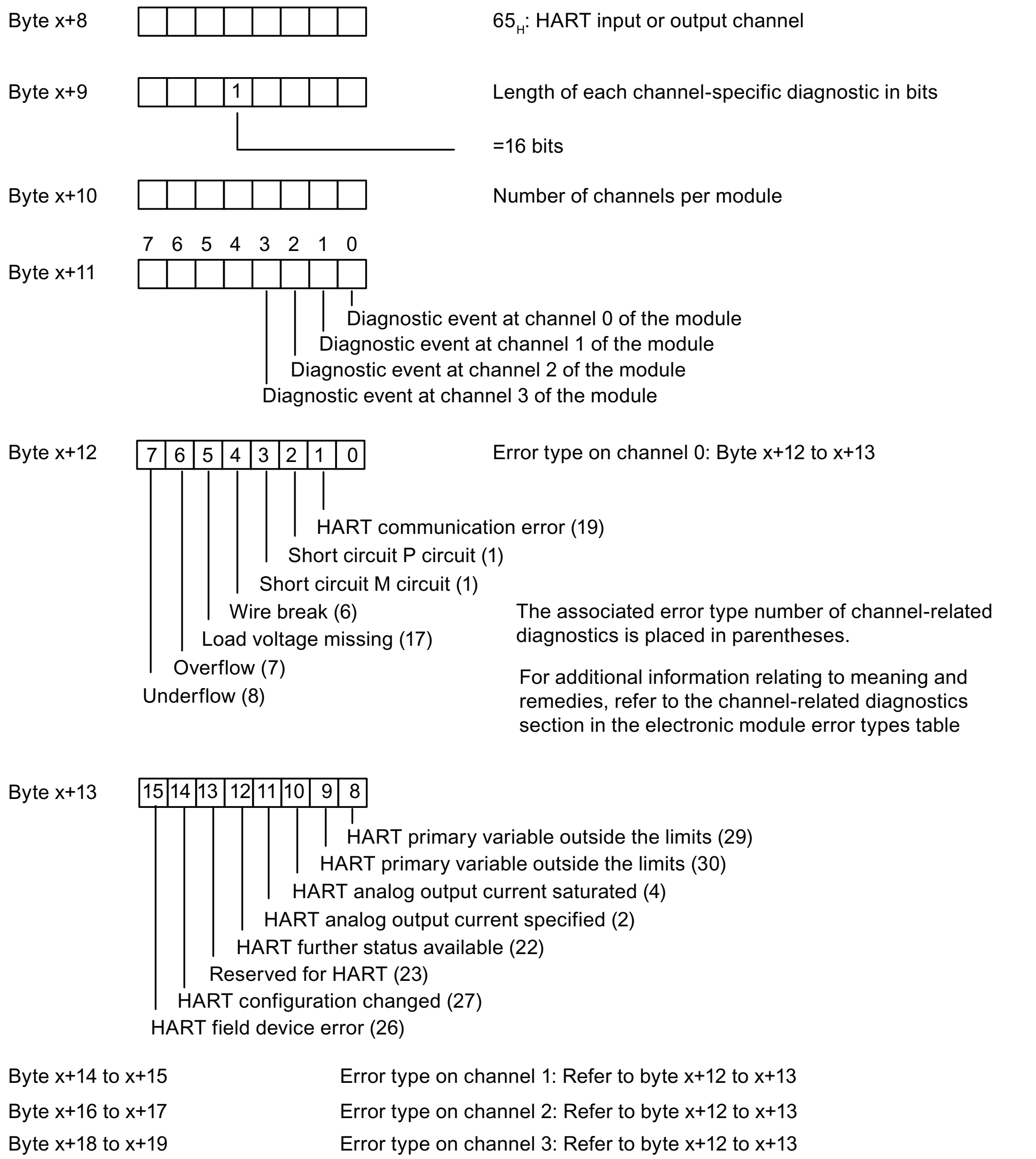


Figure 6-16 Structure starting at byte x+8 for diagnostic interrupt (input or output module with HART)

Example of a Diagnostic Interrupt

Example:

The electronic module 8 DI NAMUR reports the diagnostic interrupt "Wire Break" on channel 2.

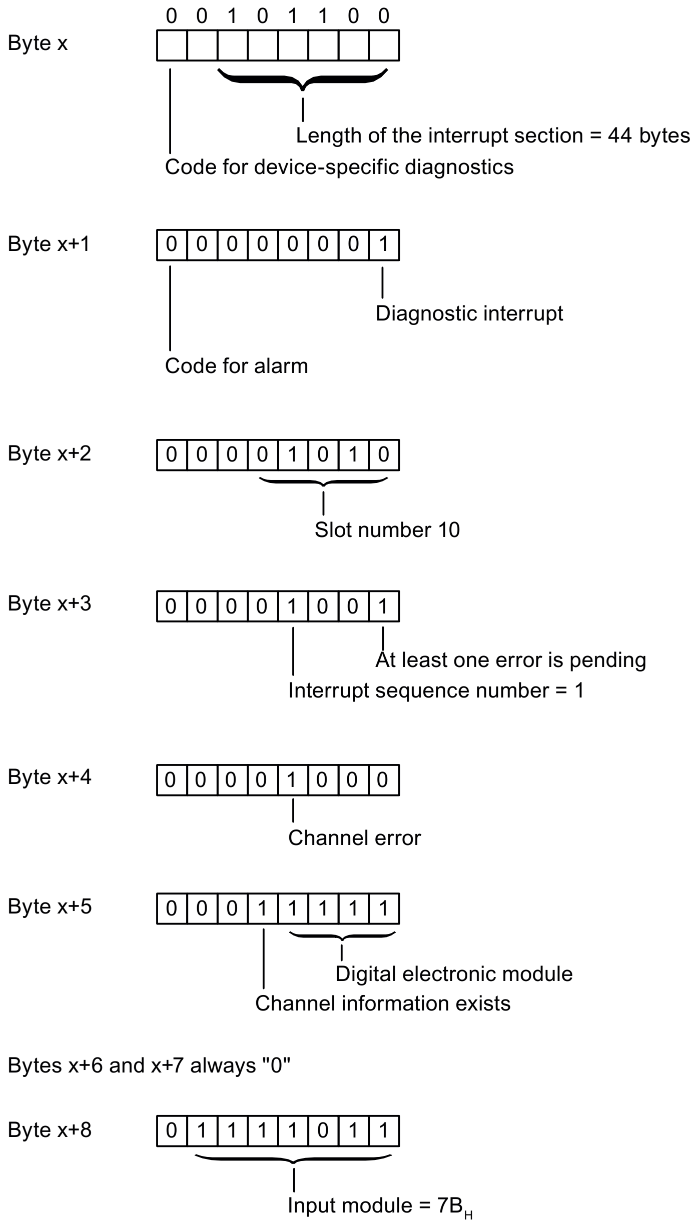


Figure 6-17 Example of a Diagnostic Interrupt

Byte x+9	0	0	1	0	0	0	0	0

Length of the channel-related diagnostics = 32 bits

Byte x+10	0	0	0	0	1	0	0	0

Number of channels per module = 8

Byte x+11	0	0	0	0	0	1	0	0

Diagnostic event on channel 2

Bytes x+12 to x+15 "0" (channel 0)

Bytes x+16 to x+19 "0" (channel 1)

	7	6	5	4	3	2	1	0
Byte x+20	0	1	0	0	0	0	0	0

Bit x+20.6 = error type 6 on channel 2 = wire break

Bytes x+21 to x+23 "0" (channel 2)

Bytes x+28 to x+31 "0" (channel 4)

Bytes x+24 to x+27 "0" (channel 3)

Bytes x+32 to x+35 "0" (channel 5)

Bytes x+36 to x+39 "0" (channel 6)

Bytes x+40 to x+43 "0" (channel 7)

Figure 6-18 Example of a diagnostic interrupt (continued)

Hardware interrupt from analog input modules

7 8 5 4 3 2 1 0
Byte x+4

1: Value exceeds high limit of channel 0
1: Value exceeds high limit of channel 1
1: Value exceeds high limit of channel 2
1: Value exceeds high limit of channel 3

7 8 5 4 3 2 1 0
Byte x+5

1: Value falls below low limit of channel 0
1: Value falls below low limit of channel 1
1: Value falls below low limit of channel 2
1: Value falls below low limit of channel 3

Bytes x+6 and x+7: are always 00_H

Figure 6-19 Structure starting at byte x+4 for hardware interrupt (analog input)

Hardware interrupt time stamping at slot 2 (IM 152)

7 6 5 4 3 2 1 0
Byte x+4 Status of time stamping

1: Message buffer ready for retrieval on IM 152
1: Overflow of the "external" message buffer: permitted message buffers are full.
1: Overflow of the "internal" message buffer: Messages may be lost.
Redundancy: active IM 152
0: Right IM of TM-IM/IM is the active one
1: Left IM of TM-IM/IM is the active one
Redundancy: Redundant mode enabled / disabled
0: Not in redundant mode
1: Redundant mode
Place the time stamping again
0: No new placement carried out
1: New placement taking place
Not applicable
Status of synchronization by means of time message frame
0: Not synchronized
1: Synchronized

7 6 5 4 3 2 1 0
Byte x+5 Data record number, if a data record is to be retrieved

7 6 5 4 3 2 1 0
Byte x+6 Number of message blocks 1 to 20 included in the data record

Byte x+7 Reserved

Figure 6-20 Structure starting at byte x+4 for hardware interrupt (time stamping)

Remove/insert interrupt

Identifier of the module that was removed or inserted is shown in bytes x+4 to x+8. Identifiers for the individual modules are shown in the GSD file.

The interrupt type in byte x+1 indicates whether the module was removed or inserted (see *Structure of the Interrupt Status of the Interrupt Section*)

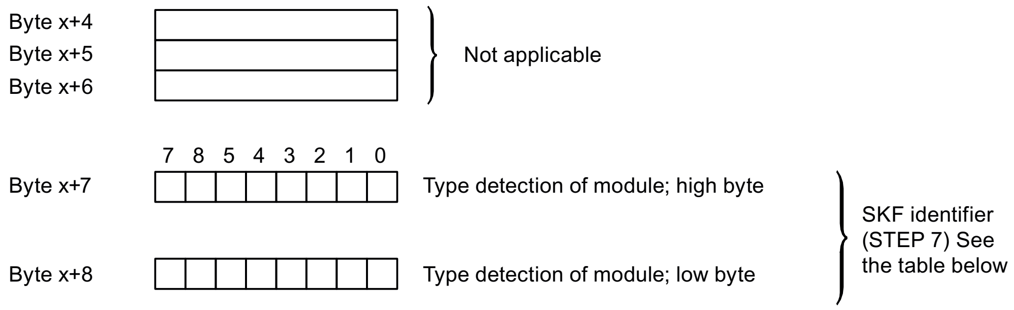


Figure 6-21 Structure starting at byte x+4 for insert/remove interrupt

Table 6- 21 SKF identifiers (STEP 7)

Modules	SKF identifier
8 DI NAMUR	79 CA$_H$
4 DO 23.1VDC/20mA SHUT DOWN "H"	79 D1$_H$
4 DO 17.4VDC/27mA SHUT DOWN "H"	79 D2$_H$
4 DO 17.4VDC/40mA SHUT DOWN "H"	79 D3$_H$
4 DO 23.1VDC/20mA SHUT DOWN "L"	79 D5$_H$
4 DO 17.4VDC/27mA SHUT DOWN "L"	79 D6$_H$
4 DO 17.4VDC/40mA SHUT DOWN "L"	79 D7$_H$
2 DO Relay UC60V/2A	79 D4$_H$
4 AI I 2WIRE HART	79 EB$_H$
4 AI I 4WIRE HART	79 EC$_H$
4 AI RTD	79 EF$_H$
4 AI TC	79 EE$_H$
4 AO I HART	79 F2$_H$
Reserve module	8F C0$_H$
Watchdog module	79 DD$_H$
Removed module	DE C0$_H$
Reserve identifier (CiR)	B6 40$_H$

Update interrupt

The update interrupt is reported when the following requirements are met:

- The parameters were incorrectly assigned.
- The parameter assignment of the ET 200iSP deviates from the parameters and identification data that is stored retentively in the modules.

Byte x+4		Data record index: Number of the parameter assignment data record that caused the update interrupt.
Byte x+5		Number of updates that could not be reported to the CPU.

Figure 6-22 Structure starting at byte x+4 for update interrupt

See also

Channel-related diagnostics (Page 167)

6.8.14 Diagnostics for incorrect ET 200iSP configuration statuses

Incorrect configuration states

The following incorrect configuration statuses on the ET 200iSP lead to an ET 200iSP station failure or prevent startup of the data exchange. These reactions are not dependent on the setting of the IM 152 parameter "Operation at Preset <> Actual Configuration":

- Two missing electronic modules
- Terminating module missing
- Number of modules exceeds the maximum configuration
- Backplane bus fault (for example defective terminal module)

Note

If one module is missing (gap) and the ET 200iSP is powered down and powered up again, the ET 200iSP will not start up. Startup with more than one missing module is not possible. If more than one electronic module is missing, then the ET 200iSP can only be guaranteed to start up reliably after these modules are inserted if the power is switched OFF and ON again.

Diagnostics

The following diagnostics can be used to identify all invalid configuration states:

Table 6- 22 Diagnostics for incorrect ET 200iSP configuration statuses

ID-related diagnostics	Module status
All the bits from slot 4 to 35 are set	01_B: "Module fault, invalid user data" up to slot causing the failure 11_B: "No module; invalid user data" starting at slot causing the failure

Maintenance 7

7.1 Activities during operation

Properties

The table below describes the activities that can be performed on the ET 200iSP in Zone 1, Zone 2, Zone 21, and Zone 22 during operation.

Requirements

WARNING

Hazardous location zone 1 and zone 2: You are allowed to open the enclosure of the ET 200iSP briefly for the permitted maintenance work.

Hazardous location zone 21 and zone 22: Do not open the ET 200iSP enclosure in locations where there is combustible dust.

Permitted activities in hazardous locations

Table 7- 1 Permitted activities in hazardous locations

Activities	Zone 1	Zone 2	Zone 21	Zone 22	Reference ...
Inserting and removing modules during operation (hot swapping) in zone 1 and zone 2	X	X			Maintenance (Page 185)
Maintenance during operation (visual checks)	X	X	X[1]	X[1]	Maintenance (Page 185)
Cleaning	X	X			Maintenance (Page 185)
Removing and inserting the bus connector from terminal module TM-IM/EM in zone 1 and zone 2	X	X			Wiring (Page 103)
Disconnecting the wires to the sensors, actuators, and HART field devices on terminal module TM-EM/EM in Zone 1 and Zone 2	X	X			Wiring (Page 103)
Requirement for disconnecting the wires to the actuators on terminal module TM-RM/RM in Zone 1 and Zone 2: Remove the Ex d isolating plug on the TM-RM/RM. Refer to Chapter "Wiring terminal module TM-RM/RM" Wiring terminal module TM-RM/RM (Page 119) .	X	X			Wiring (Page 103)
Making new parameter settings and diagnostics for the ET 200iSP	X	X			Commissioning and diagnostics (Page 133)
IM 152 firmware update via PROFIBUS DP	X	X	X[1]	X[1]	Maintenance (Page 185)
[1] In areas in which there is combustible dust, the enclosure of the ET 200iSP must not be opened to perform these activities.					

Permitted activities in zone 2

In addition to the activities permitted in zone 1, the following activity is also permitted:

CAUTION

Disconnection and connection of the PS 24 VDC power supply cables from/to terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC during operation. This activity is permitted only when there is no risk of explosion or when there is no power applied at terminal module TM-PS-A/ TM-PS-A UC or TM-PS-B/ TM-PS-B UC.

CAUTION

Disconnecting and connecting cables for the actuators at terminal module TM-RM/RM during operation. This activity is permitted only when there is no explosion hazard or when there is no voltage applied at terminal module TM-RM/RM.

See also

Inserting and labeling electronic modules 2 DO Relay UC60V/2A (Page 128)

7.2 Removing and inserting electronics modules during operation (hot swapping)

Properties

- The ET 200iSP distributed I/O station supports the removal and insertion of one electronic module (1 gap) during operation (RUN mode).
- If one electronic module is removed, the ET 200iSP remains in the RUN mode.
- If you remove more than one electronic module, this leads to an ET 200iSP station failure. Once you have inserted all the electronic modules again, you must restart the ET 200iSP; in other words, turn the power supply off and on at the power supply module PS.
- If you install only one electronic module in an ET 200iSP, removing this electronic module will lead to an ET 200iSP station failure. When you insert the electronic module, the ET 200iSP starts up again.
- All current parameters and identification data of the ET 200iSP are stored in an internal flash memory in the IM 152. After a module is replaced, the IM 152 automatically transfers the current parameters and identification data to the new module. This function is always active on the ET 200iSP and cannot be influenced by the user.
  – The current parameters and identification data are retained on the IM 152 even if the power supply for the ET 200iSP fails.
  – The default parameters of an electronic module are overwritten.

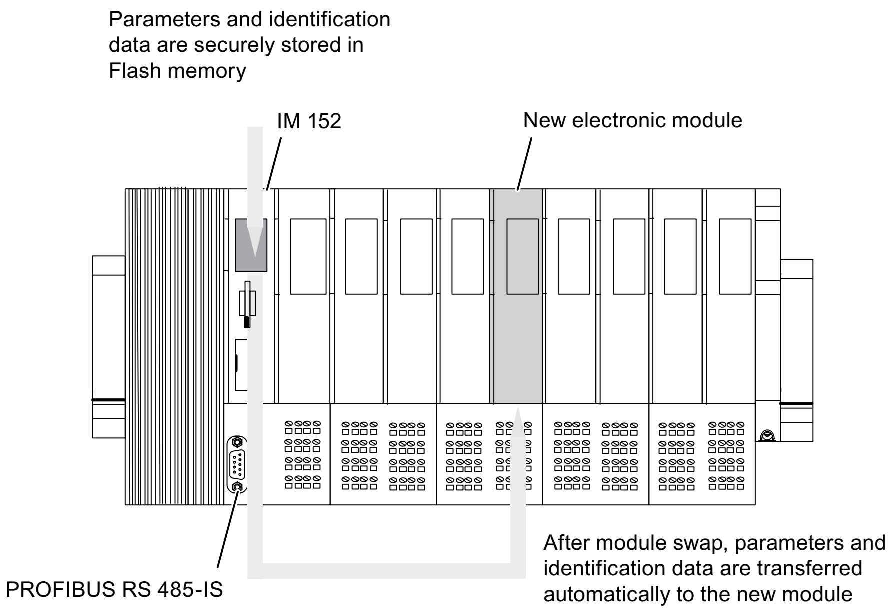


Figure 7-1 Automatic parameter assignment after replacing a module

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Note

If you reduce an existing configuration and then extend it again, you should erase the flash memory before the extension.

The Flash memory (parameters and identification data) of the IM 152 is erased when you set the PROFIBUS address to "0" and then turn the supply voltage of the ET 200iSP off and on a the Power Supply PS.

Requirements

- All modules must be inserted during the startup of the ET 200iSP.
- The removal and insertion of the electronic modules during running operation (RUN state) is only possible if you have enabled the IM 152 parameter **Operation during Preset - <> Actual configuration**.
- Only **one** electronic module may be removed at one time.
- The following table describes which module you can remove and insert during operation:

Table 7- 2 Requirements

Module exchange	Removal and insertion	Effects on ET 200iSP
Power supply PS	Yes	Remove: Failure of the ET 200iSP (Same state as when supply voltage is turned off). Insert: Starting up the ET 200iSP
Interface module IM 152	Yes	Remove: Failure of the ET 200iSP Insert: It is necessary to configure the ET 200iSP using PG (with STEP 7 only the I&M data)
Electronic module	Yes	Remove: Failure of the sensor/actuator Insert: Sensor/actuator in operation

Removal and inserting of electronic modules

Remove and insert electronic modules as described in the Chapter Inserting and labeling the power supply, interface module and electronic module (Page 123).

Note

Check the coding element before you insert the new electronic module in the terminal module.

See also

Inserting and labeling the interface module and electronic modules (Page 125)

7.3 Replacing the interface module

Properties

The IM 152 saves the parameters and I&M data to an internal flash memory. The contents are retained even if the ET 200iSP experiences a power failure.

After the IM 152-1 is replaced, STEP 7 automatically assigns parameters to the ET 200iSP. You only have to download the I&M data (if needed) to the ET 200iSP with HW Config or SIMATIC PDM.

Requirements

Replacement interface module

Replacing the interface module

1. Remove the (defective) IM 152 from the terminal module.
2. Set the PROFIBUS DP address to "0" on the new IM 152, and insert the new interface module into the terminal module.
3. Switch the supply voltage of the ET 200iSP off and then on.
4. Wait until the retentive data of the interface module are deleted (BF LED flashes at 0.5 Hz).
5. Switch off the supply voltage of the ET 200iSP.
6. Now, set the PROFIBUS DP address of the (defective) old IM 152 on the new interface module.
7. Switch on the supply voltage of the ET 200iSP.
8. Assign parameters for the ET 200iSP:
   – If you are using STEP 7, parameters will be automatically reassigned to the ET 200iSP. The ET 200iSP will then switch to data exchange with the DP master. If you need I&M data, you must also download this data to the ET 200iSP (HW Config menu command **Target system > Download Module Identification**).
   – If you use the SIMATIC PDM you must load all parameters and I&M in the ET 200iSP (menu command **Device > Load all in device**).

7.4 Maintenance during operation

Properties

Maintenance of the ET 200iSP is effectively restricted to visual inspections. These can be performed while the ET 200iSP is operating.

Prerequisites

In hazardous locations, a visual inspection should be made every six months.

Procedure

1. Check that the cable inlets in the enclosure are sealed and intact.
2. Check whether there is any water or dust inside the enclosure. If there is, find out how it got there.
3. Check that the wiring is secure (connectors, cables).

7.5 Cleaning

Safety information for zone 1 and zone 2

WARNING

Plastics can develop an electrostatic charge when they are cleaned. If you are operating the ET 200iSP in zone 1 or zone 2, this can represent a danger:

Clean the ET 200iSP only with damp cloths.

A sign with the warning "Clean the ET 200iSP only with damp cloths" must be placed inside the enclosure.

Following cleaning, run a functional check of the ET 200iSP.

Safety information for zone 21 and zone 22

WARNING

The dust layer on the enclosure of the ET 200iSP must not exceed a depth of 5 mm.

Remove the dust layer on the enclosure at regular intervals! During cleaning, make sure there is no risk of explosion!

7.6 IM 152 firmware update

Properties

- After you have implemented (compatible) functional expansions or performance enhancements, you should update the IM 152 interface module to the latest firmware version.
- You can obtain the most recent firmware versions from your Siemens representative, or download it from the Internet at: http://www.siemens.com/automation/service&support (http://www.siemens.com/automation/service&support)

  Tip:

  – Before updating, note down the current version of your firmware. You can read out the version number with HW Config or with SIMATIC PDM.

  – 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.
- The firmware update is performed by the programming device/PC via PROFIBUS DP and the CPU.

Requirements

Update via PROFIBUS DP

- STEP 7 V5.3, Service Pack 1
- The IM 152 in the station whose firmware is to be updated must be accessible online.
- The files containing the latest (new) firmware version must be available in the file system of your programming device/PC.
- To update the firmware you receive files (*.UPD) with the current firmware.

Firmware update via PROFIBUS DP

Connect the PG/PC containing the update files to the MPI interface of the CPU or via the PROFIBUS DP interface. The ET 200iSP is connected to the system over PROFIBUS DP.

The STEP 7 online help system provides information on how to proceed.

Restarting following an update

In the STEP 7 user interface you can decide whether

- the IM 152 is reset automatically following a successful update so that it can start up with the newly loaded firmware.

> **CAUTION**
>
> If there is a check mark in the "Activate firmware after download" box, there is a brief ET 200iSP station failure. If you have not made any provisions for this situation, the update will cause to CPU to go to STOP mode due to a rack failure.

- the IM 152 will be reset by turning of the power supply before the IM 152 starts up with the new firmware after turning on the power supply again.

Update

If the update fails, the IM 152 always restarts with its current ("old") FW version after the supply voltage is switched off and then on again. See table *Status and Error LEDs on the IM 152*.

See also

Status and error LEDs on the ET 200iSP (Page 143)

7.7 Reading service data

Properties

If you need to contact our Customer Support due to a service event, the department may require specific information on the status of an ET 200iSP station in your system for diagnostic purposes. This information is available as of FW version V2.0.5 of the IM 152 in the service data.

Select the “Target system -> Save service data” command to read this information and save the data to a file to forward to Customer Support.

Requirements

Installation of STEP 7 version 5.3 or higher.

Note the following:

- Save the service data directly after a ET 200sSP station has failed.
- Connect directly to IM 152 by means of PROFIBUS DP, RS 485-IS coupler and PROFIBUS RS 485-IS

Note

Connect the programming device to the PROFIBUS DP and access the IM 152 via the RS 485-IS coupler (of the inherently safe PROFIBUS RS 485-IS).

In a redundant system, you need to establish the connection to only one of the two IM 152.

Procedure

1. From the SIMATIC Manager menu choose "Target system > Show available stations".
2. Select the affected station.
3. Select the "PLC > Save service data" command

   In the next dialog box, select the file path and the file names for the service data.
4. Save the file.
5. Forward these files to Customer Support on request.

8 General technical specifications

8.1 General technical specifications

Definition

The general technical specifications contain the standards and test values to which the ET 200iSP distributed I/O station complies and adheres and the test criteria with which the ET 200iSP distributed I/O station was tested.

8.2 Standards and certifications

CE mark

The ET 200iSP distributed I/O system meets the requirements and protection objectives of the following EC Directives and complies with the harmonized European Standards (EN) for programmable logic controllers published in the Official Gazettes of the European Community:

- 2006/95/EC "Electrical Equipment Designed for Use within Certain Voltage Limits" (Low-Voltage Directive)
- 2004/108/EC "Electromagnetic Compatibility" (EMC Directive)
- 94/9/EC "Equipment and Protective Systems for Use in Potentially Explosive Atmospheres" (Directive for Explosion Protection)

ATEX approval

KEMA 04ATEX2242 (ET 200iSP system)

The module markings are described in the specifications.

The EC Declarations of Conformity are available to the responsible authorities at:

Siemens AG

Automation and Drives

I IA AS R&D ST TYPE TEST
Postfach 1963
D-92209 Amberg

See the technical data of the ET 200iSP Modules.

IECEx approval

IECEx

See the technical data of the ET 200iSP Modules.

cULus approval

Underwriters Laboratories Inc.

See the technical data of the ET 200iSP Modules.

HAZ. LOC.

FM approval

FM (Factory Mutual Research)

See the technical data of the ET 200iSP Modules.

> **WARNING**
>
> Personal injury and property damage can occur.
>
> There is a risk of injury or damage if you disconnect any plug-in connections in potentially explosive areas while the ET 200iSP is in operation.
>
> Be aware of which activities are permitted in potentially explosive areas. Refer to chapter "Activities during operation (Page 185) ".

Marking for Australia

The ET 200iSP distributed I/O station meets the requirements of AS/NZS 2064 (Class A).

INMETRO

INMETRO BR OCP-0029

See the technical data of the ET 200iSP Modules.

IEC 61131

The ET 200iSP distributed I/O station meets the requirements and criteria of IEC 61131-2 (Programmable Logic Controllers, Part 2: Equipment Requirements and Tests).

PROFIBUS standard

The ET 200iSP distributed I/O device is based on *IEC 61784-1:2002 Ed1 CP 3/1.*

Marine approval

Classification societies:

- ABS (American Bureau of Shipping)
- BV (Bureau Veritas)
- DNV (Det Norske Veritas)
- GL (Germanischer Lloyd)
- LRS (Lloyds Register of Shipping)
- Class NK (Nippon Kaiji Kyokai)

Use of the Distributed I/O Device ET 200iSP in device group I (mining) Category M2

The following conditions must be fulfilled if the ET 200iSP is used in device group I (underground mining operations and their overground systems) Category M2:

CAUTION

- To avoid ignitable sparks, the power supply PS and the mounting rail of the ET 200iSP must be packaged in shock-proof packaging for transportation and storage (e.g. for servicing) and immediately removed from the potentially explosive atmosphere.
- The enclosure in which the ET 200iSP is installed must be approved for device group I, category M2.
- Observe all other requirements concerning use of the ET 200iSP in the potentially explosive atmosphere given in this manual.

Use in industrial environment

SIMATIC products are designed for use in industrial environments.

Table 8- 1 Use in industrial environment

Area of application	Requirement for	
	Interference emission	Immunity
Industrial environments	EN 61000-6-4: 2007	EN 61000-6-2: 2005

Use in residential areas

Note

The ET 200iSP distributed I/O system is intended for use in industrial environments; when used in residential areas, it can be affected by radio/television reception.

ET 200iSP applications in residential areas must be compliant with values of EN 61000-6-3, measured acc. to EN 55016-2-3, for emission of radio interference.

Individual measures are, for example:

- Installation of the ET 200iSP in grounded switch control cabinets/boxes
- Use of filters in supply lines

8.3 Electromagnetic compatibility, transport and storage conditions

Definition of EMC

Electromagnetic compatibility is the ability of electrical equipment to function satisfactorily in its electromagnetic environment without influencing this environment.

The ET 200iSP distributed I/O station also meets the requirements of the EMC law of the European market. This requires that the ET 200iSP distributed I/O system meets the specifications and directives concerning electrical installation.

EMC according to NE21

The ET 200iSP distributed I/O device satisfies the EMC requirements of NAMUR directive NE21.

Pulseshaped interference

The following table shows the electromagnetic compatibility of the ET 200iSP distributed I/O station with relation to pulse-shaped interference variables.

Pulse-shaped interference	Test voltage	corresponds with degree of severity
Electrostatic discharge according to IEC 61000-4-2.	8 kV 6 kV	3
Burst pulses (high-speed transient interference) to IEC 61000-4-4.	2 kV (supply line) 2 kV (signal line)	3
Powerful single pulse (surge) according to IEC 61000-4-5 As of product version 3 of power supply PS (6ES7138-7EA01-0AA0), the overvoltage suppressor for the 24 VDC supply on power supply PS is no longer mandatory. Overvoltage suppressors are required for all signal modules (for appropriate types, see Appendix Lightning and overvoltage protection (Page 369))		3
• asymmetric connection	2 kV (supply line) 2 kV (supply line/data line)	
• asymmetric connection	1 kV (supply line) 1 kV (supply line/data line)	

Sinusoidal interference variables

The following table shows the electromagnetic compatibility of the distributed I/O station ET 200iSP compared with sinusoidal interference variables.

- HF irradiation

HF irradiation according to IEC 61000-4-3 Electromagnetic HF field, amplitude-modulated	
80 to 1000 MHz; 1.4 to 2 GHz	2.0 GHz to 2.7 GHz
10 V/m	1 V/m
80% AM (1 kHz)	

- HF coupling

HF injection according to IEC 61000-4-6
0.15 to 80 MHz
10 V
80% AM (1 kHz)

Emission of radio interference

Interference emission of electromagnetic fields according to EN 55016: Limit class A, Group 1 (measured at distance of 10 m).

Frequency	Interference emission
of 30 to 230 MHz	< 40 dB (µV/m)Q
of 230 to 1000 MHz	< 47 dB (µV/m)Q

Shipping and storage conditions

The distributed I/O station ET 200iSP exceeds the requirements of IEC 61131-2 for transport and storage conditions. The following data applies to modules which are transported or stored in the original packaging.

Type of condition	permissible range
at user's discretion	≤ 1 m
Temperature	from - 40 °to + 70 °C
Temperature change	20 K/h
Barometric pressure	from 1080 to 660 hPa (corresponds to a height of - 1000 to 3500 m)
Relative humidity	from 5 to 95%, without condensation

See also

General Rules and Regulations for Wiring (Page 103)

8.4 Mechanical and climatic environmental conditions

Operating conditions

The ET 200iSP is designed for stationary use in weather-proof locations. The operating conditions surpass requirements to DIN IEC 60721-3-3.

- Class 3M3 (mechanical requirements)
- Class 3K3 (climatic requirements)

Climatic environmental conditions

The following climatic environmental conditions apply:

Environmental conditions	Areas of application	Remarks
Temperature	from -20 to 70°C [1 2]	For horizontal installation
	from -20 to 50°C [1 2]	For all other mounting positions
Temperature change	10 K/h	-
Relative humidity	5 to max. 95 %	Without condensation
Barometric pressure	From 1,080 hPa to 795 hPa	Corresponds with an altitude of -1000 m to 2000 m
Concentration of pollutants	SO_2: < 0.5 ppm; rel. humidity < 60 %, no condensation H_2S: < 0.1 ppm; rel. humidity < 60 %, no condensation	Test: 10 ppm; 4 days 1 ppm; 4 days
	ISA-S71.04 severity level G1; G2; G3	-
[1]Output current of power supply PS 24 VDC (6ES7 138-7EA01-0AA0): Power supply PS 24 VDC (Page 223) [2]Output current of power supply PS 120/230 VAC (6ES7138-7EC00-0AA0): Power supply PS 120/230 VAC (Page 226)		

Mechanical environmental conditions

The table below shows the mechanical environmental conditions in the form of sinusoidal oscillations.

Frequency band	Continuous	Infrequently
5 ≤ f ≤ 9 Hz	1.75 mm amplitude	3.5 mm amplitude
9 ≤ f ≤ 150 Hz	0.5 g constant acceleration	1 g constant acceleration

Test of mechanical environmental conditions

The table below provides important information with respect to the type and scope of the test of ambient mechanical conditions.

Condition tested	Test Standard	Terminal modules and electronic modules
Vibration	Oscillation test according to IEC 60068-2-6 (sine)	Type of oscillation: Frequency sweep with a rate of change of 1 octave/minute. 5 Hz ≤ f ≤ 9 Hz, constant amplitude of 3.5 mm 9 Hz ≤ f ≤ 150 Hz, constant acceleration 1 g Duration of oscillation: 10 frequency sweeps per axis in each of the 3 mutually vertical axes
Shock	Shock tested to IEC 60068-2-27	Type of shock: half-sine Shock intensity: 15 g peak value, 11 ms duration Shock direction: 3 shocks each in +/- direction in each of the 3 mutually vertical axes

8.5 Information on dielectric strength tests, class of protection, degree of protection and rated voltage of the ET 200iSP

Test voltage

Insulation strength is demonstrated in the type test with the following proof voltages specified in IEC 61131-2:2007

Pollution degree / overvoltage category according to IEC 61131

- Pollution degree 2
- Overvoltage category
  - at U_N = 24 VDC: II
  - at U_N = 120 / 230 VAC: II

Protection class

Protection class II acc. to IEC 61131-2:2007

Degree or protection IP30

Degree of protection IP30 according to IEC 60529 for all modules of the ET 200iSP, in other words

- protection against contact with standard probe
- Protection against solid bodies with diameters in excess of 2.5 mm
- No special protection against water

Rated voltage for operation

The distributed I/O station ET 200iSP operates with the rated voltage shown in the following table and the corresponding tolerances.

rated voltage	Tolerance range
24 VDC	20 to 30 VDC (up to product version 2 of power supply PS)
	19.2 to 30 VDC (as of product version 3 of power supply PS)
120/230 VAC	85 VAC to 264 VAC

Terminal modules

9

9.1 Overview of the contents

Modules and terminal modules

The table below shows you which modules you can use on the various terminal modules.

Table 9- 1 Modules and terminal modules

Modules	Terminal modules									
	TM-PS-A TM-PS-B	TM-PS-A UC TM-PS-B UC	TM-IM/IM		TM-IM/EM 60S TM-IM/EM 60C		TM-EM/EM 60S TM-EM/EM 60C		TM-RM/RM 60S	
Order No. 6ES7193-	7DA10-0AA0 7DB10-0AA0	7DA20-0AA0 7DB20-0AA0	7AB00-0AA0		7AA00-0AA0 7AA10-0AA0		7CA00-0AA0 7CA10-0AA0		7CB00-0AA0	
Power supply PS 24 VDC (up to product version 5)	x									
Power supply PS 24 VDC (up to product version 6)	x	x								
Power supply PS 120/230 VAC		x								
Interface module IM 152			x	x	x					
8 DI NAMUR						x	x	x		
4 DO 23.1 VDC/20mA						x	x	x		
4 DO 17.4 VDC/27mA						x	x	x		
4 DO 17.4 VDC/40mA						x	x	x		
2 DO Relay UC60V/2A									x	x
4 AI I 2WIRE HART						x	x	x		
4 AI I 4WIRE HART						x	x	x		
4 AI RTD						x	x	x		
4 AI TC						x	x	x		
4 AO I HART						x	x	x		
Reserve module						x	x	x	x [1]	x [1]
WATCHDOG						x	x	x		
[1] product version 3 or higher of the reserve module										

9.2 Terminal module TM-PS-A/ TM-PS-A UC and TM-PS-B/ TM-PS-B UC

Order number

Type	Order number
TM-PS-A	6ES7193-7DA10-0AA0
TM-PS-A UC	6ES7193-7DA20-0AA0
TM-PS-B	6ES7193-7DB10-0AA0
TM-PS-B UC	6ES7193-7DB20-0AA0

Properties

- Terminal module for power supply PS
- Provides power for the entire ET 200iSP station
- Connected using screw terminals
- 3 terminals for connection of the supply voltage/ equipotential bonding
- Prewiring of the terminal module is possible
- Self-generating interference leakage from the terminal module to the mounting rail by means of a spring contact
- Polarity reversal protection guaranteed by the power supply module (only for PS 24 VDC)

Note

On terminal modules TM-PS-A / TM-PS-B (6ES7193-7DA10-0AA0/ 6ES7192-7DB10-0AA0), only power supply PS as of order number 6ES7138-7EA01-0AA0 can be inserted.

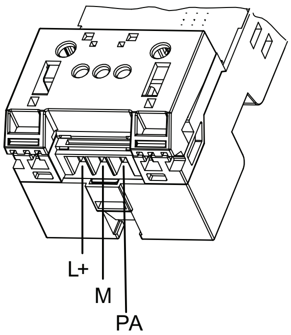
The predecessor power supply PS with order number 6ES7138-7EA00-0AA0 is prevented from being inserted by an appropriate coding.

Compatibility with predecessor modules

Terminal modules TM-PS-A (UC) TM-PS-B (UC)	Power supply PS 24 VDC 6ES7138-7EA01-0AA0 (up to product version 5)	Power supply PS 24 VDC 6ES7138-7EA01-0AA0 (Product version 6 and higher)	Power supply 120/230 VAC 6ES7138-7EC00-0AA0 (Product version 1 and higher)
6ES7193-7DA10-0AA0	X	X	---
6ES7193-7DB10-0AA0	X	X	---
6ES7193-7DA20-0AA0	---	X	X
6ES7193-7DB20-0AA0	---	X	X

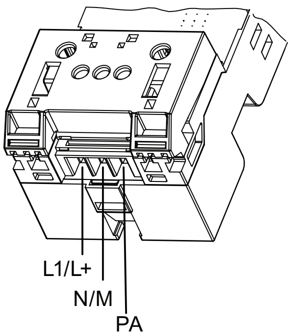
Pin assignment TM-PS-A and TM-PS-B

Table 9- 2 Pin assignment on the TM-PS-A and TM-PS-B terminal modules

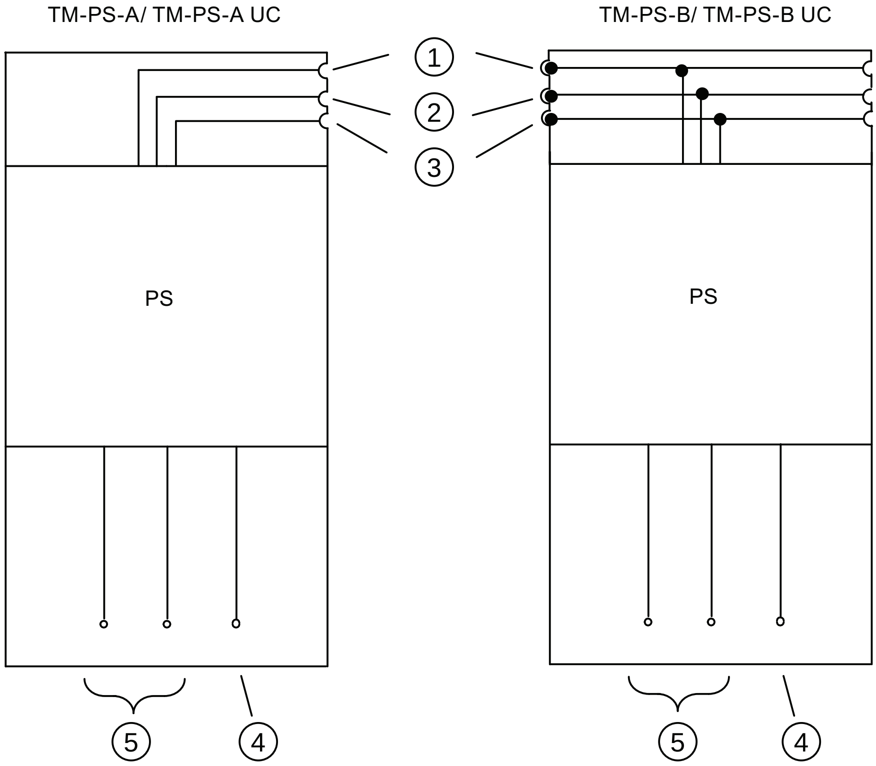
View	Terminal	Name
	L+	Power supply for inserted power supply 24 VDC
	M	
	PA	Equipotential bonding

Pin assignment TM-PS-A UC and TM-PS-B UC

Table 9- 3 Pin assignment on the terminal modules TM-PS-A UC and TM-PS-B UC

View	Terminal	Name
	L1/L+	Power supply for the inserted power supply 24 VDC (Production version 6 and higher) or 120/230 VAC
	N/M	
	PA	Equipotential bonding

Block diagram



① Power bus
② IM 152
③ Backplane bus
④ Equipotential bonding
⑤ Supply voltage terminals

Figure 9-1 Block diagram of the terminal modules TM-PS-A/ TM-PS-A UC and TM-PS-B/ TM-PS-B UC

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	60 x 190 x 52
Weight	Approx. 235 g
Module-specific data	
Number of terminals	3
Cable cross-section	0.5 to 4 mm²*
Approvals	
• ATEX	II 2 G (1) GD and I M2 Ex e [ia/ib] IIC T4; Ex e [ia/ib] I KEMA 04 ATEX 2242 CE 0344
• IECEx	IECEx KEM 05.0003
• INMETRO INMETRO BR OCP-0029	BR-Ex e [ia/ib] IIC T4 / BR-Ex e [ia/ib] I
• FM	Class I, Zone 1, AEx e [ib/ ia] IIC T4; Ex e [ib/ ia] IIC T4 Class I, DIV. 2, GP A,B, C, D T4 Class II, III, GP E,F, G
• cULus LISTED 7XA1	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx e [ib/ ia] IIC T4; Ex e [ib/ ia] IIC T4 Class I, DIV. 2, GP .A,B,C,D T4
Voltages, currents, electrical potentials	
Insulation tested	
• between supply voltages and all output voltages	2500 VDC (for TM-PS-A/ TM-PS-B) 2500 VAC (for TM-PS-A UC/ TM-PS-B UC)
Safety data	
See EC-type-examination certificate	KEMA 04ATEX2242
* Keep to the wiring rules.	

See also

Wiring Rules for the ET 200iSP (Page 109)

9.3 Terminal modules TM-IM/EM 60S and TM-IM/EM 60C

Order number

6ES7193-7AA00-0AA0 (screw terminal)

6ES7193-7AA10-0AA0 (spring terminal)

Properties

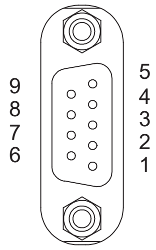
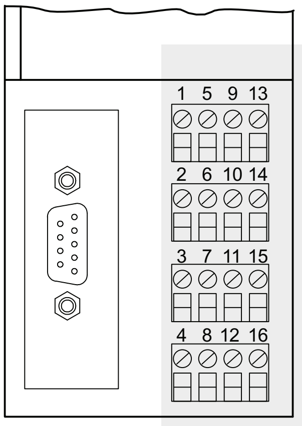
- Terminal module for an interface module (left-hand side) and an electronic module (right-hand side)
- PROFIBUS RS 485-IS connection via 9-pin Sub D socket
- Connection of actuators and sensors by means of screw terminals for TM-IM/EM 60S
- Connection of actuators and sensors by means of spring terminals for TM-IM/EM 60C
- Self-generating interference leakage from the terminal module to the mounting rail by means of a spring contact
- Prewiring of the terminal module is possible

Note

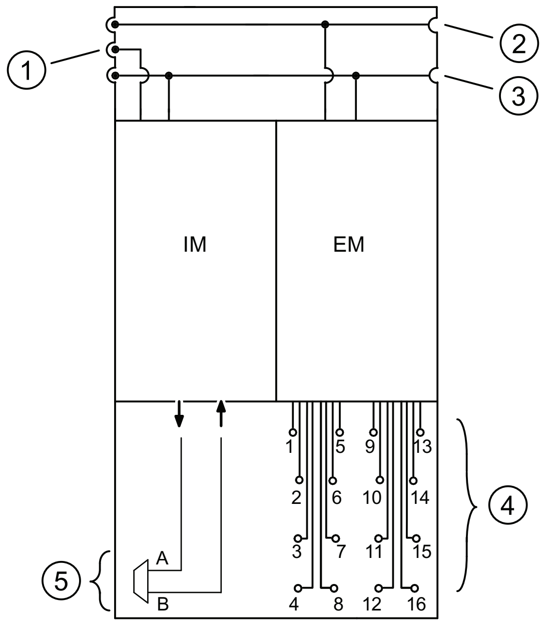
The spring contact to the mounting rail connects the cable shield of the PROFIBUS-DP cable with the equipotential bonding PA during operation.

Pin assignment

Table 9- 4 Pin assignment on the TM-IM/EM

View	Terminal		Name
	1	PA	Equipotential bonding
	2	-	-
	3	RxD/TxD-P	Data line B
	4	-	-
	5	ISGND	Bus termination ground
	6	ISP	Bus termination P
	7	-	-
	8	RxD/TxD-N	Data line A
	9	-	
	Pin assignment, see sections "Digital electronic modules (Page 239)" and "Analog electronic modules (Page 275)"		

Block diagram



① IM 152 power supply
② Power bus
③ Backplane bus
④ Terminals with connection to the electronic module
⑤ PROFIBUS RS 485-IS connection

Figure 9-2 Block diagram of terminal module TM-IM/EM

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	60 x 190 x 52
Weight	Approx. 235 g
Module-specific data	
Terminal element	9-pin Sub D socket for PROFIBUS RS 485-IS
Number of terminals	4 x 4
Cable cross-sections	0.14 mm to 2.5 mm[1]
Approvals	
• ATEX	0344
• IECEx	
• INMETRO	INMETRO BR OCP-0029
• FM	
• cULus	LISTED 7XA1
Safety data	
See EC-type-examination certificate	KEMA 04ATEX2242
[1] Follow the wiring rules.	

See also

Wiring Rules for the ET 200iSP (Page 109)

9.4 Terminal module TM-IM/IM

Order number

6ES7193-7AB00-0AA0

Properties

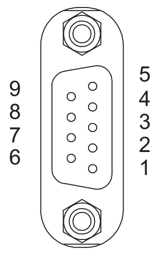
- Terminal module for two interface modules (left and right side) for use when the IM 152 is configured for redundancy
- PROFIBUS RS 485-IS connection via two 9-pin Sub D sockets
- Self-generating interference leakage from the terminal module to the mounting rail by means of spring contacts
- Prewiring of the terminal module is possible

Note

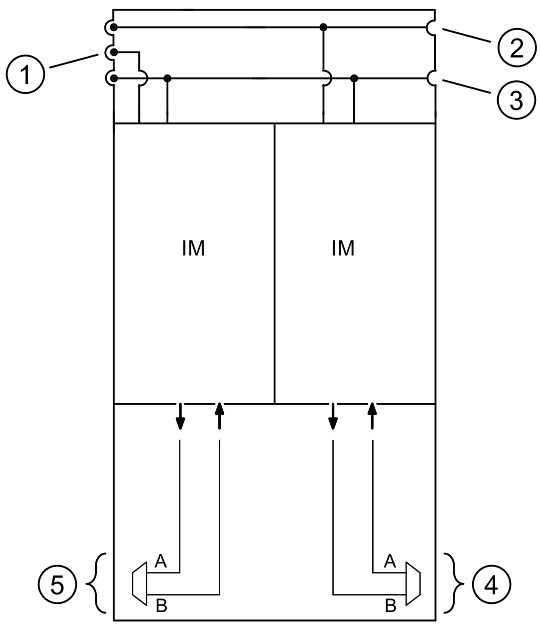
The spring contact to the mounting rail is used to connect the cable shield of the PROFIBUS DP cable with the equipotential bonding system during operation.

Pin assignment

Table 9- 5 Pin assignment on the TM-IM/IM

View	Terminal		Name
	1	PA	Equipotential bonding
	2	-	-
	3	RxD/TxD-P	Data line B
	4	-	-
	5	ISGND	Bus termination ground
	6	ISP	Bus termination P
	7	-	-
	8	RxD/TxD-N	Data line A
	9	-	

Block diagram



① IM 152 power supply
② Power bus
③ Backplane bus
④ PROFIBUS RS 485-IS connection (b)
⑤ PROFIBUS RS 485-IS connection (a)

Figure 9-3 Block diagram of terminal module TM-IM/IM

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	60 x 190 x 52
Weight	Approx. 195 g
Module-specific data	
Terminal element	Two 9-pin Sub D sockets for PROFIBUS RS 485-IS
Approvals	
• ATEX	0344
• IECEx	
• INMETRO	INMETRO BR OCP-0029
• FM	
• cULus	LISTED 7XA1
Safety data	
See EC-type-examination certificate	KEMA 04ATEX2242

9.5 Terminal modules TM-EM/EM 60S and TM-EM/EM 60C

Order Number

6ES7193-7CA00-0AA0 (screw terminal)

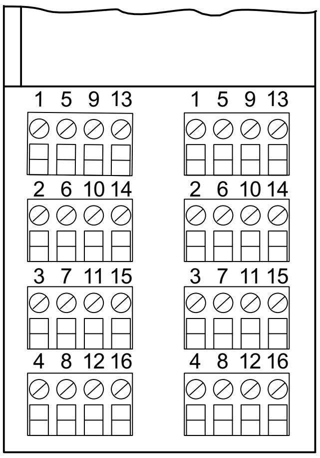
6ES7193-7CA10-0AA0 (spring terminal)

Properties

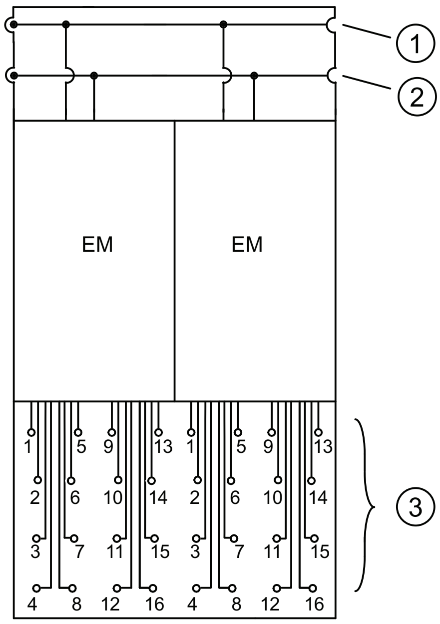
- Terminal module for 2 electronic modules
- Connection of actuators and sensors by means of screw terminals for TM-EM/EM 60S
- Connection of actuators and sensors by means of spring terminals for TM-EM/EM 60C
- Self-generating interference leakage from the terminal module to the mounting rail by means of a spring contact
- Prewiring of the terminal module is possible

Pin assignment

Table 9- 6 Pin assignment of terminal module TM-EM/EM

View	Terminal	Name
	Pin assignment, see sections "Digital electronic modules (Page 239)" and "Analog electronic modules (Page 275)"	

Block diagram



① Power bus
② Backplane bus
③ Terminals with connection to the electronic module

Figure 9-4 Block diagram of terminal module TM-EM/EM

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	60 x 190 x 52
Weight	ca. 275g
Module-specific data	
Number of terminals	8 x 4
Cable cross-sections	0.14 mm to 2.5 mm[1]
Approvals	
• ATEX	0344
• IECEx	IECEx
• INMETRO	INMETRO BR OCP-0029
• FM	FM C US APPROVED
• cULus	C UL US LISTED 7XA1
Safety data	
See EC-type-examination certificate	KEMA 04ATEX2242
[1] Follow the wiring rules.	

See also

Wiring Rules for the ET 200iSP (Page 109)

9.6 Terminal module TM-RM/RM

Order number

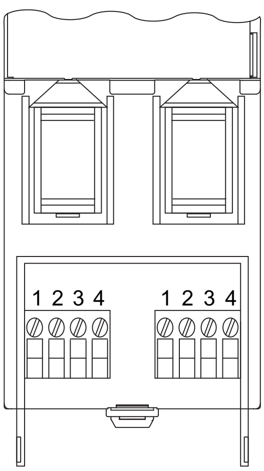
6ES7193-7CB00-0AA0 (screw terminal)

Properties

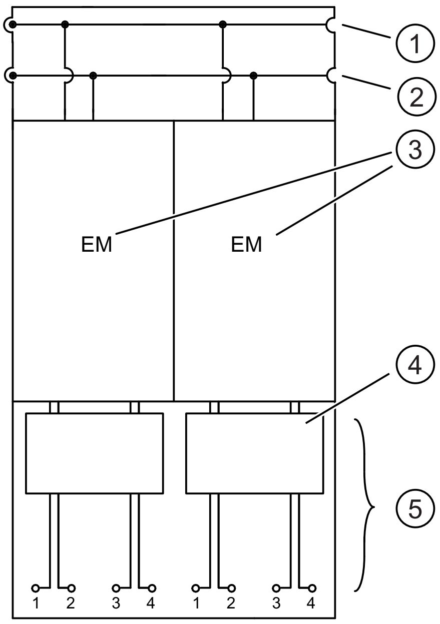
- Terminal module for 2 electronic modules 2 DO Relay UC60V/2A or reserve module (Product version 3 and higher)
- Connection of actuators by means of screw terminals for TM-RM/RM 60S.
- The screw terminals of terminal module TM-RM/RM 60S are designed with increased safety Ex e type of protection.
- Self-generating interference leakage from the terminal module to the mounting rail by means of a spring contact
- Prewiring of the terminal module is possible.
- Ex d isolating plug for removing and inserting the 2 DO Relay UC60V/2A.
- Terminal cover of the Ex e terminals must be closed for operation.

Pin assignment

Table 9- 7 Pin assignment of terminal module TM-RM/RM

View	Terminal	Name
	Pin assignment, see sections "Digital electronic modules (Page 239)" and "Analog electronic modules (Page 275)"	

Block diagram



① Power bus
② Backplane bus
③ Electronic module 2 DO Relay UC60V/2A or reserve module (as of product version 03)
④ Ex d isolating plug
⑤ Ex e terminals with connection to the electronic module

Figure 9-5 Block diagram of terminal module TM-RM/RM

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	60 x 190 x 52
Weight	ca. 275g
Module-specific data	
Number of terminals	2 x 4
Cable cross-sections	0.2 to 2.0 mm[1]
Approvals	
• ATEX	II 2 G and I M2 Ex deib IIC T4; Ex deib I KEMA 07 ATEX 0205 CE 0344
• IECEx	IECEx KEM 07.0060
• INMETRO (INMETRO; BR OCP-0029)	BR-Ex deib IIC T4 / BR-Ex deib I
• FM	Class I, Zone 1, AEx deib IIC T4; Ex deib IIC T4 Class I, DIV. 2, GP A,B,C,D T4 Class II, III, GP E,F, G
• cULus (LISTED 7XA1)	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx deib IIC T4; Ex deib IIC T4 Class I, DIV. 2, GP A,B,C,D T4
Safety data	
See EC-type-examination certificate	KEMA 07ATEX0205
[1] Follow the wiring rules.	

Note

Make sure to separate intrinsically safe cables from non-intrinsically safe cables.

Power Supply 10

10.1 Power supply PS 24 VDC

Order number

6ES7138-7EA01-0AA0

Properties

- Electrically isolated supply of the ET 200iSP with necessary output voltages:
  - Power bus
  - Interface module supply
  - Backplane bus
- Handles the safety-related limitation of the output voltages.
- Properties of the PS 24 VDC depending on product version:

Properties	Product version of the PS 24 VDC		
	up to 4	5	6 or higher
Pluggable to TM-PS-A or TM-PS-B	X	X	X
Pluggable to TM-PS-A UC or TM-PS-B UC			X
Mixed mode in the case of redundancy PS 24 VDC/ PS 120/230 VAC		X	X

Note

Overvoltage suppressor

For product version 3 and higher of power supply PS 24 VDC, the surge arrester is no longer mandatory for the 24 VDC supply on power supply PS. See No. 1 from figure in Chapter Application example for protection of ET 200iSP from overvoltages (Page 375) .

Block diagram

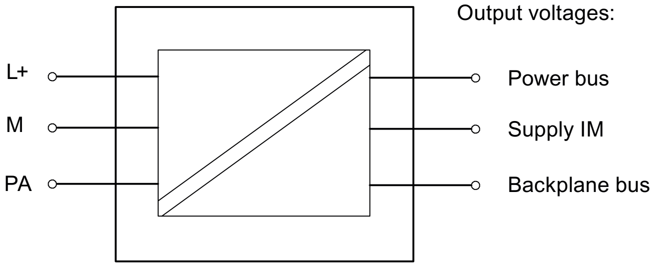


Figure 10-1 Block diagram of the power supply PS 24 VDC

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	60 x 190 x 136.5
Weight	Approx. 2700 g
Module-specific data	
Type of protection of the module	
• ATEX	II 2 G and I M2 Ex de [ib] IIC T4; Ex de [ib] I KEMA 04 ATEX 2263 CE 0344
• IECEx	IECEx KEM 05.0004
• INMETRO (INMETRO; BR OCP-0029)	BR-Ex de [ib] IIC T4 / BR-Ex de [ib] I
• FM (FM C US APPROVED)	Class I, Zone 1, AEx de [ib] IIC T4; Ex de [ib] IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 Class II, III, GP EFG
• cULus (LISTED 7XA1)	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx de [ib] IIC T4; Ex de [ib] IIC T4 Class I, Div 2, GP .ABCD T4
Voltages, currents, electrical potentials	
Nominal power supply voltage	24 V DC [1]
• Reverse polarity protection	Yes
• Power failure buffering power bus	min. 0.25 ms
• Power failure buffering IM 152	min. 15 ms
• Power failure buffering backplane bus	min. 0.25 ms

Technical specifications	
Electrical isolation	
• between the supply voltage and power bus	Yes
• between the supply voltage and backplane bus as well as IM supply	Yes
Insulation tested	
• between supply voltage and all output voltages	600 VDC
Current consumption	
• from power supply L+	Max. 4A[2]
Starting current inrush	
• for 24 VDC	24.8A
Power loss from the module	20W [3]
Permitted input power	max. 78.6 W
Output current at ambient temperature up to product version 2 of power supply PS	
• -20°C to +60°C with horizontal installation and -20°C to +40°C for all other installation positions	max. 5A
• +60°C to +70°C with horizontal installation	max. 3.5 A
Output current at ambient temperature as of product version 3 of power supply PS	
• From -20°C to +70°C with horizontal installation and -20°C to +50°C for all other installation positions	max. 5A
Status, interrupts, diagnostics	
Status display	yes (on IM 152)
Interrupts	No
Diagnostic functions	
• Group error display	No
• Diagnostic information can be read	yes (over IM 152)
Safety data	
See EC-type-examination certificate	KEMA 04ATEX2263
U_M	250 V DC, 250 V AC
[1] up to product version 2: Tolerance range 20 VDC to 30 VDC, product version 3 and higher: Tolerance range 19.2 VDC to 30 VDC. Fusing with 6 A automatic circuit breaker and tripping characteristic C (for each ET 200iSP station) [2] Rated current: 3.3A (for 24 VDC) [3] For additional information regarding power loss, refer to Chapter Restricted Number of Connectable Electronics Modules (Page 49)	

Note

Take appropriate measures to ensure that U_m = 250 VDC, 250 VAC is not violated.

10.2 Power supply PS 120/230 VAC

Order number

6ES7138-7EC00-0AA0

Properties

- Electrically isolated supply of the ET 200iSP with necessary output voltages:
  - Power bus
  - Interface module supply
  - Backplane bus
- Handles the safety-related limitation of the output voltages.
- Can be inserted on the TM-PS-A UC/ TM-PS-B UC

Block diagram

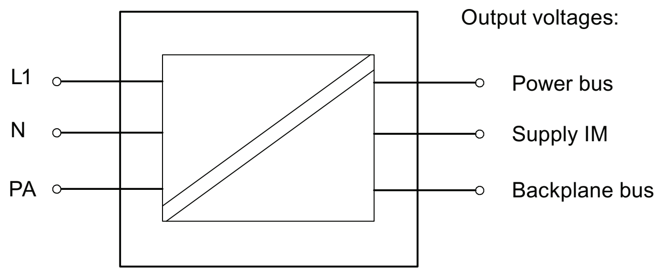


Figure 10-2 Block diagram of the power supply PS 120/230 VAC

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	60 x 190 x 136.5
Weight	Approx. 2700 g
Module-specific data	
Type of protection of the module	
• ATEX	II 2 G and I M2 Ex de [ib] IIC T4; Ex de [ib] I KEMA 09 ATEX 0156 0344
• IECEx	IECEx KEM 09.0070
• INMETRO [1] (INMETRO; BR OCP-0029)	BR-Ex de [ib] IIC T4 / BR-Ex de [ib] I
• FM [1]	Class I, Zone 1, AEx de [ib] IIC T4; Ex de [ib] IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 Class II, III, GP EFG
• cULus [1] (LISTED 7XA1)	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx de [ib] IIC T4; Ex de [ib] IIC T4 Class I, Div 2, GP .ABCD T4
Voltages, currents, electrical potentials	
Nominal power supply voltage	120/230 VAC [2]
• Power failure buffering power bus	min. 20 ms
• Power failure buffering IM 152	min. 20 ms
• Power failure buffering backplane bus	min. 20 ms
Electrical isolation	
• between the supply voltage and power bus	Yes
• between the supply voltage and backplane bus as well as IM supply	Yes
Insulation tested	
• between supply voltage and all output voltages	2500V AC
Current consumption	
• from power supply L1	Max. 1,04A [3]
Starting current inrush	
• for 120/230 VAC	28 A
Power loss from the module	21.3 W [4]
Permitted input power	max. 82.2 W

Technical specifications	
Output current for 230 VAC (170 VAC to 264 VAC) and ambient temperature	
• -20°C to +70°C with horizontal installation	max. 4A
• From -20°C to +60°C with horizontal installation and -20°C to +50°C for all other installation positions	max. 5A
Output current for 120 VAC (85 VAC to 132 VAC) and ambient temperature	
• From -20°C to +70°C with horizontal installation and -20°C to +50°C for all other installation positions	max. 3A
• from -20°C to +60°C with horizontal installation	max. 4A
• -20°C to +50°C with horizontal installation	max. 5A
Status, interrupts, diagnostics	
Status display	yes (on IM 152)
Interrupts	No
Diagnostic functions	
• Group error display	No
• Diagnostic information can be read	yes (over IM 152)
Safety data	
See EC-type-examination certificate	KEMA 09ATEX0156
U_M	264V DC, 264V AC

[1] Available soon

[2] Tolerance range 85 VAC to 264 VAC.
Fusing with 6 A automatic circuit breaker and tripping characteristic C (for each ET 200iSP station)

[3] Rated current: 0.75A (for 120 VAC)/ 0.45A (for 230 VAC)

[4] For additional information regarding power loss, refer to Chapter "Restricted Number of Connectable Electronics Modules (Page 49)"

Note

Take appropriate measures to ensure that U_m = 264 VDC, 264 VAC is not exceeded.

---

11 Interface module

11.1 Interface module IM 152

Order number

6ES7152-1AA00-0AB0

Properties

The IM 152 interface module has the following characteristics:

- Connects the ET 200iSP with the PROFIBUS RS 485-IS
- Prepares the data for the inserted electronic modules
- PROFIBUS address setting by means of switch
- Switching off the 24 VDC power supply on terminal module TM-PS-A/ TM-PS-A UC also switches off the IM 152 interface module.
- The maximum address space is 244 bytes for inputs and 244 bytes for outputs.
- Operation as DPV0, S7 DP, and DPV1 slaves
- Firmware update via PROFIBUS DP
- Backing up the parameters of the electronic modules:
  - The parameters/data are stored in flash memory of the IM 152.
  - After the power supply of the ET 200iSP is switched on, the IM 152 distributes the stored parameters/data to the electronic modules (for example, substitute values for the output modules).
  - Then, PROFIBUS DP is enabled and the automation system is put into operation by the DP master.
  - Once the ET 200iSP begins exchanging data with the DP master, the substitute values (in the flash memory) in the output are replaced with the current data from the DP master.
- Redundancy of IM 152 (V2.0 and higher)

Block diagram

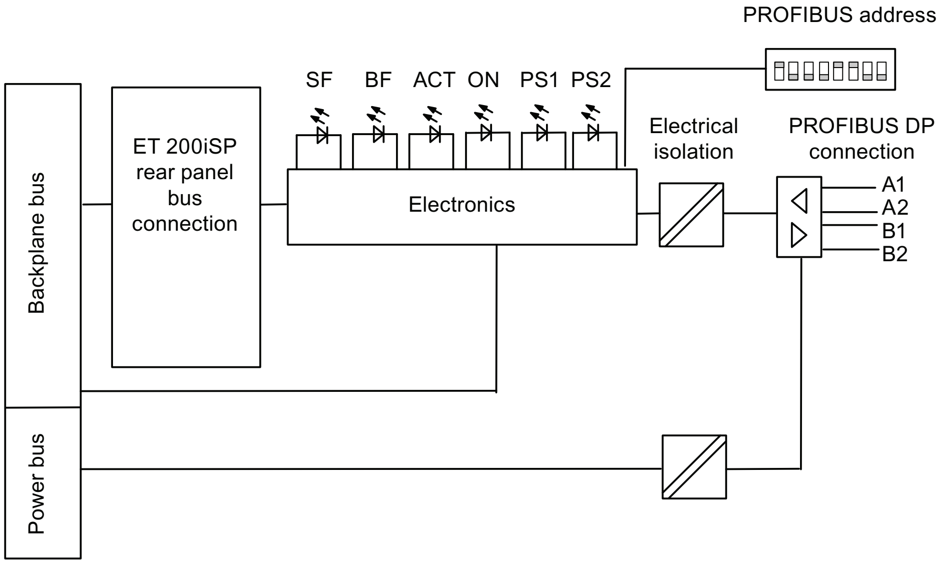


Figure 11-1 Block diagram of IM 152 interface module

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	Approx. 245 g
Module-specific data	
Transmission rate	9.6; 19.2; 45.45; 93 ,75; 187.5; 500 Kbps, 1.5 Mbps
Bus protocol	PROFIBUS RS 485-IS
Interface	RS-485 (intrinsically safe)
SYNC capability	Yes
FREEZE capability	Yes
Manufacturer's ID	8110_H
PROFIBUS addresses	1 to 125 permitted
Direct data exchange	yes, slave to slave as publisher
Isochronous operation	No
Time stamping	yes (STEP 7 only)
• Accuracy class	20 ms
• Time resolution	1 ms
• Number of digital input signals	max. 64 for accuracy class 20 ms
• Message buffer	15 message buffers each for 20 messages

Technical specifications	
• Time interval for sending the message buffers when a message is pending	1 s
• Time stamp	per digital input per digital input module entire ET 200iSP
• Time stamp for	rising/falling change as event entering or leaving state
• Time-of-day format	RFC 1119 Internet (ISP)
Acyclic functions	Yes
• Interrupts	Yes
• Diagnostics	Yes
• Parameter	Yes
• Data records	Yes
Approvals	
• ATEX	II 2 G and I M2 Ex ib IIC T4; Ex ib I KEMA 04 ATEX 1243 0344
• IECEx	IECEx IECEx KEM 05.0005
• INMETRO	INMETRO BR OCP-0029 BR-Ex ib IIC T4 / BR-Ex ib I
• FM	Class I, Zone 1, AEx ib IIC T4; Ex ib IIC T4 NI, Class I, DIV. 2, G. A,B,C,D T4 Class II, III, GP E,F,G
• cULus	LISTED 7XA1 Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx de ib IIC T4; Ex de ib IIC T4 Class I, Div 2, GP. A,B,C,D T4
Voltages, currents, electrical potentials	
Electrical isolation	
• Between the backplane bus and electronic components	No
• between PROFIBUS RS 485-IS and electronic circuits	Yes
Current consumption from power supply (power bus)	max. 30 mA
Power loss from the module	0.5 W

Technical specifications	
Status, interrupts, diagnostics	
Interrupts	Yes
Diagnostics function	Yes
• Group error • Bus monitoring • Redundancy	Red "SF" LED Red "BF" LED Yellow "ACT" LED
• Monitoring of the power supply voltage of the electronic circuit	Green "ON" LED
• Monitoring of the power supply at power supply PS 1 • Monitoring of the power supply at power supply PS 2	Green "PS1" LED green "PS2" LED
Safety data	
See EC-type-examination certificate	KEMA 04ATEX1243
Maximum values for PROFIBUS RS 485-IS interface:	
• Uo	±3.9 V
• Io	±136 mA
• Po	132 mW
• U_i	±4.2 V

11.2 Parameters for the IM 152

Parameter

The procedure for setting parameters is described in the Chapter "Commissioning (Page 133)".

Table 11- 1 Parameters for the interface module IM 152

IM 152 parameters	Range of values	Default	Applicability
Operation at Preset <> Actual Configuration	• disable • enable	disable	ET 200iSP
Self-diagnosis	• disable • enable	disable	ET 200iSP
Redundant Power Supply diagnostics	• No redundant power supply • Redundant Power Supply • Redundant Power Supply required	No redundant power supply	ET 200iSP
Diagnostic interrupts[1)]	• disable • enable	disable	ET 200iSP
Hardware interrupts[1)]	• disable • enable	disable	ET 200iSP
Time stamping (enable parameter)[2]	• Yes • No	No	ET 200iSP
Edge evaluation event entering state[2]	• rising edge (0-->1) • falling edge (1-->0) • Channel-specific	rising edge (0-->1)	ET 200iSP
Data format	• SIMATIC S7	SIMATIC S7	ET 200iSP
Noise suppression	• 50 Hz • 60 Hz	50 Hz	ET 200iSP
Temperature unit	• Celsius • Fahrenheit	Celsius	ET 200iSP
Slot reference junction 1 to 2	• None • 4 to 35	None	ET 200iSP
Input reference junction 1 to 4	• RTD on channel 0 • RTD on channel 1 • RTD on channel 2 • RTD on channel 3	RTD on channel 0	ET 200iSP

[1] It may or may not be possible to edit these parameters, depending on the configuration tool used.
[2] Can only be assigned in HW Config and if the ET 200iSP is being operated as an S7 DP slave.

11.3 Identification and Message Functions (I&M)

Reference

For information on the I&M, refer to the Chapter "Identification data I&M (Page 54)".

11.4 Description of the parameters for the IM 152

11.4.1 Operation at Preset <> Actual Configuration

Description

If the parameter is enabled and:

- a module is removed and inserted during operation, this does not lead to a station failure of the ET 200iSP.
- the actual configuration differs from the preset configuration, the ET 200iSP continues to exchange data with the DP master.

If the parameter is disabled and:

- modules are removed and inserted during operation, this leads to a station failure of the ET 200iSP.
- The actual configuration differs from the preset configuration, no data exchange takes place between the DP master and the ET 200iSP.

11.4.2 Self-diagnostics

Description

If this parameter is enabled, the diagnostic data for the redundant Power Supply PS are evaluated.

11.4.3 Redundant power supply diagnostics

Description

This parameter specifies the diagnostic behavior for the redundant Power Supply:

- "No redundant Power Supply": no diagnostics; station failure in event of Power Supply failure.
- "Redundant Power Supply": Diagnostics for failure of Power Supply PS 1 or PS 2.

  This setting is required if you are using two Power Supply units in a redundant configuration.
- "Redundant Power Supply required": Diagnostics and station failure in event of Power Supply failure.

11.4.4 Diagnostic interrupts

Description

This parameter allows you to enable or disable diagnostic interrupts ("main switch" for the ET 200iSP). Diagnostic interrupts are supported only if the ET 200iSP is in S7 DP or DPV1 mode.

11.4.5 Hardware interrupts

Description

This parameter allows you to enable or disable hardware interrupts ("main switch" for the ET 200iSP). Hardware interrupts are supported only if the ET 200iSP is in S7 DP or DPV1 mode.

11.4.6 Time stamping / edge evaluation

Description

For information on time stamping, refer to the Chapter "Fundamentals of Time Stamping (Page 62)".

11.4.7 Data format

Description

This parameter indicates the data format of all electronic modules of the ET 200iSP.

11.4.8 Noise suppression

Description

The frequency of your alternating voltage system can affect measured values negatively, particularly in the case of both measurements in small voltage ranges and thermocouples. Specify here the dominant line frequency in your system (50 Hz or 60 Hz).

The interference frequency suppression parameter is valid for all analog electronic modules. The integration time and conversion time of the individual modules are also set by means of this parameter.

Reference

You can find more detailed information in the technical specifications of the "Analog electronic modules (Page 275)" in this manual.

11.4.9 Temperature unit

Description

With this parameter, you set the temperature unit for the temperature sensor and thermocouples.

"S7 Format" data format: Unit of temperature "Celsius" or "Fahrenheit" can be selected

The unit of temperature parameter is used for the 4AI RTD and 4AI TC analog electronic modules.

11.4.10 Slot reference junction/reference junction input

Description

For a description, refer to the Chapter "Fundamentals of analog value processing (Page 311)".

See also

Wiring thermocouples (Page 311)

Digital electronic modules 12

12.1 Digital electronics module 8 DI NAMUR

Order number

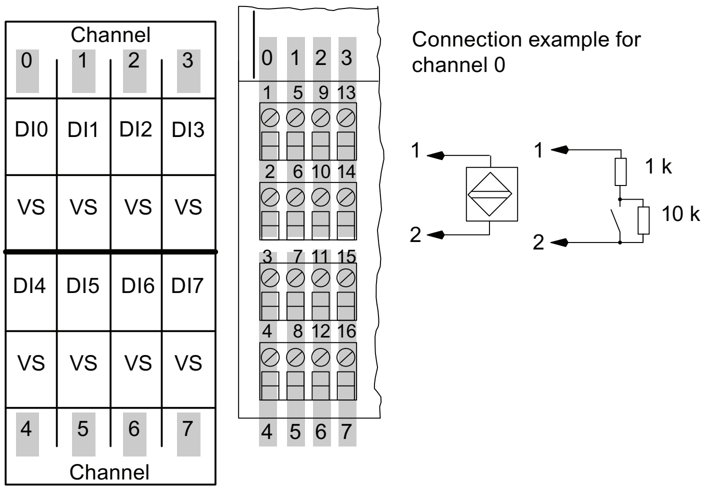
6ES7131-7RF00-0AB0

Properties

- Digital electronic module with 8 inputs
- Sensor power supply 8 V DC
- Suitable for NAMUR sensors and both closed and open mechanical contacts
- Counting and frequency measurement

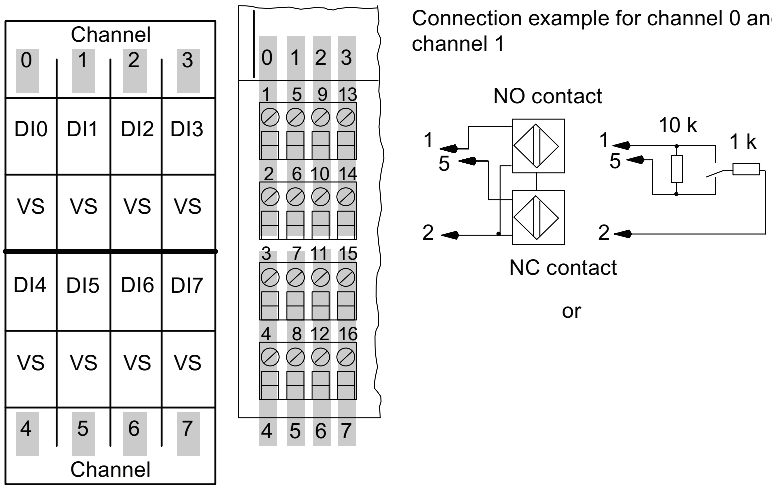
Pin assignment for NAMUR sensors or sensors complying with DIN 19234

Table 12- 1 Pin assignment for NAMUR sensors or sensors complying with DIN 19234

Pin assignment and view	Remarks
	**Sensor 1**: Channel 0: Terminals 1 and 2 **Sensor 2**: Channel 1: Terminals 5 and 6 **Sensor 3**: Channel 2: Terminals 9 and 10 **Sensor 4**: Channel 3: Terminals 13 and 14 **Sensor 5**: Channel 4: Terminals 3 and 4 **Sensor 6**: Channel 5: Terminals 7 and 8 **Sensor 7**: Channel 6: Terminals 11 and 12 **Sensor 8**: Channel 7: Terminals 15 and 16 DI: Input signal V_S: Sensor supply

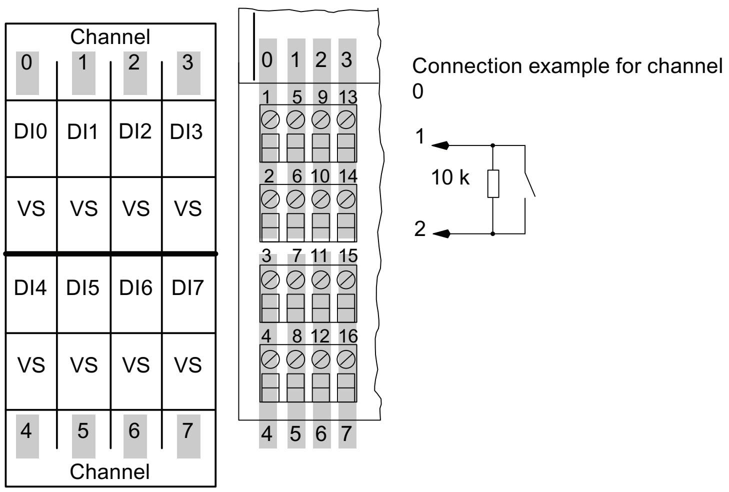
Pin assignment for NAMUR Changeover Contacts or Sensors to DIN 19234 Changeover Contacts

Table 12- 2 Pin assignment for NAMUR Changeover Contacts or Sensors to DIN 19234 Changeover Contacts

<table>
<tr><th>Pin assignment and view</th><th>Remarks</th></tr>
<tr><td>
</td><td>Changeover contact 1:
Channel 0: Terminals 1 and 2
Channel 1: Terminal 5
Changeover contact 2:
Channel 2: Terminals 9 and 10
Channel 3: Terminal 13
Changeover contact 3:
Channel 4: Terminals 3 and 4
Channel 5: Terminal 7
Changeover contact 4:
Channel 6: Terminals 11 and 12
Channel 7: Terminal 15
DI: Input signal
V_S: Sensor supply</td></tr>
</table>

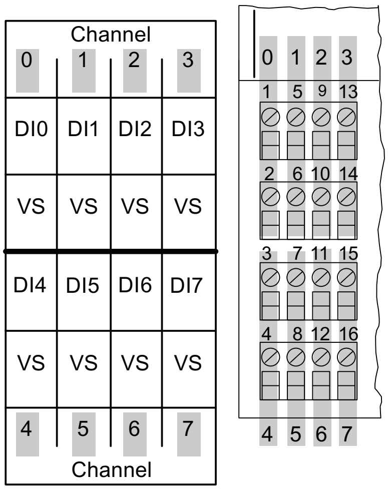
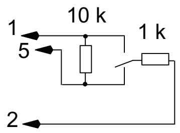
Pin assignment of a single contact with 10 kΩ load resistance (mechanical NO contact)

Table 12- 3 Pin assignment of a single contact with 10 kΩ load resistance (mechanical NO contact)

<table>
<tr><th>Pin assignment and view</th><th>Remarks</th></tr>
<tr><td>
</td><td>Single contact 1:
Channel 0: Terminals 1 and 2
Single contact 2:
Channel 1: Terminals 5 and 6
Single contact 3:
Channel 2: Terminals 9 and 10
Single contact 4:
Channel 3: Terminals 13 and 14
Single contact 5:
Channel 4: Terminals 3 and 4
Single contact 6:
Channel 5: Terminals 7 and 8
Single contact 7:
Channel 6: Terminals 11 and 12
Single contact 8:
Terminals 15 and 16
DI: Input signal
V_S: Sensor supply</td></tr>
</table>

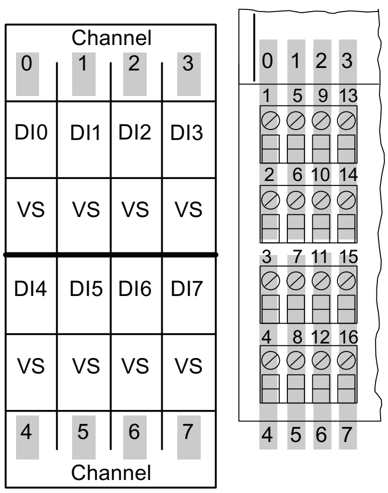
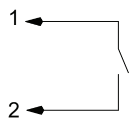
Pin assignment of a single, changeover contact with 10 kΩ (mechanical normally open contact)

Table 12- 4 Pin assignment of a closed changeover contact with 10 kΩ (mechanical changeover contact)

Pin assignment and view	Remarks
 Connection example for channel 0 and channel 1 	**Changeover contact 1:** Channel 0: Terminals 1 and 2 Channel 1: Terminal 5 **Changeover contact 2:** Channel 2: Terminals 9 and 10 Channel 3: Terminal 13 **Changeover contact 3:** Channel 4: Terminals 3 and 4 Channel 5: Terminal 7 **Changeover contact 4:** Channel 6: Terminals 11 and 12 Channel 7: Terminal 15 DI: Input signal V_S: Sensor supply

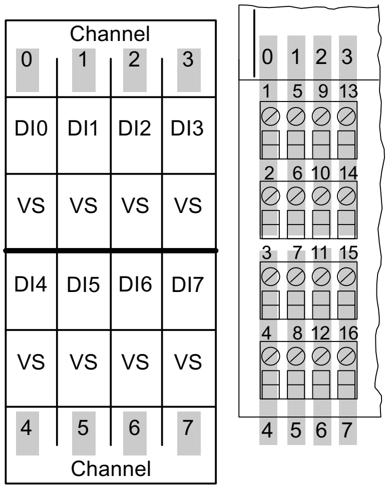
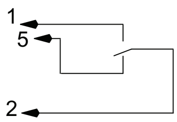
Pin assignment of a single contact without load resistance (mechanical NO contact with single contact)

Table 12- 5 Pin assignment of a single contact without load resistance (mechanical NO contact with single contact)

Pin assignment and view	Remarks
 Connection example for channel 0 	**Single contact 1:** Channel 0: Terminals 1 and 2 **Single contact 2:** Channel 1: Terminals 5 and 6 **Single contact 3:** Channel 2: Terminals 9 and 10 **Single contact 4:** Channel 3: Terminals 13 and 14 **Single contact 5:** Channel 4: Terminals 3 and 4 **Single contact 6:** Channel 5: Terminals 7 and 8 **Single contact 7:** Channel 6 Terminals 11 and 12 **Single contact 8:** Terminals 15 and 16 DI: Input signal V_S: Sensor supply

Pin assignment of a changeover contact without load resistance (mechanical changeover contact)

Table 12- 6 Pin assignment of a changeover contact without load resistance (mechanical changeover contact)

Pin assignment and view	Remarks
 Connection example for channel 0 and channel 1 	**Changeover contact 1:** Channel 0: Terminals 1 and 2 Channel 1: Terminal 5 **Changeover contact 2:** Channel 2: Terminals 9 and 10 Channel 3: Terminal 13 **Changeover contact 3:** Channel 4: Terminals 3 and 4 Channel 5: Terminal 7 **Changeover contact 4:** Channel 6: Terminals 11 and 12 Channel 7: Terminal 15 DI: Input signal V_S: Sensor supply

Block diagram

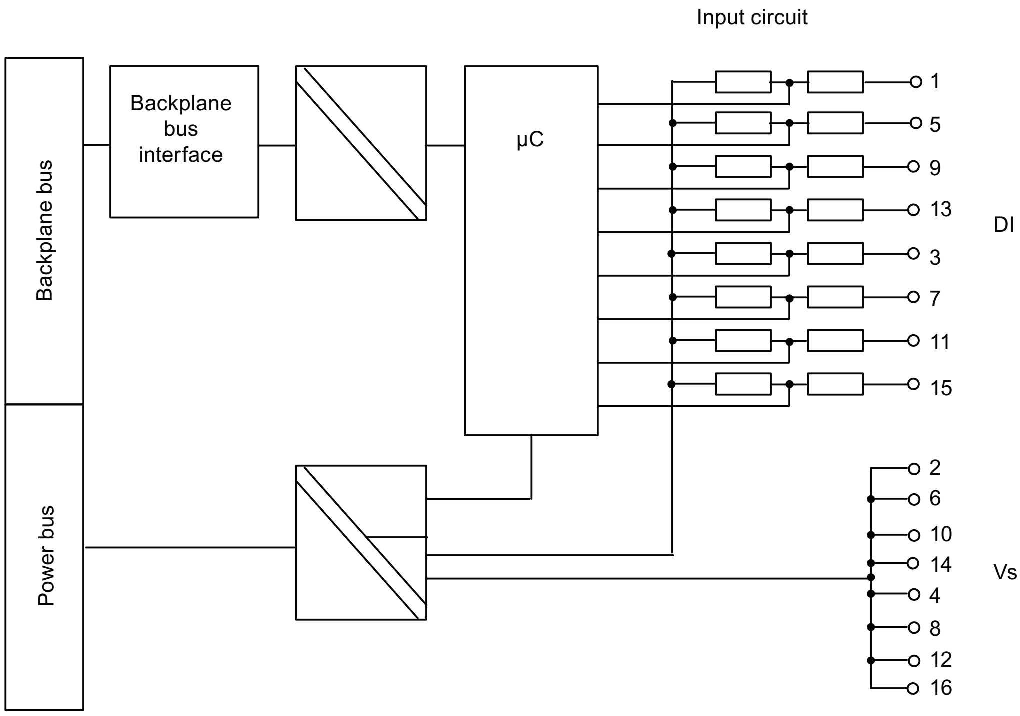


Figure 12-1 Block diagram of the 8 DI NAMUR

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	Approx. 255 g
Module-specific data	
Number of inputs	8
Cable length	
• shielded	Max. 500 m[1]
Approvals	
• ATEX	II 2 G (1) GD and I M2 Ex ib[ia] [iaD] IIC T4; Ex ib[ia] I KEMA 04 ATEX 1248 CE 0344
• IECEx	IECEx KEM 05.0010
• INMETRO (INMETRO; BR OCP-0029)	BR-Ex ib [ia] IIC T4 / BR-Ex ib [ia] I
• FM (FM C US APPROVED)	Class I, Zone 1, AEx ib[ia] IIC T4; Ex ib[ia] IIC T4 AIS, Class I, II, III DIV. 1, GP . A,B,C,D,E,F,G Class II, III, GP E,F,G
• cULus (LISTED 7XA1)	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx ib[ia] IIC T4; Ex ib[ia] IIC T4 ASSOC APP. CLI, DIV.2, GP . A,B,C,D PROVIDING INT. SAFE CIRCUITS FOR CLI, GP . A,B,C,D; CL. II, III, GP . E, F, G
Voltages, currents, electrical potentials	
Number of inputs	8
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels	No
Permissible potential difference	
• between different external circuits	60 V DC, 30 V AC
Current consumption	
• From supply voltage (power bus) with 8 x NAMUR sensors	max. 70 mA
• from power supply (power bus) with unconnected contact	max. 90 mA

Technical specifications	
Power loss from the module	
• with 8 x NAMUR sensors	0.84 W
• with unconnected contact	1.1 W
Status, interrupts, diagnostics	
Status display	
• Inputs	Green LED for each channel
Interrupts	
• Hardware interrupt	No
• Diagnostic interrupt	Yes, can be set
Diagnostic functions	
• Group error display	Red "SF" LED
• Diagnostic information can be read	Yes
Monitoring for	
• Short-circuit	R_{load} < 150 Ω[2]
• Wirebreak	I_{load} < 0.2 mA[3]
Safety data	
See EC-type-examination certificate	KEMA 04ATEX1248
Data for selecting a sensor	
Input current for NAMUR sensor [4] • for "1" signal • for "0" signal	Complies with NAMUR and EN 50227 min. 2.1 mA max. 1.2 mA
Input current for a 10 kΩ connected contact [3]	
• for "1" signal	min. 2.1 mA
• for "0" signal	max. 1.2 mA
Input current for an unconnected contact	
• for signal "1" (channel 0,1)	typ. 9.5 mA
• for "1" signal (channels 2 to 7)	typ. 7.5 mA
• Permissible quiescent current	0.5 mA
Input delay	
• for "0" to "1"	2.8 ms to 3.5 ms
• for "1" to "0"	2.8 ms to 3.5 ms
Tolerated changeover time for changeover contacts	300 ms
Parallel connection of inputs	No
Counter	
Normal or periodic counting functions	
• Quantity	2
• Channel	0, 1

Technical specifications	
Cascaded counting function	
• Quantity	1
• Channel	0
Cascaded counting function	
Sensor (max. frequency)	
• Pulse-no-pulse ratio	1:1
• Edge steepness	min. 100 ms
• Line resistance	$R_{line} \leq 1\ k\Omega$
Input frequency	
• max. line length 20 m	5 kHz
• max. line length 100 m	1 kHz
• max. line length 200 m	500 Hz
Pulse time	200 µs
Frequency meter	
Quantity	2
Channel	0, 1
Measuring frequency (GATE time)	50 ms, 200 ms, 1 s
Resolution frequency	
• at a GATE time of 50 ms	20 Hz
• at a GATE time of 200 ms	5 Hz
• at a GATE time of 1 s	1 Hz
Input frequency[5]	
• max. line length 20 m	5 kHz
• max. line length 100 m	1 kHz
• max. line length 200 m	500 Hz

[1] Maximum line length for counter and frequency meter is 200 m.

[2] applies to NAMUR sensors/ sensors according to DIN 19234 and NAMUR changeover contacts / sensors according to DIN 19234 changeover contacts.

[3] applies to NAMUR sensors/ sensors according to DIN 19234/ single contact with 10 kΩ connected and NAMUR changeover contacts/ sensors according to DIN 19234 changeover contacts/ changeover contacts with 10 kΩ connected.

[4] Input has a switching hysteresis of 0.2 mA (as of product version 05 of 8 DI NAMUR).

[5] If the input frequency rises above 8 kHz, correct actual values can no longer be output.

Diagnosis for changeover contact sensor types

When a diagnosis is made for the changeover contact sensor type, the digital electronic module controls the switchover between two input channels. If there is no signal change in the normally closed contact after the set switchover time (see technical specifications), the module reports diagnostic information.

Purpose

You can use the diagnosis for

- checking the sensor
- to make absolutely sure that there has been a switchover between a normally open contact and normally closed contact.

Principle

If the digital inputs of a channel group are assigned parameters as changeover contacts, the module runs diagnostics for changeover contact sensor types for this channel group. The tolerated switchover time between the two channels is set to the fixed value of 300 ms.

If the validity check is negative, the following applies:

- The module designates the value status of the normally open contact channel as invalid.
- The module creates a diagnostic entry for the NO contact channel.
- The module triggers a diagnostic interrupt.

The digital input signal and the value status are only updated for the NO contact channel (channel 0, 2, 4, 6). In the case of the NC contact channel (channel 1, 3, 5 and 7) the digital input signal is fixed at "zero" and the value status is "invalid" because this channel is only used for a validity check of the sensor.

Note the following points when carrying out a diagnosis for a changeover contact sensor type:

- If there is already an error on the normally open contact channel (a wire break, for example), the module no longer performs diagnostics for changeover contact errors. The diagnostics for changeover contact errors continues on the second channel.
- You will find additional points to note in the following table:

Table 12- 7 Diagnosis for changeover contacts

<table>
<tr><th>Changeover contact</th><th colspan="2">A negative check means...</th></tr>
<tr><td>Changeover contact as NAMUR</td><td>• Short-circuit or
• Wirebreak</td><td rowspan="3">Additionally:
Changeover contact or external fault (in case of DP diagnostics)</td></tr>
<tr><td>Closed changeover contact</td><td>• Sensor defective or short-circuit
No distinction can be made here between a defective-sensor and short circuit</td></tr>
<tr><td>Open changeover contact</td><td>Caution: no differentiation possible between
• signal "0" and wire break
• Signal "1" and short circuit</td></tr>
</table>

12.2 Digital electronics module 4 DO

Order number

Type	Order number
4 DO DC23.1V/20mA SHUT DOWN "H"	6ES7132-7RD01-0AB0
4 DO DC17.4V/27mA SHUT DOWN "H"	6ES7132-7RD11-0AB0
4 DO DC17.4V/40mA SHUT DOWN "H"	6ES7132-7RD21-0AB0
4 DO DC23.1V/20mA SHUT DOWN "L"	6ES7132-7GD00-0AB0
4 DO DC17.4V/27mA SHUT DOWN "L"	6ES7132-7GD10-0AB0
4 DO DC17.4V/40mA SHUT DOWN "L"	6ES7132-7GD20-0AB0

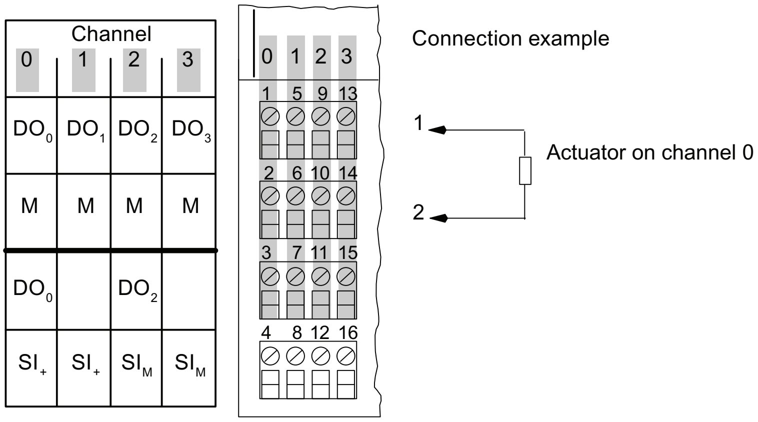
Properties

- 3 variants of SHUT DOWN "H" output modules
- 3 variants of SHUT DOWN "L" output modules
- 4 outputs per module
- Nominal load voltage 23.1 V DC or 17.4 V DC
- Outputs suitable for EEx i solenoid valves, DC current relay and actuators
- To enhance performance, you can connect in parallel two digital outputs of electronic module 4 DO DC17.4V/27mA or 4 DO DC 17.4V/40mA for one actuator. This increased power is permitted only on the same module and between the following channels:
  – Channel 0 and channel 1 Jumper from terminal 1 to terminal 5; DO connection to terminal 3
  – Channel 2 and channel 3 Jumper from terminal 9 to terminal 13; DO connection to terminal 11
- You must connect an intrinsically safe shutdown signal to the actuator disconnection input. This allow the simultaneous deactivation of all outputs of the electronic module. The function does not affect the process image output table (POI).
  – SHUT DOWN "H" output modules: Deactivation via High active, intrinsically safe switching signal.
  – SHUT DOWN "L" output modules: Deactivation via Low active, intrinsically safe switching signal.

NOTICE
Note that SHUT DOWN "H" output modules and SHUT DOWN "L" output modules require separate switching signal connections.

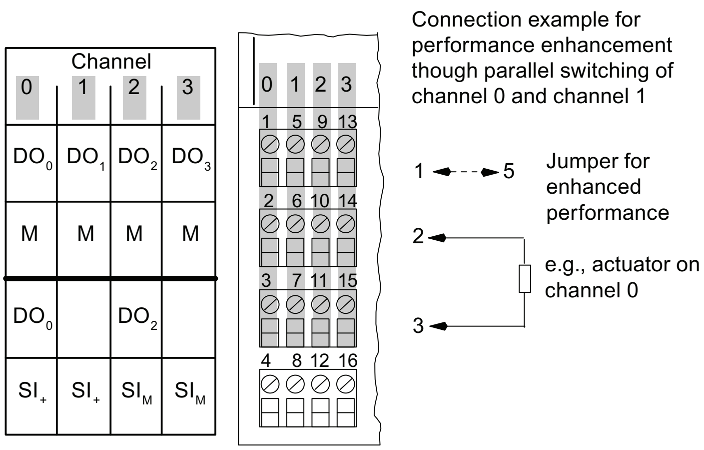
Pin assignment of actuators

Table 12- 8 Pin assignment of actuators

<table>
<tr><th>Pin assignment and view</th><th>Remarks</th></tr>
<tr><td>
</td><td>Actuator terminals:
Channel 0: Terminals 1 and 2
Channel 1: Terminals 5 and 6
Channel 2: Terminals 9 and 10
Channel 3: Terminals 13 and 14
DO: Digital outputs
M: Chassis ground</td></tr>
</table>

Pin assignment for enhanced performance (only for 4 DO DC17.4V/27mA, 4 DO DC17.4V/40mA)

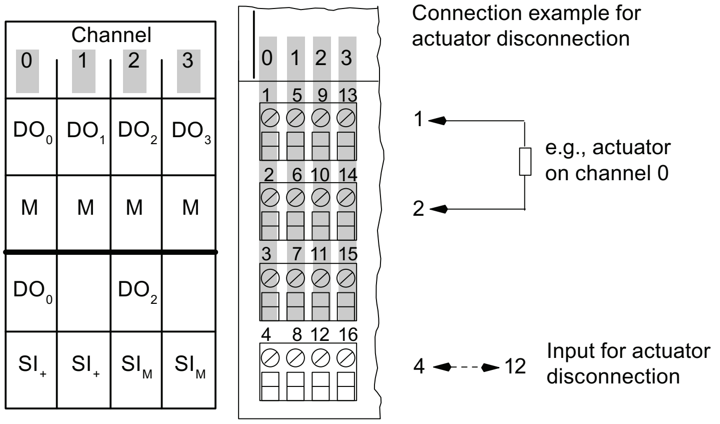
Table 12- 9 Pin assignment for enhanced performance

<table>
<tr><th>Pin assignment and view</th><th>Remarks</th></tr>
<tr><td>
</td><td>Increased power:
Parallel wiring of channel 0 and channel 1: Jumper from 1 to 5; actuator at 2 and 3
Parallel wiring of channel 2 and channel 3 Jumper from 9 to 13; actuator at 10 and 11
DO: Digital outputs
M: Chassis ground</td></tr>
</table>

NOTICE
If the actuator disconnection signal is wired in parallel via terminals 4/8 and 12/16, note this connection will be interrupted when a 4DO module is removed. If hot swapping is intended when the actuator disconnection is activated, the individual modules must be connected directly to the signal source.

Pin assignment for actuator disconnection

Table 12- 10 Pin assignment for actuator disconnection

Pin assignment and view	Remarks
	**Actuator deactivation of all outputs channel 0 to channel 3:** Terminal 4/8: High active (intrinsically safe) or low active signal (see Figure "Actuator disconnection via intrinsically safe shutdown signal for SHUT DOWN "H" output modules") Terminal 12/16: Chassis ground DO: Digital outputs M: Chassis ground SI_+: Signal input for actuator disconnection SI_M: Chassis ground

Block diagram

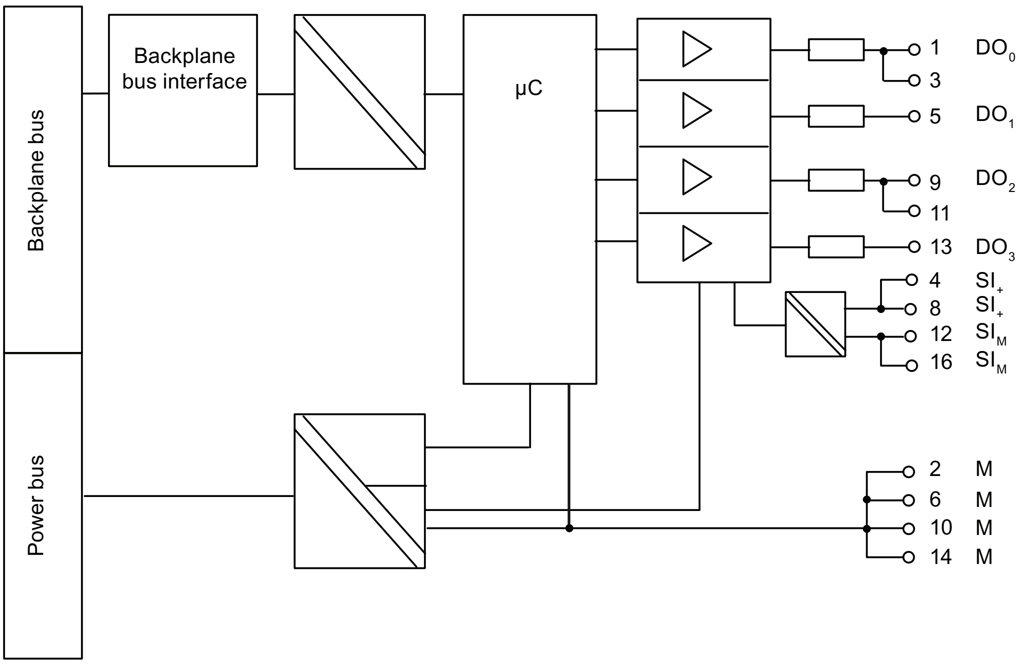


Figure 12-2 Block diagram of the 4 DO

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	Approx. 255 g
Module-specific data	
Number of outputs	4
Cable length	
• unshielded	max. 500 m
• shielded	max. 500 m
Approvals	
• ATEX	II 2 G (1) GD and I M2 Ex ib [ia] [iaD] IIC T4; Ex ib [ia] I KEMA 04 ATEX 1249 0344
• IECEx	IECEx IECEx KEM 05.0011
• INMETRO	INMETRO BR OCP-0029 BR-Ex ib [ia] IIC T4 / BR-Ex ib [ia] I
• FM	Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 AIS, Class I, II, III, DIV. 1, GP. A,B,C,D,E,F,G Class II, III, GP E,F,G
• cULus	LISTED 7XA1 Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 ASSOC APP. CLI, Div 2, GP . A,B,C,D PROVIDING INT. SAFE CIRCUITS FOR CLI, GP . A,B,C,D Cl. II, III, GP. E,F,G
Voltages, currents, electrical potentials	
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels	No
• Between the channels and load voltage (power bus)	Yes
• Between the channels and actuator disconnection input	Yes
Permissible potential difference	
• between different circuits	60 V DC, 30 V AC

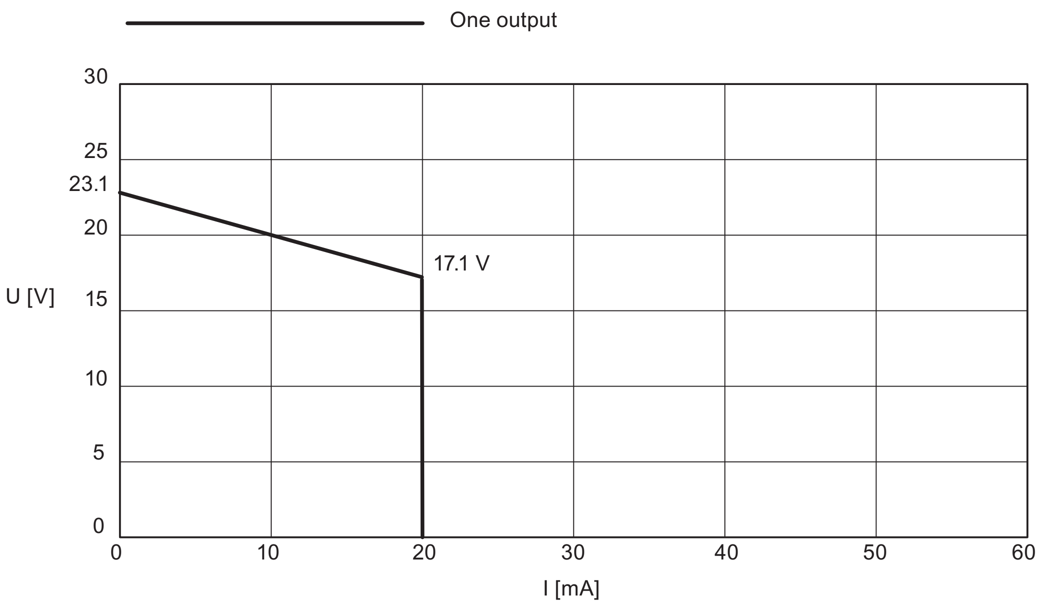
Technical specifications	
Current consumption from load voltage (power bus)	
• 4 DO DC23.1V/20mA SHUT DOWN "H"/ "L"	max. 340 mA
• 4 DO DC17.4V/27mA SHUT DOWN "H"/ "L"	max. 300 mA
• 4 DO DC17.4V/40mA SHUT DOWN "H"/ "L"	max. 400 mA
Power loss from the module	
• 4 DO DC23.1V/20mA SHUT DOWN "H"/ "L"	2.5 W
• 4 DO DC17.4V/27mA SHUT DOWN "H"/ "L"	2.1 W
• 4 DO DC17.4V/40mA SHUT DOWN "H"/ "L"	2.8 W
Status, interrupts, diagnostics	
Status display	
• Outputs	Green LED for each channel
Interrupts	
• Hardware interrupt	No
• Diagnostic interrupt	Yes, can be set
Diagnostic functions	
• Group error display	Red "SF" LED
• Diagnostic information can be read	Yes
Monitoring for	
• Short-circuit	R < 80 Ω (one output) R < 40 Ω (outputs wired in parallel)
• Wirebreak	R[1] > 10 kΩ I < 100 µA
Safety data	
See EC-type-examination certificate	KEMA 04ATEX1249
Maximum values for intrinsically safe switching signal SO:	
• U_i	28 V
• I_i	Not applicable
• P_i	1.2 W
• C_i	3 nF
• L_i	0 mH
Actuator selection data	
No load voltage U_{AO}	
• 4 DO DC23.1V/20mA SHUT DOWN "H"/ "L"	min. 23.1 V
• 4 DO DC17.4V/27mA SHUT DOWN "H"/ "L"	min. 17.4 V
• 4 DO DC17.4V/40mA SHUT DOWN "H"/ "L"	min. 17.4 V
Internal resistance R_i	
• 4 DO DC23.1V/20mA SHUT DOWN "H"/ "L"	275 Ω
• 4 DO DC17.4V/27mA SHUT DOWN "H"/ "L"	150 Ω
• 4 DO DC17.4V/40mA SHUT DOWN "H"/ "L"	150 Ω

Technical specifications	
Curve vertices E for 4 DO DC23.1/20mA SHUT DOWN "H"/ "L"	
• Voltage U_E	min. 17.1 V
• Current I_E	min 20 mA (one output)
Curve vertices E for 4 DO DC17.4/27mA SHUT DOWN "H"/ "L"	
• Voltage U_E	min. 13.2 V
• Current I_E	min 27 mA (one output) min. 54 mA (outputs switched in parallel)
Curve vertices E for 4 DO DC17.4/40mA SHUT DOWN "H"/ "L"	
• Voltage U_E	min. 11.0 V
• Current I_E	min 40 mA (one output) min. 80 mA (outputs switched in parallel)
Output delay (resistive load)	
• for "0" to "1"	2 ms
• for "1" to "0"	1.5 ms
Wiring two outputs in parallel	Yes
Switching frequency	No
• with resistive load	100 Hz
• with inductive load	2 Hz
Short circuit-proof output	Yes
Leakage current of the output	max. 25 µA
Data for selecting a sensor for the safety barrier[2]	
Minimum switching voltage	10.5 V
Minimum switching current	2 mA
[1] R=load resistance + line resistance [2] An unconnected contact is required as the input	

Output characteristic curve 4 DO DC23.1V/20mA SHUT DOWN "H"/ "L"

Table 12- 11 Output characteristic curve 4 DO DC23.1V/20mA SHUT DOWN "H"/ "L"

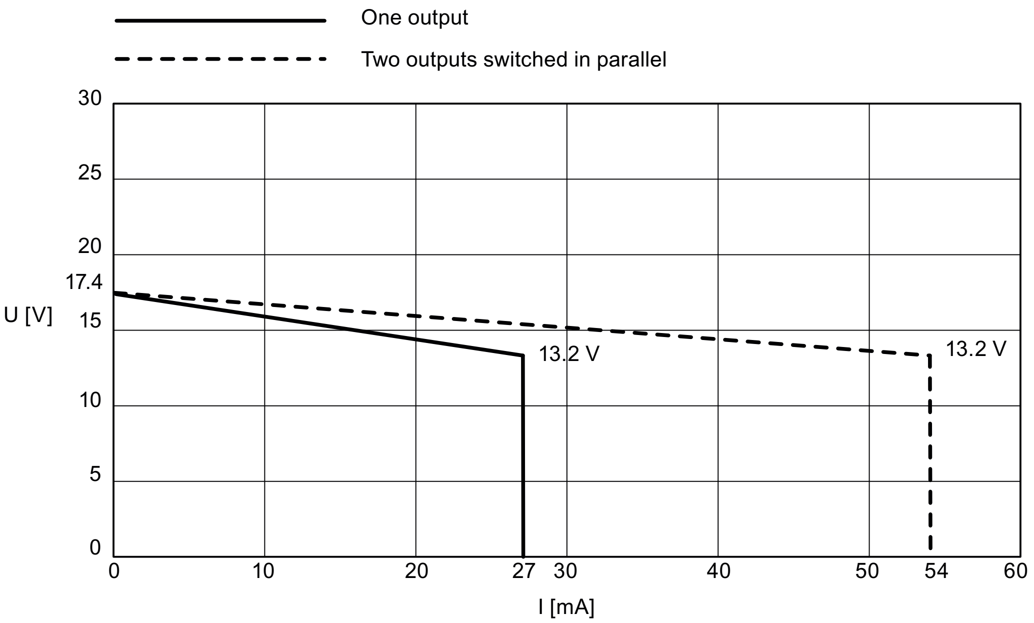
	one output



Output characteristic curve 4 DO DC17.4V/27mA SHUT DOWN "H"/ "L"

Table 12- 12 Output characteristic curve 4 DO DC17.4V/27mA SHUT DOWN "H"/ "L"

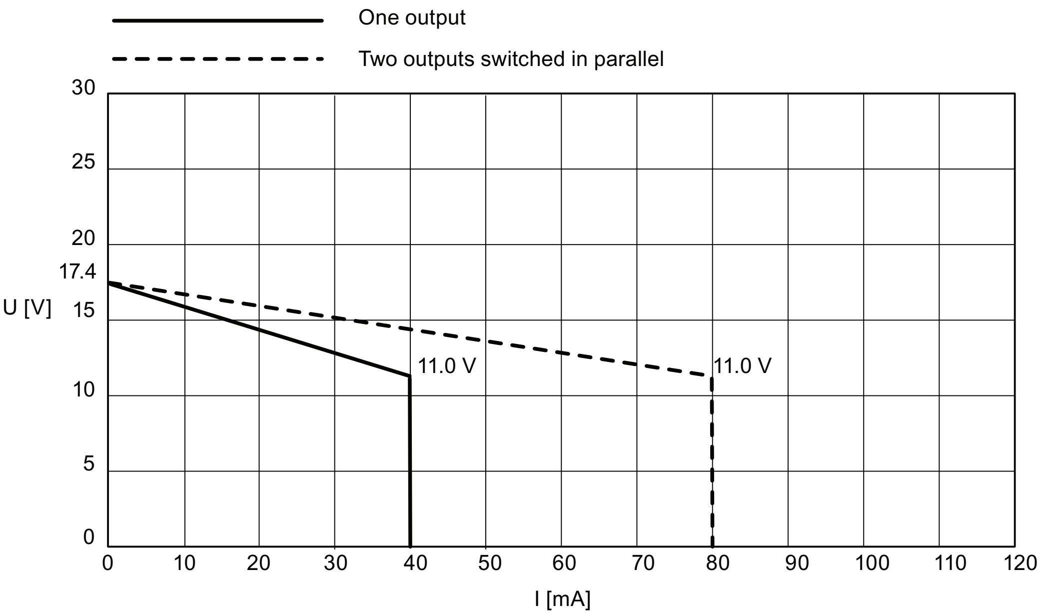
	one output
	Two outputs switched in parallel



Output characteristic curve 4 DO DC17.4V/40mA SHUT DOWN "H"/ "L"

Table 12- 13 Output characteristic curve 4 DO DC17.4V/40mA SHUT DOWN "H"/ "L"

	one output
	Two outputs switched in parallel



Actuator disconnection with an intrinsically safe shutdown signal (safety barrier)

You can use an intrinsically safe shutdown signal to shut down one or more digital output modules.

You do this by connecting the voltage of the safety barrier to terminals 4/8 (+) and 12/16 (-) of the digital output module.

You can also shut down several digital output modules switched in parallel, depending on the maximum output current at the safety barrier (see the following figure). Remember that current I_{max} = 8 mA per digital output module.

SHUT DOWN "H" output modules:

If no intrinsically safe shutdown signal is applied, the digital output module operates with its normal functionality.

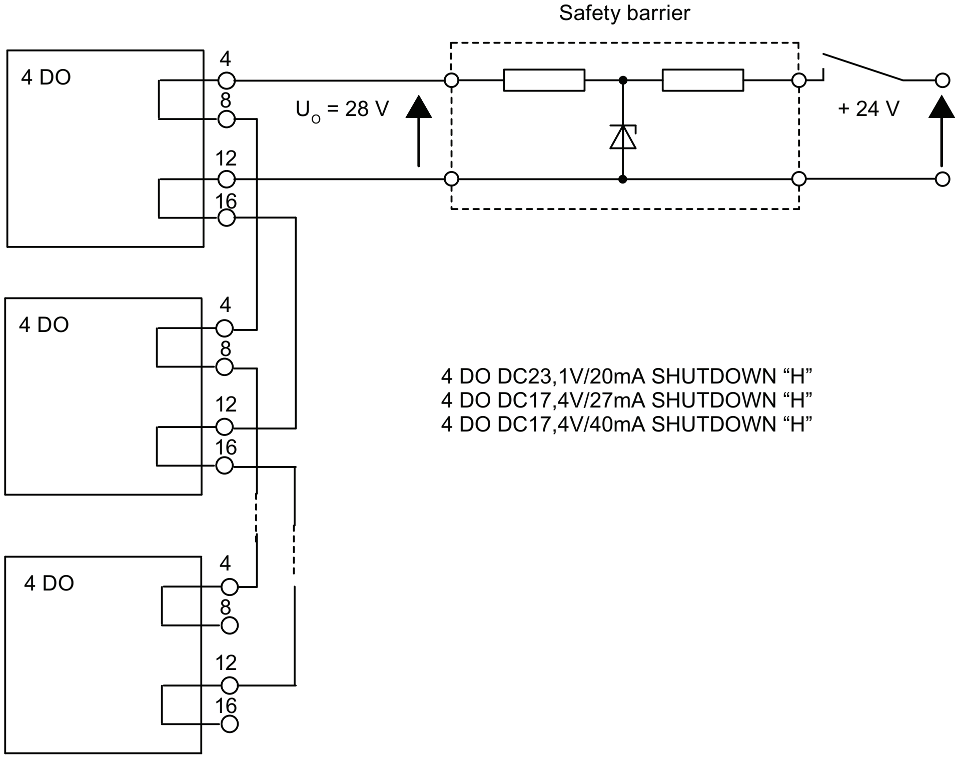


Figure 12-3 Actuator disconnection via intrinsically safe shutdown signal for SHUT DOWN "H" output modules

SHUT DOWN "L" output modules:

If no intrinsically safe shutdown signal is used, you must enable the "Deactivate shutdown signal" parameter for the SHUT DOWN "L" output modules.

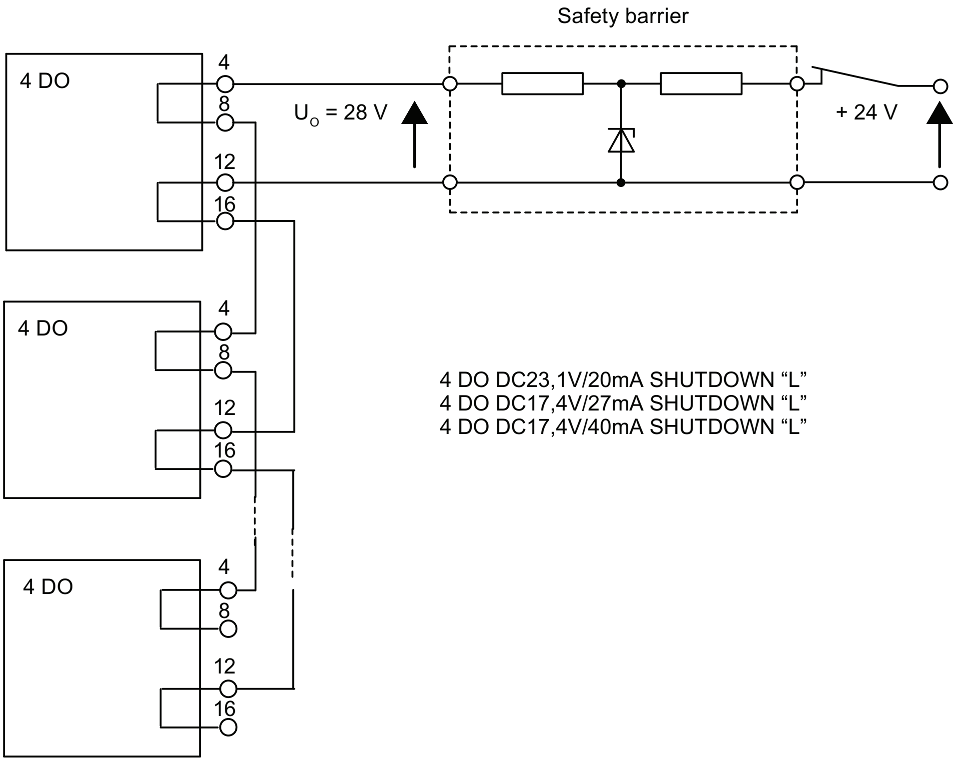


Figure 12-4 Actuator disconnection via intrinsically safe shutdown signal for SHUT DOWN "L" output modules

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Note

You can use the "Deactivate shutdown signal" parameter in HW Config only for DO modules with a "*" after the order number 6ES7....

Actuator disconnection with 11 V supply from the Watchdog module

The Watchdog module can supply 2 mA current consumption each for up to 16 digital output modules via one intrinsically safe contact K1 (e.g. Category 2G relay for installation in the Zone 1 potentially explosive area).

You do this by connecting the terminals of the intrinsically safe contact to the Pi terminal on the Watchdog module and terminals 4/8 (+) of the digital output module.

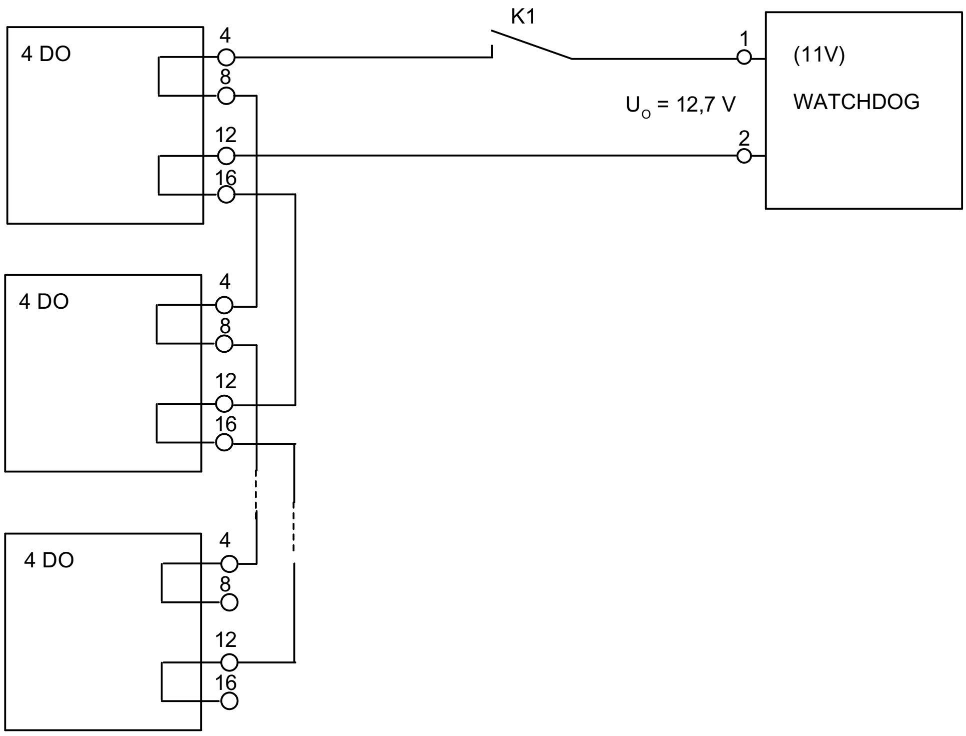


Figure 12-5 Actuator disconnection with 11 V supply from the Watchdog module

NOTICE
Only safety barriers with equipotential bonding are permitted! Connect the safety barrier and the (last) digital output module controlled by the switching signal securely to the equipotential bonding. With this wiring, all the chassis grounds of the outputs are connected to the equipotential bonding.

See also

Removing and inserting electronics modules during operation (hot swapping) (Page 187)

Interface module IM 152 (Page 231)

12.3 Digital electronic module 2 DO Relay UC60V/2A

Order number

6ES7132-7HB00-0AB0

Properties

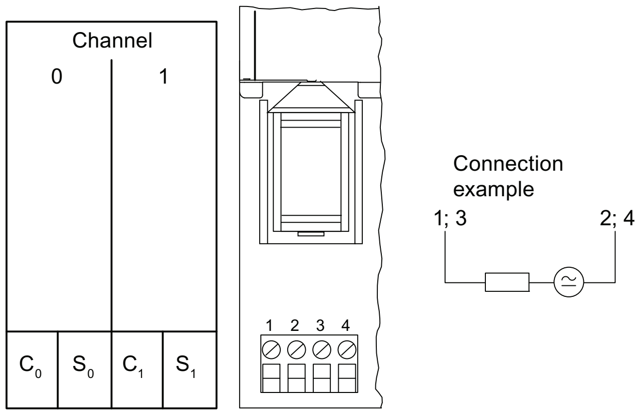
- Digital electronic module with two relay outputs
- Can only be inserted on terminal module TM-RM/RM, which means they can be used starting from slot 5 in the standard ET 200iSP configuration and from slot 4 in a redundant configuration. This configuration is checked by STEP 7.
- Output current 2 A per output
- Substitute value
- Suitable for solenoid valves, DC contactors, and indicator lights
- Isolated from the supply voltage
- NO contact

Note

If you connect an extra-low voltage system (SELV/PELF) to one channel of the relay module, you can only use an extra-low voltage (SELV/PELF) on the other channel.

Pin assignment of actuators

Table 12- 14 Pin assignment of actuators

Pin assignment and view	Remarks
	**Actuator terminals**: Channel 0: Terminals 1 and 2 Channel 1: Terminals 3 and 4 C_n: Common 0, 1 NO_n: NO contact 0, 1

Block diagram

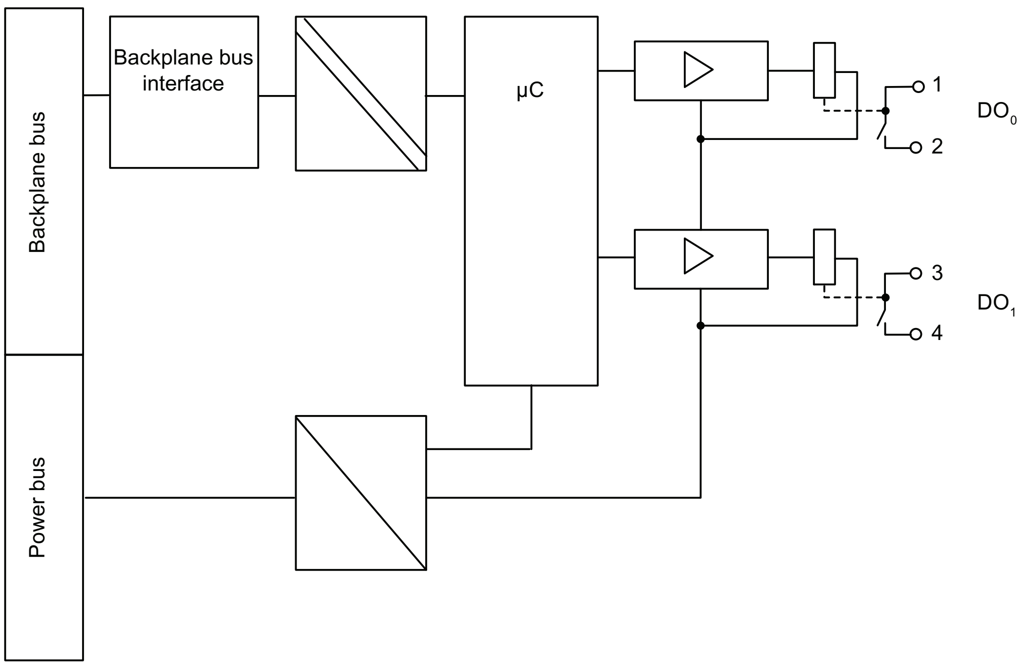


Figure 12-6 Block diagram of 2 DO Relay UC60V/2A

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	approx. 255 g
Module-specific data	
Number of outputs	2
Cable length	
• unshielded	max. 500 m
• shielded	max. 500 m
Approvals	
• ATEX	II 2 G and I M2 Ex e ib mb IIC T4; Ex e ib mb I KEMA 07 ATEX 0180 0344
• IECEx	IECEx KEM 07.0059
• INMETRO (INMETRO; BR OCP-0029)	BR-Ex e ib mb IIC T4 / BR-Ex e ib mb I
• FM (FM C US APPROVED)	Class I, Zone 1, AEx e ib mb IIC T4; Ex e ib mb IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 Class II, III, GP E,F,G
• cULus (LISTED 7XA1)	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx e ib mb IIC T4; Ex e ib mb IIC T4 Class I, DIV. 2, GP. A,B,C,D T4
Voltages, currents, electrical potentials	
Electrical isolation	
• Between channels and backplane bus	Yes
• Between channels	Yes
• Between the channels and load voltage (power bus)	Yes
Permissible potential difference	
• between different circuits	60 VDC
Current consumption from load voltage (power bus)	max. 105 mA
Power loss of module	typ. 1.1 W
Status, interrupts, diagnostics	
Status display	
• Outputs	Green LED for each channel

Technical specifications	
Interrupts	
• Hardware interrupt	No
• Diagnostic interrupt	Yes, can be set
Diagnostic functions	
• Group error display	Red "SF" LED
• Diagnostic information can be read	Yes
Safety data	
See EC-type-examination certificate	KEMA 07ATEX0180
• U_M	250 VAC/VDC
Output delay (resistive load)	
• for "0" to "1" *	7 ms
• for "1" to "0" **	3 ms
Wiring two outputs in parallel	No
Switching frequency	
• with resistive load	100 Hz
• with inductive load	2 Hz
* Activation time of relay ** Release time of relay	

Switching capacity and service life of contacts

With an external protective circuit, the contacts will last longer than specified in the following table.

The normally open contacts of the relay have a different service life. The table shows the switching capacity and service life of the contacts.

Table 12- 15 Switching capacity and service life of contacts

Resistive load	Voltage	Current	Operating examples (typ.) NO contact
for resistive load	24 VDC	2.0 A	0.5 million
		1.0 A	1.6 million
		0.5 A	4 million
		0.1 A	7 million
	60 VDC	0.5 A	1.6 million
	60 VAC	2.0 A	1.2 million
		1.0 A	2.4 million
		0.5 A	4 million
For inductive load in accordance with IEC 947-5-1 DC 13/ AC15	24 VDC	2.0 A	0.01 million
		1.0 A	0.2 million
		0.5 A	0.6 million
	60 VDC	0.5 A	0.3 million
	60 VAC	2.0 A	0.3 million
		1.0 A	0.5 million
		0.5 A	1 million
According to UL 508	60 VDC	C150 (max. 0.5 A)	0.06 million
		R150 (max. 0.5 A)	0.06 million
	60 VAC	C150 (max. 2.0 A)	0.06 million
		R150	0.06 million

Table 12- 16 Permitted switching frequency for max. 1000 switching operations

Resistive load	Voltage	Current (max.)	Switching frequency (max.)
For ohmic load, inductive load to L/R = 10 ms	24 VDC	2.0 A	1 Hz
		1.0 A	1 Hz
	60 VDC	0.5 A	1 Hz
	60 VAC	2.0 A	0.5 Hz
		1.0 A	1 Hz
For inductive load in accordance with IEC 947-5-1 DC 13/ AC15	24 VDC	2.0 A	0.2 Hz
		1.0 A	0.5 Hz
	60 VDC	0.5 A	0.5 Hz
	60 VAC	2.0 A	0.2 Hz
		1.0 A	0.5 Hz

Note

The voltage feed to the relay outputs is fuse-protected with a 6 A automatic circuit breaker with tripping characteristic C.

12.4 Identification and Message Functions (I&M)

Description

Refer to the Chapter "Identification Data I&M (Page 54)".

12.5 Parameters of the digital electronic modules

12.5.1 Digital electronic module 8 DI NAMUR

Configuration with STEP 7 as of version 5.3 Service Pack 1 and current HW update

For a description, refer to the online help for STEP 7.

Configuration with GSD file

For digital electronic module 8 DI NAMUR, there are various configurations that you can select using the following entries in the hardware catalog of the configuration software:

- "8 DI NAMUR" configuration: 8 digital inputs
- "2 Count/ 6 DI NAMUR" configuration: 2 counters and 6 digital inputs
- "2 Count/ 6 Control" configuration: 2 counters and 6 control signals
- "2 Trace/ 6 DI NAMUR" configuration: 2 frequency meters and 6 digital inputs

8 DI NAMUR parameters, "8 DI NAMUR" configuration

Table 12- 17 Parameters for "8 DI NAMUR"

Parameters	Range of values	Default	Applicability
Time stamping[1]	• enabled • disabled	disabled	Channel
Edge evaluation event entering state[1]	• rising edge (0-->1) • falling edge (1-->0)	rising edge (0-->1)	Channel
Encoder type	• Channel disabled • NAMUR sensor • Single contact, no load resistance • Single contact, connected with 10 kΩ • NAMUR changeover contact • Changeover contact, unconnected • Changeover contact, connected with 10 kΩ	NAMUR sensor	Channel
Pulse stretching	• None • 0.5 s • 1 s • 2 s	None	Channel
Group diagnostics	• enabled • disabled	enabled	Channel
Diagnostics: wire break	• enabled • disabled	enabled	Channel
Diagnostics: wire break	• enabled • disabled	enabled	Channel
Diagnostics for chatter error	• enabled • disabled	disabled	Channel
External error (changeover contact error or faulty encoder supply)	• enabled • disabled	disabled	Channel
Chatter monitoring: Monitoring window [2]	• 0.5 s • 1 s to 100 s (can be set in 1 s increments)	2 s	Channel
Chatter monitoring: Number of signal changeovers[2]	2 to 31	5	Channel
[1] Can only be assigned in HW Config and if the ET 200iSP is being operated as an S7 DP slave. [2] Parameter cannot be set unless chatter error diagnostics is enabled.			

Parameters for 8 DI NAMUR, "2 Count/ 6 DI NAMUR" or "2 Count/ 6 Control" configuration

The following parameters can be set for the counter in addition to the "8 DI NAMUR" configuration:

Table 12- 18 Parameters for "2 Count/ 6 DI NAMUR" and "2 Count/ 6 Control"

Parameters	Range of values	Default	Applicability
Sensor type counter inputs	• Channel disabled • NAMUR sensor • Single contact, no load resistance	NAMUR sensor	Channel
Mode for counter 1	• Standard counting function • Periodic counting function • Cascaded counting function	Standard counting function	Channel 0
Mode for counter 2	• Standard counting function • Periodic counting function	Standard counting function	Channel 1

Parameters for 8 DI NAMUR, "2 Count/ 6 Control" configuration

The following parameters can be set for the counter in addition to the "8 DI NAMUR" configuration:

Table 12- 19 Parameters for "2 Count/ 6 Control"

Parameters	Range of values	Default	Applicability
Control channel	• Channel disabled • NAMUR sensor • Single contact, no load resistance	NAMUR sensor	Channel

Parameters for 8 DI NAMUR, "2 Trace/ 6 DI NAMUR" configuration

The following parameters can be set for the frequency meter in addition to the "8 DI NAMUR" configuration:

Table 12- 20 Parameters for "2 Trace/ 6 DI NAMUR"

Parameters	Range of values	Default	Applicability
Sensor type frequency inputs	• Channel disabled • NAMUR sensor • Single contact, no load resistance	NAMUR sensor	Channel
Metering window (GATE)	• 50 ms • 200 ms • 1 s	1 s	Channel

12.5.2 Digital electronic module 4 DO

Parameters for 4 DO

Table 12- 21 Parameters for 4 DO

Parameters for SHUT DOWN "H" modules	Parameters for SHUT DOWN "L" modules	Range of values	Default	Applicability
Switch channels in parallel[1]		• Yes • No	No	Channel 0 Channel 2
Reaction to CPU/Master STOP		• Set substitute value • Hold last value	Set substitute value	Channel
Substitute value		• 0 • 1	0	Channel
Group diagnostics		• enabled • disabled	enabled	Channel
Diagnostics of wire-break[2]		• enabled • disabled	enabled	Channel
Diagnostics: wire break		• enabled • disabled	enabled	Channel
---	Deactivate shutdown signal[3]	• enabled • disabled	disabled	Module

[1] Not supported for 4DO DC23.1V/20mA.
[2] Wire break is detected only with a "1" signal for the digital output module.
[3] Only possible with SIMATIC PDM and in HW Config with order numbers followed by "*".

DANGER

The substitute values are stored in the flash memory of the IM 152. These are output at the next startup of the ET 200iSP until it starts exchanging data with the DP master.

Remember this behavior if you change to a different project engineering environment with the ET 200iSP.

Solution: Erase the flash memory of the IM 152 first.

12.5.3 Digital electronic module 2 DO Relay UC60V/2A

Parameters for 2 DO Relay UC60V/2A

Table 12- 22 Parameters for 2 DO Relay UC60V/2A

Parameters	Range of values	Default	Applicability
Reaction to CPU/Master STOP	• Set substitute value • Hold last value	Set substitute value	Channel
Substitute value	• 0 • 1	0	Channel

12.6 Description of the parameters of the digital electronic modules

12.6.1 Time stamping

Description

With this parameter, you can enable time stamping on a channel basis for each digital input of the module. The time stamp will be passed from the ET 200iSP to the S7-400 or OS if you also enable the "Time Stamp" parameter in the IM 152.

12.6.2 Pulse stretching

Description

Pulse extension is a function for changing a digital input signal. A pulse at a digital input is extended to at least the configured length. If the input pulse is already longer than the configured length, then the pulse will not be changed.

Principle of pulse stretching

The following figure uses examples to show if and how input pulses are changed.

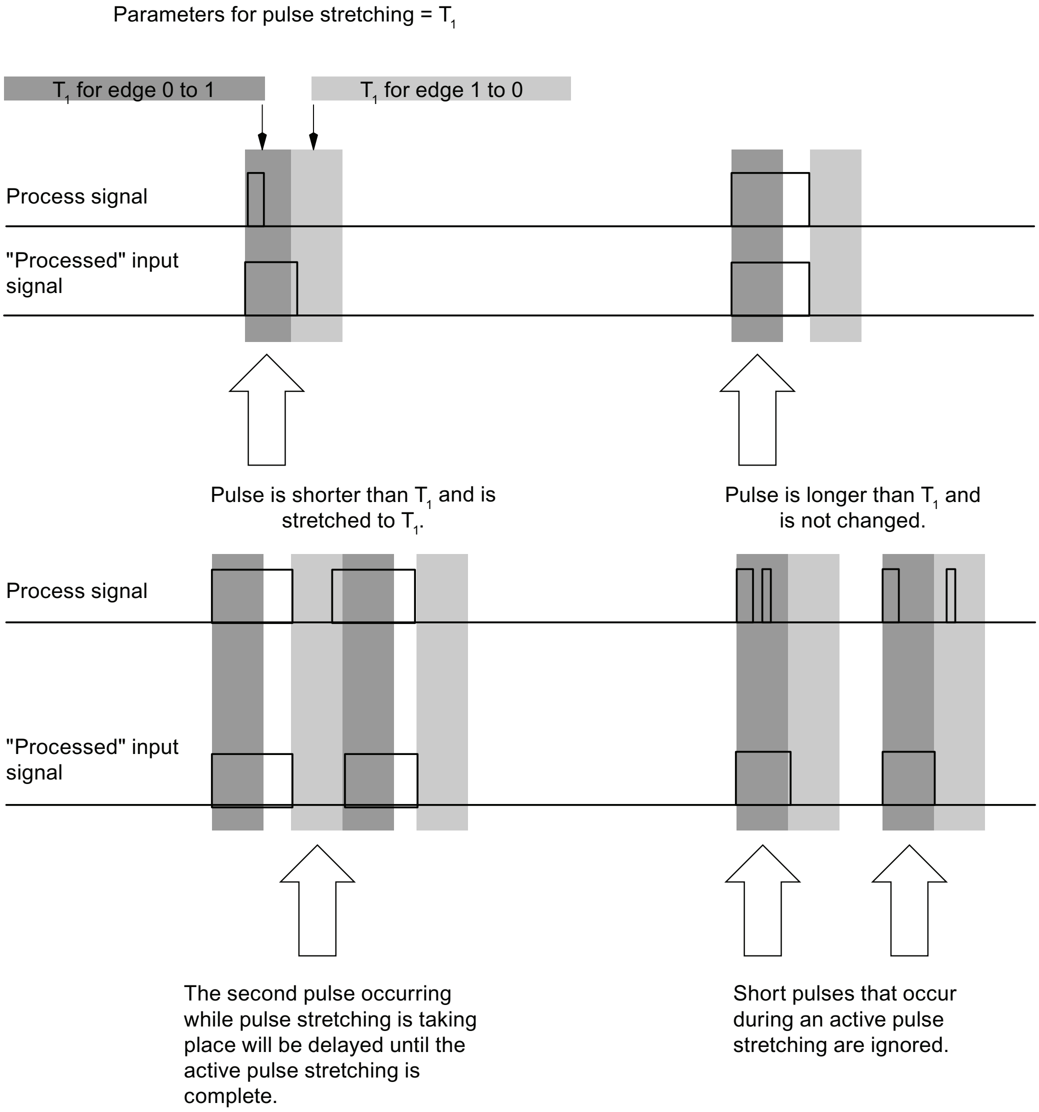


Figure 12-7 Principle of pulse stretching

Note

If you set a pulse extension for an input channel, this will also affect the flutter monitoring that you enabled for this channel. The "pulse-extended" signal is the input signal for the flutter monitoring. You should therefore match the parameter settings for pulse extension, and flutter monitoring to one another. By selecting the appropriate values for the parameters you can adjust the functions optimally to your process.

12.6.3 Flutter monitoring

Description

Chatter monitoring is a process control function for digital input signals. It detects and reports signal characteristics that are unusual from a process engineering viewpoint, such as the input signal fluctuating too frequently between "0" and "1". If signal characteristics like these occur, it is a sign that the sensors are faulty or that there are instabilities from a process engineering viewpoint.

Activating chatter monitoring

You activate chatter monitoring by setting the number of signal changes for chatter monitoring to a value other than zero.

Detecting unusual signal patterns

Each input channel has a monitoring window that has been assigned parameters. The monitoring window is started the first time the input signal changes. If the input signal changes more often within the monitoring window than the set number of signal changes, a chatter error is detected. If no chatter error is detected within the monitoring window, the monitoring window is started again at the next signal change.

Reporting a chatter error

If a chatter error has occurred, the current signal status is entered in the process image and the value of the signal is set to "invalid". A chatter error is also entered as diagnostic information, triggering an incoming diagnostic interrupt.

You must evaluate and process the status of the value and the diagnostic information in the user program.

Resetting a flutter error

If no further chattering of the input signal is detected within three monitoring windows, the diagnostic entry is removed and an outgoing diagnostic interrupt is triggered. The status of the value of the current signal in the process image is set to "valid".

Principle

The following figure gives you another graphic illustration of the principle of chatter monitoring.

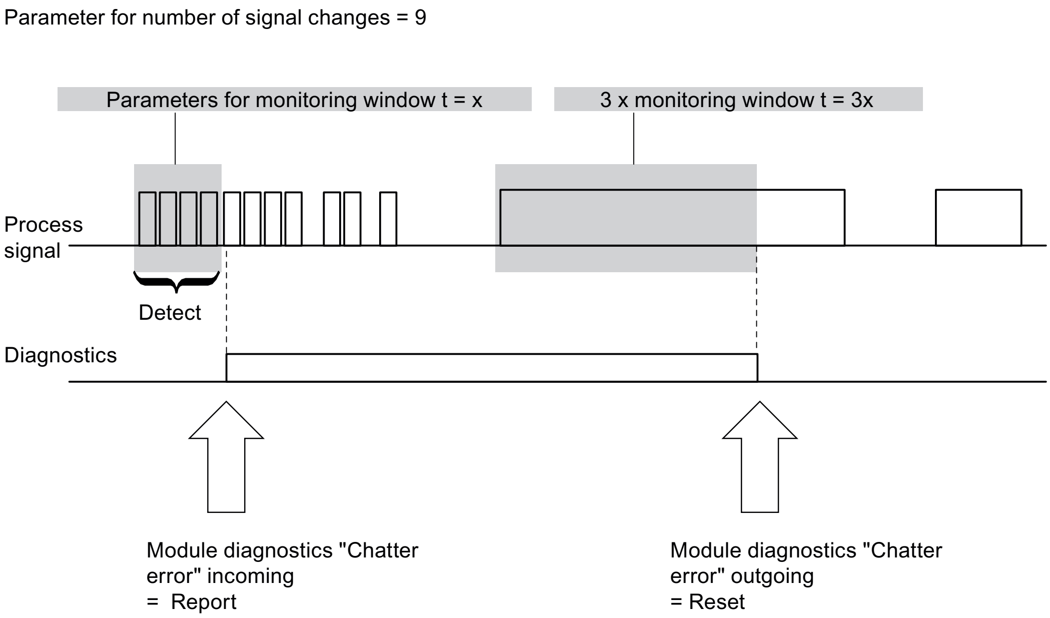


Figure 12-8 The principle of chatter monitoring

12.6.4 Shutdown signal

Parameter description: Shutdown signal

The **Shutdown signal** parameter can only be set for SHUT DOWN "L" output modules.

Enable shutdown signal: You have connected a shutdown signal.

Shutdown signal disabled: You have not connected a shutdown signal.

12.6.5 Parameters for counting

Description

Refer to Chapter "Counting (Page 66)".

See also

Properties (Page 66)

12.6.6 Parameters for metering frequencies

Description

Refer to the Chapter "Measuring frequency (Page 73)".

See also

Properties (Page 73)

13 Analog electronic modules

13.1 Behavior of the analog modules during operation and in the event of problems

Influence of the power supply and the operating state

The input and output values of the analog modules are dependent on the supply voltage for electronic components/sensors and on the operating mode of the PLC (CPU of the DP master).

Table 13- 1 How the analog input/output values depend on the operating mode of the PLC (CPU of the DP master) and the supply voltage L +

<table>
<tr><th colspan="2" rowspan="2">Operating mode of the PLC (CPU of the DP master)</th><th rowspan="2">Supply voltage L + on ET 200iSP (power supply module)</th><th>Input value of the electronic module with analog inputs (evaluation possible in the CPU of the DP master)</th><th rowspan="2">Output value of the electronic module with analog outputs</th></tr>
<tr><th>S7 format</th></tr>
<tr><td rowspan="2">POWER ON</td><td rowspan="2">RUN</td><td rowspan="2">L+ present</td><td>Process values</td><td>PLC values</td></tr>
<tr><td>7FFF_H until the first conversion after switching on or after assigning parameters to the module</td><td>Until the first value output:
• After startup, a signal of 0 V is output.
• Dependent on the "Behavior at CPU-Master-STOP" parameter</td></tr>
<tr><td rowspan="2">POWER ON</td><td rowspan="2">STOP</td><td>L+ present</td><td>Process value</td><td>Dependent on the "Behavior at CPU-Master-STOP" parameter</td></tr>
<tr><td>L+ missing</td><td>7FFF_H</td><td>-</td></tr>
</table>

Effect of the value range for the analog input

The behavior of the electronic modules with analog inputs depends on where the input values are in the value range. The following table indicates this:

Table 13- 2 Behavior of the analog modules depending on the position of the analog input value in the value range

Measured value within	Input value in the SIMATIC S7 format
Nominal range	Measured value
Overrange/underrange	Measured value
Overflow	$7FFF_H$
Underflow	8000_H
until valid measured values are available	$7FFF_H$

Influence of the range of values for the analog output

The response of the electronic module with analog outputs depends on the part of the range in which the output values lie. The following table indicates this dependency:

Table 13- 3 Response of analog module in dependency on the location of the analog output value in the range

Output value lies in the	Output value in SIMATIC S7 format
Nominal range	Value from the DP master
Overrange/underrange	Value from the DP master
Overflow	0 signal
Underflow	0 signal
prior to parameter assignment	0 signal

13.2 Analog electronics module 4 AI I 2WIRE HART

Order number

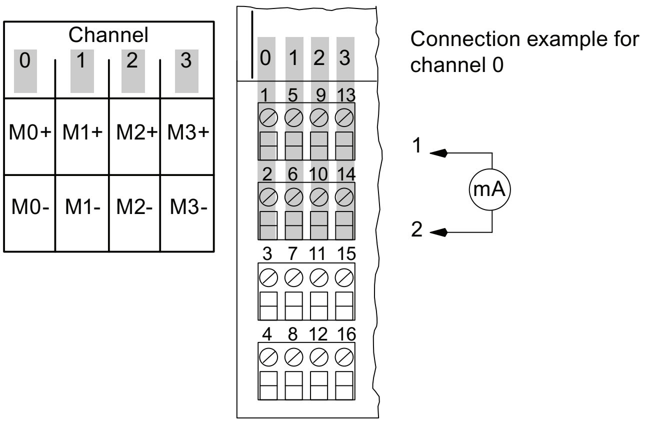
6ES7134-7TD00-0AB0

Properties

- 4 inputs for connecting HART field devices, 2-wire transducers (standard applications)
- Configurable input range: HART, 4 to 20 mA
- Resolution 12 bits + sign

Pin assignment

Table 13- 4 Pin assignment of the 4 AI I 2WIRE HART

Pin assignment and view	Remarks
	**2-wire transducer 1** Channel 0: Terminals 1 and 2 **2-wire transducer 2** Channel 1: Terminals 5 and 6 **2-wire transducer 3** Channel 2: Terminals 9 and 10 **2-wire transducer 4** Channel 3: Terminals 13 and 14 M+: Input signal "+" M-: Input signal "-" The 2-wire transducers are supplied over the measurement leads.

Block diagram

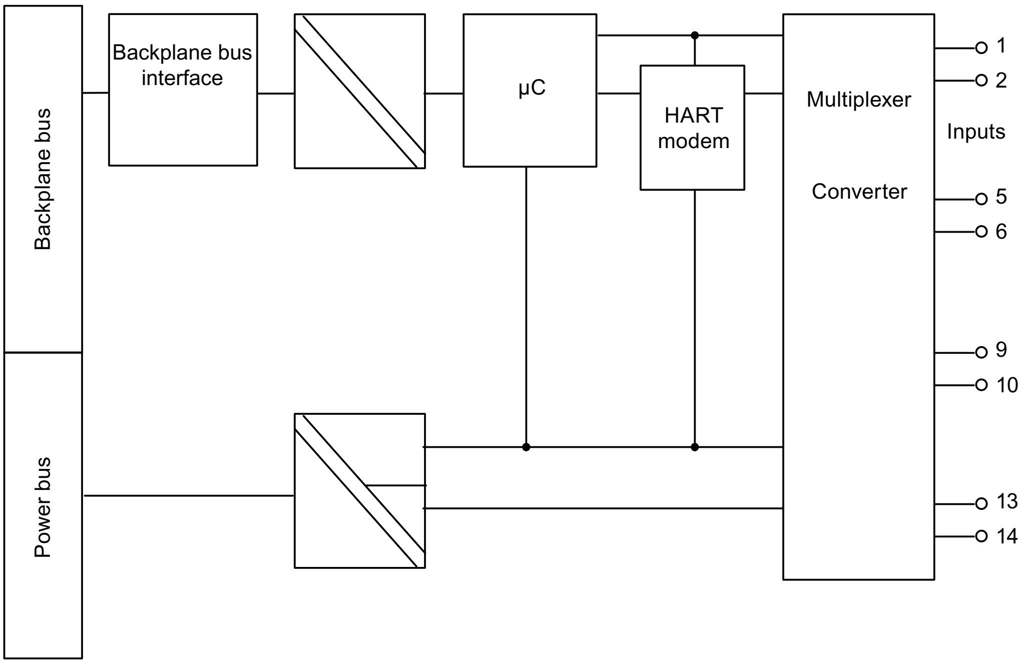


Figure 13-1 Block diagram of the 4 AI I 2WIRE HART

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	Approx. 230 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	4
Cable length	
• Shielded	max. 500 m
Approvals	
• ATEX	II 2 G (1) GD and I M2 Ex ib[ia] [iaD] IIC T4; Ex ib[ia] I KEMA 04 ATEX 1244 0344
• IECEx	IECEx IECEx KEM 05.0006
• INMETRO	INMETRO BR OCP-0029 BR-Ex ib [ia] IIC T4 / BR-Ex ib [ia] I
• FM	Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 AIS, Class I, II, III, DIV. 1, GP . A,B,C,D,E,F,G Class II, III, GP E,F,G
• cULus	LISTED 7XA1 Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 ASSOC APP . CLI, DIV. 2, GP . A,B,C,D PROVIDING INT. SAFE CIRCUITS FOR CLI, GP. A,B,C,D Cl. II, III, GP . E,F,G
Voltages, currents, electrical potentials	
Transducer power supply	Yes
• Supply current	max. 23 mA (per channel)
• short circuit-proof	Yes
Electrical isolation	
• Between channels and the backplane bus	Yes
• Between channels	No
• Between channels and power bus	Yes
Current consumption	
• from power supply (power bus)	max. 320 mA

Technical specifications	
Power loss of module	2.7 W
Formation of analog values	
Measuring principle	Integrating (sigma-delta)
Integration/conversion time/resolution (per channel)	
• Integration time can be configured	No
• Interference frequency suppression in Hz	60; 50
• Basic conversion time including integration time (per channel) in ms	30
• Cycle time in ms	Number of active channels per module x basic conversion time
• Resolution (including overrange)	12 bits + sign
Measured value smoothing	Yes, can be set in 4 steps[1]
Step:	Time constant:
None	1 x cycle time
Low	4 x cycle time
Average	32 x cycle time
High	64 x cycle time
Noise suppression, error limits	
Interference voltage suppression for f = n x (f1±1%), f1 = interference frequency	
• Series mode interference (peak value of disturbance < rated input range)	min 70 dB
Crosstalk between inputs	min. - 50 dB
Operational limits (in the entire temperature range, relative to the input range)	±0.15%
Basic error limit (operational limit at 25°C, relative to the input range)	±0.1%
Temperature error (relative to the input range)	± 0.005%/K
Linearity error (relative to the input range)	±0.015%
Repeatability (in steady state at 25 °C, relative to the input range)	±0.01%
Status, interrupts, diagnostics	
Interrupts	
• Limit value interrupt	Yes, can be set
• Diagnostic interrupt	Yes, can be set
Diagnostic functions	
• Group error display	Red "SF" LED
• Diagnostic information can be read	Yes
Monitoring for	
• Short-circuit	I_{load} > 25 mA[2]
• Wirebreak	I_{load} < 3.6 mA

Technical specifications	
Safety information	
See EC Prototype Certificate	KEMA 04ATEX1244
Data for selecting a sensor	
Input ranges (rated values) / input resistance	
• Current	4 to 20 mA
Permissible input current for current input (destruction limit)	90 mA
Connection of signal generators	supported
• for current measurement as 2-wire transducer	 supported
• Load of 2-wire transducer	Max. 750 Ω
[1] Time taken to reach 63% of the level-change value [2]: I is subject to current limiting at the moment. The current limitation cuts in at 25 mA. Short circuit at load impedance <100 Ω.	

13.3 Analog electronics module 4 AI I 4WIRE HART

Order number

6ES7134-7TD50-0AB0

Properties

- 4 inputs for connecting HART field devices, 4-wire transducers (standard applications)
- Configurable input range: HART, 0 to 20 mA, 4 to 20 mA
- Resolution 12 bits + sign

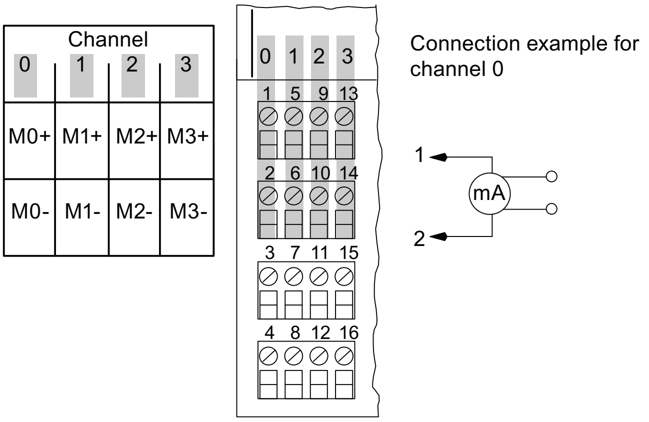
Note

If you connect up to four sensors to the electronic module, you must connect the "-" measuring connections of the sensors one below the other or connect each with equipotential bonding using wires. The wires must be arranged so that they are not liable to interrupted.

If you connect up to 2 sensors to channel 0 and channel 2 (channel 1 and 3 unconnected), no further measures are necessary.

Pin assignment

Table 13- 5 Pin assignment of the 4 AI I 4WIRE HART

Pin assignment and view	Remarks
	**4-wire transducer 1** Channel 0: Terminals 1 and 2 **4-wire transducer 2** Channel 1: Terminals 5 and 6 **4-wire transducer 3** Channel 2: Terminals 9 and 10 **4-wire transducer 4** Channel 3: Terminals 13 and 14 M+: Input signal "+" M-: Input signal "-"

Block diagram

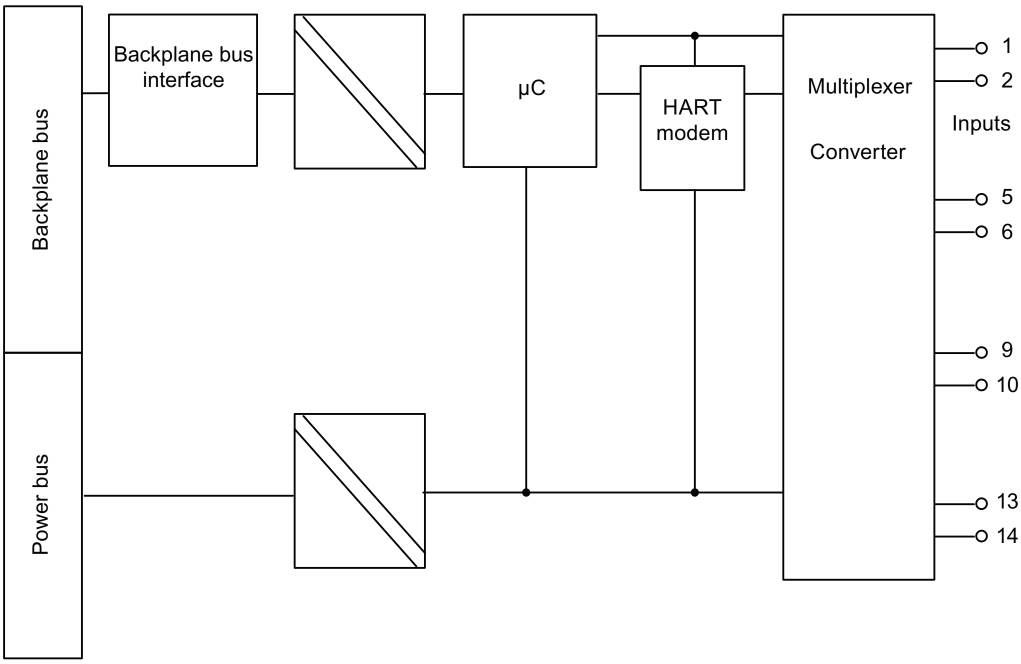


Figure 13-2 Block diagram of the 4 AI I 4WIRE HART

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	approx. 230 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	4
Cable length	
• shielded	max. 500 m
Approvals	
• ATEX	II 2 G (1) GD and I M2 Ex ib[ia] [iaD] IIC T4; Ex ib[ia] I KEMA 04 ATEX 1245 0344
• IECEx	IECEx KEM 05.0007
• INMETRO INMETRO BR OCP-0029	BR-Ex ib [ia] IIC T4 / BR-Ex ib [ia] I
• FM	Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 AIS, Class I, II, III, DIV. 1, GP . A,B,C,D,E,F,G Class II, III, GP E,F,G
• cULus LISTED 7XA1	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 ASSOC APP. CLI, DIV. 2, GP . A,B,C,D PROVIDING INT. SAFE CIRCUITS FOR CLI, GP . A,B,C,D Cl. II, III, GP . E,F,G
Voltages, currents, electrical potentials	
Transducer power supply	No
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels	No
• between channels and power bus	Yes
Current consumption	
• from power supply (power bus)	max. 30 mA
Power loss of module	0.4 W

Technical specifications	
Formation of analog values	
Measuring principle	Integrating (sigma-delta)
Integration/conversion time/resolution (per channel)	
• Integration time can be configured	Yes
• Interference frequency suppression in Hz	60; 50
• Basic conversion time including integration time (per channel) in ms	30
• Cycle time in ms	Number of active channels per module x basic conversion time
• Resolution (including overrange)	12 bits + sign
Measured value smoothing	Yes, can be set in 4 steps[1]
Step:	Time constant:
None	1 x cycle time
Low	4 x cycle time
Average	32 x cycle time
High	64 x cycle time
Noise suppression, error limits	
Interference voltage suppression for f = n x (f1±1%), f1 = interference frequency	
• Series mode interference (peak value of disturbance < rated input range)	min 70 dB
Crosstalk between inputs	min. - 50 dB
Operational limits (in the entire temperature range, relative to the input range)	±0,15%
Basic error limit (operational limit at 25 °C, relative to the input range)	±0.1%
Temperature error (relative to the input range)	± 0.005%/K
Linearity error (relative to the input range)	±0.015%
Repeatability (in steady state at 25 °C, relative to the input range)	±0.01%
Status, interrupts, diagnostics	
Interrupts	
• Limit value interrupt	Yes, can be set
• Diagnostic interrupt	Yes, can be set
Diagnostic functions	
• Group error display	Red "SF" LED
• Diagnostic information can be read	Yes
Monitoring for	
• Wirebreak	I < 3.6 mA
Safety information	
See EC Prototype Certificate	KEMA 04ATEX1245

Technical specifications	
Data for selecting a sensor	
Input ranges (rated values) / input resistance	
• Current	0 to 20 mA / 360Ω at 20 mA 4 to 20 mA / 360Ω at 20 mA
Permissible input current for current input (destruction limit)	50 mA
Connection of signal generators	supported
• for current measurement as 4-wire transducer	 supported
[1] Time taken to reach 63% of the level-change value	

13.4 Analog electronics module 4 AI RTD

Order number

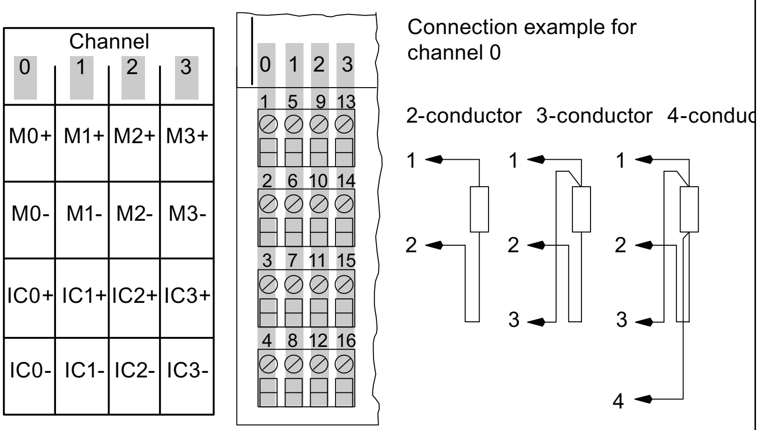
6ES7134-7SD51-0AB0

Properties

- 4 inputs for resistance thermometers or resistance measurement
- Input ranges:
  - Resistance thermometer: Pt 100; Ni 100
  - Resistance measurement: 600 ohm absolute and 1000 Ω absolute
- Resolution of 15 bits + sign

Pin assignment

Table 13- 6 Pin assignment of the 4 AI RTD

Pin assignment and view	Remarks
	**Resistance thermometer 1** Channel 0: Terminals 1 to 4 **Resistance thermometer 2** Channel 1: Terminals 5 to 8 **Resistance thermometer 3** Channel 2: Terminals 9 to 12 **Resistance thermometer 4** Channel 3: Terminals 13 to 16 M+: Measuring cable (positive) M-: Measuring cable (negative) I_C+: Constantcurrent cable (positive) I_C-: Constant current cable (negative)

Block diagram

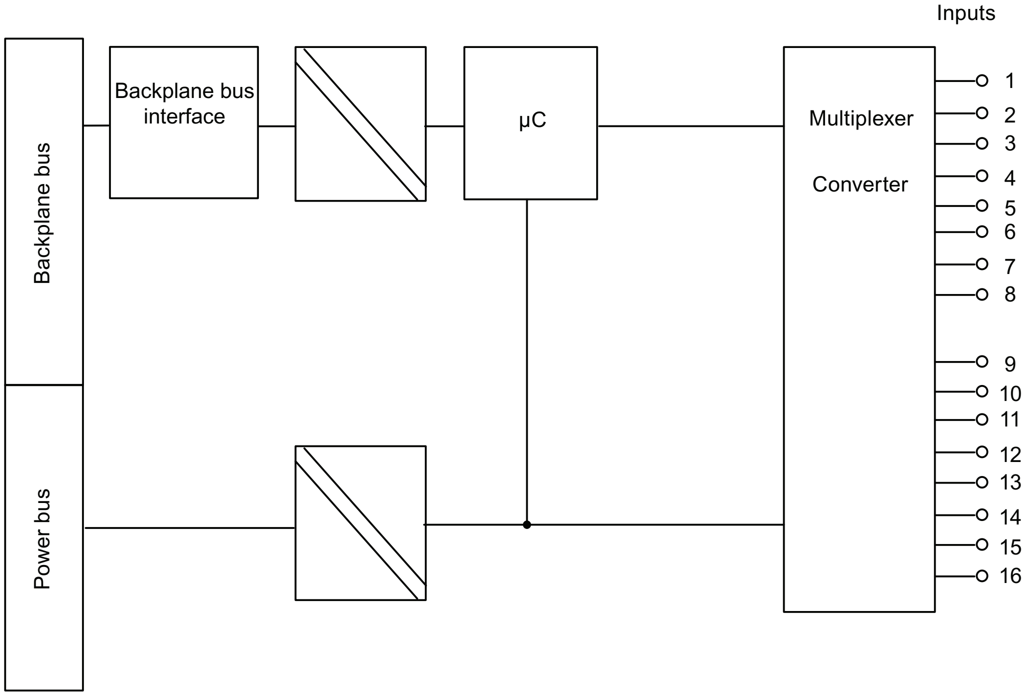


Figure 13-3 Block diagram of the 4 AI RTD

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	approx. 230 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	4
Cable length	
• Shielded	max. 500 m
Approvals	
• ATEX	II 2 G (1) GD and I M2 Ex ib[ia] [iaD] IIC T4; Ex ib[ia] I KEMA 04 ATEX 1247 0344
• IECEx	IECEx IECEx KEM 05.0009
• INMETRO	INMETRO BR OCP-0029 BR-Ex ib [ia] IIC T4 / BR-Ex ib [ia] I
• FM	FM C US APPROVED Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 AIS, Class I, II, III, DIV. 1, GP . A,B,C,D,E,F,G Class II, III, GP EFG
• cULus	LISTED 7XA1 Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 ASSOC APP. CLI, DIV. 2, GP . A,B,C,D PROVIDING INT. SAFE CIRCUITS FOR CLI, GP . A,B,C,D Cl. II, III, GP . E,F,G
Voltages, currents, electrical potentials	
Constant measuring current for resistive transducers	typ. 1 mA
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels	No
• between channels and power bus	Yes
Current consumption	
• from power supply (power bus)	max. 22 mA
Power loss of module	0.4 W

Technical specifications	
Formation of analog values	
Measuring principle	Integrating (sigma-delta)
Integration/conversion time/resolution (per channel)	
• Integration time can be configured	Yes
• Interference frequency suppression in Hz	60; 50
• Basic conversion time including integration time (per channel) in ms	66; 80
• Additional conversion time for wire break	5
• Cycle time in ms	Number of active channels per module x basic conversion time
• Resolution (including overrange)	15 bits + sign
Measured value smoothing	Yes, can be set in 4 steps[1]
Step:	Time constant:
None	1 x cycle time
Low	4 x cycle time
Average	32 x cycle time
High	64 x cycle time
Noise suppression, error limits	
Interference voltage suppression for f = n x (f1±1%), f1 = interference frequency	
• Common mode interference	min. 90 dB
• Series mode interference (peak value of disturbance < rated input range)	min 70 dB
Crosstalk between inputs	min. - 50 dB
Operational limits (in the entire temperature range, relative to the input range)	
• Resistive sensor	±0,15%
• Pt100, Ni100 standard	± 0.8 K
• Pt100, Ni100 climate	± 0.3 K
Basic error limit (operational limit at 25°C, relative to the input range)	
• Resistive sensor	±0,1%
• Pt100, Ni100 standard	± 0.5 K
• Pt100, Ni100 climate	± 0.2 K
Temperature error (relative to the input range)	± 0.02%/K
Linearity error (relative to the input range)	±0.015%
Repeatability (in steady state at 25 °C, relative to the input range)	±0.01%
Status, interrupts, diagnostics	
Interrupts	
• Limit value interrupt	Yes, can be set
• Diagnostic interrupt	Yes, can be set

Technical specifications	
Diagnostic functions	
• Group error display	Red "SF" LED
• Diagnostic information can be read	Yes
Monitoring for	
• Wirebreak	R > 2 kΩ
Safety information	
See EC Prototype Certificate	KEMA 04ATEX1247
Data for selecting a sensor	
Input ranges (rated values) / input resistance	
• Resistance	600 Ω / 1000 Ω absolute / min. 2 MΩ
• Resistance thermometer	Pt100 / min 2 MΩ Ni100 / min 2 MΩ
Connection of signal generators	
• For resistance measurement / RTD 4-wire connection 3-wire connection[2] 2-wire connection	 supported supported supported
Linearization of the characteristic curve	Yes
• of resistance thermometers	
Technical unit of data formats	Can be set

[1] Time taken to reach 63% of the level-change value
[2] With compensation of connection cables

13.5 Analog electronics module 4 AI TC

Order number

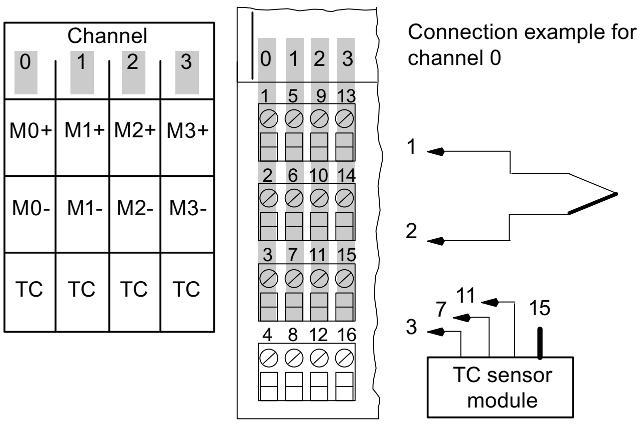
6ES7134-7SD00-0AB0

Properties

- 4 inputs for thermocouple or thermoelectrical voltage
- Input ranges
  - Thermal e.m.f. measurement: ± 80 mV
  - Thermocouples: Type B, E, J, K, L, N, R, S, T, U
  - Functional electric isolation, permissible common mode voltage 6.5 V DC, 30 V AC_{pp}
- Linearization of the sensor characteristic curves
- Resolution of 15 bits + sign
- Internal compensation of the reference junction temperature by means of TC sensor module (temperature sensor). The TC sensor module is supplied with the 4 AI TC. This is mounted on the terminal module of the 4 AI TC.

Pin assignment

Table 13- 7 Pin assignment of the 4 AI TC

Pin assignment and view	Remarks
	**Thermocouple 1** Channel 0: Terminals 1 and 2 **Thermocouple 2** Channel 1: Terminals 5 and 6 **Thermocouple 3** Channel 2: Terminals 9 and 10 **Thermocouple 4** Channel 3: Terminals 13 and 14 **TC sensor module** Terminals 3, 7, 11, 15 M+: Measuring cable (positive) M-: Measuring cable (negative)

Block diagram

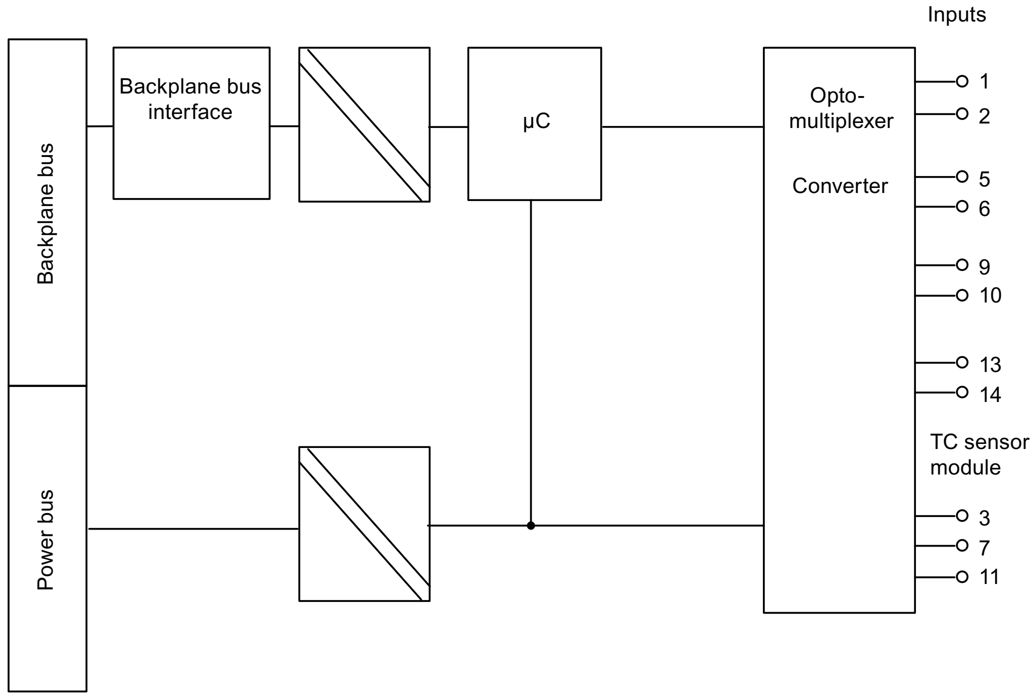


Figure 13-4 Block diagram of the 4 AI TC

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	approx. 230 g
Module-specific data	
Isochronous mode supported	No
Number of inputs	4
Cable length	
• shielded	max. 50 m
Approvals	
• ATEX	II 2 G (1) GD and I M2 Ex ib[ia] [iaD] IIC T4; Ex ib[ia] I KEMA 04 ATEX 1246 CE 0344
• IECEx	IECEx KEM 05.0008
• INMETRO (INMETRO; BR OCP-0029)	BR-Ex ib [ia] IIC T4 / BR-Ex ib [ia] I
• FM	Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 AIS, Class I, II, III, DIV. 1, GP . A,B,C,D,E,F,G Class II, III, GP E,F,G
• cULus (LISTED 7XA1)	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 ASSOC APP. CLI, DIV. 2, GP . A,B,C,D PROVIDING INT. SAFE CIRCUITS FOR CLI, GP . A,B,C,D Cl. II, III, GP . E,F,G
Voltages, currents, electrical potentials	
Electrical isolation	
• Between channels and the backplane bus	Yes
• Between channels	yes, functional
• Between channels and power bus	Yes
Current consumption	
• from power supply (power bus)	max. 30 mA
Power loss of module	0.4 W

Technical specifications	
Formation of analog values	
Measuring principle	Integrating (sigma-delta)
Integration/conversion time/resolution (per channel)	
• Integration time can be configured	Yes
• Interference frequency suppression in Hz	60; 50
• Basic conversion time including integration time (per channel) in ms	66; 80
• Additional conversion time for wire break check in ms	5
• Cycle time in ms	Number of active channels per module x basic conversion time
• Resolution (including overrange)	15 bits + sign
Measured value smoothing	Yes, can be set in 4 steps[1]
Step:	Time constant:
None	1 x cycle time
Low	4 x cycle time
Average	32 x cycle time
High	64 x cycle time
Noise suppression, error limits	
Interference voltage suppression for f = n x (f1±1%), f1 = interference frequency	
• Common-mode interference (U_{CM} < 60 V)	min 90 dB
• Series mode interference (peak value of disturbance < rated input range)	min 70 dB
Crosstalk between inputs	min. - 50 dB
Operational limit (over the entire temperature range, relative to the input range)[2]	± 1.5 K
Basic error limit (operational limit at 25°C, relative to the input range)[2]	± 1 K
Temperature error (relative to the input range)	± 0.02%/K
Linearity error (relative to the input range)	±0.015%
Repeatability (in steady state at 25 °C, relative to the input range)	±0,01%
Limits of total error when using internal compensation with TC sensor module	
• Operational limit (in the entire temperature range with a static, thermal state, ambient temperature change < 10 K/hour).	± 3.5 K
• Basic error limit (operational error limit at 25 °C in static thermal state, ambient temperature fluctuation < 0.3 K/min)	± 2 K

Technical specifications	
Status, interrupts, diagnostics	
Interrupts	
• Limit value interrupt	Yes, can be set
• Diagnostic interrupt	Yes, can be set
Diagnostic functions	
• Group error display	Red "SF" LED
• Diagnostic information can be read	Yes
Monitoring for	
• Wirebreak	Yes, can be configured R > 1.7 kΩ
• TC sensor module for internal temperature compensation	Yes
Safety information	
See EC Prototype Certificate	KEMA 04ATEX1246
[1]:Time taken to reach 63% of the level-change value [2] The specified error limits apply from the following temperatures: Thermocouple type T: -200°C Thermocouple type B: +700°C Thermocouple type N -150°C Thermocouple Type E: -150°C Thermocouple Type R: +200°C Thermocouple type S: +100 °C	
Data for selecting a sensor	
Input ranges (rated values) / input resistance	
• Thermoelectric voltage	± 80 mV/min. 1 MΩ
• Thermocouple	Type E, N, J, K, L, S, R, B, T, U/ min. 1 MΩ
Connection of signal generators	
• for thermal e.m.f. measurement	supported
Characteristic linearization	Yes
• Thermal e.m.f. measurement	Nominal range linear
• Thermocouple	Type E, N, J, K, L, S, R, B, T, U
Temperature compensation	
• Internal temperature compensation	possible via the TC sensor module supplied
• External temperature compensation	possible by means of a temperature value acquired at an analog module of the same ET 200iSP station

13.6 Analog electronics module 4AO I HART

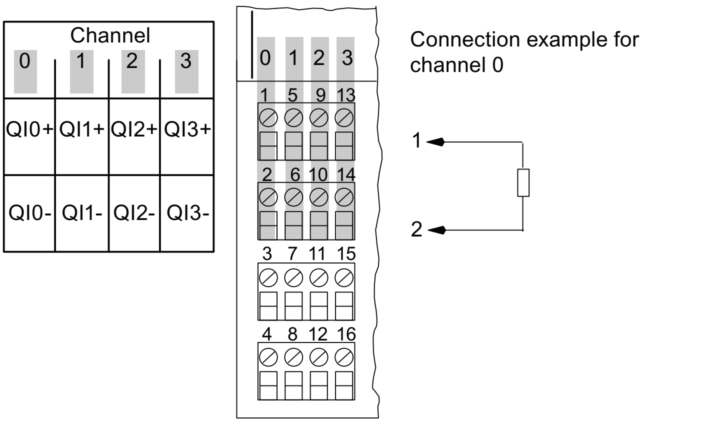
Order number

6ES7135-7TD00-0AB0

Properties

- 4 outputs for current output
- Output ranges (selectable)
  - HART
  - 4 to 20 mA
  - 0 to 20 mA
- Resolution 14 bits

Pin assignment

Pin assignment and view	Remarks
 	**Actuator 1** Channel 0: Terminals 1 and 2 **Actuator 2** Channel 1: Terminals 5 and 6 **Actuator 3** Channel 2: Terminals 9 and 10 **Actuator 4** Channel 3: Terminals 13 and 14 QI: Output positive (analog output current) M : Chassis ground

Block diagram

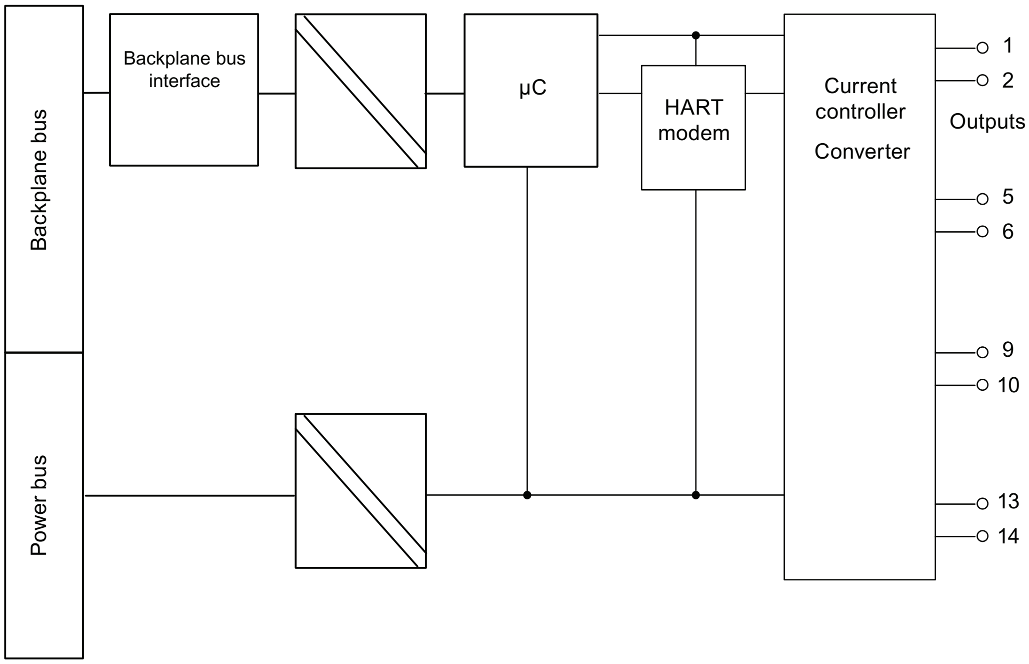


Figure 13-5 Block diagram of the 4AO I HART

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	Approx. 265 g
Module-specific data	
Isochronous mode supported	No
Number of outputs	4
Cable length	
• Shielded	max. 500 m
Approvals	
• ATEX	II 2 G (1) GD and I M2 Ex ib[ia] [iaD] IIC T4; Ex ib[ia] I KEMA 04 ATEX 1250 0344
• IECEx	IECEx KEM 05.0012
• INMETRO INMETRO BR OCP-0029	BR-Ex ib [ia] IIC T4 / BR-Ex ib [ia] I
• FM	Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 AIS, Class I, II, III, DIV. 1, GP . A,B,C,D,E,F,G Class II, III, GP EFG
• cULus LISTED 7XA1	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx ib [ia] IIC T4; Ex ib [ia] IIC T4 ASSOC APP. CLI, DIV. 2, GP . A,B,C,D PROVIDING INT. SAFE CIRCUITS FOR CLI, GP . A,B,C,D Cl. II, III, GP . E,F,G
Voltages, currents, electrical potentials	
Electrical isolation	
• between channels and the backplane bus	Yes
• between channels	No
• between channels and power bus	Yes
Current consumption	
• from load voltage (power bus)	max. 330 mA
Power loss of the module	2.7 W

Technical specifications	
Formation of analog values	
Resolution (including overrange)	14 bits
• Cycle time in ms	3.6 ms
Settling time	
• for resistive load	max. 4 ms
• with capacitive load	max. 40 ms
• with inductive load	max. 40 ms
Injection of substitute values	Yes
Noise suppression, error limits	
Crosstalk between outputs	min. - 50 dB
Operational limits (in the entire temperature range, relative to the input range)	±0.15%
Basic error limit (operational limit at 25°C, relative to the input range)	±0.1%
Temperature error (relative to the input range)	± 0.005%/K
Linearity error (relative to the input range)	±0.015%
Repeatability (in steady state at 25 °C, relative to the input range)	±0.01%
Status, interrupts, diagnostics	
Interrupts	
• Diagnostic interrupt	Yes, can be set
Diagnostic functions	
• Group error display	Red "SF" LED
• Diagnostic information can be read	Yes
Monitoring for	
• Short-circuit	I_{load} > 1 mA R_{load} < 30...60 Ω
• Wirebreak	I_{load} > 1 mA R_{load} < 0.68...24 kΩ[1]
Injection of substitute values	Yes, can be set
Safety information	
See EC Prototype Certificate	KEMA 04ATEX1250
Actuator selection data	
Output ranges (rated values)	
• Current	0 to 20 mA 4 to 20 mA
Load impedance (in the rated output range)	Max. 750 Ω
Connection of actuators	
• for current measurement 2-wire connection	supported
[1] Wire break depends on current of the load	

13.7 Identification and Message Functions (I&M)

Description

Refer to the Chapter "Identification Data I&M (Page 54)".

13.8 Representation of analog values

13.8.1 Overview

Electronic modules with analog inputs

The electronic module with analog inputs allows continuously variable signals, such as those occurring in temperature measurement and pressure measurement, to be acquired, evaluated and converted to digital values for further processing.

Electronic modules with analog outputs

With the electronic modules with analog outputs, digital values set by a controller can be converted to a corresponding analog signal (current) in an analog output module and used to control suitable actuators (setpoint input for speed controllers, temperature controllers and similar).

Measured values in the case of a wire break depending on diagnostic being enabled

The rules and additions outlined below apply to the following measuring ranges:

- 4 to 20 mA
- Temperature sensor Pt100 standard and climatic, Ni100 standard and climatic
- Thermocouples types B, E, J, K, L, N, R, S, T, U

The following additions and rules apply:

Format of the analog values S7

Table 13- 8 Measured values in the event of wire break dependent on enabled diagnostics (format S7)

Module	Parameter assignment	Measured values		Explanation
		decimal	hexadecimal	
4 AI I	• "Wire break" diagnostics enabled	32767	$7FFF_H$	• "Wire break" diagnostic message
	• "Wire break" diagnostics disabled[1] • "Overflow/underflow" diagnostics enabled	-32768	8000_H	• Measured value after leaving the underrange • "Low limit fallen below" diagnostic message
	• "Wire break" diagnostics disabled[1] • "Overflow/underflow" diagnostics disabled	-	-	• Measured value after leaving the underrange
4 AI RTD 4 AI TC	• "Wire break" diagnostics enabled	32767	$7FFF_H$	• "Wire break" diagnostic message
	• "Wire break" diagnostics disabled	-	-	• Open input: Undefined measured value

[1] Measuring range limits for wire break detection in measuring range 4 to 20 mA: At 3.6 mA

13.8.2 Analog value representation for measuring ranges with SIMATIC S7

Representation of analog values

The digitized analog value for input and output values is the same in the same rated range. Analog values are represented in twos complement.

The following table shows the analog value representation of the analog electronic modules.

Table 13- 9 Analog value representation (SIMATIC S7 format)

Resolution	Analog value															
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Significance of the bits	S	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Sign

The sign (S) of the analog value is always in bit number 15:

- "0" → +
- "1" → -

Example

Table 13- 10 Example

Analog value		
decimal	binary	hexadecimal
-1	1111 1111 1111 1111	$FFFF_H$
-32768	1000 0000 0000 0000	8000_H

Measured-value resolution

The following table shows the representation of the binary analog values and the corresponding decimal and hexadecimal representation of the units of the analog values.

The 11-, 12-, 13- and 15-bit resolutions + sign are shown in the following table. Each analog value is entered left-justified in the ACCU. The bits marked with "x" are set to "0".

Table 13- 11 Measured-value resolution of the analog values (SIMATIC S7 format)

Resolution in Bits	Units		Analog value	
	decimal	hexadecimal	High byte	Low byte
11+VZ	16	10_H	S 0 0 0 0 0 0 0	0 0 0 1 x x x x
12+S	8	8_H	S 0 0 0 0 0 0 0	0 0 0 0 1 x x x x
13+S	4	4_H	S 0 0 0 0 0 0 0	0 0 0 0 0 1 x x
15+S	1	1_H	S 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

Note

This resolution does not apply for temperature values. The converted temperature values are the result of a conversion in the analog electronic module.

13.8.3 Measuring ranges of the analog input modules in S7 format

Introduction

The tables in this section contain the digitized analog values for the measuring ranges of the analog input modules.

The binary representation of the analog values is always the same, so these tables only compare the measuring ranges and the units.

Measuring ranges for voltage: ± 80 mV

Table 13- 12 SIMATIC S7 format: Measuring range ±80 mV

Measuring range ± 80 mV	Units		Range
	decimal	hexadecimal	
> 94.071	32767	$7FFF_H$	Overflow
94.071	32511	$7EFF_H$	Overrange
:	:	:	
80.003	27649	$6C01_H$	
80.000	27648	$6C00_H$	
60.000	20736	5100_H	
:	:	:	Nominal range
- 60.000	-20736	$AF00_H$	
- 80.000	-27648	9400_H	
- 80.003	-27649	$93FF_H$	Underrange
:	:	:	
- 94.074	-32512	8100_H	
< - 94,074	-32768	8000_H	Underflow

Measuring ranges for current: 0 to 20 mA, 4 to 20 mA

Table 13- 13 SIMATIC S7 format: Measuring ranges 0 to 20 mA, 4 to 20 mA

Measuring range 0 to 20 mA	Measuring range 4 to 20 mA	Units		Range
		decimal	hexadecimal	
> 23,5178	> 22,8142	32767	$7FFF_H$	Overflow
23.5178	22.8142	32511	$7EFF_H$	Overrange
:	:	:	:	
20.0007	20.0005	27649	$6C01_H$	
20.0000	20.0000	27648	$6C00_H$	
15.0000	16.0000	20736	5100_H	
:	:	:	:	Nominal range
0.0000	4.0000	0	0_H	
Negative values are not supported	3.9995	-1	$FFFF_H$	Underrange
		:	:	
	1.1852	-4864	$ED00_H$	
	< 1,1852	-32768	8000_H	Underflow

Measuring ranges for resistance-type sensor: 600 Ω absolute and 1000 Ω absolute

Table 13- 14 SIMATIC S7 format: Measuring ranges 600 Ω absolute and 1000 Ω absolute

Measuring range 600 Ω	Measuring range 1000 Ω	Units		Range
		decimal	hexadecimal	
> 705.53	> 1175.89	32767	$7FFF_H$	Overflow
705.53	1175.89	32511	$7EFF_H$	Overrange
:	:	:	:	
600.02	1000.04	27649	$6C01_H$	
600.00	1000.00	27648	$6C00_H$	
450.00	750.00	20736	5100_H	
:	:	:	:	Nominal range
0.00	0.00	0	0_H	
(negative values are physically impossible)		-1	$FFFF_H$	Underrange[1]
		:	:	
		-4864	$ED00_H$	
		-32768	8000_H	Underflow[1]
[1] If connection is faulty				

Measuring ranges for resistance thermometer Pt 100 standard

Table 13- 15 SIMATIC S7 format: Measuring ranges Pt 100 standard in °C and °F

Pt 100 standard in °C (1 digit = 0.1°C)	Units		Pt 100 standard in °F (1 digit = 0.1 °F)	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 1000.0	32767	7FFF$_H$	> 1832.0	32767	7FFF$_H$	Overflow
1000.0 : 850.1	10000 : 8501	2710$_H$: 2135$_H$	1832.0 : 1562.1	18320 : 15621	4790$_H$: 3D05$_H$	Overrange
850.0 : -200.0	8500 : -2000	2134$_H$: F830$_H$	1562.0 : -328.0	15620 : -3280	3D04$_H$: F330$_H$	Nominal range
-200.1 : -243.0	-2001 : -2430	F82F$_H$: F682$_H$	-328.1 : -405.4	-3281 : -4054	F32F$_H$: F02A$_H$	Underrange
< - 243.0	-32768	8000$_H$	< - 405.4	-32768	8000$_H$	Underflow

Measuring ranges for resistance thermometer Pt 100 climate

Table 13- 16 SIMATIC S7 format: Measuring ranges Pt 100 climate in °C and °F

Pt 100 climate in °C (1 digit = 0.01°C)	Units		Pt 100 climate in °F (1 digit = 0.01 °F)	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 155.00	32767	7FFF$_H$	> 311.00	32767	7FFF$_H$	Overflow
155.00 : 130.01	15500 : 13001	3C8C$_H$: 32C9$_H$	311.00 : 266.01	31100 : 26601	797C$_H$: 67E9$_H$	Overrange
130.00 : -120.00	13000 : -12000	32C8$_H$: D120$_H$	266.00 : -184.00	26600 : -18400	67E8$_H$: B820$_H$	Nominal range
-120.01 : -145.00	-12001 : -14500	D11F$_H$: C75C$_H$	-184.01 : -229.00	-18401 : -22900	B81F$_H$: A68C$_H$	Underrange
< - 145.00	-32768	8000$_H$	< - 229.00	-32768	8000$_H$	Underflow

Measuring ranges for resistance thermometer Ni 100 standard

Table 13- 17 SIMATIC S7 format: Measuring ranges Ni 100 standard in °C and °F

Ni 100 standard in °C (1 digit = 0.1°C)	Units		Ni 100 standard in °F (1 digit = 0.1 °F)	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 295.0	32767	7FFF$_H$	> 563.0	32767	7FFF$_H$	Overflow
295.0	2950	B86$_H$	563.0	5630	15FE$_H$	Overrange
:	:	:	:	:	:	
250.1	2501	9C5$_H$	482.1	4821	12D5$_H$	
250.0	2500	9C4$_H$	482.0	4820	12D4$_H$	
:	:	:	:	:	:	Nominal range
-60.0	-600	FDA8$_H$	-76.0	-760	FD08$_H$	
-60.1	-601	FDA7$_H$	-76.1	-761	FD07$_H$	Underrange
:	:	:	:	:	:	
-105.0	-1050	FBE6$_H$	-157.0	-1570	F9DE$_H$	
< -105.0	-32768	8000$_H$	< -157.0	-32768	8000$_H$	Underflow

Measuring ranges for resistance thermometer Ni 100 climate

Table 13- 18 SIMATIC S7 format: Measuring ranges Ni 100 climate in °C and °F

Ni 100 climate in °C (1 digit = 0.01°C)	Units		Ni 100 climate in °F (1 digit = 0.01 °F)	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 295.00	32767	7FFF$_H$	> 325.11	32767	7FFF$_H$	Overflow
295.00 : 250.01	29500 : 25001	733C$_H$: 61A9$_H$	327.66 : 280.01	32766 : 28001	7FFE$_H$: 6D61$_H$	Overrange
250.00 : -60.00	25000 : -6000	61A8$_H$: E890$_H$	280.00 : -76.00	28000 : -7600	6D60$_H$: E250$_H$	Nominal range
-60.01 : -105.00	-6001 : -10500	E88F$_H$: D6FC$_H$	-76.01 : -157.00	-7601 : -15700	E24F$_H$: C2AC$_H$	Underrange
< - 105.00	-32768	8000$_H$	< - 157.00	-32768	8000$_H$	Underflow

Measuring range for thermocouple: Type B

Table 13- 19 SIMATIC S7 format: Measuring range type B in °C and °F

Type B in °C	Units		Type B in °F	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 2070.0	32767	$7FFF_H$	> 3276.6	32767	$7FFF_H$	Overflow
2070.0 : 1820.1	20700 : 18201	$50DC_H$: 4719_H	3276.6 : 2786.6	32766 : 27866	$7FFE_H$: $6CDA_H$	Overrange
1820.0 : 0.0	18200 : 0	4718_H : 0000_H	2786.5 : 32	27865 : 320	$6CD9_H$: 0140_H	Nominal range
-0.1 : -120.0	-1 : -1200	$FFFF_H$: $FB50_H$	31.9 : -184.0	319 : -1840	$013F_H$: $F8D0_H$	Underrange
< -120.0	-32768	8000_H	< -184.0	-32768	8000_H	Underflow

Measuring range for thermocouple type E

Table 13- 20 SIMATIC S7 format: Measuring range type E in °C and °F

Type E in °C	Units		Type E in °F	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 1200.0	32767	$7FFF_H$	> 2192.0	32767	$7FFF_H$	Overflow
1200.0 : 1000.1	12000 : 10001	$2EE0_H$: 2711_H	2192.0 : 1832.1	21920 : 18321	$55A0_H$: 4791_H	Overrange
1000.0 : -270.0	10000 : -2700	2710_H : $F574_H$	1832.0 : -454.0	18320 : -4540	4790_H : $EE44_H$	Nominal range
< -270.0	- 32768	8000_H	< -454.0	- 32768	8000_H	Underflow

Measuring range for thermocouple type J

Table 13- 21 SIMATIC S7 format: Measuring range type J in °C and °F

Type J in °C	Units		Type J in °F	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 1450.0	32767	$7FFF_H$	> 2642.0	32767	$7FFF_H$	Overflow
1450.0 : 1200.1	14500 : 12010	$38A4_H$: $2EEA_H$	2642.0 : 2192.1	26420 : 21921	6734_H : $55A1_H$	Overrange
1200.0 : -210.0	12000 : -2100	$2EE0_H$: $F7CC_H$	2192.0 : -346.0	21920 : -3460	$55A0_H$: $F27C_H$	Nominal range
< -210.0	- 32768	8000_H	< -346.0	- 32768	8000_H	Underflow

Measuring range for thermocouple type K

Table 13- 22 SIMATIC S7 format: Measuring range type K in °C and °F

Type K in °C	Units		Type K in °F	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 1622.0	32767	$7FFF_H$	> 2951.6	32767	$7FFF_H$	Overflow
1622.0 : 1372.1	16220 : 13721	$3F5C_H$: 3599_H	2951.6 : 2501.7	29516 : 25062	$734C_H$: $61B9_H$	Overrange
1372.0 : -270.0	13720 : -2700	3598_H : $F574_H$	2501.6 : -454.0	25061 : -4540	$61B8_H$: $EE44_H$	Nominal range
< -270.0	- 32768	8000_H	< -454.0	- 32768	8000_H	Underflow

Measuring range for thermocouple type L

Table 13- 23 SIMATIC S7 format: Measuring range type L in °C and °F

Type L in °C	Units		Type L in °F	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 1150.0	32767	7FFF$_H$	> 2102.0	32767	7FFF$_H$	Overflow
1150.0 : 900.1	11500 : 9001	2CEC$_H$: 2329$_H$	2102.0 : 1652.1	21020 : 16521	521C$_H$: 4089$_H$	Overrange
900.0 : -200.0	9000 : -2000	2328$_H$: F830$_H$	1652.0 : -328.0	16520 : -3280	4088$_H$: F330$_H$	Nominal range
< -200.0	-32768	8000$_H$	< -328.0	-32768	80000$_H$	Underflow

Measuring range for thermocouple type N

Table 13- 24 SIMATIC S7 format: Measuring range type N in °C and °F

Type N in °C	Units		Type N in °F	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 1550.0	32767	7FFF$_H$	> 2822.0	32767	7FFF$_H$	Overflow
1550.0 : 1300.1	15500 : 13001	3C8C$_H$: 32C9$_H$	2822.0 : 2372.1	28220 : 23721	6E3C$_H$: 5CA9$_H$	Overrange
1300.0 : -270.0	13000 : -2700	32C8$_H$: F574$_H$	2372.0 : -454.0	23720 : -4540	5CA8$_H$: EE44$_H$	Nominal range
< -270.0	-32768	8000$_H$	-32768	8000$_H$	<EE44$_H$	Underflow

Measuring range for thermocouple types R, S

Table 13- 25 SIMATIC S7 format: Measuring range type R, S in °C and °F

Type R, S in °C	Units		Type R, S in °F	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 2019.0	32767	7FFF$_H$	> 3276.6	32767	7FFF$_H$	Overflow
2019.0 : 1769.1	20190 : 17691	4EDE$_H$: 451B$_H$	3276.6 : 3216.3	32766 : 32163	7FFE$_H$: 7DA3$_H$	Overrange
1769.0 : -50.0	17690 : -500	451A$_H$: FE0C$_H$	3216.2 : -58.0	32162 : -580	7DA2$_H$: FDBC$_H$	Nominal range
-50.1 : -170.0	-510 : -1700	FE0B$_H$: F95C$_H$	-58.1 : -274.0	-581 : -2740	FDBB$_H$: F54C$_H$	Underrange
< -170.0	-32768	8000$_H$	< -274.0	-32768	8000$_H$	Underflow

Measuring range for thermocouple type T

Table 13- 26 SIMATIC S7 format: Measuring range type T in °C and °F

Type T in °C	Units		Type T in °F	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 540.0	32767	7FFF$_H$	> 1004.0	32767	7FFF$_H$	Overflow
540.0 : 400.1	5400 : 4001	1518$_H$: 0FA1$_H$	1004.0 752.1	10040 7521	2738$_H$ 1DC1$_H$	Overrange
400.0 : -270.0	4000 : -2700	0FA0$_H$: F574$_H$	752.0 : -454.0	7520 : -4540	1D60$_H$: EE44$_H$	Nominal range
< -270.0	-32768	8000$_H$	< -454.0	-32768	8000$_H$	Underflow

Measuring range for thermocouple type U

Table 13- 27 SIMATIC S7 format: Measuring range type U in °C and °F

Type U in °C	Units		Type U in °F	Units		Range
	decimal	hexadecimal		decimal	hexadecimal	
> 850.0	32767	$7FFF_H$	> 1562.0	32767	$7FFF_H$	Overflow
850.0 : 600.1	8500 : 6001	2134_H : 17771_H	1562.0 1112.1	15620 11121	$3D04_H$ $2B71_H$	Overrange
600.0 : -200.0	2000 : -2000	1770_H : $F830_H$	1112.0 : -328.0	11120 : -3280	$2B70_H$: $F330_H$	Nominal range
< -200.0	-32768	8000_H	< -328.0	-32768	8000_H	Underflow

13.8.4 Output ranges of the analog output modules in S7 format

Introduction

The tables in this section contain the digitized analog values for the measuring ranges of the analog output modules.

The binary representation of the analog values is always the same, so these tables only compare the output ranges and the units.

Output ranges for current: 0 to 20 mA; 4 to 20 mA

Table 13- 28 SIMATIC S7 format: Output ranges 0 to 20 mA; 4 to 20 mA

Output range 0 to 20 mA	Output range 4 to 20 mA	Units		Range
		decimal	hexadecimal	
0	0	> 32511	> $7EFF_H$	Overflow
23,5178	22,8100	32511	$7EFF_H$	Overrange
:	:	:	:	
20,0007	20,0005	27649	$6C01_H$	
20,0000	20,0000	27648	$6C00_H$	
:	:	:	:	Nominal range
0	4,0000	0	0_H	
0	3,9995	-1	$FFFF_H$	Underrange
:	:	:	:	
0	0	-6912	$E500_H$	
0	0	< -6913	< $E4FF_H$	Underflow

13.9 Fundamentals of analog value processing

13.9.1 Wiring thermocouples

Introduction

This section contains additional information on connecting thermocouples.

Compensation of the reference junction temperature

There are various ways of obtaining the reference junction temperature in order to get an absolute temperature value from the temperature difference between the reference junction and the measuring point.

Table 13- 29 Compensation of the reference junction temperature

Option	Explanation	Reference junction parameters
No compensation	You record not only the temperature of the measurement point. The temperature of the reference junction (transition from Cu line to thermocouple line) also affects the thermo-electromotive force. The measured value then includes an error.	None
Use of a Pt100 Climatic Range resistance thermometer to record the reference junction temperature (best method)	You can record the reference junction temperature using a resistance thermometer (Pt100 Climatic Range). If parameterized accordingly, this temperature value is distributed to the 4 AI TC modules in the ET 200iSP where it is offset against the temperature value obtained at the measuring location. Number of reference junctions: 2	The parameter assignment of the IM 152 and the 4 AI TC must be coordinated: • 4 AI RTD assigned parameters for Pt100 climatic range in correct slot; • 4 AI TC: Reference junction : "yes"; select reference junction number "1" or "2" • IM 152-1:Assignment of the reference junction to a slot with 4 AI RTD; channel selection;
Internal compensation 4 AI TC	The TC sensor module (temperature sensor) is mounted onto the terminals of terminal module EM 4 AI TC. The temperature sensor reports the temperature of the terminals to the 4 AI TC. This value is then calculated together with the measured value from the channel of the electronic module.	• 4 AI TC: Reference junction number "internal"

Extension to a reference junction

From their point of connection, thermocouples can be extended using equalizing cables as far as the reference junction (transition to copper wiring). The reference junction can also be an ET 200iSP terminal module.

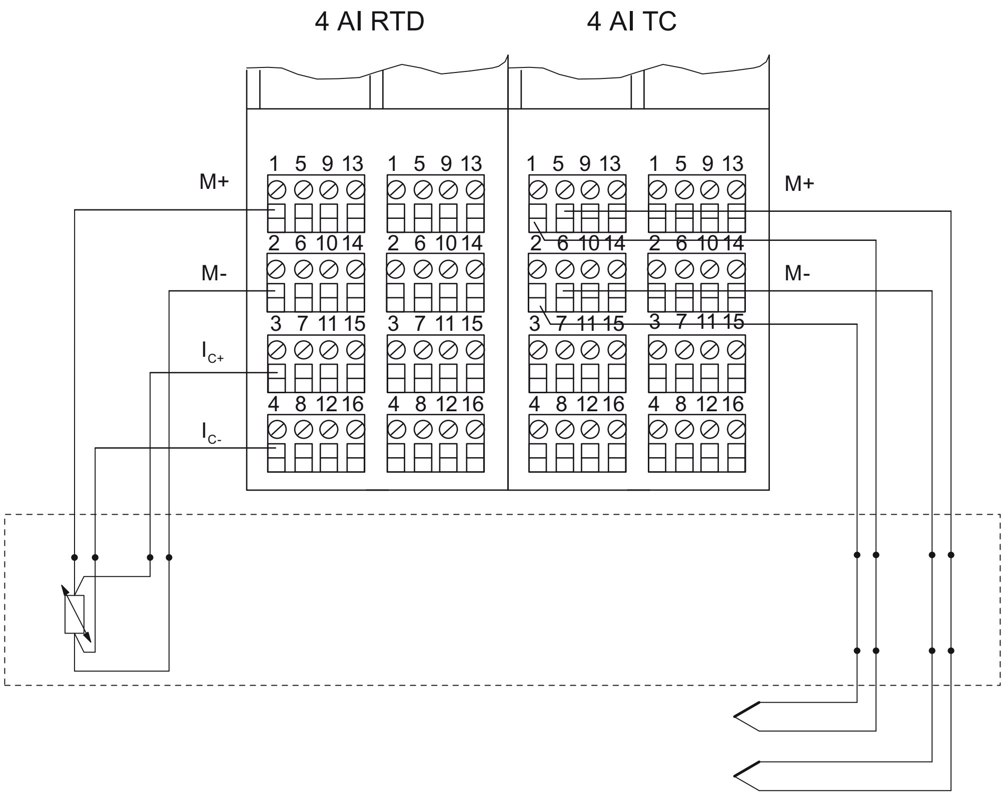
The equalization lines are made of the same material as the wires of the thermocouple. The supply lines are made of copper. Ensure correct polarity when connecting.

Compensation by means of a resistance thermometer at the 4 AI RTD

If thermocouples that are connected to the inputs of the 4 AI RTD have the same reference junction, compensate by means of a 4 AI RTD.

For both channels of the 4 AI TC module, you can select "1", "2" or "internal" as the reference junction number. If you select "1" or "2", the same reference junction (RTD channel) is always used for all four channels.

In the following figure, the 4 AI RTD electronic module is assigned parameters for the Pt100 climate measuring range. The insulated thermocouples are compensated externally by a resistance thermometer connected to the 4 AI RTD (channel 0).



M+ Measuring cable (positive)

M- Measuring cable (negative)

I_C+ Constantcurrent cable (positive)

I_C- Constant-current cable (negative)

Figure 13-6 Compensation by 4 AI RTD

Setting parameters for the reference junction

You set the reference junctions for the 4 AI TC electronic modules by means of the following parameters:

Table 13- 30 Reference junction parameters

Parameter	Module	Range of values	Explanation
Slot reference junction 1 to slot 2	IM 152	none, 4 to 35	With this parameter, you can assign up to 2 slots (none, 4 to 35), on which the channels for reference temperature measurement (calculating the compensation value) are located.
Input reference junction 1 to 4 input reference junction	IM 152	RTD on channel 0 RTD on channel 1 RTD on channel 2 RTD on channel 3	This parameter allows you to set the channel (0/1/2/3) for measuring the reference temperature (calculation of the compensation value) for the assigned slot.
Reference junction E0 to reference junction E3	4 AI TC	None Yes	This parameter allows you to enable the use of the reference junction.
Reference junction number	4 AI TC	1 2 Internal	This parameter allows you to assign the reference junction (1, 2) that contains the reference temperature (compensation value).

Example of reference junction parameter assignments

- Structure: For simplification purposes, this figure shows only RTD and TC modules:

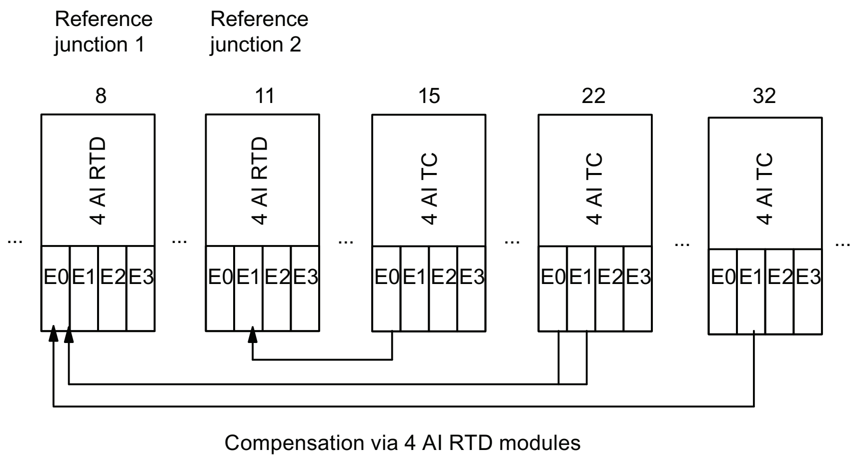


Figure 13-7 Example of reference junction parameter assignments

- Parameters relevant to the interface module IM 152

Parameter	Value
Slot reference junction 1	8
Input reference junction 1	RTD on channel 0
Slot reference junction 2	11
Input reference junction 2	RTD on channel 1

- Parameters relevant for 4 AI RTD and 4 AI TC:

Slot	Parameter	Value
8 (4 AI RTD)	Type/range of measurement I0	RTD-4 wire connection/ Pt 100 climatic range
11 (4 AI RTD)	Type/range of measurement I1	RTD-4 wire connection/ Pt 100 climatic range
15 (4 AI TC)	Reference junction I0	Yes
	Reference junction I1/I2/I3	None
	Reference junction number	2
	Measuring range I0	Type...
	Measuring range I1/I2/I3	(any)
22 (4 AI TC)	Reference junction I0/I1	Yes
	Reference junction I2/I3	None
	Reference junction number	1
	Measuring range I0/I1	Type...
	Measuring range I2/I3	(any)
32 (4 AI TC)	Reference junction I0	None
	Reference junction I1	Yes
	Reference junction I2/I3	None
	Reference junction number	1
	Measuring range I0	(any)
	Measuring range I1	Type...
	Measuring range I2/I3	(any)

Non-isolated thermocouples

When you use non-isolated thermocouples, you must comply with the permitted common-mode voltage.

13.10 Basics of HART

13.10.1 Introduction

Description

Using HART functionality you can operate the anolog module additionally with digital communication options. The HART protocol has developed into the "de facto" standard protocol for communication with intelligent field devices: HART is a registered trademark of the "HART Communication Foundation" (HCF), which holds all rights to the HART protocol.

Note

The HART analog module supports HART protocol Version 6.0

13.10.2 Properties of HART

Advantages of HART

Using HART analog modules has the following advantages:

- Compatible connection with the analog modules: current loop 4 - 20 mA
- Additional digital communication using the HART protocol
- Low energy requirements of HART, important for use in hazardous areas
- Numerous field devices with HART functions are in use

Typical applications of HART

- Commissioning of field devices (centralized parameter assignment)
- Online modification of field device parameters
- Information, maintenance and diagnostic displays for the field devices

13.10.3 Principles of HART operation

Introduction

The HART protocol describes the physical form of the transfer:

Transmission procedures, message structure, data formats and commands.

HART signal

The following schematic shows the analog signal with the HART signal superimposed on it (FSK technique). The signal is composed of sine waves of 1200 Hz and 2200 Hz having an average value of zero. It can be filtered out using an input filter so that the original analog signal is available again.

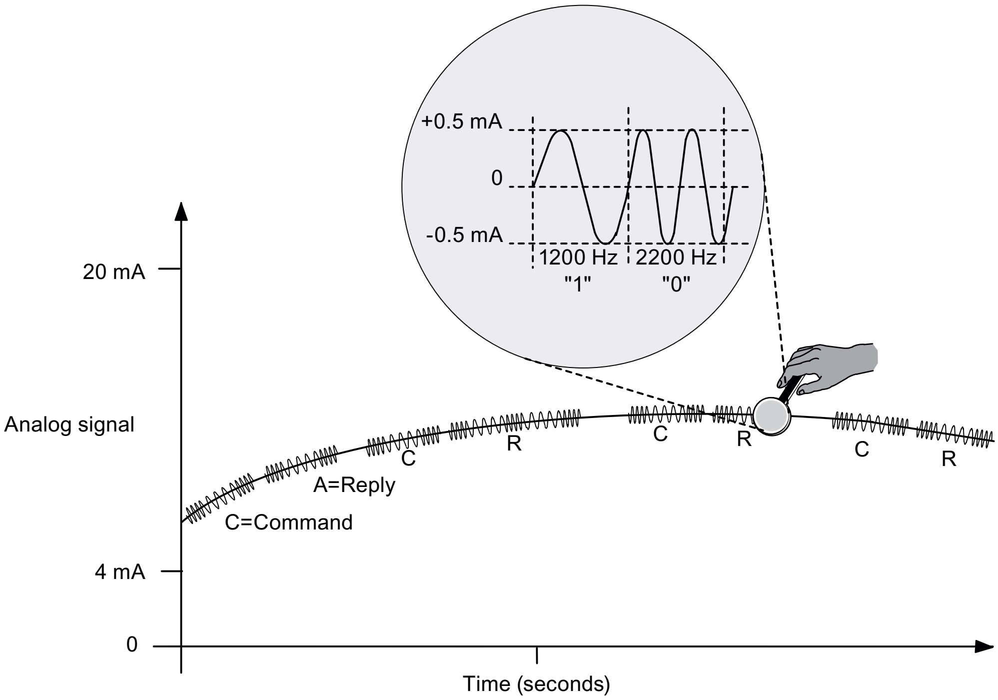


Figure 13-8 The HART signal

HART commands and parameters

You can use SIMATIC PDM to set the parameters of the HART field devices via **HART commands** and read these out via **HART responses**. The HART commands and their parameters are divided into three groups with the following properties:

- universal
- generally usable
- device specific

Universal command must be supported by all manufacturers of HART field devices; it is recommended that generally useable commands be supported. In addition there are device-specific commands, which only apply for the specific field device.

Examples of HART parameters

The following table shows HART parameters of various groups:

Table 13- 31 Examples of HART parameters

Parameter group	Parameters of the HART field device
universal	Measuring and manipulated variable (primary variable), manufacturer's name, process or actuator tags, other measured and manipulated values
generally usable	Measuring range, filter time, interrupt parameters (message, interrupt and warning limits), output range
device specific	special diagnostic information

13.10.4 Integration of HART field devices with ET 200iSP

Use in the ET 200iSP

With a HART analog module, you can connect a field device to each of the four channels. The module operates as the HART master, the field devices as HART slaves.

SIMATIC PDM sends and receives data via the HART analog module, comparable to a client to which the HART analog module acts as a server.

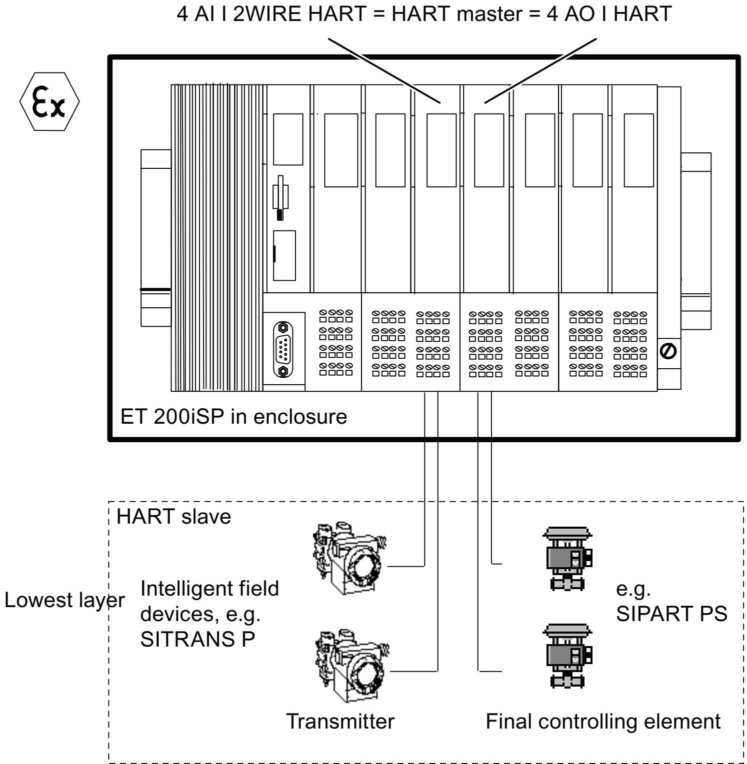


Figure 13-9 Location of the HART analog modules in the distributed system

13.10.5 Using HART

System environment for using HART

To operate an intelligent field device with HART functionality, you require the following system environment:

Current loop 4 - 20 mA via the analog electronic modules: 4 AI I 2WIRE HART, 4 AI I 4WIRE HART or 4AO I HART.

The HART analog module takes over the function of a "master" by receiving the commands from the HART parameter assignment tool, passing them on to the smart field device and then returning the reply messages. The interface of the HART analog module is represented by data records that are transferred via the I/O bus. These data records are generated or interpreted by the HART parameter assignment tool (SIMATIC PDM).

The analog values are entered in the process input and output image in 16-bit format and with up to 4 IEEE tags (master or auxiliary tags).

STEP 7, SIMATIC PDM, HART handheld

You can assign the HART parameters either with an external HART handheld device or with SIMATIC PDM. SIMATIC PDM accesses through the HART analog module while the HART handheld is connected directly in parallel to the field device.

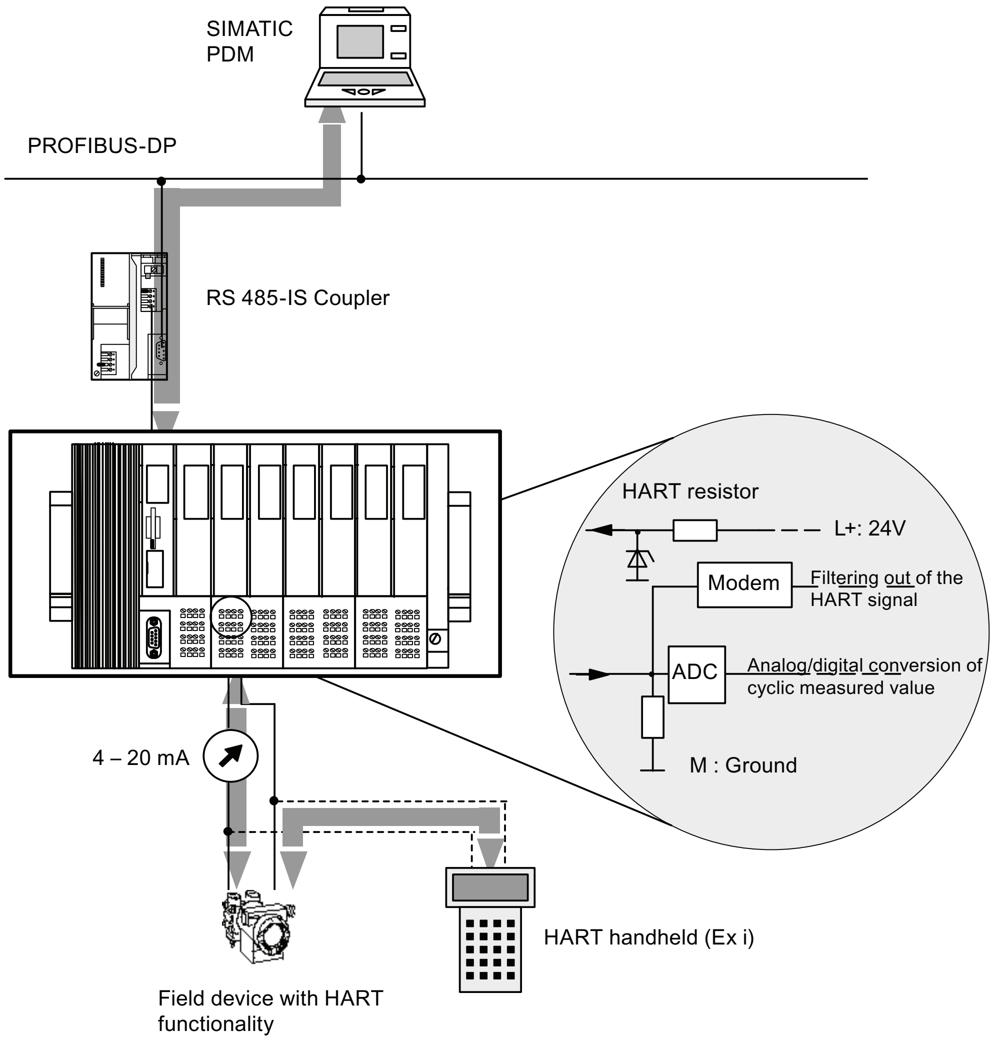


Figure 13-10 System environment for HART applications

Transparent message data - Format

The ET°200iSP HART analog modules support the *transparent message data* format. Using SIMATIC PDM you therefore have direct access to the HART field device for the commands and responses.

Each HART analog module is equipped with a common HART modem for the 4 channels. In other words, with SIMATIC PDM you can only directly access one channel of the module at any one time (multiplexes of the channels). It is not possible to simultaneously directly access another channel of the same module.

If the channels are located on different HART analog modules, you can access a maximum of 6 channel directly with SIMATIC PDM.

Other properties of the ET 200iSP HART analog module

Table 13- 32 Properties of the ET 200iSP HART analog module

Properties	Explanation
Secondary master cannot be connected (Secondary master exclusion)	No
After a Write Request there is direct feedback on the validity of the data. (Application Supported Parameter Check)	Yes
Several HART field devices are supplied by means of a single line. (Multi-Drop Mode)	No, analog value =0
Communication type with HART, in which the master requests that the HART field device respond cyclically and continuously to a predefined HART commend to send (the reading of the measured variable, for example). (Burst mode)	No
HART master cyclically sends a predefined HART command to the connected HART field device. (Scan mode)	No
Use of the compact data format (Compact HART Message Format)	Yes
A HART client sends a sequence of HART commands. No other client can interrupt this procedure. (Successive HART Commands mode)	Yes
Parameters are stored retentively. (Parameter Stored Non Volatile)	No
Automatic deactivation of burst mode (Burst-Mode Auto Disable)	No
Maximum data field length (Data length)	64 bytes (corresponds to 75 bytes data record in transparent-message-data format)
Client management (Client Management)	No, only 1 client per channel (4 "mailboxes" per module")

13.10.6 HART Fast Mode

Introduction

When HART-Fast-Mode is enabled, the HART electronic modules support the processing of HART commands as SHC sequence (Succesive HART Command)).

Prerequisites

The HART electronic modules support the HART Fast Mode as of the following product versions / STEP 7 hardware updates:

HART electronic modules	Product version	STEP 7 hardware update (HSP)
4 AI I 2WIRE HART	9	053 as of V3.0
4 AI I 4WIRE HART	8	
4 AO I HART	9	057 as of V3.0

HART Fast Mode

If a HART command with an SHC bit set for a channel is detected by the electronic module, the full HART command processing capacity is reserved on this electronic module for this channel for approx. 2 seconds. No other HART command processing is performed during this time on any other channels of the electronic module.

The electronic module reserves the HART command processing for this channel for another 2 seconds for each additional HART command with set SHC bit. If a HART command is detected without a set SHC bit for this channel or if no other command is issued for this channel within 2 seconds of the preceding HART command, the electronic module returns to "normal" HART command processing. Result: All HART channels are processed again.

NOTICE

- During the time a HART channel of the electronic module is processing a SHC sequence, which means that full HART processing capacity of the electronic module is reserved for this channel, the HART variables of all HART channels are no longer updated. Their values and quality codes remain unchanged.
- HART requests for other channels are not processed and they are acknowledged accordingly.
- If a HART channel is in use by multiple clients (for example SIMATIC PDM, user program), the response provided by the electronic module cannot be clearly directed to a specific client. HART electronic modules do not support client management.

As of V6.0 SP5, PDM supports processing of HART requests with SHC sequences. To use this, you need to specifically activate "HART RIO SHC Mode" in the "Communication" tab under "Options -> Settings" in PDM.

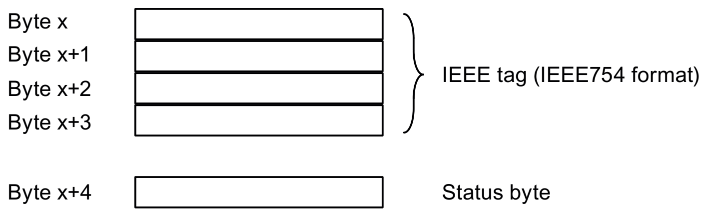
13.10.7 IEEE tags

Properties

Each analog module with HART can read up to four IEEE tags in addition to the analog value. These tags are represented in IEEE 754 format. This involves the *float format according to IEEE standard 754 short real number* (floating-point format).

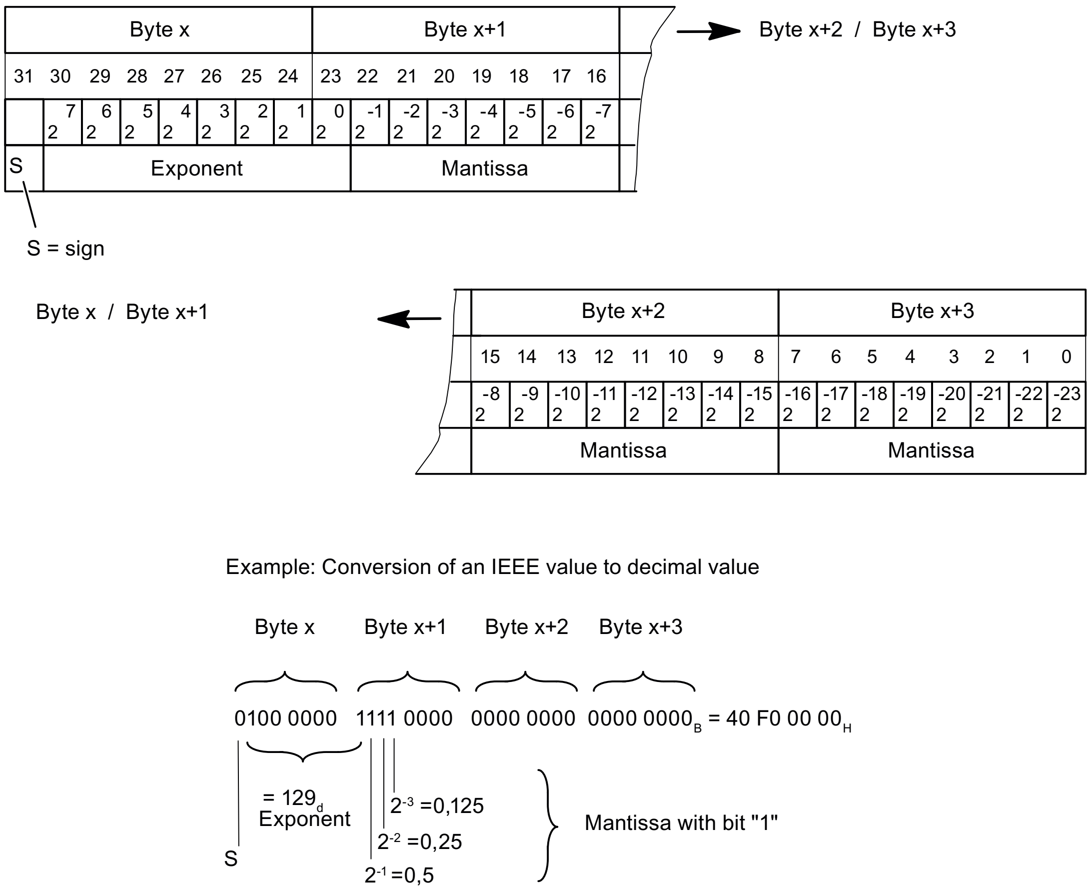
Each IEEE tag is accompanied by a status byte. The status byte informs you of the validity of the measured value.

The representation of a tag in IEEE754 format requires 4 bytes + 1 status byte.



HART measured value in IEEE format (byte x up to byte x+3)

Below you see the representation of a HART measured value in IEEE format and the conversion of an IEEE word into a decimal value.



$$\boxed{\text{Measured value} = (1)^{S} \times 2^{(\text{exponent}-127)} \times (1+\text{mantissa with bit "1"})}$$

Measured value $= (-1)^{0} \times 2^{(129-127)} \times (1+2^{-1}+2^{-2}+2^{-3})$

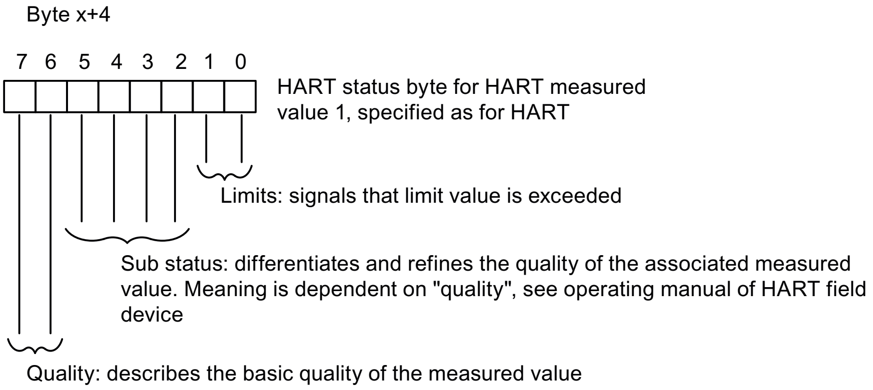
Measured value $= (1 \times 4 \times (1+0.5+0.25+0.125)$

Measured value $= 7{,}5$

Figure 13-11 IEEE754 format

Status byte (byte x +4)

The structure of the status byte corresponds to the PROFIBUS-PA profile. With ET 200iSP, the following status codes of the PROFIBUS-PA profile are used:



Utilized status codes of PROFIBUS PA profile for ET 200iSP:

01 0011 00 ($4C_H$)	Uncertain, initial value (before first contact made)
00 0110 00 (18_H)	Bad, no communication (communication error)
00 0011 00 ($0C_H$)	Bad, device failure (device malfunction)
01 0001 11 (47_H)	Uncertain, last usable event, constant (device is busy)
10 0001 00 (84_H)	Good, update event (parameter reassignment)
10 0000 00 (80_H)	Good, ok (no error)

Figure 13-12 Status byte

See also

Analog input modules with HART (4 AI I 2WIRE HART, 4 AI I 4WIRE HART) (Page 366)
Analog output module with HART (4 AO I HART) (Page 367)

13.10.8 HART data records

Prerequisites

You require this information if you want to go beyond the standard applications of STEP 7 and SIMATIC PDM or use your own configuration tool for HART communication.

Data record interface

The analog modules with HART use data records as the input and output interface:

The mapping of HART commands and HART responses in PROFIBUS-DP data records is based on the *PROFIBUS Profile HART Version 1.0*. For more detailed information on the HART protocol, refer to *PROFIBUS DP HART Profile Application Guidelines*.

The above documentation is available from PUO (PROFIBUS user organization) on the Internet PROFIBUS (http://www.profibus.com):

Table 13- 33 HART data records

Data record number	Read / write	Size in bytes	Name
148	read	13	Directory process data
	DR information (data record directory): This data record contains the data record numbers (index) of all HART data records and information on the configuration limits and for revision.		
149	read	3	HMD Feature Parameter Process Data
	HART feature flags: This data record describes which optional HART functions are supported.		
129	Read / write	6	HMD Parameter Process Data
	HART parameters: This data record contains the parameters for the HART master. The status of the parameter assignment can be evaluated during the reading of the data record. There are no manufacturer specific parameters for the analog modules with HART.		
140	Read / write	12	HART Mapping data record
	HART Mapping data record: This data record contains the assignment of the individual HART measured values to the channels of the module.		
80	Write	75	HART Request Write Process Data
	Letterbox channel 0: This data record contains the transfer data for the command from the client to the HART field device (on channel 0).		
81	read	75	HART Response Read Process Data
	Letterbox channel 0: This date record contains the transfer data for the response from the HART field device (on channel 0) to the client.		
82	Write	75	HART Request Write Process Data
	Letterbox channel 1: This data record contains the transfer data for the command from the client to the HART field device (on channel 1).		
83	read	75	HART Response Read Process Data
	Letterbox channel 1: This date record contains the transfer data for the response from the HART field device (on channel 1) to the client.		
84	read	75	HART Request Write Process Data
	Letterbox channel 2: This data record contains the transfer data for the command from the client to the HART field device (on channel 2).		

Data record number	Read / write	Size in bytes	Name
85	read	75	HART Response Read Process Data
	Letterbox channel 2: This date record contains the transfer data for the response from the HART field device (on channel 2) to the client.		
86	read	75	HART Request Write Process Data
	Letterbox channel 3: This data record contains the transfer data for the command from the client to the HART field device (on channel 3).		
87	read	75	HART Response Read Process Data
	Letterbox channel 3: This date record contains the transfer data for the response from the HART field device (on channel 3) to the client.		

Read and write data records

Use the following SFCs to read and write the data records:

- Read data record SFC 59 "RD_REC"
- Write data record: SFC 58 "WR_REC"

For more information about the SFCs, refer to the "System Software for S7-300/400 (http://support.automation.siemens.com/WW/view/en/1214574)" manual.

13.11 Parameters of the analog electronic modules

13.11.1 Parameters for analog electronics modules 4 AI I 2WIRE HART, 4 AI I 4WIRE HART

Configuration with STEP 7 Version 5.3 Service Pack 1 or higher, and current HW update

For a description, refer to the online help for STEP 7.

Configuration with GSD file

For the 4 AI I 2WIRE HART und 4 AI I 4WIRE HART analog electronic module, there are various configurations that you can select using the following entries in the hardware catalog of the project engineering software:

- Configuration "4 AI I 2WIRE HART" and "4 AI I 4WIRE HART":

  Analog values are output in S7 format.

- Configurations "4 AI I 4W+x" and "4 AI I 4W+x":

  Analog values are output in S7 format. In addition, up to four IEEE tags (master or auxiliary tag) are available in IEEE 754 format. You define the number of IEEE tags (1 to 4) in the configuration data:

  - ...4W+1
  - ...4W+2
  - ...4W+3
  - ...4W+4

Parameters for configuration "4 AI I 2WIRE HART", "4 AI I 4WIRE HART"

Table 13- 34 Parameters for configuration "4 AI I 2WIRE HART", "4 AI I 4WIRE HART"

Parameter		Range of values	Default	Applicability
4 AI I 2WIRE HART	4 AI I 4WIRE HART			
Process alarm (when limit value exceeded)		• enabled • disabled	disabled	Channel
Measuring range	---	• Disabled • 4 mA to 20 mA • HART	HART	Channel
---	Measuring range	• Disabled • 0 mA to 20 mA • 4 mA to 20 mA • HART	HART	Channel
Group diagnostics		• enabled • disabled	enabled	Module
Overflow/underflow diagnostics		• enabled • disabled	enabled	Module
Smoothing		• None • Low • Average • Strong	None	Channel
High limit		Lower to upper limit value of the over-range (SIMATIC S7)	High limit	Channel
Low limit		Lower to upper limit value of the over-range (SIMATIC S7)	Low limit	Channel
Diagnostics: wire break		• enabled • disabled	enabled	Channel
Diagnostics: wire break	---	• enabled • disabled	enabled	Channel

Parameters for configuration "4 AI I 2W+x, "4 AI I 4W+x"

In addition to configuration "4 AI I 2WIRE HART" and "4 AI I 4WIRE HART": the following parameters can be set with the configurations "...W+x":

Table 13- 35 Parameters for configuration "...W+x"

Parameter		Range of values	Default	Applicability
2 AI I 2WIRE HART	2 AI I 4WIRE HART			
HART retries (number of retries)		0 to 10	2	Module
HART Fast Mode		• enabled • disabled	disabled	Module
Channel		• 0 • 1 • 2 • 3	0	Channel
IEEE tag		• None • Primary variable • 1. Auxiliary variable • 2. Auxiliary variable • 3. Auxiliary variable	None	Channel
HART warning		• enabled • disabled	disabled	Module
HART diagnostics		• enabled • disabled	disabled	Module

13.11.2 Parameters relevant for 4 AI RTD, 4 AI TC analog electronics modules

4 AI RTD, 4 AI TC parameters

Table 13- 36 4 AI RTD, 4 AI TC parameters

Parameter		Range of values	Default	Applicability
4 AI RTD	4 AI TC			
Hardware interrupt (when limit value exceeded)[1]		• enabled • disabled	disabled	Channel
Measuring method	---	• deactivated • RTD 4-wire connection • RTD 3-wire connection • RTD 2-wire connection • R 4-wire connection • R 3-wire connection • R 2-wire connection	RTD 4-wire connection	Channel
Measuring range	---	• Pt 100 standard range • Pt 100 climate range • Ni 100 Standard range • Ni 100 climate range • 600 Ω absolute • 1000 Ω absolute	Pt 100 standard range	Channel
---	Measuring range	• deactivated • ±80 mV • Type B [PtRh - PtRh] • Type N [NiCrSi-NiSi] • Type E [NiCr-CuNi] • Type R [PtRh-Pt] • Type S [PtPh-Pt] • Type J [Fe-CuNi] • Type L [Fe-CuNi] • Type T [Cu - CuNi] • Type K [NiCr-Ni] • Type U [Cu-CuNi]	Type K [NiCr-Ni]	Channel
Group diagnostics		• enabled • disabled	enabled	Module
Diagnostics overflow/underflow		• enabled • disabled	enabled	Module
Diagnostics: wire break		• enabled • disabled	enabled	Channel

Parameter		Range of values	Default	Applicability
4 AI RTD	4 AI TC			
Diagnostics short-circuit[2]	---	• enabled • disabled	enabled	Channel
---	Reference junction	• None • Yes • RTD	None	Channel
---	Reference junction number	• 1 • 2 • Internal	1	Channel
Smoothing		• None • Low • Average • Strong	None	Channel
High limit		Lower to upper limit value of the over-range (SIMATIC S7)	High limit	Channel
Low limit		Lower to upper limit value of the over-range (SIMATIC S7)	Low limit	Channel
[1] Relates to the "High limit" and "Low limit" parameters [2] Underflow is not indicated if short-circuit diagnostics is enabled.				

13.11.3 Parameters for analog electronics module 4AO I HART

Configuration with STEP 7 Version 5.3 Service Pack 1 or higher, and current HW update

For a description, refer to the online help for STEP 7.

Configuration with GSD file

For the 4AO I HART analog electronic module, there are various configurations that you can select using the following entries in the hardware catalog of the project engineering software:

- Configuration "4AO I HART":

  Analog values are output in S7 format.

- Configurations "4AO I +x":

  Analog values are output in S7 format. In addition, up to four IEEE tags (master or auxiliary tag) are available in IEEE 754 format. You define the number of IEEE tags (1 to 4) in the configuration data:

  – ...I +1
  – ...I +2
  – ...I +3
  – ...I +4

Parameters for configuration "4AO I HART"

Table 13- 37 Parameters for configuration "4AO I HART"

Parameter	Range of values	Default	Applicability
Group diagnostics	• enabled • disabled	enabled	Module
Diagnostics: wire break	• enabled • disabled	enabled	Channel
Diagnostics: wire break	• enabled • disabled	enabled	Channel
Output range	• Disabled • 0 mA to 20 mA • 4 mA to 20 mA • HART	HART	Channel
Response to CPU/ master STOP	• Zero output current/voltage • Set substitution value • Hold last value	Set substitution value	Channel
Substitution value	Every value of the nominal range	0 to 20 mA: 0 mA 4 to 20 mA and HART: 4 mA	Channel

WARNING

The substitute values are stored in the flash memory of the IM 152. These are output at the next startup of the ET 200iSP until it starts exchanging data with the DP master.

Remember this behavior if you change to a different project engineering environment with the ET 200iSP.

Solution: Erase the flash memory of the IM 152 first.

Parameters for configuration "...I +x"

In addition to the "4AO I HART" configuration, the following parameters can be set for the "...I +x" configurations:

Table 13- 38 Parameters for configuration "I +x"

Parameter	Range of values	Default	Applicability
HART retries (number of retries)	0 to 10	2	Module
HART Fast Mode	• enabled • disabled	disabled	Module
Channel	• 0 • 1 • 2 • 3	0	Channel
IEEE tag	• None • Primary variable • 1. Auxiliary variable • 2. Auxiliary variable • 3. Auxiliary variable	None	Channel
HART warning	• enabled • disabled	disabled	Module
HART diagnostics	• enabled • disabled	disabled	Module

13.12 Parameter description of the analog electronic modules

13.12.1 Reference junction / reference junction number

Description

Refer to "Connecting thermocouples (Page 311)".

13.12.2 Smoothing

Using smoothing

Smoothed analog values provide a reliable analog signal for further processing.

It makes sense to smooth analog values when measured values change slowly (e.g. in case of temperature changes).

Parameter

The measured values are smoothed by digital filtering. Smoothing is achieved by the module forming a mean value from a specified number of converted (digitized) analog values.

You set up to four grades of smoothing (none, low, average, strong). The stage determines the number of analog signals used to form the mean value.

The stronger the smoothing, the more stable the smoothed analog value and the longer it takes until the smoothed analog signal is applied following a step response (refer to the following example).

Example

The figure below shows the number of cycles a module requires to apply a close to 100% analog value after a step response, based on the smoothing function settings. The figure applies to all signal changes at the analog input.

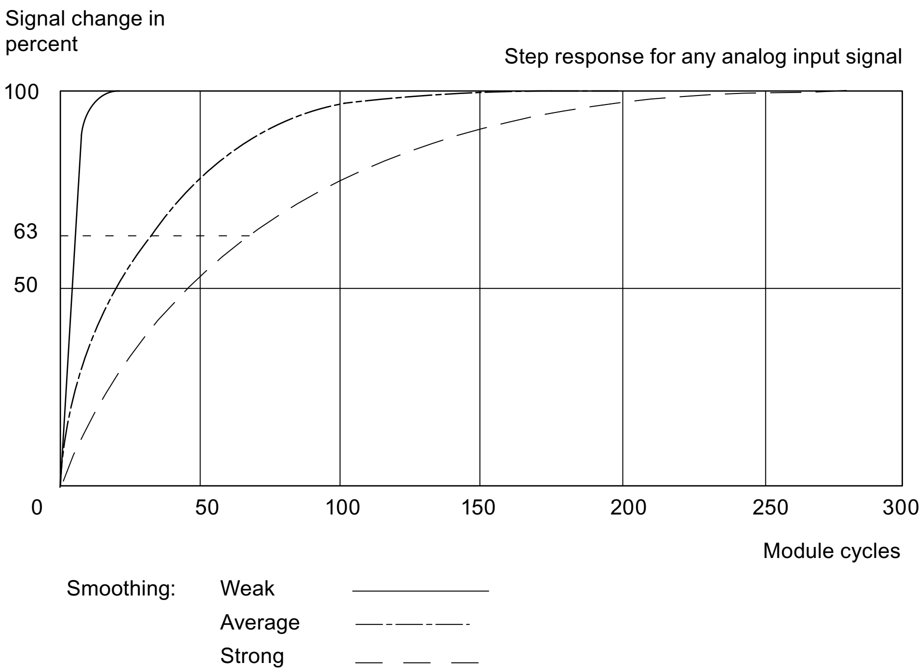


Figure 13-13 Example of the influence of smoothing on step responses

13.12.3 Assigning the channel and IEEE tag

Properties

Analog electronic modules 4 AI I 2WIRE/HART, 4 AI I 4WIRE/ HART and 4 AO I HART support up to four IEEE tags.

The process input image (PII) provides up to 20 bytes per module for the IEEE tags. Thus, four blocks of 5 bytes each are available for the four IEEE tags within the PII.

Prerequisites

The HART field device must support the assigned number of IEEE tags.

Assigning IEEE tags

You assign the IEEE tags of the field devices to any one of the four blocks in the PII.

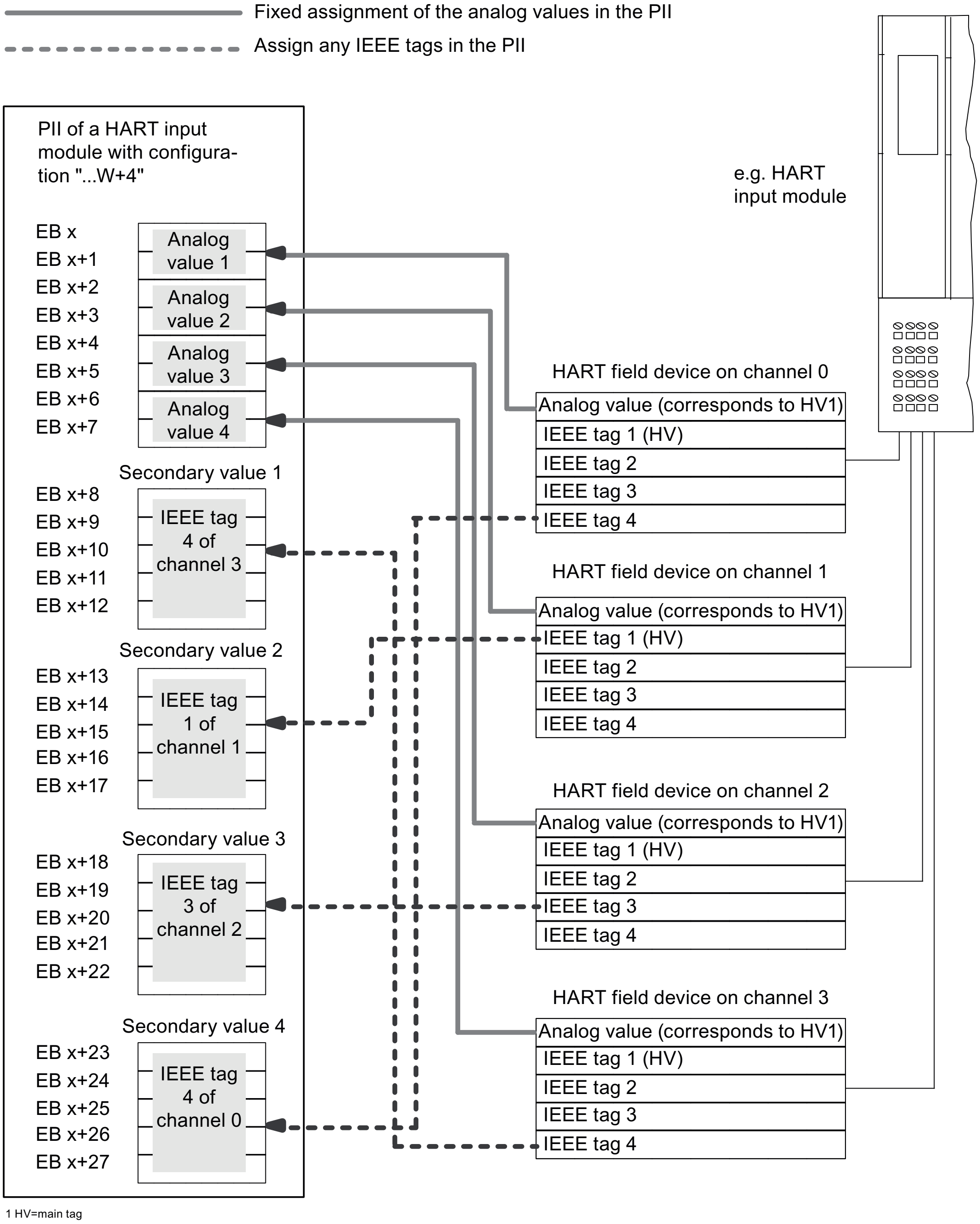


Figure 13-14 Assigning the IEEE tags

Configuring IEEE tags with STEP 7, Version 5.3 Service Pack 1 or higher, and current HW update

For a description, refer to the online help for STEP 7.

Configuring IEEE tags with GSD file.

It is first necessary to configure to the number of the required IEEE tags (1 to 4). To do so, select the corresponding entry in the configuration table of the project software:

- ...+1
- ...+2
- ...+3
- ...+4

Assigning parameters to the IEEE tags

You must now select the desired IEE variable of the field device. For each block in the PII, the following parameters are available with the analog electronic modules 4 AI I 2WIRE/HART, 4 AI I 4WIRE/ HART and 4AO I HART:

Channel parameter: This parameter is used to define from which channel and/or field device the IEEE tag is read in.

IEEE tag parameter: Here you select the IEEE tag (1 to 4) of the field device assigned to the PII.

13.12.4 HART repetitions

Description

You can use this parameter to specify the number of retries made before a diagnostic result is output for HART communication errors.

13.12.5 HART Fast Mode

Description

When HART Fast Mode is enabled, HART electronic modules support the processing of HART commands as SHC sequences (successive HART command)

13.12.6 HART warning

Description

If you enable this parameter, a diagnostic interrupt will be triggered in response to the following HART warnings (see the "Electronic module error types" table):

- HART further status available
- HART configuration changed

13.12.7 HART diagnostics

Description

If you enable this parameter, a diagnostic interrupt will be triggered in response to the following HART diagnostics (see the "Electronic module error types" table):

- HART analog output current specified
- HART analog output current saturated
- HART communication error
- HART primary variable outside the limits
- HART auxiliary variable outside the limits

Other modules 14

14.1 Reserve module

Order number

6ES7138-7AA00-0AA0

Properties

The reserve module has the following characteristic features:

- Is suitable for all terminal modules on which you can insert an electronic module.
- Reserves a slot for any electronic module. Insert the reserve module on the reserved slot of the ET 200iSP configuration.
- If any gaps (of an electronic module) develop due to the ET 200iSP configuration, the following rules apply:
  - The gap is at the last slot of the ET 200iSP: Insert a reserve module or the slot cover into the gap.
  - The gap is at a different slot (for electronic modules): Insert a reserve module into the gap (see the Diagnostics for Incorrect Module Configuration States of the ET 200iSP section).
- As of product version 03, the reserve module can also be inserted on terminal module TM-RM/RM.

Procedure with CiR

Refer to Function Manual "Modifying the system during operation via CiR (http://support.automation.siemens.com/WW/view/en/14044916)".

Pin assignment

The reserve module has no connection to the terminals of the terminal module. This means that you can wire the terminal module completely and prepare it for the future application.

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	Approx. 180 g
Module-specific data	
Approvals	
• ATEX	II 2 G and I M2 Ex ib IIC T4; Ex ib I KEMA 04 ATEX 1251 0344
• IECEx	IECEx KEM 05.0013
• INMETRO INMETRO BR OCP-0029	BR-Ex ib IIC T4 / BR-Ex ib I
• FM	Class I, Zone 1, AEx ib IIC T4; Ex ib IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 Class II, III, GP EFG
• cULus LISTED 7XA1	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx ib IIC T4; Ex ib IIC T4 Class I, Div 2, GP . A,B,C,D T4
Power loss of the module	max. 0.03 W
Status, interrupts, diagnostics	
Status display	No
Diagnostic functions	No
Safety data	
See EC-type-examination certificate	KEMA 04ATEX1251

See also

Diagnostics for incorrect ET 200iSP configuration statuses (Page 181)

Installing the Terminating Module and the Slot Cover (Page 97)

14.2 Watchdog module

Order number

6ES7138-7BB00-0AB0

Properties

Functional check of the ET 200iSP The written value is transferred to the input data according to the assigned function (see parameters of the Watchdog module). Wiring is not required for this purpose.

Note

You must integrate the functional check of the Watchdog module in your user program and evaluate it there.

- Provision of an intrinsically safe 11 V power supply for the shutdown signal of the digital output modules. See Digital electronics module 4 DO (Page 247)

  Note

  The intrinsically safe supply for the shutdown signal may only be used within the ET 200iSP station in which the Watchdog module is located.

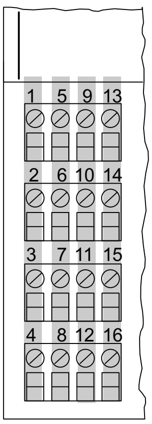
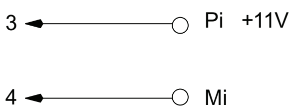
  The maximum line length for the shutdown signal is 20 m.

- Identification data I&M

Pin assignment

Pin assignment for inserted Watchdog module

Table 14- 1 Pin assignment of Watchdog electronic module

Pin assignment and view	Remarks
Channel Pi Pi Pi Pi Mi Mi Mi Mi Pi Pi Pi Pi Mi Mi Mi Mi  Provision of an intrinsically safe power supply (11 V) for the shutdown signal of the digital output modules See Digital output module 4DO. Connection example 	Connections: Pi: Terminals 1, 3, 5, 7, 9, 11, 13, 15 Mi: Terminals 2, 6, 8, 10, 12, 14, 16 Pi: Intrinsically safe power supply (11 V) Mi: Chassis ground

Block diagram

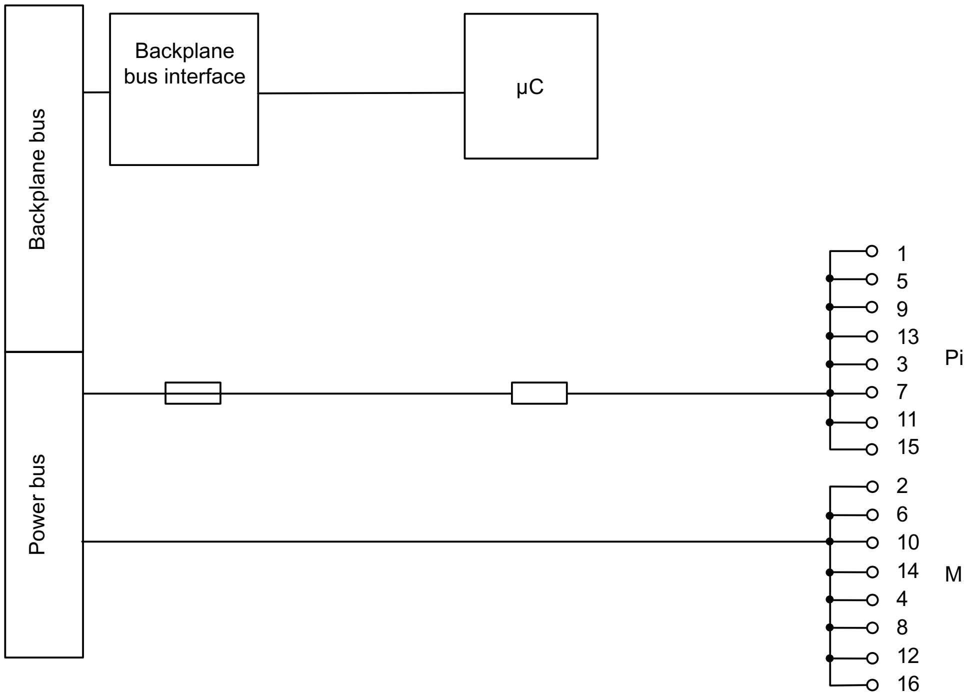


Figure 14-1 Block diagram of Watchdog module

Technical specifications

Technical specifications	
Dimensions and weights	
Dimensions W x H x D (mm)	30 x 129 x 136.5
Weight	ca. 180g
Module-specific data	
Approvals	
• ATEX	II 2 G and I M2 Ex ib IIC T4; Ex ib I KEMA 06 ATEX 0086 CE 0344
• IECEx	IECEx KEM 06.0026
• INMETRO (INMETRO; BR OCP-0029)	BR-Ex ib IIC T4 / BR-Ex ib I
• FM (FM C US APPROVED)	Class I, Zone 1, AEx ib IIC T4; Ex ib IIC T4 NI, Class I, DIV. 2, GP A,B,C,D T4 Class II, III, GP EFG
• cULus (LISTED 7XA1)	Process Cont. Eq. for Use in HAZ.LOC. Class I, Zone 1, AEx ib IIC T4; Ex ib IIC T4 Class I, DIV . 2, GP . A,B, C, D T4
Voltages, currents, electrical potentials	
Electrical isolation	
• Between the channels and backplane bus	Yes
• Between channels	No
• Between the channels and load voltage (power bus)	Yes
Permissible potential difference	
• Between different circuits	60 V DC, 30 V AC
Current consumption from load voltage (power bus)	2 mA * number of connected digital output modules.
Power loss of the module	0.05 W
Status, interrupts, diagnostics	
Status display	
• Input (bit)	Green LED
Diagnostic function	
• Group error display	Red "SF" LED
• Diagnostic function can be read	Yes
Safety data	
See EC-type-examination certificate	KEMA 06 ATEX0086

Parameter

Parameter	Range of values	Default	Applicability
Mode	• Disabled • write/ read • write/ read neg. • Toggle 0.1 Hz • Toggle 0.5 Hz • Toggle 1 Hz • Toggle 2 Hz	write/ read	Module
Response to CPU/ Master STOP	• Keep last value • Set to 00_H • Set to FF_H	Keep last value	Module

Parameter description: Mode

Disabled: A value that you write to the output byte is not transferred to the input byte.

write/ read: A value that you write to the output byte is transferred to the input byte.

write/ read neg.: A value that you write to the output byte is inverted and transferred to the input byte.

toggle 0.1 Hz; toggle 0.5 Hz; toggle 1 HZ; toggle 2 Hz: Bit 0 (see address space of inputs and outputs) in the input byte of PII toggles (flashes) at the specified frequency.

Parameter description: Response to CPU/Master STOP

Keep last value: The last value in the output byte of the PIQ is retained.

Set to 00_H: The value in the output byte of the PIQ is set to 00_H.

Set to FF_H: The value in the output byte of the PIQ is set to FF_H.

Appendix A

A.1 Order numbers

Introduction

You will find the order numbers for the ET 200iSP distributed I/O station and the PROFIBUS accessories that you may need in conjunction with the ET 200iSP below.

Interface module

Table A- 1 Interface module

Name	Quantity	Order number
Interface module IM 152	1 unit	6ES7152-1AA00-0AB0

Terminal modules

Table A- 2 Terminal modules

Name	Quantity	Order number
TM-PS-A	1 unit	6ES7193-7DA10-0AA0
TM-PS-A UC	1 unit	6ES7193-7DA20-0AA0
TM-PS-B	1 unit	6ES7193-7DB10-0AA0
TM-PS-B UC	1 unit	6ES7193-7DB20-0AA0
TM-IM/IM and terminating module	1 unit	6ES7193-7AB00-0AA0
TM-IM/EM 60S (screw terminals) and terminating module	1 unit	6ES7193-7AA00-0AA0
TM-IM/EM 60C (spring terminals) and terminating module	1 unit	6ES7193-7AA10-0AA0
TM-EM/EM 60S (screw terminals)	1 unit	6ES7193-7CA00-0AA0
TM-EM/EM 60C (spring terminals)	1 unit	6ES7193-7CA10-0AA0
TM-RM/RM (screw terminal)	1 unit	6ES7193-7CB00-0AA0

Power supply

Table A- 3 Power supply

Name	Quantity	Order number
Power supply PS 24 VDC	1 unit	6ES7138-7EA01-0AA0
Power supply PS 120/230 VAC	1 unit	6ES7138-7EC00-0AA0

Digital electronic modules

Table A- 4 Digital electronic modules

Name	Quantity	Order number
8 DI NAMUR	1 unit	6ES7131-7RF00-0AB0
4 DO DC23.1V/20mA SHUT DOWN "H"	1 unit	6ES7132-7RD01-0AB0
4 DO DC17.4V/27mA SHUT DOWN "H"	1 unit	6ES7132-7RD11-0AB0
4 DO DC17.4V/40mA SHUT DOWN "H"	1 unit	6ES7132-7RD21-0AB0
4 DO DC23.1V/20mA SHUT DOWN "L"	1 unit	6ES7132-7GD00-0AB0
4 DO DC17.4V/27mA SHUT DOWN "L"	1 unit	6ES7132-7GD10-0AB0
4 DO DC17.4V/40mA SHUT DOWN "L"	1 unit	6ES7132-7GD20-0AB0
2 DO Relay UC60V/2A	1 unit	6ES7132-7HB00-0AB0

Analog electronic modules

Table A- 5 Analog electronic modules

Name	Quantity	Order number
4 AI I 2WIRE HART	1 unit	6ES7134-7TD00-0AB0
4 AI I 4WIRE HART	1 unit	6ES7134-7TD50-0AB0
4 AI RTD	1 unit	6ES7134-7SD51-0AB0
4 AI TC and TC sensor module	1 unit	6ES7134-7SD00-0AB0
4 AO I HART	1 unit	6ES7135-7TD00-0AB0

Other modules

Table A- 6 Other modules

Name	Quantity	Order number
Reserve module	1 unit	6ES7138-7AA00-0AA0
Watchdog module	1 unit	6ES7138-7BB00-0AB0

ET 200iSP accessories

Table A- 7 ET 200iSP accessories

Name	Quantity	Order number
Ex e terminal WPE 16/E (for shield connecting element mounting rail)	1 unit	1010400000*
Mounting rail for the S7 technical setup 480 mm 530 mm 585 mm 830 mm 885 mm	1 unit	 6ES7390-1AE80-0AA0 6ES7390-1AF30-0AA0 6ES7390-1AF85-0AA0 6ES7390-1AJ30-0AA0 6ES7390-1AJ85-0AA0
DIN A4 labeling strips, 20 labeling strips for interface module and 60 labeling strips for electronic modules, foil for printing with laser printer or plotter. • Light beige • Yellow • Red • petrol	10 sheets	 6ES7193-7BA00-0AA0 6ES7193-7BB00-0AA0 6ES7193-7BD00-0AA0 6ES7193-7BH00-0AA0
Unlabeled slot number plate	100 units	8WA8848-2AY
Slot number plates 10 x labeled 1 to 20	200 units	8WA8861-0AB
Slot number plates 5 x labeled 1 to 40	200 units	8WA8861-0AC
Slot number plate 2 x labeled 1 to 68 and 1 x labeled 1 to 64	200 units	8WA8861-0DA
* Order numbers of Weidmüller GmbH & Co. KG, P.O. Box 3054, 32720 Detmold; http://www.weidmueller.com (http://www.weidmueller.com) http://catalog.weidmueller.com (http://catalog.weidmueller.com)		

Enclosure for the ET 200iSP

Table A- 8 Enclosure for the ET 200iSP

Name	Quantity	Order number
Wall enclosure for Zone 1/ 2 degree of protection Ex e; stainless steel; foldable enclosure cover; 3 rows of cable inlets M16 (41 x at 650 mm width and 68x at 950 mm width) and 2 rows of blanking plugs **Empty enclosure prepared:** • 650x450x230 suitable for max. 15 electronic modules • 950x450x230 suitable for max. 25 electronic modules **With installation and interconnection of the ET 200iSP in the wall enclosure[1]:** • 650x450x230 suitable for max. 15 electronic modules • 950x450x230 suitable for max. 25 electronic modules	1 unit	6DL2804-0AD30 6DL2804-0AE30 6DL2804-1AD30 6DL2804-1AE30
Wall enclosure for Zone 1/ 2 degree of protection Ex e; stainless steel; foldable enclosure cover; 5 rows of cable inlets M16=max. arrangement of components (66x at 650 mm width and 111x at 950 mm width) **Empty enclosure prepared:** • 650x450x230 suitable for max. 15 electronic modules • 950x450x230 suitable for max. 25 electronic modules **With installation and interconnection of the ET 200iSP in the wall enclosure[1]:** • 650x450x230 suitable for max. 15 electronic modules • 950x450x230 suitable for max. 25 electronic modules	1 unit	6DL2804-0AD50 6DL2804-0AE50 6DL2804-1AD50 6DL2804-1AE50
Wall enclosure for Zone 21/ 22 degree of protection IP65; stainless steel; foldable enclosure cover; 3 rows of cable inlets M16 (41x at 650 mm width and 68x at 950 mm width) and 2 rows of blanking plugs **Empty enclosure prepared:** • 650x450x230 suitable for max. 15 electronic modules • 950x450x230 suitable for max. 25 electronic modules **With installation and interconnection of the ET 200iSP in the wall enclosure[1]:** • 650x450x230 suitable for max. 15 electronic modules • 950x450x230 suitable for max. 25 electronic modules	1 unit	6DL2804-0DD30 6DL2804-0DE30 6DL2804-1DD30 6DL2804-1DE30
Wall enclosure for Zone 21/22 degree of protection IP65; stainless steel; foldable enclosure cover; 5 rows of cable inlets M16=max. arrangement of components (66x at 650 mm width and 111x at 950 mm width) **Empty enclosure prepared:** • 650x450x230 suitable for max. 15 electronic modules • 950x450x230 suitable for max. 25 electronic modules **With installation and interconnection of the ET 200iSP in the wall enclosure[1]:** • 650x450x230 suitable for max. 15 electronic modules • 950x450x230 suitable for max. 25 electronic modules	1 unit	6DL2804-0DD50 6DL2804-0DE50 6DL2804-1DD50 6DL2804-1DE50
[1] The components of the ET 200iSP are not included. These must be ordered and purchased separately.		

Network components

The following table lists all network components required for the use of the ET 200iSP.

Table A- 9 Network components for the ET 200iSP

Name	Quantity	Order number
RS 485-IS Coupler	1 unit	6ES7972-0AC80-0XA0
PROFIBUS bus connector RS 485 IS, with inclined outgoing cable, reversible active bus terminating resistance	1 unit	6ES7972-0DA60-0XA0
Bus cable for PROFIBUS	Sold in meters	6XV1830-0EH10
Bus cable for PROFIBUS RS485iS, blue (PB FC Standard Cable IS GP)	Sold in meters	6XV1831-2A

Automation Systems Principles of Explosion Protection manual

Manual	Contents
Automation systems basic information explosion protection as download from technical support: Technical Support (http://www.siemens.com/automation/service)	for example • Current explosion protection standards and guidelines • Explanation of protective measures and marking of equipment • Notes on setup, operation and maintenance of equipment for hazardous areas

Product Information RS 485-IS Coupler

Product information	Contents
RS 485-IS coupler as download from technical support: Technical Support (http://www.siemens.com/automation/service)	for example • Properties • Installation • Wiring technical specifications

Distributed system with PROFIBUS DP reference book

technical book	Order numbers	Contents
Decentralizing with PROFIBUS-DP - Installation, configuration and use of PROFIBUS DP with SIMATIC S7 - Josef Weigmann, Gerhard Kilian Publicis MCD Verlag, 3rd Edition	at the book store: ISBN 3895781894 at your SIEMENS office: A19100-L531-B772	Instruction manual for getting started with PROFIBUS DP and with the implementation of automation tasks using PROFIBUS DP and SIMATIC S7. Shows many practical examples of PROFIBUS DP applications based on SIMATIC S7.

SIMATIC Manual Collection - DVD

Name	Order number	Contents
SIMATIC Manual Collection	6ES7998-8XC01-8YE0	Contains all SIMATIC manuals in electronic format

Technical product data - DVD

Name	Order number	Contents
Technical product data for S7-300, S7-400 and ET 200	6ES7991-0CD01-0YX0	Contains the following technical product data for CAD/CAE systems: • Technical data according to ECAD component standard V1.2 • Graphical data (drawings) • Circuit-diagram macros

A.2 Dimensional drawings

A.2.1 Dimensional drawings

Introduction

Below you will see the dimension drawings of the most important components of the ET 200iSP.

Terminal Module TM-PS-A/ TM-PS-A UC, TM-PS-B/ TM-PS-B UC with Inserted Power Supply PS

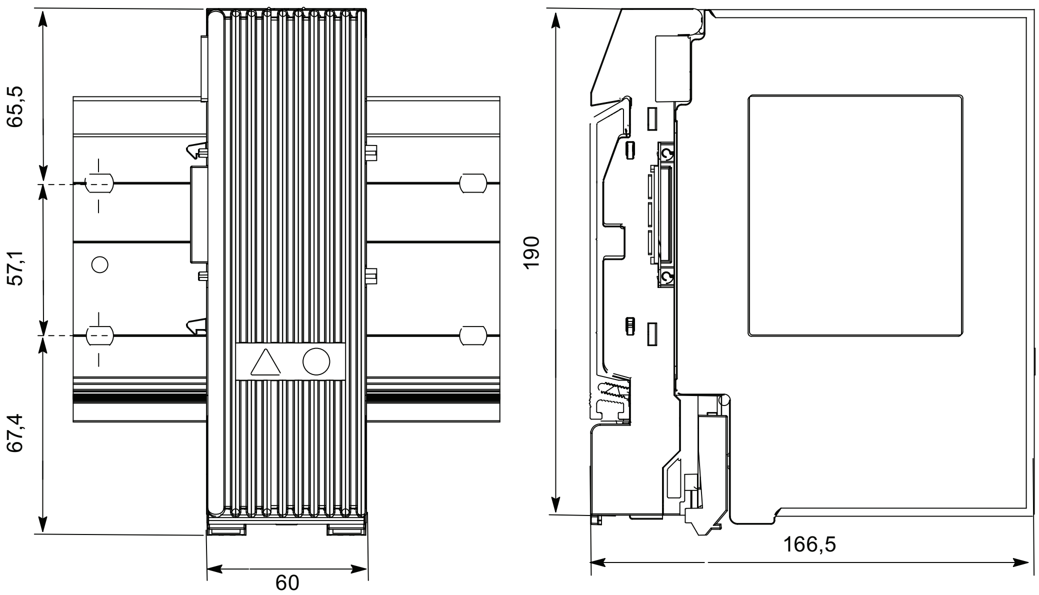


Figure A-1 Terminal module TM-PS-A, TM-PS-B with Inserted Power Supply PS

Terminal Module TM-IM/EM with Inserted Interface Module and Electronic Module

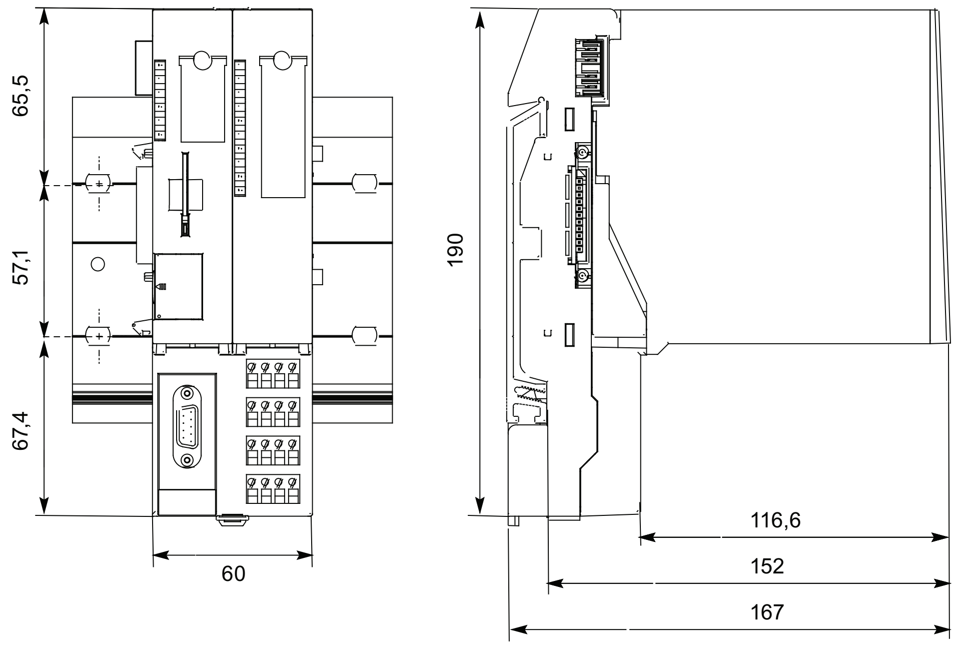


Figure A-2 Terminal Module TM-IM/EM with Inserted Interface Module and Electronic Module

Terminal Module TM-EM/EM with Inserted Electronic Modules

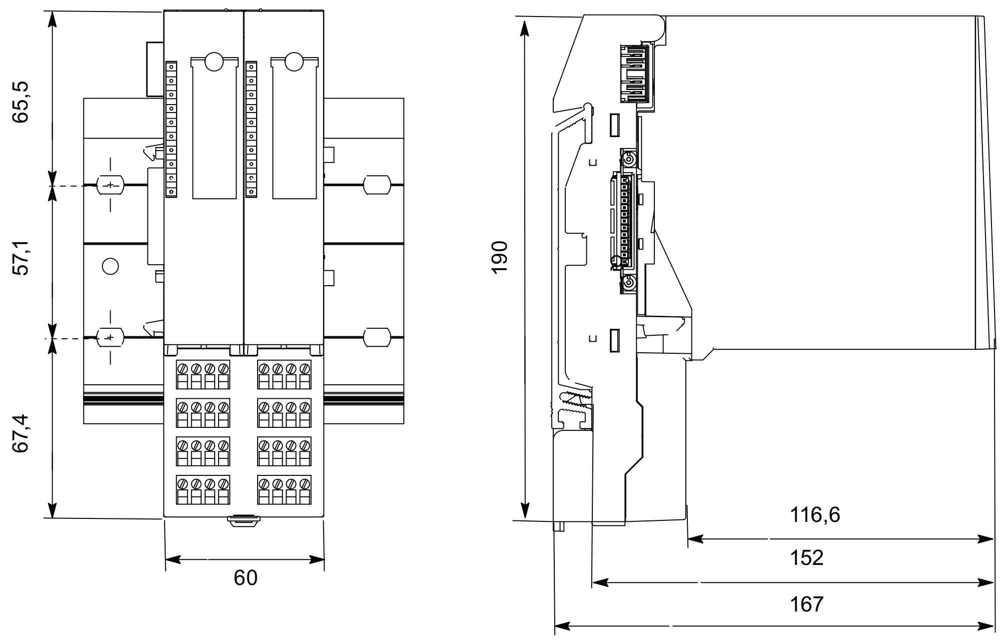


Figure A-3 Terminal Module TM-EM/EM with Inserted Electronic Modules

Terminal module TM-EM/EM with inserted electronic modules

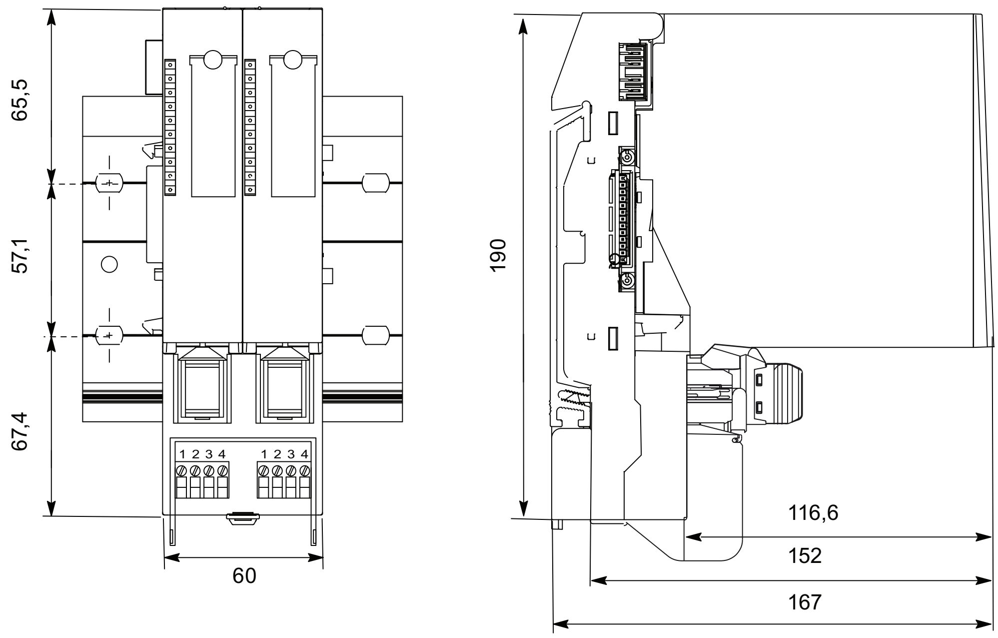


Figure A-4 Terminal module TM-EM/EM with inserted electronic modules

Terminating module

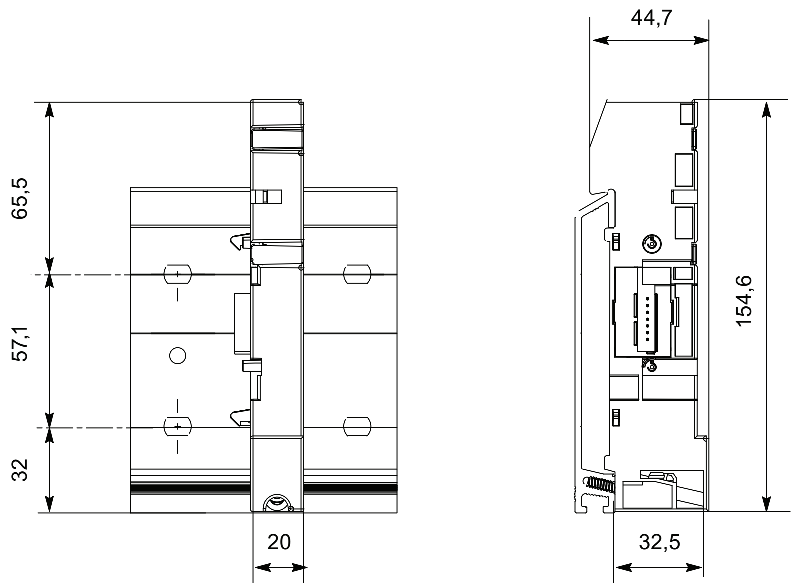


Figure A-5 Terminating module

A.3 Reaction times

A.3.1 Reaction times

Operating principle

The figure below shows the different reaction times between the DP master and the ET 200iSP.

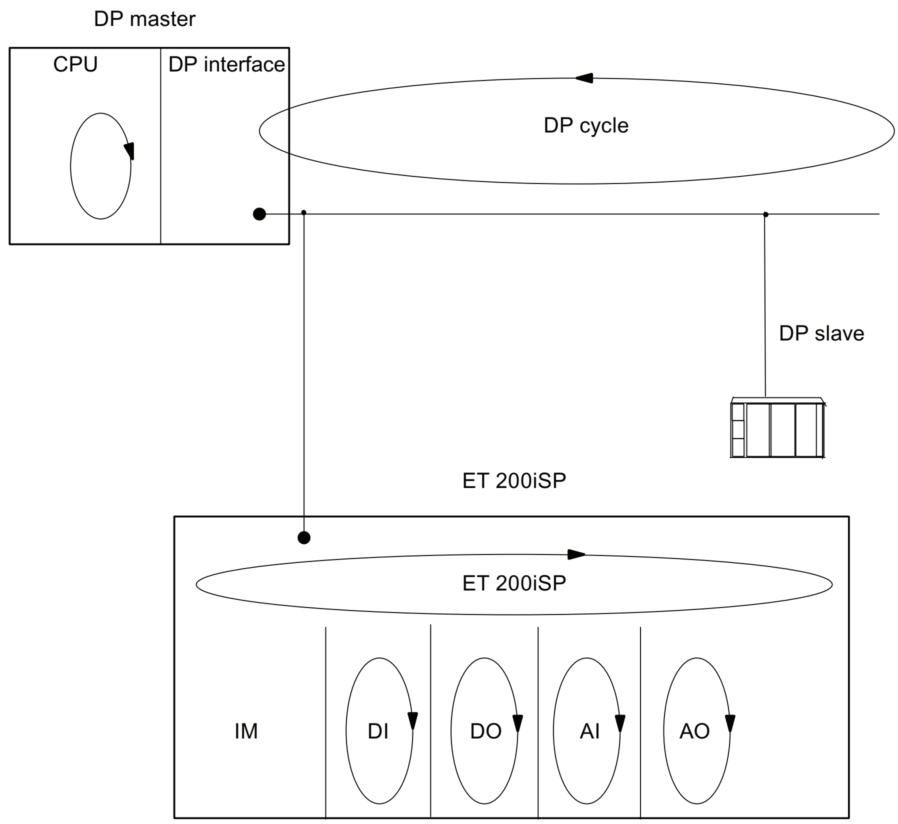


Figure A-6 Reaction times between the DP Master and ET 200iSP

A.3.2 Response times at the DP master

Reference

You will find information on the response times in the manual for the DP master.

A.3.3 Reaction times on the ET 200iSP

Response time

The reaction time on the ET 200iSP depends on:

- The number of modules
- The number of diagnostic messages
- Removing and inserting of modules
- Interrupts

A.3.4 Reaction times of digital input modules

Input delay

The reaction times of the digital input modules depend on the input delay. Refer to technical specifications Chapter "Digital electronic module (Page 239)".

See also

Digital electronics module 8 DI NAMUR (Page 239)

A.3.5 Reaction times for the digital output modules

Output delay

The response times correspond to the output delay. Refer to technical specifications Chapter "Digital electronic module (Page 239)".

See also

Digital electronics module 4 DO (Page 247)

A.3.6 Reaction times for analog input modules

Conversion time

The conversion time is made up of the basic conversion time and the time for processing wire break monitoring diagnostics (see Technical specifications for 4 AI RTD und 4 AI TC in the Chapter "Analog electronic modules (Page 275)").

The integration time of integrating conversions has a direct influence on conversion times.

Cycle time

The analog/digital conversion and the transfer of the digitized measured values to memory or to the backplane bus take place sequentially. In other words, the analog input channels are converted one after the other. The cycle time, that is, the time until an analog output value is converted again, is the sum of the conversion times of all the activated analog output channels of the analog input modules. You should deactivate unused analog input channels during parameter assignment in order to reduce the cycle time. The conversion and integration time for a deactivated channel is 0.

The following figure provides you with an overview of what makes up the cycle time for an n-channel analog input module.

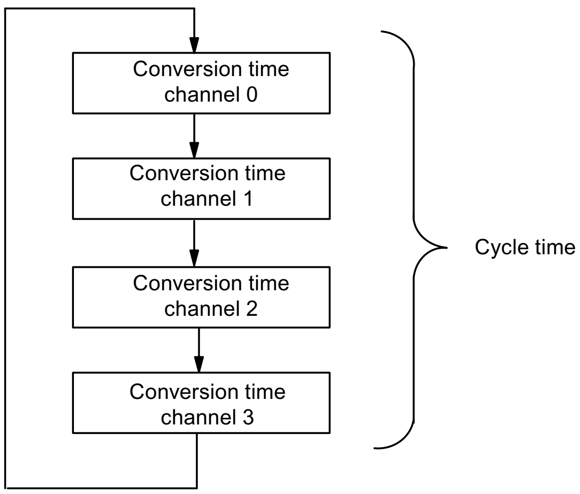


Figure A-7 Cycle time of the analog input module

A.3.7 Reaction times for analog output modules

Conversion time

The conversion time of the analog output channels includes the transfer of digitized output values from internal memory, and their digital-to-analog conversion.

Cycle time

The conversion of the analog output channels for the module takes place with a processing time and sequentially with a conversion time for channels 0,1, 2 and 3.

The cycle time, that is, the time until an analog output value is converted again, is the sum of the conversion times of all the activated analog output channels and of the processing time of the analog output module.

The following figure provides you with an overview of what makes up the cycle time for an analog output module.

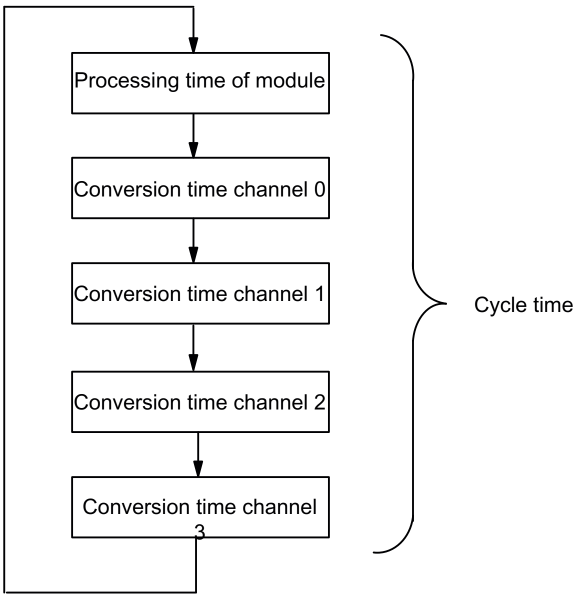


Figure A-8 Cycle time of the analog output module

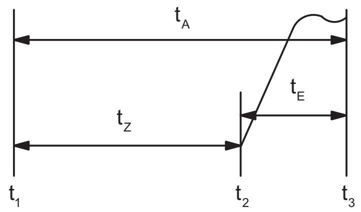
Settling time

The settling time (t_2 to t_3), time between creation of the converted value and this reaching a specific value on the analog output, is load-dependent. It is necessary to differentiate here between ohmic, capacitive and inductive load.

Response time

The response time (t_1 up to t_3), the time from the application of the digital output values in the internal memory up to the reaching of a specific value on the analog output is, in the least favorable case, the total of the cycle time and settling time. The least favorable case occurs if the analog channel was converted shortly before the transfer a new output value and the other channels were re-converted (cycle time) only after the conversion.

The following figure shows the response time of an analog output channel



t_A	Response time
t_C	Cycle time corresponds to the processing time of the module and the conversion time of the channel
t_I	Settling time
t_1	New digital output value applied
t_2	Output value applied and coverted
t_3	Specified output value reached

Figure A-9 Response time of an analog output channel

A.4 Address space of the inputs and outputs

A.4.1 Digital input module

8 DI NAMUR

The address range of the process input and output image that is assigned is dependent on the configuration, in other words, by the selection of the relevant entry in the engineering software.

8 DI NAMUR with "8 DI NAMUR" configuration

- Assignment of the process input image (PII)

	7	6	5	4	3	2	1	0	
EB x	7	6	5	4	3	2	1	0	Channels 0 to 7 of input signal

S7 format

	7	6	5	4	3	2	1	0
EB x+1	7	6	5	4	3	2	1	0
EB x+2	Unassigned							

Value status for channels 0 to 7:

1_B: Input signal is valid
0_B: Input signal is invalid

Figure A-10 PII with "8 DI NAMUR" configuration

- Assignment of the process output image (POI)

  The POI is not assigned.

8 DI NAMUR with "2 Counter/ 6 DI NAMUR" or "2 Counter/ 6 Control signals" configuration

- Assignment of the process input image (PII)

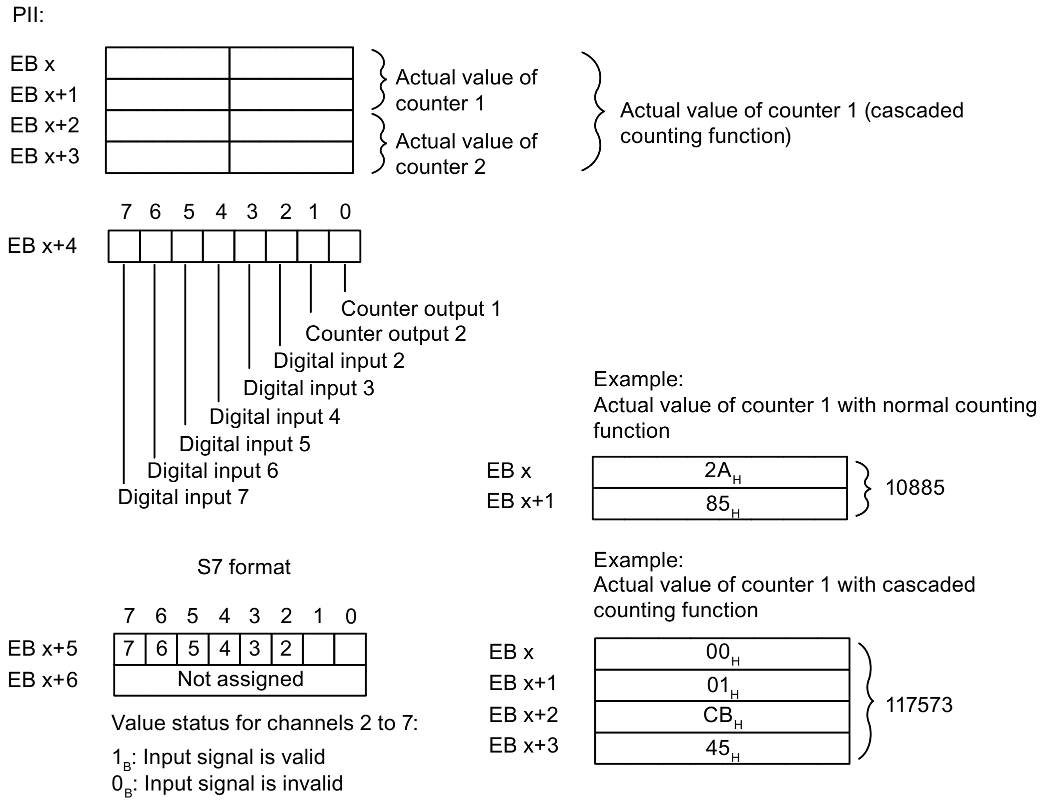


Figure A-11 PII with "2 Counter/ 6 DI NAMUR" configuration

- Assignment of the process output image (POI)

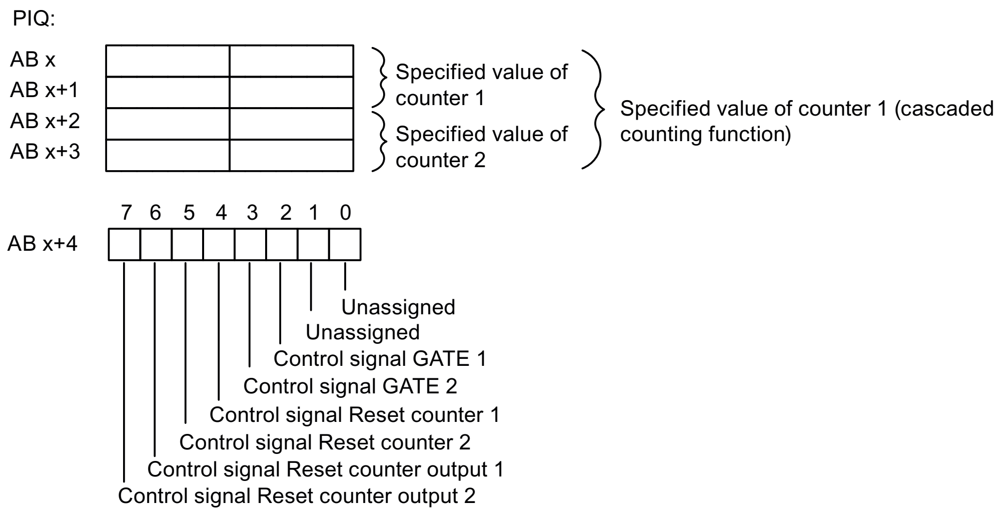


Figure A-12 POI with "2 Counter/ 6 DI NAMUR" configuration

8 DI NAMUR with "2 Trace/ 6 DI NAMUR" configuration

- Assignment of the process input image (PII)

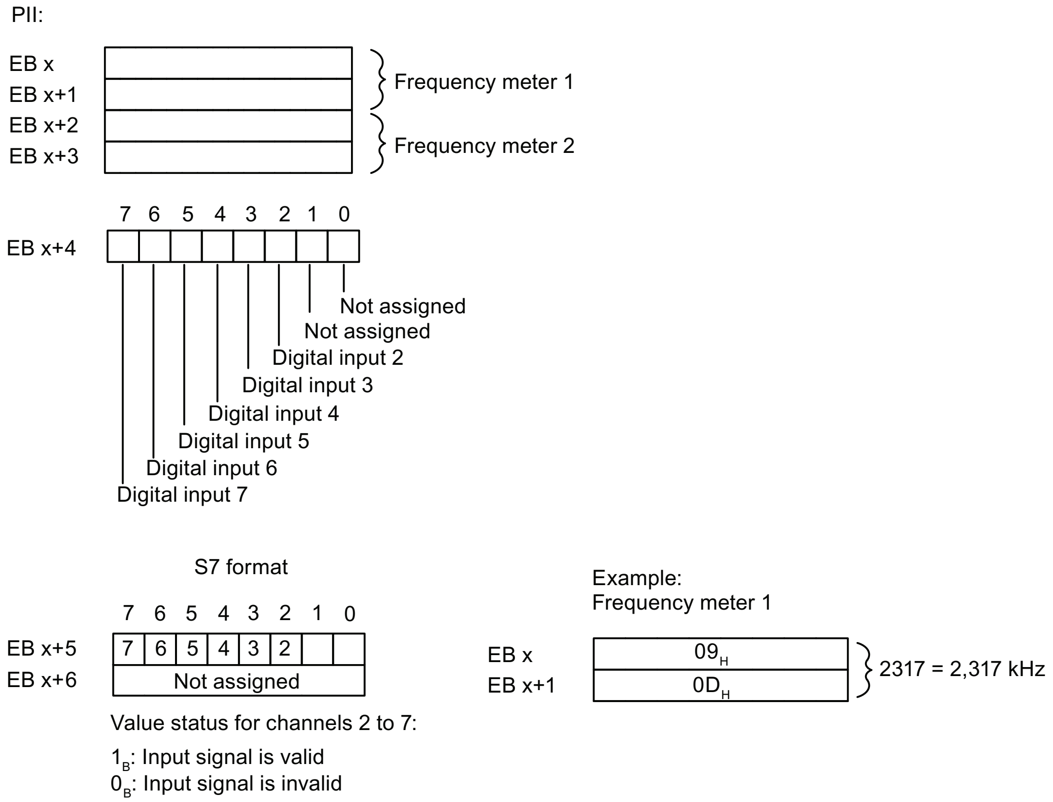


Figure A-13 PII with "2 Travel/ 6 DI NAMUR" configuration

- Assignment of the process output image (POI)

  The POI is not assigned.

A.4.2 Digital output module

Address space of digital output modules

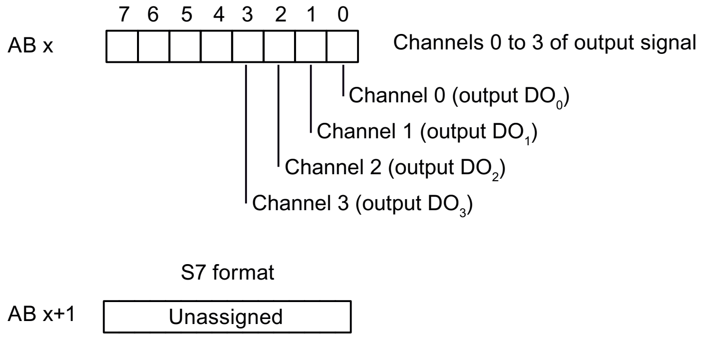


Figure A-14 POI with digital output modules

A.4.3 Digital output module 2 DO Relay UC60V/2A

Address space of digital output module 2 DO Relay UC60V/2A

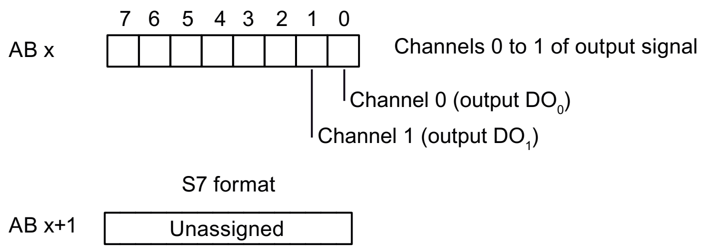


Figure A-15 PIQ for digital output module 2 DO Relay UC60V/2A

A.4.4 Analog input modules

Address space of analog input modules

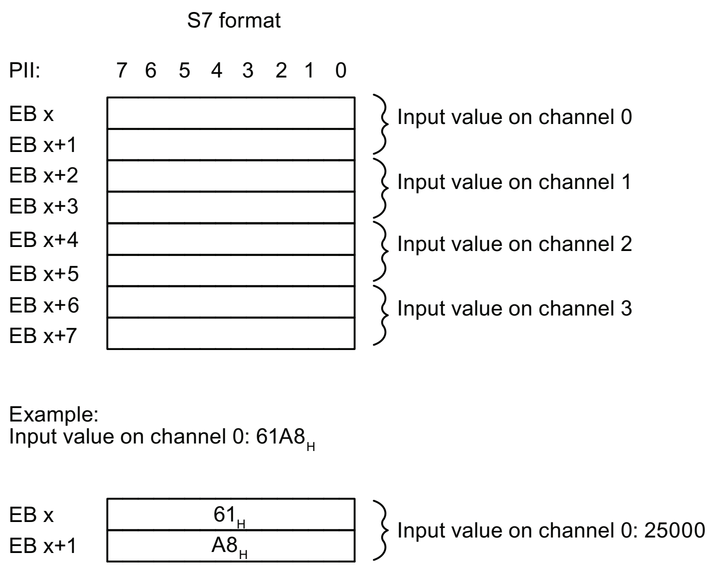


Figure A-16 PII for analog input modules

A.4.5 Analog output modules

Address space of analog output modules

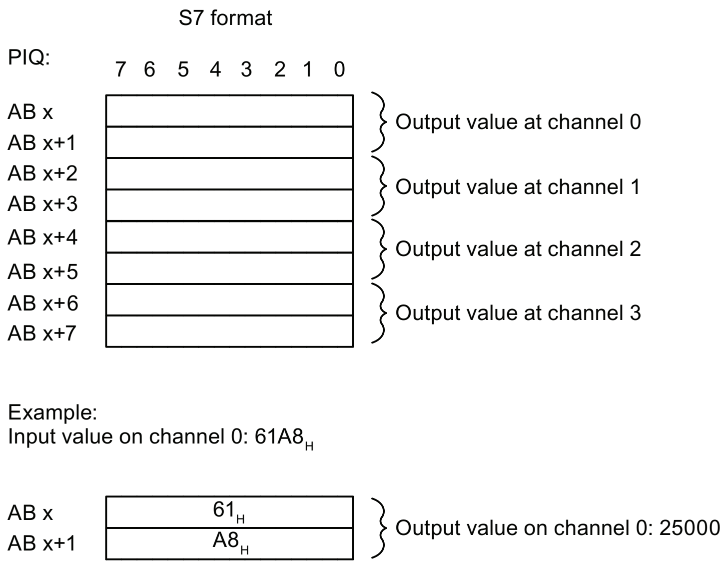


Figure A-17 POI for analog output modules

A.4.6 Analog input modules with HART (4 AI I 2WIRE HART, 4 AI I 4WIRE HART)

Address space analog input modules with HART (4 AI I 2WIRE HART, 4 AI I 4WIRE HART)

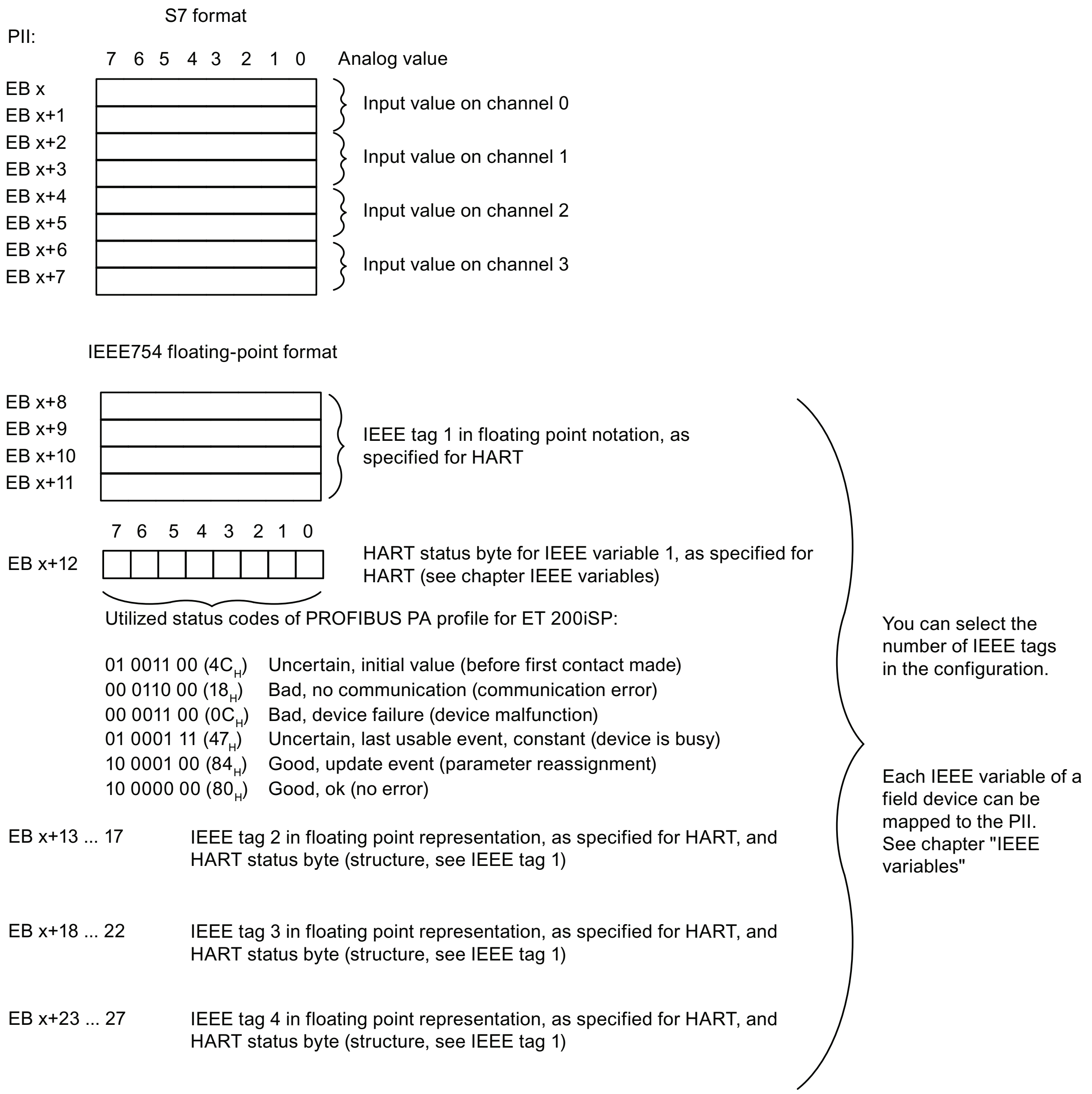


Figure A-18 PII for analog input modules with HART

A.4.7 Analog output module with HART (4 AO I HART)

Address space analog output module with HART (4 AO I HART)

S7 format

PIQ:

7 6 5 4 3 2 1 0 Analog value

AB x AB x+1	Output value at channel 0
AB x+2 AB x+3	Output value at channel 1
AB x+4 AB x+5	Output value at channel 2
AB x+6 AB x+7	Output value at channel 3

PII: IEEE754 floating-point format

EB x EB x+1 EB x+2 EB x+3	IEEE tag 1 in floating point notation, as specified for HART

7 6 5 4 3 2 1 0

EB x+4	HART status byte for IEEE tag 1, specified as for HART (see Chapter IEEE tags)

Utilized status codes of PROFIBUS PA profile for ET 200iSP:

01 0011 00 ($4C_H$)	Uncertain, initial value (before first contact made)
00 0110 00 (18_H)	Bad, no communication (communication error)
00 0011 00 ($0C_H$)	Bad, device failure (device malfunction)
01 0001 11 (47_H)	Uncertain, last usable event, constant (device is busy)
10 0001 00 (84_H)	Good, update event (parameter reassignment)
10 0000 00 (80_H)	Good, ok (no error)

EB x+5 ... 9	IEEE tag 2 in floating point representation, as specified for HART, and HART status byte (structure, see IEEE tag 1)
EB x+10 ... 14	IEEE tag 3 in floating point representation, as specified for HART, and HART status byte (structure, see IEEE tag 1)
EB x+15 ... 19	IEEE tag 4 in floating point representation, as specified for HART, and HART status byte (structure, see IEEE tag 1)

You can select the number of IEEE tags in the configuration.

Any IEEE tag of a field device can be mapped as desired to the PII. See Chapter IEEE tags

Figure A-19 POI/PII for analog output module with HART

A.4.8 Watchdog module

Address space for Watchdog module

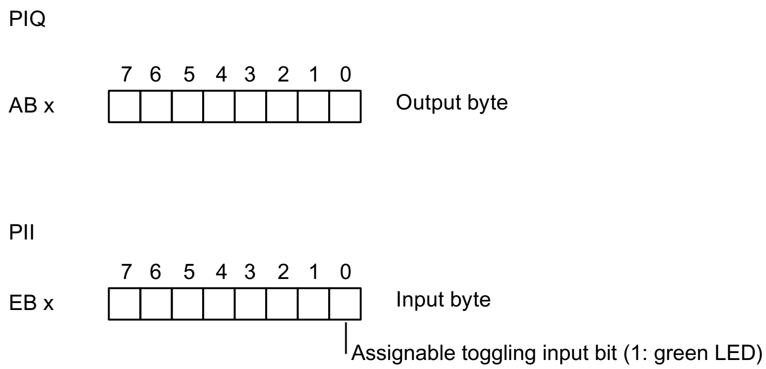


Figure A-20 PIQ and PII for the Watchdog module

A.5 Lightning and overvoltage protection

A.5.1 Overview

Introduction

One of the most common causes of failure is overvoltage caused by:

- Atmospheric or
- Electrostatic discharge

The concepts or measures for protection from overvoltages is based on the lightning protection zone concept.

The rules to be complied with for the transitions between the individual lightning protection zones are presented here.

Note

This section can only provide you with the general guide on protecting the ET 200iSP from overvoltage.

Complete protection from overvoltage is only guaranteed when the entire system design is based on the lightning protection zone concept. Comprehensive consideration must be given to this when planning construction of facilities.

We therefore recommend that you contact your Siemens representative or a company specialized in lightning and overvoltage protection if you require more detailed information about overvoltage.

In the following we refer to the overvoltage protection device using the normative terminology, i.e., according to the degree of hazard expected, overvoltage suppressor for pulse shape 8/20 µs and lightning current suppressor for pulse shape 10/350 µs.

Further references

The following information is based on the lightning protection zone concept described in IEC IEC 62305-4 - "Protection against LEMP".

A.5.2 Lightning protection zone concept

Principle of the lightning protection zone concept according to IEC 62305-4, DIN EN 62305-4, VDE 0185-4

The principle behind the lightning protection zone concept is the division of the volume to be protected from overvoltages (e.g. a control room) into lightning protection zones based on EMC considerations (see figure below).

The various lightning protection zones (LPZ) are delimited spatially as follows and not necessarily by physical boundaries, such as walls, floors, etc.

Table A- 10 Lightning protection zones

Lightning protection zones (LPZ) Lightning Protection Zone)	
Outside areas of a building with risk of a direct strike	Lightning protection zone 0_A
Outside areas of a building that are not at risk of a direct strike	Lightning protection zone (LPZ) 0_B
Inside areas of a building that follow lightning protection zone 0_B	Lightning protection zone 1
Inside areas of a building that normally represent separate EMC-reducing rooms and are in lightning protection zone 1	Lightning protection zone 2
Electrical equipment (with shielding properties) in lightning protection zone 2	Lightning protection zone (LPZ) 3

Effects of a Lightning Stroke

Direct lightning strikes occur in lightning protection zone 0_A. Effects of the lightning strike are high-energy lightning currents and strong electromagnetic fields. Because direct lightning strikes occur only in lightning protection zone 0_A (as described in the next chapter), these are not examined here.

Only the lightning protection zone transitions from 0_B to 1 and higher are examined.

Effects must be reduced from one lightning protection zone to the next through suitable lightning current or combination suppressors or shielding measures.

As described in the EN 1127-1 standard, direct lightning strokes ignite explosive atmospheres. Therefore, continuously active lightning protection systems are prescribed for such facilities according to the current lightning protection standards.

Overvoltages

Electromagnetic fields of the lightning channel can be reduced with appropriate shielding measures. Overvoltages due to inductions can be reduced to an non-dangerous level starting in lightning protection zone 0_B using overvoltage suppressors.

Diagram of the lightning protection zones

The following schematic diagrams shows the implementation of the lightning protection concept for a building with outside lightning protection. Lightning protection zone 0 shown in the figure is divided into lightning protection zone 0_A and 0_B according to the following definitions.

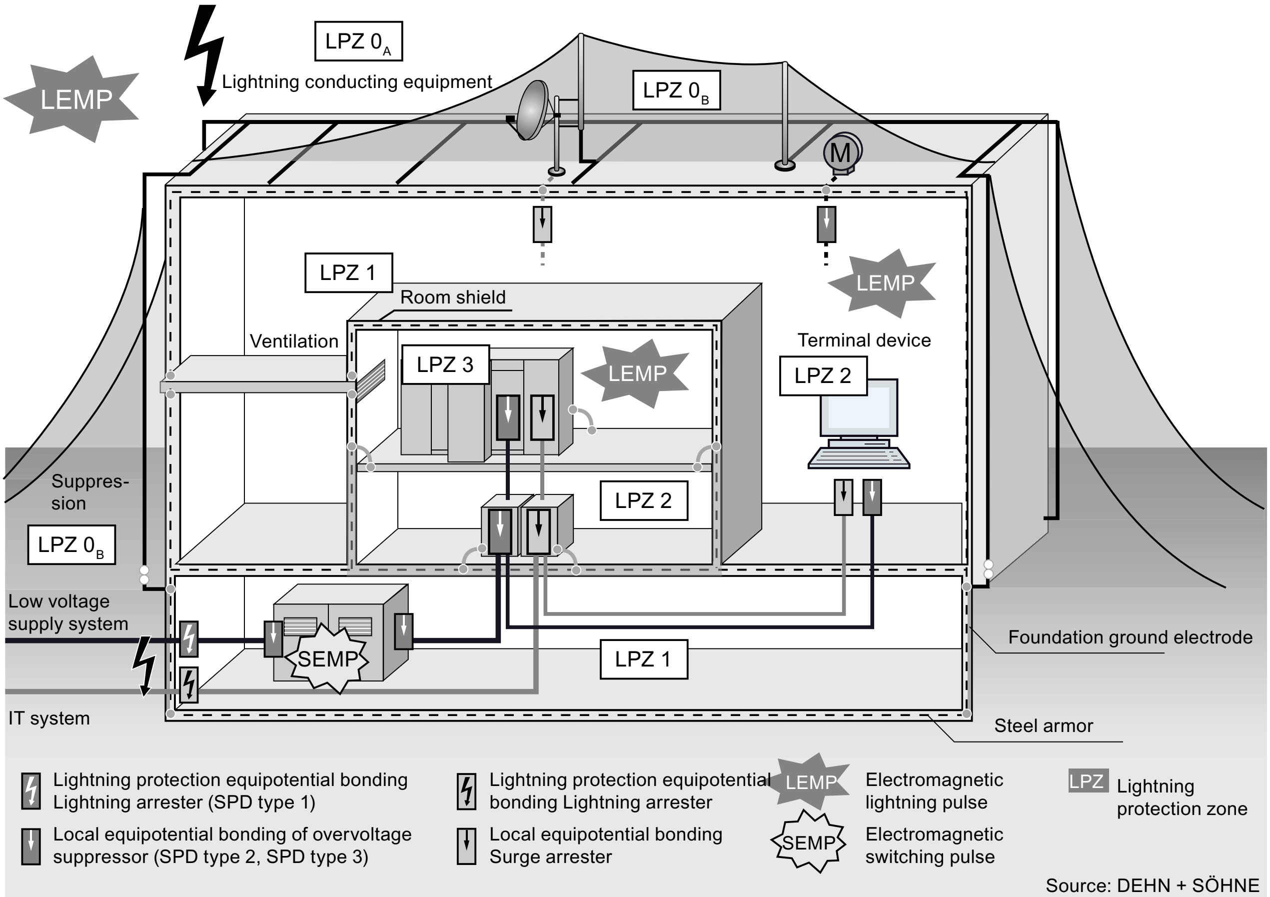


Figure A-21 Lightning protection zones of a building with outside lightning protection

Principle of interfaces between the lighting protection zones

Measures must be taken to reduce the peak current load and the magnetic fields at the interfaces between the lightning protection zones.

Each zone-penetrating metallic/electrical system must be incorporated into the equipotential bonding at the zone transition.

Note

Metal systems include channels, structural parts, pipelines (water, gas and heat), etc.

Electrical systems include power and IT cables and wires (e.g. line voltage, bus cable).

A.5.3 Rules for the interfaces between Lightning Protection Zones 0 and 1

Rules for the lightning protection zone transition 0_A to 1 (lightning protection equipotential bonding)

For lightning protection equipotential bonding at the interface of lightning protection zone 0_A to 1, the following applies:

- No introduction of lightning component currents into buildings in hazardous areas. Sufficient clearances of conductors and cables through which lightning current passes and that are fed into hazardous areas.
- Define the zone transition 0_A to 1 in the non-hazardous area.

Note

Since this zone transition is not relevant for the typical applications of the ET 200iSP, this will be discussed in no further detail in this manual.

Rules for the lightning protection zone transition 0_B to 1 (strong electromagnetic couplings)

For overvoltage protection at the interface of lightning protection zone 0_B to 1, the following applies:

- Use of power cables with peak current-capable cable shields (e.g., NYCWY) or twisted-pair IT cables (for example, A2Y(K)Y).
- Laying cables and lines
  – In continuous, peak current-capable metal pipes that are grounded at both ends, or
  – In reinforced concrete channels in which the reinforcement is grounded at both ends, or
  – On closed metal cable racks that are grounded at the beginning and end.
- Use of fiber optic cables without a metal shield if such a transmission is intended.

Other actions

If the actions listed above cannot be performed, protection by means of overvoltage suppressors must be provided. The following table contains overvoltage suppressors that may be used to protect facilities.

We recommend that three overvoltage suppressors for the signal cables and the 24 V supply be integrated into an appropriate enclosure according to the specifications of the manufacturer of the overvoltage suppressor. Refer to the "Enclosure specifications" in Chapter Application example for protection of ET 200iSP from overvoltages (Page 375).

NOTICE
To ensure the availability of a cable connection using overvoltage protection, both ends of the cable must be connected to overvoltage suppressors.

Components for the overvoltage protection

Table A- 11 Components for the overvoltage protection

Cons. number	Modules	Connection of cables at the interface of 0_B to 1 with:	Order number
1	Power supply PS 24 VDC for power supply and looping through	1 unit DEHNguard DG S 75 FM	952 091* **
		1 unit DEHNgap DGP C S FM	952 035* **
		1 unit busbar MVS 1 2	900 617* **
		1 unit pin-shaped terminal STAK 2x16	900 589* **
	Power supply PS 120/230 VAC for power supply and looping through	No overvoltage protection required	---
2	Interface module IM 152 PROFIBUS RS 485-IS	1x Blitzductor base part BXT BAS EX	920 301**
		1 unit Blitzductor module BXT ML2 BD HF EX 6	920 538**
3	8 DI NAMUR	4x Blitzductor basic part BXT BAS EX	920 301**
		4x Blitzductor module BXT ML4 BD EX 24	920 381**
4	4 DO	2x Blitzductor basic part BXT BAS EX	920 301**
		2x Blitzductor module BXT ML4 BD EX 24	920 381**
5	2 DO Relay UC60V/2A	Clarification of requirements with DEHN + SÖHNE GmbH + Co. KG **	
6	4 AI I 2WIRE HART	2x Blitzductor basic part BXT BAS EX	920 301**
		2x Blitzductor module BXT ML4 BD EX 24	920 381**
7	4 AI I 4WIRE HART	2x Blitzductor basic part BXT BAS EX	920 301**
		2x Blitzductor module BXT ML4 BD EX 24	920 381**
8	4 AI RTD	4x Blitzductor basic part BXT BAS EX	920 301**
		4x Blitzductor module BXT ML4 BD EX 24	920 381**
9	4 AI TC	2x Blitzductor basic part BXT BAS EX	920 301**
		2x Blitzductor module BXT ML4 BD EX 24	920 381**
10	4 AO I HART	2x Blitzductor basic part BXT BAS EX	920 301**
		2x Blitzductor module BXT ML4 BD EX 24	920 381**

* These components are designed for non-hazardous zones. If these units are installed in hazardous area Zone 1, the components must be installed in a certified EX d enclosure (flameproof encapsulated). For additional information and ordering refer to :
Siemens AG
I IA CE S EN
Siemensallee 84
76187 Karlsruhe
Tel. +49 (0)721 595 3776

** Direct ordering of components from:
DEHN + SÖHNE GmbH + Co. KG
Hans-Dehn-Str. 1
D-92318 Neumarkt
http://www.dehn.de

Note

For all the other PROFIBUS DP components outside the hazardous area, we recommend that you follow the instructions in the PROFIBUS SIMATIC NET (http://support.automation.siemens.com/WW/view/en/1971286) manual.

Note

If you use overvoltage protection devices, the equipotential bonding should be installed using a minimum cross section of 6 mm^2.

A.5.4 Rules for the interfaces between lightning protection zones 1 and 2 and higher

Rules for the lightning protection zone transition 1 to 2 (strong electromagnetic couplings)

For overvoltage protection at the interface of lightning protection zone 1 to 2, the following applies:

- Use of power cables with peak current-capable cable shields (e.g., NYCWY) or twisted-pair IT cables (e.g. A2Y(K)Y).
- Laying cables and lines
  - In continuous, peak current-capable metal pipes that are grounded at both ends, or
  - In reinforced concrete channels in which the reinforcement is grounded at both ends, or
  - On closed metal cable racks that are grounded at the beginning and end.
- Use of fiber optic cables without a metal shield if such a transmission is intended.
- Creation of a local equipotential bonding at the transitions of lightning protection zones, with incorporation of metal supply systems (pipes, air ducts, cable ducts, etc.) and electrical wire and cable systems.

Other actions

If the actions listed above cannot be performed, protection by means of overvoltage suppressors must be provided, if unshielded electrical wire and cable systems pass within a lightning protection zone. See Table "Components for overvoltage protection" in Chapter Rules for the interfaces between Lightning Protection Zones 0 and 1 (Page 372) .

We recommend that three overvoltage suppressors for the signal cables and the 24 V supply be integrated into an appropriate enclosure according to the specifications of the manufacturer of the overvoltage suppressor. Refer to the "Enclosure specifications" in Chapter Application example for protection of ET 200iSP from overvoltages (Page 375).

Overvoltage suppressor at lightning protection zone transition 2 --> and higher

In the ET 200iSP installation, zone transition 2 --> and higher is not normally used.

A.5.5 Application example for protection of ET 200iSP from overvoltages

Application example

The following figure shows the necessary measures for two networked ET 200iSP. Based on agreement, all cables and wires from lightning protection zone 0_B and higher, i.e. lightning component currents, must be excluded.
In the application example, the cable and wire systems are unshielded.

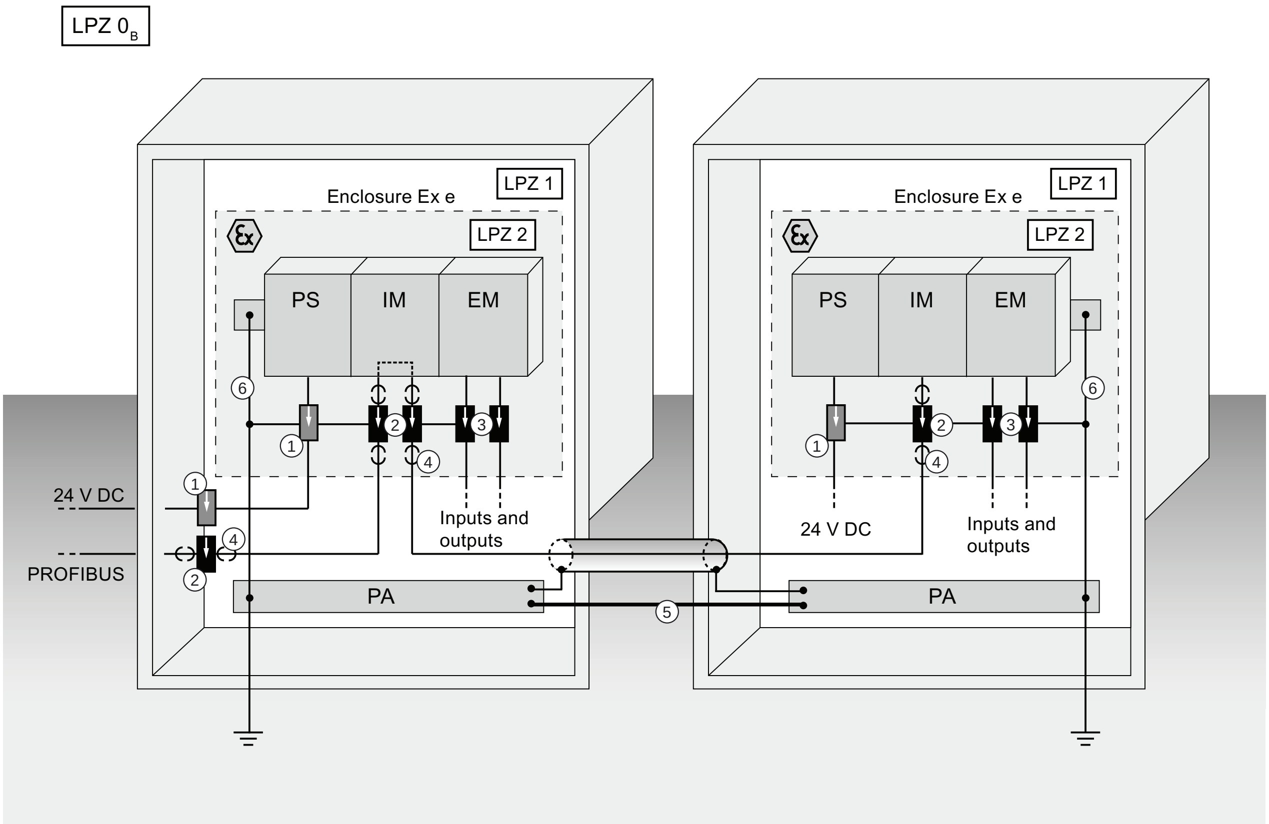


Figure A-22 Application example of two networked ET 200iSP

Components of the application example

The following table explains the components of the application example.

Table A- 12 Components for overvoltage protection of the application example

<table>
<tr><th>Consecutive number from the figure</th><th>Component</th><th>Meaning</th></tr>
<tr><td>①</td><td>Surge arrester 24 V supply
DEHNguard DG S 75 FM
Part No. 952 091* **
DEHNgap DGP C S FM
Part No. 952 035* **
Busbar MVS 1 2
Part No. 900 617* **
Pin-shaped terminal STAK 2x16
Part No. 900 589* **</td><td>Protection against indirect lighting effects and overvoltages at zone transition 0_B to 1 and 1 to 2</td></tr>
<tr><td>②</td><td>Surge arrester PROFIBUS RS 485-IS Blitzductor base part BCT BAS EX,
Part. No. 920 301**
Blitzductor module BXT ML2 BD HF EX 6,
Part. No. 920 538**</td><td>Protection against indirect lighting effects and overvoltages at zone transition 0_B to 1 and 1 to 2</td></tr>
<tr><td>③</td><td>Surge arrester I/Os, depending on the number of double cores used
Blitzductor base part BXT BAS EX,
Part. No. 920 301**
Blitzductor module BXT ML4 BD EX 24,
Part. No. 920 381**</td><td>Protection against indirect lighting effects and overvoltages at zone transition 0_B to 1 and 1 to 2</td></tr>
<tr><td>④</td><td>Additional terminal for the shield connection of the bus line</td><td>Discharging of interference currents</td></tr>
<tr><td>⑤</td><td>Equipotential bonding line 16 mm² Cu</td><td>Standardization of reference potentials</td></tr>
<tr><td>⑥</td><td>Equipotential bonding line 6 mm² Cu</td><td>Discharging of interference currents</td></tr>
<tr><td colspan="3">* These components are designed for non-hazardous zones. If these units are installed in hazardous area Zone 1, the components must be installed in a certified EX d enclosure (flameproof encapsulated). For additional information and ordering refer to :
Siemens AG
I IA CE S EN
Siemensallee 84
76187 Karlsruhe
Tel. +49 (0)721 595 3776
** Direct ordering of components from:
DEHN + SÖHNE GmbH + Co. KG
Hans-Dehn-Str. 1
D-92318 Neumarkt
http://www.dehn.de</td></tr>
</table>

Enclosure specifications for accommodation of intrinsically safe overvoltage suppressors in potentially explosive areas

Overvoltage suppressors in hazardous areas must be installed in a metal enclosure or an enclosure certified for the device application. If the application is in areas with combustible dust, enclosure degree of protection IP6X shall be selected.

- Zone 1: Enclosure with degree of protection Ex e (increased safety)
- Zone 2: Enclosure with at least IP 54 (with manufacturer's declaration for Zone 2)
- Zone 21: dust-tight (certified) enclosure with degree of protection of at least IP 6x
- Zone 22: dust-tight (certified) enclosure with degree of protection of at least IP 5x

Testing the overvoltage suppressors used

Detection of n overload of the Blitzductor BXT ML4 BD EX 24 series overvoltage suppressor before the overvoltage suppressor is destroyed is possible by means of the implemented LifeCheck technology using test device DRC LC M3 (Part No. 910 653). Use of this test device is only permitted outside the hazardous zone. Same as before, these Blitzductors have a fail-safe function that generates a signal-type interruption when the overvoltage suppressor is irrevocably destroyed, thus placing the downstream system out of operation but protecting it from further overvoltages.

Glossary

ACCU

Accumulators are registers in the CPU used as buffer storage for load and transfer operations, as well as comparison, arithmetic, and conversion operations.

Accumulated current

Total current of all output channels of a digital output module.

Automation system

An automation system is a programmable logic controller consisting of at least one CPU, various input and output modules, and operator interfaces.

Backplane bus

A serial data bus used by the interface module IM 152 to communicate with the electronic modules. Also supplies these with the required voltage. The various modules are interconnected by means of terminal modules.

Baud rate

The baud rate is the speed at which data is transferred. It indicates the number of bits transferred per second (baud rate = bit rate).

Bus

Shared data transmission path to which all nodes are connected. It has two defined ends.

In an ET 200 system, the bus is a twisted-pair cable or an optical fiber cable.

Bus connector

Physical connection between the bus nodes and the bus cable.

Chassis ground

Chassis ground includes all the interconnected inactive parts of equipment that must not carry a hazardous voltage even in the event of a fault.

Diagnostics

The detection, localization, classification, visualization and further evaluation of errors, faults and messages.

Diagnostics provides monitoring functions which run automatically while the plant is in use. This increases plant availability by reducing commissioning times and down times.

Distributed I/O systems

These are input/output units that are not located in the base unit; instead, they are distributed at some distance from the CPU, e.g.:

- ET 200M, ET 200X, ET 200L, ET 200S, ET 200iSP
- DP/AS-I link
- Other DP slaves from Siemens or other vendors

The distributed I/O systems are connected to the DP master via PROFIBUS DP.

DP master

A master that complies with the *IEC 61784–1:2002 Ed1 CP 3/1* standard is known as a DP master.

DP slave

A slave running on the PROFIBUS using the PROFIBUS DP protocol in accordance with *IEC 61784-1:2002 Ed1 CP 3/1* is known as a DP slave.

DP standard

The DP standard is the bus protocol of the ET 200 distributed I/O system in accordance with *IEC 61784-1:2002 Ed1 CP 3/1*.

DPV1

An enhanced version of the original PROFIBUS standard *IEC 61784-1:2002 Ed1 CP 3/1*.

Equipotential bonding

Electrical connection (equipotential bonding conductor) that keeps electrical equipment and extraneous conductive objects at the same or roughly identical potential in order to prevent disturbing or dangerous voltages between these objects.

ET 200

The ET 200 distributed I/O system with PROFIBUS DP protocol allows the connection of distributed I/Os to a CPU or suitable DP master. The ET 200 system is characterized by its fast response times since very little data (few bytes) are transferred.

ET 200 is based on *IEC 61784–1:2002 Ed1 CP 3/1*.

The ET 200 works on the master/slave principle. Examples of DP masters are the IM308-C master interface or the CPU 315-2 DP.

DP slaves can be the distributed I/O devices ET 200M, ET 200X, ET 200L, ET 200S, ET 200iSP, or DP slaves from Siemens or other vendors.

Flutter monitoring

Flutter monitoring is a process control function for digital input signals. Flutter monitoring detects and reports unusual signal profiles.

FREEZE

This is a control command from the DP master to a group of DP slaves.

When a DP slave receives the FREEZE control command, it freezes the current status of the inputs and transfers them cyclically to the DP master.

After each subsequent FREEZE control command, the DP slave freezes the status of the inputs again.

The input data is not transferred from the DP slave to the DP master cyclically again until the DP master sends the UNFREEZE control command.

Ground

The electrical potential of conductive ground can be pulled down to zero at any point. In the vicinity of ground connections, ground may assume a potential other than zero. For this reason, the term ”reference ground” is often used.

Grounding

Refers to connecting a conductive element to ground via a grounding system.

Grounding busbar PA

Term describing the connection of electrical equipment operated in hazardous areas to the equipotential busbar.

GSD file

The GSD file (device master file) contains all the features specific to a DP slave. The format of the GSD file is defined in *IEC 61784-1:2002 Ed1 CP 3/1*.

HART

engl.: **H**ighway **A**dressable **R**emote **T**ransducer

Hot swapping

Refers to the removal and insertion of modules while ET 200iSP is in RUN mode.

I&M (identification data)

Identification data is information stored on a module.

I data: Information about the module that is normally printed on the enclosure of the module. I data is read-only.

M data: System-specific information such as the installation location and date. M data is generated during configuration and written to the module.

Isolated

For isolated I/O modules, the reference potentials of the control and load circuits are electrically isolated, for example, by means of optical isolators, relays, or transformers. Input/output circuits may be grouped.

Master

A master station which is in possession of the token can send data to other nodes and request data from these (= active node.) Examples of DP masters are the CPU 315-2 DP or the IM308-C.

NAMUR sensor

A NAMUR sensor provides functions for monitoring cable breaks and short-circuits.

Node

A device that can send, receive, or repeat data on the bus (for example, a DP master, DP slave, or RS 485 repeater).

Non-isolated

For non-isolated I/O modules, the reference potentials of the control and load circuits are electrically connected.

Parameter assignment

Parameter assignment is the transfer of slave parameters from the DP master to the DP slave.

PCS7-OS

Operator station (operating and monitoring system) for the SIMATIC PCS 7 process control system.

Permanent wiring

All the elements carrying wiring (terminal modules) are installed on a mounting rail. The electronic modules are inserted into the terminal modules.

Prewiring

Wiring the terminal modules before the electronic modules are inserted.

Process image

The process image is a component of the system memory of the DP master. At the start of the cyclic program, the signal states of the input modules are transferred to the process image of the inputs (PII). At the end of the cyclic program, the process image of the outputs (POI) is transferred to the DP slave as a signal state.

PROFIBUS

PROcess FIeld BUS. This is an international process and fieldbus standard as defined in IEC 61784-1:2002 Ed1 CP 3/1. It specifies the functional, electrical and mechanical characteristics of a bit-serial field bus system.

PROFIBUS is a bus system that connects PROFIBUS compatible automation systems and field devices on a cell and field level.

PROFIBUS is available with the protocols DP (= distributed peripherals, that is, distributed or remote I/O), FMS (= field bus message specification), PA (= process automation), or TF (= technology functions).

PROFIBUS address

Each bus node must have a PROFIBUS address to identify it uniquely on the PROFIBUS.

The PC/programming device has PROFIBUS address “0”.

PROFIBUS addresses 1 to 125 are permitted for the ET 200iSP distributed I/O station.

Pulse stretching

Function used to extend the duration of a digital input signal. It extends the signal at a digital input by a set value.

Reference potential

The potential from which the voltages of the electrical circuits are evaluated and/or measured.

RTD

Measuring temperatures with resistive thermometers (RTD = resistance temperature detection.)

Segment

The bus cable between two terminating resistors forms a segment. An RS 485 IS segment (on RS 485-IS coupler) contains between 31 bus nodes.

SIMATIC PCS 7

PCS 7 is a powerful process control system with integrated programming, operating and monitoring functions. It allows direct connection to PCS 7. For further information, refer to the St 70 Catalog and the integrated PCS 7 Online Help.

SIMATIC PDM

SIMATIC PDM (Process Device Manager) is a versatile tool for configuring, setting parameters, commissioning, and diagnostics of intelligent process devices from any vendor. SIMATIC PDM provides a uniform user interface for the configuration of a wide range of process devices.

Slave

A slave can only exchange data with a master after it has been requested to send data by that master. Slaves include all DP slaves such as the ET 200X, ET 200M, ET 200S, ET 200iSP, etc.

SYNC

This is a control command from the DP master to a group of DP slaves.

With the SYNC control command, the DP master causes the DP slave to freeze the current states of the **outputs**. With the subsequent frames, the DP slave stores the output data, but the states of the outputs remain unchanged.

After each new SYNC control command, the DP slave sets the outputs that it has stored as output data. The outputs are not cyclically updated again until the DP master sends the UNSYNC control command.

TC

Measuring temperatures with thermocouples (TC = thermocouple).

Terminating module

The ET 200iSP distributed I/O station is terminated by the terminating module. The ET 200iSP will not work without a terminating module.

Time stamp

Information on the date and time of messages.

Time stamping

Function used to time stamp binary input signals when these change. All the binary input signals selected for time stamping must be time stamped with a specified accuracy throughout the system when they change, i.e. when two transducers on different stations of different PROFIBUS DP master systems respond at the same time, the time stamps of these signal changes may not differ by more than this selected accuracy.

Time synchronization

Time synchronization ensures that all the clocks in a system are set to the same time-of-day. A master clock distributes the time in a configurable cycle to all other components in the system that have a clock. The components use this time to set their own clocks.

Value status

The value status is additional binary information in a digital input signal. The value status is entered in the PII at the same time as the process signal, and provides information on the validity of the input signal.

WinCC

PCS 7 standard package

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