SIEMENS

SIMATIC

ET 200S
Distributed I/O System

Manual

The following supplement is part of this documentation:

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Preface, Contents
1 Product Overview
2 Brief Instructions on Commissioning ET 200S
3 Configuration Options
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Appendices

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Safety Guidelines

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Danger

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

Warning

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

Caution

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

Caution

indicates that property damage can result if proper precautions are not taken.

Notice

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

Qualified Personnel

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

Correct Usage

Note the following:

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

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

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Preface

Purpose of the manual

The information in this manual enables you to run the ET 200S distributed I/O system on PROFIBUS-DP as a DP slave.

Required level of knowledge

Knowledge of the field of automation engineering is required to understand the manual.

Scope of the manual

This manual is valid for the components of the ET 200S distributed I/O system specified in Appendix A.

This manual contains a description of the components that were valid at the time the manual was published. We reserve the right to enclose a Product Information bulletin containing up-to-date information about new components and new versions of components.

Changes since the previous version

The following changes/additions have been made since the previous version of the manual:

- New function: option handling
- New ET 200S Power Supply module
- New PM-E 24–48 VDC power module
- New 4 DI NAMUR electronic module
- Changes to the IM151-1 STANDARD and IM151-1 FO STANDARD interface modules

Certification

See Section 7.1 Standards, certificates and approvals

CE Mark of Conformity

See Section 7.1 Standards, certificates and approvals

Identification for Australia (C-tick mark)

See Section 7.1 Standards, certificates and approvals

Standards

See Section 7.1 Standards, certificates and approvals

Position in the information landscape

This manual is part of the documentation package with the order number 6ES7151-1AA00-8xA0 and comprises six manuals and one instruction list with the following contents:

ET 200S Distributed I/O System

- Installing and wiring the ET 200S
- Commissioning and diagnostics for the ET 200S
- Technical specifications of the IM151-1, digital and analog electronic modules
- Order numbers for the ET 200S

IM151-7 CPU Interface Module

- Addressing of the IM151-7 CPU
- ET 200S with IM151-7 CPU in the PROFIBUS network
- Commissioning and diagnostics for the IM151-7 CPU
- Technical specifications of the IM151-7 CPU
- *STEP 7* list of operations

ET 200S Motor Starters

- Installing and wiring motor starters
- Commissioning and diagnostics for motor starters
- Technical specifications of motor starters
- Order numbers for motor starters

ET 200S Process-Related Functions

- 1Count 24V/100kHz
- 1Count 5V/500kHz
- 1SSI
- 2PULSE

ET 200S Positioning

- 1STEP 5V/204kHz
- 1POS INC/Digital
- 1POS SSI/Digital
- 1POS INC/Analog
- 1POS SSI/Analog

ET 200S Serial Interface Module

- 1SI 3964/ASCII
- 1SI MODBUS/USS

S7-300 Instruction List CPU 31xC, CPU 31x, IM 151-7 CPU, BM 147-1 CPU, BM 147-2 CPU

- List of the instruction set and their execution times
- List of executable blocks (OBs/ SFCs/SFBs) and their execution times

Note

The *ET 200S Distributed I/O System, Fail-Safe Modules* manual is included in the *S7 F Systems and S7 Distributed Safety* documentation packages

Guide to the manual

You can quickly access specific information in the manual by using the following aids:

- At the start of the manual you will find a complete table of contents and a list of the diagrams and tables that appear in the manual.
- An overview of the contents of each section is provided in the left-hand column on each page of each chapter.
- Following the appendices, you will find a glossary in which important technical terms used in the manual are defined.
- At the end of the manual you will find a comprehensive index enabling rapid access to the information you are looking for.

Special note

In addition to this manual, you will also need the manual for the DP master (see Appendix A).

Note

You will find a complete list of the contents of the ET 200S manuals in Section 1.3 of this manual. We recommend that you begin by reading this section so as to find out which parts of which manuals are most relevant to you in helping you to do what you want to do.

Recycling and disposal

Due to the fact that it is low in contaminants, the ET 200S is recyclable. Contact a certified electronic-waste disposal company to recycle and dispose of your old equipment in an environment-friendly manner.

Additional support

Please contact your local Siemens representative if you have any queries about the products described in this manual.

`http://www.ad.siemens.com/automation/partner`

Training center

We offer a range of courses to help get you started with the xxx and SIMATIC S7 programmable controller. Please contact your local training center or the central training center in Nuremberg, D 90327 Germany.
Telephone: +49 (911) 895-3200.

Internet: `http://www.sitrain.com`

SIMATIC Technical Support

In addition to your local dealer, you can also contact one of three Support Centers:

Worldwide (Nuremberg) **Technical Support** Local time: 0:00 to 24:00 / 365 days a year Phone.: +49 (0) 180 5050 222 Fax: +49 (0) 180 5050 223 E-mail: adsupport@siemens.com GMT: +1:00		
Europe/**Africa** (Nuremberg) **Authorization** Local time: Mo. - Fr. 8:00 to 17:00 Phone.: +49 (0) 180 5050-222 Fax: +49 (0) 180 5050-223 E-mail: adsupport@siemens.com GMT: +1:00	**United States** (Johnson City) **Technical Support and Authorization** Local time: Mo. - Fr. 8:00 to 17:00 Phone.: +1 (0) 770 740 3505 Fax: +1 (0) 770 740 3699 E-mail: isd-callcenter@sea.siemens.com GMT: -5:00	**Asia**/**Australia** (Beijing) **Technical Support and Authorization** Local time: Mo. - Fr. 8:00 to 17:00 Phone.: +65 (0) 740-7000 Fax: +65 (0) 740-7001 E-mail: simatic.hotline@sea.siemens.com.sg GMT: +8:00
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- A forum in which users and specialists around the world can exchange their experiences
- Your local contact partner for Automation & Drives in our contact database
- Information on service on site, repairs, and spare parts. You will also find much more under “Services”.

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Product Overview

1

Chapter overview

The product overview tells you:

- The place of the ET 200S distributed I/O system in the ET 200 distributed I/O system
- The components that make up the ET 200S distributed I/O system
- Which of the manuals in the ET 200S manual package contains the information you require

Chapter overview

Section	Description	Page
1.1	What are distributed I/O systems?	1-2
1.2	What is the ET 200S distributed I/O system?	1-4
1.3	Guide to the ET 200S manuals	1-10

1.1 What are distributed I/O systems?

Distributed I/O systems – area of application

When a system is set up, the inputs and outputs from and to the process are often located centrally in the programmable logic controller.

If there are inputs and outputs at considerable distances from the programmable logic controller, there may be long runs of cabling which are not immediately comprehensible, and electromagnetic interference may impair reliability.

Distributed I/O systems are the ideal solution in such cases:

- The controller CPU is located centrally.
- The I/O systems (inputs and outputs) operate locally on a distributed basis.
- The high-performance PROFIBUS-DP bus system with its high data transmission rates ensures that the PLC's CPU and the I/O systems communicate smoothly.

What is PROFIBUS-DP?

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

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

The "DP" transmission protocol allows a rapid, cyclic exchange of data between the controller CPU and the distributed I/O systems.

What are DP masters and DP slaves?

The DP master links the controller CPU with the distributed I/O systems. The DP master exchanges data by means of PROFIBUS-DP with the distributed I/O systems and monitors the PROFIBUS-DP bus system.

The distributed I/O systems (= DP slaves) prepare the data of the sensors and actuators locally so that they can be transmitted by PROFIBUS-DP to the PLC's CPU.

Which devices can be connected to the PROFIBUS-DP?

An extremely wide range of devices can be connected to the PROFIBUS-DP as DP masters or DP slaves, provided their behavior complies with *IEC 61784-1:2002 Ed1 CP 3/1*. The devices that can be used include the following:

- SIMATIC S5
- SIMATIC S7/M7/C7
- SIMATIC programming device/PC
- SIMATIC human-machine interface, or HMI (operator panel, OP; operator station, OS; and text display, TD)
- Devices from other manufacturers

Structure of a PROFIBUS-DP network

The figure below illustrates a typical PROFIBUS-DP network structure. The DP masters are integrated in the relevant device – for example, the S7-400 has a PROFIBUS-DP interface and the IM 308-C is inserted in an S5-115U. The DP slaves are the distributed I/O systems connected to the DP masters by means of PROFIBUS-DP.

Figure 1-1 Typical PROFIBUS-DP network structure

1.2 What is the ET 200S distributed I/O system?

Definition

The ET 200S distributed I/O system is a finely-graduated modular, highly flexible DP slave with IP 20 protection.

Area of application

You can connect virtually any number of I/O modules in virtually any combination right next to the interface module that transfers the data to the DP master. This means you can adjust the configuration to suit local requirements.

Depending on the interface module, each ET 200S can consist of up to 63 modules – for example, power modules, I/O modules, and motor starters.

The fact that motor starters can be integrated (switching and protecting any three-phase load up to 7.5 kW) ensures that the ET 200S can be adapted quickly to suit virtually any process-related use of your machine.

The fail-safe modules of the ET 200S ensure the fail-safe reading and output of data to safety category 4 (EN 954-1)

Terminal and electronic modules

The ET 200S distributed I/O system consists primarily of various passive terminal modules to which you connect the electronic modules and motor starters.

The ET 200S distributed I/O system is connected to the PROFIBUS-DP bus system by means of PROFIBUS-DP connectors on the interface module. Each ET 200S distributed I/O system is a DP slave on the PROFIBUS-DP bus system.

View

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

Figure 1-2 View of the ET 200S distributed I/O system

Components of the ET 200S

The following table provides you with an overview of the most important components of the ET 200S:

Table 1-1 Components of the ET 200S

Component	Function	Drawing
DIN rail	...carries the ET 200S. You mount the ET 200S on the rail.	
ET 200S Power Supply	...is the power supply for the ET 200S for connection to a 240/400 VAC power system	
Interface module • IM151-1 BASIC • IM 51-1 STANDARD • IM151-1 FO STANDARD • IM151-1 HIGH FEATURE	...connects the ET 200S with the DP master and prepares the data for the electronic modules and motor starters.	RS 485 interface IM151-1 BASIC IM151-1 STANDARD IM151-1 HIGH FEATURE Fiber-optic cable interface IM151-1 FO STANDARD

Table 1-1 Components of the ET 200S

Component	Function	Drawing
Terminal module	...carries the wiring and receives the power and electronic modules. Terminal modules are available in the following variants: • For power modules • For electronic modules • With screw-type terminal • With spring terminal • With Fast Connect (quick connection method, no stripping required)	
Power module	...monitors the voltage for all the electronic modules in the potential group. The following power modules are available: • For a 24 VDC supply with diagnostics • For a 24 to 48 VDC supply with diagnostics • For a 24 to 48 VDC, 24 to 230 VAC supply with diagnostics and fuse	
Electronic module	...is connected to the terminal module and determines the function: • Digital input modules with 24 VDC, 120/230 VAC and NAMUR • Digital output modules with 24 VDC and 120/230 VAC • Relay modules • Analog input modules with voltage, current, and resistance measurement; thermal resistance; and thermocouples • Analog output modules for voltage and current • Process-related modules • Fail-safe modules • RESERVE	
Terminating module	...terminates the ET 200S and can be used to carry 6 reserve fuses (5 mm x 20 mm).	

Table 1-1 Components of the ET 200S

Component	Function	Drawing
Shield contact	...for connecting cable shields.	
Labeling sheet (DIN A4, perforated, foil)	...for machine labeling or printing • 80 strips per labeling sheet	
Slot number labels	...for identifying the slots on the terminal module.	
Color identification labels	...permit customer- and country-specific identification of the terminals on the terminal module	
PROFIBUS cable with bus connector	... connects nodes of a PROFIBUS-DP configuration to each other.	
Fiber-optic cable duplex line with simplex connector (in the plug-in adapter for IM151-1 FO STANDARD)	... connects nodes of a PROFIBUS-DP configuration to each other.	

Features and benefits of the ET 200S

Table 1-2 Features and benefits of the ET 200S

Features	Benefits
Structure	
Finely-graduated modular design • 1/2/4-channel electronic modules • Power modules • Integrated motor starters	• Function-oriented, cost-optimized station design • Considerable reduction in outlay for configuration and documentation • Space savings due to arbitrary arrangement of the modules
Extensive range of electronic modules	Broad area of application

Table 1-2 Features and benefits of the ET 200S

Features	Benefits
Communication-capable, system-integrated motor starters: direct-on-line starters and reversing starters up to 7.5 kW	PLC inputs and outputs, terminal blocks, circuit breakers and contactors in a plug-in module save space and the effort involved in wiring
Permanent wiring due to the separation of mechanical and electronic components	• Prewiring possible • Module replacement during operation of the ET 200S (“hot swapping”)
Individual connection of power modules to common potential	• Individual formation of potential groups (identifiable by color coding of the TM-P terminal modules for power modules) • Simple load interruption
Robust structure for rough industrial conditions (5 g vibration resistance)	High operating reliability when mounted directly on the machine, high availability
Connection system	
Integrated voltage buses	Reduced effort required for wiring
Power bus up to 50 A for motor starters	Minimization of wiring in 400 V range
Screw-type terminals, spring terminals and Fast Connect	A change in terminal connection method is not necessary
• Two- and three-wire connection, or • Two-, three-, and four-wire connection	Optimal selection on grounds of space and cost
Fast Connect	• Connection method with no stripping required • Saves time with wiring
Terminal box in terminal module replaceable	No need to remove the terminal module in the event of terminal damage
Automatic coding of the I/O modules	Quick and reliable module replacement
Large label plate	Adequate space for clear identification
High data transfer rate of up to 12 Mbps;	Short response times of PROFIBUS and backplane bus
Integrated safety functions With motor starters up to safety category 4 in accordance with EN 954-1	Saves spending money on costly safety equipment
Fail-safe modules	To detect and output fail-safe signals via PROFIBUS (PROFIsafe) up to safety category 4 (EN 954-1)

DP master

All the ET 200S modules can communicate with all DP masters that comply with IEC 61784-1:2002 Ed1 CP 3/1. All functions can be used with the standard master.

1.3 Guide to the ET 200S manuals

You are using the following components ...

The components of ET 200S are described in various manuals. These manuals make up the manual package for ET 200S. The figure below shows possible ET 200S configurations and the manuals required for them.

Figure 1-3 Components and the manuals required for them

Figure 1-4 Components and the manuals required for them (continued)

Where do you find what information?

The table below will help you get your bearings and find the information you need quickly. It tells you which manual you need to refer to and which chapter deals with the topic you are interested in.

Table 1-3 Topics of the manuals in the ET 200S manual package

Description	Manual						Chapter/Appendix
	***ET 200S* Distributed I/O System**	***ET 200S Process-Related Functions***	***ET 200S Positioning***	***ET 200S Serial Interface Module***	***IM151-7 CPU Interface Module***	***ET 200S Motor Starter***	
ET 200S components	x						1.2
Components of ET 200S motor starters						x	1
ET 200S configuration options	x						3
Configuration options for ET 200S motor starters						x	1
Addressing the IM151-7 CPU					x		2
Installing the ET 200S and setting the PROFIBUS address	x						4
Installing ET 200S motor starters						x	2
Electrical configuration and wiring of the ET 200S	x						5
Commissioning and diagnostics for the ET 200S	x						6
Commissioning and diagnostics for the IM151-7 CPU							4
Commissioning and diagnostics for the ET 200S with motor starters						x	3
Functions of the IM151-7 CPU					x		5
General technical specifications of the ET 200S (standards, certificates and approvals, EMC, environmental conditions etc.)	x						7
Technical specifications of interface modules, terminal modules, power modules, and digital and analog electronic modules	x						9, 10, 11, 12, 13
IQ-SENSE	x						14

Table 1-3 Topics of the manuals in the ET 200S manual package

Description	Manual						Chapter/Appendix
	***ET 200S* Distributed I/O System**	***ET 200S Process-Related Functions***	***ET 200S Positioning***	***ET 200S Serial Interface Module***	***IM151-7 CPU Interface Module***	***ET 200S Motor Starter***	
Technical specifications of the IM151-7 CPU					x		6
Technical specifications of the 1COUNT 24V/100kHz		x					2
Technical specifications of the 1COUNT 5V/500kHz		x					3
Technical specifications of the 1SSI		x					4
Technical specifications of the 1STEP 5V/204kHz			x				2
Technical specifications of the 2PULSE		x					5
Technical specifications of the 1SI 3964/ASCII				x			2
General technical specifications of ET 200S motor starters						x	4
1POS INC/Digital			x				3
1POS SSI/Digital			x				4
1POS INC/Analog			x				5
1POS SSI/Analog			x				6
Technical specifications of the 1SI Modbus/USS				x			3
ET 200S safety-integrated SIGUARD system						x	9
Cycle and response times of the IM151-7 CPU					x		7
Order numbers for the ET 200S	x						A
Order numbers for the ET 200S motor starters						x	A
Dimensioned drawings of the interface module, terminal modules with electronic modules, terminating module, shield contact	x						B

Table 1-3 Topics of the manuals in the ET 200S manual package

Description	Manual						Chapter/Appendix
	***ET 200S* Distributed I/O System**	***ET 200S Process-Related Functions***	***ET 200S Positioning***	***ET 200S Serial Interface Module***	***IM151-7 CPU Interface Module***	***ET 200S Motor Starter***	
Dimensioned drawings of the ET 200S motor starters, power modules, brake control, terminal modules, distance module						x	B
Glossary	x				x	x	Glossary

ET 200S fail-safe modules

You can find the *ET 200S Distributed I/O System, Fail-Safe Modules* manual in the *S7 F Systems* (order number 6ES7988-8FA10-8xA0) documentation package and in the *S7 Distributed Safety* documentation package (order number 6ES7988-8FB10-8xA0).

Brief Instructions on Commissioning ET 200S

2

Introduction

The following simple example teaches you step by step how to commission the ET 200S:

- Installing and wiring the ET 200S
- Configuration with STEP 7 using the device database file
- Integration in the user program
- Switching the ET 200S on
- Evaluating the diagnosis:
  - The removal and insertion of modules
  - Wire break of the actuator wiring on the digital output module
  - Switching off the load voltage on the power module

The following figure illustrates the ET 200S components you require for the example:

Figure 2-1 Components for the example

Order numbers for the brief guide

Quantity	Order information	Order number
1 ×	IM151-1 STANDARD interface module and terminating module, 1 unit	6ES7151-1AA03-0AB0
2 ×	TM-P15S23-A1 terminal module, 1 unit	6ES7193-4CC30-0AA0
2 ×	TM-E15S24-A1 terminal module, 5 units	6ES7193-4CA20-0AA0
2 ×	PM-E 24 VDC, 1 unit	6ES7138-4CA00-0AA0
1 ×	2DI 24 VDC High Feature, 5 units	6ES7131-4BB00-0AB0
1 ×	2DO 24 VDC/0.5 A High Feature, 5 units	6ES7132-4BB00-0AB0
1 ×	Bus connector	6ES7972-0BA10-0XA0

Requirements

- You must have set up an S7 station consisting of a power supply module and a DP master (for example, CPU 315-2 DP). A CPU 315-2 DP was used as the DP master in this example. However, any other DP master (IEC 61784-1:2002 Ed1 CP 3/1) could be used instead.
- *STEP 7* (as of V 5.0 with ServicePack 3) is fully installed on your programming device (PG). You must be familiar with *STEP 7*.
- The programming device must be connected to the DP master.

Installation

1. Mount the rail (35 mm x 7.5 mm or 15 mm) with a length of at least 210 mm on a solid base.
2. Install the various modules on the rail beginning on the left (hook on, swing in, move to the left). Adhere to the following sequence:
   - IM151-1 STANDARD interface module
   - TM-P15S23-A1 terminal module
   - 4 x TM-E15S24-A1 terminal module
   - TM-P15S23-A1 terminal module
   - 4 x TM-E15S24-A1 terminal module
   - Terminating module
3. Set the PROFIBUS address 3 on the IM 151-1 STANDARD interface module.

Figure 2-2 Setting the PROFIBUS address 3

Wiring and fitting

1. Wire the ET 200S as shown below:

Figure 2-3 Wiring of the example

2. Use the PROFIBUS bus connector to connect the DP master with the ET 200S. The PROFIBUS-DP interface is located on the IM 151-1 STANDARD.
3. Insert the power and electronic modules into the terminal modules.
4. Switch on the voltage supply for the DP master.
5. Watch the status LEDs on the DP master.
   CPU 315-2 DP:
   – 5 VDC → lights up
   – SF DP → off
   – BUSF → flashes

Configuration

1. Start SIMATIC Manager, and create a new project with a DP master (CPU315-2 DP, for example). Create OB1 and OB82 for the project.
2. Create the PROFIBUS subnet.
3. Connect the PROFIBUS subnet with the DP master in HW Config.
4. Take the ET 200S from the hardware catalog and put it on the PROFIBUS.
5. Set the PROFIBUS address 3 for the ET 200S.
6. Drag the various ET 200S modules from the hardware catalog to the configuration table.
7. Mark the electronic modules in the configuration table, and click the “Pack addresses” button.

Table 2-1 Configuration table in HW Config

Module/DP identifier	Order number	I address	O address	Comment
1	6ES7 138-4CA00-0AA0 PM-E 24 VDC			Power module
2	6ES7 131-4BB00-0AB0 2DI 24 VDC	0		Bits 0.0 and 0.1
3	6ES7 131-4BB00-0AB0 2DI 24 VDC			Bits 0.2 and 0.3
4	6ES7 131-4BB00-0AB0 2DI 24 VDC			Bits 0.4 and 0.5
5	6ES7 131-4BB00-0AB0 2DI 24 VDC			Bits 0.6 and 0.7
6	6ES7 138-4CA00-0AA0 PM-E 24 VDC			Power module
7	6ES7 132-4BB00-0AB0 2DO 24 VDC		0	Bits 0.0 and 0.1
8	6ES7 132-4BB00-0AB0 2DO 24 VDC			Bits 0.2 and 0.3
9	6ES7 132-4BB00-0AB0 2DO 24 VDC			Bits 0.4 and 0.5
10	6ES7 132-4BB00-0AB0 2DO 24 VDC			Bits 0.6 and 0.7

8. Set the following parameters:
   - In the DP slave properties dialog box for ET 200S:

     Startup when expected <> actual configuration: Enable

     Replace modules during operation: Enable
   - In the DP slave properties dialog box for the PM-E 24 VDC, module/DP ID 1 (in the configuration table)

     Diagnostics: No load voltage
   - In the slave DP properties dialog box for 2 DO 24 VDC, module/DP ID 7 (in the configuration table)

     Diagnostics: Wire break O0
9. Save the configuration.

Integration in the user program

1. Create the user program in the LAD/STL/FBD editor in OB1.

   Example 1: Reading an input and driving an output:

```
STL
A I 0.0                    If input bit 0.0 and
A M 2.0                    memory bit 2.0 are set, then
S Q 0.0                    set output bit 0.0
```

   Example 2: Transferring an input byte to an output byte:

```
STL
L PIB 0                    Load I/O byte 0 in the accumulator
                           (bits 0.0 to 0.7)

T PQB 0                    Transfer the contents of the accumulator to
                           I/O output byte 0 (bits 0.0 to 0.7)
```

2. Save the project in SIMATIC Manager.
3. Load the configuration in the DP master.

Switching on

1. Switch on all the power supplies of the ET 200S.
2. Watch the status LEDs on the DP master and ET 200S.
   - CPU 315-2 DP:

     5 VDC: Lights up

     SF DP: Off

     BUSF: Off
   - ET 200S:

     SF: Off

     BF: Off

     ON: Lights up

Diagnostics

1. In the event of a fault, OB 82 is started. Evaluate the start information in OB 82.

   Tip: Call SFC13 in OB 82, and evaluate the diagnostic frame. See Section 6.6.1.

Removing and inserting the 2 DI 24 VDC High Feature digital electronic module

1. Remove the 2 DI 24 VDC High Feature electronic module from the terminal module during operation.
2. Watch the status LEDs on the IM 151-1 STANDARD:
   - SF: Lights up ⇒ There is a diagnostic message.
   - BF: Off
   - ON: Lights up

   Result: The ET 200S continues to run smoothly.
3. Evaluate the diagnostic message:

   Result:
   - Station status 1 (byte 0): Bit 3 is set ⇒ External diagnosis
   - Module diagnosis: Bit 7.1 is set ⇒ Slot 2
   - Module status: Bit 19.2/19.3: 11_B ⇒ No module
4. Insert the removed electronic module in the terminal module again.

   Result:
   - Status LEDs on the IM151-1 STANDARD:

     SF: Off

     BF: Off

     ON: Lights up
   - The diagnostic message is deleted.

Switching off the load voltage on the power module

1. Switch off the load voltage on the PM-E 24 VDC (slot 1).
2. Watch the status LEDs.

   IM 151 STANDARD:

   – SF: Lights up

   Power module:

   – PWR: Off ⇒ No load voltage on the power module
   – SF: Lights up ⇒ There is a diagnostic message.

   I/O modules in the potential group:

   – LEDs: Light up
3. Evaluate the diagnosis.

   Result:

   – Station status 1 (byte 0): Bit 3 is set ⇒ External diagnosis
   – Module diagnosis: Bit 7.0 is set ⇒ Slot 1
   – Channel-specific diagnosis:

     Bits 35.0 to 35.5: 000000_B ⇒ Slot 1

     Bits 37.0 to 37.4: 10001_B ⇒ No sensor voltage or load voltage
4. Switch on the load voltage on the power module again, and evaluate the diagnosis again.

   Result:

   – Status LED on the IM 151-1 STANDARD:

     SF: Off
   – Status LEDs on the power module:

     PWR: On

     SF: Off
   – Status LEDs on the I/O modules:

     LEDs: Off
   – The diagnostic message is deleted.

Wire break in the actuator wiring

1. Remove the cable from terminal 1 on the 2 DO 24 VDC/0.5 A; High Feature electronic module (slot 7)
2. Watch the status LEDs.

   IM151-1 STANDARD:

   – SF: Lights up

   2DO 24 VDC/0.5 A High Feature electronic module:

   – SF: Lights up ⇒ There is a diagnostic message

   – 1: Off ⇒ The output is not activated
3. Evaluate the diagnostic message

   Result:

   – Station status 1 (byte 0): Bit 3 is set ⇒ External diagnosis

   – Module diagnosis: Bit 7.6 is set ⇒ Slot 7

   – Channel-specific diagnosis:

     Bits 35.0 to 35.5: 000110_B ⇒ Slot 7

     Bits 36.0 to 35.5: 000000_B ⇒ Channel 0

     Bits 37.0 to 37.4: 00110_B ⇒ Wire break
4. Attach the cable to the actuator again in terminal 1, and evaluate the diagnosis again:

   – Status LED on the IM 151-1 STANDARD:

     SF: Off

   – Status LEDs on the 2DO 24 VDC/0.5 A High Feature electronic module:

     SF: Off

     1: Off/on

   – The diagnostic message is deleted.

Configuration Options

3

Chapter overview

Section	Description	Page
3.1	Finely-graduated modular system	3-2
3.2	Power supply of the ET 200S	3-4
3.3	Placement and connection to common potential of power modules	3-5
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3.1 Finely-graduated modular system

In describing the ET 200S as a finely-graduated modular system, we mean you can adapt the ET 200S to meet the exact requirements of your application.

The figure below shows you a number of examples of ET 200S distributed I/O system configurations:

Table 3-1 Examples of ET 200S setups

Example	Setup
ET 200S with • Digital electronic modules • Analog electronic modules • Technology modules	
ET 200S with motor starters	

Table 3-1 Examples of ET 200S setups

Example	Setup
ET 200S with • Electronic modules • Motor starter	 1) Mandatory

3.2 Power supply of the ET 200S

The following alternative power supplies are available to you for the ET 200S:

- 24 VDC supply on the interface module
- 240/400 VAC supply via ET 200S Power Supply

See Table 3-2.

Table 3-2 Power supply of the ET 200S

Power supply	Configuration (example)
24 VDC on the interface module	
240/400 VAC on the ET 200S Power Supply	

3.3 Placement and connection to common potential of power modules

Placement and connection to common potential

You can choose where to position the power modules in the ET 200S. Each TM-P terminal module (for a power module) that you install in the ET 200S opens a new potential group. All the sensors and load supplies of the downstream electronic modules/motor starters are fed from this TM-P terminal module (for a power module). If you place an additional TM-P terminal module after an electronic module/motor starter, you interrupt the voltage buses (P1/P2) and simultaneously open a new potential group. This permits connection to common potential of sensor and load supplies.

AUX(iliary) Bus (AUX 1)

A TM-P terminal module (for a power module) allows you to connect additional potential (up to the maximum rated load voltage of the module), which you can apply by means of the AUX(iliary) bus. You can set the AUX(iliary) bus individually as:

- A protective ground bar
- Additionally required voltage

Placement and connection to common potential of power modules

Figure 3-1 Placement and connection to common potential of power modules

Warning

If you connect the AUX1 bus to common potential independently of the P1/P2 buses (different voltages), there is no safe electrical isolation between the AUX1 bus and the P1/P2 buses.

Connecting different potentials to the AUX1 bus

Note

If you apply different potentials to the AUX1 bus in an ET 200S station, you must isolate the potential groups by means of a power module with the terminal module TM-P15S23-A0.

3.4 Configuration options of the interface modules

The interface module to suit your application:

Table 3-3 Interface modules and the applications for which they are suited

Applications		Interface module
• Connecting the PROFIBUS-DP by means of the RS 485 interface • Operation as a DPV0 slave • Direct communication • Bus length of the ET 200S: Not applicable • Number of modules: max. 12	Transmission rates: 9.6, 19.2, 45.45, 93.75, 187.5, 500 kbps 1.5, 3, 6, 12 Mbps	IM151-1 BASIC
• Connecting the PROFIBUS-DP by means of the RS 485 interface • Operation as a DPV0 slave • Direct communication • Bus length of the ET 200S: max. 2 m (can be set) • Number of modules: max. 63 • Option handling and status byte for power modules	Transmission rates: 9.6, 19.2, 45.45, 93.75, 187.5, 500 kbps 1.5, 3, 6, 12 Mbps	IM151-1 STANDARD
• Connecting the PROFIBUS-DP by means of fiber-optic cable • Operation as a DPV0 slave • Direct communication • Bus length of the ET 200S: max. 2 m (can be set) • Number of modules: max. 63 • Option handling and status byte for power modules	Transmission rates: 9.6, 19.2, 45.45, 93.75, 187.5, 500 kbps 1.5, 12 Mbps	IM 151-1 FO STANDARD
• Connecting the PROFIBUS-DP by means of the RS 485 interface • Use of fail-safe modules • Clocking as of 1.5 Mbps • Direct communication • Updating firmware via PROFIBUS-DP with HWCONFIG • Operation as a DPV0 slave – Acyclic data exchange (read/write data record): class 2 services (e.g. updating firmware) • Operation as a DPV1 slave – Acyclic data exchange (read/write data record): class 2 services (e.g. updating firmware) and class 1 services – Diagnostic interrupts – Hardware interrupts – Insert/Remove-module interrupts • Bus length of the ET 200S: max. 1 m • Number of modules: max. 63	Transmission rates: 9.6, 19.2, 45.45, 93.75, 187.5, 500 kbps 1.5, 3, 6, 12 Mbps	IM151-1 HIGH FEATURE

Rules for setting up a fiber-optic cable network with the IM 151-1 FO STANDARD

For a fiber-optic cable network with nodes that have integrated fiber-optic cable interfaces, note the following:

- The fiber-optic cable network can be set up only as a line segment.
- If you remove the fiber-optic cable from an integrated fiber-optic cable interface, or the supply voltage to the IM151-1 FO STANDARD fails, all the downstream nodes are no longer accessible.

Example configuration of a fiber-optic cable network with the IM151-1 FO STANDARD

Figure 3-2 provides an example of setting up a fiber-optic cable network with the ET 200S and the IM151-1 FO STANDARD as the interface module.

Figure 3-2 Fiber-optic cable network with IM151-1 FO STANDARD

3.5 Configuration options between the terminal modules and electronic modules

The electronic modules to suit your application:

Table 3-4 Electronic modules and the applications for which they are suitable

Applications		Electronic module
• Evaluating switches, proximity switches (BEROs), sensors, and encoders	24 VDC	2DI 24 VDC Standard 2DI 24 VDC High Feature 4DI 24 VDC Standard 4DI 24 VDC High Feature 4DI 24 VDC/SRC Standard
	24–48 VUC	4DI 24–48 VUC High Feature
• Evaluating NAMUR sensors • Evaluating connected, unconnected mechanical sensors	4 input channels	4DI NAMUR
• Evaluating switches, proximity switches (BEROs), sensors, and encoders	120 VAC	2DI 120 VAC Standard
	230 VAC	2DI 230 VAC Standard
• Switching solenoid valves, DC and AC contactors, indicator lights, actuators	24 VDC up to 0.5 A	2DO 24 VDC/0.5 A; Standard 2DO 24 VDC/0.5 A High Feature 4DO 24 VDC/0.5 A Standard
	24 VDC up to 2 A	2DO 24 VDC/2 A Standard 2DO 24 VDC/2 A High Feature 4DO 24 VDC/2 A Standard
	120/230 VAC up to 1 A	2DO 24–230 VAC/1 A
	Up to 120 VDC/up to 230 VAC up to 5 A	2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A
	Up to 48 VDC/up to 230 VAC up to 5 A	2RO NO/NC 24–48 VDC/5 A 24–230 VAC/5 A
• Measuring voltages	±10 V/ ± 5 V/ 1 to 5 V	2AI U Standard
• Measuring voltages with high resolution	±10 V/ ± 5 V/ 1 to 5 V	2AI U High Feature
• Time-critical measuring of voltages	±10 V/ ± 5 V/ ± 2.5 V/	2AI U High Speed
• Measuring currents with two-wire measuring transducers	4 to 20 mA	2AI I 2WIRE Standard
• Time-critical measuring of currents with two-wire measuring transducers	4 to 20 mA 0 to 20 mA	2AI I 2WIRE High Speed

Table 3-4 Electronic modules and the applications for which they are suitable, continued

Applications		Electronic module
• Measuring currents with four-wire measuring transducers	±20 mA/ 4 to 20 mA	2AI I 4WIRE Standard
• Measuring currents with two-wire, four-wire measuring transducers and high resolution	±20 mA/ 4 to 20 mA	2AI I 2/4WIRE High Feature
• Time-critical measuring of currents with four-wire measuring transducers	4 to 20 mA 0 to 20 mA ±20 mA	2AI I 4WIRE High Speed
• Measuring temperatures with resistance thermometers and resistors • Measuring reference junction temperatures in thermocouple applications	Pt100/Ni100 150 Ω/300 Ω/600 Ω	2AI RTD Standard
• Measuring temperatures with resistance thermometers and resistors • Measuring reference junction temperatures in thermocouple applications • High degree of accuracy • Temperature coefficient can be parameterized	Pt100/ Ni100/ Pt 200/ Ni 120/ Pt 500/ Ni 500/ Pt 1000/ Ni 1000 150 Ω/ 300 Ω/ 600 Ω/ PTC	2AI RTD High Feature
• Measuring temperatures with thermocouples and voltages	Type E/N/J/K/L/S/R/B/T ± 80 mV	2AI TC Standard
• Measuring temperatures with thermocouples and voltages • Internal reference junction in connection with TM-E15S24-AT	Type E/N/J/K/L/S/R/B/T/C ± 80 mV	2AI TC High Feature
• Output of voltages	± 10 V/1 to 5 V	2AO U Standard
• Output of voltages with high resolution	± 10 V/1 to 5 V	2AO U High Feature
• Output of currents	± 20 mA/4 to 20 V	2AO I Standard
• Output of currents with high resolution	± 20 mA/4 to 20 V	2AO I High Feature
• Photoelectric proximity switch	Reflex sensor and diffuse sensor with the IQ-SENSE	4 IQ-SENSE
• Counting of pulses, measurement of frequency, operating speed, or period time by means of incremental encoders	24-V signals up to 100 kHz	1Count 24V/100kHz
	5 V signals up to 500 kHz	1Count 5V/500kHz

Table 3-4 Electronic modules and the applications for which they are suitable, continued

Applications		Electronic module
• Detection and evaluation of path positions by means of absolute position encoders (SSI) • Simple positioning tasks	Absolute position encoder: 13 bits/21 bits/25 bits	1SSI
• Driving power circuits of stepper motors • Positioning stepper motors	5-V pulses up to 204 kHz	1STEP 5 V/204 kHz
• Output of pulses in 4 different operating modes	Min. pulse duration of 200 µs	2PULSE
• Controlled positioning, incremental encoder 5V differential signals	Drive controlled by means of digital outputs: travel minus, travel plus, rapid traverse/creep speed	1POS INC/Digital
	Drive controlled by means of analog output ±10 V	1POS INC/Analog
• Controlled positioning, SSI sensor	Drive controlled by means of digital outputs: travel minus, travel plus, rapid traverse/creep speed	1POS SSI/Digital
	Drive controlled by means of analog output ±10 V	1POS SSI/Analog
• RS-232C/RS-422/RS-485 serial data transmission	ASCII and 3964(R) protocol	1SI 3964/ASCII
	Protocol mode and USS	1SI Modbus/USS
• Reservation of a slot for any electronic module	Width 15 mm Width 30 mm	RESERVE

The electronic modules you can use on the various terminal modules:

You can combine the terminal modules in the ET 200S configuration.

Table 3-5 Assignment of TM-P terminal modules and power modules

Power modules	TM-P terminal modules for power modules				
Screw-type term. →	**15S23-A1**	**15S23-A0**	**15S22-01**	**30S44-A0**	**F30S47-F0**
Order number 6ES7193... →	...4CC20-0AA0	...4CD20-0AA0	...4CE00-0AA0	...4CK20-0AA0	3RK1 903-3AA00
Spring terminal: →	**15C23-A1**	**15C23-A0**	**15C22-01**	**30C44-A0**	---
Order number 6ES7193... →	...4CC30-0AA0	...4CD30-0AA0	...4CE10-0AA0	...4CK30-0AA0	
Fast Connect →	**15N23-A1**	**15N23-A0**	**15N22-01**	---	---
Order number 6ES7193... →	...4CC70-0AA0	...4CD70-0AA0	...4CE60-0AA0		
PM-E 24 VDC	●	●	●		
PM E 24–48 VDC	●	●	●		
PM-E 24–48 VDC/ 24–230 VAC	●	●	●		
PM-E F 24 VDC PROFIsafe*				●	
PM-D F 24 VDC PROFISafe					●

Table 3-6 Assignment of TM-E terminal modules and electronic modules

Electronic modules	TM-E terminal modules for electronic modules						
Screw-type term. →	**15S26-A1**	**15S24-A1**	**15S24-01**	**15S23-01**	**15S24-AT**	**30S44-01**	**30S46-A1**
Order number 6ES7193... →	...4CA40-0AA0	...4CA20-0AA0	...4CB20-0AA0	...4CB00-0AA0	...4CL20-0AA0	...4CG20-0AA0	...4CF40-0AA0
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**	**30C46-A1**
Order number 6ES7193... →	...4CA50-0AA0	...4CA30-0AA0	...4CB30-0AA0	...4CB10-0AA0	...4CL30-0AA0	...4CG30-0AA0	...4CF50-0AA0
Fast Connect →	**15N26-A1**	**15N24-A1**	**15N24-01**	**15N23-01**	---	---	---
Order number 6ES7193... →	...4CA80-0AA0	...4CA70-0AA0	...4CB70-0AA0	...4CB60-0AA0			
2DI 24 VDC Standard 2DI 24 VDC High Feature 4DI 24 VDC Standard 4DI 24 VDC High Feature 4DI 24 VDC/SRC Standard	●	●	●	●			
4DI 24–48 VUC High Feature	●	●	●	●			
4DI NAMUR	●	●	●	●			

Table 3-6 Assignment of TM-E terminal modules and electronic modules, continued

Electronic modules	TM-E terminal modules for electronic modules						
Screw-type term. →	**15S26-A1**	**15S24-A1**	**15S24-01**	**15S23-01**	**15S24-AT**	**30S44-01**	**30S46-A1**
Order number 6ES7193... →	...4CA40-0AA0	...4CA20-0AA0	...4CB20-0AA0	...4CB00-0AA0	...4CL20-0AA0	...4CG20-0AA0	...4CF40-0AA0
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**	**30C46-A1**
Order number 6ES7193... →	...4CA50-0AA0	...4CA30-0AA0	...4CB30-0AA0	...4CB10-0AA0	...4CL30-0AA0	...4CG30-0AA0	...4CF50-0AA0
Fast Connect →	**15N26-A1**	**15N24-A1**	**15N24-01**	**15N23-01**	---	---	---
Order number 6ES7193... →	...4CA80-0AA0	...4CA70-0AA0	...4CB70-0AA0	...4CB60-0AA0			
2DI 120 VAC Standard	●	●	●	●			
2DI 230 VAC Standard	●	●	●	●			
2DO 24 VDC/0.5 A; Standard 2DO 24 VDC/0.5 A High Feature 4DO 24 VDC/0.5 A Standard	●	●	●	●			
2DO 24 VDC/2 A Standard 2DO 24 VDC/2 A High Feature 4DO 24 VDC/2 A Standard	●	●	●	●			
2DO 24–230 VAC/2 A	●	●	●	●			
2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A 2RO NO/NC 24–48 VDC/5 A 24–230 VAC/5 A	●	●	●	●			
2AI U Standard 2AI U High Feature 2AI U High Speed	●	●	●	●			
2AI I 2WIRE Standard 2AI I 2WIRE High Speed	●	●	●	●			
2AI I 2/4WIRE High Feature	●		●				
2AI I 4WIRE Standard 2AI I 4WIRE High Speed	●		●				
2AI RTD Standard	●		●				
2AI RTD High Feature	●	●	●	●			
2AI TC Standard	●	●	●	●			
2AI TC High Feature					●		

Table 3-6 Assignment of TM-E terminal modules and electronic modules, continued

Electronic modules	TM-E terminal modules for electronic modules						
Screw-type term. →	**15S26-A1**	**15S24-A1**	**15S24-01**	**15S23-01**	**15S24-AT**	**30S44-01**	**30S46-A1**
Order number 6ES7193... →	...4CA40-0AA0	...4CA20-0AA0	...4CB20-0AA0	...4CB00-0AA0	...4CL20-0AA0	...4CG20-0AA0	...4CF40-0AA0
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**	**30C46-A1**
Order number 6ES7193... →	...4CA50-0AA0	...4CA30-0AA0	...4CB30-0AA0	...4CB10-0AA0	...4CL30-0AA0	...4CG30-0AA0	...4CF50-0AA0
Fast Connect →	**15N26-A1**	**15N24-A1**	**15N24-01**	**15N23-01**	---	---	---
Order number 6ES7193... →	...4CA80-0AA0	...4CA70-0AA0	...4CB70-0AA0	...4CB60-0AA0			
2AO U Standard 2AO U High Feature	●		●				
2AO I Standard 2AO I High Feature	●	●	●	●			
4 IQ-SENSE	●		●				
1Count 24V/100kHz	●		●				
1Count 5V/500kHz						●	
1SSI	●		●				
1STEP 5 V/204 kHz	●		●				
2PULSE	●		●				
1POS INC/Digital						●	
1POS SSI/Digital						●	
1POS INC/Analog						●	
1POS SSI/Analog						●	
1SI 3964/ASCII	●		●				
1SI Modbus/USS	●		●				
4/8 F-DI 24 VDC*						●	●
4 F-DO 24 VDC/2 A*						●	●
RESERVE (width 15 mm)	●	●	●	●	●		
RESERVE (width 30 mm)						●	●

* See the *ET 200S Fail-Safe Modules* manual in the *S7 F Systems* and *S7 Distributed Safety* documentation packages

The power modules you can use with the various electronic modules:

Power modules	Electronic modules
PM-E 24 VDC	Can be used with all electronic modules except the 2DI 120 VAC Standard, 2DI 230 VAC Standard, and 2DO 120/230 VAC.
PM-E 24–48 VDC	Can be used with all electronic modules except the 2DI 120 VAC Standard, 2DI 230 VAC Standard, and 2DO 120/230 VAC.
PM-E 24–48 VDC/ 24–230 VAC	Can be used with all electronic modules.
PM-E F 24 VDC PROFIsafe	For the fail-safe modules. See the *ET 200S Distributed I/O System, Fail-Safe Modules* manual in the *S7 F Systems* and *S7 Distributed Safety* documentation packages
PM-D F 24 VDC PROFISafe	

How to find the right terminal module for a power module for your application:

Figure 3-3 Selecting terminal modules for power modules

Configuration examples: terminal modules for power modules

Table 3-7 Terminal modules for power modules

Terminal module	Setup
TM-P15S22-01 TM-P15C22-01 TM-P15N22-01	
TM-P15S23-A1 TM-P15C23-A1 TM-P15N23-A1	

Table 3-7 Terminal modules for power modules, continued

Terminal module	Setup
TM-P15S23-A0 TM-P15C23-A0 TM-P15N23-A0	
TM-P30S44-A0 TM-P30C44-A0	

Table 3-7 Terminal modules for power modules, continued

Terminal module	Setup
TM-PF30S47-F1	

How to find the right terminal module for an electronic module for your application:

Figure 3-4 Selecting terminal modules for electronic modules

Configuration examples: Terminal modules for electronic modules

Table 3-8 Terminal modules for electronic modules

Terminal modules	Setup
TM-E15S26-A1 TM-E15C26-A1 TM-E15N26-A1	
TM-E15S24-A1 TM-E15C24-A1 TM-E15N24-A1	

Table 3-8 Terminal modules for electronic modules, continued

Terminal modules	Setup
TM-E15S24-01 TM-E15C24-01 TM-E15N24-01	
TM-E15S23-01 TM-E15C23-01 TM-E15N23-01	

Table 3-8 Terminal modules for electronic modules, continued

Terminal modules	Setup
TM-E15S24-AT TM-E15C24-AT	
TM-E30S44-01 TM-E30C44-01	

Table 3-8 Terminal modules for electronic modules, continued

Terminal modules	Setup
TM-E30S46-A1 TM-E30C46-A1	

3.6 Direct communication

Requirements

- The ET 200S can be used as the sender (publisher) for direct communication.
- The DP master being used must, of course, also support direct communication. You will find information on this in the description of the DP master.

Principle

Direct communication is characterized by the fact that PROFIBUS-DP nodes monitor the data sent back by a DP slave to its DP master.
By means of this mechanism the monitoring node (recipient/subscriber) can directly access changes to the input data of remote DP slaves.

During configuration in *STEP 7* you specify by means of the relevant I/O input addresses the address area of the recipient in which the data of the sender is to be placed.

Example

Figure 3-5 gives an example of the direct-communication relationships you can configure with an ET 200S as the sender and which nodes as possible recipients can monitor data sent back by DP slaves to the DP master.

Figure 3-5 Direct Communication with the IM151-1 HIGH FEATURE

3.7 Clocking

Features

Reproducible response times (i.e. of equal length) are achieved in SIMATIC with an equidistant DP bus cycle, synchronization of the user program on the DP bus cycle, and the clocked transfer of I/O data to the I/O modules. The clocked sections of the user program are processed synchronously to the DP bus cycle by means of clocked interrupts (OB 61 to OB 64). The I/O data are transferred at defined and constant (clocked) intervals via the backplane bus of the DP slave to the I/O modules and switched through synchronously to the terminal.

In other words, clocking results in the synchronization of all the previously cyclic single cycles from the user program in the CPU to the DP cycle on the PROFIBUS subnetwork, to the cycle in the DP slave and, finally, to the cycle in the I/O modules of the DP slaves.
The maximum jitter is 10 µs.

Requirements

- Clocking is possible with the IM 151-1 HIGH FEATURE with the following STEP 7 versions and modules:

STEP 7 version	Module	Order number	As of product version
As of V5.1 with ServicePack 3 and Hotfix 1	2DI 24 VDC High Feature	6ES7131-4BB00-0AB0	1
	4DI 24 VDC High Feature	6ES7131-4BD00-0AB0	1
	2DO 24 VDC/0.5 A High Feature	6ES7132-4BB00-0AB0	1
	2DO 24 VDC/2 A High Feature	6ES7132-4BB30-0AB0	1
As of V5.1 with ServicePack 4	1Count 24V/100kHz	6ES7138-4DA03-0AB0	1
	1Count 5V/500kHz	6ES7138-4DE01-0AB0	1
	1SSI	6ES7138-4DB01-0AB0	1
As of V5.2	4DI 24–48 VUC High Feature	6ES7131-4CD00-0AB0	1
	2AI U High Speed	6ES7134-4FB51-0AB0	2
	2AI 2WIRE HS	6ES7134-4GB51-0AB0	2
	2AI 4WIRE HS	6ES7134-4GB61-0AB0	2
	2AO I High Feature	6ES7135-4MB01-0AB0	1
	2AO U High Feature	6ES7135-4LB01-0AB0	1

Other modules are possible in the ET 200S configuration but these do not support clocking.

- The transmission rate of the PROFIBUS-DP is at least 1.5 Mbps (shorter equidistance times can be achieved with higher transmission rates).
- The maximum equidistance is 32 ms.
- The equidistance master (class 1) must be a class 1 DP master. In other words, a programming device (PG)/PC cannot be an equidistance master.
- In equidistant operation, only one DP master (class 1) can be active in the PROFIBUS-DP bus system. PGs or PCs (class 2) can also be connected.
- Clocking can only be activated on the ET 200S if the equidistant bus cycle has been activated on the DP master system and at least one electronic module with synchronization support has been configured.
- No clocking (equidistance) is possible with the ET 200S during removal or insertion of electronic modules.
- In equidistant operation, the ET 200S requires a starting time of approx. 150 DP cycles to ensure clocking right through to the terminals.

Optimizing the equidistant time

- The longest delays for the digital input/output modules (parameterizable in the case of inputs) are decisive in determining the length of the equidistant DP cycle. Tip: Make sure during clocking that all the digital modules in the ET 200S station have the same input delay.
- The shorter the input delays you set for the HIGH FEATURE digital input modules, the shorter the equidistance times that can be achieved. Tip: If possible, set an input delay of 0.1 ms for the HIGH FEATURE digital input modules.
- The processing time of the modules should be taken into account in the case of modules that support clocking.
- The minimum equidistance time depends on the number of modules in the ET 200S. Tip: If possible, use 4-channel HIGH FEATURE digital input modules to reduce the number of modules.
  You can also achieve shorter equidistance times if you distribute the modules of an ET 200S (with a large number of modules) between two ET 200S stations.
- The equidistance time is reduced if you increase the transmission rate.
  Tip: Set the fastest transmission rate possible.

Procedure for parameterizing clocking

1. Carry out settings on the CPU:

   “Object Properties” of the CPU > “Clocked interrupts” tab

   – Set the CPU clocked interrupt

   – Select the DP master system used.

   – Select the desired partial process image.

Figure 3-6 Clocked interrupts dialog box

2. Carry out settings on the DP master system:

   “Object Properties” of the DP master > “General” tab > “Properties” button > “Parameters” tab > “Properties” button > “Network Settings” tab > “Options” button

   – Activate equidistance on the DP master system

   – Set the length of the equidistant DP cycle (max. 32 ms).

   – Set “Times Ti and To same for all Slaves” (results in synchronization of the I/O data of the different DP slaves)

   – You can set the Ti and To times separately. Recommended: Accept the default settings for Ti and To.

Figure 3-7 Options dialog box

Note

The “Recalculate” button allows you to calculate a value from STEP 7 for the equidistant DP cycle that takes into account the current PROFIBUS DP configuration. This value is then automatically entered in the “Equidistant DP cycle”, “Time Ti (...)” and “Time To (...)” boxes.

3. Carry out settings on the DP slave:

   “Object Properties” of the DP slave > “Clocking” tab

   – Enable “Synchronize DP slave with DP cycle”.

   – Enter the times Ti and To (if “Times Ti and To same for all slaves” has not been set on the DP master system). Recommended: Accept the default settings for Ti and To.

   – Select the electronic modules to be synchronized, and assign them on the “Addresses” tab to the partial process image defined in the CPU.

Figure 3-8 DP slave properties dialog box

Note

If you choose “Clocking” from the “Edit” menu, a configuration overview of the clocked modules appears.

4. Create a user program:
   - Create OB 61.
   - At the beginning of OB 61, SFC 126 must be called to upgrade the partial process image of the inputs.
   - At the end of OB 61, SFC 127 must be called to upgrade the partial process image of the outputs.
   - The partial process image to be used is the one parameterized in the CPU (”Clocked Interrupts” tab).

Troubleshooting in clocking

Effect	Cause	What to Do
Station failure of the ET 200S	Errored clocking (more than 10 lost or interrupted cycles).	Check the parameter assignment.
The equidistance times are too long.	The input delays of the HIGH FEATURE digital input modules are not optimally set.	Decrease the input delay of the HIGH FEATURE digital input modules.
No clocked signal detection/output	Wrong process image partition used Neg. RET_VAL in the case of SFCs 126/127	Check whether the same process image partition was used in the OB 61 user program (or up to OB 64) when SFCs 126/127 are called and in the configuration of the DP master/DP slave.

Further information

You can find additional information on clocking in the STEP 7 help system and in the *Isochrone Mode* manual (available as of 03/2003).

3.8 Option handling

Features

Option handling enables you to set up the ET 200S for future expansions (options). Option handling means that you install, wire, configure, and program the planned maximum configuration of the ET 200S. The electronic modules you require for this are initially replaced with inexpensive RESERVE modules which are then later simply exchanged for the required electronic modules.

This means that the ET 200S can be completely prewired (master wiring) because the RESERVE module is not connected to the terminals of the terminal module or therefore the process.

The RESERVE modules for future expansion at the right-hand end of the station are optional. In this case, preparatory installation and wiring are possible but not a prerequisite.

Note

You can find information on the removal and insertion of electronic modules in Section 5.5.

How it works

At option handling, the configuration of slots 2 to 63 of the ET 200S is checked. If the check is enabled for a slot, the RESERVE module (option) or the configured electronic module can take up this slot without a diagnosis being reported. If the check is disabled, only a configured electronic module can be located in this slot. Any other module will trigger a diagnosis. You can also control the configuration of slots 2 to 63 and monitor the configuration of slots 1 to 63 using the control and feedback interface in the process input/output image (PII) and (PIQ).

Figure 3-9 How option handling works

Prerequisites

For option handling you require:

- IM 151-1 STANDARD (6ES7151-1AA03-0AB0) or IM 151-1 FO STANDARD interface module (6ES7151-1AB02-0AB0)
- To configure the DDB file:
  - IM 151-1 STANDARD: SI02806A.GSx as of 07/2003 (as of V1.0)
  - IM 151-1 FO STANDARD: SI02806B.GSx as of 07/2003 (as of V1.0)

Note

You do not require a DDB file for option handling in STEP 7:

- as of STEP 7 V5.2 Service Pack 1 and
- the current HW update for the interface and power modules Integrate the HW update in HWCONFIG using the **Options > Install HW Updates** menu command. You can download the HW updates from Customer Support on the Internet.

You can find the description of option handling in the STEP 7 help system.

- At least one PM E 24–48 VDC or PM E 24–48 VDC/24–230 VAC power module must be present in the configuration.
- RESERVE modules as replacements for future electronic modules

Example of the use of RESERVE modules

Figure 3-10 Example of the use of the RESERVE modules

Option handling parameter assignment

Note the following prerequisites when assigning parameters:

- In STEP 7 or COM PROFIBUS, parameterize the electronic modules you want to use for future applications, such as 4DI HF, on the slots of the RESERVE modules (or the expansion modules at the right-hand end of the station):
  - Drag the electronic module to the configuration table
  - Set the parameters
- Using one of the following entries, drag a PM E 24–48 VDC or PM E 24–48 VDC/24–230 VAC power module to the configuration table.
  - ...O (option handling) or
  - ...SO (status byte + option handling)

Note

There can only be **one** power module with the ending ...O or ...SO in the ET 200S configuration.

- Parameterize the interface module as follows:

Interface module	Parameters	Setting	Description
IM 151-1 STANDARD or IM 151-1 FO STANDARD	Option handling, general	Enable	Option handling is activated for the whole ET 200S.
	Option handling: slots 2 to 63	Enable (all the slots on which RESERVE modules can be located)	There are RESERVE modules or configured electronic modules on the slot. A diagnosis is not reported.

Note

If “Operation at Preset <> Actual Configuration” is blocked at parameter assignment, the following occurs:

- The ET 200S does not start up if a module is missing or if an incorrect module is inserted. A diagnostic report is output to the effect that there is no module or the module is incorrect.
- The ET 200S starts up if you enable option handling for the slot of an inserted RESERVE module. A diagnosis is not reported.

If you have parameterized an electronic module for the RESERVE module, the following substitute values are reported:

- Digital input modules: 0
- Analog input modules: $7FFF_H$
- Function module: 0

Controlling and monitoring options

You can use the control feedback interface (PIQ) and feedback interface (PII) to control and monitor the options with the user program.

Recommended: Before you use the optional expansion of the ET 200S, check using the feedback interface (see Table 3-10) whether all the configured electronic modules are inserted.

Note

Using SFCs 14/15 it is possible to consistently access the control and feedback interface.

The control and feedback interface is in the process image of the inputs and outputs of the PM E 24–48 VDC or PM-E 24–48 VDC/24–230 VAC power modules. It is only available if in the configuration software you have selected the entries ending in ...O or ...SO for the relevant power module (see also Appendix C).

	7	6	5	4	3	2	1	0
IB/QB x	7	6	5	4	3	2	1	*
IB/QB x+1	15	14	13	12	11	10	9	8
IB/QB x+2	23	22	21	20	19	18	17	16
IB/QB x+3	31	30	29	28	27	26	25	24
IB/QB x+4	39	38	37	36	35	34	33	32
IB/QB x+5	47	46	45	44	43	42	41	40
IB/QB x+6	55	54	53	52	51	50	49	48
IB/QB x+7	63	62	61	60	59	58	57	56

Bit no.

There is one bit for each slot of the electronic or RESERVE modules in the ET 200S.

Control interface:
Slots 2 to 63

Feedback interface:
Slots 1 to 63

* Not applicable

Figure 3-11 Control (PIQ) and feedback interface (PII)

Control interface PIQ (QB x to QB x+7):

Using these bytes (8 bytes) you can control the diagnostic behavior of the slots you have enabled in HWCONFIG for option handling.

Only the bits of the slots you have enabled at parameter assignment for option handling are evaluated (they are marked with “0”).

Table 3-9 Control interface

Slot	Value of the bit	Response
2 to 63	0	Parameter assignment for option handling applies. RESERVE modules are permitted: • The station is transferring data. • A diagnosis is not reported. • The SF LED on the interface module is off.
	1	Parameter assignment for option handling is cancelled. RESERVE modules are not accepted on this slot: • The station is transferring data. • The diagnosis “Incorrect module” is reported. • The SF LED lights up on the interface module

Feedback interface PII (IB x to IB x+7):

The feedback interface (8 bytes) tells you which module is actually on each slot.

All the slots are reported, even slots that you have not enabled for option handling.

Table 3-10 Feedback interface

Slot	Value of the bit	Response
1 to 63	0	The RESERVE module or an incorrect module is on the slot or a module has been removed.
	1	The configured module is on the slot.

Troubleshooting for option handling

Table 3-11 Troubleshooting for option handling

Effect	Cause	What to Do
ET 200S does not start up; configuration error	There are **several** entries of power modules ending in ...O or ...SO in the ET 200S configuration.	Check and correct the configuration in HWCONFIG.
	There is **no** power module entry ending in ...O or ...SO in the ET 200S configuration.	Use a power module entry ending in ...O or ...SO in HWCONFIG.

3.9 Limitations on the number of modules that can be connected/maximum configuration

- Number of modules:
  - ET 200S with IM151-1 BASIC: max. 12 modules
  - ET 200S with IM151-1 STANDARD; IM151-1 FO STANDARD; IM151-1 HIGH FEATURE:
    max. 63 modules

  This includes power modules, electronic modules, RESERVE modules, and motor starters.
- Bus length of the ET 200S:
  - Not relevant to the IM151-1 BASIC (see Section 4.1).
  - Max. 2 m (can be set): in the IM151-1 STANDARD; IM151-1 FO STANDARD:
  - Max. 1 m: in the IM 151-1 HIGH FEATURE
- Parameter length: depends on the DP master used (maximum 244 bytes)

Table 3-12 Parameter length in bytes

Module	Parameter length	Module	Parameter length
IM151-1 BASIC	19 bytes	2AI I 2WIRE S	4 bytes
IM151-1 STANDARD IM151-1 FO STANDARD	27 bytes	2AI I 2WIRE High Speed	12 bytes (4 bytes***)
IM151-1 HIGH FEATURE	27 bytes 56 bytes*		
PM-E 24 VDC PM-E 24–48 VDC PM-E 24–48 VDC/24–230 VAC	3 bytes	2AI I 4WIRE Standard 2AI I 2/4WIRE High Feature	4 bytes
		2AI I 4WIRE High Speed	12 bytes (4 bytes****)
		2AI RTD Standard	4 bytes
		2AI RTD High Feature	7 bytes (4 bytes**)
2DI 24 VDC High Feature 4DI 24 VDC High Feature	3 bytes 3 bytes	2AI TC Standard 2AI TC High Feature	4 bytes
2DI 24 VDC Standard 4DI 24 VDC Standard 4DI 24 VDC/SRC Standard	1 byte	2AO U Standard 2AO U High Feature	7 bytes
4DI NAMUR	12 bytes	2AO I Standard 2AO I High Feature	7 bytes
2DI 120 VAC Standard	3 bytes		
2DI 230 VAC Standard	3 bytes	1Count 24V/100kHz	16 bytes
2DO 24 VDC/0.5 A High Feature	3 bytes	1Count 5V/500kHz	16 bytes

Table 3-12 Parameter length in bytes, continued

Module	Parameter length	Module	Parameter length
2DO 24 VDC/0.5 A; Standard 4DO 24 VDC/0.5 A Standard	1 byte	1SSI	8 bytes
2DO 24 VDC/2 A High Feature	3 bytes	1STEP 5 V/204 kHz	7 bytes
2DO 24 VDC/2 A Standard 4DO 24 VDC/2 A Standard	1 byte	2PULSE	16 bytes
2DO 24–230 VAC/1 A	3 bytes	1POS INC/Digital 1POS SSI/Digital 1POS INC/Analog 1POS SSI/Analog	16 bytes
2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A	3 bytes	1SI 3964/ASCII 1SI Modbus/USS	4/8 bytes
2AI U Standard 2AI U High Feature	4 bytes	4 IQ-SENSE	16 bytes
2AI U High Speed	12 bytes (4 bytes*****)		
RESERVE	——	Motor starter STANDARD	3 bytes
		Motor starter HIGH FEATURE	12 bytes

* Clocking is activated.
** When used as 2AI RTD Standard
*** When used as 6ES7134 4GB50-0AB0
**** When used as 6ES7134 4FB50-0AB0
***** When used as 6ES7134 4GB60-0AB0

- Address space: depends on the DP master
  - The IM151-1 BASIC interface module supports a maximum of 88 input bytes and 88 output bytes.
  - The IM151-1 STANDARD / IM151-1 FO STANDARD interface modules support a maximum of 128 input bytes and 128 output bytes.
  - The IM151-1 HIGH FEATURE interface module supports a maximum of 244 input bytes and 244 output bytes.

- Power modules: Maximum configuration per potential group

Table 3-13 Maximum configuration per potential group

Power modules	Maximum current-carrying capacity	Connectable modules
Power module PM-E 24 VDC	10 A	The number of modules that can be connected depends on the total current of all the modules in this potential group. This must not exceed 10 A in total. The total current is decisively affected by the digital output modules: • 2DO 24 VDC/0.5 A Standard • 2DO 24 VDC/0.5 A High Feature • 4DO 24 VDC/0.5 A Standard • 4DO 24 VDC/0.5 A High Feature • 2DO 24 VDC/2 A Standard • 2DO 24 VDC/2 A High Feature • 4DO 24 VDC/2 A Standard • 4DO 24 VDC/2 A High Feature • 2DO 24–230 VAC/2 A
Power module PM-E 24–48 VDC	10 A	
Power module PM-E 24–48 VDC/ 24–230 VAC	10 A (24 VDC) 8 A (120/230 VAC)	

- Number of identifiers: one module per identifier (maximum 63 identifiers)
- You can use the ET 200S with DP masters with a diagnostic frame length of 32 bytes because you can set the length of the diagnostic frame in all the interface modules (see Sections 6.6.2 and 9.1).

Installation

4

Simple installation

The ET 200S distributed I/O system is designed for simple installation.

Chapter overview

Section	Description	Page
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4.2	Installing the interface module	4-4
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4.1 Installation rules, installation position, rail, installation measurements and clearances

Installation rules

- The ET 200S distributed I/O system starts with an interface module.
- There is a power module after the interface module or at the beginning of each potential group.
- After a power module come digital, analog, process-related, or RESERVE modules.
- The ET 200S distributed I/O system ends with the terminating module.
- The maximum configuration of the distributed I/O system is as follows:
  - IM151-1 BASIC: max. 13 modules (including interface module). The length of the bus is not relevant.
  - IM151-1 STANDARD / IM151-1 FO STANDARD: max. 64 modules (including the interface module) or a max. bus length of 2 m.
  - IM151-1 HIGH FEATURE: max. 64 modules (including the interface module) or a max. bus length of 1 m.

Installation position

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

DIN rail

The ET 200S distributed I/O system is installed on a zinc-plated rail to EN 50022 (35 × 7.5 mm or 35 ×15 mm).

Note

When the ET 200S distributed I/O device is exposed to increased vibrations and shock, we recommend that you screw the rail to the mounting surface at intervals of 200 mm.

To prevent the ET 200S distributed I/O system from slipping to the side, we recommend that you fit a mechanical stop (for example, with a ground terminal, 8WA2 011-1PH20) at both ends of the device.

If you install the rail on grounded, zinc-plated mounting plates, there is no need to ground the rail separately.

Installation measurements

Table 4-1 Installation measurements

Measurements	
Installation width	• Interface module: 45 mm • Terminal modules with electronic modules: 15 mm or 30 mm • Terminating module: 7.5 mm
Installation height	• Interface module: 119.5 mm • Electronic module with terminal module: – 3 levels with screw-type or spring terminals: 119.5 mm – 3 levels with Fast Connect: 143 mm – 3 levels with screw-type or spring terminals and shield contact: 151.5 mm – 3 levels with Fast Connect and shield contact: 175 mm – 4 levels with screw-type or spring terminals: 132 mm – 4 levels with Fast Connect: 164 mm – 4 levels with screw-type or spring terminals and shield contact: 164 mm – 4 levels with Fast Connect and shield contact: 196 mm – 6 levels with screw-type or spring terminals: 157 mm – 6 levels with Fast Connect: 204 mm – 6 levels with screw-type or spring terminals and shield contact: 189 mm – 6 levels with Fast Connect and shield contact: 236 mm – 7 levels with screw-type terminal: 196.5 mm
Installation depth	• ET 200S on rail with 7.5 mm depth: 75 mm • ET 200S on rail with 15 mm depth: 82.5 mm

Minimum clearances for installation, wiring, and ventilation

When installing the ET 200S in a housing, ensure that the distance to the lid of the housing or the front door is at least 2 mm.

Figure 4-1 Minimum clearances

4.2 Installing the interface module

Features

- The interface module connects the ET 200S with the PROFIBUS-DP.
- The interface module transfers data between the higher-level controller and the I/O modules.

Requirements

- The rail must be installed.
- All the terminal modules must be installed to the right of the interface module. The maximum configuration of the ET 200S distributed I/O system is 12/63 modules (including power modules, I/O modules, reserve modules, and motor starters).

Tool required

3-mm screwdriver

Installing the interface module

1. Hang the interface module on the rail.
2. Tip the interface module back until you hear the locking mechanism engage.

Figure 4-2 Installing the interface module

Removing the interface module

The interface module is wired, and the terminal modules are on the right:

1. Switch off the supply voltage on the interface module.
2. Disconnect the wiring and the bus connector on the interface module.
3. Use a screwdriver to push the locking mechanism on the interface module down until the mechanism stops, and move the interface module to the left.

   Note: The locking mechanism is under the interface module.
4. With the locking mechanism depressed, tip the interface module so that it comes off the rail.

4.3 Installing the TM-P and TM-E terminal modules

Features

- The terminal modules receive the I/O modules and power modules.
- The terminal modules can be prewired (without I/O modules).
- All the terminal modules must be installed to the right of the interface module.

Requirements

- The rail must be installed.

Tool required

3-mm screwdriver

Installing the terminal module

1. Hang the terminal module on the rail.
2. Tip the terminal module back until you hear the locking mechanism engage.
3. Move the terminal module to the left until you hear it snap into place at the previous interface module (if already installed) or the terminal module.

Figure 4-3 Installing the terminal module

Removing the terminal module

The terminal module is wired, and there are other terminal modules on the right and left.

A terminal module in the ET 200S distributed I/O system can only be removed when there is a clearance of around 8 mm to the adjacent terminal modules (you achieve this clearance by moving the adjacent modules).

1. Switch off the supply voltage on the terminal module and, if applicable, the power module.
2. Disconnect the wiring on the terminal module.
3. Removal from the right: Use a screwdriver to push the locking mechanism on the previous terminal module/interface module (on the left) down until the mechanism stops, and move the terminal module to the right.

   Removal from the left: Use a screwdriver to push the locking mechanism on the terminal module down until the mechanism stops, and move the terminal module to the left.

   Note: The locking mechanism is under the terminal module.
4. With the locking mechanism depressed, tip the terminal module so that it comes off the rail.

Figure 4-4 Removing the terminal module (from the right)

Note

It is not necessary to remove the terminal module in order to replace the terminal box. See Section 4.4.

4.4 Replacing the terminal box on the terminal module

Features

The terminal box is part of the terminal module. If necessary, you can replace the terminal box.

Requirements

It is not necessary to remove the terminal module.

Tool required

3-mm screwdriver

Replacing the terminal box on the terminal module

The terminal module is installed, wired, and fitted with an electronic module.

1. Switch off the supply voltage on the terminal module and, if applicable, the power module.
2. Disconnect the wiring on the terminal module.
3. Simultaneously press the upper and lower release buttons of the electronic module, and remove it from the terminal module.
4. There is a small opening directly under the slot number label. Push the screwdriver into this opening diagonally from below, and at the same time pull the terminal box downward until it stops. Then pull the terminal box upward and out of the terminal module.
5. Replace the terminal box, and insert the new one into the terminal module from above (position: see Figure 4-5). Then push the terminal box upward until it snaps into place.
6. Insert the electronic module in the terminal module.
7. Wire the terminal module.
8. Switch on the supply voltage on the terminal module and, if applicable, the power module.

Figure 4-5 Replacing the terminal box on the terminal module

4.5 Installing the terminating module

Features

The ET 200S distributed I/O system is completed by the terminating module on the right-hand side. If you have not connected a terminating module, the ET 200S is not ready for operation.

Requirements

- The last terminal module must be installed.

Installing the terminating module

1. Hook the terminating module on the rail to the right of the last terminal module.
2. Tip the terminating module back on the rail.
3. Move the terminating module to the left until you hear it snap into place against the last terminal module.

Figure 4-6 Installing the terminating module

Removing the terminating module

1. Use a screwdriver to push the locking mechanism on the last terminal module down until the mechanism stops, and move the terminating module to the right.
2. Tip the terminating module so that it comes off the rail.

4.6 Installing the shield contact

Features

- You need the shield contact to connect cable shields (for example, analog electronic modules, 1Count 24V/100kHz electronic module and 1SSI electronic module).
- You fit the shield contact on the terminal module.
- The shield contact consists of a shield contact element, a conductor rail, (3 x 10 mm), a shield terminal, and a ground connection terminal.

Requirements

- The terminal modules must be installed.

Tool required

- 3-mm screwdriver
- Metal-cutting saw

Installing the shield contact

1. Push the shield contact element onto the first terminal module from below.
2. Push the shield contact element onto the last terminal module from below.

   In order to achieve stability of the conductor rail between two shield contact elements during installation, you must connect an additional shield contact element after every sixth terminal module (given a width of 15 mm).
3. Saw off the correct length from the conductor rail. The length of the conductor rail should be: the distance between the shield contact elements + 45 mm.
4. Push the conductor rail into the shield contact element. After installation, the conductor rail must protrude from the shield contact element by 15 mm on the left or right.
5. Attach the shield terminals on the conductor rail (between the shield contact elements).
6. Attach the ground connection terminal to the protruding conductor rail.

Figure 4-7 Installing the shield contact

4.7 Applying slot number labels and color identification labels

Features

- The slot number labels identify the individual I/O modules with a slot (1 to 63).
- The color identification labels permit individual color coding of the terminals in accordance with company or national conventions. The color identification labels are available in white, red, blue, brown, yellow, yellow-green, and turquoise. Each terminal on the terminal module can have a color identification label.

Requirements

- The terminal modules must be installed.
- There must be no electronic modules connected when you apply the slot number labels.
- The terminal modules should not be wired when you apply the color identification labels.
- The slot number labels and color identification labels are applied onto the terminal modules.
  - Position of the slot number label: under the coding element on the terminal module.
  - Position of the color identification labels: right next to each terminal on the terminal box.

Tool required

3-mm screwdriver (for removal only)

Applying slot number labels and color identification labels

Slot number labels:

1. Break the slot number label (1 to 63) off the strip.
2. Use your finger to press the slot number label onto the terminal module.

Color identification labels:

1. You can place the color identification labels in the opening next to the terminal while they are still on the strip and then bend the strip back to pull them off.
2. Use your finger to press the color identification labels onto the terminal module.

Figure 4-8 Applying slot number labels and color identification labels

Removing slot number labels and color identification labels

Slot number label:

1. Remove the electronic module from the terminal module.
2. Lever the slot number label out of its mount.

Color identification labels: Use a screwdriver to lever the color identification labels out of their mounts.

4.8 Setting the PROFIBUS address

Features

The PROFIBUS address defines the address at which the ET 200S distributed I/O system is found on the PROFIBUS-DP.

Requirements

- The PROFIBUS-DP address for the ET 200S is set on the interface module by means of DIP switches. The DIP switches are on the front of the interface module, protected by a sliding window.
- The permitted PROFIBUS-DP addresses are 1 to 125.
- Each address can be assigned only once on the PROFIBUS-DP.

Tool required

3-mm screwdriver

Setting the PROFIBUS address

1. Slide the window on the interface module upward.
2. Use a screwdriver on the DIP switches to set the desired PROFIBUS-DP address.
3. Close the window.

Figure 4-9 Setting the PROFIBUS address

Changing the PROFIBUS-DP address

You change the PROFIBUS-DP address in exactly the same way as you set it. A change to the PROFIBUS-DP address takes effect after power on at the interface module of the ET 200S.

Wiring and Fitting

5

Prewiring

The ET 200S distributed I/O system allows you to prewire the terminal modules with screw-type or spring terminals.

Chapter overview

Section	Description	Page
5.1	General rules and regulations for operating the ET 200S	5-2
5.2	Operating the ET 200S on a grounded supply	5-4
5.3	Electrical design of the ET 200S	5-8
5.4	Wiring the ET 200S	5-9
5.5	Inserting and identifying the electronic modules	5-24

5.1 General rules and regulations for operating the ET 200S

Introduction

When operating the ET 200S distributed I/O system as a component part of a plant or system, certain rules and regulations have to be followed depending on where the device is to be used.

This chapter provides an overview of the most important rules you have to observe when integrating the ET 200S distributed I/O system in a plant or system.

Specific applications

Note the safety and accident prevention regulations that apply to specific applications (for example, machine protection guidelines).

Emergency stop devices

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

Startup of the system after specific events

The following table tells you what you should do when the system starts up after the occurrence of specific events.

If ...	Then ...
Startup follows a voltage drop or failure Startup of the ET 200S follows an interruption of bus communication	No dangerous operating states must occur. If necessary, force an emergency stop.
Startup follows unlocking of the emergency stop device	There must not be an uncontrolled or undefined start-up.

Line voltage

The following table tells you what you have to do with regard to the line voltage.

With ...	Requirements
Permanently installed plants or systems without all-pole line disconnect switches	There must be a line disconnect switch or a fuse in the building installation system.
Load power supplies, power supply modules	The set rated voltage range must correspond to the local line voltage.
All circuits of the ET 200S distributed I/O system	Any fluctuation/deviation in the line voltage from the rated value must be within the permitted tolerances (see Section 7.4)

24 VDC supply

The following table tells you what you have to do with regard to the 24 VDC supply.

With ...	Pay attention to ...	
Buildings	Outdoor lightning protection	Take lightning protection precautions (for example, lightning conductors)
24 VDC supply lines, signal lines	Indoor lightning protection	
24 VDC supply	Safe (electrical) isolation of extra-low voltage	

Protection against outside electrical influences

The following table tells you what to do to provide protection against electrical influences or faults.

With ...	You must ensure that...
All plants or systems in which the ET 200S is integrated	The plant or system is connected to a protective conductor for diverting electromagnetic interference.
Supply, signal, and bus lines	The wiring arrangement and installation are correct.
Signal and bus lines	Any break of a line or conductor does not result in undefined states of the plant or system.

5.2 Operating the ET 200S on a grounded supply

In this section, you will find information on the overall setup of an ET 200S distributed I/O system on a grounded supply (TN-S system). The specific subjects discussed are:

- Circuit-breaking devices, short-circuit and overload protection in accordance with DIN VDE 0100 and DIN VDE 0113
- Load power supplies and load circuits

Definition: Grounded supply

In a grounded supply, the neutral conductor of the system is grounded. A mere ground fault between a live conductor and ground or a grounded section of the plant causes the protective devices to trip.

Components and protective measures

Various components and protective measures are prescribed when setting up an entire plant. The types of component and the degree to which the protective measures are binding depend on the DIN VDE regulation that applies to your plant setup. The following table refers to Figure 5-1.

Compare ...	Refer to Fig. 5-1	DIN VDE 0100	DIN VDE 0113
Circuit-breaking device for PLC, sensors and actuators	1	... Part 460: Main switch	... Part 1: Disconnector
Short-circuit and overload protection: Grouped for sensors and actuators	2 3	... Part 725: Single-pole protection of circuits	... Part 1: • With a grounded secondary circuit: **single-pole** protection • In all other cases: **all-pole** protection
Load power supply for AC load circuits with more than five electromagnetic devices	2 3	Isolation by transformer **recommended**	Isolation by transformer **recommended**

Safe electrical isolation

Safe electrical isolation must be provided for:

- Modules that must be supplied with $\leq$60 VDC or $\leq$25 VAC
- 24 VDC load circuits

Setting up the ET 200S with ungrounded reference potential

As of the IM151-1 BASIC (6ES7151-1CA00-0AB0), IM151-1 STANDARD (6ES7151-1AA02-0AB0), IM151-1 FO STANDARD (6ES7 151-1AB01-0AB0) and IM151-1 HIGH FEATURE (6ES7151-1BA00-0AB0), the reference potential M of the rated supply voltage for the IM151-1 is connected to the rail (protective conductor) by means of an RC combination, therefore making an ungrounded configuration possible.

To divert interference current, the reference potential of the IM151-1 is connected internally to the rail (protective conductor) via an RC combination (R = 10 MΩ / C = 22 nF). High-frequency interference currents are thus discharged, and static charge is prevented.

Overall configuration of the ET 200S

Figure 5-1 shows the overall configuration of the ET 200S distributed I/O system (load voltage supply and grounding concept) with supply from a TN-S system.

Figure 5-1 Configuring the ET 200S with grounded reference potential

Figure 5-2 shows the overall setup of the ET 200S distributed I/O system (load power supply and grounding concept) with the ET 200S Power Supply and an incoming supply from a TN-S system.

Figure 5-2 Operating the ET 200S with grounded reference potential (with the ET 200S Power Supply)

5.3 Electrical design of the ET 200S

Isolation between ...

- The load circuits/process and all other circuit components of the ET 200S
- The PROFIBUS-DP interface in the interface module and all other circuit components

The following figure shows the potentials of the ET 200S. Only the most important components are shown.

Figure 5-3 Potentials of the ET 200S

5.4 Wiring the ET 200S

Section	Description	Page
5.4.1	Wiring a terminal module with screw-type terminals	5-10
5.4.2	Wiring a terminal module with spring terminals	5-10
5.4.3	Wiring a terminal module with Fast Connect	5-12
5.4.4	Wiring terminal modules	5-15
5.4.5	Wiring the IM151-1 BASIC, IM151-1 STANDARD and IM151-1 HIGH FEATURE interface modules	5-20
5.4.6	Wiring the IM151-1 FO STANDARD interface module	5-21

Wiring rules for the ET 200S

Wiring rules for ...		ET 200S power supply (supply voltage)	Interface module (supply voltage)	Terminal modules (spring and screw-type terminals)	Terminal modules (Fast Connect)
Connectable wire cross-sections for rigid lines		No	No	0.14 to 2.5 mm^2	0.5 to 1.5 mm^2
Connectable wire cross-sections for flexible lines	Without wire end ferrule	No	0.25 to 2.5 mm^2	0.14 to 2.5 mm^2	0.5 to 1.5 mm^2
	With wire end ferrule	0.5 to 2.5 mm^2	0.25 to 1.5 mm^2	0.14 to 1.5 mm^2	---
Number of wires per connection		1 or a combination of 2 wires up to 1.5 mm^2 (sum) in a common wire end ferrule			1
Maximum external diameter of the wire's insulation		∅ 3.8 mm	∅ 3.8 mm	∅ 3.1 mm for 1.5 mm^2 ∅ 3.8 mm for 2.5 mm^2	∅ 3.2 mm for 1.5 mm^2
Stripping length of the wires		11 mm	11 mm		---
Wire end ferrules to DIN 46228	Without insulating collar	Design A, 8 to 12 mm long		Design A, up to 12 mm long	---
	With insulating collar 0.25 to 1.5 mm^2	Design E, up to 12 mm long			---

5.4.1 Wiring a terminal module with screw-type terminals

Features

- In terminal modules with screw-type terminals, the individual wires are screwed into the terminal.
- No wire end ferrules are required.

Requirements

Adhere to the wiring rules.

Tool required

3-mm screwdriver

Wiring a terminal module with a screw-type terminal

1. Strip 11 mm of insulation from the wires.
2. Insert the individual wires in the terminal.
3. Screw the ends of the wires with the terminal module.

5.4.2 Wiring a terminal module with spring terminals

Features

In terminal modules with spring terminals, the individual wires are held securely when you simply insert them in the terminal.

Requirements

Adhere to the wiring rules.

Tool required

3-mm screwdriver

Wiring a terminal module with spring terminals

1. Strip 11 mm of insulation from the wires.
2. Insert the screwdriver in the upper (round) opening of the terminal.
3. Insert the wire until it stops in the lower (square) opening of the terminal.
4. Release the terminal by pushing the screwdriver into the opening.
5. Push the wire into the released spring terminal, and pull the screwdriver out.

Figure 5-4 Wiring the spring terminal

5.4.3 Wiring terminal modules with Fast Connect

Features

- In the case of terminal modules with Fast Connect, the individual wires are attached using a quick connection method that requires no stripping.
- Fast Connect is a connection method that requires no preparation (i.e. the conductor does not have to be stripped).
- Each terminal of the terminal module with Fast Connect has a test opening (for measuring the voltage, for example). The test opening is suitable for test probes with a maximum diameter of ∅ 1.5 mm.
- Wire end ferrules are not permitted.
- Diagram of the Fast Connect terminal module

Figure 5-5 Block diagram of the terminal module with Fast Connect

Requirements

Adhere to the wiring rules.

Tool required

3-mm screwdriver

Connectable cables

You can connect rigid and flexible cables with PVC insulation with a conductor cross-section of 0.5 mm^2 to 1.5 mm^2 (max. external diameter 3.2 mm). If the cross-section of the conductors is the same, they can be wired fifty times. You can find a list of tested conductors at:
http://www.idc2.de

Cables and connections complying with UL

Wiring range for insulating piercing connection 22 -16 AWG solid/stranded PVC insulated conductors, UL style no. 1015 only.

Wiring terminal modules with Fast Connect

1. Insert the unstripped cable in the round opening **until it stops** (the insulation and conductor must form a flat surface).
2. Insert the screwdriver into the opening above the locking mechanism **until it stops**.
3. Press the screw driver downwards until the locking mechanism reaches the end.

   Result: The cable is connected.

Note

If you want to reconnect a cable that has already been connected, you must first cut it off.

Releasing the wiring of the terminal module with Fast Connect

1. Insert the screw driver into the opening under the locking mechanism **until it stops**.
2. Use the screwdriver to lever and push the locking mechanism upwards.
3. The wiring is released: Remove the cable.

Figure 5-6 Releasing the wiring of the terminal module with Fast Connect

Removing any remains of the conductor (only if necessary)

To remove any remains of the conductor (insulation), you can deinstall the locking mechanism from the terminal module (see Step 3). To do this, the locking mechanism must be open (upper position). You can only insert the locking mechanism in the upper position (see Step 4).

1. Insert the screwdriver in the opening below the locking mechanism (the tip of the screwdriver is on the lip of the locking mechanism).
2. Press the screwdriver downwards to lever the locking mechanism out of the terminal module.
3. Remove the locking mechanism from the terminal module. Remove any remains of the conductor from the locking mechanism.
4. Use your fingers to press the locking mechanism back into the opening. Important: Make sure the locking mechanism is inserted in the correct position, otherwise you can damage the clamping unit.

Figure 5-7 Removing the locking mechanism from the terminal module

5.4.4 Wiring terminal modules

Features

The ET 200S distributed I/O system comprises terminal modules for power modules and electronic modules:

- At the terminal modules for the power modules you connect the supply/load voltage for the respective potential group.
- Terminal modules for electronic modules connect the ET 200S with the process.
- At the terminal modules for electronic modules you can connect cable shields by means of a shield contact.

Requirements

- You must wire the terminal modules with the supply/load voltage switched off at the power module and the load voltage switched off at the electronic module.
- Adhere to the wiring rules.

Tool required

3-mm screwdriver

Wiring terminal modules for power modules

The terminal assignment of the terminal module depends on which power module is inserted. You will find information on this in the following chapters:

- Terminal modules in Chapter 10
- Power modules in Chapter 11

Figure 5-8 Wiring terminal modules for power modules

Wiring terminal modules for digital, analog, and technology modules

The terminal assignment of the terminal module depends on which electronic module is inserted. You will find information on this in the following chapters:

- Terminal modules in Chapter 10
- Digital electronic modules in Chapter 12
- Analog electronic modules in Chapter 13
- Process-related module: See the *process-related functions manual*

Figure 5-9 Wiring terminal modules for electronic modules

TM-E30S44-01 and the process-related module

AUX1 bus (PE) fed through. No connection to terminals 4 and 8 or 12 and 16.

TM-E30S46-A1 and fail-safe module*

AUX1 bus (PE) fed through. Connection to terminals A4, A8 and A3, A7 or A12, A16 and A11 and A15.

* For the terminal assignment, see the *ET 200S Fail-Safe Modules* manual in the S7 F systems documentation package

Figure 5-10 Wiring terminal modules for electronic modules, continued

Connecting cable shields

We recommend you use the shield contact to connect cable shields (in the case of analog electronic modules, the 1Count 24V/100kHz electronic module and the 1SSI electronic module, for example).

1. Remove the insulation material from the area around the shield terminal, and clamp the cable shield in the shield terminal (above the conductor rail). The shield terminal is suitable for one cable with a max. ∅ of 8 mm or two cables with a max. ∅ of 4 mm each.
2. Tighten the shield terminal (approximately 0.5 Nm)
3. Repeat steps 1 and 2 if you want to connect additional cable shields.
4. Strip the insulation from the ground wire (from 6 mm to 25 mm^2), and insert it in the ground connection terminal (under the conductor rail). Tighten the ground connection terminal (2 Nm to 2.5 Nm).
5. Attach the other end to the ground bus.

Figure 5-11 Connecting cable shields

Note

To stabilize the shield contact, you must mount and screw in at least one shield terminal over the shield contact element.

5.4.5 Wiring the IM151-1 BASIC, IM151-1 STANDARD and IM151-1 HIGH FEATURE interface modules

Features

You can connect the supply voltage and the bus connector (RS 485) to the interface modules IM151-1 BASIC, IM151-1 STANDARD and IM151-1 HIGH FEATURE.

Requirements

- Wire the interface module with the supply voltage switched off.
- Adhere to the wiring rules (see Section 5.4).

Tool required

3-mm screwdriver

Wiring the interface module

To connect the supply voltage:

1. Strip the insulation from the wires for the supply voltage of the interface module.
2. Tighten the individual wires in the screw-type terminal.

To connect the PROFIBUS-DP:

1. Insert the bus connector in the PROFIBUS-DP port.
2. Tighten the screws of the bus connector.

Figure 5-12 Wiring the IM151-1 BASIC, IM151-1 STANDARD, IM151-1 HIGH FEATURE

5.4.6 Wiring the IM151-1 FO STANDARD interface module

Features

Connect the supply voltage and the fiber-optic cable to the IM151-1 FO STANDARD interface module by means of a simplex connector.

Requirements

- Wire the interface module with the supply voltage switched off.
- Adhere to the wiring rules (see Section 5.4).

Tool required

3-mm screwdriver

Required accessories

- Packing with simplex connectors and polishing sets (6GK1901-0FB00-0AA0)
- Packing with connector adapters (6ES7195-1BE00-0XA0)

Installing simplex connectors

1. Remove about 30 cm of the cladding of the fiber-optic duplex cable.
2. Install the fiber-optic duplex cable with the appropriate simplex connectors. For detailed instructions on installing the simplex connectors, see the *SIMATIC NET PROFIBUS networks manual.*
   Tip: Do not snap the two simplex connectors together individually; instead, snap them together so that you get a “duplex connector”. In this manner you will achieve a better hold in the connector adapter.

   IMPORTANT: The cut and polished surface of the plastic fiber must be absolutely smooth and even. The plastic cladding also must not stick out or be separated roughly. Each deviation causes strong attenuation of the light signal over the fiber-optic cable.
3. Put the simplex connector in the plug-in adapter for the IM151-1 FO STANDARD and the fiber-optic cable in the appropriate cable ducts. Snap the connector adapter closed so that you can hear clearly that the side units have made contact with each other.

   When placing the connectors in the connector adapter, make sure that you position them correctly: the transmitter should always be on top and the receiver should always be on the bottom.

Bending radius for the fiber-optic cable

When placing the fiber-optic cable duplex core into the connector adapter, and when placing things on top of them, make sure that you do not go below the permitted bending radius of 30 mm. Also read the installation guidelines for fiber-optic cables in the *ET 200 Distributed I/O System Manual* or in the *SIMATIC NET – PROFIBUS networks manual*.

Using the fiber-optic cable again

Note

If you place used fiber-optic cable in the connector adapter, you must shorten both cores of the fiber-optic cable by the bent lengths and remount the simplex connectors.
In this manner you avoid possible attenuation losses from parts of the fiber-optic cable duplex core that have been bent again and highly stressed

Wiring the IM151-1 FO STANDARD interface module

To connect the supply voltage:

1. Strip the insulation from the wires for the supply voltage of the interface module.
2. Tighten the individual wires in the screw-type terminal.

To connect the PROFIBUS-DP:

1. Insert the fiber-optic cable with the mounted connector adapters in the IM151-1 FO STANDARD.
2. Push up the handle of the connector adapter that is sticking out.

Make sure that you position things correctly: Insert the sending fiber-optic cable in the receiver socket and the receiving fiber-optic cable in the sender socket of the fiber-optic cable interface of the IM151-1 FO STANDARD.

If the IM151-1 FO STANDARD is the last node of the fiber-optic cable network, you must close the unoccupied fiber-optic cable interface with filler plugs (which are in place when the IM151-1 FO STANDARD is delivered).

Caution

Do not look directly into the opening of the transmission diodes.
The light beam that comes out could damage your eyes.

Figure 5-13 Wiring the IM151-1 FO STANDARD

5.5 Inserting and identifying the electronic modules

Features

- The electronic modules are inserted in the terminal modules.
- A labeling strip allows you to identify the electronic modules.
- Electronic modules are:
  - Self-coding
  - Type-coded

  The first time you insert an electronic module, a code element engages on the terminal module. This mechanically prevents the wrong electronic module from being inserted.

Requirements

Adhere to the rules below for inserting electronic modules. See Section 3.5 (The electronic modules you can use on the various terminal modules).

Inserting and identifying the electronic modules

1. Insert the electronic module in the terminal module until you hear it snap into place.
2. Pull the labeling strip up out of the electronic module in order to identify it.
3. Then put the labeling strip back into the electronic module.

Figure 5-14 Inserting and identifying electronic modules

Removing electronic modules

1. Simultaneously press the two release buttons on the top and bottom of the electronic module.
2. Pull the electronic module out from the terminal module at the front.

Figure 5-15 Removing electronic modules

Changing the type of an electronic module

You have already removed the electronic module:

1. Use a screwdriver to push the code element out of the terminal module.
2. Put the code element on the used electronic module again.
3. Insert the new electronic module (different type) in the terminal module until you hear it snap into place.
4. Identify the new electronic module.

Figure 5-16 Removing the code element

Warning

When you make changes to the code, it can lead to dangerous states in your system.

Replacing a defective electronic module

You have already removed the electronic module:

1. Remove the code element from bottom of the new electronic module.
2. Insert the new electronic module (same type) in the terminal module until you hear it snap into place.
3. Identify the new electronic module.

Removing and inserting electronic modules during operation

ET 200S supports the removal and insertion of modules during operation (during the RUN operating mode). The ET 200S remains in RUN mode when an electronic module is removed. The protective conductor connections of the ET 200S are not interrupted.

Note

- You cannot remove and insert modules during operation unless the corresponding parameters have been assigned. See Section 9.1.
- You can remove and insert modules during operation as of the IM151-1 BASIC, IM151-1 STANDARD (6ES7 151-1AA01-0AB0), IM151-1 FO STANDARD, and IM151-1 HIGH FEATURE.
- If **one** module is missing (gap) and the ET 200S is switched on, the station will not start up (see Section 6.6.10).
- The removal and insertion of modules affects the clocking (equidistance).

If you replace more than one module, only one gap can result.

The following table indicates which modules you can remove and insert under which conditions:

Table 5-1 Removing and inserting electronic modules

Modules	Removing and inserting	Conditions
Interface module	No	——
Power modules	Yes	The load voltage must be switched off.
Digital electronic modules (input)	Yes	——
Digital electronic modules (output)	Yes	The load voltage must be switched off by means of an external switch/fuse.
Analog electronic modules	Yes	——
4 IQ-SENSE	Yes	The sensors can also be replaced during operation. These are then parameterized automatically by the electronic module.

Table 5-1 Removing and inserting electronic modules

Modules	Removing and inserting	Conditions
1Count 24V/100kHz	Yes	The load voltage must be switched off by means of an external switch/fuse.
1Count 5V/500kHz		
1SSI		
1STEP 5V/204kHz		
2PULSE		
1POS INC/Digital		
1POS SSI/Digital		
1POS INC/Analog		
1POS SSI/Analog		
1SI 3964/ASCII	Yes	——
1SI Modbus/USS	Yes	——
RESERVE	Yes	——

Commissioning and Diagnostics

6

Chapter overview

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6.1 Configuring the ET 200S

Introduction

This chapter describes how to configure and assign parameters to the ET 200S.

- Configuration: The systematic arrangement of the different ET 200S modules (setup)
- Parameter assignment: Setting the ET 200S parameters using the configuration software

Note

The ET 200S is included in the hardware catalog of HWCONFIG:

- IM151-1 BASIC: as of STEP 7 V5.2
- IM151-1 STANDARD: as of STEP 7 V5.0 with ServicePack 3
- IM151-1 FO STANDARD: as of STEP 7 V5.1 with ServicePack 1
- IM151-1 HIGH FEATURE: as of STEP 7 V5.1 with ServicePack 3

You will not need a device database file (*.GSD file). Advantages:

- Simplified grouping of the modules (by means of the “Pack Addresses” button in HWCONFIG)
- Plausibility checking of the parameters

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

STEP 7

- STEP 7 does not support the reading back of the configuration (PLC ▶ Upload).
- It is not possible to read out the ET 200S diagnosis via the CPU 315-2 DP (with the “Diagnosing Hardware” function in STEP 7) until order no. 6ES7315-2AF02.

Device database file

You configure the ET 200S distributed I/O system using the device database file (*.GSD file). The ET 200S is integrated in your system as a standard slave by means of the device database file. You can download the *.GSD file in either of the following ways:

- From the Internet under http://www.ad.siemens.de/csi_e/gsd

The following *.GSD files are available:

- IM151-1 BASIC: “SIEM80F3.GSx”
- IM151-1 STANDARD: “SI02806A.GSx”
- IM151-1 FO STANDARD: “SI02806B.GSx
- IM151-1 HIGH FEATURE: “SI0180E0.GSx

Integrating the device database file in your configuration software

Table 6-1 describes how to integrate the device database file in SIMATIC S7 or SIMATIC S5 (COM PROFIBUS).

Table 6-1 Integrating the device database file in the configuration software

Step	STEP 7 as of V5.0, ServicePack 3	COM PROFIBUS, as of V5.1, ServicePack 2, Hotfix 1[1)]
1	Start STEP 7, and call the **Options ▶ Install New *.GSD Files** menu command from HW Config.	Copy the device database file from the ET 200S to the COM PROFIBUS directory: **...CPBV51\GSD** (default) Copy the bitmap file to the following directory: **...CPBV51\BITMAPS**
2	In the dialog that appears, select the device database file to be installed and then click OK. Result: The field device is displayed in the hardware catalog in the PROFIBUS-DP directory.	Start COM PROFIBUS, and call the **File ▶ Read device database file** menu command. Result: The ET 200S is displayed in the hardware catalog in the slave configuration section.
3	Configure the ET 200S using STEP 7 (refer to the help system in STEP 7).	Configure the ET 200S using COM PROFIBUS (refer to the integrated help system in COM PROFIBUS).

1) If you are using different configuration software: see the associated documentation

Configuration

The ET 200S has maximum address space of:

- IM151-1 BASIC: up to 88 bytes for inputs and 88 bytes for outputs
- IM151-1 STANDARD, IM151-1 FO STANDARD: up to 128 bytes for inputs and 128 bytes for outputs
- IM151-1 HIGH FEATURE: up to 244 bytes for inputs and 244 bytes for outputs

To better exploit the available address space of the DP master and reduce data transfer between the ET 200S and the DP master, you can group several electronic modules/load feeders in a single byte in the input or output area of the process image. This is achieved by the systematic arrangement and designation of the ET 200S electronic modules/motor starters.

In Appendix C you will find a table giving the address space required for the individual modules.

You can group the following module types in a single byte:

- Digital input modules
- Digital output modules
- Motor starters (direct-on-line starters and reversing starters)

How to proceed with groupable modules using the DDB file

1. Integrate the device database file in your configuration software.

   Result: In the hardware catalog of your configuration software, you can recognize groupable modules by the fact that they are available in duplicate. The modules differ from each other only by a "*" in the designation.

2. Configure the ET 200S setup, adhering to the following rules:
   - The modules that you can group in a single byte must be of the same module type (see above).
   - **IM151-1 STANDARD interface module, 6ES7151-1AA00-0AB0 with product level 1 to 4:** The modules that you can group in a single byte must be inserted directly next to each other. There can be only power modules between the electronic modules. Power modules do not open a new byte.
   - **As of interface modules IM151-1 BASIC; IM151-1 STANDARD, 6ES7151-1AA00-0AB0 with product level 5, 6ES7151-1AA01-0AB0; IM151-1 FO STANDARD and IM151-1 HIGH FEATURE:** You can insert any other module types between the groupable modules.

Note

In STEP 7 applications, if you group the modules in the IM151-1 HIGH FEATURE in DPV1 mode, the following occurs:

- No removal/insertion interrupts (OB 83) are triggered for these modules. In this case, you can recognize a module that has been removed from the module status in the diagnostic frame in the cyclic user program.
- Each grouped module then receives its own diagnostic address.

  – There can be a total of no more than 8 channels (1 byte).

3. Select from the hardware catalog of your configuration software the module designation without "*". Result: You open a byte and store the first module there.
4. Select from the hardware catalog of your configuration software the module designation with "*". Result: In the open byte, you store additional modules until all the bits are occupied.
5. If a byte is filled, you must configure a module again (that is, open a new byte without "*").

Note

Configuration by means of the GSD (device database) file: The configuration software does not check whether the modules have been grouped correctly. If you configure more than 8 channels in one byte, the modules that exceed the byte limit are reported as being incorrectly configured in the diagnosis:

Module status —> 10_B: Incorrect module; invalid user data

These modules are not addressed.

Grouping of digital input modules

Figure 6-1 Grouping of input modules in a single byte

Grouping of digital output modules

Figure 6-2 Grouping of digital output modules in a single byte

Grouping of motor starters

Figure 6-3 Grouping of motor starters within a byte

Configuration example

The following example describes how to configure an ET 200S setup:

Setup of the ET 200S

* As of IM151-1 BASIC; IM151-1 STANDARD 6ES7151-1AA00-0AB0 with product level 5, 6ES7151-1AA01-0AB0, IM151-1 FO STANDARD and IM151-1 HIGH FEATURE

Figure 6-4 Setup of the ET 200S

Configuration table in your configuration software and address space

The byte addresses of the inputs and outputs can be freely selected (if the configuration software supports this). The bit addresses result automatically from the sequence of the grouped modules.

Table 6-2 Configuration table and address space

Slot	Module	Grouping	I/O address	
			Inputs	Outputs
1	6ES7138-4CA00-0AA0 PM-E 24 VDC	——	——	——
2	6ES7131-4BB00-0AB0 2DI 24 VDC	Yes	0.0 to 0.1	
3	6ES7131-4BB00-0AB0*2DI 24 VDC		0.2 to 0.3	
4	6ES7134-4FB00-0AB0 2AI U	No	1 to 4	
5	6ES7135-4GB00-0AB0 2AO I	No		0 to 3
6	6ES7131-4BD00-0AA0*4DI 24 VDC	Yes	0.4 to 0.7	
7	6ES7132-4BD00-0AA0 4DO 24 VDC	Yes		4.0 to 4.3
8	6ES7132-4BB00-0AB0*2DO 24 VDC			4.4 to 4.5
9	6ES7132-4HB00-0AB0*2DO Rel.			4.6 to 4.7
10	6ES7134-4FB00-0AB0 2AI U	No	5 to 8	
11	6ES7135-4GB00-0AB0 2AO I	No		5 to 8
12	6ES7138-4CA00-0AA0 PM-E 24 VDC	——	——	——
13	6ES7132-4BB30-0AB0 2DO 24 VDC	Yes		9.0 to 9.1
14	6ES7132-4BB30-0AB0* 2DO 24 VDC	Yes		9.2 to 9.3
15	6ES7138-4CA00-0AA0 PM-E AC230	——	——	——
16	6ES7132-4FB00-0AB0* 2DO 230 V	Yes		9.4 to 9.5
17	6ES7132-4FB00-0AB0* 2DO 230 V	Yes		9.6 to 9.7
18	3RK1903-0BA00 PM-D	——	——	——
19	3RK1301-xxB00-0AA0 DS	Yes	9.0 to 9.3	10.0 to 10.3
20	3RK1301-xxB00-0AA0 *DS		9.4 to 9.7	10.4 to 10.7
21	3RK1301-xxB00-0AA0 DS	Yes	10.0 to 10.3	11.0 to 11.3

No grouping

If you do not want to group the configuration of the ET 200S distributed I/O system digital input/output modules and motor starters in a single byte, use only those module designations without "*" in the hardware catalog of your configuration software.

Each electronic module/motor starter will then occupy one byte in the input or output area of the process image.

6.2 Commissioning and startup of the ET 200S

Software requirements

Table 6-3 Software requirements for commissioning

Configuration software used	Version	Notes
STEP 7	As of Version 5.0 and ServicePack 3	You are using HW Config. As of ServicePack 3, the ET 200S is included in the hardware catalog.
COM PROFIBUS	As of Version 5.1, ServicePack 2, Hotfix 1	You have integrated the device database file of ET 200S in *COM PROFIBUS*.
Configuration software for a different DP master		You need the device database file of ET 200S.

Requirements for commissioning the ET 200S

Table 6-4 Requirements for commissioning the ET 200S

Required Activity	See ...
1st DP slave installed	Chapter 4
2nd PROFIBUS address set on the DP slave	Section 4.8
4. DP slave wired	Chapter 5
5. DP slave configured (configured and parameters assigned)	Section 6.1
6. Supply voltage switched on for DP master	DP master manual
7. DP master set to RUN mode	DP master manual

Commissioning the ET 200S

Table 6-5 Procedure for commissioning the DP slave

Step	Procedure	See ...
1st	Switch on the supply voltage for the DP slave.	Section 9.3
2nd	Switch on the supply voltage for the load as necessary.	

Startup of the ET 200S

Figure 6-5 Startup of the ET 200S

Note

All interface modules support the default startup. In other words, you do not have to carry out configuration using the DDB file or HWCONFIG.

The following conditions apply:

- The default parameters are used (see the parameters for the electronic modules).
- AKF (general identifier format in compliance with the PROFIBUS standard) in the configuration frame
- Grouping (packing) of the electronic modules is not possible without parameterization.
- All supply voltages must be switched on at the power modules.
- It is not possible to remove or insert modules during operation.

6.3 Diagnostics using LEDs

ET 200S Power Supply

Figure 6-6 LEDs on the ET 200S Power Supply

Status and error displays by means of LEDs on the ET 200S Power Supply

Table 6-6 Status and error displays of the ET 200S Power Supply

UE P24V I>			UE: Green P24V: Green I>: Yellow	
LEDs			**Meaning**	**What to do**
UE	**P24V**	**I>**		
Off	*	*	No mains voltage	Check mains voltage
On	*	*	Mains voltage present	–
On	On	Off	Normal operation	–
On	On	On	Overload: $U_A > U_{Amin}$	Avoid additional loading
On	Off	On	Overload: $U_A < U_{Amin}$	Correct overload
On	Off	Off	Short circuit or slide switch on standby	Remove short circuit, put slide switch into On position*

* Not applicable

Interface module

Figure 6-7 LED Display on the interface module

Status and error displays using LEDs on the IM151-1 BASIC/IM151-1 STANDARD/IM151-1 FO STANDARD/IM151-1 HIGH FEATURE

Table 6-7 Status and error displays of the IM151-1 BASIC/IM151-1 STANDARD/IM151-1 FO STANDARD/IM151-1 HIGH FEATURE

SF SF: red
BF BF: red
ON ON: green

LEDs			Meaning	What to do
SF	BF	ON		
Off	Off	Off	There is no voltage applied to the interface module, or the interface module has a hardware defect.	Switch on the 24 VDC supply voltage at the interface module.
*	*	On	There is voltage applied to the interface module.	–
*	Flashing	On	The interface module is not configured or is configured incorrectly. No data transfer is taking place between the DP master and the interface module. Causes: • The PROFIBUS address is incorrect. • Configuration error • Parameter assignment error	• Check the interface module. • Check the configuration and parameter assignment. • Check the PROFIBUS address.

Table 6-7 Status and error displays of the IM151-1 BASIC/IM151-1 STANDARD/IM151-1 FO STANDARD/IM151-1 HIGH FEATURE, continued

SF BF ON			SF: red BF: red ON: green	
LEDs			**Meaning**	**What to Do**
SF	**BF**	**ON**		
*	On	On	Transmission rate detection, illegal PROFIBUS address, or lowermost DIP switch (PROFIBUS address) not in the OFF position. Causes: • The response monitoring time has elapsed. • Bus communication to the interface module via PROFIBUS-DP has been interrupted.	Set a valid PROFIBUS address (1 to 125) at the interface module, or check the bus configuration. • Check that the bus connector is correctly inserted. • Check if the interconnecting cable to the DP master has been interrupted. • Switch the 24 VDC supply voltage on and off again at the interface module.
On	*	On	The configured setup of the ET 200S does not match the actual setup of the ET 200S.	Check the setup of the ET 200S, whether a module is missing or defective, or whether an unconfigured module is inserted. Check the configuration (using COM PROFIBUS or STEP 7, for example), and correct the parameter assignment error.
			There is an error in an I/O module, or the interface module is defective.	Replace the interface module, or get in touch with your Siemens contact person.
Off	Off	On	Data transfer is taking place between the DP master and the ET 200S. The target configuration and actual configuration of the ET 200S match.	–

* Not applicable

Power modules

LEDs			Meaning	What to do
SF	FSG	PWR		
On			No parameter assignment or incorrect module inserted. There is a diagnostic message.	Check the parameter assignment. Evaluate the diagnosis.
	Off		The fuse in the power module has tripped.	Replace the fuse.
		Off	There is no load voltage at the power module.	Check the load voltage.

1) Only with the PM-E 24–48 VDC / 120–230 VAC

Figure 6-8 LEDs on the power module

Digital electronic modules

LEDs					Meaning	What to do
SF	1	5	2	6		
On					No parameter assignment or incorrect module inserted. No load voltage. There is a diagnostic message.	Check the parameter assignment. Check the load voltage. Evaluate the diagnosis.
	On				Input/output on channel 0 activated.	
		On			Input/output on channel 1 activated.	
			On		Input/output at channel 2 (only for 4DI/DO) activated	
				On	Input/output at channel 3 (only for 4DI/4DO) activated	

1) only in the case of the 2DI 24 VDC High Feature, 4DI 24 VDC High Feature, 2DO 24 VDC/0.5 A High Feature, 2DO 24 VDC/2 A High Feature and 4DI NAMUR

2) only in the case of the 4DI 24 VDC Standard, 4DI 24 VDC High Feature, 4DO 24 VDC/0.5 A Standard, 4DO 24 VDC/2 A Standard, 4DI 24–48 VUC High Feature and 4DI NAMUR

Figure 6-9 LEDs on the digital electronic modules

Analog electronic modules

LED	Meaning	What to do
SF		
On	No parameter assignment or incorrect module inserted. No load voltage. There is a diagnostic message.	Check the parameter assignment. Check the load voltage. Evaluate the diagnosis.

Figure 6-10 LEDs on the analog electronic modules

1Count 24V/100kHz

LEDs					Meaning	What to do
SF	UP	DN	4	8		
On					No parameter assignment. There is a diagnostic message.	Check the parameter assignment. Evaluate the diagnosis.
	On				Status of the counter's low bit if the counter is counting up	
		On			Status of the counter's inverted low bit if the counter is counting down	
			On		DO (direct control, comparator output) activated	
				On	DI (HW gate, synchronization, latch) activated	

Figure 6-11 LEDs on the 1Count 24V/100kHz

1Count 5V/500kHz

LEDs							Meaning	What to do
SF	UP	DN	SYN	9	13	16		
On							No parameter assignment. There is a diagnostic message.	Check the parameter assignment. Evaluate the diagnosis.
	On						Status of the counter's low bit if the counter is counting up	
		On					Status of the counter's inverted low bit if the counter is counting down	
			On				Synchronization is executed (only in count modes; image of STS_SYN feedback bit)	
				On			DO 1 is activated	
					On		DO 2 is activated	
						On	DI is activated	

Figure 6-12 LEDs on the 1Count 5V/500kHz

1SSI

LEDs					Meaning	What to do
SF	UP	DN	7	CMP		
On					No parameter assignment. There is a diagnostic message.	Check the parameter assignment. Evaluate the diagnosis.
	On				At value change from smaller to larger sensor values (including zero-crossing)	
		On			At value change from larger to smaller sensor values (including zero-crossing)	
			On		DI (latch) activated	
				On	At comparator result CMP 1	

Figure 6-13 LEDs on the EM 1SSI

1STEP 5V/204kHz

LEDs					Meaning	What to do
SF	REF	RDY	3	POS		
On					No parameter assignment. There is a diagnostic message.	Check the parameter assignment. Evaluate the diagnosis.
	On				REF activated	
		On			If parameters were assigned to the module correctly and pulse enable has been activated	
			On		DI activated	
				On	When a positioning operation is running	

Figure 6-14 LEDs on the EM 1STEP 5V/204kHz

2PULSE

LEDs					Meaning	What to do
SF	1	5	4	8		
On					No parameter assignment. There is a diagnostic message.	Check the parameter assignment. Evaluate the diagnosis.
	On				Input on channel 0 is activated	
		On			Input on channel 1 is activated	
			On		Output on channel 0 is activated	
				On	Output on channel 1 is activated	

Figure 6-15 LEDs on the 2PULSE

1POS INC/Digital, 1POS SSI/Digital, 1POS INC/Analog, 1POS SSI/Analog

LEDs							Meaning	What to do
SF	UP	DN	POS	9	13	14		
On							No parameter assignment. There is a diagnostic message.	Check the parameter assignment. Evaluate the diagnosis.
	On						In the case of a change from lower to higher actual values	
		On					In the case of a change from higher to lower actual values	
			On				**Digital:** Positioning is taking place, and one of the 3 digital outputs is set. **Analog:** Positioning is taking place, and a voltage not equal to 0 V is being output at the analog output.	
				On			DI 0 is activated	
					On		DI 1 is activated	
						On	DI 2 is activated	

Figure 6-16 LEDs on the 1POS INC/Digital, 1POS SSI/Digital, 1POS INC/Analog, 1POS SSI/Analog

1SI 3964/ASCII, 1SI Modbus/USS serial interface modules

LEDs			Meaning	What to do
SF	TX	RX		
On			Hardware fault	Check the module
			Firmware error	
			Parameter assignment error	Check the parameterization. Evaluate the diagnosis.
			Wire break or loose cable between the module and the communication partner [1]	Check the wiring.
			Communication error	Check the communication settings.
	On		The module is sending data via the interface.	
		On	The module is receiving data via the interface.	

[1] Only detected in the case of RS-422 interface connections when the default for the receive line is set to R(A) 5V/R(B) 0V.

Figure 6-17 LEDs on the 1SI 3964/ASCII, 1SI Modbus/USS

4 IQ-SENSE

LEDs					Meaning	What to do
SF	1	5	2	6		
On					No parameter assignment. There is a diagnostic message. Excess gain lower limit violated. Teach-in process running.	Check the parameter assignment. Evaluate the diagnosis. Adjust the reflex sensor. Clean the optical system. Replace the sensor. Terminate the teach-in process.
	On				Input on channel 0 is activated	
		On			Input on channel 1 is activated	
			On		Input on channel 2 is activated	
				On	Input on channel 3 is activated	

Figure 6-18 LEDs on the 4 IQ-SENSE electronic module

6.4 Diagnostic messages of the electronic modules

Actions after a diagnostic message in DPV0 operation

The error is entered in the diagnostic frame in the channel-specific diagnosis:

- The SF LED on the interface module comes on.
- Several simultaneous diagnostic messages are possible.

Actions after a diagnostic message in DPV1 operation

Each diagnostic message leads to the following actions:

- Diagnoses can be reported as diagnostic interrupts in DPV1 operation.
- After a diagnostic message this is:
  - Entered in the diagnostic frame as a diagnostic interrupt block (always only one interrupt)
  - Stored in the diagnostic buffer of the CPU
- The SF LED on the interface module comes on.
- OB82 is called. If OB82 is not available, the CPU goes into STOP mode.
- The diagnostic interrupt is acknowledged (after which a new interrupt is possible).

Causes of errors and action to be taken

The causes of the errors and the action to be taken when specific diagnostic messages appear are described in Section 6.6.8.

6.5 Evaluating the interrupts of the ET 200S

Introduction

Interrupts are triggered by the DP slave in the event of specific errors occurring. Interrupt evaluation differs depending on the DP master used.

Evaluating interrupts with an S7 DP master or DPV1 master

The ET 200S supports the following interrupts:

- Diagnostic interrupts
- Hardware interrupts
- Insert/Remove-module interrupts

Prerequisite: Interrupts are only supported when you run the ET 200S with the IM151-1 HIGH FEATURE interface module (in DPV1 operation).

In the event of an interrupt, interrupt OBs are automatically executed in the CPU of the DP master (see the programming manual System Software for S7-300/ S7-400, Program Design).

Evaluating interrupts with other DPV0 masters

If you run the ET 200S with a DPV0 master or as a standard DP slave, no interrupts are generated.

Triggering of a diagnostic interrupt

In the case of an incoming or outgoing event (e.g. wire break), the module triggers a diagnostic interrupt (provided diagnostic interrupts are enabled).

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

Evaluating hardware interrupts with STEP 7

In the event of a hardware interrupt, the CPU interrupts the processing of the user program and processes the process interrupt block OB 40 instead.

The module channel that triggered the hardware interrupt is entered in the start information of OB 40 in the OB40_POINT_ADDR variable. In the figures below you will find the assignment to the bits of the local double word 8.

Hardware interrupts in the case of:
2DI 24 VDC High Feature and 4DI 24 VDC High Feature electronic modules:

Figure 6-19 Start information of OB 40: Which event triggered a hardware interrupt with digital input modules

Hardware interrupts in the case of:
2AI U High Speed, 2AI I 2WIRE High Speed, and 2AI I 4WIRE High Speed electronic modules:

Figure 6-20 Start information of OB 40: Which event triggered a hardware interrupt with analog input modules

You will find a description of the OBs 40 in the reference manual *System and Standard Functions*.

Triggering of an insert/remove-module interrupt

Insert/remove-module interrupts are supported in DPV1 operation. The CPU interrupts processing of the user program and processes the diagnostic block OB83 instead. The result that led to the triggering of the interrupt is entered in the start information of OB83.

6.6 Diagnostics using *STEP 5* and *STEP 7*

Section	Description	Page
6.6.1	Reading out the diagnosis	6-27
6.6.2	Structure of the slave diagnosis	6-30
6.6.3	Station statuses 1 to 3	6-32
6.6.4	Master PROFIBUS address	6-34
6.6.5	Manufacturer ID	6-34
6.6.6	Module diagnosis	6-35
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6.6.9	Interrupts	6-50
6.6.10	Diagnostics in the case of invalid ET 200S configuration states	6-58

Slave diagnosis

The slave diagnosis complies with IEC 61784-1:2002 Ed1 CP 3/1. Depending on the DP master, it can be read out with *STEP 5* or *STEP 7* for all DP slaves that comply with the standard.

The reading out and structure of the slave diagnosis is described in the following sections.

6.6.1 Reading out the diagnosis

Length of the diagnostic message frame

- The maximum message frame length for the ET 200S is as follows:
  - IM151-1 BASIC: 43 bytes
  - IM151-1 STANDARD, IM151-1 FO STANDARD, IM151-1 HIGH FEATURE (DPV0 operation): 64 bytes
  - IM151-1 HIGH FEATURE (DPV1 operation): 128 bytes
- The minimum frame length is
  - 6 bytes (module diagnosis, module status, and channel-specific diagnosis blocked by parameter assignment).

Ways of reading the diagnosis

Table 6-8 Reading the diagnosis out using *STEP 7* and *STEP 5*

Programmable logic controller with DP master	Block or register in STEP *7*	Application	See ...
SIMATIC S7/M7	“DP Slave Diagnostics” tab	Slave diagnosis in plain-text form on the STEP 7 user interface	The section on hardware diagnostics in the STEP 7 online help system
	SFC13 “DP NRM_DG”	Read out slave diagnosis (store in data area of the user program)	For the structure, see Section 6.6.2; for SFC, see the *STEP 7 online help system*
	SFC 59 “RD_REC”	Read data records of the S7 diagnosis (store in the data area of the user program)	See the system and standard functions reference manual
	SFB 52 “RDREC”	Read data records from the DP slave	For SFB, see the *STEP 7 online help system* (system functions/system function blocks)
	SFB 54 “RALRM” [1]	Receive interrupts from the interrupt OBs	For SFB, see the *STEP 7 online help system* (system functions/system function blocks)
SIMATIC S5 with IM308-C as DP master	FB192 “IM308C”	Read out slave diagnosis (store in data area of the user program)	For the structure, see Section 6.6.2; for FBs, see the ET *200 Distributed I/O System* manual
SIMATIC S5 with the S5-95U PLC as DP master	FB230 “S_DIAG”		

[1] Only with S7-400 as of V3.0 and with the CPU 318 as of V3.0

Example of reading the slave diagnosis using FB192 “IM308C”

Here you will find an example of how to use FB 192 to read out the slave diagnosis for a DP slave in the *STEP 5* user program.

Assumptions

The following assumptions apply to this *STEP 5* user program:

- The IM308-C is assigned page frames 0 to 15 (number 0 of the IM308-C) as the DP master.
- The DP slave has the PROFIBUS address 3.
- The slave diagnosis is to be stored in DB20. However, you can also use any other data block for this.
- The slave diagnosis consists of a maximum of 64 bytes (IM151-1 STANDARD).

STEP 5 user program

```
STL                                  Description
        :C      DB 30
        :JU     FB 192
Name    :IM308C
DPAD    :       KH F800              Default address area of the IM 308-C
IMST    :       KY 0, 3              IM No. = 0, PROFIBUS address of DP slave = 3
FCT     :       KS SD                Function: Read slave diagnosis
GCGR    :       KM 0                 Not evaluated
TYPE    :       KY 0, 20             S5 data area: DB20
STAD    :       KF +1                Diagnostic data from data word 1
LENG    :       KF –1                Diagnosis length = joker length (all permitted
                                     bytes)
ERR     :       DW 0                 Error code stored in DW0 of DB30
```

Example of reading the S7 diagnosis using SFC13 “DP NRM_DG”

Here you will find an example of how to use SFC13 to read out the slave diagnosis for a DP slave in the *STEP 7* user program.

Assumptions

The following assumptions apply to this *STEP 7* user program:

- The diagnostic address of the ET 200S is 1022 ($3FE_H$).
- The slave diagnosis is to be stored in DB82. As of address 0.0, length 64 bytes.
- The slave diagnosis consists of a maximum 64 bytes (IM151-1 STANDARD).

STEP 7 user program

```
STL                                  Description

CALL SFC 13

REQ     :=TRUE                       Read request
LADDR   :=W#16#3FE                   Diagnostic address of the ET 200S
RET_VAL :=MW0                        RET_VAL of SFC13
RECORD  :=P#DB82.DBX 0.0 BYTE 64     Data mailbox for the diagnosis in DB82
BUSY    :=M2.0                       Read operation runs over several OB1 cycles
```

6.6.2 Structure of the slave diagnosis

Structure of the slave diagnosis

* These diagnoses can be disabled or enabled by parameter. If you disable the diagnoses, they are removed from the diagnostic frame.

** Only in the case of the IM151-1 HIGH FEATURE in DPV1 operation. If you disable the interrupts, the additional area becomes available for channel-specific diagnoses.

Figure 6-21 Structure of the slave diagnosis

Note

The length of the diagnostic message frame varies:

- Between 6 and 43 bytes in the IM151-1 BASIC
- Between 6 and 62 bytes in the IM151-1 STANDARD and IM151-1 FO STANDARD
- Between 6 and 62 bytes in the case of the IM151-1 HIGH FEATURE in DPV0 operation and between 6 and 128 bytes in DPV1 operation (depending on the parameter assignment).

You can find out the length of the last diagnostic message frame received in:

- *STEP 7* from the RET_VAL parameter of SFC13
- *STEP 5* from the ERR parameter of FB 192

6.6.3 Station statuses 1 to 3

Definition

Station statuses 1 to 3 provide an overview of the status of a DP slave.

Station status 1

Table 6-9 Structure of station status 1 (Byte 0)

Bit	Meaning	Cause/remedy
0	1: The DP slave cannot be addressed by the DP master.	• Correct PROFIBUS address set on the DP slave? • Bus connector connected? • Voltage at DP slave? • RS 485 repeater set correctly? • Reset carried out on DP slave?
1	1: The DP slave is not yet ready to exchange data.	• Wait while the DP slave starts up.
2	1: The configuration data sent by the DP master to the DP slave does not correspond to the setup of the DP slave.	• Correct station type or correct setup of the DP slave entered in the configuration software?
3	1: External diagnosis available. (Group diagnosis indication)	• Evaluate the module diagnosis, the module status and/or the channel-specific diagnosis. Bit 3 is reset as soon as all the faults have been rectified. The bit is reset when there is a new diagnostic message in the bytes of the diagnostics mentioned above.
4	1: The required function is not supported by the DP slave (for example, changing the PROFIBUS address by means of software).	• Check the configuration.
5	1: The DP master cannot interpret the response of the DP slave.	• Check the bus setup.
6	1: The DP slave type does not correspond to the software configuration.	• Correct station type entered in the configuration software?
7	1: Parameters have been assigned to the DP slave by a different DP master (not the one that currently has access to the DP slave).	• The bit is always 1, for example, if you access the DP slave with the programming device or another DP master. The PROFIBUS address of the DP master that assigned parameters to the DP slave is located in the “master PROFIBUS address” diagnostic byte.

Station status 2

Table 6-10 Structure of station status 2 (Byte 1)

Bit	Meaning
0	1: New parameters have to be assigned to the DP slave.
1	1: A diagnostic message has been issued. The DP slave will not work until the fault has been corrected (static diagnostic message).
2	1: The bit is always set to “1” in the DP slave.
3	1: Response monitoring has been enabled for this DP slave.
4	1: The DP slave has received the “FREEZE” control command[1].
5	1: The DP slave has received the “SYNC” control command[1].
6	0: The bit is always at 0.
7	1: The DP slave has been disabled, that is, it has been removed from the processing in progress.

[1] The bit is updated only if another diagnostic message changes, too.

Station status 3

Table 6-11 Structure of station status 3 (Byte 2)

Bit	Meaning
0 to 6	0: The bits are always at “0”.
7	1: • There are more diagnostic messages than the DP slave can store. • The DP master cannot enter all the diagnostic messages sent by the DP slave in its diagnostic buffer (channel-specific diagnosis).

6.6.4 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 diagnosis.

6.6.5 Manufacturer ID

Definition

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

Manufacturer ID

Table 6-12 Structure of the manufacturer ID (Bytes 4, 5)

Byte 4	Byte 5	Manufacturer ID for
80_H	$F3_H$	ET 200S with IM151-1 BASIC
80_H	$6A_H$	ET 200S with IM151-1 STANDARD
80_H	$6B_H$	ET 200S with IM151-1 FO STANDARD
80_H	$E0_H$	ET 200S with IM151-1 HIGH FEATURE

6.6.6 Module diagnosis

Definition

The module diagnosis indicates whether or not modules of the ET 200S have errors/faults. The module diagnosis begins as of byte 6 and comprises:

- 3 bytes in the case of the IM151-1 BASIC
- 9 bytes in the case of the IM151-1 STANDARD, IM151-1 FO STANDARD, and IM151-1 HIGH FEATURE.

Module diagnosis

The module diagnosis for the ET 200S with the IM151-1 BASIC is structured as follows:

Figure 6-22 Structure of the module diagnosis for the ET 200S with the IM151-1 BASIC

The module diagnosis for the ET 200S with the IM151-1 STANDARD, IM151-1 FO STANDARD, and IM151-1 HIGH FEATURE is structured as follows:

	7	6	5					0	Bit no.
Byte 6	0	1	0	0	1	0	0	1	

Length of the module diagnosis including byte 6 (= 9 bytes)

Code for module diagnosis

	7	6	5	4	3	2	1	0	Bit no.
Byte 7	8	7	6	5	4	3	2	1	Module: 1 to 8
Byte 8	16	15	14	13	12	11	10	9	Module: 9 to 16
Byte 9	24	23	22	21	20	19	18	17	Module: 17 to 24
Byte 10	32	31	30	29	28	27	26	25	Module: 25 to 32
Byte 11	40	39	38	37	36	35	34	33	Module: 33 to 40
Byte 12	48	47	46	45	44	43	42	41	Module: 41 to 48
Byte 13	56	55	54	53	52	51	50	49	Module: 49 to 56
Byte 14	*	63	62	61	60	59	58	57	Module: 57 to 63

Events on the corresponding module are indicated by set bits.

* Always “0”

Figure 6-23 Structure of the module diagnosis for the ET 200S with the IM151-1 STANDARD, IM151-1 FO STANDARD, and IM151-1 HIGH FEATURE

6.6.7 Module status

Definition

The module status indicates the status of the configured modules and expands on the module diagnosis as regards the configuration. The module status begins after the module diagnosis and comprises:

- 7 bytes in the case of the IM151-1 BASIC
- 20 bytes in the case of the IM151-1 STANDARD IM151-1 FO STANDARD, and IM151-1 HIGH FEATURE

Module status

The module status for the ET 200S with the IM151-1 BASIC is structured as follows:

Figure 6-24 Structure of the module status for the ET 200S with the IM151-1 BASIC

The module status for the ET200S with the IM151-1 STANDARD, IM151-1 FO STANDARD, and IM151-1 HIGH FEATURE is structured as follows:

Figure 6-25 Structure of the module status for the ET 200S with the IM151-1 STANDARD, IM151 FO STANDARD, and IM151 HIGH FEATURE

6.6.8 Channel-specific diagnosis

Definition

The channel-specific diagnosis gives information on channel errors of modules and expands on the module diagnosis. The channel-specific diagnosis starts after the module status (if the parameters are preset accordingly). The maximum length is limited by the total length of the slave diagnosis from 43/62 bytes in DPV0 mode to 128 bytes in DPV1 mode. The channel-specific diagnosis does not affect the module status.

A maximum of 9 (in DPV0 operation) or 15 (in DPV1 operation) channel-specific diagnostic messages are possible (see also station status 3, bit 7).

Channel-specific diagnosis

The channel-specific diagnosis for the ET 200S with the IM151-1 BASIC is structured as follows:

Figure 6-26 Structure of the channel-specific diagnosis for the ET 200S with the IM151-1 BASIC

The channel-specific diagnosis for the ET200S with the IM151-1 STANDARD, IM151-1 FO STANDARD, and IM151-1 HIGH FEATURE is structured as follows:

Figure 6-27 Structure of the channel-specific diagnosis for the ET 200S with the IM151-1 STANDARD, IM151-1 FO STANDARD, and IM151-1 HIGH FEATURE

Note

The slot of the module is coded in bits 0 to 5 of byte 16/35. The following applies: displayed number +1 ≙ slot of the module (0 ≙ slot 1; 1 ≙ slot 2; 3 ≙ slot 4, etc.)

In bits 6/7 of byte 17/36, 00_B is output if a power module reports a channel-specific diagnosis.

Power module error types

The diagnostic message is reported on channel 0 and applies to the whole module.

Table 6-13 Power module error types

Power modules electronic modules		Error type		Meaning	What to do
PM-E 24–48 VDC/ 120–230 VAC	PM-E 24 VDC PM-E 24–48 VDC	17_D	10001: Sensor or load voltage missing	No supply voltage, or inadequate supply voltage.	Correct the process wiring. Check the supply voltage.
	——	18_D	10010: Fuse defective	The fuse in the power module has tripped.	Replace the fuse.

Digital electronic module error types

Table 6-14 Digital electronic module error types

Digital electronic modules	Error type		Meaning	What to do
2DI 24 VDC High Feature	1_D	00001: Short circuit	Short circuit of the sensor supply. The diagnostic message is issued on channel 0 and applies to the whole module.	Correct the process wiring (sensor wiring).
4DI 24 VDC High Feature	1_D	00001: Short circuit (In connection with IM151-1 BASIC / IM151-1 STANDARD, as of 6ES7151-1AA02-0AB0, IM151-1 FO STANDARD, as of 6ES7151-1AB01-0AB0) or IM151-1 HIGH FEATURE	Short circuit of the sensor supply. The diagnostic message is issued on channel 0 and applies to the whole module.	Correct the process wiring (sensor wiring).
	26_D	11010: External fault (In connection with IM151-1 STANDARD, up to 6ES7151-1AA01-0AB0 or IM151-1 FO STANDARD, up to 6ES7151-1AB00-0AB0)		

Table 6-14 Digital electronic module error types, continued

Digital electronic modules	Error type		Meaning	What to do
4DI 24–48 VUC High Feature	26_D	11010: External fault	Line to the actuator interrupted.	Correct the process wiring.
			No supply voltage, or inadequate supply voltage.	Correct the process wiring. Check the supply voltage.
			Fuse triggered.	Replace the fuse.
2DO 24 VDC/0.5 A High Feature 2DO 24 VDC/2 A High Feature	1_D	00001: Short circuit	Short circuit of the actuator supply to ground.	Correct the process wiring.
	6_D	00110: Open circuit	Line to the actuator interrupted.	
4DI NAMUR	1_D	00001: Short circuit	Short circuit on the signal line to the sensor.	Correct the process wiring.
			Sensor is defective.	Replace the sensor.
			Wrong sensor type parameterized.	Correct the parameter assignment.
			Load impedance too low.	Use a sensor with increased impedance.
	6_D	00110: Open circuit	Signal line to a sensor interrupted.	Correct the process wiring.
			Sensor is defective.	Replace the sensor.
			Wrong sensor type parameterized.	Correct the parameter assignment.
			Load impedance too low.	Use a sensor with increased impedance.
	9_D	01001: Error	Internal module error occurred.	Replace the module.
			Sensor signal flutters.	Eliminate cause.
	16_D	10000: Parameter assignment error	Parameter assignment error.	Correct the parameter assignment.
	26_D	11010: External fault	Sensor error.	Replace the sensor.
			Changeover contact error.	Correct the process wiring.

Analog input module error types

Table 6-15 Analog input module error types

Analog input modules			Error type		Meaning	What to do
2AI U High Speed	2AI U Standard 2AI U High Feature 2AI I 2WIRE Standard 2AI I 2WIRE High Speed 2AI I 4WIRE Standard 2AI I 2/4WIRE High Feature 2AI I 4WIRE High Speed 2AI RTD Standard 2AI RTD High Feature	2AI TC Standard 2AI TC High Feature	16_D	10000: Parameter assignment error	Module cannot use the parameter for the channel: Inserted module does not match the one configured. Parameter assignment error.	Correct the configuration (compare actual and desired configuration). Correct the parameter assignment (parameter assignment of wire break diagnosis only with the permitted measuring ranges).
			9_D	01001: Error	Internal module error has occurred (diagnostic message on channel 0 applies to the whole module).	Replace the module.
			7_D	00111: Upper limit violation	Value is above the overrange.	Correct the module/actuator match.
			8_D	01000: Lower limit violation	Value is below the underrange.	Correct the module/actuator match.
——			6_D	00110: Wire break[1)]	Line to the sensor interrupted.	Correct the process wiring.
——	——		21_D	10101: Reference channel error	Error on the reference channel	Check the reference module (2AI RTD Standard).

1) In the case of the 2AI RTD High Feature, a wire break is reported for the measuring and constant-current lines of the sensor.

Analog output module error types

Table 6-16 Analog output module error types

Analog output modules		Error type		Meaning	What to do
2AO U Standard 2AO U High Feature	2AO I Standard 2AO I High Feature	16_D	10000: Parameter assignment error	Module cannot use the parameter for the channel: Inserted module does not match the one configured. Parameter assignment error.	Correct the configuration (compare actual and desired configuration). Correct the parameter assignment (parameter assignment of wire break diagnosis only with the permitted measuring ranges).
		9_D	01001: Error	Internal module error has occurred (diagnostic message on channel 0 applies to the whole module).	Replace the module.
	——	1_D	00001: Short circuit	Short circuit of the actuator supply.	Correct the process wiring.
——	2AO I Standard 2AO I High Feature	6_D	00110: Open circuit	Line to the actuator interrupted.	Correct the process wiring.

1SSI

Table 6-17 1SSI

Error type		Meaning	What to do
1_D	00001: Short circuit	Short circuit of the supply to the absolute position encoder.	Correct the process wiring.
9_D	01001: Error	Internal module error occurred. Load voltage from the power module is too low.	Replace the module. Correct the process wiring. Check the load voltage.
16_D	10000: Parameter assignment error	Parameters have not been assigned to the module.	Adjust the parameter assignment.
26_D	11010: External fault	Start/stop bit error (absolute position encoder error): Wire break in the sensor cable or sensor cable is not connected. Sensor type, transmission rate, and monoflop time do not correspond to the sensor connected; programmable sensors do not correspond to the settings on the 1SSI EM. Sensor is defective or there are faults.	Replace the sensor; correct the process wiring. Correct the parameter assignment.

1Count 24V/100kHz

Table 6-18 1Count 24V/100kHz

Error type		Meaning	What to do
1_D	00001: Short circuit	Short circuit of the sensor supply or the actuator.	Check the wiring to the sensor. Correct the process wiring.
5_D	00101: Temperature rise	Digital output is overloaded.	Correct the process wiring.
6_D	00110: Open circuit	Line to the actuator interrupted.	Correct the process wiring.
9_D	01001: Error	Internal module error occurred. Load voltage from the power module is too low.	Replace the module. Correct the process wiring. Check the load voltage.
16_D	10000: Parameter assignment error	Parameters have not been assigned to the module.	Adjust the parameter assignment.

1Count 5V/500kHz

Table 6-19 1Count 5V/500kHz

Error type		Meaning	What to do
1_D	00001: Short circuit	Short circuit of the sensor supply or the actuator.	Check the wiring to the sensor. Correct the process wiring.
5_D	00101: Temperature rise	Digital output is overloaded.	Correct the process wiring.
6_D	00110: Open circuit	Line to the actuator interrupted.	Correct the process wiring.
9_D	01001: Error	Internal module error occurred.	Replace the module.
16_D	10000: Parameter assignment error	Parameters have not been assigned to the module.	Adjust the parameter assignment.
26_D	11010: External fault	Wire break/short circuit of the 5 V sensor signals: A, /A, B, /B, N, /N,	Correct the parameter assignment.

1STEP 5V/204kHz

Table 6-20 EM 1STEP 5V/204kHz

Error type		Meaning	What to do
1_D	00001: Short circuit	Short circuit of the sensor supply.	Check the wiring to the switches. Correct the process wiring.
9_D	01001: Error	Internal module error occurred.	Replace the module.
16_D	10000: Parameter assignment error	Parameters have not been assigned to the module.	Adjust the parameter assignment.

2PULSE

Table 6-21 2PULSE

Error type		Meaning	What to do
1_D	00001: Short circuit	Short circuit of the sensor supply or the actuator.	Check the wiring to the momentary-contact switches and the actuators. Correct the process wiring.
9_D	01001: Error	Internal module error occurred.	Replace the module.
16_D	10000: Parameter assignment error	Parameters have not been assigned to the module.	Adjust the parameter assignment.

1POS INC/Digital, 1POS SSI/Digital, 1POS INC/Analog, 1POS SSI/Analog

Table 6-22 1POS INC/Digital, 1POS SSI/Digital, 1POS INC/Analog, 1POS SSI/Analog

Error type		Meaning	What to do
1_D	00001: Short circuit	Short circuit of the sensor supply.	Check the wiring to the sensor. Correct the process wiring.
16_D	10000: Parameter assignment error	Parameters have not been assigned to the module.	Adjust the parameter assignment.
17_D	10001: Load voltage 2L+ missing	Only applies to the 1POS INC/Digital and 1POS SSI/Digital: No supply voltage, or inadequate supply voltage	Correct the process wiring. Check the supply voltage.
26_D	11010: External fault	Wire break/short circuit of the sensor signals: Wire break in the sensor cable or sensor cable is not connected. Sensor is defective or there are faults. Sensor type, transmission rate, and monoflop time do not correspond to the sensor connected; programmable sensors do not correspond to the settings on the module.	Correct the process wiring. Correct the parameter assignment. Replace the sensor.

1SI 3964/ASCII, 1SI Modbus/USS serial interface module

Table 6-23 1SI 3964/ASCII, 1SI Modbus/USS

Error type		Meaning	What to do
6_D	00110: Open circuit	Wire broken or disconnected.	Check the wiring to the terminals. Check the cable to the partner.
7_D	00111: Upper limit violation	Buffer overflow; message length overflow	The P_RCV FB must be called more frequently.
8_D	01000: Lower limit violation	Message with a length of 0 sent[1)]	Check why the communication partner is sending frames without user data.
9_D	01001: Error	Internal module error occurred.	Replace the module.
16_D	10000: Parameter assignment error	Parameters have not been assigned to the module.	Correct the parameter assignment.
22_D	10110: Message error	Frame error, parity error	Check the communication settings.

1) EM 1SI: only with 3964(R)

4 IQ-SENSE

Table 6-24 4 IQ-SENSE

Error type		Meaning	What to do
1_D	00001: Short circuit	Short circuit of the lines between the electronic module and sensor	Check the wiring to the sensor. Correct the process wiring.
6_D	00110: Open circuit	Line to the actuator interrupted. No sensor connected. Sensor does not respond.	Correct the process wiring. Connect the sensor. Replace the fuse.
8_D	01000: Lower limit violation	Maintenance requirement (signal quality < 130 %, excess gain), sensor-dependent	Adjust the reflex sensor. Clean the optical system.
9_D	01001: Error	Communication error between the electronic module and sensor	Replace the electronic module or the sensor. Check the wiring.
16_D	10000: Parameter assignment error	Parameter assignment error. Inserted module does not match the one configured. *Teach-in* error (a new value could not be determined/obtained) Inserted sensor does not match configured sensor.	Adjust the parameter assignment. Correct the configuration (compare actual and desired configuration). *Repeat teach-in*. Correct the configuration, or insert a different sensor type.
26_D	11010: External fault	Excess gain lower limit violated (signal quality < 110 %) or sensor error, sensor-dependent	Adjust the reflex sensor. Clean the optical system. Replace the sensor.
27_D	11011: Unclear error	*Teach-in* process running. Alignment tool is active.	Terminate the *teach-in* process. Terminate the alignment tool.

6.6.9 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 comes after the channel-specific diagnosis (only in the case of the IM151-1 HIGH FEATURE in DPV1 operation)

Example: If there are 3 channel-specific diagnoses, the interrupt section begins as of byte 44.

Data records

The diagnostic data of a module can be up to 44 bytes in length and is located in data records 0 and 1:

- Data record 0 contains 4 bytes of diagnostic data describing the current status of a programmable logic controller. Data record 0 (DS0) is part of the header information of OB82 (local data bytes 8 to 11).
- Data record 1 contains the 4 bytes of diagnostic data that is also contained in data record 0 and, in addition, up to 40 bytes of module-specific diagnostic data.

You can read out data records 0 and 1 (DS0 and DS1) by means of SFC59 “RD_REC”.

Contents

The contents of the interrupt function depend on the interrupt type:

- In the case of diagnostic interrupts, diagnostic data record 1 (44 bytes) is sent as the interrupt status information (as of byte x+4).
- In the case of hardware interrupts, the interrupt status information is 4 bytes in length.
- In the case of insert/remove-module interrupts, the interrupt information is 5 bytes in length.

Interrupts

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

Figure 6-28 Structure of the interrupt status of the interrupt section

Diagnostic interrupt, byte x+4 to x+7

Figure 6-29 Structure of bytes x+4 to x+7 for diagnostic interrupt

Diagnostic interrupt of the modules

Figure 6-30 Structure as of byte x+8 for diagnostic frame

Example of a diagnostic interrupt

Example:
The 4DI electronic module reports the “short circuit” diagnostic interrupt on channel 2.

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

Length of the interrupt section = 27 bytes

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

Diagnostic interrupt

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

Slot number 10

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

There is at least 1 error

Interrupt sequence number = 1

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

Channel error

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

Digital electronic module

Channel information available

Byte x+6 and x+7 always “0”

Figure 6-31 Example of a diagnostic interrupt

Figure 6-32 Example of a diagnostic interrupt (continued)

Hardware interrupt of digital input modules

Figure 6-33 Structure as of Byte x+4 for hardware interrupt (digital input)

Hardware interrupt of analog input modules

Figure 6-34 Structure as of byte x+4 and byte x+5 for hardware interrupt (analog input)

Insert/remove-module interrupt

Figure 6-35 Structure as of byte x+4 for insert/remove-module interrupt

Byte x+4 to x+8 contains the ID of the module that has been removed or inserted.

The interrupt type in byte x+1 indicates whether the modules have been removed or inserted (see Figure 6-28).

6.6.10 Diagnostics in the case of invalid ET 200S configuration states

Invalid configuration states

The following invalid configuration states of the ET 200S lead to station failure of the ET 200S or prevent entry into data interchange. These responses occur irrespective of whether the IM parameters “Operation at Preset <> Actual Configuration”, “Replacement of Modules during Operation”, and “Startup when Expected <> Actual Configuration” have been enabled.

- Two missing modules
- Terminating module missing
- Number of modules exceeds the maximum configuration
- Module missing in slot 1 (in the case of the IM151-1 STANDARD, 6ES7151-1AA00-0AB0)
- Faulty backplane bus (for example, terminal module is defective)

Note

As of IM151-1 BASIC/IM151-1 STANDARD (6ES7151-1AA01-0AB0), IM151-1 FO STANDARD, and IM151-1 HIGH FEATURE: If **one** module is missing (gap) and the ET 200S is switched on, the station will not start up (see diagnosis below).

Diagnostics

The following diagnosis indicates all the invalid configuration states:

Interface module	Module diagnosis	Module status
IM151-1 HIGH FEATURE	All 63 bits set	01_B: “Module error; invalid user data” for all 63 modules
IM151-1 BASIC	All 12 bits set	• 01_B: “Module error; invalid user data” for all modules (slots) until the cause of the error is found • 11_B: “No module; invalid user data” once the cause of the error is found
IM151-1 STANDARD IM151-1 FO STANDARD	All 63 bits set	

General Technical Specifications

7

What are general technical specifications?

The general technical specifications comprise the standards and test specifications with which the ET 200S distributed I/O system complies, as well as the criteria on the basis of which the ET 200S distributed I/O system was tested.

Chapter overview

Section	Description	Page
7.1	Standards, certificates, and approvals	7-2
7.2	Electromagnetic compatibility, shipping and storage conditions	7-6
7.3	Mechanical and climatic environmental conditions	7-8
7.4	Information on insulation testing, safety class, degree of protection, and rated voltage of the ET 200S	7-10
7.5	Use of the ET 200S in a zone 2 hazardous area	7-11

7.1 Standards, certificates, and approvals

CE Mark of Conformity

The ET 200S 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:

- 73/23/EEC “Electrical Equipment for Use within Fixed Voltage Ranges” (Low-Voltage Directive)
- 89/336/EEC “Electromagnetic Compatibility” (EMC Directive)
- 94/9/EC “Equipment and protective systems intended for use in potentially explosive atmospheres” (Guidelines for Explosion Protection)

The EC declarations of conformity are kept
available for the responsible authorities at the following address:

Siemens Aktiengesellschaft
Automation and Drives
A&D AS RD4
Postfach 1963
D-92209 Amberg, Germany

UL Recognition

Underwriters Laboratories Inc. in accordance with

- UL 508 (Industrial Control Equipment)

CSA Mark of Conformity

Canadian Standards Association in accordance with

- C22.2 No. 142 (Process Control Equipment)

or

Underwriters Laboratories Inc. in accordance with

- UL 508 (Industrial Control Equipment)
- CSA C22.2 No. 142 (Process Control Equipment)

or

Underwriters Laboratories Inc. in accordance with

- UL 508 (Industrial Control Equipment)
- CSA C22.2 No. 142 (Process Control Equipment)
- UL 1604 (Hazardous Location)
- CSA-213 (Hazardous Location)

HAZ. LOC.

APPROVED for use in
Class I, Division 2, Group A, B, C, D Tx;
Class I, Zone 2, Group IIC Tx

The ET 200S motor starters do not have a cULus for HAZ. LOC. approval.

Note

You can find the currently valid certificates and approvals on the type plate of each module.

FM Approval

Factory Mutual Research (FM) in accordance with
Approval Standard Class Number 3611, 3600, 3810
APPROVED for use in
Class I, Division 2, Group A, B, C, D Tx;
Class I, Zone 2, Group IIC Tx

The ET 200S motor starters do not have FM approval. All the other modules of the ET 200S have FM approval.

In accordance with EN 50021 (Electrical apparatus for potentially explosive atmospheres; Type of protection “n”)

II 3 G EEx nA II T4..T5

Identification for Australia

The ET 200S Distributed I/O System fulfills the requirements of AS/NZS 2064 (Class A).

IEC 61131

The ET 200S distributed I/O system fulfills the requirements and criteria of IEC 61131-2 (programmable logic controllers, Part 2: equipment requirements and tests).

PROFIBUS Standard

The ET 200S distributed I/O system is based on the *IEC 61784-1:2002 Ed1 CP 3/1.*

Shipbuilding Approval

Classifying organizations:

- 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 in industry

SIMATIC products designed for use in industry.

Table 7-1 Use in industry

Area of application	Requirement for	
	Emitted interference	Interference immunity
Industry	EN 50081-2 : 1993	EN 50082-2 : 1995

Use in residential areas

If you use the ET 200S in residential areas, you must adhere to limit value class B in accordance with EN 55011 regarding the emission of radio interference.

Suitable measures to achieve a level of radio interference corresponding to limit value class B are:

- Installation of the ET 200S in grounded switch cabinets/switch boxes
- Use of filters in supply lines

Warning

Personal injury and material damage may be incurred.

Personal injury and material damage may be incurred in hazardous areas if you disconnect plug-in connections while the ET 200S distributed I/O device is in operation.

Always deenergize the ET 200S in hazardous areas before disconnecting plug-in connections.

7.2 Electromagnetic compatibility, shipping and storage conditions

Definition

Electromagnetic compatibility is the capability of an electrical device to function satisfactorily in its electromagnetic environment without interfering with this environment.

The ET 200S distributed I/O system also meets the requirements of the European Union's EMC legislation. A requirement for this is that the ET 200S distributed I/O system meets the specifications and directives concerning electrical installation.

Pulse-shaped interference

The following table shows the electromagnetic compatibility of the ET 200S distributed I/O system when confronted with pulse-shaped interference.

Pulse-shaped interference	Tested with	Corresponds to severity
Electrostatic discharge to IEC 61000-4-2	8 kV 4 kV	3 (air discharge) 2 (contact discharge)
Burst pulses (rapid, transient interference) to IEC 61000-4-4.	2 kV (supply line) 2 kV (signal line)	3 3
Surge to IEC 61000-4-5 Only with lightning conductors (see the DP master manual and the *SIMATIC NET PROFIBUS Network* description)		
• Asymmetrical interconnection	2 kV (supply line) 2 kV (signal line/ data line)	3
• Symmetrical interconnection	1 kV (supply line) 1 kV (signal line/ data line)	

Sine-shaped interference

The following table shows the electromagnetic compatibility of the ET 200S distributed I/O system when confronted with sinusoidal interference.

RF irradiation to IEC 61000-4-3 electromagnetic RF field		RF coupling to IEC 61000-4-6
Amplitude-modulated	Pulse-modulated	
80 MHz to 1000 MHz	900 MHz ±5 MHz	0.15 MHz to 80 MHz
10 V/m		10 V_{rms} unmodulated
80% AM (1 kHz)	50% ED	80% AM (1 kHz)
	200 Hz repetition frequency	150 Ω source impedance

Emission of radio interference

Emitted interference of electromagnetic fields to EN 55011: Limit value class A, group 1 (measured at a distance of 10 m).

Frequency	Emitted interference
From 30 MHz to 230 MHz	< 40 dB (μV/m)Q
From 230 MHz to 1000 MHz	< 47 dB (μV/m)Q

Shipping and storage conditions

The ET 200S distributed I/O system exceeds the requirements of IEC 61131-2 as regards shipping and storage conditions. The following specifications apply to modules shipped or stored in their original packaging.

Type of condition	Permitted range
Free fall	≤ 1 m
Temperature	From – 40 °C to + 70 °C
Temperature variation	20 K/h
Air pressure	From 1080 hPa to 660 hPa (corresponds to an altitude of -1000 m to 3500 m)
Relative humidity	From 5 % to 95 %, without condensation

7.3 Mechanical and climatic environmental conditions

Climatic environmental conditions

The following climatic environmental conditions apply:

Environmental conditions	Operating ranges	Remarks
Temperature	From 0 to 60°C	For horizontal installation
	From 0 to 40°C	For all other mounting positions
	From 0 to 55 °C **(see the restrictions below)***	For vertical installation
Temperature variation	10 K/h	
Relative humidity	From 15 % to maximum 95 %	Without condensation
Air pressure	From 1080 hPa to 795 hPa	Corresponds to an altitude of -1000 m to 2000 m
Contaminant concentration	SO_2: < 0.5 ppm; Rel. humidity < 60 %, no moisture condensation H_2S: < 0.1 ppm; Rel. humidity < 60 %, no moisture condensation	Test: 10 ppm; 4 days 1 ppm; 4 days

* Restrictions for the operating range of 0 to 55 °C in a vertical position

The operating range of 0 to 55 °C in a vertical installation position is only permitted for the following modules:

- IM151-1 STANDARD: 6ES7151-1AA02-0AB0
- PM-E 24 VDC: 6ES7138-4CA00-0AA0
- 2DI 24 VDC Standard: 6ES7131-4BB00-0AA0
- 2DI 24 VDC High Feature: 6ES7131-4BB00-0AB0
- 4DI 24 VDC Standard: 6ES7131-4BD00-0AA0
- 4DI 24 VDC High Feature: 6ES7131-4BD00-0AB0
- 2DO 24 VDC/0.5 A Standard: 6ES7132-4BB00-0AA0
- 2DO 24 VDC/0.5 A High Feature: 6ES7132-4BB00-0AB0
- 4DO 24 VDC/0.5 A: 6ES7132-4BD00-0AA0
- 2DO 24 VDC/2 A Standard: 6ES7132-4BB30-0AA0
- 2DO 24 VDC/2 A High Feature: 6ES7132-4BB30-0AB0
- 4DO 24 VDC/2 A Standard: 6ES7132-4BD30-0AA0
- 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A: 6ES7132-4HB00-0AB0

Note

All of the supply and load voltages of the ET 200S must not exceed 24 VDC. This voltage limit must be enforced.

Mechanical environmental conditions

The mechanical environmental conditions are shown in the following table in the form of sinusoidal oscillations.

ET 200S modules	Frequency range	Permanent	Occasional
Everything except motor starters	10 ≤ f ≤ 58 Hz	0.15 mm amplitude	0.35 mm amplitude
	58 ≤ f ≤ 150 Hz	2 g constant acceleration	5 g constant acceleration

Testing mechanical environmental conditions

The following table provides information on the type and extent of tests of mechanical environmental conditions.

Test for ...	Test Standard	Terminal modules and electronic modules
Oscillations	Oscillation test in accordance with IEC 60068-2-6	Oscillation type: frequency sweeps with a rate of change of 1 octave per minute. 10 Hz ≤ f ≤ 58 Hz, constant amplitude 0.35 mm 58 Hz ≤ f ≤ 150 Hz, constant acceleration 5 g Oscillation time: 20 frequency sweeps per axis on all of the three perpendicular axes
Shock	Shock test to IEC 60068-2-27	Type of shock: half sine Force of shock: 15 g peak value, 11 ms duration Direction of shock: 3 shocks per +/– direction in all of the three perpendicular axes
Repetitive shock	Shock test to IEC 60068-29	Type of shock: half sine Force of shock: 25 g peak value, 6 ms duration Direction of shock: 1000 shocks per +/– direction in all of the three perpendicular axes

7.4 Information on insulation testing, safety class, degree of protection, and rated voltage of the ET 200S

Test voltage

Insulation strength is demonstrated in the type test with the following test voltage in accordance with IEC 61131-2:

Circuits with a rated voltage of U_e to other circuits or ground	Test voltage
< 50 V	500 VDC
< 150 V	2500 VDC
< 250 V	4000 VDC

Pollution severity/overvoltage category in accordance with IEC 61131

- Pollution severity 2
- Overvoltage category
  - When U_N = 120/ 230 VAC: III
  - When U_N = 24 VDC: II

Safety class

Safety class I to IEC 60536

IP 20 degree of protection

IP 20 protection in accordance with IEC 60529 for all ET 200S modules, which means:

- Protection against contact with standard test probes
- Protection against foreign bodies with a diameter greater than 12.5 mm
- No special protection against water

Rated voltage for operation

The ET 200S distributed I/O system works with the rated voltage and corresponding tolerances specified in the following table.

ET 200S modules	Rated voltage	Tolerance range
Everything except motor starters	24 VDC	20.4 to 28.8 VDC [1]
		18.5 to 30.2 VDC [2]
	120 VAC	93 VAC to 132 VAC (47 Hz to 63 Hz)
	230 VAC	187 VAC to 264 VAC (47 Hz to 63 Hz)

[1] Static value: Created as functional extra-low voltage with safe electrical isolation to IEC 60364-4-41

[2] Dynamic value: Including ripple at three-phase bridge rectification

7.5 Use of the ET 200S in a zone 2 hazardous area

You will find important information in the following languages in the chapters listed below.

Chapter overview

Section	Description
7.5.1	Use of the ET 200S in a zone 2 hazardous area
7.5.2	Use of the ET 200S in a zone 2 hazardous area
7.5.3	Utilisation de l’ET 200S dans un environnement à risque d’explosion en zone 2
7.5.4	Aplicación del ET 200S en áreas con peligro de explosión, zona 2
7.5.5	Impiego dell’ET 200S nell’area a pericolo di esplosione zona 2
7.5.6	Gebruik van de ET 200S in het explosieve gebied zone 2
7.5.7	Brug af ET 200S i det eksplosionsfarlige område zone 2
7.5.8	ET 200S:n käyttö räjähdysvaarannetuilla alueilla, vyöhyke 2
7.5.9	Användning av ET 200S i explosionsriskområde zon 2
7.5.10	Uso do ET 200S em área exposta ao perigo de explosão, zona 2
7.5.11	Χρηση της συσκευης ET 200S σε ...

7.5.1 Einsatz des ET 200S im explosionsgefährdeten Bereich Zone 2

Zone 2

Explosionsgefährdete Bereiche werden in Zonen eingeteilt. Die Zonen werden nach der Wahrscheinlichkeit des Vorhandenseins einer explosionsfähigen Atmosphäre unterschieden.

Zone	Explosionsgefahr	Beispiel
2	explosive Gasatmosphäre tritt nur selten und kurzzeitig auf	Bereiche um Flanschverbindungen mit Flachdichtungen bei Rohrleitungen in geschlossenen Räumen
sicherer Bereich	nein	• außerhalb der Zone 2 • Standardanwendungen von dezentraler Peripherie

Nachfolgend finden Sie wichtige Hinweise für die Installation des Dezentralen Peripheriesystems ET 200S im explosionsgefährdeten Bereich.

Weitere Informationen

Weitere Informationen zum ET 200S und zu den verschiedenen Modulen finden Sie im Handbuch.

Fertigungsort

Siemens AG, Bereich A&D
Werner-von-Siemens-Straße 50
92224 Amberg
Germany

Zulassung

Ex **II 3 G** **EEx nA II T4 .. T5** nach EN 50021 : 1999

Prüfnummer: **KEMA 01ATEX1238 X**

Hinweis

Module mit der Zulassung Ex II 3 G EEx nA II T4 .. T5 dürfen nur in Dezentrale Peripheriesysteme ET 200S der Gerätekategorie 3 eingesetzt werden.

Instandhaltung

Für eine Reparatur muss das betroffene Modul an den Fertigungsort geschickt werden. Nur dort darf die Reparatur durchgeführt werden.

Besondere Bedingungen

1. Das Dezentrale Peripheriesystem ET 200S muss in einen Schaltschrank oder ein metallisches Gehäuse eingebaut werden. Diese müssen mindestens die Schutzart IP 54 (nach EN 60529) gewährleisten. Dabei sind die Umgebungsbedingungen zu berücksichtigen, in denen das System installiert wird. Für das Gehäuse muss eine Herstellererklärung für Zone 2 vorliegen (gemäß EN 50021).
2. Wenn am Kabel bzw. an der Kabeleinführung dieses Gehäuses unter Betriebsbedingungen eine Temperatur > 70 °C erreicht wird oder wenn unter Betriebsbedingungen die Temperatur an der Aderverzweigung > 80 °C sein kann, müssen die Temperatureigenschaften der Kabel mit den tatsächlich gemessenen Temperaturen übereinstimmen.
3. Die eingesetzten Kabeleinführungen müssen der geforderten IP-Schutzart und dem Abschnitt 7.2 (gemäß EN 50021) entsprechen.
4. Alle Geräte, einschließlich Schalter etc., die an den Ein- und Ausgängen von ET 200S-Systemen angeschlossen werden, müssen für den Explosionsschutz Typ EEx nA oder EEx nC genehmigt sein.
5. Es müssen Maßnahmen getroffen werden, dass die Nennspannung durch Transienten um nicht mehr als 40 % überschritten werden kann.
6. Umgebungstemperaturbereich: 0° C bis 60° C
7. Innerhalb des Gehäuses ist an einem nach dem Öffnen gut sichtbaren Platz ein Schild mit folgender Warnung anzubringen:
   Warnung
   Das Gehäuse darf nur kurze Zeit geöffnet werden, z. B. für visuelle Diagnose. Betätigen Sie dabei keine Schalter, ziehen oder stecken keine Module und trennen keine elektrischen Leitungen (Steckverbindungen).
   Diese Warnung kann unberücksichtigt bleiben, wenn bekannt ist, dass keine explosionsgefährdete Atmosphäre herrscht.

Liste der zugelassenen Module

Die Liste mit den zugelassenen Modulen finden Sie im Internet:

`http://www4.ad.siemens.de/view/cs/`

unter der Beitrags-ID 13702947.

7.5.2 Use of the ET 200S in a Zone 2 Hazardous Area

Zone 2

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

Zone	Explosion Hazard	Example
2	Explosive gas atmosphere occurs only seldom and for a short time	Areas around flange joints with flat gaskets in pipes in enclosed spaces
Safe area	No	• Outside zone 2 • Standard distributed I/O applications

Below you will find important information on the installation of the ET 200S distributed I/O device in a hazardous area.

Further Information

You will find further information on the ET 200S and the various modules in the manual.

Production Location

Siemens AG, Bereich A&D
Werner-von-Siemens-Straße 50
92224 Amberg
Germany

Certification

Ex **II 3 G** **EEx nA II T4 .. T5** to EN 50021 : 1999

Test number: **KEMA 01ATEX1238 X**

Note

Modules with Ex II 3 G EEx nA II T4 .. T5 certification can only be installed in ET 200S distributed I/O devices belonging to equipment category 3.

Maintenance

If repair is necessary, the affected module must be sent to the production location. Repairs can only be carried there.

Special Conditions

1. The ET 200S distributed I/O device must be installed in a cabinet or metal housing. These must comply with the IP 54 degree of protection as a minimum. The environmental conditions under which the equipment is installed must be taken into account. There must be a manufacturer's declaration for zone 2 available for the housing (in accordance with EN 50021).
2. If a temperature of > 70 °C is reached in the cable or at the cable entry of this housing under operating conditions, or if a temperature of > 80 °C can be reached at the junction of the conductors under operating conditions, the temperature-related properties of the cables must correspond to the temperatures actually measured.
3. The cable entries used must comply with the required IP degree of protection and Section 7.2 (in accordance with EN 50021).
4. All devices (including switches, etc.) that are connected to the inputs and outputs of fail-safe signal modules must be approved for EEx nA or EEx nC explosion protection.
5. Steps must be taken to ensure that the rated voltage through transients cannot be exceeded by more than 40 %.
6. Ambient temperature range: 0° C to 60° C
7. A sign containing the following warning must be put up inside the housing in an easily visible position when the housing is opened:
   Warning
   The housing can only be opened for a short time (e.g. for visual diagnostics). If you do this, do not operate any switches, remove or install any modules or disconnect any electrical cables (plug-in connections).
   You can disregard this warning if you know that the atmosphere is not hazardous (i.e. there is no risk of explosion).

List of Approved Modules

You will find the list of approved modules under the ID 13702947 on the Internet:

http://www4.ad.siemens.de/view/cs/.

7.5.3 Utilisation de l'ET 200S dans un environnement à risque d'explosion en zone 2

Zone 2

Les environnements à risque d'explosion sont répartis en zones. Les zones se distinguent par la probabilité de présence d'une atmosphère explosive.

Zone	Risque d'explosion	Exemple
2	Formation rare et brève d'une atmosphère gazeuse explosive	Environnement de raccords à joints plats dans le cas de conduites dans des locaux fermés
Zone sûre	Non	• A l'extérieur de la zone 2 • Utilisation standard de périphérie décentralisée

Vous trouverez ci-après des remarques importantes pour l'installation de la station de périphérie décentralisée ET 200S dans un environnement à risque d'explosion.

Informations complémentaires

Des informations complémentaires sur l'ET 200S et les divers modules se trouvent dans le manuel.

Lieu de production

Siemens AG, Bereich A&D
Werner-von-Siemens-Straße 50
92224 Amberg
Germany

Homologation

Ex **II 3 G** **EEx nA II T4 .. T5** selon EN 50021 : 1999

Numéro de contrôle : **KEMA 01ATEX1238 X**

Nota

Les modules homologués Ex II 3 G EEx nA II T4 .. T5 ne peuvent être utilisés que dans des stations de périphérie décentralisée ET 200S de catégorie 3.

Entretien

Si une réparation est nécessaire, le module concerné doit être expédié au lieu de production. La réparation ne doit être effectuée qu'en ce lieu.

Conditions particulières

1. La station de périphérie décentralisée ET 200S doit être installée dans une armoire ou un boîtier métallique. Ceux-ci doivent assurer au moins l'indice de protection IP 54. Il faut alors tenir compte des conditions d'environnement dans lesquelles l'appareil est installé. Le boîtier doit faire l'objet d'une déclaration de conformité du fabricant pour la zone 2 (selon EN 50021).
2. Si dans les conditions d'exploitation, une température > 70 °C est atteinte au niveau du câble ou de l'entrée du câble dans ce boîtier, ou bien si la température au niveau de la dérivation des conducteurs peut être > 80 °C, les capacités de résistance thermique des câbles doivent corespondre aux températures effectivement mesurées.
3. Les entrées de câbles utilisées doivent avoir le niveau de protection IP exigé et être conformes au paragraphe 7.2 (selon EN 50021).
4. Tous les appareillages (y compris les interrupteurs, etc.) raccordés aux entrées et sorties de modules de signaux à sécurité intrinsèque doivent être homologués pour la protection antidéflagrante type EEx nA ou EEx nC.
5. Il faut prendre des mesures pour que la tension nominale ne puisse pas être dépassée de plus de 40% sous l'influence de transitoires.
6. Plage de température ambiante : 0° C à 60° C
7. A l'intérieur du boîtier, il faut placer, à un endroit bien visible après ouverture, une plaquette comportant l'avertissement suivant :
   Avertissement
   Ouvir le boîtier le moins longtemps possible, par exemple pour effectuer un diagnostic visuel. Ce faisant, n'actionnez aucun commutateur, ne déconnectez aucun module et ne débanchez pas de câbles électriques (connexions).
   Le respect de cet avertissement n'est pas impératif s'il est certain que l'environnement ne présente pas de risque d'explosion.

Liste des modules homologués

Vous trouverez sur Internet la liste des modules homologués :

http://www4.ad.siemens.de/view/cs/

référence ID 13702947.

7.5.4 Aplicación del ET 200S en áreas con peligro de explosión, zona 2

Zona 2

Las áreas con peligro de explosión se clasifican en zonas. Las zonas se diferencian según la probabilidad de la existencia de una atmósfera capaz de sufrir una explosión.

Zona	Peligro de explosión	Ejemplo
2	La atmósfera explosiva de gas sólo se presenta rara vez y muy brevemente	Áreas alrededor de uniones abridadas con juntas planas en tuberías en locales cerrados
Área segura	no	• fuera de la zona 2 • Aplicaciones estándar de la periferia descentralizada

A continuación encontrará importantes informaciones para la instalación de la unidad periférica descentralizada ET 200S en áreas con peligro de explosión.

Otras informaciones

Encontrará otras informaciones relativas a la ET 200S y a los distintos componentes en el Manual.

Lugar de fabricación

Siemens AG, Bereich A&D
Werner-von-Siemens-Straße 50
92224 Amberg
Germany

Homologación

Ex **II 3 G** **EEx nA II T4 .. T5** según norma EN 50021 : 1999

Número de comprobación: **KEMA 01ATEX1238 X**

Nota

Los módulos con la homologación Ex II 3 G EEx nA II T4 .. T5 pueden utilizarse únicamente en unidades periféricas descentralizadas ET 200S de la categoría de equipo 3.

Mantenimiento

Para una reparación se ha de remitir el módulo afectado al lugar de fabricación. Sólo allí se puede realizar la reparación.

Condiciones especiales

1. La unidad periférica descentralizada ET 200S se ha de montar en un armario eléctrico de distribución o en una carcasa metálica. Éstos deben garantizar como mínimo el grado de protección IP 54. Para ello se han de tener en cuenta las condiciones ambientales, en las cuales se instala el equipo. La caja deberá contar con una declaración del fabricante para la zona 2 (conforme a EN 50021).
2. Si durante la operación se alcanzara una temperatura > 70° C en el cable o la entrada de cables de esta caja o bien una temperatura > 80° C en la bifurcación de hilos, deberán adaptarse las propiedades térmicas de los cables a las temperaturas medidas efectivamente.
3. Las entradas de cable utilizadas deben cumplir el grado de protección IP exigido y lo expuesto en el apartado 7.2 (conforme a EN 50021).
4. Todos los dispositivos –inclusive interruptores, etc.– conectados a las entradas y salidas de módulos de señales de alta disponibilidad deben estar homologados para la protección contra explosiones del tipo EEx nA o EEx nC.
5. Es necesario adoptar las medidas necesarias para evitar que la tensión nominal pueda rebasar en más del 40 % debido a efectos transitorios.
6. Margen de temperatura ambiente: 0° C hasta 60° C
7. Dentro de la caja deberá colocarse en un lugar perfectamente visible tras su apertura un rótulo con la siguiente advertencia:
   Precaución
   Abrir la caja sólo brevemente, p.ej. para el diagnóstico visual. Durante este tiempo Ud. no deberá activar ningún interruptor, desenchufar o enchufar módulos ni separar conductores eléctricos (conexiones enchufables).
   Esta advertencia puede ignorarse si Ud. sabe que en la atmósfera existente no hay peligro de explosión.

Lista de los módulos homologados

En la internet hallará Ud. una lista con los módulos homologados:

http://www4.ad.siemens.de/view/cs/

bajo el ID de asignación 13702947.

7.5.5 Impiego dell'ET 200S nell'area a pericolo di esplosione zona 2

Zona 2

Le aree a pericolo di esplosione vengono suddivise in zone. Le zone vengono distinte secondo la probabilità della presenza di un'atmosfera esplosiva.

Zona	Pericolo di esplosione	Esempio
2	L'atmosfera esplosiva si presente solo raramente e brevemente	Aree intorno a collegamenti a flange con guarnizioni piatte nelle condotte in ambienti chiusi
Area sicura	No	• Al di fuori della zona 2 • Applicazioni standard di periferia decentrata

Qui di seguito sono riportate delle avvertenze importanti per l'installazione dell'unità di periferia decentrata ET 200S nell'area a pericolo di esplosione.

Ulteriori informazioni

Ulteriori informazioni sull'ET 200S e sui diversi moduli si trovano nel manuale.

Luogo di produzione

Siemens AG, Bereich A&D
Werner-von-Siemens-Straße 50
92224 Amberg
Germany

Autorizzazione

Ex **II 3 G** **EEx nA II T4 .. T5** secondo EN 50021 : 1999

Numero di controllo: **KEMA 01ATEX1238 X**

Avvertenza

Le unità con l'autorizzazione Ex II 3 G EEx nA II T4 .. T5 possono essere impiegate solo nelle apparecchiature di periferia decentrata ET 200S della categoria di apparecchiature 3.

Manutenzione

Per una riparazione, il modulo interessato deve essere inviato al luogo di produzione. La riparazione può essere effettuata solo lì.

Condizioni particolari

1. L'unità di periferia decentrata ET 200S deve essere montata in un armadio elettrico o in un contenitore metallico. Questi devono assicurare almeno il tipo di protezione IP 54. In questo caso bisogna tenere conto delle condizioni ambientali nelle quali l'apparecchiatura viene installata. Per il contenitore deve essere presente una dichiarazione del costruttore per la zona 2 (secondo EN 50021).
2. Se nei cavi o nel loro punto di ingresso in questo contenitore viene raggiunta in condizioni di esercizio una temperatura > 70 °C o se in condizioni di esercizio la temperatura nella derivazione dei fili può essere > 80 °C, le caratteristiche di temperatura dei cavi devono essere conformi alla temperatura effettivamente misurata.
3. Gli ingressi dei cavi usati devono essere conformi al tipo di protezione richiesto e alla sezione 7.2 (secondo EN 50021).
4. Tutte le apparecchiature, inclusi interruttori, ecc. che vengono collegati agli ingressi/uscite di unità di segnale ad elevata sicurezza, devono essere stati omologati per la protezione da esplosione tipo EEx nA o EEx nC.
5. Devono essere prese delle misure per evitare che la tensione nominale possa essere superata per più del 40% da parte di transienti.
6. Campo termico ambientale: da 0° C a 60° C
7. All'interno del contenitore va apportata, in un luogo ben visibile dopo l'apertura, una targhetta con il seguente avvertimento:
   Attenzione
   Il contenitore può rimanere aperto solo per breve tempo, ad esempio per una diagnostica a vista. In tal caso non azionare alcun interruttore, non disinnestare o innestare unità e non staccare connessioni elettriche (connettori).
   Non è necessario tenere conto di questo avvertimento se è noto che non c'è un'atmosfera a rischio di esplosione.

Elenco delle unità abilitate

La lista con le unità omologate si trova in Internet al sito:

http://www4.ad.siemens.de/view/cs/

all'ID di voce 13702947.

7.5.6 Gebruik van de ET 200S in het explosieve gebied zone 2

Zone 2

Explosieve gebieden worden ingedeeld in zones. Bij de zones wordt onderscheiden volgens de waarschijnlijkheid van de aanwezigheid van een explosieve atmosfeer.

Zone	Explosiegevaar	Voorbeeld
2	Een explosieve gasatmosfeer treedt maar zelden op en voor korte duur	Gebieden rond flensverbindingen met pakkingen bij buisleidingen in gesloten vertrekken
Veilig gebied	neen	• Buiten de zone 2 • Standaardtoepassingen van decentrale periferie

Hierna vindt u belangrijke aanwijzigen voor de installatie van het decentraal periferieapparaat ET 200S in het explosief gebied.

Verdere informatie

In het handboek vindt u verdere informatie over de ET 200S en over de verschillende modulen.

Productieplaats

Siemens AG, Bereich A&D
Werner-von-Siemens-Strasse 50
92224 Amberg
Germany

Vergunning

Ex **II 3 G** **EEx nA II T4 .. T5** conform EN 50021 : 1999

Keuringsnummer: **KEMA 01ATEX1238 X**

Opmerking

Modulen met de vergunning Ex II 3 G EEx nA II T4 .. T5 mogen slechts worden gebruikt in decentrale periferieapparaten ET 200S van de apparaatcategorie 3.

Instandhouding

Voor reparatie moet de betreffende module naar de plaats van vervaardiging worden gestuurd. Alleen daar mag de reparatie worden uitgevoerd.

Speciale voorwaarden

1. Het decentrale periferieapparaat ET 200S moet worden ingebouwd in een schakelkast of in een behuizing van metaal. Deze moeten minstens de veiligheidsgraad IP 54 waarborgen. Hierbij dient rekening te worden gehouden met de omgevingsvoorwaarden waarin het apparaat wordt geïnstalleerd. Voor de behuizing dient een verklaring van de fabrikant voor zone 2 te worden ingediend (volgens EN 50021).
2. Als aan de kabel of aan de kabelinvoering van deze behuizing onder bedrijfsomstandigheden een temperatuur wordt bereikt > 70 °C of als onder bedrijfsomstandigheden de temperatuur aan de adervertakking > 80 °C kan zijn, moeten de temperatuureigenschappen van de kabel overeenstemmen met de werkelijk gemeten temperaturen.
3. De aangebrachte kabelinvoeringen moeten de vereiste IP-veiligheidsgraad hebben en in overeenstemming zijn met alinea 7.2 (volgens EN 50021).
4. Alle apparaten, schakelaars enz. inbegrepen, die worden aangesloten op de in- en uitgangen van tegen fouten beveiligde signaalmodulen, moeten zijn goedgekeurd voor de explosiebeveiliging type EEx nA of EEx nC.
5. Er dienen maatregelen te worden getroffen, zodat de nominale spanning door transiënten met niet meer dan 40 % kan worden overschreden.
6. Omgevingstemperatuurbereik: 0° C tot 60° C
7. Binnen de behuizing dient op een na het openen goed zichtbare plaats een bord te worden aangebracht met de volgende waarschuwing:
   Waarschuwing
   De behuizing mag slechts voor korte tijd worden geopend, bijv. voor een visuele diagnose. Bedien hierbij geen schakelaar, trek of steek geen modulen en ontkoppel geen elektrische leidingen (steekverbindingen).
   Deze waarschuwing kan buiten beschouwing blijven, indien bekend is dat er geen explosieve atmosfeer heerst.

Lijst van de toegelaten modulen

De lijst met de toegelaten modulen vindt u in het internet:

http://www4.ad.siemens.de/view/cs/

onder de bijdrage-ID 13702947.

7.5.7 Brug af ET 200S i det eksplosionsfarlige område zone 2

Zone 2

Eksplosionsfarlige områder inddeles i zoner. Zonerne adskiller sig indbyrdes efter hvor sandsynligt det er, at der er en eksplosiv atmosfære.

Zone	Eksplosionsfare	Eksempel
2	Eksplosiv gasatmosfære optræder kun sjældent og varer kort	Områder rundt om flangeforbindelser med flade pakninger ved rørledninger i lukkede rum
Sikkert område	Nej	• Uden for zone 2 • Standardanvendelser decentral periferi

I det følgende findes vigtige henvisninger vedr. installation af det decentrale periferiudstyr ET 200S i det eksplosionsfarlige område.

Yderligere informationer

Yderligere informationer om ET 200S og de forskellige moduler findes i manualen.

Produktionssted

Siemens AG, Bereich A&D
Werner-von-Siemens-Straße 50
92224 Amberg
Germany

Godkendelse

Ex **II 3 G** **EEx nA II T4 .. T5** efter EN 50021 : 1999

Kontrolnummer: **KEMA 01ATEX1238 X**

Bemærk

Komponenter med godkendelsen Ex II 3 G EEx nA II T4 .. T5 må kun monteres i decentralt periferiudstyr ET 200S - udstyrskategori 3.

Vedligeholdelse

Skal det pågældende modul repareres, bedes De sende det til produktionsstedet. Reparation må kun udføres der.

Særlige betingelser

1. Det decentrale periferiudstyr ET 200S skal monteres i et kontrolskab eller et metalkabinet. Disse skal mindst kunne sikre beskyttelsesklasse IP 54. I denne forbindelse skal der tages højde for de omgivelsestemperaturer, i hvilke udstyret er installeret. Der skal være udarbejdet en erklæring fra fabrikanten for kabinettet for zone 2 (iht. EN 50021).
2. Hvis kablet eller kabelindføringen på dette hus når op på en temperatur på > 70 °C under driftsbetingelser eller hvis temperaturen på åreforegreningen kan være > 80 °C under driftsbetingelser, skal kablernes temperaturegenskaber stemme overens med de temperaturer, der rent faktisk måles.
3. De benyttede kabelindføringer skal være i overensstemmelse med den krævede IP-beskyttelsestype og afsnittet 7.2 (iht. EN 50021).
4. Alle apparater, inkl. kontakter osv., der forbindes med ind- og udgangene til fejlsikre signalkomponenter, skal være godkendt til eksplosionsbeskyttelse af type EEx nA eller EEx nC.
5. Der skal træffes foranstaltninger, der sørger for, at den nominelle spænding via transienter ikke kan overskrides mere end 40 %.
6. Omgivelsestemperaturområde: 0° C til 60° C
7. I kabinettet skal der anbringes et skilt, der skal kunne ses, når kabinettet åbnes. Dette skilt skal have følgende advarsel:
   Advarsel
   Kabinettet må kun åbnes i kort tid, f.eks. til visuel diagnose. Tryk i denne forbindelse ikke på kontakter, træk eller isæt ikke komponenter og afbryd ikke elektriske ledninger (stikforbindelser).
   Denne advarsel skal der ikke tages højde for, hvis man ved, at der ikke er nogen eksplosionsfarlig atmosfære.

Liste over godkendte komponenter

Listen med de godkendte komponenter findes på internettet:

http://www4.ad.siemens.de/view/cs/

under bidrags-ID 13702947.

7.5.8 ET 200S:n käyttö räjähdysvaarannetuilla alueilla, vyöhyke 2

Vyöhyke 2

Räjähdysvaarannetut alueet jaetaan vyöhykkeisiin. Vyöhykkeet erotellaan räjähdyskelpoisen ilmakehän olemassa olon todennäköisyyden mukaan.

Vyöhyke	Räjähdysvaara	Esimerkki
2	Räjähtävä kaasuilmakehä ilmaantuu vain harvoin ja lyhytaikaisesti	Alueet putkistojen lattatiivisteillä varustuilla laippaliitoksilla suljetuissa tiloissa
turvallinen alue	ei	• vyöhykkeen 2 ulkopuolella • Hajautetun ulkopiirin vakiosovellukset

ET 200S asennukseen räjähdysvaarannetuilla alueilla.

Lisätietoja

Lisätietoja ET 200S:ään ja erilaisiin moduuleihin löydätte ohjekirjasta.

Valmistuspaikka

Siemens AG, Bereich A&D
Werner-von-Siemens-Straße 50
92224 Amberg
Germany

Hyväksyntä

Ex **II 3 G** **EEx nA II T4 .. T5** EN 50021 mukaan: 1999

Tarkastusnumero: **KEMA 01ATEX1238 X**

Ohje

Rakenneryhmät hyväksynnän Ex II 3 G EEx nA II T4 .. T5 kanssa saadaan käyttää ainoastaan laitekategorian 3 hajautetuissa ulkopiirilaitteissa ET 200S.

Kunnossapito

Korjausta varten täytyy kyseinen moduuli lähettää valmistuspaikkaan. Korjaus voidaan suorittaa ainoastaan siellä.

Erityiset vaatimukset

1. Hajautettu ulkopiirilaite ET 200S täytyy asentaa kytkentäkaappiin tai metalliseen koteloon. Näiden täytyy olla vähintään kotelointiluokan IP 54 mukaisia. Tällöin on huomioitava ympäristöolosuhteet, johon laite asennetaan. Kotelolle täytyy olla valmistajaselvitys vyöhykettä 2 varten (EN 50021 mukaan).
2. Kun johdolla tai tämän kotelon johdon sisäänviennillä saavutetaan > 70 °C lämpötila tai kun käyttöolosuhteissa lämpötila voi piuhajaotuksella olla > 80 °C, täytyy johdon lämpötilaominaisuuksien vastata todellisesti mitattuja lämpötiloja.
3. Käytettyjen johtojen sisäänohjauksien täytyy olla vaaditun IP-kotelointiluokan ja kohdan 7.2 (EN 50021 mukaan) mukaisia.
4. Kaikkien laitteiden, kytkimet jne. mukaan lukien, jotka liitetään virheiltä suojattujen signaalirakenneryhmien tuloille ja lähdöille, täytyy olla hyväksyttyjä tyypin EEx nA tai EEx nC räjähdyssuojausta varten.
5. Toimenpiteet täytyy suorittaa, ettei nimellisjännite voi transienttien kautta ylittyä enemmän kuin 40 %.
6. Ympäristölämpötila-alue: 0° C ... 60° C
7. Kotelon sisälle, avauksen jälkeen näkyvälle paikalle, on kiinnitettävä kilpi, jossa on seuraava varoitus:
   Varoitus
   Kotelo saadaan avata ainoastaan lyhyeksi ajaksi, esim. visuaalista diagnoosia varten. Älä tällöin käytä mitään kytkimiä, vedä tai liitä mitään rakenneryhmiä, äläkä erota mitään sähköjohtoja (pistoliittimiä).
   Tätä varoitusta ei tarvitse huomioida, kun on tiedossa, että minkäänlaista räjähdysvaarannettua ilmakehää ei ole olemassa.

Hyväksyttyjen rakenneryhmien lista

Lista hyväksiytyistä rakennesarjoista löytyy internetistä osoitteesta:

http://www4.ad.siemens.de/view/cs/

käyttäjätunnuksella 13702947.

7.5.9 Användning av ET 200S i explosionsriskområde zon 2

Zon 2

Explosionsriskområden delas in i zoner. Zonerna delas in enligt sannolikheten att en atmosfär med explosionsfara föreligger.

Zon	Explosionsfara	Exempel
2	Explosiv gasatmosfär uppstår endast sällan eller kortvarigt	Områden kring flänsförbindelser med packningar vid rörledningar i slutna utrymmen
Säkert område	Nej	• Utanför zon 2 • Standardanvändning av decentral periferi

Nedan följer viktiga anvisningar om installationen av den decentrala periferienheten ET 200S i ett explosionsriskområde.

Ytterligare information

Ytterligare information om ET 200S och de olika modulerna finner du i handboken.

Tillverkningsort

Siemens AG, Bereich A&D
Werner-von-Siemens-Straße 50
92224 Amberg
Germany

Godkännande

Ex **II 3 G** **EEx nA II T4 .. T5** enligt EN 50021 : 1999

Kontrollnummer: **KEMA 01ATEX1238 X**

Anvisning

Komponentgrupper med godkännande Ex II 3 G EEx nA II T4 .. T5 får endast användas i decentrala periferienheter ET°200S från apparatgrupp°3.

Underhåll

Vid reparation måste den aktuella modulen insändas till tillverkaren. Reparationer får endast genomföras där.

Särskilda villkor

1. Den decentrala periferienheten ET 200S måste monteras i ett kopplingsskåp eller metallhus. Dessa måste minst vara av skyddsklass IP 54. Därvid ska omgivningsvillkoren där enheten installeras beaktas. För kåpan måste en tillverkardeklaration för zon 2 föreligga (enligt EN 50021).
2. Om en temperatur på > 70°C uppnås vid husets kabel resp kabelinföring under driftvillkor eller om temperaturen vid trådförgreningen kan vara > 80°C under driftvillkor, måste kabelns temperaturegenskaper överensstämma med den verkligen uppmätta temperaturen.
3. De använda kabelinföringarna måste uppfylla kraven i det krävda IP-skyddsutförandet och i avsnitt 7.2 (enligt EN 50021).
4. Alla apparater, inklusive brytare osv, som ansluts till felsäkrade signalenheters in- och utgångar, måste vara godkända för explosionsskydd av typ EEx nA eller EEx nC.
5. Åtgärder måste vidtas så, att märkspänningen ej kan överskridas med mer än 40°% genom transienter.
6. Omgivningstemperatur: 0° C till 60° C
7. När huset öppnats ska en skylt med följande varning monteras på ett tydligt synligt ställe huset:
   Varning
   Huset får endast öppnas under kort tid, t ex för visuell diagnos. Använd därvid inga brytare, lossa eller anslut inga enheter och frånskilj inga elektriska ledningar (insticksanslutningar).
   Ingen hänsyn måste tas till denna varning om det är säkert att det inte råder någon explosionsfarlig atmosfär.

Lista över godkända komponentgrupper

Lista över godkända enheter återfinns i Internet:

http://www4.ad.siemens.de/view/cs/

under bidrags-ID 13702947.

7.5.10 Uso do ET 200S em área exposta ao perigo de explosão, zona 2

Zona 2

As áreas expostas ao perigo de explosão são divididas em zonas. As zonas são diferenciadas de acordo com a probabilidade da existência de uma atmosfera explosiva.

Zona	Perigo de explosão	Exemplo
2	Só raramente e por um breve período de tempo surgem atmosferas explosivas	Áreas em torno de ligações flangeadas com vedações chatas em tubulações em recintos fechados
Área segura	não	• fora da zona 2 • Aplicações descentralizadas de periferia descentralizada

A seguir, o Sr. encontrará avisos importantes para a instalação do aparelho periférico descentralizado ET 200S em área exposta ao perigo de explosão.

Mais informações

Para obter mais informações sobre o ET 200S e os diversos módulos, consulte o manual.

Local de produção

Siemens AG, Bereich A&D
Werner-von-Siemens-Straße 50
92224 Amberg
Germany

Licença

Ex **II 3 G** **EEx nA II T4 .. T5** seg. EN 50021 : 1999

Número de ensaio: **KEMA 01ATEX1238 X**

Aviso

Componentes com a licença Ex II 3 G EEx nA II T4 .. T5 só podem ser aplicados em aparelhos periféricos descentralizados ET 200S da categoria de aparelho 3.

Reparo

O módulo em questão deve ser remetido para o local de produção a fim de que seja realizado o reparo. Apenas lá deve ser efetuado o reparo.

Condições especiais

1. O aparelho periférico ET 200S deve ser montado em um armário de distribuição ou em uma caixa metálica. Estes devem garantir no mínimo o tipo de proteção IP 54. Durante este trabalho deverão ser levados em consideração as condições locais, nas quais o aparelho será instalado. Para a caixa deverá ser apresentada uma declaração do fabricante para a zona 2 (de acordo com EN 50021).
2. Caso no cabo ou na entrada do cabo desta carcaça sob as condições operacionais seja atingida uma temperatura de > 70 °C, ou caso sob condições operacionais a temperatura na ramificação do fio poderá atingir > 80 °C, as caraterísticas de temperatura deverão corresponder às temperaturas realmente medidas.
3. As entradas de cabo utilizadas devem corresponder ao tipo exigido de proteção IP e à seção 7.2 (de acordo com o EN 50021).
4. Todos os aparelhos, inclusive as chaves, etc., que estejam conectadas em entradas e saídas de módulos de sinais protegidos contra erro, devem possuir a licença para a proteção de explosão do tipo EEx nA ou EEx nC.
5. Precisam ser tomadas medidas para que a tensão nominal através de transitórios não possa ser ultrapassada em mais que 40 %.
6. Área de temperatura ambiente: 0° C até 60° C
7. No âmbito da carcaça deve ser colocada, após a abertura, em um ponto bem visível uma placa com a seguinte advertência:
   Advertência
   A carcaça deve ser aberta apenas por um breve período de tempo, por ex. para diagnóstico visual. Não acione nenhum interruptor, não retire ou conecte nenhum módulo e não separe nenhum fio elétrico (ligações de tomada).
   Esta advertência poderá ser ignorada caso se saiba que não há nenhuma atmosfera sujeita ao perigo de explosão.

Lista dos componentes autorizados

A lista com os módulos autorizados encontram-se na Internet:

http://www4.ad.siemens.de/view/cs/

sob o número de ID 13702947.

7.5.11 Χρήση της συσκευής ET 200S σε επικίνδυνη για έκρηξη περιοχή, ζώνη 2

Ζώνη 2

Οι επικίνδυνες για έκρηξη περιοχές χωρίζονται σε ζώνες. Οι ζώνες διαφέρουν σύμφωνα με την πιθανότητα ύπαρξης ενός ικανού για έκρηξη περιβάλλοντος.

Ζώνη	Κίνδυνος έκρηξης	Παράδειγμα
2	Εκρηκτικό περιβάλλον αερίου παρουσιάζεται μόνο σπάνια και για σύντομο χρονικό διάστημα	Περιοχές γύρω από φλαντζωτές συνδέσεις με τσιμούχες σε σωληνώσεις σε κλειστούς χώρους
Ασφαλής περιοχή	όχι	• Εκτός της ζώνης 2 • Τυπικές εφαρμογές αποκεντρωμένης περιφέρειας

Στη συνέχεια θα βρείτε σημαντικές υποδείξεις για την εγκατάσταση της αποκεντρωμένης περιφερειακής συσκευής ET 200S σε επικίνδυνη για έκρηξη περιοχή.

Επιπλέον πληροφορίες

Επιπλέον πληροφορίες για τη συσκευή ET 200S και για τα διάφορα δομοστοιχεία (ενότητες) θα βρείτε στο εγχειρίδιο.

Τόπος κατασκευής

Siemens AG, Bereich A&D
Werner-von-Siemens-Straße 50
92224 Amberg
Germany

Άδεια

Ex **II 3 G** **EEx nA II T4 .. T5** σύμφωνα με το πρότυπο EN 50021 : 1999

Αριθμός ελέγχου: **KEMA 01ATEX1238 X**

Υπόδειξη

Τα δομικά συγκροτήματα με την άδεια Ex II 3 G EEx nA II T4 .. T5 επιτρέπεται να τοποθετηθούν μόνο στην αποκεντρωμένη περιφερειακή συσκευή ET 200S της κατηγορίας συσκευής 3.

Συντήρηση

Για μια επισκευή πρέπει να σταλθεί το αντίστοιχο δομοστοιχείο στον τόπο κατασκευής. Μόνο εκεί επιτρέπεται να γίνει η επισκευή.

Ιδιαίτερες προϋποθέσεις

1. Η αποκεντρωμένη περιφερειακή συσκευή ET 200S πρέπει να ενσωματωθεί σε ένα ερμάριο ζεύξης ή σε ένα μεταλλικό περίβλημα. Αυτά πρέπει να εξασφαλίζουν το λιγότερο το βαθμό προστασίας IP 54. Σε αυτήν την περίπτωση πρέπει να ληφθούν υπόψη οι περιβαλλοντικές συνθήκες, στις οποίες θα εγκατασταθεί η συσκευή. Για το περίβλημα πρέπει να προβλέπεται δήλωση του κατασκευαστή για τη ζώνη 2 (σύμφωνα με το πρότυπο EN 50021).
2. Εάν στο καλώδιο ή στην είσοδο του καλωδίου αυτού του περιβλήματος κάτω από συνθήκες λειτουργίας η θερμοκρασία ξεπεράσει τους 70 °C ή όταν κάτω από συνθήκες λειτουργίας η θερμοκρασία στη διακλάδωση του σύρματος μπορεί να είναι μεγαλύτερη από 80 °C, πρέπει οι θερμοκρασιακές ιδιότητες των καλωδίων να ταυτίζονται με τις πραγματικά μετρημένες θερμοκρασίες.
3. Οι χρησιμοποιούμενες εισόδοι καλωδίων πρέπει να συμμορφώνονται με το βαθμό προστασίας IP 54 στην ενότητα 7.2 (σύμφωνα με το πρότυπο EN 50021).
4. Όλες οι συσκευές, συμπεριλαμβανομένων διακοπτών κ.α., που συνδέονται στις εισόδους και εξόδους δομικών συγκροτημάτων ασφαλών σημάτων, πρέπει να φέρουν εγκριμένη προστασία κατά έκρηξης τύπου EEx nA ή EEx nC.
5. Πρέπει να ληφθούν μέτρα, να μην μπορεί να γίνει υπέρβαση της ονομαστικής τάσης μέσω αιφνίδιας μεταβολής της τάσης πάνω από 40 %.
6. Περιοχή θερμοκρασίας περιβάλλοντος: 0° C έως 60° C
7. Πρέπει να τοποθετηθεί μέσα στο περίβλημα σε ευδιάκριτο σημείο μετά το άνοιγμα μία πινακίδα με την ακόλουθη προειδοποίηση:
   Προειδοποίηση
   Το περίβλημα επιτρέπεται να ανοίγει μόνο για μικρό χρονικό διάστημα, π.χ. για τη διενέργεια οπτικής διάγνωσης. Μην κάνετε χρήση διακοπτών, μην τραβάτε ή εμβυσματώνετε δομικά συγκροτήματα και μη διαχωρίζετε ηλεκτροφόρους αγωγούς (εμβσυματώσιμες συνδέσεις).
   Η προειδοποίηση αυτή δε χρειάζεται να ληφθεί υπ' όψιν, εάν είναι γνωστό ότι δεν υφίσταται ατμόσφαιρα παρουσιάζουσα κίνδυνο έκρηξης.

Κατάλογος των εγκεκριμένων δομικών συγκροτημάτων

Η λίστα με τα εγκριμένα δομικά συγκροτήματα υπάρχει στο διαδίκτυο:

http://www4.ad.siemens.de/view/cs/

με τον κωδικό συνδρομής 13702947.

ET 200S Power Supply

8

Order number

6ES7138-4JC00-0AA0

Features

- Power supply for connection to a 240/400 VAC power system
- Output voltage 24 VDC/5 A
- Can be replaced without changing the wiring by means of removable connectors
- Labeling strips for identification
- Slide switch: There is a slide switch next to the connector. This functions as a standby switch and can be operated using a screwdriver or other appropriate pointed object.

| = On: The output voltage is switched on

⏻ = Standby: The output voltage is switched off

Figure 8-1 ET 200S Power Supply

Terminal assignment

The following table shows the terminal assignment of the ET 200S Power Supply:

View	Terminal assignment	Remarks
	24 V → M → 24 VDC L1 ← N ← 240 VAC L1 ← L2 ← 400 VAC ← PE	24 VDC : Output voltage M: chassis ground of the output voltage L1/L2: Input voltage N: Neutral conductor PE: Ground terminal

Technical specifications of the PS ET 200S

Dimensions, weight and conductor cross-sections	
Dimensions W x H x D (mm)	90 x 132 x 75
Weight	0.45 kg
Conductor cross-section	0.5 – 2.5 mm^2 finely stranded
Input variables	
Input voltage	
• Rated value	240/400 VAC
• Permitted range	146 to 460 VAC
Line frequency	
• Rated value	50/60 Hz
• Permitted range	47 to 63 Hz
Input rated current I_N	
• At 240 VAC	0.55 A
• At 400 VAC	0.33 A
Inrush current	
• At rated voltage	Peak value 15 x I_N Half-value width >5 ms Recovery time >20 s
• I^2t	<0.5 A^2s
An external miniature circuit breaker that at the same time also protects the supply to the device is required.	
Output variables	
Output voltage	
• Rated value	24 VDC
• Permitted range	
– Static	20.4 – 28.8 VDC
– Dynamic	18.5 – 30.2 VDC
Output current	
• Rated value	5 A
Residual ripple	<2.9 V (100 Hz)
Ripple	200 mV_{pp}
Maximum operating peaks	500 mVS/<100 ms
Ramp-up time	<1 s
No-load conditions	Stable at no load
Overload	Stable at overload
Current limiting	Yes
Short-circuit strength	Yes, automatic restart
Overvoltage protection	No
Parallel switching	Yes, no uniform current distribution
Redundancy	No
Performance characteristics	
Safety class to IEC 60536	I, with protective conductor
Overvoltage category	II
Protective separation to IEC 61010	Yes
Pollution severity	2
Test voltage primary<–>secondary	3 kVAC
Bridging of power failures	
• Brief voltage dips to 0 V	In accordance with NAMUR
• Break time	<20 ms
• Recovery time	>1 s
• Events per hour	10
Power consumption	<134 W
Power loss	<14 W

The above information applies to horizontal installation.

You can find information on other types of installation on the Internet at:
www4.ad.siemens.de/view/cs/de/15395124

Interface Modules

9

Chapter overview

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9.1 Parameters for interface modules

Parameters for the IM151-1 BASIC interface module

Table 9-1 Parameters for the IM151-1 BASIC interface module

IM151-1 BASIC	Value range	Default	Applicability
Operation at Preset <> Actual configuration	Disable/enable	Disable	ET 200S
Identifier-related diagnostics	Disable/enable	Enable	ET 200S
Module status	Disable/enable	Enable	ET 200S
Channel-specific diagnosis	Disable/enable	Enable	ET 200S
Analog-value format	SIMATIC S7 SIMATIC S5	S7	ET 200S
Interference frequency suppression	50 Hz/60 Hz	50 Hz	ET 200S
Reference junction slot	None/2 to 12	None	ET 200S
Reference junction input	RTD on channel 0/ RTD on channel 1	0	ET 200S

Parameters for the IM151-1 STANDARD and IM151-1 FO STANDARD interface modules

Table 9-2 Parameters for the IM151-1 STANDARD and IM151-1 FO STANDARD interface modules

IM151-1 STANDARD/ IM151-1 FO STANDARD	Value range	Default	Applicability
Bus length	≤ 1 m / > 1 m	≤1 m	ET 200S
Operation at Preset <> Actual Configuration	Disable/enable	Disable	ET 200S
Option handling, general	Disable/enable	Disable	ET 200S
Option handling: slots 2 to 63	Disable/enable	Disable	Module
Analog-value format	SIMATIC S7/ SIMATIC S5	S7	ET 200S
Interference frequency suppression	50 Hz/60 Hz	50 Hz	ET 200S
Reference junction slot	None/2 to 63	None	ET 200S
Reference junction input	RTD on channel 0/ RTD on channel 1	0	ET 200S

Parameters for the IM151-1 HIGH FEATURE interface module

Table 9-3 Parameters for the IM151-1 HIGH FEATURE interface module (parameter assignment tab)

IM151-1 HIGH FEATURE	Value range	Default	Applicability
DPV1 operation	Disable/enable	Enable[1)]	ET 200S
Operation at Preset <> Actual Configuration	Disable/enable	Enable	ET 200S
Diagnostic interrupt[2)]	Disable/enable	Disable	ET 200S
Hardware interrupt[2)]	Disable/enable	Disable	ET 200S
Insert/remove-module interrupt[1]	Disable/enable	Disable	ET 200S
Identifier-related diagnostics	Disable/enable	Enable	ET 200S
Module status	Disable/enable	Enable	ET 200S
Channel-specific diagnosis	Disable/enable	Enable	ET 200S

Table 9-3 Parameters for the IM151-1 HIGH FEATURE interface module (parameter assignment tab), continued

IM151-1 HIGH FEATURE	Value range	Default	Applicability
Analog-value format	SIMATIC S7/ SIMATIC S5	S7	ET 200S
Interference frequency suppression	50 Hz/60 Hz	50 Hz	ET 200S
Reference junction slot	None/2 to 63	None	ET 200S
Reference junction input	RTD on channel 0/ RTD on channel 1	0	ET 200S

1) In the device database file, the default setting of the parameter is ”Disable”.
2) Only parameterizable in DPV1 operation of the IM151-1 HIGH FEATURE.

Table 9-4 Parameters for the IM151-1 HIGH FEATURE interface module (clocking tab)

IM151-1 HIGH FEATURE	Value range	Default	Applicability
Synchronize DP slave with DP cycle[1)]	Disable/enable	Disable	ET 200S
Time Ti (read in process values)[1)]	(Values are preset by STEP 7)	(Value is preset by STEP 7)	ET 200S
Time To (read out process values)[1)]	(Values are preset by STEP 7)	(Value is preset by STEP 7)	ET 200S

1) Only parameterizable as of STEP 7 V5.1 with ServicePack 3

DPV1 operation (only with IM151-1 HIGH FEATURE)

This parameter allows you to enable or disable DPV1 operation of the ET 200S. If DPV1 operation is enabled, C1 data records and interrupts are supported (parameterizable).

Prerequisite:

- The DP master also support DPV1.

Bus length

≤ 1 m: Default setting – the maximum bus length is 1 m.

> 1 m: The bus length of the ET 200S is > 1 m and can be a maximum 2 m. This setting will, however, increase the response time of the ET 200S (see Appendix D).

Operation at Preset <> Actual Configuration

If the parameter is enabled and:

- Modules are removed and inserted during operation, this does not lead to a station failure of the ET 200S.
- The actual configuration differs from the expected configuration, the ET 200S remains engaged in data transfer 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 200S.
- The actual configuration differs from the expected configuration, there is no data transfer between the DP master and the ET 200S. Exception: Option handling with RESERVE modules (see Section 3.8).

Option handling, general

Using this parameter you can enable or disable the option handling parameter for the entire ET 200S.

Option handling: slots 2 to 63

Using this parameter you can enable or disable the checking of the configuration.

- Slots 2 to 63 are enabled: Instead of the configured electronic module you can also insert a RESERVE module in the relevant slot without a diagnosis being reported.
- Slots 2 to 63 are disabled: Only the configured module can be located on the relevant slot. RESERVE modules are treated as incorrect modules. Depending on the setting of the “Operation at Preset <> Actual Configuration“ parameter, the ET 200S will either fail or remain in data transfer.

Diagnostic interrupt

This parameter allows you to enable or disable diagnostic interrupts. Diagnostic interrupts are only supported when the ET 200S is in DPV1 mode.

Hardware interrupt

This parameter allows you to enable or disable hardware interrupts. Hardware interrupts are only supported when the ET 200S is in DPV1 mode.

Insert/remove-module interrupt

This parameter allows you to enable or disable insert/remove-module interrupts. Insert/remove-module interrupts are only supported when the ET 200S is in DPV1 mode.

Analog-value format

Here you set the number format for all analog electronic modules.

Interference frequency suppression

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. See the technical specifications of the analog electronic modules in Chapter 13.

Reference junction slot

See Section 13.2.2

Reference junction input

See Section 13.2.2

Synchronize DP slave with DP cycle

You can use this parameter to enable or disable clocking.

If you enable clocking, the I/Os of the ET 200S are synchronized with the global control frame of the master (as an equidistance clocking).

Prerequisites: See Section 3.7

Time Ti (read in process values)

This value can only be set provided you have enabled the “Synchronize DP slave with DP cycle” parameter.

Ti is the time reserved for reading in the input data at the ET 200S. At the beginning of Ti, the input data is converted at the terminals and stored in a buffer via the backplane bus of the ET 200S. Ti ends at the beginning of the next, equidistant DP cycle (i.e. with the global control frame).

At this point, the most recent, most up-to-date input data must be available to be read in on the PROFIBUS subnet. The time Ti must take into account the processing and delay times in the modules and in the backplane bus of the ET 200S and, in the case of modular slaves, is therefore dependent on the configuration.

The time Ti can only be set in the specified increments between the minimum and maximum values. Normally, the default values should be accepted.

Time To (output process values)

This value can only be set provided you have enabled the “Synchronize DP slave with DP cycle” parameter.

The end of the To time is the point at which the output data is switched to the module terminals in its converted form. The time To includes the following:

- Distribution of the output data via the PROFIBUS-DP bus system to the slaves (= cyclic data-exchange master slave)
- Distribution of the output data to the modules via the backplane bus of the slave
- Conversion and transfer of the output data to the output terminals of the module

To starts with the arrival of the global control frame. Like Ti, the time can be set in the specified increments between the minimum and maximum values. Normally, you should accept the default values.

9.2 IM151-1 BASIC interface module (6ES7151-1CA00-0AB0)

Order number

6ES7151-1CA00-0AB0

Features

The IM151-1 BASIC interface module has the following features:

- It connects the ET 200S with PROFIBUS-DP via the RS485 interface.
- It prepares the data for the electronic modules and motor starters that are fitted.
- It supplies the backplane bus.
- The PROFIBUS-DP address of the ET 200S can be set by means of switches.
- If the 24 VDC power supply is disconnected, the IM151-1 BASIC interface module is also disconnected.
- The maximum address space is 88 bytes for inputs and 88 bytes for outputs.
- The reference potential M of the rated supply voltage of the IM151-1 BASIC to the rail (protective conductor) is connected by means of an RC combination, thus permitting an ungrounded configuration.
- It can be operated as a DPV0 slave.
- A maximum of 12 modules can be operated with the IM151-1 BASIC.
- The maximum bus length is not relevant.

Terminal assignment

The following table shows the terminal assignment of the IM151-1 BASIC interface module for the 24 VDC voltage supply and PROFIBUS-DP:

Table 9-5 Terminal assignment of the IM151-1 BASIC interface module

View	Signal name		Designation
	1	–	–
	2	–	–
	3	RxD/TxD-P	Data line B
	4	RTS	Request To Send
	5	M5V2	Data reference potential (station)
	6	P5V2	Supply plus (station)
	7	–	–
	8	RxD/TxD-N	Data line A
	9		
	1L+		24 VDC
	2L+		24 VDC (for loop through)
	1M		Chassis ground
	2M		Ground (for loop through)

Block diagram

Figure 9-1 Block diagram for the IM151-1 BASIC interface module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	45 x 119.5 x 75
Weight	Approx. 150 g
Data for specific modules	
Transmission rate	9.6; 19.2; 45.45; 93.75; 187.5; 500 kbps, 1.5 ; 3; 6; 12 Mbps
Bus protocol	PROFIBUS-DP
Interface	RS 485
SYNC capability	Yes
FREEZE capability	Yes
Manufacturer ID	$80F3_H$
Direct communication	Yes
Clocking	No
Max. output current of the PROFIBUS-DP interface (5, 6)	80 mA
Voltages, currents, potentials	
Rated supply voltage of the electronic components (1L+) [1]	24 VDC
• Reverse polarity protection	Yes
• Power failure bypass	No
Isolation	
• Between the backplane bus and electronic components	No
• Between the PROFIBUS-DP and electronic components	Yes
• Between the supply voltage and electronic components	No
Permitted potential difference (to the rail)	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption from rated supply voltage (1L+)	Approx. 70 mA
Power dissipation of the module	Typ. 1.5 W
Status, interrupts, diagnostics	
Interrupts	None
Diagnostic function	Yes
• Group error	Red “SF” LED
• PROFIBUS-DP bus monitoring	Red “BF” LED
• Monitoring of the power supply voltage of the electronics	Green “ON” LED

1) Fusing the supply voltage:
– Fuse type: 24 V/2.5 A /type C
– Inrush current: 3.5 A

9.3 IM151-1 STANDARD interface module (6ES7151-1AA03-0AB0)

Order number

6ES7151-1AA03-0AB0

Features

The IM151-1 STANDARD interface module has the following features:

- It connects the ET 200S with PROFIBUS-DP via the RS485 interface.
- It prepares the data for the electronic modules and motor starters that are fitted.
- It supplies the backplane bus.
- The PROFIBUS-DP address of the ET 200S can be set by means of switches.
- If the 24 VDC power supply is disconnected, the IM151-1 STANDARD interface module is also disconnected.
- The maximum address space is 128 bytes for inputs and 128 bytes for outputs.
- The reference potential M of the rated supply voltage of the IM151-1 STANDARD to the rail (protective conductor) is connected by means of an RC combination, thus permitting an ungrounded configuration.
- It can be operated as a DPV0 slave.
- A maximum of 63 modules can be operated with the IM151-1 STANDARD.
- The maximum bus length is 2 m (can be set).
- Supports option handling (see Section 3.8) and the status byte for power modules.

Terminal assignment

The following table shows the terminal assignment of the IM151-1 STANDARD interface module for the 24 VDC voltage supply and PROFIBUS-DP:

Table 9-6 Terminal assignment of the IM151-1 STANDARD interface module

View	Signal name		Designation
	1	–	–
	2	–	–
	3	RxD/TxD-P	Data line B
	4	RTS	Request To Send
	5	M5V2	Data reference potential (station)
	6	P5V2	Supply plus (station)
	7	–	–
	8	RxD/TxD-N	Data line A
	9		
	1L+		24 VDC
	2L+		24 VDC (for loop through)
	1M		Chassis ground
	2M		Ground (for loop through)

Block diagram

Figure 9-2 Block diagram for the IM151-1 STANDARD interface module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	45 x 119.5 x 75
Weight	Approx. 150 g
Data for specific modules	
Transmission rate	9.6; 19.2; 45.45; 93.75; 187.5; 500 kbps, 1.5 ; 3; 6; 12 Mbps
Bus protocol	PROFIBUS-DP
Interface	RS 485
SYNC capability	Yes
FREEZE capability	Yes
Manufacturer ID	$806A_H$
Direct communication	Yes
Clocking	No
Max. output current of the PROFIBUS-DP interface (5, 6)	80 mA
Voltages, currents, potentials	
Rated supply voltage of the electronic components (1L+) [1]	24 VDC
• Reverse polarity protection	Yes
• Power failure bypass	Min. 20 ms
Isolation	
• Between the backplane bus and electronic components	No
• Between the PROFIBUS-DP and electronic components	Yes
• Between the supply voltage and electronic components	No
Permitted potential difference (to the rail)	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption from rated supply voltage (1L+)	Approx. 200 mA
Power dissipation of the module	Typ. 3.3 W
Status, interrupts, diagnostics	
Interrupts	None
Diagnostic function	Yes
• Group error	Red “SF” LED
• PROFIBUS-DP bus monitoring	Red “BF” LED
• Monitoring of the power supply voltage of the electronics	Green “ON” LED

1) Fusing the supply voltage:
– Fuse type: 24 V/2.5 A /type C
– Inrush current: 3.5 A

9.4 IM151-1 FO STANDARD interface module (6ES7151-1AB02-0AB0)

Order number

6ES7151-1AB02-0AB0

Features

The IM151-1 FO STANDARD interface module has the following features:

- It connects the ET 200S with PROFIBUS-DP via the fiber-optic cable interface
- It prepares the data for the electronic modules and motor starters that are fitted.
- It supplies the backplane bus.
- The PROFIBUS-DP address of the ET 200S can be set by means of switches.
- If the 24 VDC power supply is disconnected, the IM151-1 FO STANDARD interface module is also disconnected.
- The maximum address space is 128 bytes for inputs and 128 bytes for outputs.
- The reference potential M of the supply voltage of the IM151-1 FO STANDARD to the rail (protective conductor) is connected by means of an RC combination, thus permitting an ungrounded configuration.
- It can be operated as a DPV0 slave.
- A maximum of 63 modules can be operated with the IM151-1 FO STANDARD.
- The maximum bus length is 2 m (can be set).
- Supports option handling (see Section 3.8) and the status byte for power modules.

Terminal assignment

The following table shows the terminal assignment of the IM151-1 FO STANDARD interface module for the 24 VDC voltage supply and PROFIBUS-DP with fiber-optic cable interface:

Table 9-7 Terminal assignment of the IM151-1 FO STANDARD interface module

View	Signal name	Designation
	1L+	24 VDC
	2L+	24 VDC (for loop through)
	1M	Chassis ground
	2M	Ground (for loop through)

Block diagram

Figure 9-3 Block diagram for the IM151-1 FO STANDARD interface module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	45 x 119.5 x 75
Weight	Approx. 150 g
Data for specific modules	
Transmission rate	9.6, 19.2, 45.45, 93.75, 187.5, 500 kbps 1.5, 12 Mbps
Bus protocol	PROFIBUS-DP
Interface	Fiber-optic cable
SYNC capability	Yes
FREEZE capability	Yes
Manufacturer ID	$806B_H$
Direct communication	Yes
Clocking	No
Voltages, currents, potentials	
Rated supply voltage of the electronic components (1L+) [1]	24 VDC
• Reverse polarity protection	Yes
• Power failure bypass	Min. 20 ms
Isolation	
• Between the backplane bus and electronic components	No
• Between the supply voltage and electronic components	No
Current consumption from rated supply voltage (1L+)	Approx. 200 mA
• Power supply for the ET 200S backplane bus	Max. 700 mA
Power dissipation of the module	Typ. 3.3 W

Status, interrupts, diagnostics	
Interrupts	None
Diagnostic function	Yes
• Group error	Red “SF” LED
• PROFIBUS-DP bus monitoring	Red “BF” LED
• Monitoring of the power supply voltage of the electronics	Green “ON” LED

1) Fusing the supply voltage:
– Fuse type: 24 V/2.5 A /type C
– Inrush current: 3.5 A

9.5 IM151-1 HIGH FEATURE interface module (6ES7151-1BA00-0AB0)

Order number

6ES7151-1BA00-0AB0

Features

The IM151-1 HIGH FEATURE interface module has the following features:

- It connects the ET 200S with PROFIBUS-DP.
- It prepares the data for the electronic modules and motor starters that are fitted.
- It supplies the backplane bus.
- It can be synchronized with the DP cycle (clocking).
- The firmware can be updated via PROFIBUS-DP using HWCONFIG.
- The PROFIBUS-DP address of the ET 200S can be set by means of switches.
- If the 24 VDC power supply is disconnected, the IM151-1 HIGH FEATURE interface module is also disconnected.
- The maximum address space is 244 bytes for inputs and 244 bytes for outputs.
- The reference potential M of the rated supply voltage of the IM151-1 HIGH FEATURE to the rail (protective conductor) is connected by means of an RC combination, thus permitting an ungrounded configuration.
- It can be operated as a DPV0 slave.
  - Acyclic data exchange (read/write data record): class 2 services (e.g. updating firmware)
- It can be operated as a DPV1 slave.
  - Acyclic data exchange (read/write data record): class 2 services (e.g. updating firmware) and class 1 services
  - Diagnostic interrupts
  - Hardware interrupts
  - Insert/remove-module interrupts
- A maximum of 63 modules can be operated with the IM151-1 HIGH FEATURE.
- The maximum bus length is 1 m.

Terminal assignment

The following table shows the terminal assignment of the IM151-1 HIGH FEATURE interface module for the 24 VDC voltage supply and PROFIBUS-DP:

Table 9-8 Terminal assignment of the IM151-1 HIGH FEATURE interface module

View	Signal name		Designation
	1	–	–
	2	–	–
	3	RxD/TxD-P	Data line B
	4	RTS	Request To Send
	5	M5V2	Data reference potential (station)
	6	P5V2	Supply plus (station)
	7	–	–
	8	RxD/TxD-N	Data line A
	9		
	1L+		24 VDC
	2L+		24 VDC (for loop through)
	1M		Chassis ground
	2M		Ground (for loop through)

Block diagram

Figure 9-4 Block diagram for the IM151-1 HIGH FEATURE interface module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	45 x 119.5 x 75
Weight	Approx. 150 g
Data for specific modules	
Transmission rate	9.6; 19.2; 45.45; 93.75; 187.5; 500 kbps, 1.5 ; 3; 6; 12 Mbps
Bus protocol	PROFIBUS-DP
Interface	RS 485
SYNC capability	Yes
FREEZE capability	Yes
Manufacturer ID	$80E0_H$
Direct communication	Yes
Clocking	Yes[1)]
Max. output current of the PROFIBUS-DP interface (5, 6)	80 mA
Voltages, currents, potentials	
Rated supply voltage of the electronic components (1L+) [2)]	24 VDC
• Reverse polarity protection	Yes
• Power failure bypass	Min. 20 ms
Isolation	
• Between the backplane bus and electronic components	No
• Between the PROFIBUS-DP and electronic components	Yes
• Between the supply voltage and electronic components	No
Permitted potential difference (to the rail)	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption from rated supply voltage (1L+)	Approx. 200 mA
Power dissipation of the module	Typ. 3.3 W
Status, interrupts, diagnostics	
Interrupts	Yes
Diagnostic function	Yes
• Group error	Red “SF” LED
• PROFIBUS-DP bus monitoring	Red “BF” LED
• Monitoring of the power supply voltage of the electronics	Green “ON” LED

1) As of 1.5 Mbps

2) Fusing the supply voltage:
– Fuse type: 24 V/2.5 A /type C
– Inrush current: 3.5 A

Updating the firmware of the IM151-1 HIGH FEATURE

Features

- As of STEP 7 V5.1, ServicePack 3, you can update the firmware of the IM151-1 HIGH FEATURE.
- To update the firmware you receive files (*.UPD) with the current firmware.

Requirements

- The IM151-1 HIGH FEATURE in the station whose firmware is to be updated must be accessible online.
- The files with the current firmware version must be available in the file system of your programming device (PG)/PC.

Procedure

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

Note

We recommend you update the firmware using PROFIBUS-DP.

Restrictions when operating the modules with the IM 151 High Feature

The following modules cannot be used with the IM 151 High Feature:

Module	Up to order number	Up to product version
1Count 24V/100kHz	6ES7138-4DA02-0AB0	1
1Count 5V/500kHz	6ES7138-4DE00-0AB0	1
1SSI	6ES7138-4DB00-0AB0	3
1STEP 5V/204kHz	6ES7138-4DC00-0AB0	3
1SI serial interface module	6ES7138-4DF00-0AB0	1
Modbus/USS serial interface module	6ES7138-4DF10-0AB0	1
2AI U High Feature	6ES7134-4LB00-0AB0	1
2AI I 2/4DMU High Feature	6ES7134-4MB00-0AB0	1
2AO U High Feature	6ES7135-4LB00-0AB0	1

Terminal Modules

10

Chapter overview

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Terminal modules and the electronic modules for which they are suitable

The following table describes which electronic modules you can use with the different terminal modules:

Table 10-1 Assignment of TM-P terminal modules and power modules

Power modules	**TM-P terminal modules for power modules**			
Screw-type term. →	**15S23-A1**	**15S23-A0**	**15S22-01**	**30S44-A0**
Order number 6ES7193... →	4CC20-0AA0	4CD20-0AA0	4CE00-0AA0	4CK20-0AA0
Spring terminal: →	**15C23-A1**	**15C23-A0**	**15C22-01**	**30C44-A0**
Order number 6ES7193... →	4CC30-0AA0	4CD30-0AA0	4CE10-0AA0	4CK30-0AA0
Fast Connect →	**15N23-A1**	**15N23-A0**	**15N22-01**	---
Order number 6ES7193... →	4CC70-0AA0	4CD70-0AA0	4CE60-0AA0	
PM-E 24 VDC	●	●	●	
PM-E 24–48 VDC	●	●	●	
PM-E 24–48 VDC/ 120–230 VAC	●	●	●	
PM-E F 24 VDC PROFIsafe				●

Table 10-2 Assignment of TM-E terminal modules and electronic modules

Electronic modules	**TM-E terminal modules for electronic modules**						
Screw-type term. →	**15S26-A1**	**15S24-A1**	**15S24-01**	**15S23-01**	**15S24-AT**	**30S44-01**	**30S46-A1**
Order number 6ES7193... →	4CA40-0AA0	4CA20-0AA0	4CB20-0AA0	4CB00-0AA0	4CL20-0AA0	4CG20-0AA0	4CF40-0AA0
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**	**30C46-A1**
Order number 6ES7193... →	4CA50-0AA0	4CA30-0AA0	4CB30 -0AA0	4CB10-0AA0	4CL30-0AA0	4CG30-0AA0	4CF50-0AA0
Fast Connect →	**15N26-A1**	**15N24-A1**	**15N24-01**	**15N23-01**	---	---	---
Order number 6ES7193... →	4CA80-0AA0	4CA70-0AA0	4CB70-0AA0	4CB60-0AA0			
2DI 24 VDC Standard 2DI 24 VDC High Feature 4DI 24 VDC Standard 4DI 24 VDC High Feature 4DI 24 VDC/SRC Standard	●	●	●	●			
4DI 24–48 VUC High Feature	●	●	●	●			
4DI NAMUR	●	●	●	●			
2DI 120 VAC Standard	●	●	●	●			
2DI 230 VAC Standard	●	●	●	●			

Table 10-2 Assignment of TM-E terminal modules and electronic modules, continued

Electronic modules	TM-E terminal modules for electronic modules						
Screw-type term. →	**15S26-A1**	**15S24-A1**	**15S24-01**	**15S23-01**	**15S24-AT**	**30S44-01**	**30S46-A1**
Order number 6ES7193... →	4CA40-0AA0	4CA20-0AA0	4CB20-0AA0	4CB00-0AA0	4CL20-0AA0	4CG20-0AA0	4CF40-0AA0
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**	**30C46-A1**
Order number 6ES7193... →	4CA50-0AA0	4CA30-0AA0	4CB30-0AA0	4CB10-0AA0	4CL30-0AA0	4CG30-0AA0	4CF50-0AA0
Fast Connect →	**15N26-A1**	**15N24-A1**	**15N24-01**	**15N23-01**	---	---	---
Order number 6ES7193... →	4CA80-0AA0	4CA70-0AA0	4CB70-0AA0	4CB60-0AA0			
2DO 24 VDC/0.5 A Standard 2DO 24 VDC/0.5 A High Feature 4DO 24 VDC/0.5 A Standard	●	●	●	●			
2DO 24 VDC/2 A Standard 2DO 24 VDC/2 A High Feature 4DO 24 VDC/2 A Standard	●	●	●	●			
2DO 24–230 VAC/2 A	●	●	●	●			
2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A 2RO NO/NC 24–48 VDC/5 A, 24–230 VAC/5 A	●	●	●	●			
2AI U Standard 2AI U High Feature 2AI U High Speed	●	●	●	●			
2AI I 2WIRE Standard 2AI I 2WIRE High Speed	●	●	●	●			
2AI 2/4WIRE High Feature	●		●				
2AI I 4WIRE Standard, 2AI I 4WIRE High Speed	●		●				
2AI RTD Standard	●		●				
2AI RTD High Feature	●	●	●	●			
2AI TC Standard	●	●	●	●			
2AI TC High Feature					●		
2AO U Standard 2AO U High Feature	●		●				

Table 10-2 Assignment of TM-E terminal modules and electronic modules, continued

Electronic modules	TM-E terminal modules for electronic modules						
Screw-type term. →	**15S26-A1**	**15S24-A1**	**15S24-01**	**15S23-01**	**15S24-AT**	**30S44-01**	**30S46-A1**
Order number 6ES7193... →	4CA40-0AA0	4CA20-0AA0	4CB20-0AA0	4CB00-0AA0	4CL20-0AA0	4CG20-0AA0	4CF40-0AA0
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**	**30C46-A1**
Order number 6ES7193... →	4CA50-0AA0	4CA30-0AA0	4CB30-0AA0	4CB10-0AA0	4CL30-0AA0	4CG30-0AA0	4CF50-0AA0
Fast Connect →	**15N26-A1**	**15N24-A1**	**15N24-01**	**15N23-01**	---	---	---
Order number 6ES7193... →	4CA80-0AA0	4CA70-0AA0	4CB70-0AA0	4CB60-0AA0			
2AO I Standard 2AO I High Feature	●	●	●	●			
4 IQ-SENSE	●		●				
1Count 24V/100kHz	●		●				
1Count 5V/500kHz						●	
1SSI	●		●				
1STEP 5V/204kHz	●		●				
2PULSE	●		●				
1POS INC/Digital						●	
1POS SSI/Digital						●	
1POS INC/Analog						●	
1POS SSI/Analog						●	
1SI 3964/ASCII	●		●				
1SI Modbus/USS	●		●				
4/8 F-DI 24 VDC*						●	●
4 F-DO 24 VDC/2A*						●	●
RESERVE (width 15 mm)	●	●	●	●	●		
RESERVE (width 30 mm)						●	●

* See the *ET 200S Distributed I/O System, Fail-Safe Modules* manual in the *S7 F Systems* and *S7 Distributed Safety* documentation packages

10.1 TM-P15S23-A1, TM-P15C23-A1, and TM-P15N23-A1 terminal modules (6ES7193-4CCx0-0AA0)

Order number

6ES7193 4CC20-0AA0 (screw-type terminal)
6ES7193 4CC30-0AA0 (spring terminal)
6ES7193 4CC70-0AA0 (Fast Connect)

Features

- Terminal module for power module
- Infeed for a new potential group up to the next TM-P terminal module
- Connection by means of screw-type terminal with the TM-P15S23-A1
- Connection by means of spring terminal with the TM-P15C23-A1
- Connection via Fast Connect with the TM-P15N23-A1
- 2 x 3 terminals
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Uninterrupted AUX1 bus with connection to terminals A4 and A8

Terminal assignment

The following table shows the terminal assignment of the terminal module:

Table 10-3 Terminal assignment of the TM-P15S23-A1, TM-P15C23-A1, and TM-P15N23-A1 terminal modules

View	Terminal		Designation
	2	L+/L	Rated load voltage for inserted power module and associated potential group
	3	M/ N	
	A 4	AUX1	Any connection for PE or voltage bus up to the maximum rated load voltage of the module
	6	L+/L	Rated load voltage for inserted power module and associated potential group
	7	M/ N	
	A 8	AUX1	Any connection for PE or voltage bus up to the maximum rated load voltage of the module

Block diagram

Figure 10-1 Block diagram of the TM-P15S23-A1, TM-P15C23-A1, and TM-P15N23-A1 terminal modules

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	
• Screw-type/spring terminals	15 x 132 x 43
• Fast Connect	15 x 162 x 43
Weight	Approx. 65 g
Data for specific modules	
Number of terminals	2 x 3

10.2 TM-P15S23-A0, TM-P15C23-A0, and TM-P15N23-A0 terminal modules (6ES7193-4CDx0-0AA0)

Order number

6ES7193-4CD20-0AA0 (screw-type terminal)
6ES7193-4CD30-0AA0 (spring terminal)
6ES7193-4CD70-0AA0 (Fast Connect)

Features

- Terminal module for power module
- Infeed for a new potential group up to the next TM-P terminal module
- Connection by means of screw-type terminal with the TM-P15S23-A0
- Connection by means of spring terminal with the TM-P15C23-A0
- Connection via Fast Connect with the TM-P15N23-A0
- 2 x 3 terminals
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Interrupted AUX1 bus with connection to terminals A4 and A8

Table 10-4 Terminal assignment of the TM-P15S23-A0, TM-P15C23-A0, and TM-P15N23-A0 terminal modules

View	Terminal		Designation
	2	L+/L	Rated load voltage for inserted power module and associated potential group
	3	M/ N	
	A 4	AUX1	Any connection for PE or voltage bus up to the maximum rated load voltage of the module
	6	L+/L	Rated load voltage for inserted power module and associated potential group
	7	M/ N	
	A 8	AUX1	Any connection for PE or voltage bus up to the maximum rated load voltage of the module

Block diagram

Figure 10-2 Block diagram for the TM-P15S23-A0, TM-P15C23-A0, and TM-P15N23-A0 terminal modules

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	
• Screw-type/spring terminals	15 x 132 x 43
• Fast Connect	15 x 162 x 43
Weight	Approx. 65 g
Data for specific modules	
Number of terminals	2 x 3

10.3 TM-P15S22-01, TM-P15C22-01, and TM-P15N22-01 terminal modules (6ES7193-4CEx0-0AA0)

Order number

6ES7193-4CE00-0AA0 (screw-type terminal)
6ES7193-4CE10-0AA0 (spring terminal)
6ES7193-4CE60-0AA0 (Fast Connect)

Features

- Terminal module for power module
- Infeed for a new potential group up to the next TM-P terminal module
- Connection by means of screw-type terminal with the TM-P15S22-01
- Connection by means of spring terminal with the TM-P15C22-01
- Connection via Fast Connect with the TM-P15N22-01
- 2 x 2 terminals
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Uninterrupted AUX1 bus without a connection to the terminals

Terminal assignment

The following table shows the terminal assignment of the terminal module:

Table 10-5 Terminal assignment of the TM-P15S22-01, TM-P15C22-01, and TM-P15N22-01 terminal modules

View	Signal name		Designation
	2	L+/L	Rated load voltage for inserted power module and associated potential group
	3	M/ N	
	6	L+/L	Rated load voltage for inserted power module and associated potential group
	7	M/ N	

Block diagram

Figure 10-3 Block diagram for the TM-P15S22-01, TM-P15C22-01, and TM-P15N22-01 terminal modules

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	
• Screw-type/spring terminals	15 x 119.5 x 43
• Fast Connect	15 x 142 x 43
Weight	Approx. 55 g
Data for specific modules	
Number of terminals	2 x 3

10.4 TM-P30S44-A0 and TM-P30C44-A0 terminal modules (6ES7193-4CKx0-0AA0)

Order number

6ES7193-4CK20-0AA0 (screw-type terminal)
6ES7193-4CK30-0AA0 (spring terminal)

Features

- Terminal module for the fail-safe PM-E F 24 VDC PROFIsafe power module
- Infeed for a new potential group up to the next TM-P terminal module
- Wiring of the fail-safe digital outputs of the PM-E F 24 VDC PROFIsafe
- Prewiring possible
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Interrupted AUX1 bus with connection to terminals A4 and A8

Terminal assignment

The following table shows the terminal assignment of the terminal module:

Table 10-6 Terminal assignment of the TM-P30S44-A0 and TM-P30C44-A0 terminal module

View	Terminal		Designation
	2	24 VDC	Load voltage of 24 VDC for: inserted power module and associated potential group. DO 0 and DO 1 and P1 and P2 voltage buses
	3	M	Chassis ground
	A 4	AUX 1	Any connection for PE or voltage bus up to the maximum rated load voltage of the module
	6	24 VDC	Load voltage of 24 VDC for: inserted power module and associated potential group. DO 0 and DO 1 and P1 and P2 voltage buses
	7	M	Chassis ground
	A 8	AUX 1	Any connection for PE or voltage bus up to the maximum rated load voltage of the module
	9	DO 0 P	Connections for fail-safe digital output 0 (switching to P/M potential)
	10	DO 0 M	
	11	DO 2 P	Connections (relay contacts) for fail-safe switching of the voltage buses P1 and P2. P1 and P2 can also be used as DO 2 M and DO 2 P (for a diagram of the wiring, see the *ET 200S Fail-Safe Modules manual).*
	12	DO 2 M	
	13	DO 1 P	Connections for fail-safe digital output 0 (switching to P/M potential)
	14	DO 1 M	
	15	DO 2 P	Connections (relay contacts) for fail-safe switching of the voltage buses P1 and P2. P1 and P2 can also be used as DO 2 M and DO 2 P (for a diagram of the wiring, see the *ET 200S Fail-Safe Modules manual).*
	16	DO 2M	

Caution

If high currents occur at DO 2 P and DO 2 M, you must wire terminals 11 and 15 (DO 2 P) and 12 and 16 (DO 2 M) in parallel.
Otherwise, the temperature of the terminals cannot be prevented from rising due to the current load.

Block diagram

Figure 10-4 Block diagram of the TM-P30S44-A0 and TM-P30C44-A0 terminal module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	30 x 132 x 43
Weight	Approx. 116 g (TM-P30S44-A0) Approx. 100 g (TM-P30C44-A0)
Data for specific modules	
Number of terminals	14

Description of the PM-E F 24 VDC PROFIsafe power module

You can find a description of the PM-E F DC 24V PROFIsafe power module you can use with the above terminal modules in the *ET 200S Distributed I/O, Fail-Safe Modules* manual in the *S7 F Systems* and *S7 Distributed Safety* documentation packages

10.5 TM-PF30S47-F1 terminal module (for PM-D F 24 VDC) (3RK1-903-3AA00)

Order number

3RK1 903-3AA00 (screw-type terminal)

Features

- Terminal module for the fail-safe PM-D F 24 VDC PROFIsafe power module
- Infeed for a new potential group up to the next TM-P terminal module
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Uninterrupted AUX1 bus without a connection to the terminals

Terminal assignment

The following table shows the terminal assignment of the terminal module:

Table 10-7 Terminal assignment of the TM-PF30S47-F1 terminal module

View	Terminal		Designation
	20	24 VDC	Rated load voltage of 24 VDC: for inserted power module and voltage buses SG 1 to SG 6 and U 1
	21	M	Chassis ground
	27	24 VDC	Rated load voltage of 24 VDC: for inserted power module and voltage buses SG 1 to SG 6 and U 1
	28	M	Chassis ground

Block diagram

Figure 10-5 Block diagram of the TM-PF30S47-F1 terminal module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	30 x 196.5 x 102
Weight	Approx. 300 g
Data for specific modules	
Number of terminals	4

10.6 TM-E15S26-A1, TM-E15C26-A1, and TM-E15N26-A1 universal terminal modules (6ES7193-4CAx0-0AA0)

Order number

6ES7193-4CA40-0AA0 (screw-type terminal)
6ES7193-4CA50-0AA0 (spring terminal)
6ES7193-4CA80-0AA0 (Fast Connect)

Features

- Universal terminal module for the electronic modules
- Connection by means of screw-type terminal with the TM-E15S26-A1
- Connection by means of spring terminal with the TM-E15C26-A1
- Connection via Fast Connect with the TM-E15N26-A1
- 2 x 6 terminals
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Uninterrupted AUX1 bus with connection to terminals A4, A8 and A3, A7

Terminal assignment

- Terminal assignment of the TM-E15S26-A1, TM-E15C26-A1, and TM-E15N26-A1 terminal modules with the 4-channel digital electronic modules:

View	Terminal		Designation
	1	DI_0/DO_0	DI: Digital input DO: Digital output 24 VDC: Sensor supply M: Ground, load power supply
	2	DI_2/DO_2	
	3	24 VDC for DI_0/ M for DO_0	
	4	24 VDC for DI_2/ M for DO_2	
	5	DI_1/ DO_1	
	6	DI_3/ DO_3	
	7	24 VDC for DI_1/ M for DO_1	
	8	24 VDC for DI_3/ M for DO_3	
	A 4	AUX1 bus fed through. Connection to terminals A4, A8 and A3, A7.	
	A 3		
	A 8		
	A 7		

- Terminal assignment of the TM-E15S26-A1, TM-E15C26-A1, and TM-E15N26-A1 terminal modules with the 2-channel electronic modules and technology modules:

  The terminal assignment of terminals 1 to 8 corresponds to that of the TM-E15S24-01, TM-E15C24-01, and TM-E15N24-01 terminal modules. You will find the various terminal assignments in the technical specifications of the different electronic modules.

  You can obtain the terminal assignment of terminals A4, A8 and A3, A7 from the above table.

Block diagram

Figure 10-6 Block diagram for the TM-E15S26-A1, TM-E15C26-A1, and TM-E15N26-A1 terminal modules

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	
• Screw-type/spring terminals	15 x 157 x 43
• Fast Connect	15 x 202 x 43
Weight	Approx. 70 g (TM-E15C26-A1) Approx. 83 g (TM-E15S26-A1) Approx. 95 g (TM-E15NS26-A1)
Data for specific modules	
Number of terminals	2 x 6

10.7 TM-E15S24-A1, TM-E15C24-A1, and TM-E15N24-A1 terminal modules (6ES7193-4CAx0-0AA0)

Order number

6ES7193-4CA20-0AA0 (screw-type terminal)
6ES7193-4CA30-0AA0 (spring terminal)
6ES7193-4CA70-0AA0 (Fast Connect)

Features

- Terminal module for electronic modules
- Connection by means of screw-type terminal with the TM-E15S24-A1
- Connection by means of spring terminal with the TM-E15C24-A1
- Connection via Fast Connect with the TM-E15N24-A1
- 2 x 4 terminals
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Uninterrupted AUX1 bus with connection to terminals A4 and A8

Terminal assignment

The following table shows the terminal assignment of the terminal module:

Table 10-8 Terminal assignment of the TM-E15S24-A1, TM-E15C24-A1, and TM-E15N24-A1 terminal modules

View	Terminal		Designation
	1	The assignment depends on which electronic module is inserted	
	2		
	3		
	A 4	AUX1	Any connection for PE or voltage bus up to the maximum rated load voltage of the module
	5	The assignment depends on which electronic module is inserted	
	6		
	7		
	A 8	AUX1	Any connection for PE or voltage bus up to the maximum rated load voltage of the module

Block diagram

Figure 10-7 Block diagram for the TM-E15S24-A1, TM-E15C24-A1, and TM-E15N24-A1 terminal modules

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	
• Screw-type/spring terminals	15 x 132 x 43
• Fast Connect	15 x 162 x 43
Weight	Approx. 65 g (TM-E15S24-A1 and TM-E15C24-A1) Approx. 72 g (TM-E15N24-A1)
Data for specific modules	
Number of terminals	2 x 4

10.8 TM-E15S24-01, TM-E15C24-01, and TM-E15N24-01 terminal modules (6ES7193-4CBx0-0AA0)

Order number

6ES7193-4CB20-0AA0 (screw-type terminal)
6ES7193-4CB30-0AA0 (spring terminal)
6ES7193-4CB70-0AA0 (Fast Connect)

Features

- Terminal module for electronic modules
- Connection by means of screw-type terminal with the TM-E15S24-01
- Connection by means of spring terminal with the TM-E15C24-01
- Connection via Fast Connect with the TM-E15N24-01
- 2 x 4 terminals
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Uninterrupted AUX1 bus without connection to terminals 4 and 8

Terminal assignment

The following table shows the terminal assignment of the terminal module:

Table 10-9 Terminal assignment of the TM-E15S24-01, TM-E15C24-01, and TM-E15N24-01 terminal modules

View	Terminal	Designation
	1	The assignment depends on which electronic module is inserted
	2	No access to the AUX1 bus.
	3	Terminals not used by the electronic module can be used for unneeded connecting wires. The permitted potential corresponds to the potential of the electronic module used.
	4	
	5	
	6	
	7	
	8	

Block diagram

Figure 10-8 Block diagram for the TM-E15S24-01, TM-E15C24-01, and TM-E15N24-01 terminal modules

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	
• Screw-type/spring terminals	15 x 132 x 43
• Fast Connect	15 x 162 x 43
Weight	Approx. 65 g (TM-E15S24-01 and TM-E15C24-01) Approx. 72 g (TM-E15N24-01)
Data for specific modules	
Number of terminals	2 x 4

10.9 TM-E15S23-01, TM-E15C23-01, and TM-E15N23-01 terminal modules (6ES7193-4CBx0-0AA0)

Order number

6ES7193-4CB00-0AA0 (screw-type terminal)
6ES7193-4CB10-0AA0 (spring terminal)
6ES7193-4CB60-0AA0 (Fast Connect)

Features

- Terminal module for electronic modules
- Connection by means of screw-type terminal with the TM-E15S23-01
- Connection by means of spring terminal with the TM-E15C23-01
- Connection via Fast Connect with the TM-E15N23-01
- 2 x 3 terminals
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Uninterrupted AUX1 bus without a connection to the terminals

Terminal assignment

The following table shows the terminal assignment of the terminal module:

Table 10-10 Terminal assignment of the TM-E15S23-01, TM-E15C23-01, and TM-E15N23-01 terminal modules

View	Terminal	Designation
	1	The assignment depends on which electronic module is inserted
	2	
	3	No access to the AUX1 bus.
	5	
	6	
	7	

Block diagram

Figure 10-9 Block diagram for the TM-E15S23-01, TM-E15C23-01, and TM-E15N23-01 terminal modules

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	
• Screw-type/spring terminals	15 x 120 x 43
• Fast Connect	15 x 142 x 43
Weight	Approx. 55 g (TM-E15S23-01 and TM-E15C23-01) Approx. 60 g (TM-E15N23-01)
Data for specific modules	
Number of terminals	2 x 3

10.10 TM-E15S24-AT and TM-E15C24-AT terminal modules (6ES7193-4CLx0-0AA0)

Order number

6ES7193-4CL20-0AA0 (screw-type terminal)
6ES7193-4CL30-0AA0 (spring terminal)

Features

- Terminal module for the 2AI TC High Feature electronic module

Caution

You can only insert the 2AI TC HF electronic module into the TM-E15S24-AT/TM-E15C24-AT terminal module. Inserting another electronic module can result in the destruction of the internal reference junction of the terminal module.

- Terminal module has an internal reference junction for temperature compensation. Temperature compensation is thus possible directly at the reference junction of the thermocouples.
- Connection by means of screw-type terminal with the TM-E15S24-AT
- Connection by means of spring terminal with the TM-E15C24-AT
- 2 x 2 terminals
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Uninterrupted AUX1 bus without connection to terminals 4 and 8

Terminal assignment

The following table shows the terminal assignment of the terminal module:

Table 10-11 Terminal assignment of the TM-E15S24-AT and TM-E15C24-AT terminal module

View	Terminal	Designation
	1	Assignment: See the 2AI TC High Feature electronic module
	2	
	3	Not available
	4	
	5	Assignment: See the 2AI TC High Feature electronic module
	6	
	7	Not available
	8	

Block diagram

Figure 10-10 Block diagram of the TM-E15S24-AT and TM-P15C24-AT terminal module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 132 x 43
Weight	Approx. 55 g
Data for specific modules	
Number of terminals	2 x 2

Note

You will find the accuracy information on the internal reference junction in Section 13.16.

10.11 TM-E30S44-01 and TM-E30C44-01 terminal modules (6ES7193-4CGx0-0AA0)

Order number

6ES7193-4CG20-0AA0 (screw-type terminal)
6ES7193-4CG30-0AA0 (spring terminal)

Features

- Terminal module for electronic modules with a width of 30 mm and fail-safe electronic modules
- Connection by means of screw-type terminal with the TM-E30S44-01
- Connection by means of spring terminal with the TM-E30C44-01
- 4 x 4 terminals
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Uninterrupted AUX1 bus without a connection to terminals 4 and 8 or 12 and 16.

Terminal assignment

The following table shows the terminal assignment of the terminal module:

Table 10-12 Terminal assignment of the TM-E30S44-01 and TM-E30C44-01 terminal module

View	Terminal	Designation
	1	The assignment depends on which electronic module is inserted No access to the AUX1 bus. Terminals not used by the electronic module can be used for unneeded connecting wires. The permitted potential corresponds to the potential of the electronic module used.
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
	12	
	13	
	14	
	15	
	16	

Block diagram

Figure 10-11 Block diagram of the TM-E30S44-01 and TM-E30C44-01 terminal module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	30 x 132 x 43
Weight	Approx. 110 g (TM-E30C44-01) Approx. 125 g (TM-E30S44-01)
Data for specific modules	
Number of terminals	4 x 4

10.12 TM-E30S46-A1 and TM-E30C46-A1 terminal modules (6ES7193-4CFx0-0AA0)

Order number

6ES7193-4CF40-0AA0 (screw-type terminal)
6ES7193-4CF50-0AA0 (spring terminal)

Features

- Terminal module for the fail-safe electronic modules 4/8 F-DI 24 VDC PRFOFIsafe and 4 F-DO 24 VDC/2A PROFIsafe.
- Connection by means of screw-type terminal with the TM-E30S46-A1
- Connection by means of spring terminal with the TM-E30C46-A1
- 6 x 4 terminals
- Prewiring of the terminal module
- Noise diversion from the electronic module to the DIN rail by means of spring contact
- Fitting of a shield contact element
- Uninterrupted AUX1 bus with a connection to terminals A4, A8, A3, A7 and A12, A16, A11, A15.

Terminal assignment

The following table shows the terminal assignment of the terminal module:

Table 10-13 Terminal assignment of the TM-E30S46-A1 and TM-E30C46-A1 terminal module

View	Terminal	F-DI	F-DO	Designation
	1	DI 0	DO 0 P	DI: Digital input DO P and DO M: Connection for fail-safe digital output (switching to P/M potential) Vs1: Internal sensor supply 1 for DI 0 to DI 3 Vs2: Internal sensor supply 2 for DI 4 to DI 7
	2	Vs1	DO 0 M	
	3	DI 2	-	
	4	Vs1	-	
	5	DI 1	DO 1 P	
	6	Vs1	DO 1 M	
	7	DI 3	-	
	8	Vs1	-	
	9	DI 4	DO 2 P	
	10	Vs2	DO 2 M	
	11	DI 6	-	
	12	Vs2	-	
	13	DI 5	DO 3 P	
	14	Vs2	DO 3 M	
	15	DI 7	-	
	16	Vs 2	-	
	A4, A3, A8, A7	AUX1		AUX1 bus fed through. Connection to terminals A4, A8 and A3, A7.
	A12; A11, A16, A15	AUX1		AUX1 bus fed through. Connection to terminals A12, A11 and A16, A15.

Block diagram

Figure 10-12 Block diagram of the TM-E30S46-A1 and TM-E30C46-A1 terminal module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	30 x 157 x 43
Weight	Approx. 158 g (TM-E30S46-A1) Approx. 131 g (TM-E30C46-A1)
Data for specific modules	
Number of terminals	6 x 4

Description of the electronic modules

You can find a description of the 4/8 F-DI 24VDC PROFIsafe and 4 F-DO 24 VDC/2A PROFIsafe electronic modules you can use with the above terminal modules in the *ET 200S Distributed I/O Module, Fail-Safe Modules* manual in the *S7 F Systems* and *S7 Distributed Safety* documentation packages.

Power Modules

11

Chapter overview

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11.1 Parameters for power modules

Parameters

The following table describes the parameters of the power modules.

Table 11-1 Parameters for power modules

Power module			Value range	Default	Applica-bility
PM-E 24 VDC	PM-E 24–48 VDC	PM-E 24–48 VDC/ 24–230 VAC			
Diagnos-tics: No load voltage	Diagnos-tics: No load voltage	Diagnostics: No load volt-age	Disable/en-able	Disable	Power mod-ule
——	——	Diagnostics: Fuse blown	Disable/en-able	Disable	Power mod-ule
——	——	Voltage type	DC/AC	DC	Power mod-ule

Diagnostics: No load voltage

You use this parameter to enable a diagnostic message about missing load voltage.

In the absence of load voltage, only the diagnostic message of the affected power module is forwarded to the DP master. The SF error LEDs of all the modules in the affected potential group come on.

Diagnostics: Fuse blown

You use this parameter to enable a diagnostic message about a blown fuse.

In the event of a blown fuse, only the diagnostic message of the affected power module is forwarded to the DP master. The SF error LEDs of all the modules in the affected potential group come on.

Voltage type

You use this parameter to select the load voltage connected to the power module: DC voltage or AC voltage.

The correct diagnosis is thus provided in the event of missing load voltage or a blown fuse.

11.2 PM-E 24 VDC power module (6ES7138-4CA00-0AA0)

Order number

6ES7138-4CA00-0AA0

Features

- The PM-E 24 VDC power module monitors the supply voltage for all the electronic modules in the potential group. The supply voltage is fed in by means of the TM-P terminal module.
- You can use any electronic module in the potential group of the PM-E 24 VDC power module except the 2DI 120 VAC Standard, 2DI 230 VAC Standard and 2DO 24–230 VAC/1 A.

Caution

Only connect the specified rated load voltage of 24 VDC to the TM-P terminal module of the power module.

The connected rated load voltage must correspond to the supply voltage of the electronic modules in the potential group.

- The current status of the power module is stored in the status byte in the process input image (PII). This is updated irrespective of whether the “No Load Voltage” diagnosis has been enabled (see Appendix C).

Terminal assignment

The following table illustrates the terminal assignment of the PM-E 24 VDC power module for the different terminal modules:

Table 11-2 Terminal assignment of the PM-E 24 VDC power module

View	Terminal assignment	Remarks
	TM-P15S23-A1 and PM-E 24 VDC	24 VDC: Rated load voltage M: Chassis ground AUX1: Ground terminal or usable as any voltage bus up to the level of the load voltage.
	TM-P15S23-A0 and PM-E 24 VDC	24 VDC: Rated load voltage M: Chassis ground AUX1: Ground terminal or usable as any voltage bus up to the level of the load voltage. AUX1 is used as PE.
	TM-P15S22-01 and PM-E 24 VDC	24 VDC: Rated load voltage M: Chassis ground

Block diagram

Figure 11-1 Block diagram of the PM-E 24 VDC power module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 35 g

Voltages, currents, potentials	
Rated load voltage	24 VDC
• Overvoltage protection	No
Protection with automatic circuit breakers	Yes, type C tripping characteristics
Max. current-carrying capacity (up to 60 °C)	10 A
• Short-circuit protection	No
Isolation	
• Between rated load voltage and backplane bus	Yes
• Between the power modules	Yes
Insulation tested with	500 VDC
Current consumption	
• From the load voltage L+ (no load)	Max. 4 mA
Power dissipation of the module	Typ. 100 mW

Status, interrupts, diagnostics	
Diagnostic function	Yes
• Group error	Red “SF” LED
• Load voltage monitoring	Green “PWR” LED
• Diagnostic information readable	Yes

11.3 PM-E 24–48 VDC power module (6ES7138-4CA50-0AA0)

Order number

6ES7138-4CA50-0AA0

Features

- The PM-E 24–48 VDC power module monitors the supply voltage for all the electronic modules in the potential group. The supply voltage is fed in by means of the TM-P terminal module.
- You can use all the electronic modules except the 2DI 120 VAC Standard, 2DI 230 VAC Standard and 2DO 24–230 VAC/1 A in the potential group of the PM-E 24–48 VDC power module.
- Control interface (PIQ) and feedback interface (PII) in the process image for option handling (see Appendix C).
- The current status of the power module is stored in the status byte in the process input image (PII). This is updated irrespective of whether the “No Load Voltage” diagnosis has been enabled (see Appendix C).
- The PM-E 24–48 VDC power module is suitable for fail-safe modules.

Caution

Only connect the specified rated load voltage of 24–48 VDC to the TM-P terminal module of the power module.

The connected rated load voltage must correspond to the supply voltage of the electronic modules in the potential group.

Terminal assignment

The following table shows you the terminal assignment of the PM-E 24–48 VDC power module for the different terminal modules:

Table 11-3 Terminal assignment of the PM-E 24–48 VDC power module

View	Terminal assignment	Remarks
		24–48 VDC: Rated load voltage M: Chassis ground AUX1: Ground terminal or usable as any voltage bus up to the level of the load voltage.
		24–48 VDC: Rated load voltage M: Chassis ground AUX1: Ground terminal or usable as any voltage bus up to the level of the load voltage. AUX1 is used as PE.
		24–48 VDC: Rated load voltage M: Chassis ground

Block diagram

Figure 11-2 Block diagram of the PM-E 24–48 VDC power module

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 35 g

Voltages, currents, potentials	
Rated load voltage	24–48 VDC
• Reverse polarity protection	Yes
• Overvoltage protection	No
Protection with automatic circuit breakers	Yes, tripping characteristic B, C
Max. current-carrying capacity (up to 60 °C)	10 A
• Short-circuit protection	No
Isolation	
• Between rated load voltage and backplane bus	Yes
• Between the power modules	Yes
Insulation tested with	500 VDC
Current consumption	
• From the load voltage L+ (no load)	Max. 12 mA
Power dissipation of the module	Typ. 500 mW

Status, interrupts, diagnostics	
Diagnostic function	Yes
• Group error	Red “SF” LED
• Load voltage monitoring	Green “PWR” LED
• Diagnostic information readable	Yes

11.4 PM-E 24–48 VDC, 24–230 VAC power module (6ES7138-4CB10-0AB0)

Order number

6ES7138-4CB10-0AB0

Features

The PM-E 24–48 VDC, 24–230 VAC has the following characteristic features:

- Monitors the supply voltage for all the electronic modules in the potential group. The supply voltage is fed in by means of the TM-P terminal module.
- Can be used universally and can be parameterized for DC and AC load voltage for use with any electronic module.
- Is required at least once for the ET 200S (to the right of the interface module).
- Control interface (PIQ) and feedback interface (PII) in the process image for option handling (see Appendix C).
- The current status of the power module is stored in the status byte in the process input image (PII). This is updated irrespective of whether the “No Load Voltage” diagnosis has been enabled (see Appendix C).
- Is additionally equipped with a replaceable fuse (5 mm x 20 mm).

Figure 11-3 Replacing the fuse

Note

The PM-E 24–48 VDC, 24–230 VAC power module (6ES7138-4CB10-0AB0) is not a direct replacement for the device with the order number 6ES7138-4CB00-0AB0 for AC applications because you have to select either AC or DC supply voltage. In the case of DC applications, the new module is a direct replacement because the default setting of the new parameter is “DC”. If you want to replace the device 6ES7138-4CB00-0AB0 in AC applications, you have to create a new hardware configuration and set the value “AC” for the load voltage type parameter.

If the hardware configuration is not changed for AC applications, the SF status LED remains on all the time. If the “No load voltage” diagnostic interrupt is enabled, several interrupts are activated in each AC cycle. The electronic modules that are connected to the potential group of this PM-E continue to function normally, however.

Terminal assignment

The following table indicates the terminal assignment of the PM-E 24–48 VDC, 24–230 VAC power module for the different terminal modules:

View	Terminal assignment	Remarks
	TM-P15S23-A1 and PM-E 24–48 VDC, 24–230 VAC	24–48 VDC/ L1: Rated load voltage M/ N: Ground/neutral conductor AUX1: Ground terminal or usable as any voltage bus up to the level of the load voltage.
	TM-P15S23-A0 and PM-E 24–48 VDC, 24–230 VAC	24–48 VDC/ L1: Rated load voltage M/ N: Ground/neutral conductor AUX1: Ground terminal or usable as any voltage bus up to the level of the load voltage. AUX1 is used as PE.

View	Terminal assignment	Remarks
		24–48 VDC/ L1: Rated load voltage M/ N: Ground/neutral conductor

Block diagram

Figure 11-4 Block diagram of the PM-E 24–48 VDC, 24–230 VAC

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	34g

Voltages, currents, potentials	
Rated load voltage	24–56.7 VDC 24–48 VAC/ 120–230 VAC
• Overvoltage protection	Yes
Max. current-carrying capacity	10 A
• For 24–56.7 VDC	Up to 30 °C: max. 10 A Up to 40 °C: max. 9 A Up to 60 °C: max. 7 A
• For 24–48/120/230 VAC	Up to 30 °C: max. 8 A Up to 40 °C: max. 7 A Up to 60 °C: max. 5 A
• Short-circuit protection	Yes, IEC 127-2/1, 250 V, 10 A, fast fuse (5 x 20 mm), replaceable[1)]
Isolation	
• Between rated load voltage and backplane bus	Yes
• Between the power modules	Yes
Insulation tested with	1500 VAC
Current consumption	
From the backplane bus	Max. 9.5 mA
• From load voltage L1/L+ (no load)	Max. 9 mA
Power dissipation of the module	Max. 5 W

Status, interrupts, diagnostics	
Diagnostic function	Yes
• Group error	Red “SF” LED
• Load voltage monitoring	Green “PWR” LED
• Fuse	Green “FSG” LED
• Diagnostic information can be displayed	Yes

1) The fuses on this module are only additional fuses. External overcurrent protection (suitable for branch circuits in accordance with the applicable national regulations for electrical engineering) is required in the supply lines of the load circuit.

Digital Electronic Modules

12

Introduction

The range of digital electronic modules (EM) includes input and output modules for 24 VDC. Input and output modules for 120/230 VAC are also available.

A relay module enables the switching of voltages for AC and DC.

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12.1 Parameters for digital electronic modules

Parameters for digital input modules

Table 12-1 Parameters for digital input modules

2DI 24 VDC High Feature	4DI 24 VDC High Feature	4DI 24–48 VUC High Feature	2DI/ 4DI 24 VDC Standard 4DI 24 VDC/SRC Standard 2DI 120 VAC Standard 2DI 230 VAC Standard	Value range	Default	Applicability
Hardware interrupt[3]		—	—	• Disable • Enable	Disable	Module
---		Diagnostic interrupt	—	• Disable • Enable	Disable	Module
Input delay[1]		—	—	• 0.1 ms • 0.5 ms • 3 ms • 15 ms	3 ms	Module
Diagnostics: Short circuit to M[2]		—	—	• Disable • Enable	Disable	Module
---		Diagnostics: Wire break[4]	—	• Disable • Enable	Disable	Module
---		Diagnostics: Fuse defect	—	• Disable • Enable	Disable	Module
---		Diagnostics: Load voltage missing	—	• Disable • Enable	Disable	Module
Trigger for hardware interrupt, rising edge[3]	Trigger for hardware interrupt, rising edge[3]	—	—	• Disable • Enable	Disable	Channel 0
						Channel 1
—						Channel 2
						Channel 3

1) The input delay applies to “0” to “1” and to “1” to “0”.
2) Short circuit of the sensor supply.
3) Can only be parameterized for the IM151-1 High Feature interface module and the IM151-7 CPU
4) If the wire break check is activated, all the unused inputs must be stabilized to prevent them from triggering a module wire break. To do this, connect a resistor between terminal 24/48 V (3, A4, 7, A8) and the free input. The resistor must provide at least 0.5 mA of input current (see “Sensor Switching” in the table of technical specifications). This ensures that sufficient current is flowing to prevent wire break detection.
A sensor must provide a minimum of 0.5 mA in the off state (otherwise a wire break is detected in the off state). Alternatively, a resistor can be connected parallel to the sensor terminals (the current must be at least 0.5 mA).

Parameters for 4DI NAMUR

Table 12-2 Parameters for 4DI NAMUR

4DI NAMUR	Value range	Default	Applicability
Diagnostic interrupt	• Enable • Disable	Disable	Module
Sensor type	• Channel blocked • NAMUR sensor • Open single contact • Single contact, closed, with 10 kΩ • NAMUR changeover contact • Open changeover contact • Changeover contact, closed, with 10 kΩ	Disable	Channel
Pulse extension	• None • 0.5 s • 1 s • 2 s	None	Channel
Diagnostics No sensor supply	• Enable • Disable	Disable	Module
Diagnostics: wire break	• Enable • Disable	Disable	Channel
Diagnostics: wire break	• Enable • Disable	Disable	Channel
Flutter monitoring: Monitoring window*	• 0.5 s • 1 s to 100 s (can be set at increments of 1 s)	0.5 s	Channel
Flutter monitoring: Number of signal changes	• Disable • 2 to 31	Disable	Channel

* The parameters can only be set when the number of signal changes for flutter monitoring is activated

Parameters for digital output modules

Table 12-3 Parameters for digital output modules

2DO 24 VDC/ 0.5 A High Feature	2DO 24–230 VAC/1 A	2RO NO NC 24–48 VDC/5 A 24–230 VAC/ 5 A	2DO/ 4DO 24 VDC/ 0.5 A Standard	Value range	Default	Applicability
2DO 24 VDC/ 2 A High Feature	2RO NO 24–120 VDC/ 5 A 24–230 VAC/5 A		2DO/ 4DO 24 VDC/ 2 A Standard			
Reaction to CPU-/master-STOP			—	• Switch substitute value • Keep last value	Substitute a value	Module
Substitute value [1]			—	• “0” • “1”	“0”	Channel
---				• Disable • Enable	Disable	Module
Diagnostics: Wire break	—			• Disable • Enable	Disable	Channel
Diagnostics: Short-circuit to M	—			• Disable • Enable	Disable	Channel

[1] If the interface module becomes deenergized, the digital output modules will not produce substitute values. The value that is output = 0.

Hardware interrupt

This parameter enables the hardware interrupts for the module.

Input delay

You can use this parameter to suppress signal interference. Changes to the signal are detected once the set time has elapsed.

Trigger for hardware interrupt, rising edge

This parameter allows you to enable a hardware interrupt at a rising edge (of a signal status change) for each channel.

Pulse extension

Pulse extension is a function that changes a digital input signal. A pulse at a digital input is extended to at least the parameterized length. If the input pulse already longer than the parameterized length, the pulse is not changed.

The principle of pulse extension

The following figure uses examples to illustrate how and when input pulses are changed.

Figure 12-1 The principle of pulse extension

Note

If you set a pulse extension for an input channel, this also affects the flutter monitoring enabled for this channel. The signal with a lengthened pulse is the input signal for flutter monitoring. Make sure, therefore, that the parameter assignment for pulse extension and flutter monitoring correspond with one another. By selecting the appropriate values for the parameters you can adapt the functions to suit your process.

Flutter monitoring

Flutter 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 flutter monitoring

You activate flutter monitoring by setting the number of signal changes for flutter monitoring to a value other than zero.

Detecting unusual signal patterns

Each input channel has a parameterized monitoring window. 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 flutter error is detected. If no flutter error is detected within the monitoring window, the monitoring window is started again at the next signal change.

Reporting a flutter error

If a flutter error has occurred, the current signal status is entered in the process image and the value of the signal is set to “invalid”. A flutter 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 fluttering 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 flutter monitoring.

Figure 12-2 The principle of flutter monitoring

12.2 2DI 24 VDC Standard digital electronic module (6ES7131-4BB00-0AA0)

Order number

6ES7131-4BB00-0AA0

Features

- Digital electronic module with two inputs
- Rated input voltage 24 VDC
- Suitable for switches and proximity switches (BEROs)

Terminal assignment

The following table illustrates the terminal assignment of the 2DI 24 VDC Standard for the different terminal modules:

Table 12-4 Terminal assignment of the 2DI 24 VDC Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DI: Input signal 24 VDC: Sensor supply M: Chassis ground
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DI: Input signal 24 VDC: Sensor supply M: Chassis ground Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Table 12-4 Terminal assignment of the 2DI 24 VDC Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DI: Input signal 24 VDC: Sensor supply M: Chassis ground
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 DI: Input signal 24 VDC: Sensor supply M: Chassis ground Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 12-3 Block diagram of the 2DI 24 VDC Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 35 g
Data for specific modules	
Number of inputs	2
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated supply voltage (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption	
• From supply voltage	Dependent on the sensor
Power dissipation of the module	Typ. 0.4 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No

Sensor supply output	
Output voltage	
• With load	Min. L+ (–0.5 V)
Output current	
• Rated value	500 mA
• Permitted range	0 to 500 mA
Data for selecting a sensor	
Input voltage	
• Rated value	24 VDC
• For signal “1”	15 to 30 V
• For signal “0”	-30 to 5 V
Input current	
• At signal “1”	Typ. 7 mA (at 24 V)
Input delay	
• At “0” to “1”	Typ. 3 ms (2.0 to 4.5 ms)
• At “1” to “0”	Typ. 3 ms (2.0 to 4.5 ms)
Input characteristic curve	To IEC 61131, Type 1
Connection of two-wire BEROs	Possible
• Permitted bias current	Max. 1.5 mA

12.3 4DI 24 VDC Standard digital electronic module (6ES7131-4BD00-0AA0)

Order number

6ES7131-4BD00-0AA0

Features

- Digital electronic module with four inputs
- Rated input voltage 24 VDC
- Suitable for switches and proximity switches (BEROs)

Terminal assignment

The following table indicates the terminal assignment of the 4DI 24 VDC Standard for the different terminal modules:

Table 12-5 Terminal assignment of the 4DI 24 VDC Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal 24 VDC: Sensor supply
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DI: Input signal 24 VDC: Sensor supply

Table 12-5 Terminal assignment of the 4DI 24 VDC Standard, continued

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal 24 VDC: Sensor supply
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DI: Input signal 24 VDC: Sensor supply

Block diagram

Figure 12-4 Block diagram of the 4DI 24 VDC Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 35 g
Data for specific modules	
Number of inputs	4
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated supply voltage (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption	
• From supply voltage	Dependent on the sensor
Power dissipation of the module	Typ. 0.7 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No

Sensor supply output	
Output voltage	
• With load	Min. L+ (–0.5 V)
Output current	
• Rated value	500 mA
• Permitted range	0 to 500 mA
Data for selecting a sensor	
Input voltage	
• Rated value	24 VDC
• For signal “1”	15 to 30 V
• For signal “0”	-30 to 5 V
Input current	
• At signal “1”	Typ. 7 mA (at 24 V)
Input delay	
• At “0” to “1”	Typ. 3 ms (2.0 to 4.5 ms)
• At “1” to “0”	Typ. 3 ms (2.0 to 4.5 ms)
Input characteristic curve	To IEC 61131, Type 1
Connection of two-wire BEROs	Possible
• Permitted bias current	Max. 1.5 mA

12.4 4DI 24 VDC/SRC Standard digital electronic module (6ES7131-4BD50-0AA0)

Order number

6ES7131-4BD50-0AA0

Features

- Digital electronic module with four inputs
- Source input
- Rated input voltage 24 VDC
- Suitable for switches and proximity switches (BEROs)

NULLTerminal assignment

The following table indicates the terminal assignment of the 4DI 24 VDC/SRC Standard for the different terminal modules:

Table 12-6 Terminal assignment of the 4DI 24 VDC/SRC Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal M: Sensor supply

Table 12-6 Terminal assignment of the 4DI 24 VDC/SRC Standard, continued

View	Terminal assignment	Remarks
	TM-E15S24-01 and 4DI 24 VDC/SRC Standard	Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DI: Input signal M: Sensor supply
	TM-E15S23-01 and 4DI 24 VDC/SRC Standard	Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal M: Sensor supply
	TM-E15S26-A1 and 4DI 24 VDC/SRC Standard	Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DI: Input signal M: Sensor supply

Block diagram

Figure 12-5 Block diagram of the 4DI 24 VDC/SRC Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 35 g
Data for specific modules	
Number of inputs	4
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated supply voltage (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption	
• From supply voltage	Dependent on the sensor
Power dissipation of the module	Typ. 0.7 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No

Sensor supply output	
Output voltage	
• With load	Max. M +0.5 V
Output current	
• Rated value	500 mA
• Permitted range	0 to 500 mA
Data for selecting a sensor	
Input voltage	
• Rated value	24 VDC
• For signal “1”	-15 to -30 V[1)]
• For signal “0”	30 to -5 V[1)]
Input current	
• At signal “1”	Typ. 7 mA (at 24 V)
Input delay	
• At “0” to “1”	Typ. 3 ms (2.0 to 4.5 ms)
• At “1” to “0”	Typ. 3 ms (2.0 to 4.5 ms)
Input characteristic curve	To IEC 61131, Type 1
Connection of two-wire BEROs	Possible
• Permitted bias current	Max. 1.5 mA

1) Reference potential is L+

12.5 2DI 24 VDC High Feature digital electronic module (6ES7131-4BB00-0AB0)

Order number

6ES7131-4BB00-0AB0

Features

- Digital electronic module with two inputs
- Rated input voltage 24 VDC
- Suitable for switches and proximity switches (BEROs)
- Supports clocked operation

Terminal assignment

The following table illustrates the terminal assignment of the 2DI 24 VDC High Feature for the different terminal modules:

Table 12-7 Terminal assignment of the 2DI 24 VDC High Feature

View	Terminal assignment	Remarks
When there are 4 conductors, AUX1 must be applied to PE.		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DI: Input signal 24 VDC: Sensor supply M: Chassis ground

Table 12-7 Terminal assignment of the 2DI 24 VDC High Feature, continued

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DI: Input signal 24 VDC: Sensor supply M: Chassis ground Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DI: Input signal 24 VDC: Sensor supply M: Chassis ground
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 DI: Input signal 24 VDC: Sensor supply M: Chassis ground Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 12-6 Block diagram of the 2DI 24 VDC High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 35 g
Data for specific modules	
Supports clocked operation	Yes
Number of inputs	2
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated supply voltage (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption	
• From supply voltage	Dependent on the sensor
Power dissipation of the module	Typ. 0.4 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Interrupts	
• Hardware interrupt	Parameters can be assigned
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic information can be displayed	Yes

Sensor supply output	
Output voltage	
• With load	Min. L+ (–0.5 V)
Output current	
• Rated value	500 mA
• Permitted range	0 to 500 mA
Short-circuit protection	Yes, electronic[1)]
Data for selecting a sensor	
Input voltage	
• Rated value	24 VDC
• For signal “1”	11 to 30 V
• For signal “0”	–30 to 5 V
Input current	
• At signal “1”	Typ. 8 mA
Input delay (parameters can be assigned)	
• At “0” to “1”	0.1 ms (0.05 to 0.15 ms) 0.5 ms (0.4 to 0.6 ms) 3 ms (2.7 to 3.3 ms) 15 ms (14.85 to 15.15 ms)
• At “1” to “0”	0.1 ms (0.05 to 0.15 ms) 0.5 ms (0.4 to 0.6 ms) 3 ms (2.7 to 3.3 ms) 15 ms (14.85 to 15.15 ms)
Input characteristic curve	To IEC 61131, Type 1
Connection of two-wire BEROs	Possible
• Permitted bias current	Max. 1.5 mA

1) Per module

12.6 4DI 24 VDC High Feature digital electronic module (6ES7131-4BD00-0AB0)

Order number

6ES7131-4BD00-0AB0

Features

- Digital electronic module with four inputs
- Rated input voltage 24 VDC
- Suitable for switches and proximity switches (BEROs)
- Supports clocked operation

Terminal assignment

The following table indicates the terminal assignment of the 4DI 24 VDC High Feature for the different terminal modules:

Table 12-8 Terminal assignment of the 4DI 24 VDC High Feature

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal 24 VDC: Sensor supply

Table 12-8 Terminal assignment of the 4DI 24 VDC High Feature, continued

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DI: Input signal 24 VDC: Sensor supply
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal 24 VDC: Sensor supply
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DI: Input signal 24 VDC: Sensor supply

Block diagram

Figure 12-7 Block diagram of the 4DI 24 VDC High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 35 g
Data for specific modules	
Supports clocked operation	Yes
Number of inputs	4
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated supply voltage (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption	
• From supply voltage	Dependent on the sensor
Power dissipation of the module	Typ. 0.7 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Interrupts	
• Hardware interrupt	Parameters can be assigned
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic information can be displayed	Yes

Sensor supply output	
Output voltage	
• With load	Min. L+ (–0.5 V)
Output current	
• Rated value	500 mA
• Permitted range	0 to 500 mA
Short-circuit protection	Yes, electronic[1)]
Data for selecting a sensor	
Input voltage	
• Rated value	24 VDC
• For signal “1”	11 to 30 V
• For signal “0”	-30 to 5 V
Input current	
• At signal “1”	Typ. 8 mA
Input delay (parameters can be assigned)	
• At “0” to “1”	0.1 ms (0.05 to 0.15 ms) 0.5 ms (0.4 to 0.6 ms) 3 ms (2.7 to 3.3 ms) 15 ms (14.85 to 15.15 ms)
• At “1” to “0”	0.1 ms (0.05 to 0.15 ms) 0.5 ms (0.4 to 0.6 ms) 3 ms (2.7 to 3.3 ms) 15 ms (14.85 to 15.15 ms)
Input characteristic curve	To IEC 61131, Type 1
Connection of two-wire BEROs	Possible
• Permitted bias current	Max. 1.5 mA

1) Per module

12.7 4DI 24–48 VUC High Feature digital electronic module (6ES7131-4CD00-0AB0)

Order number

6ES7131-4CD00-0AB0

Features

- Digital electronic module with four inputs
- Rated input voltage 24–48 VAC/VDC
- Parameter assignment length: 3 bytes
- Diagnostics: Wire break
- Diagnostics: Fuse blown
- Diagnostics: Load voltage missing
- Suitable for switches and proximity switches (BEROs)
- Supports clocked operation

Terminal assignment

The following table indicates the terminal assignment of the 4DI 24–48 VUC High Feature for the different terminal modules:

Table 12-9 Terminal assignment of the 4DI 24–48 VUC High Feature

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal 24 VDC sensor supply PE: Chassis ground

Table 12-9 Terminal assignment of the 4DI 24–48 VUC High Feature, continued

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DI: Input signal 24 VDC sensor supply
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal 24 VDC sensor supply
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DI: Input signal 24 VDC sensor supply AUX: Terminals A4, A3, A8 DC/AC and A7 can be used for unused cables up to 30 VDC.

Block diagram

Figure 12-8 Block diagram of the 4DI 24–48 VUC High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D	15 × 81 × 52 (mm)
Weight	Approx. 35 g
Data for specific modules	
Supports clocked operation	Yes
Number of inputs	4
Cable length	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltage, currents, potentials	
Rated supply voltage (from the power module)	24–48 VAC/VDC
• Horizontal configuration up to 60 °C	
• Vertical configuration up to 40 °C	
• Reverse polarity protection	AC or DC automatically
Isolation	
• Between the channels	No
• Between channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested with	2500 VDC
Current consumption	
• From the power supply L+	Dependent on the sensor
• From the backplane bus	Max. 10 mA
Power dissipation of the module	Typ. 0.7 W
Status, interrupts, diagnostics	
Status display	Green LEDs per channel
Diagnostic functions	Parameters can be assigned
• Group error display	Red LEDs (SF)

Sensor power supply outputs	
Output voltage	
• With load	Min. L+ (–0.5 V)
Output current	
• Rated value	500 mA
• Permitted range	0 to 500 mA
Short-circuit protection	Yes (per module)
Data for selecting a sensor	
Input voltage	
• Rated value	24 to 48 VUC
• For signal “1”	–15 VDC to –57.6 VDC 15 VDC to 57.6 VDC 15 VAC to 48 VAC
• For signal “0”	–6 VDC to 6 VDC 0 VAC to 5 VAC
• Frequency range	47 Hz to 63 Hz
Input current	From 4 mA to 10 mA
• At signal “1”	
Input delay	
• At “0” to “1”	Max. 15 ms
• At “1” to “0”	Max. 15 ms
Input characteristic curve[1)]	
Connection of two-wire BEROs	Possible
• Permitted bias current	Max. 0.5 to 2 mA[2)]
Sensor switching	
Resistance circuit of the sensor for wire break monitoring	
• Nominal voltage 24 V (15 V to 35 V)	18 kΩ
• Nominal voltage 48 V (30 V to 60 V)	39 kΩ

1) IEC 61131 does not provide technical specifications for UC modules. However, the values have been adjusted to IEC 61131 as closely as possible.

2) Minimum load current is required in the case of wire-break monitoring.

12.8 4DI NAMUR digital electronic module (6ES7131-4RD00-0AB0)

Order number

6ES7131-4RD00-0AB0

Features

- Digital electronic module with four inputs
- 8.2 VDC sensor supply
- Suitable for NAMUR sensors and both closed and open mechanical contacts

Terminal assignment of NAMUR sensors and sensors to DIN 19234

Table 12-10 Terminal assignment of NAMUR sensors and sensors to DIN 19234

View	Terminal assignment	Remarks
		Sensor 1: Channel 0: Terminals 1 and 3 **Sensor 2:** Channel 1: Terminals 5 and 7 **Sensor 3:** Channel 2: Terminals 2 and 3 **Sensor 4:** Channel 3: Terminals 6 and 7 DI: Input signal V_S: Sensor supply

Terminal assignment of NAMUR changeover contacts and sensors to DIN 19234

Table 12-11 Terminal assignment of NAMUR changeover contacts and sensors to DIN 19234

View	Terminal assignment	Remarks
	TM-E-15S24-01 and 4DI NAMUR Example of connection for channel 0 Normally open contact Normally closed contact	**Changeover contact 1:** Terminals 1, 5 and 3 **Changeover contact 2** Terminals 2, 6 and 7 DI: Input signal Vs: Sensor supply

Terminal assignment of a single, closed contact with 10 kΩ (mechanical normally open contact)

Table 12-12 Terminal assignment of a single, closed contact with 10 kΩ (mechanical normally open contact)

View	Terminal assignment	Remarks
	TM-E-15S23-01 and 4DI NAMUR Example of connection for channel 0	**Single contact 1:** Channel 0: Terminals 1 and 3 **Single contact 2:** Channel 1: Terminals 5 and 7 **Single contact 3:** Channel 2: Terminals 2 and 3 **Single contact 4:** Channel 3: Terminals 6 and 7 DI: Input signal Vs: Sensor supply

Terminal assignment of a closed changeover contact with 10 kΩ (mechanical changeover contact)

Table 12-13 Terminal assignment of a closed changeover contact with 10 kΩ (mechanical changeover contact)

View	Terminal assignment	Remarks
	TM-E-15S24-01 and 4DI NAMUR Example of connection for channel 0 and channel 1	**Changeover contact 1:** terminals 1, 5 and 3 **Changeover contact 2:** terminals 2, 6 and 7 DI: Input signal Vs: Sensor supply

Terminal assignment of an open single contact (mechanical normally open contact with single contact)

Table 12-14 Terminal assignment of an open single contact (mechanical normally open contact with single contact)

View	Terminal assignment	Remarks
	TM-E-15S24-01 and 4DI NAMUR Example of connection for channel 0	**Single contact 1:** Channel 0: Terminals 1 and 3 **Single contact 2:** Channel 1: Terminals 5 and 7 **Single contact 3:** Channel 2: Terminals 2 and 4 **Single contact 4:** Channel 3: Terminals 6 and 8 DI: Input signal Vs: Sensor supply

Terminal assignment of an open changeover contact (mechanical changeover contact)

Table 12-15 Terminal assignment of an open changeover contact (mechanical changeover contact)

View	Terminal assignment	Remarks
		Changeover contact 1: terminals 1, 5 and 3 **Changeover contact 2:** terminals 2, 6 and 7 DI: Input signal Vs: Sensor supply

Block diagram

Figure 12-9 Block diagram of the 4DI NAMUR

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 35 g
Data for specific modules	
Number of inputs	4
Length of cable	
• Shielded	Max. 200 m
Voltage, currents, potentials	
Number of inputs that can be triggered simultaneously	4
• Horizontal configuration up to 60 °C	4
• All other mounting positions up to 40 °C	4
Isolation	
• Between the channels	No
• Between channels and backplane bus	Yes
• Between channels and load voltage	Yes
• Between load voltage and backplane bus	Yes
Permissible potential difference	
• Between different circuits	75 VDC, 60 VAC

Insulation tested with:	
• Channels against the backplane bus and load voltage	500 VDC
• Load voltage against the backplane bus	500 VDC
Current consumption	
• From load voltage L+	Dependent on the sensor
Power dissipation of the module	Typ. 1.6 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Interrupts	
• Hardware interrupt	No
• Diagnostic interrupt	Yes, can be set
Diagnostic functions	
• Group error display	Red “SF” LED
• Diagnostic information can be displayed	Possible
Monitoring for	
• Short circuit	I > 7 mA*
• Wire break	I < 0.35 mA*

* Only for NAMUR sensors and closed contacts.

Data for selecting a sensor	
Input current for NAMUR sensors	Complies with NAMUR and EN 50227
• At signal “1”	2.1 mA to 7 mA
• At signal ”0”	0.35 mA to 1.2 mA
Input current for a closed contact	
• At signal “1”	2.1 mA to 7 mA
• For signal “0”	0.35 mA to 1.2 mA
Input current for an open contact	
• At signal “1”	Typ. 8 mA
• Permitted bias current	0.5 mA
Input delay	
• At “0” to “1”	Max. 4.6 ms
• At “1” to “0”	Max. 4.6 ms
Tolerated switchover time with changeover contacts	300 ms
Parallel connection of inputs	No

Sensor power supply outputs	
Number of outputs	1
Output voltage	
• With load	Min. 8.2 V
Output current	
• Rated value	45 mA
Additional (redundant) supply	Not permissible
Short-circuit protection	Yes, electronic

Value status

The value status provides additional binary information on a digital input signal. The value status is entered in the process input image at the same time as the signal, and it provides information on the validity of the input signal. The value status is affected by:

- Wire break check/short circuit
- Flutter monitoring
- Pulse extension
- Validity check of changeover contact sensor types

Meaning of the value status:

- “1”: input signal is valid
- “0”: input signal is invalid

Assignment in the process input image

The data is transferred to the process image in two bytes (16 bits).

Figure 12-10 Assignment in the process input image for 4DI NAMUR

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 a diagnosis.

Purpose

You can use the diagnosis for the following:

- A diagnosis of 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 parameterized as changeover contacts, the module carries out a diagnosis for changeover contact sensor types for this channel group. The tolerated switchover time between the two channels is fixed at 300 ms.

If the plausibility 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 and 2). In the case of the NC contact channel (channel 1 and 3) the digital input signal is fixed at zero and the value status is invalid because this channel is only used for a plausibility check on 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 NO contact channel (wire break, for example), the module will not carry out a diagnosis for changeover contact errors. The diagnosis for changeover contact errors continues to be carried out on the second channel.
- You will find additional points to note in the following table:

Table 12-16 Diagnosis for changeover contacts

Changeover contact	A negative check means...	
Changeover contact as NAMUR	• Short circuit or • Wire break	Additionally: Changeover contact error or external fault (in the case of DP diagnosis)
Closed changeover contact	• Defective sensor or short circuit No distinction can be made here between a defective sensor and short circuit	
Open changeover contact	Important: No distinction is possible between • Signal “0” and wire break • Signal “1” and short circuit	

12.9 2DI 120 VAC Standard digital electronic module (6ES7131-4EB00-0AB0)

Order number

6ES7131-4EB00-0AB0

Features

- Digital electronic module with two inputs
- Rated input voltage 120 VAC
- Suitable for switches

Terminal assignment

The following table illustrates the terminal assignment of the 2DI 120 VAC Standard for the different terminal modules:

Table 12-17 Terminal assignment of the 2DI 120 VAC Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DI: Input signal L1: Sensor supply N: Neutral conductor
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DI: Input signal L1: Sensor supply N: Neutral conductor Terminals 4 and 8 can be used for unneeded wires of up to 120 VAC.

Table 12-17 Terminal assignment of the 2DI 120 VAC Standard, continued

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DI: Input signal L1: Sensor supply N: Neutral conductor
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 DI: Input signal L1: Sensor supply N: Neutral conductor Terminals 4 and 8 can be used for unneeded wires of up to 120 VAC.

Block diagram

Figure 12-11 Block diagram of the 2DI 120 VAC Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 31 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Supply voltage (from the power module)	120 VAC
• Frequency	47 to 63 Hz
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between $M_{internal}$ and the inputs	1500 VAC
Insulation tested with	2500 VDC
Power dissipation of the module	Typ. 0.5 W

Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No
Data for selecting a sensor	
Input voltage	
• Rated value	120 VAC
• For signal “1”	79 to 132 VAC
• For signal “0”	0 to 20 VAC
Input current	
• At signal “1”	3 to 9 mA
Input delay	
• At “0” to “1”	15 ms
• At “1” to “0”	25 ms
Input characteristic curve	To IEC 61131, Type 1
Connection of two-wire BEROs	No
• Permitted bias current	Max. 1 mA

12.10 2DI 230 VAC Standard digital electronic module (6ES7131-4FB00-0AB0)

Order number

6ES7131-4FB00-0AB0

Features

- Digital electronic module with two inputs
- Rated input voltage 230 VAC
- Suitable for switches

Terminal assignment

The following table illustrates the terminal assignment of the 2DI 230 VAC Standard for the different terminal modules:

Table 12-18 Terminal assignment of the 2DI 230 VAC Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DI: Input signal L1: Sensor supply N: Neutral conductor
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DI: Input signal L1: Sensor supply N: Neutral conductor Terminals 4 and 8 can be used for unneeded wires of up to 230 VAC.

Table 12-18 Terminal assignment of the 2DI 230 VAC Standard, continued

View	Terminal assignment	Remarks
	TM-E15S23-01 and 2DI 230 VAC Standard	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DI: Input signal L1: Sensor supply N: Neutral conductor
	TM-E15S26-A1 and 2DI 230 VAC Standard	Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 DI: Input signal L1: Sensor supply N: Neutral conductor Terminals 4 and 8 can be used for unneeded wires of up to 230 VAC.

Block diagram

Figure 12-12 Block diagram of the 2DI 230 VAC Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 31 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Supply voltage (from the power module)	230 VAC
• Frequency	47 to 63 Hz
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between $M_{internal}$ and the inputs	1500 VAC
Insulation tested with	4000 VDC
Power dissipation of the module	Typ. 0.7 W

Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No
Data for selecting a sensor	
Input voltage	
• Rated value	230 VAC
• For signal “1”	164 to 264 VAC
• For signal “0”	0 to 40 VAC
Input current	
• At signal “1”	5 to 15 mA
Input delay	
• At “0” to “1”	15 ms
• At “1” to “0”	45 ms
Input characteristic curve	To IEC 61131, Type 1
Connection of two-wire BEROs	No
• Permitted bias current	Max. 2 mA

12.11 2DO 24 VDC/0.5 A Standard digital electronic module (6ES7132-4BB00-0AA0)

Order number

6ES7132-4BB00-0AA0

Features

- Digital electronic module with two outputs
- Output current 0.5 A per output
- Rated load voltage 24 VDC
- Suitable for solenoid valves, DC contactors, and indicator lights

Peculiarity

When you connect the 24 VDC rated load voltage to the power module by means of a mechanical contact, depending on the circuit the digital outputs carry the “1” signal for approximately 50 µs. You need to take this into account if you connect the module to fast counters.

Terminal assignment

The following table indicates the terminal assignment of the 2DO 24 VDC, 0.5 A Standard for the different terminal modules:

Table 12-19 Terminal assignment of the 2DO 24 VDC/0.5 A Standard

View	Terminal assignment	Remarks
TM-E15S24-A1 and 2DO 24 VDC/0.5 A Standard CH0 / CH1 DO_0 / DO_1 24 VDC / 24 VDC M / M AUX1 (e.g. PE) / AUX1 (e.g. PE) 2 conductors 3 conductors 4 conductors When there are 4 conductors, AUX1 must be applied to PE.		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DO: Output signal (maximum 0.5 A per channel) 24 VDC: Sensor supply M: Ground, load power supply

Table 12-19 Terminal assignment of the 2DO 24 VDC/0.5 A Standard, continued

View	Terminal assignment	Remarks
TM-E15S24-01 and 2DO 24 VDC/0.5 A Standard **CH0** / **CH1** DO_0 / DO_1 24 VDC / 24 VDC M / M n. c. / n. c. 2 conductors / 3 conductors		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DO: Output signal (maximum 0.5 A per channel) 24 VDC: Sensor supply M: Ground, load power supply Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
TM-E15S23-01 and 2DO 24 VDC/0.5 A Standard **CH0** / **CH1** DO_0 / DO_1 24 VDC / 24 VDC M / M 2 conductors / 3 conductors		Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DO: Output signal (maximum 0.5 A per channel) 24 VDC: Sensor supply M: Ground, load power supply
TM-E15S26-A1 and 2DO 24 VDC/0.5 A Standard **CH0** / **CH1** DO_0 / DO_1 24 VDC / 24 VDC M / M n. c. / n. c. AUX1 (e.g. M) / AUX1 (e.g. M) AUX1 (e.g. M) / AUX1 (e.g. M) 2 conductors / 3 conductors		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 DO: Output signal (maximum 0.5 A per channel) 24 VDC: Sensor supply M: Ground, load power supply Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 12-13 Block diagram of the 2DO 24 VDC/0.5 A Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of outputs	2
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes[1)]
Total current of the outputs (per module)	1 A
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested	500 VDC
Current consumption	
• From the load voltage L+ (no load)	Max. 5 mA per channel
Power dissipation of the module	Typ. 0.4 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No

Data for selecting an actuator	
Output voltage	
• At signal “1”	Min. L+ (-1 V)
Output current	
• At signal “1”	
– Rated value	0.5 A
– Permitted range	7 mA to 0.6 A
• With signal “0” (leakage current)	Max. 0.3 mA
Output delay (for resistive load)	
• At “0” to “1”	Max. 200 µs
• At “1” to “0”	Max. 1.3 ms
Load resistor range	48 Ω to 3.4 kΩ
Lamp load	Max. 5 W
Connecting two outputs in parallel	
• For redundant triggering of a load	Yes (per module)
• To increase performance	No
Control of a digital input	Yes
Switch rate	
• For resistive load	100 Hz
• With inductive load	2 Hz
• For lamp load	10 Hz
Limitation (internal) of the voltage induced on circuit interruption	Typ. L+ (–55 to –60 V)
Reverse-voltage proof	Yes, if using the same load voltage as at the power module
Short-circuit protection of the output	Yes[2)]
• Threshold on	Typ. 0.7 to 1.8 A

1) Polarity reversal can lead to the digital outputs being connected through.

2) Per channel

12.12 4DO 24 VDC/0.5 A Standard digital electronic module (6ES7132-4BD00-0AA0)

Order number

6ES7132-4BD00-0AA0

Features

- Digital electronic module with four outputs
- Output current 0.5 A per output
- Rated load voltage 24 VDC
- Suitable for solenoid valves, DC contactors, and indicator lights

Peculiarity

When you connect the 24 VDC rated load voltage to the power module by means of a mechanical contact, depending on the circuit the digital outputs carry the “1” signal for approximately 50 µs. You need to take this into account if you connect the module to fast counters.

Terminal assignment

The following table indicates the terminal assignment of the 4DO 24 VDC, 0.5 A Standard for the different terminal modules:

Table 12-20 Terminal assignment of the 4DO 24 VDC/0.5 A Standard

View	Terminal assignment	Remarks
TM-E15S24-A1 and 4DO 24 VDC/0.5 A Standard **CH0** **CH2** DO_0 DO_2 M AUX1 (e.g. PE)	**CH1** **CH3** DO_1 DO_3 M AUX1 (e.g. PE) 2 conductors	Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DO: Output signal (maximum 0.5 A per channel) M: Ground, load power supply

Table 12-20 Terminal assignment of the 4DO 24 VDC/0.5 A Standard, continued

View	Terminal assignment	Remarks
TM-E15S24-01 and 4DO 24 VDC/0.5 A Standard **CH0** **CH2** DO_0 DO_2 M M **CH1** **CH3** DO_1 DO_3 M M 2 conductors		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DO: Output signal (maximum 0.5 A per channel) M: Ground, load power supply
TM-E15S23-01 and 4DO 24 VDC/0.5 A Standard **CH0** **CH2** DO_0 DO_2 M **CH1** **CH3** DO_1 DO_3 M 2 conductors		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DO: Output signal (maximum 0.5 A per channel) M: Ground, load power supply
TM-E15S26-A1 and 4DO 24 VDC/0.5 A Standard **CH0** **CH2** DO_0 DO_2 M M AUX1 (e.g. PE) AUX1 (e.g. PE) **CH1** **CH3** DO_1 DO_3 M M AUX1 (e.g. PE) AUX1 (e.g. PE) 2 conductors		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DO: Output signal (maximum 0.5 A per channel) M: Ground, load power supply

Block diagram

Figure 12-14 Block diagram of the 4DO 24 VDC/0.5 A Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of outputs	4
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes[1)]
Total current of the outputs (per module)	2 A
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested	500 VDC
Current consumption	
• From the load voltage L+ (no load)	Max. 5 mA per channel
Power dissipation of the module	Typ. 0.8 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No

Data for selecting an actuator	
Output voltage	
• At signal “1”	Min. L+ (-1 V)
Output current	
• At signal “1”	
– Rated value	0.5 A
– Permitted range	7 mA to 0.6 A
• With signal “0” (leakage current)	Max. 0.3 mA
Output delay (for resistive load)	
• At “0” to “1”	Max. 100 µs
• At “1” to “0”	Max. 300 µs
Load resistor range	48Ω to 3.4 kΩ
Lamp load	Max. 5 W
Connecting two outputs in parallel	
• For redundant triggering of a load	Yes (per module)
• To increase performance	No
Control of a digital input	Yes
Switch rate	
• For resistive load	100 Hz
• With inductive load	2 Hz
• For lamp load	10 Hz
Limitation (internal) of the voltage induced on circuit interruption	Typ. L+ (–55 to –60 V)
Reverse-voltage proof	Yes, if using the same load voltage as at the power module
Short-circuit protection of the output	Yes[2)]
• Threshold on	Typ. 0.7 to 1.5 A

1) Polarity reversal can lead to the digital outputs being connected through.

2) Per channel

12.13 2DO 24 VDC/0.5 A High Feature digital electronic module (6ES7132-4BB00-0AB0)

Order number

6ES7132-4BB00-0AB0

Features

- Digital electronic module with two outputs
- Output current 0.5 A per output
- Rated load voltage 24 VDC
- Suitable for solenoid valves, DC contactors, and indicator lights
- Supports clocked operation

Peculiarity

When you connect the 24 VDC rated load voltage to the power module by means of a mechanical contact, depending on the circuit the digital outputs carry the “1” signal for approximately 50 µs. You need to take this into account if you connect the module to fast counters.

Terminal assignment

The following table indicates the terminal assignment of the 2DO 24 VDC, 0.5 A High Feature for the different terminal modules:

Table 12-21 Terminal assignment of the 2DO 24 VDC/0.5 A High Feature

View	Terminal assignment	Remarks
TM-E15S24-A1 and 2DO 24 VDC/0.5 A High Feature CH0 / CH1 DO_0 / DO_1 24 VDC / 24 VDC M / M AUX1 (e.g. PE) / AUX1 (e.g. PE) 2 conductors / 3 conductors / 4 conductors When there are 4 conductors, AUX1 must be applied to PE.		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DO: Output signal (maximum 0.5 A per channel) 24 VDC: Sensor supply M: Ground, load power supply

Table 12-21 Terminal assignment of the 2DO 24 VDC/0.5 A High Feature, continued

View	Terminal assignment	Remarks
TM-E15S24-01 and 2DO 24 VDC/0.5 A High Feature **CH0** / **CH1** DO_0 / DO_1 24 VDC / 24 VDC M / M n. c. / n. c.	2 conductors 3 conductors	Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DO: Output signal (maximum 0.5 A per channel) 24 VDC: Sensor supply M: Ground, load power supply Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
TM-E15S23-01 and 2DO 24 VDC/0.5 A High Feature **CH0** / **CH1** DO_0 / DO_1 24 VDC / 24 VDC M / M	2 conductors 3 conductors	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DO: Output signal (maximum 0.5 A per channel) 24 VDC: Sensor supply M: Ground, load power supply
TM-E15S26-A1 and 2DO 24 VDC/0.5 A High Feature **CH0** / **CH1** DO_0 / DO_1 24 VDC / 24 VDC M / M n. c. / n. c. AUX1 / AUX1 AUX1 / AUX1	2 conductors 3 conductors	Channel 0: Terminals 1 to A7 Channel 1: Terminals 5 to A3 DO: Output signal (maximum 0.5 A per channel) 24 VDC: Sensor supply M: Ground, load power supply Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 12-15 Block diagram of the 2DO 24 VDC/0.5 A High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	Yes
Number of outputs	2
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes[1)]
Total current of the outputs (per module)	1 A
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested	500 VDC
Current consumption	
• From the load voltage L+ (no load)	Max. 5 mA per channel
Power dissipation of the module	Typ. 0.4 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Data for selecting an actuator	
Output voltage	
• At signal “1”	Min. L+ (–1 V)
Output current	
• At signal “1”	
– Rated value	0.5 A
– Permitted range	7 mA to 0.6 A
• With signal “0” (leakage current)	Max. 0.3 mA
Output delay (for resistive load)	
• At “0” to “1”	Max. 100 µs
• At “1” to “0”	Max. 400 µs
Load resistor range	48 Ω to 3.4 kΩ
Lamp load	Max. 2.5 W
Connecting two outputs in parallel	
• For redundant triggering of a load	Yes (per module)
• To increase performance	No
Control of a digital input	Yes
Switch rate	
• For resistive load	100 Hz
• With inductive load	2 Hz
• For lamp load	10 Hz
Limitation (internal) of the voltage induced on circuit interruption	Typ. L+ (–55 to –60 V)
Reverse-voltage proof	Yes, if using the same load voltage as at the power module
Short-circuit protection of the output	Yes[2)]
• Threshold on	Typ. 1.5 A

1) Polarity reversal can lead to the digital outputs being connected through.

2) Per channel

12.14 2DO 24 VDC/2 A Standard digital electronic module (6ES7132-4BB30-0AA0)

Order number

6ES7132-4BB30-0AA0

Features

- Digital electronic module with two outputs
- Output current 2 A per output
- Rated load voltage 24 VDC
- Suitable for solenoid valves, DC contactors, and indicator lights

Peculiarity

When you connect the 24 VDC rated load voltage to the power module by means of a mechanical contact, depending on the circuit the digital outputs carry the “1” signal for approximately 50 µs. You need to take this into account if you connect the module to fast counters.

Terminal assignment

The following table indicates the terminal assignment of the 2DO 24 VDC, 2 A Standard for the different terminal modules:

Table 12-22 Terminal assignment of the 2DO 24 VDC/2 A Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DO: Output signal (maximum 2 A per channel) 24 VDC: Sensor supply M: Ground, load power supply

Table 12-22 Terminal assignment of the 2DO 24 VDC/2 A Standard, continued

View	Terminal assignment	Remarks
TM-E15S24-01 and 2DO 24 VDC/2 A Standard 		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DO: Output signal (maximum 2 A per channel) 24 VDC: Sensor supply M: Ground, load power supply Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
TM-E15S23-01 and 2DO 24 VDC/2 A Standard 		Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DO: Output signal (maximum 2 A per channel) 24 VDC: Sensor supply M: Ground, load power supply
TM-E15S26-A1 and 2DO 24 VDC/2 A Standard 		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 DO: Output signal (maximum 2 A per channel) 24 VDC: Sensor supply M: Ground, load power supply Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 12-16 Block diagram of the 2DO 24 VDC/2 A Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of outputs	2
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Polarity reversal	Yes[1)]
Total current of the outputs (per module)	4 A
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested	500 VDC
Current consumption	
• From rated load voltage L+ (no load)	Max. 5 mA per channel
Power dissipation of the module	Typ. 1.4 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No

Data for selecting an actuator	
Output voltage	
• At signal “1”	Min. L+ (-1 V)
Output current	
• At signal “1”	
– Rated value	2 A
– Permitted range	7 mA to 2.4 A
• With signal “0” (leakage current)	Max. 0.5 mA
Output delay (for resistive load)	
• At “0” to “1”	Max. 200 µs
• At “1” to “0”	Max. 1.3 ms
Load resistor range	12 Ω to 3.4 kΩ
Lamp load	Max. 10 W
Connecting two outputs in parallel	
• For redundant triggering of a load	Yes (per module)
• To increase performance	No
Control of a digital input	Yes
Switch rate	
• For resistive load	100 Hz
• With inductive load	2 Hz (0.5 H)
• For lamp load	10 Hz
Limitation (internal) of the voltage induced on circuit interruption	Typ. L+ (–55 to –60 V)
Reverse-voltage proof	Yes, if using the same load voltage as at the power module
Short-circuit protection of the output	Yes[2)]
• Threshold on	Typ. 2.8 to 7.2 A

1) Polarity reversal can lead to the digital outputs being connected through

2) Per channel

12.15 4DO 24 VDC/2 A Standard digital electronic module (6ES7132-4BD30-0AA0)

Order number

6ES7132-4BD30-0AA0

Features

- Digital electronic module with four outputs
- Output current 2 A per output
- Rated load voltage 24 VDC
- Suitable for solenoid valves, DC contactors, and indicator lights

Peculiarity

When you connect the 24 VDC rated load voltage to the power module by means of a mechanical contact, depending on the circuit the digital outputs carry the “1” signal for approximately 50 µs. You need to take this into account if you connect the module to fast counters.

Terminal assignment

The following table indicates the terminal assignment of the 4DO 24 VDC, 2 A Standard for the different terminal modules:

Table 12-23 Terminal assignment of the 4DO 24 VDC/2 A Standard

View	Terminal assignment	Remarks
TM-E15S24-A1 and 4DO 24 VDC/2 A Standard **CH0** **CH2** DO_0 DO_2 M AUX1 (e.g. PE)	**CH1** **CH3** 2 conductors DO_1 DO_3 M AUX1 (e.g. PE)	Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DO: Output signal (maximum 2 A per channel) M: Ground, load power supply

Table 12-23 Terminal assignment of the 4DO 24 VDC/2 A Standard, continued

View	Terminal assignment	Remarks
TM-E15S24-01 and 4DO 24 VDC/2 A Standard **CH0** **CH2** DO_0 DO_2 M M	**CH1** **CH3** DO_1 DO_3 M M 2 conductors	Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DO: Output signal (maximum 2 A per channel) M: Ground, load power supply
TM-E15S23-01 and 4DO 24 VDC/2 A Standard **CH0** **CH2** DO_0 DO_2 M	**CH1** **CH3** DO_1 DO_3 M 2 conductors	Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DO: Output signal (maximum 2 A per channel) M: Ground, load power supply
TM-E15S26-A1 and 4DO 24 VDC/2 A Standard **CH0** **CH2** DO_0 DO_2 M M AUX1 (e.g. PE) AUX1 (e.g. PE)	**CH1** **CH3** DO_1 DO_3 M M AUX1 (e.g. PE) AUX1 (e.g. PE) 2 conductors	Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DO: Output signal (maximum 2 A per channel) M: Ground, load power supply

Block diagram

Figure 12-17 Block diagram of the 4DO 24 VDC/2 A Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of outputs	4
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Polarity reversal	Yes[1)]
Total current of the outputs (per module)	4 A
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested	500 VDC
Current consumption	
• From rated load voltage L+ (no load)	Max. 5 mA per channel
Power dissipation of the module	Typ. 1.6 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No

Data for selecting an actuator	
Output voltage	
• At signal “1”	Min. L+ (-1 V)
Output current	
• At signal “1”	
– Rated value	2 A
– Permitted range	7 mA to 2.4 A
• With signal “0” (leakage current)	Max. 0.5 mA
Output delay (for resistive load)	
• At “0” to “1”	Max. 200 µs
• At “1” to “0”	Max. 1.3 ms
Load resistor range	12 Ω to 3.4 kΩ
Lamp load	Max. 10 W
Connecting two outputs in parallel	
• For redundant triggering of a load	Yes (per module)
• To increase performance	No
Control of a digital input	Yes
Switch rate	
• For resistive load	100 Hz
• With inductive load	2 Hz (0.5 H)
• For lamp load	10 Hz
Limitation (internal) of the voltage induced on circuit interruption	Typ. L+ (–55 to –60 V)
Reverse-voltage proof	Yes, if using the same load voltage as at the power module
Short-circuit protection of the output	Yes[2)]
• Threshold on	Typ. 2.8 to 7.2 A

1) Polarity reversal can lead to the digital outputs being connected through

2) Per channel

12.16 2DO 24 VDC/2 A High Feature digital electronic module (6ES7132-4BB30-0AB0)

Order number

6ES7132-4BB30-0AB0

Features

- Digital electronic module with two outputs
- Output current 2 A per output
- Rated load voltage 24 VDC
- Suitable for solenoid valves, DC contactors, and indicator lights
- Supports clocked operation

Peculiarity

When you connect the 24 VDC rated load voltage to the power module by means of a mechanical contact, depending on the circuit the digital outputs carry the “1” signal for approximately 50 µs. You need to take this into account if you connect the module to fast counters.

Terminal assignment

The following table indicates the terminal assignment of the 2DO 24 VDC, 2 A High Feature for the different terminal modules:

Table 12-24 Terminal assignment of the 2DO 24 VDC/2 A High Feature

View	Terminal assignment	Remarks
When there are 4 conductors, AUX1 must be applied to PE.		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DO: Output signal (maximum 2 A per channel) 24 VDC: Sensor supply M: Ground, load power supply

Table 12-24 Terminal assignment of the 2DO 24 VDC/2 A High Feature, continued

View	Terminal assignment	Remarks
TM-E15S24-01 and 2DO 24 VDC/2 A High Feature 		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DO: Output signal (maximum 2 A per channel) 24 VDC: Sensor supply M: Ground, load power supply Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
TM-E15S23-01 and 2DO 24 VDC/2 A High Feature 		Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DO: Output signal (maximum 2 A per channel) 24 VDC: Sensor supply M: Ground, load power supply
TM-E15S26-A1 and 2DO 24 VDC/2 A High Feature 		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 DO: Output signal (maximum 2 A per channel) 24 VDC: Sensor supply M: Ground, load power supply Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 12-18 Block diagram of the 2DO 24 VDC/2 A High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	Yes
Number of outputs	2
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Polarity reversal	Yes[1)]
Total current of the outputs (per module)	4 A
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested	500 VDC
Current consumption	
• From rated load voltage L+ (no load)	Max. 5 mA per channel
Power dissipation of the module	Typ. 1.4 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Data for selecting an actuator	
Output voltage	
• At signal “1”	Min. L+ (–1 V)
Output current	
• At signal “1”	
– Rated value	2 A
– Permitted range	7 mA to 2.4 A
• With signal “0” (leakage current)	Max. 0.5 mA
Output delay (for resistive load)	
• At “0” to “1”	Max. 100 µs
• At “1” to “0”	Max. 400µs
Load resistor range	12 Ω to 3.4 kΩ
Lamp load	Max. 5 W
Connecting two outputs in parallel	
• For redundant triggering of a load	Yes (per module)
• To increase performance	No
Control of a digital input	Yes
Switch rate	
• For resistive load	100 Hz
• With inductive load	2 Hz (0.5 H)
• For lamp load	10 Hz
Limitation (internal) of the voltage induced on circuit interruption	Typ. L+ (–55 to –60 V)
Reverse-voltage proof	Yes, if using the same load voltage as at the power module
Short-circuit protection of the output	Yes[2)]
• Threshold on	Typ. 4 A

1) Polarity reversal can lead to the digital outputs being connected through

2) Per channel

12.17 2DO 24–230 VAC/2 A digital electronic module (6ES7132-4FB00-0AB0)

Order number

6ES7132-4FB00-0AB0

Features

- Digital electronic module with two outputs
- Output current 2 A per output
- Rated load voltage 24-48/120/230 VAC
- Substitute value
- Parameter assignment length: 3 bytes
- Suitable for solenoid valves, AC contactors, and indicator lights

Terminal assignment

The following table indicates the terminal assignment of the 2DO 24–230 VAC, 2 A for the different terminal modules:

Table 12-25 Terminal assignment of the 2DO 24–230 VAC/2 A

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DO: Output signal (maximum 2 A per channel) N: Neutral conductor

Table 12-25 Terminal assignment of the 2DO 24–230 VAC/2 A, continued

View	Terminal assignment	Remarks
	TM-E15S24-01 and 2DO 24–230 VAC/2 A	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DO: Output signal (maximum 2 A per channel) N: Neutral conductor Terminals 4 and 8 can be used for unneeded wires of up to 230 VAC.
	TM-E15S23-01 and 2DO 24–230 VAC/2 A	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DO: Output signal (maximum 2 A per channel) N: Neutral conductor
	TM-E15S26-A1 and 2DO 24–230 VAC/2 A	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DO: Output signal (maximum 2 A per channel) N: Neutral conductor Terminals 4 and 8 can be used for unneeded wires of up to 230 VAC.

Block diagram

Figure 12-19 Block diagram of the 2DO 24–230 VAC/2 A

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 37 g
Data for specific modules	
Supports clocked operation	No
Number of outputs	2
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated load voltage L1 (from the power module)	24-230 VAC
• Frequency	47 to 63 Hz
Total current of the outputs (per module)	
• Up to 40 °C	Max. 2 A
• Up to 60 °C	Max. 1 A
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Insulation tested	2500 VDC
Current consumption	
• From the backplane bus	Max. 18 mA
• From rated load voltage L1 (no load)	Max. 15 mA per channel
Power dissipation of the module	Max. 4 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No

Data for selecting an actuator	
Output voltage	
• At signal “1”	Min. L (–1.5 V)
Output current	
• At signal “1”	
– Rated value	2 A
– Permitted range	0.1 mA to 2.2 A
• With signal “0” (leakage current)	Max. 3 mA
Output delay (for resistive load)	
• At “0” to “1”	Max. 15 ms
• At “1” to “0”	Max. 15 ms
Zero cross inhibit voltage	Max. 25 V
Motor starter size	
• Up to 40 °C	Max. size in accordance with NEMA: 5
• Up to 60 °C	Max. size in accordance with NEMA: 4
Lamp load	Max. 100 W
Connecting two outputs in parallel	
• For redundant triggering of a load	Yes (per module)
• To increase performance	No
Control of a digital input	Possible
Switch rate	
• For resistive load	Max. 10 Hz
• With inductive load	Max. 0.5 Hz
• For lamp load	Max. 1 Hz
Short-circuit protection of the output	Yes, by means of fuse in the power module

12.18 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A digital electronic module (6ES7132-4HB00-0AB0)

Order number

6ES7132-4HB00-0AB0

Note

If you connect an extra-low voltage system (SELV/PELF) on one channel of the 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A, you can only use an extra-low voltage system (SELV/PELF) on the other channel.

As of version 2 of the 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A there is no longer an internal jumper between terminals 2 and 6. If you need this jumper, you can replace it with an external jumper between terminals 3 and 7 (see Figure 12-20).

Features

- Digital electronic module with two relay outputs
- Output current 5 A per output
- Rated load voltage up to 120 VDC and up to 230 VAC
- Suitable for solenoid valves, DC contactors, and indicator lights
- Isolated from the supply voltage

Caution

The rated supply voltage of the 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A is 24 VDC. The 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A can only be located in a potential group with 24 VDC (from the power module).

Terminal assignment

The following table indicates the terminal assignment of the 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A for the different terminal modules:

Table 12-26 Terminal assignment of the 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A (as of Version 2)

View	Terminal assignment	Remarks
	TM-E15S24-A1 and 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A **CH1** 23 24 24 AUX1 (e.g. PE) The AUX1 bus must be applied to PE.	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 13, 14: normally open contact channel 0 23, 24: normally open contact channel 1 Internal jumper between terminals 2 and 3, 6 and 7
	TM-E15S24-01 and 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A **CH1** 23 24 24 n. c. 	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 13, 14: normally open contact channel 0 23, 24: normally open contact channel 1 Terminals 4 and 8 can be used for unneeded wires up to the load voltage used. Internal jumper between terminals 2 and 3, 6 and 7
	TM-E15S23-01 and 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A **CH1** 23 24 24 	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 13, 14: normally open contact channel 0 23, 24: normally open contact channel 1 Internal jumper between terminals 2 and 3, 6 and 7

Table 12-26 Terminal assignment of the 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A (as of Version 2)

View	Terminal assignment	Remarks
	TM-E15S26-A1 and 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7
CH0	**CH1**	
13	23	13, 14: normally open contact channel 0
14	24	23, 24: normally open contact channel 1
14	24	
n. c.	n. c.	Terminals 4 and 8 can be used for unneeded wires up to the load voltage used.
AUX1	AUX1	
AUX1	AUX1	Internal jumper between terminals 2 and 3, 6 and 7

Block diagram

* As of version 2 of the 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A there is no longer an internal jumper between terminals 2 and 6. If you need this jumper, you can replace it with an external jumper between terminals 3 and 7.

Figure 12-20 Block diagram of the 2RO NO 24–120 VDC/5 A, 230 VAC/5 A

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 50 g
Data for specific modules	
Supports clocked operation	No
Number of outputs	2
Length of cable	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated supply voltage L+ (from the power module)	24 VDC
Reverse polarity protection	Yes
Current per channel	
• Up to 50 °C	Max. 5 A
• Up to 60 °C	Max. 4 A
Isolation	
• Between the channels	Yes
• Between the channels and backplane bus	Yes
• Between the channels and supply voltage	Yes
• Between the supply voltage and backplane bus	Yes
Permissible potential difference	
• Between the supply voltage and backplane bus	75 VDC, 60 VAC
• Between channels and backplane bus	240 VAC
• Between the channels and supply voltage	240 VAC
Insulation tested	Yes
• Between the supply voltage and backplane bus	500 VDC
• Between channels and backplane bus	1500 VAC
• Between the channels and supply voltage	1500 VAC
Current consumption	
• From the power supply L+	Max. 30 mA
Power dissipation of the module	Typ. 0.6 W
Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	No
Data for selecting an actuator	
Output current	
• Continuous thermal current	Max. 5 A
• Min. load current	8 mA
• Min. voltage	17 V
Connecting two outputs in parallel	
• For redundant triggering of a load	No
• To increase performance	No
Control of a digital input	Yes
Switch rate	
• For resistive load	2 Hz
• With inductive load	0.5 Hz
• For lamp load	2 Hz
Limitation (internal) of the voltage induced on circuit interruption	No
Short-circuit protection of the output [1]	No

[1] The relay outputs must be protected by means of an external safety fuse (6 A, quick-response).

Switching capacity and lifetime of the contacts

With an external suppression circuit, the contacts will last longer than specified in the table:

Table 12-27 Switching capacity and lifetime of the relay contacts

Resistive load	Voltage	Current	Operating cycles (typical)
For resistive load	24 VDC	5.0 A	0.1 million
		4.0 A	0.2 million
		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
	120 VDC	0.2 A	1.6 million
	48 VAC	2.0 A	1.6 million
	60 VAC	2.0 A	1.2 million
	120 VAC	5.0 A	0.1 million
		3.0 A	0.2 million
		2.0 A	0.4 million
		1.0 A	0.8 million
		0.5 A	1.5 million
	230 VAC	5.0 A	0.1 million
		3.0 A	0.2 million
		2.0 A	0.4 million
		1.0 A	0.8 million
		0.5 A	1.5 million
For inductive load in accordance with IEC 947-5-1 DC 13/ AC 15	24 VDC	2.0 A	0.1 million
		1.0 A	0.2 million
		0.5 A	0.5 million
	60 VDC	0.5 A	0.2 million
	120 VDC	0.2 A	0.5 million
	48 VAC	1.0 A	0.7 million
	60 VAC	1.0 A	0.5 million
	120 VAC	2.0 A	0.1 million
		1.0 A	0.3 million
		0.5 A	1 million
		0.1 A	2 million
For inductive load in accordance with IEC 947-5-1 DC 13/ AC 15	230 VAC	2.0 A	0.1 million
		1.0 A	0.3 million
		0.5 A	1 million

12.19 2RO NO/NC 24–48 VDC/5 A 24–230 VAC/5 A digital electronic module (6ES7132-4HB10-0AB0)

Note

If you connect an extra-low voltage system (SELV/ PELV) on one channel of the relay module, you can only use an extra-low voltage system (SELV/ PELV) on the other channel.

Features

- Digital electronic module with two relay outputs
- Output current 5 A per output
- Substitute value
- Parameter assignment length: 3 bytes
- Suitable for solenoid valves, DC contactors, and indicator lights
- Isolated from the supply voltage
- Normally open contact and normally closed contact

Terminal assignment

The following table indicates the terminal assignment of the 2RO NO/NC 24–48 VDC/5 A, 24–230 VAC/5 A for the different terminal modules:

Table 12-28 Terminal assignment of the 2RO NO/NC 24–48 VDC/5 A, 24–230 VAC/5 A

View	Terminal assignment	Remarks
	TM-E15S24-A1 and 2RO NO/NC 24–48 VDC/5 A, 24–230 VAC/5 A **CH0** / **CH1** Common / Common Normally open contact / Normally open contact Normally closed contact / Normally closed contact AUX1 (e.g. PE) / AUX1 (e.g. PE) The AUX1 bus must be applied to PE.	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 1, 2: normally open contact channel 0 1, 3: normally closed contact channel 0 5, 6: normally open contact channel 1 5, 7: normally closed contact channel 1

Table 12-28 Terminal assignment of the 2RO NO/NC 24–48 VDC/5 A, 24–230 VAC/5 A, continued

View	Terminal assignment	Remarks
	TM-E15S24-01 and 2RO NO/NC 24–48 VDC/5 A, 24–230 VAC/5 A **CH1** Common Normally open contact Normally closed contact	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 1, 2: normally open contact channel 0 1, 3: normally closed contact channel 0 5, 6: normally open contact channel 1 5, 7: normally closed contact channel 1
	TM-E15S23-01 and 2RO NO/NC 24–48 VDC/5 A, 24–230 VAC/5 A **CH1** Common Normally open contact Normally closed contact	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 1, 2: normally open contact channel 0 1, 3: normally closed contact channel 0 5, 6: normally open contact channel 1 5, 7: normally closed contact channel 1
	TM-E15S26-A1 and 2RO NO/NC 24–48 VDC/5 A, 24–230 VAC/5 A **CH1** Common Normally open contact Normally closed contact AUX1 AUX1	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 1, 2: normally open contact channel 0 1, 3: normally closed contact channel 0 5, 6: normally open contact channel 1 5, 7: normally closed contact channel 1

Block diagram

Figure 12-21 Block diagram of the 2RO NO/NC 24–48 VDC/5 A 24–230 VAC/5 A

Technical specifications

Dimensions and weight	
Dimensions W × H × D	15 × 81 × 52 (mm)
Weight	Approx. 50 g
Data for specific modules	
Supports clocked operation	No
Number of outputs	2
Cable length	
• Unshielded	Max. 600 m
• Shielded	Max. 1000 m
Voltages, currents, potentials	
Rated supply voltage L+ (from the power module)	24 VDC
Reverse polarity protection	Yes
Current per channel	
• Up to 50 °C	Max. 5 A
• Up to 60 °C	Max. 4 A
Isolation	
• Between the channels	Yes
• Between channels and backplane bus	Yes
• Between the channels and supply voltage	Yes
• Between the supply voltage and backplane bus	Yes
Permissible potential difference	
• Between the supply voltage and backplane bus	75 VDC, 60 VAC
• Between channels and backplane bus	240 VAC
• Between the channels and supply voltage	240 VAC
Insulation tested	
• Between the supply voltage and backplane bus	500 VDC
• Between channels and backplane bus	2500 VDC
• Between the channels and supply voltage	2500 VDC
Current consumption	
• From the power supply L+	Max. 30 mA
• From the backplane bus	Max. 10 mA
Power dissipation of the module	Typ. 0.6 W
Status, interrupts, diagnostics	
Status display	Green LEDs per channel
Diagnostic functions	No
Data for selecting an actuator	
Output current	
• Continuous thermal current	Max. 5 A
• Min. load current	8 mA
Connecting two outputs in parallel	
• For redundant triggering of a load	No
• To increase performance	No
Control of a digital input	Yes
Switch rate	
• For resistive load	2 Hz
• With inductive load	0.5 Hz
• For lamp load	2 Hz
Limitation (internal) of the voltage induced on circuit interruption	No
Short-circuit protection of output [1]	No

1) The relay outputs must be protected by means of an external safety fuse (6 A, quick-response).
When installing in a hazardous area, only remove the fuse using a suitable tool in accordance with the National Electric Code (NEC) if the module is not in a potentially explosive area.

Switching capacity and lifetime of the contacts

With an external suppression circuit, the contacts will last longer than specified in the following table:

The normally open and normally closed contacts of the relay vary in their length of service life.

Table 12-29 Switching capacity and lifetime of the contacts

Resistive load	Voltage	Current	Operating cycles (typ.) Normally open contact	Operating cycles (typ.) Normally closed contact
For resistive load	24 VDC	5.0 A	0.1 million	0.15 million
		4.0 A	0.2 million	0.175 million
		2.0 A	0.45 million	0.3 million
		0.5 A	1.4 million	1.1 million
		0.1 A	1.5 million	1.5 million
	48 VDC	2.0 A	0.15 million	0.11 million
		1.0 A	0.3 million	0.2 million
		0.5 A	0.6 million	0.6 million
		0.1 A	0.8 million	0.6 million
	48 VAC	2.0 A	0.45 million	0.35 million
	60 VAC	2.0 A	0.45 million	0.35 million
	120 VAC	5.0 A	0.1 million	0.1 million
		3.0 A	0.2 million	0.2 million
		2.0 A	0.4 million	0.3 million
		1.0 A	0.8 million	0.6 million
		0.5 A	1.5 million	1.0 million
	230 VAC	5.0 A	0.1 million	0.1 million
		3.0 A	0.2 million	0.2 million
		2.0 A	0.4 million	0.3 million
		1.0 A	0.8 million	0.6 million
		0.5 A	1.5 million	1.0 million

Table 12-29 Switching capacity and lifetime of the contacts, continued

Resistive load	Voltage	Current	Operating cycles (typ.) Normally open contact	Operating cycles (typ.) Normally closed contact
For inductive load in accordance with IEC 947-5-1 DC 13/ AC15	24 VDC	2.0 A	0.1 million	0.1 million
		1.0 A	0.2 million	0.2 million
		0.5 A	0.5 million	0.5 million
	48 VDC	2.0 A	0.07 million	0.05 million
		1.0 A	0.15 million	0.1 million
		0.5 A	0.4 million	0.25 million
	48 VAC	1.0 A	0.5 million	0.3 million
	60 VAC	1.0 A	0.5 million	0.3 million
	120 VAC	2.0 A	0.1 million	0.1 million
		1.0 A	0.3 million	0.1 million
		0.5 A	0.9 million	0.6 million
		0.1 A	1.5 million	1.0 million
	230 VAC	2.0 A	0.1 million	0.1 million
		1.0 A	0.5 million	0.3 million
		0.5 A	0.9 million	0.6 million
		0.1 A	1.0 million	1.0 million

Analog Electronic Modules 13

Introduction

The range of analog electronic modules (EM) includes modules for measuring voltages and currents. For time-critical measuring of voltage and current, you can use the High Speed modules. The High Feature modules provide a higher resolution and greater accuracy.

There are also modules available for connecting thermocouples and resistance thermometers or resistors.

Modules for connecting loads/actuators to current and voltage outputs complete the range.

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13.1 Analog value representation

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Electronic modules with analog inputs

You can use electronic modules with analog inputs to record, evaluate, and convert continuously changing signals to digital values that you can process further. Examples of such continuously changing signals are those that occur when measuring temperature or pressure.

Electronic modules with analog outputs

The electronic modules with analog outputs allow digitized values that are input by means of a controller to be converted in an analog output module to a corresponding analog signal (current or voltage) to control actuators (setpoint input for speed controllers, temperature controllers, etc.).

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:

- 1 V to 5 V, 4 mA to 20 mA
- Temperature sensor Pt xxx Standard and Climatic, Ni xx Standard and Climatic, Cu 10 Standard and Climatic
- Thermocouple type E, N, J, K, L, S, R, B, C, T

Table 13-1 Measured values in the case of a wire break depending on diagnostic being enabled

Format	Parameter assignment	Measured values		Description
		Decimal	Hexadec.	
S7	• "Wire break" enabled (at 1 to 5 V, 4 to 20 mA, RTD)[1]	32767	$7FFF_H$	• "Open circuit" diagnostic message
	• "Wire break check" enabled (in the case of TC)	32767	$7FFF_H$	• "Open circuit" diagnostic message
	• "Wire break" disabled (at 1 to 5 V, 4 to 20 mA, RTD)[1] • "Overflow/underflow" enabled	–32767	8000_H	• Measured value after leaving the underrange • "Lower limit value violated" diagnostic message
	• "Wire break" disabled (at 1 to 5 V, 4 to 20 mA, RTD)[1] • "Overflow/underflow" disabled	–32767	8000_H	• Measured value after leaving the underrange
	• "Wire break check" disabled (in the case of TC)	——	—	• Open input: undefined measured value

[1] Measuring range limits for detecting the wire break/underflow:
1 to 5 V: at 0.296 V
4 to 20 mA: at 1.185 mA

13.1.1 Analog value representation for measuring ranges with SIMATIC S7

Analog value representation

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 13-2 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” → –

Measured-value resolution

In the table below, you will find the representation of the binary analog values and the associated decimal and hexadecimal representation of the units of the analog values.

Table 13-3 shows the resolutions 11-, 12-, 13-, and 15 bits + sign (S). Each analog value is entered in the accumulator with left justification. The bits marked “x” are set to “0”.

Table 13-3 Measured-value resolution of the analog values (SIMATIC S7 format)

Resolution in bits	Units		Analog value	
	Decimal	Hexadec.	High byte	Low byte
11+ sign (S)	16	10_H	S 0 0 0 0 0 0 0	0 0 0 1 x x x x
12 + sign (S)	8	8_H	S 0 0 0 0 0 0 0	0 0 0 0 1 x x x
13 + sign (S)	4	4_H	S 0 0 0 0 0 0 0	0 0 0 0 0 1 x x
15 + sign (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 to temperature values. The converted temperature values are the result of a conversion in the analog electronic module (see Table 13-3).

Note

The following applies to temperature measurements: In the overrange and underrange, the gradient of the characteristic curve at the point where the linearized rated range is left is retained.

13.1.2 Analog value representation for the measuring ranges of the analog input modules in SIMATIC 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, ± 2.5 V, ± 5 V, ± 10 V

Table 13-4 SIMATIC S7 format: Measuring ranges ±80 mV, ±2.5 V, ±5 V and ±10 V

Measuring range ± 80 mV	Measuring range ± 2.5 V	Measuring range ± 5 V	Measuring range ± 10 V	Units		Range
				Decimal	Hexadec.	
> 94.071	> 2.9397	> 5.8794	> 11.7589	32767	$7FFF_H$	Overflow
94.071	2.9397	5.8794	11.7589	32511	$7EFF_H$	Overrange
:	:	:	:	:	:	
80.003	2.5001	5.0002	10.0004	27649	$6C01_H$	
80.000	2.5	5.00	10.00	27648	$6C00_H$	Rated range
60.000	1.86	3.75	7.50	20736	5100_H	
:	:	:	:	:	:	
– 60.000	– 1.86	– 3.75	– 7.50	–20736	$AF00_H$	
– 80.000	– 2.50	– 5.00	– 10.00	–27648	9400_H	
– 80.003	– 2.5001	– 5.0002	– 10.0004	–27649	$93FF_H$	Underrange
:	:	:	:	:	:	
– 94.074	– 2.9397	– 5.8796	– 11.759	–32512	8100_H	
< – 94.074	< – 2.9397	< – 5.8796	< – 11.759	–32768	8000_H	Underflow

Measuring ranges for voltage and current: 1 to 5 V, 0 to 20 mA, 4 to 20 mA

Table 13-5 SIMATIC S7 format: Measuring ranges 1 to 5 V, 0 to 20 mA, 4 to 20 mA

Measuring range 1 to 5 V	Measuring range 0 to 20 mA	Measuring range 4 to 20 mA	Units		Range
			Decimal	Hexadec.	
> 5.704	> 23.5178	> 22.8142	32767	$7FFF_H$	Overflow
5.704	23.5178	22.8142	32511	$7EFF_H$	Overrange
:	:	:	:	:	
5.000145	20.0007	20.0005	27649	$6C01_H$	
5.000	20.0000	20.0000	27648	$6C00_H$	Rated range
3.000	16.0000	16.0000	20736	5100_H	
:	:	:	:	:	
1.000	0.0000	4.0000	0	0_H	
0.999855	Negative values not possible	3.9995	–1	$FFFF_H$	Underrange
:			:	:	
0.296		1.1852	–4864	$ED00_H$	
< 0.296		< 1.1852	–32768	8000_H	Underflow

Measuring range for current: ± 20 mA

Table 13-6 SIMATIC S7 format: Measuring range ±20 mA

Measuring range ± 20 mA	Units		Range
	Decimal	Hexadec.	
> 23.5150	32767	$7FFF_H$	Overflow
23.5150	32511	$7EFF_H$	Overrange
:	:	:	
20.0007	27649	$6C01_H$	
20.0000	27648	$6C00_H$	Rated range
14.9980	20736	5100_H	
:	:	:	
– 14.9980	–20736	$AF00_H$	
– 20.0000	–27648	9400_H	
– 20.0007	–27649	$93FF_H$	Underrange
:	:	:	
– 23.5160	–32512	8100_H	
< – 23.5160	–32768	8000_H	Underflow

Measuring ranges for resistance-type sensors: 150Ω, 300Ω, 600Ω, 3000Ω

Table 13-7 SIMATIC S7 format: Measuring ranges 150Ω, 300Ω, 600Ω, 3000Ω

Measuring range 150 Ω	Measuring range 300 Ω	Measuring range 600 Ω	Measuring range 3000 Ω	Units		Range
				Decimal	Hexadec.	
> 176.38	> 352.77	> 705.53	> 3527.67	32767	$7FFF_H$	Overflow
176.38	352.77	705.53	3527.67	32511	$7EFF_H$	Overrange
:	:	:	:	:	:	
150.005	300.01	600.02	3000.11	27649	$6C01_H$	
150.00	300.00	600.00	3000.00	27648	$6C00_H$	Rated range
112.50	225.00	450.00	2250.00	20736	5100_H	
:	:	:	:	:	:	
0.00	0.00	0.00	0.00	0	0_H	
(Negative values not physically possible)				–1	$FFFF_H$	Underrange*
				:	:	
				–4864	$ED00_H$	
				–32768	8000_H	Underflow*

* If the resistors are connected incorrectly

Measuring ranges for resistance thermometer Pt x00 Standard

Table 13-8 SIMATIC S7 format: Measuring ranges Pt 100, 200, 500, 1000 Standard in °C and °F

Pt x00 Standard in °C (1 digit = 0.1°C)	Units		Pt x00 Standard in °F (1 digit = 0.1 °F)	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 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	$3D04_H$: $F330_H$	Rated 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 x00 Climatic

Table 13-9 SIMATIC S7 format: Measuring ranges Pt 100, 200, 500, 1000 Climatic in °C and °F

Pt x00 Climatic in °C (1 digit = 0.01°C)	Units		Pt x00 Climatic in °F (1 digit = 0.01 °F)	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 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	$67E8_H$: $B820_H$	Rated 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 x00 Standard

Table 13-10 SIMATIC S7 format: Measuring ranges Ni 100, 120, 200, 500, 1000 Standard in °C and °F

Ni x00 Standard in °C (1 digit = 0.1°C)	Units		Ni x00 Standard in °C (1 digit = 0.1°F)	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 295.0	32767	$7FFF_H$	> 563.0	32767	$7FFF_H$	Overflow
295.0 : 250.1	2950 : 2501	$B86_H$: $9C5_H$	563.0 : 482.1	5630 : 4821	$15FE_H$: $12D5_H$	Overrange
250.0 : –60.0	2500 : –600	$9C4_H$: $FDA8_H$	482.0 : –76.0	4820 : –760	$12D4_H$: $FD08_H$	Rated range
–60.1 : –105.0	–601 : –1050	$FDA7_H$: $FBE6_H$	–76.1 : –157.0	–761 : –1570	$FD07_H$: $F9DE_H$	Underrange
< –105.0	–32768	8000_H	< –157.0	–32768	8000_H	Underflow

Measuring ranges for resistance thermometer Ni x00 Climatic

Table 13-11 SIMATIC S7 format: Measuring ranges Ni 100, 120, 200, 500, 1000 Climatic in °C and °F

Ni x00 Climatic in °C (1 digit = 0.01°C)	Units		Ni x00 Climatic in °F (1 digit = 0.01 °F)	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 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	$6D60_H$: $E250_H$	Rated 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 ranges for resistance thermometer Cu 10 Standard

Table 13-12 SIMATIC S7 format: Measuring ranges Cu 10 Standard in °C and °F

Cu 10 Standard in °C (1 digit = 0.1°C)	Units		Cu 10 Standard in °F (1 digit = 0.1 °F)	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 312.0	32767	$7FFF_H$	> 593.6	32767	$7FFF_H$	Overflow
312.0 : 260.1	3120 : 2601	$C30_H$: $A29_H$	593.6 : 500.1	5936 : 5001	1730_H : $12D5_H$	Overrange
260.0 : –200.0	2600 : –2000	$A28_H$: $F830_H$	500.0 : –328.0	5000 : –3280	1389_H : $F330_H$	Rated range
–200.1 : –240.0	–2001 : –2400	$F82F_H$: $F6A0_H$	–328.1 : –400.0	–3281 : –4000	$F32F_H$: $F060_H$	Underrange
< – 240.0	–32768	8000_H	< – 400.0	–32768	8000_H	Underflow

Measuring ranges for resistance thermometer Cu 10 Climatic

Table 13-13 SIMATIC S7 format: Measuring ranges Cu 10 Climatic in °C and °F

Cu 10 Climatic in °C (1 digit = 0.01°C)	Units		Cu 10 Climatic in °F (1 digit = 0.01 °F)	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 180.00	32767	$7FFF_H$	> 325.11	32767	$7FFF_H$	Overflow
180.00 : 150.01	18000 : 15001	4650_H : $3A99_H$	327.66 : 280.01	32766 : 28001	$7FFE_H$: $6D61A_H$	Overrange
150.00 : –50.00	15000 : –5000	$3A98_H$: $EC78_H$	280.00 : –58.00	28000 : –5800	$6D60_H$: $E958_H$	Rated range
–50.01 : –60.00	–5001 : –6000	$EC77_H$: E890H	–58.01 : –76.00	–5801 : –7600	$E957_H$: $E250_H$	Underrange
< – 60.00	–32768	8000_H	< – 76.00	–32768	8000_H	Underflow

Measuring range for thermocouple: Type B

Table 13-14 SIMATIC S7 format: Measuring range type B in °C and °F

Type B in °C	Units		Type B in °F	Units		Range
	Dec.	Hex.		Dec.	Hex.	
>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	Rated 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 C

Table 13-15 SIMATIC S7 format: Measuring range type C in °C and °F

Type C in °C	Units		Type C in °F	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 2500.0	32767	$7FFF_H$	> 3276.6	32767	$7FFF_H$	Overflow
2500.0 : 2315.1	25000 : 23151	$61A8_H$: $5A6F_H$	3276.6 : 2786.6	32766 : 27866	7FFEH : 6CDAH	Overrange
2315.0 : 0.0	23150 : 0	$5A6E_H$: 0000_H	2786.5 : 32.0	27865 : 320	$6CD9_H$: 0140_H	Rated range
0.1 : –120.0	–1 : –1200	FFFFH : $FB50_H$	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 13-16 SIMATIC S7 format: Measuring range type E in °C and °F

Type E in °C	Units		Type E in °F	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 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 : $EE44_H$	Rated range
< –270.0	–32768	8000_H	< –454.0	–32768	8000_H	Underflow

Measuring range for thermocouple type J

Table 13-17 SIMATIC S7 format: Measuring range type J in °C and °F

Type J in °C	Units		Type J in °F	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 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	$55A0_H$: $F27C_H$	Rated range
< –210.0	–32768	8000_H	< –346.0	–32768	8000_H	Underflow

Measuring range for thermocouple type K

Table 13-18 SIMATIC S7 format: Measuring range type K in °C and °F

Type K in °C	Units		Type K in °F	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 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	$61B8_H$: $EE44_H$	Rated range
< –270.0	–32768	8000_H	< –454.0	–32768	8000_H	Underflow

Measuring range for thermocouple type L

Table 13-19 SIMATIC S7 format: Measuring range type L in °C and °F

Type L in °C	Units		Type L in °F	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 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 : $F330_H$	Rated range
< –200.0	–32768	8000_H	< –328.0	–32768	80000_H	Underflow

Measuring range for thermocouple type N

Table 13-20 SIMATIC S7 format: Measuring range type N in °C and °F

Type N in °C	Units		Type N in °F	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 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	$5CA8_H$: $EE44_H$	Rated range
< –270.0	–32768	8000_H	–32768	8000_H	<$EE44_H$	Underflow

Measuring range for thermocouple types R, S

Table 13-21 SIMATIC S7 format: Measuring range type R, S in °C and °F

Types R, S in °C	Units		Types R, S in °F	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 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	$7DA2_H$: $FDBC_H$	Rated 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 13-22 SIMATIC S7 format: Measuring range type T in °C and °F

Type T in °C	Units		Type T in °F	Units		Range
	Dec.	Hex.		Dec.	Hex.	
> 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	$1D60_H$: $EE44_H$	Rated range
< –270.0	–32768	8000_H	< –454.0	–32768	8000_H	Underflow

13.1.3 Analog value representation for the measuring ranges of the analog output modules in SIMATIC 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 voltage and current: ± 5 V; ± 10 V; ± 20 mA

Table 13-23 SIMATIC S7 format: Output ranges ±5 V; ±10 V; ±20 mA

Output range ± 5 V	Output range ± 10 V	Output range ± 20 mA	Units		Range
			Decimal	Hexadecimal	
0	0	0	> 32511	> $7EFF_H$	Overflow
5.8800	11.7589	23.5150	32511	$7EFF_H$	Overrange
:	:	:	:	:	
5.0002	10.0004	20.0007	27649	$6C01_H$	
5.0000	10.0000	20.0000	27648	$6C00_H$	Rated range
3.7500	7.5000	14.9980	20736	5100_H	
:	:	:	:	:	
– 3.7500	– 7.5000	– 14.9980	–20736	$AF00_H$	
– 5.0000	– 10.0000	– 20.0000	–27648	9400_H	
– 5.0002	– 10.0004	– 20.0007	–27649	$93FF_H$	Underrange
:	:	:	:	:	
– 5.8800	– 11.7589	– 23.5160	–32512	8100_H	
0	0	< – 23.5160	< –32512	< 8100_H	Underflow

Output Ranges for Voltage and Current: 1 to 5 V, 4 to 20 mA

Table 13-24 SIMATIC S7 Format: Output ranges 1 to 5 V, 4 to 20 mA

Output range 1 to 5 V	Output range 4 to 20 mA	Units		Range
		Decimal	Hexadec.	
0	0	> 32511	> $7EFF_H$	Overflow
5.7000 : 5.0002	22.8100 : 20.0005	32511 : 27649	$7EFF_H$: $6C01_H$	Overrange
5.0000 : 1.0000	20.0000 : 4.0000	27648 : 0	$6C00_H$: 0_H	Rated range
0.9998 : 0	3.9995 : 0	–1 : –6912	$FFFF_H$: $E500_H$	Underrange
0	0	< –6913	< $E4FF_H$	Underflow

13.2 Fundamentals of analog value processing

13.2.1 Connecting measuring sensors

Introduction

You can connect different measuring sensors to the analog input modules, depending on the type of module involved:

- Voltage sensor
- Current sensors as:
  - Two-wire measuring transducer
  - Four-wire measuring transducer
- Resistance-type sensor

In this chapter you will find out how to connect the measuring sensors and what to watch for when doing so.

Lines for analog signals

You should use shielded and twisted-pair lines for the analog signals. This reduces the effect of interference. You should ground the shield of the analog lines at both ends of the line. If there are differences in potential between the ends of the line, a compensating current flows via the shield that can interfere with the analog signals. If this is the case, you should only ground the shield at one end of the line.

Analog input modules

In the case of the analog input modules there is electrical isolation:

- Between the logic circuitry and backplane bus
- Between the load voltage and the channels. The following differences exist:
  - No isolation: Connection between M_{ANA} and the central grounding point
  - Isolation: No connection between M_{ANA} and the central grounding point (U_{ISO})

Analog output modules

In the case of the analog output modules there is generally electrical isolation:

- Between the logic circuitry and backplane bus
- Between the load voltage and $M_{ANA.}$

Note

Ensure that this potential difference (U_{ISO}) does not exceed the permitted value. If there is a possibility of exceeding the permitted value, make a connection between terminal M_{ANA} and the central grounding point.

Connecting measuring sensors to analog inputs

Between the measuring lines M– of the input channels and the reference point of the measuring circuit M_{ANA} there can be only a limited potential difference U_{CM} (common-mode voltage). To ensure that the permitted value is not exceeded, you must take different steps depending on the whether the sensors are isolated or non-isolated. The steps you have to take are described in this chapter.

Generally speaking, however, when connecting two-wire measuring transducers for current measurement and when connecting resistance-type sensors, you should not make a connection from M– to M_{ANA}. This also applies to correspondingly parameterized but unused inputs.

Note

For the analog input modules 2AI U, 2AI RTD, and 2AI TC, you must short-circuit unused analog inputs.

Abbreviations used

The meanings of the abbreviations in the figures below are as follows:

M +:	Measuring line (positive)
M –:	Measuring line (negative)
M_{ANA}:	Reference potential of the analog measuring circuit
M:	Frame connection
L +:	Rated load voltage 24 VDC
U_{CM}:	Potential difference between inputs and reference potential of the measuring circuit M_{ANA}
U_{ISO}:	Potential difference between M_{ANA} and the central grounding point

Isolated measuring sensors

The isolated measuring sensors are not connected to the local ground potential. They can be floating. Depending on local conditions or interference, potential differences U_{CM} (static or dynamic) can occur between the measuring lines M– of the input channels and the reference point of the measuring circuit M_{ANA}.

To ensure that the permitted value for U_{CM} is not exceeded in environments with strong EMC interference, the following applies:

- In the case of the analog input modules 2AI U, 2AI I 4WIRE, and 2AI TC: Connect M– to M_{ANA}.
- When connecting two-wire measuring transducers for current measurement and when connecting resistance-type sensors, you must not connect M– to M_{ANA}.

Isolated measuring sensors (continued)

Figure 13-1 illustrates the connection of isolated measuring sensors to the floating analog input modules.

Figure 13-1 Connection of isolated measuring sensors to a floating analog input module

Non-isolated measuring sensors

The non-isolated measuring sensors are connected to the local ground potential. You must connect M_{ANA} to the ground potential. Depending on local conditions or interference, potential differences U_{CM} (static or dynamic) can occur between the locally distributed measuring points.

If the permitted value for U_{CM} is exceeded, there must be equalizing lines between the measuring points.

Figure 13-2 illustrates the connection of non-isolated measuring sensors to a floating analog input module.

Figure 13-2 Connection of non-isolated measuring sensors to a floating analog input module

Operating four-wire measuring transducers on an external voltage supply

If there is isolation between the output and the supply of the measuring transducer, you can connect it to the 2AI I 4WIRE without additional connections.

If there is no isolation between the output and the supply of the measuring transducer, you can connect it to the 2AI I 4WIRE only if the reference potential of the power supply voltages (24 VDC) is the same.

If there is an increase in interference radiation, a connection between M– and M_{ana} on the terminal module of the 2AI I 4WIRE is recommended.

13.2.2 Connecting 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 13-25 Compensation of the reference junction temperature

Option	Description	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 is thus errored.	None
Use of a compensating box on the incoming lines of a single thermocouple	You compensate using a compensating box. The compensating box is the transition point from the Cu line to the thermocouple line. No further processing is necessary through the 2AI TC Standard.	None

Table 13-25 Compensation of the reference junction temperature

Option	Description	Reference junction parameters
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). Given appropriate parameter assignment, this temperature value in the ET 200S is distributed to the 2AI TC Standard modules and calculated in the modules together with the temperature value obtained for the measurement point. Number of reference junctions: 1	The parameter assignment of the IM151-1 and the 2AI TC must be coordinated: • 2AI RTD Standard parameterized to the Pt100 climatic range at the correct slot; • 2AI TC Standard: reference junction: RTD; select reference junction number 1 • IM: Assignment of the reference junction to a slot with the 2AI RTD Standard; selection of a channel;
Internal compensation in the case of the 2AI TC High Feature	There is a temperature sensor in the TM-E15S24-AT and TM-E15C24-AT terminal modules. The temperature sensor reports the temperature of the terminals to the 2AI TC High Feature. This value is then calculated together with the measured value from the channel of the electronic module.	• 2AI TC High Feature: Reference junction: yes

Extension to a reference junction

The thermocouples can be extended from their connection point by means of equalizing lines to the reference junction (transition to Cu line) or the compensating box. The reference junction can also be an ET 200S terminal module.

The equalization lines are made of the same material as the wires of the thermocouple. The incoming lines are made of copper. Ensure correct polarity when connecting.

Use of a compensating box

The influence of the temperature on the reference junction of a thermocouple (for example, terminal boxes) can be adjusted with a compensating box.

The compensating box contains a bridge circuit that is adjusted for a certain reference junction temperature (compensating temperature). You connect the thermocouples or their adjustment lines to the compensating box. The compensating box then forms the reference junction.

If the actual reference temperature differs from the compensating temperature, the temperature-dependent bridge resistance changes. A positive or negative compensation voltage occurs that is added to the thermo-electromotive force.

Compensating boxes with a **reference junction temperature of 0 °C** must be used for the compensation of the analog input modules.

Please note:

- The compensating box must be supplied on an isolated basis.
- The power supply unit must have adequate interference filtering (by means of a grounded shielding winding, for example).

Compensation by means of a resistance thermometer at the 2AI RTD

If thermocouples that are connected to the inputs of the 2AI TC have the same reference junction, compensate by means of a 2AI RTD.

For both channels of the 2AI TC module, you can select “RTD” or “None” as the reference junction. If you select “RTD,” the same reference junction (RTD channel) is always used for both channels.

Figure 13-3 Compensation by means of the 2AI RTD

Parameter assignment of the reference junction for the 2AI TC and the interface module

You set the reference junctions for the 2AI TC electronic modules by means of the following parameters:

Table 13-26 Reference junction parameters

Parameters	Module	Value range	Explanation
Reference junction slot	IM 151	None, 2 to 12 (IM151-1 BASIC) None, 2 to 63 (IM151-1 HIGH FEATURE) IM 151-1 STANDARD IM 151-1FO STANDARD	This parameter allows you to assign a slot (none, 2 to 12 or 2 to 63) where the channel for measuring the reference temperature is located (calculation of the compensation value).
Reference junction input	IM 151	RTD at channel 0 RTD at channel 1	This parameter allows you to set the channel (0/1) for measuring the reference temperature (calculation of the compensation value) for the assigned slot.
Reference junction E0 and reference junction E1	2AI TC	None, RTD	This parameter allows you to enable the use of the reference junction.
Reference junction number	2AI TC	1	This parameter allows you to assign the reference junction (1) that contains the reference temperature (compensation value).

Example of assigning parameters of reference junctions

- Setup: To keep things simple, only RTD and TC modules are shown in Figure 13-4:

Figure 13-4 Example of assigning parameters of reference junctions

- Relevant parameters to be set for the interface module

Parameters	Value
Reference junction slot	3
Reference junction input	RTD at channel 0

- (Relevant) parameters for 2AI RTD and 2AI TC:

Slot	Parameters	Value
8 (2AI RTD)	Type/range of measurement E0	RTD-4L Pt100 Climatic
5 (2AI TC)	Reference junction E0	RTD
	Reference junction E1	None
	Reference junction number	1
	Type/range of measurement E0	TC-EL Type...
	Type/range of measurement E1	(any)
8 (2AI TC)	Reference junction E0	RTD
	Reference junction E1	RTD
	Reference junction number	1
	Type/range of measurement E0	TC-EL Type...
	Type/range of measurement E1	TC-EL Type...
11 (2AI TC)	Reference junction E0	None
	Reference junction E1	RTD
	Reference junction number	1
	Type/range of measurement E0	(any)
	Type/range of measurement E1	TC-EL Type...

Non-isolated thermocouples

When you use non-isolated thermocouples, you must comply with the permitted common-mode voltage.

13.2.3 Notes on and circuits of unused channels of the analog input modules

- Deactivate unused input channels during parameter assignment.
- A deactivated channel always returns a value of $7FFF_H$.
- In the case of the standard modules 2AI U, 2AI I 2WIRE, 2AI I 4WIRE, 2AI RTD Standard, 2AI RTD High Feature, 2AI TC Standard, and 2AI TC High Feature, the cycle time of the module is halved.
- In the case of the high-speed modules 2AI U, 2AI I 2WIRE, and 2AI I 4WIRE, the cycle time remains unchanged at 1 ms.
- To adhere to the permissible potential differences (U_{CM}), you must wire jumpers on the terminal module for the unused channels. This is necessary in the case of the following modules:

Analog input module	TM terminal							
	Channel 0				Channel 1			
	1	2	3	4	5	6	7	8
2AI U Standard	●	●	●		●	●	●	
2AI RTD Standard, 2AI RTD High Feature, 2AI TC High Feature	●	●			●	●		
2AI TC Standard	●	●	●		●	●	●	
2AI U High Speed	●	●	●		●	●	●	

13.3 Behavior of the analog modules during operation and in the event of problems

This section deals with the following topics:

- The dependence of the analog input and output values on the supply voltage of the electronic module and on the operating modes of the PLC
- The behavior of the analog electronic modules depending on the position of the analog values in the respective value range
- The effect of errors on the analog inputs/outputs
- Use of the shield contact

Effect of the supply voltage and the operating mode

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 13-27 How the analog input/output values depend on the operating mode of the PLC (CPU of the DP master) and the supply voltage L +

Operating mode of the PLC (CPU of the DP master)		Supply voltage L + to ET 200S (power module)	Input value of the electronic module with analog inputs (evaluation possible in the CPU of the DP master)	Output value of the electronic module with analog outputs
Power on	RUN	L + applied	Process values	PLC values
			$7FFF_H$ until the first conversion after switching on or after parameterization of the module	Until the first value output: • After switching on, a signal of 0 mA or 0 V is output • Dependent on the “Behavior at CPU-Master-STOP” parameter
		L + not applied	$7FFF_H$	–
Power on	STOP	L + applied	Process value	Dependent on the “Behavior at CPU-Master-STOP” parameter
		L + not applied	$7FFF_H$	–
Power off	–	L + applied	–	Dependent on the “Behavior at CPU-Master-STOP” parameter
		L + not applied	–	–

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 13-28 illustrates this dependency.

Table 13-28 Behavior of the analog modules depending on the position of the analog input value in the value range

Measured value in	Input value in SIMATIC S7 format	Input value in SIMATIC S5 format
Rated range	Measured value	Measured value
Overrange/underrange	Measured value	Measured value
Overflow	$7FFF_H$	End of the overrange +1 plus overflow bit
Underflow	8000_H	End of the underrange –1 plus overflow bit
Before assigning parameters or in the case of incorrect parameter assignment[1)]	$7FFF_H$	$7FFF_H$

1) The following applies to 2AI U Standard, 2AI I 2WIRE Standard, 2AI I 4WIRE Standard, 2AI RTD Standard, and 2AI TC Standard with product version 1: If you assign a parameter incorrectly and trigger the diagnostic message for a parameterization error (for example, wire break for measuring range ± 20 mA), the SF LED lights up on the module and you can evaluate the diagnosis. In this state, correct input values are delivered to the DP master.

Effect of the value range for the analog output

The behavior of the electronic modules with analog outputs depends on where the output values are in the value range. The following table indicates this:

Table 13-29 Behavior of the analog modules depending on the position of the analog output value in the value range

Output value in	Output value in SIMATIC S5/S7 format
Rated range	Value from DP master
Overrange/underrange	Value from DP master
Overflow	0 signal
Underflow	0 signal
Before assigning parameters or in the case of incorrect parameter assignment[1)]	0 signal

1) The following applies to 2AO U Standard, 2AO I Standard with product version 1: If the substitute value that was assigned as parameter is outside the nominal range, a diagnostic message for parameter error is entered and the SF LED lights up. In this state, the output values transmitted by the DP master are output at the analog output modules.

Use of the shield contact

To avoid interference with analog electronic modules, we recommend:

- Shielded cable to the sensors/actuators
- Cable shields applied to the shield contact element
- Connecting the shield contact to the ground bus

13.4 Parameters for analog electronic modules

Parameters for

- 2AI U Standard analog electronic module
- 2AI I 2WIRE Standard analog electronic module
- 2AI I 4WIRE Standard analog electronic module

Table 13-30 Parameters for analog input modules U, I Standard

2AI U Standard	2AI I 2WIRE Standard	2AI I 4WIRE Standard	Value range	Default	Applicability
Group diagnosis (parameter assignment error, internal error)			• Disable • Enable	Disable	Module
Diagnostics: Overflow/underflow			• Disable • Enable	Disable	Module
Diagnostics: Wire break[2)]	Diagnostics: Wire break	Diagnostics: Wire break[1)]	• Disable • Enable	Disable	Channel
Smoothing			• None • Weak • Medium • Strong	None	Channel
Type/range of measurement	—	—	• Deactivated • ± 5 V • 1 to 5 V • ± 10 V	±10 V	Channel
—	Type/range of measurement	—	• Deactivated • 2WIRE: 4 to 20 mA	2WIRE: 4 to 20 mA	Channel
—	—	Type/range of measurement	• Deactivated • 4WIRE: 4 to 20 mA • 4WIRE: ±20 mA	2WIRE: 4 to 20 mA	Channel

1) Only in the measuring range 4 to 20 mA
2 Only in the measuring range 1 to 5 V

Parameters for

- 2AI U High Feature analog electronic module
- 2AI I 2/4WIRE High Feature analog electronic module

Table 13-31 Parameters for analog electronic modules U, I High Feature

2AI U High Feature	2AI I 2/4WIRE High Feature	Value range	Default	Applicability
Group diagnosis (parameter assignment error, internal error)		• Disable • Enable	Disable	Module
Diagnostics: Overflow/underflow		• Disable • Enable	Disable	Module
——	Diagnostics: Wire break[1)]	• Disable • Enable	Disable	Channel
Smoothing		• None • Weak • Medium • Strong	None	Channel
Type/range of measurement	——	• Deactivated • ±5 V • 1 to 5 V • ±10 V	±10 V	Channel
——	Type/range of measurement	• Deactivated • 4 to 20 mA • ±20 mA	4 to 20 mA	Channel
Interference frequency suppression		• Disable • Enable	Disable	Module
Run-time calibration		• Disable • Enable	Disable	Module

[1)] Only in the measuring range 4 to 20 mA

Parameters for

- 2AI U High Speed analog electronic module
- 2AI I 2WIRE High Speed analog electronic module
- 2AI I 4WIRE High Speed analog electronic module

Table 13-32 Parameters for U, I, and High Speed analog input modules

2AI U High Speed	2AI I 2WIRE High Speed	2AI I 4WIRE High Speed	Value range	Default	Applicability
Group diagnosis (parameter assignment error, internal error)			• Disable • Enable	Disable	Module
Diagnostics: Overflow/underflow			• Disable • Enable	Disable	Module
——	Diagnostics: Wire break	Diagnostics: Wire break	• Disable • Enable	Disable	Channel
Smoothing			• None • Weak • Medium • Strong	None	Channel
Type/range of measurement	——	——	• Deactivated • ±10 V • ±5 V • ± 2.5 V • 1 to 5 V	±10 V	Channel
——	Type/range of measurement	——	• Deactivated • 4 to 20 mA • 0 to 20 mA	4 to 20 mA	Channel
——	——	Type/range of measurement	• Deactivated • 4 to 20 mA • 0 to 20 mA • ± 20 mA	4 to 20 mA	Channel

Note

If you deactivate a channel of the High Speed module, you do not achieve any speed advantage on account of the measuring procedure used.

Parameters for

- 2AI RTD Standard analog electronic module
- 2AI TC Standard analog electronic module
- 2AI TC High Feature analog electronic module

Table 13-33 Parameters for analog input modules RTD, TC

2AI RTD Standard	2AI TC Standard	2AI TC High Feature	Value range	Default	Applica-bility
Group diagnosis (parameter assignment error, internal error)			• Disable • Enable	Disable	Module
Diagnostics: Overflow/underflow			• Disable • Enable	Disable	Module
Diagnos-tics: Wire break[2)]	Diagnostics: Wire break check[1)]		• Disable • Enable	Disable	Channel
Smoothing			• None • Weak • Medium • Strong	None	Channel
		Temperature unit	• Celsius • Fahrenheit	Celsius	Module
——	Reference junction	——	• None • RTD	None	Channel
——		Reference junction	• None • Yes (i.e. internal)	None	Channel
——	Reference junction number	——	• None • 1 to 8 (in the case of the IM151-1 STANDARD, IM151-1 FO STANDARD) • 1 (in the case of the IM151-1 BASIC, IM151-1 HIGH FEATURE)	None	Module
Type/ range of measure-ment	——		• Deactivated • 150 ohms • 300 ohms • 600 ohms • Pt100 Climatic • Ni100 Climatic Range • Pt100 Standard • Ni100 Standard	Pt100 Standard	Channel

Table 13-33 Parameters for analog input modules RTD, TC, continued

2AI RTD Standard	2AI TC Standard	2AI TC High Feature	Value range	Default	Applica-bility
——	Type/range of measure-ment	——	• Deactivated • Voltage ± 80 mV • TC-EL type T (Cu-CuNi) • TC-EL type K (NiCr-Ni) • TC-EL type B (PtRh-PtRh) • TC-EL type N (NiCrSi-NiSi) • TC-EL type E (NiCr-CuNi) • TC-EL type R (PtRh-Pt) • TC-EL type S (PtRh-Pt) • TC-EL type J (Fe-Cu-Ni) • TC-EL type L (Fe-Cu-Ni)	TC-EL type K (NiCr-Ni)	Channel
		Type/range of measurement	• Deactivated • Voltage ± 80 mV • TC-EL type T (Cu-CuNi) • TC-EL type K (NiCr-Ni) • TC-EL type B (PtRh-PtRh) • TC-EL type C (WRe-WRe) • TC-EL type N (NiCrSi-NiSi) • TC-EL type E (NiCr-CuNi) • TC-EL type R (PtRh-Pt) • TC-EL type S (PtRh-Pt) • TC-EL type J (Fe-Cu-Ni) • TC-EL type L (Fe-Cu-Ni)	TC-EL type K (NiCr-Ni)	Channel

1) Only with thermocouples. A parameter assignment error occurs when the wire break diagnosis is enabled in the voltage measuring range. The module does not start up.
2) The wire break is only detected with constant-current lines.

Parameters for

- 2AI RTD High Feature analog electronic module

Table 13-34 Parameters for 2AI RTD High Feature analog electronic module

Parameters	Value range	Default	Applicability
Group diagnosis	• Disable • Enable	Disable	Module
Diagnostics: Overflow/underflow	• Disable • Enable	Disable	Module
Diagnostics: Wire break	• Disable[1)] • Enable	Disable	Channel
Smoothing	• None • Weak • Medium • Strong	None	Channel
Temperature unit	• Celsius • Fahrenheit	Celsius	Module
Type of measurement	• Deactivated • Four-conductor resistor • Three-conductor resistor • Two-conductor resistor • Four-conductor thermal resistor • Three-conductor thermal resistor • Two-conductor thermal resistor	Four-conductor thermal resistor	Channel
Temperature coefficient	• Pt 0.003850 • Pt 0.003916 • Pt 0.003902 • Pt 0.003920 • Pt 0.003851 • Ni 0.006180 • Ni 0.006720 • Ni 0.005000 • Cu 0.00427	Pt 0.003851	Channel

Table 13-34 Parameters for 2AI RTD High Feature analog electronic module, continued

Parameters	Value range	Default	Applicability
Measuring range	• 150Ω • 300Ω • 600Ω • 3000Ω • PTC • Pt100 Climatic • Ni100 Climatic Range • Pt100 Standard • Ni100 Standard • Pt500 standard range • Pt1000 standard range • Ni1000 standard range • Pt200 climatic range • Pt500 climatic range • Pt1000 climatic range • Ni1000 climatic range • Pt200 standard range • Ni120 standard range • Ni120 climatic range • Cu10 climatic range • Cu10 standard range • Ni200 standard range • Ni200 climatic range • Ni500 standard range • Ni500 climatic range	Pt100 Standard	Channel

1) Wire break diagnosis is locked if
– Type of measurement = “deactivated” or
Measuring Range = “PTC” was assigned.

Type of measurement - temperature coefficient - measuring range

The following table lists the temperature coefficients and measuring ranges you can set for each measurement type:

Type of measurement	Temperature coefficient	Measuring range
Deactivated	-	-
Four-conductor resistor Three-conductor resistor	-	150Ω / 300Ω / 600Ω / 3000Ω
Two-conductor resistor	-	150Ω / 300Ω / 600Ω / 3000Ω / PTC
Three-conductor thermal resistor	Pt 0.003850/ Pt 0.003916 / Pt 0.003902 / Pt 0.003920 / Pt 0.003851[1)]	Pt100 climatic range / Pt100 standard range / Pt200 climatic range / Pt200 standard range / Pt500 climatic range / Pt500 standard range / Pt1000 climatic range / Pt1000 standard range
	Ni 0.006180[1)] / Ni 0.006720	Ni100 climatic range / NI100 standard range / Ni120 climatic range / Ni120 standard range / Ni200 climatic range / Ni200 standard range / Ni500 climatic range / Ni500 standard range / Ni1000 climatic range / Ni1000 standard range
	Ni 0.005000	Ni 1000 climatic range[2)] Ni 1000 standard range[2)]
	Cu 0.00427[1)]	Cu10 climatic range / Cu10 standard range
Two-conductor thermal resistor Four-conductor thermal resistor	Pt 0.003850 / Pt 0.003916 / Pt 0.003902 / Pt 0.003920 / Pt 0.003851	Pt100 climatic range Pt100 standard range Pt200 climatic range / Pt200 standard range / Pt500 climatic range / Pt500 standard range / Pt1000 climatic range / Pt1000 standard range
	Ni 0.006180 / Ni 0.006720	Ni100 climatic range / NI100 standard range / Ni120 climatic range / Ni120 standard range / Ni200 climatic range / Ni200 standard range / Ni500 climatic range / Ni500 standard range / Ni1000 climatic range / Ni1000 standard range
	Ni 0.005000	Ni 1000 climatic range[2)] Ni 1000 standard range[2)]

1) The default settings for the temperature coefficients are valid for Europe.
2) For LG-Ni 1000 sensors from Siemens Building Ltd (Landis & Stäfa)

Temperature coefficient

The correction factor for the temperature coefficient (α value) specifies how much the resistance of a certain material changes when the temperature is raised by 1°C.

The temperature coefficient depends on the chemical composition of the material. Only one value is used in Europe for each type of sensor (default value).

Additional values enable you to make a sensor-specific setting for the temperature coefficient, therefore ensuring more accuracy.

Parameters for

- 2AO U Standard, 2AO U High Feature analog electronic module
- 2AO I Standard, 2AO I High Feature analog electronic module

Table 13-35 Parameters for analog output modules U, I

2AO U Standard, 2AO U High Feature	2AO I Standard, 2AO I High Feature	Value range	Default	Applicability
Group diagnosis (parameter assignment error, internal error)		• Disable • Enable	Disable	Module
Diagnostics: Short-circuit to M	——	• Disable • Enable	Disable	Channel
——	Diagnostics: Wire break	• Disable • Enable	Disable	Channel
Reaction to CPU-/master-STOP		• Output de-energized • Substitute a value • Keep last value	Output de-energized	Module
Type/range of output	——	• Deactivated • 1 to 5 V • ± 10 V	±10 V	Channel
——	Type/range of output	• Deactivated • 4 to 20 mA • ± 20 mA	4 to 20 mA	Channel
Substitute value [1]		0 to 65535 (value range must be inside the rated range)	±10 V/±20 V: 0 V 4 to 20 mA: 4 mA 1 to 5 V: 1 V	Channel

[1] If there is no voltage going to the IM but the supply to the analog output modules continues, the parameterized substitute values are output. Substitute values must be within the nominal range. You can assign as parameters values from –27648 to +27648 (in the case of parameter assignment by means of the device database file).

Smoothing

The individual measured values are smoothed by means of digital filtering. The smoothing can be adjusted in 4 steps, where the smoothing factor k multiplied by the cycle time of the electronic module corresponds to the time constant of the smoothing filter. The greater the smoothing, the greater the time constant of the filter.

The figures below show the step response for the different smoothing factors depending on the number of module cycles.

- Smoothing in the case of the 2AI U Standard, 2AI U High Feature, 2AI I 2WIRE Standard, 2AI I 4WIRE Standard, 2AI I 2/4WIRE High Feature, 2AI RTD Standard, 2AI RTD High Feature, 2AI TC Standard, 2AI TC High Feature

Figure 13-5 Smoothing in the case of the 2AI U Standard, 2AI U High Feature, 2AI I 2WIRE Standard, 2AI I 4WIRE Standard, 2AI I 2/4WIRE High Feature, 2AI RTD Standard, 2AI RTD High Feature, 2AI TC Standard, 2AI TC High Feature

- Smoothing in the case of the 2AI U High Speed, 2AI I 2WIRE High Speed, 2AI I 4WIRE High Speed

Figure 13-6 Smoothing in the case of the 2AI U High Speed, 2AI I 2WIRE High Speed, 2AI I 4WIRE High Speed

Interference frequency suppression

The 2AI U High Feature and 2AI I 2/4WIRE High Feature analog input modules support the interference frequency suppression setting (50 Hz or 60 Hz) for the interface module. These High Feature analog input modules also allow you to disable interference frequency suppression, thus ignoring the setting made on the interface module. If you disable interference frequency suppression, the conversion and cycle times become faster for these modules.

Run-time calibration

- 2AI U High Feature

  Run-time calibration can be enabled at module parameterization for the 2AI U High Feature analog electronic module to adjust for component drift due to changes in ambient temperature. During the calibration interval, new data updates will be delayed for 250 ms. Calibration takes place every time there is a 5° C change in ambient temperature.

- 2AI I 2/4WIRE High Feature

  Run-time calibration can be enabled at module parameterization for the 2AI I 2/4WIRE High Feature analog electronic module to periodically adjust for the offset voltage drift of the A/D converter. During the calibration interval, new data updates will be delayed for 200 ms. The accuracy limits of the module will be met without run-time calibration.

Reference junction

See Section 13.2.2

Reference junction number:

See Section 13.2.2

13.5 2AI U Standard analog electronic module (6ES7134-4FB00-0AB0)

Order number

6ES7134-4FB00-0AB0

Features

- 2 inputs for measuring voltage
- Input ranges:

  ± 10 V, resolution 13 bits + sign

  ± 5 V, resolution 13 bits + sign

  1 to 5 V, resolution 13 bits
- Isolated from the load voltage L+
- Permitted common-mode voltage 2 VAC_{pp}

Terminal assignment

The following table indicates the terminal assignment of the 2AI U Standard for the different terminal modules:

Table 13-36 Terminal assignment of the 2AI U Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground of the module

Table 13-36 Terminal assignment of the 2AI U Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground of the module Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
		Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground of the module
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground of the module Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 13-7 Block diagram of the 2AI U Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels	No

Permissible potential difference	
• Between inputs and M_{ANA} (U_{CM})	2 VAC_{pp}
• Between M_{ANA} and the central grounding point (U_{ISO})	75 VDC/60 VAC
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 30 mA
Power dissipation of the module	Typ. 0.6 W
Status, interrupts, diagnostics	
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Analog value generation		
Measuring principle	Integrative	
Integration and cycle time/ resolution per channel:		
• Integration time parameterizable	Yes	
• Interference frequency suppression in Hz	60	50
• Integration time in milliseconds	16.7	20
• Conversion time in ms	55	65
• Cycle time in ms	Number of active channels per module × conversion time	
• Resolution (including overrange)	± 10 V/13 bits + sign ± 5 V/13 bits + sign 1 to 5 V/13 bits	

Suppression of interference, limits of error	
Interference voltage suppression for f = n x (f1 ± 1%), (f1 = interference frequency)	
• Common-mode interference (U_{pp})	Min. 90 dB
• Series-mode interference (peak interference value < rated value of input range)	Min. 70 dB
• Crosstalk between the inputs	Min. –50 dB
Operational limit (entire temperature range with reference to input range)	± 0.6 %
Basic error limit (operational limit at 25 °C with reference to input range)	±0.4%
Temperature error (with reference to the input range)	±0.01%/K
Linearity error (with reference to the input range)	±0.01%
Repeatability (in steady state at 25 °C with reference to input range)	±0.05 %

Data for selecting a sensor	
Input range (rated value)/input resistance	
• Voltage	±5 V/min. 100 kΩ 1 to 5 V/min. 100 kΩ ±10 V/min. 100 kΩ
Permitted input voltage (destruction limit)	35 V continuous, 75 V for max. 1 ms (pulse duty factor 1:20)
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	4 x cycle time
Medium	32 x cycle time
Strong	64 x cycle time

13.6 2AI U High Feature analog electronic module (6ES7134-4LB00-0AB0)

Order number

6ES7134-4LB00-0AB0

Features

- 2 inputs for measuring voltage
- Input ranges:
  - ±10 V, resolution 15 bits + sign
  - ±5 V, resolution 15 bits + sign
  - 1 to 5 V, resolution 15 bits
- Isolated from the load voltage L+
- Permitted common-mode voltage between the channels 100 VAC

Terminal assignment

The following table indicates the terminal assignment of the 2AI U High Feature for the different terminal modules:

Table 13-37 Terminal assignment of the 2AI U High Feature

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Input signal “+” M–: Input signal “–”

Table 13-37 Terminal assignment of the 2AI U High Feature, continued

View	Terminal assignment	Remarks
	TM-E15S24-01 and 2AI U High Feature	Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Input signal “+” M–: Input signal “–” Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
	TM-E15S23-01 and 2AI U HF	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 M+: Input signal “+” M–: Input signal “–” Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
	TM-E15S26-A1 and 2AI U High Feature	Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+: Input signal “+” M–: Input signal “–” Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 13-8 Block diagram of the 2AI U High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Shielded	Max. 200 m

Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels and PE	Yes
• Between the channels	No
Permissible potential difference	
• Between the channels	140 VDC/100 VAC
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 53 mA
Power dissipation of the module	Typ. 0.85 W

Status, interrupts, diagnostics			
Diagnostic functions			
• Group error	Red “SF” LED		
• Diagnostic functions readable (wire break diagnosis is not supported on the module.)	Yes		
Analog value generation			
Measuring principle	Integrative		
Integration and cycle time/resolution per channel			
• Integration time parameterizable	Yes		
• Interference frequency suppression in Hz	60	50	No
• Integration time in milliseconds	16.67	20	7.5
• Conversion time in ms			
– 1 channel active per module	25	30	10
– 2 channels active per module	58.3	70	26
• Cycle time in ms			
– 1 channel active per module	75	90	30
– 2 channels active per module	175	210	78
• Resolution (including overrange)	±10 V/ 15 bits +sign ±5 V/ 15 bits + sign 1 to 5 V/ 15 bits		
Suppression of interference, limits of error			
Interference frequency suppression for f = n x (f1 ± 0.5%), (f1 = interference frequency)			
• Common-mode interference (U_{pp})	Min. 100 dB		
• Series-mode interference (peak interference value < rated value of input range)	Min. 90 dB		
• Crosstalk between the inputs	Min. –100 dB		

Operational limit (entire temperature range with reference to input range; calibration enabled[1])	±0.1%
Operational limit (entire temperature range with reference to input range; calibration disabled)	±0.5%
Basic error limit (operational limit at 25°C with reference to input range; calibration enabled[1])	±0.05%
Temperature error (with reference to input range; calibration enabled[1])	±0.003%/K
Temperature error (with reference to input range; calibration disabled)	±0.015%/K
Linearity error (with reference to the input range)	±0.03%
Repeatability (in steady state at 25 °C with reference to input range)	±0.01%

Data for selecting a sensor	
Input range (rated value)/input resistance	
• Voltage	±10 V/min. 1 MΩ ±5 V/min. 1 MΩ 1 to 5 V/min. 1 MΩ
Permitted input voltage (destruction limit)	35 V continuous, 75 V for max. 1 ms
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	4 x cycle time
Medium	32 x cycle time
Strong	64 x cycle time

1) Run-time calibration can be enabled at module parameter assignment to adjust for component drift due to changes in ambient temperature. During the calibration interval, new data updates will be delayed for 250 ms. Calibration takes place every time there is a 5°C change in ambient temperature.

13.7 2AI U High Speed analog electronic module (6ES7134-4FB51-0AB0)

Order number

6ES7134-4FB51-0AB0

Features

- 2 inputs for measuring voltage
- Input ranges:

  ± 10 V, resolution 13 bits + sign

  ± 5 V, resolution 13 bits + sign

  ± 2.5 V, resolution 13 bits + sign

  1 to 5 V, resolution 13 bits
- Isolated from the load voltage L+
- Permitted common-mode voltage 100 VAC_{pp}
- Supports clocked operation
  - Minimum time for the clocked DP cycle (T_{DPmin}): 2.5 ms
  - Minimum conversion time of the input modules (T_{WEmin}): 1.1 ms

Terminal assignment

The following table indicates the terminal assignment of the 2AI U High Speed for the different terminal modules:

Table 13-38 Terminal assignment of the 2AI U High Speed

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground of the module

Table 13-38 Terminal assignment of the 2AI U High Speed, continued

View	Terminal assignment	Remarks
	TM-E15S24-01 and 2AI U High Speed	Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground of the module Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
	TM-E15S23-01 and 2AI U High Speed	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground of the module
	TM-E15S26-A1 and 2AI U High Speed	Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground of the module Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 13-9 Block diagram of the 2AI U High Speed

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	Yes
Number of inputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels	No
Permissible potential difference	
• Between inputs and M_{ANA} (U_{CM})	100 VAC_{pp}
• Between M_{ANA} and the central grounding point (U_{ISO})	75 VDC/60 VAC
Insulation tested	500 VDC
Current consumption	
• Power supply and load voltage L+ (no load)	Max. 35 mA
Power dissipation of the module	Typ. 0.8 W
Status, interrupts, diagnostics	
Interrupts	
• Hardware interrupt	Parameters can be assigned[1)]
Diagnostic functions	
• Group error display	Red “SF” LED
• Diagnostic information can be displayed	Possible[2)]

Analog value generation	
Measuring principle	Instantaneous value encoding
Cycle time/resolution:	
• Conversion time in ms (per channel)	0.1
• Cycle time in ms (per module)	1
• Resolution (including overrange)	± 10 V/13 bits + sign ± 5 V/13 bits + sign ± 2.5 V/13 bits + sign 1 to 5 V/13 bits
Suppression of interference, limits of error	
• Common mode interference (U_{cm}) < 100 V_{pp})	> 70 dB
Crosstalk between the inputs	> 50 dB
Operational limit (entire temperature range with reference to input range)	± 0.3%
Basic error limit (operational limit at 25 °C with reference to input range)	±0.2%
Temperature error (with reference to the input range)	±0.01%/K
Linearity error (with reference to the input range)	±0.01%
Repeatability (in steady state at 25 °C with reference to input range)	±0.05%

Data for selecting a sensor	
Input ranges (rated value)/input resistance	
• Voltage	±10 V/min. 100 kΩ ±5 V/min. 100 kΩ ±2.5 V/min. 100 kΩ 1 – 5 V/min. 100 kΩ
Maximum input voltage for voltage input (destruction limit)	50 V continuous, 100 V for max. 1 ms (pulse duty factor 1:20)
Connection of the sensors	
• For measuring voltage	Possible
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	64 x cycle time
Medium	128 x cycle time
Strong	512 x cycle time

1) DPV1 only
2) Parameter assignment error
Violation of lower limit value
Violation of upper limit value
Open circuit (only with 1 to 5 V)
Hardware interrupt lost

13.8 2AI I 2WIRE Standard analog electronic module (6ES7134-4GB00-0AB0)

Order number

6ES7134-4GB00-0AB0

Features

- 2 inputs for measuring current
- Input range:

  4 to 20 mA, resolution 13 bits

Terminal assignment

The following table indicates the terminal assignment of the 2AI I 2WIRE Standard for the different terminal modules:

Table 13-39 Terminal assignment of the 2AI I 2WIRE Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground (of power module) Two-wire measuring transducer is supplied by means of the measuring circuits.
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground (of power module) Two-wire measuring transducer is supplied by means of the measuring circuits. Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Table 13-39 Terminal assignment of the 2AI I 2WIRE Standard, continued

View	Terminal assignment	Remarks
	TM-E15S23-01 and 2AI I 2WIRE Standard	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground (of power module) Two-wire measuring transducer is supplied by means of the measuring circuits.
	TM-E15S26-A1 and 2AI I 2WIRE Standard	Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground (of power module) Two-wire measuring transducer is supplied by means of the measuring circuits. Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 13-10 Block diagram of the 2AI I 2WIRE Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Power supply of the transmitters	Yes
• Short-circuit protection	Yes, (destruction limit 35 mA per channel)

Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	No
• Between the channels	No
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 80 mA
Power dissipation of the module	Typ. 0.6 W
Status, interrupts, diagnostics	
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Analog value generation		
Measuring principle	Integrative	
Integration and cycle time/ resolution per channel:		
• Integration time parameterizable	Yes	
• Interference frequency suppression in Hz	60	50
• Integration time in milliseconds	16.7	20
• Conversion time in ms	55	65
• Cycle time in ms	Number of active channels per module × conversion time	
• Resolution (including overrange)	4 to 20 mA/13 bits	

Suppression of interference, limits of error	
Interference voltage suppression for f = n x (f1 ± 1%), (f1 = interference frequency)	
• Series-mode interference (peak interference value < rated value of input range)	Min. 70 dB
Crosstalk between the inputs	Min. –50 dB
Operational limit (entire temperature range with reference to input range)	± 0.6%
Basic error limit (operational limit at 25 °C with reference to input range)	± 0.4%
Temperature error (with reference to the input range)	± 0.005%/K
Linearity error (with reference to the input range)	± 0.01%
Repeatability (in steady state at 25 °C with reference to input range)	± 0.05%

Data for selecting a sensor	
Input range (rated value)/input resistance	
• Current	4 to 20 mA/50 Ω
Permitted input current (destruction limit)	40 mA
Load of the two-wire measuring transducer	Max. 750Ω
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	4 x cycle time
Medium	32 x cycle time
Strong	64 x cycle time

13.9 2AI I 2WIRE High Speed analog electronic module (6ES7134-4GB51-0AB0)

Order number

6ES7134-4GB51-0AB0

Features

- 2 inputs for measuring current
- Current-limited sensor supply (90 mA)
- Input ranges:

  4 to 20 mA, resolution 13 bits

  0 to 20 mA, resolution 13 bits
- Supports clocked operation
  - Minimum time for the clocked DP cycle (T_{DPmin}): 2.5 ms
  - Minimum conversion time of the input modules (T_{WEmin}): 1.1 ms

Terminal assignment

The following table indicates the terminal assignment of the 2AI I 2WIRE High Speed for the different terminal modules:

Table 13-40 Terminal assignment of the 2AI I 2WIRE High Speed

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground (of power module) Two-wire measuring transducer is supplied by means of the measuring circuits.

Table 13-40 Terminal assignment of the 2AI I 2WIRE High Speed, continued

View	Terminal assignment	Remarks
	TM-E15S24-01 and 2AI I 2WIRE High Speed	Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground (of power module) Two-wire measuring transducer is supplied by means of the measuring circuits. Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
	TM-E15S23-01 and 2AI I 2WIRE High Speed	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground (of power module) Two-wire measuring transducer is supplied by means of the measuring circuits.
	TM-E15S26-A1 and 2AI I 2WIRE High Speed	Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground (of power module) Two-wire measuring transducer is supplied by means of the measuring circuits. Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 13-11 Block diagram of the 2AI I 2WIRE High Speed

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	Yes
Number of inputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
• Short-circuit protection	Yes, (destruction limit 35 mA per channel)
Isolation	
• Between channels and backplane bus	Yes
• Between channels and load voltage L+	No
• Between the channels	No
Permissible potential difference	
• Between M_{ANA} and $M_{internal}$ (U_{ISO})	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption	
• Power supply and load voltage L+ (no load)	Max. 35 mA[1]
Power dissipation of the module	Typ. 0.8 W
Status, interrupts, diagnostics	
Interrupts	
• Hardware interrupt	Parameters can be assigned[2]
Diagnostic functions	
• Group error display	Red “SF” LED
• Diagnostic functions readable	Possible[3)]

Analog value generation	
Measuring principle	Instantaneous value encoding
Cycle time/resolution:	
• Conversion time in ms (per channel)	0.1
• Cycle time in ms (per module)	1
• Resolution (including overrange)	4 to 20 mA/13 bits 0 to 20 mA/13 bits
Suppression of interference, limits of error	
Crosstalk between the inputs	> 50 dB
Operational limit (entire temperature range with reference to input range)	±0.3%
Basic error limit (operational limit at 25 °C with reference to input range)	±0.2%
Temperature error (with reference to the input range)	±0.01%/K
Linearity error (with reference to the input range)	±0.01%
Repeatability (in steady state at 25 °C with reference to input range)	±0.05%
Sensor power supply outputs	
Number of outputs	2
Output voltage	
• With load	L+ (–2.5 V)
Output current	
• Rated value	90 mA (both channels)
• Permitted range	0 mA to 90 mA
Short-circuit protection	Yes, electronic

Data for selecting a sensor	
Input range (rated value/input resistance)	
• Current	4 to 20 mA/50 Ω 0 to 20 mA/50 Ω
Connection of the sensors	
• For current measurement as two-wire transmitter	Possible
Load of the two-wire measuring transducer	Max. 670Ω
Maximum input current for current input (destruction limit)	60 mA

Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	64 x cycle time
Medium	128 x cycle time
Strong	512 x cycle time

1) Without sensor supply voltage
2) DPV1 only
3) Parameter assignment error
Violation of lower limit value
Violation of upper limit value
Open circuit (only with 4 to 20 mA)
Hardware interrupt lost

13.10 2AI I 4WIRE Standard analog electronic module (6ES7134-4GB10-0AB0)

Order number

6ES7134-4GB10-0AB0

Features

- 2 inputs for measuring current
- Input ranges:
  - ± 20 mA, resolution 13 bits + sign
  - 4 to 20 mA, resolution 13 bits
- Permitted common-mode voltage 2 VAC_{pp}

Terminal assignment

The following table indicates the terminal assignment of the 2AI I 4WIRE Standard for the different terminal modules:

Table 13-41 Terminal assignment of the 2AI I 4WIRE Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Input signal “+” M–: Input signal “–” 24 VDC: Power supply for four-wire measuring transducer M_{ana}: Ground (of power module) Four-wire measuring transducer is supplied by means of the module.
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+: Input signal “+” M–: Input signal “–” 24 VDC: Power supply for four-wire measuring transducer M_{ana}: Ground (of power module) Four-wire measuring transducer is supplied by means of the module.

Block diagram

Figure 13-12 Block diagram of the 2AI I 4WIRE Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Power supply of the transmitters	Yes
• Short-circuit protection	Yes, 60 mA (for both channels)

Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	No
• Between the channels	No
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 30 mA
Power dissipation of the module	Typ. 0.6 W
Status, interrupts, diagnostics	
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Analog value generation		
Measuring principle	Integrative	
Integration and cycle time/ resolution per channel:		
• Integration time parameterizable	Yes	
• Interference frequency suppression in Hz	60	50
• Integration time in milliseconds	16.7	20
• Conversion time in ms	55	65
• Cycle time in ms	Number of active channels per module × conversion time	
• Resolution (including overrange)	± 20 mA/13 bits + sign 4 to 20 mA/13 bits	

Suppression of interference, limits of error	
Interference voltage suppression for f = n x (f1 ± 1%), (f1 = interference frequency)	
• Series-mode interference (peak interference value < rated value of input range)	Min. 70 dB
Crosstalk between the inputs	Min. –50 dB
Operational limit (in the entire temperature range, with reference to the input range)	± 0.6%
Basic error limit (operational limit at 25 °C with reference to input range)	± 0.4%
Temperature error (with reference to the input range)	± 0.005%/K
Linearity error (with reference to the input range)	± 0.01%
Repeatability (in steady state at 25 °C with reference to input range)	± 0.05%

Data for selecting a sensor	
Input range (rated value)/input resistance	
• Current	± 20 mA/50Ω 4 to 20 mA/50 Ω
Permitted input current (destruction limit)	40 mA
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	4 x cycle time
Medium	32 x cycle time
Strong	64 x cycle time

13.11 2AI I 2/4WIRE High Feature analog electronic module (6ES7134-4MB00-0AB0)

Order number

6ES7134-4MB00-0AB0

Features

- 2 inputs for measuring current
- Input ranges:
  - ±20 mA, resolution 15 bits + sign
  - 4 to 20 mA, resolution 15 bits
- Isolated from the load voltage L+
- Permitted common-mode voltage between the channels 100 VAC
- Supports two-wire or four-wire measuring transducers

Terminal assignment

The following table indicates the terminal assignment of the 2AI I 2/4WIRE High Feature for the different terminal modules:

Table 13-42 Terminal assignment of the 2AI I 2/4WIRE High Feature

View	Terminal assignment	Remarks
TM-E15S24-01 and 2AI I 2/4WIRE High Feature 4 conductors Four-wire measuring transducer **CH0** / **CH1** M_{0+} (1) / M_{1+} M_{0-} (2) / M_{1-} 24 VDC+ (3) / 24 VDC+ 24 VDC– (4) / 24 VDC–		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+ : Input signal “+” M–: Input signal “–” 24 VDC+: Power supply for four-wire measuring transducer 24 VDC–: Return circuit for measuring transducer supply It is possible to supply four-wire measuring transducers by means of the module. To support isolation between the channels, use an external supply to feed one of the measuring transducers.

Table 13-42 Terminal assignment of the 2AI I 2/4WIRE High Feature, continued

View	Terminal assignment	Remarks
TM-E15S24-01 and 2AI I 2/4WIRE High Feature (Alternative terminal assignment for 2WIRE) 2 conductors Two-wire measuring transducer **CH0** / **CH1** M_{0+} (1) / M_{1+} M_{0-} (2) / M_{1-} 24 VDC+ (3) / 24 VDC+ 24 VDC– (4) / 24 VDC– mA		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+ : Input signal “–” M– : Connect to 24 VDC– 24 VDC+: Input signal “+” Two-wire measuring transducers are supplied by means of the measuring circuits. Mixing two-wire and four-wire measuring transducers is permitted. To support isolation between the channels, use an external supply to feed one of the measuring transducers.
TM-E15S26-A1 and 2AI I 2/4WIRE High Feature 4 conductors Four-wire measuring transducer **CH0** / **CH1** M_{0+} (1) / M_{1+} M_{0-} (2) / M_{1-} 24 VDC+ (3) / 24 VDC+ 24 VDC– (4) / 24 VDC– AUX1 (A4) / AUX1 AUX1 (A3) / AUX1 mA		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+ : Input signal “+” M–: Input signal “–” 24 VDC+: Power supply for four-wire measuring transducer 24 VDC–: Return circuit for measuring transducer supply It is possible to supply four-wire measuring transducers by means of the module. To support isolation between the channels, use an external supply to feed one of the measuring transducers.

Table 13-42 Terminal assignment of the 2AI I 2/4WIRE High Feature, continued

View	Terminal assignment	Remarks
TM-E15S26-A1 and 2AI I 2/4WIRE High Feature (Alternative terminal assignment for 2WIRE) 2 conductors Two-wire measuring transducer CH0 / CH1 M_{0+} 1 5 M_{1+} M_{0-} 2 6 M_{1-} 24 VDC+ 3 7 24 VDC+ 24 VDC– 4 8 24 VDC– AUX1 A A 4 8 AUX1 AUX1 A A 3 7 AUX1 mA		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+ : Input signal "–" M– : Connect to 24 VDC– 24 VDC+: Input signal"+" Two-wire measuring transducers are supplied by means of the measuring circuits. Mixing two-wire and four-wire measuring transducers is permitted. To support isolation between the channels, use an external supply to feed one of the measuring transducers.

Block diagram

Figure 13-13 Block diagram of the 2AI I 2/4WIRE High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Power supply of the transmitters	Yes
• Short-circuit protection	Yes, 60 mA (for both channels)
Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels and PE	Yes
• Between the channels	No
Permissible potential difference	
• Between the channels	140 VDC/100 VAC (with isolated power supply of the measuring transducers)
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 53 mA
Power dissipation of the module	Typ. 0.85 W

Status, interrupts, diagnostics			
Diagnostic functions			
• Group error	Red “SF” LED		
• Diagnostic functions readable	Yes		
Analog value generation			
Measuring principle	Integrative		
Integration and cycle time/resolution per channel:			
• Integration time parameterizable	Yes		
• Interference frequency suppression in Hz	60	50	No
• Integration time in milliseconds	16.67	20	7.5
• Conversion time in ms			
– 1 channel active per module	25	30	10
– 2 channels active per module	58.3	70	26
• Cycle time in ms			
– 1 channel active per module	75	90	30
– 2 channels active per module	175	210	78
• Resolution (including overrange)	±20 mA/15 bits + sign 4 to 20 mA/15 bits		
Suppression of interference, limits of error			
Interference frequency suppression for f = n x (f1 ± 0.5%), (f1 = interference frequency)			
• Common-mode interference (U_{pp})	Min. 100 dB		
• Series-mode interference (peak interference value < rated value of input range)	Min. 90 dB		
Crosstalk between the inputs	Min. –100 dB		
Operational limit[1)] (entire temperature range with reference to input range)	±0.1%		

Basic error limit[1] (operational limit at 25°C with reference to input range)	±0.05%
Temperature error (with reference to the input range)	±0.003%/K
Linearity error (with reference to the input range)	±0.03%
Repeatability (in steady state at 25 °C with reference to input range)	±0.01%
Data for selecting a sensor	
Input range (rated value)/input resistance	
• Current	±20 mA/50Ω 4 to 20 mA/50 Ω

Permitted input current (destruction limit)	40 mA (on a single channel)
Load of the two-wire measuring transducer	Max. 750Ω
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	4 x cycle time
Medium	32 x cycle time
Strong	64 x cycle time

1) Run-time calibration can be enabled at module parameter assignment to periodically adjust for the offset voltage drift of the A/D converter. During the calibration interval, the updating of data is delayed by 200 ms. The accuracy limits of the module will be met without run-time calibration.

13.12 2AI I 4WIRE High Speed analog electronic module (6ES7134-4GB61-0AB0)

Order number

6ES7134-4GB61-0AB0

Features

- 2 inputs for measuring current
- Current-limited sensor supply (90 mA)
- Input ranges:
  - 4 to 20 mA, resolution 13 bits
  - 0 to 20 mA, resolution 13 bits
  - ±20 mA, resolution 13 bits + sign
- Supports clocked operation
  - Minimum time for the clocked DP cycle (T_{DPmin}): 2.5 ms
  - Minimum conversion time of the input modules (T_{WEmin}): 1.1 ms

Terminal assignment

The following table indicates the terminal assignment of the 2AI I 4WIRE High Speed for the terminal module.

Table 13-43 Terminal assignment of the 2AI I 4WIRE High Speed

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Input signal “+” M–: Input signal “–” 24 VDC: Power supply for four-wire measuring transducer M_{ana}: Ground (of power module) Four-wire measuring transducer is supplied by means of the module.
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+: Input signal “+” M–: Input signal “–” 24 VDC: Power supply for four-wire measuring transducer M_{ana}: Ground (of power module) Four-wire measuring transducer is supplied by means of the module.

Block diagram

Figure 13-14 Block diagram of the 2AI I 4WIRE High Speed

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	Yes
Number of inputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between channels and backplane bus	Yes
• Between channels and load voltage L+	No
• Between the channels	No
Permissible potential difference	
• Between M_{ANA} and $M_{internal}$ (U_{ISO})	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption	
• Power supply and load voltage L+ (no load)	Max. 35 mA[1)]
Power dissipation of the module	Typ. 0.8 W
Status, interrupts, diagnostics	
Interrupts	
• Hardware interrupt	Parameters can be assigned[2)]
Diagnostic functions	
• Group error display	Red “SF” LED
• Diagnostic information readable	Possible[3)]

Analog value generation	
Measuring principle	Instantaneous value encoding
Cycle time/resolution:	
• Conversion time in ms (per channel)	0.1
• Cycle time in ms (per module)	1
• Resolution (including overrange)	4 to 20 mA/13 bit 0 to 20 mA/13 bit ±20 mA/13 bits + sign

Suppression of interference, limits of error	
Crosstalk between the inputs	> 50 dB
Operational limit (entire temperature range with reference to input range)	±0.3%
Basic error limit (operational limit at 25 °C with reference to input range)	±0.2%
Temperature error (with reference to the input range)	±0.01%/K
Linearity error (with reference to the input range)	±0.01%
Repeatability (in steady state at 25 °C with reference to input range)	±0.05%

Sensor power supply outputs	
Number of outputs	2
Output voltage	
• With load	L+ (-2.5 V)
Output current	
• Rated value	90 mA (both channels)
• Permitted range	0 mA to 90 mA
Short-circuit protection	Yes, electronic

Data for selecting a sensor	
Input range (rated value)/input resistance	
• Current	4 to 20 mA/50 Ω 0 to 20 mA/50 Ω ±20 mA/50 Ω
Connection of the sensors	
• For current measurement as two-wire transmitter	Possible
Load of the two-wire measuring transducer	Max. 670Ω
Maximum input current for current input (destruction limit)	60 mA
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	64 x cycle time
Medium	128 x cycle time
Strong	512 x cycle time

1) Without sensor supply voltage
2) DPV1 only
3) Parameter assignment error
Violation of lower limit value
Violation of upper limit value
Open circuit (only with 4 to 20 mA)
Hardware interrupt lost

13.13 2AI RTD Standard analog electronic module (6ES7134-4JB50-0AB0)

Order number

6ES7134-4JB50-0AB0

Features

- 2 inputs for resistance thermometers or resistance measurement
- Input ranges:
  - Resistance thermometers: Pt100, Ni100; resolution 15 bits + sign
  - Resistance measurement: 150 Ω, 300 Ω, 600 Ω; resolution max. 15 bits + sign
- Isolated from the load voltage L+
- Linearization of the sensor characteristic curves

Terminal assignment

The resistance thermometers/resistors are measured in a four-conductor connection. Constant current is fed to the resistance thermometers/resistors by means of connections I_C + and I_C –. The voltage generated at the resistance thermometer/resistor is measured by means of the connections M + and M –. This ensures highly accurate measurement results with the four-conductor connection.

With the two/three-conductor connection, you must apply corresponding jumpers to the module between M+ and I_c+ or M– and I_c–. However, you have to expect a loss of accuracy in the measurement results.

The following table indicates the terminal assignment of the 2AI RTD Standard on the terminal module.

Table 13-44 Terminal assignment of the 2AI RTD Standard

View	Terminal assignment	Remarks
	TM-E15S24-01 and 2AI RTD Standard	Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Measuring line (positive) I_{C-}: Constant-current line (negative) M–: Measuring line (negative) I_{C+}: Constant-current line (positive)
	TM-E15S26-A1 and 2AI RTD Standard	Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+: Measuring line (positive) I_{C-}: Constant-current line (negative) M–: Measuring line (negative) I_{C+}: Constant-current line (positive)

Note

A wire break in the measuring lines of the temperature sensors for three- or four-conductor connections (connections 1 and 2, or 5 and 6) is not detected. Undefined values can be reported.

Block diagram

Figure 13-15 Block diagram of the 2AI RTD Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Power supply of the transmitters	Yes
• Constant-current supply for resistance-type sensors	Approx. 1.5 mA
• Short-circuit protection	Yes

Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels	No
Permissible potential difference	
• Between M_{ANA} and the central grounding point (U_{ISO})	75 VDC/60 VAC
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 30 mA
Power dissipation of the module	Typ. 0.6 W
Status, interrupts, diagnostics	
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Analog value generation		
Measuring principle	Integrative	
Integration and cycle time/ resolution per channel:		
• Integration time parameterizable	Yes	
• Interference frequency suppression in Hz	60	50
• Integration time in milliseconds	16.7	20
• Conversion time in ms	110	130
• Cycle time in ms	Number of active channels per module × conversion time	
• Resolution (including overrange)	Pt100, Ni100/ 15 bits + sign 150Ω/14 bits/ 300Ω, 600Ω/15 bits	

Suppression of interference, limits of error	
Interference voltage suppression for f = n x (f1 ± 1%), (f1 = interference frequency)	
• Common-mode interference (U_{pp})	Min. 90 dB
• Series-mode interference (peak interference value < rated value of input range)	Min. 70 dB
Crosstalk between the inputs	Min. –50 dB
Operational limit (in the entire temperature range, with reference to the input range)	± 0.6%
Basic error limit (operational limit at 25°C with reference to input range)	± 0.4%
Temperature error (with reference to the input range)	± 0.005%/K
Linearity error (with reference to the input range)	± 0.01%
Repeatability (in steady state at 25°C with reference to input range)	± 0.05%

Data for selecting a sensor	
Input range (rated value)/input resistance	
• Resistance-type sensor	150 Ω/min. 2 MΩ 300 Ω/min. 2 MΩ 600 Ω/min. 2 MΩ
• Resistance thermometers	Pt100/min. 2 MΩ Ni100/min. 2 MΩ
Permitted input voltage (destruction limit)	Max. 9 V
Connection of the sensors	
• For measuring resistance	
– Two and three-conductor connection	Yes, line resistances are also measured, jumpers at T_R
– Four-conductor connection	Yes
Characteristic curve linearization	Yes, parameters can be assigned for Pt100, Ni100
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	4 x cycle time
Medium	32 x cycle time
Strong	64 x cycle time

13.14 2AI RTD High Feature analog electronic module (6ES7134-4NB50-0AB0)

Order number

6ES7134-4NB50-0AB0

Features

- 2 inputs for resistance thermometers or resistance measurement
- Input ranges
  - Resistance thermometers: Pt100; Ni100; Ni120; Pt200; Ni200; Pt500; Ni500; Pt1000; Ni1000; Cu10;
    resolution max. 15 bits + sign
  - Resistance measurement: 150Ω; 300Ω; 600Ω; 3000Ω; PTC;
    resolution max. 15 bits
- Automatic compensation of line resistances in the case of a three-conductor connection
- Temperature coefficient can be parameterized for resistance-type sensors
- High degree of accuracy
- Isolated from the load voltage
- Linearization of the sensor characteristic curves
- Parameter length 7 bytes
- Permitted common-mode voltage 5 VACss
- Recording of reference junction temperature (together with the 2AI TC Standard electronic module)
- Compatible with the 2AI RTD Standard (6ES7134-4JB50-0AB50)

Note

The EM 2AI RTD High Feature can replace a 2AI RTD Standard in an existing system.

- The wiring does not have to be changed. The additional bridges on the terminal module of the 2AI RTD Standard do not have to be removed.
- The configuration (in HWCONFIG or the DDB file) does not have to be changed. Only the new functions of the 2AI RTD High Feature cannot be parameterized in this instance.

Terminal assignment

The following table indicates the terminal assignment of the 2AI RTD High Feature on the terminal modules.

Table 13-45 Terminal assignment of the 2AI RTD High Feature

View	Terminal assignment	Remarks
	TM-E15S23-01 and 2AI RTD High Feature	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 M+: Measuring line (positive) M–: Measuring line (negative) I_{C+}: Constant-current line (positive)
	TM-E15S24-A1 and 2AI RTD High Feature	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Measuring line (positive) M–: Measuring line (negative) I_{C+}: Constant-current line (positive)

Table 13-45 Terminal assignment of the 2AI RTD High Feature, continued

View	Terminal assignment	Remarks
	TM-E15S24-01 and 2AI RTD High Feature	Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Measuring line (positive) I_{C-}: Constant-current line (negative) M–: Measuring line (negative) I_{C+}: Constant-current line (positive)
	TM-E15S26-A1 and 2AI RTD High Feature	Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+: Measuring line (positive) I_{C-}: Constant-current line (negative) M–: Measuring line (negative) I_{C+}: Constant-current line (positive)

Block diagram

Figure 13-16 Block diagram of the 2AI RTD High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Power supply of the transmitters	Yes
• Constant-current supply for resistance-type sensors	Approx. 1.25 mA
• Short-circuit protection	Yes

Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels	No
Permissible potential difference	
• Between M_{ANA} and the central grounding point (U_{ISO})	75 VDC/60 VAC
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 30 mA
Power dissipation of the module	Typ. 0.6 W
Status, interrupts, diagnostics	
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Analog value generation		
Measuring principle	Integrating (sigma-delta)	
Integration and cycle time/ resolution per channel:		
• Integration time parameterizable	Yes	
• Interference frequency suppression in Hz	60	50
• Integration time in milliseconds	16.7	20
• Basic conversion time including Integration time in milliseconds	50	60
• Additional conversion time for wire break check diagnosis in ms	5	5
• Additional conversion time in ms for line compensation in three-conductor connections	50	60
• Cycle time in ms	Number of active channels per module × conversion time	
• Resolution (including overrange)	Pt 100; Ni 100; Ni120; Pt 200; Ni 200; Pt 500; Ni 500; Pt 1000; Ni 1000; Cu 10 / 15 bits + sign 150Ω; 300Ω; 600Ω; 3000Ω; / 15 bits PTC[1)] / 1 bit	

Suppression of interference, limits of error	
Interference voltage suppression for f = n x (f1 ± 1%), (f1 = interference frequency)	
• Common-mode interference (U_{pp})	Min. 90 dB
• Series-mode interference (peak interference value < rated value of input range)	Min. 70 dB
Crosstalk between the inputs	Min. –50 dB
Operational limit (in the entire temperature range, with reference to the input range)	
• Resistance-type sensor	± 0.1%
• Pt100, Pt200, Pt500, Pt1000 Standard	± 1.0 K
• Pt100, Pt200, Pt500, Pt1000 Climatic	± 0.25 K
• Ni100, Ni120, Ni200, Ni500, Ni 1000 Standard and Climatic	± 0.4 K
• Cu10	± 1.5 K
Basic error limit for resistance-type sensors (operational limit at 25 °C with reference to the input range)	
• Resistance-type sensor	± 0.05%
• Pt100, Pt200, Pt500, Pt1000 Standard	± 0.6 K
• Pt100, Pt200, Pt500, Pt1000 Climatic	± 0.13 K
• Ni100, Ni120, Ni200, Ni500, Ni 1000 Standard and Climatic	± 0.2 K
• Cu10	± 1.0 K
Temperature error (with reference to the input range)	± 0.0009%/K
Linearity error (with reference to the input range)	± 0.01%
Repeatability (in steady state at 25 °C with reference to input range)	± 0.05%

Data for selecting a sensor	
Input range (rated value)/input resistance	
• Resistance-type sensor	150 Ω/min. 10 MΩ 300 Ω/min. 10 MΩ 600 Ω/min. 10 MΩ 3000Ω/min. 10 MΩ PTC min 10 MΩ
• Resistance thermometer	Pt100/min. 10 MΩ Ni100/min. 10MΩ Ni120/min. 10MΩ Pt200/min. 10MΩ Ni200/min. 10MΩ Pt500/min. 10MΩ Ni500/min. 10MΩ Pt1000/min. 10MΩ Ni1000/min. 10MΩ Cu10/min. 10MΩ

Permitted input voltage (destruction limit)	Max. 9 V
Connection of the sensors	
• For resistance measurement	
– Two-conductor connection	Yes
– Three-conductor connection	Yes, internal compensation of line resistances
– Four-conductor connection	Yes
Characteristic curve linearization	Yes, parameterizable for Ptxxx, Nixxx
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	4 x cycle time
Medium	32 x cycle time
Strong	64 x cycle time

1) In accordance with VDE 0660 Part 302/303, Type A

Use of Cu10 sensors

- Select “Three-conductor thermal resistor” and “Cu10” at parameter assignment.
- Wire the Cu10 sensor in accordance with the three-conductor connection method.
- Automatic, internal compensation of line resistance for the missing measuring line occurs during operation.

Note

Please note the following to ensure optimum line compensation in the case of Cu10:

- The sum of the cable resistance and measurement resistance must not exceed 31Ω.
- The cable must have a resistance of no more than 8Ω if you want to use the temperature range up to and above 312°C. Example: A 200 m Cu cable with a 0.5 mm^2 conductor cross-section has approximately 7Ω. A smaller cross-section shortens the permissible cable length accordingly.

Use of PTC resistors

PTCs are suitable for temperature monitoring and as thermal protective devices for complex drives and transformer windings.

- Select “Two-conductor resistor” and “PTC” at parameter assignment:
- Connect the PTC in accordance with the two-conductor connection method.
- Apply PTC resistors of type A (PTC thermistors) in accordance with DIN / VDE 0660, Part 302.
- Sensor data for the PTC resistor:

Feature	Technical specifications	Remarks
Switching points	On/reset Max. 750 Ω	**Measured resistance < response threshold** • SIMATIC S7: bit 0 = “0” (in the PII) • SIMATIC S5: bit 3 = “0” (in the PII)
	Off From 1650Ω to 4000Ω	Temperature increase **Measured resistance > response threshold** • SIMATIC S7: bit 0 = “1” (in the PII) • SIMATIC S5: bit 3 = “1” (in the PII)
	On/reset From 1650Ω to 750Ω	Temperature decrease **Measured resistance < response threshold** • SIMATIC S7: bit 0 = “0” (in the PII) • SIMATIC S5: bit 3 = “0” (in the PII)
(TNF–5) °C (TNF+5) °C (TNF+15) °C Measuring voltage Voltage on the PTC	Max. 550Ω Min. 1330Ω Min. 4000Ω Max. 7.5 V	TNF= rated operating temperature

- Assignment in the process input image (PII) in the case of SIMATIC S7

	7	6	5	4	3	2	1	0
IB x	0	0	0	0	0	0	0	
IB x + 1	0	0	0	0	0	0	0	0

0: measured resistance < response threshold

1: measured resistance > response threshold

- Assignment in the process input image (PII) in the case of SIMATIC S5

	7	6	5	4	3	2	1	0
IB x	0	0	0	0		0	0	0
IB x + 1	0	0	0	0	0	0	0	0

0: measured resistance < response threshold

1: measured resistance > response threshold

- Notes on programming

Important

- Only bit 0/ 3 is relevant for the purposes of evaluation in the process input image. You can use bit 0/ 3 to monitor the temperature of a motor, for example.
- Bit 0/ 3 in the process input image does not have a retentive function. Make sure at parameter assignment that motor start-up is controlled (by means of an acknowledgment), for example.
- For security reasons, always evaluate the diagnostic inputs of the 2AI RTD High Feature because measurement is not possible when the EM is removed, when the power supply to the EM has failed, or in the event of a wire break or short-circuit of the measuring lines.

13.15 2AI TC Standard analog electronic module (6ES7134-4JB00-0AB0)

Order number

6ES7134-4JB00-0AB0

Features

- 2 inputs for thermocouple or voltage measurement
- Input ranges:
  - Voltage measurement: ± 80 mV, resolution 15 bits + sign
  - Thermocouples: type E, N, J, K, L, S, R, B, T, resolution 15 bits + sign
- Isolated from the load voltage L+
- Linearization of the sensor characteristic curves
- Permitted common-mode voltage 2 VAC_{pp}

Terminal assignment

The following table indicates the terminal assignment of the 2AI TC Standard for the different terminal modules:

Voltage measurement as for 2AI U Standard (see Section 13.5).

Table 13-46 Terminal assignment of the 2AI TC Standard

View	Terminal assignment	Remarks
 AUX1 must be applied to PE.		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Measuring line (positive) M–: Measuring line (negative) M_{ana}: Ground of the module

Table 13-46 Terminal assignment of the 2AI TC Standard, continued

View	Terminal assignment	Remarks
	TM-E15S24-01 and 2AI TC Standard	Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Measuring line (positive) M–: Measuring line (negative) M_{ana}: Ground of the module Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.
	TM-E15S23-01 and 2AI TC Standard	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 M+: Measuring line (positive) M–: Measuring line (negative) M_{ana}: Ground of the module
	TM-E15S26-A1 and 2AI TC Standard	Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 M+: Measuring line (positive) M–: Measuring line (negative) M_{ana}: Ground of the module Terminals 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 13-17 Block diagram of the 2AI TC Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Shielded	Max. 50 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels	No
• Between the channels and 24 V supply voltage	Yes
Permissible potential difference	
• Between M_{ANA} and the central grounding point (U_{ISO})	75 VDC/60 VAC
• Between inputs and M_{ANA} (U_{CM})	2 VAC_{pp}
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 30 mA
Power dissipation of the module	Typ. 0.6 W
Status, interrupts, diagnostics	
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Analog value generation		
Measuring principle	Integrative	
Integration time/conversion time/resolution per channel:		
• Integration time parameterizable	Yes	
• Interference frequency suppression in Hz	60	50
• Integration time in milliseconds	16.7	20
• Basic conversion time including Integration time in milliseconds	55	65
• Additional conversion time for wire break check diagnosis in ms	20	20
• Cycle time in ms	Number of active channels per module × conversion time	
• Resolution (including overrange)	15 bits plus sign	

Suppression of interference, limits of error	
Interference voltage suppression for f = n x (f1 ± 1%), (f1 = interference frequency)	
• Common-mode interference (U_{pp})	Min. 90 dB
• Series-mode interference (peak interference value < rated value of input range)	Min. 70 dB
Crosstalk between the inputs	Min. –50 dB
Operational limit (in the entire temperature range, with reference to the input range) [1]	± 0.6%
Basic error limit (operational limit at 25 °C with reference to input range) [1]	± 0.4%
Temperature error (with reference to the input range)	± 0.005%/K
Linearity error (with reference to the input range)	± 0.01%
Repeatability (in steady state at 25 °C with reference to input range)	± 0.05%

Data for selecting a sensor	
Input range (rated value)/input resistance	
• Voltage	± 80 mV/min. 1 MΩ
• Thermocouple	Type E, N, J, K, L, S, R, B, T/min. 1 MΩ
Permitted input voltage (destruction limit)	± 10 V, continuous
Connection of the sensors	
• For measuring voltage	Possible
Characteristic curve linearization	Yes, parameterizable for type E, N, J, K, L, S, R, B, T to IEC 584
Temperature compensation	
• Internal temperature compensation	Not possible
• External temperature compensation by looping a compensating box into the measuring circuit	Possible, one external compensating box per channel
• External compensation by means of temperature value obtained at an analog module of the same ET 200S station	Yes
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	4 x cycle time
Medium	32 x cycle time
Strong	64 x cycle time

[1] For type N: as of –150 °C, type B: as of 200 °C, type T: as of –230 °C

Compensation of thermocouples with a compensating box

As well as the error limits of the 2AI TC Standard electronic module (see Table "Technical specifications" in this chapter) you must also take the accuracy of the compensating box into account.

Compensation of thermocouples with a Pt100 on the 2AI RTD Standard

Factors affecting the accuracy of the temperature measurement	
Wiring rules	Ensure there is good thermal contact between the reference junction and the Pt100 used for compensation.
	We recommend that you wire the Pt100 with a four-conductor connection.
Additional technical specifications on the error limits of the 2AI TC	The accuracy of the thermal resistor (Pt100) used for compensation must be taken into account.*
	The error of the measurement input (2AI RTD Standard) used for compensation must be taken into account.*

* In the case of thermocouples with a characteristic curve with a very shallow gradient, these errors can lead to a major measurement discrepancy.
For the following thermocouples, this leads to a restriction of the input range of the thermocouples in which the accuracy specifications of the manual apply:
Type N: –100 °C
Type K: –230 °C
Type E: –230 °C

13.16 2AI TC High Feature analog electronic module (6ES7134-4NB00-0AB0)

Order number

6ES7134-4NB00-0AB0

Features

- 2 inputs for thermocouple or voltage measurement
- Input ranges:
  - Voltage measurement: ± 80 mV, resolution 15 bits + sign
  - Thermocouples: Types E, N, J, K, L, S, R, B, T, C, resolution 15 bits + sign
- 2AI TC High-Feature is inserted on the TM-E15S24-AT or TM-E15C24-AT
- Isolated from the load voltage L+
- Linearization of the sensor characteristic curves
- Permitted common-mode voltage 140 VDC/100 VAC
- Internal reference junction in connection with TM-E15S24-AT or TM-E15C24-AT

Terminal assignment

The following table indicates the terminal assignment of the 2AI TC High Feature for the TM-E15S24-AT or TM-E15C24-AT terminal modules

Voltage measurement as for 2AI U Standard (see Section 13.5).

Table 13-47 Terminal assignment of the 2AI TC High Feature

View	Terminal assignment	Remarks
TM-E15S24-AT and 2AI TC High Feature		Channel 0: Terminals 1 to 2 Channel 1: Terminals 5 to 6 M+: Measuring line (positive) M–: Measuring line (negative)

Block diagram

Figure 13-18 Block diagram of the 2AI TC High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of inputs	2
Length of cable	
• Shielded	Max. 50 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels	No
• Between the channels and 24 V supply voltage	Yes

Permissible potential difference	
• Between M_{ANA} and the central grounding point (U_{ISO})	75 VDC/60 VAC
• Between inputs and M_{ANA} (U_{CM})	140 VDC/100 VAC
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 30 mA
Power dissipation of the module	Typ. 0.6 W
Status, interrupts, diagnostics	
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Analog value generation		
Measuring principle	Integrative	
Integration time/conversion time/resolution per channel:		
• Integration time parameterizable	Yes	
• Interference frequency suppression in Hz	60	50
• Integration time in milliseconds	16.7	20
• Basic conversion time including Integration time in milliseconds	66	80
• Additional conversion time for wire break check diagnosis in ms	5	5
• Cycle time in ms	Number of active channels per module × conversion time	
• Resolution (including overrange)	15 bits plus sign	

Suppression of interference, limits of error	
Interference voltage suppression for f = n x (f1 ± 1%), (f1 = interference frequency)	
• Common-mode interference (U_{pp})	Min. 90 dB
• Series-mode interference (peak interference value < rated value of input range)	Min. 70 dB
Crosstalk between the inputs	Min. –50 dB
Operational limit for ± 80 mV (in the entire temperature range with reference to the input range)	± 0.1%
Operational limit for thermocouples (in the entire temperature range with reference to the input range)[1]	± 1.5 K
Operational limit for thermocouple type C (in the entire temperature range with reference to the input range)[1]	± 7 K
Basic error limit for ± 80 mV (operational limit at 25 °C with reference to the input range)	± 0.05%
Basic error limit for thermocouples (operational limit at 25 °C with reference to the input range)[1]	± 1 K
Basic error limit for thermocouples of type C (operational limit at 25 °C with reference to the input range)[1]	± 5 K
Temperature error (with reference to the input range)	± 0.005%/K
Linearity error (with reference to the input range)	± 0.01%
Repeatability (in steady state at 25 °C with reference to input range)	± 0.05%
Overall error limits using internal compensation	
• Operational limit (in the entire temperature range with a static, thermal state, ambient temperature change < 0.3 K/min)[2]	± 2.5 K
• Basic error limit (operational limit at 25 °C with a static, thermal state, ambient temperature change < 0.3 K/min)[3]	± 1.5 K

Data for selecting a sensor	
Input range (rated value)/input resistance	
• Voltage	±80 mV/min. 1 MΩ
• Thermocouple	Types E, N, J, K, L, S, R, B, T, C/ min. 1 MΩ
Permitted input voltage (destruction limit)	±20 V, continuous
Connection of the sensors	
• For measuring voltage	Possible
Characteristic curve linearization	Yes, parameterizable for types E, N, J, K, L, S, R, B, T, C to IEC 584
Temperature compensation	
• Internal temperature compensation	Possible with TM-E15S24-AT TM-E15C24-AT
• External temperature compensation by looping a compensating box into the measuring circuit	Possible, one external compensating box per channel
Smoothing of the measured values	Yes, parameterizable in 4 steps by means of digital filtering
Step	Time constant
None	1 x cycle time
Weak	4 x cycle time
Medium	32 x cycle time
Strong	64 x cycle time

1) The specified error limits apply as of the following temperatures:
Thermocouple type T: –200 °C
Thermocouple type K: –100 °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

2 In the case of thermocouple type C: ±8 K

3 In the case of thermocouple type C: ±6 K

Compensation of thermocouples with a compensating box

In addition to the error limits of the 2AI TC High Feature electronic module (see the table entitled “Technical specifications” in this chapter), you must take into account the accuracy of the compensating box.

Internal compensation with TM-E 15S24-AT or TM-E15C24-AT

Factors affecting the accuracy of the temperature measurement	
Rules on using internal temperature compensation	The connected channel with internal compensation must be parameterized separately.
	Don't insert the 2AI TC High Feature directly next to a power module with high incoming current (> 3 A). An incoming current of 10 A can result in a further ±2 K error.
Additional technical specifications for the error limits of the 2AI TC High Feature	The station must be in a static state* to ensure that the specified accuracy is achieved.
	Accuracy is achieved 30 minutes after the static state has been achieved.
	The overall malfunction of the channel is caused by the combination of the input error and the internal compensation error.

* The static state is defined by an almost constant ambient temperature (no draft, for example, in a closed cabinet!)

13.17 2AO U Standard analog electronic module (6ES7135-4FB00-0AB0)

Order number

6ES7135-4FB00-0AB0

Features

- 2 outputs for voltage output
- Output range:
  - ± 10 V, resolution 13 bits + sign
  - 1 to 5 V, resolution 12 bits
- Isolated from the load voltage L+

Terminal assignment

The following table indicates the terminal assignment of the 2AO U Standard for the terminal module:

Table 13-48 Terminal assignment of the 2AO U Standard

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 QV: Analog output voltage S+: Detector line (positive) M_{ana}: Ground of the module S–: Detector line (negative)
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 QV: Analog output voltage S+: Detector line (positive) M_{ana}: Ground of the module S–: Detector line (negative)

Block diagram

Figure 13-19 Block diagram of the 2AO U Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of outputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels	No
Permissible potential difference	
• Between M_{ANA} and the central grounding point (U_{ISO})	75 VDC/60 VAC
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 130 mA
Power dissipation of the module	Max. 2 W
Status, interrupts, diagnostics	
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Analog value generation	
Resolution (including overrange)	± 10 V/13 bits + sign 1 to 5 V/12 bits
Cycle time	Max. 1.5 ms
Settling time	
• For resistive load	0.1 ms
• For capacitive load	0.5 ms
• For inductive load	0.5 ms
Substitute value parameterizable	Yes

Suppression of interference, limits of error	
Crosstalk between the outputs	min. –40dB
Operational limit (in the entire temperature range, with reference to the output range)	±0.4%
Basic error limit (operational limit at 25 °C with reference to output range)	±0.2%
Temperature error (with reference to the output range)	±0.01%/K
Linearity error (with reference to the output range)	±0.02%
Repeatability (in steady state at 25 °C with reference to output range)	±0.05%
Output ripple (with reference to output range, bandwidth 0 to 50 kHz)	±0.02%

Data for selecting an actuator	
Output range (rated value)	±10 V 1 to 5 V
Load resistance	Min. 1.0 kΩ
• For capacitive load	Max. 1 μF
• Short-circuit protection	Yes
• Short-circuit current	Approx. 25 mA
Destruction limit against voltages/currents applied from outside	
• Voltage at the outputs to M_{ANA}	Max. 15 V continuous; 75 V for max. 1 s (pulse duty factor 1:20)
• Current	Max. DC 50 mA
Connection of actuators	
• Two-conductor connection	Possible, without compensation of the line resistances
• Four-conductor connection	Yes

13.18 2AO U High Feature analog electronic module (6ES7135-4LB01-0AB0)

Order number

6ES7135-4LB01-0AB0

Features

- 2 outputs for voltage output
- Output range:
  - ± 10 V, resolution 15 bits + sign
  - 1 to 5 V, resolution 14 bits
- Isolated from the load voltage L+
- Supports clocked operation
  - Minimum time for the clocked DP cycle (T_{DPmin}): 3.75 ms
  - Minimum conversion time of the output modules: (T_{WAmin}): 1.5 ms

Terminal assignment

The following table indicates the terminal assignment of the 2AO U High Feature for the terminal module:

Table 13-49 Terminal assignment of the 2AO U High Feature

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 QV: Analog output voltage S+: Detector line (positive) M_{ana}: Ground of the module S–: Detector line (negative)
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 QV: Analog output voltage S+: Detector line (positive) M_{ana}: Ground of the module S–: Detector line (negative)

Block diagram

Figure 13-20 Block diagram of the 2AO U High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	Yes
Number of outputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels	No
Permissible potential difference	
• Between M_{ANA} and the central grounding point (U_{ISO})	75 VDC/60 VAC
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 130 mA
Power dissipation of the module	Max. 2 W
Status, interrupts, diagnostics	
Diagnostic functions	
• Group error display	Red “SF” LED
• Diagnostic information readable	Possible
Substitute values can be applied	Yes, parameters can be assigned

Analog value generation	
Resolution (including sign)	± 10 V/16 bits 1 to 5 V/14 bits
Conversion time (per channel)	Max. 1.0 ms
Settling time	
• For resistive load	0.1 ms
• For capacitive load	0.5 ms
• For inductive load	0.5 ms
Suppression of interference, limits of error	
Crosstalk between the outputs	> 60 dB
Operational limit (in the entire temperature range, with reference to the output range)	±0,07%
Basic error limit (operational limit at 25 °C with reference to output range)	±0.03%
Temperature error (with reference to the output range)	±0.001%/K
Linearity error (with reference to the output range)	±0.02%
Repeatability (in steady state at 25 °C with reference to output range)	±0.01%
Output ripple (with reference to output range, bandwidth 0 to 50 kHz)	±0.02%

Data for selecting an actuator	
Output range (rated value)	±10 V 1 to 5 V
Load impedance (in the rated range of the output)	
• For voltage outputs	Min. 1.0 kΩ
Capacitive load	Max. 1 μF
Voltage output	
• Short-circuit protection	Yes
• Short-circuit current	Approx. 25 mA
Destruction limit against voltages/currents applied from outside	
• Voltage at the outputs to M_{ANA}	Max. 15 V continuous; 75 V for max. 1 s (pulse duty factor 1:20)
• Current	Max. DC 50 mA
Connection of actuators	
• Voltage output	
Two-conductor connection	Possible, without compensation of the line resistances
Four-conductor connection	Possible

13.19 2AO I Standard analog electronic module (6ES7135-4GB00-0AB0)

Order number

6ES7135-4GB00-0AB0

Features

- 2 outputs for current output
- Output range:
  - ± 20 mA, resolution 13 bits + sign
  - 4 to 20 mA, resolution 13 bits
- Isolated from the load voltage L+

Terminal assignment

The following table indicates the terminal assignment of the 2AO I Standard for the different terminal modules:

Table 13-50 Terminal assignment of the 2AO I Standard

View	Terminal assignment	Remarks
	TM-E15S24-A1 and 2AO I Standard	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 QI: Analog output current M_{ana}: Ground of the module Terminals 2 and 6 can be used for unneeded wires of up to 30 VDC.

Table 13-50 Terminal assignment of the 2AO I Standard, continued

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 QI: Analog output current M_{ana}: Ground of the module Terminals 2 and 6 and 4 and 8 can be used for unneeded wires of up to 30 VDC.
		Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 QI: Analog output current M_{ana}: Ground of the module Terminals 2 and 6 can be used for unneeded wires of up to 30 VDC.
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 QI: Analog output current M_{ana}: Ground of the module Terminals 2 and 6 and 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 13-21 Block diagram of the 2AO I Standard

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	No
Number of outputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage	Yes
• Between the channels	No
Permissible potential difference	
• Between M_{ANA} and the central grounding point (U_{ISO})	75 VDC/60 VAC
Insulation tested	500 VDC
Current consumption	
• From the power supply L+	Max. 150 mA
Power dissipation of the module	Max. 2 W
Status, Interrupts, Diagnostics	
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes
Analog value generation	
Resolution (including overrange)	± 20 mA/13 bits + sign 4 to 20 mA/13 bits
Cycle time	Max. 1.5 ms

Settling time	
• For resistive load	0.1 ms
• For capacitive load	0.5 ms
• For inductive load	0.5 ms
Substitute values can be applied	Yes
Suppression of interference, limits of error	
Crosstalk between the outputs	min. –40dB
Operational limit (in the entire temperature range, with reference to the output range)	± 0.5%
Basic error limit (operational limit at 25 °C with reference to output range)	± 0.3%
Temperature error (with reference to the output range)	± 0.01%/K
Linearity error (with reference to the output range)	± 0.02%
Repeatability (in steady state at 25 °C with reference to output range)	± 0.05%
Output ripple (with reference to output range, bandwidth 0 to 50 kHz)	± 0.02%
Data for selecting an actuator	
Output range (rated value)	± 20 mA 4 to 20 mA
Load resistance	Max. 500 Ω
• For inductive load	1 mH
• No-load voltage	18 V
Destruction limit against voltages/currents applied from outside	
• Voltage at the outputs to M_{ANA}	Max. 15 V continuous; 75 V for max. 1 s (pulse duty factor 1:20)
• Current	Max. DC 50 mA
Connection of actuators	
• Two-conductor connection	Yes
• Four-conductor connection	No

13.20 2AO I High Feature analog electronic module (6ES7135-4MB01-0AB0)

Order number

6ES7135-4MB01-0AB0

Features

- 2 outputs for current output
- Output range:
  - ± 20 mA, resolution 15 bits + sign
  - 4 to 20 mA, resolution 15 bits
- Isolated from the load voltage L+
- Supports clocked operation
  - Minimum time for the clocked DP cycle (T_{DPmin}): 3.75 ms
  - Minimum conversion time of the output modules: (T_{WAmin}): 1.5 ms

Terminal assignment

The following table indicates the terminal assignment of the 2AO I High Feature for the different terminal modules:

Table 13-51 Terminal assignment of the 2AO I High Feature

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 QI: Analog output current M_{ana}: Ground of the module Terminals 2 and 6 can be used for unneeded wires of up to 30 VDC.

Table 13-51 Terminal assignment of the 2AO I High Feature, continued

View	Terminal assignment	Remarks
	TM-E15S24-01 and 2AO I High Feature	Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 QI: Analog output current M_{ana}: Ground of the module Terminals 2 and 6 and 4 and 8 can be used for unneeded wires of up to 30 VDC.
	TM-E15S23-01 and 2AO I High Feature	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 QI: Analog output current M_{ana}: Ground of the module Terminals 2 and 6 can be used for unneeded wires of up to 30 VDC.
	TM-E15S26-A1 and 2AO I High Feature	Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 QI: Analog output current M_{ana}: Ground of the module Terminals 2 and 6 and 4 and 8 can be used for unneeded wires of up to 30 VDC.

Block diagram

Figure 13-22 Block diagram of the 2AO I High Feature

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for specific modules	
Supports clocked operation	Yes
Number of outputs	2
Length of cable	
• Shielded	Max. 200 m
Voltages, currents, potentials	
Rated supply voltage of the electronics L+	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels and backplane bus	Yes
• Between channels and power supply of the electronics	Yes
• Between the channels	No
Permissible potential difference	
• Between M_{ANA} and $M_{internal}$ (U_{ISO})	75 VDC/60 VAC
Insulation tested	500 VDC
Current consumption	
• From the power supply L+	Max. 150 mA
Power dissipation of the module	Max. 2 W
Status, interrupts, diagnostics	
Diagnostic functions	
• Group error display	Red “SF” LED
• Diagnostic information readable	Yes
Substitute values can be applied	Yes, parameters can be assigned
Analog value generation	
Resolution (including sign)	±20 mA/16 bits 4 to 20 mA/15 bits
Conversion time (per channel)	Max. 1.0 ms
Settling time	
• For resistive load	0.25 ms
• For capacitive load	1.0 ms
• For inductive load	0.5 ms
Suppression of interference, limits of error	
Crosstalk between the outputs	> 60 dB
Operational limit (in the entire temperature range, with reference to the output range)	±0.07%
Basic error limit (operational limit at 25 °C with reference to output range)	±0.03%
Temperature error (with reference to the output range)	±0.001%/K
Linearity error (with reference to the output range)	±0.02%
Repeatability (in steady state at 25 °C with reference to output range)	±0.01%
Output ripple (with reference to output range, bandwidth 0 to 50 kHz)	±0.02%
Data for selecting an actuator	
Output range (rated value)	±20 mA 4 to 20 mA
Load impedance (in the rated range of the output)	
• For current outputs	Max. 500 Ω
For inductive load	1 mH
Current output	
• No-load voltage	18 V
Destruction limit against voltages/currents applied from outside	
• Voltage at the outputs to M_{ANA}	Max. 15 V continuous; 75 V for max. 1 s (pulse duty factor 1:20)
• Current	Max. DC 50 mA
Connection of actuators	
Connection of actuators	
• Current output	
Two-conductor connection	Possible

4 IQ-SENSE

14

Chapter overview

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Order number

6ES7138-4GA00-0AB0

Features

The 4 IQ-SENSE has the following features:

- Connection of sensors with IQ-SENSE®, photoelectric proximity switches: for example, reflex sensors, diffuse sensors, and laser sensors.
- You can connect up to 4 sensors. Each sensor requires a two-wire cable.
- Excess gain and monitoring
- Parameterizable time functions, switching hysteresis, synchronization groups
- Sensitivity and distance values can be specified *(IntelliTeach* using the "IQ-SENSE Opto" FB*)*
- Teach-in
- Module can be removed and inserted during operation (reboot the *teach-in* using the *"IQ-SENSE Opto"* function block or the switch on the sensor)
- Sensors can be removed and inserted during operation (automatic reparameterization)
- Supports sensors with alignment tool
- The 4 IQ-SENSE is a single-width (15 mm) electronic module that can be used with the following terminal modules:
  - TM-E15S24-01, TM-E15C24-01 and TM-E15N24-01
  - TM-E15S26-A1, TM-E15C26-A1 and TM-E15N26-A1

Parameter assignment

You set the parameters for the 4 IQ-SENSE using the STEP 7 parameter assignment software.

Configuration rules	
With STEP 7 as of V5.1, ServicePack 3	**With STEP 7 as of V5.0, ServicePack 3 or other configuration software**
Contained in the hardware catalog of HWCONFIG. A DDB file is not required.	IM151-1 BASIC: DDB file SIEM80F3.GSx as of 09/02 (as of V1.0)
	IM151-1 STANDARD: DDB file SIEM806A.GSx as of 10/01 (as of V1.10)
	IM151-1 FO STANDARD: DDB file SIEM806B.GSx as of 10/01 (as of V1.5)
	IM151-1 HIGH FEATURE: DDB file SIR380E0.GSx as of 12/01 (as of V1.0)

14.1 Parameters for the 4 IQ-SENSE

Parameters

Table 14-1 Parameters for the 4 IQ-SENSE

Parameters	Value range	Default	Applicability
Group diagnosis	• Disable • Enable	Disable	Module
Synchronization group	• 1 • 2 • 3 • 4	1	Module
Sensor type	• Reflex sensor • Diffuse sensor • Deactivated	Reflex sensor	Channel
Switching hysteresis	• 5 % • 10 % • 20 % • 50 %	20 %	Channel
Time functions	• None • Return delay • Pickup delay • Pickup and return delay • Momentary impulse	None	Channel
Time value	• 5 ms • 10 ms • 20 ms • 50 ms • 100 ms • 200 ms • 500 ms • 1 s • 2 s • 5 s • 10 s	5 ms	Channel
Teach in – disable	• *Teach in* with button possible • *Teach in* with button not possible	*Teach in* with button possible	Channel

Note

Unused channels of the module must be deactivated otherwise the wire break diagnosis will be reported.

Measurement type parameter: **Deactivated**

- All the diagnoses are suppressed.
- Sensitivity/distance values and circuit states are set to “0”.
- The sensor is switched off.

14.1.1 Group diagnosis parameter

If you enable group diagnosis, a queued diagnostic message is entered. See Section 6.6.8 Channel-specific diagnosis.

14.1.2 Synchronization group parameter

Features

- Sensors of different modules of the 4 IQ-SENSE can affect one another with scattered light, for example.
- To prevent this interference between adjacent sensors on different modules, you can assign each module a separate synchronization group with this parameter. Modules with different synchronization groups do not affect each other.
- It is not possible for sensors on the same module to affect one another.

Operating principle

The following figure illustrates how the synchronization group parameter works:

Figure 14-1 Synchronization group

Note

When you install sensors of the same synchronization group, you must ensure that the minimum clearance is adhered to (see the sensor information leaflet) to prevent any interference between the sensors.

14.1.3 Sensor type parameter

Features

You use this parameter to set the sensor type for each channel.

- Reflex sensor
- Diffuse sensor
- Deactivated

Diffuse sensor

Figure 14-2 Diffuse sensor

Reflex sensor

Figure 14-3 Reflex sensor

14.1.4 Switching hysteresis parameter

Features

Faults with the diffuse sensor or in the production process can result in signal wobbles. The measured value then changes the switching threshold by 100 % (object detected – object not detected). You can prevent this switching threshold wobble using the switching hysteresis parameter. This will ensure a stable output signal on the sensor.

You can parameterize 5%/10%/20%/50% for switching hysteresis.

Requirements

You can only set the switching hysteresis parameter for diffuse sensors with background fadeout.

Operating principle

Figure 14-4 Switching hysteresis parameter

14.1.5 Time functions and time value parameters

Features

Using these parameters you can customize the electronic module to suit your application.

Operating principle

Figure 14-5 Time value, time functions parameters

14.1.6 Teach in – disable parameter

Features

Using this parameter you can disable the *teach-in* key on the sensor.

14.2 Control and feedback interface (PIQ/PII)

You can configure the address space of the control and feedback interfaces of the 4 IQ-SENSE. You can choose between **Standard** and **Enhanced**.

Standard features

- The 4 IQ-SENSE occupies 4 bits in the feedback interface.
- You can evaluate the circuit state of each channel using the feedback interface.

Enhanced features

- The 4 IQ-SENSE occupies one byte in the control interface and one in the feedback interface.
- You can use the control interface to specify the sensitivity and distance values for each channel (*IntelliTeach* via “IQ-SENSE Opto” FB) and execute *teach-in*.
- You can use the feedback interface to evaluate the acquired sensitivity and distance values (switching threshold) and the circuit state for each channel.

Prerequisites:

- You can use the “IQ-SENSE Opto” function block. The FB facilitates easy access to the control and feedback interface.
- Please note that in this case PII equals PIQ.
- You can download the function block and the relevant product information on the Internet at **http://www.ad.siemens.de/csi_e/gsd**.

Configuring the address space

Address Space	With STEP 7 as of V5.1, ServicePack 3	With STEP 7 as of V4.02 or COM PROFIBUS or other configuration software
Standard	In the hardware catalog of HWCONFIG, choose **4IQ-SENSE Opto S**.	From the DDB file, choose **S 6ES7 138-4GA00-0AB0 IQ-SENSE Opto**.
Enhanced	In the hardware catalog of HWCONFIG, choose **4IQ-SENSE Opto E**.	From the DDB file, choose **E 6ES7 138-4GA00-0AB0 IQ-SENSE Opto**.

14.2.1 Standard

Feedback interface (PII)

Table 14-2 Standard feedback interface

Address	Assignment
Byte 0	Bit 7: 0 (unassigned)
	Bit 6: 0 (unassigned)
	Bit 5: 0 (unassigned)
	Bit 4: 0 (unassigned)
	Bit 3: Circuit state sensor on channel 3 1: Object detected 0: Object not detected
	Bit 2: Circuit state sensor on channel 2 1: Object detected 0: Object not detected
	Bit 1: Circuit state sensor on channel 1 1: Object detected 0: Object not detected
	Bit 0: Circuit state sensor on channel 0 1: Object detected 0: Object not detected

14.2.2 Enhanced

Feedback interface (PII)

Table 14-3 Enhanced feedback interface

Address	Assignment	Designation on “IQ-SENSE Opto” FB
Byte 0	**Bit 0:** Circuit state sensor on channel 0 1: Object detected 0: Object not detected	Q_CH0
	Bit 1 to bit 7: Acquired sensitivity/distance values on channel 0 by **teach-in** *	TEACH_VAL_OUT

Table 14-3 Enhanced feedback interface

Address	Assignment	Designation on "IQ-SENSE Opto" FB
Byte 1	**Bit 0:** Circuit state sensor on channel 1 1: Object detected 0: Object not detected	Q_CH1
	Bit 1 to bit 7: Acquired sensitivity/distance values on channel 1 by **teach-in** *	TEACH_VAL_OUT
Byte 2	**Bit 0:** Circuit state sensor on channel 2 1: Object detected 0: Object not detected	Q_CH2
	Bit 1 to bit 7: Acquired sensitivity/distance values on channel 2 by **teach-in** *	TEACH_VAL_OUT
Byte 3	**Bit 0:** Circuit state sensor on channel 3 1: Object detected 0: Object not detected	Q_CH3
	Bit 1 to bit 7: Acquired sensitivity/distance values on channel 3 by **teach-in** *	TEACH_VAL_OUT

* The current sensitivity/distance value is entered:
- After teach-in is completed on the sensor
- After teach-in is completed via the "IQ-SENSE Opto" FB

Control interface (PIQ)

Table 14-4 Enhanced control interface

Address	Assignment	Designation on "IQ-SENSE Opto" FB
Byte 0	**Specify sensitivity/distance value on channel 0** • **Bit 0:** 1: Transfer sensitivity/distance value to the sensor on channel 0 (using rising edge) 0: Deactivated	WR_TEACH_VAL
	• **Bit 1 to bit 7:** Sensitivity/distance value on channel 0: 1 to 126 (depending on the sensor)	TEACH_VAL_IN
	Teach-in on the sensor on channel 0 • **Bit 0:** 1: Start teach-in on the sensor on channel 0 (at the rising edge) 0: Deactivated • **Bit 1 to bit 7:** 0	START_TEACH
Byte 1	**Specify sensitivity/distance value on channel 1** • **Bit 0:** 1: Transfer sensitivity/distance value to the sensor on channel 1 (using rising edge) 0: Deactivated	WR_TEACH_VAL
	• **Bit 1 to bit 7:** Sensitivity/distance value on channel 1: 1 to 126 (depending on the sensor)	TEACH_VAL_IN
	Teach-in on the sensor on channel 1 • **Bit 0:** 1: Start teach-in on the sensor on channel 1 (at the rising edge) 0: Deactivated • **Bit 1 to bit 7:** 0	START_TEACH

Table 14-4 Enhanced control interface

Address	Assignment	Designation on "IQ-SENSE Opto" FB
Byte 2	**Specify sensitivity/distance value on channel 2** • **Bit 0:** 1: Transfer sensitivity/distance value to the sensor on channel 2 (using rising edge) 0: Deactivated • **Bit 1 to bit 7:** Sensitivity/distance value on channel 2: 1 to 126 (depending on the sensor)	WR_TEACH_VAL TEACH_VAL_IN
	Teach-in on channel 2 • **Bit 0:** 1: Start teach-in on the sensor on channel 2 (at the rising edge) 0: Deactivated • **Bit 1 to bit 7:** 0	START_TEACH
Byte 3	**Specify sensitivity/distance value on channel 3** • **Bit 0:** 1: Transfer sensitivity/distance value to the sensor on channel 3 (using rising edge) 0: Deactivated • **Bit 1 to bit 7:** Sensitivity/distance value on channel 3: 1 to 126 (depending on the sensor)	WR_TEACH_VAL TEACH_VAL_IN
	Teach-in on the sensor on channel 3 • **Bit 0:** 1: Start teach-in on the sensor on channel 3 (at the rising edge) 0: Deactivated • **Bit 1 to bit 7:** 0	START_TEACH

How it works: Specifying a sensitivity/distance value (IntelliTeach)

Figure 14-6 How it works: Specifying a sensitivity/distance value (IntelliTeach)

How it works: Teach-in

Figure 14-7 How it works: Teach-in

14.3 Terminal assignment

The following table indicates the terminal assignment of the 4 1Q-SENSE for the different terminal modules:

Table 14-5 Terminal assignment of the 4 IQ-SENSE

View	Terminal assignment	Remarks
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 M_+: Input signal“+” $M_–$: Input signal “–”
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 M_+: Input signal“+” $M_–$: Input signal “–”

Note

- The connections to the sensors are protected against polarity reversal.
- The minimum conductor cross-section for the sensors is 0.25 mm^2
- The connecting cable for the sensors is described in Appendix A.

14.4 Block diagram

Figure 14-8 Block diagram of the 4 IQ-SENSE

14.5 Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 35 g
Data for specific modules	
Number of inputs	4
Length of cable	
• Unshielded	Max. 50 m
• Shielded	Max. 50 m
Voltages, currents, potentials	
Rated supply voltage (from the power module)	24 VDC
• Reverse polarity protection	Yes
Isolation	
• Between the channels	No
• Between the channels and backplane bus	Yes
Permissible potential difference	
• Between the different circuits	75 VDC, 60 VAC
Insulation tested with	500 VDC
Current consumption	
• From supply voltage	Max. 0.3 A
Power dissipation of the module	Typ. 0.85 W

Status, interrupts, diagnostics	
Status display	Green LED per channel
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic information can be displayed	Yes
Data for selecting a sensor	
Connectable sensors	Photoelectric proximity switch with IQ-SENSE
Response times	
Cycle time	Max. 3.24 ms

RESERVE Modules

15

Order number

6ES7138-4AA00-0AA0 (installation width 15 mm)

6ES7138-4AA10-0AA0 (installation width 30 mm)

Features

The RESERVE module has the following characteristic features:

- Suitable for all TM-E terminal modules (installation widths 15 mm and 30 mm)
- Reserves a slot for any electronic module slot. Insert the RESERVE module in the reserved slot of the ET 200S configuration.

Note

- The following applies with the IM 151 (6ES7151-1AA01-0AB0, 6ES7151-1AA02-0AB0), IM 151 FO (6ES7151-1AB00-0AB0, 6ES7151-1AB01-0AB0) and IM 151/ CPU (6ES7151-7AA00-0AB0):
  If you remove an electronic module from the ET 200S during operation and insert a RESERVE module in its place, you must then switch the supply voltage to the interface module OFF and ON.
- Note with the IM 151 (6ES7151-1AA00-0AB0):
  The RESERVE module cannot be used in the ET 200S.

Parameter assignment (without option handling)

- In STEP 7 or COM PROFIBUS, parameterize the electronic module you want to use for future applications, such as 4DI DC High Feature on the slot of the RESERVE module.
  - Drag the module to the configuration table
  - Set the parameters

- Parameterize the interface module as follows:

Parameters	Setting
Operation at Preset <> Actual Configuration	Enable

- If you have parameterized an electronic module with inputs for the RESERVE module, the following substitute values are reported:
  - Digital input modules: 0
  - Analog input modules: $7FFF_H$
  - Function module: 0

Note

If you use RESERVE modules:

- The SF LED lights up on the interface module
- A channel-specific diagnosis and module status “10_B: Wrong module” for the RESERVE module slot.

You can find out about functionality and parameter assignment with option handling in Section 3.8.

Terminal assignment

The RESERVE module has no connection to the terminals of the TM-E terminal module. This enables you to fully wire the TM-E terminal module and prepare it for the subsequent application.

Technical specifications

Dimensions and weight	
Dimensions W × H × D (mm)	15 × 81 × 52 30 × 81 × 52
Weight	Approx. 33 g (installation width 15 mm) Approx. 55 g (installation width 30 mm)
Voltages, currents, potentials	
Power dissipation of the module	Typ. 0.025 W

Status, interrupts, diagnostics	
Status display	No
Diagnostic functions	No

Order Numbers

A

Introduction

You will find below the order numbers for the ET 200S distributed I/O system and the PROFIBUS accessories that you may need to use with the ET 200S.

ET 200S Power Supply

Table A-1 ET 200S Power Supply

Designation	Order number
ET 200S Power Supply, 1 unit	6ES7138-4JC00-0AA0

Interface module

Table A-2 Interface module order numbers

Designation	Order number
IM151-1 BASIC interface module and terminating module, 1 unit	6ES7151-1CA00-0AB0
IM151-1 STANDARD interface module and terminating module, 1 unit	6ES7151-1AA03-0AB0
IM151-1 FO STANDARD interface module and terminating module, 1 unit	6ES7151-1AB02-0AB0
IM151-1 HIGH FEATURE interface module and terminating module, 1 unit	6ES7151-1BA00-0AB0

Figure A-1 Explanation of the abbreviated designation

Table A-3 Terminal module order numbers

Designation	Order number
TM-P15S23-A1 (screw-type terminal), 1 unit	6ES7193-4CC20-0AA0
TM-P15C23-A1 (spring terminal), 1 unit	6ES7193-4CC30-0AA0
TM-P15N23-A1 (Fast Connect), 1 unit	6ES7193-4CC70-0AA0
TM-P15S23-A0 (screw-type terminal), 1 unit	6ES7193-4CD20-0AA0
TM-P15C23-A0 (spring terminal), 1 unit	6ES7193-4CD30-0AA0
TM-P15N23-A0 (Fast Connect), 1 unit	6ES7193-4CD70-0AA0
TM-P15S22-01 (screw-type terminal), 1 unit	6ES7193-4CE00-0AA0
TM-P15C22-01 (spring terminal), 1 unit	6ES7193-4CE10-0AA0
TM-P15N23-01 (Fast Connect), 1 unit	6ES7193-4CE60-0AA0
TM-P30S44-A0 (screw-type terminal), 1 unit	6ES7193-4CK20-0AA0
TM-P30C44-A0 (spring terminal), 1 unit	6ES7193-4CK30-0AA0
TM-PF30S47-F1 (screw–type terminal), 1 unit	3RK1903-3AA00
TM-E15S26-A1 (screw-type terminal), 5 units	6ES7193-4CA00-0AA0
TM-E15C26-A1 (spring terminal), 5 units	6ES7193-4CA50-0AA0
TM-E15S24-A1 (screw-type terminal), 5 units	6ES7193-4CA20-0AA0
TM-E15C24-A1 (spring terminal), 5 units	6ES7193-4CA30-0AA0
TM-E15N24-A1 (Fast Connect), 5 units	6ES7193-4CA70-0AA0

Table A-3 Terminal module order numbers, continued

Designation	Order number
TM-E15S24-01 (screw-type terminal), 5 units	6ES7193-4CB20-0AA0
TM-E15C24-01 (spring terminal), 5 units	6ES7193-4CB30-0AA0
TM-E15N24-01 (Fast Connect), 5 units	6ES7193-4CB70-0AA0
TM-E15S23-01 (screw-type terminal), 5 units	6ES7193-4CB00-0AA0
TM-E15C23-01 (spring terminal), 5 units	6ES7193-4CB10-0AA0
TM-E15N23-01 (Fast Connect), 1 unit	6ES7193-4CB60-0AA0
TM-E15S24-AT (screw-type terminal), 5 units	6ES7193-CL20-0AA0
TM-E15C24-AT (spring terminal), 5 units	6ES7193-CL30-0AA0
TM-E30S44-01 (screw-type terminal), 1 unit	6ES7193-4CG20-0AA0
TM-E30C44-01 (spring terminal), 1 unit	6ES7193-4CG30-0AA0
TM-E30S46-A1 (screw-type terminal), 1 unit	6ES7193-4CF40-0AA0
TM-E30C46-A1 (spring terminal), 1 unit	6ES7193-4CF50-0AA0

Power modules

Table A-4 Power module order numbers

Designation	Order number
PM-E 24 VDC, 1 unit	6ES7138-4CA00-0AA0
PM-E 24–48 VDC/24–230 VAC, 1 unit	6ES7138-4CB10-0AB0
PM-E 24–48 VDC, 1 unit	6ES7138-4CA50-0AB0

Digital electronic modules

Table A-5 Digital electronic module order numbers

Designation	Order number
2DI 24 VDC Standard, 5 units	6ES7131-4BB00-0AA0
4DI 24 VDC Standard, 5 units	6ES7131-4BD00-0AA0
4DI 24 VDC/SRC Standard, 5 units	6ES7131-4BD50-0AA0
2DI 24 VDC High Feature, 5 units	6ES7131-4BB00-0AB0
4DI 24 VDC High Feature, 5 units	6ES7131-4BD00-0AB0
4DI 24–48 VUC High Feature, 5 units	6ES7131-4CD00-0AB0
4DI NAMUR	6ES7131-4RD00-0AB0
2DI 120 VAC Standard, 5 units	6ES7131-4EB00-0AB0
2DI 230 VAC Standard, 5 units	6ES7131-4FB00-0AB0
2DO 24 VDC/0.5 A Standard, 5 units	6ES7132-4BB00-0AA0
4DO 24 VDC/0.5 A Standard, 5 units	6ES7132-4BD00-0AA0
2DO 24 VDC/0.5 A High Feature, 5 units	6ES7132-4BB00-0AB0
2DO 24 VDC/2 A Standard, 5 units	6ES7132-4BB30-0AA0
4DO 24 VDC/2 A Standard, 5 units	6ES7132-4BD30-0AA0
2DO 24 VDC/2 A High Feature, 5 units	6ES7132-4BB30-0AB0
2DO 24–230 VAC/2 A, 5 units	6ES7132-4FB00-0AB0
2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A, 5 units	6ES7132-4HB00-0AB0
2RO NO/NC 24–48 VDC/5 A, 24–230 VAC/5 A, 5 units	6ES7132-4HB10-0AB0
4 IQ-SENSE, 5 units	6ES7138-4GA00-0AB0

Analog electronic modules

Table A-6 Analog electronic module order numbers

Designation	Order number
2AI U Standard, 1 unit	6ES7134-4FB00-0AB0
2AI U High Feature, 1 unit	6ES7134-4LB00-0AB0
2AI U High Speed, 1 unit	6ES7134-4FB51-0AB0
2AI I 2WIRE Standard, 1 unit	6ES7134-4GB00-0AB0
2AI I 2WIRE High Speed, 1 unit	6ES7134-4GB51-0AB0
2AI I 4WIRE Standard, 1 unit	6ES7134-4GB10-0AB0
2AI I 2/4WIRE High Feature, 1 unit	6ES7134-4MB00-0AB0
2AI I 4WIRE High Speed, 1 unit	6ES7134-4GB61-0AB0
2AI RTD Standard, 1 unit	6ES7134-4JB50-0AB0
2AI RTD High Feature, 1 unit	6ES7134-4NB50-0AB0
2AI TC Standard, 1 unit	6ES7134-4JB00-0AB0
2AI TC High Feature, 1 unit	6ES7134-4NB00-0AB0
2AO U Standard, 1 unit	6ES7135-4FB00-0AB0
2AO U High Feature, 1 unit	6ES7135-4LB01-0AB0
2AO I Standard, 1 unit	6ES7135-4GB00-0AB0
2AO I High Feature, 1 unit	6ES7135-4MB01-0AB0

Process-related modules

Table A-7 Process-related module order numbers

Designation	Order number
1Count 24V/100kHz, 1 unit	6ES7138-4DA00-0AB0
1Count 5V/500kHz, 1 unit	6ES7138-4DE00-0AB0
1 SSI, 1 unit	6ES7138-4DB00-0AB0
1 STEP 5 V/204 kHz, 1 unit	6ES7138-4DC00-0AB0
2PULSE, 1 unit	6ES7138-4DD00-0AB0
1POS INC/Digital	6ES7138-4DG00-0AB0
1POS SSI/Digital	6ES7138-4DH00-0AB0
1POS INC/Analog	6ES7138-4DJ00-0AB0
1POS INC/Analog	6ES7138-4DK00-0AB0
1SI 3964/ASCII serial interface module	6ES7138-4DF00-0AB0
1SI Modbus/USS serial interface module	6ES7138-4DF10-0AB0

RESERVE modules

Table A-8 Reserve module order numbers

Designation	Order number
RESERVE (width 15 mm), 5 units	6ES7138-4AA00-0AA0
RESERVE (with 30 mm), 1 unit	6ES7138-4AA10-0AA0

ET 200S accessories

Table A-9 ET 200S accessories order numbers

Designation	Order number
Shield contact:	
Shield contact element, 5 units	6ES7193-4GA00-0AA0
Power rail, 1 units at 1 m, 3x10 mm	8WA2 842
Shield terminal, 5 units	6ES7193-4GB00-0AA0
Ground connection terminal	8WA2 868
DIN A4 labeling sheet, white, 10 units	6ES7193-4BA00-0AA0
DIN A4 labeling sheet, red, 10 units	6ES7193-4BD00-0AA0
DIN A4 labeling sheet, yellow, 10 units	6ES7193-4BB00-0AA0
DIN A4 labeling sheet, petrol, 10 units	6ES7193-4BH00-0AA0
Color identification labels (10 strips each containing 20 items in each color)	
• White	6ES7193-4LA10-0AA0
• Red	6ES7193-4LD10-0AA0
• Yellow	6ES7193-4LB10-0AA0
• Yellow-green	6ES7193-4LC10-0AA0
• Brown	6ES7193-4LG10-0AA0
• Blue	6ES7193-4LF10-0AA0
• Turquoise	6ES7193-4LH10-0AA0
Slot number labels, 10x (1 to 20), 200 units	8WA8 861-0AB
Slot number labels, 5x (1 to 40), 200 units	8WA8 861-0AC
Terminating module, 1 unit	6ES7193-4JA00-0AA0

Network components for the ET 200

The table below lists all the network components for the ET 200 distributed I/O system that you may require to use the ET 200S.

Table A-10 ET 200 network component order numbers

Designation	Order number
RS 485 repeater, PROFIBUS-DP, IP 20	6ES7972-0AA00-0XA0
PROFIBUS bus connector (12 Mbps) • Anthracite (without programming port) • Anthracite (with programming port)	 6ES7972-0BA11-0XA0 6ES7972-0BB11-0XA0
Bus cable • Normal • Drum cable • Direct-buried cable	 6XV1830-0EH10 6XV1830-3BH10 6XV1830-3AH10
Repeater adapter	6GK1510-1AA00
Active RS 485 terminating element	6ES7972-0DA00-0AA0
Optical link modules for glass fiber-optic cable	6GK1502-3AB10 6GK1502-4AB10
PROFIBUS connecting cable	6ES7901-4BD00-0XA0
Fiber-optic cable • SIMATIC NET PROFIBUS plastic fiber-optic, duplex core (50 m ring) • SIMATIC NET PROFIBUS plastic fiber optic, standard cable Meterware 50 m ring 100 m ring • SIMATIC NET PROFIBUS PCF fiber optic, standard cable Various lengths from 50 m to 300 m	 6XV1821-2AN50 6XV1821-0AH10 6XV1821-0AN50 6XV1821-0AT10 6XV1821-1Cxxx
Plugs for fiber-optic cable • Package of 100 simplex plugs and 5 polishing sets • Package of 50 plug adapters	 6GK1901-0FB00-0AA0 6ES7195-1BE00-0XA0

Connecting cable for 4 IQ-SENSE electronic module

The following table contains the connecting cables for the sensors on the 4 IQ-SENSE electronic module. You will also find these connecting cables in the NS BERO catalog (in the chapter on 3RX1 plug connections).

Table A-11 Connecting cable for 4 IQ-SENSE electronic module

Designation	Order number
Cable box (M12) for screw-type attachment with 5 m PUR connecting cable 3 x 0.34 mm^2	3RX1533
Cable box (M12) for screw-type attachment with 5 m PUR connecting cable 4 x 0.34 mm^2	3RX1536

STEP 7 and SIMATIC S7 manuals

To program and commission the ET 200S with *STEP 7*, you require one of the following manuals.

Table A-12 STEP 7 and SIMATIC S7 manuals

Designation	Contents
S7-300 Programmable Controller documentation package consisting of:	Includes:
• Reference manual – CPU data: CPU 312 IFM to 318-2 DP – CPU data: CPU 31xC and CPU 31x	• Operating instructions and a description of the functions and technical specifications of the CPUs
• Manual – CPU 31xC: Process-related functions including CD with examples	• Description of the different process-related functions
• Installation manual – S7-300 Programmable Controller: Hardware and Installation: CPU 312 IFM to 318-2 DP – S7-300 Programmable Controller: Hardware and Installation: CPU 31xC and CPU 31x	• Description of the configuration, mounting, wiring, networking and commissioning of an S7-300
• Reference manual: – S7-300 Programmable Controller Module Specifications	• Functional descriptions and technical specifications of the signal modules, power supply modules and interface modules
• Instruction list 312 IFM to 318-2 DP (can also be ordered separately) • Instruction list CPU 31x C and CPU 31x (can also be ordered separately)	• List of the instruction set of CPUs and their execution times List of executable blocks and their execution times
• Getting Started	• Examples of different commissioning steps leading up to a functional application

Table A-12 STEP 7 and SIMATIC S7 manuals, continued

Designation	Contents
S7 F Systems documentation package	Includes: • Description of the tasks that have to be executed to create and commission a fail-safe S7 F Systems system
S7 Distributed Safety documentation package	Includes: • Description of the tasks that have to be executed to create and commission a fail-safe S7 Distributed Safety system
S7-400, M7-400 Programmable Controllers *Hardware and Installation*	Among other things: • Description of the PROFIBUS-DP master interface in S7-400 and M7-400 • Installing a PROFIBUS-DP network • RS 485 repeater
System Software for S7-300/400 *Program Design* *Programming Manual*	Among other things: Description of addressing and diagnostics in SIMATIC S7
System Software for S7-300/400 *System and Standard Functions* *Reference Manual*	Description of the SFCs in *STEP 7*
Description	SIMATIC NET PROFIBUS networks laying of lines and cables (primarily)

ET 200 manual in SIMATIC S5

To program and commission the ET 200S with *STEP 7* and *COM PROFIBUS*, you need the following manual.

Table A-13 STEP 7 and SIMATIC S7 manuals

Designation	Contents
ET 200 Distributed I/O System	Among other things: • Description of the IM308-C master interface for S5-115U/H, S5-135U, and S5-155U/H • Description of the S5-95U with the PROFIBUS-DP master interface • Description of the procedure for installing a DP system and an FMS system with the CP 5412 (A2) as master • Handling *COM PROFIBUS* • Working with the FB IM308C/FB 230

Technical Guide to PROFIBUS-DP with SIMATIC S7 and STEP 7

Table A-14 Technical Guide to PROFIBUS-DP and SIMATIC S7

Technical guide	Order numbers	Contents
Decentralizing with PROFIBUS-DP – Aufbau, Projektierung und Einsatz des PROFIBUS-DP mit SIMATIC S7 (Structure, Configuration, and Use of the PROFIBUS-DP with the SIMATIC S7) Josef Weigmann, Gerhard Kilian Publicis MCD Verlag, 1998	From booksellers: ISBN 3-89578-074-X From your Siemens branch office: A19100-L531-B714	Instruction manual for a simple introduction to the PROFIBUS-DP and implementation of automation tasks with the PROFIBUS-DP and SIMATIC S7. Use of the PROFIBUS-DP is illustrated for the SIMATIC S7 with a large number of practical examples.

Dimension Drawings

B

Introduction

You will find below dimension drawings of the most important components of the ET 200S.

Minimum clearances for installation, wiring, and ventilation

Figure B-1 Minimum clearances

Interface module

Figure B-2 Interface module dimension drawing

Terminal modules (screw-type/spring terminals) with an electronic module inserted

The dimensions of the terminal modules with the power module inserted are identical.

Figure B-3 Dimensioned drawing of terminal modules (screw-type/spring terminals) with an electronic module inserted

Figure B-4 Dimensioned drawing of terminal modules (screw-type/spring terminals) with an electronic module inserted

Figure B-5 Dimensioned drawing of terminal modules (screw-type/spring terminals) with an electronic module inserted

Figure B-6 Dimensioned drawing of a terminal module (screw-type terminal) with an electronic module inserted

Terminal modules (Fast Connect) with an electronic module inserted

The dimensions of the terminal modules with the power module inserted are identical.

Figure B-7 Dimensioned drawing of terminal modules (Fast Connect) with an electronic module inserted

Figure B-8 Dimensioned drawing of terminal modules (Fast Connect) with an electronic module inserted

Terminating module

Figure B-9 Terminating module dimensioned drawing

Shield contact

Figure B-10 Shield contact dimension drawing

Address Space of the Input and Outputs of the ET 200S

C

Address area of the modules

Table C-1 Inputs and outputs for the ET 200S

Module	Address space of the inputs		Address space of the outputs	
	Without grouping	With grouping[1)]	Without grouping	With grouping[1)]
Power modules				
With status byte (S)[2)]	1 byte		——	
With option handling (O)[2)]	8 bytes		8 bytes	
With status byte and option handling (SO)[2)]	9 bytes		9 bytes (9th byte not relevant)	
Digital input modules	1 byte	2 bits (2DI) 4 bits (4DI)	——	——
Digital output modules	——	——	1 byte	2 bits (2DI) 4 bits (4DI)
Analog input modules	4 bytes		——	——
Analog output modules	——	——	4 bytes	
1Count 24V/100kHz	8 bytes		8 bytes	
1Count 5V/500kHz	8 bytes		8 bytes	
1SSI	8 bytes		8 bytes	
1SSI fast	4 bytes		——	
1STEP 5V/204kHz	8 bytes		8 bytes	
2PULSE	8 bytes		8 bytes	
1POS INC/Digital	8 bytes		8 bytes	
1POS SSI/Digital	8 bytes		8 bytes	
1POS INC/Analog	8 bytes		8 bytes	
1POS SSI/Analog	8 bytes		8 bytes	
1SI 3964/ASCII serial interface module	4/8 bytes		4/8 bytes	
1SI Modbus/USS serial interface module	4/8 bytes		4/8 bytes	
4 IQ-SENSE (standard)	1 byte	——	——	
4 IQ-SENSE (Enhanced)	4 bytes		4 bytes	

Table C-1 Inputs and outputs for the ET 200S, continued

Module	Address space of the inputs		Address space of the outputs	
	Without grouping	With grouping[1)]	Without grouping	With grouping[1)]
Direct-on-line starter	1 byte	4 bits	1 byte	4 bits
Reversing starter	1 byte	4 bits	1 byte	4 bits

1) See Section 6.1 (on configuring the ET 200S)
2) Additional optional entries you can select from the DBB file

Address area for option handling and status byte

You can control and monitor option handling, and evaluate the status byte of the power module using the control (PIQ) and feedback interface (PII).

The address range of the control (PIQ) and feedback interface (PII) depends on the configuration or selection of the corresponding entry in the configuration software.

In STEP 7, HWCONFIG or COM PROFIBUS or other configuration software	Control interface PII	Control interface PIQ
Usual entry for the power module	---	---
Ends in ...S	EBx Status byte	---
Ends in ...O	EBx : EBx+7 Option handling	ABx : ABx+7 Option handling
Ends in ...SO	EBx : EBx+7 Option handling EBx+8 Status byte	ABx : ABx+7 Option handling ABx+8 Not applicable

Option handling in PIQ/PII

	7	6	5	4	3	2	1	0	Bit no.
QB/IB x	7	6	5	4	3	2	1	*	
QB/IB x+1	15	14	13	12	11	10	9	8	
QB/IB x+2	23	22	21	20	19	18	17	16	
QB/IB x+3	31	30	29	28	27	26	25	24	
QB/IB x+4	39	38	37	36	35	34	33	32	
QB/IB x+5	47	46	45	44	43	42	41	40	
QB/IB x+6	55	54	53	52	51	50	49	48	
QB/IB x+7	63	62	61	60	59	58	57	56	* Not applicable

PIQ: QB x to QB x+7

Slots 2 to 63

0: Parameter assignment for option handling applies. RESERVE modules are permitted:

- The station is engaged in data transfer.
- A diagnosis is not reported.
- The SF LED on the interface module is off.

1: Parameter assignment for option handling is cancelled. RESERVE modules are not accepted on this slot:

- The station is engaged in data transfer.
- The diagnosis “Incorrect module” is reported.
- The SF LED lights up on the interface module

PII: : IB x to IB x+7

Slots 1 to 63

0: The RESERVE module or an incorrect module is on the slot or a module has been removed.

1: The configured module is on the slot.

Status byte power modules

Response Times

D

Introduction

The figure below shows the different response times between the DP master and the ET 200S.

Figure D-1 Response times between the DP master and the ET 200S

D.1 Response times at the DP master

You will find information on the response times in the manual for the DP master.

D.2 Response times for the ET 200S

Calculating the response time as of IM151-1 BASIC, 6ES7151-1CA00-0AB0

The following formula enables you to make an approximate calculation of the ET 200S response time:

$$\text{Response time } [\mu s] = 156 \cdot m + 33 \cdot do + 486 \cdot ai + 374 \cdot ao + 1633 \cdot t + 934$$

Explanation of the parameters:

- **m**: Total number of all modules (power modules, digital electronic modules, analog electronic modules, IQ-SENSE electronic modules, process-related modules, and motor starters)
- **do**: Sum of all the digital output modules
- **ai**: Sum of all the analog input modules and 1SSI fast electronic modules
- **ao**: Sum of all the analog output modules
- **t**: Number of all process-related modules (except 1SSI fast)

Example of the calculation of the ET 200S response time as of IM151-1 BASIC 6ES7151-1CA00-0AB0

Figure D-2 Example setup for calculating the response time in the case of the IM151-1 BASIC

Example of the calculation of the response time as of the IM151-1 STANDARD, 6ES7151-1AA01-0AB0, IM151-1 FO STANDARD

The following formula enables you to make an approximate calculation of the ET 200S response time:

Response time [µs]* = 55 · m +110 · a + 400 · t + 190

* Bus length parameter > 1m: the response time is increased by an additional 40%.

Explanation of the parameters:

- **m**: Total number of all modules (power modules, digital electronic modules, analog electronic modules, IQ-SENSE electronic modules, process-related modules, and motor starters)
- **a**: Sum of all the analog electronic modules, 4 IQ-SENSE electronic modules, and 1SSI fast electronic modules
- **t**: Number of all process-related modules (except 1SSI fast)

Note

The formula specified applies to cyclic data transfer. The following prerequisites must be fulfilled:

- No diagnoses are reported.
- No modules are removed and inserted.

Example for the calculation of the ET 200S response time as of the IM151-1 STANDARD, 6ES7151-1AA01-0AB0, IM151-1 FO STANDARD

Figure D-3 Example of the calculation of the response time in the case of the IM151-1 STANDARD, IM 151-1 FO STANDARD

Calculation of the response time in the case of the IM151-1 HIGH FEATURE

When you calculate the ET 200S response time, you have to choose between 2 setup variants:

1. If there are only power modules, digital electronic modules, and motor starters in your ET 200S setup (exception: **no** motor starters; High Feature), the following formula applies:

$$\text{Response time } [\mu s] = \text{response time}_{PII} + \text{response time}_{PIQ} + 1000^*$$

$$\text{Response time}_{PII}\ [\mu s] = 55 \cdot m + 130$$

$$\text{Response time}_{PIQ}\ [\mu s] = 10 \cdot m_{do} + 90$$

2. If your ET 200S setup differs from no.1, the following formula applies:

$$\text{Response time } [\mu s] = \text{response time}_{PII} + \text{response time}_{PIQ} + 1000^*$$

$$\text{Response time}_{PII}\ [\mu s] = 55 \cdot m + 125 \cdot ai + 175 \cdot t + 250$$

$$\text{Response time}_{PIQ}\ [\mu s] = 10 \cdot m_{do} + 125 \cdot ao + 175 \cdot t + 130$$

Explanation of the parameters:

- **m**: Total number of all modules (power modules, digital electronic modules, analog electronic modules, IQ-SENSE electronic modules, process-related modules, and motor starters)
- $\mathbf{m_{do}}$: Slot number of the last digital output module, 4 IQ-SENSE electronic module, or motor starter in the ET 200S setup. You should place these modules or motor starters on the front slots to improve the response time.
- **ai**: Sum of all the analog input modules
- **ao**: Sum of all the analog output modules
- **t**: Number of all process-related modules
- ***:** In the case of clocking, this value can be increased at configuration (settings on the DP master system in HWCONFIG: equidistant DP cycle). Note: This value (1000 µs) must be included in the calculation even if you have not set clocking.

Example of the calculation of the ET 200S response time in the case of the IM151-1 HIGH FEATURE

$m = 17$; $m_{do}=6$

Response $time_{PII}$ [µs] = 55 · m +130 = 55 · 17 +130 = 1065 µs

Response $time_{PIQ}$ [µs] = 10 · m_{do} +90 = 10 · 6 +90 = 150 µs

Response time [µs] = response $time_{PII}$ + response $time_{PIQ}$ + 1000

Response time [µs] = 1065 + 150 + 1000 = **2215 µs**

Figure D-4 Example setup for the calculation of the ET 200S response time in the case of the IM151-1 HIGH FEATURE

D.3 Response times for the digital input modules

Input delay

The response times of the digital input modules depend on the input delay. See the technical specifications in Chapter 12.

D.4 Response times for the digital output modules

Output delay

The response times correspond to the output delay. See the technical specifications in Chapter 11.

D.5 Response times for analog input modules

Conversion time

The conversion time comprises the basic conversion time and the processing time for the wire break monitoring diagnosis (see the technical specifications for the 2AI TC STANDARD in Section 13.15 and 2AI TC HIGH FEATURE, Section 13.16).

In integrative conversion processes, the integration time is included directly in the conversion time.

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.

Figure D-5 provides you with an overview of what makes up the cycle time for an n-channel analog input module.

Figure D-5 Cycle time of the analog input module

D.6 Response times for analog output modules

Conversion time

The conversion time of the analog output channels comprises the time for the transfer of the digitized output values from internal memory and the digital/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 and 1.

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.

Figure D-6 provides you with an overview of what makes up the cycle time for an analog output module.

Figure D-6 Cycle time of the analog output module

Settling time

The settling time (t_2 to t_3) – that is, the time from the application of the converted value until the specified value is obtained at the analog output – depends on the load. A distinction must be drawn between resistive, capacitive, and inductive loads.

Response time

The response time (t_1 to t_3) – that is, the time from the application of the digital output values in internal memory until the specified value is obtained at the analog output – is, in the most unfavorable case, the sum of the cycle time and the settling time. The most unfavorable case is when the analog channel is converted shortly before the transfer of a new output value and is not converted again until after the conversion of the other channels (cycle time).

Figure D-7 shows the response time of an analog output channel.

t_A = response time

t_Z = cycle time, corresponding to the processing time of the module and the conversion time of the channel

t_E = settling time

t_1 = new digital value applied

t_2 = output value transferred and converted

t_3 = specified output value obtained

Figure D-7 Response time of an analog output channel

D.7 Response times for a 4 IQ-SENSE electronic module

The response time of the 4 IQ-SENSE electronic module is specified as a cycle time in the technical specifications.

D.8 Response times for process-related modules

The response times of the process-related modules are indicated as response time or update rate in the technical specifications. See the *ET 200S Process-Related Functions* manual

Determining the Leakage Resistance of an ET 200S Station

E

Ohmic resistance

When determining the leakage resistance for an ET 200S station (for a ground-fault detector, for example), you must take into account the ohmic resistance from the RC combination of each module:

Module	Ohmic resistance from RC network
Interface module	10 MΩ (–5%)
PM-E 24 VDC power module	10 MΩ (–5%)
PM-E 24 VDC / 120/230 VAC power module	——

Formula

You can use the following formula to calculate the leakage resistance of an ET 200S station if you secure all the modules listed above with **a single** ground-fault detector:

$$R_{ET\ 200S} = \frac{R_{Modul}}{N}$$

$R_{ET\ 200S}$ Leakage resistance of the ET 200S station
R_{Module} Leakage resistance of a module
N Number of power/interface modules in the ET 200S station

$$R_{IM\ 151} = R_{PM-E\ 24VDC} = R_{Modul} = 9,5\ M\Omega$$

$R_{IM\ 151}$ Leakage resistance of the IM151-1 interface module
$R_{PM\text{-}E\ 24\ VDC}$ Leakage resistance of the PM-E 24 VDC power module

Figure E-1 Formula for determining the leakage resistance of an ET 200S station

If you secure the modules listed above in an ET 200S station with a number of ground-fault detectors, you must obtain the leakage resistance for each ground-fault detector.

Example

An ET 200S configuration contains an IM151-1 STANDARD, two PM-E 24 VDC power modules, and various input and output modules. The entire ET 200S station is equipped with **a single** ground-fault detector:

$$R_{ET\ 200S} = \frac{9,5\ M\Omega}{3} = 3,17\ M\Omega$$

Figure E-2 Leakage resistance example

Special Measures for Interference-Free Operation

F

Inductive voltages

Overvoltage occurs when sources of inductance are switched off. Examples of this are relay coils and contactors.

Integrated overvoltage protection

The digital output modules of the ET 200S have an integrated overvoltage protection device.

Additional overvoltage protection

Inductance can only be wired with additional overvoltage protection devices in the following cases:

- If digital output circuits can be switched off by additionally installed contacts, such as relay contacts.
- If the inductance cannot be controlled by digital output modules.

Note: Find out from the supplier of the inductance what dimensions the overvoltage protection device should have.

Example

The following figure shows an output circuit that requires additional overvoltage protection devices.

Figure F-1 Relay contact for emergency stop in the output circuit

Wiring of DC-operated coils

DC-operated coils are wired with diodes and Zener diodes as illustrated in the following figure.

Figure F-2 Wiring of DC-operated coils

A circuit with diodes/Zener diodes has the following features:

- Switching overvoltages can be completely avoided.

  A Zener diode has higher circuit interruption voltage.
- Long switch-off delay (6 to 9 times longer than without a protective circuit).

  A Zener diode switches off quicker than a diode circuit

Wiring of AC-operated coils

AC-operated coils are wired with varistors or RC elements as illustrated in the figure.

Figure F-3 Wiring of AC-operated coils

A circuit with a varistor has the following features:

- The amplitude of the switching overvoltage is limited but not dampened.
- The gradient of the overvoltage remains the same.
- The switch-off delay is short.

A circuit with RC elements has the following properties:

- The amplitude and gradient of the switching overvoltage are reduced.
- The switch-off delay is short.

Glossary

Aggregate current

The sum of the currents of all the output channels of a digital output module.

AUX1 bus

Power modules permit you to connect additional potential (up to 230 VAC), which you can apply by means of the AUX(iliary) bus. You can set the AUX(iliary) bus individually as:

Backplane bus

The backplane bus is a serial data bus via which the IM151-1 interface communicates with the electronic modules/motor starters, supplying them with the required voltage. The connection between the individual modules is established by means of the terminal modules.

Bus

A common transfer route connecting all notes and having two defined ends.

In the case of the ET 200, the bus is a two-wire or fiber-optic cable.

Bus connector

A physical connection between the bus nodes and the bus line.

Chassis ground

Chassis ground refers to all the interconnected inactive parts of a piece of equipment that, even in the event of a fault, cannot carry voltage that is dangerous to the touch.

Configuration

The systematic arrangement of the different ET 200S modules (setup)

Device database file

A device database file contains all the DP slave-specific properties. The format of the DDB file is defined in IEC 61784-1:2002 Ed1 CP 3/1.

Diagnostics

Diagnostics involves the identification, localization, classification, display, and further evaluation of errors, faults, and messages.

Diagnostics includes monitoring functions that run automatically while the system is in operation. This increases the availability of systems by reducing setup times and downtimes.

Direct-on-line starter

A direct-on-line starter is a → motor starter that switches a motor on or off directly. It consists of a circuit breaker and a contactor.

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. The following are examples of such units:

- ET 200M, ET 200X, ET 200L, ET 200S
- DP/AS-i Link
- S5-95U with PROFIBUS-DP slave interface
- Other DP slaves from either Siemens or other vendors

The distributed I/O systems are connected to the DP master by means of PROFIBUS-DP.

DP master

A → master that complies with IEC 61784-1:2002 Ed1 CP 3/1 is known as a DP master.

DP slave

A → slave running on the PROFIBUS on the basis of 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.

Equipotential bonding

Electrical connection (equipotential bonding conductor) that brings the exposed conductive parts of electrical equipment and other conductive parts to the same or approximately the same potential in order to prevent troublesome or dangerous voltages arising between these parts.

ET 200

The ET 200 distributed I/O system with the PROFIBUS-DP protocol enables distributed I/O devices to be connected to a CPU or an appropriate DP master. A feature of the ET 200 is its fast response times, since only a small amount of data (bytes) is transferred.

The 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, or ET 200S or DP slaves from Siemens or other vendors.

FREEZE

This is a control command of 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 again cyclically until the DP master sends the UNFREEZE control command.

Ground

The conductive mass of earth, the electrical potential of which is equivalent to zero. In the vicinity of grounding electrodes, the potential may not be zero. The term “reference ground” is often used here.

Grounding

Grounding means connecting an electrically conductive part to a grounding electrode by means of a grounding system.

Grouping

The opening of a new potential group by a power module. This permits the individual grouping of the sensor and load supplies.

Hot swapping

This is the removal and insertion of modules during the operation of the ET 200S.

Isolated

In the case of isolated input/output modules, the reference potentials of the control and load circuit are galvanically isolated – for example, by means of optical isolators, relays, or transformers. Input/output circuits can be grouped.

Master

When it has a token, a master can send data to and request data from other nodes (= active participants). Examples of DP masters are the CPU 315-2 DP or the IM308-C.

Motor starter (MS)

Motor starter is the generic term for → direct-on-line and → reversing starters. The startup and direction of rotation of a motor are determined by motor starters.

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

In the case of non-isolated input/output modules, the reference potentials of the control and load circuit are electrically connected.

Parameter assignment

Parameter assignment is the transfer of slave parameters from the DP master to the DP slave.

PELV

Protective **E**xtra **L**ow **V**oltage = functional extra-low voltage with safety separation

Potential group

A group of electronic modules supplied by a power module.

Power buses (P1/ P2)

Two internal buses (P1 and P2) that supply the electronic modules with voltage. The power buses are fed by the power module and connected by means of the terminal modules.

Prewiring

The wiring of 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. The signal states of the input modules are transferred to the process-image input area at the beginning of the cyclic program. At the end of the cyclic program, the values of the process-image output area are transferred to the DP slave as the signal states.

Process-related modules

Modules that are equipped with technological functions, such as counting pulses, positioning, and controlling stepping motor power units.

PROFIBUS

PROcess FIeld BUS, a German process and field bus standard defined in IEC 61784-1:2002 Ed1 CP 3/1. It defines the functional, electrical, and mechanical properties of a bit-serial field bus system.

PROFIBUS is available with the protocols DP (which stands for distributed peripherals, that is, distributed or remote I/O), FMS (which stands for field bus message specification), PA (= process automation), or TF (= technology functions).

PROFIBUS address

Each bus node must receive a PROFIBUS address to identify it uniquely on the PROFIBUS.

The PC/programming device has the PROFIBUS address “0”.

The PROFIBUS addresses 1 to 125 are permitted for the ET 200S distributed I/O system.

Programmable controller

A programmable logic controller consisting of at least one CPU, various input and output modules, and operator interfaces.

- A protective ground bar
- Additionally required voltage

Reference potential

Potential from which the voltages of the circuits involved can be observed and/or measured.

Reversing starter

A reversing starter is a → motor starter that determines the direction of rotation of a motor. It consists of a circuit breaker and two contactors.

Segment

The bus line between two terminating resistors forms a segment. A segment contains 0 to 32 → bus nodes. Segments can be interconnected by means of RS 485 repeaters.

SELV

Safety **E**xtra **L**ow **V**oltage = safety extra-low voltage

Slave

A slave can only exchange data with a → master when requested by it to do so. By slaves we mean, for example, all DP slaves such as ET 200X, ET 200M, ET 200S, etc.

SSI

The positional information is transferred synchronously on the basis of the SSI (synchronous serial interface) protocol. The SSI protocol is used with absolute encoders.

Stationary wiring

All the wiring-carrying elements (terminal modules) are mounted on a rail. The power and electronic modules are inserted in the terminal modules.

SYNC

This is a control command of the DP master to a group of DP slaves.

By means of the SYNC control command, the DP master causes the DP slave to freeze the current statuses of the **outputs**. With the subsequent frames, the DP slave stores the output data, but the statuses 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.

Terminating module

The ET 200S distributed I/O system is completed by the terminating module. If you have not connected a terminating module, the ET 200S is not ready for operation.

Transmission rate

The transmission rate of a data transfer is measured in bits transmitted per second.

In the case of the ET 200S, transmission rates of 9.6 kbps to 12 Mbps are possible.

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Product Information for the

ET 200S Distributed I/O System manual, version 07/2003

Introduction

This product information document describes the corrections and additions to the ET 200S manual (part of the ET 200S documentation package with the order number 6ES7151-1AA00-8BA0).

Configuration of the IM 151-1 STANDARD interface module (6ES7151-1AA03-0AB0)

Configuration rules	
With STEP 7 as of V5.2 Service Pack 1 and HW update ET 200S IM151-1 STANDARD	**With STEP 7 as of V4.02 or COM PROFIBUS or other configuration software**
Contained in the hardware catalog of HWCONFIG. A DDB file is not required.	DDB file as of 07/03 SI02806A.GSx (as of V1.0)

Configuration of the IM 151-1 FO STANDARD interface module (6ES7151-1AB02-0AB0)

Configuration rules	
With STEP 7 as of V5.2 Service Pack 1 and HW update ET 200S IM151-1 FO	**With STEP 7 as of V4.02 or COM PROFIBUS or other configuration software**
Contained in the hardware catalog of HWCONFIG. A DDB file is not required.	DDB file as of 07/03 SI02806B.GSx (as of V1.0)

Configuration of the PM-E 24–48 VDC power module (6ES7138-4CA50-0AB0)

Configuration rules	
With STEP 7 as of V5.2 Service Pack 1 and HW update ET 200S PM-E 24–48 VDC	**With STEP 7 as of V4.02 or COM PROFIBUS or other configuration software**
Contained in the hardware catalog of HWCONFIG. A DDB file is not required.	IM 151-1 STANDARD: DDB file as of 07/03 SI02806A.GSx (as of V1.0)
	IM 151-1 FO STANDARD: DDB file as of 07/03 SI02806B.GSx (as of V1.0)
	IM 151-1 HIGH FEATURE: DDB file as of 07/03 SI0180E0.GSx (as of V1.2)
	IM 151-1 BASIC: DDB file as of 07/03 SIEM80F3.GSx (as of V1.1)

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Configuration of the 4DI NAMUR electronic module (6ES7131-4RD00-0AB0)

Configuration rules	
With STEP 7 as of V5.2 Service Pack 1	**With STEP 7 as of V4.02 or COM PROFIBUS or other configuration software**
Contained in the hardware catalog of HWCONFIG. A DDB file is not required.	IM 151-1 STANDARD: DDB file as of 07/03 SIEM806A.GSx (as of V1.13) **or** SI02806A.GSx (as of V1.0)
	IM 151-1 FO STANDARD: DDB file as of 07/03 SIEM806B.GSx (as of V1.8) **or** SI02806B.GSx (as of V1.0)
	IM 151-1 HIGH FEATURE: DDB file as of 07/03 SI0180E0.GSx (as of V1.2)
	IM 151-1 BASIC: DDB file as of 07/03 SIEM80F3.GSx (as of V1.1)

Restrictions that apply to the 2PULSE electronic module (6ES7138-4DD00-0AB0)

Note

The following restrictions apply to the 2PULSE module used with the IM151-7 CPU, IM151-1 HIGH FEATURE and IM 151-1 BASIC:

- Configuration is only possible in the IM 151-7 CPU as of STEP 7 V5.1, Service Pack 1 and Hotfix 1.
- You **cannot** enable the group diagnosis parameter in the configuration if you use the 2PULSE module.

Maximum cable lengths in the case of the 1POS INC/DIGITAL electronic module (6ES7138-4DG00-0AB0) 1POS INC/ANALOG electronic module (6ES7138-4DJ00-0AB0) 1POS SSI/ANALOG electronic module (6ES7138-4DK00-0AB0)

Electronic module	Order number	Maximum cable lengths	
1PosInc/Digital	6ES7138-4DG00-0AB0	Sensor signals:	max. 50 m shielded
1PosInc/Analog	6ES7138-4DJ00-0AB0	Sensor signals:	max. 50 m shielded
		Analog output:	max. 100 m shielded
1POS SSI/Analog	6ES7138-4DK00-0AB0	Analog output:	max. 100 m shielded