SIEMENS

SIMATIC

DeviceNet ET 200S Distributed I/O System

Manual

Edition 11/2004

Safety Guidelines

This manual contains notices intended to ensure personal safety, as well as to protect the products and connected equipment against damage. These notices are highlighted by the symbols shown below and graded according to severity by the following texts:

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 **may** 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.

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:

Warning

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

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

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Disclaim of Liability

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

Preface

Purpose of the Manual

The information in this manual is intended to enable you to operate the ET 200S Distributed I/O System on DeviceNet as a 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 5136-DNS-200S DeviceNet Slave Adapter module and 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.

Certification

The 5136-DNS-200S DeviceNet Adapter complies with DeviceNet Specification Volume I, Release 2.0 and Volume II, Release 2.0.

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

The 5136-DNS-200S DeviceNet Adapter complies with DeviceNet Specification Volume I, Release 2.0 and Volume II, Release 2.0.

See Section 7.1 Standards, certificates and approvals

Position in the Information Landscape

The following list shows a summary of the documentation packages or manuals for the ET 200S:

SIMATIC ET 200S motor starter **6ES7151-1AA10-8xA0**[1] • 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** **6ES7151-1AC00-8xA0**[1] • 1Count 24V/100kHz • 1Count 5V/500kHz • 1SSI • 2PULSE
ET 200S Positioning **6ES7151-1AD00-8xA0**[1] • EM 1STEP 5V/204kHz • 1POS INC/Digital • 1POS SSI/Digital • 1POS INC/Analog • 1POS SSI/Analog	**ET 200S serial interfaces and modules** **6ES7151-1AE00-8xA0**[1] • 1SI 3964/ASCII • 1SI MODBUS/USS

1 x = language designation for order numbers

The documentation packages or manuals can only be ordered in German and English. In addition, French, Spanish and Italian are available in the Internet (see Service & Support in the Internet)

Guide

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.
- Language identification for the order numbers of the manuals, for example, 6ES7151-1AA10-8xA0

  x is for : A = German,
  B = English

Special note

In addition to this manual, you will also need the manual for the master.

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 environmentally-friendly manner.

Technical Support for the SST 5136-DNS-200S DeviceNet Slave Adapter

Technical support is available during regular business hours by telephone, fax, or e-mail from any Woodhead Software and Electronics office, or their website at www.woodhead.com.

Americas

Canada:
Tel: 519-725-5136
Fax: 519-725-1515
E-mail: Supportna@Woodhead.com

Europe

France:
Tel: 33-2-32-96-04-20
Fax: 33-2-32-96-04-21
E-mail: supportfr@applicom-int.com

United Kingdom:
Tel: 44-1495-35-04-36
Fax: 44-1495-35-08-77
E-mail: contact@wdhd.co.uk

Asia-Pacific

Japan:
Tel: 81-4-5224-3560
Fax: 81-4-5224-3561
E-mail: sst@woodhead.co.jp

Singapore:
Tel: 65-261-6533
Fax: 65-265-6605
E-mail: info@woodhead.com.sg

Additional Support

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

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

If you require assistance in contacting your distributor or sales office in the United States, phone 1-800-964-4114.

For additional technical assistance, call the Siemens Technical Services Group in Johnson City, Tennessee at 1-800-333-7421 or 423-262-2522, or contact them by e-mail at **simatic.hotline@siemens.com**. For technical assistance outside the United States, call 49-911-895-7200.

Should you have any questions regarding motor starters, please get in touch with the point of contact in your region responsible for low-voltage switchgear/ controlgear with communication capability. You can obtain a list of the points of contact by dialing the following fax polling number: +49 8765/9302/781001.

Should you have any questions or remarks concerning the manual itself, please complete the reply form at the end of the manual and return it to the address indicated.

A&D Technical Support

Worldwide, available 24 hours a day:

Worldwide (Nuernberg) **Technical Support** 24 hours a day, 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** (Nuernberg) **Authorization** Local time: Mon.-Fri. 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: Mon.-Fri. 8:00 to 17:00 Phone: +1 (0) 800-333-7421 Fax: +1 (0) 423 262 2200 E-Mail: simatic.hotline@ siemens.com GMT: -5:00	**Asia** / **Australia** (Beijing) **Technical Support and Authorization** Local time: Mon.-Fri. 8:00 to 17:00 Phone: +86 10 64 75 75 75 Fax: +86 10 64 74 74 74 E-Mail: adsupport.asia@ siemens.com GMT: +8:00
The languages of the SIMATIC Hotlines and the authorization hotline are generally German and English.		

Service & Support on the Internet

In addition to our documentation, we also offer you all of our know-how online on the Internet.

`http://www.siemens.com/automation/service&support`

There you will find:

- The newsletter, which provides you with the latest information on your products
- The documents you need using the Search function in Service & Support
- 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”.

Contents

Figures

Figures

Figures

Tables

Tables

Tables

Tables

Tables

1 Product Overview

Chapter Overview

The product overview tells you:

- The description of the ET 200S 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

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 DeviceNet network ensures that the controller CPU and I/O systems communicate smoothly.

What are Masters and Slaves?

The master links the controller CPU with the distributed I/O systems. The master exchanges data by means of DeviceNet with the distributed I/O systems and monitors the DeviceNet network.

The distributed I/O systems (= slaves) prepare the data of the sensors and actuators locally so that they can be transmitted by DeviceNet to the controller CPU.

1.2 What is the ET 200S Distributed I/O System?

Definition

The ET 200S distributed I/O system is a highly modular, extremely flexible slave I/O device with IP20 degree of 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 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 quickly adapted to suit virtually any process-related use of your machine.

Terminal Modules 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 DeviceNet network by means of a DeviceNet connector on the interface module. Each ET 200S distributed I/O system is a slave on the DeviceNet network.

View

Figure 1-1 shows an example of an ET 200S configuration.

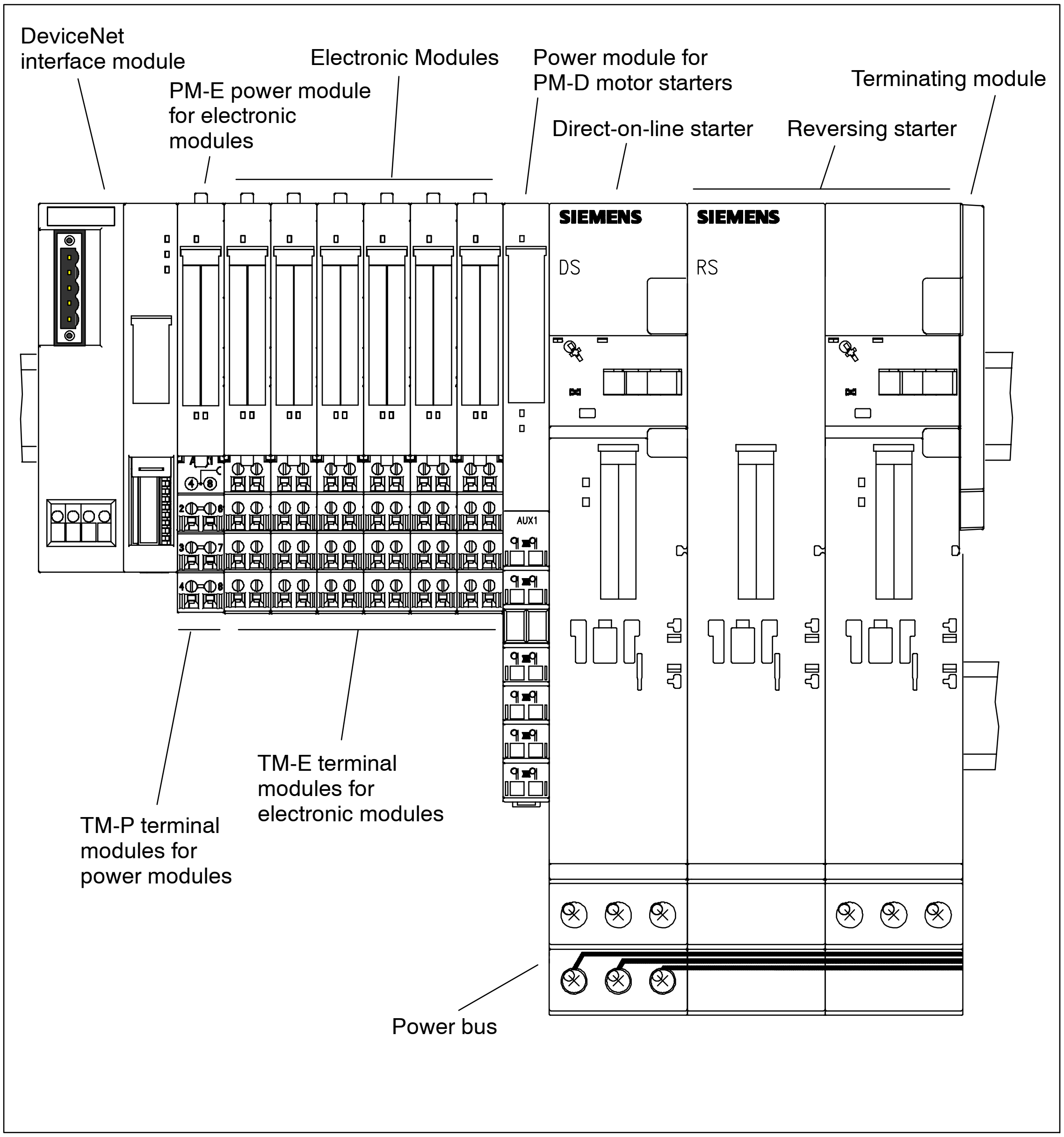


Figure 1-1 View of the ET 200S Distributed I/O System

ET 200S Components

Table 1-1 provides you with an overview of the most important components of the ET 200S system:

Table 1-1 ET 200S Components

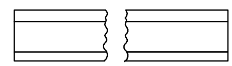
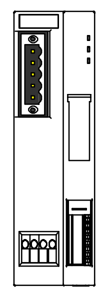
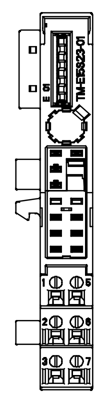
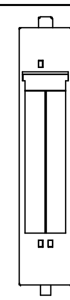
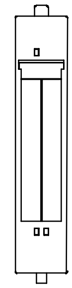
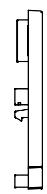
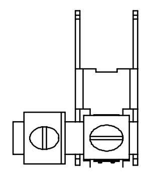
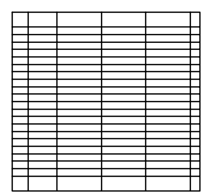
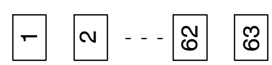
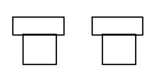
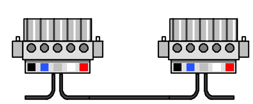
Component	Function	Drawing
Rail	...carries the ET 200S. You mount the ET 200S on the rail.	
Interface module • DeviceNet adapter	...connects the ET 200S with the DeviceNet master and prepares the data for the electronic modules and motor starters.	
Terminal module	...carries the wiring and receives the 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	

Table 1-1 ET 200S Components, continued

Component	Function	Drawing
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	
Terminating module	...terminates the ET 200S and can be used to carry 6 reserve fuses (5 mm x 20 mm).	
Shield contact	...for connecting cable shields.	
Labeling sheet (DI 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	
DeviceNet cable with bus connector	... connects nodes of a DeviceNet 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
Communication capacity, system-integrated motor starter: direct and reversing starter 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
• 2- and 3-wire connection, or • 2-, 3-, and 4-wire connection	Optimal selection on grounds of space and cost
Fast Connect	• Quick 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
Integrated safety functions With motor starters up to safety category 4 in accordance with EN 954-1	Saves spending money on costly safety equipment

1.3 Guide to the ET 200S Manuals

You Are Using the Following Components ...

The components of ET 200S are described in various manuals. They are parts of various documentation packages. The figure below shows possible configuration variants of the ET 200S and the necessary manuals in the documentation packages.

The ET 200S consists of the following components:	**You will require the information** contained in the following manuals:	**Order numbers for the necessary documentation packages or manuals**
IM, PM-E, 2DO, 2 AI, 2 AO	→ *DeviceNet ET 200S Distributed I/O System*	2810145-0004
IM, PM-E, 2DO, 1SSI, 2PULSE	→ *DeviceNet ET 200S Distributed I/O System* +	2810145-0004
	→ *ET 200S Process-Related Functions*	6ES7151-1AC00-8xA0
IM, PM-E, 2DO, 1PosInc/Digital, 1PosInc/Analog	→ *DeviceNet ET 200S Distributed I/O System* +	2810145-0004
	→ *ET 200S Positioning*	6ES7151-1AD00-8xA0
IM, PM-E, 2DO, 2 AI, Modbus/USS	→ *DeviceNet ET 200S Distributed I/O System* +	2810145-0004
	→ *ET 200S Serial Interface Module*	6ES7151-1AE00-8xA0

Figure 1-2 Components and the Manuals Required for Them

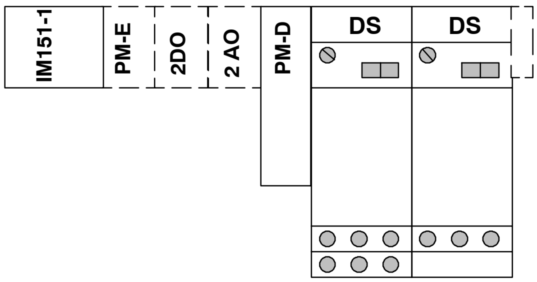
The ET 200S consists of the following components:	You will require the information contained in the following manuals:	Order numbers for the necessary documentation packages or manuals
	*DeviceNet ET 200S Distributed I/O System*	2810145-0004
	+	
	ET 200S motor starter *Safety-integrated SIGUARD*	contained in 6ES7151-1AA10-8xA0

Figure 1-3 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					
	DeviceNet ET 200S Distributed I/O System	ET 200S motor starter	ET 200S Process-Related Functions	ET 200S Positioning	ET 200S Serial Interface Module	Safety Equipment System Description
ET 200S components	1	1				2
Brief Instructions on Commissioning	2	2				
Configuration Options	3	1				3
Communication						4
Configuration		4				7
Addressing	4					
Installation	4	3				
Electrical configuration and wiring of the ET 200S	5					
Programming						8
Commissioning and Diagnostics	6	4				
General Technical Specifications	7	5				
Technical specifications			2-5	2	2,3	
Terminal modules	9	6, 10-12				
Power modules	10	7,10, 12				
Direct starters and soft starters		8				
Reversible starters		9				
Safety-integrated ET 200S SIGUARD		10				
Interface Modules	8					

Table 1-3 Topics of the Manuals in the ET 200S Manual Package, continued

Description	Manual					
	DeviceNet ET 200S Distributed I/O System	ET 200S motor starter	ET 200S Process-Related Functions	ET 200S Positioning	ET 200S Serial Interface Module	Safety Equipment System Description
Electronic modules	11, 12					
Positioning module				3-6		
Expansion modules		11				
Monitoring, cycle and reaction times						9
Order Numbers	A	A				
Dimension Drawings	B	B				
Applications	C-F	C				
Glossary	Gl	Gl				10

DeviceNet Slave Adapter

2

Chapter Overview

2.1 Product Overview

DeviceNet Interface Module Package

The DeviceNet interface module package (DNH200S) includes as 1 unit the following listed components:

- interface module and terminating module (5136-DNS-200S)
- terminal module (TM-P15S23-A0 (screw-type terminal), 1 unit
- power module (6ES7 138-4CB10-0AB0)

DeviceNet Module Features

The 5136-DNS-200S DeviceNet Slave Adapter is a communications adapter for interfacing to the Siemens SIMATIC ET 200S distributed I/O system. It provides connectivity between a DeviceNet network and ET 200S expansion modules.

Figure 2-1 shows the hardware features of the DeviceNet module.

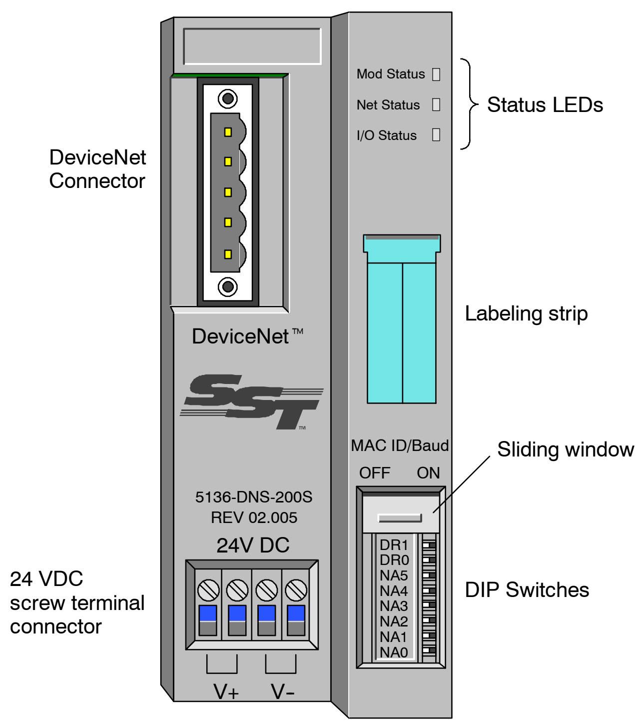


Figure 2-1 5136-DNS-200S DeviceNet Slave Adapter

24 VDC Terminals

The 24 VDC screw terminal connector on the front of the DeviceNet Adapter module provides logic power for the Adapter module itself as well as the expansion modules.

DIP Switches

The DIP switch group on the front of the DeviceNet Adapter module is used to set the data transmission rate (baud rate) and the node address for the module.

DeviceNet Features

The DeviceNet Adapter provides the following functional features:

- Complies with DeviceNet Specification Volume I, Release 2.0 and Volume II, Release 2.0
- Supports all standard DeviceNet data rates: 125, 250 and 500 K baud
- Operates as a Group 2 Only Server (non-UCMM-capable)
- Supports Explicit messaging connection for use by configuration and parameterization tool software
- Supports Poll, Strobe, Cyclic, and Change-of-State I/O connections
- Supports Fragmented I/O (maximum 244 bytes output and/or input)
- Supports Fragmented Explicit Messaging
- Supports Configuration Consistency Value (CCV)
- Data rate and Node Address (MAC ID) configured via DIP switch
- Supports Device Heartbeat messages
- Supports Device Shutdown messages

I/O Features

The DeviceNet Adapter provides the following I/O features:

- Provides support for most ET 200S expansion modules (Refer to Appendix A.)
- Supports up to 63 expansion modules per DeviceNet Adapter Module
- Supports expansion module parameterization
- Supports expansion module diagnostics

2.2 Hardware Configuration

Setting the Data Transmission Rate

Table 2-1 shows the DIP switch positions for configuring the data transmission (baud) rate.

Table 2-1 Data Transmission Rate Settings

Baud Rate	Switch DR1	Switch DR0
125 K baud	OFF	OFF
250 K baud	OFF	ON
500 K baud	ON	OFF
Reserved	ON	ON

Setting the Node Address (MAC ID)

Table 2-2 shows the DIP switch positions for configuring the node address. Refer to Section 4.8 for more information on setting the node address.

Table 2-2 Node Address Configuration Settings

Node Address (decimal)	DIP Switch Positions					
	NA5	NA4	NA3	NA2	NA1	NA0
0	OFF	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	OFF	ON	OFF
•	•	•	•	•	•	•
15	OFF	OFF	ON	ON	ON	ON
16	OFF	ON	OFF	OFF	OFF	OFF
•	•	•	•	•	•	•
60	ON	ON	ON	ON	OFF	OFF
61	ON	ON	ON	ON	OFF	ON
62	ON	ON	ON	ON	ON	OFF
63	ON	ON	ON	ON	ON	ON

Example of Node Address and the Data Transmission Rate Setting

You assign the node address (MAC ID) and data transmission rate (baud rate) for network communications by setting the 8-position DIP switch on the front of the module. Figure 2-2 shows an example of a module configured with a node address of 9 and a data transmission rate of 250 K baud.

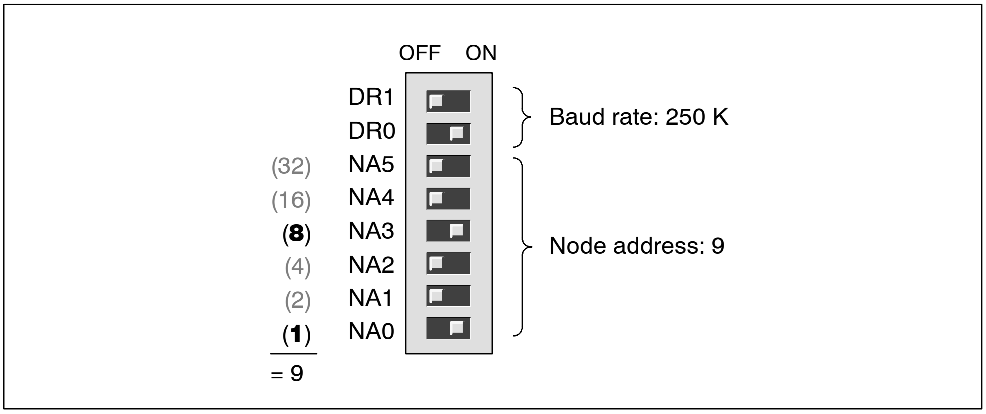


Figure 2-2 Example of Node Address and Baud Rate Settings

Connecting to the Network

The connector is a standard 5-pin connector plug with screw locks that conforms to the standard DeviceNet pinout. The 5-wire DeviceNet cable provides 24 VDC power for devices on the network.

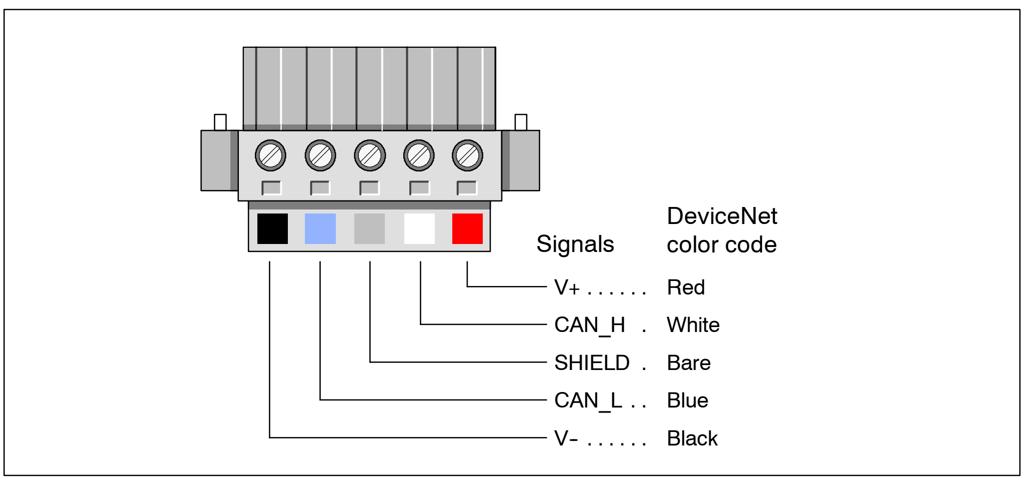


Figure 2-3 DeviceNet Connector Pinout

Connector Signals

The signals for the network connector cable are defined in Table 2-3.

Table 2-3 Signal Definitions for 5-Wire Connector

Wire	Signal	Definition
Red	V+	Power supply terminal; provides power to network interface.
White	CAN_H	Controller Area Network communication bus signal.
Bare	SHIELD	Network cable shield. The shield should be connected directly to earth ground at only one point in the network. This terminal is bypassed to the chassis ground provided in the DeviceNet module.
Blue	CAN_L	Controller Area Network communication bus signal.
Black	V–	Power supply terminal; provides power to network interface.

LED Status Indicators

The DeviceNet Adapter module has three bi-color LEDs that provide diagnostic information about the current state of the device and provide an indication of any faults. The LEDs conform to the behaviors defined in the DeviceNet Specification for the Module Status, Network Status, and I/O Status LEDs.

Module Status LED: The bi-color Module Status LED indicates the current state of the DeviceNet Module, as described in Table 2-4.

Table 2-4 Module Status LED

State	Description
Off	No power applied to device
Flashing Green	Device needs commissioning due to configuration error: • Invalid parameter data • Invalid slot configuration data
Green	Device has initialized successfully and no errors were detected.
Flashing Red	Recoverable fault
Red	Unrecoverable fault detected: hardware failure

Network Status LED: The bi-color Network Status LED indicates the current state of the DeviceNet communications link, as described in Table 2-5.

Table 2-5 Network Status LED

State	Description
Off	Device is not online • Duplicate MAC ID test not yet complete • Device is not powered
Flashing Green	Device has completed and passed the MAC ID test and is online. No connections have been established by the master.
Green	Device is online and allocated to a master.
Flashing Red	One or more connections are in the timed-out state.
Red	Communications failed: • Excessive bus errors (bus off) • Duplicate MAC ID check failed

I/O Status LED: The bi-color I/O Status LED provides diagnostic information about the current state of the I/O under the control of the DeviceNet module, as described in Table 2-6.

Table 2-6 I/O Status LED

State	Description
Off	All outputs and inputs are inactive. • Configuration errors prevent enabling of inputs/outputs.
Green	One or more outputs or inputs are active and under control (no faults are present on any I/O).
Flashing Green	One or more outputs are idle and no outputs are active (no faults present).
Flashing Red	One or more outputs or inputs are faulted.

Installing the DeviceNet Slave Adapter

The DeviceNet Adaper transfers data between ET 200S expansion I/O modules and the DeviceNet network. Chapter 4 provides information on installing the components that make up an ET 200S distributed I/O system.

Refer to Section 4.2 for information on installing and removing the DeviceNet Adapter module.

2.3 Operation

Operating Modes

The DeviceNet slave adapter is a modular device capable of operating out of the box without any special configuration software, but to take full advantage of advanced diagnostics and features, a configuration tool is required.

The DeviceNet slave adapter operates in one of two modes: Automatic Configuration and User Configured. The default mode, as shipped from the factory, is Automatic Configuration.

Automatic Configuration Mode

When operating in Automatic Configuration mode, the DeviceNet module configures its I/O sizes, I/O module parameterization data, and configuration data according to the combination of ET 200S expansion modules present at power-up or reset. In Automatic Configuration mode:

- Expansion module parameter data cannot be specified; the expansion modules use the default parameters. The user must make certain that the default parameters for the expansion modules satisfy the application requirements.
- DeviceNet Configuration Consistency Value is based on the automatically generated I/O configuration bytes.
- I/O configuration cannot be verified; the DeviceNet master is responsible for verifying the configuration by examining I/O sizes.

  Note that the DeviceNet adapter module is unable to differentiate modules of similar configuration types (for example, a 2 A discrete output as compared to a 0.5 A discrete output module).
- Slot object instance attributes are not settable.
- No external tool is required for configuration. (A tool is still required to access diagnostic information.)
- The I/O data format is defined by the combination of modules installed.
- Expansion module grouping is enabled.

Note

Motor starters require User Configured mode.

Caution

When using Automatic Configuration Mode, the interface module and expansion modules must all be powered.

When in Automatic Configuration Mode, if power is applied to the interface module before the expansion modules, the interface module cannot detect the microprocessor-based expansion modules (for example, analog input and analog output modules) and will not configure them. Power interruptions may also cause this condition.

Once the interface module and expansion modules are all powered, the expansion module power may be cycled. The interface module power should not be cycled.

User Configured Mode

When operating in User Configured mode, the DeviceNet module I/O sizes, I/O module parameterization data, and I/O configuration data is stored in non-volatile memory and accessed via the Slot Object. In User Configured mode:

- Expansion module parameter data can be modified allowing access to more advanced configuration options and diagnostics.
- DeviceNet Configuration Consistency Value is based on the entire stored non-volatile configuration data.
- I/O configuration is verified; mismatching I/O configurations result in an error.

  Note that the DeviceNet adapter module is unable to differentiate modules of similar configuration types (for example, a 2 A discrete output as compared to a 0.5 A discrete output module).
- Slot object instance attributes can be set, providing no I/O connections are open.
- The I/O data format is defined by the user by using the combination of modules configured.
- The status of the DeviceNet Slave Adapter may be viewed by any DeviceNet compatible configuration tool capable of using EDS files. This includes the receive and transmit byte sizes and the Auto Config or User Config modes.
- Expansion module grouping is available but must be specified by the configuration selections.

Note

The DNS-200S Configuration Tool is required for configuration of a 5136-DNS-200 node in User Configured mode.

This tool is available from Siemens under the part number DNSCONFIG.

Online operation requires an SST DeviceNet Interface card or RsLynx connection. Refer to the DNS200 manual which accompanies the software.

I/O Status Byte

Attribute 9 of the Adapter object allows you to enable or disable the generation of an additional I/O Status byte to detect faults in the 5136-DNS-200S Adapter. If the IoStatusEnable attribute is TRUE (1), an additional status byte is placed at the beginning of the input data packet, prior to any expansion module data. In the event of a fault, the appropriate bit is set in the status byte, and the I/O data of the related modules may be interrupted depending on the source of the fault. If the fault originates from a power module, then the Master should ignore input data from the modules in that potential group and no output data is transferred to them. If the fault originates from an I/O module, then I/O data transfer is not affected.

If the IoStatusEnable attribute is FALSE (0), the input data packet contains only expansion module data as configured. In the event of a fault, the Adapter module transmits zero length I/O messages (no data), and the output data received from the Master for the associated modules is handled as above.

Strobe I/O Operation

The strobe I/O protocol is intended for simple input only devices. The maximum produced size across a strobe I/O connection, as defined by the DeviceNet protocol, is 8 bytes. The strobe I/O protocol has only a single bit of output data per device. The 5136-DNS-200S does not make use of its output bit and can return up to a maximum of 8 bytes of input data depending on the configuration present.

Note

Any configurations in which output data is required or in which the input data size exceeds 8 bytes will result in the disabling of the strobe I/O connection.

Configuration

- User configuration data is only accessible when the AutoConfig attribute in the 5136-DNS-200S adapter object is false (0).
- Attempts to modify any parameters of the Slot Objects will result in an object state conflict if the AutoConfig attribute is not set to zero (0 = FALSE).
- Changes to user configuration data do not take effect until the device is reset (done via reset service with data value of zero (0) to the identity object or a power cycle), or an I/O module is hot-swapped.
- Changes to user configuration data are stored in non-volatile memory immediately (before the explicit message response is sent).
  - Changes to configuration data that have not taken effect yet are indicated by the ConfigChanged attribute in the 5136-DNS-200S adapter object — the next device reset will apply the changes and clear ConfigChanged.

Configuration Consistency Value

The Configuration Consistency Value (CCV) is an indication of the current configuration within the device. If any configuration information changes which affects the behavior of the device (i.e. expansion modules removed, parameter data modified etc.), the CCV is updated.

Note

Because of the modular nature of the device and the method used to calculate the CCV, it is not possible to guarantee that there will never be a duplicate CCV for 2 different configurations.

Module Grouping

For more efficient use of address space and data transfer, the DeviceNet Slave Adapter supports the grouping of expansion module data. In AutoConfig mode, the expansion module data is always grouped. Table 2-7 shows the input/output requirements of each module with and without module grouping.

Table 2-7 Expansion Module Grouping

Module	Input Data		Output Data	
	Ungrouped	Grouped	Ungrouped	Grouped
Digital input	1 byte	2 or 4 bits	—	
Digital output	—		1 byte	2 or 4 bits
NAMUR input	2 bytes		—	
Analog input	4 bytes		—	
Analog output	—		4 bytes	
1 Count	8 bytes		8 bytes	
1 SSI	8 bytes		8 bytes	
1 Step	8 bytes		8 bytes	
Direct on-line starter	1 byte	4 bits	1 byte	4 bits
Reversing starter	1 byte	4 bits	1 byte	4 bits

Example Configuration of Data Formatting

Certain rules also apply for how expansion module data behaves. Table 2-8 shows an example of a large configuration of expansion modules and how the module data would be formatted in grouped and ungrouped configurations. The example shows only input data since output data is formatted in the same manner. Refer to Section 6.1: Configuring the ET 200S for more information.

Table 2-8 Example Configuration of Data Formatting

Module Type	No. of Bits	Ungrouped		Grouped	
		Byte Offset	Bit Offset	Byte Offset	Bit Offset
2 DI	2	0	0 – 1	0	0 – 1
2 DI	2	1	0 – 1	0	2 – 3
2 DI	2	2	0 – 1	0	4 – 5
2 DI	2	3	0 – 1	0	6 – 7
4 DI NAMUR	8	4	0 – 7	1	0 – 7
		5		2	
AI	8	6	0 – 7	3	0 – 7
	8	7		4	
	8	8		5	
	8	9		6	
2 DI	2	10	0 – 1	7	0 – 1
4 DI	4	11	0 – 3	7	2 – 5
2 DI	2	12	0 – 1	7	6 – 7
4 DI	4	13	0 – 3	8	0 – 3
2 DI	2	14	0 – 1	8	4 – 5
4 DI	4	15	0 – 3	9	0 – 3*
1 SSI	8	16	0 – 7	10	0 – 7
	8	17		11	
	8	18		12	
	8	19		13	
	8	20		14	
	8	21		15	
	8	22		16	
	8	23		17	

*Expansion module data is not broken across byte boundaries.

2.4 Faults / Diagnostics

Configuration Faults

Faults in the expansion module configuration/parameterization data are handled slightly differently depending on when they are detected. In any case, the following occurs:

- 200S Adapter Object AdapterStatus attribute indicates the appropriate code.
- Identity Object status attribute indicates a minor recoverable fault.

Fault detected at power-up or as a result of a hot-swap when no I/O connections are open

- Attempts to open I/O connections result in a Device State Conflict error.

Fault detected as a result of a hot-swap when one or more I/O connections are open

- I/O connection(s) produce zero-length data, or, if the *IoStatusEnable* attribute is TRUE, a fault is indicated in the I/O Status byte at the beginning of the input data packet.
- Output data from master is ignored.
- Any attempt to allocate I/O connections will be rejected by the device.

Configuration Fault Recovery

Recovery from configuration faults is achieved by:

- Installing/removing I/O module(s) to make the actual configuration match the user-defined configuration,
- And/or changing the configuration data to match the actual configuration and either restarting/resetting the adapter or hot-swapping a module to trigger reconfiguration.

The I/O configuration is reapplied each time a module is hot-swapped and at module startup or reset.

Expansion Module Faults

Faults in Expansion Modules are reported as follows:

- Serious faults (as determined by the Adapter) force the produced I/O data to zero-length, or, if the *IoStatusEnable* attribute is TRUE, a fault is indicated in the I/O Status byte at the beginning of the input data packet.
- The appropriate Slot Object instance SlotStatus attribute and Channel<n>Status attribute(s) indicate the nature of the fault.
- The I/O Status LED state is flashing red.

Module Hot Swap

The 5136-DNS-200S Adapter supports expansion module hot-swap, which allows you to replace expansion modules while the device is active on the network, without removing power.

A configuration mismatch due to an improper module substitution is considered a fault (see “Configuration Faults”). A subsequent hot-swap that results in a match between the original configuration and the new module configuration clears the fault and the 5136-DNS-200S resumes normal operation.

2.5 Troubleshooting

Overview

The following sections describe some typical problems and how to diagnose the problem.

Unable to Communicate with the Device

If you are unable to communicate with the device, ensure that you have specified an appropriate MAC ID (via the DIP switches) which does not conflict with any other devices on the network, and that the correct baud rate has been set.

All of the LEDs are Off

It is necessary to provide module power via the screw terminals on the front of the 5136-DNS-200S Adapter. The 5136-DNS-200S Adapter will not attempt to initialize until power has been applied to the 24 VDC terminals.

Module LED is Solid Red

If a major unrecoverable fault occurs, the device will cease all communication on the network and the Module Status LED will be solid red. This condition could occur due to an invalid baud rate setting (both DR0 and DR1 set ON) or due to a hardware failure that prevents proper operation of the device.

Module LED is Flashing Green

If the Module LED is flashing green, this is most likely due to a configuration error. In Auto Config mode, this may be due to a module hot-swap in which an incorrect module was used in place of the previous module or a new module has not been inserted. In User Config mode, this may indicate that an invalid Adapter parameter combination has been specified or the configuration specified by the Adapter Module does not match the actual expansion module configuration currently connected to the 5136-DNS-200S Adapter.

Network Status LED is Solid Red

There are two cases in which the Network Status LED would be solid red.

- The first would be if the device fails the Duplicate MAC ID check sequence during power-up due to a conflicting node ID.
- The second reason for this condition is a Bus Off condition caused by excessive errors on the bus. This may be caused by an attempt to go online at an incorrect baud rate or due to excessive noise on the DeviceNet bus.

To attempt to recover from either condition, simply remove the DeviceNet connector from the device and re-insert it. The 5136-DNS-200S device detects the loss and re-application of network power, re-initializes the CAN chip, and executes the Duplicate MAC ID sequence again. To prevent continuous failure of the Duplicate MAC ID check, you must either change the MAC ID of the 5136-DNS-200S device or identify and re-configure the conflicting device.

Network Status LED Flashing Red

If the Network Status LED is flashing red, one or more I/O connections are in the time-out state. In most cases, if the master has unexpectedly stopped communicating with the device, the Master/Slave connection set will automatically release when all connections have entered the time-out state based on the Expected Packet Rates (EPR) configured with the device during connection establishment. If for some reason any EPR was set to zero (0), the Master/Slave connection set will not release automatically. In this case it may be necessary to cycle power to remove this condition.

I/O Status LED Flashing Red

If the I/O Status LED is flashing red, one or more of the inputs/outputs are faulted. This may be caused by a diagnostic alarm due to a short circuit on an output module, a missing module due to hot-swapping, or a missing Terminating Module.

2.6 Device Profile: Required Objects

This section describes the implementation of the objects required by the DeviceNet specification.

Identity Object

Class Code: 0x01

Class Attributes: No attributes are supported for the Identity Object at the class level.

Number of instances: 1

Instance 1 Attributes: Table 2-9 lists the Instance 1 attributes for the Identity Object.

Table 2-9 Instance 1 Attributes for Identity Object

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	Vendor	UINT	0008_H
2	Get	Device Type	UINT	$000C_H$
3	Get	Product Code	UINT	$019D_H$
4	Get	Revision Major Revision Minor Revision	Structure of: USINT USINT	 ? ?
5	Get	Status	WORD	Device_Status*
6	Get	Serial Number	UDINT	Unique 32-bit number
7	Get	Product Name String Length ASCII String	Structure of: USINT STRING	 12 “200S Adapter”
9	Get	Configuration Consistency Value	UINT	?
10	Get/Set	Device Heartbeat Interval	USINT	0

*See Device_Status word definition in Table 2-10.

Device_Status Definitions

Table 2-10 Device_Status for Identity Object

Bit(s)	Called	Definition
0	Owned	0 = not owned 1 = Group 2 allocated to a master
1	Reserved	Always 0
2	Configured	0 = “out-of-box” configuration 1 = configuration modified (not including comms)
3	Reserved	Always 0
4, 5, 6, 7	Vendor specific	Always 0
8	Minor recoverable fault	Minor configuration fault
9	Minor non-recoverable fault	Minor device fault (non-recoverable)
10	Major recoverable fault	Major configuration fault
11	Major non-recoverable fault	Major device fault (non-recoverable)
12, 13	Reserved	Always 0
14, 15	Reserved	Always 0

Common Services

Table 2-11 Common Services for Identity Object

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single
0x05	No	Yes	Reset

DeviceNet Object

Class Code: 0x03

Class Attributes:

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	Revision	UINT	2

Number of instances: 1

Table 2-12 Instance 1 Attributes for DeviceNet Object

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	MAC ID	USINT	Defined by switches
2	Get	Baud rate	USINT	Defined by switches
5	Get	Allocation information: Allocation choice byte Master's Node Address	Structure of: BYTE USINT	 Allocation_Byte** 0 - 63 = master MAC 255 = unallocated
6	Get	MAC ID Switch Changed	BOOL	The Node Address switch has changed since last power-up/reset. 0=No Change. 1= Change since last Reset or Power-up.
7	Get	Baud Rate Switch Changed	BOOL	The Baud Rate switch has changed since last power-up/reset. 0=No Change. 1= Change since last Reset or Power-up.
8	Get	MAC ID Switch Value	USINT	Actual value of Node Address switch. Range 0-63
9	Get	Baud Rate Switch Value	USINT	Actual value of Baud Rate switch. Range 0-3 (0=125k, 1=250k, 2=500k, 3=invalid.)

**See Allocation_Byte definition in Table 2-13.

Table 2-13 Allocation_Byte

Bit(s)	Called	Definition
0	Explicit message	Supported, 1 to allocate
1	Poll	Supported, 1 to allocate
2	Strobe	Supported, 1 to allocate
3	Reserved	Always 0
4	Change-of-state	Supported, 1 to allocate
5	Cyclic	Supported, 1 to allocate
6	Acknowledge suppress	Supported, 1 to allocate
7	Reserved	Always 0

Common Services

Table 2-14 Common Services for DeviceNet Object

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	No	Set_Attribute_Single
Service Code	Implemented for		Service Name
	Class	Instance	
0x4B	No	Yes	Allocate_Master/Slave_Connection_Set
0x4C	No	Yes	Release_Master/Slave_Connection_Set

Connection Object

Class Code: 0x05

Class Attributes: No attributes are supported for the Connection Object at the class level.

Number of instances: 4

Instance Attributes: Tables 2-15 through 2-21 list the instance attributes for the Connection Object.

Table 2-15 Instance 1 Attributes for Connection Object (Explicit Message Connection)

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	State	USINT	0 = nonexistent 3 = established 5 = deferred delete
2	Get	Instance type	USINT	0 = explicit message
3	Get	Transport class trigger	USINT	0x83
4	Get	Produced connection ID	UINT	10XXXXXX011b X = Slave Mac ID
5	Get	Consumed connection ID	UINT	10XXXXXX100b X = Slave Mac ID
6	Get	Initial comm characteristics	USINT	0x21
7	Get	Produced connection size	UINT	7 non-fragmented X – fragmented
8	Get	Consumed connection size	UINT	7 non-fragmented X – fragmented
9	Get/Set	Expected packet rate	UINT	*default = 2500*
12	Get/Set	Watchdog timeout action	USINT	Default 0 = transition to timeout
13	Get	Produced connection path length	UINT	0
14	Get	Produced connection path	Structure of:	Null (no data)
15	Get	Consumed connection path length	UINT	0
16	Get	Consumed connection path	Structure of:	Null (no data)
17	Get	Production inhibit time	UINT	0

Table 2-16 Instance 2 Attributes for Connection Object (Polled I/O Connection, Polled with COS/Cyclic I/O Connection)

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	State	USINT	0 = nonexistent 1 = configuring 3 = established 4 = timed out
2	Get	Instance type	USINT	1 = I/O message
3	Get	Transport class trigger	USINT	0x83
4	Get	Produced connection ID	UINT	01111XXXXXXb X = Slave Mac ID
5	Get	Consumed connection ID	UINT	10XXXXXX101b X = Slave Mac ID
6	Get	Initial comm characteristics	USINT	0x01
7	Get	Produced connection size	UINT	*Configuration dependent*
8	Get	Consumed connection size	UINT	*Configuration dependent*
9	Get/Set	Expected packet rate	UINT	*Default = 0*
12	Get	Watchdog timeout action	USINT	0 = Timeout 1 = Auto delete 2 = Auto reset *Default = 0*
13	Get	Produced connection path length	UINT	6
14	Get	Produced connection path Logical segment, Class Class number Logical segment, Instance Instance number Logical segment, Attribute Attribute number	Structure of: USINT USINT USINT USINT USINT USINT	 0x20 0x04 0x24 0x64 0x30 0x03
15	Get	Consumed connection path length	UINT	6
16	Get	Consumed connection path	Structure of: USINT USINT USINT USINT USINT USINT	 0x20 0x04 0x24 0x65 0x30 0x03
17	Get	Production inhibit time	UINT	0

Table 2-17 Instance 2 Attributes for Connection Object (COS/Cyclic Consuming I/O Connection, Acknowledged)

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	State	USINT	0 = nonexistent 1 = configuring 3 = established 4 = timed out
2	Get	Instance type	USINT	1 = I/O message
3	Get	Transport class trigger	USINT	0x83
4	Get	Produced connection ID	UINT	01111XXXXXXb X = Slave Mac ID
5	Get	Consumed connection ID	UINT	10XXXXXX101b X = Slave Mac ID
6	Get	Initial comm characteristics	USINT	0x01
7	Get	Produced connection size	UINT	0
8	Get	Consumed connection size	UINT	*Configuration dependent*
9	Get/Set	Expected packet rate	UINT	*Default = 0*
12	Get	Watchdog timeout action	USINT	0 = Timeout 1 = Auto delete 2 = Auto reset *Default = 0*
13	Get	Produced connection path length	UINT	0
14	Get	Produced connection path	Structure of:	Empty
15	Get	Consumed connection path length	UINT	6
16	Get	Consumed connection path	Structure of: USINT USINT USINT USINT USINT USINT	 0x20 0x04 0x24 0x65 0x30 0x03
17	Get	Production inhibit time	UINT	0

Table 2-18 Instance 2 Attributes for Connection Object (COS/Cyclic Consuming I/O Connection, Unacknowledged)

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	State	USINT	0 = nonexistent 1 = configuring 3 = established 4 = timed out
2	Get	Instance type	USINT	1 = I/O message
3	Get	Transport class trigger	USINT	0x80
4	Get	Produced connection ID	UINT	0xFFFF
5	Get	Consumed connection ID	UINT	10XXXXXX101b X = Slave Mac ID
6	Get	Initial comm characteristics	USINT	0xF1 (slave does not produce)
7	Get	Produced connection size	UINT	0
8	Get	Consumed connection size	UINT	*Configuration dependent*
9	Get/Set	Expected packet rate	UINT	*Default = 0*
12	Get	Watchdog timeout action	USINT	0 = Timeout 1 = Auto delete 2 = Auto reset *Default = 0*
13	Get	Produced connection path length	UINT	0
14	Get	Produced connection path	Structure of:	Empty
15	Get	Consumed connection path length	UINT	6
16	Get	Consumed connection path	Structure of: USINT USINT USINT USINT USINT USINT	 0x20 0x04 0x24 0x65 0x30 0x03
17	Get	Production inhibit time	UINT	0

Table 2-19 Instance 3 Attributes for Connection Object (Strobed I/O Connection)

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	State	USINT	0 = nonexistent 1 = configuring 3 = established 4 = timed out
2	Get	Instance type	USINT	1 = I/O message
3	Get	Transport class trigger	USINT	0x83
4	Get	Produced connection ID	UINT	01110XXXXXXb X = Slave Mac ID
5	Get	Consumed connection ID	UINT	10XXXXXX000b X = Master's Mac ID
6	Get	Initial comm characteristics	USINT	0x02
7	Get	Produced connection size	UINT	*Configuration dependent*
8	Get	Consumed connection size	UINT	8
9	Get/Set	Expected packet rate	UINT	*Default = 0*
12	Get	Watchdog timeout action	USINT	0 = Timeout (default) 1 = Auto delete 2 = Auto reset
13	Get	Produced connection path length	UINT	6
14	Get	Produced connection path Logical segment, Class Class number Logical segment, Instance Instance number Logical segment, Attribute Attribute number	Structure of: USINT USINT USINT USINT USINT USINT	Empty 0x20 0x04 0x24 0x64 0x30 0x03
15	Get	Consumed connection path length	UINT	0
16	Get	Consumed connection path	Structure of:	Null (no data)
17	Get	Production inhibit time	UINT	0

Table 2-20 Instance 4 Attributes for Connection Object (COS/Cyclic Producing I/O Connection, Acknowledged)

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	State	USINT	0 = nonexistent 1 = configuring 3 = established 4 = timed out
2	Get	Instance type	USINT	1 = I/O message
3	Get	Transport class trigger	USINT	For a cyclic connection: 02_H or 03_H. For a change of state connection: 12_H or 13_H.
4	Get	Produced connection ID	UINT	01101XXXXXXb X = Slave Mac ID
5	Get	Consumed connection ID	UINT	10XXXXXX010b X = Slave Mac ID
6	Get	Initial comm characteristics	USINT	0x01
7	Get	Produced connection size	UINT	*Configuration dependent*
8	Get	Consumed connection size	UINT	0 (zero length acknowledge)
9	Get/Set	Expected packet rate	UINT	Default = 0
12	Get	Watchdog timeout action	USINT	0 = Timeout (default) 1 = Auto delete 2 = Auto reset
13	Get	Produced connection path length	UINT	6
14	Get	Produced connection path Logical segment, Class Class number Logical segment, Instance Instance number Logical segment, Attribute Attribute number	Structure of: USINT USINT USINT USINT USINT USINT	 0x20 0x04 0x24 0x64 0x30 0x03
15	Get	Consumed connection path length	UINT	4
16	Get	Consumed connection path	Structure of: USINT USINT USINT USINT	 0x20 0x2B 0x24 0x01
17	Get/Set	Production inhibit time	UINT	0

Table 2-21 Instance 4 Attributes for Connection Object (COS/Cyclic Producing I/O Connection, Unacknowledged)

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	State	USINT	0 = nonexistent 1 = configuring 3 = established 4 = timed out
2	Get	Instance type	USINT	1 = I/O message
3	Get	Transport class trigger	USINT	For a cyclic connection: 02_H or 03_H. For a change of state connection: 12_H or 13_H.
4	Get	Produced connection ID	UINT	01101XXXXXXb X = Slave Mac ID
5	Get	Consumed connection ID	UINT	0xFFFF
6	Get	Initial comm characteristics	USINT	0x0F (slave does not consume)
7	Get	Produced connection size	UINT	*Configuration dependent*
8	Get	Consumed connection size	UINT	0
9	Get/Set	Expected packet rate	UINT	Default = 0
12	Get	Watchdog timeout action	USINT	0 = Timeout 1 = Auto delete 2 = Auto reset *Default = 0*
13	Get	Produced connection path length	UINT	6
14	Get	Produced connection path Logical segment, Class Class number Logical segment, Instance Instance number Logical segment, Attribute Attribute number	Structure of: USINT USINT USINT USINT USINT USINT	 0x20 0x04 0x24 0x64 0x30 0x03
15	Get	Consumed connection path length	UINT	0
16	Get	Consumed connection path	Structure of:	Empty
17	Get/Set	Production inhibit time	UINT	0

Common Services

Table 2-22 Common Services for Connection Object

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Acknowledge Handler Object

Class Code: 0x2B

Class Attributes: No attributes are supported by the Acknowledge Handler Object at the class level.

Number of instances: 1

Instance Attributes: Table 2-23 lists the instance attributes for the Acknowledge Handler Object.

Table 2-23 Instance 1 Attributes for Acknowledge Handler Object

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get/Set	Acknowledge timer	UINT	Default = 16
2	Get	Retry limit	USINT	1
3	Get	COS/CYC producing connection instance ID	USINT	4

2.7 Device Profile: Application-Specific Objects

This section describes the implementation of application-specific objects.

Assembly Object

Class Code: 0x04

Class Attributes: No attributes are supported for the assembly object at the class level.

Number of instances: 2

Instance Attributes: Tables 2-24 and 2-25 list the instance attributes of the Assembly Object.

Table 2-24 Instance 100 (64_H) Attributes (vendor-specific input assembly)

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
3	Get	Data value	Array of USINT	Size dependent on configuration

Table 2-25 Instance 101 (65_H) Attributes (vendor-specific output assembly)

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
3	Get	Data value	Array of USINT	Size dependent on configuration

Common Services

Table 2-26 Common Services for Assembly Object

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single

Adapter Object

Class Code: 0x64

The 5136-DNS-200S Adapter Object provides the external configuration and monitoring interface to the DeviceNet Adapter module.

Class Attributes: No attributes are supported for the Adapter Object at the class level.

Number of instances: 1

Instance Attributes: Table 2-27 lists the instance attributes of the Adapter Object.

Table 2-27 Instance 1 Attributes of the Adapter Object

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get	AdapterStatus	USINT	Adapter Status (see Table 2-28)
2	Get	InputSize	USINT	Currently configured input assembly size
3	Get	OutputSize	USINT	Currently configured output assembly size
4	Get/Set	AutoConfig	BOOL	Automatic Configuration Mode 1 Automatic configuration: the rack self-configures based on the modules installed. 0 Manual configuration: the rack configuration is stored in non-volatile memory.
5	Get	ConfigChanged	BOOL	True if manual configuration changes have been made but have not taken effect (changes will take effect at next reset).
6	Get	Diagnostic String	Array of USINT [65]	An array of USINT containing slot diagnostics. The first byte of the array indicates the number of valid diagnostic bytes within the array (the remaining bytes within the array can be ignored).
7	Get	ConfiguredSlots	USINT	Indicates the number of configured slot objects.
8	Get/Set	Parameters	Array of USINT [19]	Configuration information for expansion modules and adapter module behavior.
9	Get/Set	IoStatusEnable	BOOL	Enables the generation of an I/O status byte at the beginning of the input data I/O packet.
10	Get/Set	HeadParamByte1	USINT	Parameter bytes for expansion module and adapter module behavior.

Table 2-27 Instance 1 Attributes of the Adapter Object , continued

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
11	Get/Set	HeadParamByte2	USINT	Parameter bytes for expansion module and adapter module behavior.
12	Get/Set	HeadParamByte3	USINT	
13	Get/Set	HeadParamByte4	USINT	
14	Get/Set	HeadParamByte5	USINT	
15	Get/Set	HeadParamByte6	USINT	
16	Get/Set	HeadParamByte7	USINT	
17	Get/Set	HeadParamByte8	USINT	
18	Get/Set	HeadParamByte9	USINT	
19	Get/Set	HeadParamByte10	USINT	
20	Get/Set	HeadParamByte11	USINT	
21	Get/Set	HeadParamByte12	USINT	
22	Get/Set	HeadParamByte13	USINT	
23	Get/Set	HeadParamByte14	USINT	
24	Get/Set	HeadParamByte15	USINT	
25	Get/Set	HeadParamByte16	USINT	
26	Get/Set	HeadParamByte17	USINT	
27	Get/Set	HeadParamByte18	USINT	
28	Get/Set	HeadParamByte19	USINT	

Attribute 1 [AdapterStatus] Details: The AdapterStatus attribute, listed in Table 2-28, reports the status of the 5136-DNS-200S Adapter and expansion modules.

Table 2-28 AdapterStatus Details

Bit(s)	Name	Description
0	Hot swap	A module hot-swap has occurred since power-up.
1	Parameters rejected	One or more expansion modules rejected the parameters specified by its slot object.
2	Configuration rejected	One or more expansion modules rejected the configuration byte specified by its slot object.
3	Expansion module diagnostics	One or more expansion modules is reporting an error.
4 – 7		Reserved

Attribute 9 [IoStatusEnable] Details

The IoStatusEnable attribute enables/disables the generation of a single I/O status byte at the beginning of the input data I/O packet. This status byte indicates if any faults have occurred which would result in invalid data. The default value for Attribute 9 is enabled (1).

The format of the I/O status byte is shown below:

Table 2-29 I/O Status Byte Format

7	6	5	4	3	2	1	0
—	—	—	—	—	—	—	Fault

Attributes 10-28 [HeadParamByte(n)] Details

The HeadParamByte attributes provide single byte (USINT) access to the elements of the HeadParameters attribute (attribute 8) for access via tools not supporting complex data type representation. Modification of either of the HeadParameters will affect all the corresponding HeadParamByte attributes and visa versa.

Common Services

Table 2-30 Common Services for the Adapter Object

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

5136-DNS-200S Slot Object

Class Code: 0x65

The 5136-DNS-200S Slot Object provides the external configuration and monitoring interface to the I/O module in one 5136-DNS-200S slot. One instance of this object exists for each available slot.

Class Attributes: No attributes are supported for the 5136-DNS-200S Slot Object at the class level.

Number of instances: 63

Instance Attributes: Table 2-31 lists the instance attributes for the 200S Slot Object.

Table 2-31 Instance Attributes of the 5136-DNS-200S Slot Object

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
1	Get/Set[1,2]	ModuleReference	UINT	For configuration tool use
2	Get/Set[1,2]	ParameterSize	USINT	Number of parameter bytes required by this slot
3	GetSet[2]	Parameters	Array of USINT	Parameter bytes for this slot: array size is set by attribute 2
4	Get/Set[2]	ConfigByte	USINT	Configuration byte for this slot
5	Get	SlotStatus	USINT	Slot status code (see Table 2-32)
6	Get	Channel0Status	USINT	Channel Status code (see Table 2-33)
7	Get	Channel1Status	USINT	
8	Get	Channel2Status	USINT	
9	Get	Channel3Status	USINT	
10	Get	Channel4Status	USINT	
11	Get	Channel5Status	USINT	
12	Get	Channel6Status	USINT	
13	Get	Channel7Status	USINT	
14	Get	Channel0Type	USINT	Channel Type code (see Table 2-34). The Channel Type code is zero if the corresponding Channel Status code is zero.
15	Get	Channel1Type	USINT	
16	Get	Channel2Type	USINT	
17	Get	Channel3Type	USINT	
18	Get	Channel4Type	USINT	
19	Get	Channel5Type	USINT	
20	Get	Channel6Type	USINT	
21	Get	Channel7Type	USINT	
22	Get/Set	ParamByte1	USINT	Parameter bytes for this slot: Number actually used is set by Attribute 2.
23	Get/Set	ParamByte2	USINT	
24	Get/Set	ParamByte3	USINT	
25	Get/Set	ParamByte4	USINT	

Table 2-31 Instance Attributes of the 5136-DNS-200S Slot Object, continued

Attribute ID	Access Rule	Name	DeviceNet Data Type	Data Value
26	Get/Set	ParamByte5	USINT	Parameter bytes for this slot: Number actually used is set by Attribute 2.
27	Get/Set	ParamByte6	USINT	
28	Get/Set	ParamByte7	USINT	
29	Get/Set	ParamByte8	USINT	
30	Get/Set	ParamByte9	USINT	
31	Get/Set	ParamByte10	USINT	
32	Get/Set	ParamByte11	USINT	
33	Get/Set	ParamByte12	USINT	
34	Get/Set	ParamByte13	USINT	
35	Get/Set	ParamByte14	USINT	
36	Get/Set	ParamByte15	USINT	
37	Get/Set	ParamByte16	USINT	
38	Get/Set	ParamByte17	USINT	
39	Get/Set	ParamByte18	USINT	
40	Get/Set	ParamByte19	USINT	
41	Get/Set	ParamByte20	USINT	
42	Get/Set	ParamByte21	USINT	
43	Get/Set	ParamByte22	USINT	
44	Get/Set	ParamByte23	USINT	
45	Get/Set	ParamByte24	USINT	
46	Get/Set	ParamByte25	USINT	
47	Get/Set	ParamByte26	USINT	
48	Get/Set	ParamByte27	USINT	
49	Get/Set	ParamByte28	USINT	
50	Get/Set	ParamByte29	USINT	
51	Get/Set	ParamByte30	USINT	
52	Get/Set	ParamByte31	USINT	
53	Get/Set	ParamByte32	USINT	

1 When Adapter Object AutoConfig attribute is true: These attributes reflect the non-volatile configuration parameters and are not used by the adapter. Setting this attribute returns OBJECT_STATE_CONFLICT.

2 When an I/O connection is open: Setting this attribute returns DEVICE_STATE_CONFLICT.

Attribute 5 [SlotStatus] Details: The SlotStatus attribute, listed in Table 2-32, reports the operating status of the module installed.

Table 2-32 SlotStatus Details

Status Code	Text	Description
0	OK	Module is operating normally.
1	Module error	
2	Wrong module	
3	No module	Slot is empty – no module installed.
4 – 255		Reserved

Attribute 6 - 13 [Channel<n>Status] Details: The Channel<n>Status attributes, listed in Table 2-33, report the operating status of each channel in the module. (Refer to Section 6.4 for more information on diagnostics.)

Table 2-33 ChannelStatus Details

Status Code	Text	Description
0	No error	Channel is either not used or operating normally.
1	Short	
2	Under voltage	
3	Over voltage	
4	Overload	
5	Excess temperature	
6	Wire break	
7	Upper limit exceeded	
8	Lower limit exceeded	
9	Error	
10 – 15		Reserved
16 – 31		Manufacturer specific error codes
32 – 255		Reserved

Attribute 14 - 21 [Channel<n>Type] Details: The Channel<n>Type attributes, listed in Table 2-34, provide additional detail when the corresponding Channel<n>Status is reporting an error.

Table 2-34 ChannelStatus Details

Status Code	Text	Description
0	N/A	Reported when corresponding Channel<n>Status is reporting “No error”
1	Bit	1-bit channel
2	2 Bit	2-bit channel
3	4 Bit	4-bit channel
4	Byte	8-bit channel
5	Word	16-bit channel
6	2 Word	32-bit channel
7 – 255		Reserved

Attributes 22-53 [ParamByte(n)] Details

The ParamByte attributes provide single byte (USINT) access to the first 32 elements of the Parameters attribute (attribute 3) for access via tools not supporting complex data type representation. Modification of the Parameters attribute will affect all the corresponding ParamByte attributes and visa versa. The DNS-200S limits the slot object’s ParameterSize attribute to a maximum value of 16.

Common Services

Table 2-35 Common Services for the 200S Slot Object

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

2.8 Technical Specifications

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	45 x 119.5 x 75
Weight	Approximately 153 g
Data for Specific Modules	
Transmission rate	125; 250; 500 kbaud
Bus protocol	DeviceNet
Interface	5-pin DeviceNet
Voltage, Currents, Potentials	
Rated supply voltage of the electronics (1L+)	24 VDC, Class 2 power supply [Note1]
• Reverse polarity protection	Yes
Maximum Ambient	
• Mounting rail horizontal	60 °C
• Mounting rail vertical	40 °C
Isolation	
• Between the backplane bus and electronic components	No
• Between DeviceNet and electronic components	Yes
• Between the supply voltage and electronic components	No
Insulation tested with	500 VDC

Current consumption	
• From input voltage – total (DN module + 63 bus modules)	250 mA max @ 24 VDC
• Total from input voltage – (DN module + no bus modules)	125 mA max @ 24 VDC
DeviceNet Interface	
• Supply voltage from DeviceNet cable	11 to 25 VDC
• Current	75 mA max.
Power dissipation of the interface module	Typically 3.8 W
Status, Diagnostics	
Interrupts	None
Diagnostic function	Yes
• Module status	Red/Green LED
• Network status	Red/Green LED
• I/O status	Red/Green LED

[Note1] 24 VDC power for module power and network interface power is provided by user-supplied Class 2 power supplies. The 5136-DNS-200S should have separate power supplies for input current and output load power to ensure isolation between the interface module and output circuits.

2.9 Byte Ordering Examples

Analog Module Assignment of the Feedback and Control Interface

The digitized analog value for input and output values is the same in the same rated range. Analog values are represented in twos complement.

Tables 2-36 and 2-37 show the analog value assignments for the analog electronic modules, as interpreted by the DeviceNet master.

Table 2-36 2-Channel Analog Input (6ES7 134-4FB00-0AB0)

Address	Assignment
Byte 0	Channel 0 analog value 2^7 through 2^0
Byte 1	Channel 0 analog value 2^{15} through 2^8 (Bit number 15 is the sign bit.)
Byte 2	Channel 1 analog value 2^7 through 2^0
Byte 3	Channel 1 analog value 2^{15} through 2^8 (Bit number 15 is the sign bit.)

Table 2-37 2-Channel Analog Output (6ES7 135-4FB00-0AB0)

Address	Assignment
Byte 0	Channel 0 analog value 2^7 through 2^0
Byte 1	Channel 0 analog value 2^{15} through 2^8 (Bit number 15 is the sign bit.)
Byte 2	Channel 1 analog value 2^7 through 2^0
Byte 3	Channel 1 analog value 2^{15} through 2^8 (Bit number 15 is the sign bit.)

Sign

The sign (S, +/-) of the analog value is always in bit number 15:

- “0” → +
- “1” → −

1Count Module Assignment of the Feedback and Control Interface

Table 2-38 1Count24V/100kHz (6ES7 138-4DA03-0AB0) Feedback Interface (Inputs)

Address	Assignment	Designation
Byte 0	Count value 2^7 through 2^0	
Byte 1	Count value 2^{15} through 2^8	
Byte 2	Count value 2^{23} through 2^{16}	
Byte 3	Count value 2^{31} through 2^{24}	
Byte 4	Reserve = 0	
Byte 5	Bit 7: Zero-crossing in the count range in counting without a main counting direction Bit 6: Lower count limit Bit 5: Upper count limit Bit 4: Comparator 2 status Bit 3: Comparator 1 status Bit 2: Reserve = 0 Bit 1: Reserve = 0 Bit 0: Synchronization status	STS_ND STS_UFLW STS_OFLW STS_CMP2 STS_CMP1 STS_SYN
Byte 6	Bit 7: Down direction status Bit 6: Up direction status Bit 5: Reserve = 0 Bit 4: DO2 status Bit 3 DO1 status Bit 2: Reserve = 0 Bit 1: DI status Bit 0: Internal gate status	STS_C_DN STS_C_UP STS_DO2 STS_DO1 STS_DI STS_GATE
Byte 7	Bit 7: Short circuit of the sensor supply Bit 6: Short circuit / wire break / overtemperature Bit 5: Parameter assignment error Bit 4: Reserve = 0 Bit 3: Reserve = 0 Bit 2: Resetting of status bit active Bit 1: Load function error Bit 0: Load function active	ERR_24V ERR_DO1 ERR_PARA RES_STS_A ERR_LOAD STS_LOAD

Table 2-39 1Count24V/100kHz (6ES7 138-4DA03-0AB0) Control Interface (Outputs)

Address	Assignment	Designation
Byte 0	Load value 2^7 through 2^0	
Byte 1	Load value 2^{15} through 2^8	
Byte 2	Load value 2^{23} through 2^{16}	
Byte 3	Load value 2^{31} through 2^{24}	
Byte 4	Reserve = 0	
Byte 5	Reserve = 0	
Byte 6	Bit 7: Reserve = 0 Bit 6: Reserve = 0 Bit 5: Reserve = 0 Bit 4: Change function and behavior of DO1, DO2 Bit 3 Load comparison value 2 Bit 2: Load comparison value 1 Bit 1: Load counter (preparatory) Bit 0: Load counter (direct)	 C_DOPARAM CMP_VAL2 CMP_VAL1 LOAD_PREPARE LOAD_VAL
Byte 7	Bit 7: Diagnostic error acknowledgement Bit 6: Enable DO2 Bit 5: DO2 control bit Bit 4: Enable DO1 Bit 3: DO1 control bit Bit 2: Start resetting of status bit Bit 1: Enable synchronization Bit 0: SW gate control bit	EXTF_ACK CTRL_DO2 SET_DO2 CTRL_DO1 SET_DO1 RES_STS CTRL_SYN SW_GATE

1STEP Module Assignment of the Feedback and Control Interface

Table 2-40 1STEP5V/204kHz (6ES7 138-4DC00-0AB0) Feedback Interface (Inputs)

Address	Assignment	Designation
Byte 0	Residual distance value 2^7 through 2^0	
Byte 1	Residual distance value 2^{15} through 2^8	
Byte 2	Residual distance value 2^{19} through 2^{16} Reserve = 0 value 2^{23} through 2^{20}	
Byte 3	Reserve = 0	
Byte 4	Reserve = 0	
Byte 5	Reserve = 0	
Byte 6	Bit 7: Positioning in operation Bit 6: Cause of STOP: Limit switch Bit 5: Cause of STOP: Limit switch Bit 4: Cause of STOP: External STOP Bit 3 Cause of STOP: Reference cam Bit 2: DI status Bit 1: Status reference input Bit 0: Status pulse enable active	POS STOP_LIMIT_P STOP_LIMIT_M STOP_EXT STOP_REF STS_DI STS_REF STS_DRV_EN
Byte 7	Bit 7: Sensor supply short circuit Bit 6: Reserve = 0 Bit 5: Parameter assignment error Bit 4: Reference point determines Bit 3: Residual value < 0 Bit 2: Position reached Bit 1: Error during job transfer Bit 0: Job transfer currently running	ERR_24V ERR_PARA SYNC DIS_NEG POS_RCD ERR_JOB STS_JOB

Table 2-41 1STEP5V/204kHz (6ES7 138-4DC00-0AB0) Control Interface (Outputs)

Address	Assignment		Designation
	Positioning Job	Parameter Assignment Request	
Byte 0	Distance value 2^7 through 2^0	Base Frequency	
Byte 1	Distance value 2^{15} through 2^8	Multiplier n	
Byte 2	Distance value 2^{19} through 2^{16} Reserve = 0 value 2^{23} through 2^{20}	Multiplier i	
Byte 3	Multiplier value 2^7 through 2^0	Reserve = 0	
Byte 4	Reserve = 0		
Byte 5	Reserve = 0		
Byte 6	Bit 7: Diagnostic error acknowledgement Bit 6: Parameter assignment job change parameter Bit 5: Reserve = 0 Bit 4: Reserve = 0 Bit 3: Stop at the reference cam Bit 2: Pulse enable (only relevant if you assigned parameters to the digital input as external STOP) Bit 1: Limit switch in forward direction Bit 0: Limit switch in backward direction		EXTF_ACK C_PAR STOP_REF_EN DRV_EN LIMIT_P LIMIT_M
Byte 7	Bit 7: Reduction factor Bit 6: Bit 5: Backward start Bit 4: Forward start Bit 3 Reserve = 0 Bit 2: Reserve = 0 Bit 1: Reserve = 0 Bit 0: 0 = incremental mode / 1 = search for reference		R STOP DIR_M DIR_P Mode

Serial Interface Module (SI) Module Assignment of the Feedback and Control Interface

Table 2-42 SI (6ES7 138-4DF00-0AB0) Feedback Interface (Inputs)

Address	Assignment	Designation
Byte 0	1st data byte (8th data byte)	Data
Byte 1	Status value 2^0 through 2^7 (7th data byte)	Data
Byte 2	Status value 2^8 through 2^{15} (6th data byte)	Data
Byte 3	Bit 7: Reserve = 0 Bit 6: Set by the module to acknowledge that the job has been accepted; value 2^2 Bit 5: Set by the module to acknowledge that the job has been accepted; value 2^1 Bit 4: Set by the module to acknowledge that the job has been accepted; value 2^0 Bit 3 Set by the module to indicate that a segment was not received in the correct order. The execution number field indicates ths last valid execution number. Bit 2: Send job: Incremented by the module by 1 when the module is ready to accept another segment from the CPU. Receive job: Incremented by the module by 1 when the module sends another segment to the CPU. (The value goes from 1 to 7.); value 2^2 Bit 1: Same as bit 2; value 2^1 Bit 0: Same as bit 2; value 2^0	 Job Code Job Code Job Code Error Execution Number Execution Number Execution Number
Byte 4	5^{th} data byte (12^{th} data byte)	Data
Byte 5	^{4th} data byte (11^{th} data byte)	Data
Byte 6	3^{rd} data byte (10^{th} data byte)	Data
Byte 7	2^{nd} data byte (9^{th} data byte)	Data

Note

When the module is used in 4-byte mode, bytes 0 through 3 contain the information shown above. Bytes 4 through 7 are omitted.

Table 2-43 SI (6ES7 138-4DF00-0AB0) Control Interface (Outputs)

Address	Assignment	Designation
Byte 0	1st data byte (8th data byte)	Data
Byte 1	Length value 2^0 through 2^7 (7th data byte)	Data
Byte 2	Length value 2^8 through 2^{15} (6th data byte)	Data
Byte 3	Bit 7: Reserve = 0 Bit 6: Set by the CPU to initiate a job; value 2^2 Bit 5: Set by the CPU to initiate a job; value 2^1 Bit 4: Set by the CPU to initiate a job; value 2^0 Bit 3 Set by the CPU to indicate that a segment was not received in the correct order. The execution number field indicates the last valid execution number. Bit 2: <u>Send job</u>: Incremented by the CPU by 1 when the CPU sends another segment to the 1SI module. <u>Receive job</u>: Incremented by the CPU by 1 when the CPU is ready to accept another segment from the module. (The value goes from 1 to 7.); value 2^2 Bit 1: Same as bit 2; value 2^1 Bit 0: Same as bit 2; value 2^0	 Job Code Job Code Job Code Error Execution Number Execution Number Execution Number
Byte 4	5th data byte (12th data byte)	Data
Byte 5	4th data byte (11th data byte)	Data
Byte 6	3rd data byte (10th data byte)	Data
Byte 7	2nd data byte (9th data byte)	Data

Note

When the module is used in 4-byte mode, bytes 0 through 3 contain respectively:

- Length value 2^8 through 2^{15}
- Job Code and Execution Number
- 1st data byte
- Length value 2^0 through 2^7

Bytes 4 through 7 are omitted.

DS1e-X High Feature Motor Starter Module Assignment of the Feedback and Control Interface

Table 2-44 DS1e-X High Feature Motor Starter (3RK1 301-0AB10-0AA2) Feedback Interface (Inputs)

Address	Assignment	Designation
Byte 0	Bit 7: 0 = Not active 1 = Active Bit 6: 0 = No manual operation local 1 = Manual operation local Bit 5: value 2^5 Bit 4: value 2^4 Bit 3: value 2^3 Bit 2: value 2^2 Bit 1: value 2^1 Bit 0: value 2^0	Ramp operation (for soft starter) Manual operation local Motor current I_{act} Motor current I_{act} Motor current I_{act} Motor current I_{act} Motor current I_{act} Motor current I_{act}
Byte 1	Bit 7: 1 or 0 Bit 6: 1 or 0 Bit 5: 1 or 0 Bit 4: 1 or 0 Bit 3: 0 = No warning 1 = Warning Bit 2: 0 = No faults 1 = Fault Bit 1: 0 = Off 1 = On (clockwise/counterclockwise rotation) Bit 0: 0 = Starter cannot be operated by host/PLC 1 = Starter can be operated by host	Input 4 [Note1] Input 3 [Note1] Input 2 [Note2] Input 1 [Note2] General warning General fault Motor on [Note3] Ready

[Note1] From the 2DI/-2DO COM control module (optional)

[Note2] From the expansion module (for example, brake control xB3.4 (optional)

[Note3] Signal is 1 if the motor current is > 18.75% of the set rated current.

Table 2-45 DS1e-X High Feature Motor Starter (3RK1 301-0AB10-0AA2) Control Interface (Outputs)

Address	Assignment	Designation
Byte 0	Reserve = 0	
Byte 1	Bit 7: Reserve = 0 Bit 6: Reserve = 0 Bit 5: Reserve = 0 Bit 4: 0 = Not active 1 = Active Bit 3: 0 = Trip Reset inactive 1 = Trip Reset active Bit 2: 0 = No drive (brake control: brake active and motor braked) 1 = Drive (brake control: brake released and motor unbraked) Bit 1: 0 = Motor off 1 = Motor on Bit 0: 0 = Motor off 1 = Motor on	Emergency start Trip reset Drive for expansion module (brake control) Motor ccw (for RS1e-X) Motor cw

Configuration Options

3

Chapter overview

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.

Table 3-1 below shows you a number of examples of ET 200S distributed I/O system configurations:

Table 3-1 Examples of ET 200S Setups

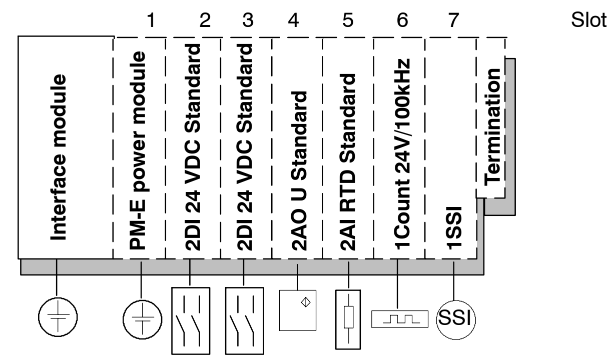
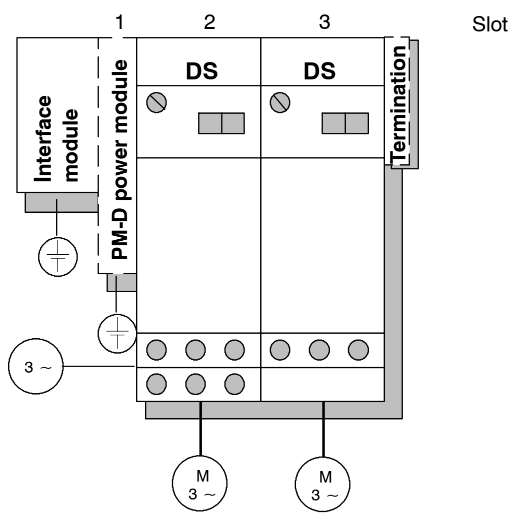
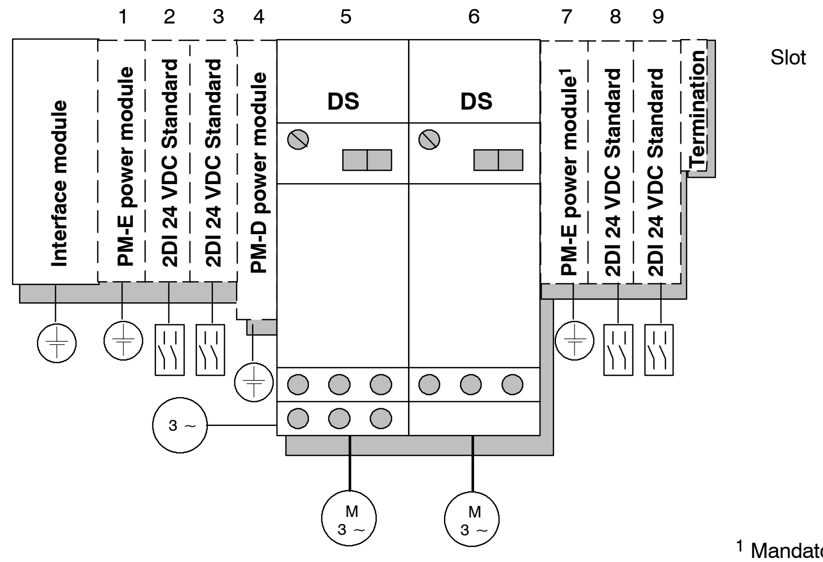
Example	Structure
ET 200S with • Digital electronic modules • Analog electronic modules • Technology modules	
ET 200S with motor starters	

Table 3-1 Examples of ET 200S Setups, continued

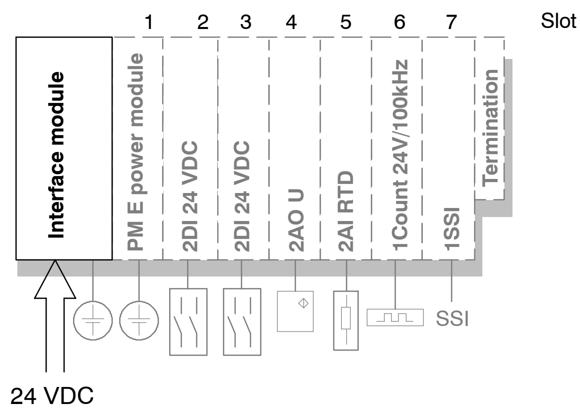
Example	Structure
ET 200S with • Electronic modules • Motor starters	 [1] Mandatory

3.2 Power Supply of the ET 200S

The following power supplies are available for the ET 200S

- 24 VDC on the interface module (see table 3-2).

Table 3-2 Power Supply of the ET 200S

Power supply	Configuration (example)
24 VDC on the interface module	

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

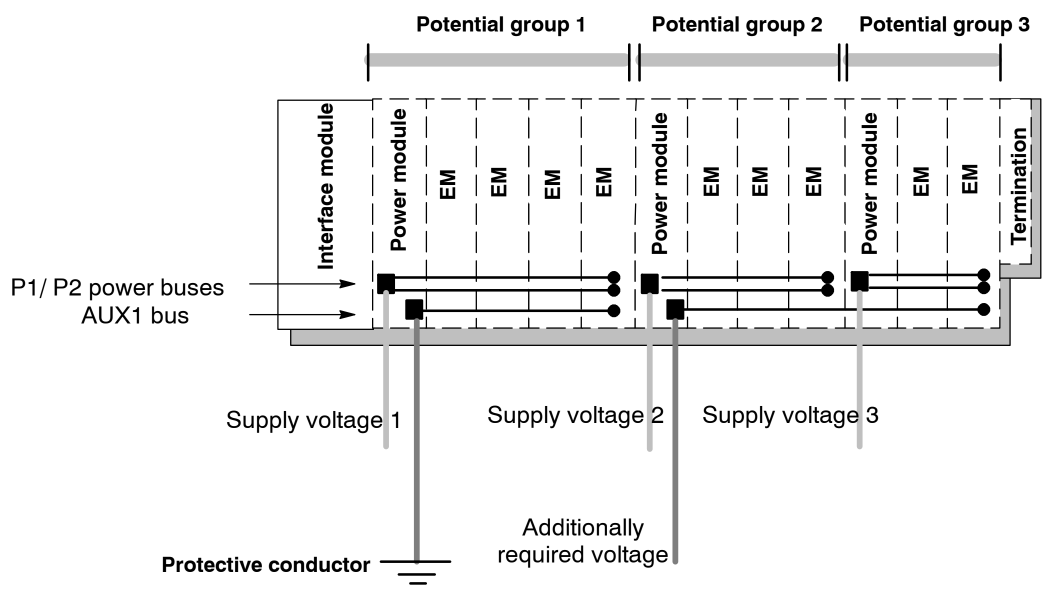


Figure 3-1 Placement and Connection to Common Potential of Power Modules

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 between the Terminal Modules and Electronic Modules

The Electronic Modules to Suit Your Application:

Table 3-3 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 wired (10K) and unwired 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	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
	VDC up to 2 A	2DO 24 VDC/2 A Standard 2DO 24 VDC/2 A High Feature 4DO 24 VDC/2 A Standard
	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	±10V/ ± 5V/ 1 to 5V	2AI U Standard
• Measuring voltages with high resolution	±10V/ ± 5V/ 1 to 5V	2AI U High Feature
• Time-critical measuring of voltages	±10V/ ± 5V/ ± 2.5V/	2AI U High Speed
• Measuring of currents with two-wire measuring transducers	4 to 20 mA	2AI I 2WIRE Standard

Table 3-3 Electronic Modules and the Applications for Which They Are Suitable, continued

Applications		Electronic module
• Time-critical measuring of currents with two-wire measuring transducers	4 to 20mA 0 to 20 mA	2AI I 2WIRE High Speed
• Measuring of currents with four-wire measuring transducers	±20mA/ 4 to 20 mA	2AI I 4WIRE Standard
• Measuring of currents with two-wire, four-wire measuring transducers and high resolution	±20mA/ 4 to 20 mA	2AI I 2/4WIRE High Feature
• Time-critical measuring of currents with four-wire measuring transducers	4 to 20mA 0 to 20mA ± 20mA	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	±10V/ 1 to 5V	2AO U Standard
• Output of voltages with high resolution	±10V/ 1 to 5V	2AO U High Feature
• Output of currents	±20mA/ 4 to 20V	2AO I Standard
• Output of currents with high resolution	±20mA/ 4 to 20V	2AO I High Feature

Table 3-3 Electronic Modules and the Applications for Which They Are Suitable, continued

Applications		Electronic module
• 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
• 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	EM 1STEP 5V/204kHz
• 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
• RS232C/RS422/RS485 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 3-4 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**
Order number 6ES7193... →	**...4CC20-0AA0**	**...4CD20-0AA0**	**...4CE00-0AA0**
Spring terminal: →	**15C23-A1**	**15C23-A0**	**15C22-01**
Order number 6ES7193... →	**...4CC30-0AA0**	**...4CD30-0AA0**	**...4CE10-0AA0**
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 24-48VDC/ 24-230VAC	●	●	●

Table 3-5 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**
Order number 6ES7193... →	**...4CA40-0AA0**	**...4CA20-0AA0**	**...4CB20-0AA0**	**...4CB00-0AA0**	**...4CL20-0AA0**	**...4CG20-0AA0**
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**
Order number 6ES7193... →	**...4CA50-0AA0**	**...4CA30-0AA0**	**...4CB30-0AA0**	**...4CB10-0AA0**	**...4CL30-0AA0**	**...4CG30-0AA0**
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	●	●	●	●		
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	●	●	●	●		

Table 3-5 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**
Order number 6ES7193... →	**...4CA40-0AA0**	**...4CA20-0AA0**	**...4CB20-0AA0**	**...4CB00-0AA0**	**...4CL20-0AA0**	**...4CG20-0AA0**
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**
Order number 6ES7193... →	**...4CA50-0AA0**	**...4CA30-0AA0**	**...4CB30-0AA0**	**...4CB10-0AA0**	**...4CL30-0AA0**	**...4CG30-0AA0**
Fast Connect →	**15N26-A1**	**15N24-A1**	**15N24-01**	**15N23-01**	**---**	**---**
Order number 6ES7193... →	**...4CA80-0AA0**	**...4CA70-0AA0**	**...4CB70-0AA0**	**...4CB60-0AA0**		
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					●	
2AO U Standard 2AO U High Feature	●		●			
2AO I Standard 2AO I High Feature	●	●	●	●		
1Count 24V/100kHz	●		●			
1Count 5V/500kHz						●
1SSI	●		●			
EM 1STEP 5V/204kHz	●		●			
2PULSE	●		●			
1POS INC/Digital						●
1POS SSI/Digital						●
1POS INC/Analog						●
1POS SSI/Analog						●

Table 3-5 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**
Order number 6ES7193... →	**...4CA40-0AA0**	**...4CA20-0AA0**	**...4CB20-0AA0**	**...4CB00-0AA0**	**...4CL20-0AA0**	**...4CG20-0AA0**
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**
Order number 6ES7193... →	**...4CA50-0AA0**	**...4CA30-0AA0**	**...4CB30-0AA0**	**...4CB10-0AA0**	**...4CL30-0AA0**	**...4CG30-0AA0**
Fast Connect →	**15N26-A1**	**15N24-A1**	**15N24-01**	**15N23-01**	**---**	**---**
Order number 6ES7193... →	**...4CA80-0AA0**	**...4CA70-0AA0**	**...4CB70-0AA0**	**...4CB60-0AA0**		
1SI 3964/ASCII	●		●			
1SI Modbus/USS	●		●			
RESERVE (width 15 mm)	●	●	●	●	●	
RESERVE (width 30 mm)						●

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.

How to Find the Right Terminal Module for a Power Module for Your Application:

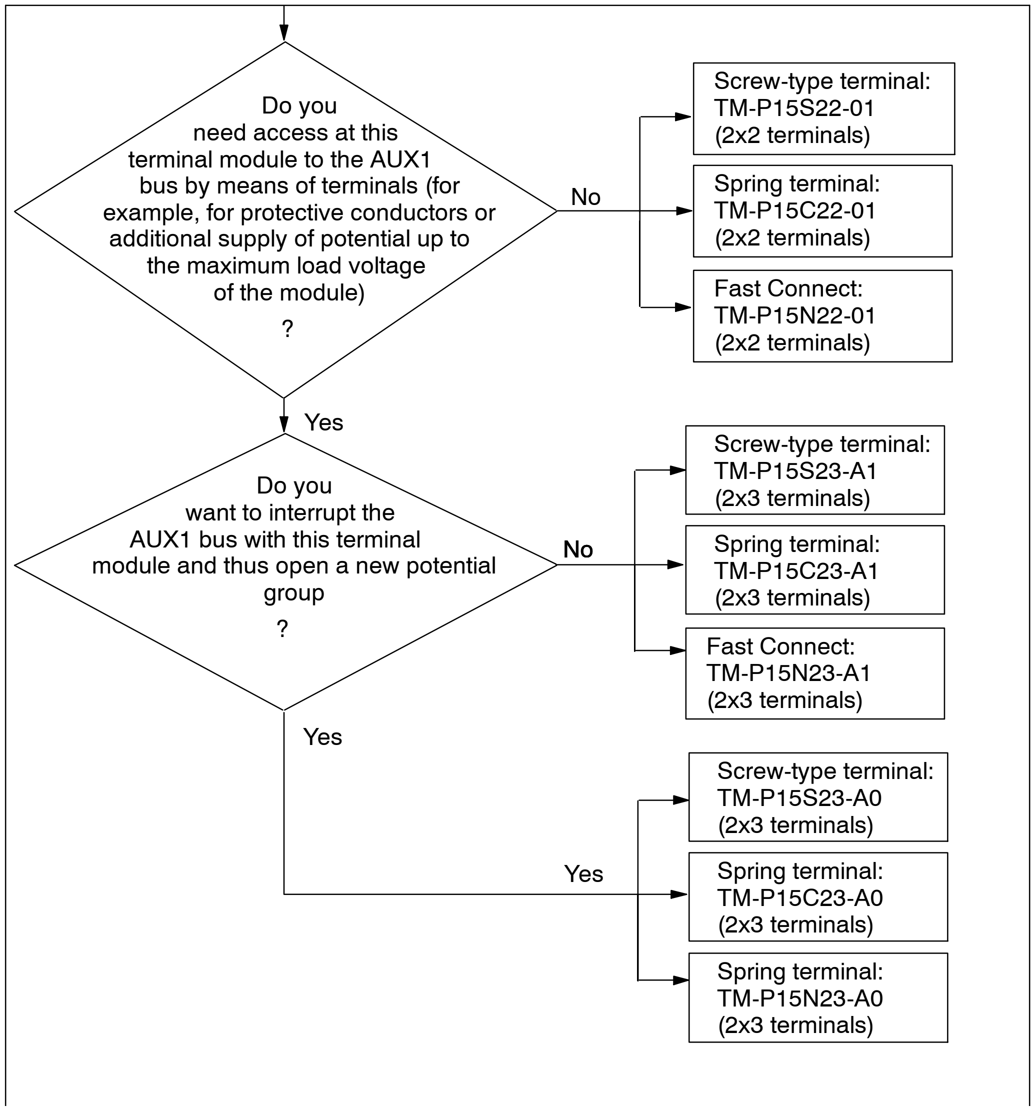


Figure 3-2 Selecting Terminal Modules for Power Modules

Configuration Examples of Terminal Modules for Power Modules

Table 3-6 Terminal Modules for Power Modules

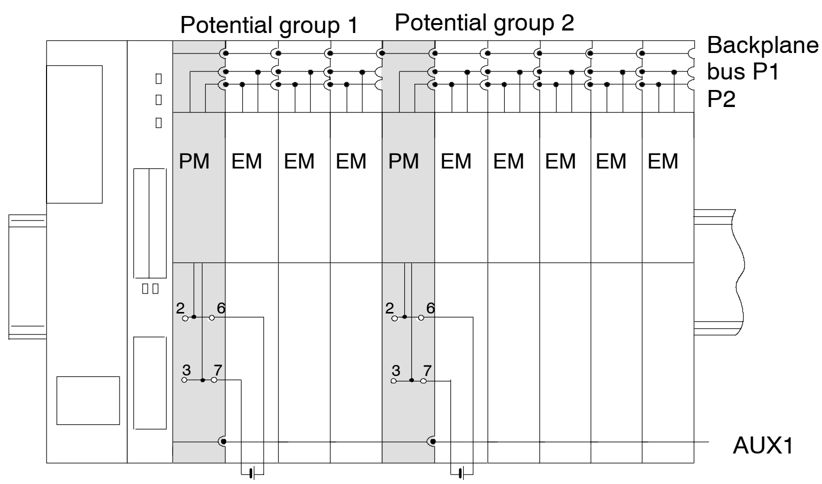
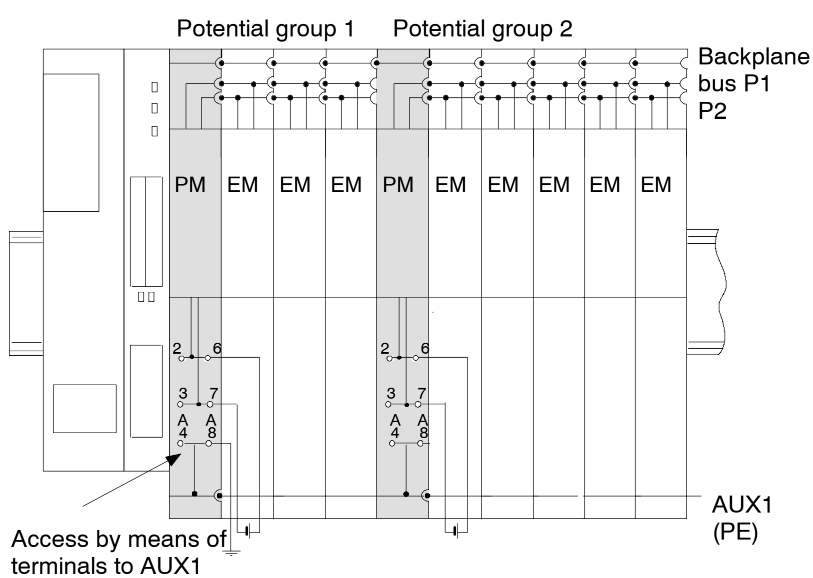
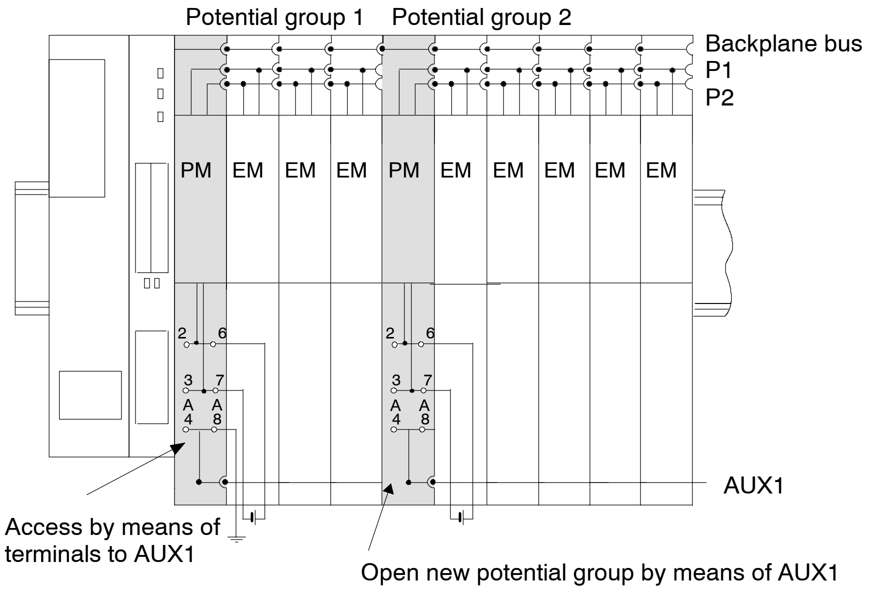
Terminal Module	Structure
TM-P15S22-01 TM-P15C22-01 TM-P15N22-01	
TM-P15S23-A1 TM-P15C23-A1 TM-P15N23-A1	

Table 3-6 Terminal Modules for Power Modules, continued

Terminal Module	Structure
TM-P15S23-A0 TM-P15C23-A0 TM-P15N23-A0	

How to Find the Right Terminal Module for an Electronic Module for Your Application:

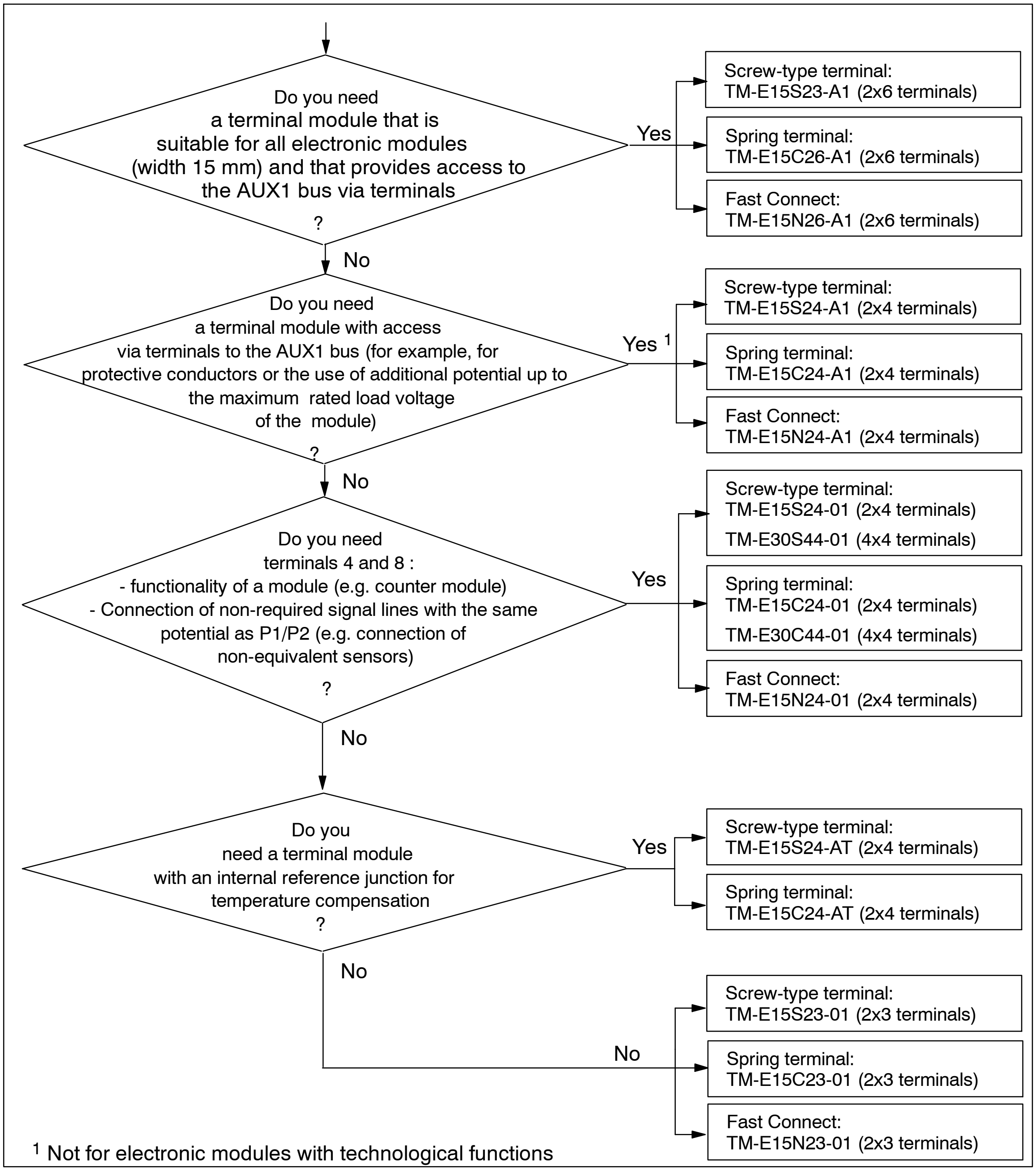


Figure 3-3 Selecting Terminal Modules for Electronic Modules

Configuration Examples of Terminal Modules for Electronic Modules

Table 3-7 Terminal Modules for Electronic Modules

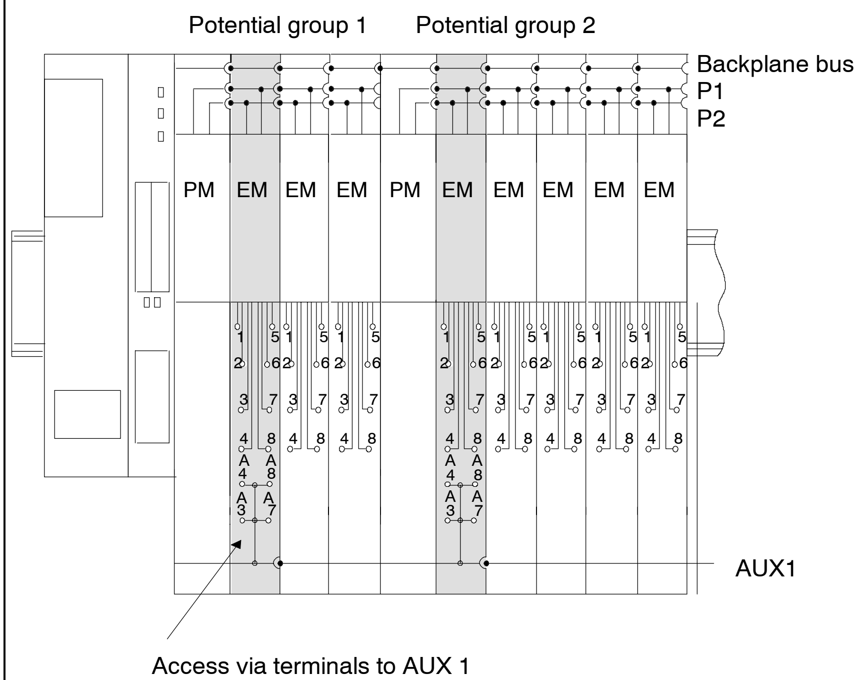
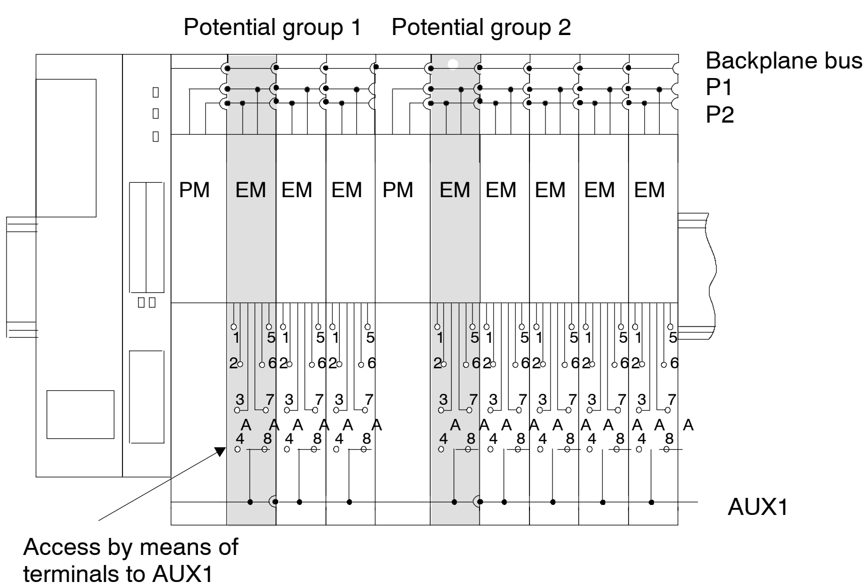
<table>
<tr><th>Terminal modules</th><th>Structure</th></tr>
<tr><td>TM-E15S26-A1
TM-E15C26-A1
TM-E15N26-A1</td><td>
</td></tr>
<tr><td>TM-E15S24-A1
TM-E15C24-A1
TM-E15N24-A1</td><td>
</td></tr>
</table>

Table 3-7 Terminal Modules for Electronic Modules, continued

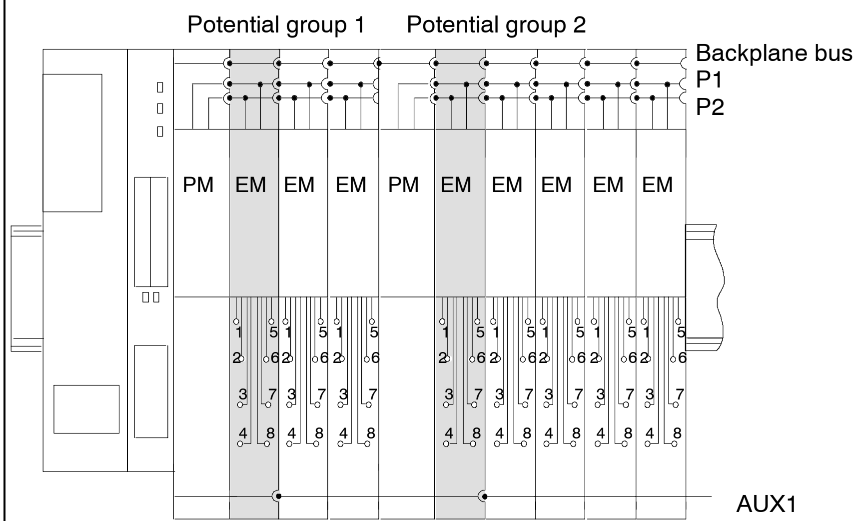
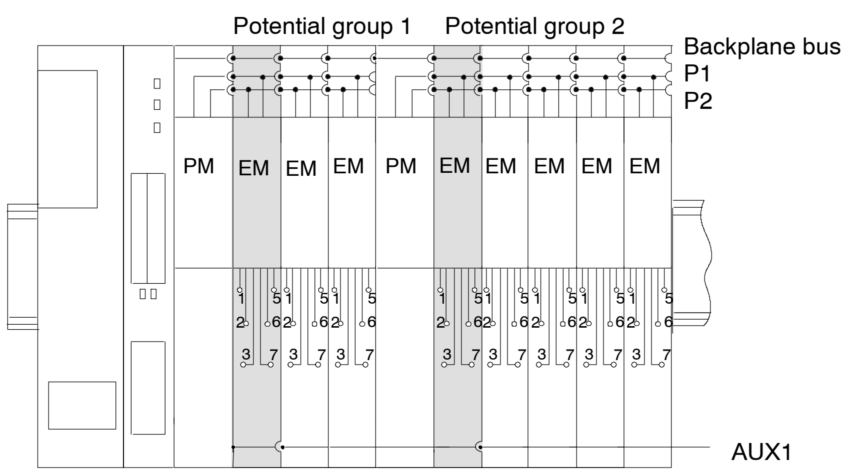
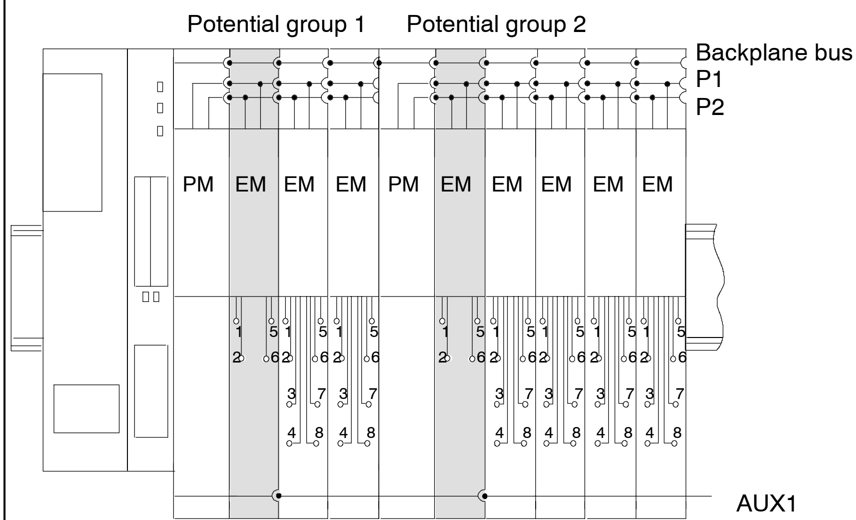
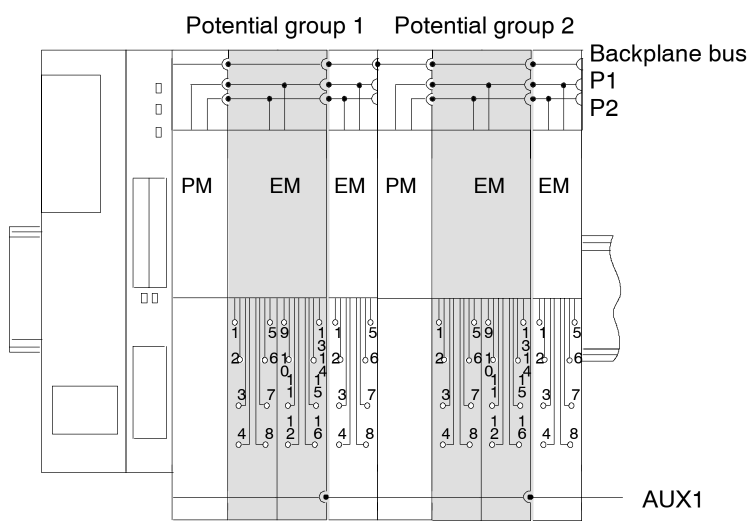
Terminal modules	Structure
TM-E15S24-01 TM-E15C24-01 TM-E15N24-01	
TM-E15S23-01 TM-E15C23-01 TM-E15N23-01	

Table 3-7 Terminal Modules for Electronic Modules, continued

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

3.5 Options for Future Expansion on ET 200S

Features

You can set up the ET 200S for future expansions (options). This 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.

Note

The I/O Status LED flashes red, the I/O Status Byte is 1, and the ET 200S reports Incorrect Module for each RESERVE module while data transfer continues.

Example of the Use of the RESERVE Modules

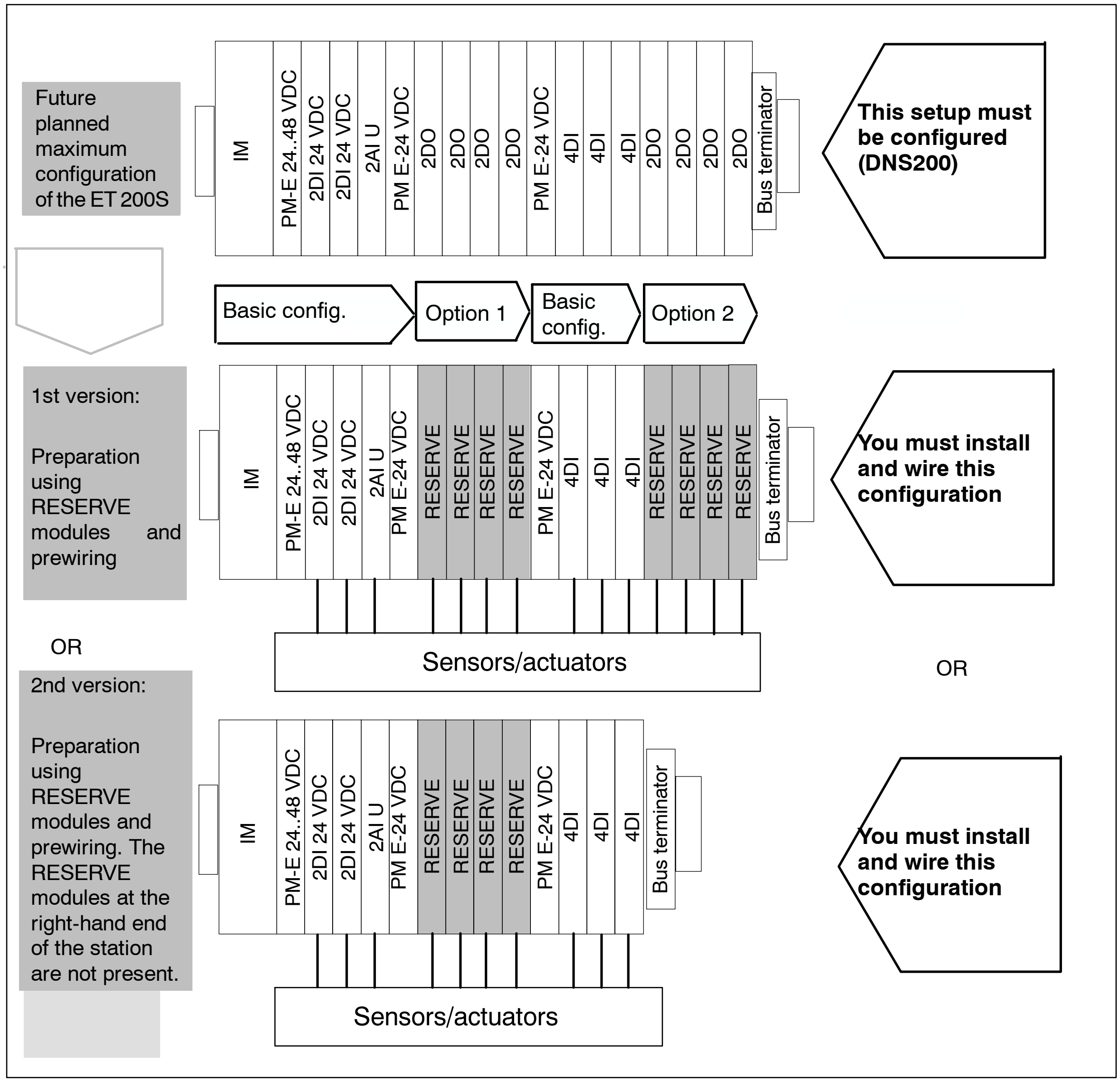


Figure 3-4   Example of the Use of the RESERVE Modules

Option Parameter Assignment

Note the following prerequisites when assigning parameters:

- In DNS200, 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):
  - Set the parameters
- Parameterize the interface module as follows:

Interface Module	Parameters	Setting	Description
5136-DNS-200S	Operation at Preset <> Actual Configuration	Enable	When the actual configuration differs from the expected configuration, the ET 200S continues to exchange data with the master.
	I/O Status Byte Enable	Enable	The I/O Status Enable attribute enables/disables the generation of a single I/O status byte at the beginning of the input data I/O packet. This status byte indicates if any faults have occurred which would result in invalid data.

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

3.6 Limitations on the Number of Modules That Can Be Connected/Maximum Configuration

- Number of modules: Each ET 200S consists of a maximum of 63 modules. This includes power modules, electronic modules, RESERVE modules, and motor starters.
- Bus length of the ET 200S: Maximum of 1 m
- Parameter length: Maximum of 244 bytes

Table 3-8 Parameter Length in Bytes

Module	Parameter Length
IM	26 bytes
PM-E 24 VDC PM-E 24-48 VDC PM-E 24-48 VDC/ 24-230 VAC	3 bytes
2DI 24 VDC High Feature 4DI 24 VDC High Feature	3 bytes 3 bytes
2DI 24 VDC Standard 4DI 24 VDC Standard 4DI 24 VDC/SRC Standard	1 byte
4DI NAMUR	12 bytes
2DI 120 VAC Standard	3 bytes
2DI 230 VAC Standard	3 bytes
2DO 24 VDC/0.5 A High Feature	3 bytes
2DO 24 VDC/0.5 A Standard 4DO 24 VDC/0.5 A Standard	1 byte
2DO 24 VDC/2 A High Feature	3 bytes
2DO 24 VDC/2 A Standard 4DO 24 VDC/2 A Standard	1 byte
2DO 24-230 VAC/1 A	3 bytes
2RO NO 24-120 VDC/5 A 24-230 VAC/5 A	3 bytes
2RO NO/NC 24-48 VDC/5 A 24-230 VAC/5 A	3 bytes
2AI U Standard 2AI U High Feature	4 bytes
2AI U High Speed	12 bytes (4 bytes****)

Module	Parameter Length
RESERVE	---
2AI I 2WIRE S	4 bytes
2AI I 2WIRE High Speed	12 bytes (4 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*)
2AI TC Standard 2AI TC High Feature	4 bytes
2AO U Standard 2AO U High Feature	7 bytes
2AO I Standard 2AO I High Feature	7 bytes
1Count 24V/100kHz	16 bytes
1Count 5V/500kHz	16 bytes
1SSI	8 bytes
EM 1STEP 5V/204kHz	7 bytes
2PULSE	16 bytes
1POS INC/Digital 1POS SSI/Digital 1POS INC/Analog 1POS SSI/Analog	16 bytes
1SI 3964/ASCII 1SI Modbus/USS	12 bytes
Motor starter STANDARD	3 bytes
Motor starter HIGH FEATURE	12 bytes

* When used as 2AI RTD Standard
** When used as 6ES7134 4GB50-0AB0
*** When used as 6ES7134 4GB50-0AB0
**** When used as 6ES7134 4GB50-0AB0

- Address space: depends on the master. The interface module supports a maximum of 244 input bytes and 244 output bytes.
- Power module: maximum configuration per potential group

Table 3-9 Maximum Configuration per Potential Group

Power Modules	Maximum Current-Carrying Capacity	Connectable Modules
PM-E 24 VDC power module	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
PM-E power module 24..48 VDC	10 A	
PM-E power module 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)

Installation

4

Important Information

Warning

Open operating equipment

The modules of an ET 200S are open operating equipment. This means that you can only install the ET 200S in cases, cabinets or electrical plant rooms where they will only be accessible with a key or a tool. Only trained or authorized personnel should have access to the cases, cabinets or electrical plant rooms.

Simple Installation

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

Chapter Overview

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 63 modules.

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.

Rail

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

Note

If 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

Measure-ments	
Installation width	• Interface module: 45 mm (1.77 in) • Terminal modules with electronic modules: 15 mm (0.59 in) or 30 mm (1.18 in) • Terminating module: 7.5 mm (0.3 in)
Installation height	• Interface module: 119.5 mm (4.7 in) • Electronic module with terminal module: – 3 levels with screw-type or spring terminals: 119.5 mm (4.7 in) – 3 levels with Fast Connect: 143 mm (5.63 in) – 3 levels with screw-type or spring terminals and shield contact: 151.5 mm (5.96 in) – 3 levels with Fast Connect and shield contact: 175 mm (6.88 in) – 4 levels with screw-type or spring terminals: 132 mm (5.2 in) – 4 levels with Fast Connect: 164 mm (6.45 in) – 3 levels with screw-type or spring terminals and shield contact: 164 mm (6.45 in) – 4 levels with Fast Connect and shield contact: 196 mm (7.71 in) – 6 levels with screw-type or spring terminals: 157 mm (6.18 in) – 6 levels with Fast Connect: 204 mm (8.02 in) – 6 levels with screw-type or spring terminals and shield contact: 189 mm (7.43 in) – 6 levels with Fast Connect and shield contact: 236 mm (9.28 in) – 7 levels with screw-type terminal: 196.5 mm (7.73 in)
Installation depth	• ET 200S on rail 7.5 mm deep: 75 mm (2.95 in) • ET 200S on rail with 15 mm depth: 82.5 mm (3.24 in)

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.

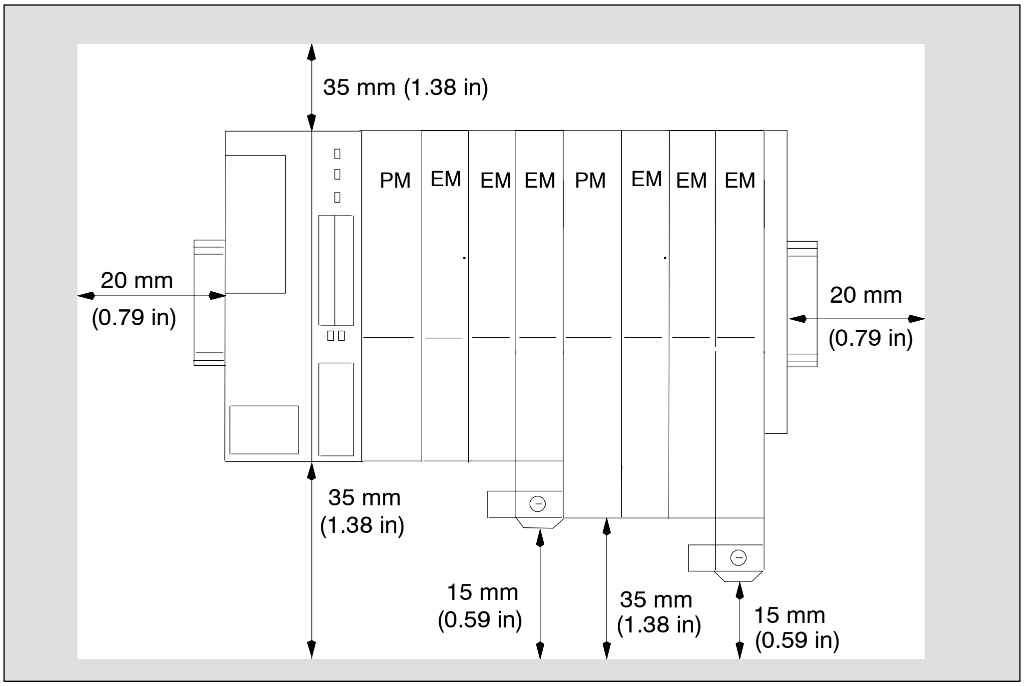


Figure 4-1 Minimum Clearances

4.2 Installing the DeviceNet Interface Module

Features

- The DeviceNet Slave Adapter interface module connects the ET 200S with the DeviceNet network.
- The interface module transfers data between the higher-level controller and the I/O modules.

Prerequisites

- 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 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.

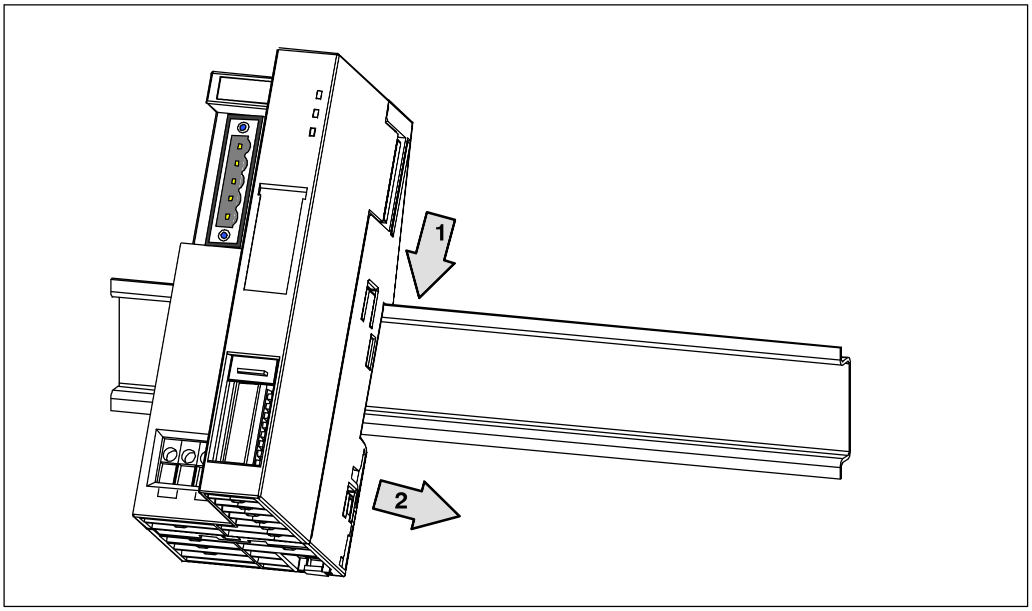


Figure 4-2 Installing the Interface Module

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.

Prerequisites

- 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.

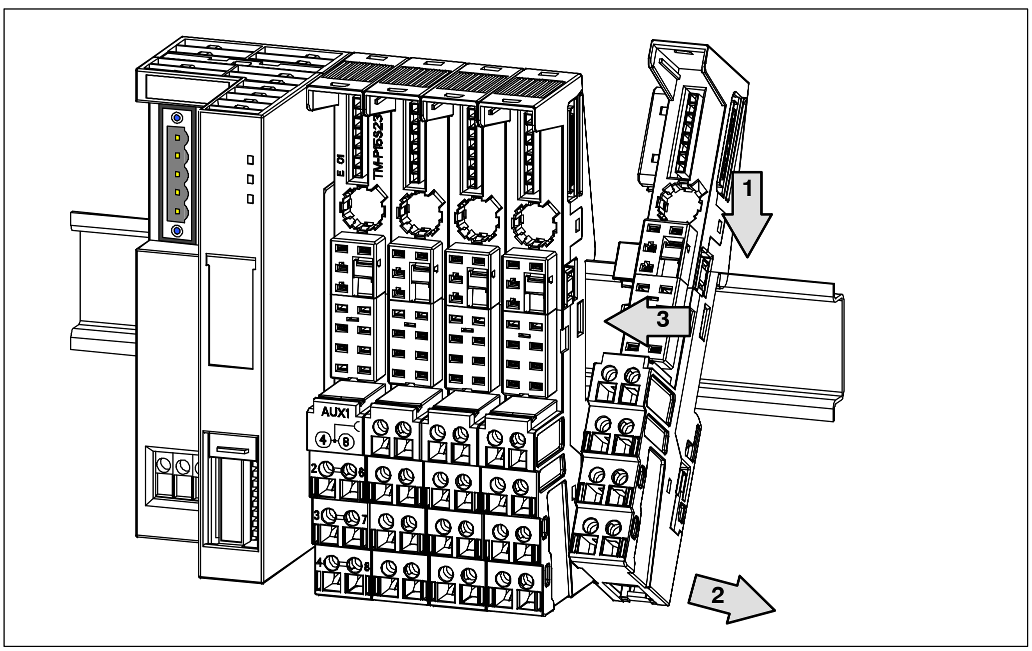


Figure 4-3 Installing the Terminal Module

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.

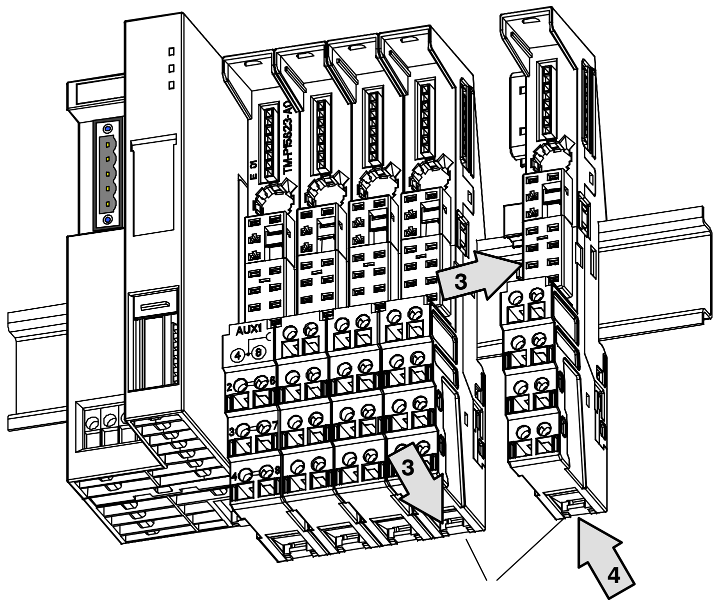


Figure 4-4 Removing the Terminal Module (from the Right)

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.

Prerequisites

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.

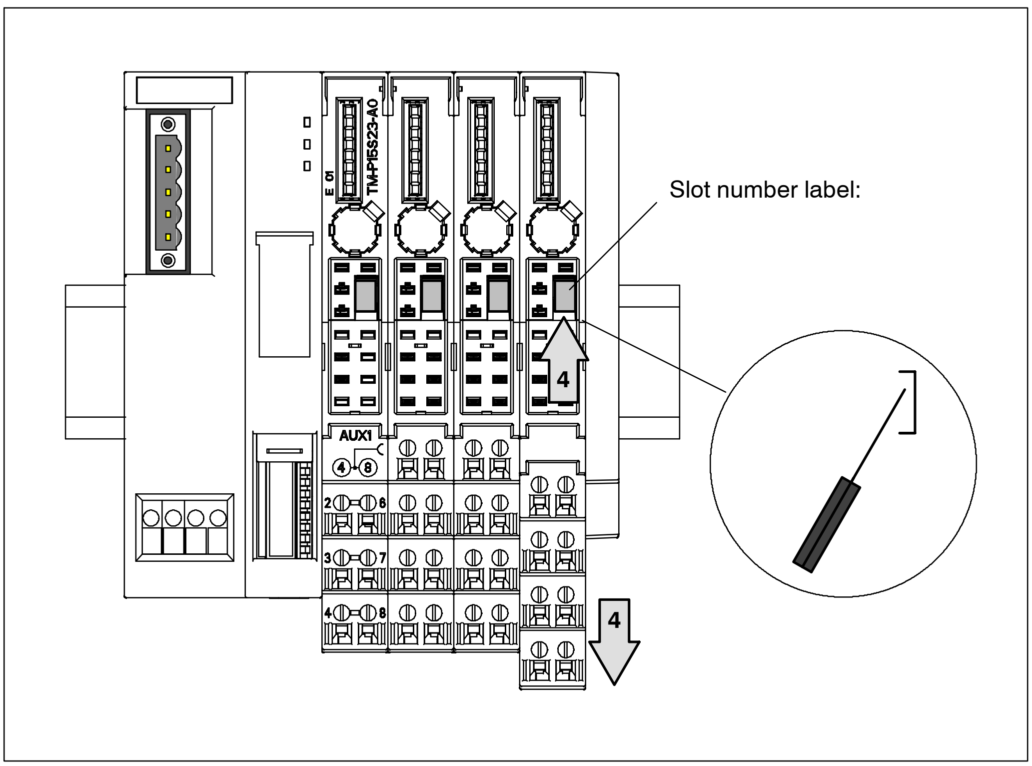


Figure 4-5 Replacing the Terminal Box on the Terminal Module

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.

Prerequisites

- 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.

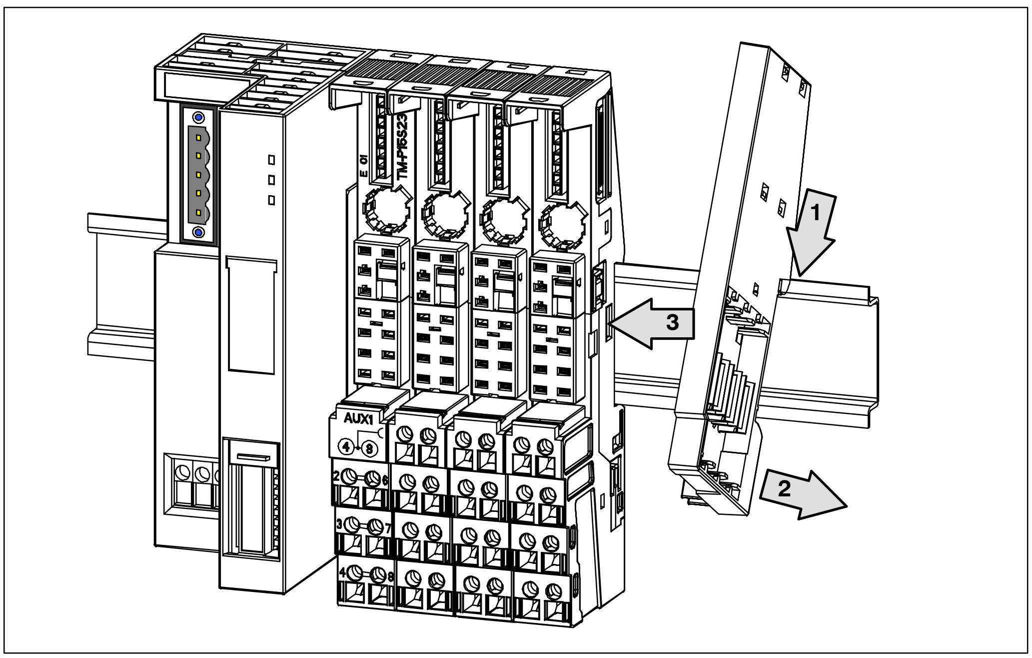


Figure 4-6 Installing the Terminating Module

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).
- 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.

Prerequisites

- 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.

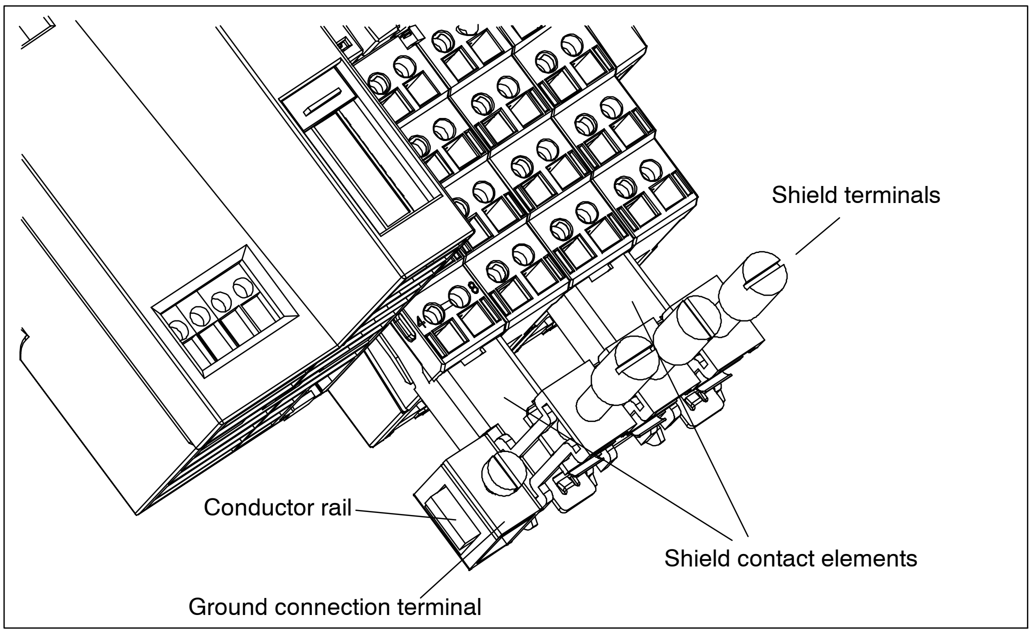


Figure 4-7 Installing the Shield Contact

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.

Prerequisites

- 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.

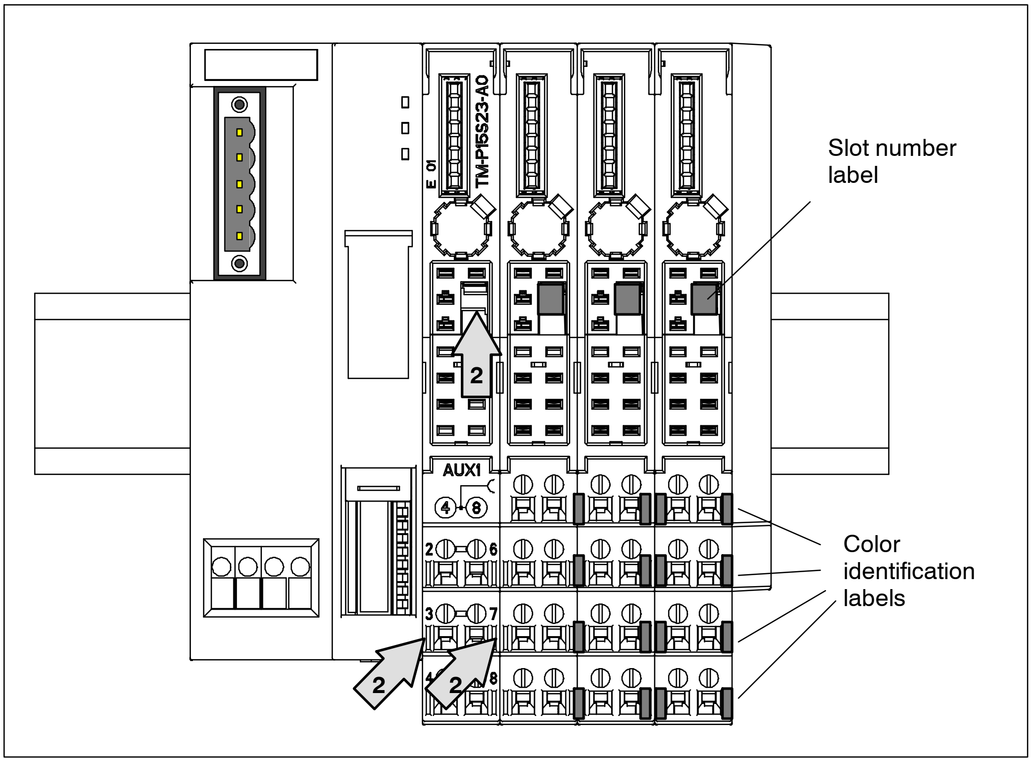


Figure 4-8 Applying Slot Number Labels and Color Identification Labels

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 Node Address

Features

The node address defines the address at which the ET 200S distributed I/O system is found on the DeviceNet network.

Prerequisites

- The node 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 node addresses are 0 to 63 (refer also to Table 2-2).
- Each address can be assigned only once on the network.

Tool Required

3 mm screwdriver

Setting the Node address

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

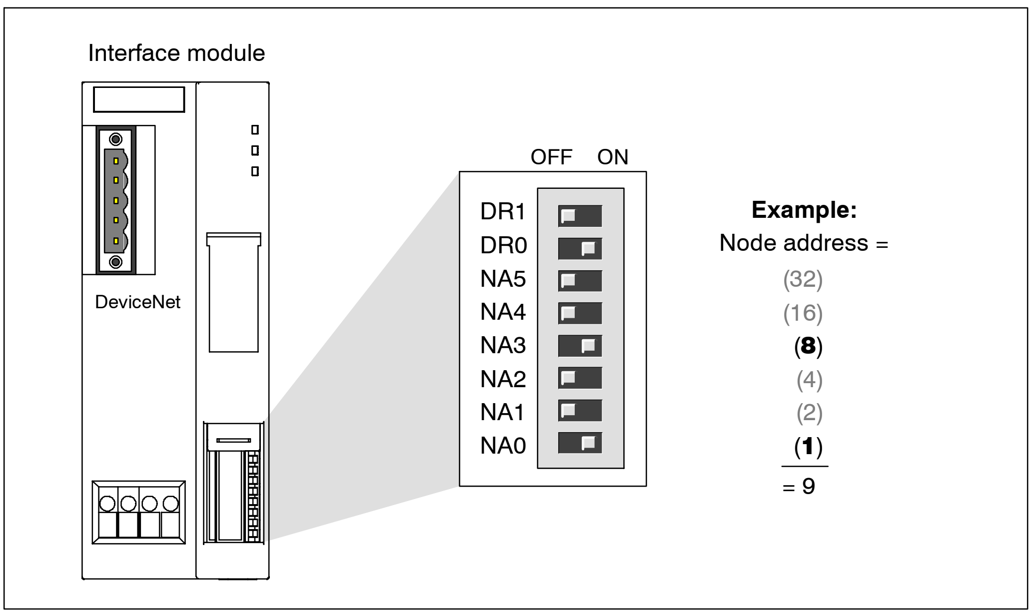


Figure 4-9 Setting the Node Address

Changing the Node Address

You change the node address in exactly the same way as you set it. A change to the node 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

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, the Machine Directive).

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 Figure 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 operated at the following voltages:
  ≤ 60 VDC or ≤ 25 VAC
- 24 VDC operating current circuits

Setting up the ET 200S with Ungrounded Reference Potential

The reference potential M of the rated supply voltage for the IM 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 IM 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.

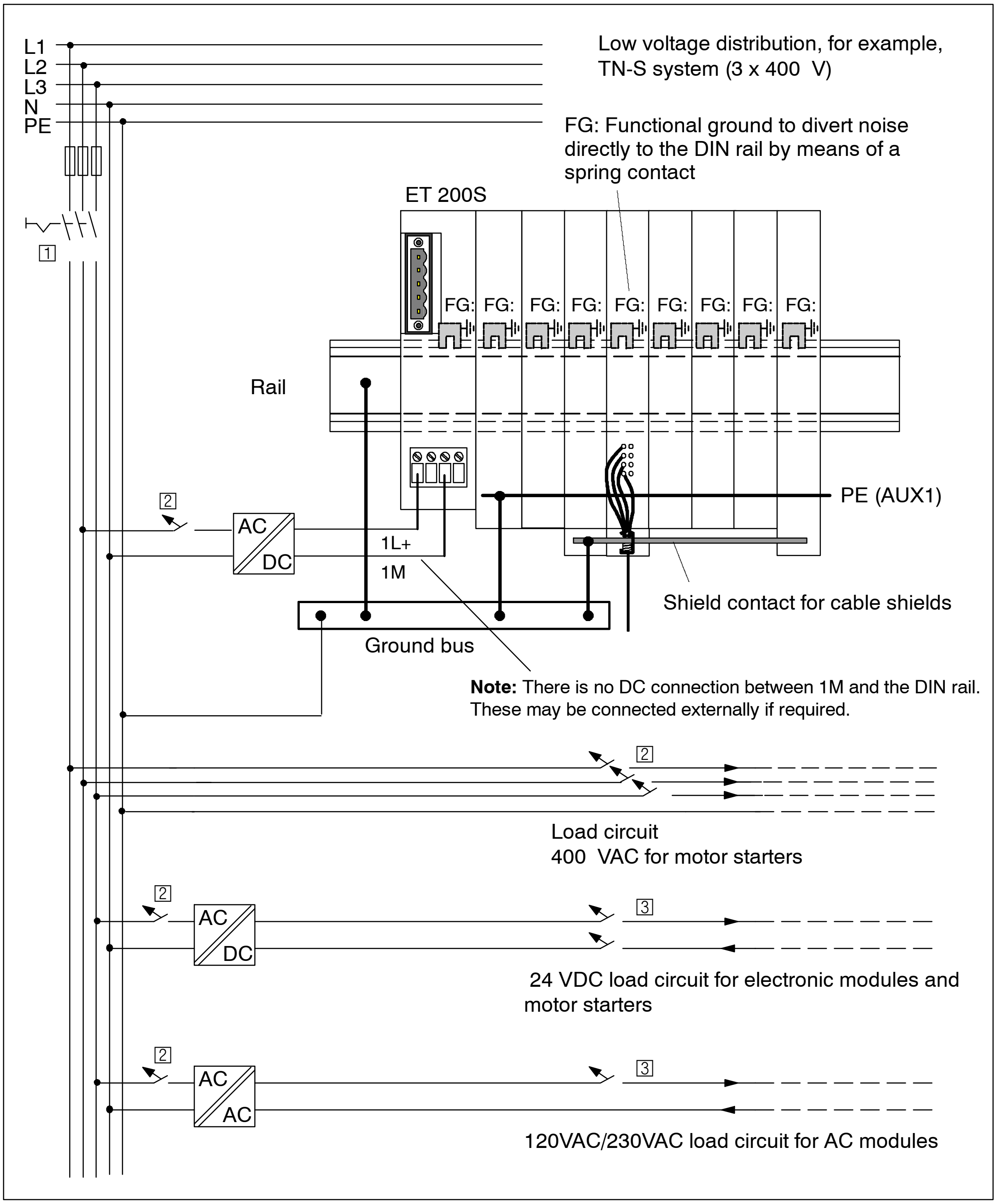


Figure 5-1 Configuring the ET 200S with Grounded Reference Potential

5.3 Electrical Design of the ET 200S

Isolation between ...

- The load circuits/process and all other circuit components of the ET 200S
- The 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.

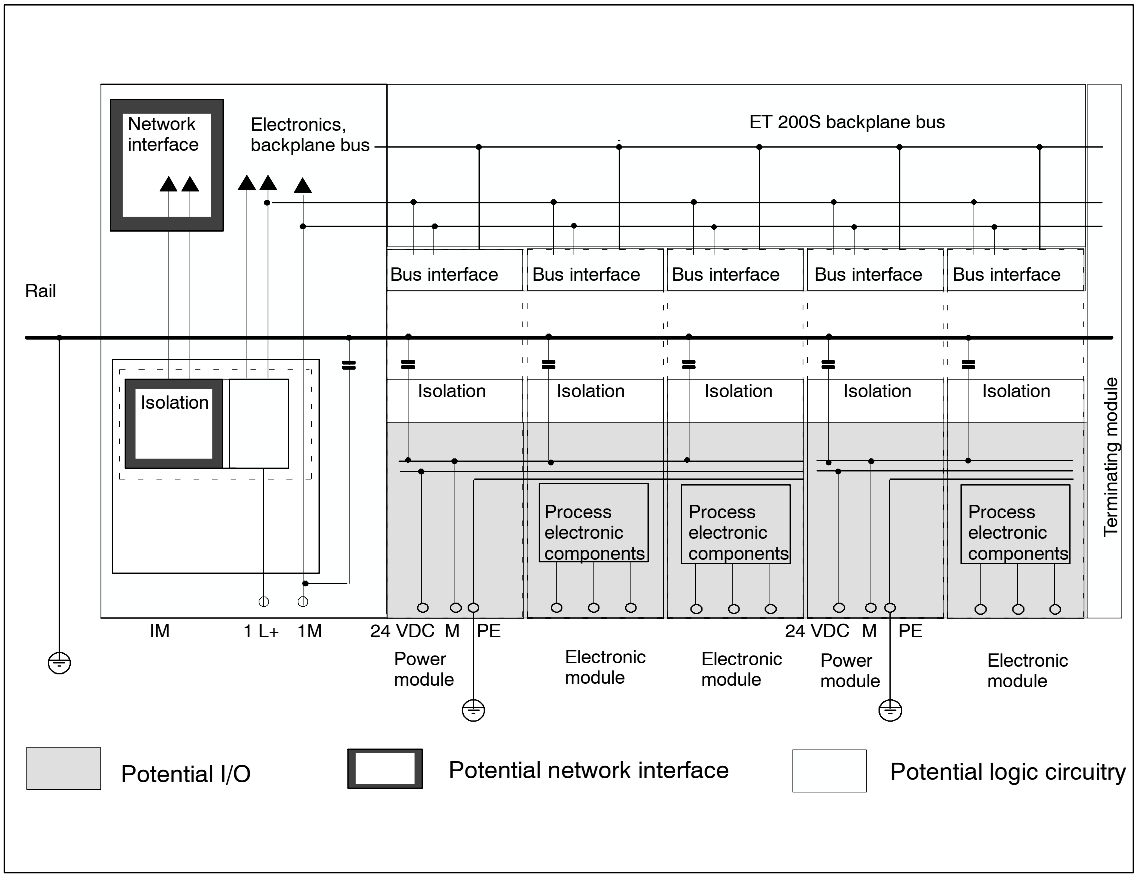


Figure 5-2 Potentials of the ET 200S

5.4 Wiring the ET 200S

Wiring Rules for the ET 200S

<table>
<tr><th colspan="2">Wiring Rules for ...</th><th>Interface Module (Supply Voltage)</th><th>Terminal Modules (Spring and Screw-Type Terminals)</th><th>Terminal Modules (Fast Connect)</th></tr>
<tr><td colspan="2">Connectable wire cross-sections for rigid lines</td><td>No</td><td>0.14 to 2.5 mm^2</td><td>0.5 to 1.5 mm^2</td></tr>
<tr><td rowspan="2">Connectable wire cross-sections for flexible lines</td><td>Without wire end ferrule</td><td>0.25 to 2.5 mm^2</td><td>0.14 to 2.5 mm^2</td><td>0.5 to 1.5 mm^2</td></tr>
<tr><td>With wire end ferrule</td><td>0.25 to 1.5 mm^2</td><td>0.14 to 1.5 mm^2</td><td>---</td></tr>
<tr><td colspan="2">Number of wires per connection</td><td colspan="2">1 or a combination of 2 wires up to 1.5 mm^2 (sum) in a common wire end ferrule</td><td>1</td></tr>
<tr><td colspan="2">Maximum external diameter of the wire’s insulation</td><td>∅ 3.8 mm</td><td>∅ 3.1 mm at 1.5 mm^2
∅ 3.8 mm at 2.5 mm^2</td><td>∅ 3.2 mm at 1.5 mm^2</td></tr>
<tr><td colspan="2">Stripping length of the wires</td><td colspan="2">11 mm</td><td>---</td></tr>
<tr><td rowspan="2">Wire end ferrules to DIN 46228</td><td>Without insulating collar</td><td>Design A, 8 to 12 mm long</td><td>Design A, up to 12 mm long</td><td>---</td></tr>
<tr><td>With insulating collar 0.25 to 1.5 mm^2</td><td colspan="2">Design E, up to 12 mm long</td><td>---</td></tr>
</table>

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.

Prerequisites

Adhere to the wiring rules.

Tool Required

3 mm screwdriver

Wiring a Terminal Module with a Screw-Type Terminal

1. Strip 11 mm (0.43 in) of insulation from the wires.
2. Insert the individual wires in the terminal.
3. Screw the ends of the individual wires onto the terminal module (torque: 0.4...0.7 Nm).

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.

Prerequisites

Adhere to the wiring rules.

Tool Required

3 mm screwdriver

Wiring a Terminal Module with Spring Terminals

1. Strip 11 mm (0.43 in) 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.

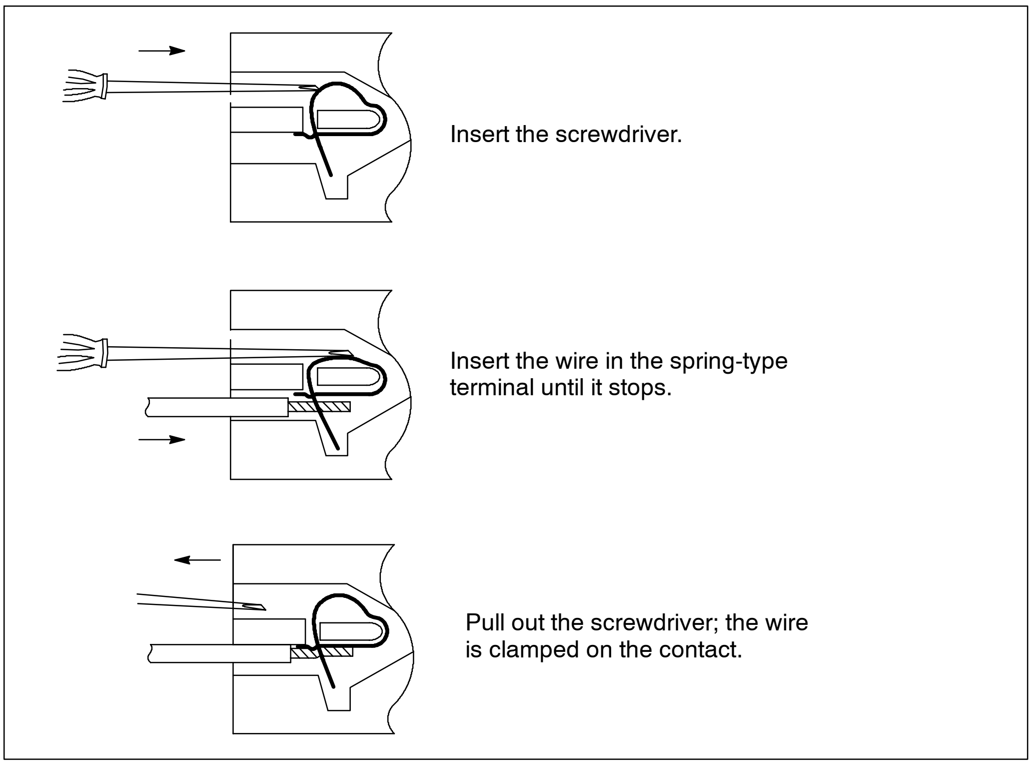


Figure 5-3 Wiring the Spring Terminal

5.4.3 Wiring a Terminal Module 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

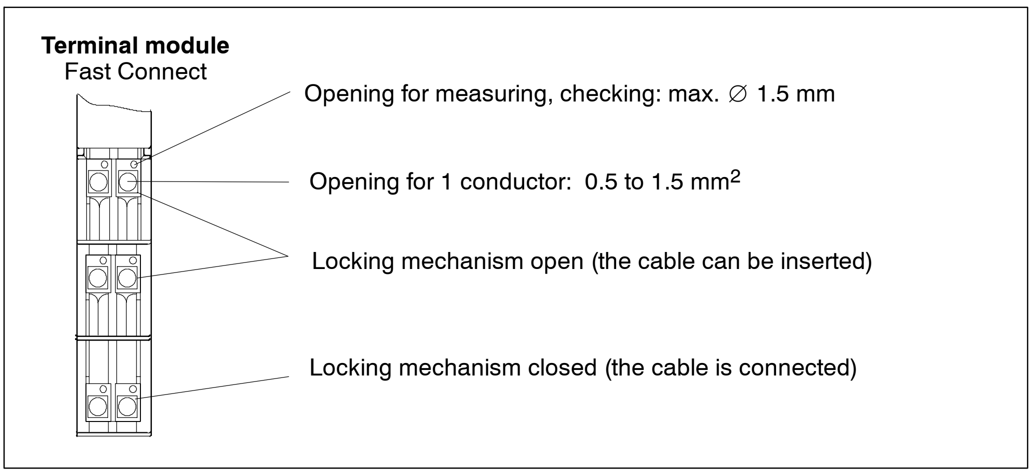


Figure 5-4 Block diagram of the Terminal Module with Fast Connect

Prerequisites

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.

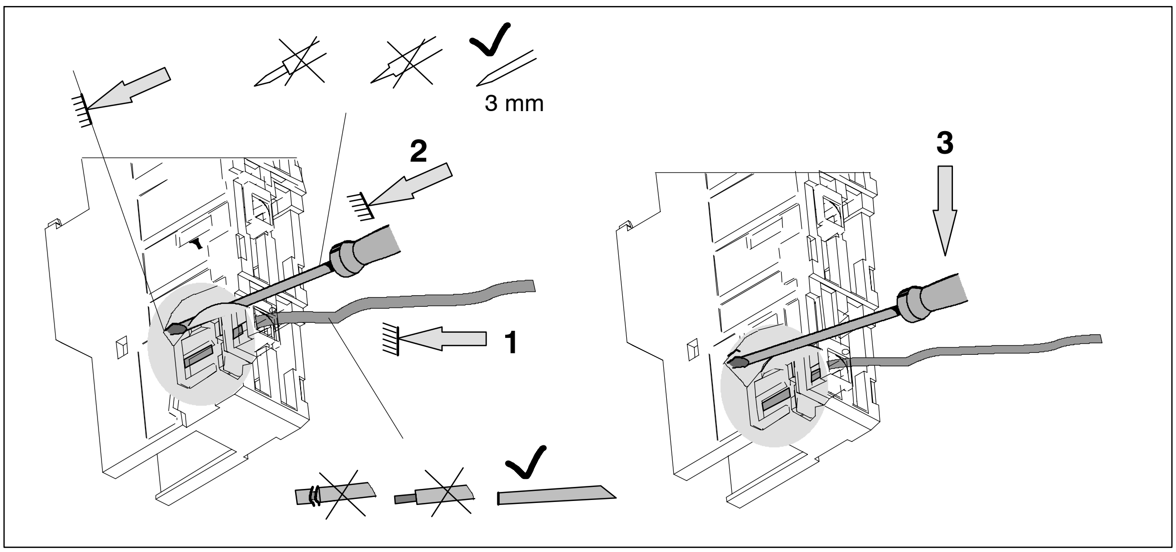


Figure 5-5 Wiring Terminal Modules with Fast Connect

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 screwdriver into the opening below 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.

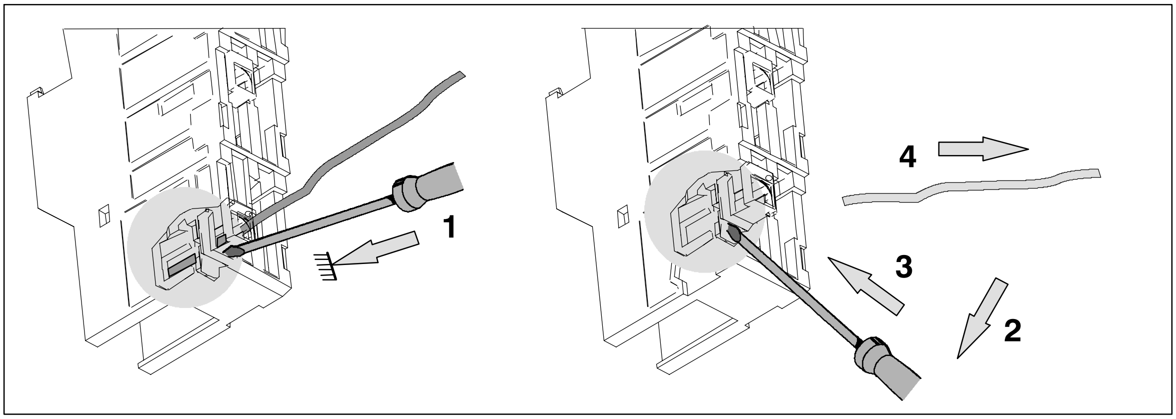


Figure 5-6 Releasing the Wiring of the Terminal Module with Fast Connect

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.

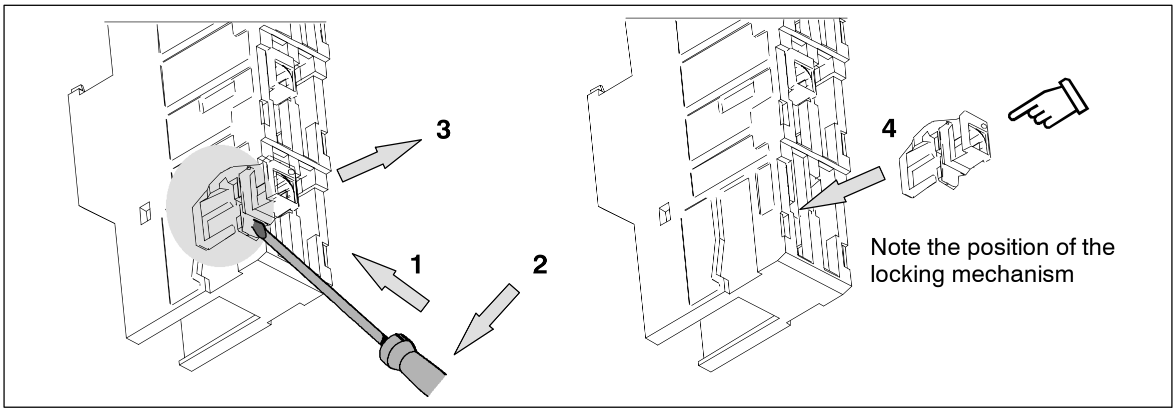


Figure 5-7 Removing the Locking Mechanism from the Terminal Module

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.

Prerequisites

- 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 9
- Power modules in Chapter 10

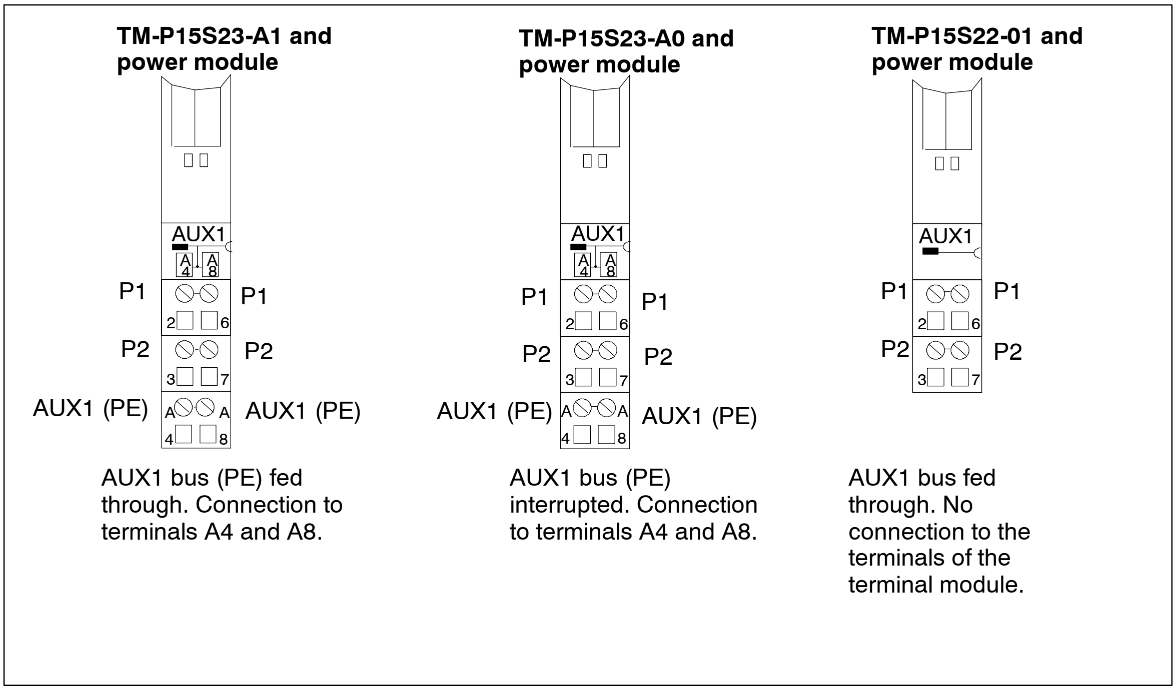


Figure 5-8 Wiring Terminal Modules for Power Modules

Wiring Terminal Modules for Digital, Analog, and Process-related 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 9
- Digital electronic modules in Chapter 11
- Analog electronic modules in Chapter 12
- Process-related modules: See the *process-related functions* manual

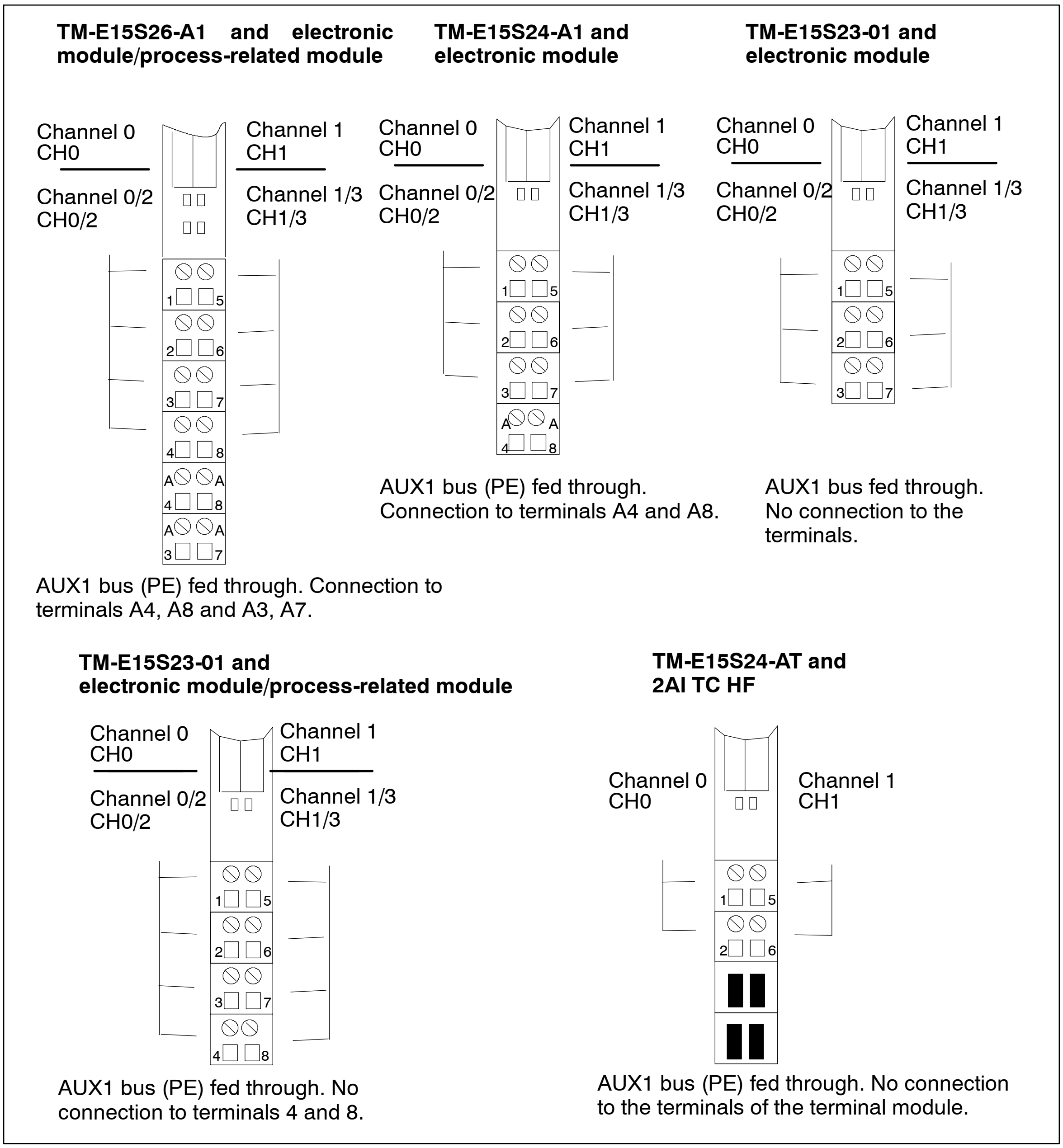
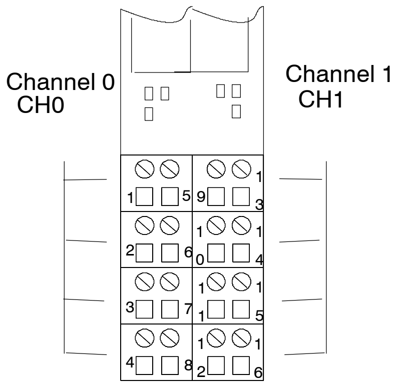


Figure 5-9 Wiring terminal modules for electronic modules

TM-E30S44-01 and process-related module



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

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.

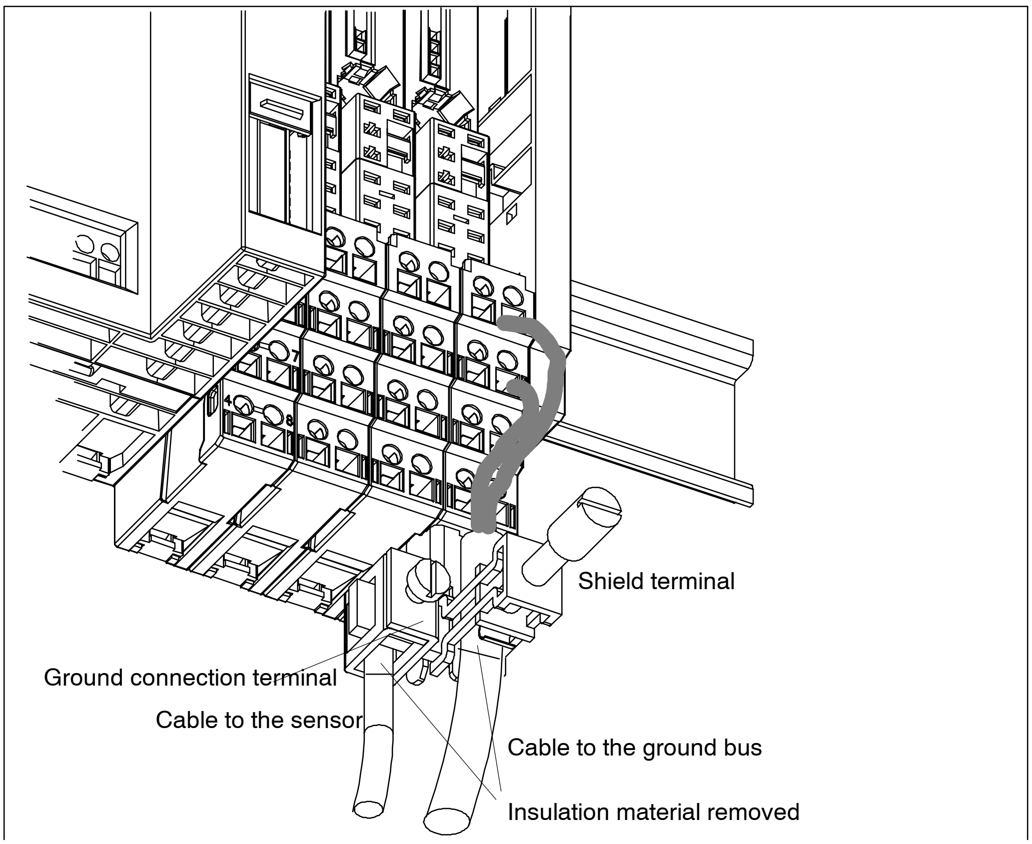


Figure 5-11 Connecting Cable Shields

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 DeviceNet Interface Module

Features

You can connect the supply voltage and the cable connector to the interface module.

Prerequisites

- 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 DeviceNet 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 DeviceNet cable:

1. Insert the cable connector in the DeviceNet port.
2. Tighten the screws of the connector.

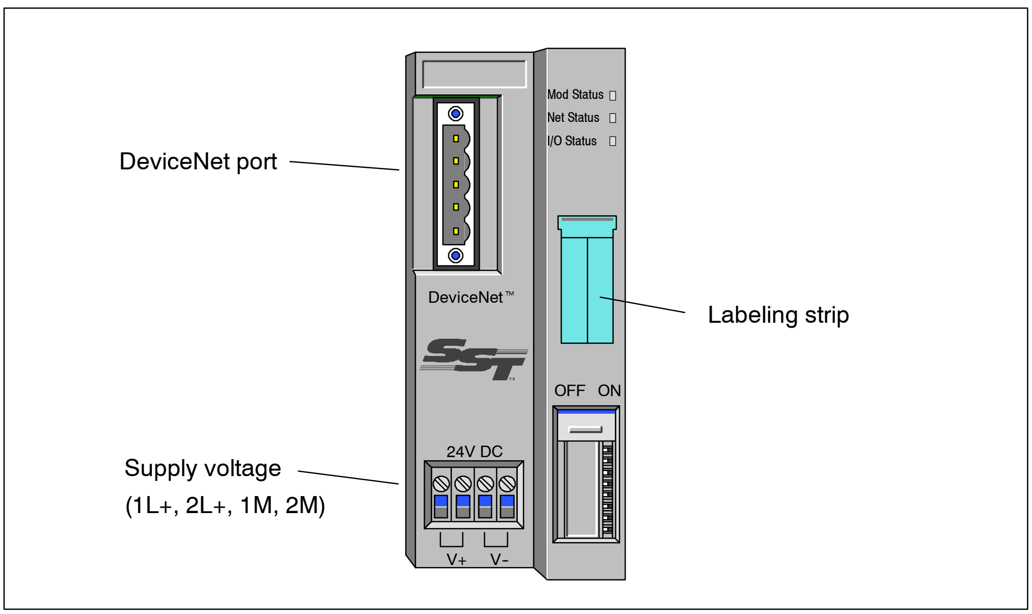


Figure 5-12 Wiring the DeviceNet Module

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.

Prerequisites

Adhere to the rules below for inserting electronic modules. See Section 3.4 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.

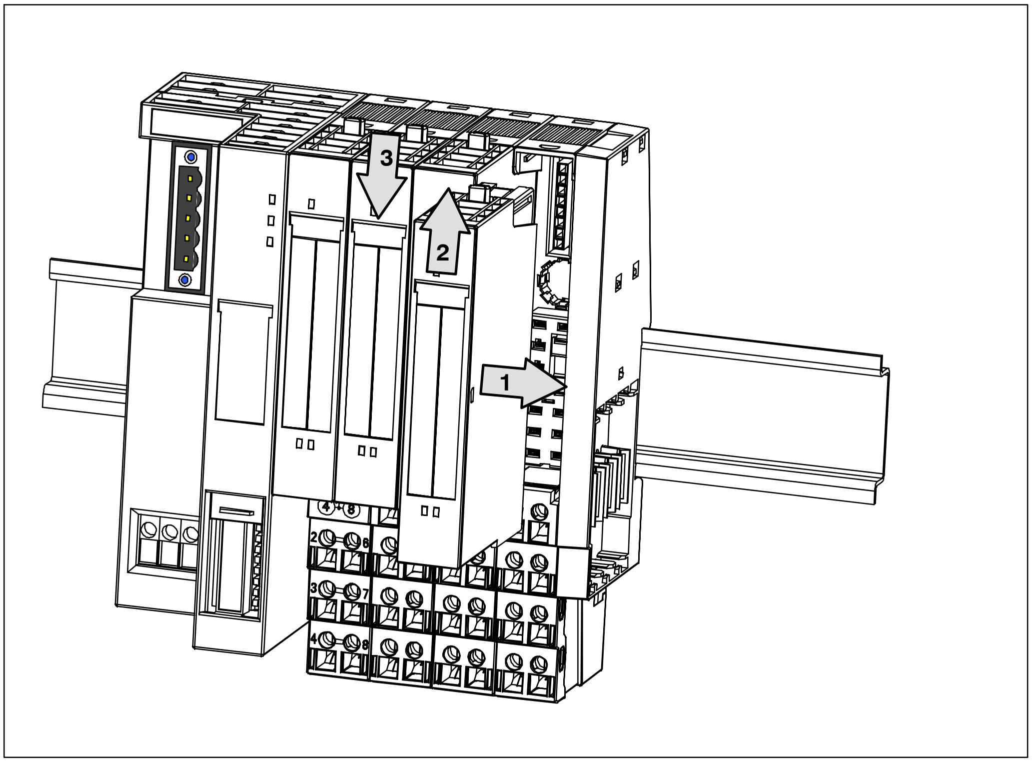


Figure 5-13 Inserting and Identifying Electronic Modules

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.

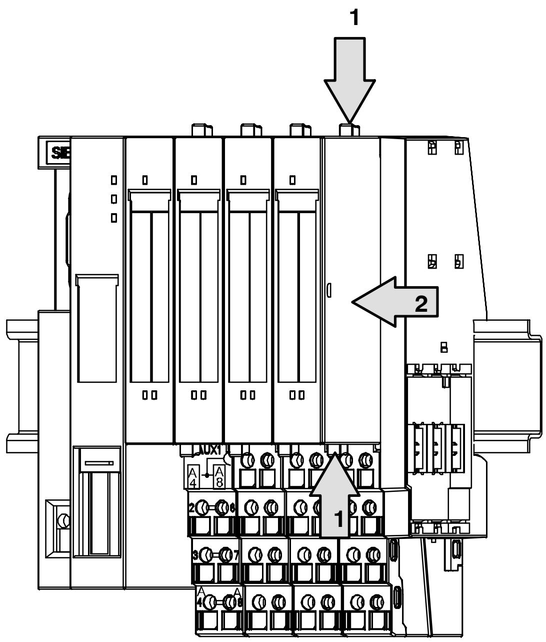


Figure 5-14 Removing Electronic Modules

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.

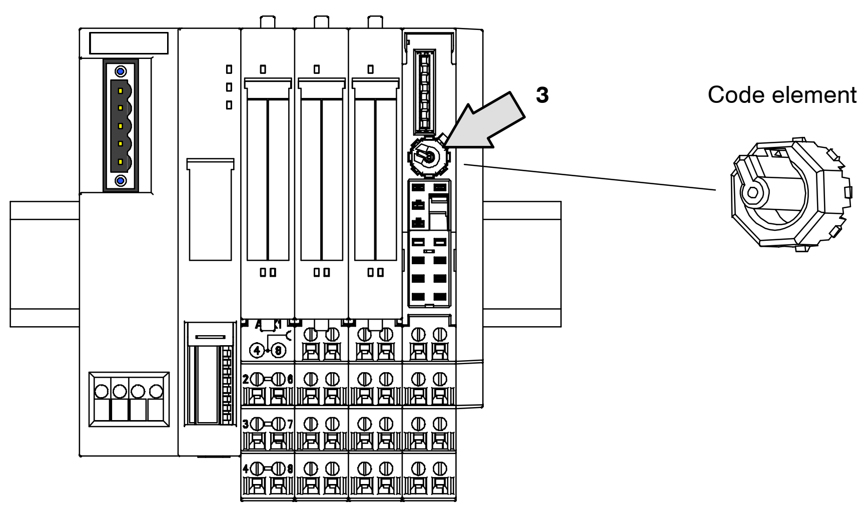


Figure 5-15 Removing the Code Element

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 8.1.
- If **one** module is missing (gap) and the ET 200S is switched off and then on again, this action results in a station failure of the ET 200S.

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	---

Table 5-1 Removing and Inserting Electronic Modules, continued

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		
EM 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

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

Configuration

The ET 200S has address space of up to 244 bytes for inputs and 244 bytes for outputs. To better exploit the available address space of the master and reduce data transfer between the ET 200S and the 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)

Procedure for Groupable Modules

1. 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).
   - 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

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

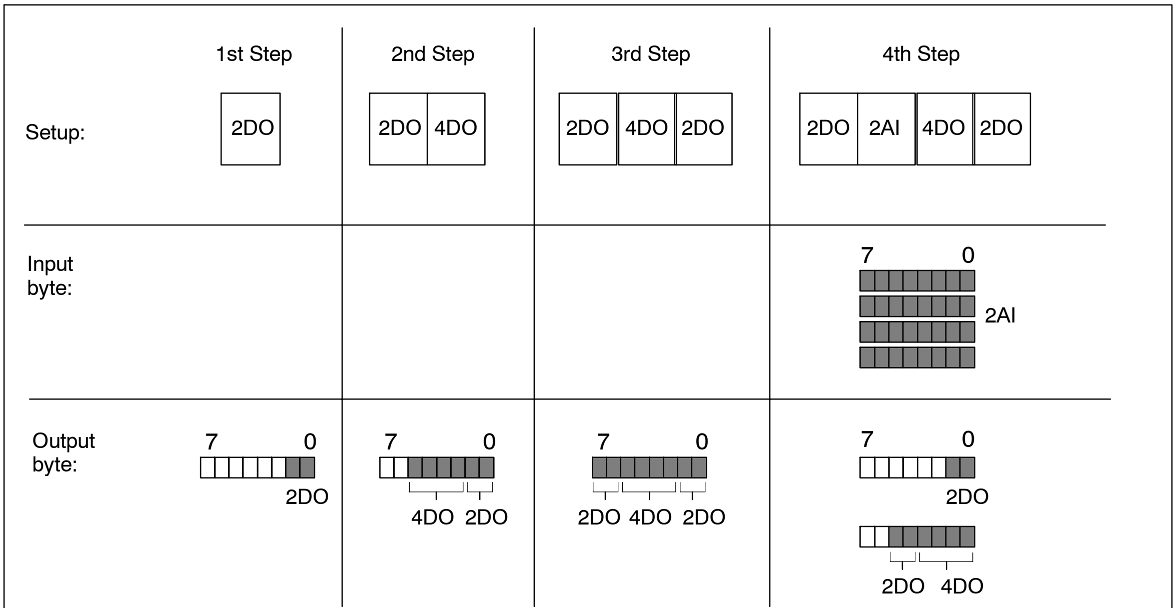
These modules are not addressed.

Note

The DeviceNet Slave Adapter assembles data on byte boundaries. Some DeviceNet masters may only provide access to this data on word boundaries. You should organize your ET 200S modules to conform to the master's restrictions.

For example, configure the grouping of digital modules so that an analog module will occupy bytes 0 to 3 or 4 to 7. In this way, the analog modules will begin on even-byte boundaries to avoid an analog value being split between two words.

Grouping of Modules in Auto Config Mode (Default)



Note: The presence of an analog module (of any type) causes the digital modules to start packing a new byte.

Figure 6-1 Grouping of Modules in Auto Config Mode

Grouping of Modules in User Config Mode

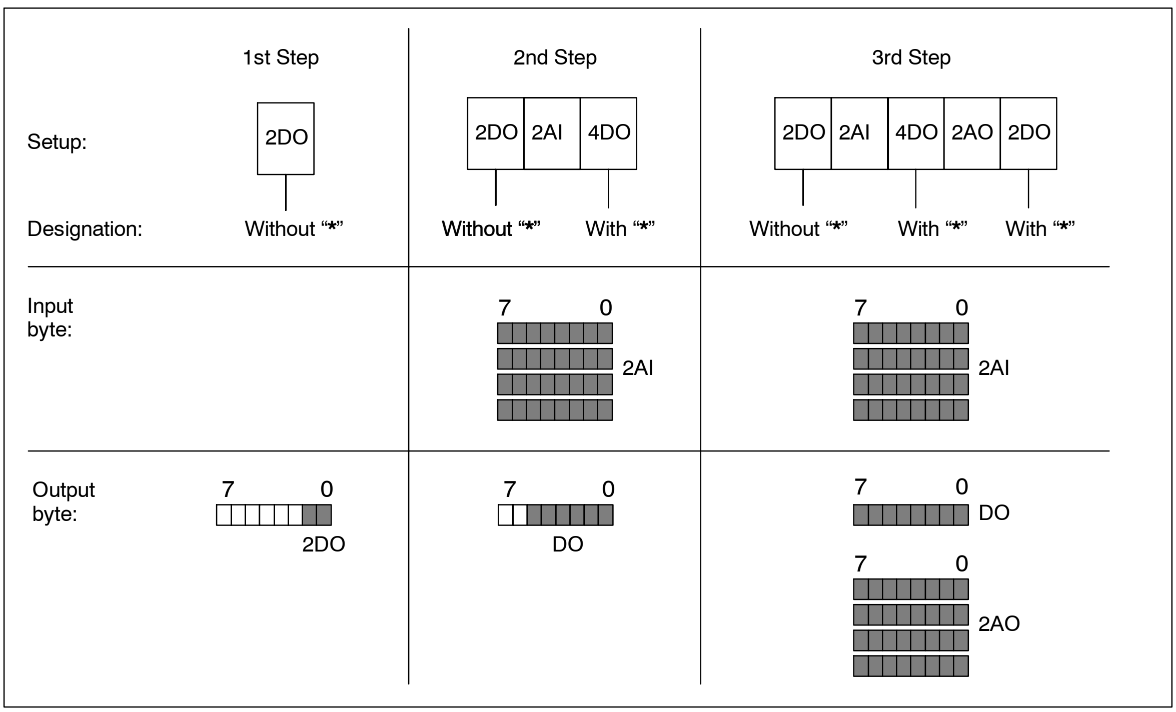


Figure 6-2 Grouping of Modules in User Config Mode

Grouping of Motor Starters

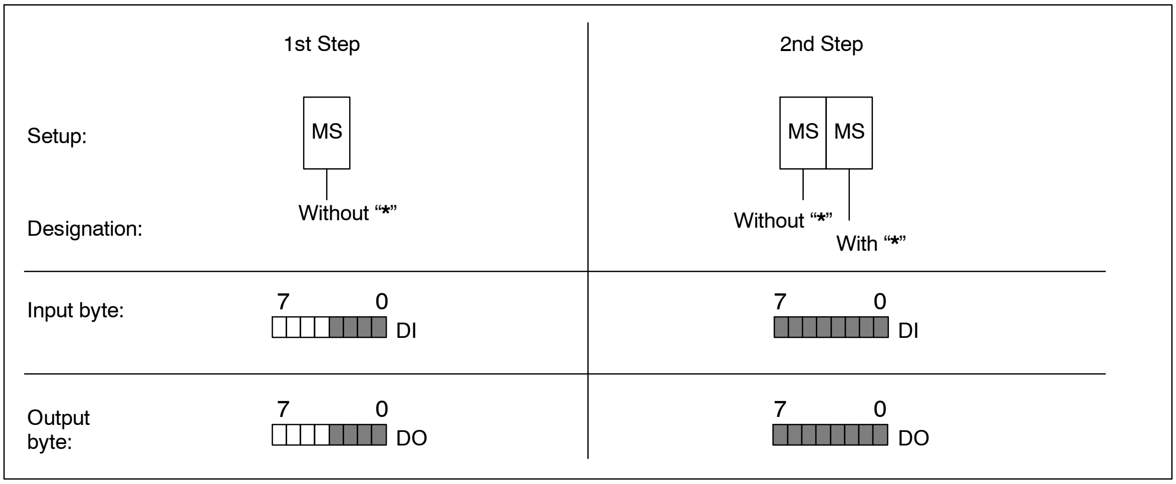


Figure 6-3 Grouping of Motor Starters within a Byte

Configuration Example

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

Setup of the ET 200S

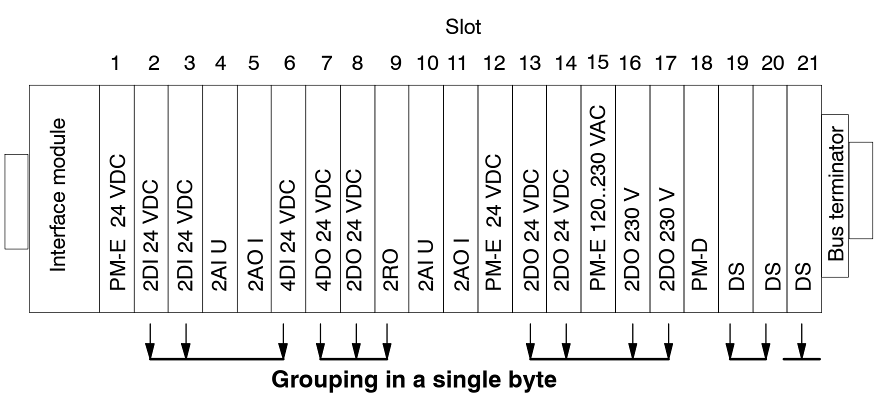


Figure 6-4 Setup of the ET 200S

Configuration table in your configuration software and address space

The byte and bit addresses result automatically from the sequence of the grouped modules.

Table 6-1 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 230 VAC	---	---	---
16	6ES7132-4BB00-0AB0*2DO 24 VDC/0.5 A	Yes		9.4 to 9.5
17	6ES7132-4BB00-0AB0*2DO 24 VDC/0.5 A	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

To configure the DeviceNet Slave Adapter interface module, use the DNS-200 Configuration Tool software package. Refer to its documentation for information on how to configure the system.

Requirements for Commissioning the ET 200S

Table 6-2 Requirements for Commissioning the ET 200S

Required Activity	See ...
1. Slave installed	Chapter 4
2. Node address set on the slave	Section 4.8
3. Slave wired	Chapter 5
4. Slave configured (configured and parameters assigned)	Section 6.1
5. Supply voltage switched on for master	Master manual
6. Master set to RUN mode	Master manual

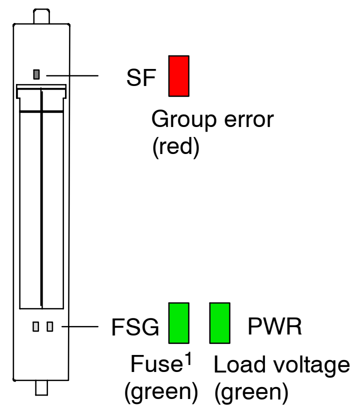
Commissioning the ET 200S

Table 6-3 Procedure for Commissioning the Slave

Step	Procedure	See ...
1.	Switch on the supply voltage for the slave.	Section 8.2
2.	Switch on the supply voltage for the load as necessary.	

6.3 Diagnostics Using LEDs

Power Modules

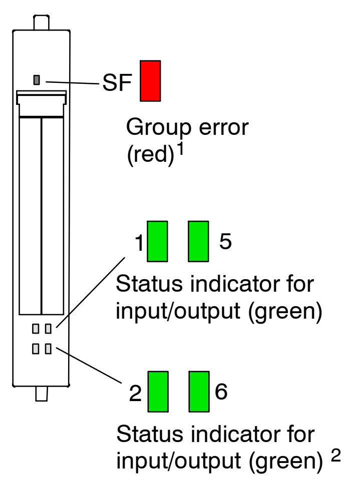


LEDs			Meaning	What to Do
SF	FSG	PWR		
On			No parameter assignment or incorrect module inserted. There is a diagnostic message.	Check the parameter assignment. Evaluate the diagnosis.
	Off		The fuse in the power module has tripped.	Replace the fuse.
		Off	There is no load voltage at the power module.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

[1] Only with the PM-E 24-48 VDC / 120-230 VAC

Figure 6-5 LEDs on the Power Module

Digital Electronic Modules

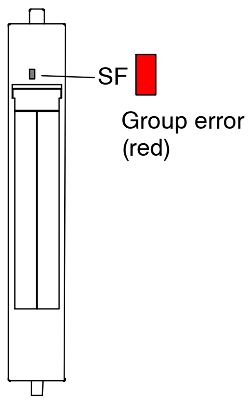


LEDs					Meaning	What to Do
SF	1	5	2	6		
On					No parameter assignment or incorrect module inserted. No load voltage. There is a diagnostic message.	Check the parameter assignment. Check the load voltage. Evaluate the diagnosis.
	On				Input/output on channel 0 activated.	
		On			Input/output on channel 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 and 2DO 24 VDC/2 A High Feature
[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 and 4DI 24-48 VUC

Figure 6-6 LEDs on the Digital Electronic Modules

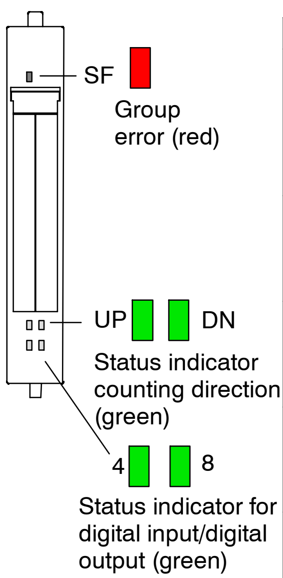
Analog Electronic Modules



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 6-7 LEDs on the Analog Electronic Modules

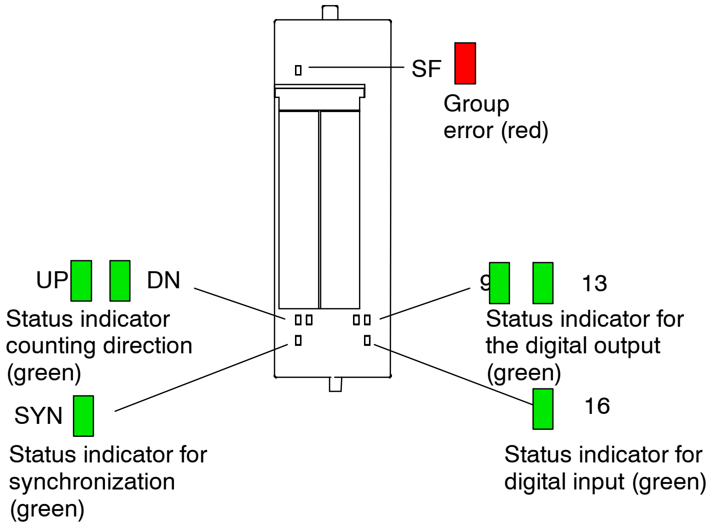
1COUNT 24V/100 kHz



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 6-8 LEDs on the 1COUNT 24 V/100 kHz

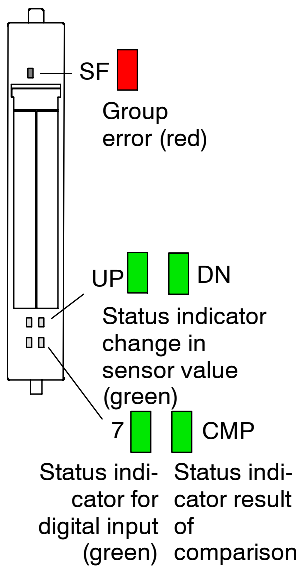
1COUNT 5V/500 kHz



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 6-9 LEDs on the 1COUNT 5V/500 kHz

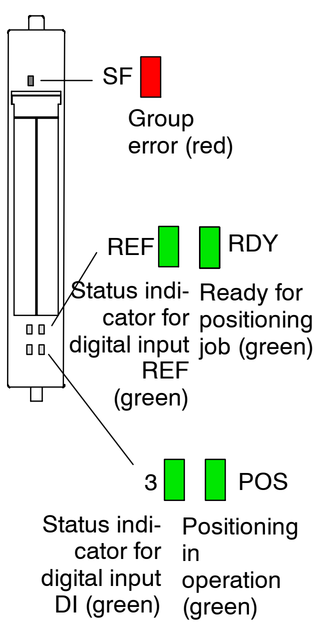
1SSI



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 6-10 LEDs on the EM 1SSI

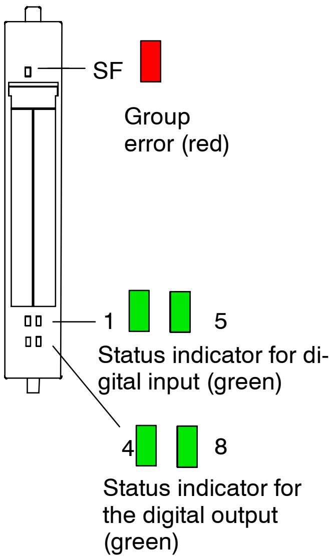
1STEP 5V/204 kHz



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 6-11 LEDs on the EM 1STEP 5 V/204 kHz

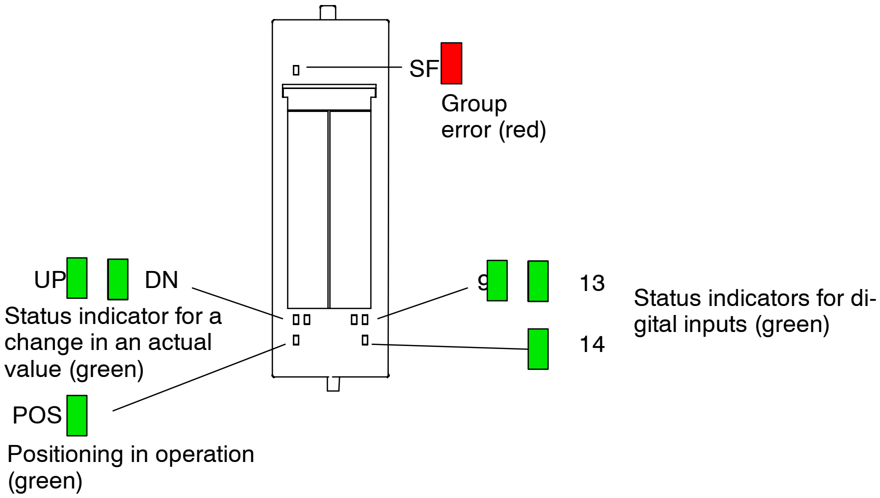
2PULSE



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 6-12 LEDs on the 2PULSE

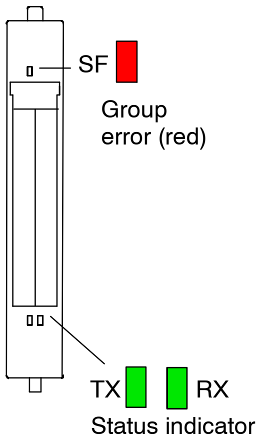
1POS INC/Digital, 1POS SSI/Digital, 1POS INC/Analog, 1POS SSI/Analog



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 6-13 LEDs on the 1POS INC/Digital, 1POS SSI/Digital, 1POS INC/Analog, 1POS SSI/Analog

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



LEDs			Meaning	What to Do
SF	TX	RX		
On			Hardware fault Firmware error Parameter assignment error Wire break or loose cable between the module and the communication partner [1] Communication error	Check the module Check the parameterization. Evaluate the diagnosis. Check the wiring. 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 6-14 LEDs on the 1SI 3964/ASCII, 1SI Modbus/USS

6.4 Diagnostics

Power Module Error Types

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

Table 6-4 Power Module Error Types

Power Modules Electronic Modules		Error Type		Meaning	Remedy
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 6-5 Digital Electronic Module Error Types

Digital Electronic Modules	Error Type		Meaning	Remedy
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	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		
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.

Table 6-5 Digital Electronic Module Error Types, continued

Digital Electronic Modules	Error Type		Meaning	Remedy
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 in signal line to 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 6-6 Analog Input Module Error Types

<table>
<tr><th colspan="3">Analog Input Modules</th><th colspan="2">Error Type</th><th>Meaning</th><th>Remedy</th></tr>
<tr><td rowspan="4">2AI U
High
Speed</td><td rowspan="5">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</td><td rowspan="6">2AI TC
Standard
2AI TC
High
Feature</td><td>16_D</td><td>10000:
Parameter assignment error</td><td>Module cannot use the parameter for the channel:
Inserted module does not match the one configured.
Parameter assignment error.</td><td>Correct the configuration (compare actual and desired configuration).
Correct the parameter assignment (parameter assignment of wire break diagnosis only with the permitted measuring ranges).</td></tr>
<tr><td>9_D</td><td>01001: Error</td><td>Internal module error has occurred (diagnostic message on channel 0 applies to the whole module).</td><td>Replace the module.</td></tr>
<tr><td>7_D</td><td>00111: Upper limit violation</td><td>Value is above the overrange.</td><td>Correct the module/actuator match.</td></tr>
<tr><td>8_D</td><td>01000: Lower limit violation</td><td>Value is below the underrange.</td><td>Correct the module/actuator match.</td></tr>
<tr><td>---</td><td>6_D</td><td>00110: Open circuit[1]</td><td>Line to the sensor interrupted.</td><td>Correct the process wiring.</td></tr>
<tr><td>---</td><td>---</td><td>21_D</td><td>10101:
Reference channel error</td><td>Error on the reference channel</td><td>Check the reference module
(2AI RTD Standard).</td></tr>
</table>

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 6-7 Analog Output Module Error Types

<table>
<tr><th colspan="2">Analog Output Modules</th><th colspan="2">Error Type</th><th>Meaning</th><th>Remedy</th></tr>
<tr><td rowspan="3">2AO U Standard
2AO U High Feature</td><td rowspan="2">2AO I Standard
2AO I High Feature</td><td>16_D</td><td>10000: Parameter assignment error</td><td>Module cannot use the parameter for the channel:
Inserted module does not match the one configured.
Parameter assignment error.</td><td>Correct the configuration (compare actual and desired configuration).
Correct the parameter assignment (parameter assignment of wire break diagnosis only with the permitted measuring ranges).</td></tr>
<tr><td>9_D</td><td>01001: Error</td><td>Internal module error has occurred (diagnostic message on channel 0 applies to the whole module).</td><td>Replace the module.</td></tr>
<tr><td>---</td><td>1_D</td><td>00001: Short circuit</td><td>Short circuit of the actuator supply.</td><td>Correct the process wiring.</td></tr>
<tr><td>---</td><td>2AO I Standard
2AO I High Feature</td><td>6_D</td><td>00110: Open circuit</td><td>Line to the actuator interrupted.</td><td>Correct the process wiring.</td></tr>
</table>

1SSI

Table 6-8 1SSI

Error type		Meaning	Remedy
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 6-9 1COUNT 24V/100kHz

Error type		Meaning	Remedy
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 6-10 1COUNT 5V/500kHz

Error type		Meaning	Remedy
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 6-11 1STEP 5V/204kHz

Error type		Meaning	Remedy
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 6-12 2PULSE

Error type		Meaning	Remedy
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 6-13 1POS INC/Digital, 1POS SSI/Digital, 1POS INC/Analog, 1POS SSI/Analog

Error type		Meaning	Remedy
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.

Serial Interface Module 1SI 3964/ASCII, 1SI Modbus/USS

Table 6-14 1SI 3964/ASCII, 1SI Modbus/USS

Error type		Meaning	Remedy
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	Call receive function more frequently, or use serial flow control.
8_D	01000: Lower limit violation	Message of length 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)

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

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/EWG "Electrical Equipment for Use within Fixed Voltage Ranges" (Low-Voltage Directive)
- 89/336/EWG "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

Woodhead Industries Inc.
3 Parkway North Suite 550
Deerfield, Illinois 60015
Phone: 847.236.9300
Fax: 847.236.0503

UL Approval

Canadian Standards Association in accordance with

- UL 508 (Industrial Control Equipment)

or

Underwriters Laboratories Inc. in accordance with

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

or

HAZ. LOC.

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)

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 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

T4A @60 °C

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

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).

DeviceNet Standard

The DeviceNet Slave Adapter terminal module complies with DeviceNet Specification Volume I, Release 2.0 and Volume II, Release 2.0.

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

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 According to IEC 61000-4-2 (IEC 801-2)	8 kV 6 kV	3 (air discharge) 2 (contact discharge)
Burst pulses (rapid, transient interference) to IEC 61000-4-4 (IEC 801-4)	2 kV (supply line) 2 kV (signal line)	3 3
Surge to IEC 61000-4-5 (IEC 801-5) Only with lightning conductors • Asymmetrical interconnection • Symmetrical interconnection	 2 kV (supply line) 2 kV (signal line/ data line) 1 kV (supply line) 1 kV (signal line/ data line)	3

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 to 1000 MHz	900 MHz ±5 MHz	0.15 to 80 MHz
10 V/m		10 V_{eff} 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	< 40dB (μV/m)Q
From 230 MHz to 1000 MHz	< 47dB (μV/m)Q

Shipping and Storage Conditions

The ET 200S distributed I/O system exceeds the requirements of IEC 61131-2/IEC60068-2-32 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
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

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	$10 \leq f \leq 58$Hz	0.15 mm amplitude	0.35 mm amplitude
	$58 \leq f \leq 150$Hz	2g constant acceleration	5g 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 (during operation)	Oscillation test to IEC 60721-3-3 (IEC 68 Part 2-6) (sine)	Oscillation type: frequency sweeps with a rate of change of 1 octave per minute. 10 Hz $\leq$ f $\leq$ 58 Hz, constant amplitude 0.075 mm 58 Hz $\leq$ f $\leq$ 150 Hz, constant acceleration 1 g Oscillation time: 10 frequency sweeps per axis on all of the three perpendicular axes
Shock (during operation)	Shock test to IEC 670068-2-27 (IEC 68 Part 2-27)	Type of shock: half sine Force of shock: 150 M/S, 11 ms duration Direction of shock: 5 shocks per +/- direction in all of the three perpendicular axes
Oscillations (during transport)	Oscillation test in accordance with IEC 60068-2-6 Test Fc (IEC 68 Part 2-6)	Oscillation type: frequency sweeps with a rate of change of 1 octave per minute. 5 Hz $\leq$ f $\leq$ 9 Hz, constant amplitude 3.5 mm 9 Hz $\leq$ f $\leq$ 500 Hz, constant acceleration 1 g Oscillation time: 10 frequency sweeps per axis on all of the three perpendicular axes
Repetitive shock (during transport)	Shock test to IEC 60068-2-29 Test Eb (IEC 68 Part 2-29)	Type of shock: half sine Force of shock: Acceleration 250 M/S^2, 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 as per IEC 60536

Degree of Protection IP20

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	VAC to 132 VAC (47 Hz to 63 Hz)
	230 VAC	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

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 system 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

II 3 G	**EEx nA II T4..T5**	to EN 50021 : 1999
Test number:	**KEMA 01ATEX1238 X**	

Note

Modules with II 3 G EEx nA II T4 .. T5 certification can only be installed in ET 200S distributed I/O systems 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 out there.

Special Conditions

1. The ET 200S distributed I/O system 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. Steps must be taken to ensure that the rated voltage through transients cannot be exceeded by more than 40 %.
5. Ambient temperature range: 0° C to 60° C
6. 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 12443956 on the Internet:

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

Interface Module

8

Chapter Overview

8.1 Parameters for Interface Module

Parameter Assignment

You set the parameters for the DeviceNet Slave Adapter interface module using the DNS-200 Configuration Tool software. After loading new parameters into the interface module, you must reset the module to make the parameters take effect. You can do this by a command from the DNS-200 software or by switching the interface module power off and back on.

Parameters

The following table describes the parameters of the interface module.

Table 8-1 Parameters for the Interface Module

DeviceNet IM	Value Range	Default	Applicability
Startup preset <> Actual configuration	Disable/enable	Disable	ET 200S
Replace modules during operation	Disable/enable	Disable	ET 200S
Analog-value format	SIMATIC S7/ SIMATIC S5	S7	ET 200S
Interference frequency suppression	50 Hz/60 Hz	60 Hz	ET 200S
Reference junction slot 1 to 8	None/2 to 63	None	ET 200S
Reference junction input 1 to 8	RTD on channel 0/ RTD on channel 1	0	ET 200S

Startup Preset <> Actual Configuration

If the parameter is enabled and:

- The actual configuration differs from the expected configuration, the ET 200S remains engaged in data transfer with the DeviceNet Slave Adapter interface module.

If the parameter is disabled and:

- The actual configuration differs from the expected configuration, there is no data transfer between the DeviceNet Slave Adapter interface module and the ET 200S.

Replacement of Modules during Operation

If you enable this parameter, you can remove and insert modules during operation. See Section 5.5

Note

The following parameter combination is not permitted:

- Startup preset <> actual configuration: Disable
- Replace modules during operation: Enable

Result: The ET 200S will not start up.

Analog-Value Format

Here you set the number format for all analog electronic modules. Only the S7 selection is useful for the DeviceNet interface module.

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 12.

Reference Junction Slot 1 to 8

See Chapter 12.2.2

Reference Junction Input 1 to 8

See Chapter 12.2.2

8.2 DeviceNet Interface Module

Order Number

5136-DNS-200S

Features

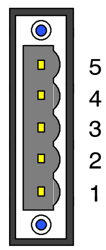
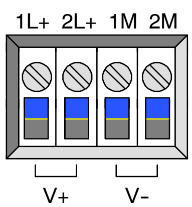
The DeviceNet Slave Adapter interface module has the following features:

- It connects the ET 200S with the DeviceNet network.
- It prepares the data for the electronic modules and motor starters that are fitted.
- It supplies the backplane bus.
- The node address of the ET 200S can be set by means of switches.
- If the 24 VDC power supply is disconnected, the 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 interface module to the rail (protective conductor) is connected by means of an RC combination, thus permitting an ungrounded configuration.
- A maximum of 63 modules can be operated with the interface module.
- The maximum width of the station is 1 m.

Terminal Assignment

The following table shows the terminal assignment of the interface module for the 24 VDC voltage supply and DeviceNet communications:

Table 8-2 Terminal Assignment of the DeviceNet Interface Module

<table>
<tr><th>View</th><th colspan="2">Signal Name</th><th>Designation</th></tr>
<tr><td rowspan="9">
</td><td>1</td><td>V–</td><td>Black</td></tr>
<tr><td>2</td><td>CAN_L</td><td>Blue</td></tr>
<tr><td>3</td><td>Shield</td><td>Bare</td></tr>
<tr><td>4</td><td>CAN_H</td><td>White</td></tr>
<tr><td>5</td><td>V+</td><td>Red</td></tr>
<tr><td colspan="2">1L+</td><td>24 VDC</td></tr>
<tr><td colspan="2">2L+</td><td>24 VDC (for loop through)</td></tr>
<tr><td colspan="2">1M</td><td>Ground</td></tr>
<tr><td colspan="2">2M</td><td>Ground (for loop through)</td></tr>
</table>

Technical Specifications

Refer to Section 2.8 for the DeviceNet interface module technical specifications.

Terminal Modules 9

Chapter Overview

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 9-1 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**
Order number 6ES7193... →	4CC20-0AA0	4CD20-0AA0	4CE00-0AA0
Spring terminal: →	**15C23-A1**	**15C23-A0**	**15C22-01**
Order number 6ES7193... →	4CC30-0AA0	4CD30-0AA0	4CE10-0AA0
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	●	●	●

Table 9-2 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**
Order number 6ES7193... →	4CA40-0AA0	4CA20-0AA0	4CB20-0AA0	4CB00-0AA0	4CL20-0AA0	4CG20-0AA0
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**
Order number 6ES7193... →	4CA50-0AA0	4CA30-0AA0	4CB30 -0AA0	4CB10-0AA0	4CL30-0AA0	4CG30-0AA0
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	●	●	●	●		

Table 9-2 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**
Order number 6ES7193... →	4CA40-0AA0	4CA20-0AA0	4CB20-0AA0	4CB00-0AA0	4CL20-0AA0	4CG20-0AA0
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**
Order number 6ES7193... →	4CA50-0AA0	4CA30-0AA0	4CB30 -0AA0	4CB10-0AA0	4CL30-0AA0	4CG30-0AA0
Fast Connect →	**15N26-A1**	**15N24-A1**	**15N24-01**	**15N23-01**	---	---
Order number 6ES7193... →	4CA80-0AA0	4CA70-0AA0	4CB70-0AA0	4CB60-0AA0		
4DI 24-48 VUC High Feature	●	●	●	●		
4DI NAMUR	●	●	●	●		
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 2/4WIRE High Feature	●		●			

Table 9-2 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**
Order number 6ES7193... →	4CA40-0AA0	4CA20-0AA0	4CB20-0AA0	4CB00-0AA0	4CL20-0AA0	4CG20-0AA0
Spring terminal: →	**15C26-A1**	**15C24-A1**	**15C24-01**	**15C23-01**	**15C24-AT**	**30C44-01**
Order number 6ES7193... →	4CA50-0AA0	4CA30-0AA0	4CB30-0AA0	4CB10-0AA0	4CL30-0AA0	4CG30-0AA0
Fast Connect →	**15N26-A1**	**15N24-A1**	**15N24-01**	**15N23-01**	---	---
Order number 6ES7193... →	4CA80-0AA0	4CA70-0AA0	4CB70-0AA0	4CB60-0AA0		
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	●		●			
2AO I Standard 2AO I High Feature	●	●	●	●		
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	●		●			
RESERVE (width 15 mm)	●	●	●	●	●	
RESERVE (width 30 mm)						●

9.1 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)

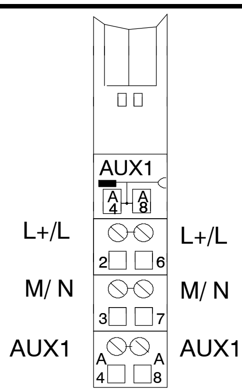
Features

- 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 9-3 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	
	A4	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	
	A8	AUX1	Any connection for PE or voltage bus up to the maximum rated load voltage of the module

Block Diagram

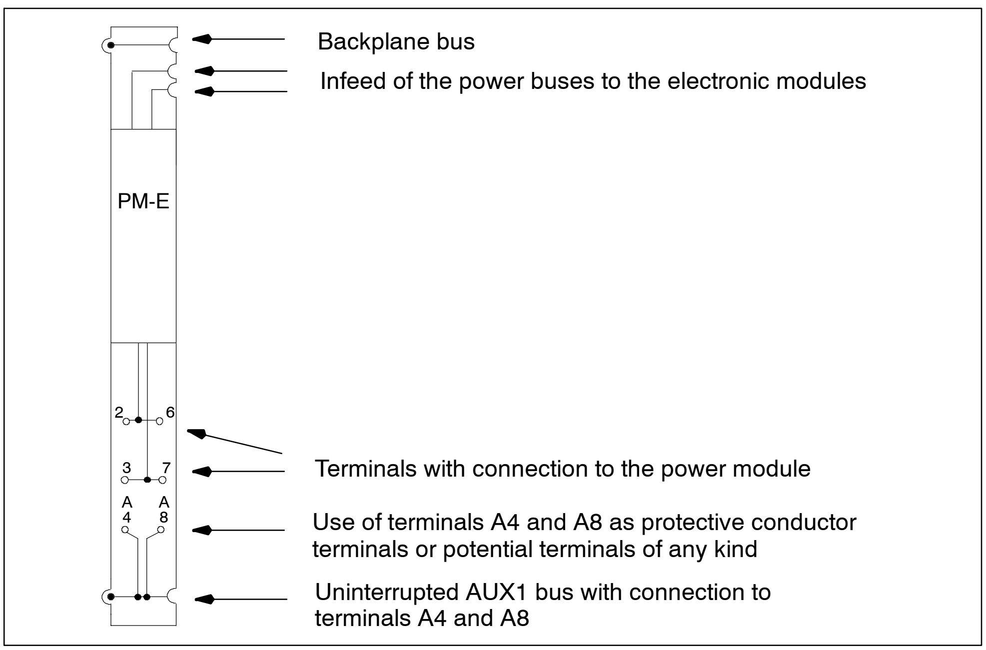


Figure 9-1 Block Diagram of the TM-P15S23-A1, TM-P15C23-A1, and TM-P15N23-A1 Terminal Modules

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

9.2 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)

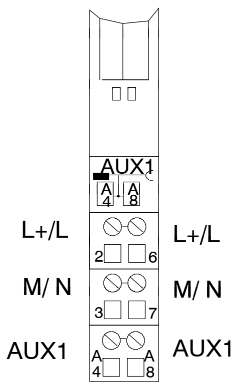
Features

- 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

Terminal Assignment

The following table shows the terminal assignment of the terminal module:

Table 9-4 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

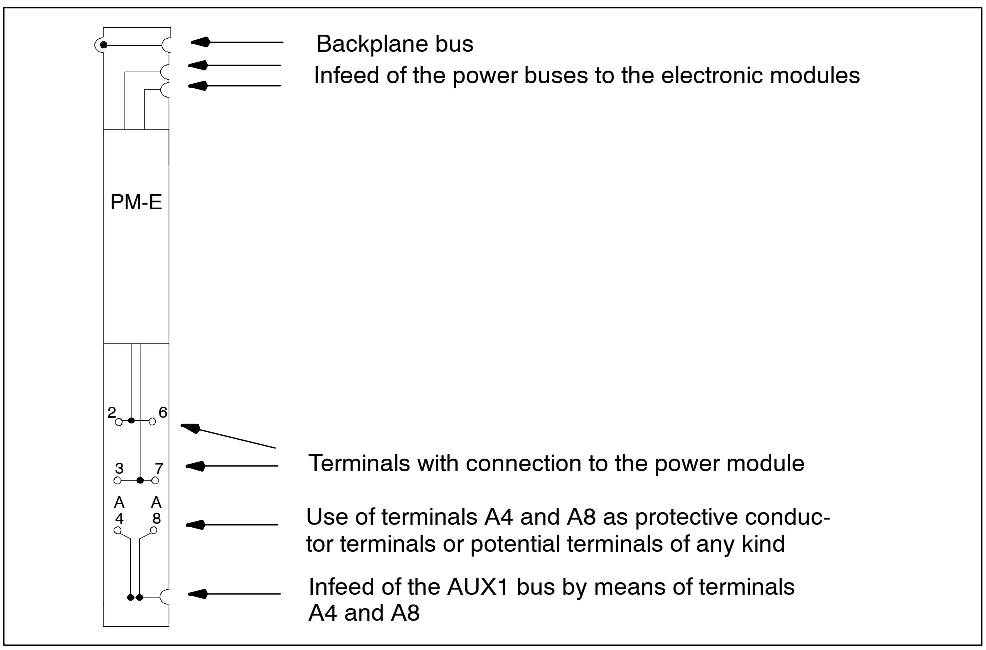


Figure 9-2 Block Diagram for the TM-P15S23-A0, TM-P15C23-A0, and TM-P15N23-A0 Terminal Modules

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

9.3 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)

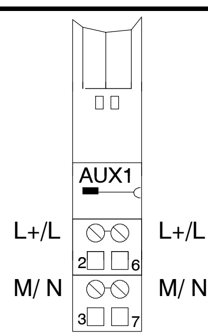
Features

- 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 9-5 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

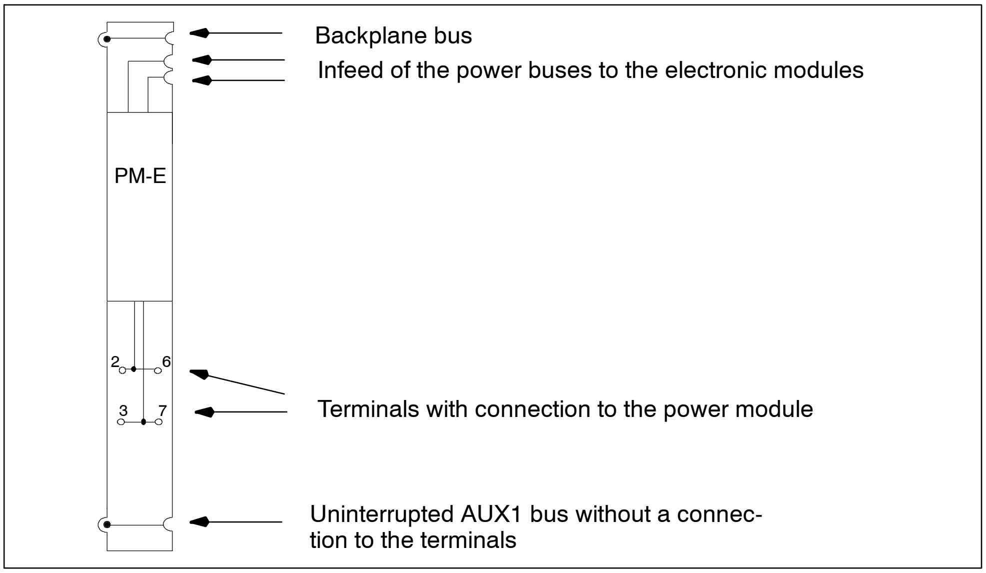


Figure 9-3 Block Diagram for the TM-P15S22-01, TM-P15C22-01, and TM-P15N22-01 Terminal Modules

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 2

9.4 TM-E15S26-A1, TM-E15C26-A1, and TM-E15N26-A1 Universal Terminal Modules (6ES7193-4CAx0-0AA0)

Order Number

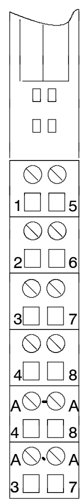
6ES7193-4CA40-0AA0 (screw-type terminal)
6ES7193-4CA50-0AA0 (spring terminal)
6ES7193-4CA80-0AA0 (Fast Connect)

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	
	A4	AUX1 bus fed through. Connection to terminals A4, A8 and A3, A7.	
	A3		
	A8		
	A7		

- 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

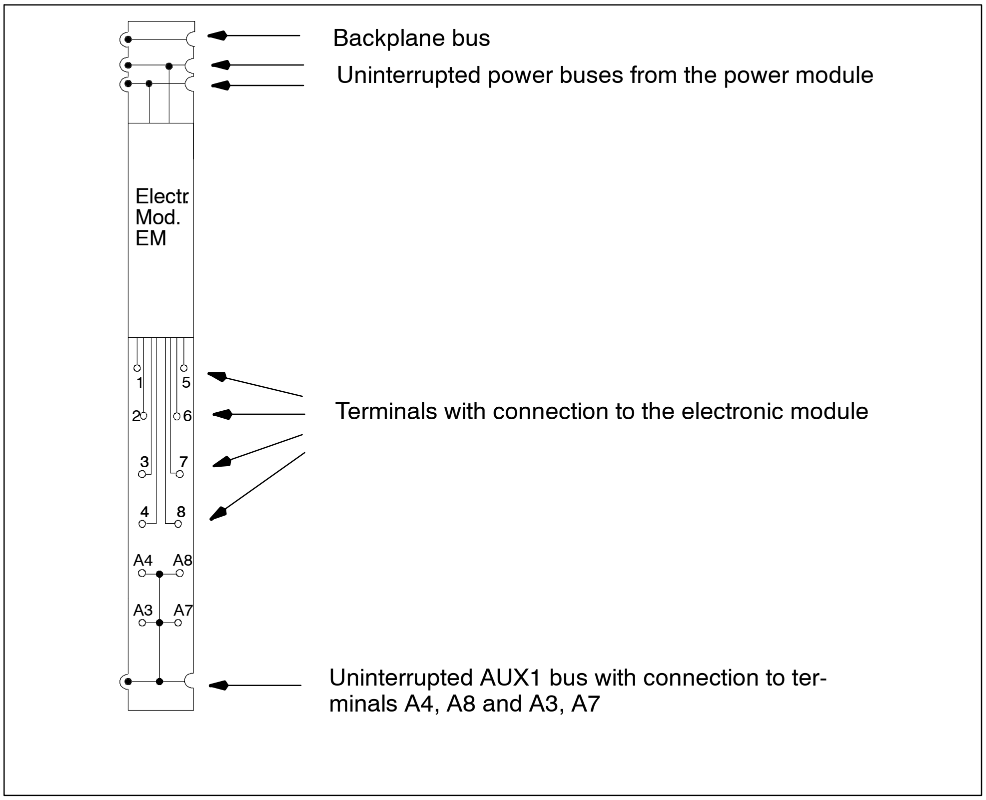


Figure 9-4 Block Diagram for the TM-E15S26-A1, TM-E15C26-A1, and TM-E15N26-A1 Terminal Modules

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

9.5 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)

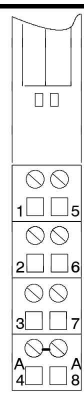
Features

- 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 9-6 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

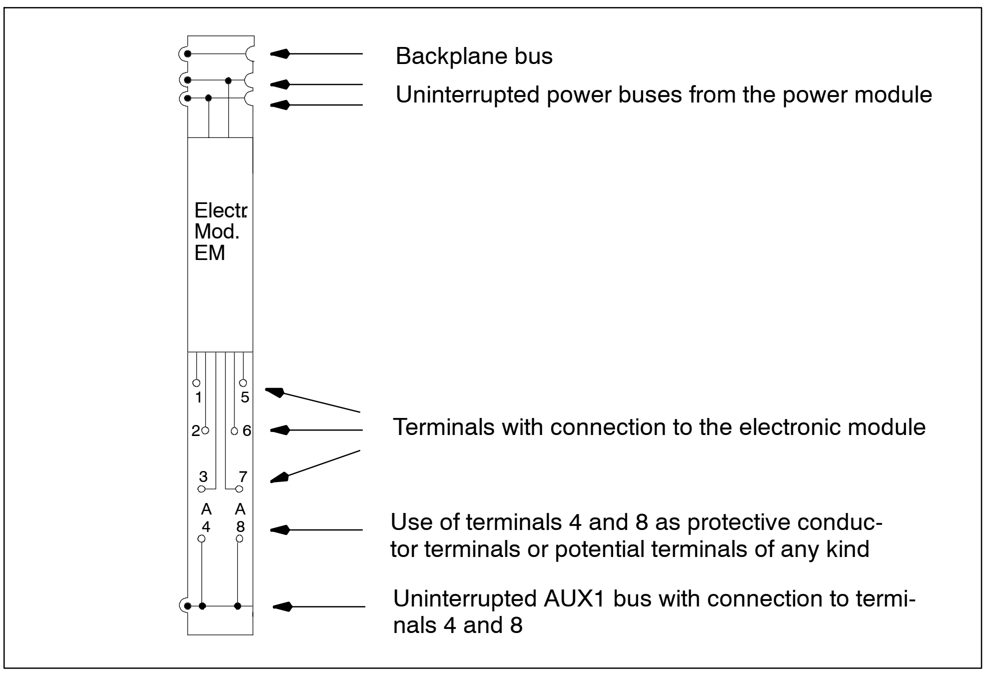


Figure 9-5 Block Diagram for the TM-E15S24-A1, TM-E15C24-A1, and TM-E15N24-A1 Terminal Modules

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

9.6 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)

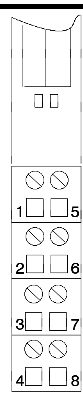
Features

- 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 9-7 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

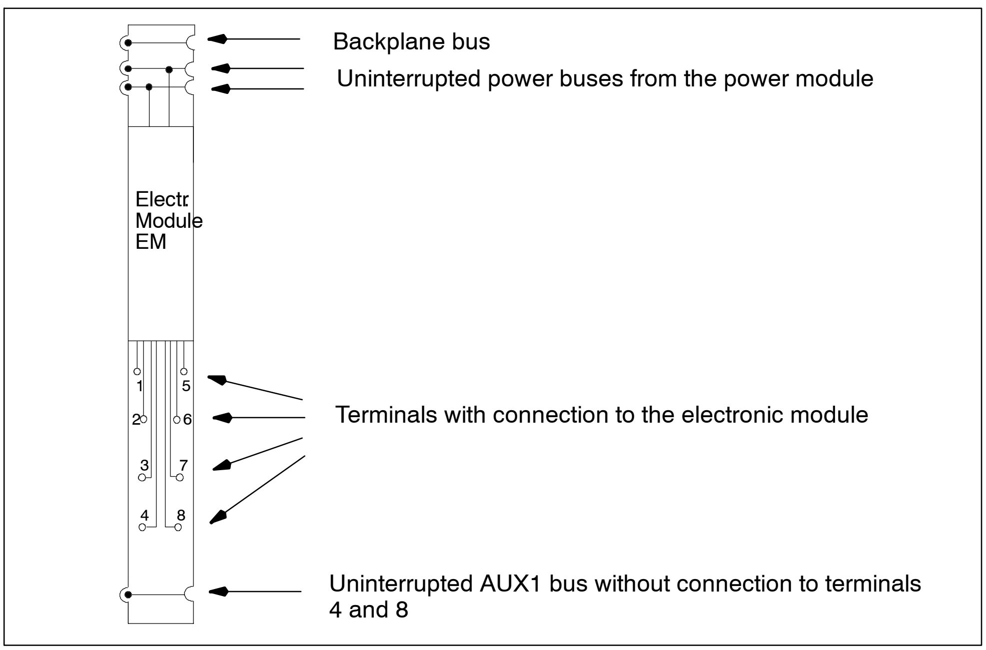


Figure 9-6 Block Diagram for the TM-E15S24-01, TM-E15C24-01, and TM-E15N24-01 Terminal Modules

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

9.7 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)

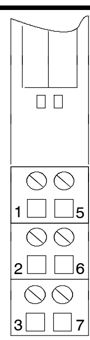
Features

- 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 9-8 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. No access to the AUX1 bus
	2	
	3	
	5	
	6	
	7	

Block Diagram

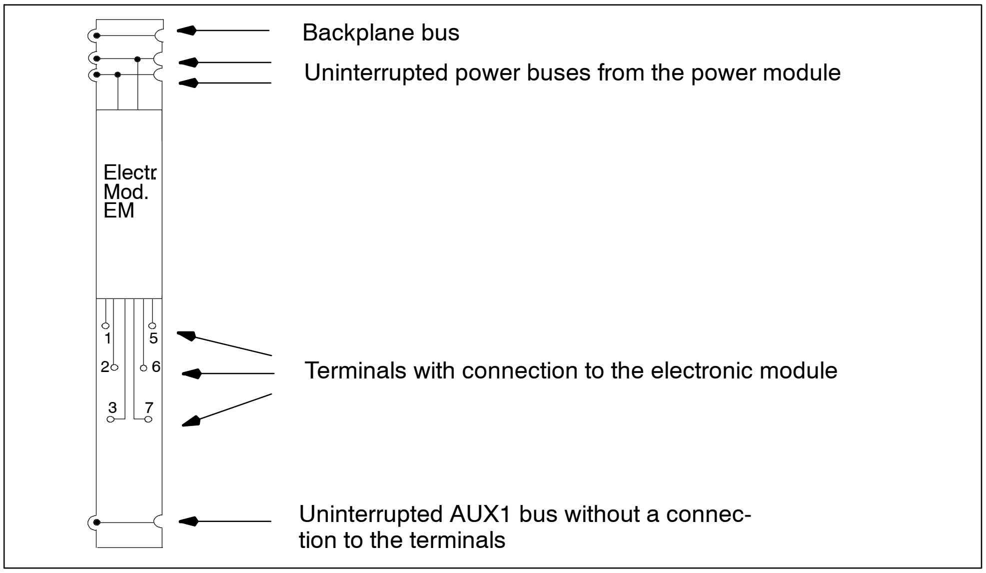


Figure 9-7 Block Diagram for the TM-E15S23-01, TM-E15C23-01, and TM-E15N23-01 Terminal Modules

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

9.8 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

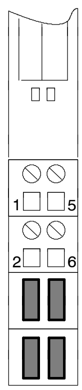
You can only insert the 2AI TC HF electronic module into the TM-E15S24-AT/TM-E15C24-AT terminal module. Inserting another electronic module can result in the destruction of the internal reference junction of the terminal module.

- 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 9-9 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

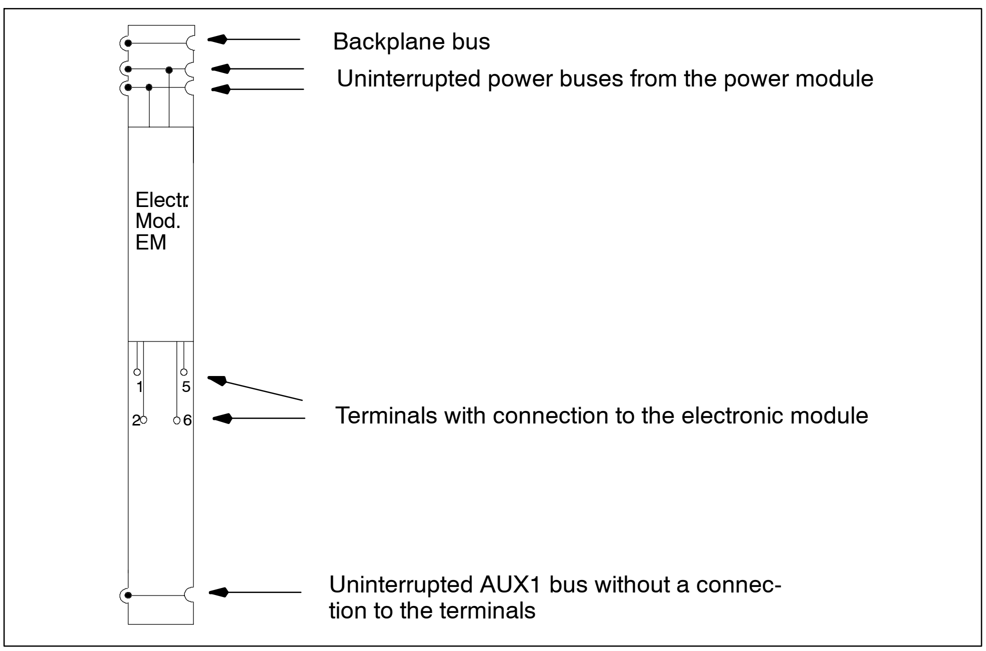


Figure 9-8 Block Diagram of the TM-E15S24-AT and TM-P15C24-AT Terminal Module

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 12.16.

9.9 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)

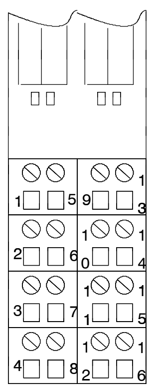
Features

- Terminal module for electronic modules with a width of 30 mm
- 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 9-10 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

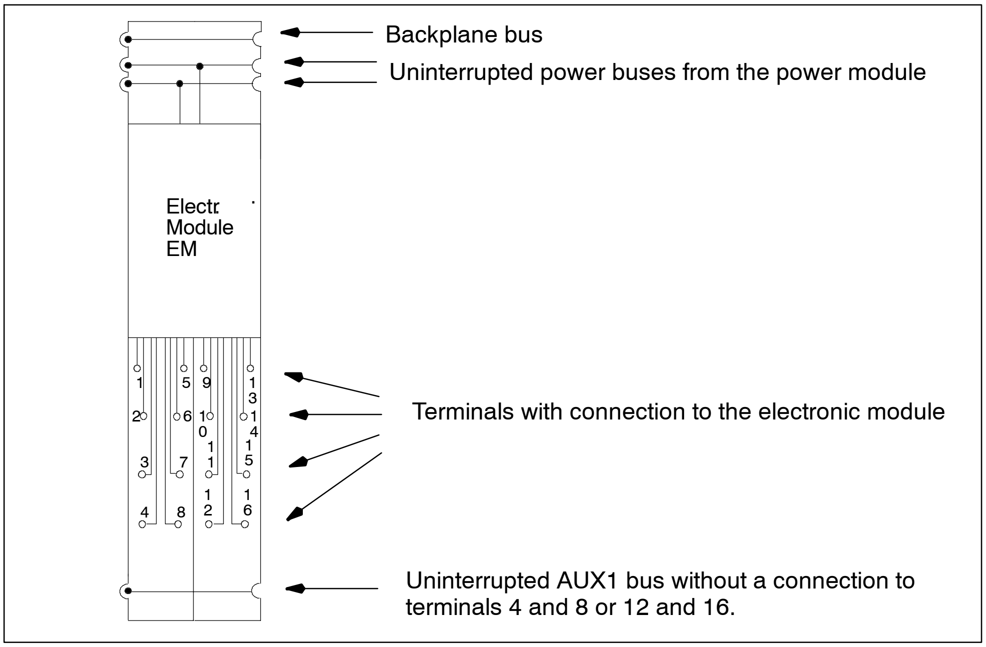


Figure 9-9 Block Diagram of the TM-E30S44-01 and TM-E30C44-01 Terminal Module

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

Power Modules 10

Chapter Overview

10.1 Parameters for Power Modules

Parameter Assignment

You set the parameters for the power modules using the DNS-200S Configuration Tool software.

Parameters

The following table describes the parameters of the power modules.

Table 10-1 Parameters for Power Modules

Power Module				Value Range	Default	Applica-bility
PM-E 24 VDC	**PM-E 24-48 VDC**	**PM-E 24 VDC / 120/230 VAC**	**PM-E 24-48 VDC/ 24-230 VAC**			
Diagnostics: No load voltage	Diagnostics: No load voltage	Diagnostics: No load voltage	Diagnostics: No load voltage	Disable/ enable	Enable	Power module
---	---	Diagnostics: Fuse blown	Diagnostics: Fuse blown	Disable/ enable	Enable	Power module
---	---	---	Voltage type	DC/AC	DC	Power module

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 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 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.

10.2 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.

Terminal Assignment

The following table illustrates the terminal assignment of the PM-E 24 VDC power module for the different terminal modules:

Table 10-2 Terminal Assignment of the PM-E 24 VDC Power Module

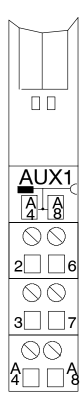
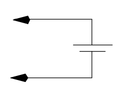
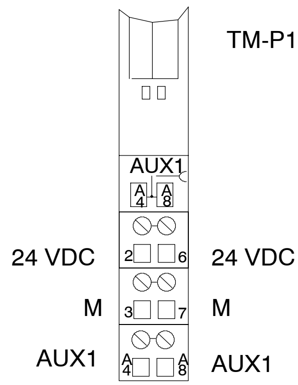
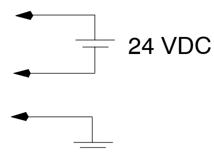
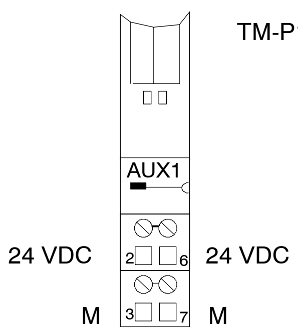
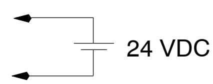
View	Terminal Assignment	Remarks
TM-P15S23-A1 and PM-E 24 VDC 24 VDC M AUX1  24 VDC M AUX1	 24 VDC	24 VDC: Rated load voltage M: Chassis ground AUX1: Ground terminal or usable as any voltage bus up to the level of the load voltage.

Table 10-2 Terminal Assignment of the PM-E 24 VDC Power Module, continued

<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr>
<td>
</td>
<td>TM-P15S23-A0 and PM-E 24 VDC

</td>
<td>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.</td>
</tr>
<tr>
<td>
</td>
<td>TM-P15S22-01 and PM-E 24 VDC

</td>
<td>24 VDC: Rated load voltage
M: Chassis ground</td>
</tr>
</table>

Block Diagram

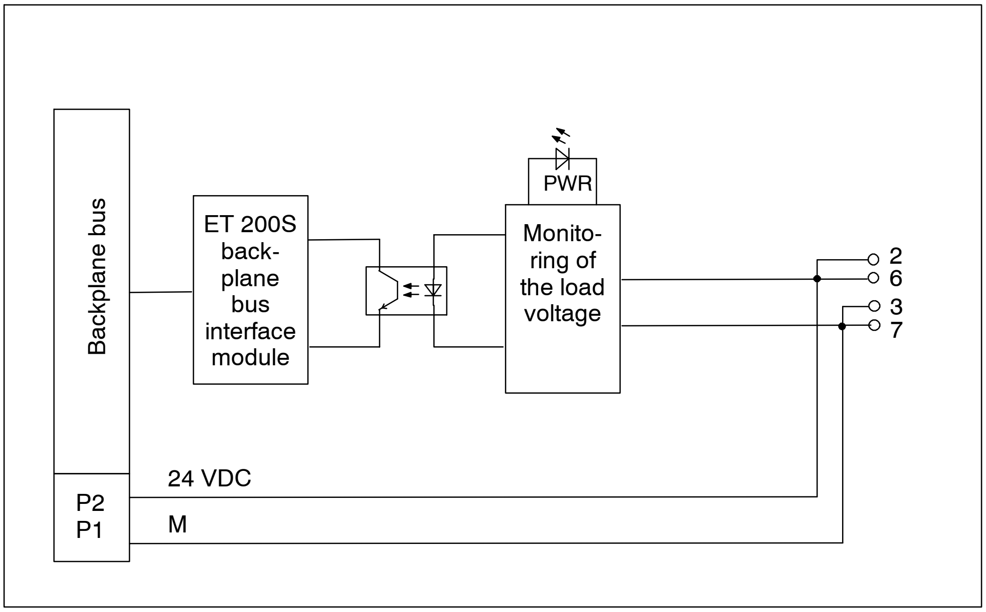


Figure 10-1 Block Diagram of the PM-E 24 VDC Power Module

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, Diagnostics	
Diagnostic function	Yes
• Group error	Red “SF” LED
• Load voltage monitoring	Green “PWR” LED
• Diagnostic information readable	Yes

10.3 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.

Caution

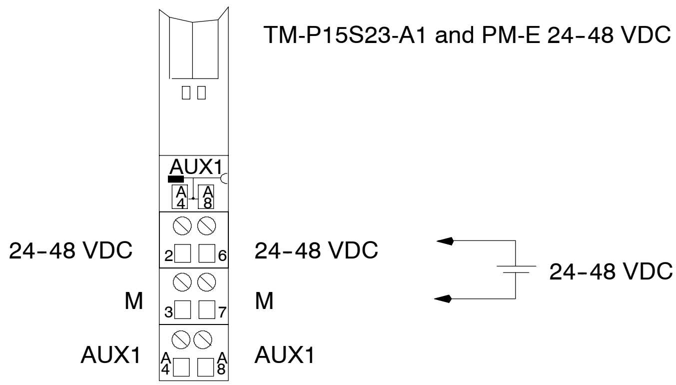
Only connect the specified rated load voltage of 24-48 VDC to the TM-P terminal module of the power module.

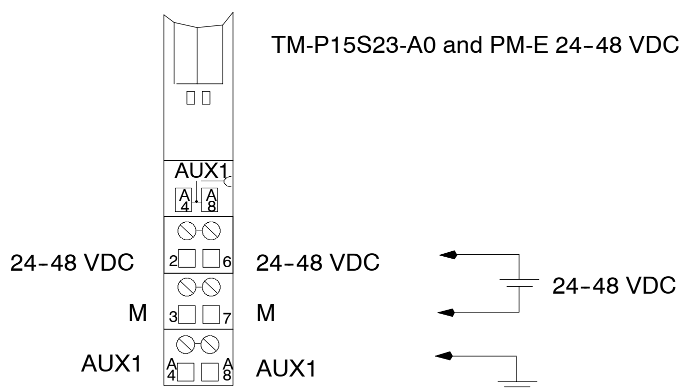
The connected rated load voltage must correspond to the supply voltage of the electronic modules in the potential group.

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 10-3 Terminal Assignment of the PM-E 24–48 VDC Power Module

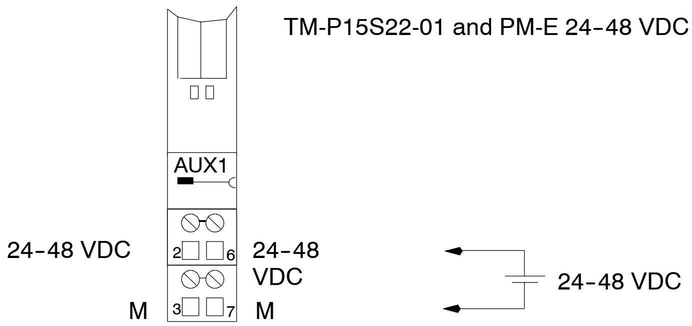
<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr><td colspan="2">
</td><td>24–48 VDC:
Rated load voltage
M: Chassis ground

AUX1: Ground terminal or usable as any voltage bus up to the level of the load voltage.</td></tr>
<tr><td colspan="2">
</td><td>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.</td></tr>
</table>

Table 10-3 Terminal Assignment of the PM-E 24–48 VDC Power Module, continued

View	Terminal Assignment	Remarks
TM-P15S22-01 and PM-E 24–48 VDC  		24–48 VDC: Rated load voltage M: Chassis ground

Block Diagram

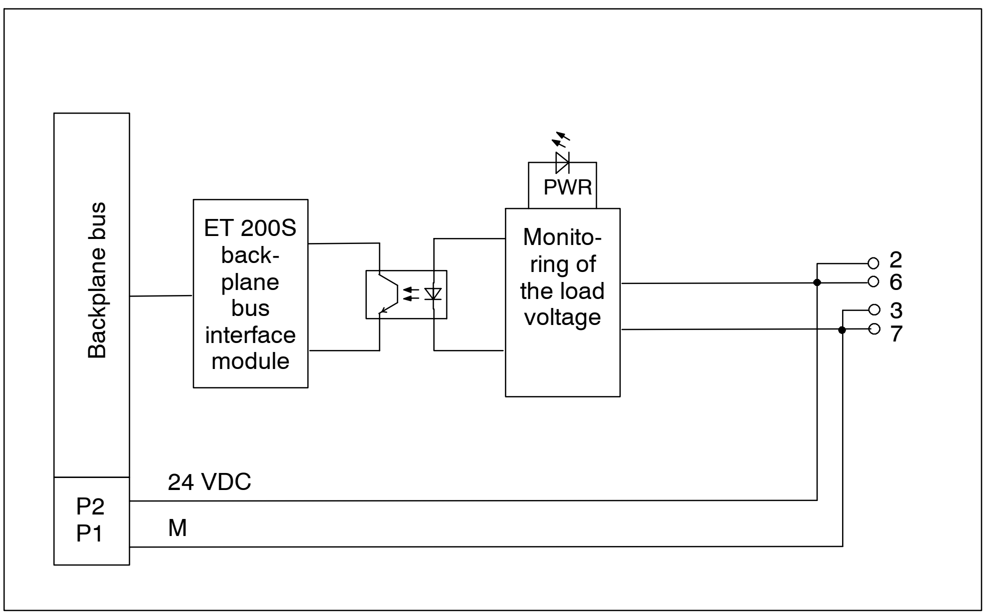


Figure 10-2 Block Diagram of the PM-E 24–48 VDC Power Module

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, Diagnostics	
Diagnostic function	Yes
• Group error	Red “SF” LED
• Load voltage monitoring	Green “PWR” LED
• Diagnostic information readable	Yes

10.4 PM-E 24 VDC, 120/230 VAC Power Module (6ES7138-4CB00-0AB0)

Order Number

6ES7 138-4CB00-0AB0

Features

The PM-E 24 VDC / 120/230 VAC 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.
- Is universally applicable and can be used for any electronic module.
- Is required at least once (on the right of the interface module) for the ET 200S distributed I/O device.
- Is additionally equipped with a replaceable fuse (5 mm x 20 mm).

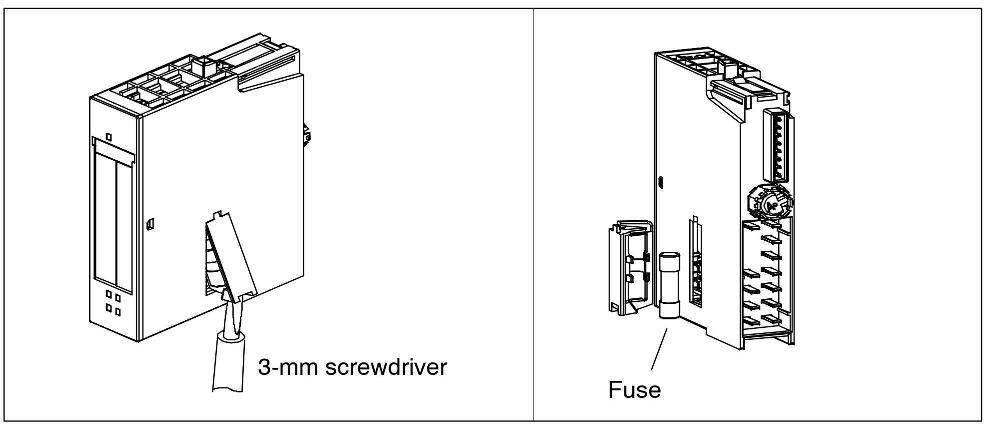
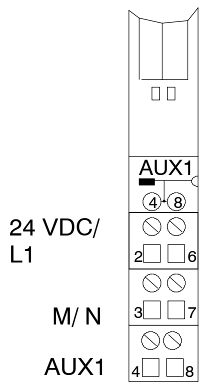
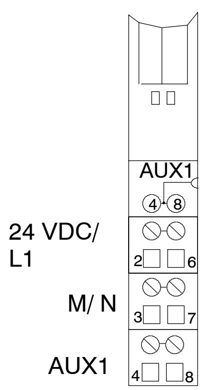
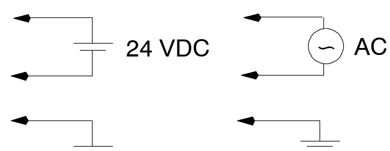
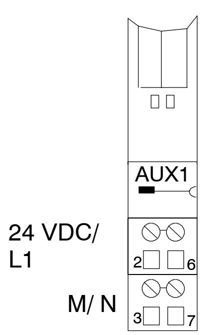


Figure 10-3 Replacing the Fuse

Terminal Assignment

The following table illustrates the terminal assignment of the PM-E 24 VDC / 120/230 VAC power module for the different terminal modules:

Table 10-4 Terminal Assignment of the PM-E 24 VDC / 120/230 VAC Power Module

View	Terminal Assignment	Remarks
	TM-P15S23-A1 and PM-E 24 VDC / 120/230 VAC 	24 VDC/L1: Rated load voltage M/ N: Ground/neutral conductor AUX1: Ground terminal or usable as any voltage bus up to the load voltage.
	TM-P15S23-A0 and PM-E 24 VDC / 120/230 VAC 	24 VDC/L1: Rated load voltage M/ N: Ground/neutral conductor AUX1: Ground terminal or usable as any voltage bus up to the load voltage. AUX1 is used as PE.
	TM-P15S22-01 and PM-E 24 VDC / 120/230 VAC 	24 VDC/L1: Rated load voltage M/ N: Ground/neutral conductor

Block Diagram

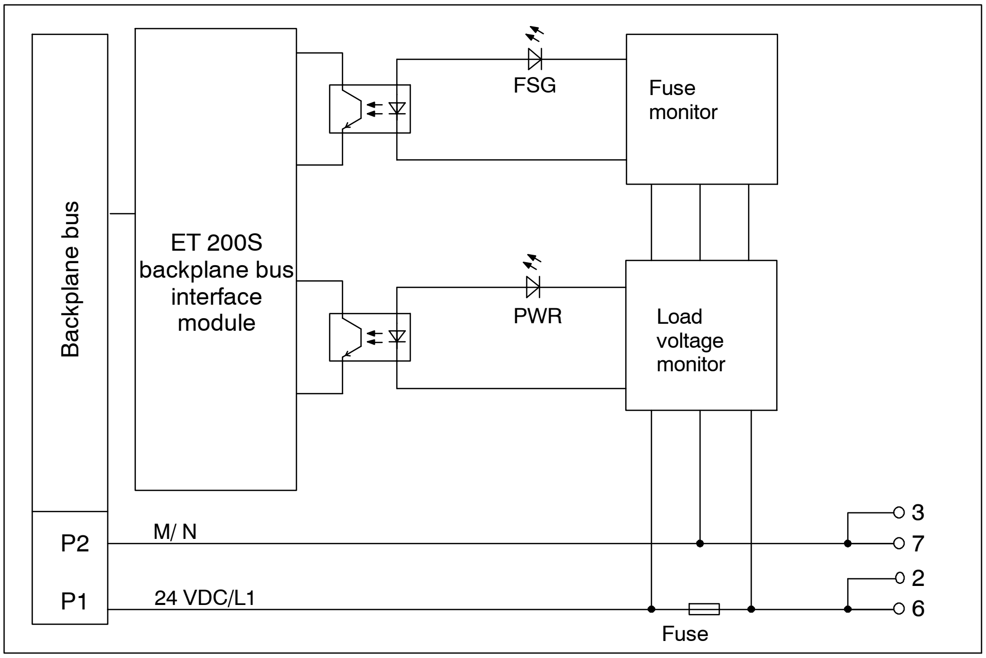


Figure 10-4 Block Diagram of the PM-E 24 VDC / 120/230 VAC Power Module

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	 15 × 81 × 52
Weight	34 g
Voltage, Currents, Potentials	
Rated load voltage	24 VDC 120/230 VAC
• Overvoltage protection	Yes
Maximum current-carrying capacity	10 A
• For 24 VDC	Up to 30 °C: max. 10 A Up to 40 °C: max. 9 A Up to 60 °C: max. 7 A
• For 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
Isolation	
• Between rated load voltage and backplane bus	Yes
• Between the power modules	Yes
Insulation tested with	1500 VAC
Current input	
• From load voltage L1/L+ (no load)	Maximum 9 mA
• From backplane bus	Maximum 8.7 mA
Power dissipation of the module	Maximum 5 W

Status, Diagnostics	
Diagnostic function	Yes
• Group error	Red “SF” LED
• Load voltage monitoring	Green “PWR” LED
• Fuse	Green “FSG” LED
• Diagnostic information readable	Yes

10.5 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).
- Is additionally equipped with a replaceable fuse (5 mm x 20 mm).

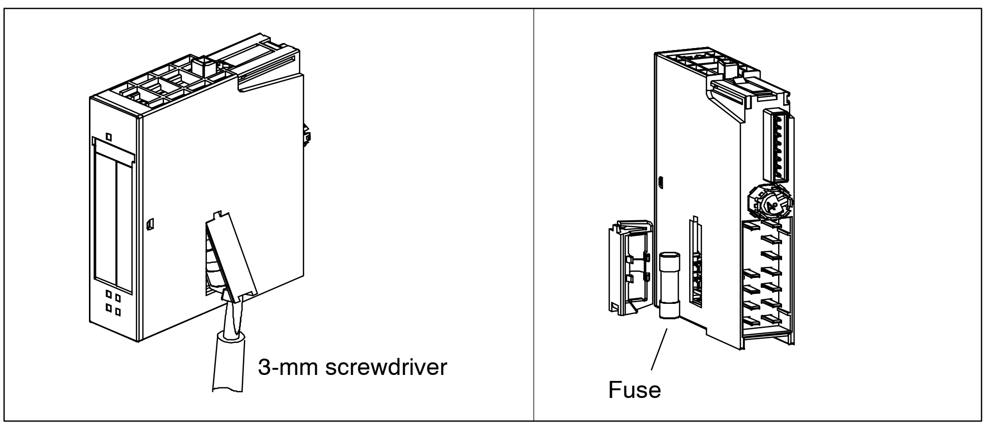


Figure 10-5 Replacing the Fuse

Note

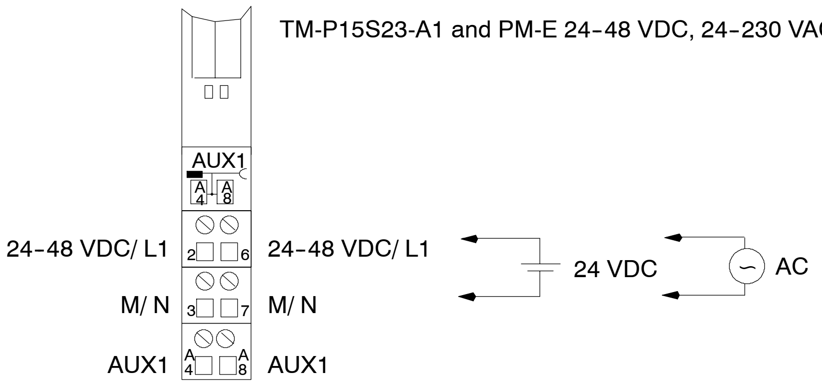
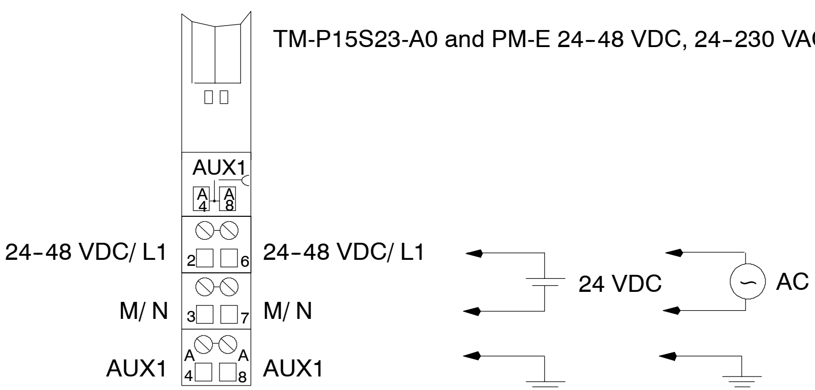
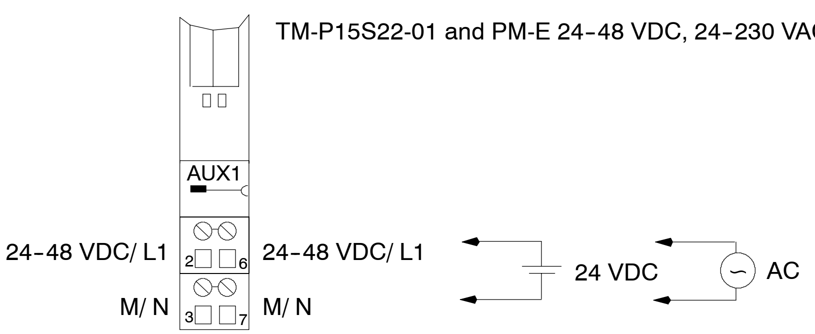
The PM-E 24–48 VDC, 24–230 VAC power module (6ES7138-4CB10-0AB0) is not a direct replacement for the device with the order number 6ES7138-4CB00-0AB0 for AC applications because you have to select either AC or DC supply voltage. In the case of DC applications, the new module is a direct replacement because 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:

Table 10-5 Terminal Assignment of the PM-E 24–48 VDC, 24–230 VAC Power Module

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.
TM-P15S22-01 and PM-E 24–48 VDC, 24–230 VAC 		24–48 VDC/ L1: Rated load voltage M/ N: Ground/neutral conductor

Block Diagram

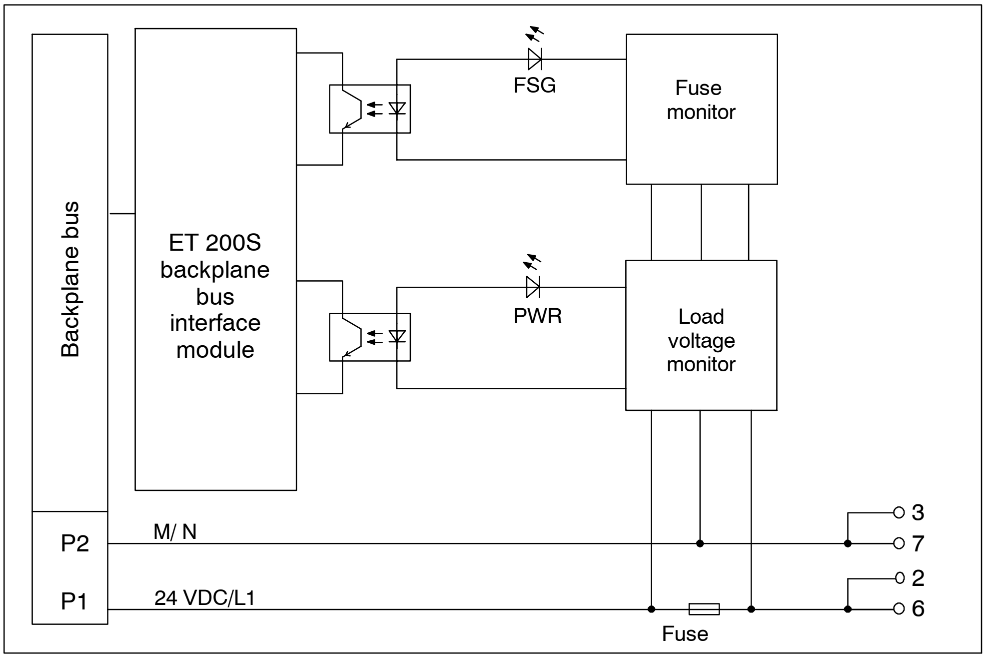


Figure 10-6 Block Diagram of the PM-E 24–48 VDC, 24–230 VAC

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, 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

11

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.

Chapter Overview

11.1 Parameters for Digital Electronic Modules

Parameter Assignment

You set the parameters for the digital electronic modules using the DNS-200S Configuration Tool.

Parameters for Digital Input Modules

Table 11-1 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
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[3]	---	• Disable • Enable	Disable	Module
---		Diagnostics: Fuse defect	---	• Disable • Enable	Disable	Module
---		Diagnostics: Load voltage missing	---	• Disable • Enable	Disable	Module

1) The input delay applies to “0” to “1” and to “1” to “0”.
2) Short circuit of the sensor supply.
3) 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 11-2 Parameters for 4DI NAMUR

4DI NAMUR	Value range	Default	Applicability
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 11-3 Parameters for Digital Output Modules

<table>
<tr><th>2DO 24 VDC/ 0.5 A High Feature</th><th>2DO 24-230 VAC/1 A</th><th rowspan="2">2RO NO NC 24-48 VDC/5 A 24-230 VAC/ 5 A</th><th>2DO/ 4DO 24 VDC/ 0.5 A Standard</th><th rowspan="2">Value range</th><th rowspan="2">Default</th><th rowspan="2">Applicability</th></tr>
<tr><th>2DO 24 VDC/ 2 A High Feature</th><th>2RO NO 24-120 VDC/ 5 A 24-230 VAC/5 A</th><th>2DO/ 4DO 24 VDC/ 2 A Standard</th></tr>
<tr><td colspan="3">Reaction to CPU-/master-STOP</td><td>---</td><td>• Switch substitute value
• Keep last value</td><td>Substitute a value</td><td>Module</td></tr>
<tr><td colspan="3">Substitute value [1)]</td><td>---</td><td>• “0”
• “1”</td><td>“0”</td><td>Channel</td></tr>
<tr><td>Diagnostics: Wire break</td><td colspan="3">---</td><td>• Disable
• Enable</td><td>Disable</td><td>Channel</td></tr>
<tr><td>Diagnostics: Short-circuit to M</td><td colspan="3">---</td><td>• Disable
• Enable</td><td>Disable</td><td>Channel</td></tr>
</table>

1) If the interface module becomes deenergized, the digital output modules will not produce substitute values. The value that is output = 0.

Input delay

You can use this parameter to suppress signal interference. Changes to the signal are detected once the set time has elapsed.

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 is 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.

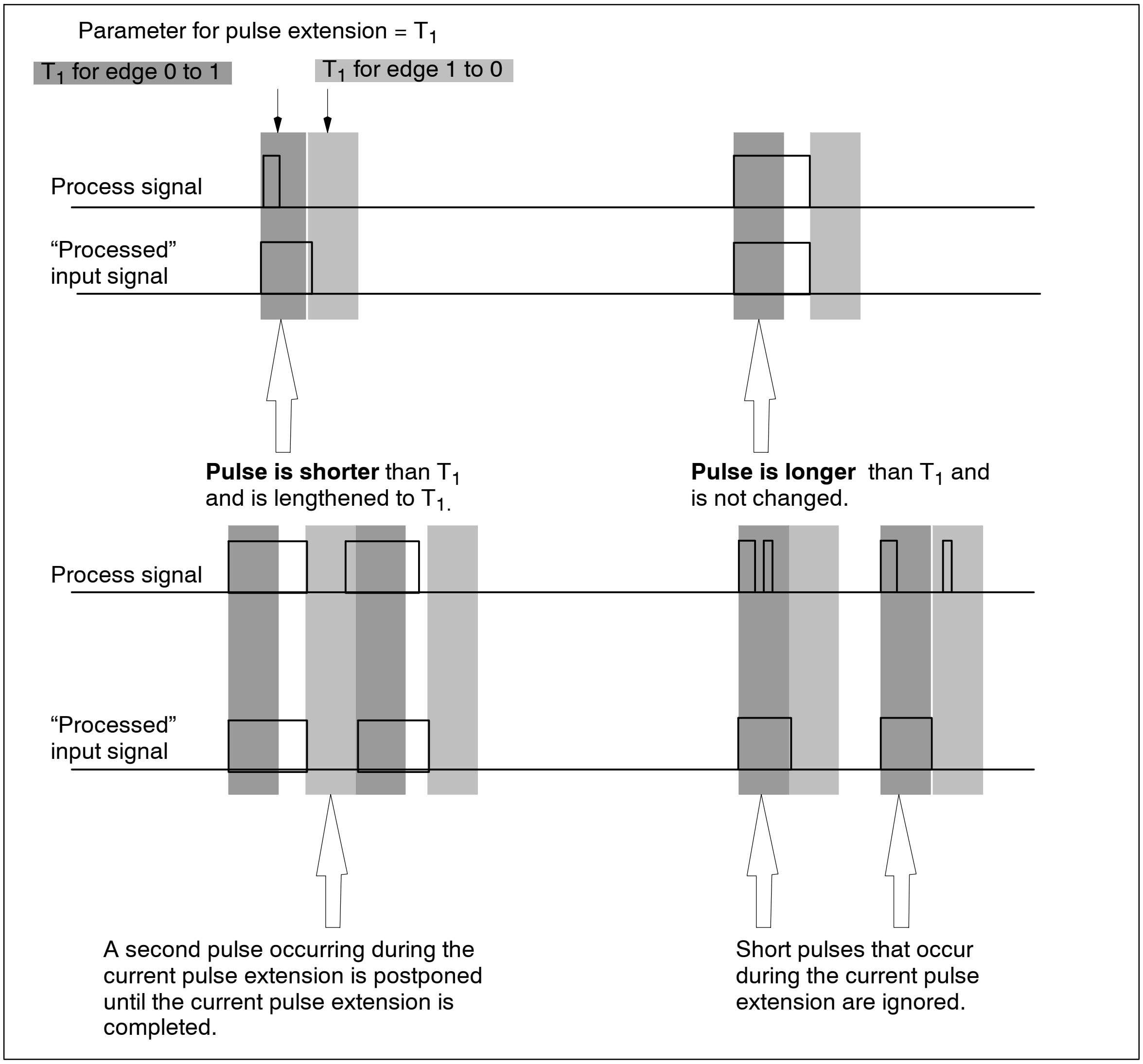


Figure 11-1 The Principle of Pulse Extension

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.

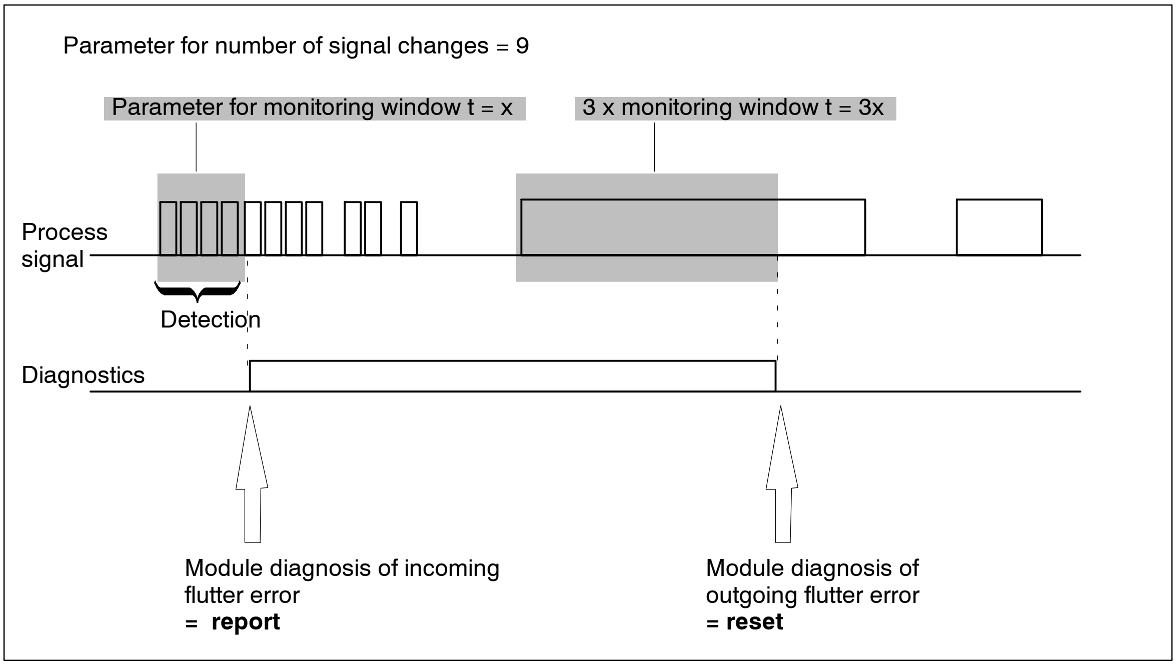


Figure 11-2 The Principle of Flutter Monitoring

11.2 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 11-4 Terminal Assignment of the 2DI 24 VDC Standard

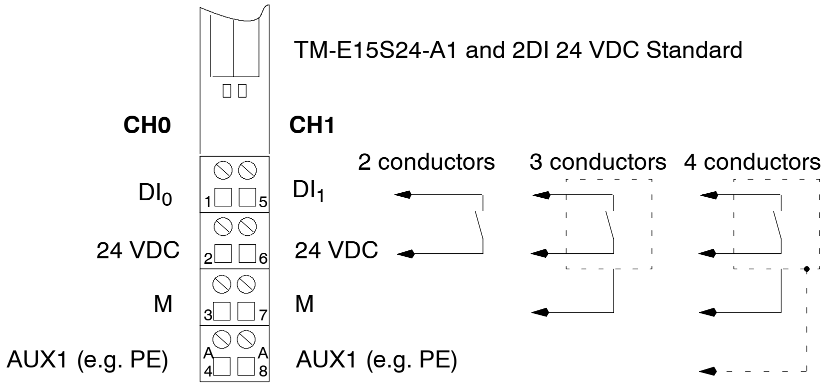
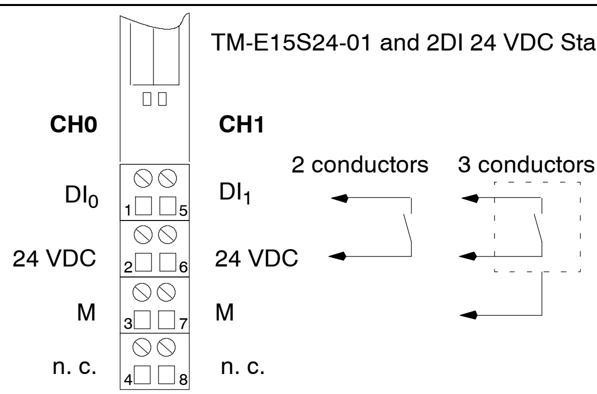
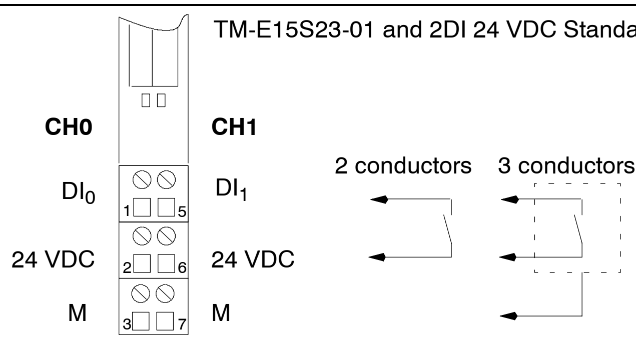
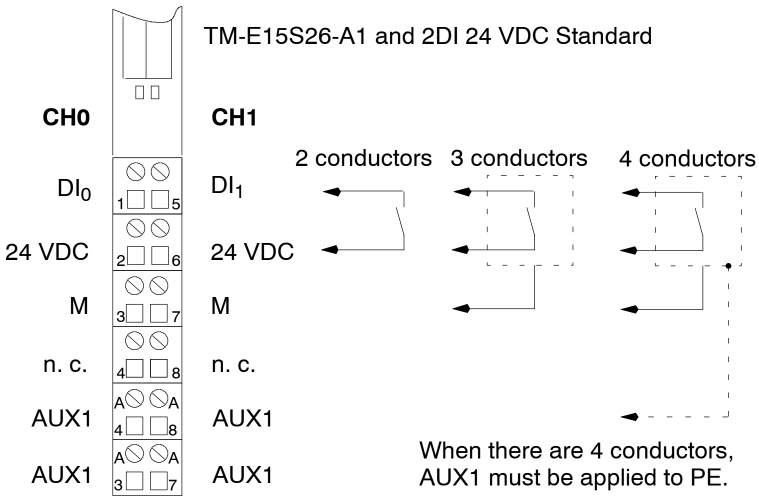
View	Terminal Assignment	Remarks
TM-E15S24-A1 and 2DI 24 VDC Standard  	When there are 4 conductors, AUX1 must be applied to PE.	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DI: Input signal 24 VDC: Sensor supply M: Ground, load power supply
TM-E15S24-01 and 2DI 24 VDC Standard  		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DI: Input signal 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 2DI 24 VDC Standard  		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 DI: Input signal 24 VDC: Sensor supply M: Ground, load power supply

Table 11-4 Terminal Assignment of the 2DI 24 VDC Standard, continued

View	Terminal Assignment	Remarks
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 DI: Input signal 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

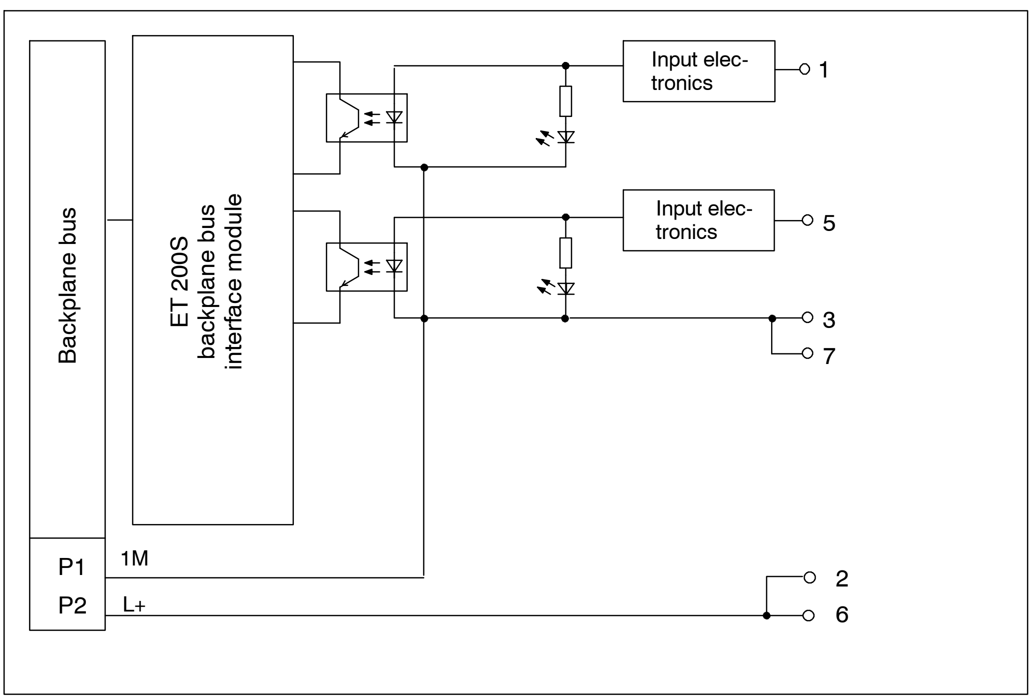


Figure 11-3 Block Diagram of the 2DI 24 VDC Standard

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 diffe-rence	
• 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 mo-dule	Typ. 0.4 W
Status, 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

11.3 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 11-5 Terminal Assignment of the 4DI 24 VDC Standard

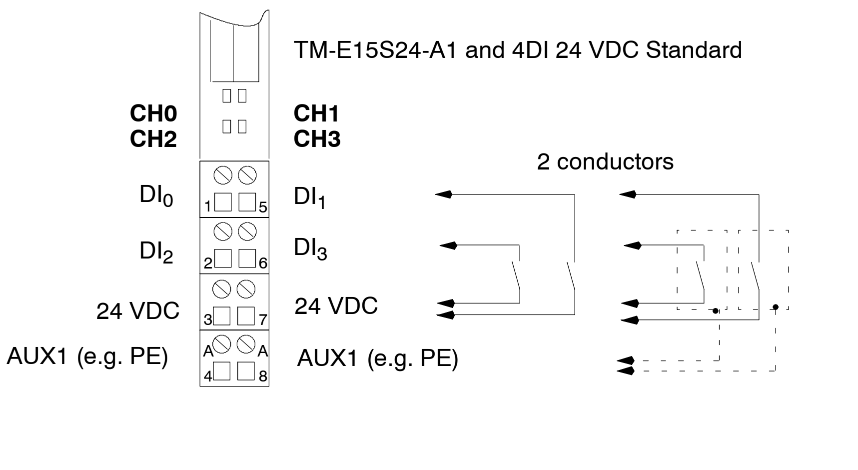
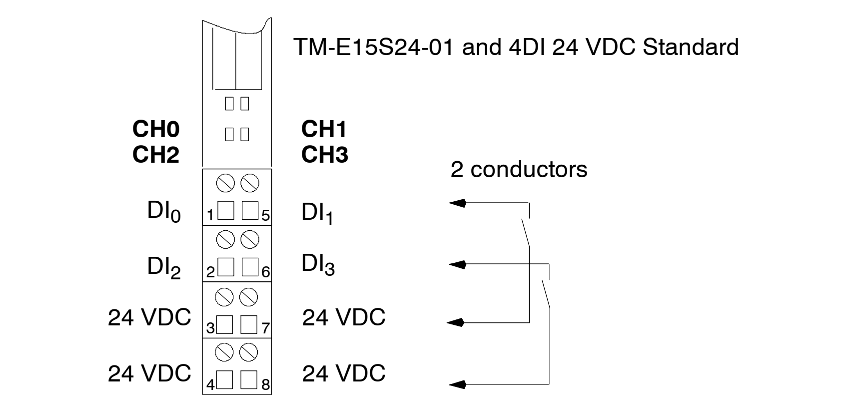
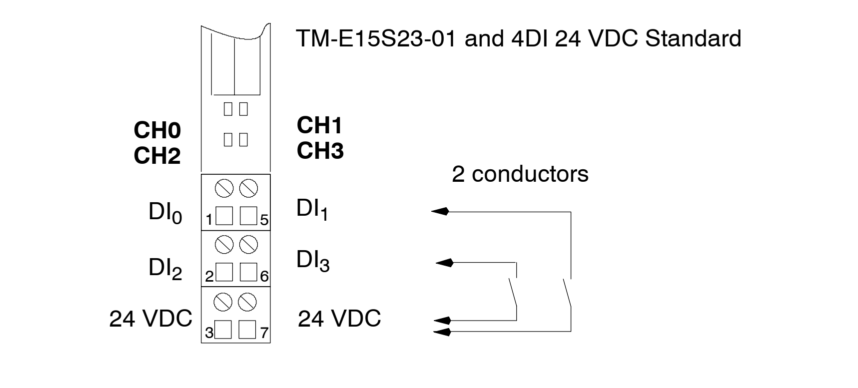
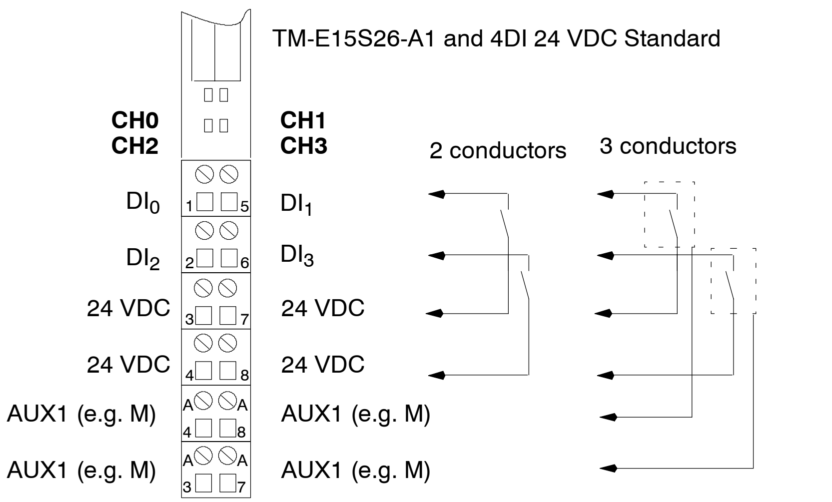
View	Terminal Assignment	Remarks
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal 24 VDC: Sensor supply
		Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 4 Channel 3: Terminals 6 and 8 DI: Input signal 24 VDC: Sensor supply
		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 11-5 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 4 Channel 3: Terminals 6 and 8 DI: Input signal 24 VDC: Sensor supply

Block Diagram

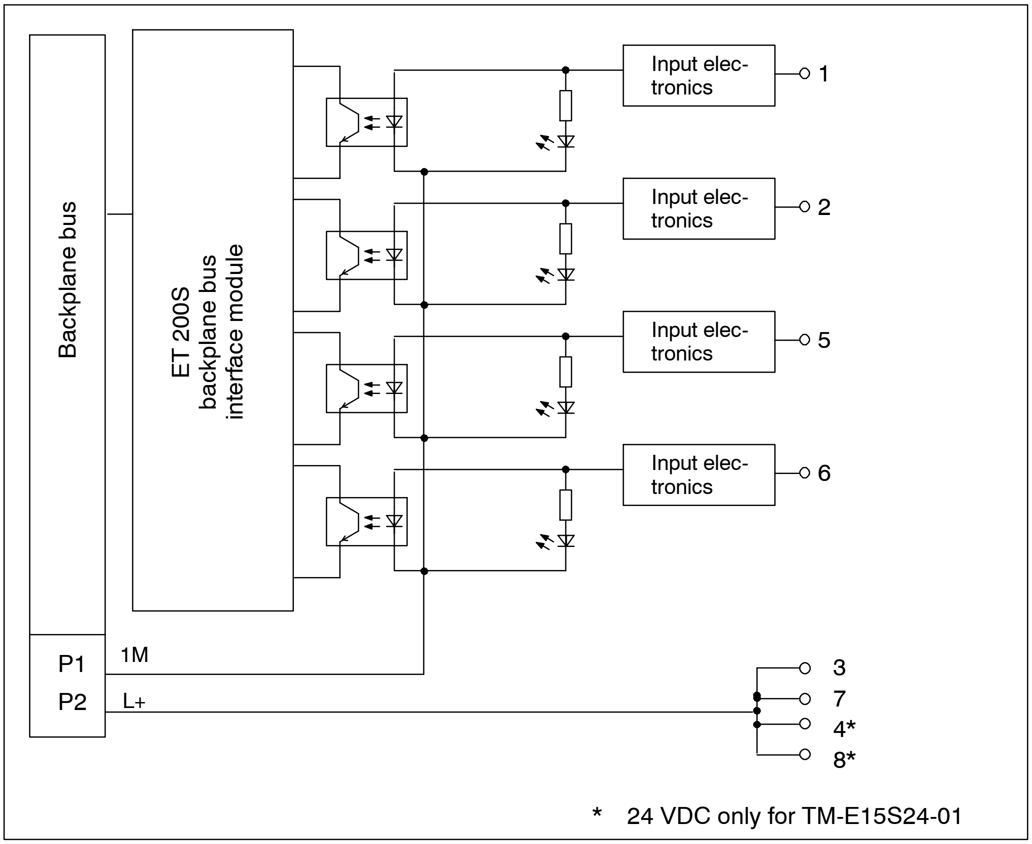


Figure 11-4 Block Diagram of the 4DI 24 VDC Standard

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, 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

11.4 4DI 24 VDC/SRC Standard Digital Electronic Module (6ES7131-4BD50-0AA0)

Order Number

6ES7131-4BD50-0AA0

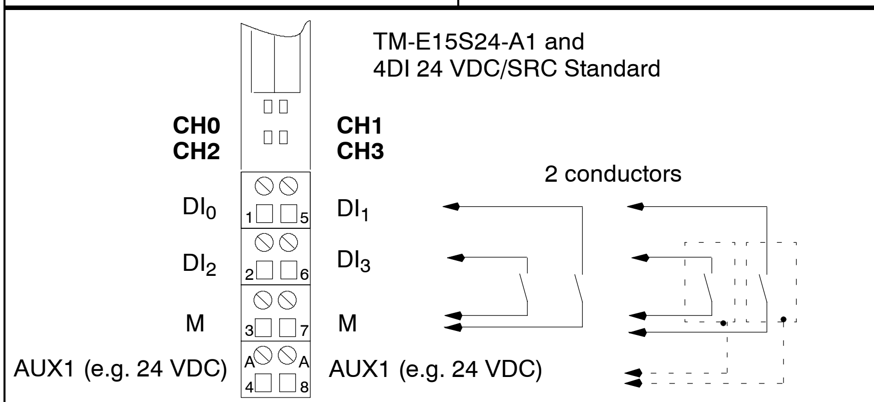
Features

- Digital electronic module with four inputs
- Source input
- Rated input voltage 24 VDC
- Suitable for switches and proximity switches (BEROs)

Terminal Assignment

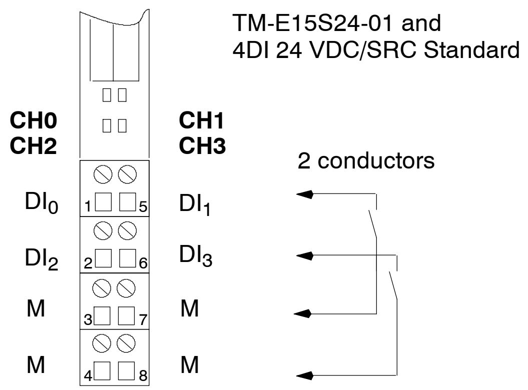
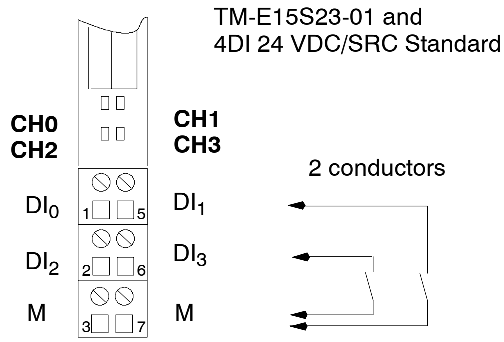
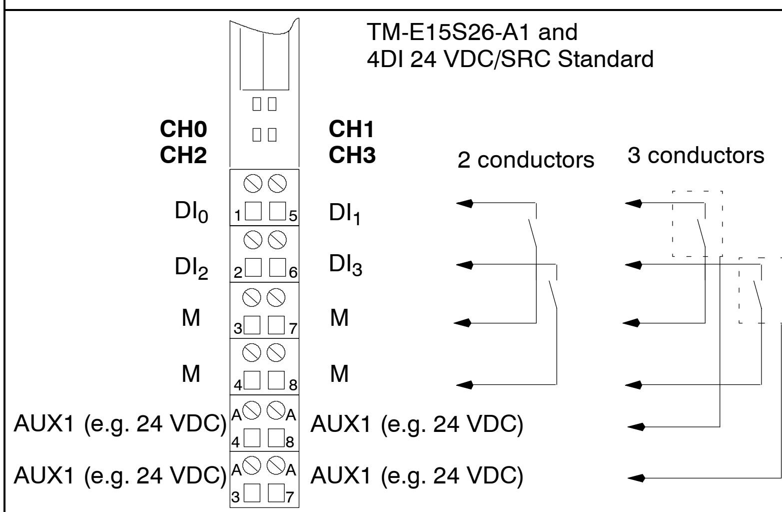
The following table indicates the terminal assignment of the 4DI 24 VDC/SRC Standard for the different terminal modules:

Table 11-6 Terminal Assignment of the 4DI 24 VDC/SRC Standard

<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr><td colspan="2">
</td><td>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</td></tr>
</table>

Table 11-6 Terminal Assignment of the 4DI 24 VDC/SRC Standard, 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 M: 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 M: 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 M: Sensor supply

Block Diagram

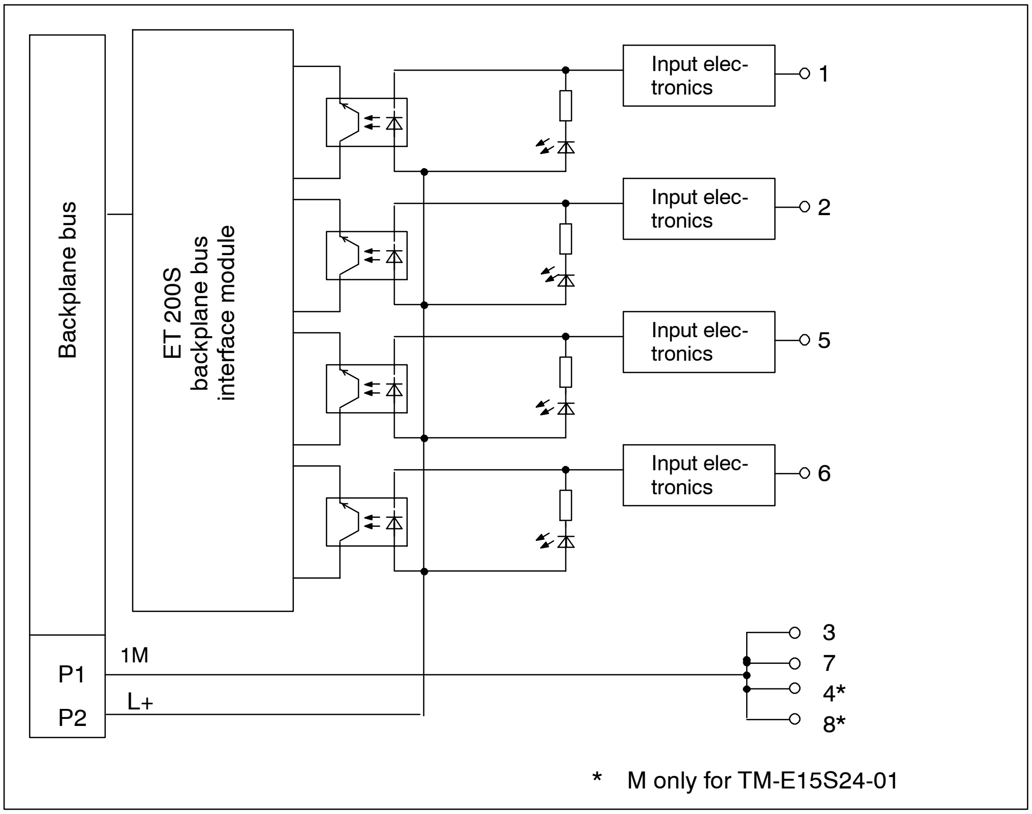


Figure 11-5 Block Diagram of the 4DI 24 VDC/SRC Standard

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 diffe-rence	
• 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 mo-dule	Typ. 0.7 W
Status, 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+

11.5 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)

Terminal Assignment

The following table illustrates the terminal assignment of the 2DI 24 VDC High Feature for the different terminal modules:

Table 11-7 Terminal Assignment of the 2DI 24 VDC High Feature

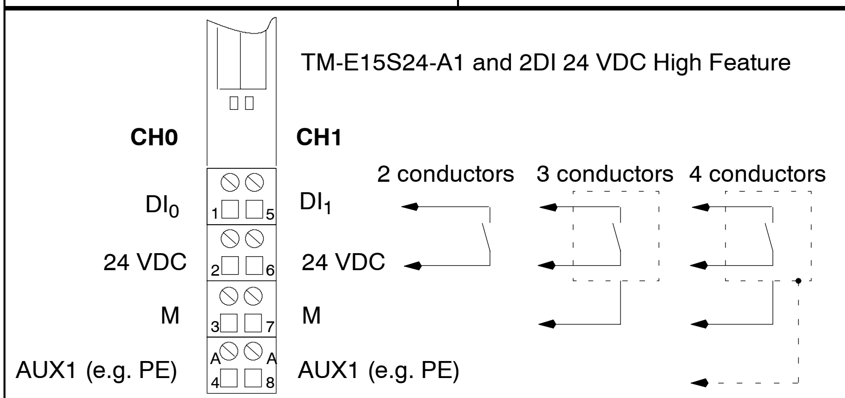
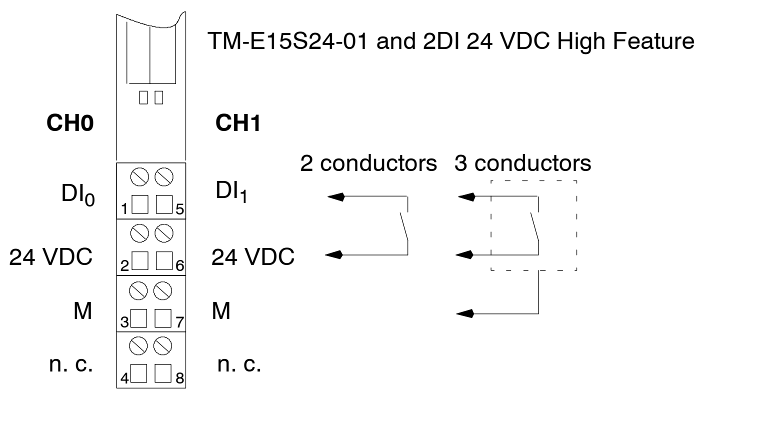
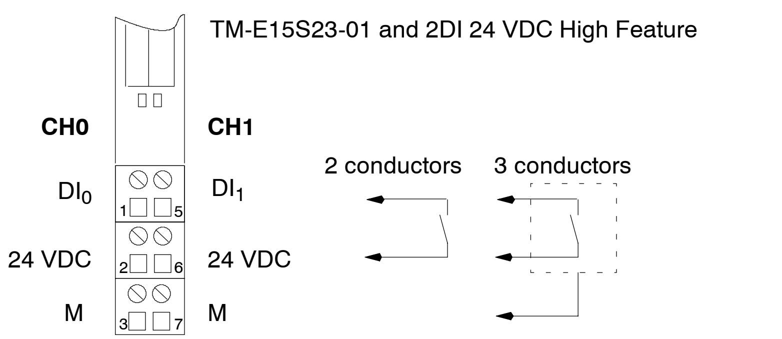
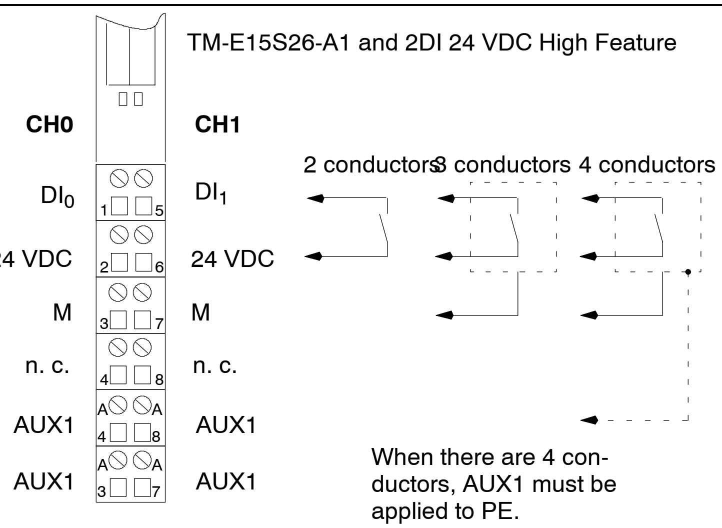
View	Terminal Assignment	Remarks
TM-E15S24-A1 and 2DI 24 VDC High Feature  	When there are 4 conductors, AUX1 must be applied to PE.	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DI: Input signal 24 VDC: Sensor supply M: Ground, load power supply

Table 11-7 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: Ground, load power supply 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: Ground, load power supply
		Channel 0: Terminals 1 to A3 Channel 1: Terminals 5 to A7 DI: Input signal 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

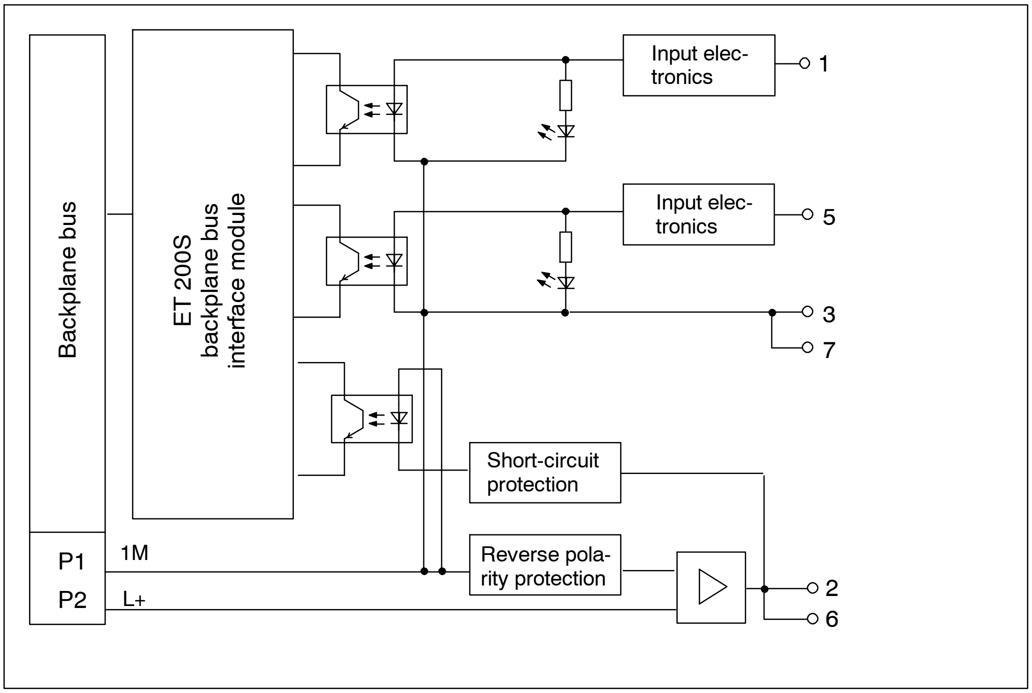


Figure 11-6 Block Diagram of the 2DI 24 VDC High Feature

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 35 g
Data for Specific Modules	
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 diffe-rence	
• 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, Diagnostics	
Status display	Green LED per chan-nel
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

11.6 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)

Terminal Assignment

The following table indicates the terminal assignment of the 4DI 24 VDC High Feature for the different terminal modules:

Table 11-8 Terminal Assignment of the 4DI 24 VDC High Feature

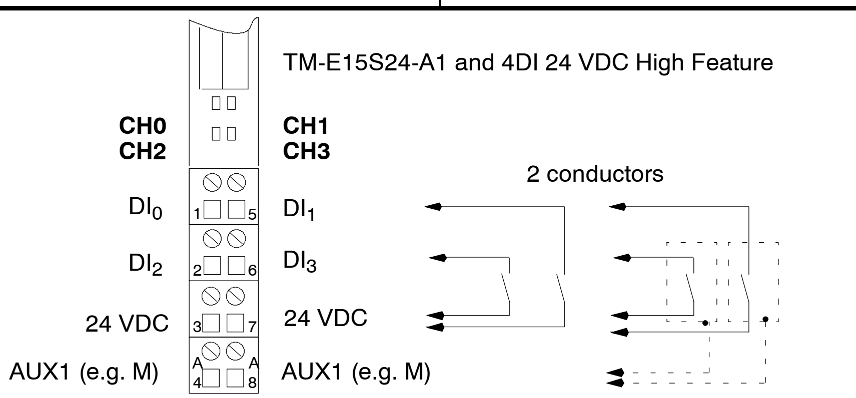
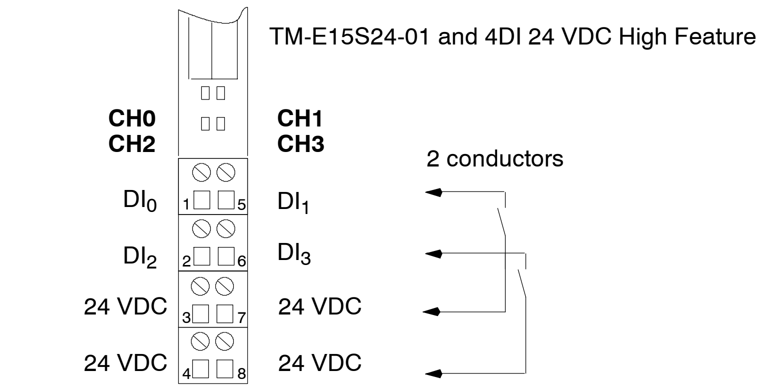
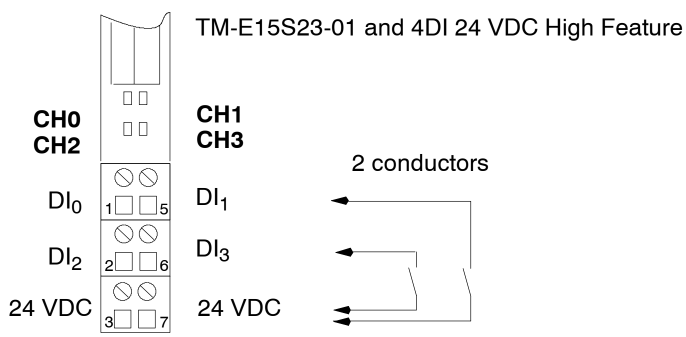
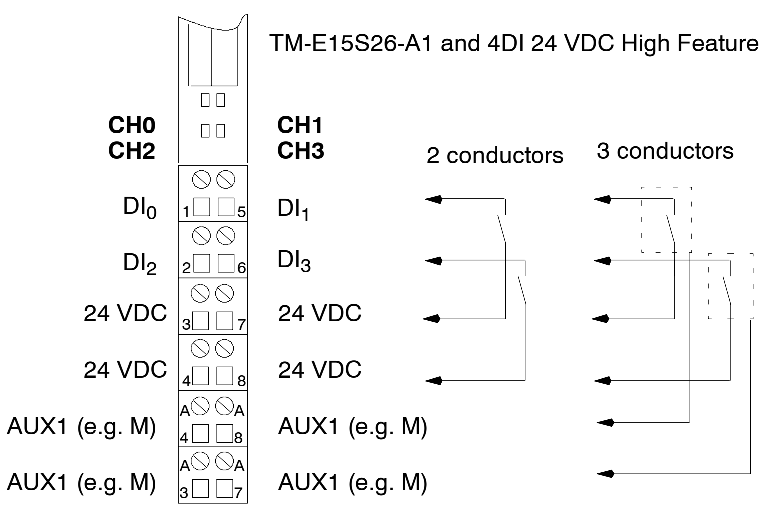
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 4DI 24 VDC High Feature	Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal 24 VDC: Sensor supply

Table 11-8 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

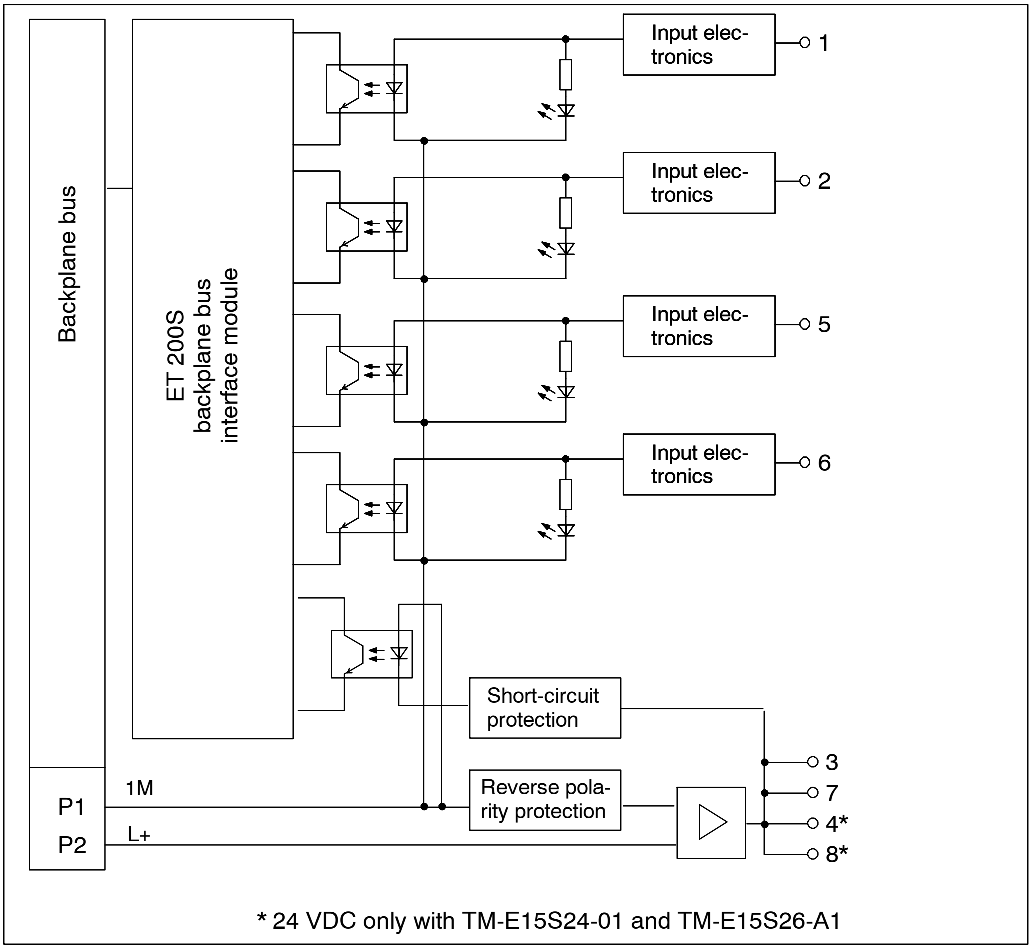


Figure 11-7 Block Diagram of the 4DI 24 VDC High Feature

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, Diagnostics	
Status display	Green LED per channel
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

11.7 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)

Terminal Assignment

The following table indicates the terminal assignment of the 4DI 24-48 VUC High Feature for the different terminal modules:

Table 11-9 Terminal Assignment of the 4DI 24-48 VUC High Feature

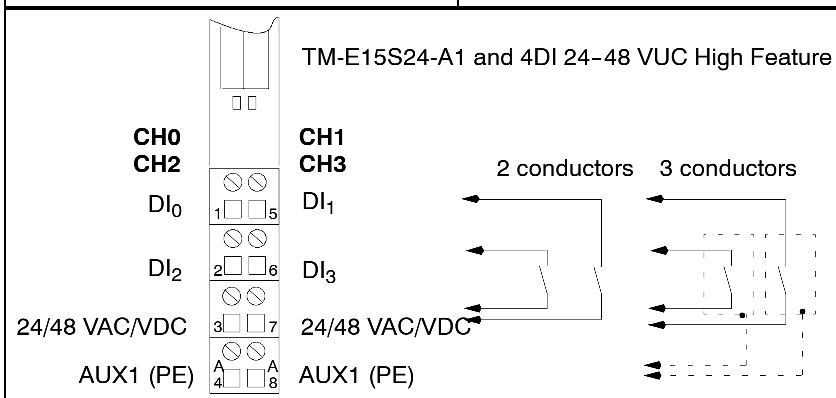
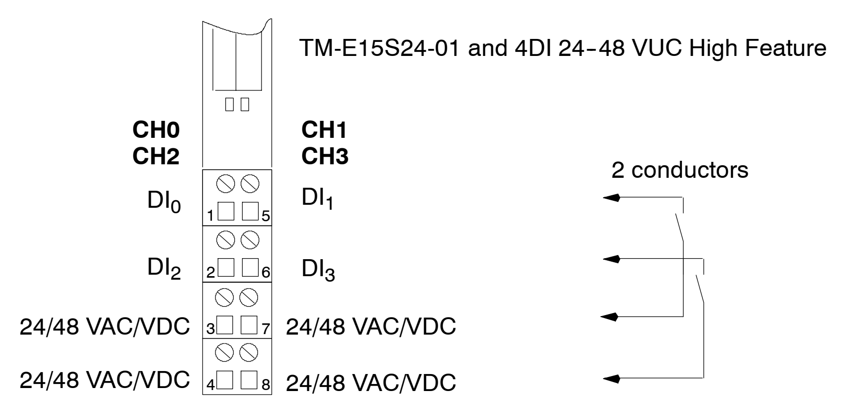
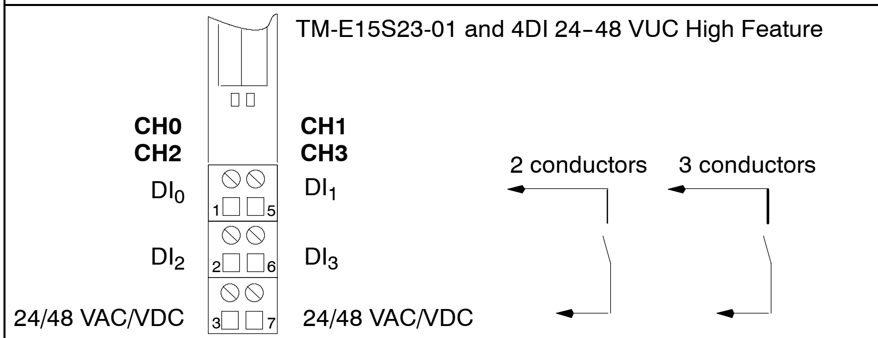
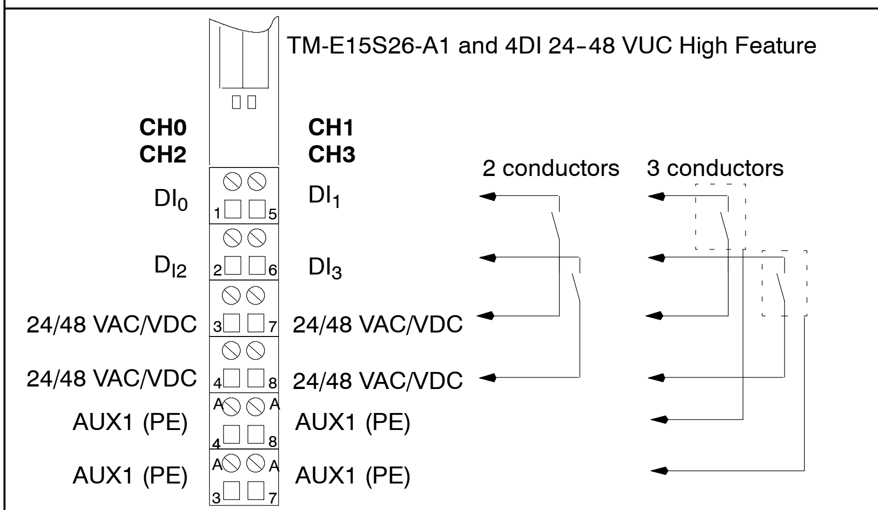
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 4DI 24-48 VUC High Feature	Channel 0: Terminals 1 and 3 Channel 1: Terminals 5 and 7 Channel 2: Terminals 2 and 3 Channel 3: Terminals 6 and 7 DI: Input signal 24 VDC sensor supply PE: Chassis ground

Table 11-9 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

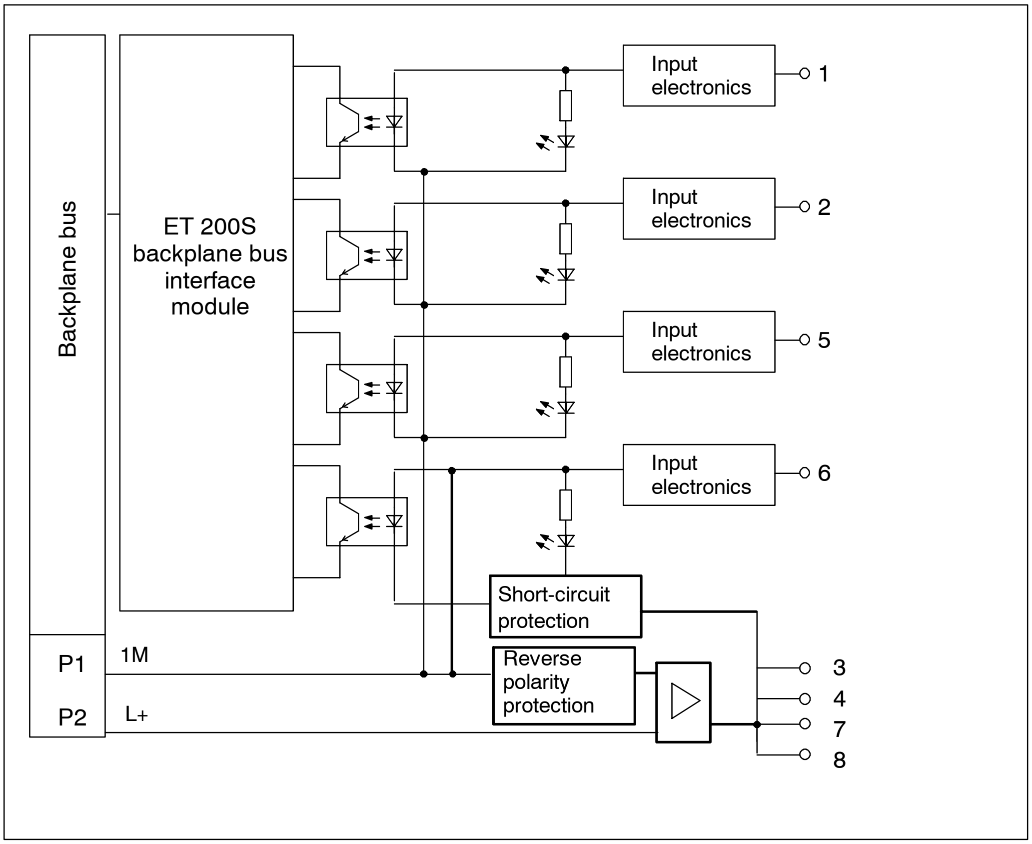


Figure 11-8 Block Diagram of the 4DI 24–48 VUC High Feature

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D	15 × 81 × 52 (mm)
Weight	Approx. 35 g
Data for Specific Modules	
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, 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	
• At signal “1”	From 4 mA to 10 mA
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.

11.8 4DI NAMUR Digital Electronic Module (6ES7131-4RD00-0AB0)

Order Number

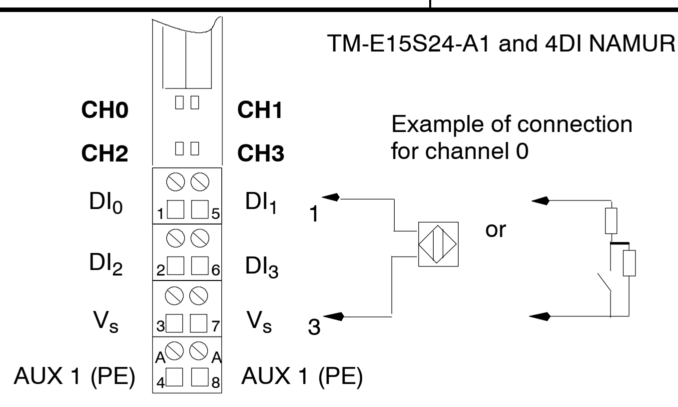
6ES7131-4RD00-0AB0

Features

- Digital electronic module with four inputs
- 8.2 VDC sensor supply
- Suitable for NAMUR sensors and both closed and open mechanical contacts

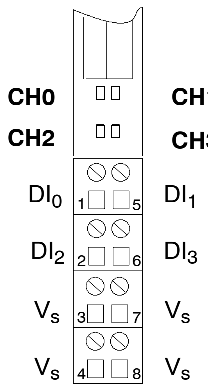
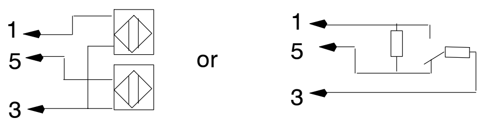
Terminal Assignment of NAMUR Sensors and Sensors to DIN 19234

Table 11-10 Terminal Assignment of NAMUR Sensors and Sensors to DIN 19234

View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 4DI NAMUR Example of connection for channel 0	**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

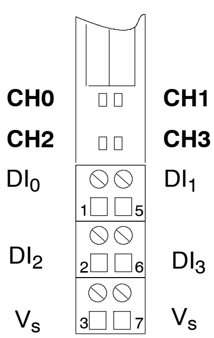
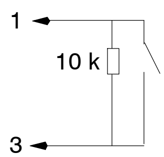
Terminal Assignment of NAMUR Changeover Contacts and Sensors to DIN 19234

Table 11-11 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

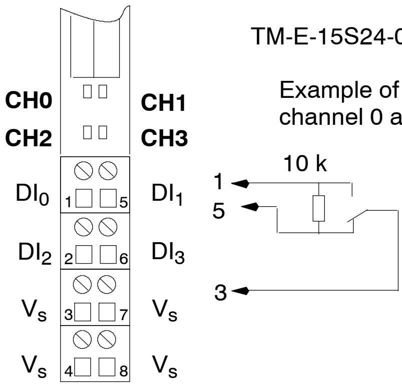
Terminal Assignment of a Single, Closed Contact with 10 kΩ (Mechanical Normally Open Contact)

Table 11-12 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

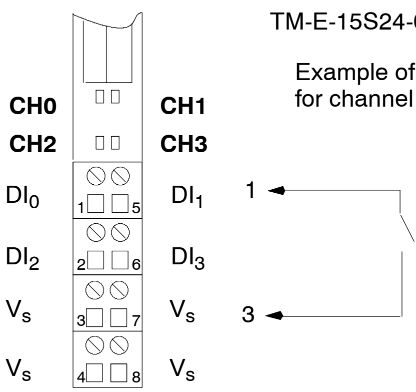
Terminal Assignment of a Closed Changeover Contact with 10 kΩ (Mechanical Changeover Contact)

Table 11-13 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

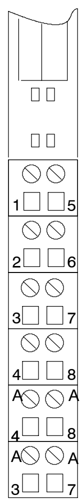
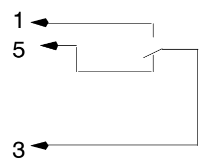
Terminal Assignment of an Open Single Contact (Mechanical Normally Open Contact with Single Contact)

Table 11-14 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 11-15 Terminal Assignment of an Open Changeover Contact (Mechanical Changeover Contact)

View	Terminal Assignment	Remarks
	TM-E-15S26-A1 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

Block Diagram

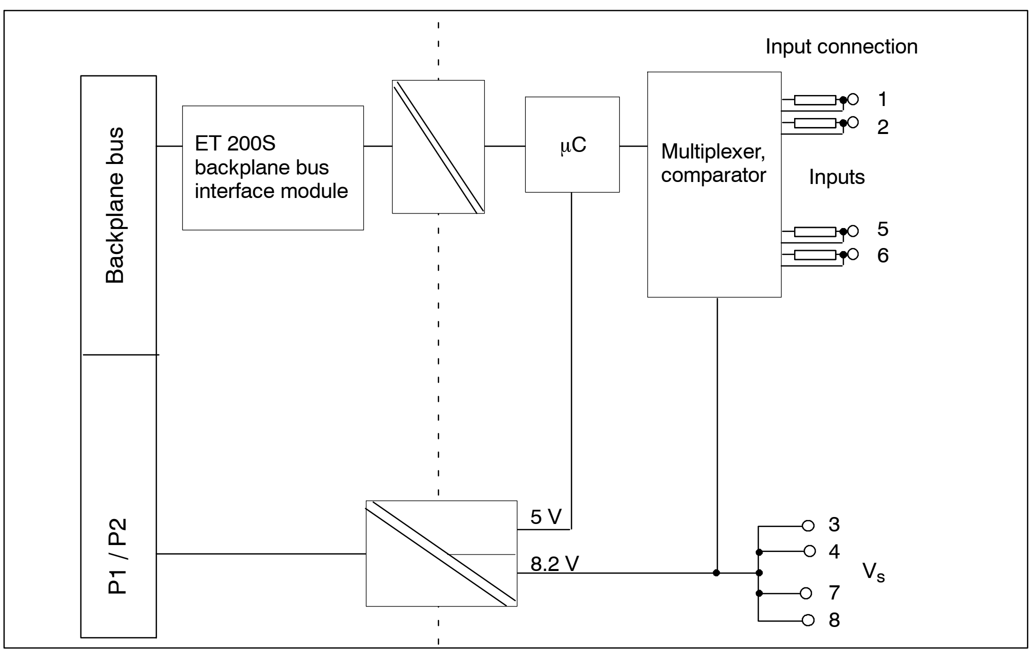


Figure 11-9 Block Diagram of the 4DI NAMUR

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, Diagnostics	
Status display	Green LED per channel
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*
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

* Only for NAMUR sensors and closed contacts.

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).

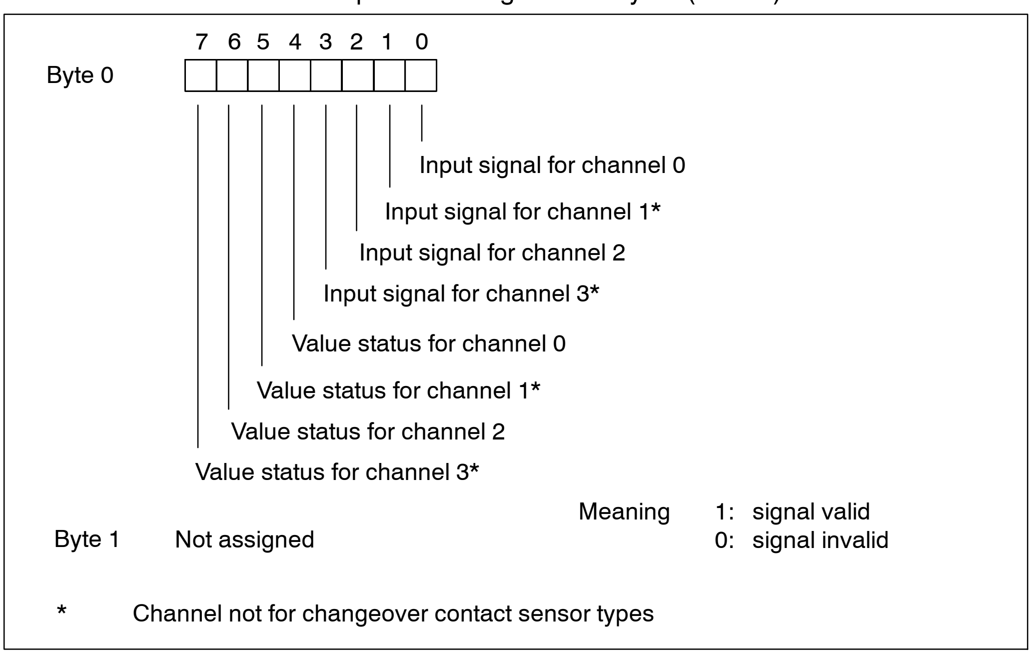


Figure 11-10 Assignment in the Process Input Image for 4DI NAMUR

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 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 11-16 Diagnosis for Changeover Contacts

<table>
<tr><th>Changeover Contact</th><th colspan="2">A Negative Check Means...</th></tr>
<tr><td>Changeover contact as NAMUR</td><td>• Short circuit or
• Wire break</td><td rowspan="3">Additionally:
Changeover contact error or external fault (in the case of DP diagnosis)</td></tr>
<tr><td>Closed changeover contact</td><td>• Defective sensor or short circuit
No distinction can be made here between a defective sensor and short circuit</td></tr>
<tr><td>Open changeover contact</td><td>Important: No distinction is possible between
• Signal “0” and wire break
• Signal “1” and short circuit</td></tr>
</table>

11.9 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 11-17 Terminal Assignment of the 2DI 120 VAC Standard

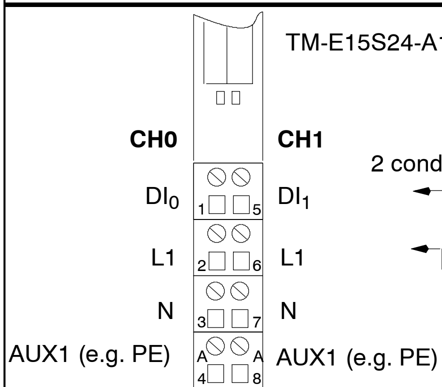
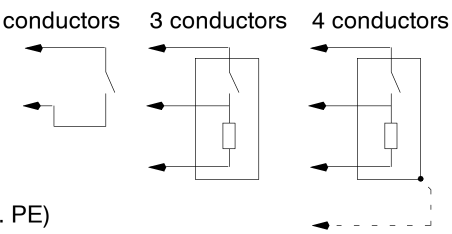
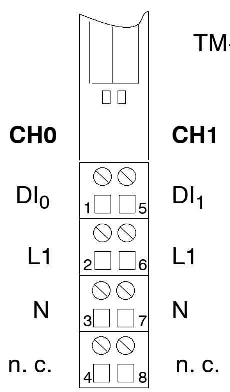
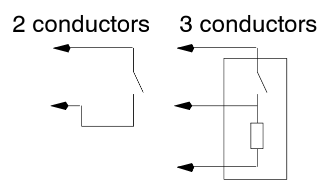
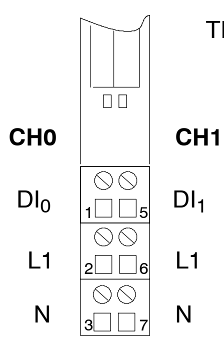
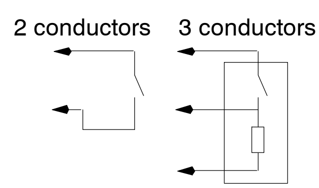
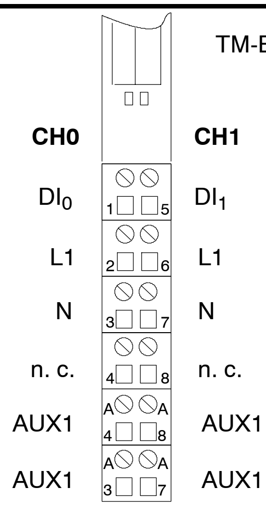
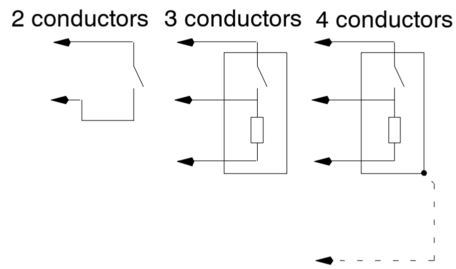
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 2DI 120 VAC Standard  When there are 4 conductors, the AUX1 bus must be applied to PE.	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DI: Input signal L1: Sensor supply N: Neutral conductor
	TM-E15S24-01 and 2DI 120 VAC Standard 	Channel 0: 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.
	TM-E15S23-01 and 2DI 120 VAC Standard 	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DI: Input signal L1: Sensor supply N: Neutral conductor

Table 11-17 Terminal Assignment of the 2DI 120 VAC Standard, continued

View	Terminal Assignment	Remarks
	TM-E15S26-A1 and 2DI 120 VAC Standard  When there are 4 conductors, the AUX1 bus must be applied to PE.	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

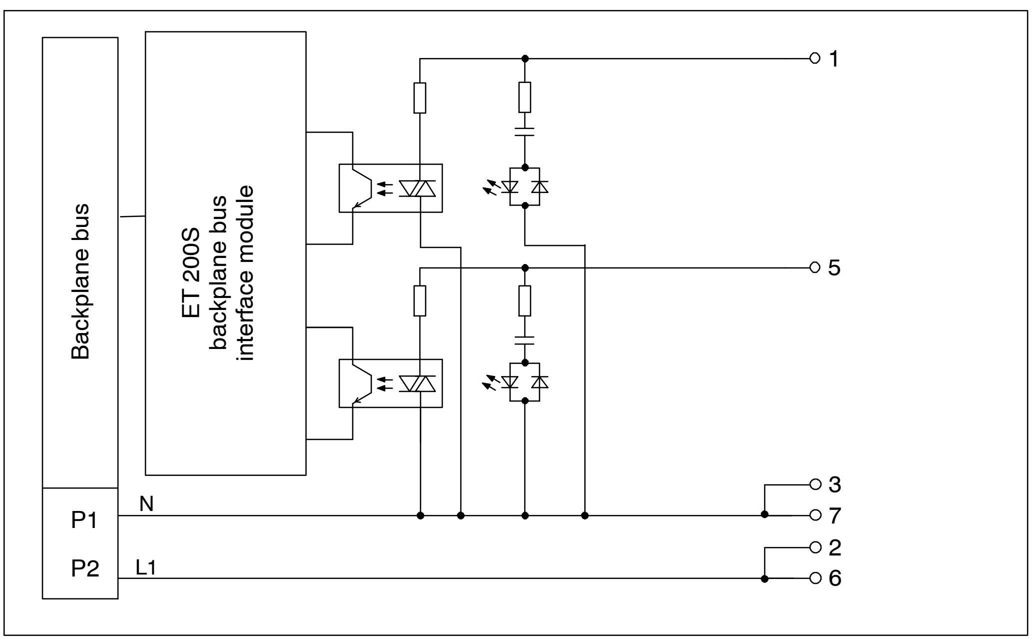


Figure 11-11 Block Diagram of the 2DI 120 VAC Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 31 g
Data for Specific Modules	
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, 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

11.10 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 11-18 Terminal Assignment of the 2DI 230 VAC Standard

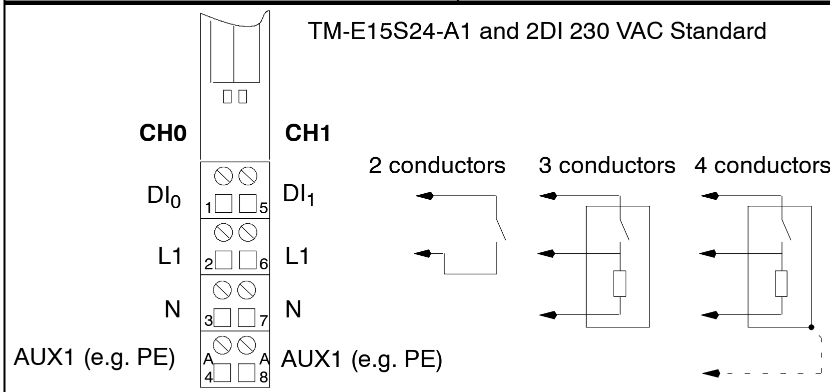
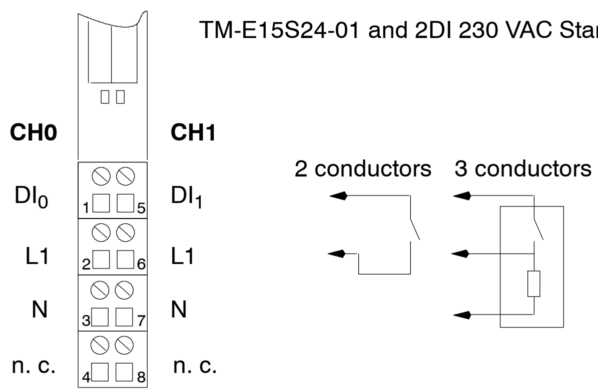
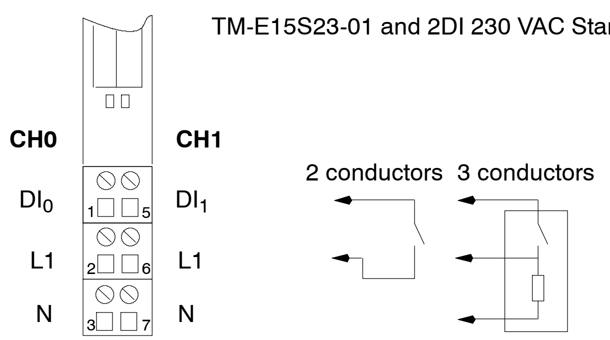
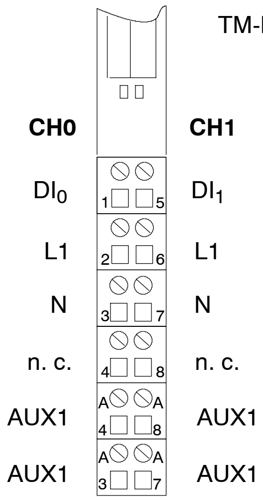
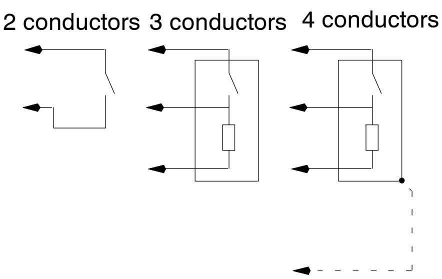
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 2DI 230 VAC Standard When there are 4 conductors, AUX1 must be applied to PE.	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DI: Input signal L1: Sensor supply N: Neutral conductor
	TM-E15S24-01 and 2DI 230 VAC Standard	Channel 0: Terminals 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.
	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

Table 11-18 Terminal Assignment of the 2DI 230 VAC Standard, continued

View	Terminal Assignment	Remarks
	TM-E15S26-A1 and 2DI 230 VAC Standard  When there are 4 conductors, AUX1 must be applied to PE.	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

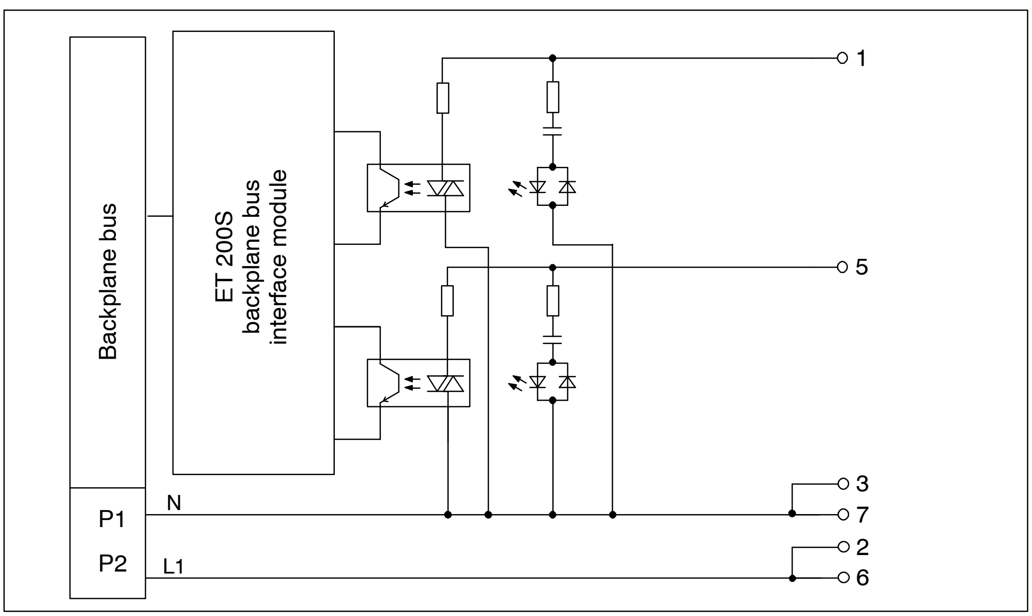


Figure 11-12 Block Diagram of the 2DI 230 VAC Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 31 g
Data for Specific Modules	
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, 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

11.11 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

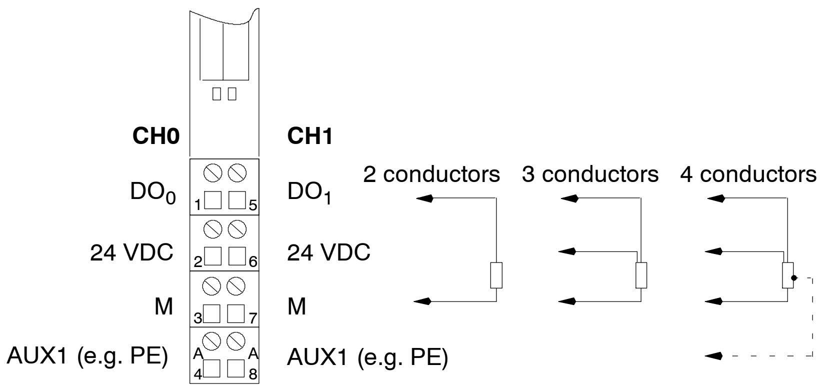
Peculiarity

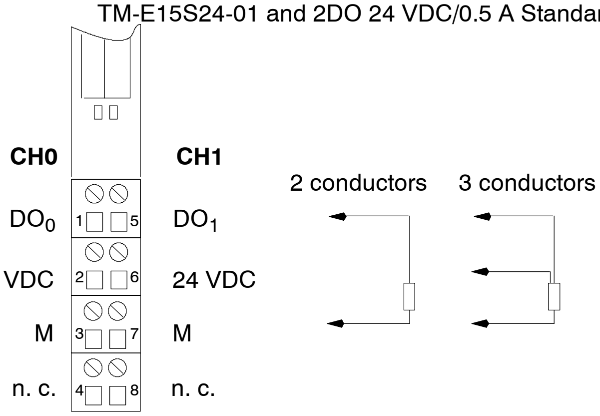
When you connect the 24 VDC rated load voltage to the power module by means of a mechanical contact, depending on the circuit, the digital outputs carry the “1” signal for approximately 50 μs. You need to take this into account if you connect the module to fast counters.

Terminal Assignment

The following table indicates the terminal assignment of the 2DO 24 VDC, 0.5 A Standard for the different terminal modules:

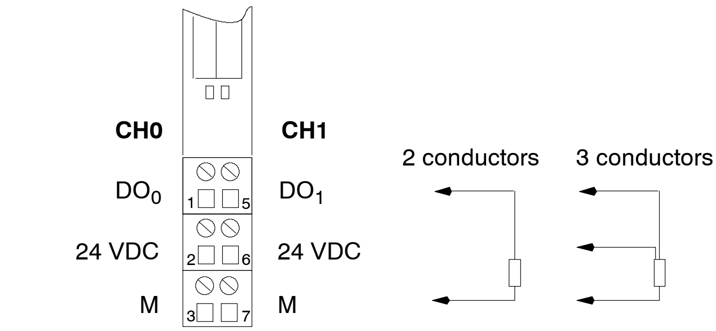
Table 11-19 Terminal Assignment of the 2DO 24 VDC/0.5 A Standard

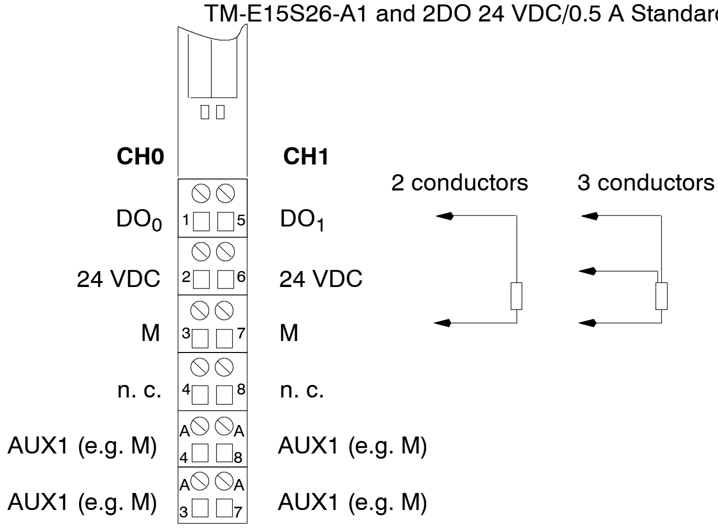
<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr><td colspan="2">TM-E15S24-A1 and 2DO 24 VDC/0.5 A Standard

When there are 4 conductors, AUX1 must be applied to PE.</td><td>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</td></tr>
<tr><td colspan="2">TM-E15S24-01 and 2DO 24 VDC/0.5 A Standard
</td><td>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.</td></tr>
</table>

Table 11-19 Terminal Assignment of the 2DO 24 VDC/0.5 A Standard, continued

<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr><td colspan="2">TM-E15S23-01 and 2DO 24 VDC/0.5 A Standard
</td><td>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</td></tr>
<tr><td colspan="2">TM-E15S26-A1 and 2DO 24 VDC/0.5 A Standard
</td><td>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.</td></tr>
</table>

Block Diagram

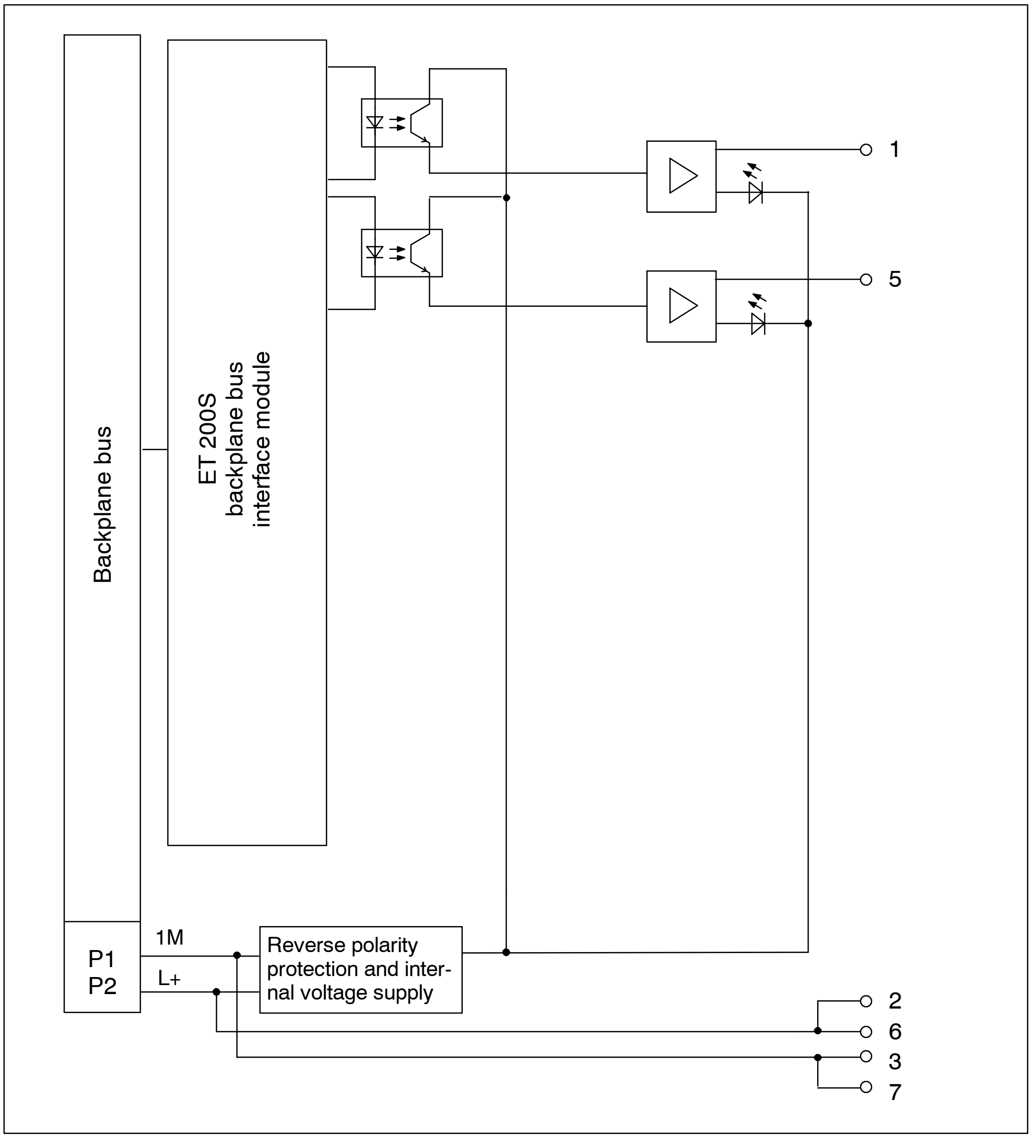


Figure 11-13   Block Diagram of the 2DO 24 VDC/0.5 A Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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

11.12 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

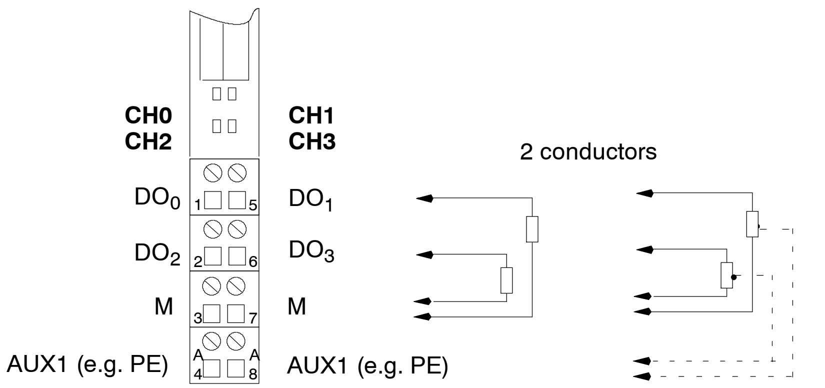
Peculiarity

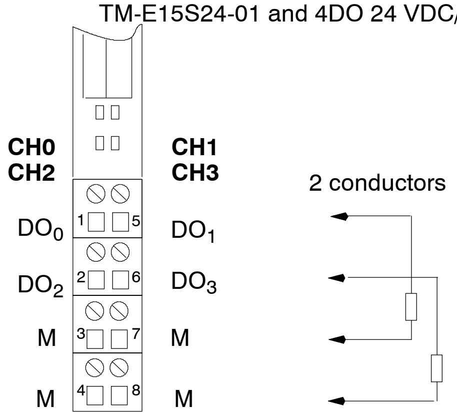
When you connect the 24 VDC rated load voltage to the power module by means of a mechanical contact, depending on the circuit, the digital outputs carry the “1” signal for approximately 50 μs. You need to take this into account if you connect the module to fast counters.

Terminal Assignment

The following table indicates the terminal assignment of the 4DO 24 VDC, 0.5 A Standard for the different terminal modules:

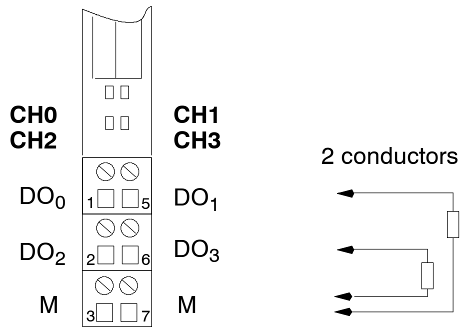
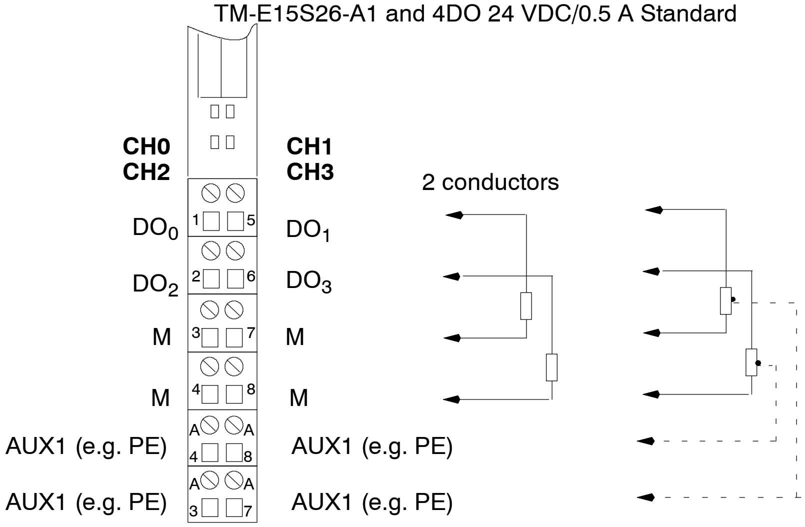
Table 11-20 Terminal Assignment of the 4DO 24 VDC/0.5 A Standard

<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr><td colspan="2">TM-E15S24-A1 and 4DO 24 VDC/0.5 A Standard

</td><td>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</td></tr>
<tr><td colspan="2">TM-E15S24-01 and 4DO 24 VDC/0.5 A Standard

</td><td>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</td></tr>
</table>

Table 11-20 Terminal Assignment of the 4DO 24 VDC/0.5 A Standard, continued

View	Terminal Assignment	Remarks
TM-E15S23-01 and 4DO 24 VDC/0.5 A 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 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 		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

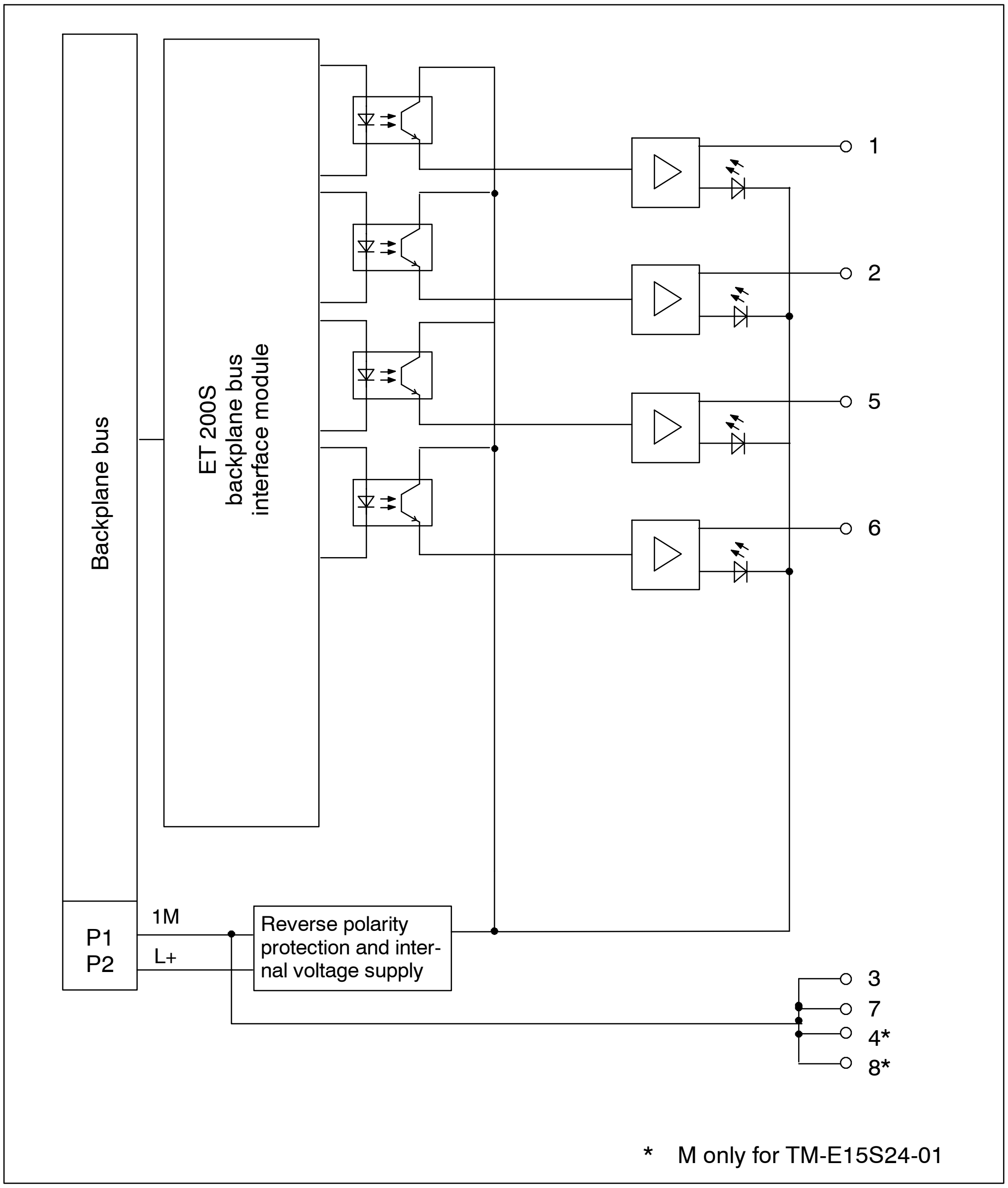


Figure 11-14 Block Diagram of the 4DO 24 VDC/0.5 A Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for Specific Modules	
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 diffe-rence	
• 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, 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

11.13 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

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 11-21 Terminal Assignment of the 2DO 24 VDC/0.5 A High Feature

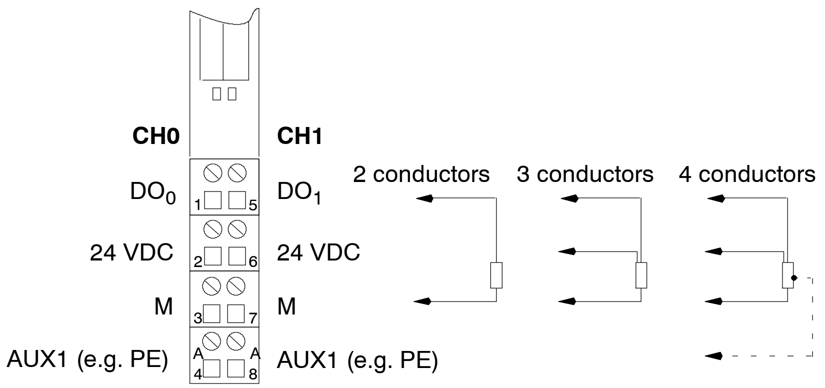
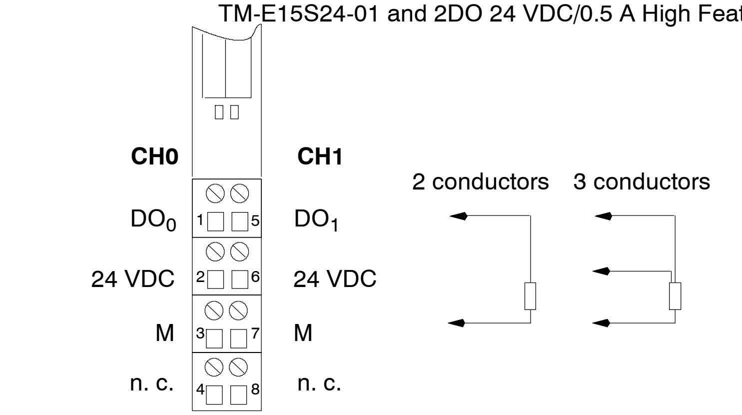
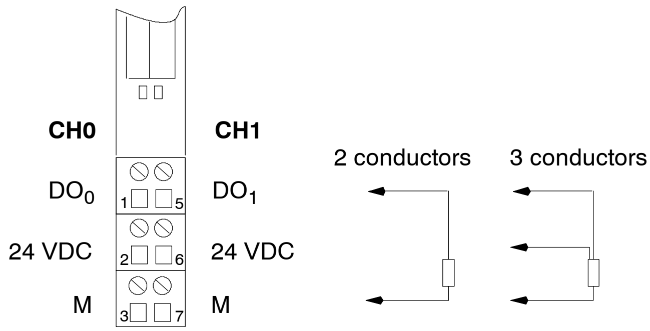
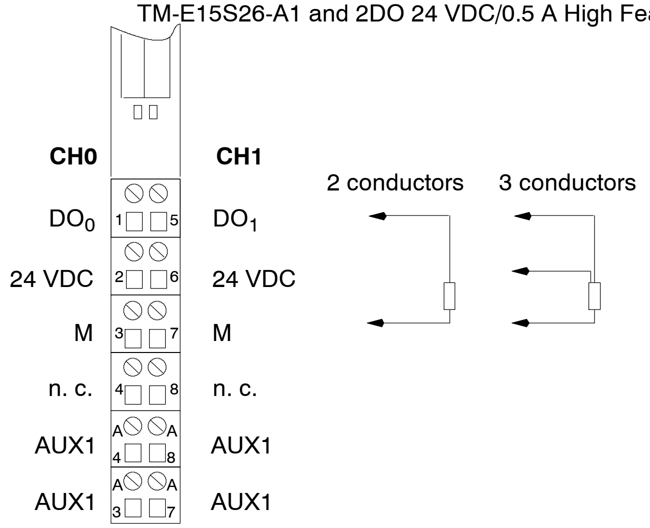
View / Terminal Assignment	Remarks
TM-E15S24-A1 and 2DO 24 VDC/0.5 A High Feature  When there are 4 conductors, AUX1 must be applied to PE.	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DO: Output signal (maximum 0.5 A per channel) 24 VDC: Sensor supply M: Ground, load power supply
TM-E15S24-01 and 2DO 24 VDC/0.5 A High Feature 	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.

Table 11-21 Terminal Assignment of the 2DO 24 VDC/0.5 A High Feature, continued

<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr><td colspan="2">TM-E15S23-01 and 2DO 24 VDC/0.5 A High Feature

</td><td>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</td></tr>
<tr><td colspan="2">TM-E15S26-A1 and 2DO 24 VDC/0.5 A High Feature

</td><td>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.</td></tr>
</table>

Block Diagram

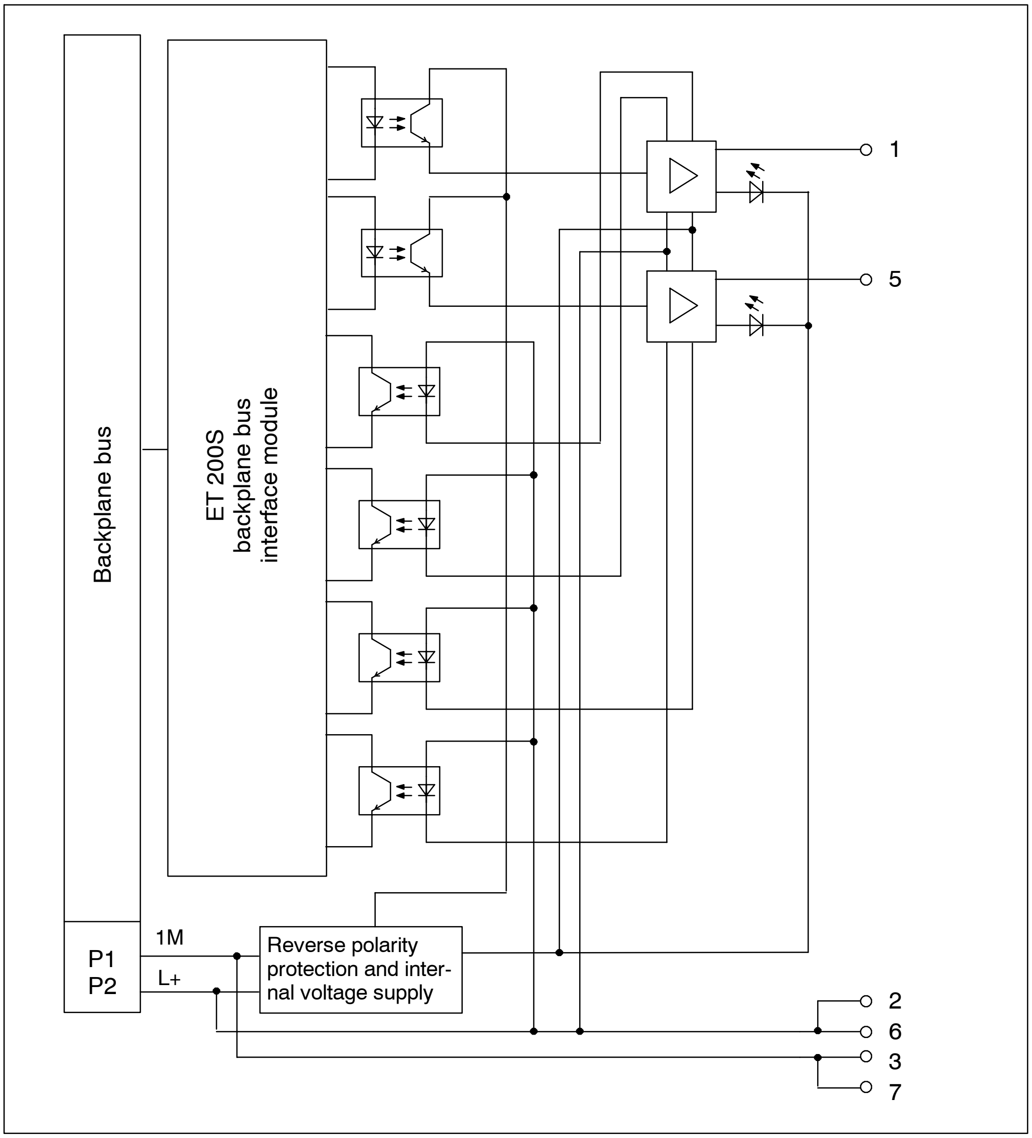


Figure 11-15 Block Diagram of the 2DO 24 VDC/0.5 A High Feature

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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

11.14 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

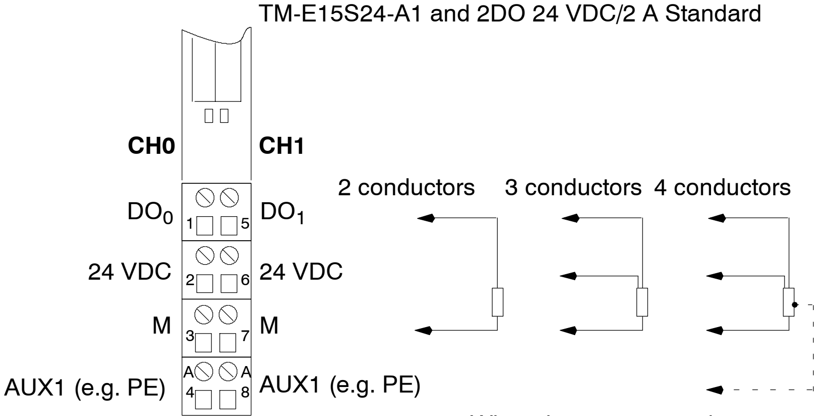
Peculiarity

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.

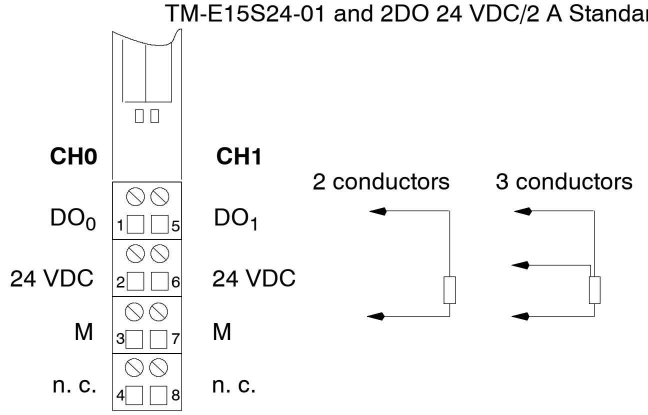
Terminal Assignment

The following table indicates the terminal assignment of the 2DO 24 VDC, 2 A Standard for the different terminal modules:

Table 11-22 Terminal Assignment of the 2DO 24 VDC/2 A Standard

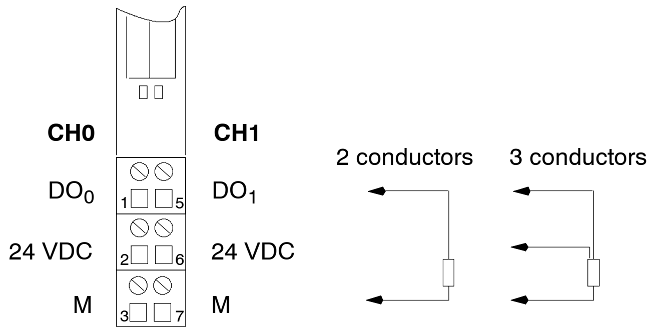
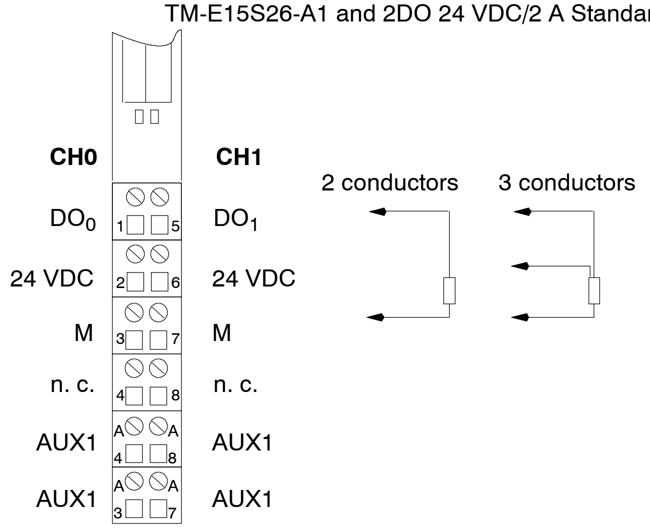
<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr><td colspan="2">TM-E15S24-A1 and 2DO 24 VDC/2 A Standard


When there are 4 conductors, AUX1 must be applied to PE.</td><td>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</td></tr>
<tr><td colspan="2">TM-E15S24-01 and 2DO 24 VDC/2 A Standard

</td><td>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.</td></tr>
</table>

Table 11-22 Terminal Assignment of the 2DO 24 VDC/2 A Standard, continued

View	Terminal Assignment	Remarks
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

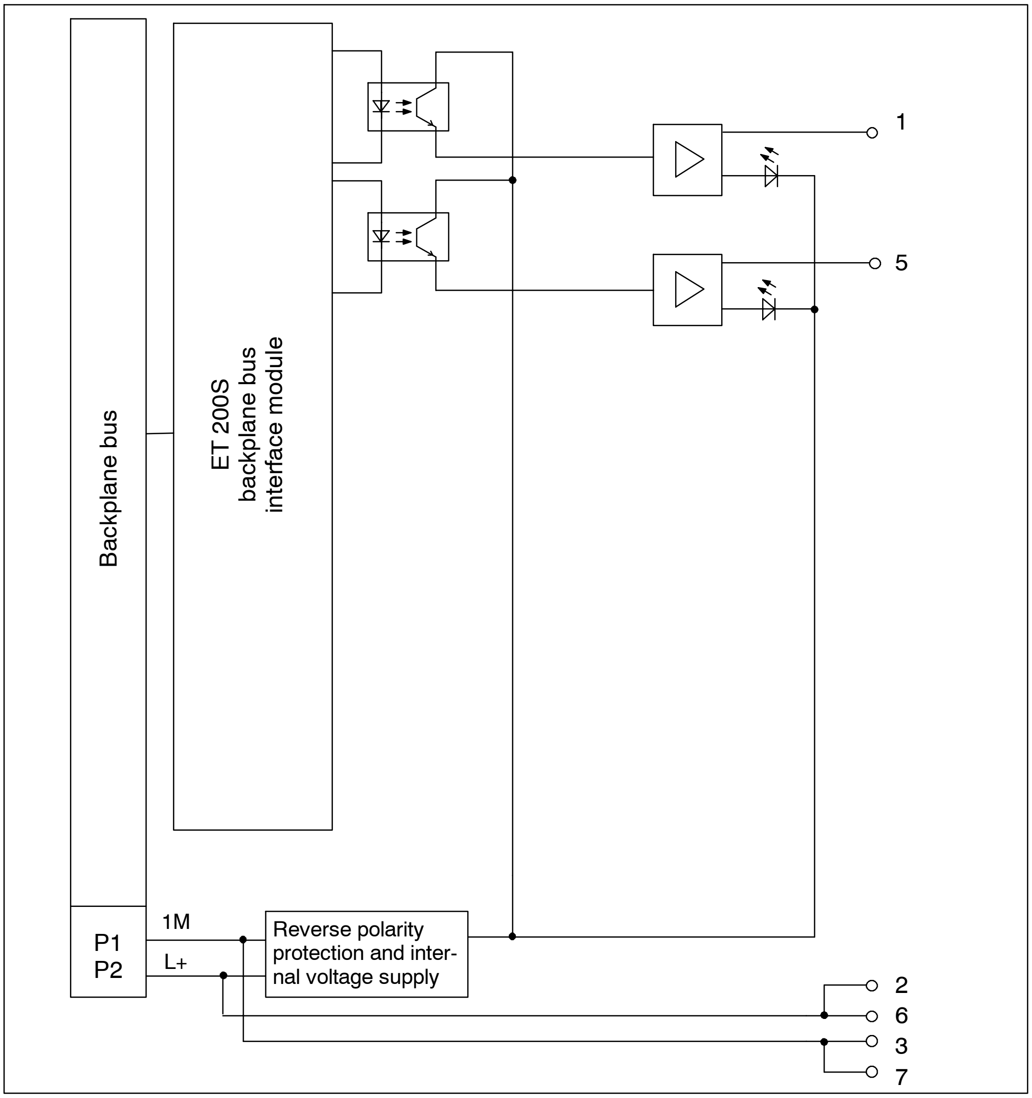


Figure 11-16 Block Diagram of the 2DO 24 VDC/2 A Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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

11.15 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

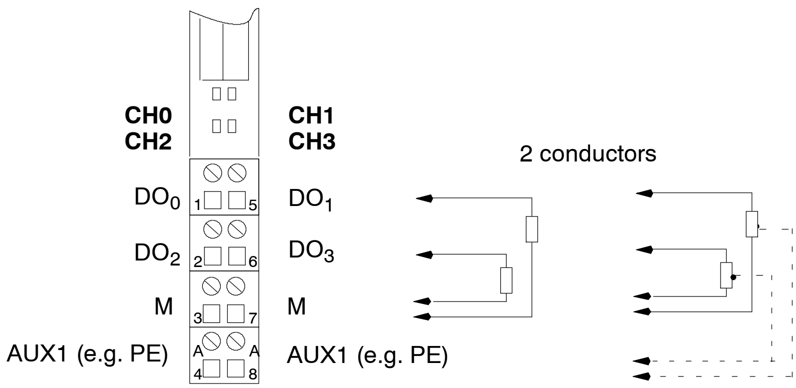
Peculiarity

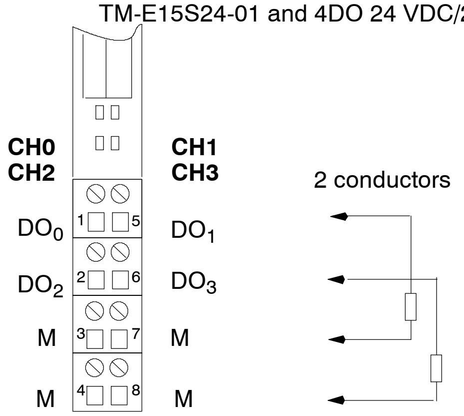
When you connect the 24 VDC rated load voltage to the power module by means of a mechanical contact, depending on the circuit, the digital outputs carry the “1” signal for approximately 50 μs. You need to take this into account if you connect the module to fast counters.

Terminal Assignment

The following table indicates the terminal assignment of the 4DO 24 VDC, 2 A Standard for the different terminal modules:

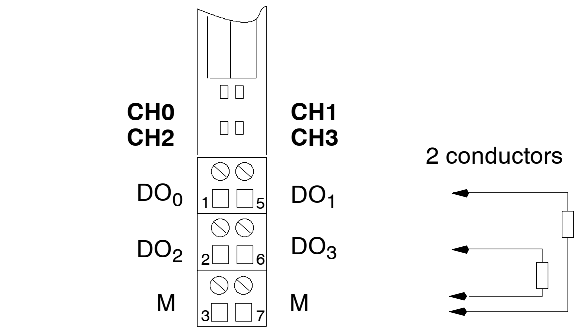
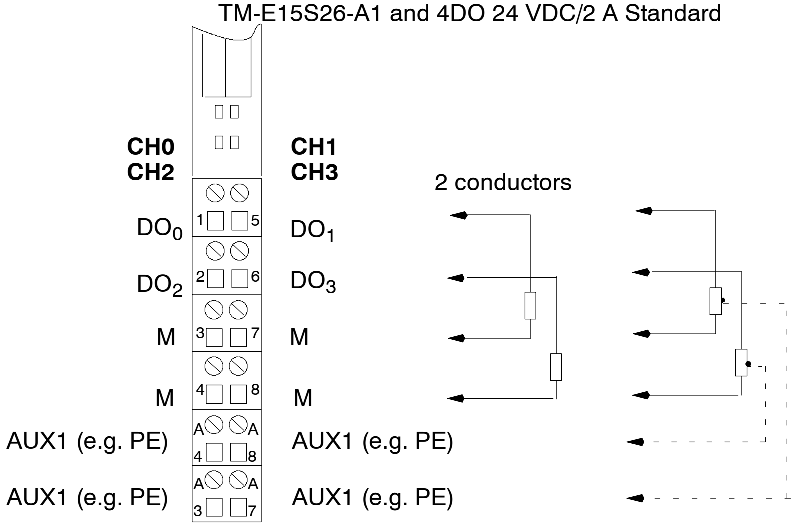
Table 11-23 Terminal Assignment of the 4DO 24 VDC/2 A Standard

<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr><td colspan="2">TM-E15S24-A1 and 4DO 24 VDC/2 A Standard
</td><td>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</td></tr>
<tr><td colspan="2">TM-E15S24-01 and 4DO 24 VDC/2 A Standard
</td><td>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</td></tr>
</table>

Table 11-23 Terminal Assignment of the 4DO 24 VDC/2 A Standard, continued

View	Terminal Assignment	Remarks
TM-E15S23-01 and 4DO 24 VDC/2 A 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 DO: Output signal (maximum 2 A per channel) M: Ground, load power supply
TM-E15S26-A1 and 4DO 24 VDC/2 A 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 DO: Output signal (maximum 2 A per channel) M: Ground, load power supply

Block Diagram

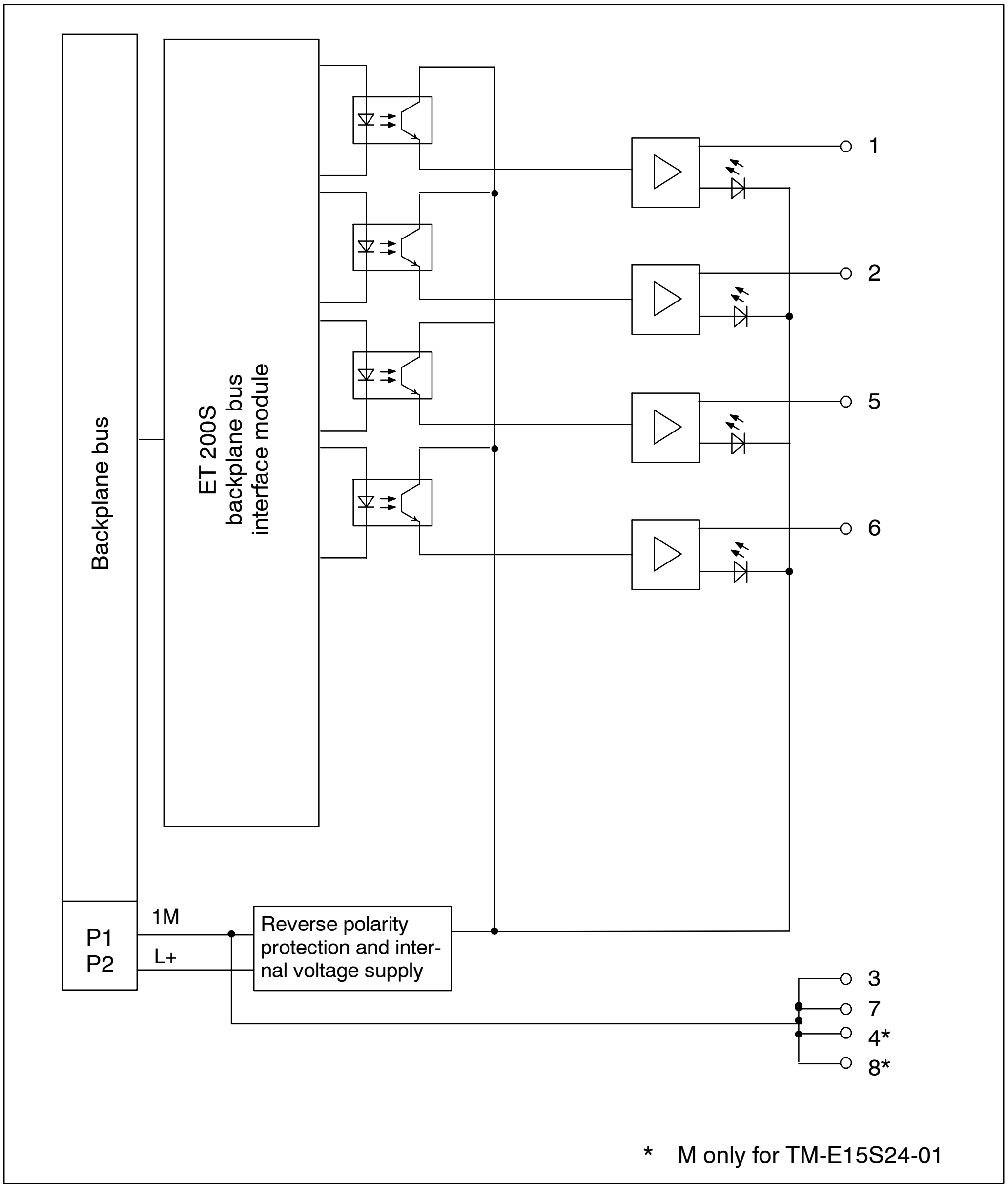


Figure 11-17 Block Diagram of the 4DO 24 VDC/2 A Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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

11.16 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

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 11-24 Terminal Assignment of the 2DO 24 VDC/2 A High Feature

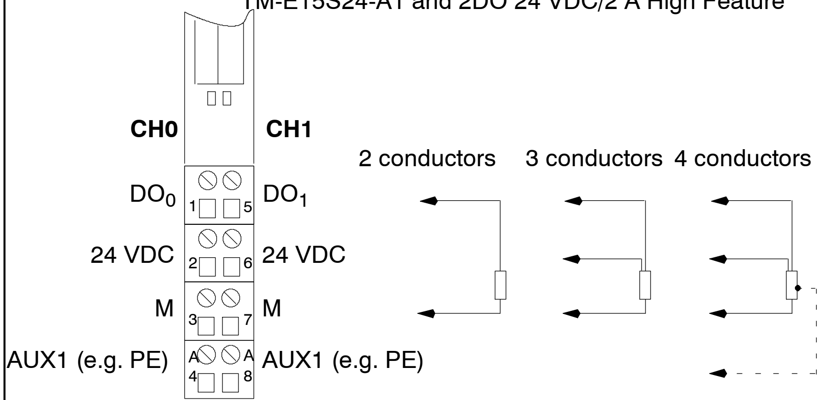
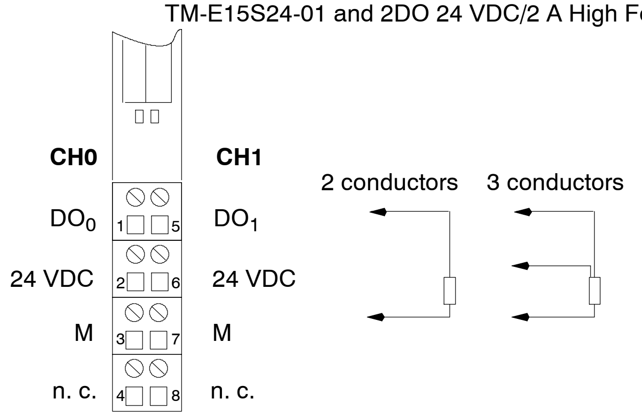
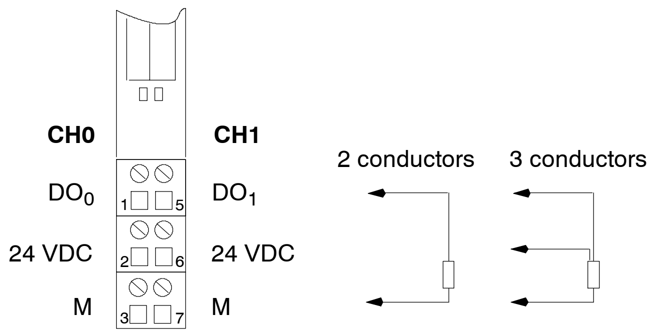
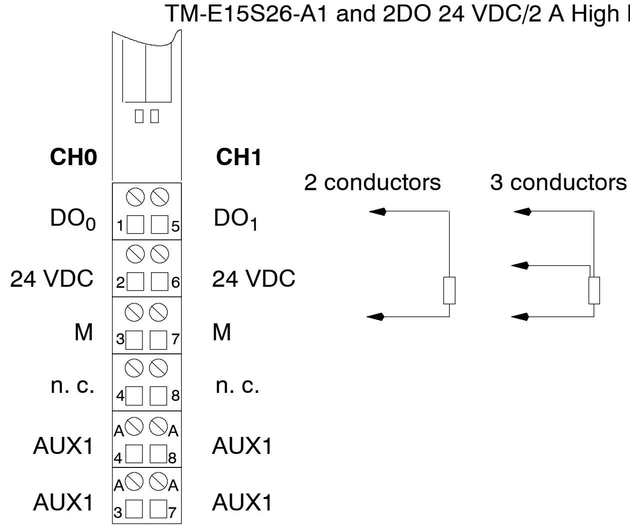
View	Terminal Assignment	Remarks
TM-E15S24-A1 and 2DO 24 VDC/2 A High Feature  When there are 4 conductors, AUX1 must be applied to PE.		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 DO: Output signal (maximum 2 A per channel) 24 VDC: Sensor supply M: Ground, load power supply
TM-E15S24-01 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.

Table 11-24 Terminal Assignment of the 2DO 24 VDC/2 A High Feature, continued

View	Terminal Assignment	Remarks
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

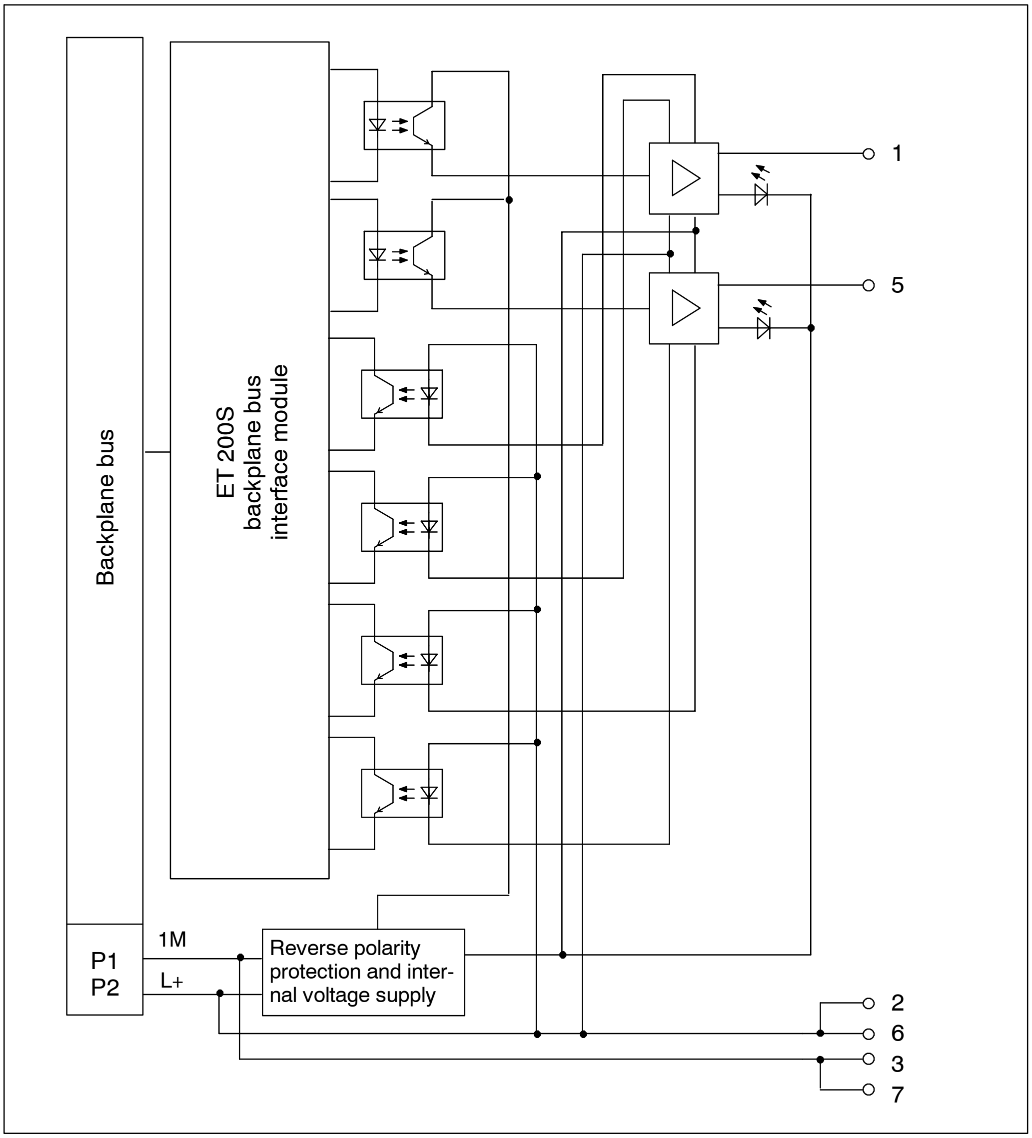


Figure 11-18 Block Diagram of the 2DO 24 VDC/2 A High Feature

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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

11.17 2DO AC24..230V 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 AC24..230V for the different terminal modules:

Table 11-25 Terminal Assignment of the 2DO 24–230 VAC

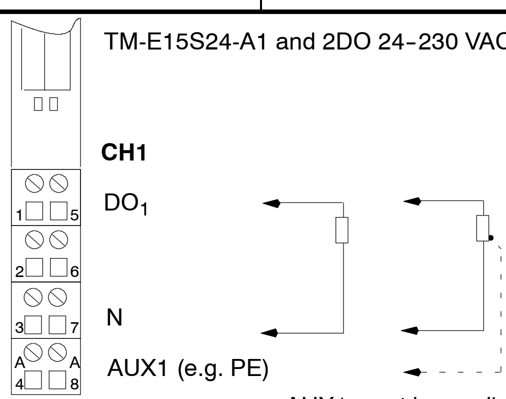
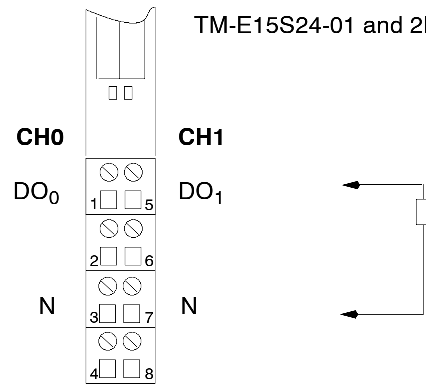
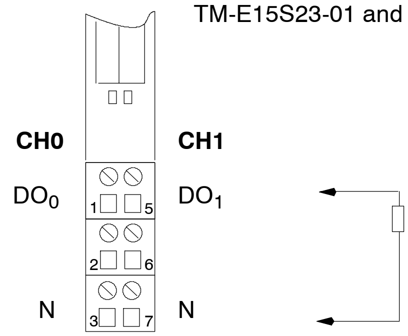
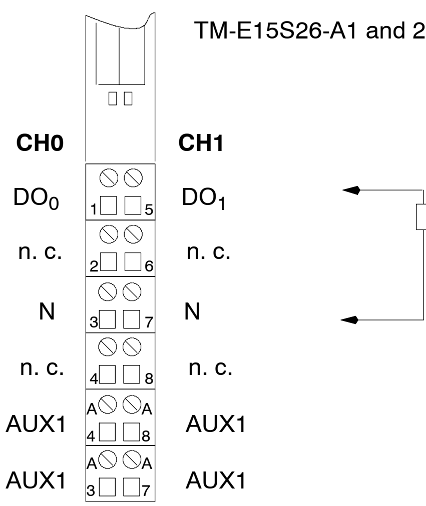
View	Terminal Assignment	Remarks
 CH0 DO_0 N AUX1 (e.g. PE)	TM-E15S24-A1 and 2DO 24–230 VAC CH1 DO_1 N AUX1 (e.g. PE) AUX1 must be applied to PE.	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 DO: Output signal (maximum 2 A per channel) N: Neutral conductor

Table 11-25 Terminal Assignment of the 2DO 24-230 VAC, continued

View	Terminal Assignment	Remarks
	TM-E15S24-01 and 2DO 24-230 VAC	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	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	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

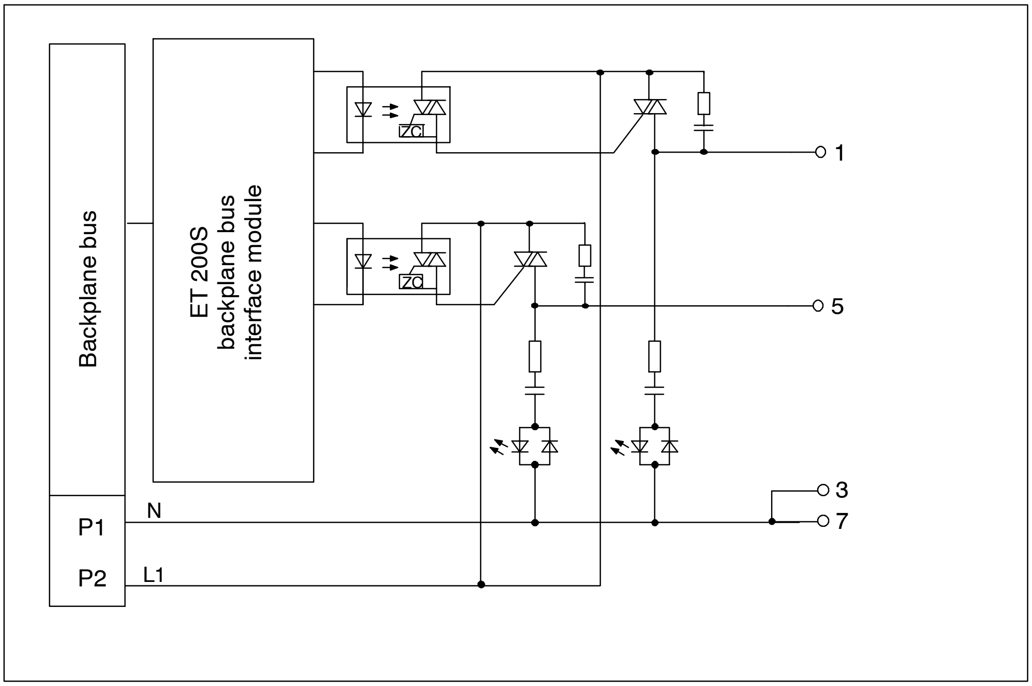


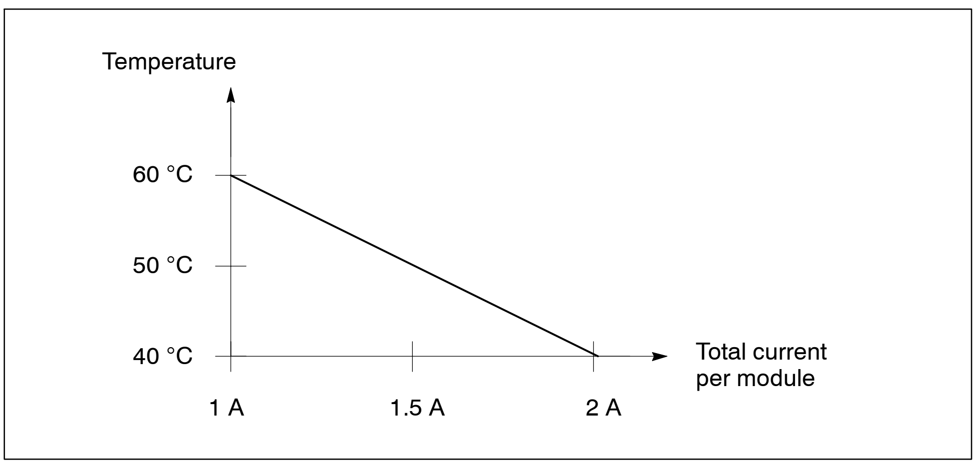
Figure 11-19 Block Diagram of the 2DO 24-230 VAC

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 × 81 × 52
Weight	Approx. 37 g
Data for Specific Modules	
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, 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 (per channel)	
• 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

*Total Current of the Outputs (per Module)



11.18 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 11-20).

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 11-26 Terminal Assignment of the 2RO NO 24-120 VDC/5 A, 24-230 VAC/5 A (as of Version 2)

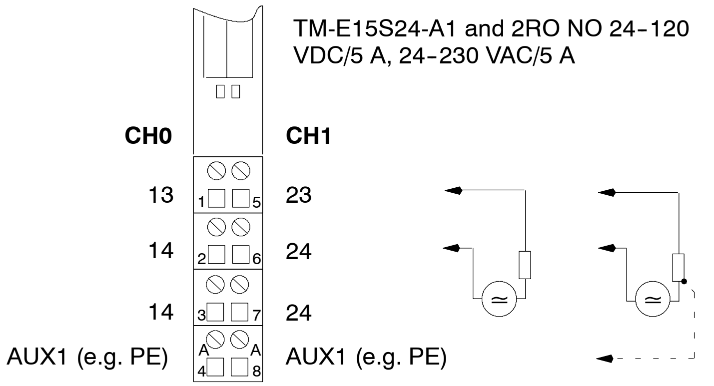
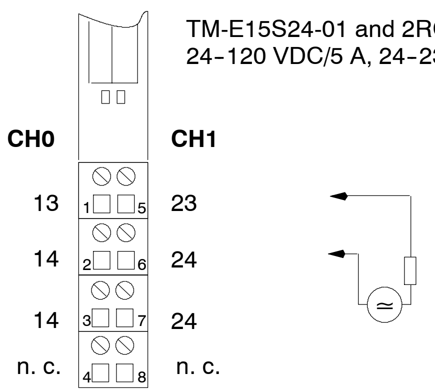
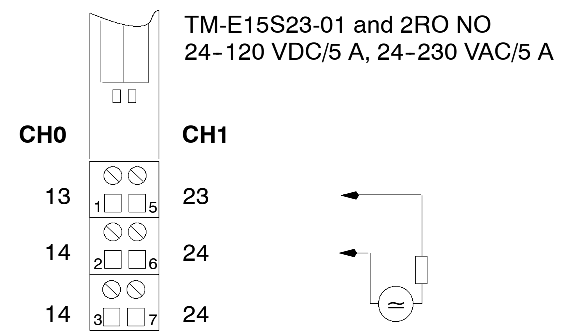
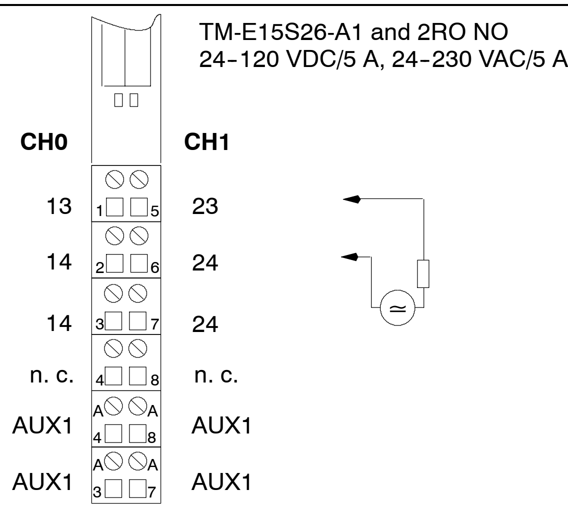
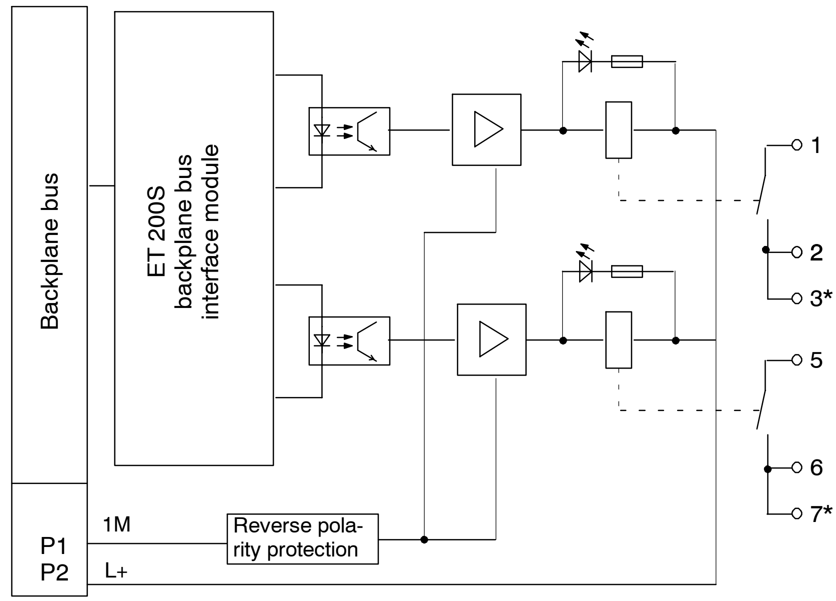
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 2RO NO 24-120 VDC/5 A, 24-230 VAC/5 A The AUX1 bus must be applied to PE.	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 13, 14: normally open contact channel 0 23, 24: normally open contact channel 1 Internal jumper between terminals 2 and 3, 6 and 7
	TM-E15S24-01 and 2RO NO 24-120 VDC/5 A, 24-230 VAC/5 A	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

Table 11-26 Terminal Assignment of the 2RO NO 24–120 VDC/5 A, 24–230 VAC/5 A (as of Version 2), continued

View	Terminal Assignment	Remarks
		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
		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

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 11-20 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	
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, 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 11-27 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

11.19 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.

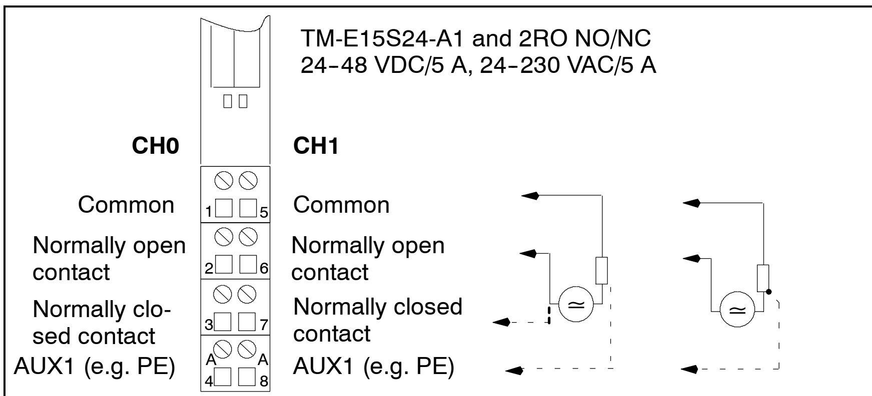
Features

- 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:

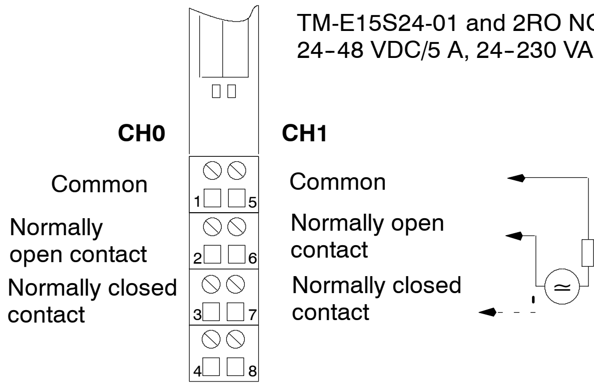
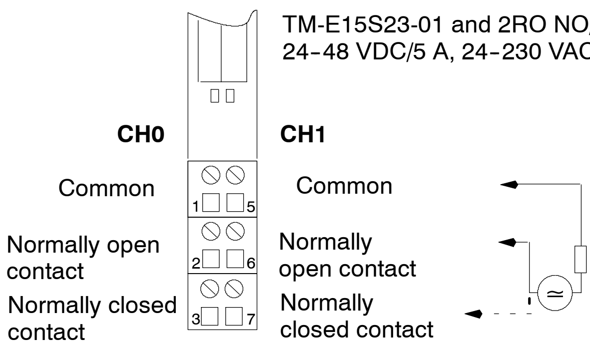
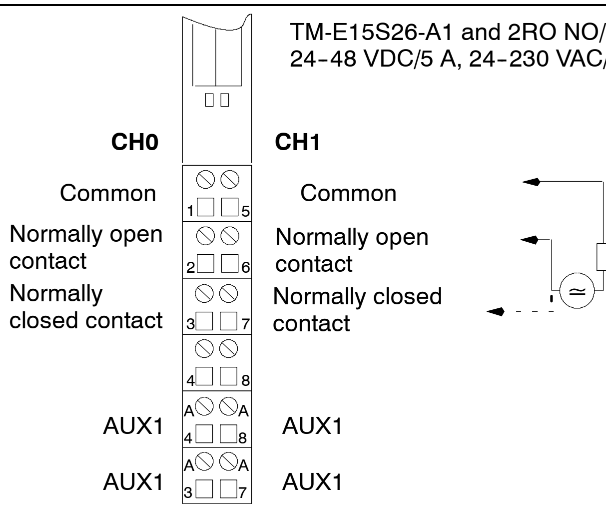
Table 11-28 Terminal Assignment of the 2RO NO/NC 24-48 VDC/5 A, 24-230 VAC/5 A

<table>
<tr>
<td>

The AUX1 bus must be applied to PE.</td>
<td>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</td>
</tr>
</table>

Table 11-28 Terminal Assignment of the 2RO NO/NC 24-48 VDC/5 A, 24-230 VAC/5 A, continued

	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
	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
	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

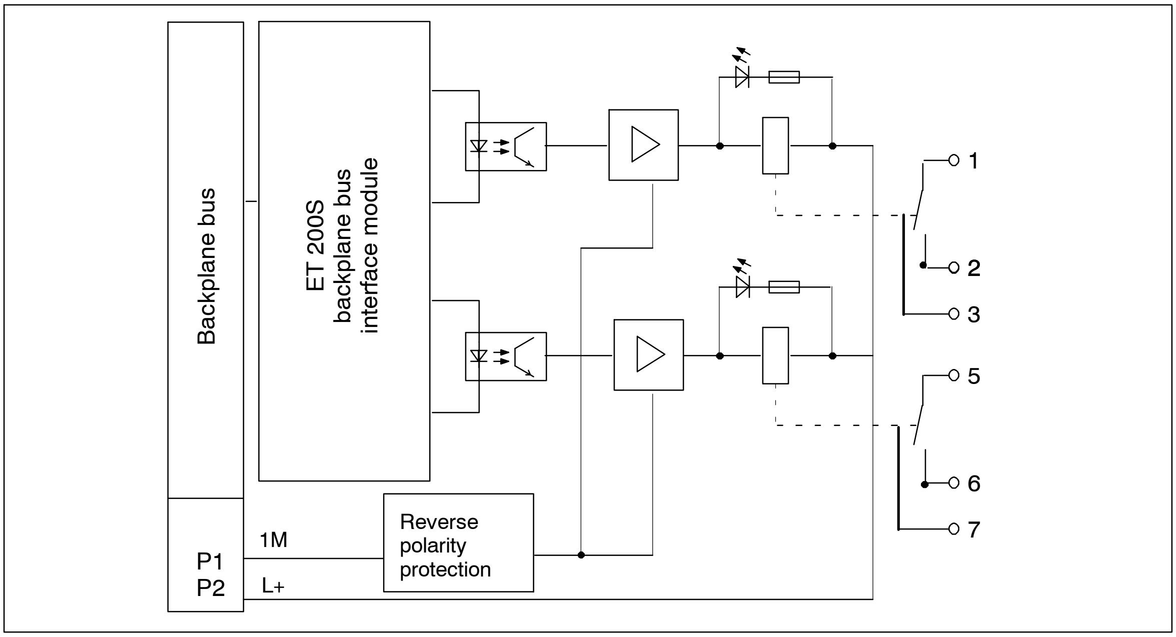


Figure 11-21 Block Diagram of the 2RO NO/NC 24–48 VDC/5 A 24–230 VAC/5 A

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D	15 × 81 × 52 (mm)
Weight	Approx. 50 g
Data for Specific Modules	
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, 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 11-29 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 11-29 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

12 Analog Electronic Modules

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.

Chapter Overview

12.1 Analog Value Representation

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 12-1 Measured Values in the Case of a Wire Break Depending on Diagnostic Being Enabled

Parameter Assignment	Measured Values		Description
	Decimal	Hexadec.	
• “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

12.1.1 Analog Value Representation for Measuring Ranges

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.

Table 12-2 shows the analog value representation of the analog electronic modules as interpreted by the DeviceNet master..

Table 12-2 Analog Value Representation

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

Table 12-3, 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 12-3 shows the resolutions 11-, 12-, 13-, and 15 bits + sign (S) as interpreted by the DeviceNet master. Each analog value is entered in the accumulator with left justification. The bits marked “x” are set to “0”.

Table 12-3 Measured-Value Resolution of the Analog Values

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 12-3).

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.

12.1.2 Analog Value Representation for the Measuring Ranges of the Analog Input Modules

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 12-4 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 : 80.003	2.9397 : 2.5001	5.8794 : 5.0002	11.7589 : 10.0004	32511 : 27649	$7EFF_H$: $6C01_H$	Overrange
80.000 60.000 : – 60.000 – 80.000	2.5 1.86 : – 1.86 – 2.50	5.00 3.75 : – 3.75 – 5.00	10.00 7.50 : – 7.50 – 10.00	27648 20736 : –20736 –27648	$6C00_H$ 5100_H : $AF00_H$ 9400_H	Rated range
– 80.003 : – 94.074	– 2.5001 : – 2.9397	– 5.0002 : – 5.8796	– 10.0004 : – 11.759	–27649 : –32512	$93FF_H$: 8100_H	Underrange
< – 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 12-5 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 Decimal	Units Hexadec.	Range
> 5.704	> 23.5178	> 22.8142	32767	$7FFF_H$	Overflow
5.704 : 5.000145	23.5178 : 20.0007	22.8142 : 20.0005	32511 : 27649	$7EFF_H$: $6C01_H$	Overrange
5.000 4.000 : 1.000	20.0000 15.0000 : 0.0000	20.0000 16.0000 : 4.0000	27648 20736 : 0	$6C00_H$ 5100_H : 0_H	Rated range
0.999855 : 0.296	Negative values not possible	3.9995 1.1852	-1 : -4864	$FFFF_H$: $ED00_H$	Underrange
< 0.296		< 1.1852	-32768	8000_H	Underflow

Measuring Range for Current: ± 20 mA

Table 12-6 Measuring Range ±20 mA

Measuring Range ± 20 mA	Units Decimal	Units Hexadec.	Range
> 23.5150	32767	$7FFF_H$	Overflow
23.5150 : 20.0007	32511 : 27649	$7EFF_H$: $6C01_H$	Overrange
20.0000 14.9980 : - 14.9980 - 20.0000	27648 20736 : -20736 -27648	$6C00_H$ 5100_H : $AF00_H$ 9400_H	Rated range
Measuring Range ± 20 mA	**Units Decimal**	**Units Hexadec.**	**Range**

Table 12-6 Measuring Range ±20 mA, continued

Measuring Range ± 20 mA	Units		Range
	Decimal	Hexadec.	
– 20.0007 : – 23.5160	-27649 : -32512	$93FF_H$: 8100_H	Underrange
< – 23.5160	-32768	8000_H	Underflow

Measuring Ranges for Resistance-Type Sensors: 150Ω, 300Ω, 600Ω, 3000Ω

Table 12-7 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 : 150.005	352.77 : 300.01	705.53 : 600.02	3527.67 : 3000.11	32511 : 27649	$7EFF_H$: $6C01_H$	Overrange
150.00 112.50 : 0.00	300.00 225.00 : 0.00	600.00 450.00 : 0.00	3000.00 2250.00 : 0.00	27648 20736 : 0	$6C00_H$ 5100_H : 0_H	Rated range
(Negative values not physically possible)				-1 : -4864	$FFFF_H$: $ED00_H$	Underrange*
				-32768	8000_H	Underflow*

* If the resistors are connected incorrectly

Measuring Ranges for Resistance Thermometer Pt x00 Standard

Table 12-8 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 12-9 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 12-10 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 12-11 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 12-12 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 12-13 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 12-14 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	20700	50DC$_H$	3276.6	32766	7FFE$_H$	
:	:	:	:	:	:	Overrange
1820.1	18201	4719$_H$	2786.6	27866	6CDA$_H$	
1820.0	18200	4718$_H$	2786.5	27865	6CD9$_H$	
:	:	:	:	:	:	Rated range
0.0	0	0000$_H$	32	320	0140$_H$	
–0.1	–1	FFFF$_H$	31.9	319	013F$_H$	
:	:	:	:	:	:	Underrange
–120.0	–1200	FB50$_H$	–184.0	–1840	F8D0$_H$	
< –120.0	–32768	8000$_H$	< –184.0	–32768	8000$_H$	Underflow

Measuring Range for Thermocouple: Type C

Table 12-15 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	25000	61A8$_H$	3276.6	32766	7FFEH	
:	:	:	:	:	:	Overrange
2315.1	23151	5A6F$_H$	2786.6	27866	6CDAH	
2315.0	23150	5A6E$_H$	2786.5	27865	6CD9$_H$	
:	:	:	:	:	:	Rated range
0.0	0	0000$_H$	32.0	320	0140$_H$	
0.1	–1	FFFFH	31.9	319	013F$_H$	
:	:	:	:	:	:	Underrange
–120.0	–1200	FB50$_H$	–184.0	–1840	F8D0$_H$	
< –120.0	–32768	8000$_H$	< –184.0	–32768	8000$_H$	Underflow

Measuring Range for Thermocouple Type E

Table 12-16 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 12-17 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 12-18 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 12-19 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	8000_H	Underflow

Measuring Range for Thermocouple Type N

Table 12-20 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 12-21 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 12-22 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

12.1.3 Analog Value Representation for the Measuring Ranges of the Analog Output Modules

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 12-23 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 : 5.0002	11.7589 : 10.0004	23.5150 : 20.0007	32511 : 27649	$7EFF_H$: $6C01_H$	Overrange
5.0000 3.7500 : – 3.7500 – 5.0000	10.0000 7.5000 : – 7.5000 – 10.0000	20.0000 14.9980 : – 14.9980 – 20.0000	27648 20736 : –20736 –27648	$6C00_H$ 5100_H : $AF00_H$ 9400_H	Rated range
– 5.0002 : – 5.8800	– 10.0004 : – 11.7589	– 20.0007 : – 23.5160	–27649 : –32512	$93FF_H$: 8100_H	Underrange
0	0	< – 23.5160	< –32512	< 8100_H	Underflow

Output Ranges for Voltage and Current: 1 to 5 V, 4 to 20 mA

Table 12-24 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

12.2 Fundamentals of Analog Value Processing

12.2.1 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 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}.

Figure 12-1 illustrates the connection of isolated measuring sensors to the floating analog input modules.

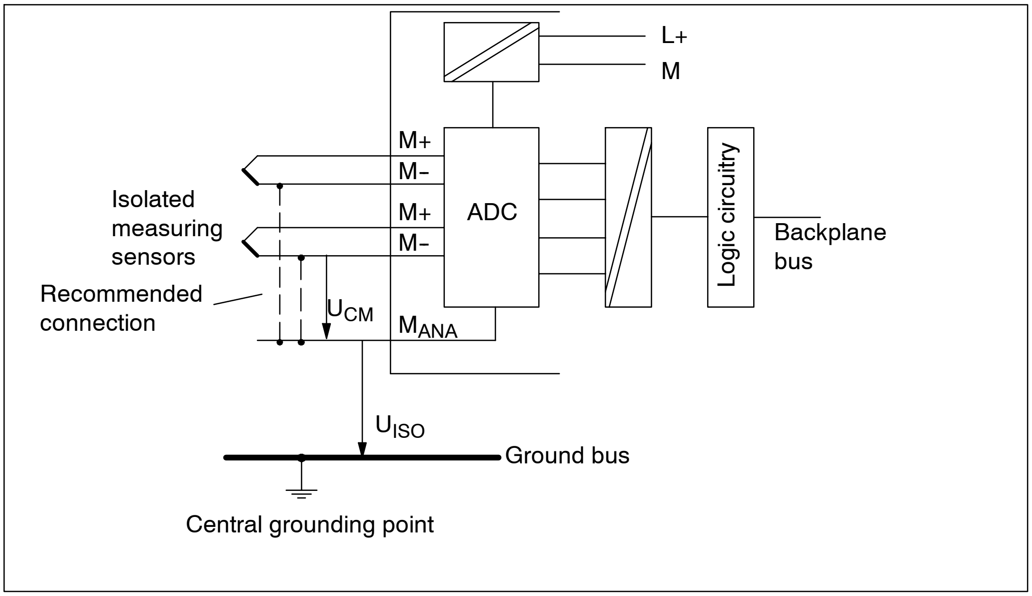


Figure 12-1 Connection of Isolated Measuring Sensors to a Floating Analog Input Module

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 12-2 illustrates the connection of non-isolated measuring sensors to a floating analog input module.

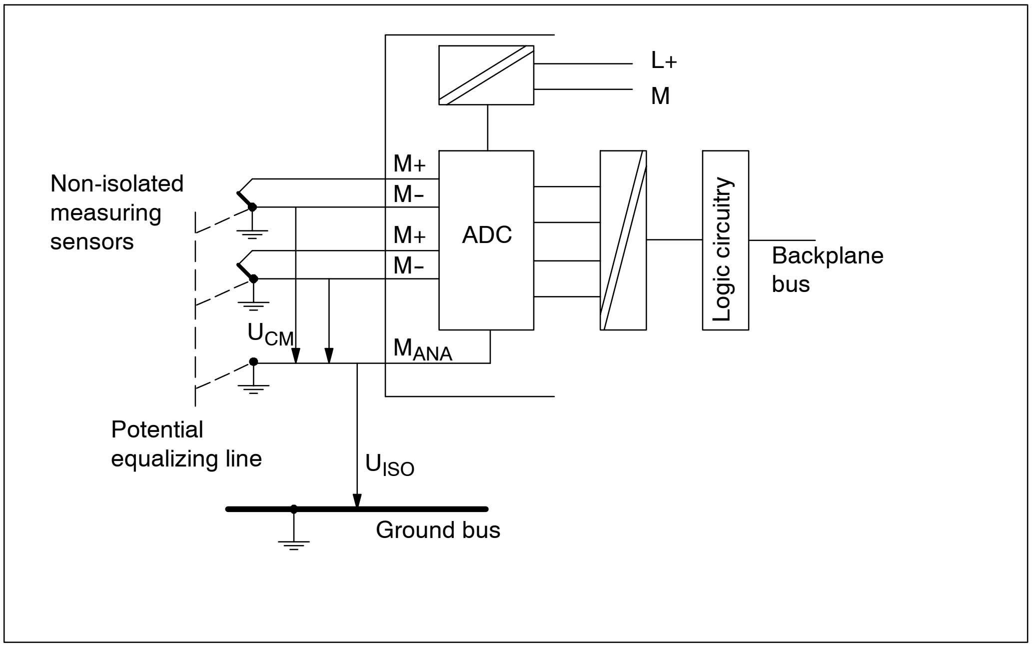


Figure 12-2 Connection of Non-Isolated Measuring Sensors to a Floating Analog Input Module

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.

12.2.2 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 12-25 Compensation of the Reference Junction Temperature

Option	Description	Reference Junction Parameters
No compensation	You record not only the temperature of the measurement point, but also the value of the cold junction error. 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 12-25 Compensation of the Reference Junction Temperature, continued

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 IM 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.

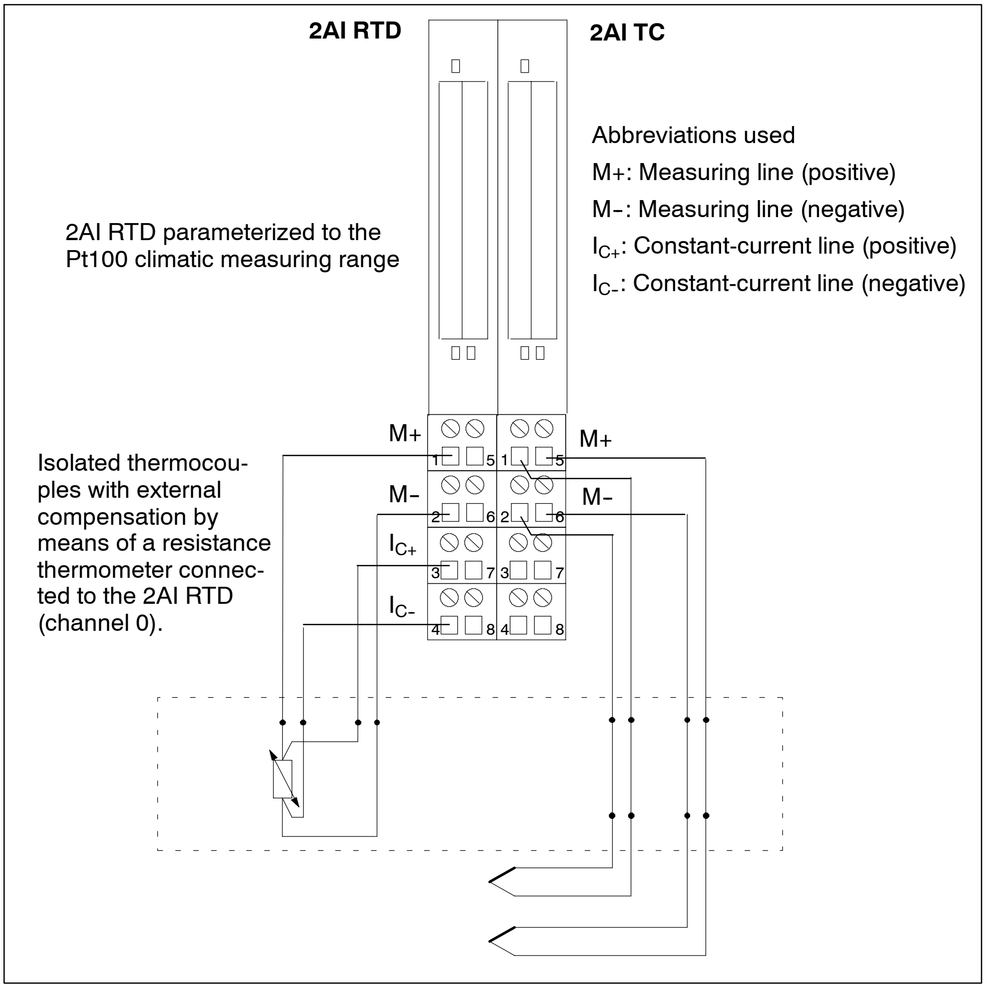


Figure 12-3 Compensation by Means of the 2AI RTD

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 12-26 Reference Junction Parameters

Parameters	Module	Value Range	Explanation
Reference junction slot	IM	None, 2 to 63	This parameter allows you to assign a slot (none, or 2 to 63) where the channel for measuring the reference temperature is located (calculation of the compensation value).
Reference junction input	IM	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 12-4:

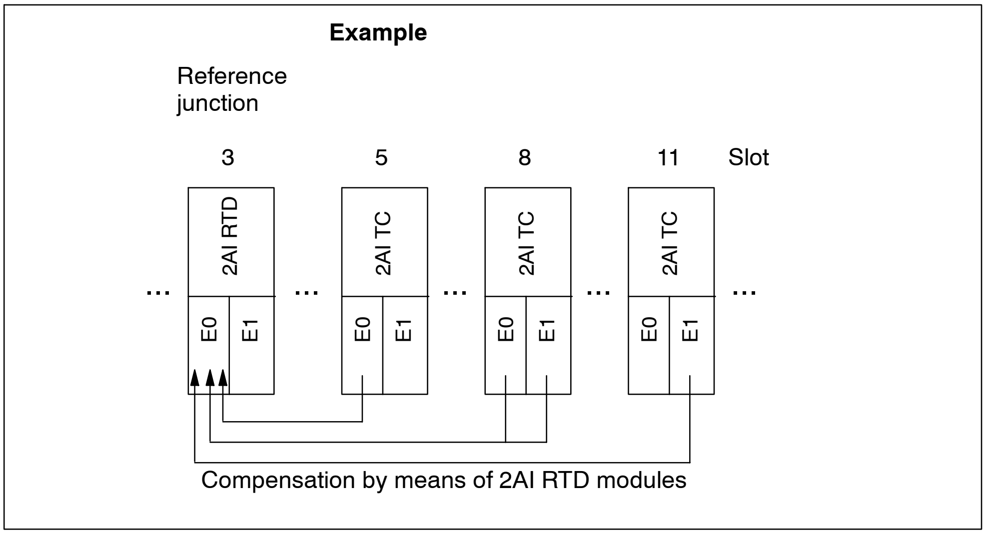


Figure 12-4 Example of Assigning Parameters of Reference Junctions

- 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.

12.2.3 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	●	●	●		●	●	●	

12.3 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 master).

Table 12-27 How the Analog Input/Output Values Depend on the Operating Mode of the PLC (CPU of the Master) and the Supply Voltage L +

Operating Mode of the PLC (CPU of the 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 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. Table 12-28 illustrates this dependency.

Table 12-28 Behavior of the Analog Modules Depending on the Position of the Analog Input Value in the Value Range

Measured Value In	Input Value
Rated range	Measured value
Overrange/underrange	Measured value
Overflow	$7FFF_H$
Underflow	8000_H
Before assigning parameters or in the case of incorrect parameter assignment[1)]	$7FFF_H$

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 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. Table 12-29 indicates this:

Table 12-29 Behavior of the Analog Modules Depending on the Position of the Analog Output Value in the Value Range

Output Value In	Output Value
Rated range	Value from master
Overrange/underrange	Value from 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 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

12.4 Parameters for Analog Electronic Modules

Parameter Assignment for Diagnostics

You set the parameters for the analog electronic modules using the DNS-200S Configuration Tool.

Parameters for

- 2AI U Standard Analog Electronic Module
- 2AI I 2WIRE Standard Analog Electronic Module
- 2AI I 4WIRE Standard Analog Electronic Module

Table 12-30 Parameters for Analog Input Modules U, I Standard

<table>
<tr><th>2AI U Standard</th><th>2AI I 2WIRE Standard</th><th>2AI I 4WIRE Standard</th><th>Value Range</th><th>Default</th><th>Applicability</th></tr>
<tr><td colspan="3">Group diagnosis (parameter assignment error, internal error)</td><td>• Disable
• Enable</td><td>Disable</td><td>Module</td></tr>
<tr><td colspan="3">Diagnostics: Overflow/underflow</td><td>• Disable
• Enable</td><td>Disable</td><td>Module</td></tr>
<tr><td>Diagnostics: Wire break[2)]</td><td>Diagnostics: Wire break</td><td>Diagnostics: Wire break[1)]</td><td>• Disable
• Enable</td><td>Disable</td><td>Channel</td></tr>
<tr><td colspan="3">Smoothing</td><td>• None
• Weak
• Medium
• Strong</td><td>None</td><td>Channel</td></tr>
<tr><td>Type/range of measurement</td><td>---</td><td>---</td><td>• Deactivated
• ± 5 V
• 1 to 5 V
• ± 10 V</td><td>± 10 V</td><td>Channel</td></tr>
<tr><td>---</td><td>Type/range of measurement</td><td>---</td><td>• Deactivated
• 2WIRE: 4 to 20 mA</td><td>2WIRE: 4 to 20 mA</td><td>Channel</td></tr>
<tr><td>---</td><td>---</td><td>Type/range of measurement</td><td>• Deactivated
• 4WIRE: 4 to 20 mA
• 4WIRE: ±20 mA</td><td>2WIRE: 4 to 20 mA</td><td>Channel</td></tr>
</table>

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 12-31 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 12-32 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 12-33 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	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 12-33 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 12-34 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 12-34 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:

Table 12-35 RTD Temperature Coefficients and Measuring Ranges for Measurement Types

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

Table 12-35 RTD Temperature Coefficients and Measuring Ranges for Measurement Types, continued

Type of Measurement	Temperature Coefficient	Measuring 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 12-36 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.

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.

Figures 12-5 and 12-6 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

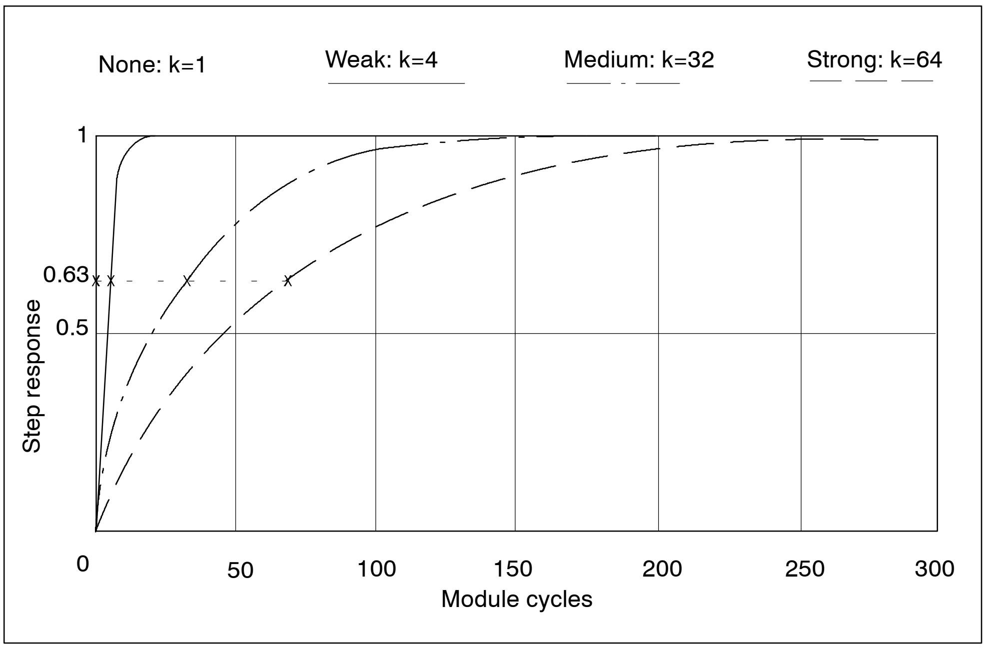


Figure 12-5 Smoothing in the Case of the 2AI U Standard, 2AI U High Feature, 2AI I 2WIRE Standard, 2AI I 4WIRE Standard, 2AI I 2/4WIRE High Feature, 2AI RTD Standard, 2AI RTD High Feature, 2AI TC Standard, 2AI TC High Feature

- Smoothing in the case of the 2AI U High Speed, 2AI I 2WIRE High Speed, 2AI I 4WIRE High Speed

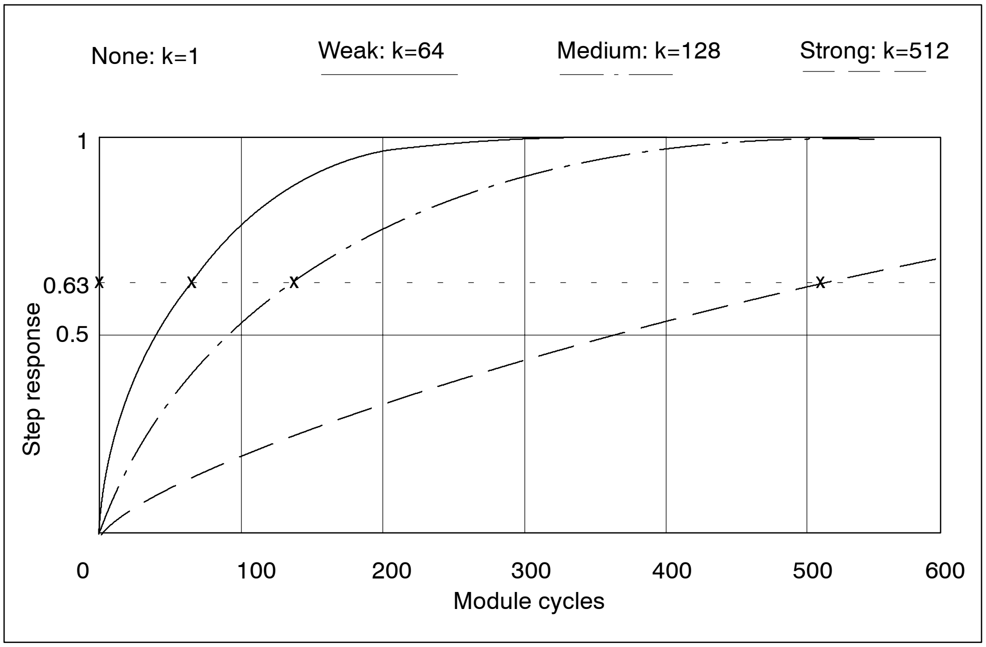


Figure 12-6 Smoothing in the Case of the 2AI U High Speed, 2AI I 2WIRE High Speed, 2AI I 4WIRE High Speed

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 12.2.2

Reference Junction Number:

See Section 12.2.2

12.5 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 12-37 Terminal Assignment of the 2AI U Standard

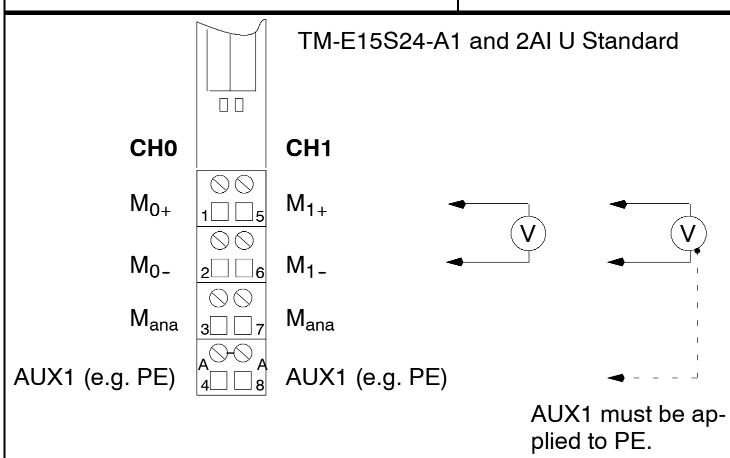
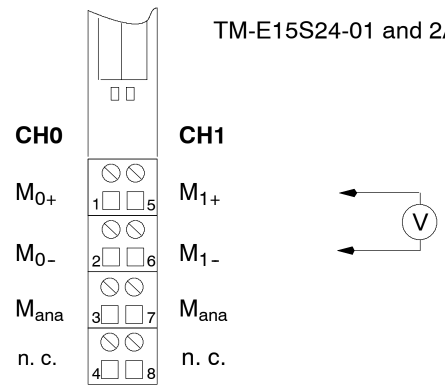
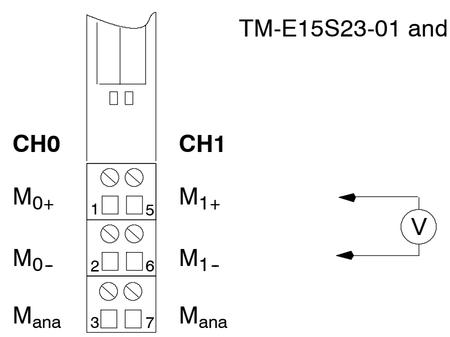
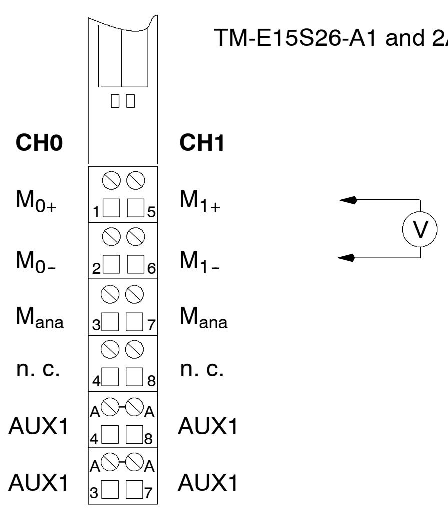
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 2AI U Standard	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground of the module

Table 12-37 Terminal Assignment of the 2AI U Standard, continued

View	Terminal Assignment	Remarks
	TM-E15S24-01 and 2AI U Standard	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 Standard	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 Standard	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

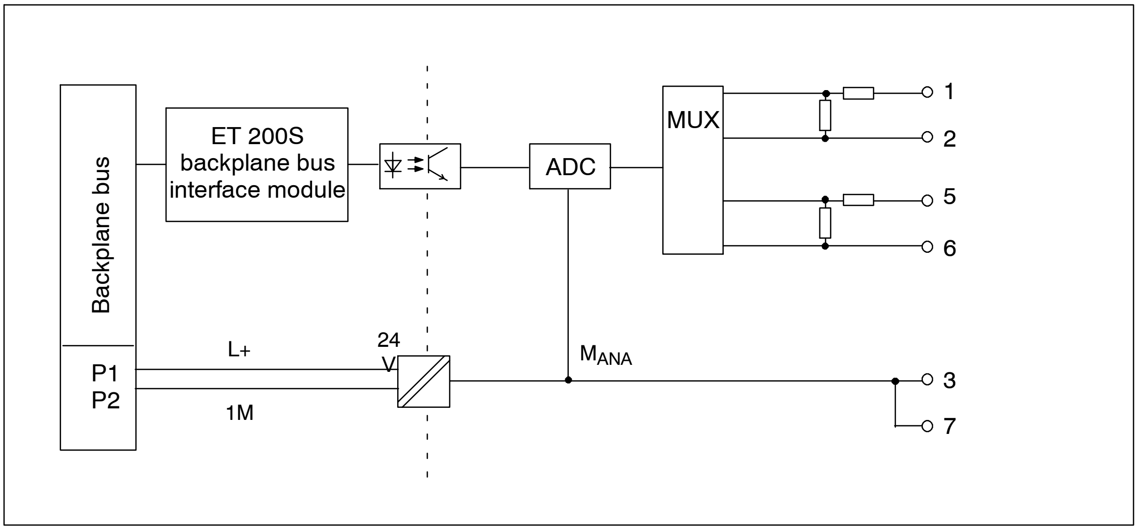


Figure 12-7 Block Diagram of the 2AI U Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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
<u>Step</u>	Time constant
None	1 x cycle time
Weak	4 x cycle time
Medium	32 x cycle time
Strong	64 x cycle time

12.6 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 12-38 Terminal Assignment of the 2AI U High Feature

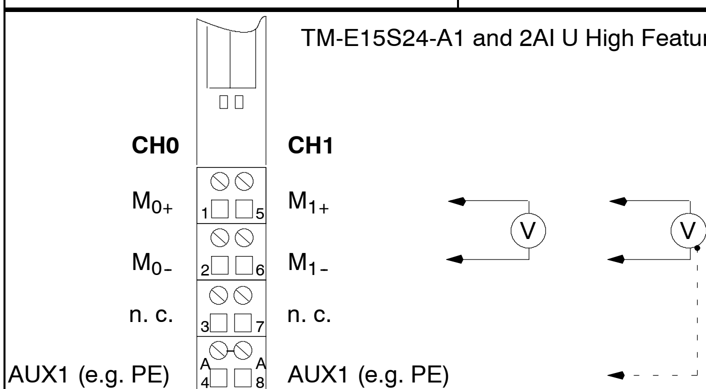
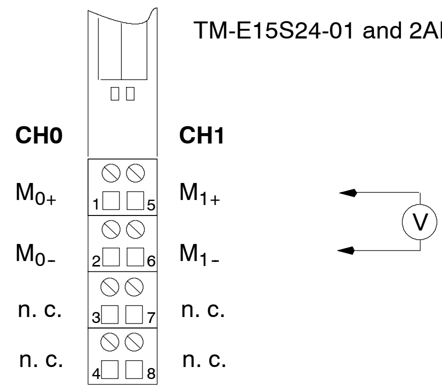
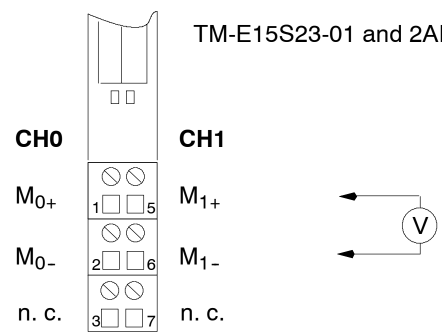
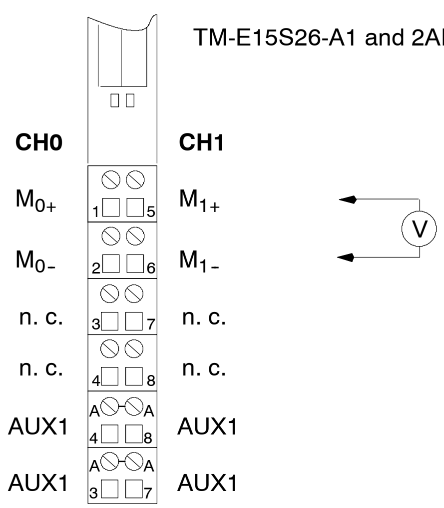
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 2AI U High Feature AUX1 must be applied to PE.	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Input signal “+” M–: Input signal “–”

Table 12-38 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 "–"
	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

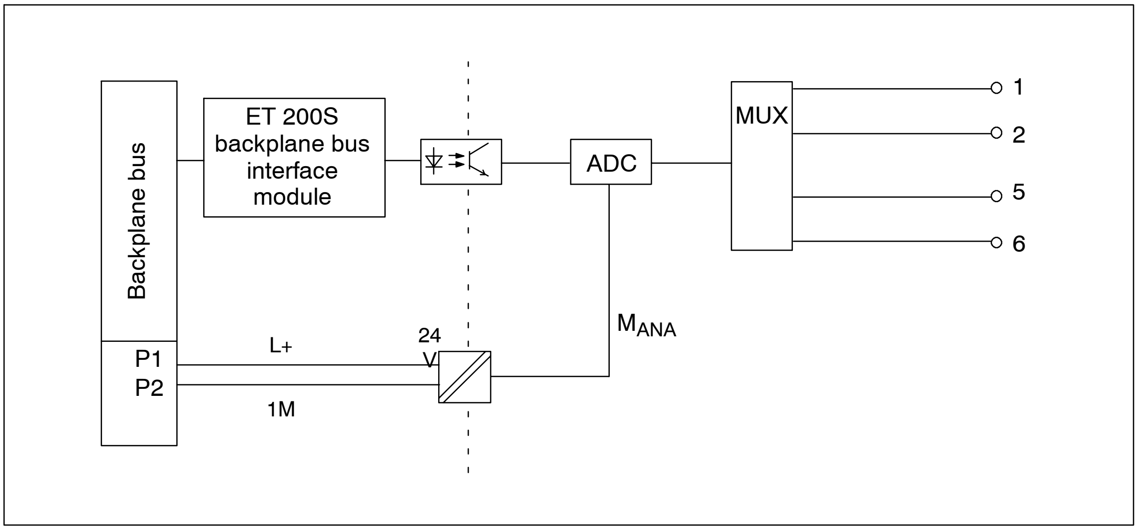


Figure 12-8 Block Diagram of the 2AI U High Feature

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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.

12.7 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}

Terminal Assignment

The following table indicates the terminal assignment of the 2AI U High Speed for the different terminal modules:

Table 12-39 Terminal Assignment of the 2AI U High Speed

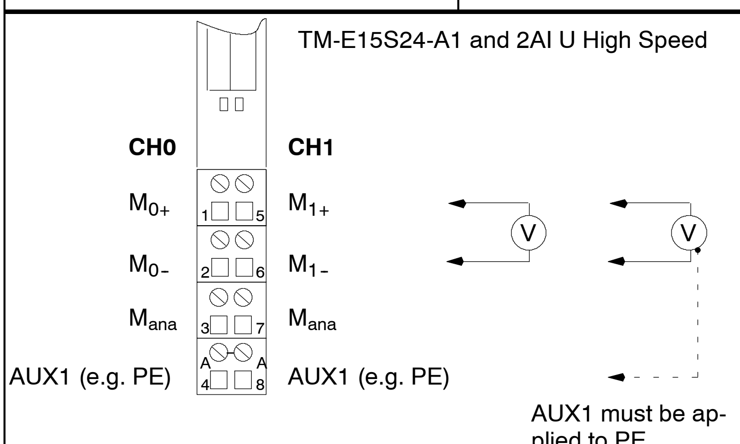
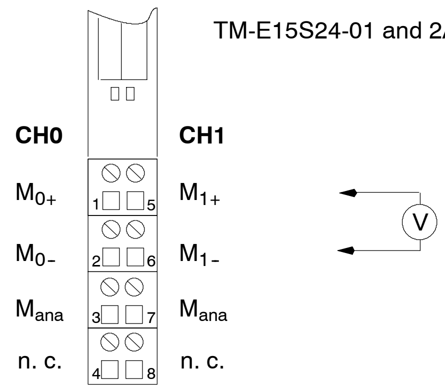
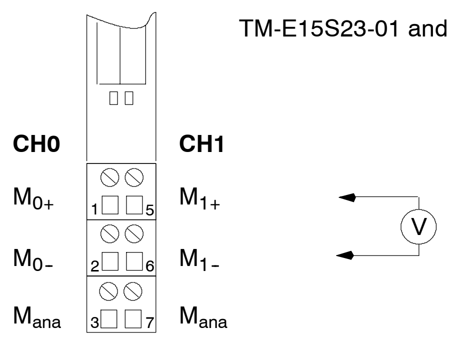
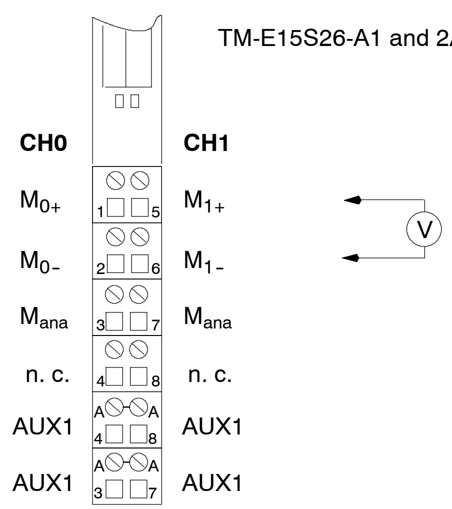
View	Terminal Assignment	Remarks
TM-E15S24-A1 and 2AI U High Speed 		Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Input signal "+" M–: Input signal "–" M_{ana}: Ground of the module

Table 12-39 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

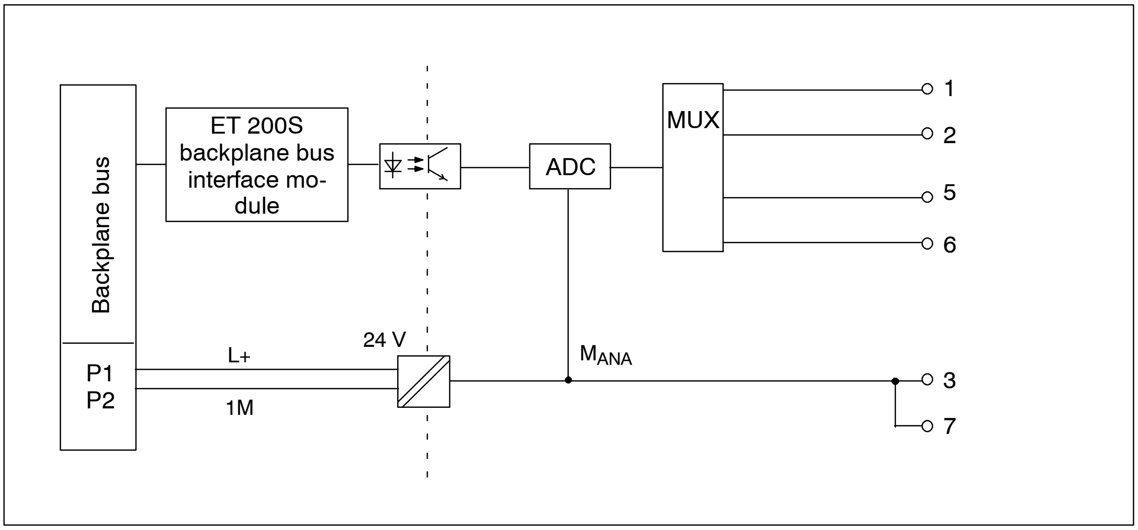


Figure 12-9 Block Diagram of the 2AI U High Speed

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, Diagnostics	
Diagnostic functions	
• Group error display	Red “SF” LED
• Diagnostic information can be displayed	Possible[1)]

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) Parameter assignment error
Violation of lower limit value
Violation of upper limit value
Open circuit (only with 1 to 5 V)

12.8 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 12-40 Terminal Assignment of the 2AI I 2WIRE Standard

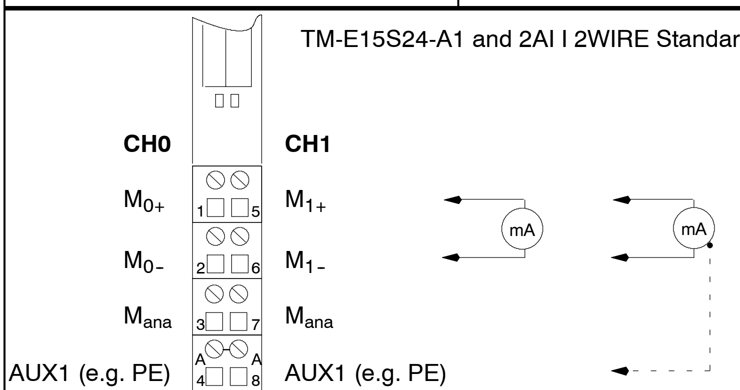
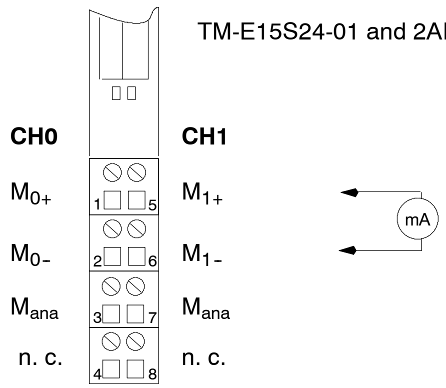
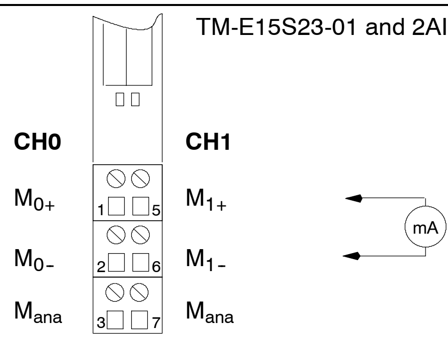
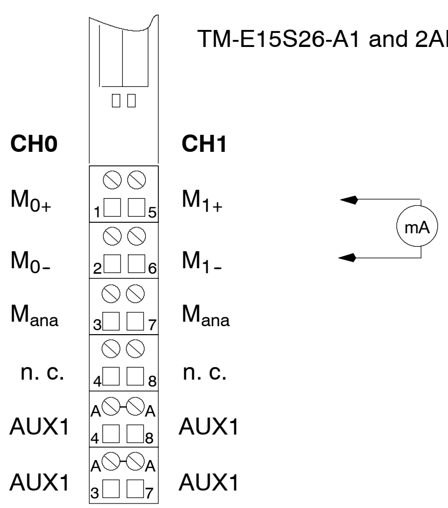
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 2AI I 2WIRE Standard AUX1 must be applied to PE.	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Input signal “+” M–: Input signal “–” M_{ana}: Ground (of power module) Two-wire measuring transducer is supplied by means of the measuring circuits.

Table 12-40 Terminal Assignment of the 2AI I 2WIRE Standard, continued

View	Terminal Assignment	Remarks
	TM-E15S24-01 and 2AI I 2WIRE Standard	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 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

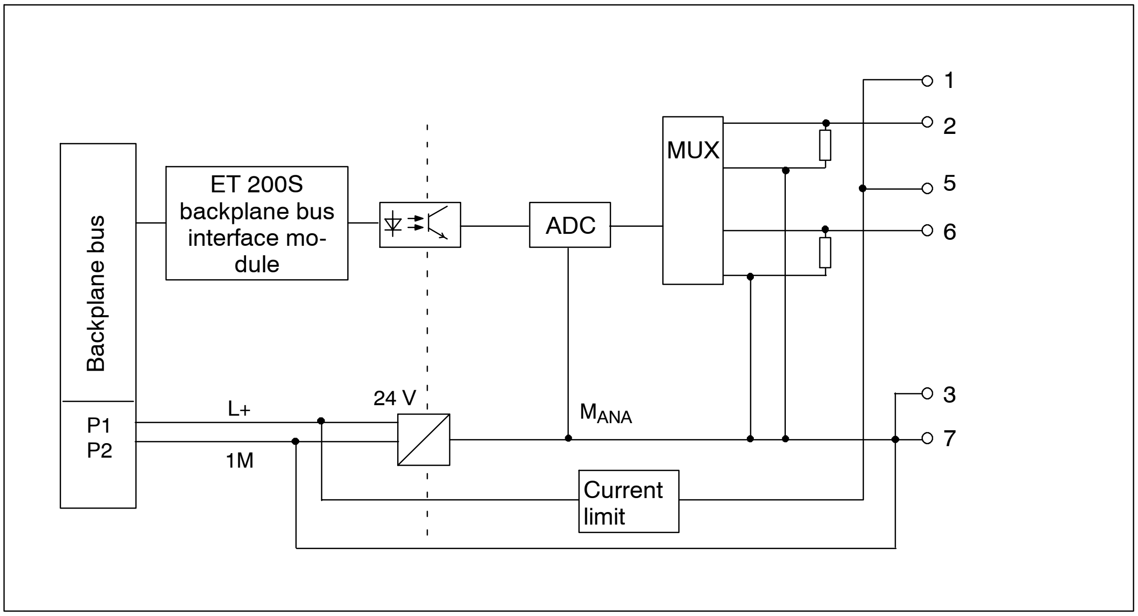


Figure 12-10 Block Diagram of the 2AI I 2WIRE Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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

12.9 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

Terminal Assignment

The following table indicates the terminal assignment of the 2AI I 2WIRE High Speed for the different terminal modules:

Table 12-41 Terminal Assignment of the 2AI I 2WIRE High Speed

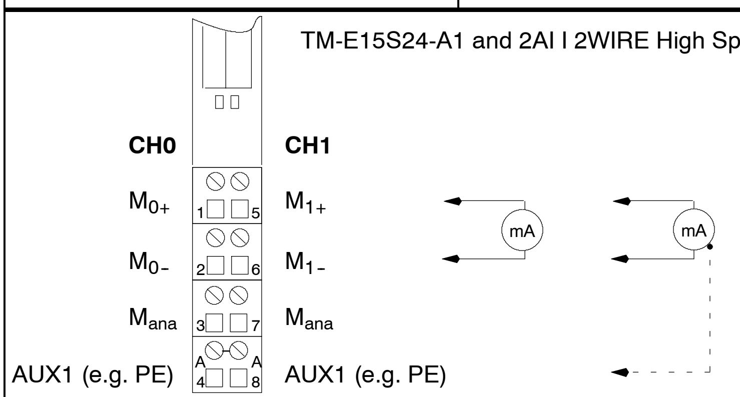
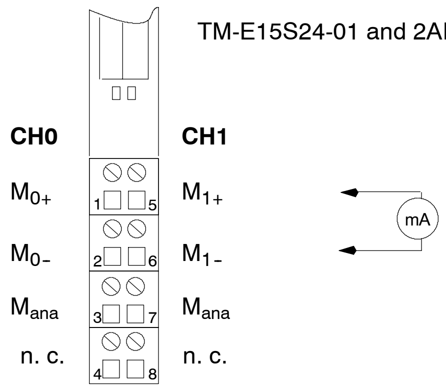
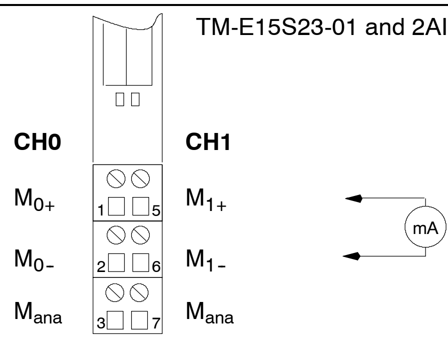
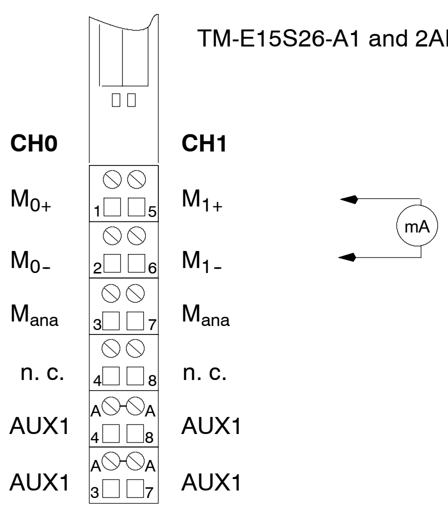
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 2AI I 2WIRE High Speed AUX1 must be applied to PE.	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Input signal "+" M-: Input signal "-" M_{ana}: Ground (of power module) Two-wire measuring transducer is supplied by means of the measuring circuits.

Table 12-41 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

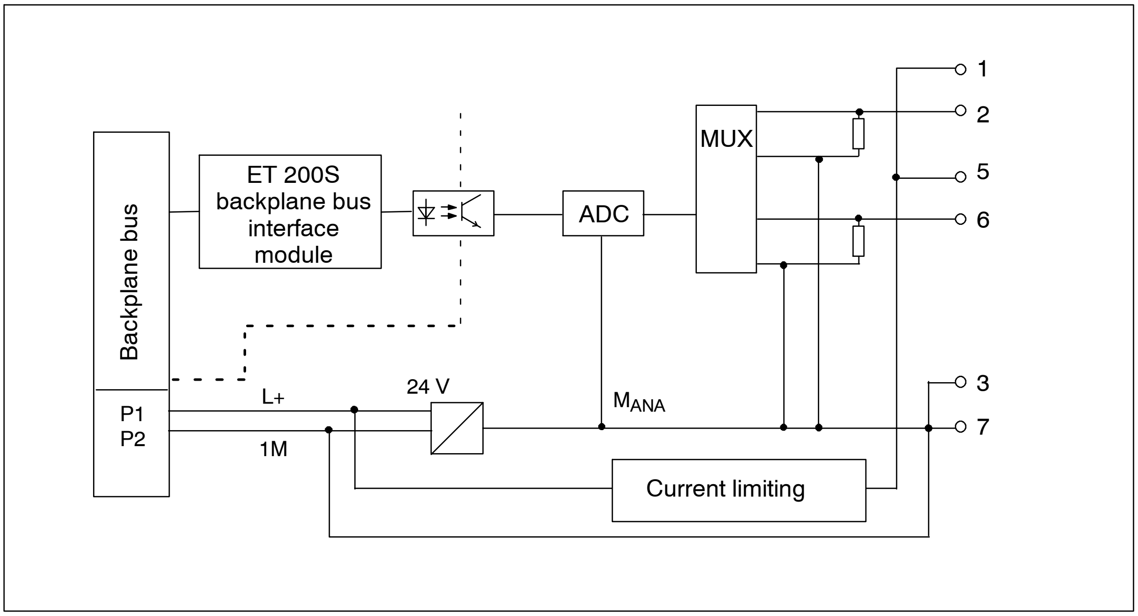


Figure 12-11 Block Diagram of the 2AI I 2WIRE High Speed

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
Number of inputs	Yes
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, Diagnostics	
Diagnostic functions	
• Group error display	Red “SF” LED
• Diagnostic functions readable	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)	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 Parameter assignment error
Violation of lower limit value
Violation of upper limit value
Open circuit (only with 4 to 20 mA)

12.10 2AI I 4WIRE Standard Analog Electronic Module (6ES7134-4GB10-0AB0)

Order Number

6ES7134-4GB10-0AB0

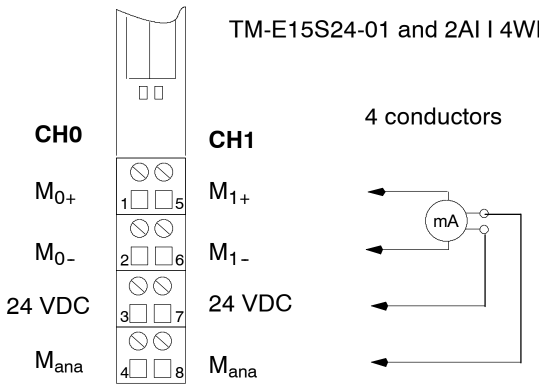
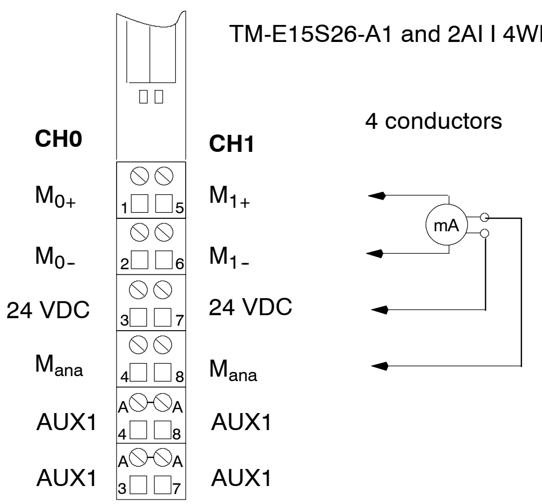
Features

- 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 12-42 Terminal Assignment of the 2AI I 4WIRE Standard

View	Terminal Assignment	Remarks
	TM-E15S24-01 and 2AI I 4WIRE Standard 4 conductors	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.
	TM-E15S26-A1 and 2AI I 4WIRE Standard 4 conductors	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

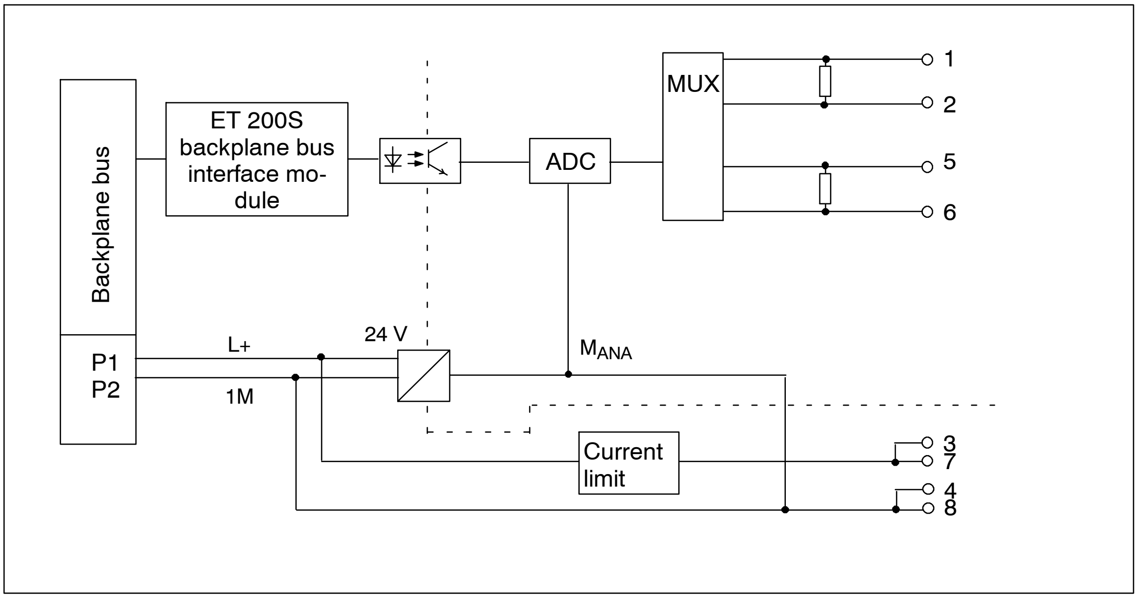


Figure 12-12 Block Diagram of the 2AI I 4WIRE Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, Diagnostics	
Diagnostic functions	
• Group error	Red “SF” LED
• Diagnostic functions readable	Yes

Analog Value Deneration		
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

12.11 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 12-43 Terminal Assignment of the 2AI I 2/4WIRE High Feature

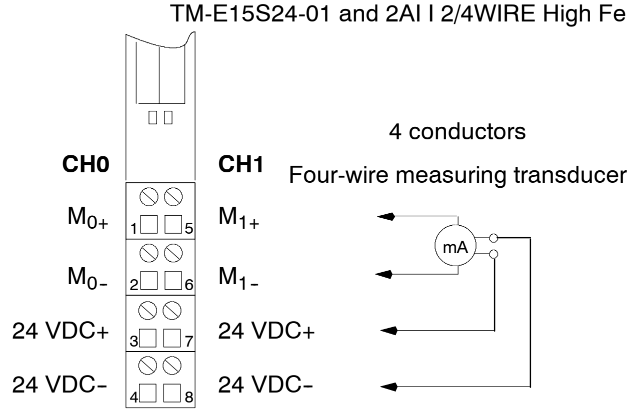
View	Terminal Assignment	Remarks
TM-E15S24-01 and 2AI I 2/4WIRE High Feature  		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+ : Input signal "+" M–: Input signal "–" 24 VDC+: Power supply for four-wire measuring transducer 24 VDC–: Return circuit for measuring transducer supply It is possible 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 12-43 Terminal Assignment of the 2AI I 2/4WIRE High Feature, continued

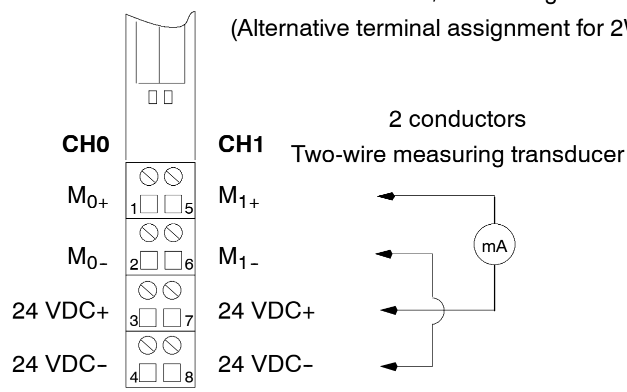
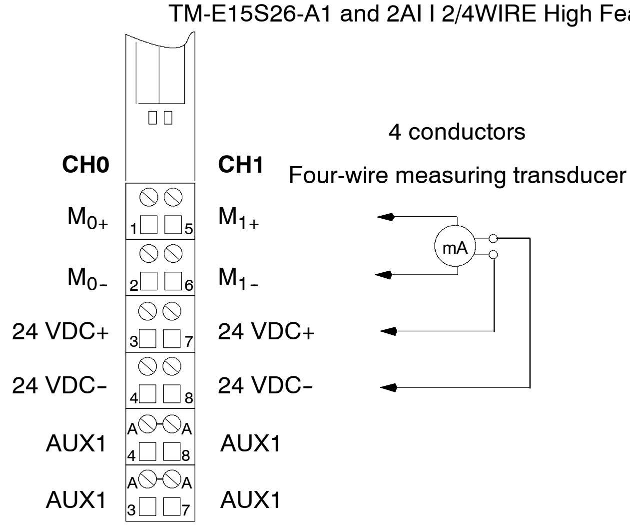
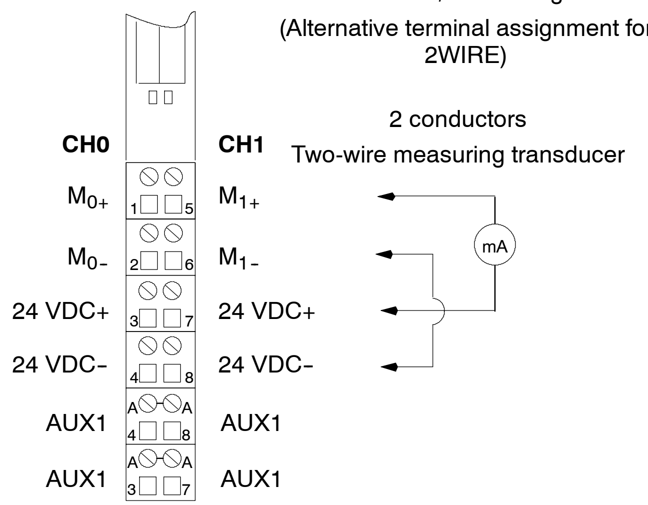
View	Terminal Assignment	Remarks
TM-E15S24-01 and 2AI I 2/4WIRE High Feature (Alternative terminal assignment for 2WIRE)  		Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+ : Input signal "–" M– : Connect to 24 VDC– 24 VDC+: Input signal "+" Two-wire measuring transducers are supplied by means 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  		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 12-43 Terminal Assignment of the 2AI I 2/4WIRE High Feature, continued

<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr><td colspan="2">TM-E15S26-A1 and 2AI I 2/4WIRE High Feature

</td><td>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.</td></tr>
</table>

Block Diagram

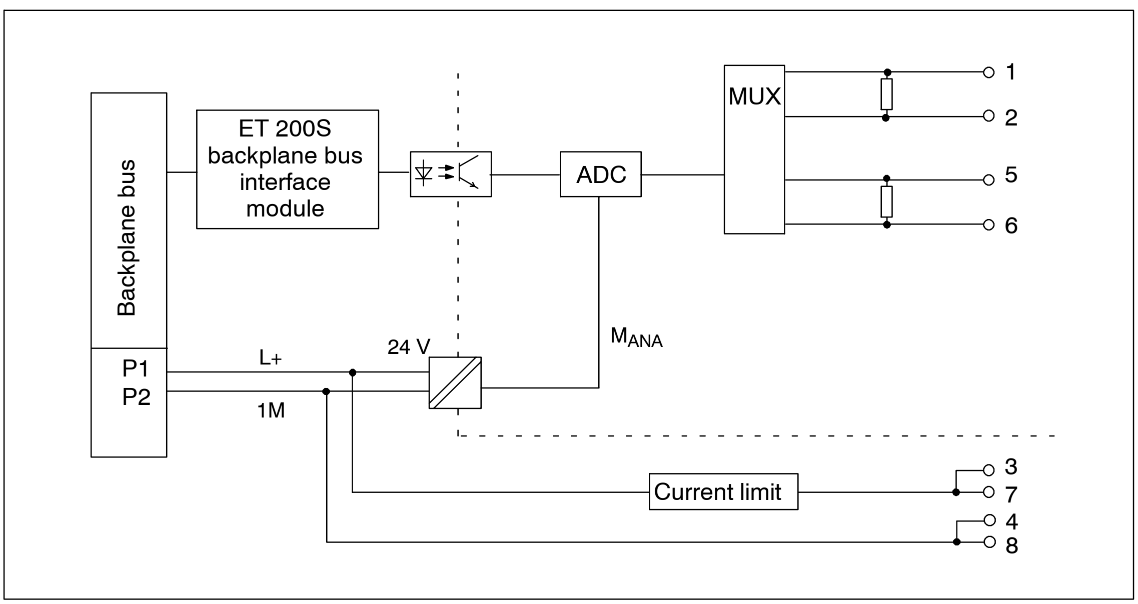


Figure 12-13 Block Diagram of the 2AI I 2/4WIRE High Feature

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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.

12.12 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

Terminal Assignment

The following table indicates the terminal assignment of the 2AI I 4WIRE High Speed for the terminal module.

Table 12-44 Terminal Assignment of the 2AI I 4WIRE High Speed

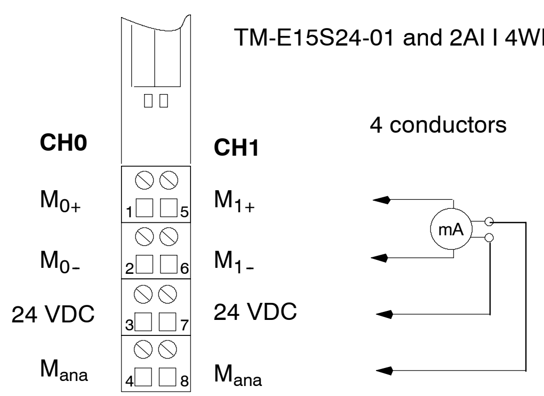
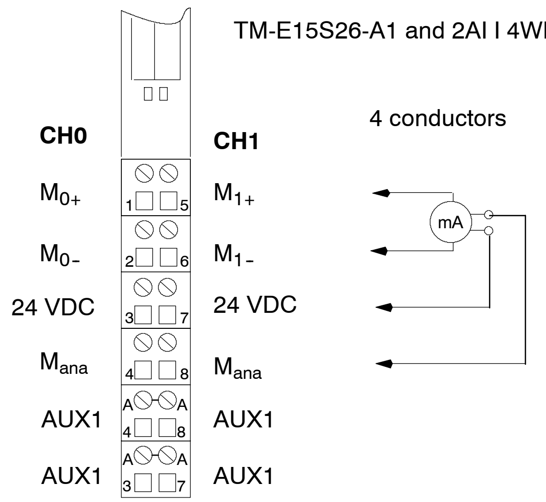
View	Terminal Assignment	Remarks
	TM-E15S24-01 and 2AI I 4WIRE High Speed 4 conductors	Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 M+: Input signal “+” M–: Input signal “–” 24 VDC: Power supply for four-wire measuring transducer M_{ana}: Ground (of power module) Four-wire measuring transducer is supplied by means of the module.

Table 12-44 Terminal Assignment of the 2AI I 4WIRE High Speed, continued

View	Terminal Assignment	Remarks
TM-E15S26-A1 and 2AI I 4WIRE High Speed 4 conductors 		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

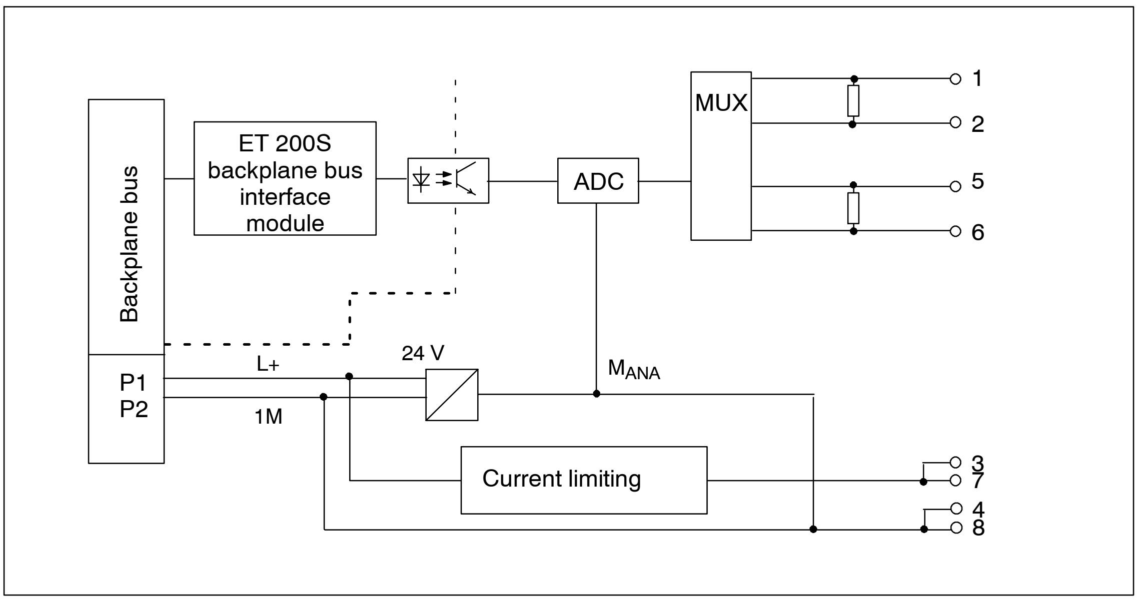


Figure 12-14 Block Diagram of the 2AI I 4WIRE High Speed

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, Diagnostics	
Diagnostic functions	
• Group error display	Red "SF" LED
• Diagnostic information readable	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)	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) Parameter assignment error
Violation of lower limit value
Violation of upper limit value
Open circuit (only with 4 to 20 mA)

12.13 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

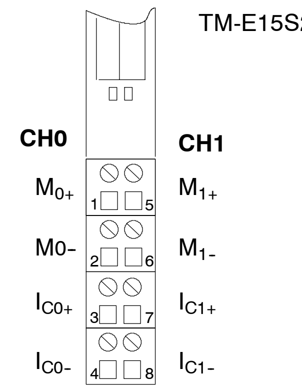
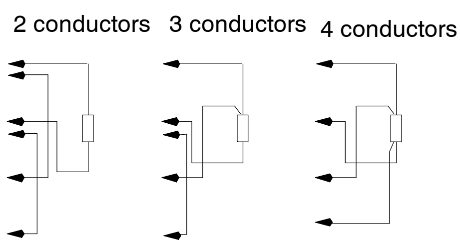
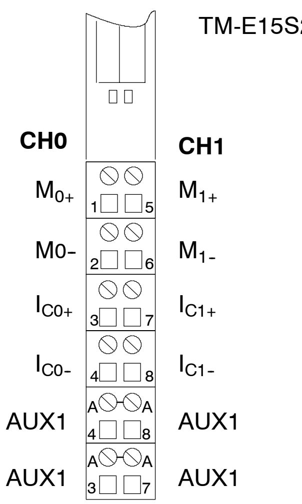
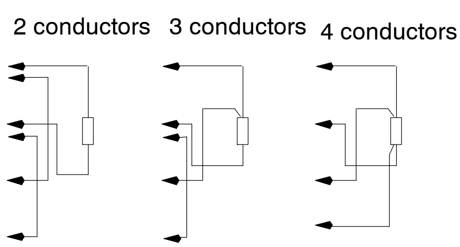
Terminal Assignment

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 12-45 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

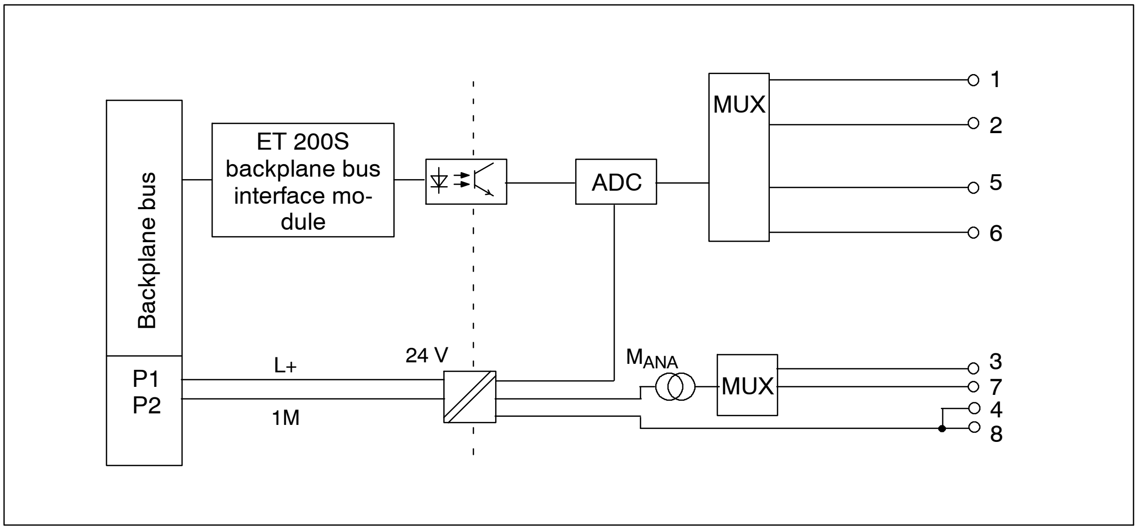


Figure 12-15 Block Diagram of the 2AI RTD Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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

12.14 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 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 12-46 Terminal Assignment of the 2AI RTD High Feature

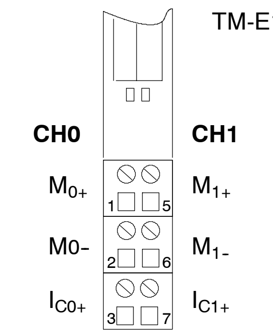
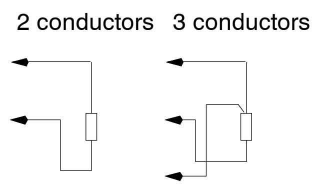
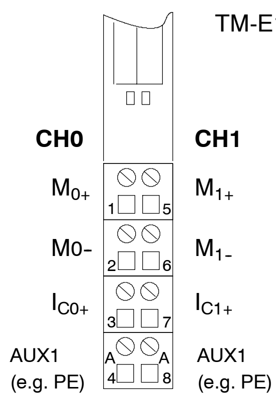
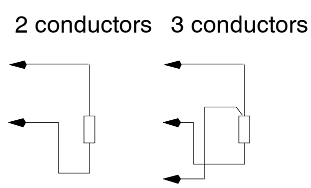
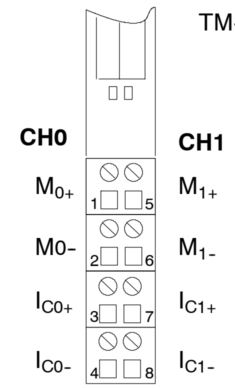
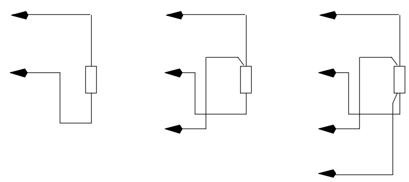
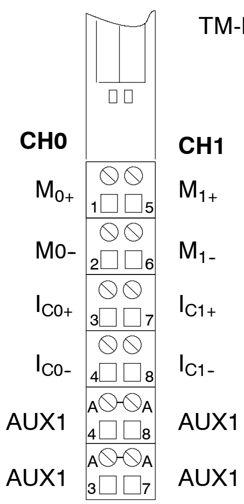
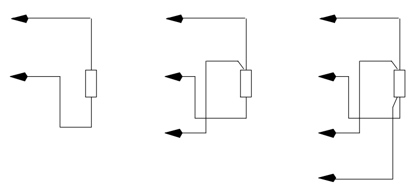
View	Terminal Assignment	Remarks
	TM-E15S23-01 and 2AI RTD High Feature 	Channel 0: Terminals 1 to 3 Channel 1: Terminals 5 to 7 M+: Measuring line (positive) M–: Measuring line (negative) I_{C+}: Constant-current line (positive)
	TM-E15S24-A1 and 2AI RTD High Feature 	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Measuring line (positive) M–: Measuring line (negative) I_{C+}: Constant-current line (positive)

Table 12-46 Terminal Assignment of the 2AI RTD High Feature, continued

View	Terminal Assignment	Remarks
	TM-E15S24-01 and 2AI RTD High Feature 2 conductors 3 conductors 4 conductors 	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 2 conductors 3 conductors 4 conductors 	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

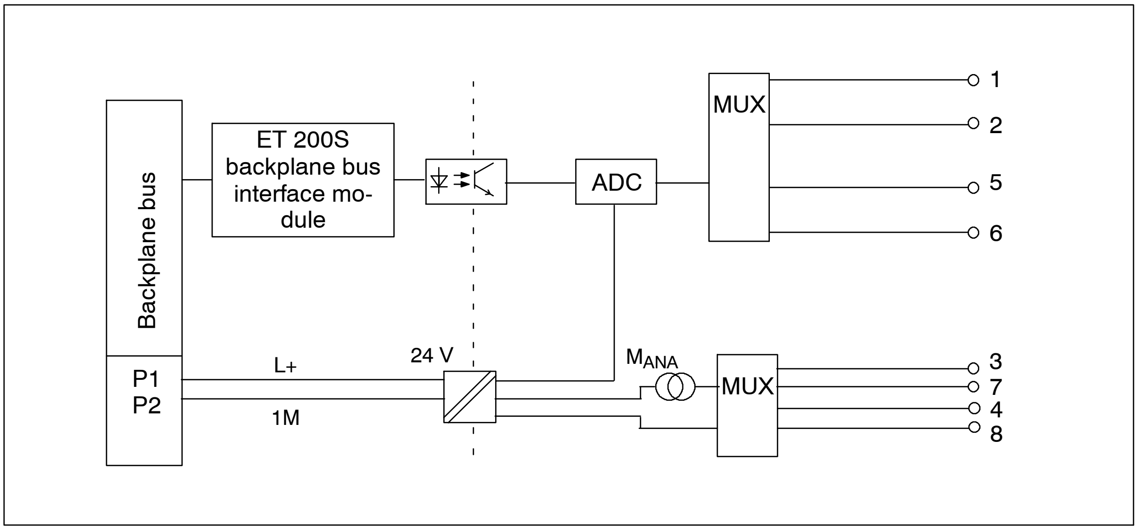


Figure 12-16 Block Diagram of the 2AI RTD High Feature

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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** • bit 0 = “0” (in the PII)
	Off From 1650Ω to 4000Ω	Temperature increase **Measured resistance > response threshold** • bit 0 = “1” (in the PII)
	On/reset From 1650Ω to 750Ω	Temperature decrease **Measured resistance < response threshold** • bit 0 = “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 DeviceNet Memory

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

0: measured resistance < response threshold

1: measured resistance > response threshold

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

- 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.

12.15 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 12.5).

Table 12-47 Terminal Assignment of the 2AI TC Standard

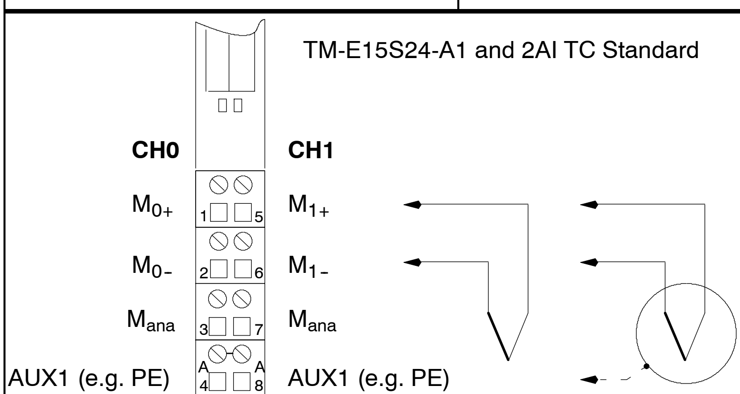
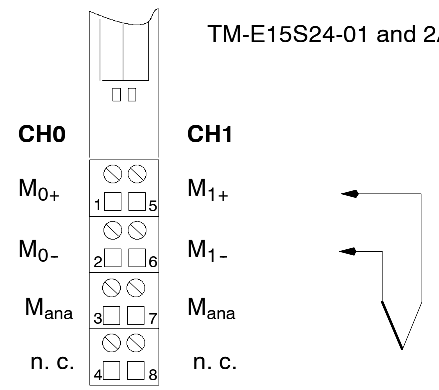
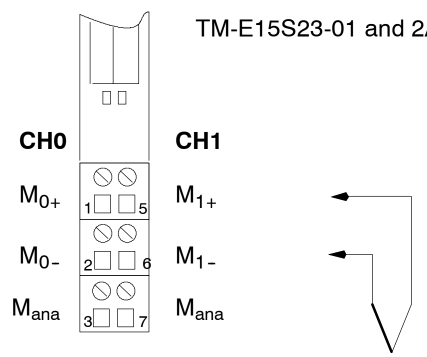
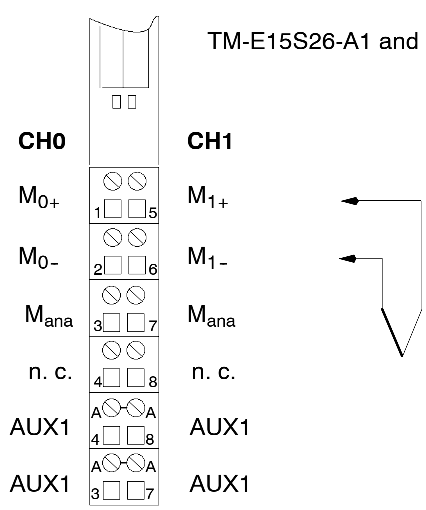
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 2AI TC Standard AUX1 must be applied to PE.	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 M+: Measuring line (positive) M–: Measuring line (negative) M_{ana}: Ground of the module

Table 12-47 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

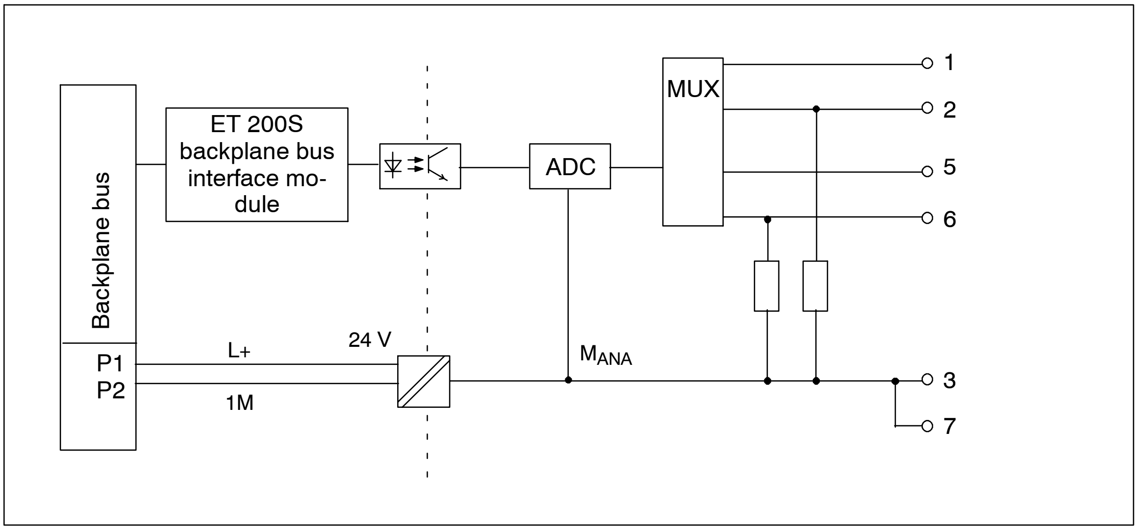


Figure 12-17 Block Diagram of the 2AI TC Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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
<u>Step</u>	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

12.16 2AI TC High Feature Analog Electronic Module (6ES7134-4NB00-0AB0)

Order Number

6ES7134-4NB00-0AB0

Features

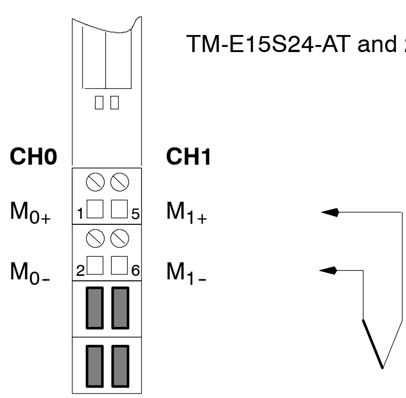
- 2 inputs for thermocouple or voltage measurement
- Input ranges:
  - Voltage measurement: ± 80 mV, resolution 15 bits + sign
  - Thermocouples: Types E, N, J, K, L, S, R, B, T, C, resolution 15 bits + sign
- 2AI TC High-Feature is inserted on the TM-E15S24-AT or TM-E15C24-AT
- Isolated from the load 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 12.5).

Table 12-48 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

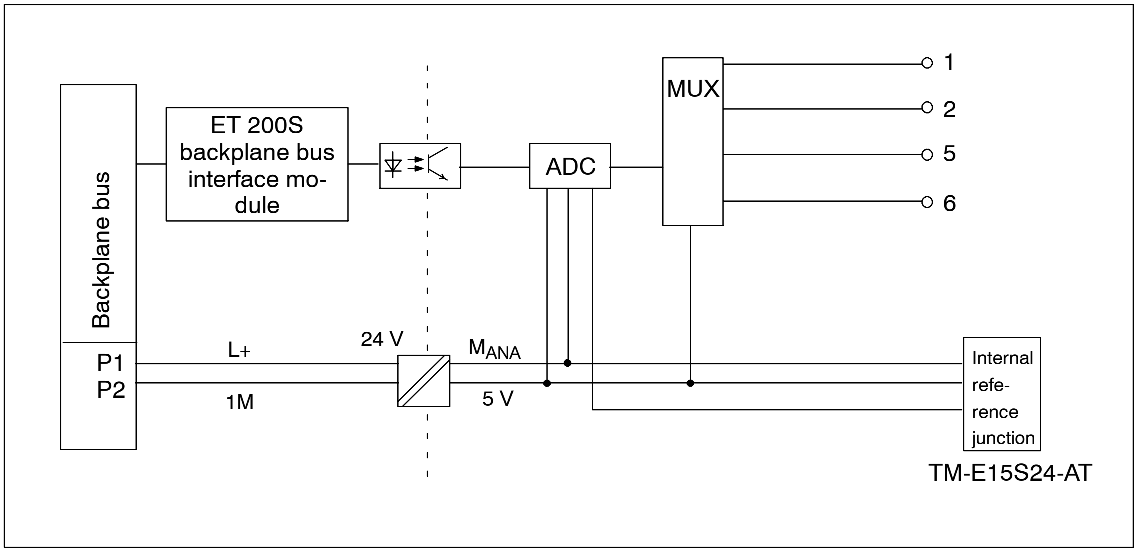


Figure 12-18 Block Diagram of the 2AI TC High Feature

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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 diffe- rence	
• 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, 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!)

12.17 2AO U Standard Analog Electronic Module (6ES7135-4FB00-0AB0)

Order Number

6ES7135-4FB00-0AB0

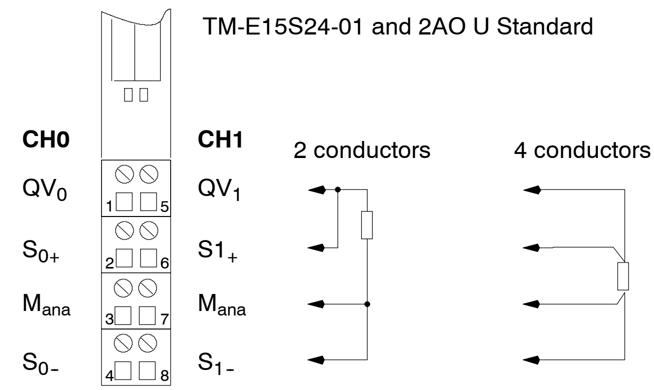
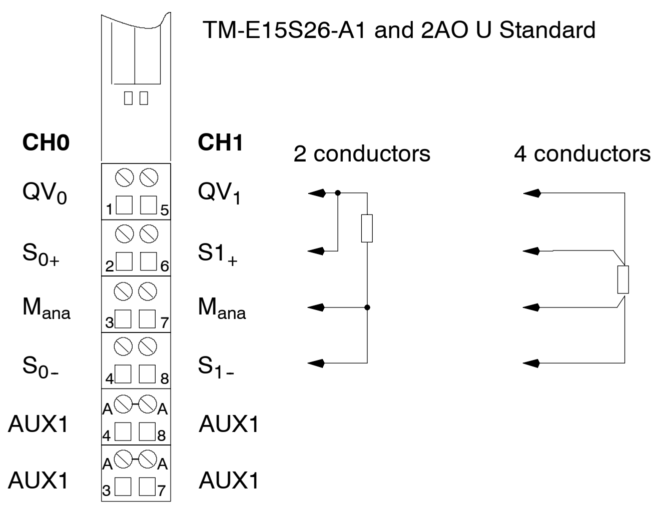
Features

- 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 12-49 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

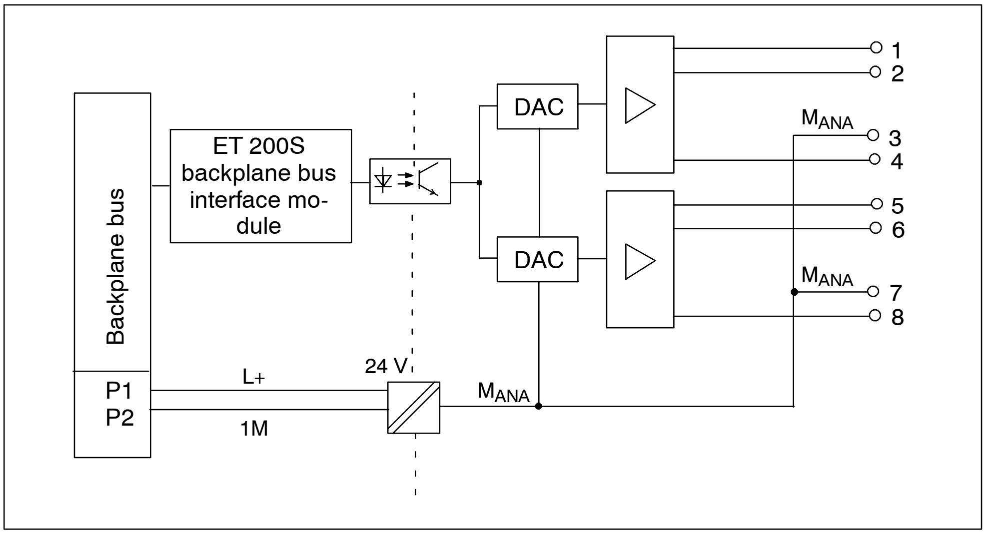


Figure 12-19 Block Diagram of the 2AO U Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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 parametrizable	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

12.18 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+

Terminal Assignment

The following table indicates the terminal assignment of the 2AO U High Feature for the terminal module:

Table 12-50 Terminal Assignment of the 2AO U High Feature

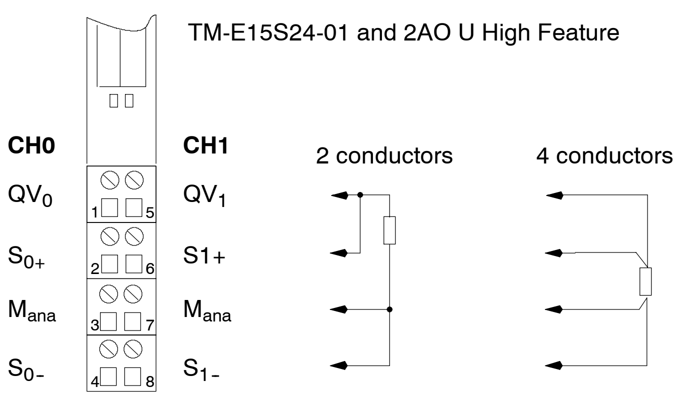
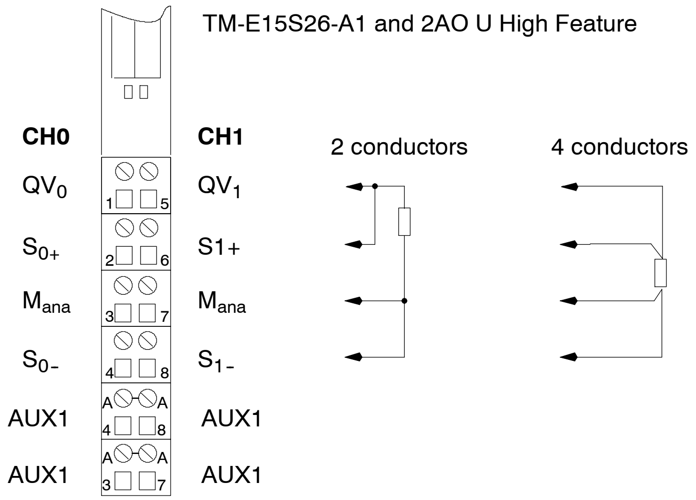
View	Terminal Assignment	Remarks
	TM-E15S24-01 and 2AO U High Feature	Channel 0: Terminals 1 to 4 Channel 1: Terminals 5 to 8 QV: Analog output voltage S+: Detector line (positive) M_{ana}: Ground of the module S–: Detector line (negative)

Table 12-50 Terminal Assignment of the 2AO U High Feature, continued

View	Terminal Assignment	Remarks
	TM-E15S26-A1 and 2AO U High Feature	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

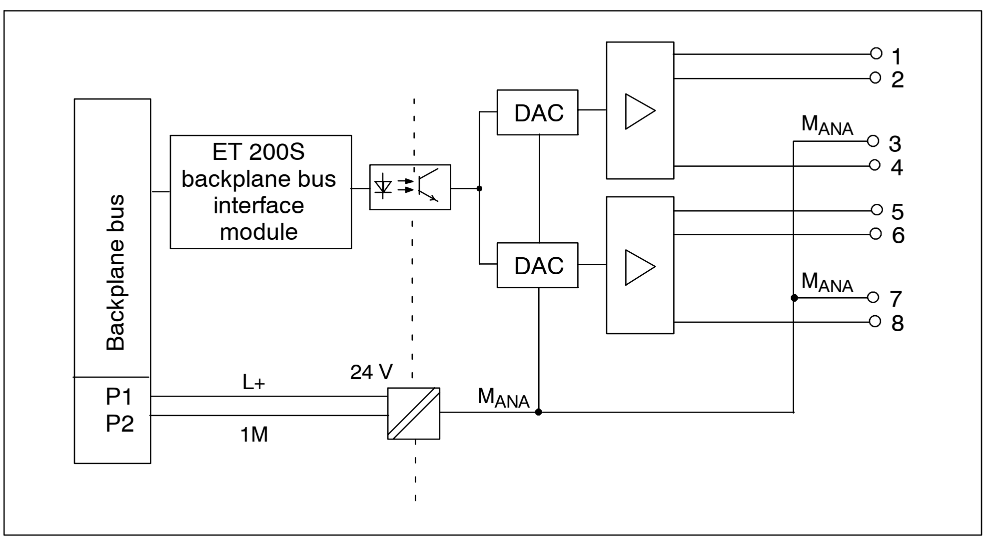


Figure 12-20 Block Diagram of the 2AO U High Feature

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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

12.19 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 12-51 Terminal Assignment of the 2AO I Standard

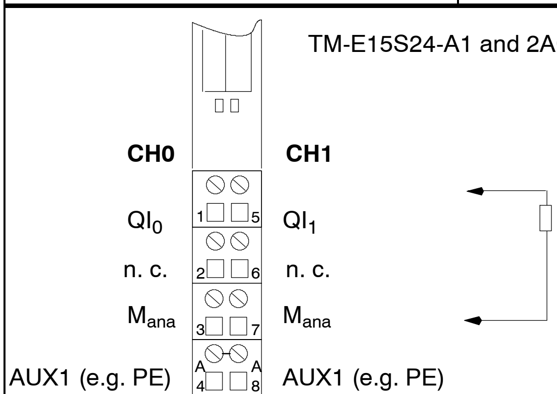
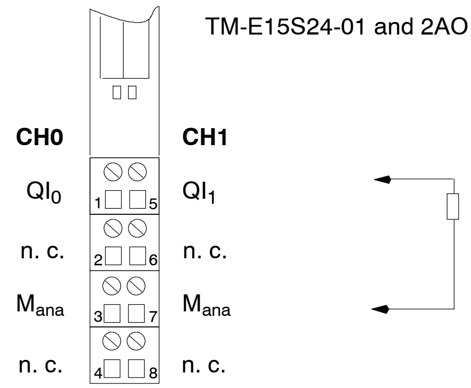
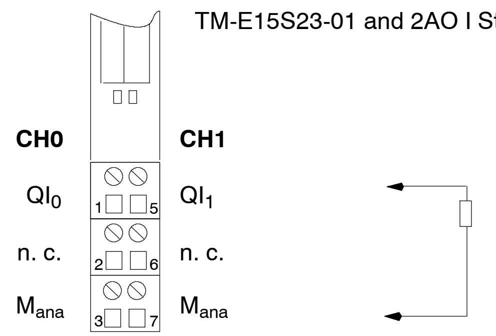
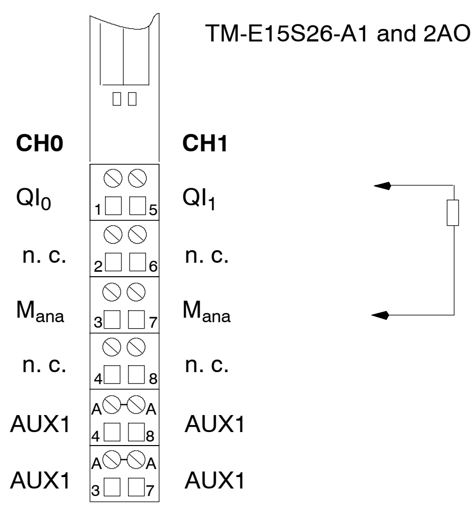
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 2AO I Standard	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 QI: Analog output current M_{ana}: Ground of the module Terminals 2 and 6 can be used for unneeded wires of up to 30 VDC.

Table 12-51 Terminal Assignment of the 2AO I Standard, continued

View	Terminal Assignment	Remarks
	TM-E15S24-01 and 2AO I Standard	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 Standard	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 Standard	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

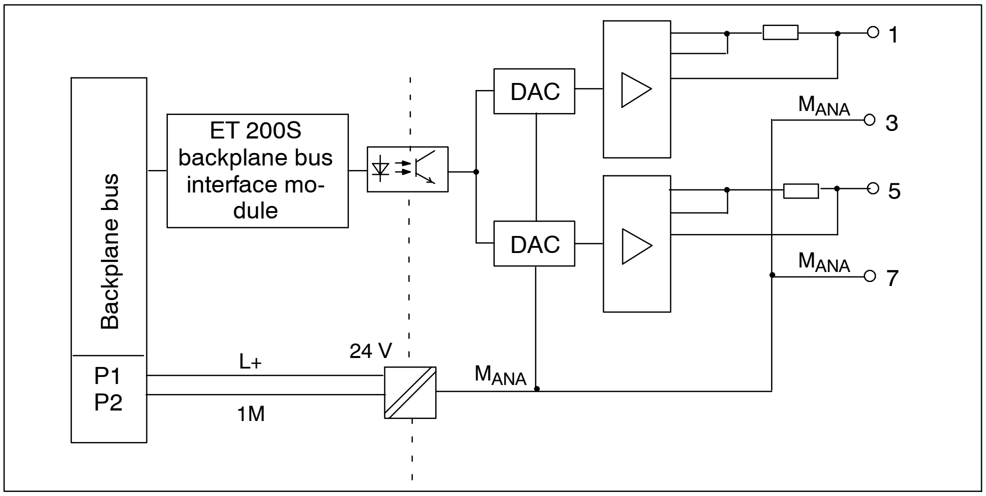


Figure 12-21 Block Diagram of the 2AO I Standard

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	 15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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 diffe-rence	
• 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, 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

12.20 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+

Terminal Assignment

The following table indicates the terminal assignment of the 2AO I High Feature for the different terminal modules:

Table 12-52 Terminal Assignment of the 2AO I High Feature

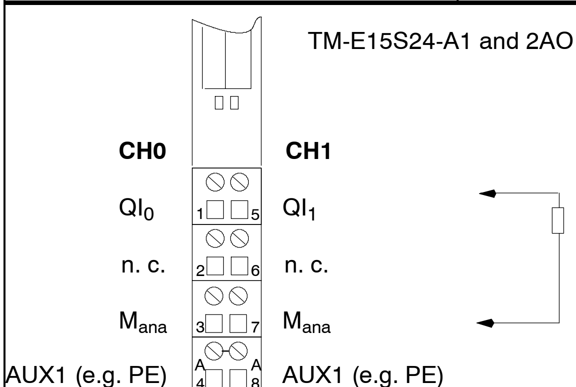
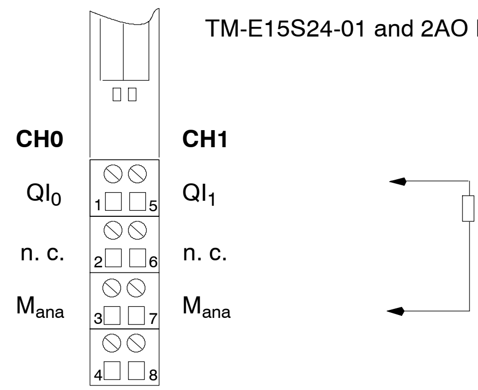
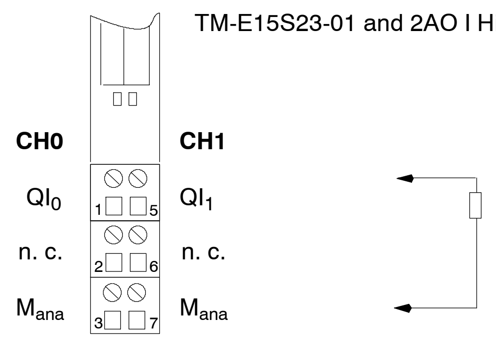
View	Terminal Assignment	Remarks
	TM-E15S24-A1 and 2AO I High Feature	Channel 0: Terminals 1 to A4 Channel 1: Terminals 5 to A8 QI: Analog output current M_{ana}: Ground of the module Terminals 2 and 6 can be used for unneeded wires of up to 30 VDC.

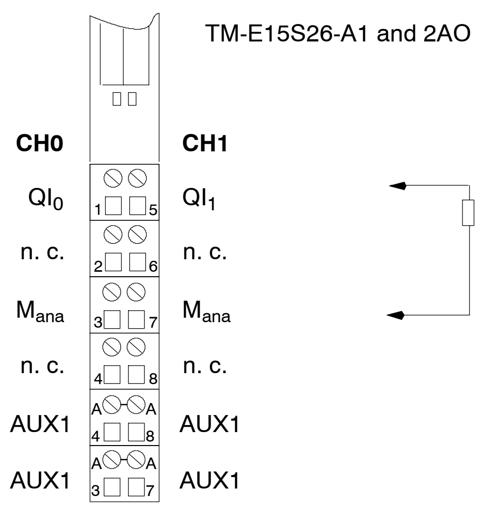
Table 12-52 Terminal Assignment of the 2AO I High Feature, continued

<table>
<tr><th>View</th><th>Terminal Assignment</th><th>Remarks</th></tr>
<tr><td colspan="2">TM-E15S24-01 and 2AO I High Feature

</td><td>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.</td></tr>
<tr><td colspan="2">TM-E15S23-01 and 2AO I High Feature

</td><td>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.</td></tr>
<tr><td colspan="2">TM-E15S26-A1 and 2AO I High Feature

</td><td>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.</td></tr>
</table>

Block Diagram

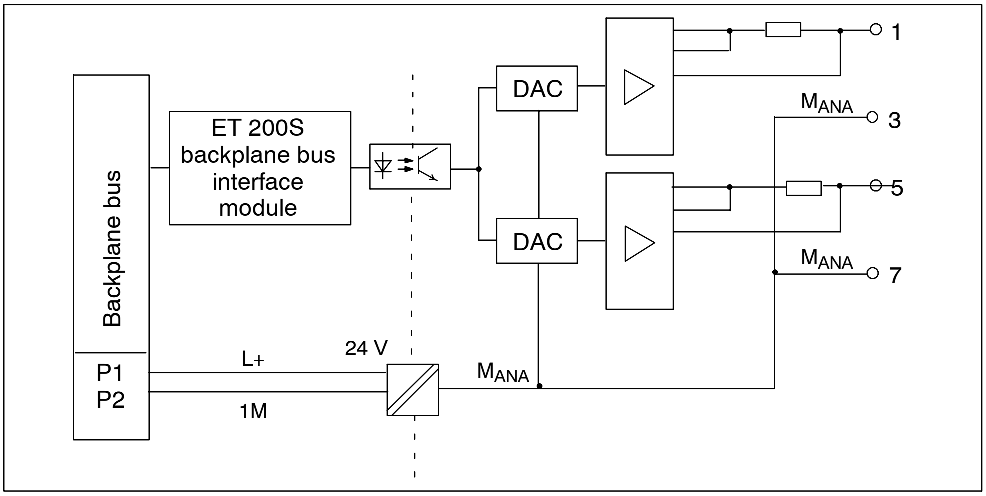


Figure 12-22 Block Diagram of the 2AO I High Feature

Technical Specifications

Dimensions and Weight	
Dimensions W × H × D (mm)	15 x 81 x 52
Weight	Approx. 40 g
Data for Specific Modules	
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, 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	
• Current output	
Two-conductor connection	Possible

RESERVE Modules 13

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 to the 5136-DNS-200S DeviceNet Slave Adapter:
  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.

Parameter Assignment

- Using the DNS-200 Configuration Tool software, parameterize the electronic module you want to use for future applications, such as 4DI DC High Feature on the slot of the RESERVE module.

- Parameterize the interface module as follows:

Parameters	Setting
Operation at Preset <> Actual Configuration	Enable
I/O Status Byte Enable	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 I/O Status LED flashes.
- The I/O Status Byte returns 1.
- A channel-specific diagnosis and module status “10_B: Wrong module” for the RESERVE module slot are generated.

Refer to Section 3.5 for more information.

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, 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 accessories that you may need to use with the ET 200S.

Interface Module

Table A-1 Interface Module Order Numbers

Designation	Order Number
DeviceNet interface module package, which includes as 1 unit: – interface module and terminating module (5136-DNS-200S) – terminal module (TM-P15S23-A0 (screw-type terminal), 1 unit – power module (6ES7 138-4CB10-0AB0)	DNH200S

Terminal Modules

Explanation of the abbreviated designation

TM-P 15S24-01

01: Uninterrupted AUX1 bus without a connection to the terminals
A1: Uninterrupted AUX1 bus with a connection to the terminals
A0: Interrupted AUX1 bus with a connection to the terminals

Number of terminals (columns x rows)

S: Screw-type terminal
C: spring terminal
N: Fast Connect

Width in millimeters

P: Power module
E: Electronic module

Terminal module

Figure A-1 Explanation of the Abbreviated Designation

Table A-2 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-P15N22-01 (Fast Connect), 1 unit	6ES7193-4CE60-0AA0
TM-E15S26-A1 (screw-type terminal), 5 units	6ES7193-4CA40-0AA0
TM-E15C26-A1 (spring terminal), 5 units	6ES7193-4CA50-0AA0
TM-E15N26-A1 (spring terminal), 5 units	6ES7193-4CA80-0AA0
TM-E15S24-A1 (screw-type terminal), 5 units	6ES7193-4CA20-0AA0
TM-E15C24-A1 (spring terminal), 5 units	6ES7193-4CA30-0AA0

Table A-2 Terminal Module Order Numbers, continued

Designation	Order Number
TM-E15N24-A1 (Fast Connect), 5 units	6ES7193-4CA70-0AA0
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	6ES7193-4CL20-0AA0
TM-E15C24-AT (spring terminal), 5 units	6ES7193-4CL30-0AA0
TM-E30S44-01 (screw-type terminal), 1 unit	6ES7193-4CG20-0AA0
TM-E30C44-01 (screw-type terminal), 1 unit	6ES7193-4CG30-0AA0

Power Modules

Table A-3 Power Module Order Numbers

Designation	Order Number
PM-E 24 VDC, 1 unit	6ES7138-4CA00-0AA0
PM-E 24 VDC / 120/230 VAC, 1 unit	6ES7138-4CB00-0AB0
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-4 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

Table A-4 Digital Electronic Module Order Numbers, continued

Designation	Order Number
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

Analog Electronic Modules

Table A-5 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-6 Process-Related Module Order Numbers

Designation	Order Number
1Count 24V/100kHz, 1 unit	6ES7138-4DA03-0AB0
1Count 5V/500kHz, 1 unit	6ES7138-4DE01-0AB0
1 SSI, 1 unit	6ES7138-4DB01-0AB0
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-7 Reserve Module Order Numbers

Designation	Order Number
RESERVE (with 15mm), 5 unit	6ES7138-4AA00-0AA0
RESERVE (with 30 mm), 1 unit	6ES7138-4AA10-0AA0

ET 200S Accessories

Table A-8 ET 200S Accessories Order Numbers

Designation	Order Number
Shield contact: Shield contact element, 5 units Power rail, 1 units at 1 m, 3x10 mm Shield terminal, 5 units Ground connection terminal	 6ES7193-4GA00-0AA0 8WA2 842 6ES7193-4GB00-0AA0 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 • Red • Yellow • yellow-green • Brown • Blue • Turquoise	 6ES7193-4LA10-0AA0 6ES7193-4LD10-0AA0 6ES7193-4LB10-0AA0 6ES7193-4LC10-0AA0 6ES7193-4LG10-0AA0 6ES7193-4LF10-0AA0 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

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

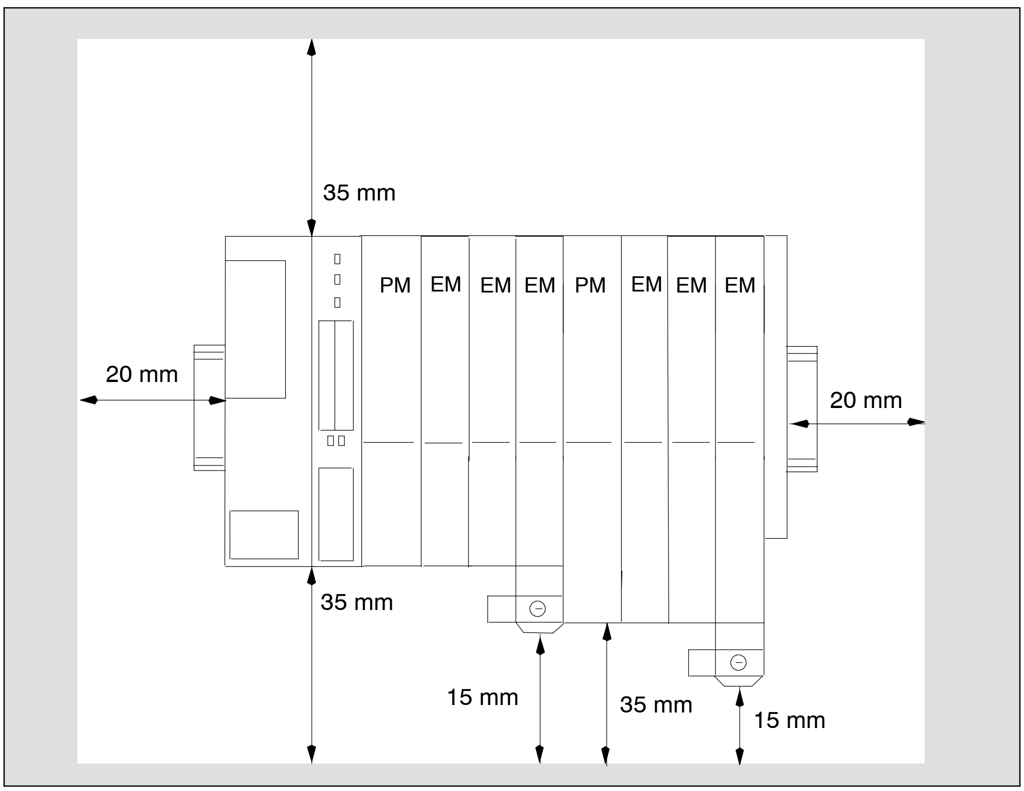


Figure B-1 Minimum Clearances

Interface Module

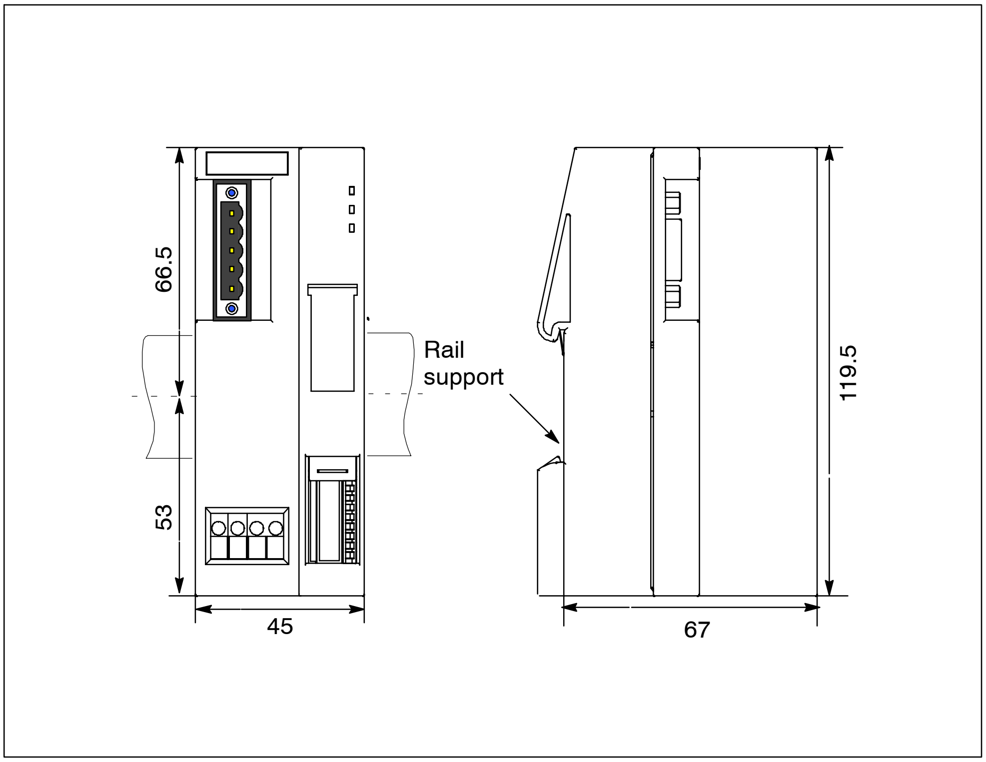
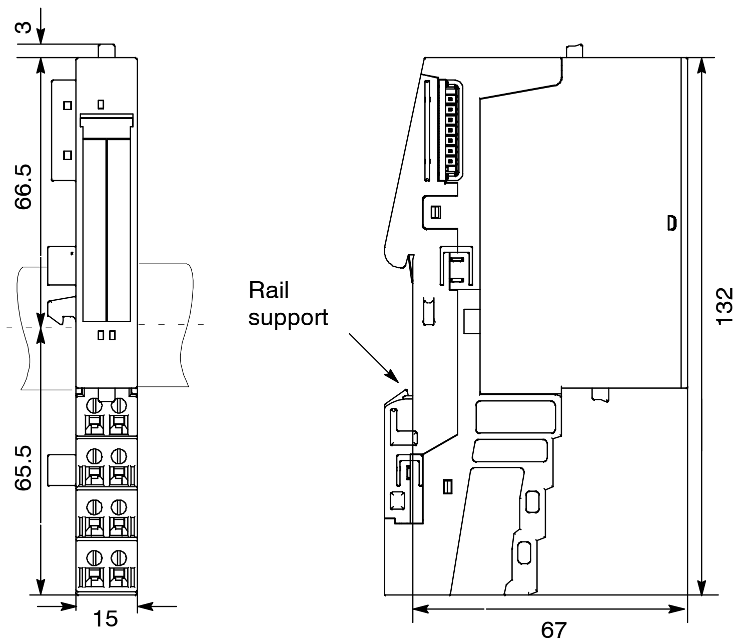


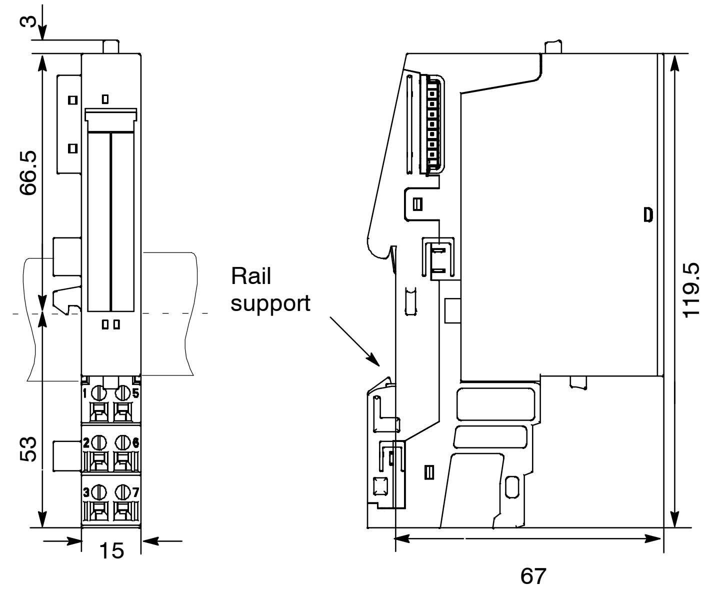
Figure B-2 Interface Module Dimension Drawing

Terminal Modules (Screw-Type/Spring Terminals) with an Electronic Module Inserted

The dimensions of the terminal modules with the power module inserted are identical.

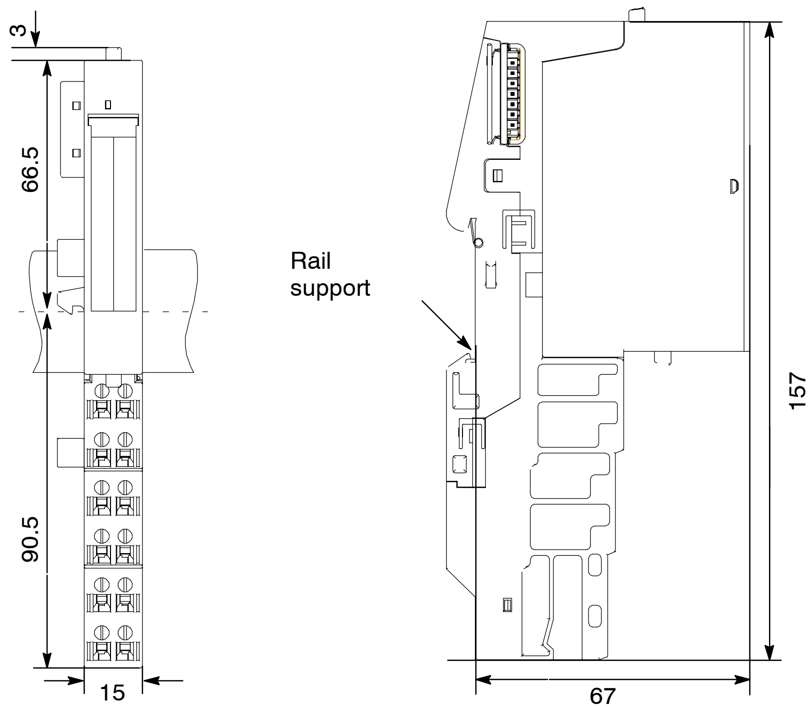


TM-E15S24-A1, TM-E15C24-A1, and TM-E15N24-A1 Terminal Modules (6ES7193-4CAx0-0AA0) and TM-E15S24-01, TM-E15C24-01, and TM-E15N24-01 Terminal Modules (6ES7193-4CBx0-0AA0)

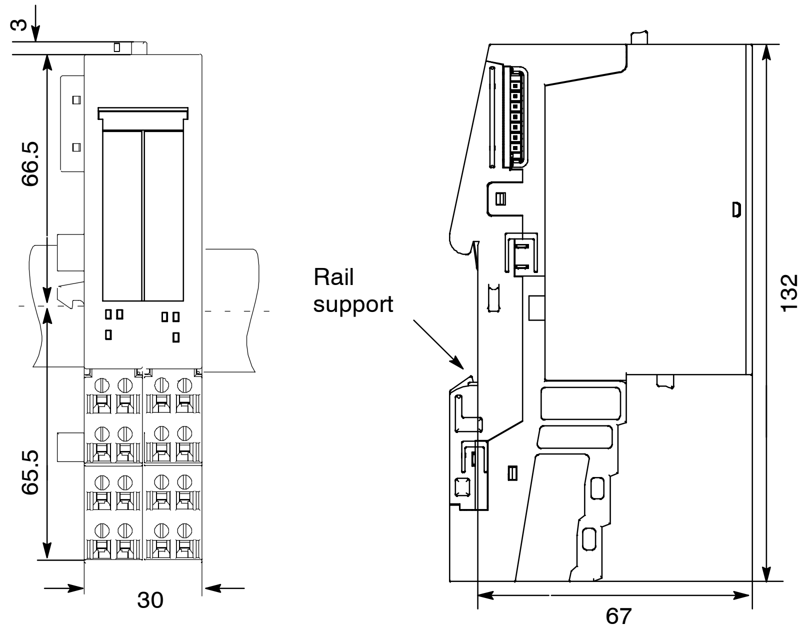


TM-E15S23-01, TM-E15C23-01, and TM-E15N23-01 Terminal Modules (6ES7193-4CBx0-0AA0)

Figure B-3 Dimensioned Drawing of Terminal Modules (Screw-Type/Spring Terminals) with an Electronic Module Inserted



TM-E15S26-A1, TM-E15C26-A1, and TM-E15N26-A1
Universal Terminal Modules (6ES7193-4CAx0-0AA0)

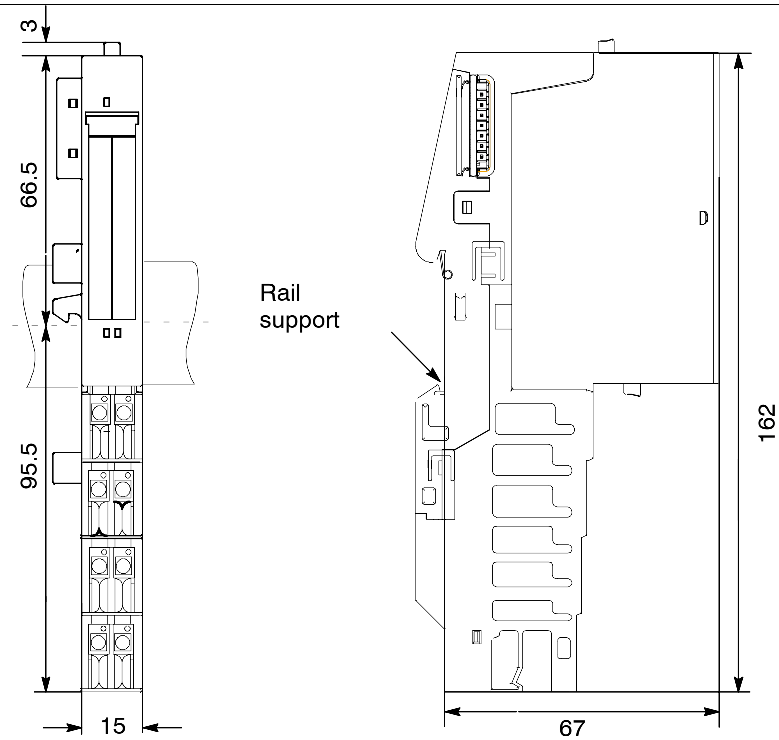


TM-E30S44-01 and TM-E30C44-01 Terminal Modules
(6ES7193-4CGx0-0AA0)

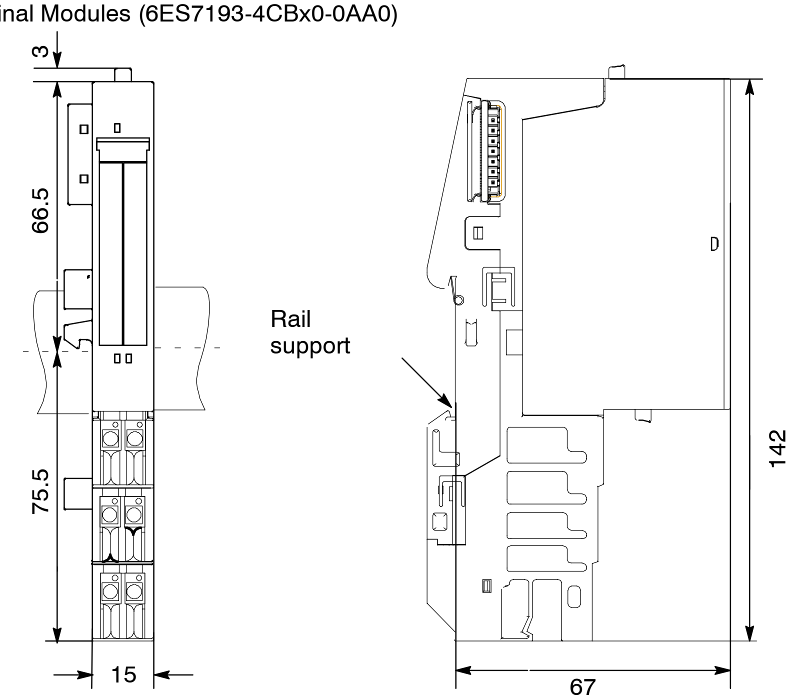
Figure B-4 Dimensioned Drawing of Terminal Modules (Screw-Type/Spring Terminals) with an Electronic Module Inserted

Terminal Modules (Fast Connect) with an Electronic Module Inserted

The dimensions of the terminal modules with the power module inserted are identical.

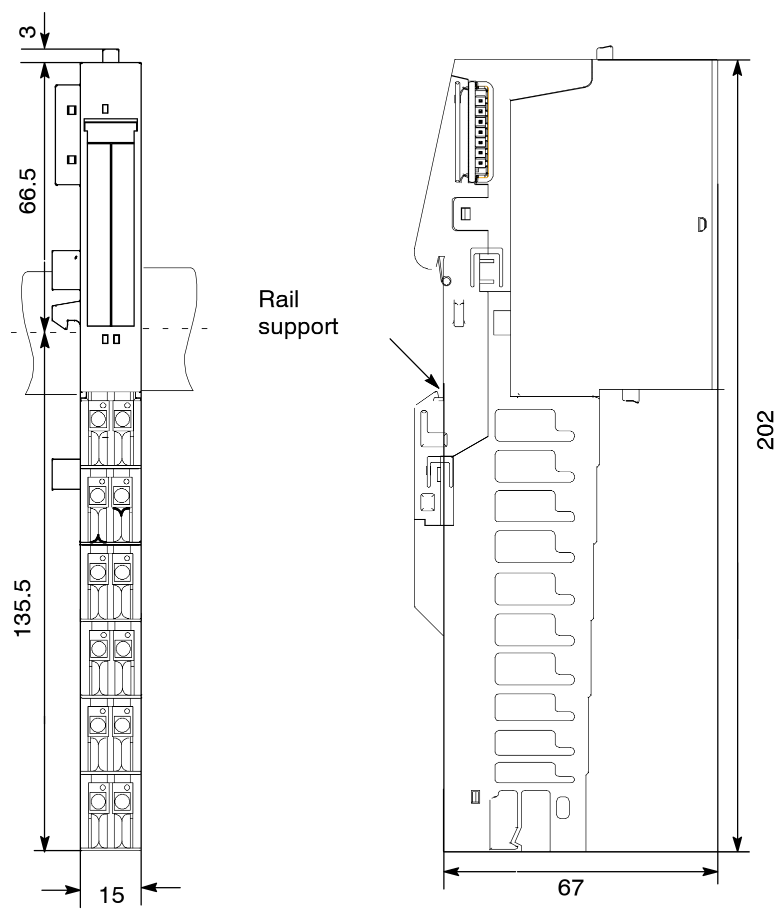


TM-E15S24-A1, TM-E15C24-A1, and TM-E15N24-A1 Terminal Modules (6ES7193-4CAx0-0AA0) and TM-E15S24-01, TM-E15C24-01, and TM-E15N24-01 Terminal Modules (6ES7193-4CBx0-0AA0)



TM-E15S23-01, TM-E15C23-01, TM-E15N23-01 Terminal Modules (6ES7193-4CBx0-0AA0)

Figure B-5 Dimensioned Drawing of Terminal Modules (Fast Connect) with an Electronic Module Inserted



TM-E15S26-A1, TM-E15C26-A1, and TM-E15N26-A1
Universal Terminal Modules (6ES7193-4CAx0-0AA0)

Figure B-6 Dimensioned Drawing of Terminal Modules (Fast Connect) with an Electronic Module Inserted

Terminating Module

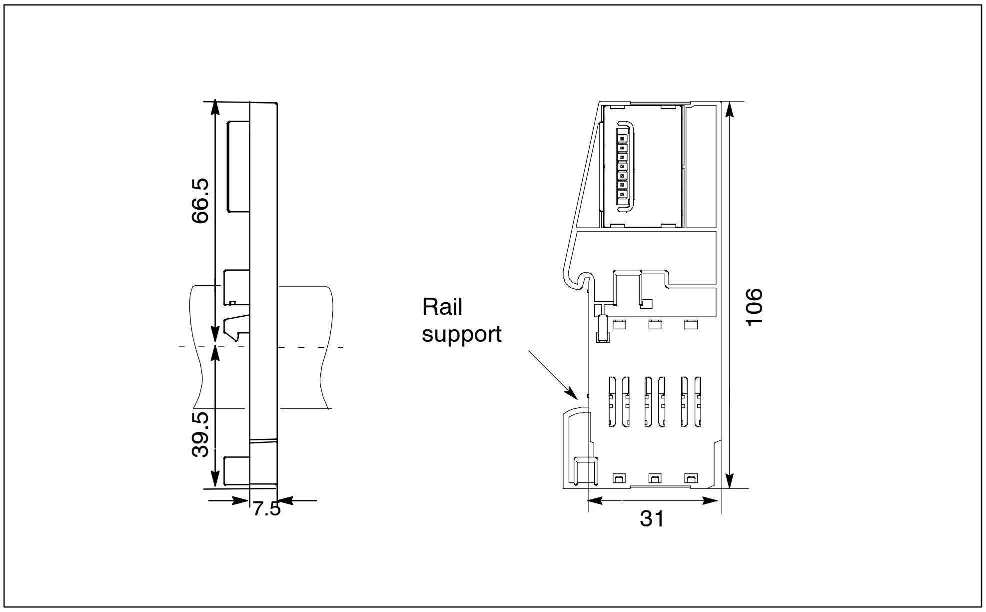


Figure B-7 Terminating Module Dimensioned Drawing

Shield Contact

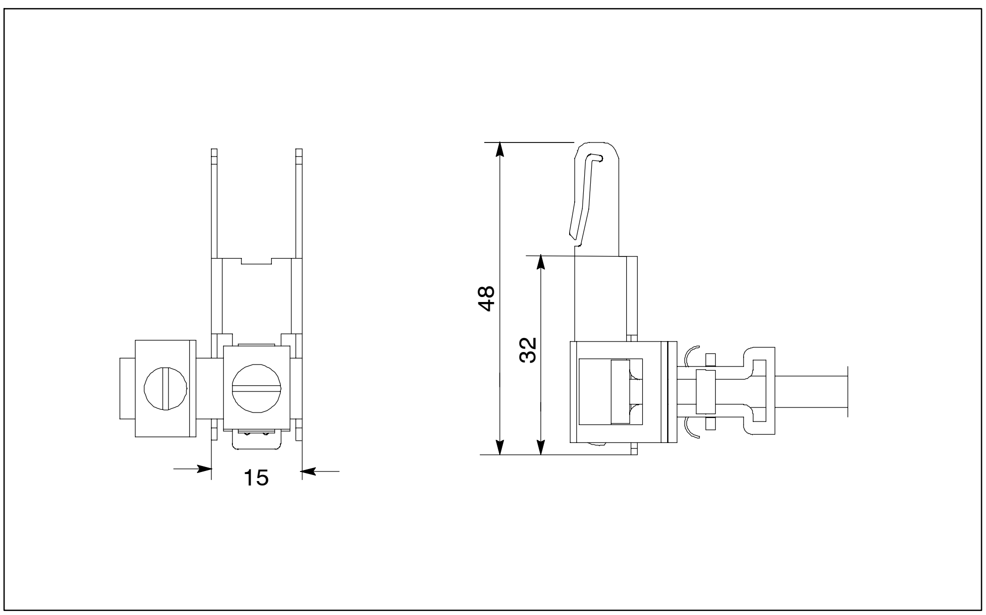


Figure B-8 Shield Contact Dimension Drawing

Address Space of the Inputs 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]
Digital input modules	1 byte	2 bits (2DI) 4 bits (4DI)	---	---
Digital output modules	---	---	1 byte	2 bits (2DI) 4 bits (4DI)
NAMUR input	2 bytes		—	
Analog input modules	4 byte		---	---
Analog output modules	---	---	4 byte	
1Count 24V/100kHz	8 byte		8 byte	
1Count 5V/500kHz	8 byte		8 byte	
1SSI	8 byte		8 byte	
1SSI fast	4 byte		---	
EM 1STEP 5V/204kHz	8 byte		8 byte	
2PULSE	8 byte		8 byte	
1POS INC/Digital	8 byte		8 byte	
1POS SSI/Digital	8 byte		8 byte	
1POS INC/Analog	8 byte		8 byte	
1POS SSI/Analog	8 byte		8 byte	
1SI 3964/ASCII serial interface module	4/8 bytes		4/8 bytes	
1SI Modbus/USS serial interface module	4/8 bytes		4/8 bytes	
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 (Configuring the ET 200S)

Response Times

D

Introduction

The figure below shows the different response times between the master and the ET 200S.

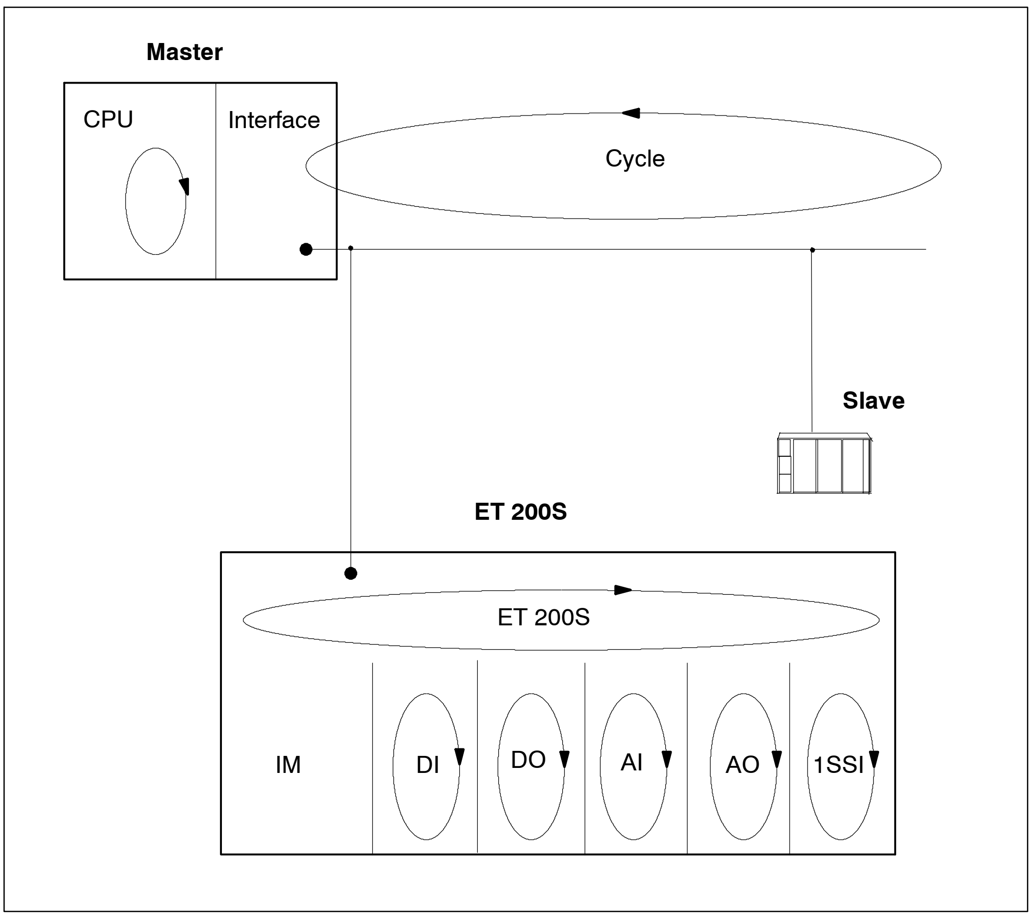


Figure D-1 Response Times between the Master and the ET 200S

D.1 Response Times at the Master

You will find information on the response times in the manual for the master.

D.2 Response Times for the ET 200S

Calculation of the Response Time

The following formula enables you to make an approximate calculation of the ET 200S response time:

Response time [μs]* = $55 \cdot m + 110 \cdot a + 400 \cdot t + 190$

Explanation of the parameters:

- **m**: Total number of all modules (power modules, digital electronic modules, analog electronic modules, process-related modules, and motor starters)
- **a**: Sum of all the analog 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 Calculating the ET 200S Response Time

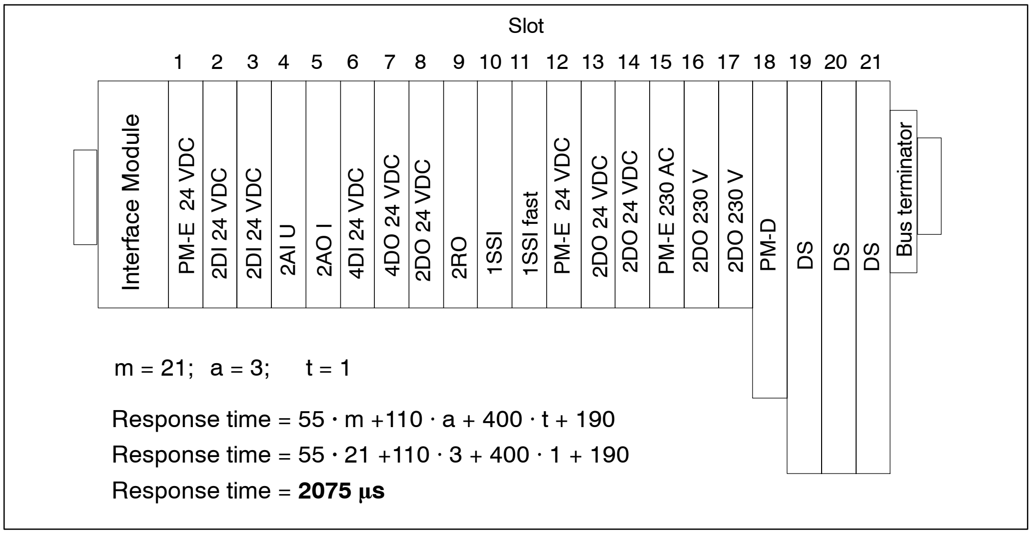


Figure D-2 Example of Calculating the ET 200S Response Time

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 11.

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 12.15 and 2AI TC HIGH FEATURE, Section 12.16).

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-3 provides you with an overview of what makes up the cycle time for an n-channel analog input module.

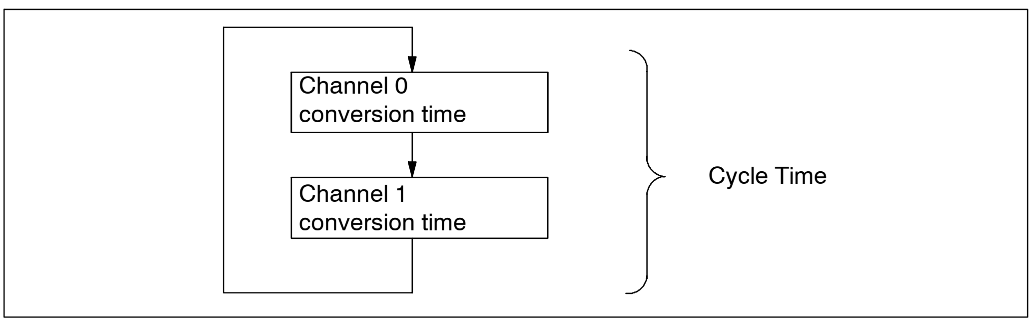


Figure D-3 Cycle Time of the Analog Input Module

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-4 provides you with an overview of what makes up the cycle time for an analog output module.

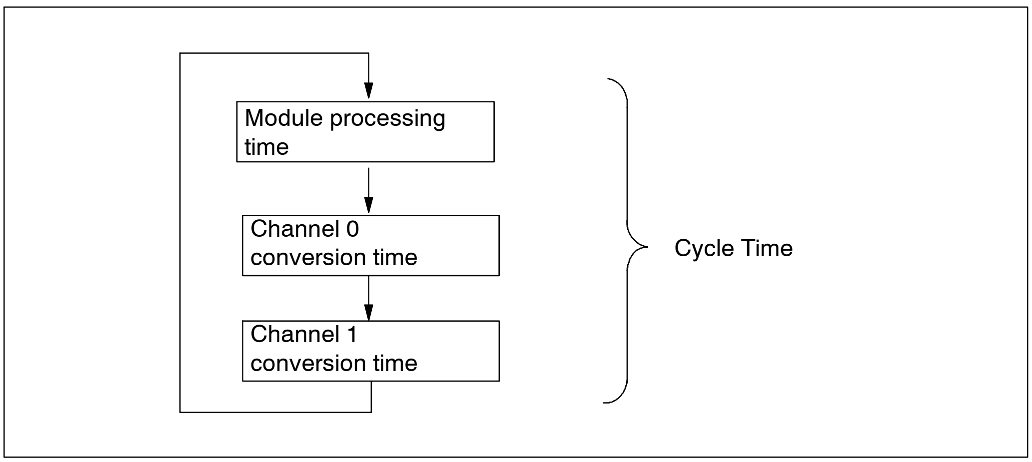


Figure D-4 Cycle Time of the Analog Output Module

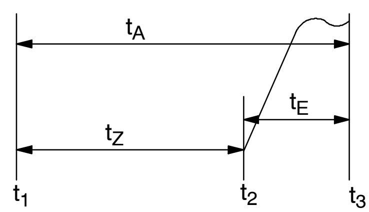
Settling Time

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-5 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 = specific output value reached

Figure D-5 Response Time of an Analog Output Channel

D.7 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	---

Note

Refer to the DeviceNet specification for details of the DeviceNet cable interface.

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 **one** 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

$$R_{IM} = R_{PM-E\ DC24V} = R_{Modul} = 9.5\ M\Omega$$

R_{IM} Leakage resistance of the 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 a 5136-DNS-200S, two PM-E 24 VDC power modules, and various input and output modules. The entire ET 200S station is equipped with **one** 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

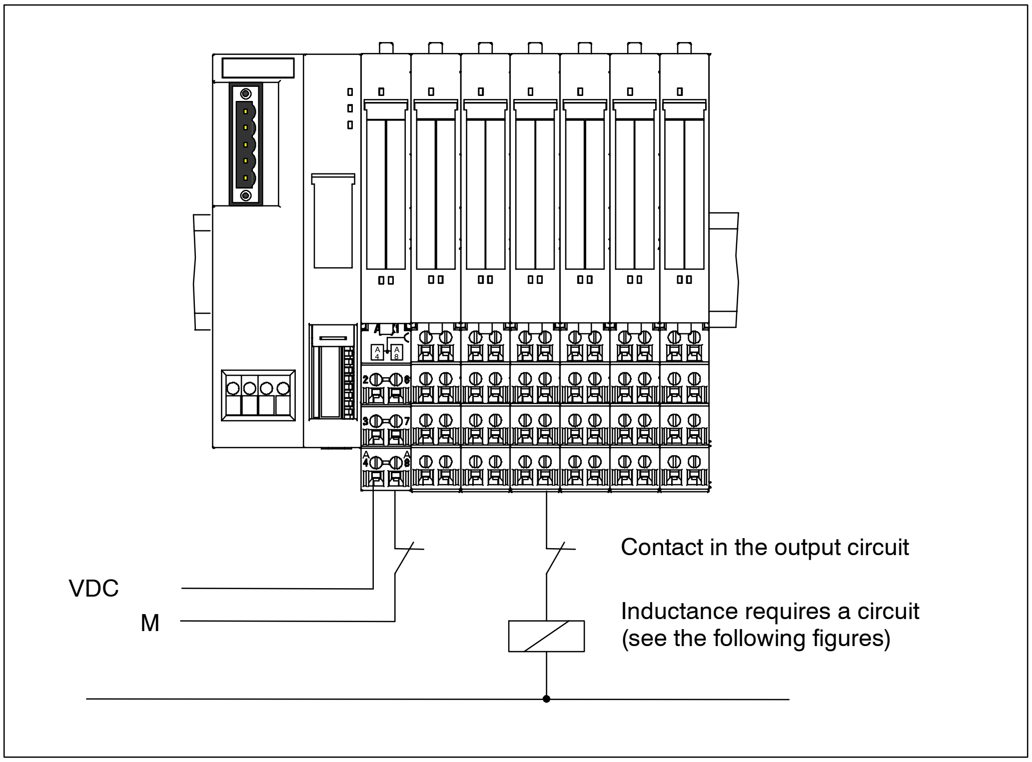


Figure F-2 Relay Contact for Emergency Stop in the Output Circuit

Wiring of DC-operated Coils

DC-operated coils are wired with diodes and Zener diodes as illustrated in the following figure.

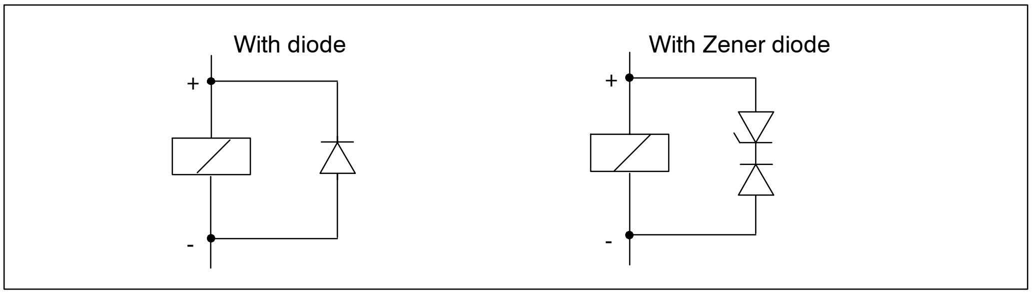


Figure F-3 Wiring of DC-operated Coils

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.

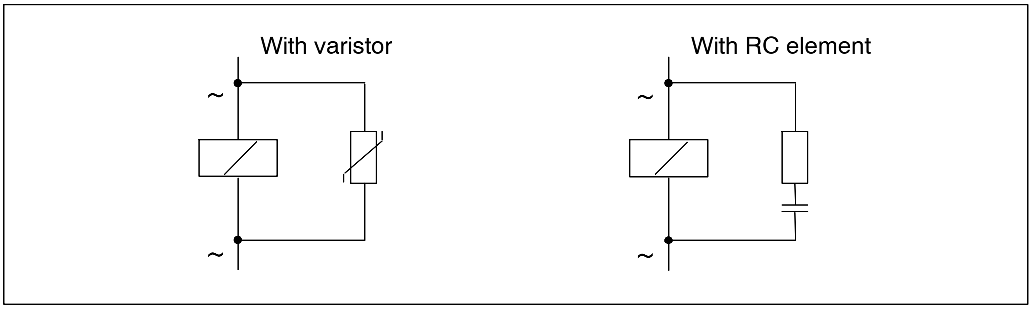


Figure F-4 Wiring of AC-operated Coils

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 potentials (up to 230 VAC), 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

Backplane bus

The backplane bus is a serial data bus by means of which the interface module 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 nodes 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)

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 distributed I/O systems are connected to the master by means of DeviceNet.

Expected Packet Rate (EPR)

For each Master/Slave connection, a timer is set to timeout a connection if there is no response within 4*EPR.

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 DeviceNet enables distributed I/O devices to be connected to a CPU. 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.

Slaves can be the distributed I/O devices (for example, ET 200S and ET 200X).

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

Grouping enables the more efficient use of the ET 200S distributed I/O system address space and data transfer. The data of digital input/output modules may be packed into shared bytes, instead of using a whole byte for each module’s data.

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).

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.

Node address

Each node must receive a node address to identify it uniquely on the network.

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 master to the slave.

PELV

Protective Extra Low Voltage = functional extra-low voltage with safe disconnection

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 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 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.

Programmable controller

A programmable controller is a programmable logic controller consisting of at least one CPU, various input and output modules, and operator interfaces.

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.

SELV

Protective Extra Low Voltage = safe 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 slaves, such as ET 200X and ET 200S.

SSI

The position 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.

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.

Index

Numbers

A

B

C

D

E

F

G

H

I

L

M

N

O

P

Q

R

U

V

W

To

SIEMENS ENERGY & AUTOMATION INC
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ONE INTERNET PLAZA
PO BOX 4991
JOHNSON CITY TN USA 37604-4991

From

Name: _
Job Title: _
Company Name: _
Street: _
City and State: _
Country: _
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