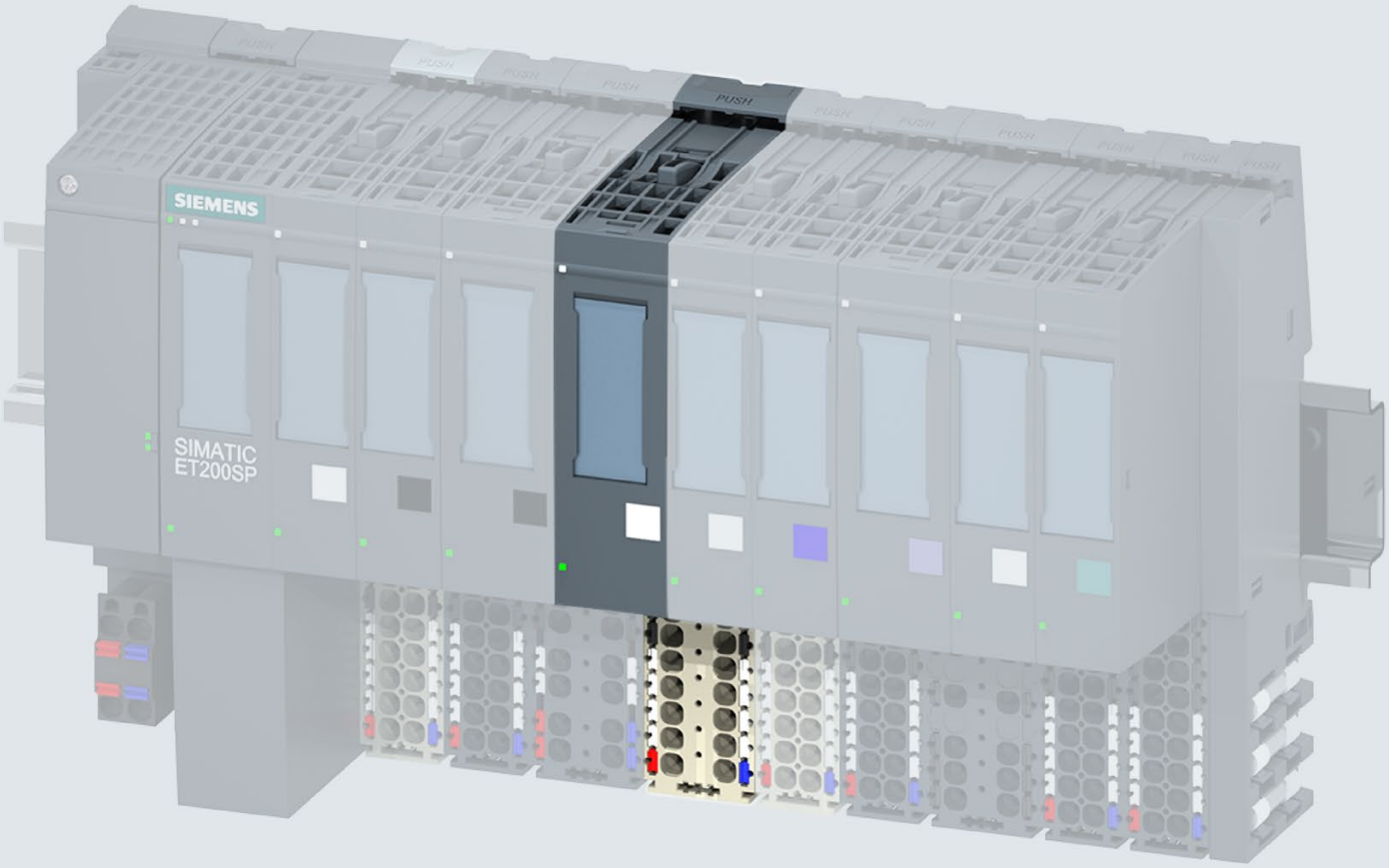
SIEMENS



Manual

SIMATIC

ET 200SP

Digital input module
DI 8x24VAC/48VUC BA (6ES7131-6CF00-0AU0)

Edition 07/2018

support.industry.siemens.com

SIEMENS

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ET 200SP
Digital input module
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Manual

07/2018

A5E42285997-AA

Legal information

Warning notice system

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Preface

Purpose of the documentation

This manual supplements the system manual ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293).

Functions that generally relate to the system are described in this manual.

The information provided in this manual and in the system/function manuals supports you in commissioning the system.

Conventions

CPU: When the term "CPU" is used in this manual, it applies to the CPUs of the S7-1500 automation system as well as to the CPUs/interface modules of the distributed I/O system ET 200SP.

STEP 7: In this documentation, "STEP 7" is used as a synonym for all versions of the configuration and programming software "STEP 7 (TIA Portal)".

Please also observe notes marked as follows:

Note

A note contains important information on the product described in the documentation, on the handling of the product or on the section of the documentation to which particular attention should be paid.

Recycling and disposal

For environmentally friendly recycling and disposal of your old equipment, contact a certified electronic waste disposal company and dispose of the equipment according to the applicable regulations in your country.

Security information

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

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

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit (https://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customers' exposure to cyber threats.

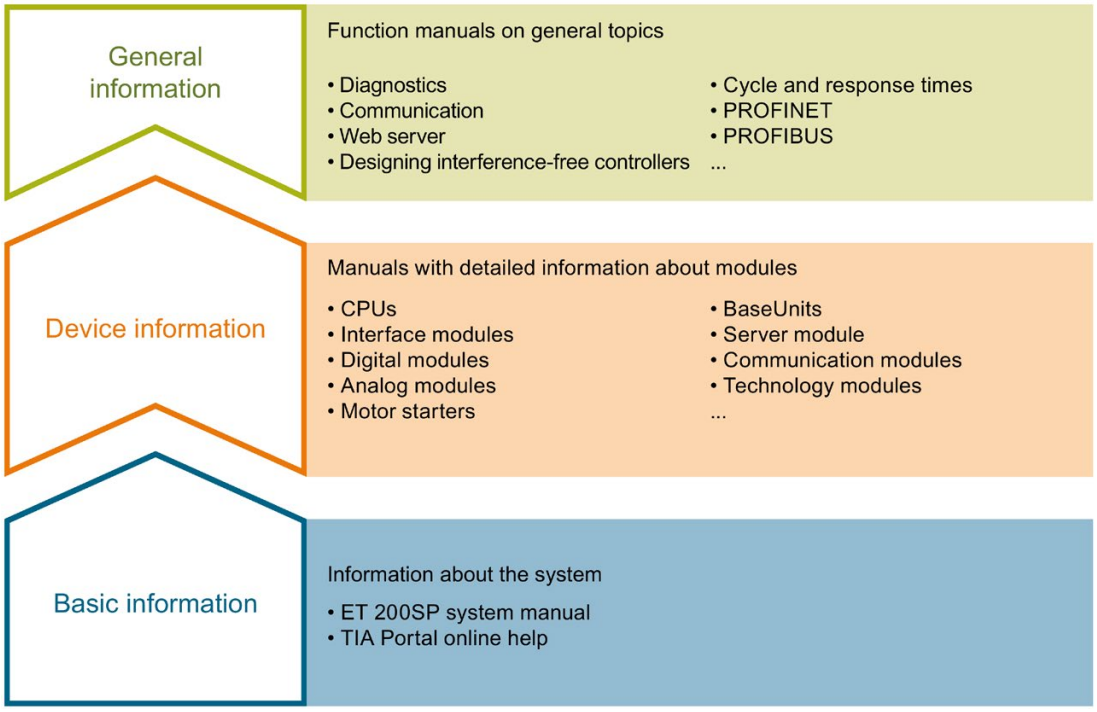
To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under (https://www.siemens.com/industrialsecurity).

Table of contents

Guide to documentation

1

The documentation for the SIMATIC ET 200SP distributed I/O system is arranged into three areas.
This arrangement enables you to access the specific content you require.



Basic information

The system manual describes in detail the configuration, installation, wiring and commissioning of the SIMATIC ET 200SP. distributed I/O system. The STEP 7 online help supports you in the configuration and programming.

Device information

Product manuals contain a compact description of the module-specific information, such as properties, wiring diagrams, characteristics and technical specifications.

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC ET 200SP distributed I/O system, e.g. diagnostics, communication, Web server, motion control and OPC UA.

You can download the documentation free of charge from the Internet (https://support.industry.siemens.com/cs/ww/en/view/109742709).

Changes and supplements to the manuals are documented in a Product Information.

You can download the product information free of charge from the Internet (https://support.industry.siemens.com/cs/us/en/view/73021864).

Manual Collection ET 200SP

The Manual Collection contains the complete documentation on the SIMATIC ET 200SP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet (http://support.automation.siemens.com/WW/view/en/84133942).

"mySupport"

With "mySupport", your personal workspace, you make the most of your Industry Online Support.

In "mySupport" you can store filters, favorites and tags, request CAx data and put together your personal library in the Documentation area. Furthermore, your data is automatically filled into support requests and you always have an overview of your current requests.

You need to register once to use the full functionality of "mySupport".

You can find "mySupport" in the Internet (https://support.industry.siemens.com/My/ww/en).

"mySupport" - Documentation

In the Documentation area of "mySupport", you have the possibility to combine complete manuals or parts of them to make your own manual.
You can export the manual in PDF format or in an editable format.

You can find "mySupport" - Documentation in the Internet (http://support.industry.siemens.com/My/ww/en/documentation).

"mySupport" - CAx Data

In the CAx Data area of "mySupport", you can have access the latest product data for your CAx or CAe system.

You configure your own download package with a few clicks.

In doing so you can select:

- Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files
- Manuals, characteristics, operating manuals, certificates
- Product master data

You can find "mySupport" - CAx Data in the Internet (http://support.industry.siemens.com/my/ww/en/CAxOnline).

Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus in individual products.

You can find the application examples on the Internet (https://support.industry.siemens.com/sc/ww/en/sc/2054).

TIA Selection Tool

With the TIA Selection Tool, you can select, configure and order devices for Totally Integrated Automation (TIA).
This tool is the successor of the SIMATIC Selection Tool and combines the known configurators for automation technology into one tool.
With the TIA Selection Tool, you can generate a complete order list from your product selection or product configuration.

You can find the TIA Selection Tool on the Internet (http://w3.siemens.com/mcms/topics/en/simatic/tia-selection-tool).

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to run commissioning and maintenance activities simultaneously on various SIMATIC S7 stations as a bulk operation independently of the TIA Portal.

The SIMATIC Automation Tool provides a multitude of functions:

- Scanning of a PROFINET/Ethernet network and identification of all connected CPUs
- Address assignment (IP, subnet, gateway) and station name (PROFINET device) to a CPU
- Transfer of the data and the programming device/PC time converted to UTC time to the module
- Program download to CPU
- Operating mode switchover RUN/STOP
- Localization of the CPU by means of LED flashing
- Reading out CPU error information
- Reading the CPU diagnostic buffer
- Reset to factory settings
- Updating the firmware of the CPU and connected modules

You can find the SIMATIC Automation Tool on the Internet (https://support.industry.siemens.com/cs/ww/en/view/98161300).

PRONETA

With SIEMENS PRONETA (PROFINET network analysis), you analyze the plant network during commissioning. PRONETA features two core functions:

- The topology overview independently scans PROFINET and all connected components.
- The IO check is a fast test of the wiring and the module configuration of a system.

You can find SIEMENS PRONETA on the Internet (https://support.industry.siemens.com/cs/ww/en/view/67460624).

SINETPLAN

SINETPLAN, the Siemens Network Planner, supports you in planning automation systems and networks based on PROFINET. The tool facilitates professional and predictive dimensioning of your PROFINET installation as early as in the planning stage. In addition, SINETPLAN supports you during network optimization and helps you to exploit network resources optimally and to plan reserves. This helps to prevent problems in commissioning or failures during productive operation even in advance of a planned operation. This increases the availability of the production plant and helps improve operational safety.

The advantages at a glance

- Network optimization thanks to port-specific calculation of the network load
- Increased production availability thanks to online scan and verification of existing systems
- Transparency before commissioning through importing and simulation of existing STEP 7 projects
- Efficiency through securing existing investments in the long term and optimal exploitation of resources

You can find SINETPLAN on the Internet (https://www.siemens.com/sinetplan).

Product overview

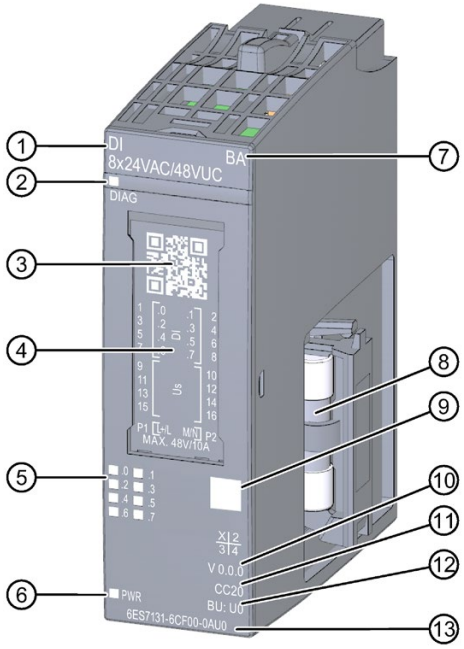
2

2.1 Properties

Article number

6ES7131-6CF00-0AU0

View of the module



① Module type and name
② LED for diagnostics
③ 2D matrix code
④ Wiring diagram
⑤ LEDs for channel status
⑥ LED for supply voltage
⑦ Function class
⑧ Replaceable fuse
⑨ Color coding module type
⑩ Function and firmware version
⑪ Color code for selecting the color identification labels
⑫ BU type
⑬ Article number

Figure 2-1 View of the module DI 8x24VAC/48VUC BA

Note

Replace the fuse

1. Remove the module from the station.
2. Insert a screwdriver into the slotted top face of the fuse holder.
3. Lift out the fuse holder.
4. Replace the fuse.
5. Slide the fuse holder back into the module.

Properties

The module has the following technical properties:

- 8 digital inputs
- Suitable for connection of switches and 2-wire sensors in accordance with IEC 61131, type 1

The module supports the following functions:

Table 2- 1 Version dependencies of the functions

Function	HW version	FW version	STEP 7		GSD file	
			TIA Portal	V5.x	PROFINET IO	PROFIBUS DP
Identification data I&M0 to I&M3	FS01	V0.0.0 and higher	as of V15 with HSP 0254	as of V5.5 SP3 with HSP 0229 V8.0	X	X
Configuration in RUN	FS01	V0.0.0 and higher	as of V15 with HSP 0254	as of V5.5 SP3 with HSP 0229 V8.0	X	X

Accessories

The following accessories must be ordered separately:

- Labeling strips
- Color identification labels
- Reference identification label
- Shield connector

You can find additional information on the accessories in the ET 200SP Distributed I/O System (https://support.industry.siemens.com/cs/ww/en/view/58649293) system manual.

Wiring

3

3.1 Wiring and block diagram

This section includes the block diagram of the DI 8x24VAC/48VUC BA module with the terminal assignments for a 1-wire and 2-wire connection.

Information about wiring of the BaseUnit is available in the system manual ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293).

Note

You may use and combine the different wiring options for all channels.

Note

Hazardous voltage, risk of fatal or serious injury

Always disconnect the system and module from the power supply before commencing work.

Note

Limiting overvoltage

You must ensure overvoltage is limited to 1 kV for the encoder supply.

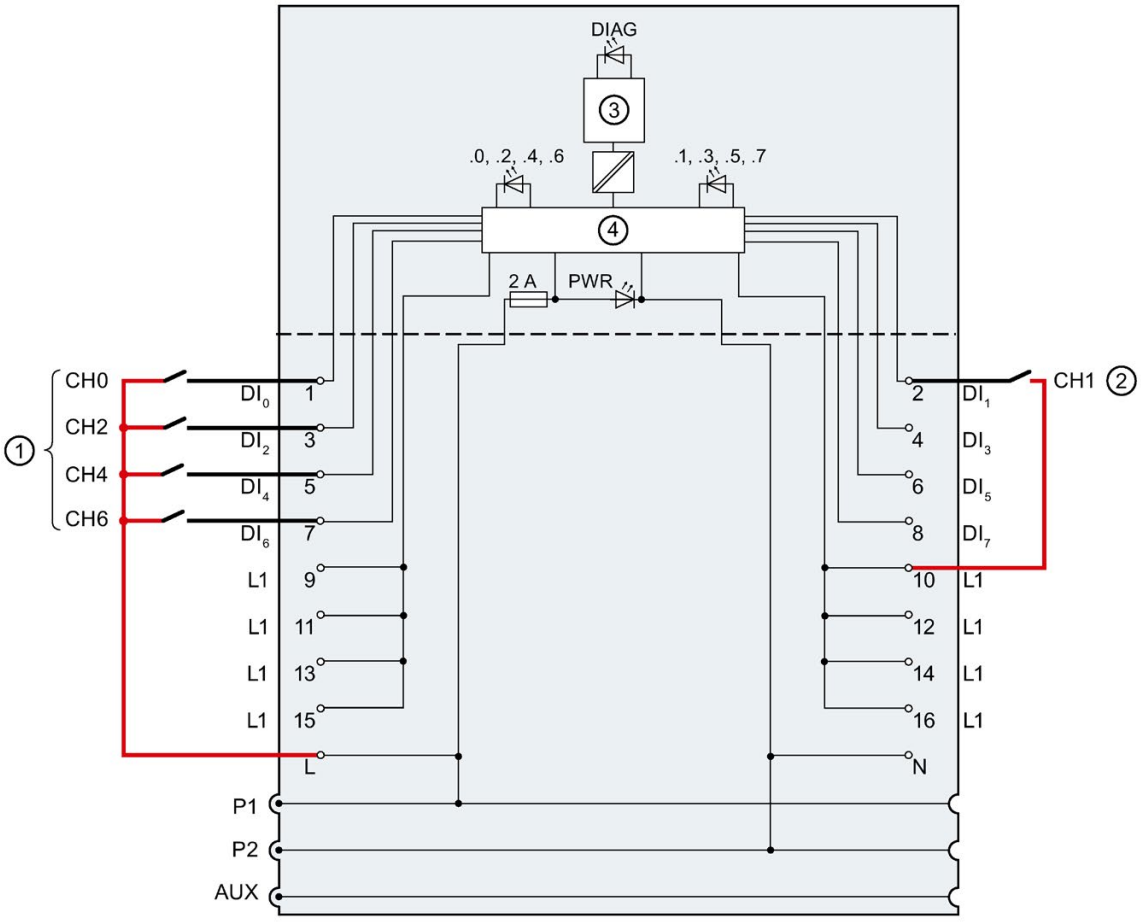
Note

Power limitation

To limit power, each input voltage must have a fuse with a maximum rating of 10 A tripping current. The fuse must be a quick-acting microfuse.

Connection: 1-wire and 2-wire connection

The following figure shows the block diagram and an example of the terminal assignment of the digital output module DI 8x24VAC/48VUC BA on the BaseUnit BU type U0 (1-wire and 2-wire connection).



①	1-wire connection	DI_n	Input signal, channel n
②	2-wire connection	L1	Encoder supply, channel n
③	Backplane bus interface	L	Supply 24 V AC / 48 V UC
④	Input electronics	N	N-conductor connection
P1, P2, AUX	Internal self-assembling voltage buses Connection to left (dark-colored BaseUnit) Connection to left interrupted (light-colored BaseUnit)	DIAG	Error or diagnostics LED (green, red)
.0 to .7	Channel status LED (green)	PWR	Power LED (green)

Figure 3-1 Wiring and block diagram for 1-wire and 2-wire connection of encoders

Parameter assignment/addressing

4

4.1 Parameters

Parameters of DI 8x24VAC/48VUC BA

During configuration of the module with STEP 7, define the properties of the module via various parameters. The following table lists the configurable parameters. The effective range of the configurable parameters depends on the type of configuration.

The following configurations are possible:

- Central operation with an ET 200SP CPU
- Distributed operation on PROFINET IO in an ET 200SP system
- Distributed operation with PROFIBUS DP in an ET 200SP system

When performing the configuration in the user program, use the "WRREC" instruction to transfer the parameters to the module using data records (refer to the section Parameter assignment and structure of parameter data record (Page 24)).

The following parameter settings are possible:

Table 4- 1 Configurable parameters and their defaults (GSD file)

Parameters	Value range	Default	Configuration in RUN	Effective range with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP [1]
Diagnostics, No supply voltage L	• Disable • Enable	Disable	Yes	Module	Module
Channel activated	• Disable • Enable	Enable	Yes	Channel	Channel
Potential group	• Use potential group of the left module (module plugged into a dark-colored BaseUnit) • Enable new potential group (module plugged into light-colored BaseUnit)	Use potential group of the left module	No	Module	Module

[1] The parameter length of the I/O module is 3 bytes.

4.2 Explanation of parameters

Diagnostics No supply voltage L

Enabling of the diagnostics for no or insufficient supply voltage L.

Channel activated

Determines whether a channel is enabled or disabled.

Potential group

A potential group consists of a group of directly adjacent I/O modules within an ET 200SP station, which are supplied via a common supply voltage.

A potential group begins with a light-colored BaseUnit through which the required voltage is supplied for all modules of the potential group. The light-colored BaseUnit interrupts the three self-assembling voltage buses P1, P2 and AUX to the left neighbor.

All additional I/O modules of this potential group are plugged into dark-colored BaseUnits. You take the potential of the self-assembling voltage buses P1, P2 and AUX from the left neighbor.

A potential group ends with the dark-colored BaseUnit, which is followed by a light-colored BaseUnit or server module in the station configuration.

4.3 Address space

The module can be configured differently in STEP 7; see following table. Depending on the configuration, additional/different addresses are assigned in the process image input.

Configuration options of DI 8x24VAC/48VUC BA

You can configure the module with STEP 7 (TIA Portal) or with a GSD file. If you configure the module using a GSD file, the configurations are available under various short designations/module names; see the table below. The following configurations are possible:

Table 4- 2 Configuration options with GSD file

Configuration	Short designation/module name in the GSD file	Configuration software, e.g. with STEP 7 (TIA Portal)		
		Integrated in hardware catalog STEP 7	GSD file PROFINET IO	GSD file PROFIBUS DP
1 x 8-channel without value status	DI 8x24VAC/48VUC BA	as of V15 with HSP 0254	X	X

Address space of the digital input module DI 8x24VAC/48VUC BA

The figure below shows the assignment of the address space for DI 8x24VAC/48VUC BA.

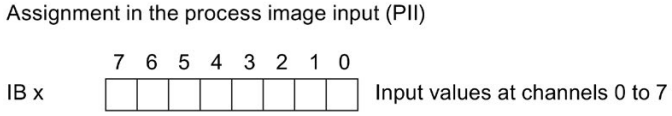


Figure 4-1 Address space of the digital input module DI 8x24VAC/48VUC BA

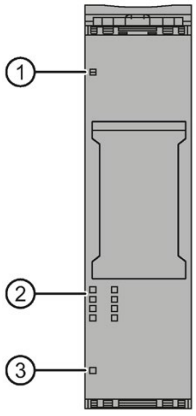
Interrupts/diagnostics alarms

5

5.1 Status and fault displays

LED displays

The figure below shows the LED displays (status and error displays) of the DI 8x24VAC/48VUC BA.



① DIAG (green/red)
② Channel status (green)
③ PWR (green)

Figure 5-1 LED display

Meaning of the LEDs

The tables below explain the meaning of the Status and fault displays.

LED DIAG

Table 5- 1 LED DIAG fault display

LED DIAG	Meaning
Off	Backplane bus supply of the ET 200SP not OK
Flashing	Module parameters not assigned
On	Module parameters assigned
Flashing	Module diagnostics is available

LED channel status

Table 5- 2 Channel status LED status and fault display

LED channel status	Meaning
Off	Process signal = 0
On	Process signal = 1

LED PWR

Table 5- 3 LED PWR status display

LED PWR	Meaning
Off	No supply voltage L
On	Supply voltage L present

5.2 Interrupts

The DI 8x24VAC/48VUC BA digital input module supports diagnostics interrupts.

Diagnostic interrupts

The module generates a diagnostic interrupt at the following events:

- Parameter assignment error
- No supply voltage

5.3 Diagnostics alarms

A diagnostic alarm is generated and the DIAG-LED flashes on the module for each diagnostics event. You can read out the diagnostics alarms, for example, in the diagnostics buffer of the CPU. You can evaluate the error codes with the user program.

Table 5- 4 Diagnostics alarms, their meaning and how to deal with them

Diagnostics alarm	Error code	Meaning	Remedy
Parameter assignment error	10_H	• The module cannot evaluate parameters for the channel. • Incorrect parameter assignment.	Correct the parameter assignment
No supply voltage	11_H	No or insufficient supply voltage L	• Check supply voltage L at the BaseUnit • Check BaseUnit type

Technical specifications

6

Technical specifications of the DI 8x24VAC ... 48VUC BA

Article number	6ES7131-6CF00-0AU0
General information	
Product type designation	DI 8x24VAC/48VUC BA
Firmware version	
• FW update possible	No
usable BaseUnits	BU type U0
Engineering with	
• STEP 7 TIA Portal configurable/integrated as of version	V15
• STEP 7 configurable/integrated as of version	Configurable via GSD file
• PROFIBUS as of GSD version/GSD revision	GSD Revision 5
• PROFINET as of GSD version/GSD revision	GSDML V2.3
Operating mode	
• DI	Yes
• Counter	No
• Oversampling	No
• MSI	No
Supply voltage	
Rated value (DC)	48 V
permissible range, lower limit (DC)	40.8 V
permissible range, upper limit (DC)	57.6 V
Rated value (AC)	48 V; 24 V/48 V; 50 Hz/60 Hz
Reverse polarity protection	Yes
Input current	
Current consumption, max.	70 mA; without sensor supply
Encoder supply	
Number of outputs	8
Short-circuit protection	Yes; Per module, 5x 20 mm fuse, 2 A/250 V, quick-response, replaceable
Output current	
• up to 60 °C, max.	1 A

Article number	6ES7131-6CF00-0AU0
24 V encoder supply	
• 24 V	No
Power loss	
Power loss, typ.	1.5 W
Address area	
Address space per module	
• Address space per module, max.	1 byte
Hardware configuration	
Automatic encoding	
• Mechanical coding element	Yes
Selection of BaseUnit for connection variants	
• 1-wire connection	BU type U0
• 2-wire connection	BU type U0
• 3-wire connection	BU type U0 + Potential isolation module
• 4-wire connection	BU type U0 + Potential isolation module
Digital inputs	
Number of digital inputs	8
Source/sink input	P-reading
Input characteristic curve in accordance with IEC 61131, type 1	Yes
Input characteristic curve in accordance with IEC 61131, type 2	No
Input characteristic curve in accordance with IEC 61131, type 3	No
Pulse extension	No
Input voltage	
• Type of input voltage	AC/DC
• for signal "0"	AC/DC < 10 V
• for signal "1"	AC > 14 V, DC > 34 V
Input current	
• for signal "1", typ.	3.5 mA
Input delay (for rated value of input voltage) for standard inputs	
– parameterizable	No
– at "0" to "1", max.	15 ms
– at "1" to "0", max.	20 ms
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m

Article number	6ES7131-6CF00-0AU0
Encoder	
Connectable encoders	
• 2-wire sensor	Yes
Isochronous mode	
Isochronous operation (application synchronized up to terminal)	No
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Alarms	
• Diagnostic alarm	Yes
Diagnostic messages	
• Diagnostic information readable	Yes
• Monitoring the supply voltage	Yes
• Monitoring of encoder power supply	Yes
• Group error	Yes
Diagnostics indication LED	
• Monitoring of the supply voltage (PWR-LED)	Yes; green PWR LED
• Channel status display	Yes; Green LED
• for channel diagnostics	No
• for module diagnostics	Yes; green/red DIAG LED
Potential separation	
Potential separation channels	
• between the channels	No
• between the channels and backplane bus	Yes
• between the channels and the power supply of the electronics	No
Isolation	
Isolation tested with	1 200 V DC between supply voltage and backplane bus
Dimensions	
Width	20 mm
Height	73 mm
Depth	58 mm
Weights	
Weight, approx.	40 g

Dimensional drawing

See the manual ET 200SP BaseUnits (http://support.automation.siemens.com/WW/view/en/59753521)

Parameter data record

A

A.1 Parameter assignment and structure of parameter data record

The data record of the module has an identical structure, regardless of whether you configure the module with PROFIBUS DP or PROFINET IO. With data record 128, you can reconfigure the module in your user program regardless of your programming. This means that you can use all the functions of the module even if you configured it via PROFIBUS-GSD.

Parameter assignment in the user program

The module parameters can be reassigned in RUN without affecting the other channels.

Changing parameters in RUN

The "WRREC" instruction is used to transfer the parameters to the module using data record 128. The parameters set with STEP 7 are not changed in the CPU, which means the parameters set in STEP 7 will be valid after a restart.

Output parameter STATUS

The module ignores errors that occur during the transfer of parameters with the "WRREC" instruction and continues operation with the previous parameter assignment. However, a corresponding error code is written to the STATUS output parameter.

The description of the "WRREC" instruction and the error codes is available in the STEP 7 online help.

Structure of data record 128

Note

Channel 0 includes the diagnostics enable for the entire module.

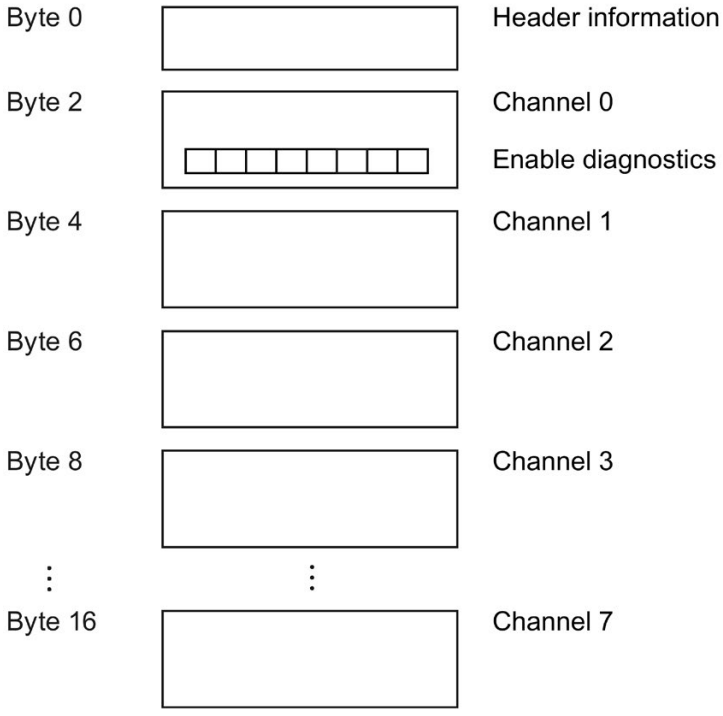


Figure A-1 Structure of data record 128

Header information

The figure below shows the structure of the header information.

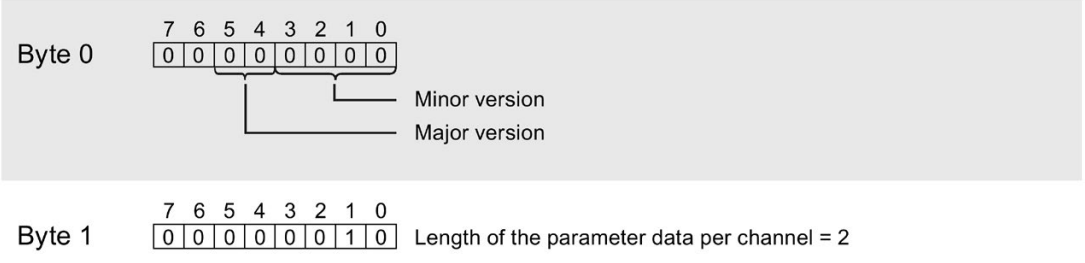


Figure A-2 Header information

Parameters

The figure below shows the structure of the parameters for channels 0 to 7.

You enable a parameter by setting the corresponding bit to "1".

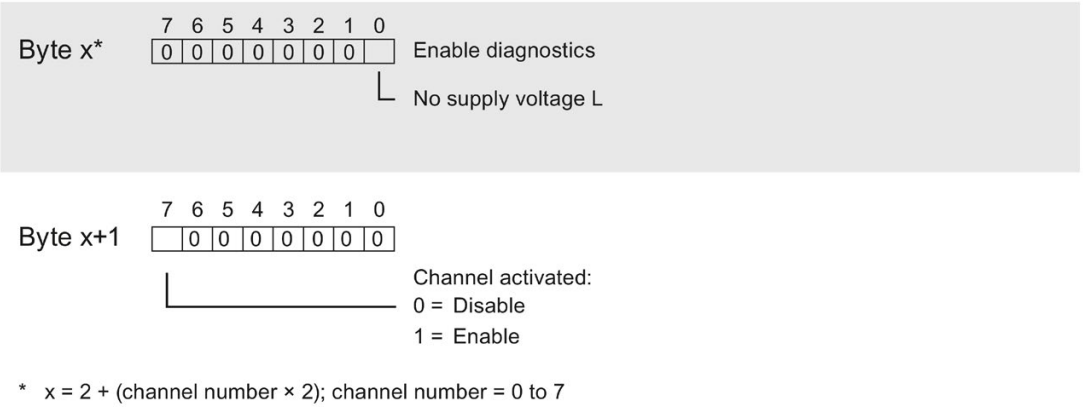


Figure A-3 Structure byte x to x+1 for the channels 0 to 7

Error transferring the data record

The module always checks all the values of the transferred data record. Only if all the values were transferred without errors does the module apply the values from the data record.

The WRREC instruction for writing data records returns corresponding error codes when errors occur in the STATUS parameter, see also the description of the "STATUS" parameter in the STEP 7 online help).

The following table shows the module-specific error codes and their meaning for the parameter data record 128.

Error code in STATUS parameter (hexadecimal)				Meaning	Solution
Byte 0	Byte 1	Byte 2	Byte 3		
DF	80	B0	xx	Number of the data record unknown.	Enter a valid number for the data record.
DF	80	B1	xx	Length of the data record incorrect.	Enter a valid value for the data record length.
DF	80	B2	xx	Slot invalid or cannot be accessed.	• Check the station whether the module is plugged or drawn. • Check the assigned values for the parameters of the WRREC instruction.
DF	80	E0	xx	Wrong version or error in the header information.	Correct the version, length and number of parameter blocks.
DF	80	E1	07	Invalid coding for input filter time.	Check the parameters of the module.