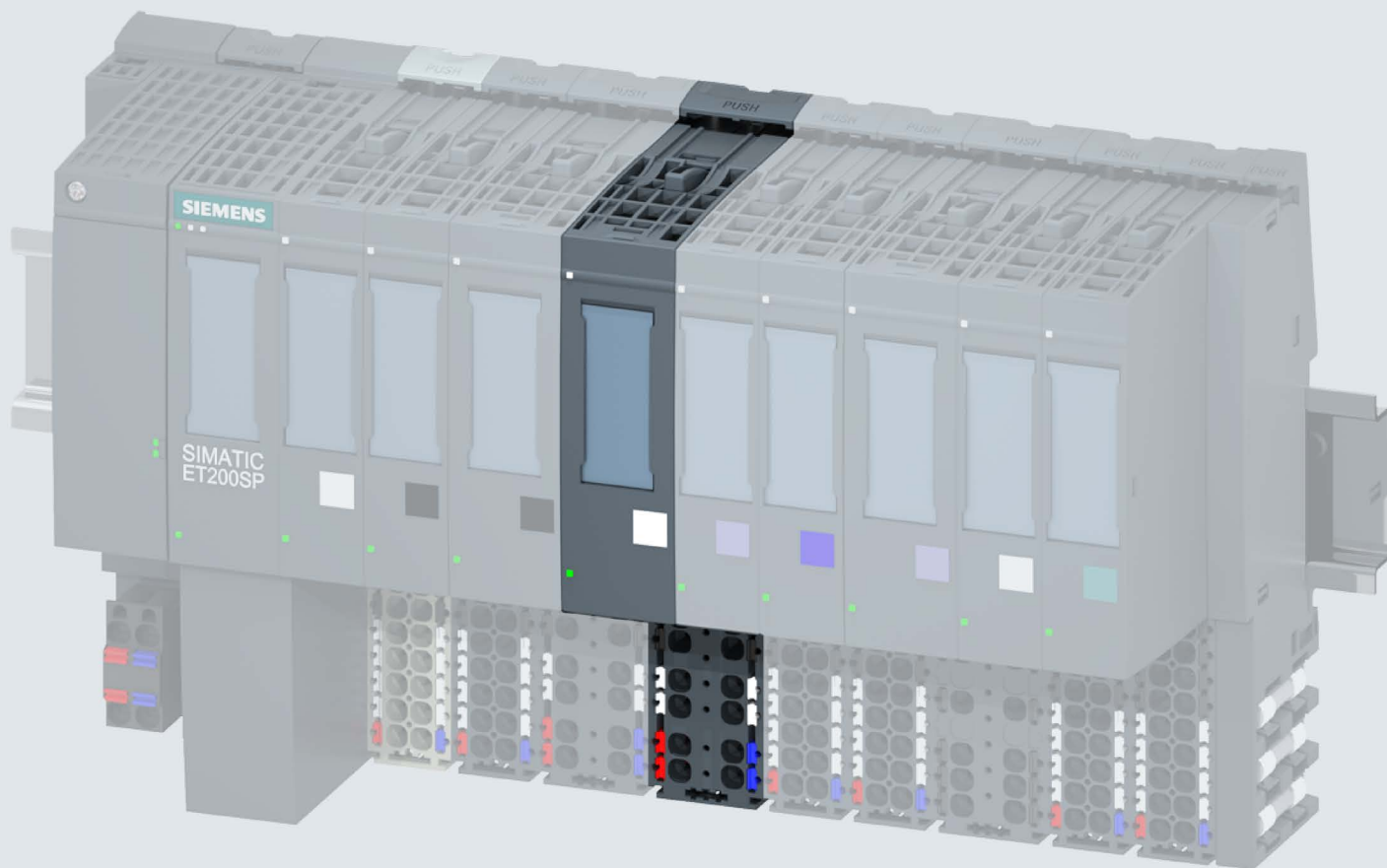


SIEMENS



Manual

SIMATIC

ET 200SP

Digital input module
DI 4x120..230VAC ST (6ES7131-6FD01-0BB1)

Edition

09/2017

support.industry.siemens.com

SIMATIC

ET 200SP Digital input module DI 4x120..230VAC ST (6ES7131-6FD01-0BB1)

Manual

Preface

Guide to documentation

1

Product overview

2

Wiring

3

Parameters/address space

4

Interrupts/diagnostics alarms

5

Technical specifications

6

Parameter data record

A

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.

Proper use of Siemens products

Note the following:

WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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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.

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.

Changes compared to previous version

Compared to the previous version, this manual contains the following change:

Due to the change in hardware, the article number of the module has been changed from 6ES7131-6FD00-0BB1 to 6ES7131-6FD01-0BB1. Both modules are compatible, except for the firmware-update function.

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.

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 (<http://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.

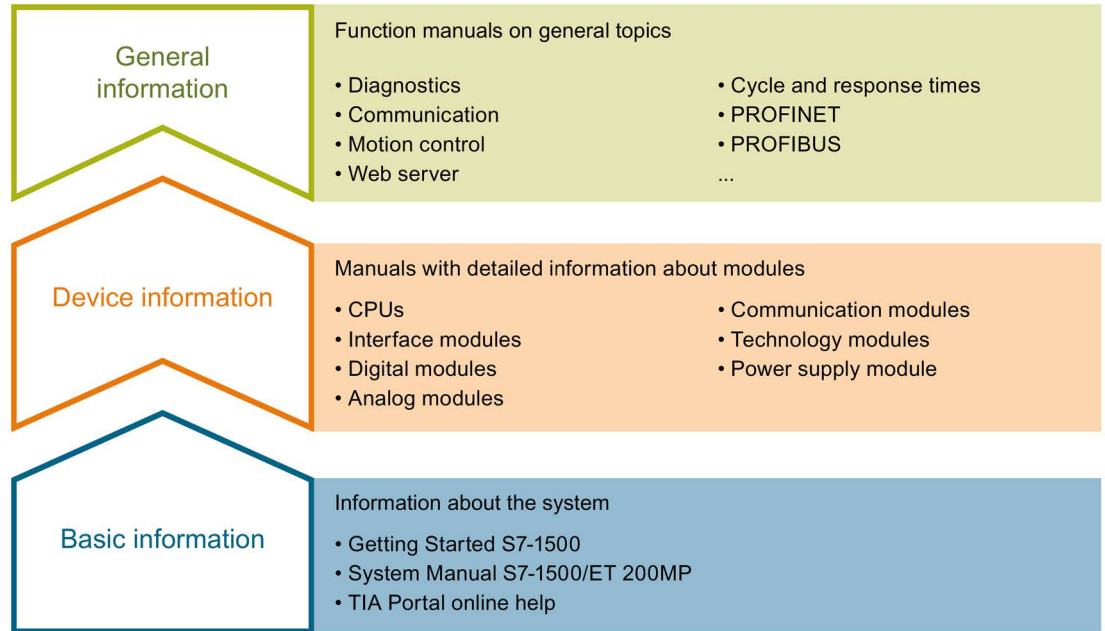
To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under (<http://www.siemens.com/industrialsecurity>).

Table of contents

	Preface	4
1	Guide to documentation	7
2	Product overview	12
	2.1 Properties	12
3	Wiring	14
	3.1 Wiring and block diagram	14
4	Parameters/address space	17
	4.1 Parameters.....	17
	4.2 Explanation of parameters	17
	4.3 Address space	18
5	Interrupts/diagnostics alarms.....	19
	5.1 Status and fault displays	19
	5.2 Diagnostics alarms.....	21
	5.3 Load voltage status	21
6	Technical specifications	22
	6.1 Technical specifications	22
A	Parameter data record	26
	A.1 Parameter assignment and structure of parameter data record.....	26

Guide to documentation

The documentation for the SIMATIC S7-1500 automation system and the SIMATIC ET 200MP 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 and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems. 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 S7-1500 and ET 200MP systems, e.g. diagnostics, communication, motion control, Web server, OPC UA.

You can download the documentation free of charge from the Internet (<http://w3.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/Pages/Default.aspx>).

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/68052815>).

Manual Collection S7-1500/ET 200MP

The Manual Collection contains the complete documentation on the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/86140384>).

SIMATIC S7-1500 comparison list for programming languages

The comparison list contains an overview of which instructions and functions you can use for which controller families.

You can find the comparison list on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/86630375>).

"mySupport"

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

In "mySupport", you can save filters, favorites and tags, request CAx data and compile your personal library in the Documentation area. In addition, your data is already filled out in support requests and you can get an overview of your current requests at any time.

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

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

"mySupport" - Documentation

In the Documentation area in "mySupport" you can combine entire manuals or only parts of these to your own manual.

You can export the manual as PDF file or in a format that can be edited later.

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

"mySupport" - CAx data

In the CAx data area in "mySupport", you can access the current 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 on 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 on individual products.

You will 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 perform commissioning and maintenance activities simultaneously on various SIMATIC S7 stations as a bulk operation independent of the TIA Portal.

General function overview:

- Network browsing and creation of a table showing the accessible devices in the network.
- Flashing of device LEDs or HMI display to locate a device
- Downloading of addresses (IP, subnet, gateway) to a device
- Downloading the PROFINET name (station name) to a device
- Placing a CPU in RUN or STOP mode
- Setting the time in a CPU to the current time of your PG/PC
- Downloading a new program to a CPU or an HMI device
- Downloading from CPU, downloading to CPU or deleting recipe data from a CPU
- Downloading from CPU or deleting data log data from a CPU
- Backup/restore of data from/to a backup file for CPUs and HMI devices
- Downloading service data from a CPU
- Reading the diagnostics buffer of a CPU
- Performing a CPU memory reset
- Resetting devices to factory settings
- Downloading a firmware update to a device

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 PROFINET network during commissioning. PRONETA features two core functions:

- The topology overview independently scans PROFINET network 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

2.1 Properties

Order number

6ES7131-6FD01-0BB1

View of the module

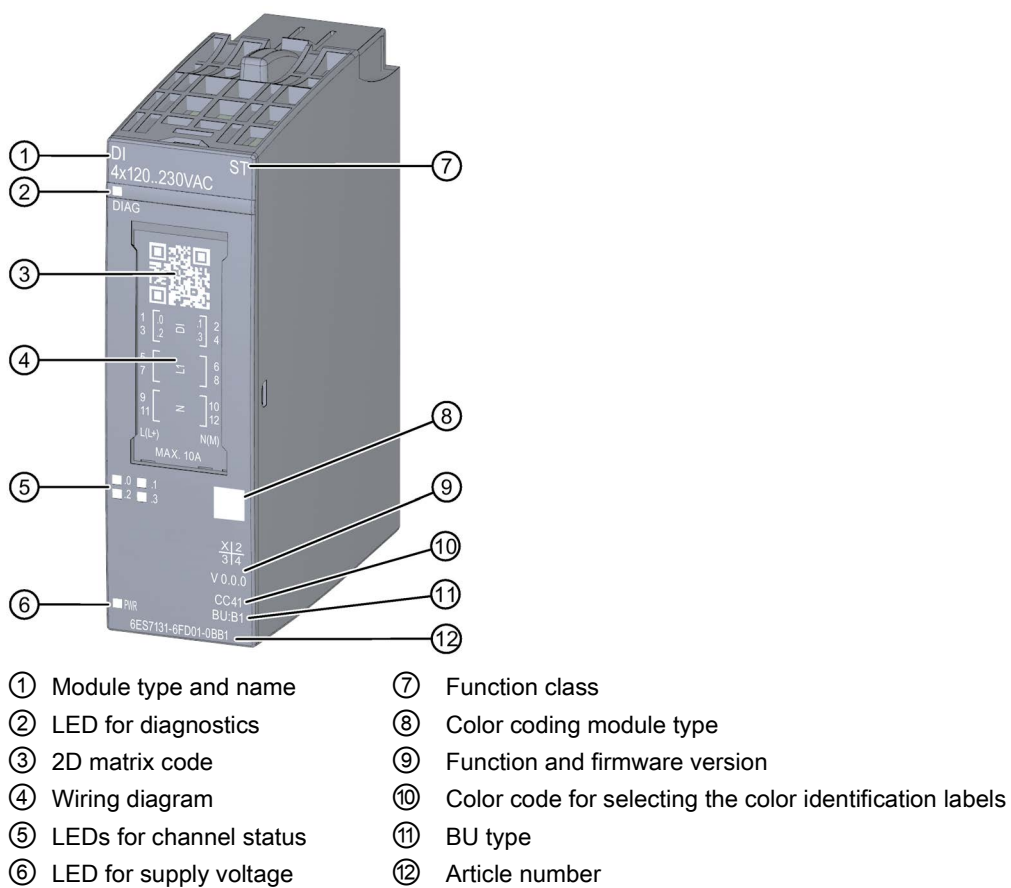


Figure 2-1 View of the module DI 4x120..230VAC ST

Properties

The module has the following technical properties:

- 4 digital inputs
- Supply voltage L+
- Suitable for connection of switches and 2-wire sensors in accordance with IEC 61131, type 3

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	V14 or higher with HSP 0222	V5.5 SP3 or higher with HSP 0229 V7.0	X	X
Configuration in RUN	FS01	V0.0.0 and higher	V14 or higher with HSP 0222	V5.5 SP3 or higher with HSP 0229 V7.0	X	X
Value status	FS01	V0.0.0 and higher	V14 or higher with HSP 0222	V5.5 SP3 or higher with HSP 0229 V7.0	X	X

Accessories

The following accessories must be ordered separately:

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

See also

You can find additional information on the accessories in the ET 200SP Distributed I/O System (<http://support.automation.siemens.com/WW/view/en/58649293>) system manual.

Wiring

3.1 Wiring and block diagram

This section includes the block diagram of the DI 4x120...230VAC ST module with the terminal assignments for a 2-wire, 3-wire and 4-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.

NOTICE
Hazardous voltage, risk of fatal or serious injury
Always disconnect the system and module from the power supply before commencing work.

Note**Limiting overvoltage**

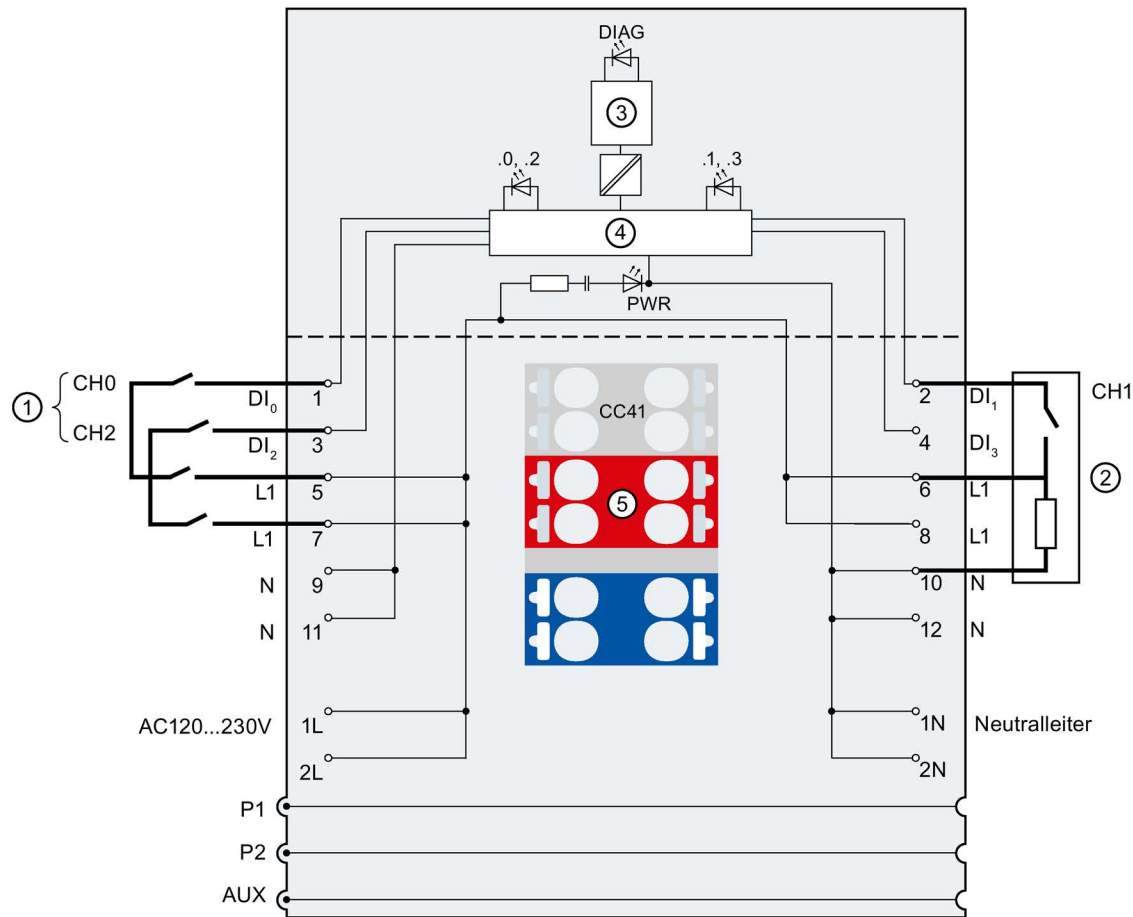
You must ensure overvoltage is limited to 1 kV for the encoder supply.

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: 2-wire and 3-wire connection

The following figure shows the block diagram and an example of the terminal assignment of the digital input module DI 4x120..230VAC ST on the BaseUnit BU type B1 without AUX terminals (2-wire and 3-wire connection).

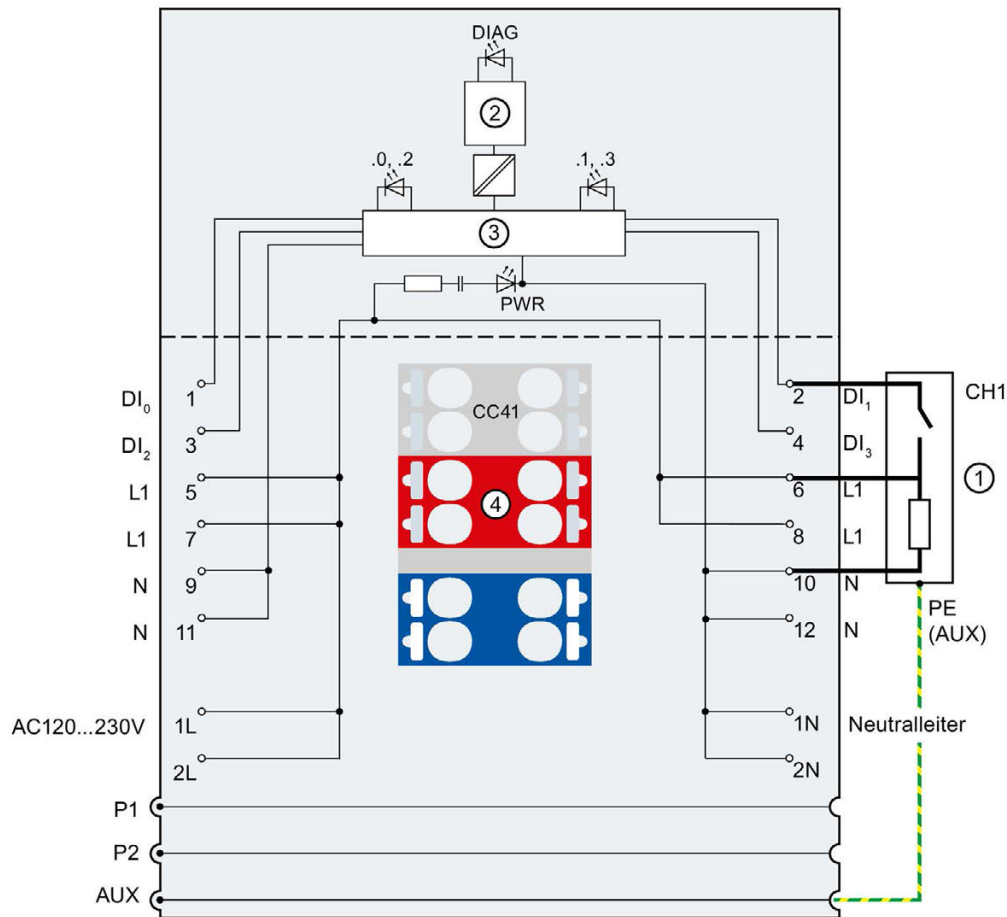


①	2-wire connection	DI _n	Input signal, channel n
②	3-wire connection	L1	Encoder supply, channel n
③	Backplane bus interface	1L / 2L	Infeed 120 ... 230 V AC
④	Input electronics	1N / 2N	N-conductor connection
⑤	Color identification label CCxx (optional)	DIAG	Error or Diagnostics LED (green, red)
P1, P2, AUX	Internal self-assembling voltage buses	PWR	Power LED (green)
	Connection to left (dark-colored BaseUnit)		
	Connection to left interrupted (light-colored BaseUnit)		
.0 to .3	Channel status LED (green)		

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

Connection: 4-wire connection:

The following figure shows the block diagram and an example of the terminal assignment of the digital input DI 4x120...230VAC ST on the BaseUnit BU type B1 with AUX terminals (4-wire connection).



①	4-wire connection	DI _n	Input signal, channel n
②	Backplane bus interface	L1	Encoder supply, channel n
③	Input electronics	1L / 2L	Infeed 120 ... 230 V AC
④	Color identification label CCxx (optional)	1N / 2N	N-conductor connection
P1, P2, AUX	Internal self-assembling voltage buses	DIAG	Error or diagnostics LED (green, red)
	Connection to left (dark-colored BaseUnit)		
	Connection to left interrupted (light-colored BaseUnit)		
.0 to .3	Channel status LED (green)	PWR	Power LED (green)

Figure 3-2 Wiring and block diagram for 4-wire connection of encoders.

Parameters/address space

4.1 Parameters

Parameters of the DI 4x120..230VAC ST

Specify the module properties with the various parameters in the course of your STEP 7 configuration. 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 26)).

The following parameter settings are possible:

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

Parameters	Value range	Default	Configuration in RUN	Scope with configuration software, e.g. STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Channel activated	• Disable • Enable	Enable	Yes	Channel	Channel

4.2 Explanation of parameters

Channel activated

Determines whether a channel is enabled or disabled.

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 of the inputs.

Configuration options of DI 4x120..230VAC ST

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 4-channel without value status	DI 4x120..230VAC ST V0.0	V14, SP1 or higher with HSP 0222	X	X
1 x 4-channel with value status	DI 4x120..230VAC ST V0.0, QI	V14, SP1 or higher with HSP 0222	X	---

Evaluating the value status

An additional two bytes are allocated in the input address space if you enable the value status for the digital module. Bits 0 to 3 in these bytes are assigned to a channel. They provide information about the validity of the digital value.

Bit = 1: No fault is present on the channel.

Bit = 0: Channel is disabled or there is a fault/error on the module.

If a fault/error occurs on a channel with this module, the value status for all channels is 0.

Address space of the digital input module DI 4x120..230VAC ST

The following figure shows the assignment of the address space for the DI 4x120..230VAC ST with value status (Quality Information (QI)). The addresses for the value status are only available if the value status is enabled.

Assignment in the process image of the inputs (PII)

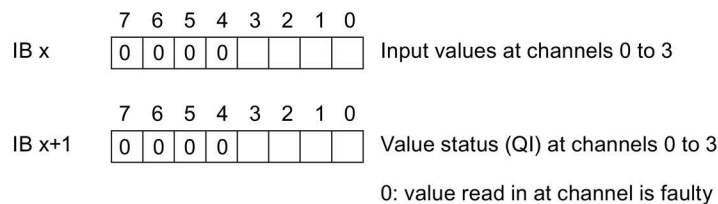


Figure 4-1 Address space of the DI 4x120..230VAC ST digital input module with value status

Note

Value status

The value status is independent of the connected supply voltage 120 ... 230 V AC.

Interrupts/diagnostics alarms

5.1 Status and fault displays

LED displays

The figure below shows the LED displays (status and fault displays) of the DI 4x120..230VAC ST.

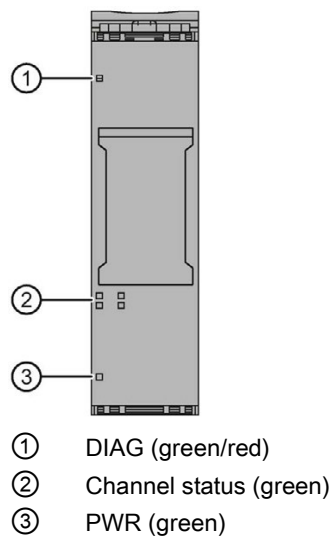


Figure 5-1 LED display

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	Supply voltage L+ missing
 On	Supply voltage L+ present

5.2 Diagnostics alarms

Diagnostics alarms

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

Table 5- 4 Diagnostic alarm, meaning and corrective measures

Diagnostics alarm	Error code	Meaning	Solution
Parameter assignment error	10 _H	• The module cannot evaluate parameters for the channel. • Incorrect parameter assignment.	Correct the parameter assignment

5.3 Load voltage status

Load voltage status

The firmware of the module cannot detect the status of the load voltage.

If the "Load voltage status" function tied to the server module is used, a "1" is always displayed in the status bit for a slot with the DI 4×120..230VAC ST. Even when the load voltage is not applied.

Technical specifications

6.1 Technical specifications

DI 4×120..230VAC ST technical specifications

Article number	6ES7131-6FD01-0BB1
General information	
Product type designation	DI 4x120 ... 230 V AC ST
Firmware version	V0.0
• FW update possible	No
usable BaseUnits	BU type B1
Color code for module-specific color identification plate	CC41
Product function	
• I&M data	Yes; I&M0 to I&M3
Engineering with	
• STEP 7 TIA Portal configurable/integrated as of version	V14
• STEP 7 configurable/integrated as of version	V5.5 SP3
• PROFIBUS as of GSD version/GSD revision	One GSD file each, Revision 3 and 5 and higher
• PROFINET as of GSD version/GSD revision	GSDML V2.3
Operating mode	
• DI	Yes
• Counter	No
• Oversampling	No
• MSI	No
Supply voltage	
Rated value (AC)	230 V
Reverse polarity protection	No
Input current	
Current consumption (rated value)	10 mA

Article number	6ES7131-6FD01-0BB1
Encoder supply	
Number of outputs	4
Short-circuit protection	No; when using BU type B1, a fuse with 10 A tripping current must be provided
Output current	
• up to 60 °C, max.	10 A
Power loss	
Power loss, typ.	1 W; Active power, load voltage 230 V, all inputs connected with 230 V, 50 Hz
Address area	
Address space per module	
• Inputs	1 byte; + 1 byte for QI information
Hardware configuration	
Automatic encoding	Yes
• Mechanical coding element	Yes
Selection of BaseUnit for connection variants	
• 1-wire connection	BU type B1
• 2-wire connection	BU type B1
• 3-wire connection	BU type B1
• 4-wire connection	BU type B1 + potential distributor module
Digital inputs	
Number of digital inputs	4
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Input voltage	
• Type of input voltage	120/230V AC (47 Hz to 63 Hz)
• Rated value (AC)	230 V
• for signal "0"	0V AC to 40V AC
• for signal "1"	74 V AC to 264 V AC
Input current	
• for signal "1", typ.	10.8 mA
Input delay (for rated value of input voltage) for standard inputs	
– parameterizable	No
– at "0" to "1", min.	1.5 ms
– at "0" to "1", max.	4 ms
– at "1" to "0", min.	10 ms
– at "1" to "0", max.	10 ms

6.1 Technical specifications

Article number	6ES7131-6FD01-0BB1
Cable length	
shielded, max.	1 000 m
unshielded, max.	600 m
Encoder	
Connectable encoders	
2-wire sensor	Yes
Isochronous mode	
Isochronous operation (application synchronized up to terminal)	No
Interrupts/diagnostics/status information	
Alarms	
Diagnostic alarm	No
Hardware interrupt	No
Diagnostic messages	
Monitoring the supply voltage	No
Wire-break	No
Short-circuit	No
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	2 545 V DC/2 s (routine test)
Altitude during operation based on sea level	
Ambient air temperature-barometric pressure-altitude	On request: Ambient temperatures lower than 0 °C (without condensation) and/or installation altitudes greater than 2 000 m

Article number	6ES7131-6FD01-0BB1
Dimensions	
Width	20 mm
Height	73 mm
Depth	58 mm
Weights	
Weight, approx.	36 g

Dimensional drawing

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

Parameter data record

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

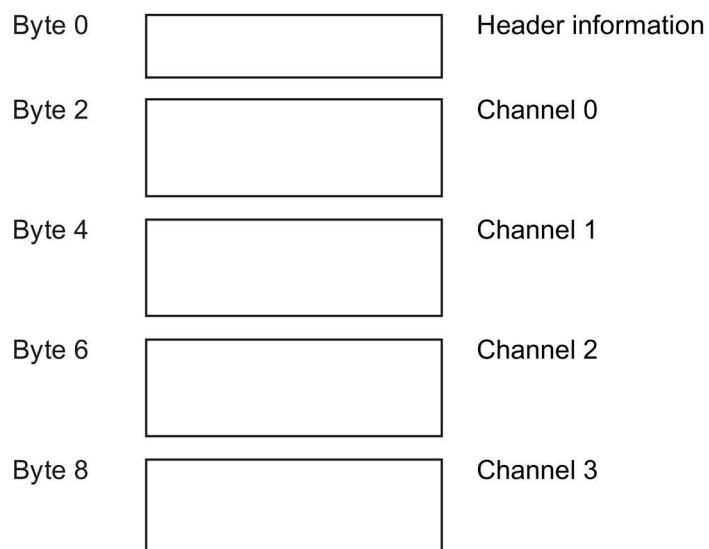


Figure A-1 Structure of data record 128

Header information

The figure below shows the structure of the header information.

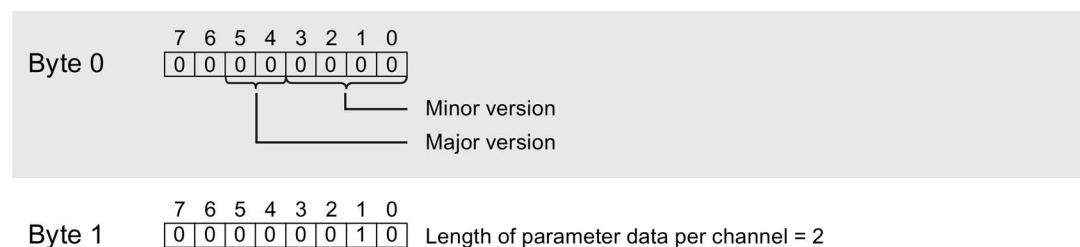


Figure A-2 Header information

Parameters

The figure below shows the structure of the parameters for channels 0 to 3.

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

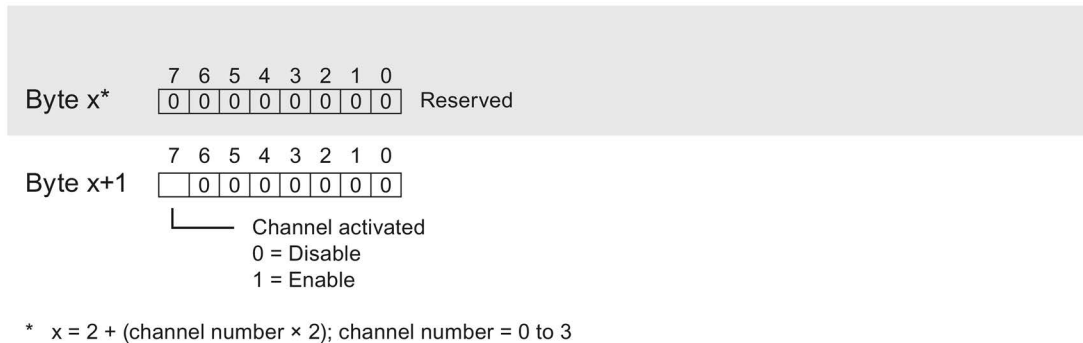


Figure A-3 Structure byte x to x+1 for the channels 0 to 3

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.