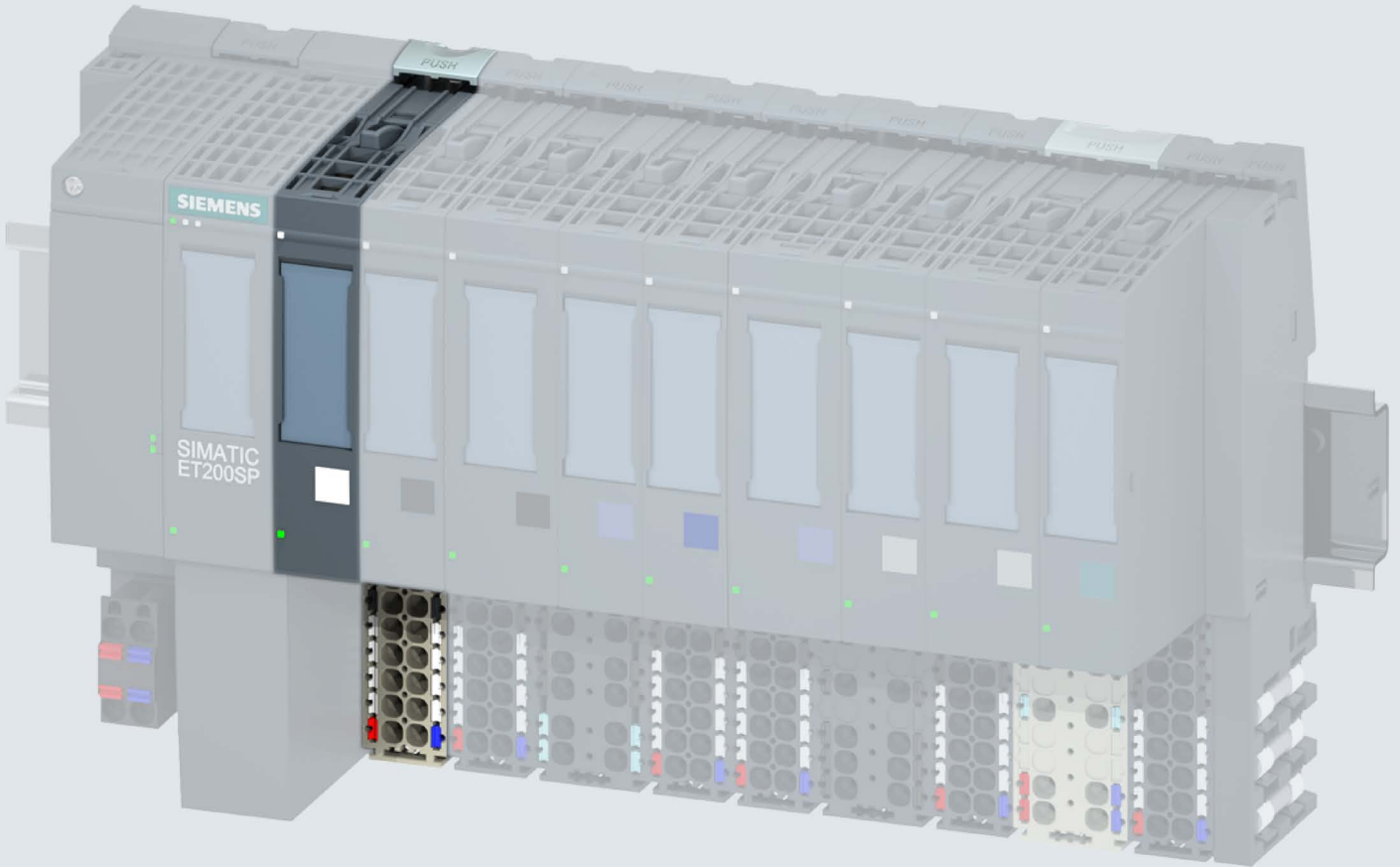


SIEMENS



Manual

SIMATIC

ET 200SP

Digital input module
DI 8x24VDC HF (6ES7131-6BF00-0CA0)

Edition

12/2017

support.industry.siemens.com

SIEMENS

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ET 200SP
Digital input module
DI 8x24VDC HF
(6ES7131-6BF00-0CA0)

Manual

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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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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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Disclaimer of Liability

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:

Number in pack: 10 units (6ES7131-BF00-2CA0)

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 (<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>).

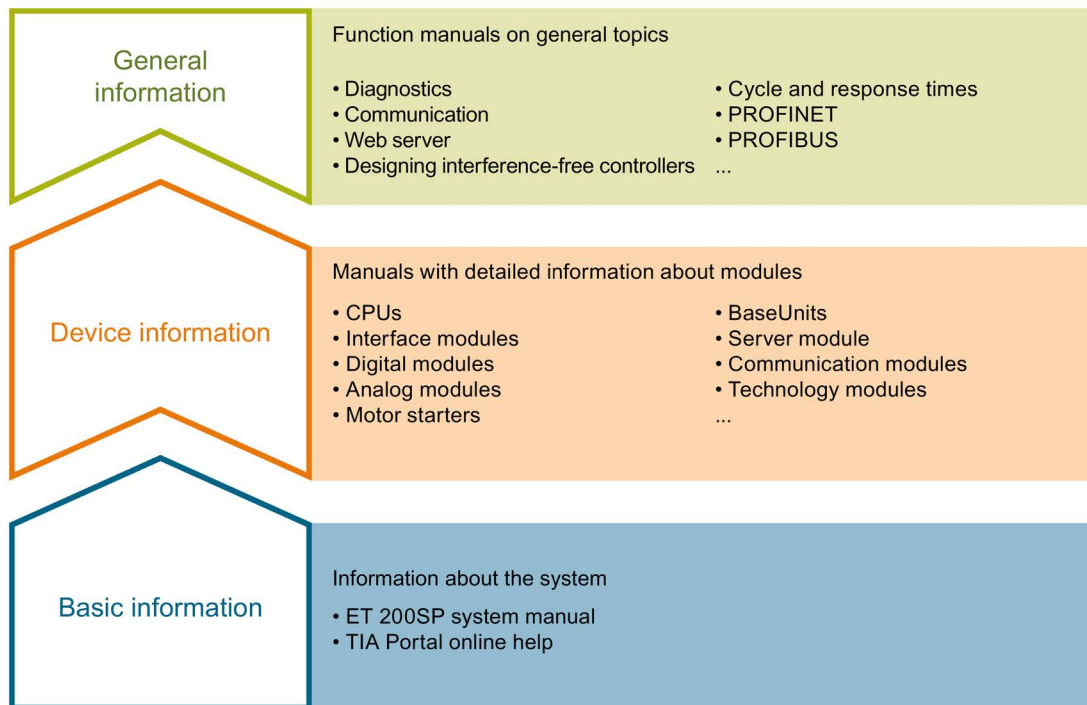
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Documentation guide

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 (<http://w3.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/tech-doc-et200/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/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

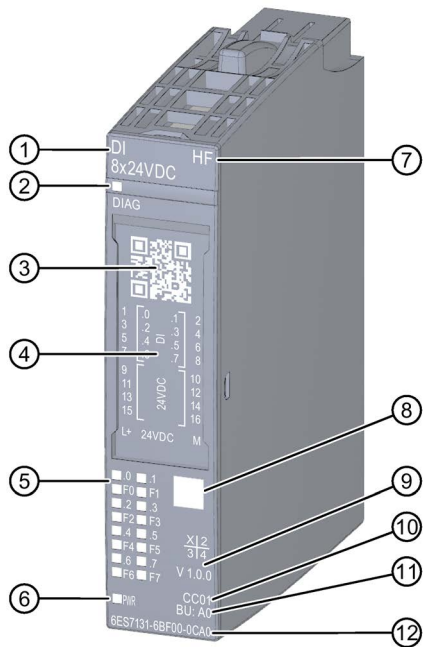
2.1 Properties

Article number

6ES7131-6BF00-0CA0 (number in pack: 1 unit)

6ES7131-6BF00-2CA0 (number in pack: 10 units)

View of the module



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

Figure 2-1 View of the DI 8x24VDC HF module

Properties

The module has the following technical properties:

- Digital input module with 8 inputs
- Sink input (PNP, active high)
- Supply voltage L+
- Configurable input delay 0.05 ms to 20 ms (per channel)
- Configurable diagnostics (per channel)
- Configurable hardware interrupts (per channel)
- Suitable for connection of switches and 2-wire sensors according to IEC 61131, type 1 and 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
Pulse stretching	FS01	V1.0.0 or higher	V12 or higher	V5.5 SP3 or higher with HSP 0229 V1.0 or higher	X	X
Firmware update	FS01	V1.0.0 or higher	V12 or higher	V5.5 SP3 or higher with HSP 0229 V1.0 or higher	X	X
Identification data I&M0 to I&M3	FS01	V1.0.0 or higher	V12 or higher	V5.5 SP3 or higher with HSP 0229 V1.0 or higher	X	X
Reconfiguration in RUN	FS01	V1.0.0 or higher	V12 or higher	V5.5 SP3 or higher with HSP 0229 V1.0 or higher	X	X
Value status	FS01	V1.1.0 or higher	V12, SP1 or higher with HSP 0057	V5.5 SP3 or higher with HSP 0229 V2.0 or higher	X	X
Isochronous mode	FS01	V1.1.0 or higher	V12, SP1 or higher with HSP 0057	V5.5 SP3 or higher with HSP 0229 V2.0 or higher	X	X

Function	HW version	FW version	STEP 7		GSD file	
			TIA Portal	V5.x	PROFINET IO	PROFIBUS DP
Module-internal shared input (MSI)	FS01	V1.2..0 or higher	V13 or higher	V5.5 SP3 or higher with HSP 0229 V3.1 or higher	X	X
Configurable sub-module/submodules for shared device	FS01	V2.0.0 or higher	V13 SP1 Update 4 or higher with HSP 0163	V5.5 SP3 or higher with HSP 0229 V6.0 or higher	X	X

Accessories

The following accessories are supplied with the module and can also be ordered separately as spare parts:

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

See also

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

Wiring

3.1 Wiring and block diagrams

This section includes the block diagram of the DI 8x24VDC HF module with the terminal assignments for a 1-wire, 2-wire and 3-wire connection in the DI operating mode. You can use and combine the different wiring options for all channels.

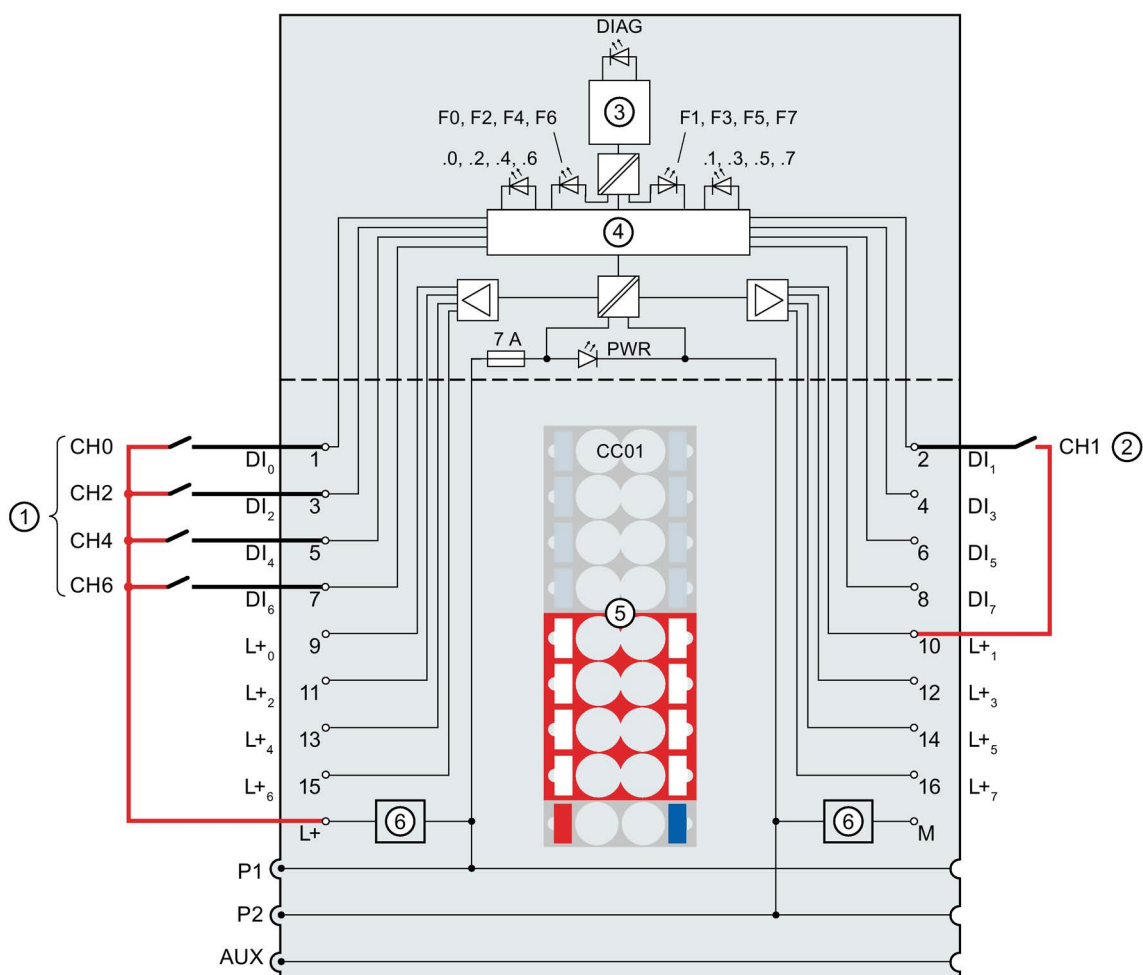
You can find information on wiring the BaseUnit in the system manual ET 200SP distributed I/O system (<https://support.industry.siemens.com/cs/ww/en/view/91696622>).

Note

The load group of the module must begin with a light-colored BaseUnit. Keep this in mind also during the configuration.

Wiring: 1 and 2-wire connection

The following figure shows the block diagram and an example of the terminal assignment of the digital input module DI 8x24VDC HF on the BaseUnit BU type A0 without AUX terminals (1- and 2-wire connection).



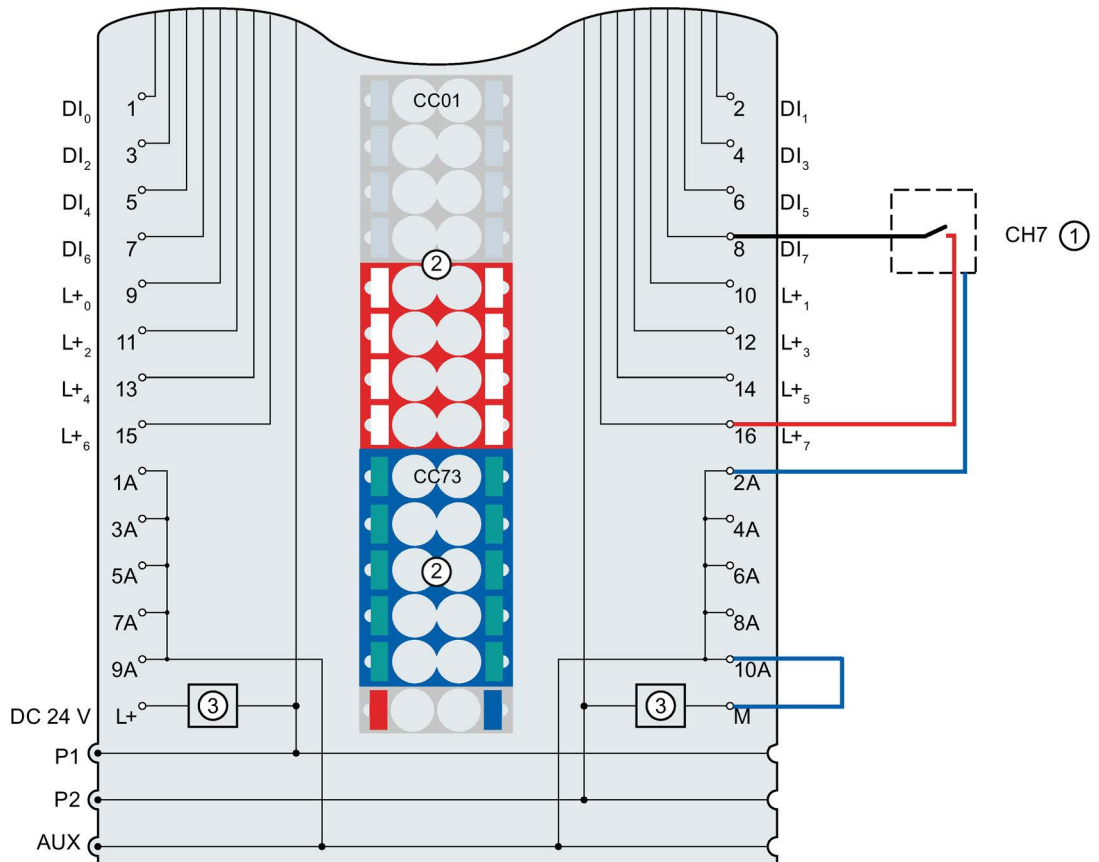
①	1-wire connection	L _n	Encoder supply, channel n
②	2-wire connection	L ₊	24 V DC (infeed only with light BaseUnit)
③	Backplane bus interface	DIAG	Error or diagnostics LED (green, red)
④	Input electronics	.0 to .7	Channel status LED (green)
⑤	Color-coded label with color code CC01 (optional)	PWR	Power LED (green)
⑥	Supply voltage filter circuit (only available with light BaseUnit)	F0 to F7	Channel fault LED (red)
M	Ground	P1, P2, AUX	Internal self-configuring voltage buses Connection to the left (dark BaseUnit) Connection to the left interrupted (light BaseUnit)

DI_n Input signal, channel n

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

Wiring: 3-wire connection

The following figure shows an example of the terminal assignment of the digital input module DI 8x24VDC HF on the BaseUnit BU type A0 with AUX terminals (3-wire connection).



- ① 3-wire connection
- ② Color-coded labels with color code CC01 and CC73 (optional)
- ③ Supply voltage filter circuit (only available with light BaseUnit)
- DI_n Input signal, channel n
- L_{+n} Encoder supply, channel n
- DC 24 V Supply voltage L+ (infeed only with light BaseUnit)
- M Ground
- 1A ... 10A AUX terminals
- P1, P2, AUX Internal self-configuring voltage buses
 Connection to the left (dark BaseUnit)
 Connection to the left interrupted (light BaseUnit)

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

Parameters/address space

4.1 Parameters

Parameters of the DI 8x24VDC HF

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 assigning parameters in the user program, use the "WRREC" instruction to transfer the parameters to the module by means of data records (see chapter Parameter assignment and structure of the parameter data record (Page 37)).

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

Parameter	Value range	Default	Configuration in RUN	Scope with configuration software, e.g., STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Diagnostics No supply voltage L+	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Yes	Channel	Channel
Diagnostics Short-circuit to ground	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Yes	Channel	Channel
Diagnostics wire break ¹	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Yes	Channel	Channel
Channel activated	<ul style="list-style-type: none"> • Disable • Enable 	Enable	Yes	Channel	Channel

4.1 Parameters

Parameter	Value range	Default	Configuration in RUN	Scope with configuration software, e.g., STEP 7 (TIA Portal)	
				GSD file PROFINET IO	GSD file PROFIBUS DP
Input delay	<ul style="list-style-type: none"> • None • 0.05 ms • 0.1 ms • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms 	3.2 ms	Yes	Channel	Module ²
Pulse stretching	<ul style="list-style-type: none"> • None • 0.05 s • 0.1 s • 0.2 s • 0.5 s • 1 s • 2 s 	None	Yes	Channel	²
Hardware interrupt rising edge	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Yes	Channel	²
Hardware interrupt falling edge	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Yes	Channel	²
Potential group	<ul style="list-style-type: none"> • 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 If you use a floating switch, you need to connect a resistor in parallel so that the wire break diagnostics is enabled in the open state (sensor resistance for the wire break diagnostics: 25 kΩ to 45 kΩ).

² Due to the limited number of parameters of a maximum of 244 bytes per ET 200SP station with a PROFIBUS GSD configuration, the parameter assignment options are restricted. The parameter length of the I/O module is 6 bytes with PROFIBUS GSD configuration. If necessary, you can set this parameter, however, with data records 0 to 7 or data record 128, see Appendix "Parameter data record".

4.2 Explanation of parameters

Diagnostics: No supply voltage L+

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

Diagnostics: Short-circuit to ground

Enabling of the diagnostics if a short-circuit of the actuator supply to ground occurs.

Diagnostics: Wire break

Enabling diagnostics if the line to the encoder is interrupted.

Channel activated

Determines whether a channel is activated or deactivated.

Input delay

This parameter can be used to suppress signal interference. Changes to the signal are only detected if they are constantly pending longer than the set input delay time.

In isochronous mode, the terminal signal is read in at the time T_i (time for reading the input data). The read-in time T_i refers to the channel for which no input delay time was configured.

For input channels with longer input delays, the read-in time is moved accordingly. This means individual channels can be assigned input delays, if necessary, without having a negative impact on the possible cycle time.

Isochronous configuration is only possible if there is no input delay configured for at least one channel.

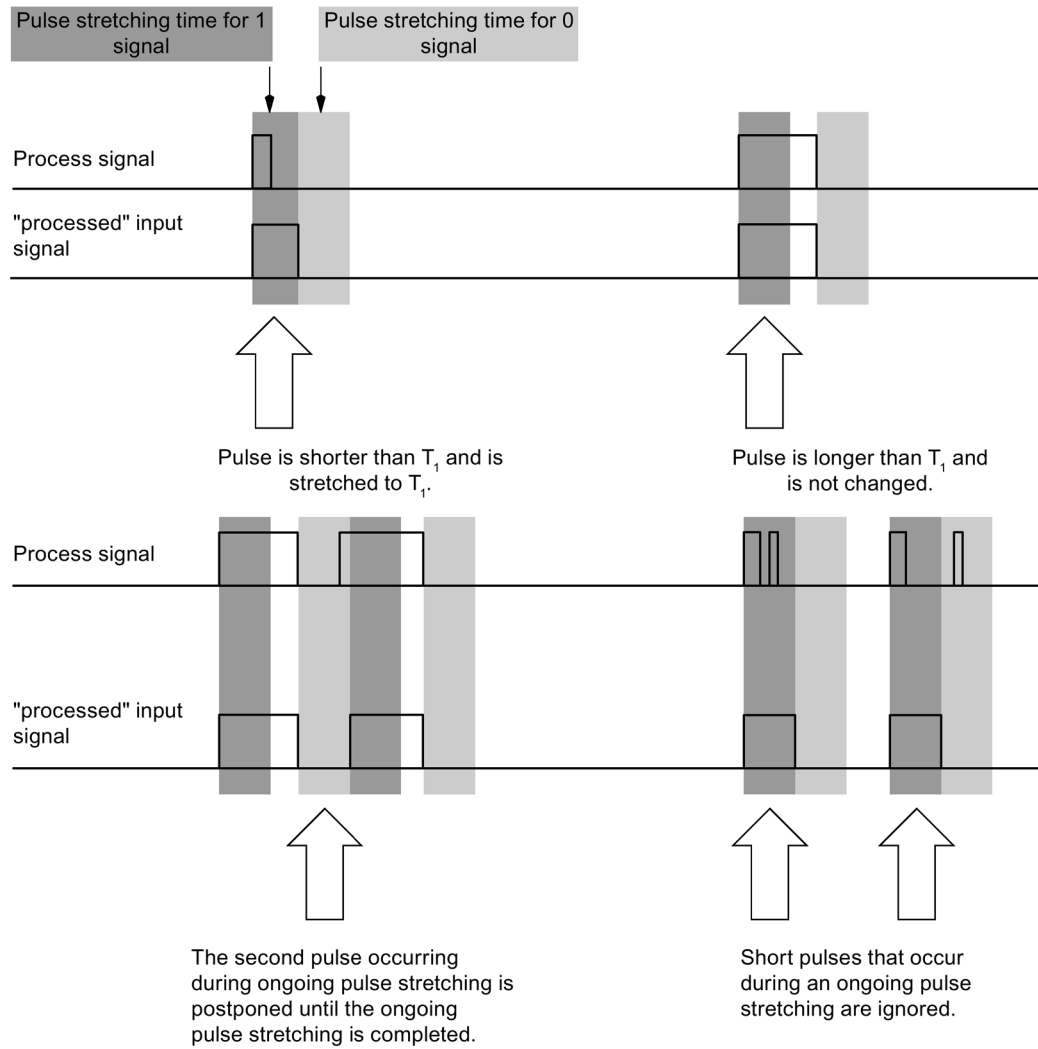
Pulse stretching

Pulse stretching is a function used to change a digital input signal. A pulse on a digital input is stretched to at least the configured length. If the input pulse is already longer than the configured length, the pulse is not changed.

In isochronous mode, the terminal signal is read in at time T_i (time for reading in the input data), i.e. smaller pulses than T_{DC} (data cycle) are not recognized in certain cases.

Principle of pulse stretching

The figure below uses examples to show whether and how input pulses are changed.



T_1 Pulse stretching parameter

Figure 4-1 Principle of pulse stretching

Hardware interrupt, rising edge

Specifies whether a hardware interrupt is generated by a rising edge.

Hardware interrupt, falling edge

Specifies whether a hardware interrupt is generated by a falling edge.

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 follows a light-colored BaseUnit or server module in the station configuration.

See also

You can find additional information in the system manual ET 200SP distributed I/O system (<https://support.industry.siemens.com/cs/ww/en/view/91696622>).

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 8x24VDC HF

You can configure the module with STEP 7 (TIA Portal) or with a GSD file. If you configure the module by means of 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 the hardware catalog STEP 7, as of V13, SP1	GSD file PROFINET IO	GSD file PROFIBUS DP
1 x 8-channel without value status	DI 8x24VDC HF V1.0	X	X	X
1 x 8-channel without value status	DI 8x24VDC HF V1.1	X	X	X
1 x 8-channel with value status	DI 8x24VDC HF V1.1, QI	X	X	---
1 x 8-channel without value status	DI 8x24VDC HF V1.2	X	X	X
1 x 8-channel with value status for module-internal Shared Input with up to 4 submodules	DI 8x24VDC HF V1.2, MSI	X	X	---
1 x 8-channel with value status	DI 8x24VDC HF V1.2, QI	X	X	---
1 x 8-channel without value status	DI 8x24VDC HF V2.0	---	X	X
1 x 8-channel with value status for module-internal Shared Input with up to 4 submodules	DI 8x24VDC HF V2.0, MSI	---	X	---
1 x 8-channel with value status	DI 8x24VDC HF V2.0, QI	---	X	---
2 x 4-channel without value status	DI 8x24VDC HF V2.0, S.2	---	X	---
2 x 4-channel with value status	DI 8x24VDC HF V2.0, S.2 QI	---	X	---
4 x 2-channel without value status	DI 8x24VDC HF V2.0, S.4	---	X	---
4 x 2-channel with value status	DI 8x24VDC HF V2.0, S.4 QI	---	X	---

Note

The following functions are only fully available when the submodule X.1 is configured and the IO controller to which submodule X.1 is assigned has established a connection to the IO device.

- Firmware update
- I&M identification data
- PROFIenergy

2 x 4- / 4 x 2-channel configuration

For the configuration, the channels of the module are divided into submodules. The submodules can be assigned to different IO controllers when the module is used in a shared device.

The number of usable submodules is dependent on the interface module used. Read the information in the manual for the particular interface module.

Value status (Quality Information, QI)

The value status is always activated for the following module names:

- DI 8x24VDC HF QI,
- DI 8x24VDC HF MSI

An additional bit is assigned to each channel for the value status. The value status bit indicates if the read in digital value is valid. (0 = value is incorrect).

Address space for configuration as 1 x 8-channel DI 8x24VDC HF

The figure below shows the address space assignment for configuration as a 8-channel module without value status.

Assignment in the process image input (PII)

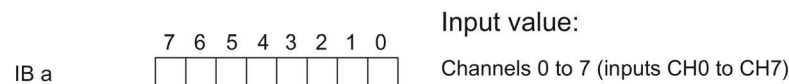
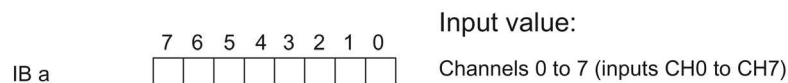


Figure 4-2 Address space for configuration as 1 x 8-channel DI 8x24VDC HF without value status

Address space for configuration as 1 x 8-channel DI 8x24VDC HF, QI

The following figure shows the assignment of the address space for the configuration as a 8-channel module with value status. You can freely assign the start address for the module. The addresses of the channels are derived from the start address.

Assignment in the process image input (PII)



0 = Value read in at the channel is faulty

Figure 4-3 Address space for configuration as 1 x 8-channel DI 8x24VDC HF QI with value status

Address space for configuration as 1 x 8-channel DI 8x24VDC HF MSI

The channels 0 to 7 of the module are copied in up to four submodules with configuration 1 x 8-channel module (Module-internal shared input, MSI). Channels 0 to 7 are then available with identical input values in various submodules. These submodules can be assigned to up to four IO controllers when the module is used in a shared device. Each IO controller has read access to the same channels.

The number of usable submodules is dependent on the interface module used. Please observe the information in the manual for the particular interface module.

Value status (Quality Information,QI)

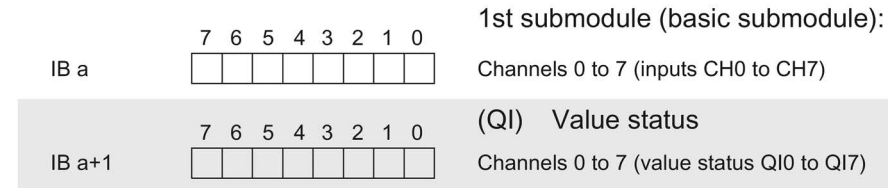
The meaning of the value status depends on the submodule on which it occurs.

For the 1st submodule (=basic submodule), the value status 0 indicates that the value is incorrect.

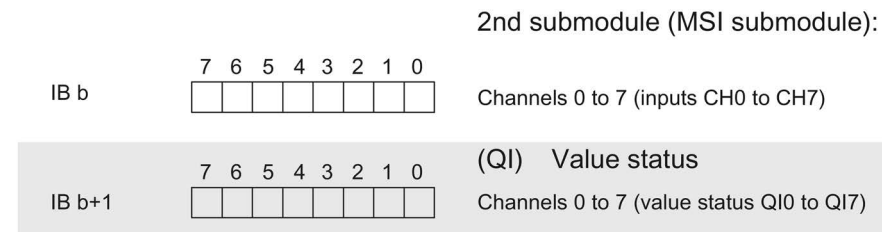
For the 2nd to 4th submodule (=MSI submodule), the value status 0 indicates that the value is incorrect or the basic submodule has not yet been configured (not ready).

The following figure shows the assignment of the address space with submodule 1, 2, 3 and 4 and the value status.

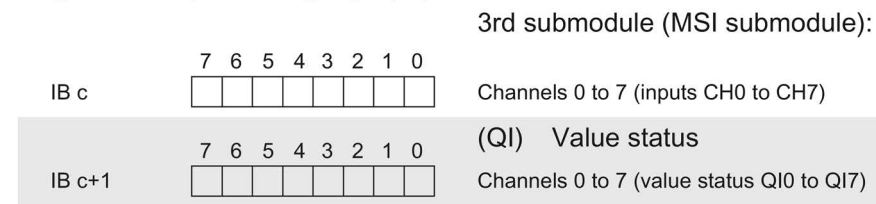
Assignment in the process image input (PII) for 1st submodule



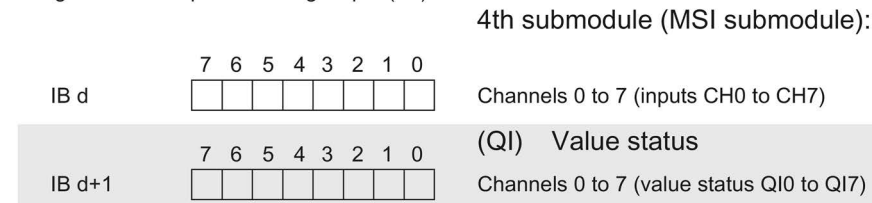
Assignment in the process image input (PII) for 2nd submodule



Assignment in the process image input (PII) for 3rd submodule



Assignment in the process image input (PII) for 4th submodule



0 = Value read in at the channel is faulty

Figure 4-4 Address space for configuration as 1 x 8-channel DI 8x24VDC HF MSI with value status

4.3 Address space

Address space for configuration as 2 x 4-channel DI 8x24VDC HF V2.0, S.2

The figure below shows the address space assignment for configuration as a 2 x 4-channel module without value status.

Assignment in the process image input (PII)

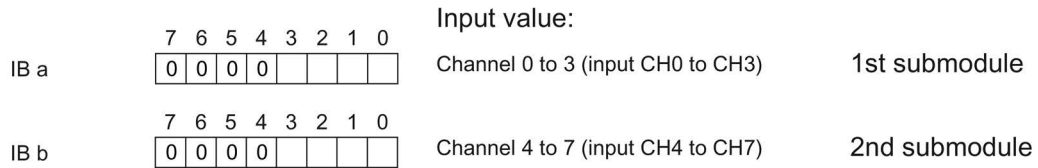
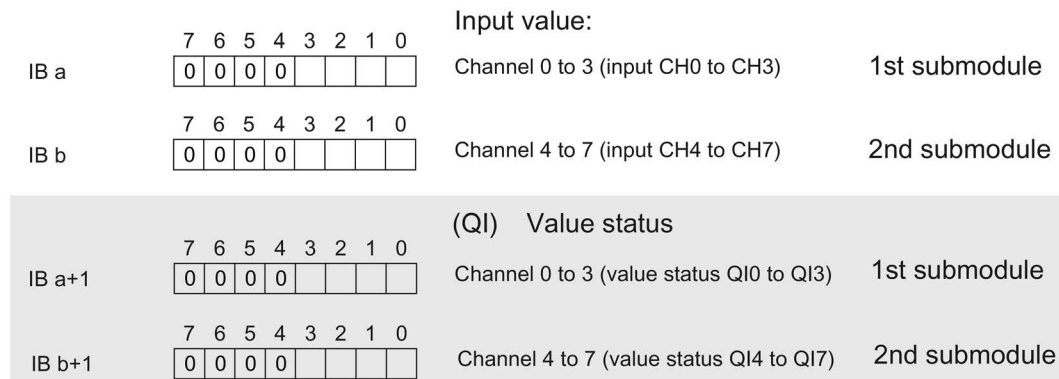


Figure 4-5 Address space for configuration as 2 x 4-channel DI 8x24VDC HF V2.0, S.2 without value status

Address space for configuration as 2 x 4-channel DI 8x24VDC HF V2.0, S.2 QI

Each of the two submodules has a freely assignable start address.

Assignment in the process image input (PII)



0 = Value read in at the channel is faulty

Figure 4-6 Address space for configuration as 2 x 4-channel DI 8x24VDC HF V2.0, S.2 QI with value status

Address space for configuration as 4 x 2-channel DI 8x24VDC HF V2.0, S.4

The figure below shows the address space assignment for configuration as a 4 x 2-channel module without value status.

Assignment in the process image input (PII)

	7	6	5	4	3	2	1	0	Input value:	
IB a	0	0	0	0	0	0	0	0	Channels 0 and 1 (inputs CH0 and CH1)	1st submodule
IB b	0	0	0	0	0	0	0	0	Channel 2 and 3 (input CH2 and CH3)	2nd submodule
IB c	0	0	0	0	0	0	0	0	Channel 4 and 5 (input CH4 and CH5)	3rd submodule
IB d	0	0	0	0	0	0	0	0	Channel 6 and 7 (input CH6 and CH7)	4th submodule

Figure 4-7 Address space for configuration as 4 x 2-channel DI 8x24VDC HF V2.0, S.4 without value status

Address space for configuration as 4 x 2-channel DI 8x24VDC HF V2.0, S.4 QI

Each of the four submodules has a freely assignable start address.

Assignment in the process image input (PII)

	7	6	5	4	3	2	1	0	Input value:	
IB a	0	0	0	0	0	0	0	0	Channels 0 and 1 (inputs CH0 and CH1)	1st submodule
IB b	0	0	0	0	0	0	0	0	Channel 2 and 3 (input CH2 and CH3)	2nd submodule
IB c	0	0	0	0	0	0	0	0	Channel 4 and 5 (input CH4 and CH5)	3rd submodule
IB d	0	0	0	0	0	0	0	0	Channel 6 and 7 (input CH6 and CH7)	4th submodule

	7	6	5	4	3	2	1	0	(QI) Value status	
IB a+1	0	0	0	0	0	0	0	0	Channels 0 and 1 (value status QI0 and QI1)	1st submodule
IB b+1	0	0	0	0	0	0	0	0	Channel 2 and 3 (value status QI2 and QI3)	2nd submodule
IB c+1	0	0	0	0	0	0	0	0	Channel 4 and 5 (value status QI4 and QI5)	3rd submodule
IB d+1	0	0	0	0	0	0	0	0	Channel 6 and 7 (value status QI6 and QI7)	4th submodule

0 = Value read in at the channel is faulty

Figure 4-8 Address space for configuration as 4 x 2-channel DI 8x24VDC HF V2.0, S.4 QI with value status

Interrupts/diagnostics alarms

5.1 Status and error displays

LED displays

The figure below shows the LED displays (status and error displays) of the DI 8x24VDC HF.

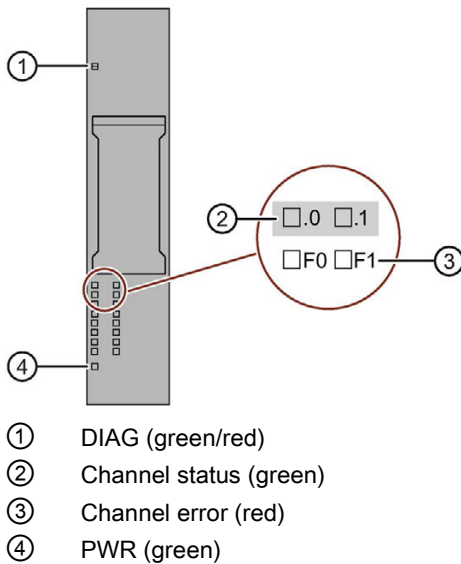


Figure 5-1 LED display

Meaning of the LEDs

The tables below explain the meaning of the status and error displays. Corrective measures for diagnostics alarms can be found in section Diagnostics alarms (Page 32).

DIAG LED

Table 5- 1 Error display of the DIAG LED

DIAG LED	Meaning
□ Off	Backplane bus supply of the ET 200SP not OK
⚡ Flashes	Module not ready for operation (no parameters assigned)
■ On	Module parameters assigned and no module/channel diagnostics
⚡ Flashes	Module parameters assigned and module/channel diagnostics

LED channel status/channel error

Table 5- 2 Status / error display of the LED channel status / channel error

LED channel status	LED channel error	Meaning
□ Off	□ Off	Channel deactivated or process signal = 0
■ On	□ Off	<ul style="list-style-type: none"> No supply voltage present or Process voltage > 11 V is present regardless of whether or not the channel is activated and regardless of whether diagnostics was detected
□ Off	■ On	Supply voltage is available and process voltage < 11V is present regardless of whether or not the channel is activated and regardless of whether diagnostics was detected
■ On	■ On	Channel activated and diagnostics enable was recognized

PWR LED

Table 5- 3 Status display of the PWR LED

PWR LED	Meaning
□ Off	Missing supply voltage L+
■ On	Supply voltage L+ present

5.2 Interrupts

The digital input module DI 8x24VDC HF supports hardware and diagnostics alarms.

Diagnostics interrupts

The module generates a diagnostic interrupt at the following events:

- Short-circuit
- Wire break
- Parameter assignment error
- Supply voltage missing
- Hardware interrupt lost
- Channel temporarily unavailable

Evaluating hardware interrupts with IO controller

The module generates a hardware interrupt at the following events:

- At positive edge (signal change from 0 to 1)
- At negative edge (signal change from 1 to 0)

In the event of an interrupt, interrupt OBs are automatically executed in the CPU of the IO controller.

You can obtain detailed information on the event in the hardware interrupt organization block with the "RALARM" (read additional interrupt information) instruction and in the STEP 7 online help.

The module channel that triggered the hardware interrupt is entered in the start information of the organization block. The following figure shows the assignment to the bits of double word 8 in local data.

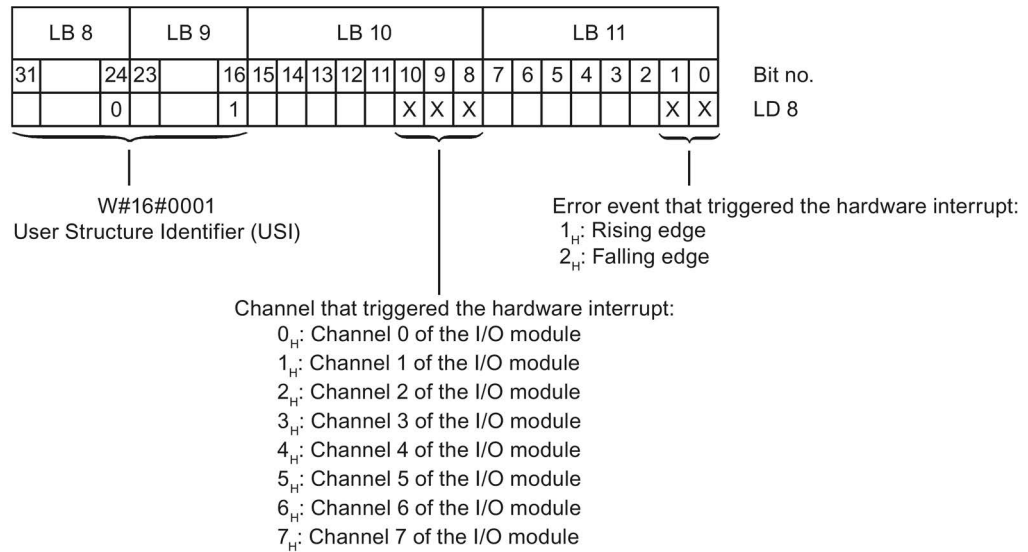


Figure 5-2 Start information of the organization block

Structure of the additional interrupt information

Table 5- 4 Structure of USI = W#16#0001

Data block name	Content	Comment	Bytes
USI	W#16#0001	User Structure Identifier: Additional interrupt information for hardware interrupts of the I/O module	2
The channel that triggered the hardware interrupt follows.			
Channel	B#16#00 to B#16#07	Channel 0 to 7 of the I/O module	1
It follows the error event that triggered the hardware interrupt.			
Error event	B#16#01	Positive edge	1
	B#16#02	Negative edge	

5.3 Diagnostics alarms

Diagnostics alarms

A diagnostics 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- 5 Diagnostics alarms, their meaning and corrective measures

Diagnostics alarm	Error code	Meaning	Solution
Short-circuit	1H	Short-circuit to ground at sensor supply	Correct the process wiring
Wire break	6H	Impedance of encoder circuit too high	Use a different encoder type or modify the wiring, for example, use cables with larger cross-section
		Wire break between the module and sensor	Connect the cable
		Channel not connected (open)	<ul style="list-style-type: none"> • Disable diagnostics • Connect in parallel a resistor of 25 kOhm to 45 kOhm to the encoder contacts
Parameter assignment error	10H	<ul style="list-style-type: none"> • The module cannot evaluate parameters for the channel. • Incorrect parameter assignment. 	Correct the parameter assignment
Supply voltage missing	11H	No or insufficient supply voltage L+	<ul style="list-style-type: none"> • Check supply voltage L+ on the BaseUnit • Check BaseUnit type
Hardware interrupt lost	16H	The module cannot trigger an interrupt because the previous interrupt was not acknowledged; possible configuration error	<ul style="list-style-type: none"> • Change interrupt processing in the CPU and, if necessary, edit the module parameters. • The error persists until the module is assigned new parameters
Channel/component temporarily unavailable	1FH	Firmware update is currently in progress or has been canceled. The module does not read in process values in this state.	<ul style="list-style-type: none"> • Wait for firmware update. • Restart the firmware update.

Technical specifications

6.1 Technical specifications

Technical specifications of the DI 8x24VDC HF

Article number	6ES7131-6BF00-0CA0
General information	
Product type designation	DI 8x24 V DC HF
Firmware version	V2.0
<ul style="list-style-type: none"> FW update possible 	Yes
usable BaseUnits	BU type A0
Color code for module-specific color identification plate	CC01
Product function	
<ul style="list-style-type: none"> I&M data 	Yes; I&M0 to I&M3
Engineering with	
<ul style="list-style-type: none"> STEP 7 TIA Portal configurable/integrated as of version 	V13 SP1 / -
<ul style="list-style-type: none"> STEP 7 configurable/integrated as of version 	V5.5 / -
<ul style="list-style-type: none"> PCS 7 configurable/integrated as of version 	V8.1 SP1
<ul style="list-style-type: none"> PROFIBUS as of GSD version/GSD revision 	One GSD file each, Revision 3 and 5 and higher
<ul style="list-style-type: none"> PROFINET as of GSD version/GSD revision 	GSDML V2.3
Operating mode	
<ul style="list-style-type: none"> DI 	Yes
<ul style="list-style-type: none"> Counter 	No
<ul style="list-style-type: none"> Oversampling 	No
<ul style="list-style-type: none"> MSI 	Yes
Supply voltage	
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V
Reverse polarity protection	Yes

Article number	6ES7131-6BF00-0CA0
Encoder supply	
Number of outputs	8
Output voltage encoder supply, min.	19.2 V
Short-circuit protection	Yes
24 V encoder supply	
• 24 V	Yes
• Short-circuit protection	Yes; per channel, electronic
Power loss	
Power loss, typ.	1.5 W; 24 V, 8 inputs supplied via encoder supply
Address area	
Address space per module	
• Inputs	1 byte; + 1 byte for QI information
Hardware configuration	
Automatic encoding	Yes
• Mechanical coding element	Yes
Submodules	
• Number of configurable submodules, max.	4
Selection of BaseUnit for connection variants	
• 1-wire connection	BU type A0
• 2-wire connection	BU type A0
• 3-wire connection	BU type A0 with AUX terminals
• 4-wire connection	BU type A0 + Potential isolation module
Digital inputs	
Number of digital inputs	8
Digital inputs, parameterizable	Yes
Source/sink input	P-reading
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Pulse extension	Yes; Pulse duration from 4 µs
• Length	2 s; 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s
Edge evaluation	Yes; rising edge, falling edge, edge change
Input voltage	
• Type of input voltage	DC
• Rated value (DC)	24 V
• for signal "0"	-30 to +5V
• for signal "1"	+11 to +30V
Input current	
• for signal "1", typ.	2.5 mA

Article number	6ES7131-6BF00-0CA0
Input delay (for rated value of input voltage) for standard inputs	
– parameterizable	Yes; 0.05 / 0.1 / 0.4 / 0.8 / 1.6 / 3.2 / 12.8 / 20 ms (in each case + delay of 30 to 500 µs, depending on line length)
– at "0" to "1", min.	0.05 ms
– at "0" to "1", max.	20 ms
– at "1" to "0", min.	0.05 ms
– at "1" to "0", max.	20 ms
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m
Encoder	
Connectable encoders	
• 2-wire sensor	Yes
– permissible quiescent current (2-wire sensor), max.	1.5 mA
Isochronous mode	
Isochronous operation (application synchronized up to terminal)	Yes
Filtering and processing time (TCI), min.	420 µs
Bus cycle time (TDP), min.	500 µs
Jitter, max.	8 µs
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Alarms	
• Diagnostic alarm	Yes; channel by channel
• Hardware interrupt	Yes; Parameterizable, channels 0 to 7
Diagnostic messages	
• Diagnostic information readable	Yes
• Monitoring the supply voltage	Yes
– parameterizable	Yes
• Monitoring of encoder power supply	Yes; channel by channel
• Wire-break	Yes; Channel by channel, optional protective circuit for preventing wire-break diagnostics in the case of simple encoder contacts: 25 kOhm to 45 kOhm
• Short-circuit	Yes; channel by channel

Article number	6ES7131-6BF00-0CA0
Diagnostics indication LED	
<ul style="list-style-type: none"> Monitoring of the supply voltage (PWR-LED) Channel status display for channel diagnostics for module diagnostics 	<p>Yes; green PWR LED</p> <p>Yes; Green LED</p> <p>Yes; Red LED</p> <p>Yes; green/red DIAG LED</p>
Potential separation	
Potential separation channels	
<ul style="list-style-type: none"> between the channels between the channels and backplane bus between the channels and the power supply of the electronics 	<p>No</p> <p>Yes</p> <p>No</p>
Isolation	
Isolation tested with	707 V DC (type test)
Ambient conditions	
Ambient temperature during operation	
<ul style="list-style-type: none"> horizontal installation, min. horizontal installation, max. vertical installation, min. vertical installation, max. 	<p>0 °C</p> <p>60 °C</p> <p>0 °C</p> <p>50 °C</p>
Altitude during operation relating to sea level	
<ul style="list-style-type: none"> Ambient air temperature-barometric pressure-altitude 	On request: Negative ambient temperature down to -30 °C (without condensation), installation altitudes between 2 000 m and 5 000 m
Dimensions	
Width	15 mm
Height	73 mm
Depth	58 mm
Weights	
Weight, approx.	28 g

Dimension drawing

See manual ET 200SP BaseUnits

<http://support.automation.siemens.com/WW/view/en/58532597/133300>

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.

With data records 0 to 7, you can reconfigure individual channels.

Operation of the module behind a PROFIBUS DP interface module

If the module is operated behind a PROFIBUS DP interface module, the parameter data records 0 and 1 cannot be read back. You obtain the diagnostics data records 0 and 1 with the read back parameter data records 0 and 1. You can find additional information in the Interrupts section of the PROFIBUS DP interface module manual on the Internet (<http://support.automation.siemens.com/WW/view/en/78324181>).

Parameter assignment in the user program

The module parameters can be re-assigned in RUN (for example, the input delay of selected channels can be edited in RUN without having an effect on the other channels).

Changing parameters in RUN

The WRREC instruction is used to transfer the parameters to the module using data record 128 or data records 0 to 7. The parameters set in STEP 7 are not changed in the CPU, which means that the parameters set in STEP 7 will be valid again after a restart.

If you reconfigure a module and diagnostics are pending prior to the reconfiguration, these diagnostics are not signaled as "outgoing".

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. The STATUS output parameter contains a corresponding error code.

You will find a description of the "WRREC" instruction and the error codes in the STEP 7 online help.

Data record structure

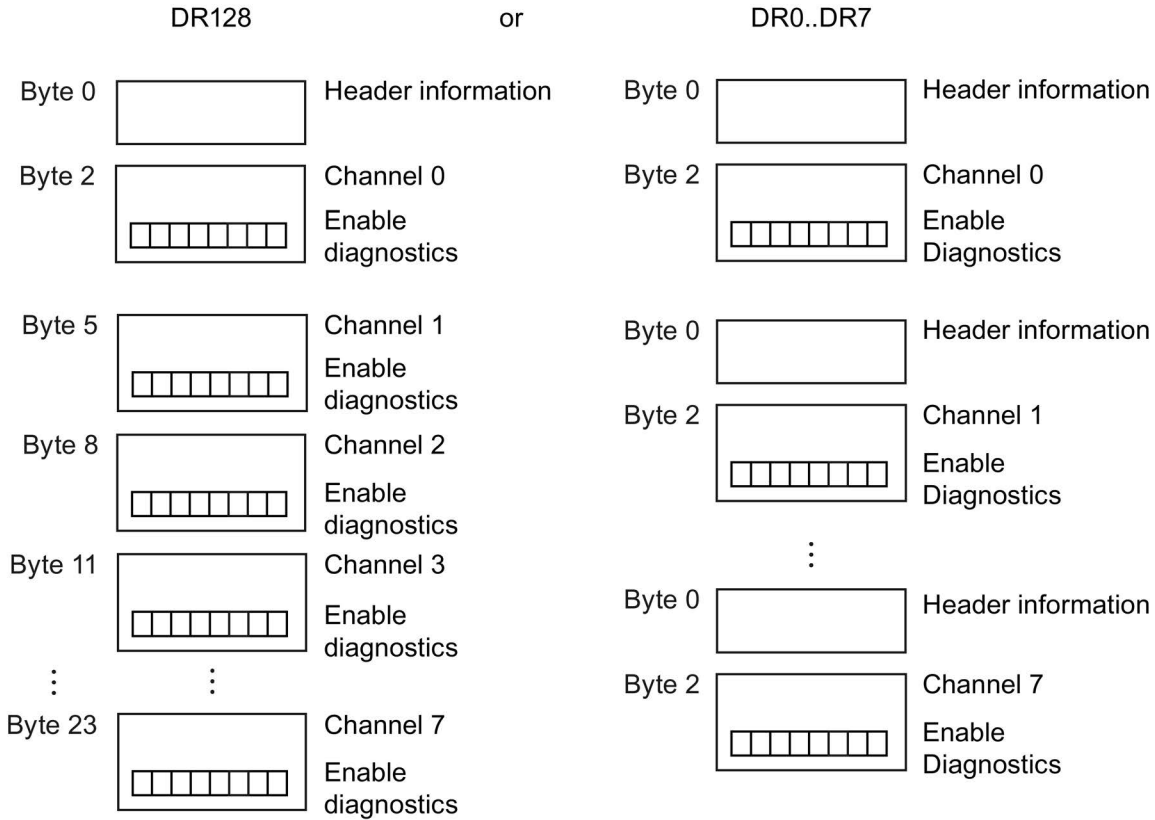


Figure A-1 Structure of data record 128 and data records 0 to 7

Header information

The figure below shows the structure of the header information.

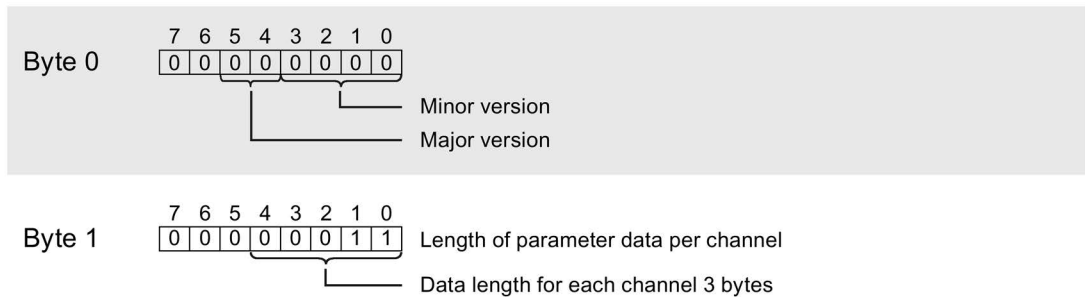
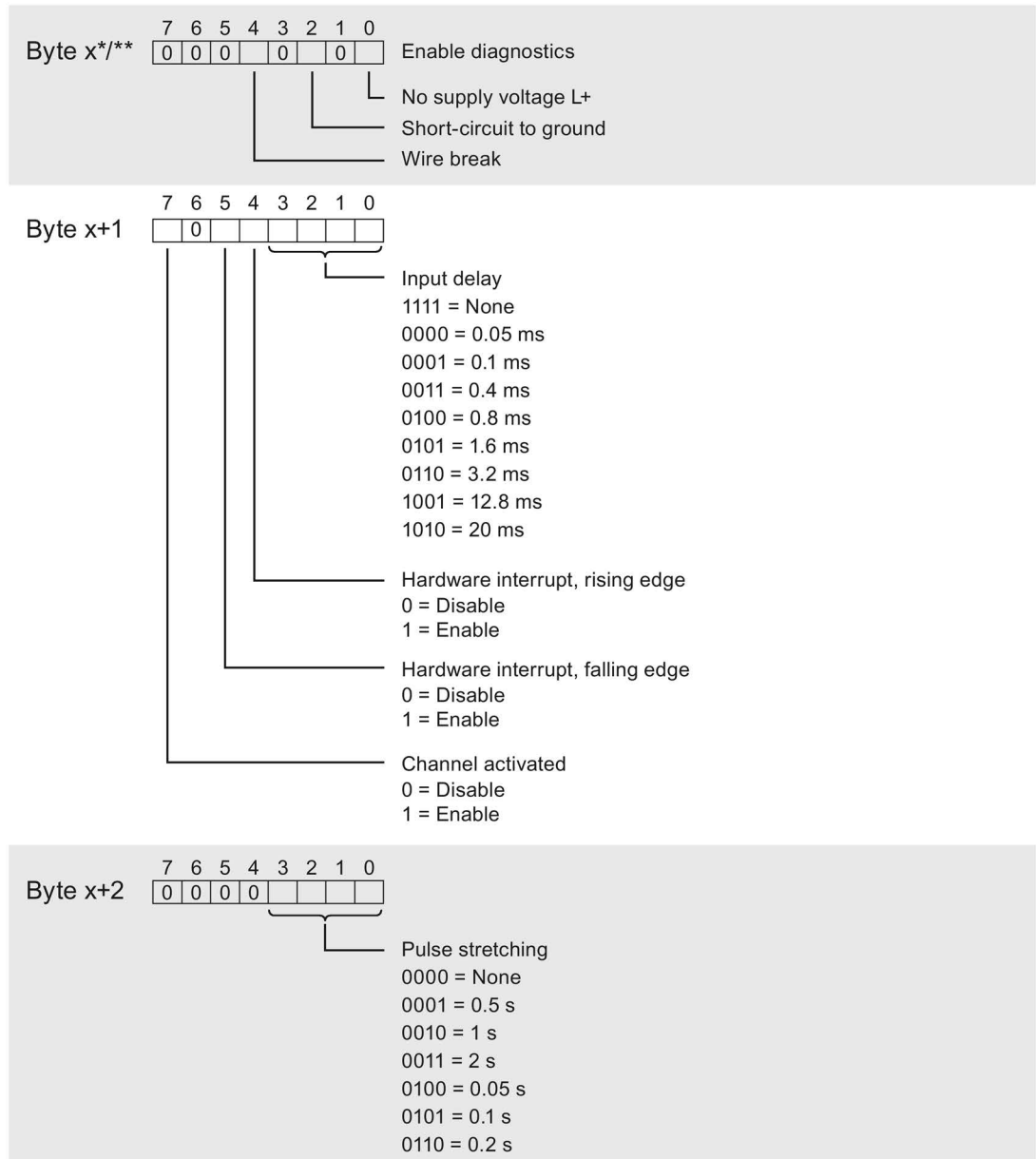


Figure A-2 Header information

Parameter

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".



* $x = 2 + (\text{channel number} \times 3)$; channel number = 0 to 7 for DR 128

** $x = 2$ for DR 0 to DR 7

Figure A-3 Structure of byte x to x+2 for channels 0 to 7

Error transmitting the data record

The module always checks all values of the data record to be sent. The module applies the values from the data record only when all values have been transmitted without errors.

The WRREC instruction for writing data records returns the appropriate error code if there are errors in the STATUS parameter.

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

Error code in the 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 unavailable	<ul style="list-style-type: none"> • Check the station to determine whether the module is plugged or pulled. • Check assigned values for the parameters of the WREC 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	xx	Parameter error	Check the parameters of the module