SIEMENS

SIMATIC

S7-1500/ET 200MP DI 16x24VDC HF Digital Input Module (6ES7521-1BH00-0AB0)

Manual

01/2013

A5E03485952-01

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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.

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Preface

Purpose of the documentation

This manual complements the system manuals:

- S7-1500 Automation System
- ET 200MP distributed I/O system

Functions that generally concern the systems are described in these manuals.

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

Conventions

The term "CPU" is used in this manual both for the CPUs of the S7-1500 automation system, as well as for interface modules of the ET 200MP distributed I/O system.

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.

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Table of contents

Documentation guide

1

Introduction

The documentation of SIMATIC products has a modular structure and covers topics relating to your automation system.

The complete documentation for the S7-1500 and ET 200MP systems consists of the respective system manual, function manuals and manuals.

Moreover, the STEP 7 information system (online help) supports you in configuring and programming your automation system.

Overview of the documentation for digital input module DI 16x24VDC HF

The following table lists additional documentation that you will need when using the DI 16x24VDC HF digital input module.

Table 1- 1 Documentation for digital input module DI 16x24VDC HF

Topic	Documentation	Most important contents
System description	S7-1500 Automation System (http://support.automation.siemens.com/WW/view/en/59191792) system manual ET 200MP Distributed I/O Device (http://support.automation.siemens.com/WW/view/en/59193214) system manual	• Application planning • Installation • Wiring • Commissioning
Configuring interference-free controllers	Configuring interference-free controllers (http://support.automation.siemens.com/WW/view/en/59193566) function manual	• Basics • Electromagnetic compatibility • Lightning protection
System diagnostics	System Diagnostics (http://support.automation.siemens.com/WW/view/en/59192926) function manual	• Overview • Diagnostic evaluation of hardware/software

SIMATIC manuals

All current manuals for the SIMATIC products are available for download free of charge from the Internet (http://www.siemens.com/automation/service&support).

Product overview

2

2.1 Properties

Order number:

6ES7521-1BH00-0AB0

View of the module

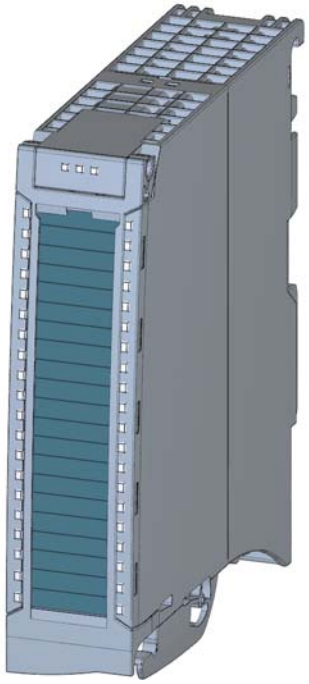


Figure 2-1 View of the DI 16x24VDC HF module

Properties

The module has the following properties:

- Technical properties
  - 16 digital inputs, electrically isolated in groups of 16
  - Rated input voltage 24 V DC
  - Channel-based configurable input delay: 0.05 ms to 20 ms
  - Channel-based configurable diagnostics
  - Channel-based configurable hardware interrupt
  - Suitable for switches and 2-/3-/4-wire proximity switches
- Supported functions
  - Firmware update
  - Identification data I&M0 to I&M3
  - Reconfiguration in RUN (channel-based)
  - Isochronous mode

Accessories

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

- Labeling strips
- U connector
- Universal front door

Other components

The following component must be ordered separately:

Front connectors, including potential jumpers and cable ties

Wiring

3

The following figures show the block diagram of the module and various wiring options.

For more information on front connector wiring and creating cable shields, for example, refer to the "Wiring" section in the S7-1500 Automation System (http://support.automation.siemens.com/WW/view/en/59191792) and ET 200MP distributed I/O system (http://support.automation.siemens.com/WW/view/en/59193214) system manuals.

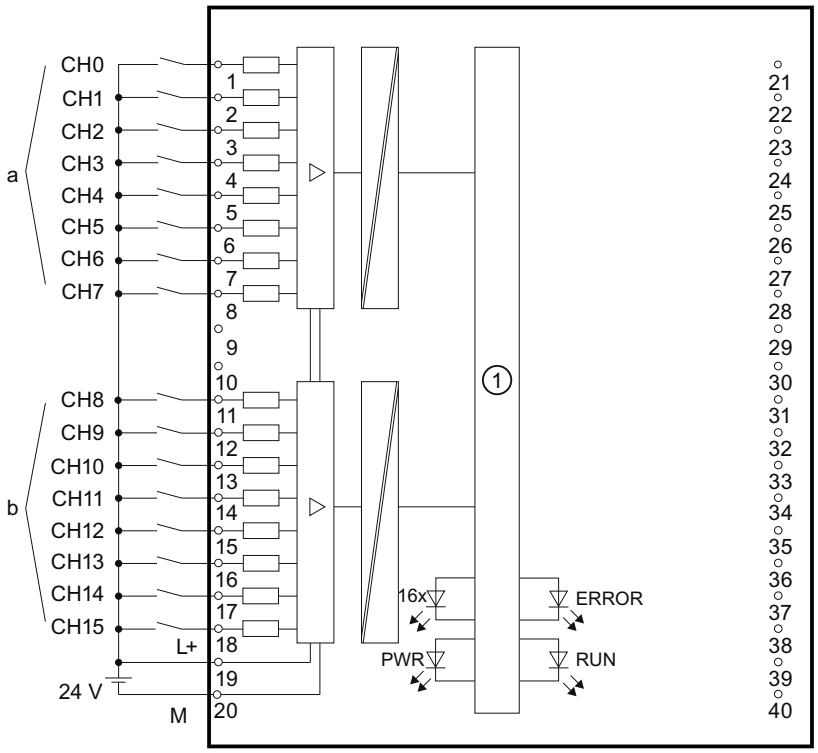
Abbreviations used

Meaning of the abbreviations used in the following figures:

L+	Supply voltage connection
M	Ground connection
CHx	Channel or display of the channel status
PWR	Display for the supply voltage (POWER)

Wiring and block diagrams

The figure below shows you how to connect the module and channel addressing (input byte a to input byte b).



① Backplane bus interface

Figure 3-1 Block diagram and terminal assignment

Resistor circuitry of the encoders

To detect a wire break, it is necessary that enough quiescent current is flowing even when the encoder contacts are open. Connect a resistor of 25 kΩ to 45 kΩ with 0.25 W to the encoder contacts for this reason.

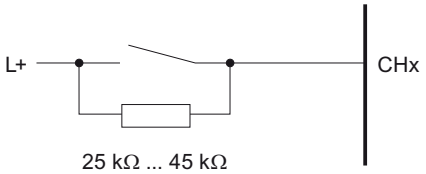


Figure 3-2 Resistor circuitry of the encoders

Tip: Using the potential jumpers

Use the potential jumpers supplied with the front connector if you want to distribute the 24V DC supply voltage to a neighboring module. This helps you to avoid having to terminate two wires to one terminal.

Proceed as follows:

1. Connect the 24 V DC supply voltage to terminals 19 and 20.
2. Insert the potential jumpers between terminals 19 and 39 (L+) and between terminals 20 and 40 (M).
3. Use the terminals 39 and 40 to distribute the potential to the next module

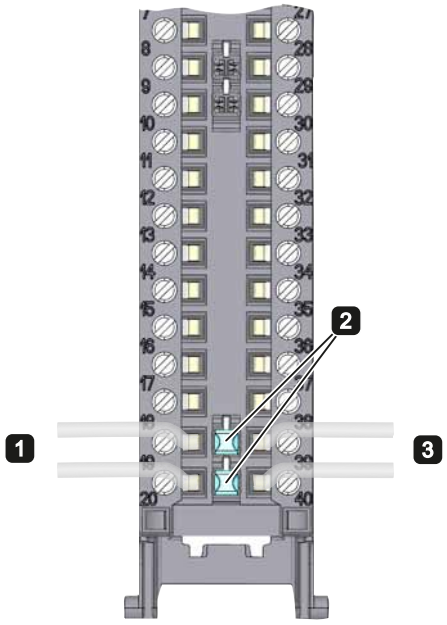


Figure 3-3 Using the potential jumpers

Note

Ensure that the maximum current load of 8 A per potential jumper is not exceeded!

Parameters/address space

4

4.1 Parameters

DI 16x24VDC HF parameters

When assigning the module parameters in STEP 7, use different parameters to declare the module properties. The following table lists the configurable parameters.

When assigning parameters in the user program, use the WRREC instruction (configuration in RUN) to transfer the parameters to the module using data records; refer to section Parameter assignment and structure of the parameter data records (Page 27).

Table 4- 1 Configurable parameters and their defaults

Parameters	Range of values	Default	Configuration in RUN	Effective range
Diagnostics				
• Missing supply voltage L+	Yes/No	No	Yes	Channel*
• Wire break	Yes/No	No	Yes	Channel
Input delay	0.05 ms, 0.1 ms, 0.4 ms, 1.6 ms, 3.2 ms, 12.8 ms, 20 ms	3.2 ms	Yes	Channel
Hardware interrupt				
• Positive edge	Yes/No	No	Yes	Channel
• Negative edge	Yes/No	No	Yes	Channel
• Positive and negative edge	Yes/No	No	Yes	Channel

* If you enable diagnostics for multiple channels, you will receive an alarm surge on failure of the supply voltage because each enabled channel will detect this fault.

You can prevent this alarm surge by assigning the diagnostics function to one channel only.

4.2 Address space

Address space of DI 16x24VDC HF

The following figure shows the address space allocation for the configuration as 16-channel DI 16x24VDC HF with value status (Quality Information (QI)). The addresses for the value status are only available if the value status is enabled.

The letters "a" and "b" are printed on the module. "IB a" represents the module start address.

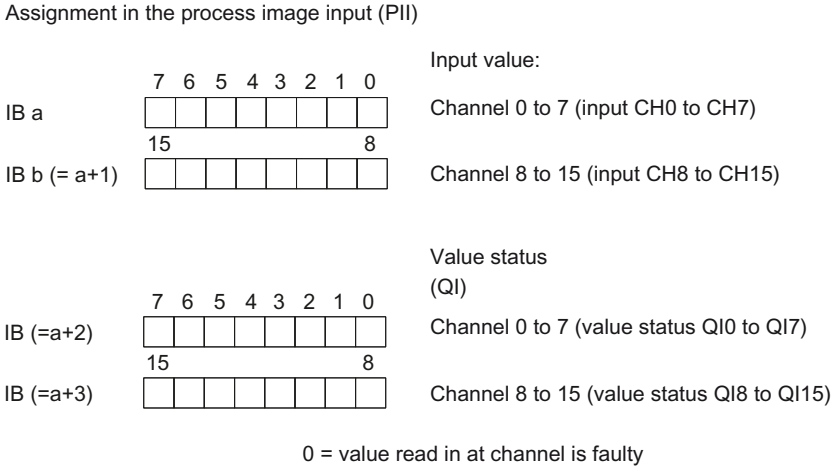


Figure 4-1 Address space of DI 16x24VDC HF with value status

Configuration options of DI 16x24VDC HF

The following configurations are possible:

- Configuration 1: 1 x 16-channel (no value status)
- Configuration 2: 1 x 16-channel (with value status)

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. Each bit in this byte is assigned to a channel and returns information about the validity of the digital value (0 = incorrect value).

Interrupts/diagnostic alarms

5

5.1 Status and error displays

LED displays

The following figure shows you the LED displays (status and error displays) of DI 16x24VDC HF.

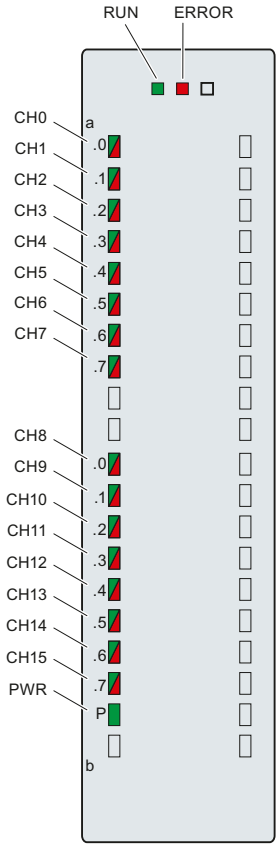


Figure 5-1 LED displays of the module DI 16x24VDC HF

Meaning of the LED displays

The following tables explain the meaning of the status and error displays. Corrective measures for diagnostic alarms can be found in chapter Diagnostic alarms (Page 20).

Table 5- 1 Status and error displays RUN/ERROR

LED		Meaning	To correct or avoid errors
RUN	ERROR		
Off	Off	Voltage missing or too low at backplane bus	• Switch on the CPU and/or the system power supply modules. • Verify that the U connectors are inserted. • Check to see if too many modules are inserted.
Flashes	Off	The module starts and flashes until the valid parameter assignment is set.	---
On	Off	Module is configured	
On	Flashes	Indicates module errors (there is an error on at least one channel, for example, a wire break).	Evaluate the diagnostics data and eliminate the error (e.g., wire break).
Flashes	Flashes	Hardware defective	Replace the module.

Table 5- 2 PWR status display

LED PWR	Meaning	To correct or avoid errors
Off	Supply voltage L+ too low or missing	Check supply voltage L+.
On	Supply voltage L+ is present and OK	---

Table 5- 3 CHx status display

LED CHx	Meaning	To correct or avoid errors
Off	0 = Status of the input signal	---
On	1 = Status of the input signal	---
On	Diagnostics: Wire break	Check the wiring. When using simple switches, deactivate diagnostics or connect a resistor (25 kΩ … 45 kΩ) to the encoder contacts.
	Supply voltage L+ too low or missing	Check supply voltage L+.

5.2 Interrupts

Digital input module DI 16x24VDC HF supports diagnostic and hardware interrupts.

Diagnostic interrupt

The module generates a diagnostic interrupt at the following events:

- Missing supply voltage L+
- Wire break

Hardware interrupt

The module generates a hardware interrupt at the following events:

- Positive edge
- Negative edge
- Positive and negative edge

For detailed information on the error event, refer to the hardware interrupt organization block with the "RALRM" instruction (read additional interrupt information) and to the STEP 7 online help.

5.3 Diagnostic alarms

Diagnostic alarms

A diagnostic alarm is output for each diagnostic event and the ERROR LED flashes on the module. The diagnostic alarms can, for example, be read from the diagnostic buffer of the CPU. You can evaluate the error codes with the user program.

Table 5- 4 Diagnostic alarms, their meaning and corrective measures

Diagnostic alarm	Error code	Meaning	Corrective measures
Load voltage missing	17_D	Supply voltage L+ of the module is missing	Connect supply voltage L+ to module/channel
Wire break	6_D	Impedance of encoder circuit too high	Use a different encoder type or modify the wiring, for example, using cables with larger cross-section
		Wire break between the module and sensor	Connect the cable
		Channel not connected (open)	• Disable diagnostics • Connect a resistor of 25 kΩ to 45 kΩ to the encoder contacts
Hardware interrupt lost	22_D	The module cannot trigger an interrupt because the previous interrupt was not acknowledged; possibly a configuration error	• Change interrupt processing in the CPU and, if necessary, edit the module parameters. • The error persists until the module is assigned new parameters

Technical specifications

6

Technical specifications of the DI 16x24VDC HF

	6ES7521-1BH00-0AB0
Product type designation	DI 16x24VDC HF
General information	
Hardware product version	E01
Firmware version	V1.0.0
• I&M data	Yes; IM0 to IM3
Engineering with	
STEP 7 TIA Portal can be configured/integrated as of version	V12.0 / V12.0
STEP 7 can be configured/integrated as of version	as of V5.5 SP3 / -
Supply voltage	
Voltage type of the supply voltage	DC
• Rated value (DC)	24 V
• Low limit of permissible range (DC)	20.4 V
• High limit of permissible range (DC)	28.8 V
• Reverse polarity protection	Yes
Input current	
• Current consumption, max.	20 mA; (with 24 V DC supply)
Power	
• Power consumption from the backplane bus	1.1 W
Power loss	
• Power loss, typ.	2.6 W
Digital inputs	
• Number of inputs	16
• reading m/p	Yes; reading p
• Input characteristic curve acc. to IEC 61131, type 3	Yes

	6ES7521-1BH00-0AB0
Input voltage	
Type of input voltage	DC
• Rated value, DC	24 V
for signal "0"	-30 to +5 V
for signal "1"	11 to 30 V
• Permissible voltage at input, max.	30 V
• Permissible voltage at input, min.	-30 V
Input current	
• for signal "1", typ.	2.5 mA
Input delay (for rated value of input voltage)	
For standard inputs	
• Configurable	Yes; 0.05 / 0.1 / 0.4 / 1.6 / 3.2 / 12.8 / 20 ms
• with "0" to "1", min.	0.05 ms
• with "0" to "1", max.	20 ms
• with "1" to "0", min.	0.05 ms
• with "1" to "0", max.	20 ms
For interrupt inputs	
• Configurable	Yes
Cable length	
• Cable length shielded, max.	1000 m
• Cable length unshielded, max.	600 m
Encoders	
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.	80 µs; with 50 µs filter time
• Bus cycle time (TDP), min.	250 µs

	6ES7521-1BH00-0AB0
Interrupts/diagnostics/status information	
Interrupts	
• Diagnostic interrupt	Yes
• Hardware interrupt	Yes
Diagnostic alarms	
Diagnostics	Yes
• Monitoring of supply voltage	Yes
• Wire break	Yes; to I < 350 µA
• Short-circuit	No
• Fuse blown	No
Diagnostic indicator LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• Monitoring of supply voltage	Yes; green LED
• Channel status display	Yes; green LED
• For channel diagnostics	Yes; red LED
• For module diagnostics	Yes; red LED
Electrical isolation	
Electrical isolation channels	
• Between the channels	No
• Between the channels, in groups of	16
• Between the channels and the backplane bus	Yes
• Between the channels and the supply voltage of the electronics	No
Permitted potential difference	
Between different circuits	75 V DC / 60 V AC (basic insulation)
Insulation	
Insulation tested with	707 V DC (type test)
Distributed mode	
• Supports fast startup	Yes; 500 ms
Dimensions	
• Width	35 mm
• Height	147 mm
• Depth	129 mm
Weights	
• Weight, approx.	240 g

Tolerances of the programmable input delay

Table 6- 1 Tolerances of the programmable input delay

Input delay	Tolerance
0.05 ms	43 µs to 57 µs
0.1 ms	86 µs to 114 µs
0.4 ms	344 µs to 456 µs
1.6 ms	1.5 ms to 1.9 ms
3.2 ms (preset)	3 ms to 4 ms
12.8 ms	12 ms to 15 ms
20 ms	19 ms to 23 ms

Dimensional drawing

A

The dimensional drawing of the module on the mounting rail, as well as a dimensional drawing with open front cover, are provided in the appendix. Always observe the specified dimensions for installation in cabinets, control rooms, etc.

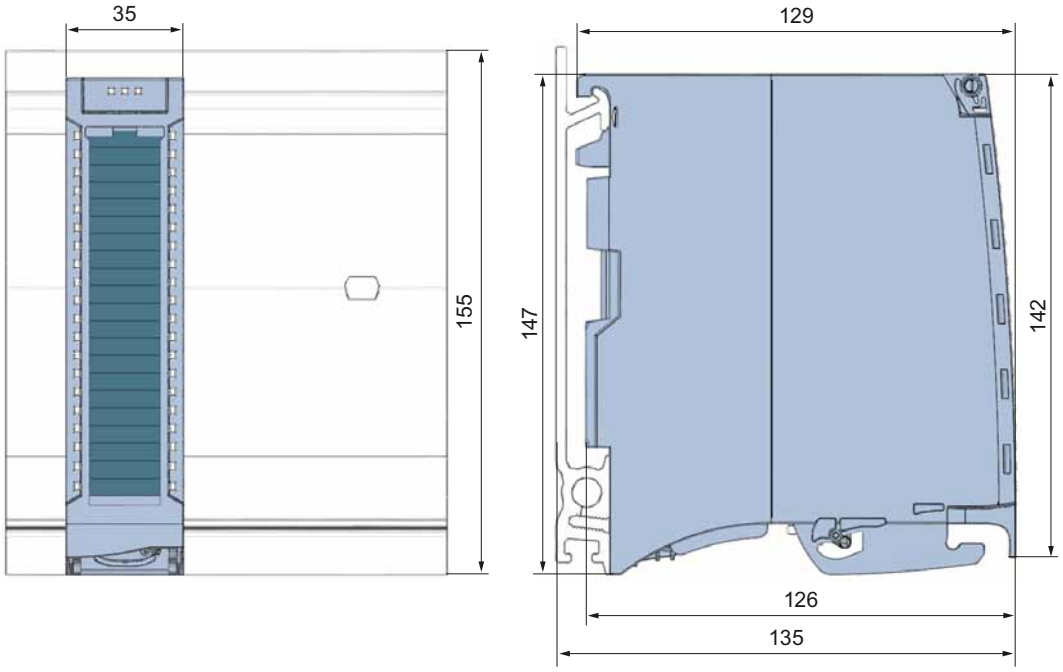


Figure A-1 Dimensional drawing of the DI 16x24VDC HF module

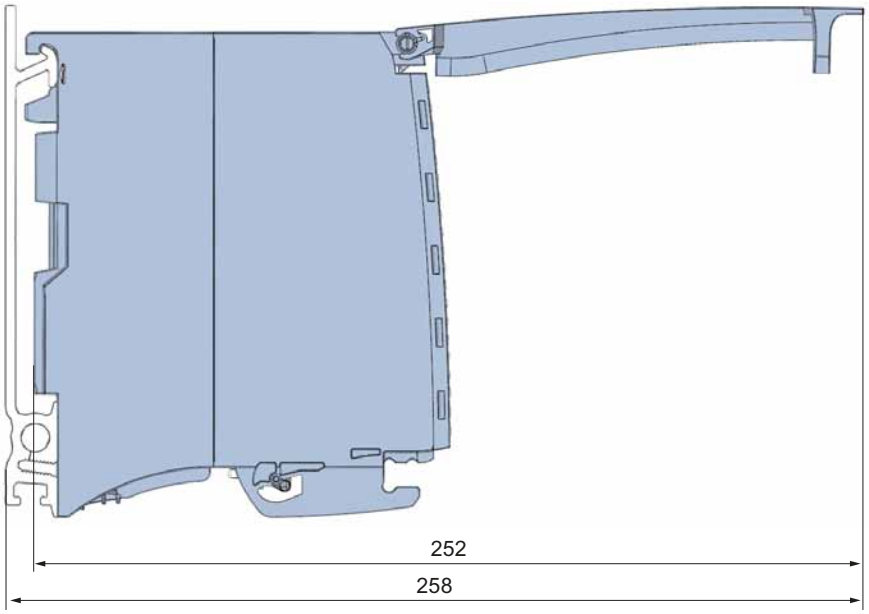


Figure A-2 Dimensional drawing of the DI 16x24VDC HF module, side view with open front cover

Parameter data records

B

B.1 Parameter assignment and structure of the parameter data records

Parameter assignment in the user program

You have the option to reconfigure the module in RUN (e.g. the input delay values of selected channels can be edited 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 records 0 to 15. The parameters set in STEP 7 will not be 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 occurred 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 are available in the STEP 7 online help.

Assignment of data record and channel

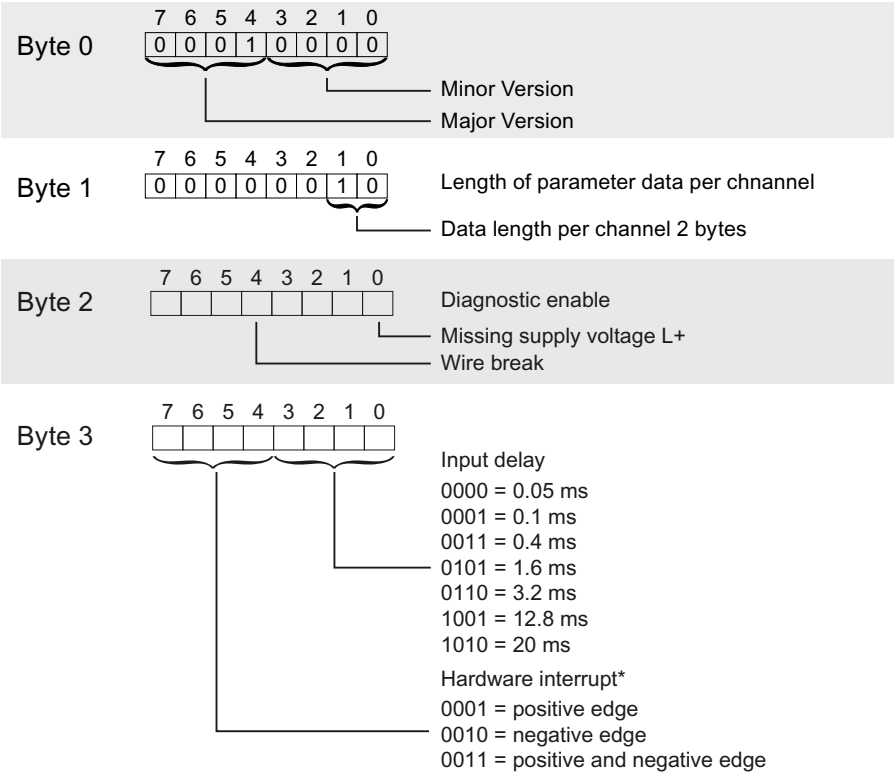
The channel parameters of the module are included in data records 0 to 15 and are assigned as follows:

- Data record 0 for channel 0
- Data record 1 for channel 1
- …
- Data record 14 for channel 14
- Data record 15 for channel 15

Data record structure

The example in the following figure shows the structure of data record 0 for channel 0. The structure of channels 1 to 15 is identical. The values in byte 0 and byte 1 are fixed and may not be changed.

Activate a parameter by setting the corresponding bit to "1".



* You can only activate the hardware interrupts by means of the data record if a hardware interrupt OB is assigned to the channel in STEP 7.

Figure B-1 Structure of data record 0: Bytes 0 to 3