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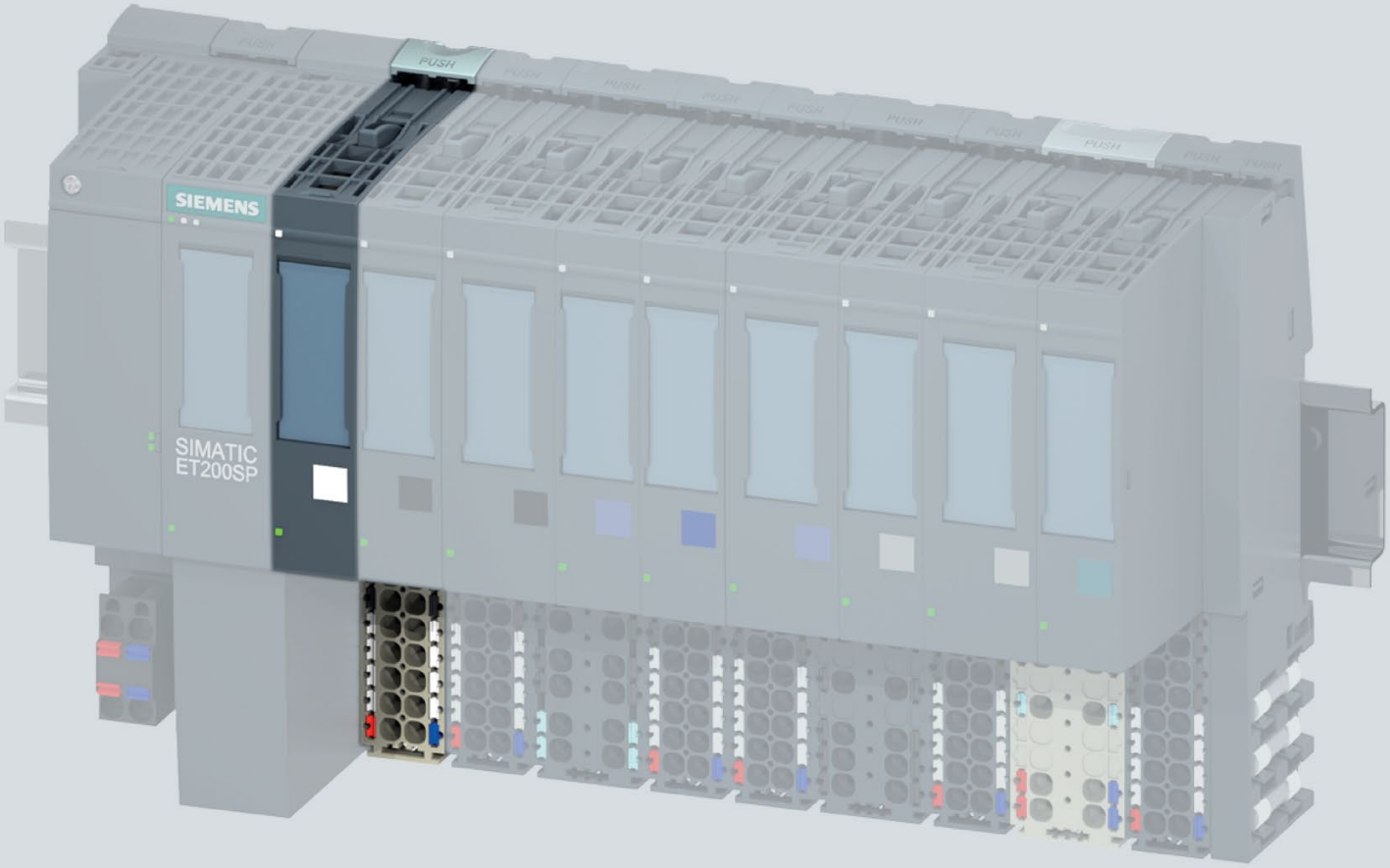

Manual

SIMATIC

ET 200SP

Digital input module
DI 8x24VDC HS (6ES7131-6BF00-0DA0)

Edition 11/2019

support.industry.siemens.com

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SIMATIC

ET 200SP
Digital input module DI 8x24VDC HS (6ES7131-6BF00-0DA0)

Equipment Manual

11/2019

A5E35243810-AD

Legal information

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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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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.

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

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A5E35243810-AD
℗ 11/2019 Subject to change

Preface

Purpose of the documentation

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

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

The information provided in this manual and in the system/function manuals supports you when commissioning the ET 200SP distributed I/O system.

Changes compared to the previous version

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

Parameters and value range are harmonized in "Counting" mode (GSD file and TIA Portal).

Conventions

Please pay particular attention to notes highlighted as follows:

Note

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

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

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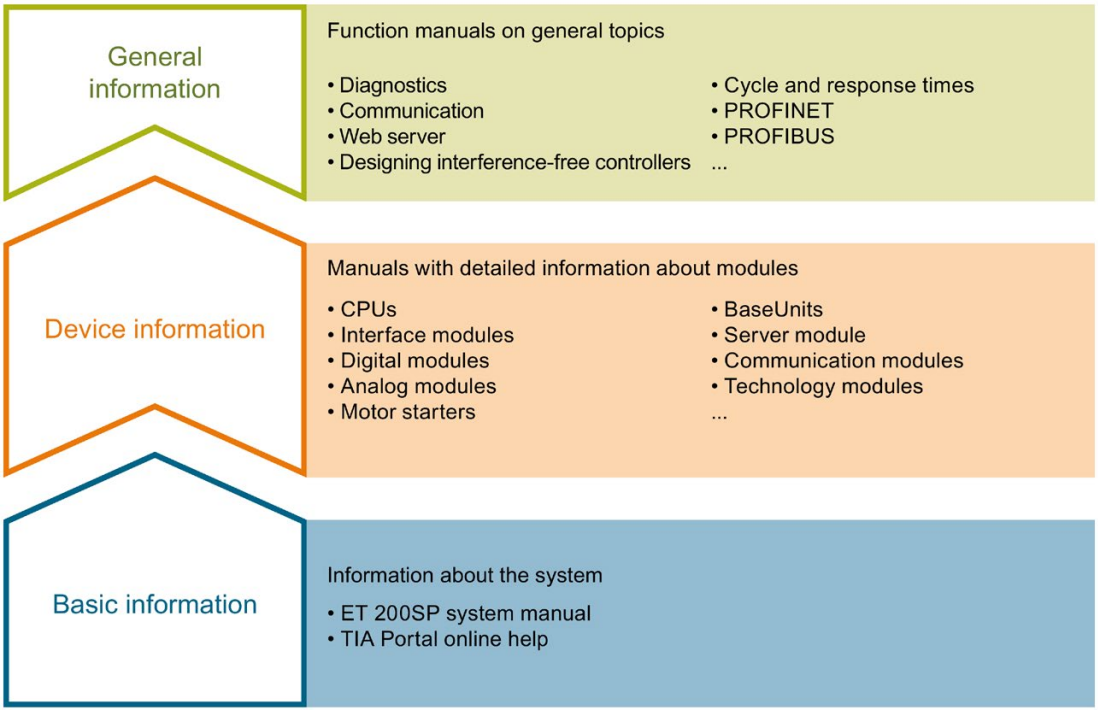
Table of contents

Documentation guide

1

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



Basic information

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

Device information

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

General information

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

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

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

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

Manual Collection ET 200SP

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

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

"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".

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"mySupport" - Documentation

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

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"mySupport" - CAx data

In the CAx data area of "mySupport", you can 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 on the Internet (https://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 (https://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 TIA Portal.

The SIMATIC Automation Tool provides a multitude of functions:

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

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

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

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 the optimal use of resources

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

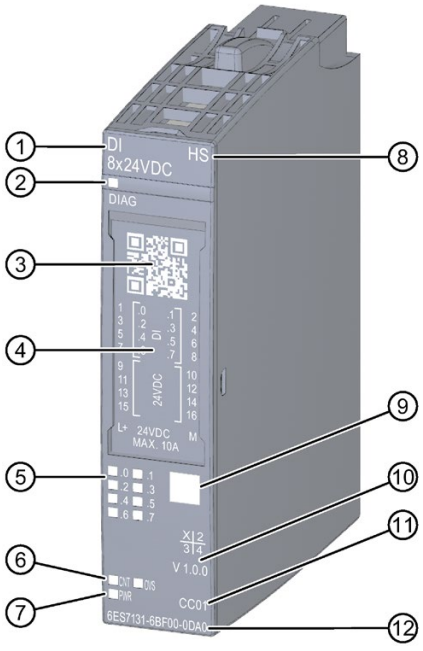
2 Product overview

2.1 Properties

Article number

6ES7131-6BF00-0DA0

View of the module



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

Figure 2-1 View of the DI 8×24VDC HS module

Properties

The module has the following technical properties:

- Digital input module with 8 high-speed inputs
- Supply voltage L+
- Sink input (PNP)
- Module-specific configurable diagnostics for supply voltage and short-circuit to M
- Suitable for connection of switches and 2-wire sensors in accordance with IEC 61131, type 1 and 3
- Three operating modes:

Table 2- 1 Operating modes of the DI 8×24VDC HS

Property		Operating mode			
		DI (Page 15)		Counting (CNT) (Page 31)	Oversampling (OVS) (Page 53)
		Without value status (QI)	With value status (QI)		
Number of channels		8	8	4	8
Isochronous mode		Yes, optional	Yes, optional	Yes, optional	Yes, required
• Shortest send clock		125 µs	125 µs	125 µs	250 µs
Oversampling		No	No	No	Yes
• Number of oversampling levels (sampling rate)		—	—	—	2 ... 32
• Shortest sub-cycle (= shortest sampling time)		—	—	—	7.8125 µs
Counter length, max. counting frequency		—	—	32-bit, 10 kHz *	—
Configurable input delay		0 ms ... 20 ms	0 ms ... 20 ms	0.05 ms - 20 ms	0 ms ... 20 ms
Configurable hardware interrupts; rising edge and/or falling edge (per channel)		×	×	—	—
Data length	Inputs	1 byte	2 bytes	25 bytes	32 bytes
	Outputs	0 bytes	0 bytes	20 bytes	0 bytes

* If a diagnostic event occurs, the maximum counting frequency is reduced to 9 kHz.

The module supports the following functions:

- Isochronous mode
- Firmware update
- I&M identification data
- Reconfiguration in RUN
- PROFIenergy

The module can be configured with HSP or a GSD file. The configurations for the operating modes can be found under various codes / module names:

Table 2- 2 Codes / module names for the configuration options

Operating mode		Configuration software			
		HSP0127 for STEP 7 (TIA Portal)	HSP0229 for STEP 7	GSD file PROFINET IO	GSD file PROFIBUS DP
DI	Without QI	DI 8×24VDC HS	DI 8×24VDC HS DI/OVS	DI 8×24VDC HS	DI 8×24VDC HS
	With QI			DI 8×24VDC HS QI	—
Counting (CNT)			DI 8×24VDC HS CNT	DI 8×24VDC HS CNT	DI 8×24VDC HS CNT
Oversampling (OVS) *			DI 8×24VDC HS DI/OVS	—	—

* The interface module or CPU with which the module is used must support isochronous mode.

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 (https://support.industry.siemens.com/cs/ww/en/view/58649293) system manual.

Operating mode DI

3

3.1 Wiring up

3.1.1 Wiring and block diagrams

This section contains the block diagram for the DI 8x24VDC HS with the pin assignments for 1, 2 and 3-wire connection in DI operating mode. You may use and combine the different wiring options for all channels.

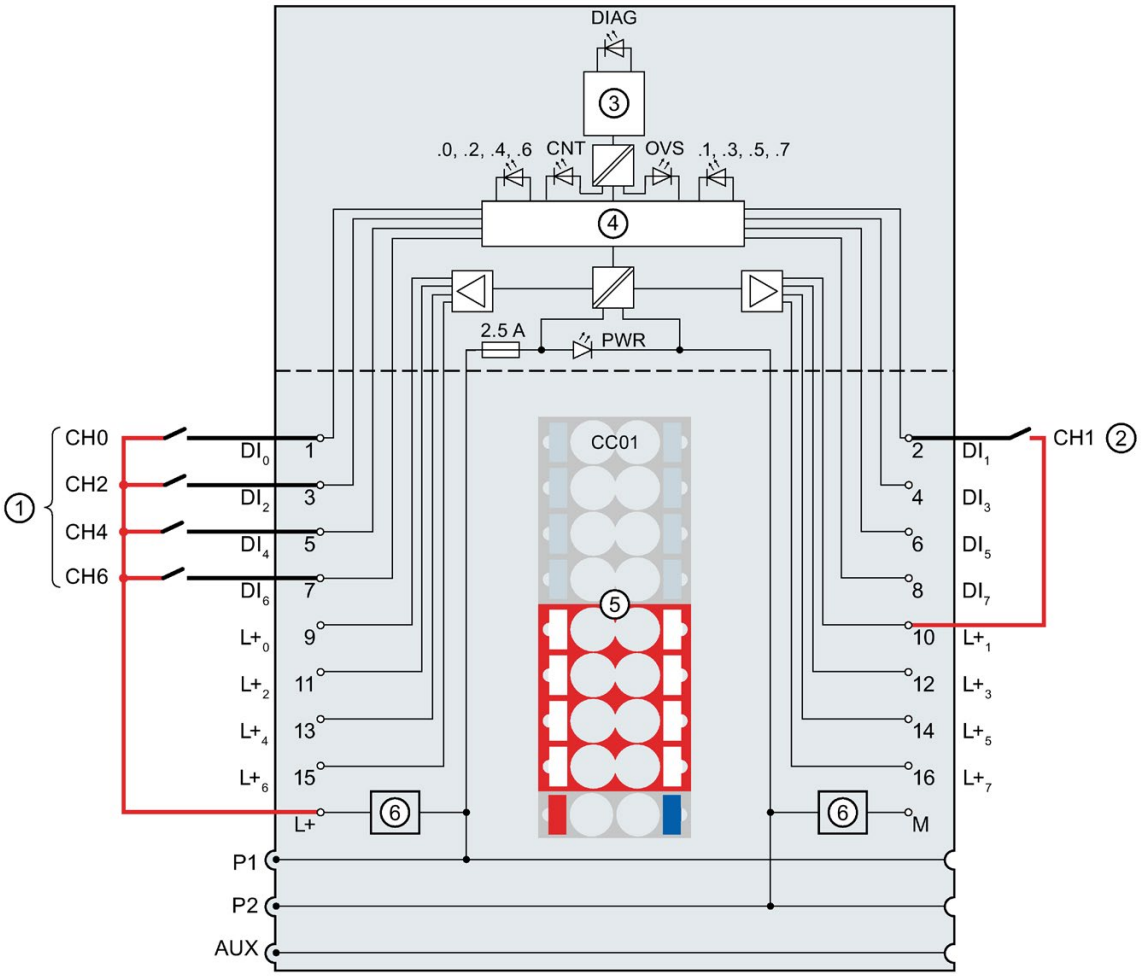
Information on wiring the BaseUnit can be found in the system manual ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/58649293).

Note

The module's load group must start with a light BaseUnit. Keep this in mind also during the configuration.

Wiring: 1 and 2-wire connection

The figure below shows the block diagram and an example of pin assignment for the DI 8×24VDC HS digital input module on the BaseUnit BU type A0 without AUX terminals (1 and 2-wire connection).

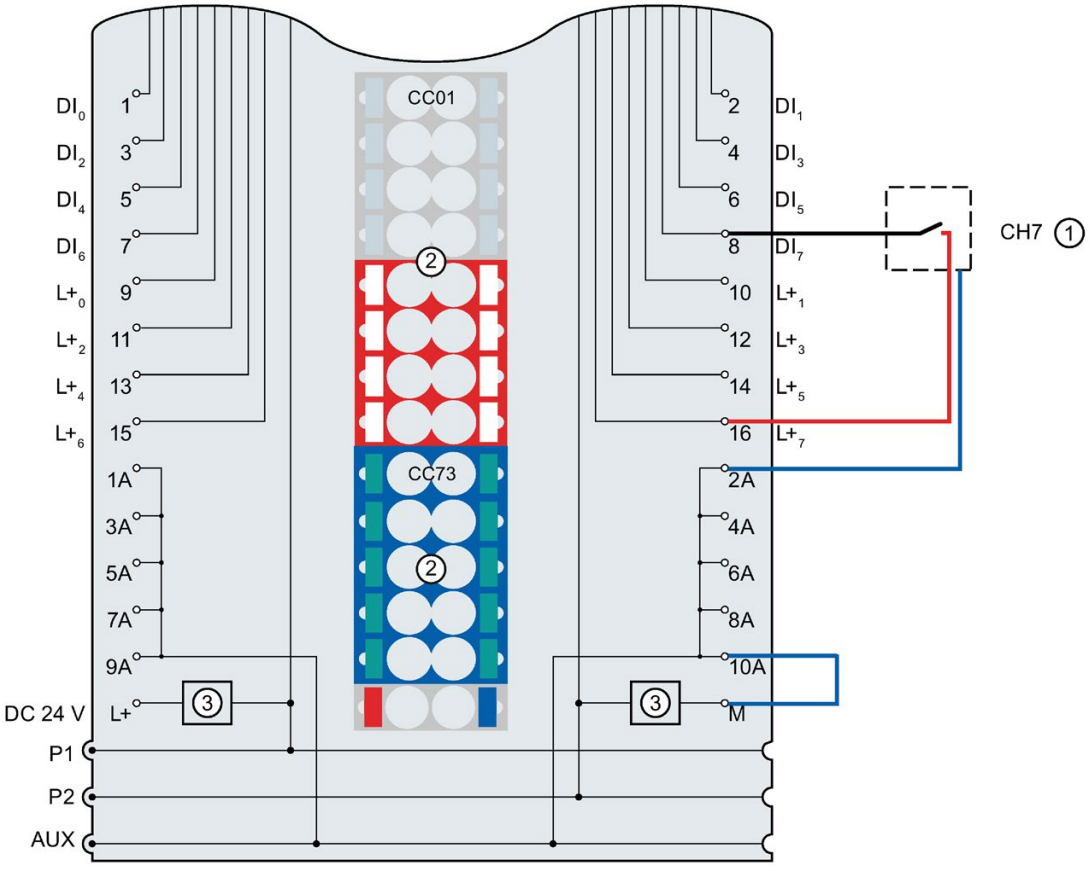


①	1-wire connection	$L+_n$	Encoder supply, channel n
②	2-wire connection	L+	24 V DC (infeed only with light BaseUnit)
③	Backplane bus interface	DIAG	LED error or diagnostics (green, red)
④	Input electronics	.0 to .7	LED channel status (green)
⑤	Color-coded label CCxx (optional)	PWR	LED power (green)
⑥	Supply voltage filter circuit (only available with light BaseUnit)	CNT	LED operating mode Count (green)
M	Ground	OVS	LED operating mode Oversampling (green)
DI_n	Input signal, channel n	P1, P2, AUX	Internal self-configuring voltage buses Connection to the left (dark BaseUnit) Connection to the left interrupted (light BaseUnit)

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

Wiring: 3-wire connection

The figure below shows an example of pin assignment for the DI 8×24VDC HS digital input module on the BaseUnit BU type A0 with AUX terminals (3-wire connection).



①	3-wire connection
②	Color-coded labels CCxx (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

3.2 Parameters/address space

3.2.1 High-speed inputs

Function

In operating mode DI, use all eight channels as digital high-speed inputs. High-speed inputs make sense when rapid reactions to input signals are needed (reaction time < 2 ms).

Requirement

Low reaction times require a cycle time of less than 750 µs.

3.2.2 Parameters

The effective range of the parameters depends on the type of configuration. The following configurations are possible:

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

In addition to configuration via the configuration software, you can also configure parameters in RUN mode (dynamic) via the user program. When assigning parameters in the user program, use the "WRREC" instruction to transfer the parameters to the module using the data records; refer to the section Parameter assignment and structure of parameter data record for DI operating mode (Page 71).

The following parameter settings are possible for each operating mode:

Table 3- 1 Configurable parameters in DI operating mode

Parameters	Value range	Default	Reconfiguration in RUN	Effective range with configuration software	
				HSP0127 for STEP 7 (TIA Portal); HSP0229 for STEP 7; PROFINET IO GSD file	GSD file PROFIBUS DP
Operating mode[1]	• DI / Oversampling • Counting	—	no	Module	Module
Diagnostics No supply voltage L+	• Disable • Enable	Disable	yes	Module	Module
Diagnostics Short-circuit to ground	• Disable • Enable	Disable	yes	Module	Module
Channel activated	• Disable • Enable	Enable	yes	Channel	Channel

Parameters	Value range	Default	Recon-figura-tion in RUN	Effective range with configuration software	
				HSP0127 for STEP 7 (TIA Portal); HSP0229 for STEP 7; PROFINET IO GSD file	GSD file PROFIBUS DP
Input delay	• 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	• None • 0.05 s • 0.1 s • 0.2 s • 0.5 s • 1 s • 2 s	None	yes	Channel	— [3]
Hardware interrupt: rising edge	• Disable • Enable	Disable	yes	Channel	— [3]
Hardware interrupt: falling edge	• Disable • Enable	Disable	yes	Channel	— [3]
Potential group	• Use potential group of the left module • Enable new potential group	Use potential group of the left module	No	Module	Module

[1] When configuring with HSP0229 for STEP 7 or with a GSD file, the operating mode is specified by selecting the module name.

[2] Due to the limited number of parameters at a maximum of 244 bytes per ET 200SP station with a PROFIBUS GSD configuration, the configuration options are restricted. If your PROFIBUS Master supports the "Read / write data record" function, you can set this parameter via data record 128.

[3] If your PROFIBUS Master supports the "Read / write data record" function, you can set this parameter for each channel via data record 128.

3.2.3 Explanation of parameters

Operating mode

At the module level, specifies the operating mode in which the module's channels are operated:

- DI / Oversampling (Page 53)
- Counting (Page 31)

When configuring with HSP0229 for STEP 7 or with a GSD file, the operating mode is specified by selecting the module name.

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.

Channel activated

Determines whether a channel is enabled or disabled. If a digital input is disabled, the module ignores its signals.

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. With Pulse stretching, you can reliably detect very short input signals without having to use a correspondingly short cycle time.

In isochronous mode, the terminal signal is read in at the time T_i (time for reading the input data). In some cases, pulses that are shorter than the cycle time (send clock) are not detected.

If you want to detect short signals isochronously, the Oversampling operating mode is recommended. Oversampling also provides more precise information about the time at which a signal occurs.

Principle of pulse stretching

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

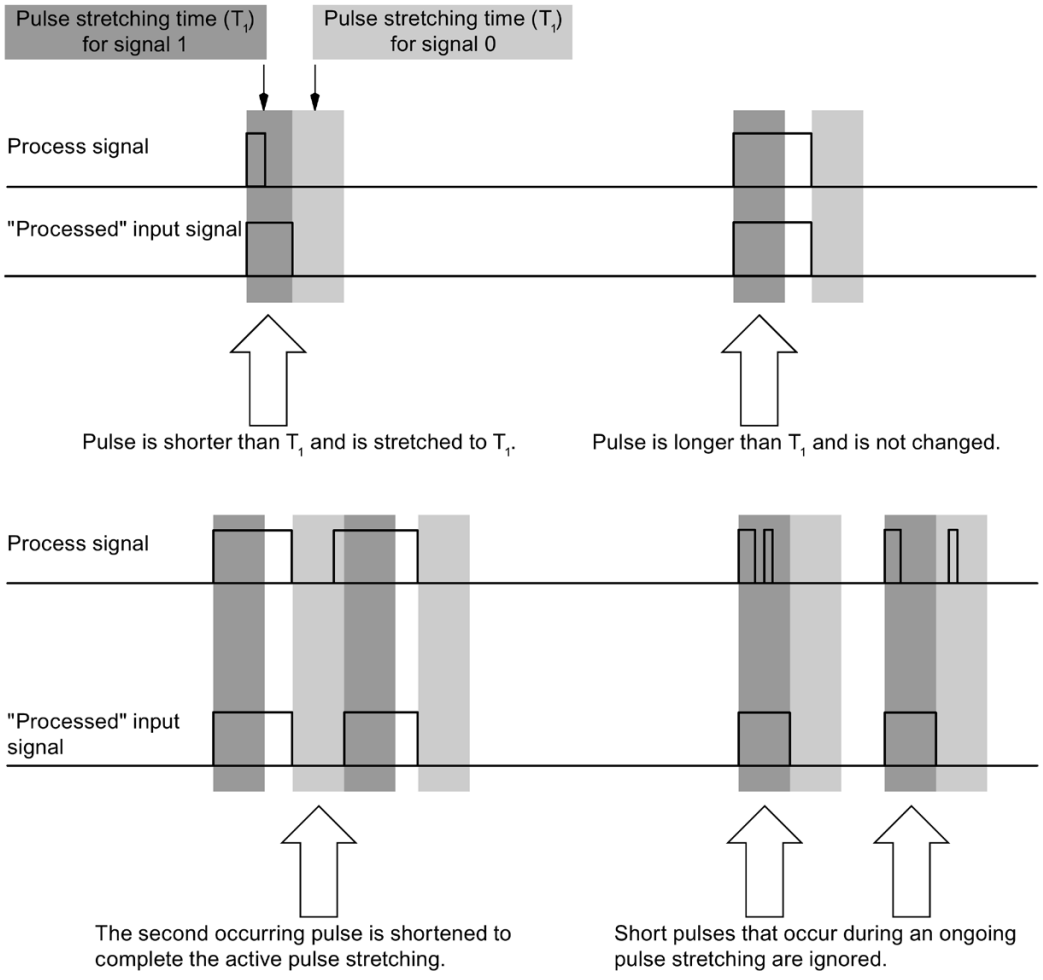


Figure 3-3 Principle of pulse stretching

Input delay

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

Isochronous configuration is only possible if there is no input delay configured for at least one channel. In isochronous mode, the terminal signal is read in at the time T_i (time for reading the input data). The read time T_i refers to the channel for which no input delay time was configured.

For input channels with longer input delays, the read 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.

Note

If you select the "None" or "0.05 ms" option for the input delay, you have to use shielded cables for connection of the digital inputs.

Hardware interrupt: rising edge

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

Hardware interrupt: falling edge

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

Potential group

Specifies whether a light-colored BaseUnit with incoming supply voltage is located on this slot (see ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/58649293) system manual).

3.2.4 Address space

Address space with value status (Quality Information, QI)

The figure below shows the assignment of the address space with value status (Quality Information (QI)). "IB x" represents the start address of input byte x.

The addresses for the value status are only available if the value status is enabled.

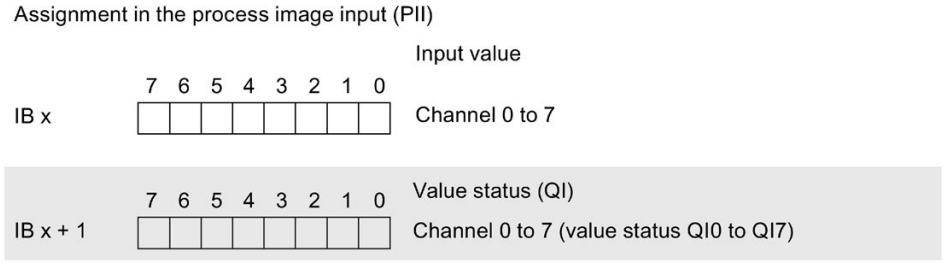


Figure 3-4 Address space with value status

Evaluating the value status

An additional byte is allocated in the input address space if you enable the value status for the digital module. Bits 0 to 7 in this byte are each 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.

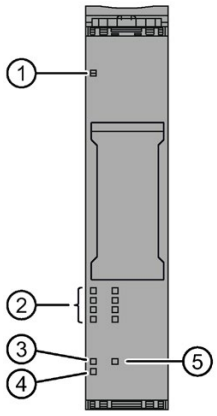
If a fault/error occurs on a channel with this module, the value status for all channels is 0.

3.3 Interrupts/diagnostics alarms

3.3.1 Status and error display

LED display

The figure below shows the LED display of the DI 8×24VDC HS.



① DIAG (green/red)
② Channel status (green)
③ CNT (green)
④ PWR (green)
⑤ OVS (green)

Figure 3-5 LED display

Meaning of the LED displays

The following tables show the meaning of the status and error displays. Remedial measures for dealing with diagnostic interrupts can be found in the section Diagnostics alarms (Page 30).

DIAG LED

Table 3- 2 DIAG LED fault/error display

DIAG LED	Meaning
▫ Off	Backplane bus supply of the ET 200SP not OK
☼ Flashes	Module parameters not assigned
■ On	Module parameters assigned and no module diagnostics
☼ Flashes	Module parameters assigned and module diagnostics

Channel status LED

Table 3- 3 Status display of the channel status LED

Channel status LED	Meaning
▫ Off	Process signal = 0
■ On	Process signal = 1

CNT LED

Table 3- 4 Status display of the CNT LED

CNT LED	Meaning
▫ Off	Counting operating mode disabled
■ On	Counting operating mode enabled

OVS LED

Table 3- 5 Status display of the OVS LED

OVS LED	Meaning
□ Off	Oversampling operating mode disabled
■ On	Oversampling operating mode enabled

PWR LED

Table 3- 6 Status display of the PWR LED

PWR LED	Meaning
□ Off	No supply voltage L+
■ On	Supply voltage L+ present

3.3.2 Interrupts

The digital input module DI 8×24VDC HS supports hardware and diagnostics alarms in the DI mode.

Diagnostic interrupts

The module generates a diagnostics interrupt at the following events:

- Channel temporarily unavailable
- Short-circuit
- Parameter assignment error
- No load voltage
- Hardware interrupt lost

Evaluating hardware interrupts with IO controller

The module generates a hardware interrupt at the following events:

- At rising edge (signal change from 0 to 1)
- At falling edge (signal change from 1 to 0)

If an interrupt occurs, a corresponding interrupt OB is called in the CPU of the IO controller.

S7-1500

Detailed information on the event is available in the STEP 7 online help.

The block interface is shown here with optimized block access, which is set in the TIA Portal by default.

Name	Data type	Comment
LADDR	HW_IO	Hardware identifier of the module triggering the interrupt
USI	WORD	USI (High/Low)
IChannel	USInt	Channel that triggered the hardware interrupt
EventType	Byte	Error event

S7-300/400 or a different CPU

The module generates a hardware interrupt at the following events:

- At rising edge (signal change from 0 to 1)
- At falling edge (signal change from 1 to 0)

If an interrupt occurs, a corresponding interrupt OB is called in the CPU of the IO controller.

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

The channel of the module that triggered the hardware interrupt is entered in the start information of OB40 in the OB40_POINT_ADDR tag. The following figure shows the assignment to the bits of double word 8 in local data.

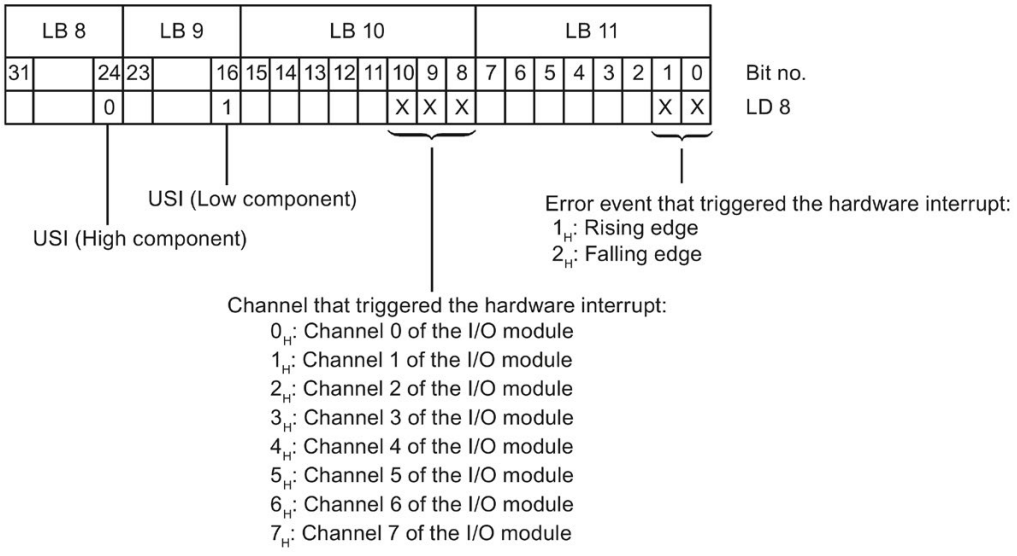


Figure 3-6 OB40_POINT_ADDR tag

Structure of the additional interrupt information

Table 3- 7 Structure of USI = W#16#0001

Data block name		Content	Comment	Bytes
USI		W#16#0001	User Structure Identifier: Additional interrupt info 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	Rising edge	1
		B#16#02	Falling edge	

3.3.3 Diagnostics alarms

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

Table 3- 8 Diagnostic interrupts, their meaning and how to deal with them

Diagnostic interrupt	Error code	Meaning	Remedy
Short-circuit	1_H	Short-circuit to ground at encoder supply	Correct process wiring
Parameter assignment error	10_H	• The module cannot evaluate parameters for the channel/module. • Incorrect parameter assignment.	Correct parameter assignment
No load voltage	11_H	No or insufficient supply voltage L+	• Check supply voltage L+ on the BaseUnit • Check BaseUnit type
Hardware interrupt lost	16_H	• Module cannot send an interrupt because a previous interrupt has not been processed • Possible cause: Too many hardware interrupts in too short a time	Change interrupt processing in the CPU and re-assign module parameters correspondingly
Channel temporarily unavailable	$1F_H$	Firmware update in progress or update has been canceled. The module reads no process values in this state.	• Wait for firmware update. • Restart the firmware update.

Counting operating mode (CNT) 4

4.1 Connecting

4.1.1 Wiring and block diagrams

This section contains the block diagram for the DI 8×24VDC HS module with the pin assignments for 1, 2 and 3-wire connection in counting operating mode. You may use and combine the different wiring options for all channels.

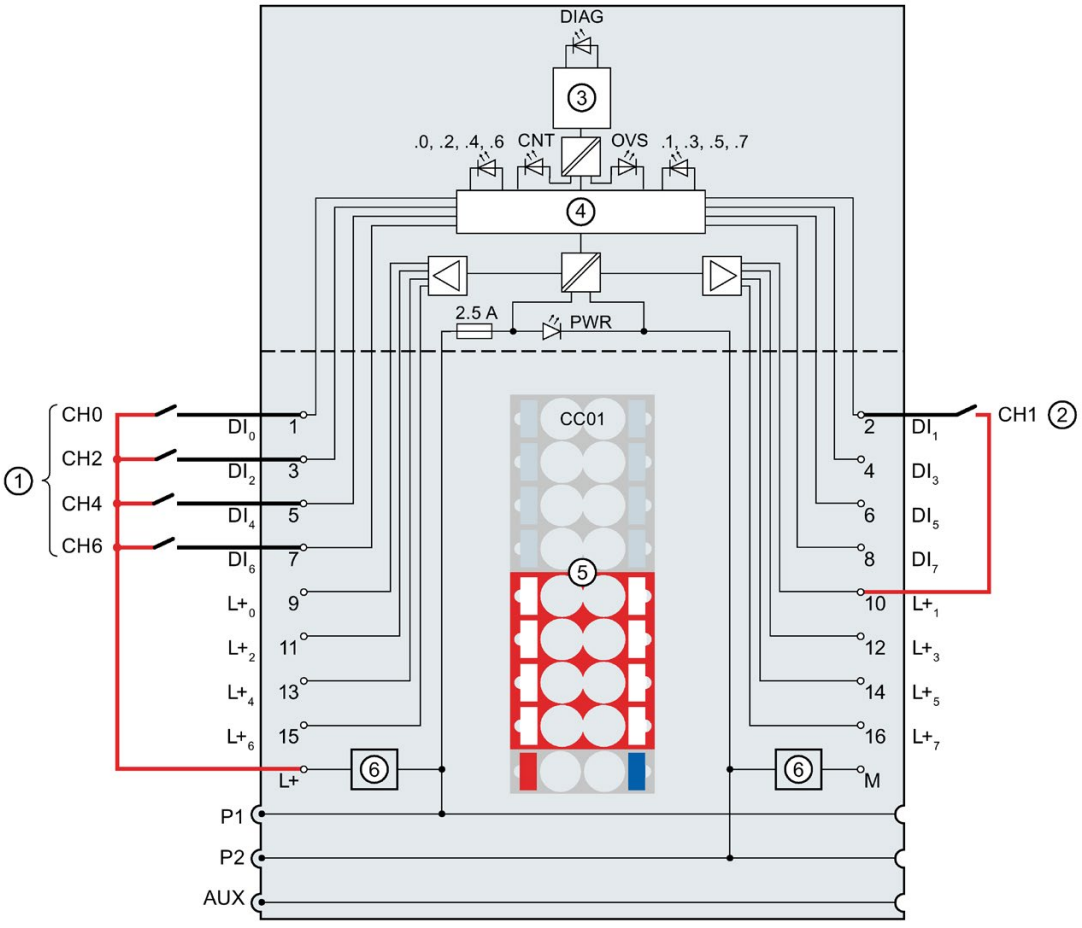
Information on wiring the BaseUnit can be found in the system manual ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/58649293).

Note

The module's load group must start with a light BaseUnit. Keep this in mind also during the configuration.

Wiring: 1 and 2-wire connection

The figure below shows the block diagram and an example of pin assignment for the DI 8×24VDC HS digital input module on the BaseUnit BU type A0 without AUX terminals (1 and 2-wire connection).

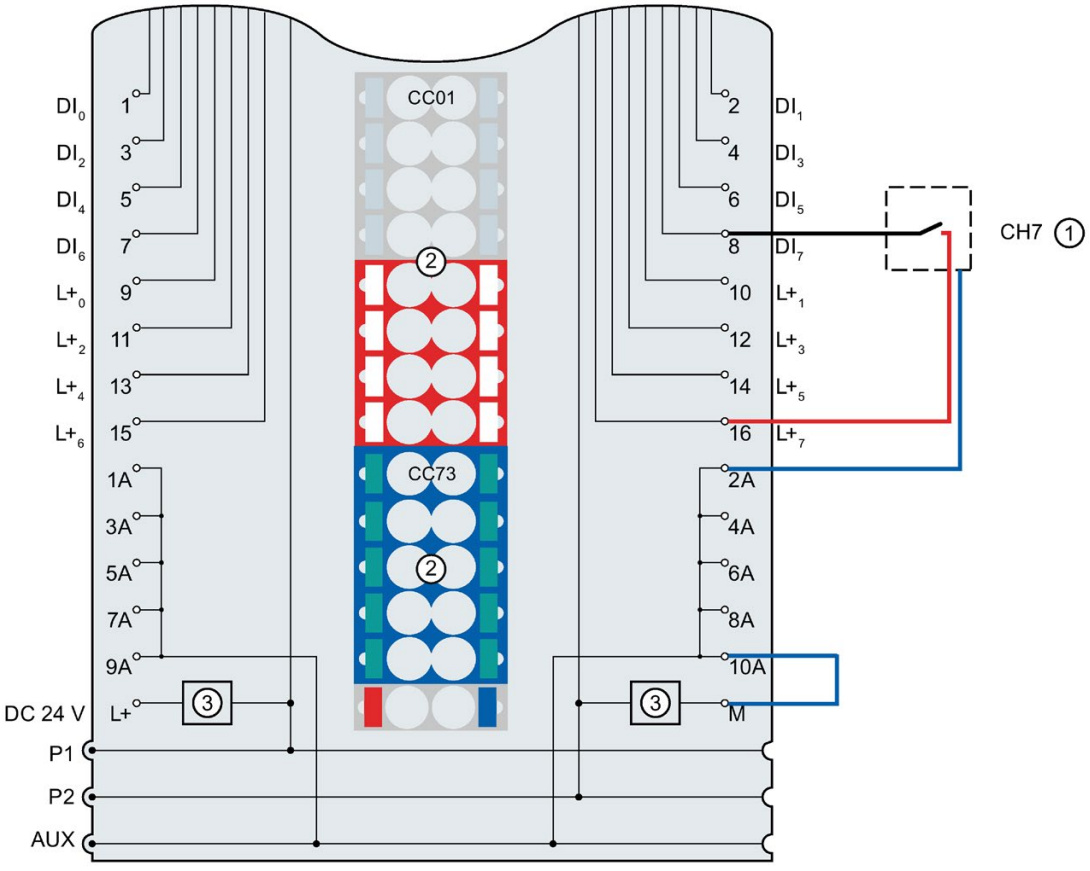


①	1-wire connection	DIAG	LED error or diagnostics (green, red)
②	2-wire connection	.0 to .7	LED channel status (green)
③	Backplane bus interface	PWR	LED power (green)
④	Input electronics	CNT	LED operating mode Count (green)
⑤	Color-coded label CCxx (optional)	OVS	LED operating mode Oversampling (green)
⑥	Supply voltage filter circuit (only available with light BaseUnit)	DI_0 - DI_3	Counter input, channels 0-3
M	Ground	DI_4	Direction input or gate input for DI_0, channel 4
$L+_n$	Encoder supply, channel n	DI_5	Direction input or gate input for DI_1, channel 5
L+	24 V DC (infeed only with light BaseUnit)	DI_6	Direction input or gate input for DI_2, channel 6
P1, P2, AUX	Internal self-configuring voltage buses Connection to the left (dark BaseUnit) Connection to the left interrupted (light BaseUnit)	DI_7	Direction input or gate input for DI_3, channel 7

Figure 4-1 Pinout and block diagram for 1 and 2-wire connection of encoders

Wiring: 3-wire connection

The figure below shows an example of pin assignment for the DI 8×24VDC HS digital input module on the BaseUnit BU type A0 with AUX terminals (3-wire connection).



①	3-wire connection
②	Color-coded labels CCxx (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 4-2 Pinout and block diagram for 3-wire connection of encoders

4.2 Parameters/address space

4.2.1 Counting

Function

Counting refers to the detection and summation of events. The respective counters of the module detect encoder signals and pulses and evaluate them accordingly, for example:

- For counting general piece goods up to a maximum limit
- For applications with recurring counting processes

You can count with DI_0 through DI_3. You can specify each counter's characteristics using the functions described below.

Counter limits

The counting limits define the counter value range used. The counter limits are configurable and can be modified during runtime using the user program.

The maximum possible counting limit is 2147483647 (2^{31}–1). The minimum possible counting limit is –2147483648 (–2^{31}).

You can continue or stop counting upon violation of a counting limit (automatic gate stop) Upon high and low limit violations of the counter value, an event bit is set in the feedback interface (Page 44) in each case.

Start value

You can configure a start value within the counter limits. The start value can be modified during runtime with the user program.

Gate control

Opening and closing the hardware gate and software gate defines the period of time during which the counting signals are recordd.

The control of the hardware gate takes place externally via the digital inputs DI_4 through DI_7. The software gate is controlled via the user program. Use of the hardware gate can be enabled through parameter assignment.

Count direction

The counting direction is specified either via suitable external pulse signals at the each counter's control input or via the configuration.

Comparison values

You define two comparison values that can control the STS_DQ feedback bit, independent of the user program. If the current counter value meets the configured comparison condition, the STS_DQ reset bit is set. You can use the STS_DQ reset bit in order to control a digital output module's digital output.

The comparison values are configurable and can be modified during runtime with the user program. When a comparison event occurs, in each case an event bit is set in the feedback interface (Page 44).

4.2.2 Parameters

The effective range of the parameters depends on the type of configuration. The following configurations are possible:

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

In addition to configuration via the configuration software, you can also configure parameters in RUN mode (dynamic) via the user program. When assigning parameters in the user program, use the "WRREC" instruction to transfer the parameters to the module using the data records; refer to the section Parameter assignment and structure of parameter data record for Counting operating mode (Page 75).

The following parameter settings are possible for each operating mode:

Table 4- 1 Configurable parameters in Counting operating mode

Parameters	Value range	Default	Reconfiguration in RUN	Effective range with configuration software	
				HSP0127 for STEP 7 (TIA Portal); HSP0229 for STEP 7; PROFINET IO GSD file	GSD file PROFIBUS DP
Operating mode[1]	• DI / Oversampling • Counting	—	No	Module	Module
Diagnostics No supply voltage L+	• Disable • Enable	Disable	Yes	Module	Module
Diagnostics: Short-circuit to ground	• Disable • Enable	Disable	Yes	Module	Module
Channel activated	• Disable • Enable	Enable	Yes	Channel	Channel
Input delay	• 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]
Reaction to violation of a counting limit	• Stop counting • Continue counting	Stop counting	Yes	Channel	Channel

Parameters	Value range	Default	Reconfiguration in RUN	Effective range with configuration software	
				HSP0127 for STEP 7 (TIA Portal); HSP0229 for STEP 7; PROFINET IO GSD file	GSD file PROFIBUS DP
Edge selection	• At rising edge • At falling edge	At rising edge	Yes	Channel	Channel
Count direction	• Up • Down	Up	Yes	Channel	Channel
Set output	• Off (DQ = 0) • Off (DQ = 1) • Between comparison value 0 and 1 • Not between comparison value 0 and 1	Off (DQ = 0)	Yes	Channel	Channel
Set function of DI	• Digital input • Gate start/stop • Count direction	Digital input	Yes	Channel	Channel
High counting limit	-2147483648...2147483647	2147483647	Yes	Channel	Channel
Low counting limit	-2147483648...2147483647	0	Yes	Channel	— [3]
Start value	-2147483648...2147483647	0	Yes	Channel	— [3]
Comparison value 1	-2147483648...2147483647	10	Yes	Channel	Channel
Comparison value 0	-2147483648...2147483647	0	Yes	Channel	— [3]
Potential group	• Use potential group of the left module • Enable new potential group	Use potential group of the left module	No	Module	Module

1 When configuring with HSP0229 for STEP 7 or with a GSD file, the operating mode is specified by selecting the module name.

2 If your PROFIBUS Master supports the "Read / write data record" function, you can set this parameter for each channel via data record 128.

3 Due to the limited number of parameters at a maximum of 244 bytes per ET 200SP station with a PROFIBUS GSD configuration, the configuration options are restricted. If your PROFIBUS Master supports the "Read / write data record" function, you can set this parameter via data record 128.

4.2.3 Explanation of parameters

Operating mode

Selection of the operating mode in which all of the module's channels are operated.

- DI (Page 15) / Oversampling (Page 53)
- Counting

When configuring with HSP0229 for STEP 7 or with a GSD file, the operating mode is specified by selecting the module name.

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.

Channel activated

Determines whether a channel is enabled or disabled. If a digital input is disabled, the module ignores its signals.

Input delay

You use this parameter to suppress signal interferences. The module only detects changes to the signal if the changed signal is constantly pending longer than the set input delay time.

Note

If you select the "0.05 ms" value range for the input delay, you have to use shielded cables for connection of the digital inputs.

Reaction to violation of a counting limit

Selection of the reaction to violation of the counter high limit in the upward direction or the counter low limit in the downward direction:

- Stop counting:
  After a counting limit is violated, the internal gate is closed. This stops the counting process. The counter value is set to the opposite counting limit. To restart counting, you must close and reopen the software/hardware gate.
- Continue counting:
  After a counting limit is violated, the counter value is set to the opposite counting limit and counting continues.

Edge selection

Selects the edge that is counted:

- At rising edge:
  The respective counter counts all rising edges at the digital input.
- At falling edge:
  The respective counter counts all falling edges at the digital input.

Note

If the "Reverse direction" option is selected in "Set function of DI" and the counting direction in the process changes, the counting edge is automatically adjusted (opposite edges).

Count direction

Count direction selection:

- Up:
  The respective counter counts up.
- Down:
  The respective counter counts down.

Note

This parameter has no effect if the "Reverse direction" option is selected in "Set function of DI".

Set output

Selects the function that controls the response of the STS_DQ feedback bit (Page 44): You use the feedback bit STS_DQ to control a digital output of a digital output module.

- Off (DQ = 0):
  STS_DQ is independent of the counter value and permanently not set.
- Off (DQ = 1):
  STS_DQ is independent of the counter value and permanently set.
- Between comparison value 0 and 1:
  STS_DQ is set if counter value ≥ comparison value 0 and counter value ≤ comparison value 1.
- Not between comparison value 0 and 1:
  STS_DQ is set if counter value < comparison value 0 or counter value > comparison value 1.

Set function of DI

Selects the function of DI_{n+4}, which controls the assigned counter input DI_n:

- Digital input:
  No function is assigned to DI_{n+4}. The signal status of DI_{n+4} is read by the CPU using the feedback interface (Page 44).
- Gate start/stop:
  Setting DI_{n+4} opens the hardware gate for DI_n. Resetting DI_{n+4} closes the hardware gate for DI_n.
- Count direction:
  DI_{n+4} reverses the counting direction at DI_n, in order to adjust it to the process. If DI_{n+4} is not set, DI_n counts up. If DI_{n+4} is set, DI_n counts down.

Counter high limit

Sets counter high limit.

The following applies:

- Counter high limit > counter low limit
- Counter high limit ≤ 2147483647 (2^{31} - 1)

Counter low limit

Sets the counter low limit.

The following applies:

- Counter low limit < counter high limit
- Counter low limit ≥ -2147483648 (-2^{31})

Start value

Sets the start value.

The following applies:

- Start value ≥ counter low limit
- Start value ≤ counter high limit

Comparison value 1

Sets the second comparison value.

The following applies:

- Comparison value 1 > comparison value 0
- Comparison value 1 ≤ counter high limit

Comparison value 0

Sets the first comparison value.

The following applies:

- Comparison value 0 < comparison value 1
- Comparison value 0 ≥ counter low limit

Potential group

Specifies whether a light-colored BaseUnit with incoming supply voltage is located on this slot (see ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/58649293) system manual).

4.2.4 Address space

4.2.4.1 Assignment of the control interface

Control interface

The user program uses the control interface to influence the behavior of the module's counter. The figure below shows the address space allocation for the control interface in the process image of the outputs.

The following table shows the offset of the control interface for the channels of the module:

Channel	Offset x
0	0
1	5
2	10
3	15

Enter the offset from the table for x in the following screen.

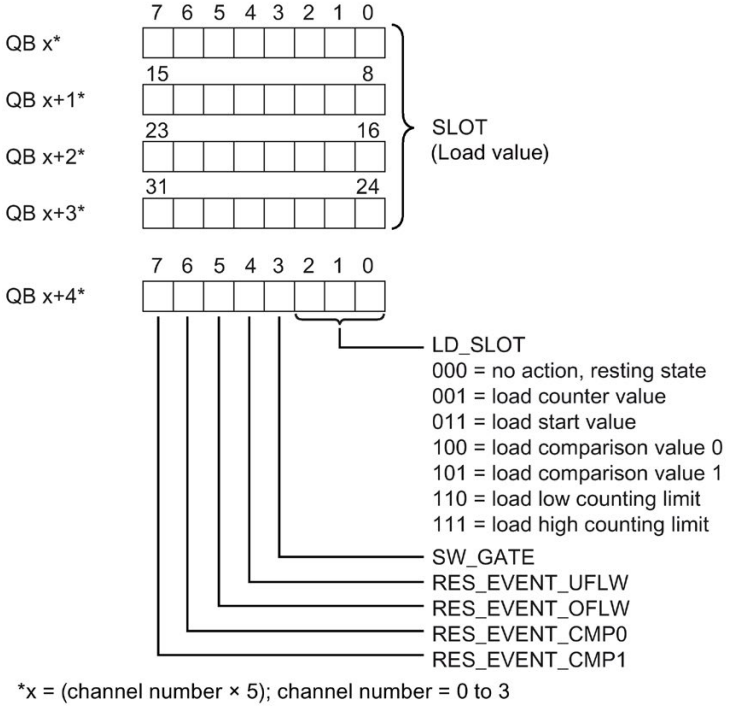


Figure 4-3 Assignment of the control interface

Notes on the control bits

Control bit	Notes
SLOT	This value is used to specify the loaded value for each channel. Use the LD_SLOT load request to evaluate the loaded value.
LD_SLOT	This load request is used to specify the meaning of the SLOT (loaded value) value for each channel. The user program performs the respective action, as soon as LD_SLOT changes. When the loading request LD_SLOT = 011_B is entered and the software gate is opened, each counting operation begins with the start value. If another load request is entered and the software gate is opened, counting continues with the current count at each start of the counting operation. These two situations are also in effect when the hardware gate is configured and the software gate is closed.
SW_GATE	With this bit, you open and close the software gate of the respective channel. Together, the software gate and the hardware gate form the internal gate. The module only counts if the internal gate is open. 0 means: Software gate closed 1 means: Software gate open
RES_EVENT_UFLW	Use this bit to initiate the resetting of the saved event in the EVENT_UFLW feedback bit for the respective channel.
RES_EVENT_OFLW	Use this bit to initiate the resetting of the saved event in the EVENT_OFLW feedback bit for the respective channel.
RES_EVENT_CMP0	Use this bit to initiate the resetting of the saved event in the EVENT_CMP0 feedback bit for the respective channel.
RES_EVENT_CMP1	Use this bit to initiate the resetting of the saved event in the EVENT_CMP1 feedback bit for the respective channel.

4.2.4.2 Assignment of the feedback interface

Feedback interface

The user program receives current values and status information from the module via the feedback interface. The figure below shows the address space allocation for the feedback interface in the process image of the inputs.

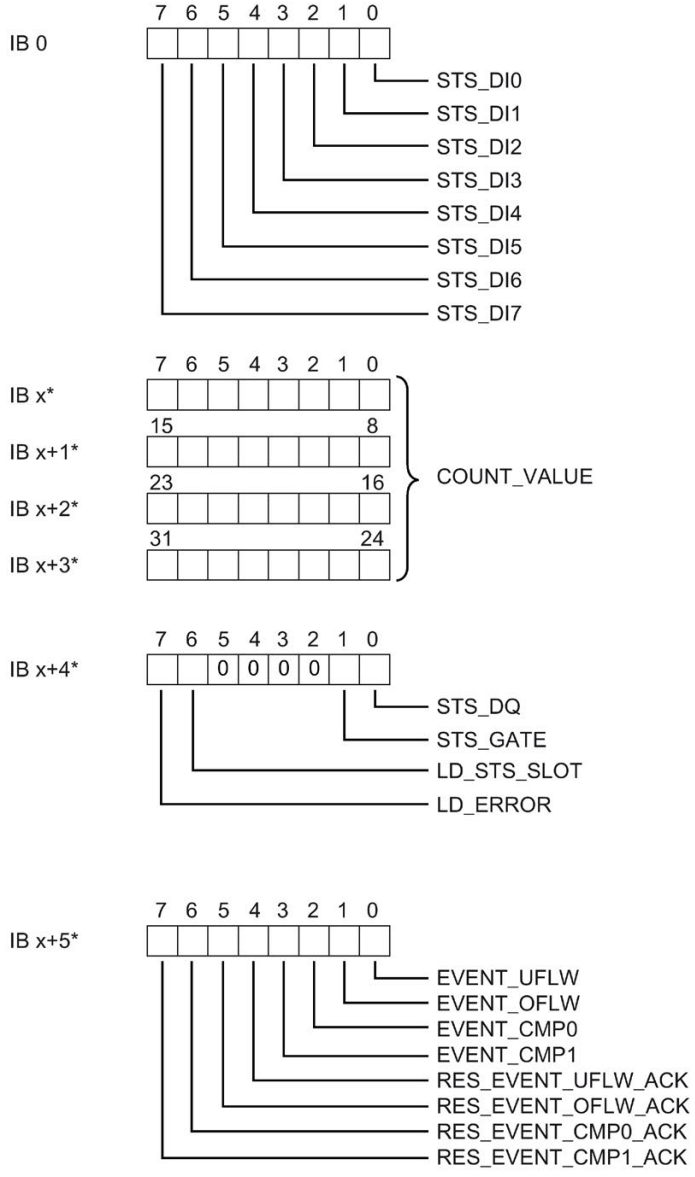
Note

In isochronous mode, current values and the status information in the feedback interface is updated at the time T_i (time for reading the input data).

The following table shows the offset of the feedback interface for the channels of the module:

Channel	Offset x
0	1
1	7
2	13
3	19

Enter the offset from the table for x in the following screen.



*x = (channel number × 6); channel number = 0 to 3

Figure 4-4 Assignment of the feedback interface

Notes on the feedback bits

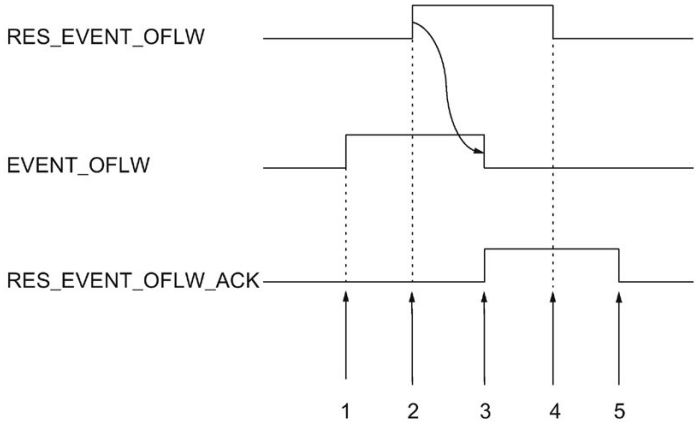
Feedback bit	Notes
STS_DIn	This bit indicates the status of the respective digital input DI_n.
COUNT_VALUE	This value returns the current counter value for the respective channel.
STS_DQ	This bit depends on the "Set output" parameter of the respective channel. You can use STS_DQ in each case, in order to control a digital output module's digital output.
STS_GATE	Together, the software gate and the hardware gate form the internal gate. This bit indicates the status of the internal gate for the respective channel. The module only counts if the internal gate is open. 0 means: Gate closed 1 means: Gate open Note: If you change a channel parameter in RUN mode via data record 128, all of the changed channel's values are retransferred to the module. In doing so, the internal gate of the respective channel is closed and the counter value is set to the start value. To restart counting, you need to close and reopen the software gate in each case.
LD_STS_SLOT	This bit indicates for the respective channel, by mean of a status change (toggling), that the load request for SLOT (LD_SLOT) has been detected and executed.
LD_ERROR	This bit indicates for the respective channel that an error occurred (latching) during loading via the control interface. The loaded value was not applied. One of the following conditions has not been met: • Counter low limit ≤ counter value (If this condition is not met, the start value is loaded as the current counter value.) • Counter low limit ≤ start value • Counter low limit ≤ comparison value 0/1 • Counter high limit ≥ counter value (If this condition is not met, the start value is loaded as the current counter value.) • Counter high limit ≥ start value • Counter high limit ≥ comparison value 0/1 • Counter low limit < counter high limit • Comparison value 0 < comparison value 1 • Do not write a reserved load request in LD_SLOT
EVENT_UFLW	For the respective channel, this bit indicates the saved state which shows that there was a counter value underflow (a violation of the counter low limit). You reset the status by acknowledgment with RES_EVENT_UFLW.
EVENT_OFLW	For the respective channel, this bit indicates the saved state which shows that there was a counter value overflow (a violation of the counter high limit). You reset the status by acknowledgment with RES_EVENT_OFLW.
EVENT_CMP0	For the respective channel, this bit indicates the saved status which shows that a comparison event with comparison value 0 has occurred. You reset the status by acknowledgment with RES_EVENT_CMP0. The EVENT_CMP0 bit is not set when you set the counter value to the start value.
EVENT_CMP1	For the respective channel, this bit indicates the saved status which shows that a comparison event with comparison value 1 has occurred. You reset the status by acknowledgment with RES_EVENT_CMP1. The EVENT_CMP1 bit is not set when you set the counter value to the start value.

Feedback bit	Notes
RES_EVENT_UFLW_ACK	This bit indicates for the respective channel that the reset of event bit EVENT_UFLW is active.
RES_EVENT_OFLW_ACK	This bit indicates for the respective channel that the reset of event bit EVENT_OFLW is active.
RES_EVENT_CMP0_ACK	This bit indicates for the respective channel that the reset of event bit EVENT_CMP0 is active.
RES_EVENT_CMP1_ACK	This bit indicates for the respective channel that the reset of event bit EVENT_CMP1 is active.

Complete acknowledgment principle

Saving bits are acknowledged according to the complete acknowledgment principle.

The figure below shows an example of the sequence of the complete acknowledgment principle in the event of an overflow:



① The EVENT_OFLW feedback bit is set as a saving event upon overflow.
② You set the RES_EVENT_OFLW control bit to trigger EVENT_OFLW reset.
③ The RES_EVENT_OFLW_ACK feedback bit is set when reset of EVENT_OFLW is detected.
④ You then rest the control bit RES_EVENT_OFLW .
⑤ The RES_EVENT_OFLW_ACK feedback bit is reset.

Figure 4-5 Acknowledgment principle

Note

If you have initiated the reset of an event bit, you must wait for the respective feedback bit. Then you can initiate another reset.

Note

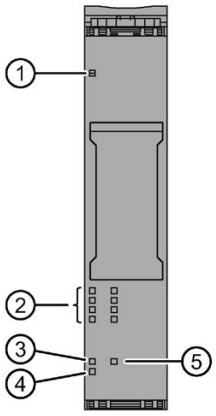
Opening the software gate or hardware gate (0-1 transition) resets all event bits.

4.3 Interrupts/diagnostic messages

4.3.1 Status and error display

LED display

The figure below shows the LED display of the DI 8×24VDC HS.



① DIAG (green/red)
② Channel status (green)
③ CNT (green)
④ PWR (green)
⑤ OVS (green)

Figure 4-6 LED display

Meaning of the LED displays

The following tables show the meaning of the status and error displays. Remedial measures for dealing with diagnostic interrupts can be found in the section Diagnostics alarms (Page 52).

DIAG LED

Table 4- 2 DIAG LED fault/error display

DIAG LED	Meaning
Off	Backplane bus supply of the ET 200SP not OK
Flashes	Module parameters not assigned
On	Module parameters assigned and no module diagnostics
Flashes	Module parameters assigned and module diagnostics

Channel status LED

Table 4- 3 Status display of the channel status LED

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

CNT LED

Table 4- 4 Status display of the CNT LED

CNT LED	Meaning
Off	Counting operating mode disabled
On	Counting operating mode enabled

OVS LED

Table 4- 5 Status display of the OVS LED

OVS LED	Meaning
□ Off	Oversampling operating mode disabled
■ On	Oversampling operating mode enabled

PWR LED

Table 4- 6 Status display of the PWR LED

PWR LED	Meaning
□ Off	No supply voltage L+
■ On	Supply voltage L+ present

4.3.2 Interrupts

The digital input module DI 8×24VDC HS supports diagnostics alarms in the Counting mode.

Diagnostic interrupts

The module generates a diagnostics interrupt at the following events:

- Channel temporarily unavailable
- Short-circuit
- Parameter assignment error
- No load voltage

4.3.3 Diagnostics alarms

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

Table 4- 7 Diagnostic interrupts, their meaning and how to deal with them

Diagnostic interrupt	Error code	Meaning	Remedy
Short-circuit	1_H	Short-circuit to ground at encoder supply	Correct process wiring
Parameter assignment error	10_H	• The module cannot evaluate parameters for the channel. • Incorrect parameter assignment.	Correct parameter assignment
No load voltage	11_H	No or insufficient supply voltage L+	• Check supply voltage L+ on the BaseUnit • Check BaseUnit type
Channel temporarily unavailable	$1F_H$	Firmware update in progress or update has been canceled. The module reads no process values in this state.	• Wait for firmware update. • Restart the firmware update.

Oversampling (OVS) operating mode

5

5.1 Connecting

5.1.1 Wiring and block diagrams

This section contains the block diagram for the DI 8×24VDC HS module with the pin assignments for 1, 2 and 3-wire connection in Oversampling operating mode. You may use and combine the different wiring options for all channels.

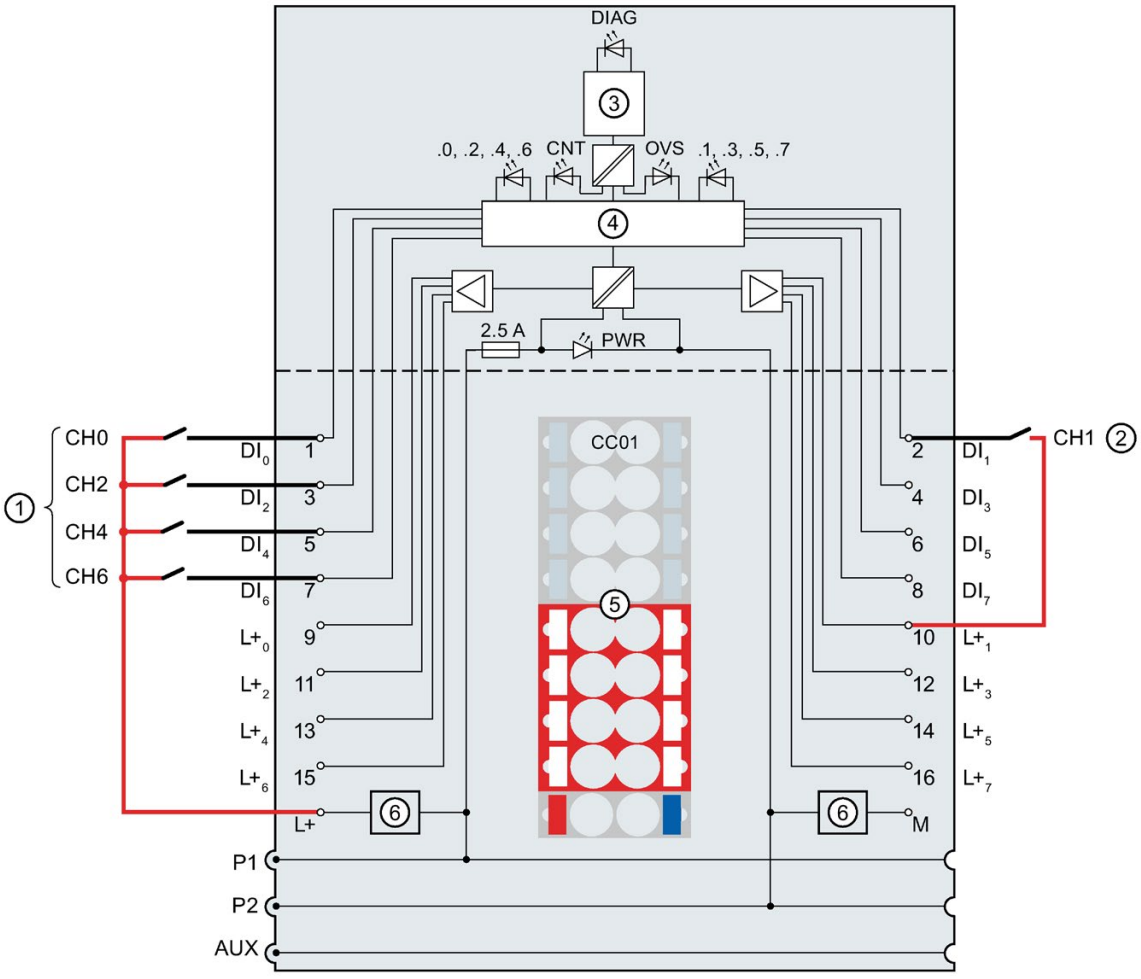
Information on wiring the BaseUnit can be found in the system manual ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/58649293).

Note

The module's load group must start with a light BaseUnit. Keep this in mind also during the configuration.

Wiring: 1 and 2-wire connection

The figure below shows the block diagram and an example of pin assignment for the DI 8×24VDC HS digital input module on the BaseUnit BU type A0 without AUX terminals (1 and 2-wire connection).

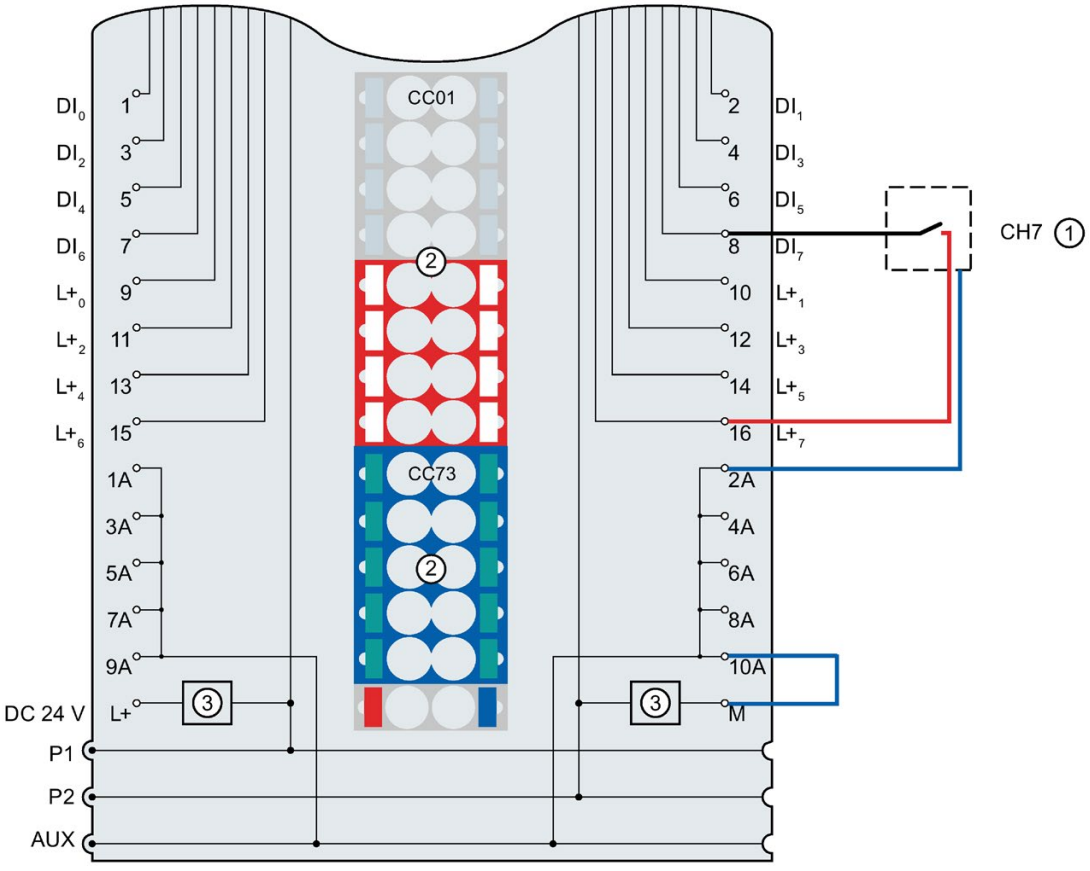


①	1-wire connection	$L+_n$	Encoder supply, channel n
②	2-wire connection	L+	24 V DC (infeed only with light BaseUnit)
③	Backplane bus interface	DIAG	LED error or diagnostics (green, red)
④	Input electronics	.0 to .7	LED channel status (green)
⑤	Color-coded label CCxx (optional)	PWR	LED power (green)
⑥	Supply voltage filter circuit (only available with light BaseUnit)	CNT	LED operating mode Count (green)
M	Ground	OVS	LED operating mode Oversampling (green)
DI_n	Input signal, channel n	P1, P2, AUX	Internal self-configuring voltage buses Connection to the left (dark BaseUnit) Connection to the left interrupted (light BaseUnit)

Figure 5-1 Pinout and block diagram for 1 and 2-wire connection of encoders

Wiring: 3-wire connection

The figure below shows an example of pin assignment for the DI 8×24VDC HS digital input module on the BaseUnit BU type A0 with AUX terminals (3-wire connection).



①	3-wire connection
②	Color-coded labels CCxx (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 5-2 Pinout and block diagram for 3-wire connection of encoders

5.2 Parameters/address space

5.2.1 Oversampling

Function

Oversampling is the acquisition of data in constant bus cycle segments (sub-cycles), whereby n sub-cycles correspond to one PROFINET bus cycle.

Oversampling is useful whenever you require acquisition of data with high time resolution but without using an extremely short PROFINET bus cycle and thus fast CPU cycles.

With the oversampling function, a PROFINET bus cycle is divided into constant bus sub-cycles:

- Each subcycle detects an 8-bit value.
- A subcycle is at least 7.8125 µs in length.
- Subcycles are possible in steps from 2 to 32 (sampling rate).

Requirement

Oversampling is only possible when isochronous mode is set.

Configuration

You configure oversampling with the following parameter:

- Sampling rate

Note

Do not use a reduction ratio for blocks in the case of configuration with oversampling in the runtime groups of your user program. This will ensure that the data processing in the user program of the CPU is synchronized with the acquisition on the module.

Sampling interval

The duration of a subcycle is the sampling interval. The cycle time T (send clock) for isochronous mode is specified in the configuration software. This time, divided by the configured sampling rate n_{Sample}, yields the sampling interval t_{Sample} of the module.

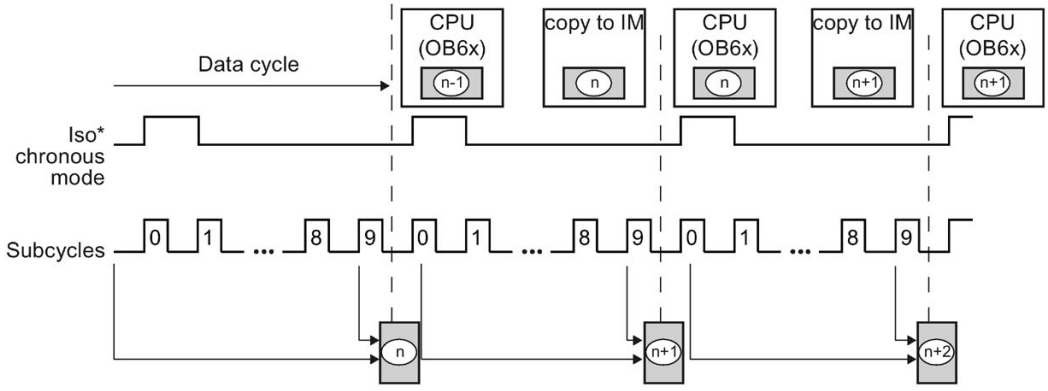
Example calculation:

$$t_{Sample} = \frac{T}{n_{Sample}} = \frac{1\ ms}{16} = 62{,}5\ \mu s$$

Figure 5-3 Example of calculating the sampling interval

Chronological sequence

The figure below shows the chronological sequence for oversampling. The detected input data of a data cycle (send clock) is copied to the interface module in the next cycle data and are available to the CPU in the data cycle after the next one.



n Detected value from cycle n

Sub-cycle 8 bits apiece x 32 (max.) = max. 32 bytes of input data per data cycle

Figure 5-4 Oversampling

Note

Do not use a reduction ratio for the send clock in this operating mode for blocks in your user program (for example, OB61). This will ensure that the data processing in the user program of the CPU is synchronized with the acquisition on the module.

5.2.2 Parameters

In distributed mode, you can use the Oversampling operating mode on the PROFINET IO in an ET 200SP system.

In addition to configuration via the configuration software, you can also configure parameters in RUN mode (dynamic) via the user program. When assigning parameters in the user program, use the "WRREC" instruction to transfer the parameters to the module using the data records; refer to the section Parameter assignment and structure of parameter data record for Oversampling operating mode (Page 80).

The following parameter settings are possible:

Table 5- 1 Configurable parameters in the Oversampling operating mode

Parameters	Value range	Default	Reconfiguration in RUN	Effective range with configuration software
				HSP0127 for STEP 7 (TIA Portal); HSP0229 for STEP 7
Operating mode[1]	• DI / Oversampling • Counting	—	no	Module
Sampling rate	• 2 values / cycle • 3 values / cycle • ... • 32 values / cycle	—	yes	Module
Diagnostics No supply voltage L+	• Disable • Enable	Disable	yes	Module
Diagnostics Short-circuit to ground	• Disable • Enable	Disable	yes	Module
Channel activated	• Disable • Enable	Enable	yes	Channel

Parameters	Value range	Default	Reconfiguration in RUN	Effective range with configuration software
				HSP0127 for STEP 7 (TIA Portal); HSP0229 for STEP 7
Input delay	• None • 0.05 ms • 0.1 ms • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms	None	yes	Channel
Potential group	• Use potential group of the left module • Enable new potential group	Use potential group of the left module	No	Module

[1] When configuring with HSP0229 for STEP 7, the operating mode is specified by selecting the module name.

5.2.3 Explanation of parameters

Operating mode

At the module level, specifies the operating mode in which the module's channels are operated.

- DI (Page 15) / Oversampling
- Counting (Page 31)

When configuring with HSP0229 for STEP 7, the operating mode is specified by selecting the module name.

Sampling rate

Specifies the number of subcycles per isochronous data cycle.

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.

Channel activated

Determines whether a channel is enabled or disabled. If a digital input is disabled, the module ignores its signals.

Input delay

This parameter can be used to avoid signal faults. Changes to the signal are only detected if they are constantly pending longer than the set input delay time.
Isochronous configuration is only possible if there is no input delay configured for at least one channel. In isochronous mode, the terminal signal is read in at the time T_i (time for reading the input data). The read time T_i refers to the channel for which no input delay time was configured.
For input channels with longer input delays, the read 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.

Note
If you select the "None" or "0.05 ms" option for the input delay, you have to use shielded cables for connection of the digital inputs.

Potential group

Specifies whether a light-colored BaseUnit with incoming supply voltage is located on this slot (see ET 200SP Distributed I/O System (http://support.automation.siemens.com/WW/view/en/58649293) system manual).

5.2.4 Address space

Address space

The figure below shows the assignment of the address space. "IB x" represents the start address of input byte x.

In the respective bit, the subcycles are counted from left to right. Up to 32 subcycles are possible. If fewer than 32 subcycles are configured, the bits that are consequently unused are set to 0.

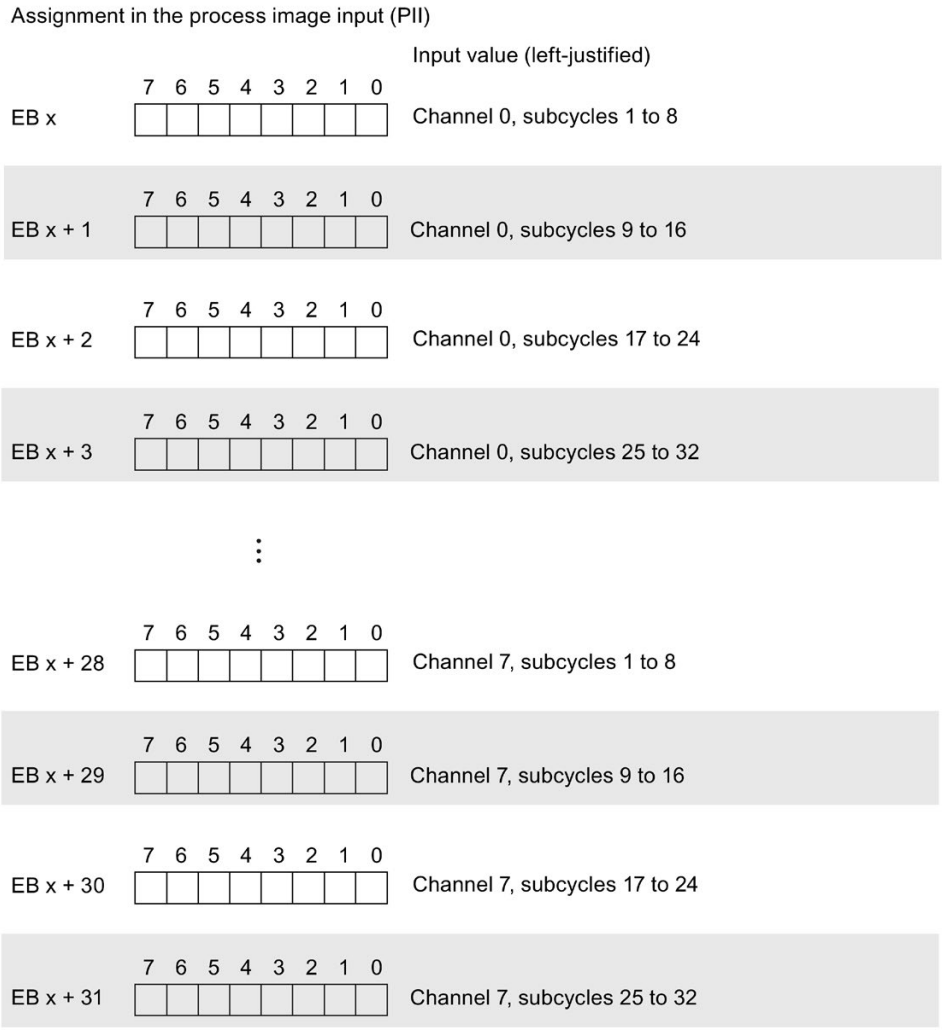


Figure 5-5 Address space for oversampling

Note

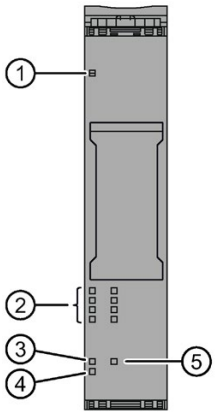
While you are changing parameters in RUN mode, corruption of input data can occur.

5.3 Interrupts/diagnostic messages

5.3.1 Status and error display

LED display

The figure below shows the LED display of the DI 8×24VDC HS.



① DIAG (green/red)
② Channel status (green)
③ CNT (green)
④ PWR (green)
⑤ OVS (green)

Figure 5-6 LED display

Meaning of the LED displays

The following tables show the meaning of the status and error displays. Remedial measures for dealing with diagnostic interrupts can be found in the section Diagnostics alarms (Page 66).

DIAG LED

Table 5- 2 DIAG LED fault/error display

DIAG LED	Meaning
Off	Backplane bus supply of the ET 200SP not OK
Flashes	Module parameters not assigned
On	Module parameters assigned and no module diagnostics
Flashes	Module parameters assigned and module diagnostics

Channel status LED

Table 5- 3 Status display of the channel status LED

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

CNT LED

Table 5- 4 Status display of the CNT LED

CNT LED	Meaning
Off	Counting operating mode disabled
On	Counting operating mode enabled

OVS LED

Table 5- 5 Status display of the OVS LED

OVS LED	Meaning
□ Off	Oversampling operating mode disabled
■ On	Oversampling operating mode enabled

PWR LED

Table 5- 6 Status display of the PWR LED

PWR LED	Meaning
□ Off	No supply voltage L+
■ On	Supply voltage L+ present

5.3.2 Interrupts

The digital input module DI 8×24VDC HS supports diagnostics alarms in the Oversampling mode.

Diagnostic interrupts

The module generates a diagnostics interrupt at the following events:

- Short-circuit
- Parameter assignment error
- No load voltage
- Channel temporarily unavailable

5.3.3 Diagnostics alarms

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

Table 5- 7 Diagnostic interrupts, their meaning and how to deal with them

Diagnostic interrupt	Error code	Meaning	Remedy
Short-circuit	1_H	Short-circuit to ground at encoder supply	Correct process wiring
Parameter assignment error	10_H	• The module cannot evaluate parameters for the channel. • Incorrect parameter assignment.	Correct parameter assignment
No load voltage	11_H	No or insufficient supply voltage L+	• Check supply voltage L+ on the BaseUnit • Check BaseUnit type
Channel temporarily unavailable	$1F_H$	Firmware update in progress or update has been canceled. The module reads no process values in this state.	• Wait for firmware update. • Restart the firmware update.

Technical specifications

6

6.1 Technical specifications

Technical specifications of the DI 8x24VDC HS

The following table shows the technical specifications as of 09/2019. You will find a data sheet including daily updated technical specifications on the Internet (https://support.industry.siemens.com/cs/ww/en/pv/6ES7131-6BF00-0DA0/td?dl=en)

Article number	6ES7131-6BF00-0DA0
General information	
Product type designation	DI 8x24 V DC HS
HW functional status	from FS04
Firmware version	V1.0.2
• FW update possible	Yes
usable BaseUnits	BU type A0
Color code for module-specific color identification plate	CC01
Product function	
• I&M data	Yes; I&M0 to I&M3
Engineering with	
• STEP 7 TIA Portal configurable/integrated as of version	V13 SP1
• STEP 7 configurable/integrated as of version	V5.5 SP3 / -
• PROFIBUS as of GSD version/GSD revision	GSD Revision 5
• PROFINET as of GSD version/GSD revision	GSDML V2.3
Operating mode	
• DI	Yes
• Counter	Yes
• Oversampling	Yes
• MSI	No
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	6ES7131-6BF00-0DA0
Input current	
Current consumption, max.	70 mA; without sensor supply
24 V encoder supply	
• 24 V	Yes
• Short-circuit protection	Yes; per module, electronic
• Output current, max.	700 mA
Power loss	
Power loss, typ.	1.5 W
Address area	
Address space per module	
• Address space per module, max.	45 byte
• Inputs	32 byte; 1 byte + 1 byte for QI information in DI mode; 32 bytes in Oversampling mode; 25 bytes in Counter mode
• Outputs	20 byte; In count mode
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 + external terminals
Digital inputs	
Number of digital inputs	8
Source/sink input	P-reading
Pulse extension	Yes
• Length	2 s; 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s
Digital input functions, parameterizable	
• Gate start/stop	Yes
• Freely usable digital input	Yes
• Counter	Yes
– Number, max.	4
– Counting frequency, max.	10 kHz
– Counting width	32 bit
– Counting direction up/down	Yes
• Digital input with oversampling	Yes
– Number, max.	8
– Values per cycle, max.	32
– Resolution, min.	7.8125 µs

Article number	6ES7131-6BF00-0DA0
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.	6 mA
Input delay (for rated value of input voltage)	
for standard inputs	
– parameterizable	Yes; none / 0.05 / 0.1 / 0.4 / 0.8 / 1.6 / 3.2 / 12.8 / 20 ms
for interrupt inputs	
– parameterizable	Yes
for technological functions	
– parameterizable	Yes
Cable length	
• shielded, max.	50 m
• unshielded, max.	50 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
Bus cycle time (TDP), min.	125 µs
Jitter, max.	5 µs
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Alarms	
• Diagnostic alarm	Yes
• Hardware interrupt	Yes
Diagnostic messages	
• Diagnostic information readable	Yes
• Monitoring the supply voltage	Yes
– parameterizable	Yes
• Monitoring of encoder power supply	Yes; Module-wise
• Wire-break	No

Article number	6ES7131-6BF00-0DA0
• Short-circuit	Yes; Module-wise
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	707 V DC (type test)
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-30 °C
• horizontal installation, max.	60 °C
• vertical installation, min.	-30 °C
• vertical installation, max.	50 °C
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	5 000 m; Restrictions for installation altitudes > 2 000 m, see manual
Dimensions	
Width	15 mm
Height	73 mm
Depth	58 mm
Weights	
Weight, approx.	28 g

Dimension drawing

See manual ET 200SP BaseUnits
(ttps://support.industry.siemens.com/cs/ww/en/view/59753521)

Parameter data records

A

A.1 Parameter assignment and structure of parameter data record for DI operating mode

Parameter assignment in the user program

You can change the parameters of the module in RUN.

Changing parameters in RUN

The "WRREC" instruction is used to transfer the parameters to the module using data record 128. 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.

Note

Changing parameters in RUN

A parameter data record that has content different from the startup parameter assignment can result in a brief exit from clocked mode and renewed synchronization with the fieldbus cycle.

Output parameter STATUS

If errors occur when transferring parameters with the "WRREC" instruction, the module continues operation with the previous parameter assignment. The STATUS output parameter contains a corresponding error code.

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

Structure of data record 128 for the complete module

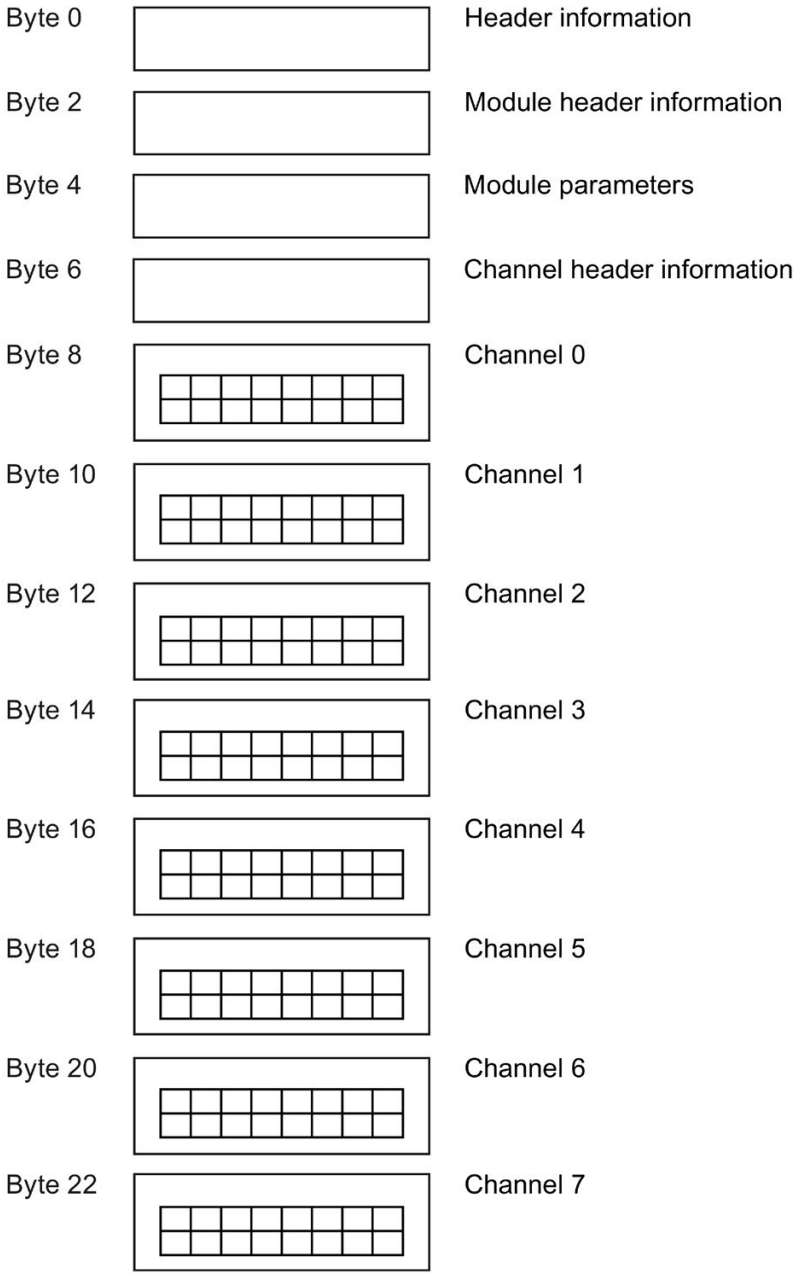


Figure A-1 Structure of data record 128 for the complete module

Header information

The figure below shows the structure of the header information.

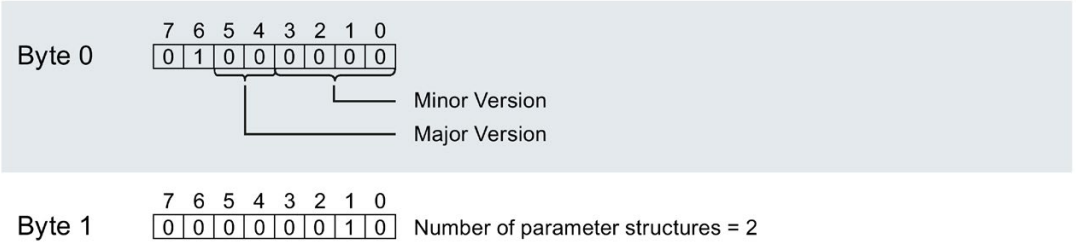


Figure A-2 Structure of the header information

Module header information

The figure below shows the structure of the module header information.

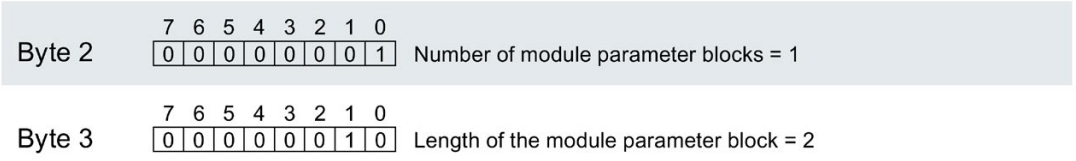


Figure A-3 Module header information

Module parameter block

The figure below shows the structure of the module parameter block for channels 0 to 7. You enable a parameter by setting the corresponding bit to "1".

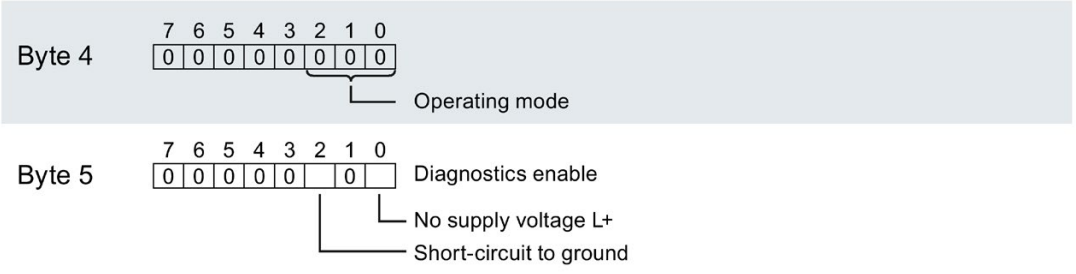


Figure A-4 Module parameter block

Channel header information

The figure below shows the structure of the channel header information.

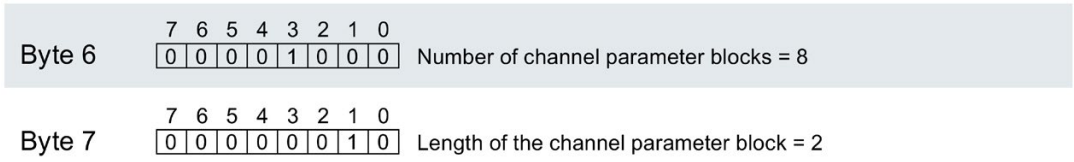
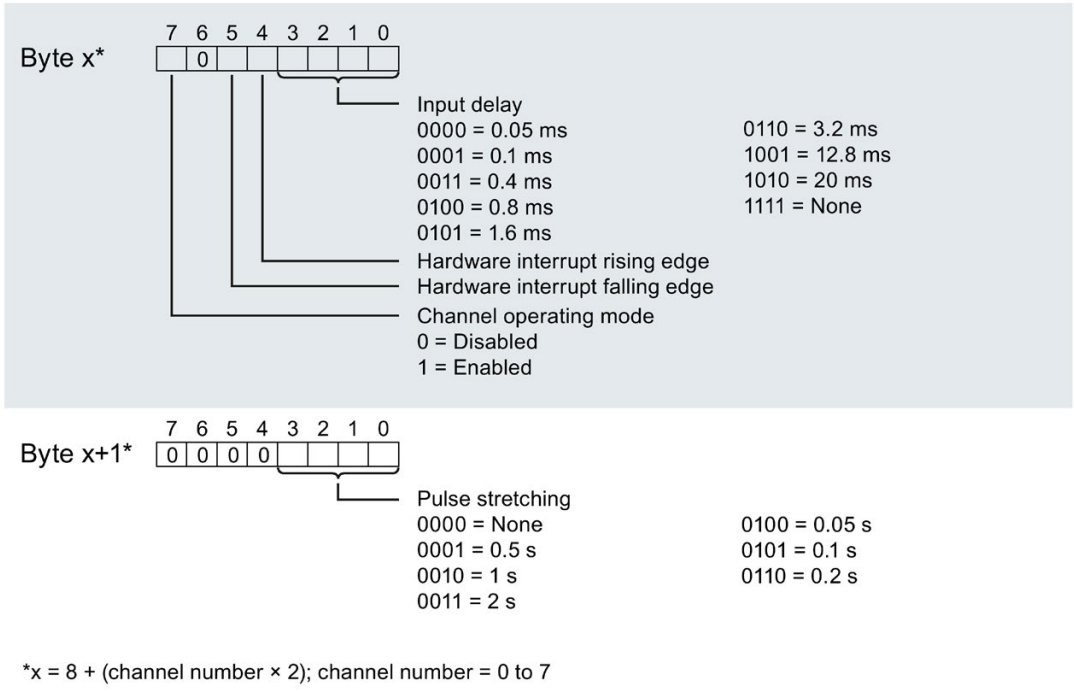


Figure A-5 Channel header information

Channel parameter block

The figure below shows the structure of the channel parameter block. You enable a parameter by setting the corresponding bit to "1".



*x = 8 + (channel number × 2); channel number = 0 to 7

Figure A-6 Structure byte x to x+1 for the channels 0 to 7

A.2 Paramter assignment and structure of parameter data record for Counting operating mode

Parameter assignment in the user program

You can change the parameters of the module in RUN.

Changing parameters in RUN

The "WRREC" instruction is used to transfer the parameters to the module using data record 128. 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.

Note

Changing parameters in RUN

A parameter data record that has content different from the startup parameter assignment can result in a brief exit from clocked mode and renewed synchronization with the fieldbus cycle.

Output parameter STATUS

If errors occur when transferring parameters with the "WRREC" instruction, the module continues operation with the previous parameter assignment. The STATUS output parameter contains a corresponding error code.

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

Structure of data record 128 for the complete module

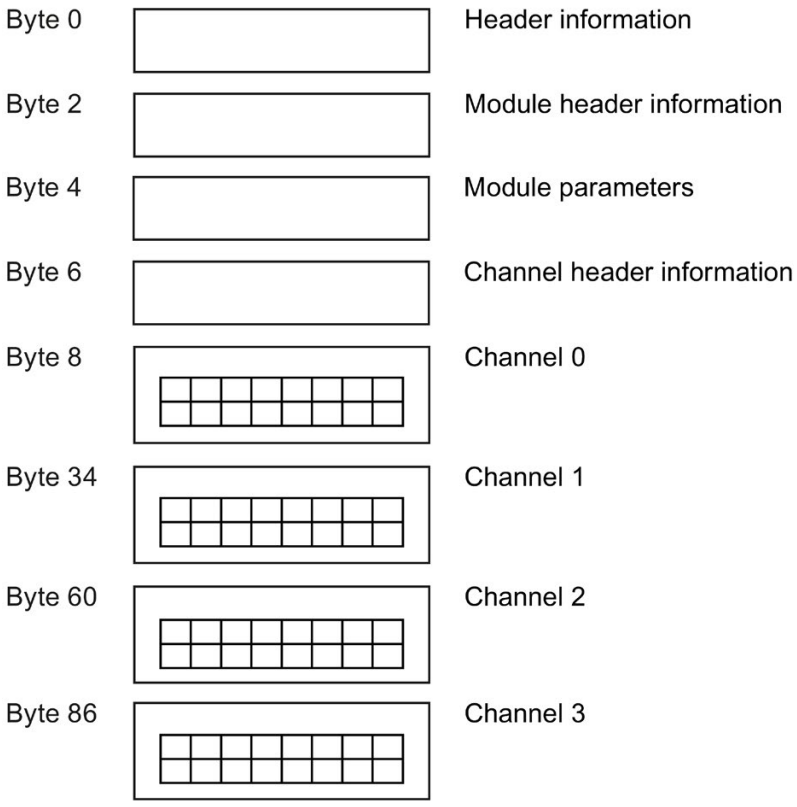


Figure A-7 Structure of data record 128 for the complete module

Header information

The figure below shows the structure of the header information.

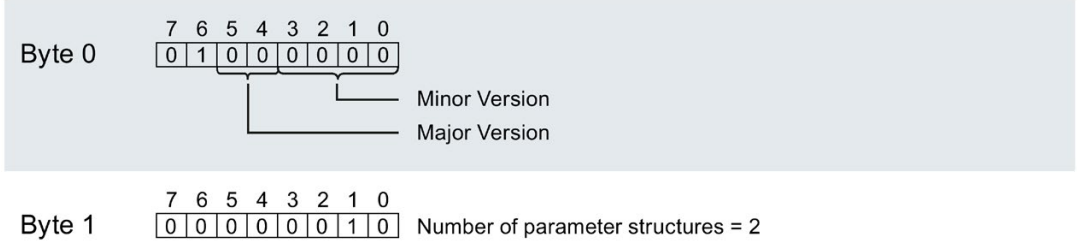


Figure A-8 Structure of the header information

Module header information

The figure below shows the structure of the module header information.

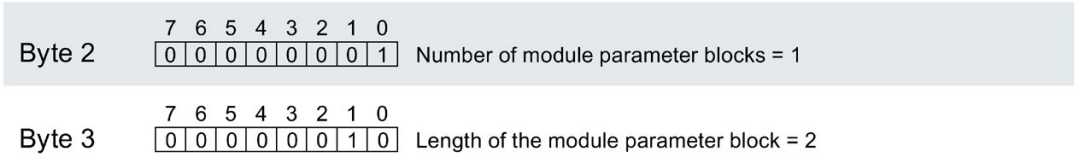


Figure A-9 Module header information

Module parameter block

The figure below shows the structure of the module parameter block for channels 0 to 3. You enable a parameter by setting the corresponding bit to "1".

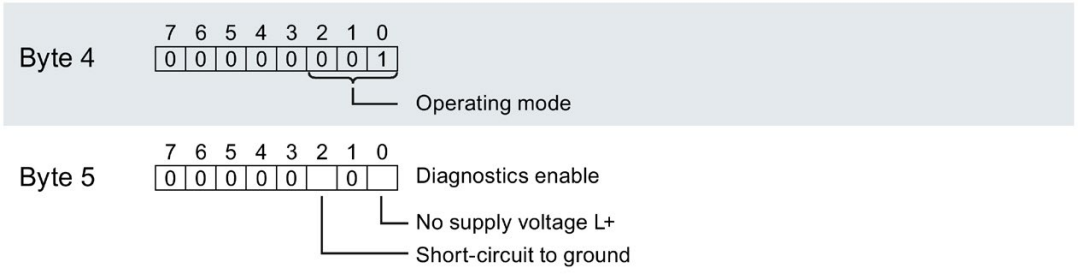


Figure A-10 Module parameter block

Channel header information

The figure below shows the structure of the channel header information.

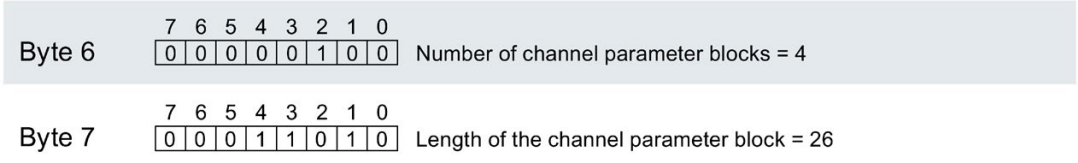
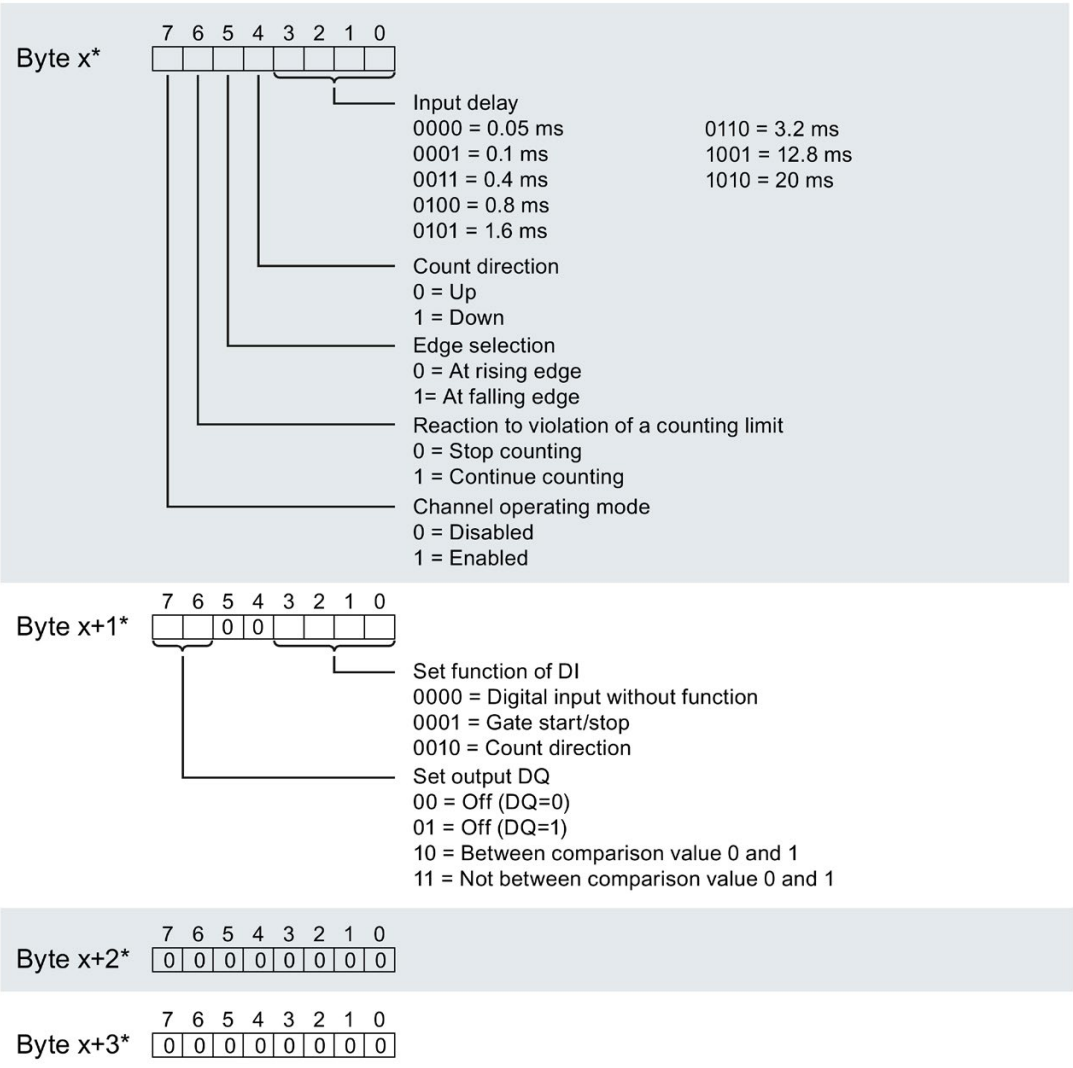


Figure A-11 Channel header information

Channel parameter block

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".



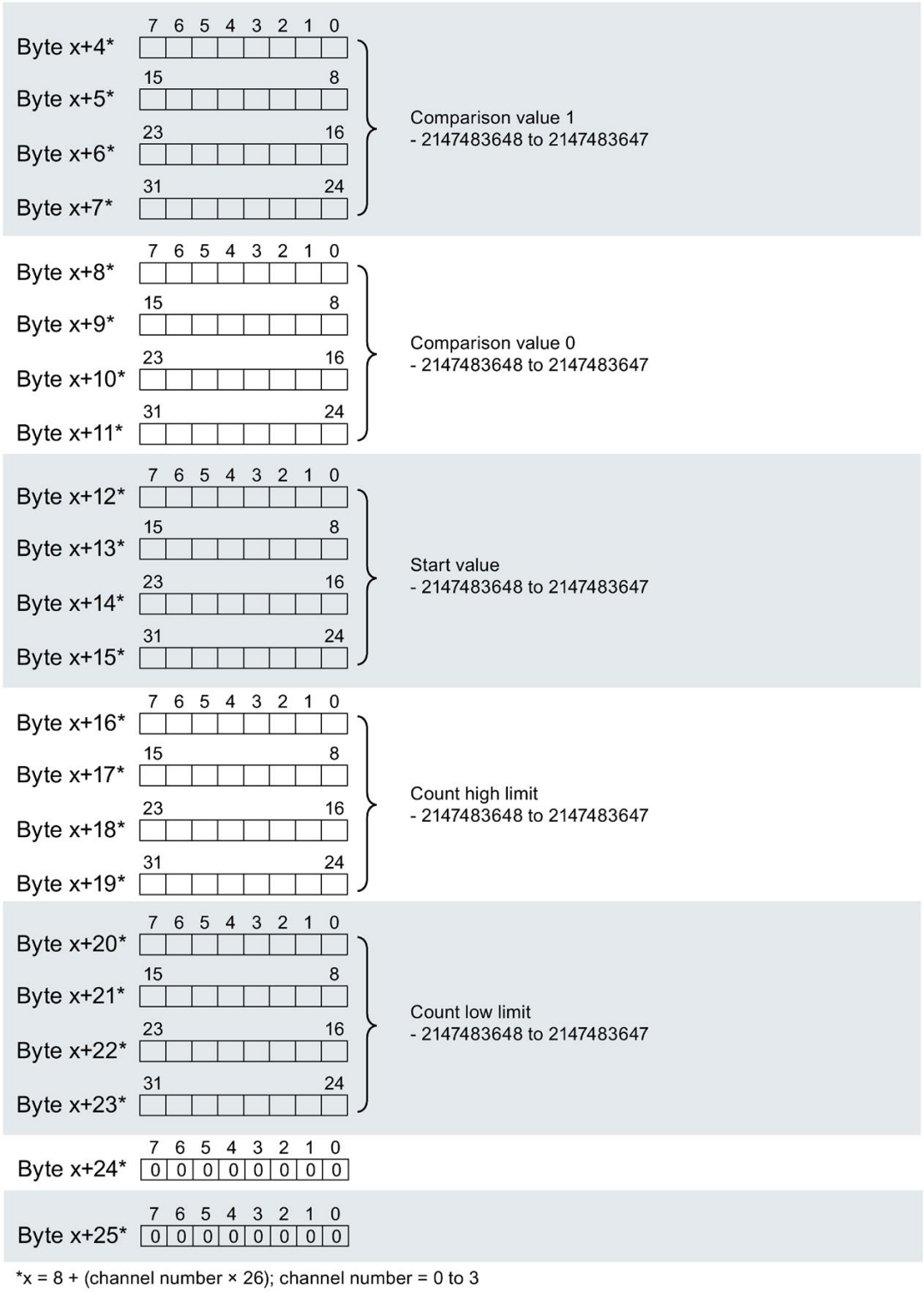


Figure A-12 Structure byte x to x+25 for the channels 0 to 3

A.3 Parameter assignment and structure of parameter data record for Oversampling operating mode

Parameter assignment in the user program

You can change the parameters of the module in RUN.

Changing parameters in RUN

The "WRREC" instruction is used to transfer the parameters to the module using data record 128. 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.

Note

Changing parameters in RUN

If you change parameters in RUN mode, falsifications can occur in the input data.

A parameter data record that has content different from the startup parameter assignment can result in a brief exit from clocked mode and renewed synchronization with the fieldbus cycle.

Output parameter STATUS

If errors occur when transferring parameters with the "WRREC" instruction, the module continues operation with the previous parameter assignment. The STATUS output parameter contains a corresponding error code.

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

Structure of data record 128 for the complete module

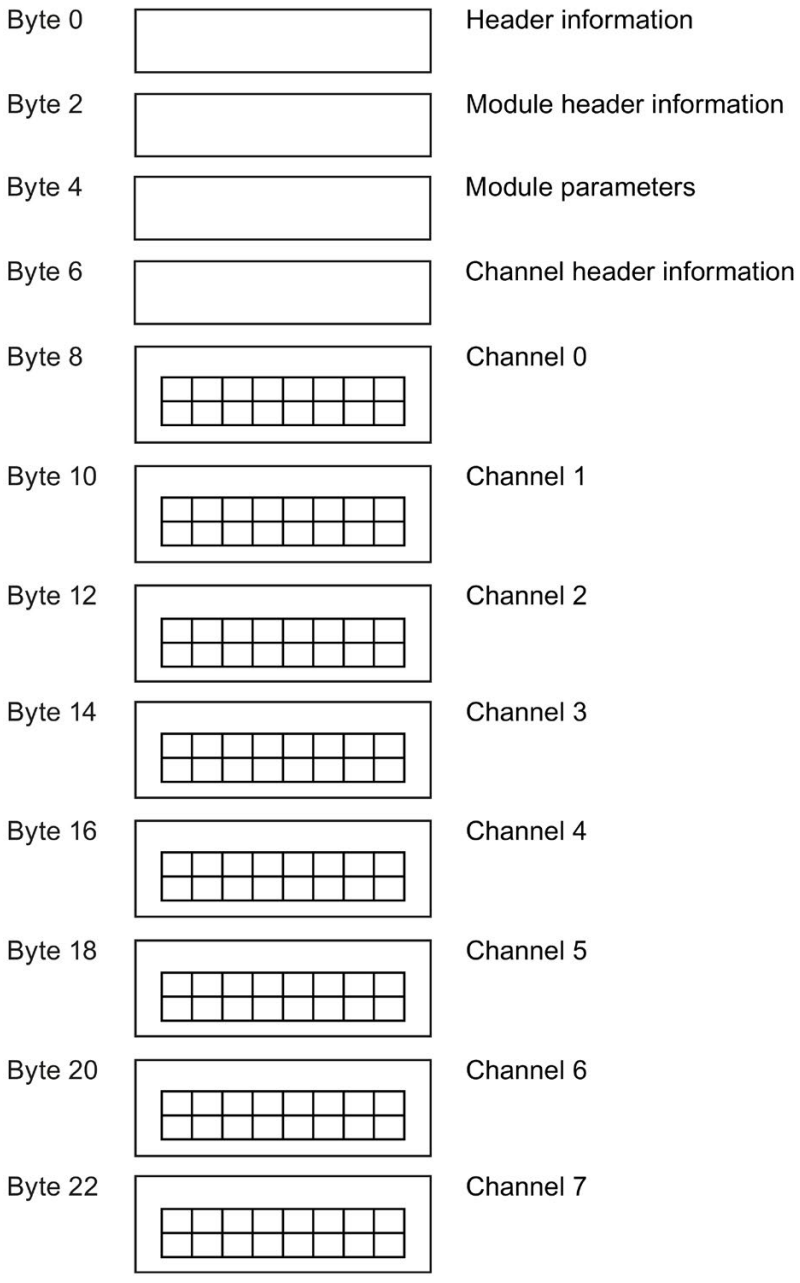


Figure A-13 Structure of data record 128 for the complete module

Header information

The figure below shows the structure of the header information.

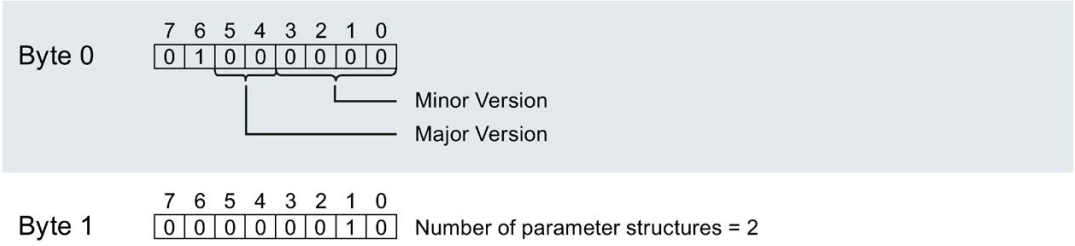


Figure A-14 Structure of the header information

Module header information

The figure below shows the structure of the module header information.

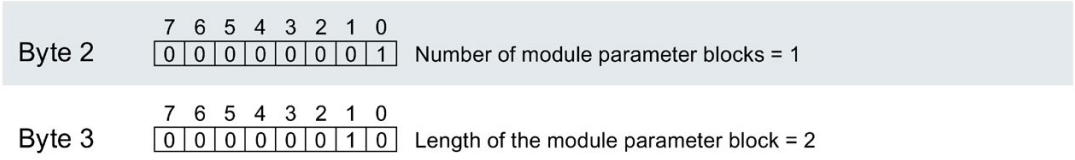


Figure A-15 Module header information

Module parameter block

The figure below shows the structure of the module parameter block for channels 0 to 7. You enable a parameter by setting the corresponding bit to "1".

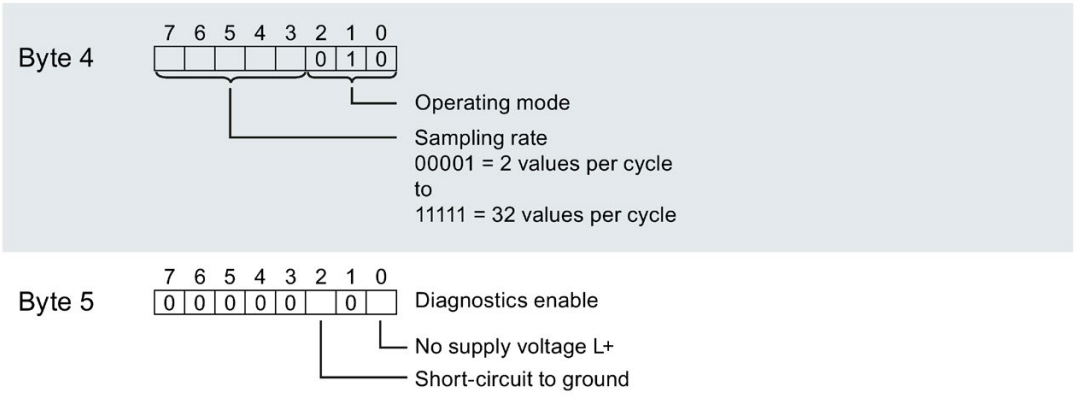


Figure A-16 Module parameter block

Channel header information

The figure below shows the structure of the channel header information.

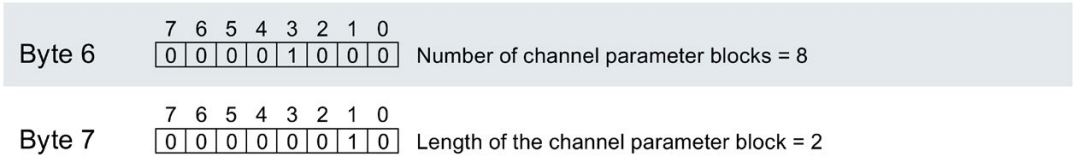
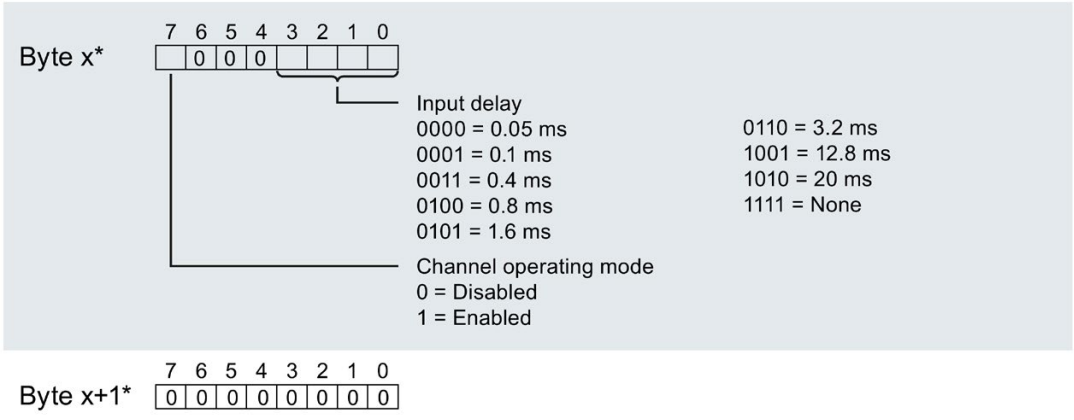


Figure A-17 Channel header information

Channel parameter block

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 = 8 + (channel number × 2); channel number = 0 to 7

Figure A-18 Structure byte x to x+1 for the channels 0 to 7