

SIEMENS

SIMATIC

ET 200SP HA DI 16x24VDC HA

Equipment Manual

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6DL1131-6BH00-OEH1

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Legal information

Warning notice system

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

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

WARNING

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

CAUTION

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

NOTICE

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

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

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Disclaimer of Liability

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

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Security information

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

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under

<https://www.siemens.com/industrialsecurity>.

Preface

Validity of the documentation

This equipment manual describes the following I/O modules:

System family	I/O module	Article No.
SIMATIC Distributed I/O System ET 200SP HA	DI 16x24VDC HA	6DL1131-6BH00-0PH1
SIMATIC Distributed I/O System ET 200SP HA	DI 16x24VDC HA	6DL1131-6BH00-0EH1

It complements the system manual of the ET 200SP HA Distributed I/O System.

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

The information in this device manual and the system/function manuals enables you to put the ET 200SP HA into operation.

Conventions

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.

2D Matrix code (QR code / EAN code)

The 2D matrix code on the product is a coded representation of the product-specific article number.

Access to product-related information

For reading the 2D matrix code, SIEMENS offers an app for mobile use. Information about the app and the download can be found on the Internet: "Mobile use via app (<https://support.industry.siemens.com/cs/ww/en/sc/2067>)".

The app provides direct access to the technical forum and product-related posts, such as:

- FAQs
- Application examples
- Manuals
- Certificates
- Product notices

Product overview

4.1 I/O module

Definition

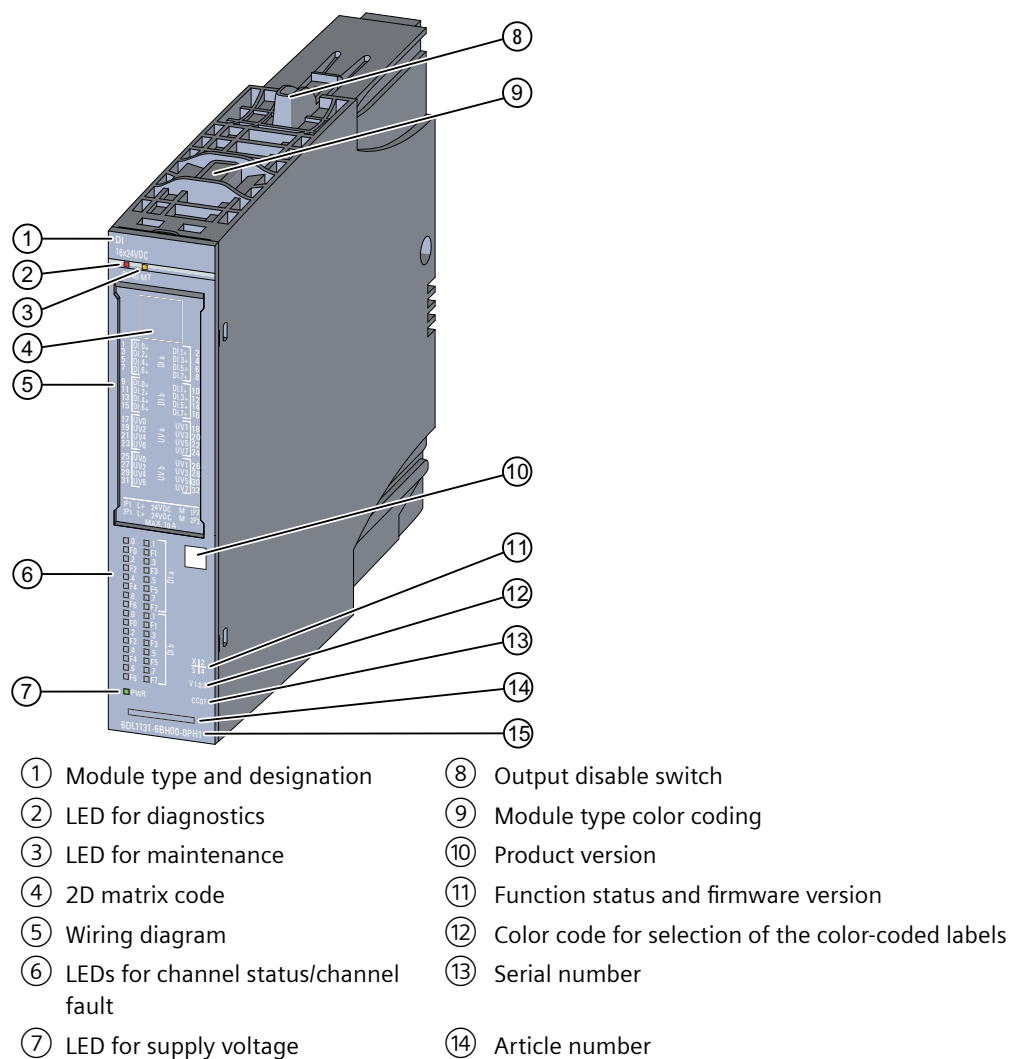
The DI 16x24VDC HA I/O module is a digital input module with 16 power inputs for process control.

In addition to the technical specifications, this module has the following properties:

- Sink input (PNP, active high)
- Parameter reassignment in RUN
- Value status QI
- Output disable switch

Description

The I/O module consists of the following components:



4.2 Accessories

Definition

Accessories for the I/O module must be ordered separately.

Description

The following accessories must be ordered separately:

- Labeling strips
- Color-coded labels

- Reference identification label
- Shield connector

4.3 Output disable switch

Definition

The output disable switch switches the I/O module load-free.

NOTICE

Dangerous plant conditions possible (disconnect the load)

If you want to pull the I/O module in runtime, **you have to press the output disable switch for 3 seconds** for the I/O module to be load free (deenergized).

Pulling the I/O module in runtime (Page 13)

4.4 Pulling the I/O module in runtime

Requirement

The normally closed contacts are closed.

Procedure

Press the output disable switch for 3 seconds.

Note

Pressing the output disable switch interrupts any ongoing firmware update. A firmware update cannot be performed when the device is deenergized.

Result

The I/O module is load-free.

The LED DIAG flashes red, the LED MT lights up yellow and the I/O module generates a diagnostics message.

Status and error displays (Page 25)

4.5 Terminal blocks

Definition

The terminal blocks provide the process terminals (push-in terminals) for components such as devices to be connected.

Description

The following terminal blocks are available for the I/O module:

Article number	Color	Description
6DL1193-6TP00-0DH1	Lit	
6DL1193-6TP00-0BH1	Dark	
6DL1193-6TP00-0DM1	Lit	For redundant configuration
6DL1193-6TP00-0BM1	Dark	For redundant configuration
6DL1193-6TP00-0DN0	Lit	With additional potential distributors for ground connection of the actuators
6DL1193-6TP00-0BN0	Dark	With additional potential distributors for ground connection of the actuators

Note

Terminal blocks are not included in the scope of delivery of the I/O module and must be ordered separately.

You can find additional information on the configuration in the system manual.

Terminal

5.1 Pin assignment

Definition

The terminal assignment provides information about the arrangement and marking of the terminals when wiring a connector.

Description

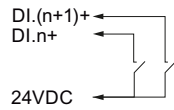
The general pin assignment is structured as follows:

Terminal	Assignment	Terminal	Assignment	Explanations								
1	DI a /DI.0+	2	DI a /DI.1+	DI a /DI.n+: Input signal, channel n (0...7)								
3	DI a /DI.2+	4	DI a /DI.3+	DI b /DI.n+: Input signal, channel n+8 (8...15)								
5	DI a /DI.4+	6	DI a /DI.5+	UV a /UV.n: Sensor supply, channel n (0...7)								
7	DI a /DI.6+	8	DI a /DI.7+	UV b /UV.n: Sensor supply, channel n+8 (8...15)								
9	DI b /DI.0+	10	DI b /DI.1+	1P1: Supply voltage L+ of the voltage bus 1P								
11	DI b /DI.2+	12	DI b /DI.3+	2P1: Supply voltage L+ of the voltage bus 2P								
13	DI b /DI.4+	14	DI b /DI.5+	1P2: Ground reference of the voltage bus 1P								
15	DI b /DI.6+	16	DI b /DI.7+	2P2: Ground reference of the voltage bus 2P								
17	UV a/UV0	18	UV a/UV1	1 <table><tr><td>DI.0+</td><td>DI.1+</td></tr><tr><td>DI.2+</td><td>DI.3+</td></tr><tr><td>DI.4+</td><td>DI.5+</td></tr><tr><td>DI.6+</td><td>DI.7+</td></tr></table> 2	DI.0+	DI.1+	DI.2+	DI.3+	DI.4+	DI.5+	DI.6+	DI.7+
DI.0+	DI.1+											
DI.2+	DI.3+											
DI.4+	DI.5+											
DI.6+	DI.7+											
19	UV a/UV2	20	UV a/UV3	3 <table><tr><td>DI.2+</td><td>DI.3+</td></tr><tr><td>DI.4+</td><td>DI.5+</td></tr><tr><td>DI.6+</td><td>DI.7+</td></tr></table> 4	DI.2+	DI.3+	DI.4+	DI.5+	DI.6+	DI.7+		
DI.2+	DI.3+											
DI.4+	DI.5+											
DI.6+	DI.7+											
21	UV a/UV4	22	UV a/UV5	5 <table><tr><td>DI.4+</td><td>DI.5+</td></tr><tr><td>DI.6+</td><td>DI.7+</td></tr></table> 6	DI.4+	DI.5+	DI.6+	DI.7+				
DI.4+	DI.5+											
DI.6+	DI.7+											
23	UV a/UV6	24	UV a/UV7	7 <table><tr><td>DI.6+</td><td>DI.7+</td></tr></table> 8	DI.6+	DI.7+						
DI.6+	DI.7+											
25	UV b/UV0	26	UV b/UV1	9 <table><tr><td>DI.0+</td><td>DI.1+</td></tr><tr><td>DI.2+</td><td>DI.3+</td></tr><tr><td>DI.4+</td><td>DI.5+</td></tr><tr><td>DI.6+</td><td>DI.7+</td></tr></table> 10	DI.0+	DI.1+	DI.2+	DI.3+	DI.4+	DI.5+	DI.6+	DI.7+
DI.0+	DI.1+											
DI.2+	DI.3+											
DI.4+	DI.5+											
DI.6+	DI.7+											
27	UV b/UV2	28	UV b/UV3	11 <table><tr><td>DI.2+</td><td>DI.3+</td></tr><tr><td>DI.4+</td><td>DI.5+</td></tr><tr><td>DI.6+</td><td>DI.7+</td></tr></table> 12	DI.2+	DI.3+	DI.4+	DI.5+	DI.6+	DI.7+		
DI.2+	DI.3+											
DI.4+	DI.5+											
DI.6+	DI.7+											
29	UV b/UV4	30	UV b/UV5	13 <table><tr><td>DI.4+</td><td>DI.5+</td></tr><tr><td>DI.6+</td><td>DI.7+</td></tr></table> 14	DI.4+	DI.5+	DI.6+	DI.7+				
DI.4+	DI.5+											
DI.6+	DI.7+											
31	UV b/UV6	32	UV b/UV7	15 <table><tr><td>DI.6+</td><td>DI.7+</td></tr></table> 16	DI.6+	DI.7+						
DI.6+	DI.7+											
1P1	L+	1P2	M	17 <table><tr><td>UV0</td><td>UV1</td></tr><tr><td>UV2</td><td>UV3</td></tr><tr><td>UV4</td><td>UV5</td></tr><tr><td>UV6</td><td>UV7</td></tr></table> 18	UV0	UV1	UV2	UV3	UV4	UV5	UV6	UV7
UV0	UV1											
UV2	UV3											
UV4	UV5											
UV6	UV7											
2P1 ¹	L+	2P2	M	19 <table><tr><td>UV2</td><td>UV3</td></tr><tr><td>UV4</td><td>UV5</td></tr><tr><td>UV6</td><td>UV7</td></tr></table> 20	UV2	UV3	UV4	UV5	UV6	UV7		
				UV2	UV3							
				UV4	UV5							
				UV6	UV7							
21 <table><tr><td>UV4</td><td>UV5</td></tr><tr><td>UV6</td><td>UV7</td></tr></table> 22	UV4	UV5	UV6	UV7								
UV4	UV5											
UV6	UV7											
23 <table><tr><td>UV6</td><td>UV7</td></tr></table> 24	UV6	UV7										
UV6	UV7											
				25 <table><tr><td>UV0</td><td>UV1</td></tr><tr><td>UV2</td><td>UV3</td></tr><tr><td>UV4</td><td>UV5</td></tr><tr><td>UV6</td><td>UV7</td></tr></table> 26	UV0	UV1	UV2	UV3	UV4	UV5	UV6	UV7
UV0	UV1											
UV2	UV3											
UV4	UV5											
UV6	UV7											
				27 <table><tr><td>UV2</td><td>UV3</td></tr><tr><td>UV4</td><td>UV5</td></tr><tr><td>UV6</td><td>UV7</td></tr></table> 28	UV2	UV3	UV4	UV5	UV6	UV7		
UV2	UV3											
UV4	UV5											
UV6	UV7											
				29 <table><tr><td>UV4</td><td>UV5</td></tr><tr><td>UV6</td><td>UV7</td></tr></table> 30	UV4	UV5	UV6	UV7				
UV4	UV5											
UV6	UV7											
				31 <table><tr><td>UV6</td><td>UV7</td></tr></table> 32	UV6	UV7						
UV6	UV7											
		</										

¹ If the module is plugged into a TB45R-P32 terminal block suitable for IO redundancy, the potential at this terminal is 1P3.

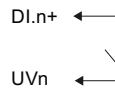
5.2 Sample connection scheme for 1-wire connection

Example



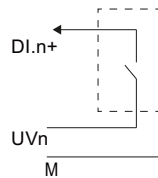
5.3 Sample connection scheme for 2-wire connection

Example



5.4 Sample connection scheme for 3-wire connection

Example



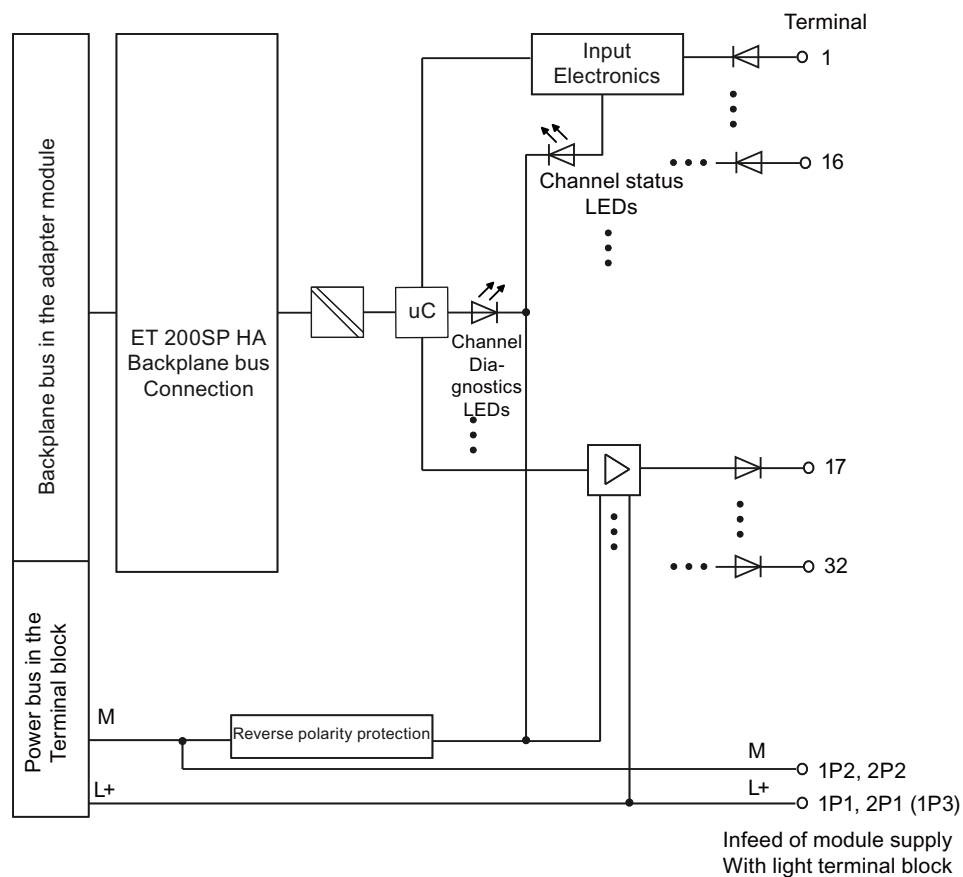
5.5 Schematic circuit diagram

Definition

A block diagram contains the schematic representation of individual function blocks.

Description

The block diagram for the I/O module is structured as follows:



5.5 Schematic circuit diagram

Parameters

6.1 Module/channel parameters

Definition

Module/channel parameters are specific parameters whose configuration can affect the entire module or channels.

Description

The following module/channel parameters are available:

Table 6-1 Parameters and their defaults

Parameter	Value range	Default	Parameter re-assignment in RUN	Efficiency range
Diagnostics, Missing supply voltage L+ (Page 20)	- Enabled - Disabled	Enabled	Yes	Module
IO redundancy (Page 21)	- None 2 modules	None	No	Module
Diagnostics, Short-circuit to ground (Page 21)	- Enabled - Disabled	Enabled	Yes	Channel
Diagnostics, Wire break (Page 21) ¹	- Enabled - Disabled	Enabled	Yes	Channel
Wire-break check (Page 21)	- Enabled - Disabled	Enabled	Yes	Channel
Channel activated (Page 22)	- Enabled - Disabled	Enabled	Yes	Channel
Input delay (Page 22) ²	- 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

6.3 Explanation of the module/channel parameters

Parameter	Value range	Default	Parameter re-assignment in RUN	Efficiency range
Pulse stretching (Page 22) ²	- None 0.05 s 0.1 s 0.2 s 0.5 s 1 s 2 s	None	Yes	Channel
Hardware interrupts positive edge (Page 23) ²	- Enabled - Disabled	Disabled	Yes	Channel
Hardware interrupts negative edge (Page 24) ²	- Enabled - Disabled	Disabled	Yes	Channel
Potential group (Page 24)	- Potential group of the left module (dark gray terminal block) - New potential group (light gray terminal block) - No potential group (black terminal block)	Use potential group of the left module	No	Module

¹ The wire break diagnostics can only be enabled when the "Check for wire break" parameter is enabled. If you use a simple encoder contact, you need to connect a parallel resistor to enable wire break diagnostics in the open state (sensor resistance for wire break diagnostics: 15 kΩ to 18 kΩ).

² The input delay is switched off on all channels when high precision time stamping is activated. When high precision time stamping is activated, pulse stretching and the rising/falling edge hardware interrupt are deactivated on all channels (not adjustable).

6.2 Parameter reassignment

Definition

Each configuration change resets the corresponding reaction. Changing the configuration of a function does not affect other functions.

6.3 Explanation of the module/channel parameters

6.3.1 Diagnostics, Missing supply voltage L+

Definition

Enabling of the diagnostics for missing or insufficient supply voltage L+.

6.3.2 IO redundancy

Definition

You can configure two identical modules redundantly. To do so, plug both modules into a redundant terminal block side by side. You can find additional information on mounting modules in an IO redundancy configuration in the ET 200SP HA System Manual, section "Installing", "Installing terminal block".

In IO redundancy mode, the left module is the master and the right module is the slave.

Description

Both redundant modules measure simultaneously and independently in the process. Both redundant modules generate diagnostics, interrupts and process values.

6.3.3 Diagnostics, Short-circuit to ground

Definition

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

6.3.4 Diagnostics, Wire break

Definition

When wire-break check is activated, you can enable wire-break diagnostics via the Diagnostics, Wire break parameter for insufficient current flow on the input.

6.3.5 Wire-break check

Definition

Enable for wire break check. The I/O module can only detect a wire break if wire-break is activated.

6.3 Explanation of the module/channel parameters

6.3.6 Channel activated

Definition

Specifies whether a channel is activated or deactivated.

6.3.7 Input delay

Definition

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.

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

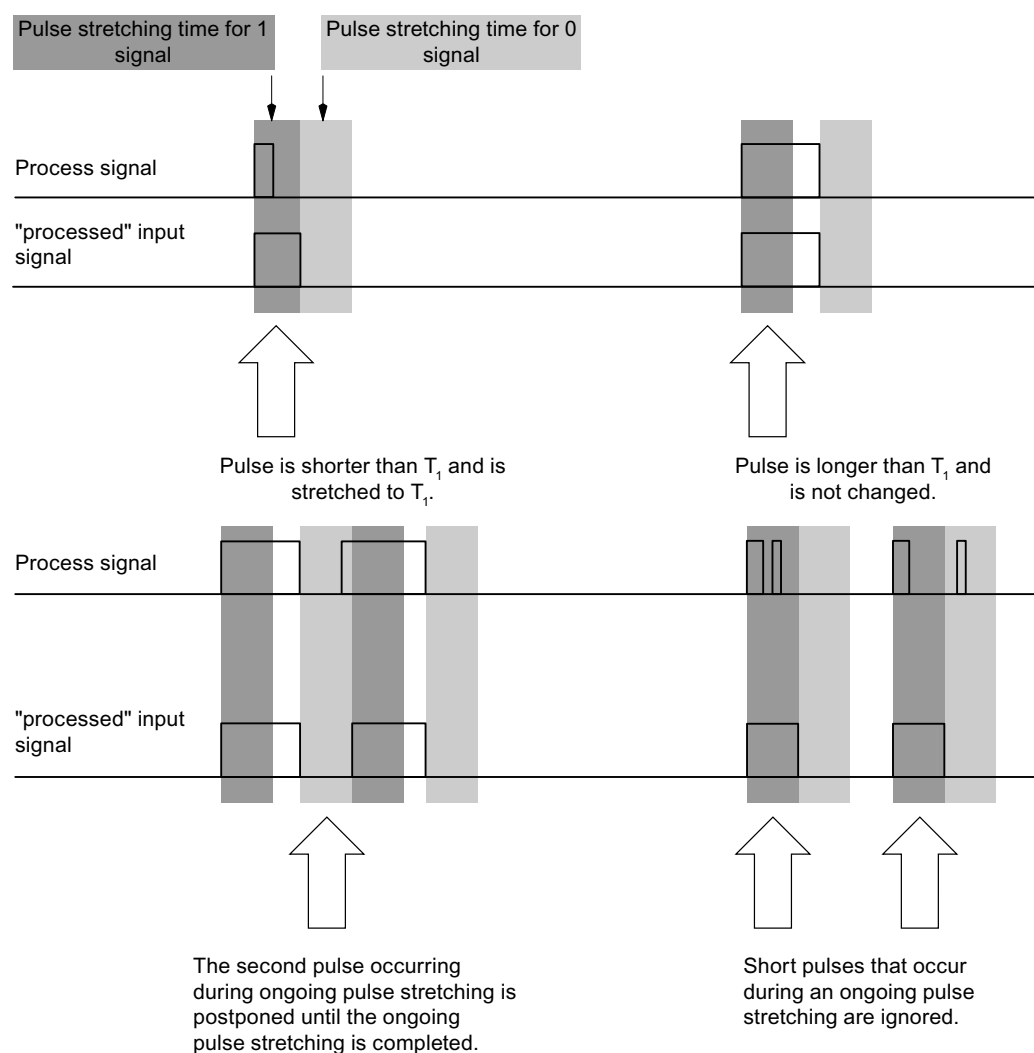
6.3.8 Pulse stretching

Definition

Pulse stretching is a function for changing 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.

Description

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



T_1 Pulse stretching parameter

6.3.9 Hardware interrupts positive edge

Definition

Specifies if a hardware interrupt should be generated for a rising edge.

6.3.10 Hardware interrupts negative edge

Definition

Specifies if a hardware interrupt should be generated for a negative edge.

6.3.11 Potential group

Definition

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

Description

A potential group is built up from left to right by using terminal blocks.

A new potential group starts on the left side with a light gray terminal block, via which the supply voltage for the potential group is fed in.

The potential group is continued to the right with dark gray terminal blocks and ends when a new potential group is built up next to it.

The potential group also ends if there is a black terminal block next to it. Black terminal blocks are fed individually and cannot be included in potential groups.

You can find additional information on the configuration of the potential group in the system manual *SIMATIC; Distributed I/O System; ET 200SP HA*.

Displays and interrupts

7.1 Status and error displays

Definition

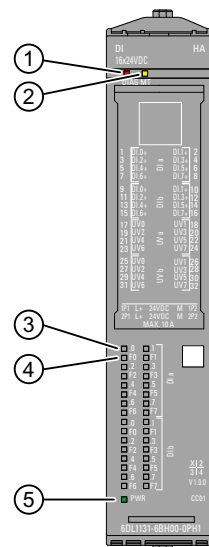
The LED displays are status and error indicators.

Diagnostics messages and maintenance events, as well as their possible causes or solutions, are described in the diagnostics messages and maintenance events.

Diagnostics messages (Page 42)

Description

The following figure explains the LED displays of the I/O module.



- ① DIAG LED (Page 26) (green/red)
- ② MT LED (Page 26) (yellow)
- ③ Channel status / fault LEDs (Page 27) Channel status LED (green)
- ④ Channel status / fault LEDs (Page 27) Channel fault LED (red)
- ⑤ PWR LED (Page 27) (green)

7.2 LEDs

7.2.1 DIAG LED

Definition

The DIAG LED provides you diagnostic information.

Description

The diagnostic display of the DIAG LED is as follows:

DIAG LED	Meaning
 Off	The power supply of the ET 200SP HA is disrupted or switched off.
 flashes	Module is not configured.
 On	Module parameters are assigned. No diagnostic message is pending.
 flashes	Module parameters are assigned. At least one diagnostic message is pending.

7.2.2 MT LED

Definition

The MT LED provides maintenance information.

Description

The MT LED indicates the following maintenance status:

MT LED	Meaning
 Off	No maintenance is required.
 On	Maintenance is required. At least one maintenance event has occurred.

7.2.3 Channel status / fault LEDs

Definition

The channel status and channel fault LEDs provide you information about the status and faults of the channels.

Description

Regardless of the parameter assignment, the green LED channel status shows the signal level at the input terminal. It lights up starting at approximately 10 V of terminal current.

The red channel fault LED lights up when a channel diagnostics is active for an enabled channel.

The channel status and channel fault LEDs indicate the following:

LED channel status	LED channel error	Meaning
□ Off	□ Off	Process signal = 0 and - Channel disabled or module switched off - Channel enabled and no channel diagnostics pending - Module diagnostics pending
■ On	□ Off	Process signal = 1 and - Channel disabled or module switched off - Channel enabled and no channel diagnostics pending - Module diagnostics pending
□ Off	■ On	Process signal = 0 and Channel enabled and channel diagnostics pending
■ On	■ On	Process signal = 1 and Channel enabled and channel diagnostics pending

7.2.4 PWR LED

Definition

The PWR LED provides you status information about supply voltage L+.

Description

The PWR LED indicates the following status:

PWR LED	Meaning
□ Off	Supply voltage L+ missing.
■ On	Supply voltage L+ present.

7.3 Interrupts

Definition

A diagnostics interrupt is an alarm that reports activated events of a device status to the system operator with the appropriate operating authorization (maintenance and service).

Description

The I/O module generates a diagnostics interrupt at the following events:

- Supply voltage missing
- Short-circuit to ground
- Wire break
- Parameter assignment error
- Hardware interrupt lost
- Channel/component temporarily unavailable
- Retentive memory in carrier module defective
- Retentive memory in the terminal block defective
- Shutdown on button activation
- IO redundancy parameter assignment inconsistent

The I/O module generates a maintenance message for the following events:

- Redundancy partner has different hardware/firmware
- IO redundancy warning
- Retentive memory in carrier module defective
- Retentive memory in the terminal block defective

Technical specifications

Technical specifications of the DI 16X24VDC HA

Article number	6DL1131-6BH00-0PH1
General information	
Firmware version	V1.0
• FW update possible	Yes
Usable terminal block	TB type H1, M1 and N0
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 from version	V16
• STEP 7 configurable/integrated from version	V5.6
• PCS 7 configurable/integrated from version	V9.0
• PROFINET from GSD version/GSD revision	GSDML V2.3
Operating mode	
• DI	Yes
Redundancy	
• Redundancy capability	Yes; With TB type M1
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
Input current	
Current consumption (rated value)	60 mA; without sensor supply
Current consumption, max.	120 mA; without sensor supply
Encoder supply	
Output voltage, min.	18.2 V; L+ (-1 V)
Output current	
• up to 60 °C, max.	2 A; 1 A when mounted vertically; see derating information in Equipment Manual
• up to 70 °C, max.	1 A; See derating information in Equipment Manual
24 V encoder supply	
• 24 V	Yes

Article number	6DL1131-6BH00-0PH1
Short-circuit protection	Yes; electronic (response threshold 0.7 A to 1.3 A; for IO redundancy up to 2.6 A) Ensure sufficient low-resistance cable routing to the sensor/actuator in order to attain the response threshold. Depending on the cable cross-section used, there may be constraints regarding the usable length of cable
Output current per channel, max.	0.5 A
Output current per module, max.	2 A
Power	
Power available from the backplane bus	80 mW
Power loss	
Power loss, typ.	3.6 W; Maximum value (taking the max. encoder current and the max. operating voltage into account)
Address area	
Address space per module	
Address space per module, max.	2 byte; + 2 bytes for QI information (additional 18 bytes when using high-precision time stamping)
Hardware configuration	
Automatic encoding	
Mechanical coding element	Yes
Digital inputs	
Digital inputs, parameterizable	Yes
Source/sink input	Yes; P-reading
Input characteristic curve in accordance with IEC 61131, type 1	Yes
Input characteristic curve in accordance with IEC 61131, type 2	No
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Pulse extension	Yes
Length	off, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s
Time stamping	Yes; Resolution 10 ms
Time stamp (with precision of 1 ms)	Yes; Resolution 1ms
Edge evaluation	Yes; rising edge, falling edge, edge change
Input voltage	
for signal "0"	-30 to +5 V
for signal "1"	+11 to +30V
Cable length	
shielded, max.	1 000 m
unshielded, max.	600 m
Encoder	
Connectable encoders	
2-wire sensor - permissible quiescent current (2-wire sensor), max.	Yes 1.5 mA

Article number	6DL1131-6BH00-0PH1
Interrupts/diagnostics/status information	
Diagnostics function	Yes
Diagnoses	
• Diagnostic information readable	Yes
• Monitoring the supply voltage	Yes; Module-wise
– parameterizable	Yes
• Monitoring of encoder power supply	Yes
• Short-circuit to M	Yes; Encoder supply to M, channel by channel
Diagnostics indication LED	
• MAINT LED	Yes; Yellow LED
• Monitoring of the supply voltage (PWR-LED)	Yes; green PWR LED
• Channel status display	Yes; green LED
• for channel diagnostics	Yes; red LED
• for module diagnostics	Yes; green/red LED
Potential separation	
Potential separation channels	
• between the channels	No
• between the channels and backplane bus	Yes
• between the channels and the power supply of the electronics	No
Isolation	
Isolation tested with	1 500 V DC/1 min, type test
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-40 °C
• horizontal installation, max.	70 °C
• vertical installation, min.	-40 °C
• vertical installation, max.	60 °C
Dimensions	
Height	115 mm
Depth	138 mm
Weights	
Weight, approx.	135 g

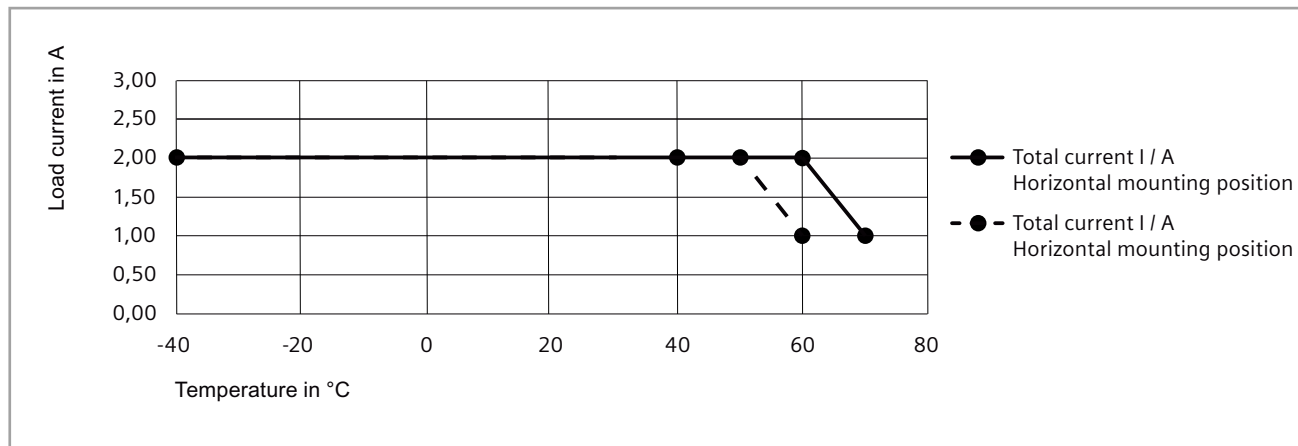
Article number	6DL1131-6BH00-0EH1
General information	
Firmware version	V1.0
• FW update possible	Yes
Usable terminal block	TB type H1 and M1
Color code for module-specific color identification plate	CC01
Engineering with	
• SPPA-T3000 can be configured/integrated from version	V8.0
Operating mode	
• DI	Yes
Redundancy	
• Redundancy capability	Yes; With TB type M1
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
Input current	
Current consumption (rated value)	60 mA; without sensor supply
Current consumption, max.	120 mA; without sensor supply
Encoder supply	
Output current	
• up to 60 °C, max.	2 A; 1 A when mounted vertically; see derating information in Equipment Manual
• up to 70 °C, max.	1 A; See derating information in Equipment Manual
24 V encoder supply	
• 24 V	Yes
• Short-circuit protection	Yes; electronic (response threshold 0.7 A to 1.3 A; for IO redundancy up to 2.6 A) Ensure sufficient low-resistance cable routing to the sensor/actuator in order to attain the response threshold. Depending on the cable cross-section used, there may be constraints regarding the usable length of cable
Power	
Power available from the backplane bus	80 mW
Power loss	
Power loss, typ.	3.6 W; Maximum value (taking the max. encoder current and the max. operating voltage into account)
Address area	
Address space per module	

Article number	6DL1131-6BH00-0EH1
Address space per module, max.	24 byte; Without SOE: PII: 2 bytes, +2 bytes for QI information, +1 byte of PROFINET status data; PIO: 1 byte of PROFINET status data; with SOE: PII: 2 bytes, +18 bytes for SOE (if 1 ms time stamp is used), +2 bytes for QI information, +1 byte of PROFINET status data; PIO: 1 byte PROFINET status data
Hardware configuration	
Automatic encoding	
Mechanical coding element	Yes
Digital inputs	
Digital inputs, parameterizable	Yes
Input characteristic curve in accordance with IEC 61131, type 1	Yes
Input characteristic curve in accordance with IEC 61131, type 2	No
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Pulse extension	Yes
Length	off, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s
Time stamping	Yes; Resolution 10 ms
Time stamp (with precision of 1 ms)	Yes; Resolution 1ms
Edge evaluation	Yes; rising edge, falling edge, edge change
Input voltage	
- for signal "0" - for signal "1"	-30 to +5 V +11 to +30V
Encoder	
Connectable encoders	
2-wire sensor – permissible quiescent current (2-wire sensor), max.	Yes 1.5 mA
Interrupts/diagnostics/status information	
Diagnoses	
- Diagnostic information readable - Monitoring the supply voltage – parameterizable - Monitoring of encoder power supply - Short-circuit to M	Yes Yes; Module-wise Yes Yes Yes; Encoder supply to M, channel by channel
Diagnostics indication LED	
- MAINT LED - Monitoring of the supply voltage (PWR-LED) - Channel status display - for channel diagnostics - for module diagnostics	Yes; Yellow LED Yes; green PWR LED Yes; green LED Yes; red LED Yes; green/red LED
Potential separation	
Potential separation channels	

Article number	6DL1131-6BH00-0EH1
• between the channels • between the channels and backplane bus • between the channels and the power supply of the electronics	No Yes No
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min. • horizontal installation, max. • vertical installation, min. • vertical installation, max.	-40 °C 70 °C -40 °C 60 °C
Dimensions	
Height	115 mm
Depth	138 mm

Derating curve

The following figure shows the load current derating with horizontal and vertical mounting positions.



Cycle time

The cycle time describes the time slice in which signals from the inputs are acquired and processed. The cycle time of the I/O module is 1 ms (250 µs for time stamping).

Minimum pulse length

In order for a pulse or an edge transition to be reliably detected by the I/O module, the signal status must be active for at least the duration of the minimum pulse length.

In non-redundant mode, the minimum pulse length is greater than the input delay and greater than the cycle time.

In IO redundancy mode, the minimum pulse length is greater than the input delay and greater than the cycle time + 50 ms.

Redundancy failover time

At an I/O redundancy failover, the update time of the process values or the detection of an edge transition is delayed once by no longer than this time.

The maximum redundancy failover time of the I/O module is 55 ms.

Drivers, parameters, diagnostics messages and address space

A

A.1 Parameter assignment

Parameter assignment in the user program

You can reconfigure individual channels of the module in RUN without this having an effect on the other channels.

Changing parameters in RUN

The parameters are transferred to the module with the "WRREC" instruction via data record 128.

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 the corresponding error code.

The STATUS output parameter is 4 bytes long and is configured as followed:

- Byte1: Function_Num, general error code
- Byte2: Error_Decode, location of the error code
- Byte3: Error_Code_1, error code
- Byte4: Error_Code_2, manufacturer-specific extension of the error code

Module-specific errors are displayed via Error_Decode = 0x80 and Error_Code_1 / Error_Code_2.

Error_Code_1	Error_Code_2	Cause	Remedy
0xB0	0x00	Number of the data record unknown	Enter valid number for data record.
0xB1	0x01	Length of the data record is incorrect	Enter valid value for data record length.
0xB2	variable	Module cannot be reached	• Check station - is the module plugged in correctly? • Check the parameters of the WRREC instruction.
0xE0	0x01	Wrong version in the header	Correct the version number of the parameter block.
0xE0	0x02	Header error (number or length of parameter block)	Correct the length and number of the parameter blocks.

Error_ Code_ 1	Error_ Code_ 2	Cause	Remedy
0xE1	0x01	Reserved bit set	Check and correct the parameters
0xE1	0x02	Invalid diagnostics enable bit set for operating mode	
0xE1	0x03	Invalid hardware interrupt enable bit set for operating mode	
0xE1	0x07	Invalid coding for input delay	
0xE1	0x0B	Invalid coding for pulse stretching	
0xE1	0x0E	Invalid redundancy parameter assignment	

A.2 Parameter assignment and structure of the module/channel parameters

Structure of data record 128

Data record 128 has a length of 76 bytes.

It contains module parameters as well as channel or technology parameters of the 16 channels; 4 bytes each.

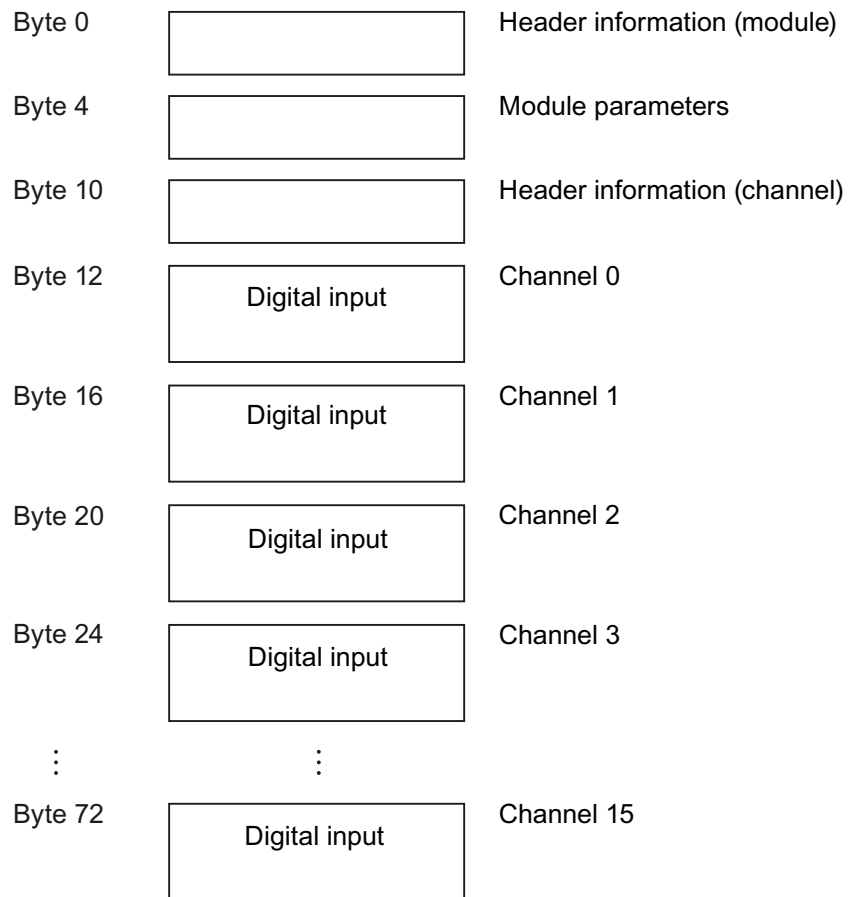


Figure A-1 Structure of data record 128

Header information and module parameters

The following figure shows the configuration of the header information and module parameters.

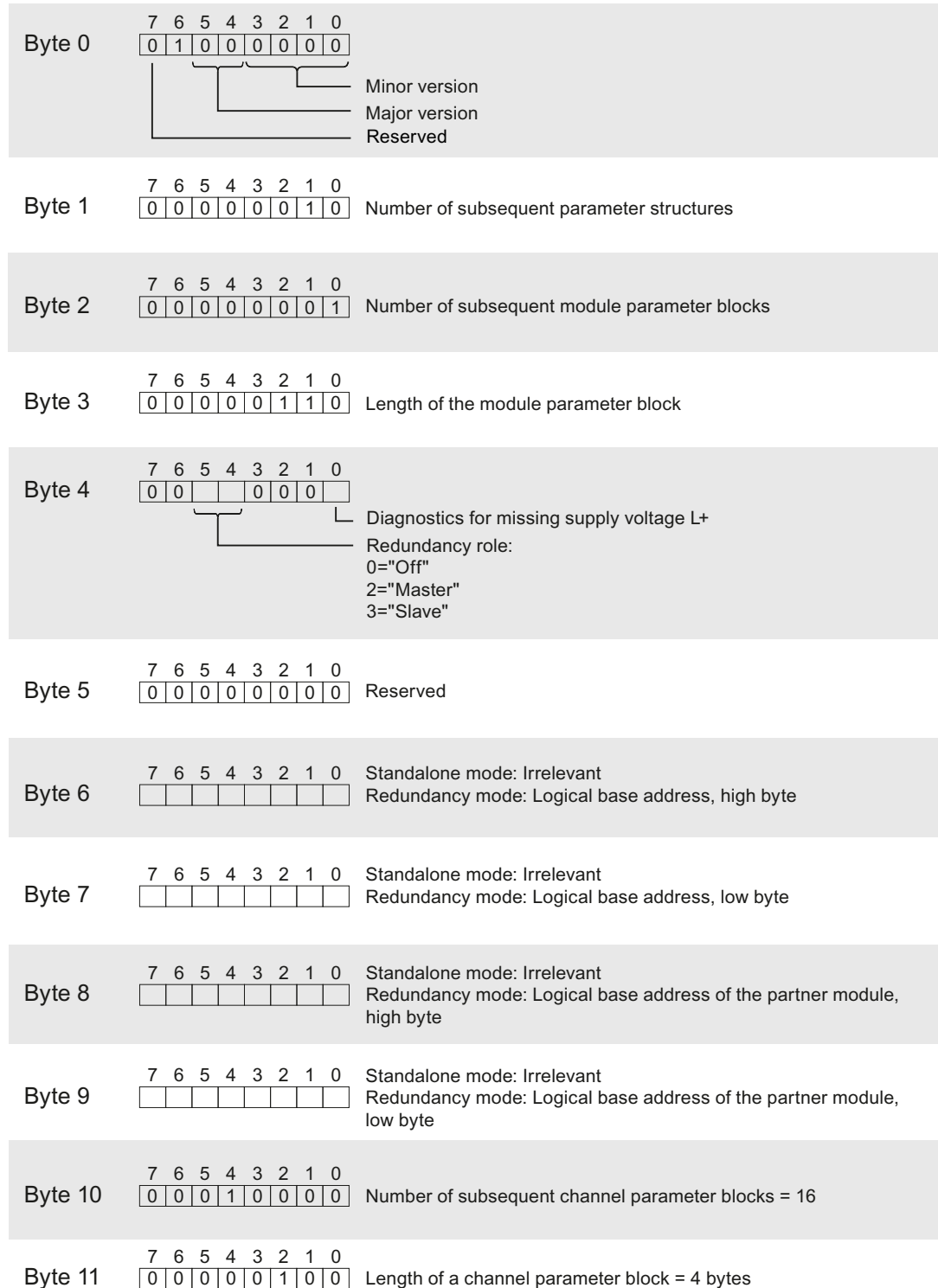


Figure A-2 Header information and module parameters of data record 128

Channel parameters

Each channel parameter block contains the cable parameters for the digital input (4 bytes).

The following figure shows the configuration of the channel parameters for channels 0 to 15.

$x = 12 + (\text{channel number} * 4)$; with channel number 0...15

All unused bits and the bits or bytes marked as "reserved" must be set to zero.

You activate a channel parameter by setting the corresponding bit to "1" or the corresponding value.

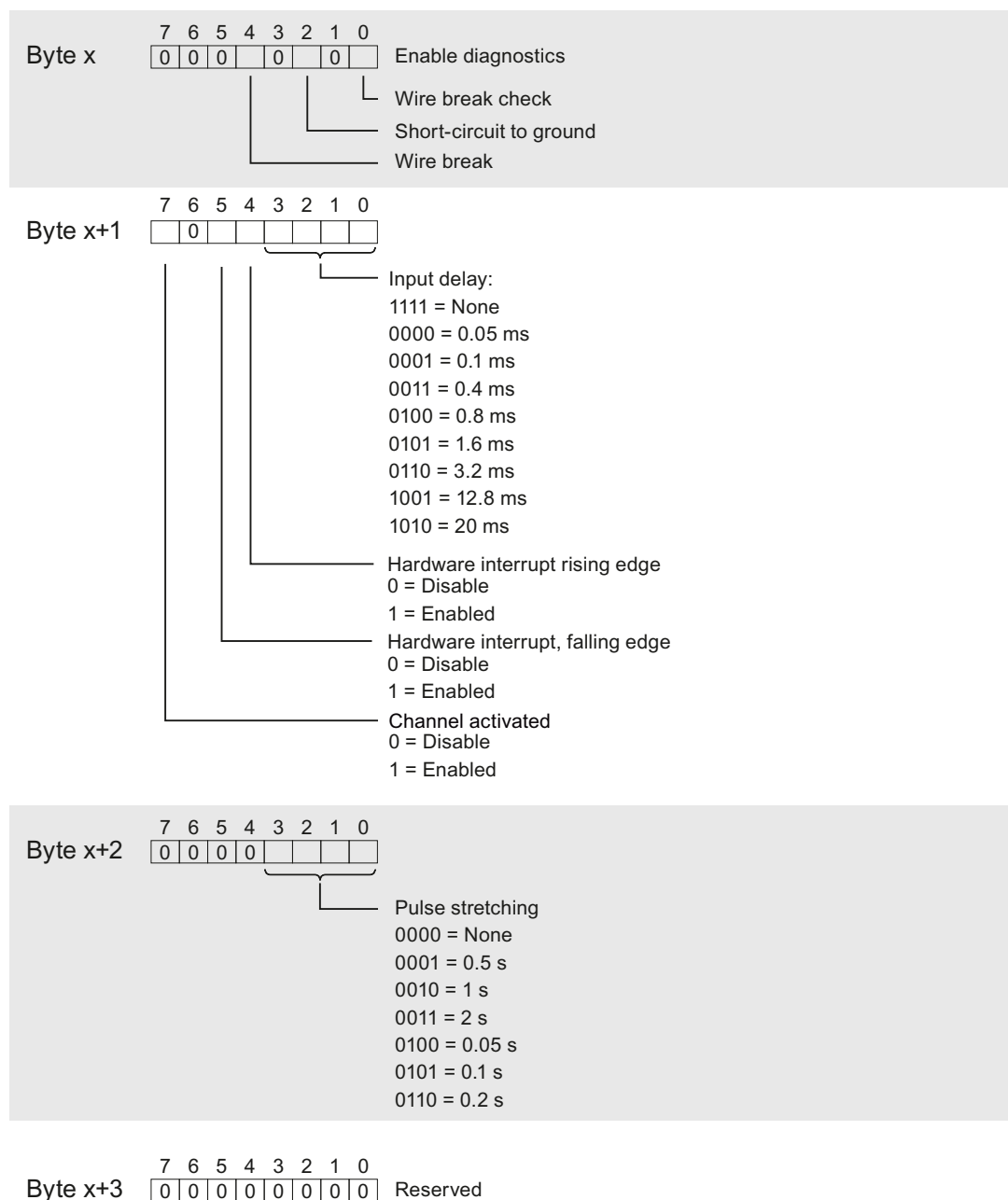


Figure A-3 Configuration byte x to x+3 for the channels 0 to 15

A.3 Diagnostics messages

Diagnostics alarms

A diagnostics message is generated for each diagnostics event and the DIAG LED on the DI 16x24VDC HA flashes red or the MT LED lights up yellow.

In addition, channel-specific channel diagnostics are displayed through the corresponding channel error/status LEDs.

The diagnostics messages can be read in the diagnostics buffer of the CPU, for example.

Diagnostic messages are assigned either channel-specific to an input or assigned as module messages to all inputs. All channels are switched off for diagnostics messages that affect the entire module. Only the corresponding digital input is affected by diagnostics messages, which refer to individual channels.

Table A-1 Diagnostic messages, their meanings and remedy options

Diagnostics message	Error code	Assignment	Meaning	Remedy
Wire break	6 _H	Channel	Impedance of encoder circuitry is too high	Use another type of encoder or wiring, for example, use conductors with a larger cross-section
			Wire break between the module and sensor	Connect the cable
			Channel not connected (open)	• Disable diagnostics • Connect encoder contacts with a 15 kΩ to 18 kΩ resistor¹⁾ • Switch off wire break check
Parameter assignment error	10 _H	Module	• Parameter assignment does not match the terminal block used • Incorrect parameter assignment	• Correct the parameter assignment • Check terminal block²⁾
Supply voltage missing	11 _H	Module	Missing or insufficient supply voltage L+	• Check the supply voltage L+ on the terminal block • Check terminal block
Hardware interrupt lost	16 _H	Module	Error is reported because the events occur faster than they can be processed in the system.	
Channel/component temporarily unavailable	1F _H	Module	Firmware update is in progress or has been canceled during the update. The module does not read any process values in this state.	• Restart the firmware update • Wait for firmware update
Short-circuit/overload at external encoder supply	10E _H	Channel	Short-circuit of the encoder supply to ground	Correction of the process wiring
Shutdown on button activation	122 _H	Module	The output disable switch was activated.	Pull module
Inconsistent parameter assignment	123 _H	Module	Errors in the redundancy parameters sent to the module	Check the parameter assignment

Diagnostics message	Error code	Assignment	Meaning	Remedy
Retentive memory in carrier module defective	154 _H	Module	Fault detected in the memory block on the carrier module during startup.	Replace carrier module
Retentive memory in the terminal block defective	155 _H	Module	Fault detected in the memory block on the terminal block during startup.	Replace terminal block

¹⁾ 47 kΩ resistors can be used provided that the following supplementary conditions are complied with: Only singular structure of the I/O modules (no IO redundancy); the process cables are shielded; no certification required according to the following standards: NE21 or Power Station 6100-6-5

²⁾ Only the terminal blocks (TB 45R ...) are suitable for use with I/O modules in IO redundancy.

A.4 Maintenance events

Maintenance events

A maintenance event is generated for each maintenance required identified. The MT LED lights up on the module.

Maintenance messages do not have a direct influence on the functions of the module or digital inputs.

Maintenance message	Error code	Assignment	Meaning / Cause	Remedy
Redundancy partner has different hardware/firmware version	120 _H	Module	The redundantly configured and interconnected I/O modules are not compatible.	Check the operating status and firmware version of the modules and replace modules or perform a firmware update.
IO redundancy warning	121 _H	Module	Unable to correctly communicate with the partner module.	• Check/replace right-hand module • Check/replace left-hand module • Check/replace terminal block See also the "ET 200SP HA Distributed I/O system" system manual, Chapter "Replacing an I/O module at IO redundancy".
Retentive memory in carrier module defective	154 _H	Module	Fault detected in the memory block on the carrier module during operation.	Replace carrier module
Retentive memory in the terminal block defective	155 _H	Module	Fault detected in the memory block on the terminal block during operation.	Replace terminal block

A.5 Hardware interrupts

Hardware interrupts

The DI 16x24VDC HA generates a hardware interrupt for the following events:

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

Interrupt OBs are called automatically if an interrupt occurs.

You can find detailed information on the event in the hardware interrupt organization block with the "RALRM" instruction (read additional interrupt information).

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

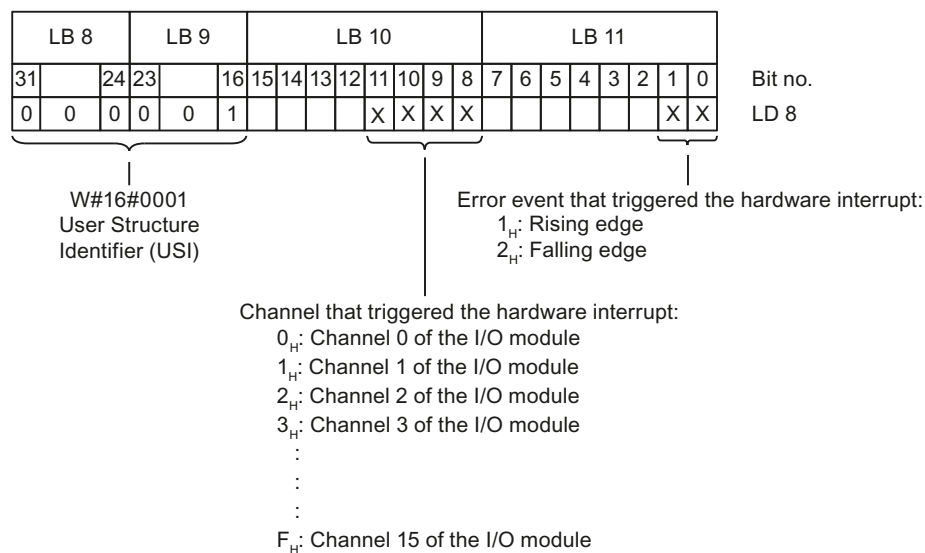


Figure A-4 Start information of the organization block

A.6 Address space

Abbreviations

- "IB" stands for input byte, that is, the module start address in the input area
- "DI" stands for digital input
- "QDI_n" stands for the value status (QI) of digital input n

Address space

The following figure shows the mapping of the address space of the DI 16x24VDC HA.

Table A-2 Address space of the DI 16x24VDC HA

IB x +	7	6	5	4	3	2	1	0
0	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0
1	DI15	DI14	DI13	DI12	DI11	DI10	DI9	DI8
2	QDI7	QDI6	QDI5	QDI4	QDI3	QDI2	QDI1	QDI0
3	QDI15	QDI14	QDI13	QDI12	QDI11	QDI10	QDI9	QDI8

Evaluate value status

There is a bit value status for each digital input in the input address space.

Irrespective of the diagnostics enables, each value status (each QI bit) provides information on the validity of the corresponding process value.

- Value status = 1: Process value okay, "good"
- Value status = 0: Process value not okay, "bad"

Basically, the value status is set to "good" if the digital value can be detected without error. The value status is set to "bad" in the following cases:

- The digital value cannot be output due to an error.
- The digital channel is deactivated.

Note

The value status is not set to "bad" when there is a wire break on the channel and the wire break test is disabled.

A.7 Address space of the time stamping (accuracy 1 ms)

Address space

The following table shows the mapping of the address space of the DI 16x24VDC HA with time stamping (accuracy 1 ms).

Table A-3 Address space of the DI 16x24VDC HA with time stamping (accuracy 1 ms)

IB x +	7	6	5	4	3	2	1	0
0	I7	I6	I5	I4	I3	I2	I1	I0
1	I15	I14	I13	I12	I11	I10	I9	I8
2	QI7	QI6	QI5	QI4	QI3	QI2	QI1	QI0

A.7 Address space of the time stamping (accuracy 1 ms)

IB x +	7	6	5	4	3	2	1	0
3	QI15	QI14	QI13	QI12	QI11	QI10	QI9	QI8
4 to 21	Time information for time stamping (accuracy 1 ms)							