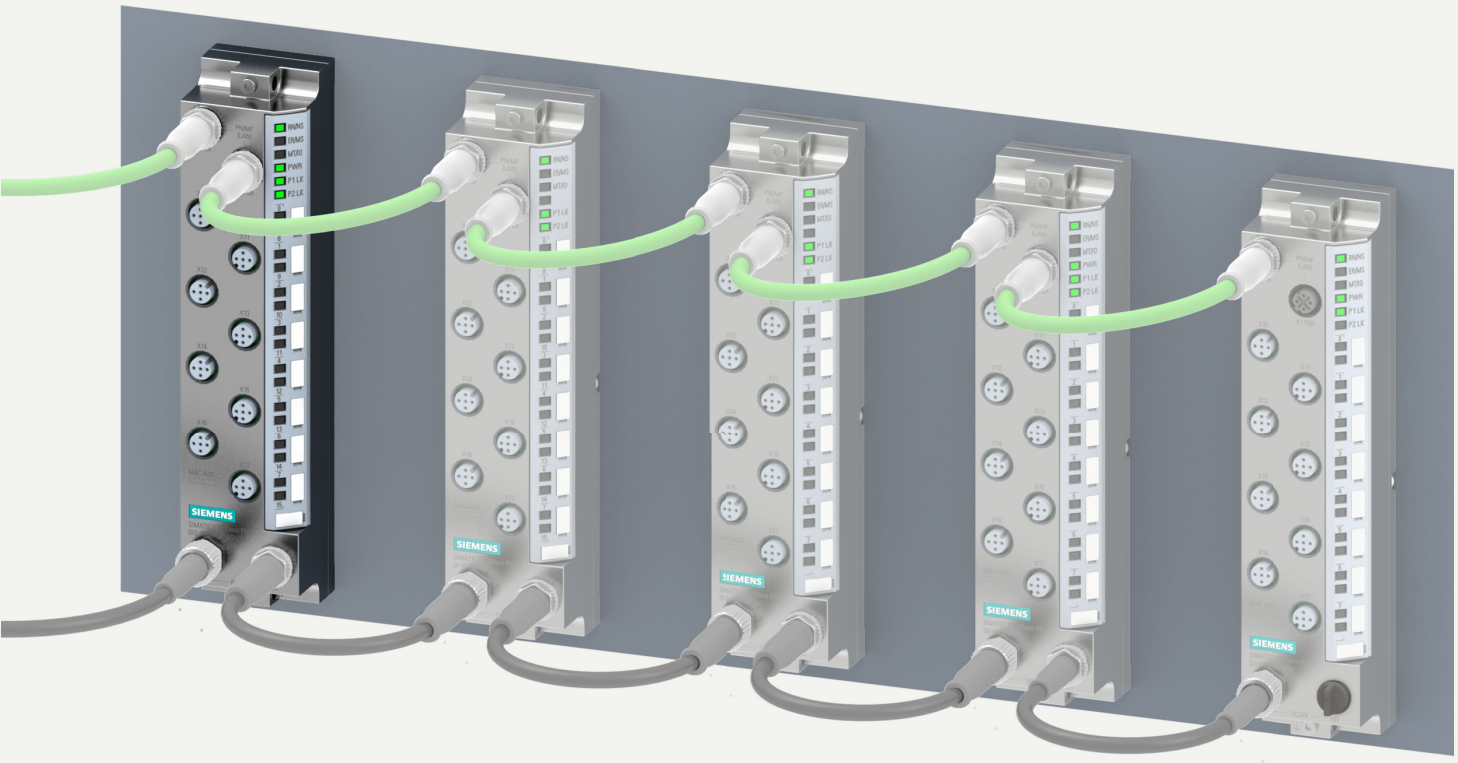
SIEMENS



Edition 03/2023

Equipment Manual

SIMATIC

ET 200eco PN M12-L

Digital inputs/outputs of the I/O device
DIQ 16x24VDC/0.5A/2A M12-L 8xM12
(6ES7143-6BH00-0BB0)

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SIMATIC

ET 200eco PN
Digital inputs/outputs DIQ 16x24VDC/0.5A/2A M12-L 8xM12 (6ES7143-6BH00-0BB0)

Equipment Manual

Guide to ET 200eco PN M12-L 1

Product overview 2

Wiring 3

PROFINET IO 4

EtherNet/IP 5

Modbus TCP 6

Technical specifications 7

Dimension drawing A

Parameter data record B

03/2023
A5E46571210-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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⚠ 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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Qualified Personnel

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

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A5E46571210-AD
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Preface

Purpose of the documentation

This equipment manual supplements the ET 200eco PN M12-L Distributed I/O System (https://support.industry.siemens.com/cs/ww/en/view/109778292) system manual. Functions that relate in general to the distributed I/O devices ET 200eco PN M12-L are described in this system manual.

The MultiFieldbus (https://support.industry.siemens.com/cs/ww/en/view/109773209) Function Manual describes general MultiFieldbus functions. This equipment manual describes the specific adaptations for this I/O device.

The information provided in this equipment manual and in the system manual and the function manuals supports you in commissioning the ET 200eco PN M12-L distributed I/O devices.

Changes compared to the previous version

This manual contains the following changes/additions compared to the previous version:

- Supplement to section Parameter data record (Page 79)
- Technical specifications (Page 69) Updated

Conventions

Also observe notes marked as follows:

NOTE

A note contains important information:

- On the product described in the documentation
- On handling the product
- On the part of the documentation to which particular attention is paid

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Security information

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

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To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed visit (https://www.siemens.com/cert).

Table of contents

1 Guide to ET 200eco PN M12-L 8

1.1 Information classes ET 200eco PN M12-L 8

1.2 Basic tools 9

1.3 MultiFieldbus Configuration Tool (MFCT) 11

1.4 SIMATIC Technical Documentation 12

2 Product overview 14

2.1 Properties 14

2.2 Operator controls and display elements 17

3 Wiring 18

3.1 Terminal and block diagram 18

3.2 Pin assignment 20

4 PROFINET IO 24

4.1 Parameters/address space 24
4.1.1 Parameters 24
4.1.2 Explanation of the parameters 25
4.1.3 Address space 27

4.2 Interrupts/diagnostics alarms 34
4.2.1 Status and error displays 34
4.2.2 Interrupts 37
4.2.3 Alarms 38
4.2.3.1 Diagnostics alarms 38
4.2.3.2 Maintenance events 39
4.2.3.3 Hardware interrupts 39

5 EtherNet/IP 40

5.1 Functions/parameters/address space 40
5.1.1 Supported EtherNet/IP functions 40
5.1.2 Parameters 41
5.1.3 Explanation of the parameters 42
5.1.4 Update time of the I/O data 44
5.1.5 Address space 44

5.2 Diagnostics 51
5.2.1 Status and error displays for EtherNet/IP 51

6 Modbus TCP 55

6.1 Functions/parameters/address space 55

6.1.1 Supported Modbus TCP functions ... 55
6.1.2 Parameters ... 56
6.1.3 Explanation of the parameters ... 57
6.1.4 Update time of the I/O data ... 58
6.1.5 Address space ... 59
6.2 Diagnostics ... 66
6.2.1 Status and error displays for Modbus TCP ... 66

7 Technical specifications ... 69

A Dimension drawing ... 78
A.1 Dimension drawing ... 78

B Parameter data record ... 79
B.1 Dependencies for the configuration ... 79
B.2 Structure of data record 128 for I/O device parameter assignment ... 80
B.3 Error transferring the data record ... 84

Guide to ET 200eco PN M12-L

1

1.1 Information classes ET 200eco PN M12-L



The documentation for the SIMATIC ET 200eco PN M12-L distributed I/O system is arranged into three areas.
This arrangement enables you to access the specific content you require.
You can download the documentation free of charge from the Internet (https://support.industry.siemens.com/cs/de/en/view/109742718).

Basic information



The System Manual describes in detail the configuration, installation, wiring and commissioning of the SIMATIC ET 200eco PN M12-L distributed I/O system.
The STEP 7 online help supports you in the configuration and programming.
Examples:

- ET 200eco PN M12-L System Manual
- Online help in the TIA Portal

Device information



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

- I/O Device Digital Inputs Equipment Manuals
- I/O Device Digital Inputs Equipment Manuals
- I/O Device Digital Inputs/Outputs Equipment Manuals
- IO-Link Master I/O Device Communication Module Equipment Manual
- I/O Device Analog Inputs Equipment Manual

General information



The function manuals contain detailed descriptions on general topics relating to the SIMATIC ET 200eco PN M12-L distributed I/O system.
Examples:

- Function Manual Diagnostics
- Function Manual Communication
- PROFINET Function Manual
- Function Manual Designing Interference-free Controllers
- IO-Link System Function Manual
- MultiFieldbus Function Manual

1.2 Basic tools

The tools described below support you in all steps: from planning, over commissioning, all the way to analysis of your system.

TIA Selection Tool

The TIA Selection Tool tool supports you in the selection, configuration, and ordering of devices for Totally Integrated Automation (TIA).

As successor of the SIMATIC Selection Tools , the TIA Selection Tool assembles the already known configurators for automation technology into a single 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://support.industry.siemens.com/cs/ww/en/view/109767888)

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to perform commissioning and maintenance activities on various SIMATIC S7 stations as bulk operations independent of TIA Portal.

The SIMATIC Automation Tool offers a wide range of functions:

- Scanning of a PROFINET/Ethernet system network and identification of all connected CPUs
- Assignment of addresses (IP, subnet, Gateway) and device 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 through LED flashing
- Reading out of CPU error information
- Reading the CPU diagnostic 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) is a commissioning and diagnostic tool for PROFINET networks. PRONETA Basic has two core functions:

- In the network analysis, you get an overview of the PROFINET topology. Compare a real configuration with a reference installation or make simple parameter changes, e.g. to the names and IP addresses of the devices.
- The "IO test" is a simple and rapid test of the wiring and the module configuration of a plant, including documentation of the test results.

You can find SIEMENS PRONETA Basic on the Internet:
(https://support.industry.siemens.com/cs/ww/en/view/67460624)

SIEMENS PRONETA Professional is a licensed product that offers you additional functions. It offers you simple asset management in PROFINET networks and supports operators of automation systems in automatic data collection/acquisition of the components used through various functions:

- The user interface (API) offers an access point to the automation cell to automate the scan functions using MQTT or a command line.
- With PROFIenergy diagnostics, you can quickly detect the current pause mode or the readiness for operation of devices that support PROFIenergy and change these as needed.
- The data record wizard supports PROFINET developers in reading and writing acyclic PROFINET data records quickly and easily without PLC and engineering.

You can find SIEMENS PRONETA Professional on the Internet.
(https://www.siemens.com/proneta-professional)

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://new.siemens.com/global/en/products/automation/industrial-communication/profinet/sinetplan.html).

1.3 MultiFieldbus Configuration Tool (MFCT)

MultiFieldbus Configuration Tool

MultiFieldbus Configuration Tool (MFCT) is a PC-based software and supports the configuration of MultiFieldbus- and DALI-devices. In addition, the MFCT offers convenient options for mass firmware updates of ET 200 devices with MultiFieldbus- support and reading service data for many other Siemens devices.

Functional scope of the MFCT

- MultiFieldbus configuration:
  Engineering, configuration and diagnostics of MultiFieldbus-devices, provision of the required project files (project, UDT-, CSV- and EDS-file), transfer/export of the files to device and/or data memory.
- DALI configuration:
  Device selection and online configuration of DALI devices.
- TM FAST:
  Generation and download of FPGA-UPD- and FPGA-DB-files.
- Maintenance:
  Topology scan of a Ethernet network, reading of service data, parameter assignment and firmware update.
- Settings:
  Language switching German / English, network scanner speed, setting of the network adapter, installation of GSDML-and EDS-files.

System/installation requirements for MFCT

The MFCT runs under Microsoft Windows and does not require installation or administrator rights.

For MFCT you must also install the following software:

- Microsoft .NET Framework 4.8 (You can find an Offline Installer on the Internet. (https://support.microsoft.com/en-us/topic/microsoft-net-framework-4-8-offline-installer-for-windows-9d23f658-3b97-68ab-d013-aa3c3e7495e0))
- NPcap from directory "Misc"
- PG/PC interface from directory "Misc"
- Microsoft C++ Redistributable for x86-systems (you can find the installation data for download on the Internet. (https://aka.ms/vs/15/release/vc_redist.x86.exe))

The download of the tool and further information as well as documentation on the individual functions of the MFCT can be found on the Internet.
(https://support.industry.siemens.com/cs/de/en/view/109773881)

1.4 SIMATIC Technical Documentation

Additional SIMATIC documents will complete your information. You can find these documents and their use at the following links and QR codes.
The Industry Online Support gives you the option to get information on all topics. Application examples support you in solving your automation tasks.

Overview of the SIMATIC Technical Documentation

Here you will find an overview of the SIMATIC documentation available in Siemens Industry Online Support:

Industry Online Support International (https://support.industry.siemens.com/cs/ww/en/view/109742705)

Watch this short video to find out where you can find the overview directly in Siemens Industry Online Support and how to use Siemens Industry Online Support on your mobile device:

Quick introduction to the technical documentation of automation products per video (https://support.industry.siemens.com/cs/us/en/view/109780491)

YouTube video: Siemens Automation Products - Technical Documentation at a Glance (https://youtu.be/TwLSxxRQQsA)

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With "mySupport" you can get the most out of your Industry Online Support.

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CAx data	The CAx data area gives you access to the latest product data for your CAx or CAe system. You configure your own download package with a few clicks: • 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" on the Internet. (https://support.industry.siemens.com/My/ww/en)

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 can find the application examples on the Internet.
(https://support.industry.siemens.com/cs/ww/en/ps/ae)

Product overview

2

2.1 Properties

Article number

6ES7143-6BH00-0BB0

View of the I/O device

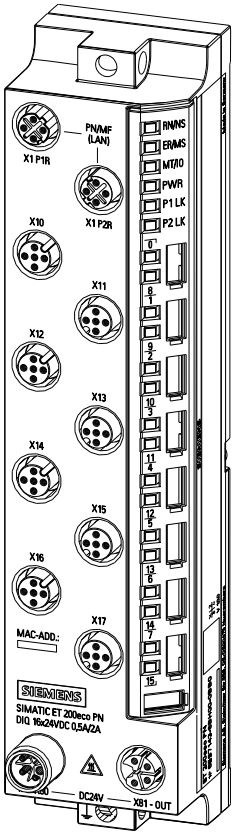


Figure 2-1 View of the I/O device DIQ 16x24VDC/0.5A/2A M12-L 8xM12

Properties

The I/O device has the following technical properties:

- Using the MultiFieldbus function, it connects the ET 200eco PN M12-L distributed I/O system with one of the following bus protocols:
  - PROFINET IO
  - EtherNet/IP
  - Modbus TCP
- 16 digital inputs/digital outputs, depending on configuration and parameter assignment
  - 8 DIQ signals connected to 1L+ (non-switched)
  - 8 DIQ signals connected to 2L+ (switched)
- M12 sockets for connection of sensors or actuators
- Digital inputs:
  - 24 V DC supply voltage
  - Configurable input delay 0.05 to 20 ms (per channel)
  - Configurable diagnostics can be set for each channel
  - Configurable hardware interrupt can be set for each channel
  - Suitable for switches and proximity switches
- Digital outputs:
  - Rated load voltage 24 V DC
  - Configurable diagnostics can be set for each channel
  - Output current per output 0.5 A at X10 to X13
    total current max. 2 A for group X10 to X13
  - Output current per output 2 A at X14 to X17
    total current max. 6 A for group X14 to X17
  - Suitable for solenoid valves, DC contactors, and indicator lights
- Integrated switch with 2 ports
- Dual assignment of the sockets
- Dimensions 45 x 200 mm

The I/O device supports the following functions:

- Firmware update
- Identification and maintenance data I&M0 to I&M3
- Value status (Quality Information)
- Module-internal Shared Input/Output (MSI/MSO)
- Shared device

Accessories

The following components are included in the I/O device package:

- Identification labels

Other components

The following component can be ordered as spare part:

- Identification labels

The following components can be ordered as accessories:

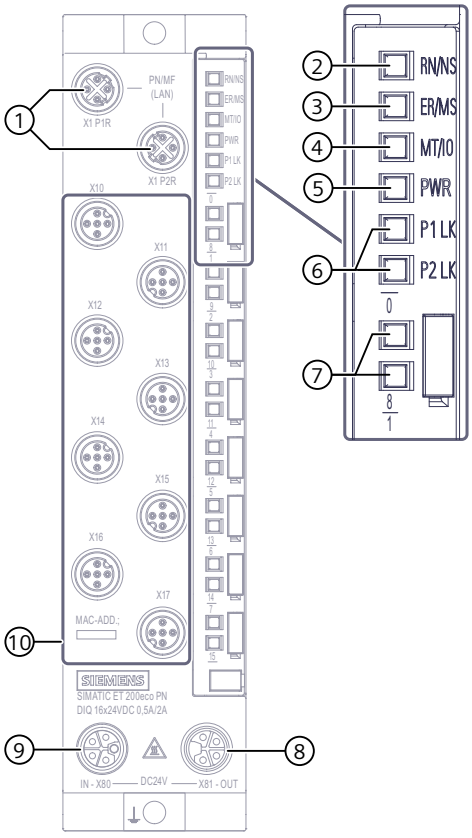
- Mounting rail
- Connectors and cables
- M12 sealing cap

See also

You can find additional information on the accessories in the ET 200eco PN M12-L distributed I/O system (https://support.industry.siemens.com/cs/ww/en/view/109778292) system manual.
See also Function Manual IO-Link System (https://support.industry.siemens.com/cs/us/en/view/65949252).

2.2 Operator controls and display elements

The figure below shows the operator controls and display elements of the DIQ 16x24VDC/0.5A/2A M12-L 8xM12 I/O device.



① PN/MF (LAN): Sockets for connecting MultiFieldbus
② RN/NS: RUN/network status LED
③ ER/MS: ERROR/module status LED
④ MT/IO: MAINT/IO status LED
⑤ PWR: Power LED for load voltage 2L+
⑥ P1 LK/P2 LK: LINK port status LEDs
⑦ LED displays 0 to 15 for channel status/channel error
⑧ X81: Socket for loop-through of the supply and load voltage
⑨ X80: Connector for infeed of supply and load voltage
⑩ X10 to X17: Sockets for the input/output signal

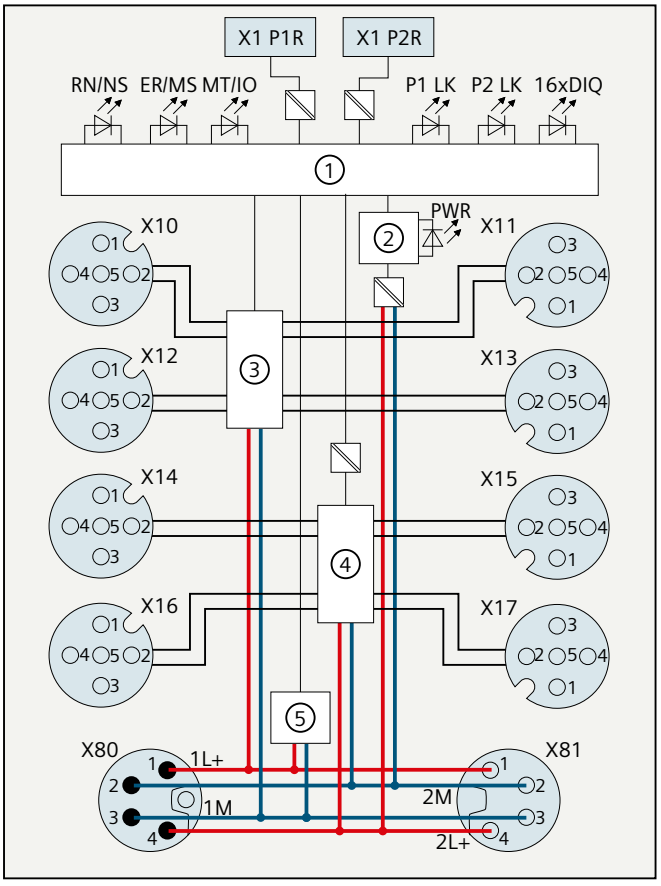
Figure 2-2 Operator controls and display elements

Wiring

3

3.1 Terminal and block diagram

The figure below shows an example of the connections and components of the I/O device.

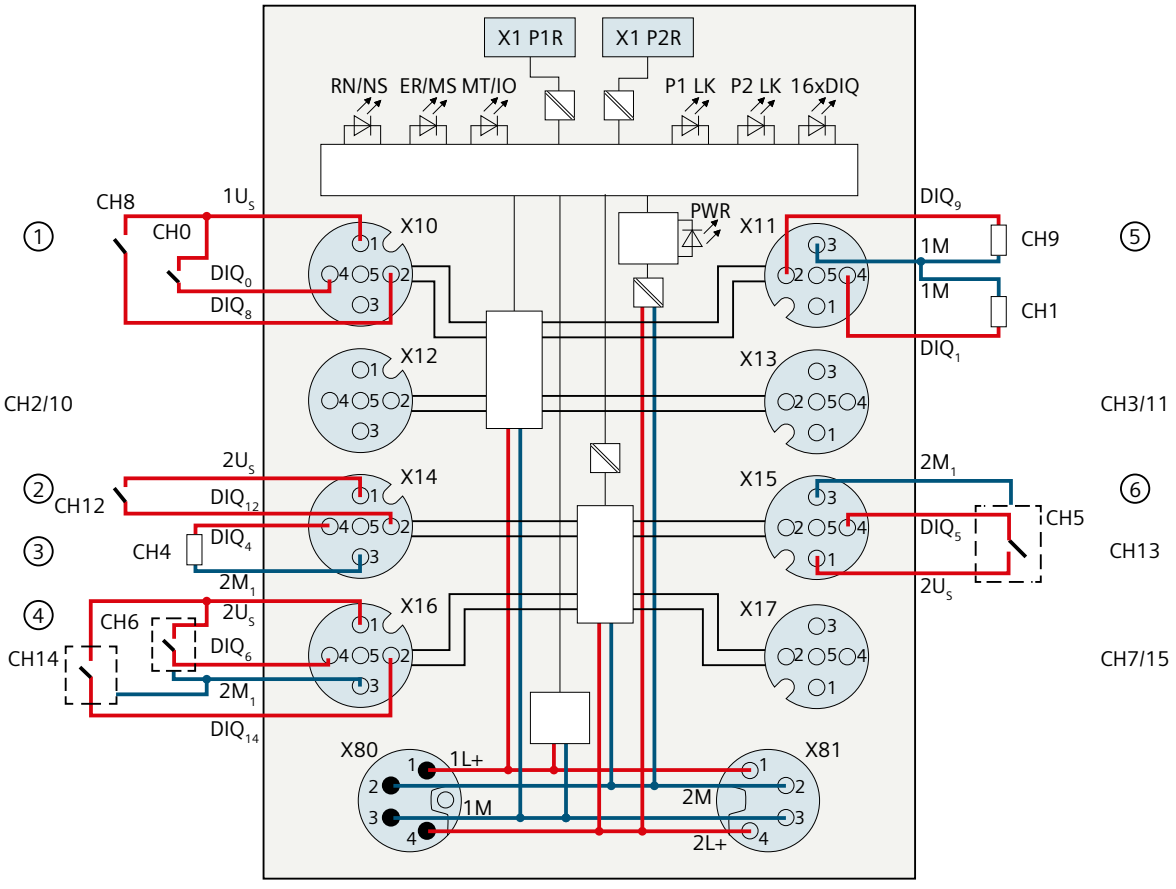


①	Bus interface with integrated 2-port switch	X10 to X17	Channels 0 to 15	RN/NS	RUN/network status LED
②	Monitoring	X1 P1R	MultiFieldbus interface X1 Port 1	ER/MS	ERROR/module status LED
③	DIQ circuit (1L+, 1M)	X1 P2R	MultiFieldbus interface X1 Port 2	MT/IO	MAINT/IO status LED
④	DIQ circuit (2L+, $2M_1$)	1L+	Supply voltage 1L+ (non-switched)	P1 LK	Link port 1 LED
⑤	Internal supply voltage	1M	Ground 1M (non-switched)	P2 LK	Link port 2 LED
X80	Infeed of supply and load voltage	2L+	Load voltage 2L+ (switched)	DIQ	Channel status/channel error LEDs
X81	Loop-through of supply and load voltage	2M	Ground 2M (switched)	PWR	LED load voltage 2L+

Figure 3-1 Block diagram

Terminal circuit diagram

The figure below shows an example of the pin assignment of signal outputs and signal inputs with single and dual assignment of the sockets.



①	Configured as inputs: 2-wire connection	⑥	Configured as input: 3-wire connection	2L+	Load voltage 2L+ (switched)
②	Configured as input: 2-wire connection	1L+	Supply voltage 1L+ (non-switched)	2M	Ground 2M (switched)
③	Configured as output	1M	Ground 1M (non-switched)	$2M_1$	Ground with reverse polarity protection, diverted from 2M (switched)
④	Configured as inputs: 3-wire connection	$1U_S$	24 V encoder supply (from 1L+)	$2U_S$	24 V encoder supply (from 2L+)
⑤	Configured as outputs	DIQ_n	Input/output signal		

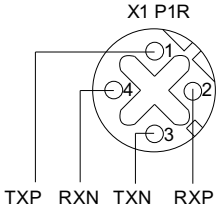
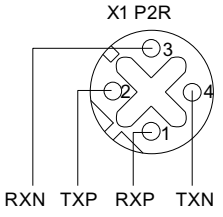
Figure 3-2 Terminal circuit diagram

3.2 Pin assignment

Pin assignment MultiFieldbus connector

The following table shows the pin assignment of the MultiFieldbus connector.

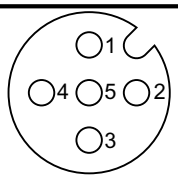
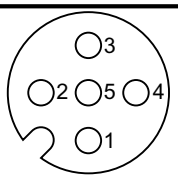
Table 3-1 Pin assignment of the MultiFieldbus connector, port 1 and 2

Pin	Assignment of the core color of the PROFINET cable	Assignment	Front view of the connectors
Assignment X1 P1R			
1	Yellow	TXP	
2	White	RXP	
3	Orange	TXN	
4	Blue	RXN	
Thread		Functional earth FE	
Assignment X1 P2R			
1	Yellow	RXP	
2	White	TXP	
3	Orange	RXN	
4	Blue	TXN	
Thread		Functional earth FE	

Pin assignment of the sockets for digital inputs/digital outputs

The tables below show the pin assignments of the 8 sockets for connection of the digital inputs/digital outputs.

Table 3-2 Pin assignment for digital inputs/digital outputs

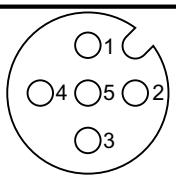
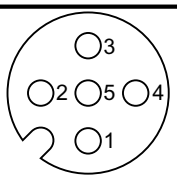
Pin	Assignment	Front view of the sockets	
	X10 to X13 - sockets for digital inputs/digital outputs	**X10, X12**	**X11, X13**
1	24 V encoder supply $1U_S$ (derived from 1L+ non-switched)		
2	Connector X10: Input/output signal DIQ_8 Connector X11: Input/output signal DIQ_9 Connector X12: Input/output signal DIQ_{10} Connector X13: Input/output signal DIQ_{11}		
3	Ground 1M		
4	Connector X10: Input/output signal DIQ_0 Connector X11: Input/output signal DIQ_1 Connector X12: Input/output signal DIQ_2 Connector X13: Input/output signal DIQ_3		
5	Functional earth FE		

NOTICE

24 V encoder supply $1U_S$

Use only the 24 V encoder supply $1U_S$ provided by the I/O device to supply power to the encoders.

Table 3-3 Pin assignment for digital inputs/digital outputs

Pin	Assignment	Front view of the sockets	
	X14 to X17 - sockets for digital inputs/digital outputs	**X14, X16**	**X15, X17**
1	24 V encoder supply $2U_S$ (derived from 2L+ switched)		
2	Connector X14: Input/output signal DIQ_{12} Connector X15: Input/output signal DIQ_{13} Connector X16: Input/output signal DIQ_{14} Connector X17: Input/output signal DIQ_{15}		
3	Ground $2M_1$		
4	Connector X14: Input/output signal DIQ_4 Connector X15: Input/output signal DIQ_5 Connector X16: Input/output signal DIQ_6 Connector X17: Input/output signal DIQ_7		
5	Functional earth FE		

NOTICE

24 V encoder supply $2U_S$

Use only the 24 V encoder supply $2U_S$ provided by the I/O device to supply power to the encoders.

NOTICE

Reverse polarity protection

To guarantee reverse polarity protection, use the ground $2M_1$ supplied by the I/O device at pin 3 of the respective socket.

Reverse polarity protection is suspended for a connection of 2M and $2M_1$.

NOTE

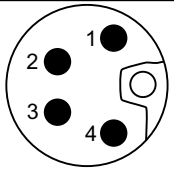
Safety-related shutdown

If you use the digital outputs for safety-related shutting down, follow the information in the System Manual in the "Safety-related shutdown" chapter. See also: ET200 ecoPN M12-L System Manual (https://support.industry.siemens.com/cs/ww/en/view/109778292)

Pin assignment of the connector for infeed of the supply voltage (M12 L-coded)

The table below shows the pin assignment of the M12 L-coded connector for infeed of the supply voltage.

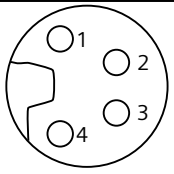
Table 3-4 Pin assignment of the supply voltage connector

Pin	Assignment of the core color of the power cable	Assignment **X80 - connector (POWER input)**	Front view of the connector
1	Brown	Supply voltage 1L+ (non-switched)	
2	White	Ground 2M (switched)	
3	Blue	Ground 1M (non-switched)	
4	Black	Load voltage 2L+ (switched)	

Pin assignment of the socket for loop-through of the supply voltage (M12 L-coded)

The table below shows the pin assignment of the M12 L-coded socket for loop-through of the supply voltage.

Table 3-5 Pin assignment of the supply voltage socket

Pin	Assignment of the core color of the power cable	Assignment **X81 - socket (POWER output)**	Front view of the socket
1	Brown	Supply voltage 1L+ (non-switched)	
2	White	Ground 2M (switched)	
3	Blue	Ground 1M (non-switched)	
4	Black	Load voltage 2L+ (switched)	

PROFINET IO

4

4.1 Parameters/address space

4.1.1 Parameters

The table below shows the parameters for the I/O device DIQ 16x24VDC/0.5A/2A M12-L 8xM12.

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

Parameters	Value range	Default	Scope with configuration software, e.g. STEP 7 (TIA Portal)
Diagnostics: Low voltage 1L+	• Deactivated • Activated	Deactivated	Channel
Diagnostics: Missing 2L+	• Deactivated • Activated	Deactivated	Channels 4...7, 12...15
Diagnostics: Short-circuit	• Deactivated • Activated	Deactivated	Channel
Diagnostics: Wire break detection and alarm	• Deactivated • Activated	Deactivated	Channel (Digital inputs)
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	Channel (Digital inputs)
Hardware interrupt on rising edge	• Deactivated • Activated	Deactivated	Channel (Digital inputs)
Hardware interrupt on falling edge	• Deactivated • Activated	Deactivated	Channel (Digital inputs)
Configuration mode	• DI • DQ	DI	Channel
Reaction to CPU STOP	• Shutdown • Keep last value • Output substitute value 1	Shutdown	Channel (Digital outputs)

4.1.2 Explanation of the parameters

Diagnostics: Low voltage 1L+

Enabling of the diagnostics for insufficient supply voltage 1L+.
Diagnostics: Low voltage 1L+ triggers the "Undervoltage" maintenance event. You can find more information in section Maintenance events (Page 38).

Diagnostics: Missing 2L+

Enabling of the diagnostics for missing or insufficient load voltage 2L+.

NOTE

This diagnostics is only available for channels supplied with 2L+ voltage.

Diagnostics: Short-circuit

Enable diagnostics:

- for short-circuit of the encoder supply to ground.
- for short-circuit of the output to ground.
- for short-circuit of the output to 1L+ or 2L+.

Diagnostics: Wire break detection and alarm

Activates wire break detection and enabling of diagnostics for the digital input. In the event of an interruption of the line between the encoder and I/O device, a diagnostic message is generated.

NOTE

- This diagnostics is only available for channels configured as inputs.
- Influence on the value status:
  If the parameter is deactivated, wire break detection is switched off. A wire break does not have an effect on the value status.

Input delay

This parameter can be used to suppress signal interference. Changes to the signal are only detected if they are present consistently for 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.

Hardware interrupt on rising edge

Specifies whether a hardware interrupt is generated for a rising edge on the channel.
A hardware interrupt is only generated for the channel when there is a fault-free signal (value status/QI = 1). This means no diagnostics is pending for the channel. See also: Address space (Page 26)

Hardware interrupt on falling edge

Specifies whether a hardware interrupt is generated for a falling edge on the channel.
A hardware interrupt is only generated for the channel when there is a fault-free signal (value status/QI = 1). This means no diagnostics is pending for the channel. See also: Address space (Page 26)

Configuration mode

Specifies whether the channel operates as digital input (DI) or digital output (DQ).

Reaction to CPU STOP

With this parameter, you set the reaction of the digital outputs of the I/O device after a CPU STOP:

- Shutdown: The digital output is de-energized.
- Keep last value: The last value of the digital output remains activated.
- Output substitute value 1: The I/O device outputs the substitute value "1".

4.1.3 Address space

The DIQ 16x24VDC/0.5A/2A M12-L 8xM12 I/O device can be configured differently; see following table. Depending on the configuration, additional/different addresses are assigned in the process images.

Configuration options of the DIQ 16x24VDC/0.5A/2A M12-L 8xM12 I/O device

You can configure the I/O device Digital Inputs / Outputs like this:

- With STEP 7 (TIA Portal)
- With GSD file in any configuration software

When you configure the I/O device by means of the GSD file, the configurations are available under different short designations/device names in the device view of your configuration software.

The following configurations are possible:

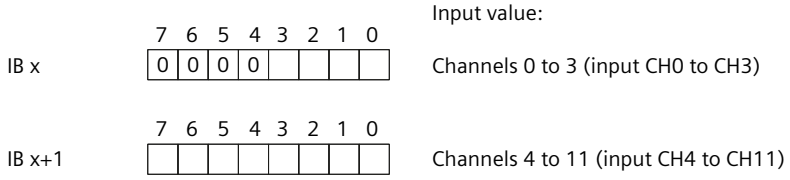
Table 4-2 Configuration options

Configuration	Short designation/ device name in the GSD file (device view in the configuration software)	Configuration software, e.g., with STEP 7 (TIA Portal)	
		Integrated in hardware catalog STEP 7 (TIA Portal)	GSD file in STEP 7 (TIA Portal) V11 or higher or STEP 7 V5.5 SP4 HF1 or higher
1 x 16-channel DIQ 16x24VDC	DIQ 16x24VDC/0.5A/2A	V16 or higher with HSP 0299	X
1 x 16-channel DIQ 16x24VDC QI	DIQ 16x24VDC/0.5A/2A, QI	V16 or higher with HSP 0299	X
1 x 16-channel DIQ 16x24VDC MSI/MSO	DIQ 16x24VDC/0.5A/2A, MSI/MSO	V16 or higher with HSP 0299	X
2 x 8-channel DIQ 16x24VDC S	DIQ 16x24VDC/0.5A/2A, S	-	X

Address space for configuration as 1 x 16-channel DIQ 16x24VDC

The following figure shows the address space allocation for the configuration as 16-channel I/O device with digital inputs/digital outputs without value status. The start address for the I/O device can be assigned freely. The addresses of the channels are derived from the start address.

Assignment in the process image input (PII)



Assignment in the process image output (PIQ)

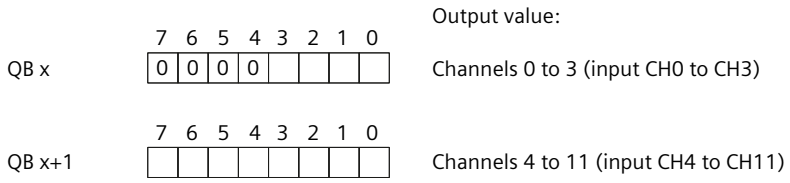


Figure 4-1 Address space for configuration as 1 x 16-channel DIQ 16x24VDC without value status

Value status (Quality Information, QI)

The value status is always returned with the following configuration options:

- DIQ 16x24VDC/0.5A/2A, QI
- DIQ 16x24VDC/0.5A/2A, MSI/MSO

Evaluating the value status

An additional 4 bytes are occupied in the input address space if you enable the value status for the I/O device. Bits 0 to 15 in these bytes are assigned to a channel and return information about the validity of the digital input/digital output value.

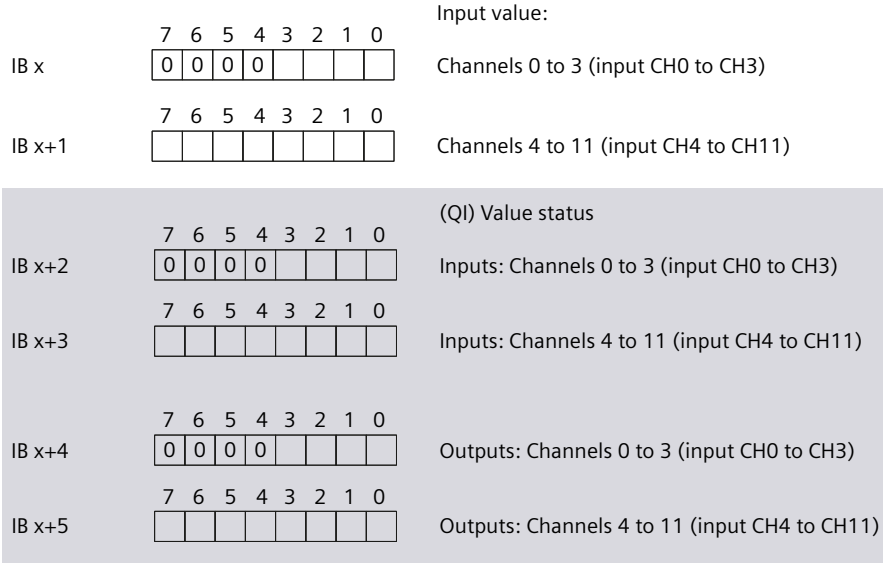
Bit = 1: No error on channel.

Bit = 0: Error on channel.

Address space for configuration as 1 x 16-channel DIQ 16x24VDC QI

The following figure shows the address space allocation for the configuration as 16-channel I/O device with digital inputs/digital outputs with value status. The start address for the I/O device can be assigned freely. The addresses of the channels are derived from the start address.

Assignment in the process image input (PII)



0 = Value read in at the channel is incorrect

Assignment in the process image output (PIQ)

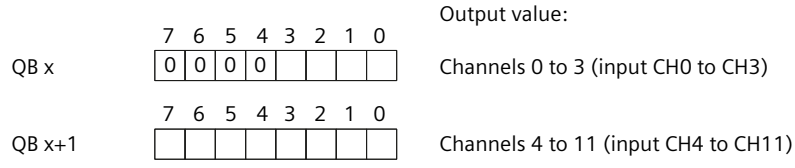


Figure 4-2 Address space for configuration as 1 x 16-channel DIQ 16x24VDC QI with value status

Address space for configuration as 1 x 16-channel DIQ 16x24VDC MSI/MSO

The 1st submodule (= basic submodule) behaves like a 1 x 16-channel DIQ 16x24VDC. The value status (Quality Information, QI) is always activated for the submodule. Diagnostics and hardware interrupts are signaled for this submodule.

The outputs and inputs of the 1st submodule are copied into the 2nd submodule (= MSI/MSO submodule). You cannot assign parameters to the 2nd submodule. No diagnostics or hardware interrupts are signaled for this submodule. Instead of diagnostics, the 2nd submodule always signals the value status (Quality Information, QI).

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

The submodules can be assigned to two IO controllers when the I/O device is used in a shared device:

- The IO controller to which submodule 1 is assigned has **read** and **write** access to inputs/outputs 0 to 15.
- The IO controller to which submodule 2 is assigned has **read** access to inputs/outputs 0 to 15.

Value status (Quality Information, QI)

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

For the 1st submodule (basic submodule)

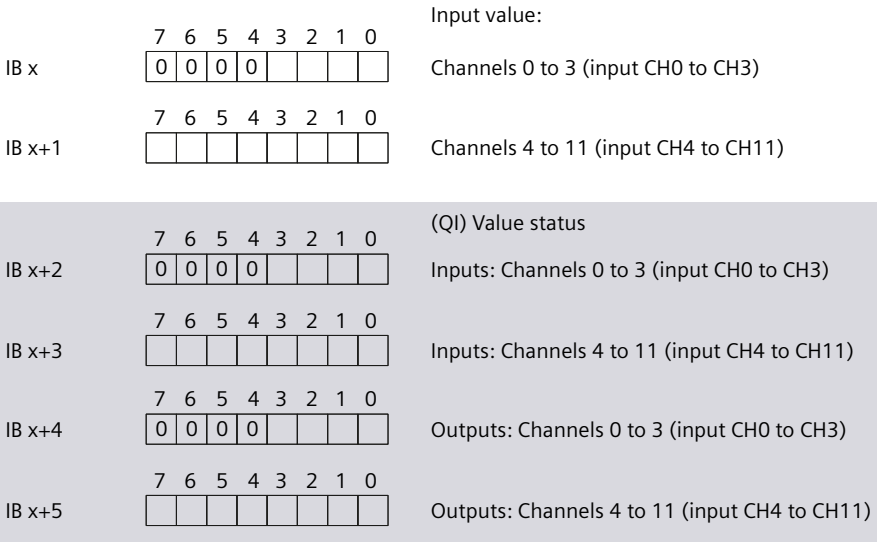
- Configuration mode DI: The value status 0 indicates that the value is incorrect.
- Configuration mode DQ: The value status 0 indicates that the value is incorrect or that the IO controller of the basic submodule is in STOP state.

For the 2nd submodule (= MSI/MSO submodule), the value status 0 indicates that the value is incorrect or one of the following errors has occurred:

- The basic submodule is not yet assigned parameters or the parameter assignment is incorrect (not ready).
- The connection between the IO controller and the basic submodule has been interrupted.

The following figure shows the assignment of the address space with submodules 1 and 2 and the value status.

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



Assignment in the process image output (PIQ) for 1st submodule (basic submodule)

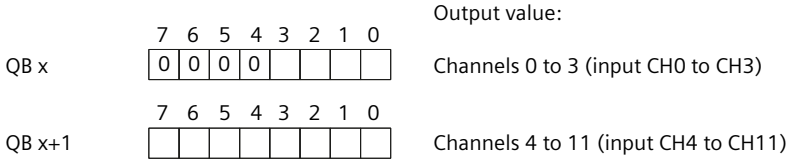


Figure 4-3 Address space for configuration as 1 x 16-channel DIQ 16x24VDC QI with value status (basic submodule)

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

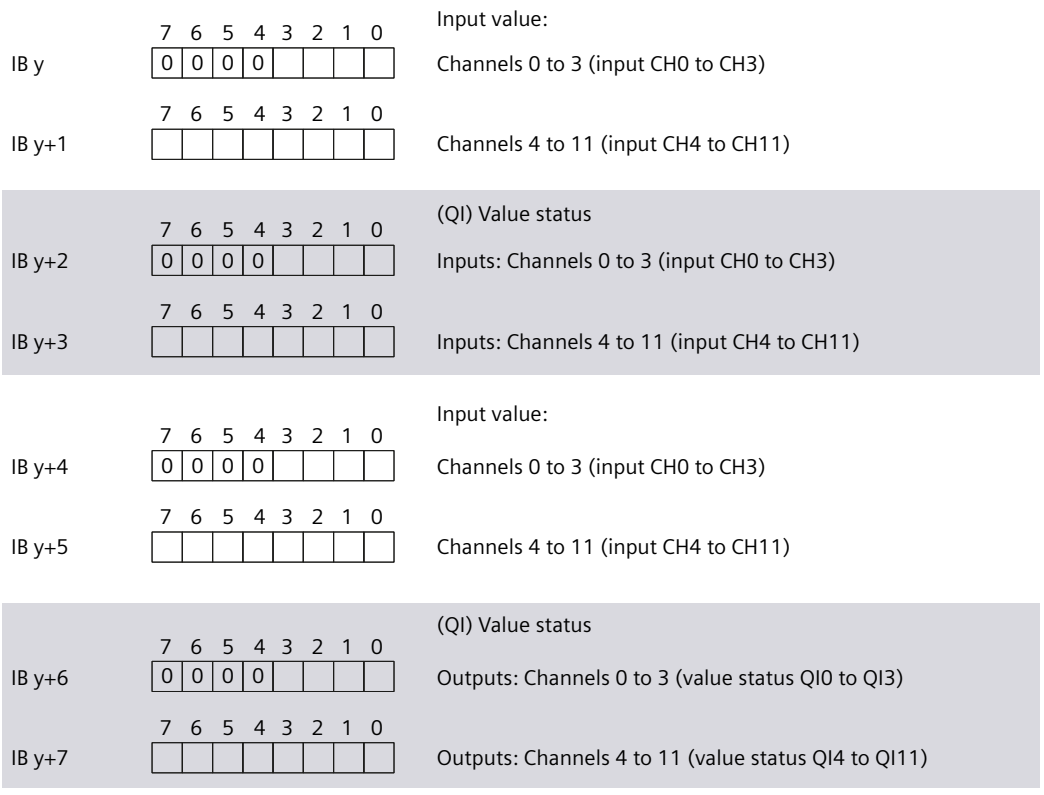


Figure 4-4 Address space for configuration as 1 x 16-channel DIQ 16x24VDC MSI/MSO with value status (MSI/MSO submodule)

Reference

You can find information on the functionality **Module-internal Shared Input/Shared Output (MSI/MSO)** in the STEP 7 online help or in the function manual SIMATIC PROFINET with STEP 7 (https://support.industry.siemens.com/cs/ww/en/view/49948856).

Address space for configuration as 2 x 8-channel DIQ 16x24VDC S

The figure below shows the address space assignment for configuration as a 2 x 8-channel I/O device with digital inputs/digital outputs without value status. Each of the two submodules has a freely assignable start address.

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

	7	6	5	4	3	2	1	0	Input value:
IB x	0	0	0	0					Channel 0 to 3 (input CH0 to CH3)
IB x+1	0	0	0	0					Channels 8 to 11 (input CH8 to CH11)

Assignment in the process image output (PIQ) for 1st submodule

	7	6	5	4	3	2	1	0	Output value:
QB x	0	0	0	0					Channels 0 to 3 (output CH0 to CH3)
QB x+1	0	0	0	0					Channels 8 to 11 (output CH8 to CH11)

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

	7	6	5	4	3	2	1	0	Input value:
IB y	0	0	0	0					Channels 4 to 7 (input CH4 to CH7)
IB y+1	0	0	0	0					Channels 12 to 15 (input CH12 to CH15)

Assignment in the process image output (PIQ) for 2nd submodule

	7	6	5	4	3	2	1	0	Output value:
QB y	0	0	0	0					Channels 4 to 7 (output CH4 to CH7)
QB y+1	0	0	0	0					Channels 12 to 15 (output CH12 to CH15)

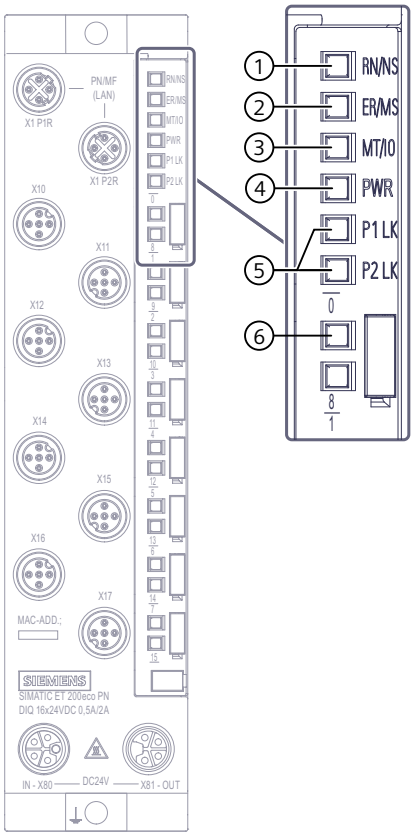
Figure 4-5 Address space for configuration as 2 x 8-channel DIQ 16x24VDC S without value status

4.2 Interrupts/diagnostics alarms

4.2.1 Status and error displays

LED displays

The figure below shows the LED displays (status and error displays) of the I/O device DIQ 16x24VDC/0.5A/2A M12-L 8xM12.



① RN/NS: RUN/network status LED
② ER/MS: ERROR/module status LED
③ MT/IO: MAINT/IO status LED
④ PWR: Power LED for load voltage 2L+
⑤ P1 LK/P2 LK: LINK port status LEDs
⑥ LED displays 0 to 15 for channel status/channel error

Figure 4-6 LED displays

Meaning of the LEDs

The following tables set out the meaning of the status and error displays. Measures for dealing with diagnostics alarms can be found in the section Diagnostics alarms (Page 37-38).

Behavior of the LEDs RN/NS (RUN/network status), ER/MS (ERROR/module status) and MT/IO (MAINT/IO status) on PROFINET

Table 4-3 Error display of the LEDs

LEDs			Meaning	Solution
RN/ NS	ER/ MS	MT/ IO		
Off	Off	Off	Missing or insufficient supply voltage at the I/O device.	Check the supply voltage.
On	On	On	Test of LEDs during startup: The three LEDs light up simultaneously for approximately 0.25 s.	---
			The three LEDs light up simultaneously for approximately 2 s while "Reset to factory settings" is running.	---
Flashes	Off	Off	The ET 200eco PN is disabled.	Activate the ET 200eco PN with the configuration software or via the user program.
			The ET 200eco PN is not or incorrectly configured.	Configure the ET 200eco PN via the configuration software.
			The ET 200eco PN is starting up.	---
			The ET 200eco PN is being assigned parameters.	
			Loading firmware (when the firmware update is performed during startup, all LEDs retain their current status)	
On	Not relevant	Not relevant	The ET 200eco PN is currently exchanging data with the IO controller.	
Not relevant	Flashes	Not relevant	Module diagnostics is available	Evaluate the diagnostics and eliminate the error.
			The preset configuration does not match the actual configuration.	Check the configuration of the ET 200eco PN.
			Parameter error	Correct the errors in the parameter assignment.
Not relevant	Not relevant	On	Maintenance	Evaluate the maintenance events.
Flashes	Flashes	Flashes	The "Node flash test" is running (the P1 LK and P2 LK LEDs of the PROFINET interface are also flashing).	---
			Hardware or firmware defective. (The P1 LK and P2 LK LEDs of the PROFINET interface are **not** flashing).	Replace the ET 200eco PN I/O device.

PWR LED

Table 4-4 Status display of the PWR LED

PWR LED	Meaning
□ Off	Load voltage 2L+ is missing or too low
■ On	Load voltage 2L+ present

P1 LK and P2 LK LEDs

Table 4-5 Error display of the P1 LK and P2 LK LEDs

LEDs		Meaning	Solution
P1 LK	P2 LK		
□ Off		There is **no** Ethernet connection between the communications interface of your IO device and a communication partner (e.g. IO controller).	Check whether the bus cable to the switch/communication partner is interrupted.
■ On		There is an Ethernet connection between the communications interface of your IO device and a communication partner (e.g. IO controller).	---
☼ Flashes		The "Node flash test" is running (the RN/NS, ER/MS and MT/IO LEDs also flash).	---
		Communications: a physical connection exists, communication is not possible, however.	Check the PROFINET IO settings.

Channel status/channel error LEDs

Table 4-6 Status and error display of the channel status/channel error LEDs

LEDs	Meaning
Channel status/channel error	
□ Off	Process value = 0
■ On	Process value = 1
■ On	Channel diagnostics

4.2.2 Interrupts

The I/O device digital inputs DIQ 16x24VDC/0.5A/2A M12-L 8xM12 supports diagnostic and maintenance interrupts.

Diagnostic interrupt

The I/O device generates a diagnostic interrupt on the following events:

- Wire break
- Internal module fault
- Parameter error
- Hardware interrupt lost
- 2L+ missing or too low
- Short-circuit

Maintenance alarm

The I/O device generates a maintenance alarm on the following event:

- Low voltage 1L+

Hardware interrupt

If the fault-free signal (value status/QI = 1) is pending at the channel, meaning no diagnostic error interrupt, the I/O device generates a hardware interrupt for the following events:

- Rising edge
- Falling edge

4.2.3 Alarms

4.2.3.1 Diagnostics alarms

A diagnostics alarm is output for each diagnostics event. On the I/O device DIQ 16x24VDC/0.5A/2A M12-L 8xM12 the LED ER/MS flashes red. You can read out the diagnostics alarms in the diagnostics buffer of the CPU, for example. You can evaluate the error codes with the user program.

NOTE

Wiring two outputs in parallel

For parallel connection of two outputs for redundant control of a load, deactivate the channel diagnostics "Wire break" and "Short-circuit to L+".

Uncouple the parallel switched outputs via external diodes.

Table 4-7 Diagnostics alarms, their meanings and corrective measures

Diagnostics alarm	Error code	Meaning	Corrective measures
Wire break	6_H	Fault in the external circuitry	Check the external circuitry and correct the fault.
		Encoder faulty	Replace the encoder.
		Impedance of encoder circuitry is too high	Use a different encoder type or modify the wiring. For example, use cables with a larger cross-section.
		Interruption of cable between the I/O device and sensor.	Establish the connection.
		Channel not connected (open)	• Disable diagnostics • Connect a resistor of 25 kΩ to 45 kΩ to the encoder contacts.
Parameter error	10_H	• I/O device cannot evaluate parameters for the channel • Incorrect parameter assignment	Correct the parameter assignment.
Load voltage 2L+ missing	11_H	Load voltage 2L missing or too low.	Check the supply voltage on the I/O device.
Hardware interrupt lost	16_H	The I/O device cannot trigger an interrupt because the previous interrupt was not acknowledged; possible configuration error	• Change the interrupt handling on the CPU and reassign the parameters to the I/O device, if necessary. • The error persists until the I/O device is assigned new parameters.
Short-circuit	105_H	Short-circuit to L+	• Correct the process wiring. • Replace the defective encoder/actuator.
	106_H	Short-circuit to ground	

4.2.3.2 Maintenance events

Triggering of a maintenance event

The MultiFieldbus interfaces of the ET 200eco PN M12-L support the diagnostics concept and maintenance concept in PROFINET according to the IEC 61158-6-10 standard. The goal is to detect and remove potential problems as soon as possible.
The I/O device signals a maintenance event to the higher-level diagnostic system on the following event:

Table 4-8 Triggering of a maintenance event

Maintenance alarm	Error code	Event	Meaning
Maintenance demanded MT/IO LED is lit	2_H	Undervoltage	Supply voltage 1L+ is below the tolerance limit.

System alarms in STEP 7

The maintenance information is generated in STEP 7 with the following system alarms:

- Maintenance demanded - indicated for each port by a yellow wrench icon in the device view or in the hardware configuration.

You can find additional information in the STEP 7 online help.

4.2.3.3 Hardware interrupts

During a hardware interrupt, the CPU interrupts processing of the user program and processes the hardware interrupt organization block.
For detailed information on the event, refer to the hardware interrupt organization block with the "RALRM" instruction (read additional interrupt info) and to the STEP 7 online help.
The information on which channel of the I/O device triggered the hardware interrupt is entered in the start information of the organization block. The figure below shows the assignment to the bits of the local data double word 8.

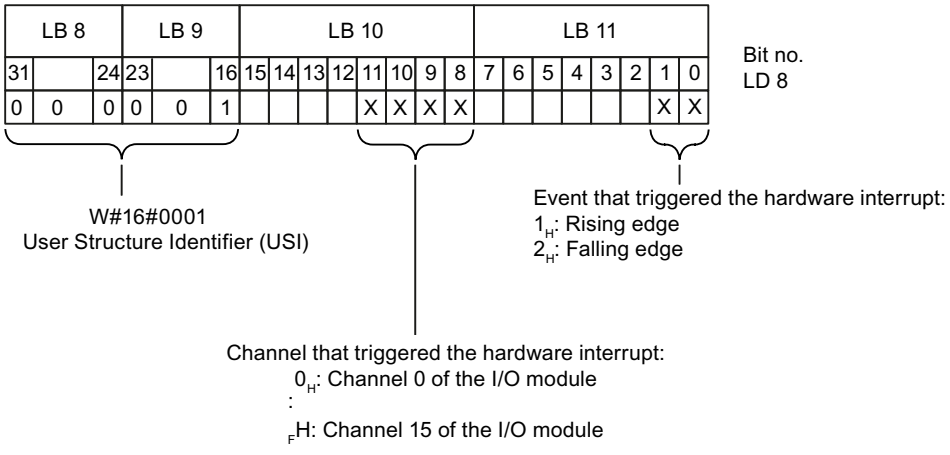


Figure 4-7 Start information of the organization block

EtherNet/IP

5

5.1 Functions/parameters/address space

5.1.1 Supported EtherNet/IP functions

Supported functions

The table below shows the functions that the I/O device supports with EtherNet/IP.

Supported functions	Remarks
I/O communication with scanner	FW 5.1.x or higher
Parameter assignment	FW 5.1.x or higher
Reading diagnostics	FW 5.1.x or higher
Normative CIP objects	FW 5.1.x or higher
Reset to factory settings	FW 5.1.x or higher
Diagnostics bit in data status of cyclic I/O data per submodule	FW 5.1.x or higher
Shared device functions	FW 5.1.x or higher
EtherNet/IP basic service	FW 5.1.x or higher
Reading events (hardware interrupts)	FW 5.1.x or higher
Data record interface	FW 5.1.x or higher

Supported diagnostics

The table below shows the diagnostics that the I/O device supports with EtherNet/IP.

Supported diagnostics	Remarks
Reading diagnostics via CIP EtherNet/IP	FW 5.1.x or higher
Reading diagnostics with MFCT	FW 5.1.x or higher
Reading hardware interrupt via CIP EtherNet/IP	FW 5.1.x or higher
PULL/PLUG event EtherNet/IP	FW 5.1.x or higher
Reading service data with MFCT	FW 5.1.x or higher

Supported CIP objects for EtherNet/IP

The table below shows the CIP objects that the I/O device supports with EtherNet/IP.

Supported CIP objects	Remarks
Identity object	FW 5.1.x or higher
Assembly object	FW 5.1.x or higher
Connection Manager object	FW 5.1.x or higher
TCP/IP Interface object	FW 5.1.x or higher
EtherNet Link object	FW 5.1.x or higher
LLDP Management object	FW 5.1.x or higher
LLDP Data Table object	FW 5.1.x or higher
Param object	FW 5.1.x or higher

5.1.2 Parameters

The table below shows the parameters for the I/O device DIQ 16x24VDC/0.5A/2A M12-L 8xM12.

Table 5-1 Configurable parameters and their defaults (GSD file)

Parameters	Value range	Default	Effective range with configuration software, for example, MFCT
Diagnostics: Low voltage 1L+	• Deactivated • Activated	Deactivated	Channel
Diagnostics: Missing 2L+	• Deactivated • Activated	Deactivated	Channels 4...7, 12...15
Diagnostics: Short-circuit	• Deactivated • Activated	Deactivated	Channel
Diagnostics: Wire break detection and alarm	• Deactivated • Activated	Deactivated	Channel (Digital inputs)
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	Channel (Digital inputs)
Hardware interrupt on rising edge	• Deactivated • Activated	Deactivated	Channel (Digital inputs)

Parameters	Value range	Default	Effective range with configuration software, for example, MFCT
Hardware interrupt on falling edge	• Deactivated • Activated	Deactivated	Channel (Digital inputs)
Configuration mode	• DI • DQ	DI	Channel
Reaction to CPU STOP	• Shutdown • Keep last value • Output substitute value 1	Shutdown	Channel (Digital outputs)

5.1.3 Explanation of the parameters

Diagnostics: Low voltage 1L+

Enabling of the diagnostics for insufficient supply voltage 1L+.

Diagnostics: Missing 2L+

Enabling of the diagnostics for missing or insufficient load voltage 2L+.

NOTE

This diagnostics is only available for channels supplied with 2L+ voltage.

Diagnostics: Short-circuit

Enable diagnostics:

- for short-circuit of the encoder supply to ground.
- for short-circuit of the output to ground.
- for short-circuit of the output to 1L+ or 2L+.

Diagnostics: Wire break detection and alarm

Activates wire break detection and enabling of diagnostics for the digital input in case of an interruption of the cable between the encoder and I/O device.

NOTE

- This diagnostics is only available for channels configured as inputs.
- Influence on the value status:
  If the parameter is deactivated, wire break detection is switched off. A wire break does not have an effect on the value status.

Input delay

This parameter can be used to suppress signal interference. Changes to the signal are only detected if they are present consistently for 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.

Hardware interrupt on rising edge

Specifies whether a hardware interrupt is generated via the data status on a rising edge on the channel. The hardware interrupt information can be read and confirmed via CIP EtherNet/IP.

A hardware interrupt is only generated for the channel when there is a fault-free signal (value status/QI = 1). This means no diagnostics is pending for the channel. See also: Address space (Page 44)

Hardware interrupt on falling edge

Specifies whether a hardware interrupt is generated via the data status on a falling edge on the channel. The hardware interrupt information can be read and confirmed via CIP EtherNet/IP.

A hardware interrupt is only generated for the channel when there is a fault-free signal (value status/QI = 1). This means no diagnostics is pending for the channel. See also: Address space (Page 44)

Configuration mode

Specifies whether the channel operates as digital input (DI) or digital output (DQ).

Reaction to CPU STOP

With this parameter, you set the reaction of the digital outputs of the I/O device after a CPU STOP:

- Shutdown: The digital output is de-energized.
- Keep last value: The last value of the digital output remains activated.
- Output substitute value 1: The I/O device outputs the substitute value "1".

5.1.4 Update time of the I/O data

You can estimate the typical update time for an I/O cycle as follows:

RPI timer (settable from 2 to 20 ms ± 10 %) default 10 ms

+ I/O processing (typically 1.4 ms, ± 1 ms jitter due to free-running cycles)

+ EM conversion (dependent on cycle time and parameter assignment of the module)

If necessary, you must take into account other influences caused by the EIP scanner and network components by adding them.

5.1.5 Address space

The DIQ 16x24VDC/0.5A/2A M12-L 8xM12 I/O device can be configured differently; see following table. Depending on the configuration, additional/different addresses are assigned in the process images.

Configuration options of the DIQ 16x24VDC/0.5A/2A M12-L 8xM12 I/O device

When the I/O device is configured using a GSD file, the configurations are available under different short designations/device names in the device view of MFCT.

The following configurations are possible:

Table 5-2 Configuration options

Configuration	Short designation/ device name in the GSD file (device view in the configuration software)	Configuration software, e.g. with MFCT
		GSD file in MFCT V1.3 SP1 or higher
1 x 16-channel DIQ 16x24VDC	DIQ 16x24VDC/0.5A/2A	X
1 x 16-channel DIQ 16x24VDC QI	DIQ 16x24VDC/0.5A/2A, QI	X
1 x 16-channel DIQ 16x24VDC MSI/MSO	DIQ 16x24VDC/0.5A/2A, MSI/MSO	X
2 x 8-channel DIQ 16x24VDC S	DIQ 16x24VDC/0.5A/2A, S	X

Address space for configuration as 1 x 16-channel DIQ 16x24VDC

The following figure shows the address space allocation for the configuration as 16-channel I/O device with digital inputs/digital outputs without value status. The addresses of the channels are derived from the start address.

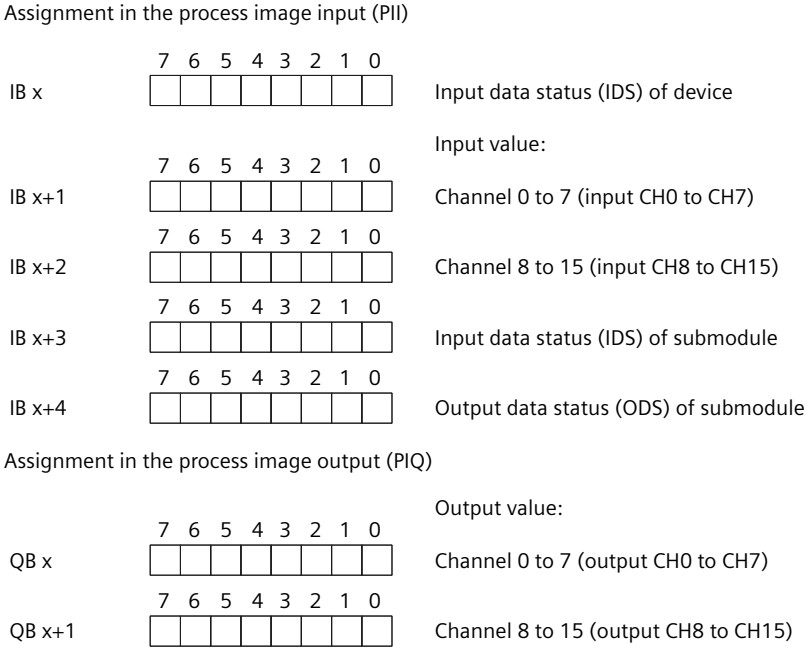


Figure 5-1 Address space for configuration as 1 x 16-channel DIQ 16x24VDC without value status

Value status (Quality Information, QI)

The value status is always returned with the following configuration options:

- DIQ 16x24VDC/0.5A/2A, QI
- DIQ 16x24VDC/0.5A/2A, MSI/MSO

Evaluating the value status

An additional 4 bytes are occupied in the input address space if you enable the value status for the I/O device. Bits 0 to 15 are assigned to a channel and provide information about the validity of the digital input/digital output value.

Bit = 1: No error on channel.

Bit = 0: Error on channel.

Address space for configuration as 1 x 16-channel DIQ 16x24VDC QI

The following figure shows the address space allocation for the configuration as 16-channel I/O device with digital inputs/digital outputs with value status. The addresses of the channels are derived from the start address.

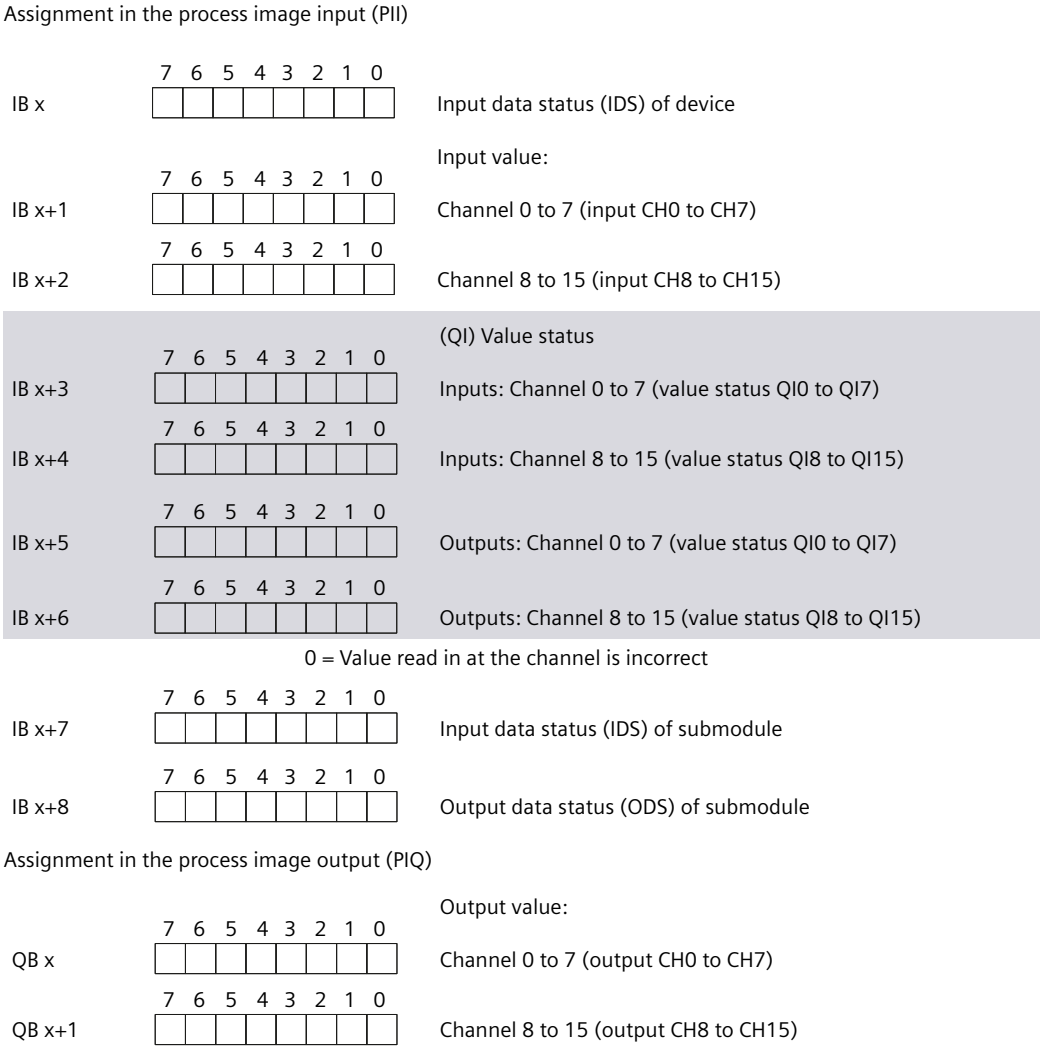


Figure 5-2 Address space for configuration as 1 x 16-channel DIQ 16x24VDC QI with value status

Address space for configuration as 1 x 16-channel DIQ 16x24VDC MSI/MSO

The 1st submodule (= basic submodule) behaves like a 1 x 16-channel DIQ 16x24VDC. The value status (Quality Information, QI) is always activated for the submodule. Diagnostics and hardware interrupts are signaled for this submodule.

The outputs and inputs of the 1st submodule are copied into the 2nd submodule (= MSI/MSO submodule). You cannot assign parameters to the 2nd submodule. No diagnostics or hardware interrupts are signaled for this submodule. Instead of diagnostics, the 2nd submodule always signals the value status (Quality Information, QI).

The submodules can be assigned to two IO controllers when the I/O device is used in a shared device:

- The IO controller to which submodule 1 is assigned has **read** and **write** access to inputs/outputs 0 to 15.
- The IO controller to which submodule 2 is assigned has **read** access to inputs/outputs 0 to 15.

Value status (Quality Information, QI)

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

For the 1st submodule (basic submodule)

- Configuration mode DI: The value status 0 indicates that the value is incorrect.
- Configuration mode DQ: The value status 0 indicates that the value is incorrect or that the IO controller of the basic submodule is in STOP state.

For the 2nd submodule (= MSI/MSO submodule), the value status 0 indicates that the value is incorrect or one of the following errors has occurred:

- The basic submodule is not yet assigned parameters or the parameter assignment is incorrect (not ready).
- The connection between the IO controller and the basic submodule has been interrupted.

The following figure shows the assignment of the address space with submodules 1 and 2 and the value status.

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

	7 6 5 4 3 2 1 0	
IB x		Input data status (IDS) of device
		Input value:
IB x+1		Channel 0 to 7 (input CH0 to CH7)
IB x+2		Channel 8 to 15 (input CH8 to CH15)
		(QI) Value status
IB x+3		Inputs: Channel 0 to 7 (value status QI0 to QI7)
IB x+4		Inputs: Channel 8 to 15 (value status QI8 to QI15)
IB x+5		Outputs: Channel 0 to 7 (value status QI0 to QI7)
IB x+6		Outputs: Channel 8 to 15 (value status QI8 to QI15)
IB x+7		Input data status (IDS) of submodule
IB x+17		Output data status (ODS) of submodule

Assignment in the process image output (PIQ) for 1st submodule (basic submodule)

	7 6 5 4 3 2 1 0	
		Output value:
QB x		Channel 0 to 7 (output CH0 to CH7)
QB x+1		Channel 8 to 15 (output CH8 to CH15)

Figure 5-3 Address space for configuration as 1 x 16-channel DIQ 16x24VDC QI with value status (basic submodule)

Assignment in the process image of the inputs (PII) for 2nd submodule (MSI/MSO submodule)

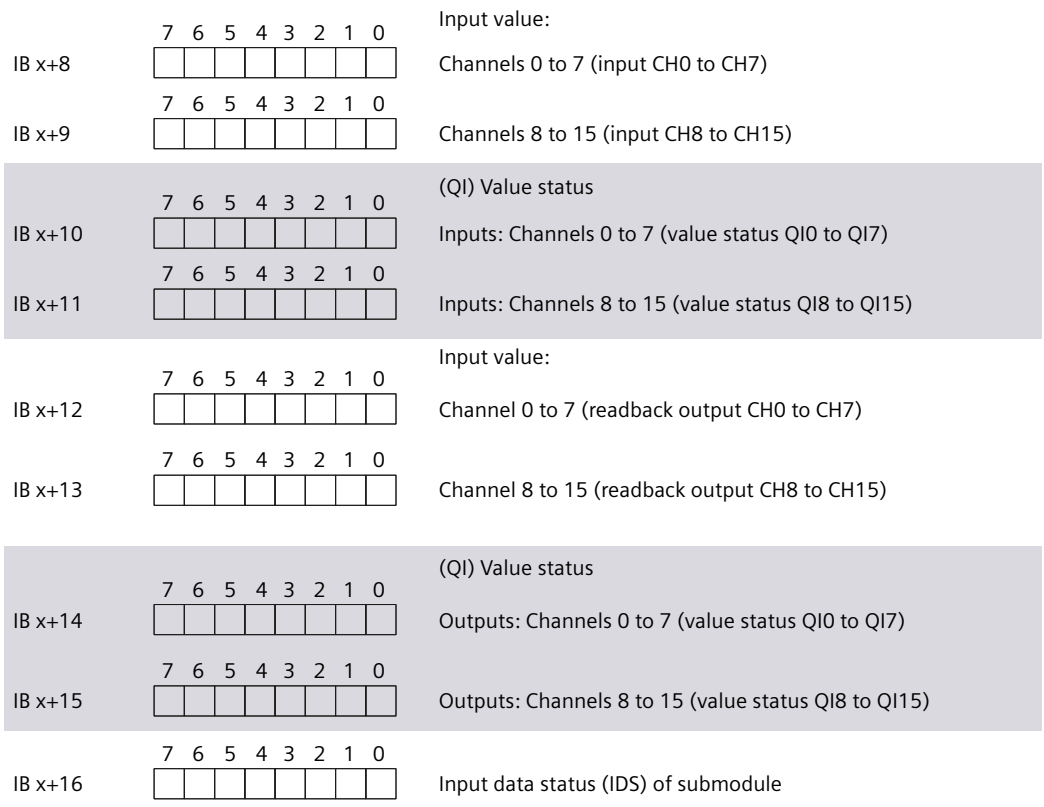


Figure 5-4 Address space for configuration as 1 x 16-channel DIQ 16x24VDC MSI/MSO with value status (MSI/MSO submodule)

Reference

You can find information about the **Module Internal Shared Input/Shared Output (MSI/MSO)** functionality in the MultiFieldbus (https://support.industry.siemens.com/cs/ww/en/view/109773209) Function Manual SIMATIC PROFINET with STEP 7 (https://support.industry.siemens.com/cs/ww/en/view/49948856).

Address space for configuration as 2 x 8-channel DIQ 16x24VDC S

The figure below shows the address space assignment for configuration as a 2 x 8-channel I/O device with digital inputs/digital outputs without value status.

Assignment in the process input image (PII) for device status

	7	6	5	4	3	2	1	0	
IB x									Input data status (IDS) of device

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

									Input value:
	7	6	5	4	3	2	1	0	
IB x+1	0	0	0	0					Channel 0 to 3 (input CH0 to CH3)
	7	6	5	4	3	2	1	0	
IB x+2	0	0	0	0					Channel 8 to 11 (input CH8 to CH11)
	7	6	5	4	3	2	1	0	
IB x+3									Input data status (IDS) of 1st submodule

Assignment in the process image output (PIQ) for 1st submodule

									Output value:
	7	6	5	4	3	2	1	0	
QB x	0	0	0	0					Channels 0 to 3 (output CH0 to CH3)
	7	6	5	4	3	2	1	0	
QB x+1	0	0	0	0					Channel 8 to 11 (output CH8 to CH11)

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

									Input value:
	7	6	5	4	3	2	1	0	
IB x+4	0	0	0	0					Channel 4 to 7 (input CH4 to CH7)
	7	6	5	4	3	2	1	0	
IB x+5	0	0	0	0					Channel 12 to 15 (input CH12 to CH15)
	7	6	5	4	3	2	1	0	
IB x+6									Input data status (IDS) of 2nd submodule
	7	6	5	4	3	2	1	0	
IB x+7									Output data status (QDS) of 1st submodule
	7	6	5	4	3	2	1	0	
IB x+8									Output data status (QDS) of 2nd submodule

Assignment in the process image output (PIQ) for 2nd submodule

									Output value:
	7	6	5	4	3	2	1	0	
QB x+2	0	0	0	0					Channels 4 to 7 (output CH4 to CH7)
	7	6	5	4	3	2	1	0	
QB x+3	0	0	0	0					Channel 12 to 15 (output CH12 to CH15)

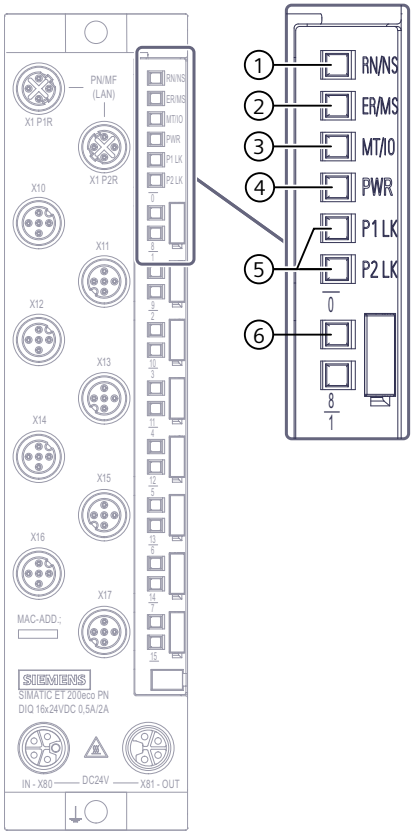
Figure 5-5 Address space for configuration as 2 x 8-channel DIQ 16x24VDC S without value status

5.2 Diagnostics

5.2.1 Status and error displays for EtherNet/IP

LED displays

The figure below shows the LED displays (status and error displays) of the I/O device DIQ 16x24VDC/0.5A/2A M12-L 8xM12.



① RN/NS: RUN/network status LED
② ER/MS: ERROR/module status LED
③ MT/IO: MAINT/IO status LED
④ PWR: Power LED for load voltage 2L+
⑤ P1 LK/P2 LK: LINK port status LEDs
⑥ LED displays 0 to 15 for channel status/channel error

Figure 5-6 LED displays

Behavior of the LEDs RN/NS (RUN/network status), ER/MS (ERROR/module status) and MT/IO (MAINT/IO status) on EtherNet/IP

The LEDs display the status with the **highest priority** if there are different LED states due to overlaid events. (0 = off, 1 = green flashing, 2 = green, 3 = yellow, 4 = red flashing, 5 = red)

The following table shows the meaning of the RN/NS, ER/MS LEDs and MT/IO LEDs for EtherNet/IP:

Table 5-3 Error display of the LEDs

LEDs			Meaning	Remedy
RN/ NS	ER/ MS	MT/ IO		
□ Off	□ Off	□ Off	Missing or insufficient supply voltage at the I/O device.	• Check the supply voltage.
☼ Flashes	Not relevant	Not relevant	I/O device on, no data exchange	
■ On	Not relevant	Not relevant	The ET 200eco PN is currently exchanging data with the scanner.	
☼ Flashes	Not relevant	Not relevant	EtherNet/IP connection interrupted	
■ On	■ On	■ On	The ET 200eco PN is currently exchanging data with at least one EtherNet/IP connection.	---
			I/O devices used by EtherNet/IP are in RUN mode.	---
Not relevant	□ Off	Not relevant	No valid MultiFieldbus project is loaded in the ET 200eco PN.	
Not relevant	☼ Flashes	Not relevant	No data exchange. A valid MultiFieldbus project is loaded in the ET 200eco PN.	
Not relevant	■ On	Not relevant	Data exchange via EtherNet/IP	
Not relevant	☼ Flashes	Not relevant	Errors in the configuration or parameter assignment.	
Not relevant	Not relevant	□ Off	The EtherNet/IP I/O devices are in STOP mode. No error	
Not relevant	Not relevant	■ On	The EtherNet/IP I/O devices are in RUN mode.	
Not relevant	Not relevant	■ On	Maintenance	Evaluate the maintenance events.
Not relevant	Not relevant	☼ Flashes	IO diagnostics or missing I/O device of slots used by EtherNet/IP	

LEDs			Meaning	Remedy
RN/ NS	ER/ MS	MT/ IO		
Flashes	Flashes	Flashes	Test of LEDs during startup: The three LEDs light up simultaneously for approximately 0.25 s in red. Then for approximately 0.25 s in green.	---
Flashes	Flashes	Flashes	Hardware or firmware defective.	• You can read out the service data with MFCT.
Flashes	Flashes	Flashes	The "Node flash test" is running (the P1 LK and P2 LK LEDs are also flashing).	

PWR LED

Table 5-4 Status display of the PWR LED

PWR LED	Meaning
Off	Load voltage 2L+ is missing or too low
On	Load voltage 2L+ present

P1 LK and P2 LK LEDs

Table 5-5 Error display of the P1 LK and P2 LK LEDs

LEDs		Meaning	Remedy
P1 LK	P2 LK		
Off		There is **no** Ethernet connection between the communications interface of your IO device and a communication partner (e.g. scanner).	Check whether the bus cable to the switch/communication partner is interrupted.
On		There is an Ethernet connection between the communications interface of your IO device and a communication partner (e.g. scanner).	---
Flashes		The "Node flash test" is running (the RN/NS, ER/MS and MT/IO LEDs also flash).	---

Channel status/channel error LED

Table 5-6 Status and error display of the channel status/channel error LED

LEDs	Meaning
Channel status/channel error	
□ Off	Process value = 0
■ On	Process value = 1
■ On	Channel diagnostics

Modbus TCP

6

6.1 Functions/parameters/address space

6.1.1 Supported Modbus TCP functions

Supported functions

The table below shows the functions that the I/O device supports with Modbus TCP.

Supported functions	RegLayoutVersion	Remarks
I/O communication with Modbus client	V1.0	FW 5.1.x or higher
Free user registers (e.g. for coordination of the redundancy)	V1.0	FW 5.1.x or higher
Device information	V1.0	FW 5.1.x or higher
Module configuration status register	≥ V1.1	FW 5.1.x or higher
Diagnostics bit in data status of cyclic I/O data per submodule	V1.0	FW 5.1.x or higher
Shared device functions	V1.0	FW 5.1.x or higher
Reading events (hardware interrupts)	V1.0	FW 5.1.x or higher
Data record interface	≥ V1.1	FW 5.1.x or higher

Supported diagnostics

The table below shows the diagnostics that the I/O device supports with Modbus TCP.

Supported diagnostics	Remarks
Reading diagnostics with MFCT	FW 5.1.x or higher
Reading hardware interrupts via event interface	FW 5.1.x or higher
PULL/PLUG event Modbus TCP	FW 5.1.x or higher
Reading service data with MFCT	FW 5.1.x or higher

6.1.2 Parameters

The table below shows the parameters for the I/O device DIQ 16x24VDC/0.5A/2A M12-L 8xM12.

Table 6-1 Configurable parameters and their defaults (GSD file)

Parameters	Value range	Default	Effective range with configuration software, for example, MFCT
Diagnostics: Low voltage 1L+	• Deactivated • Activated	Deactivated	Channel
Diagnostics: Missing 2L+	• Deactivated • Activated	Deactivated	Channels 4...7, 12...15
Diagnostics: Short-circuit	• Deactivated • Activated	Deactivated	Channel
Diagnostics: Wire break detection and alarm	• Deactivated • Activated	Deactivated	Channel (Digital inputs)
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	Channel (Digital inputs)
Hardware interrupt on rising edge	• Deactivated • Activated	Deactivated	Channel (Digital inputs)
Hardware interrupt on falling edge	• Deactivated • Activated	Deactivated	Channel (Digital inputs)
Configuration mode	• DI • DQ	DI	Channel
Reaction to CPU STOP	• Shutdown • Keep last value • Output substitute value 1	Shutdown	Channel (Digital outputs)

6.1.3 Explanation of the parameters

Diagnostics: Low voltage 1L+

Enabling of the diagnostics for insufficient supply voltage 1L+.

Diagnostics: Missing 2L+

Enabling of the diagnostics for missing or insufficient load voltage 2L+.

NOTE

This diagnostics is only available for channels supplied with 2L+ voltage.

Diagnostics: Short-circuit

Enable diagnostics:

- for short-circuit of the encoder supply to ground.
- for short-circuit of the output to ground.
- for short-circuit of the output to 1L+ or 2L+.

Diagnostics: Wire break detection and alarm

Activates wire break detection and enabling of diagnostics for the digital input in case of an interruption of the cable between the encoder and I/O device.

NOTE

- This diagnostics is only available for channels configured as inputs.
- Influence on the value status:
  If the parameter is deactivated, wire break detection is switched off. A wire break does not have an effect on the value status.

Input delay

This parameter can be used to suppress signal interference. Changes to the signal are only detected if they are present consistently for 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.

Hardware interrupt on rising edge

Specifies whether a hardware interrupt is generated via the data status on a rising edge on the channel. The hardware interrupt information can be read and confirmed via CIP Ethernet/IP.

A hardware interrupt is only generated for the channel when there is a fault-free signal (value status/QI = 1). This means no diagnostics is pending for the channel. See also: Address space (Page 58)

Hardware interrupt on falling edge

Specifies whether a hardware interrupt is generated via the data status on a falling edge on the channel. The hardware interrupt information can be read and confirmed via CIP Ethernet/IP.

A hardware interrupt is only generated for the channel when there is a fault-free signal (value status/QI = 1). This means no diagnostics is pending for the channel. See also: Address space (Page 58)

Configuration mode

Specifies whether the channel operates as digital input (DI) or digital output (DQ).

Reaction to CPU STOP

With this parameter, you set the reaction of the digital outputs of the I/O device after a CPU STOP:

- Shutdown: The digital output is de-energized.
- Keep last value: The last value of the digital output remains activated.
- Output substitute value 1: The I/O device outputs the substitute value "1".

6.1.4 Update time of the I/O data

You can estimate the typical update time for an I/O cycle as follows:

Update time (can be set starting at 2 ms)
+ I/O processing (typically 1.4 ms, +/- 1 ms jitter due to free-running cycles)
+ EM conversion (dependent on cycle time and parameter assignment of the module)

If necessary, you must take into account other influences caused by the MTCP client and network components by adding them.

6.1.5 Address space

The DIQ 16x24VDC/0.5A/2A M12-L 8xM12 I/O device can be configured differently; see following table. Depending on the configuration, additional/different addresses are assigned in the process images.

Configuration options of the DIQ 16x24VDC/0.5A/2A M12-L 8xM12 I/O device

When the I/O device is configured using a GSD file, the configurations are available under different short designations/device names in the device view of MFCT.
The following configurations are possible:

Table 6-2 Configuration options

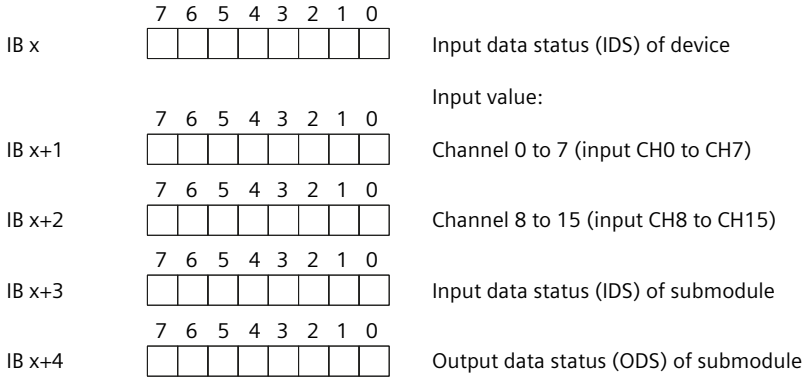
Configuration	Short designation/ device name in the GSD file (device view in the configuration software)	Configuration software, e.g. with MFCT
		GSD file in MFCT V1.3 SP1 or higher
1 x 16-channel DIQ 16x24VDC	DIQ 16x24VDC/0.5A/2A	X
1 x 16-channel DIQ 16x24VDC QI	DIQ 16x24VDC/0.5A/2A, QI	X
1 x 16-channel DIQ 16x24VDC MSI/MSO	DIQ 16x24VDC/0.5A/2A, MSI/-MSO	X
2 x 8-channel DIQ 16x24VDC S	DIQ 16x24VDC/0.5A/2A, S	X

NOTE
Writing of outputs
For correct device functioning, execute the write service for the process image output cyclically, even if the I/O device is configured as an input module with 16 inputs. In this configuration, the outputs are so-called dummy outputs.

Address space for configuration as 1 x 16-channel DIQ 16x24VDC

The following figure shows the address space allocation for the configuration as 16-channel I/O device with digital inputs/digital outputs without value status. The addresses of the channels are derived from the start address.

Assignment in the process image input (PII)



Assignment in the process image output (PIQ)

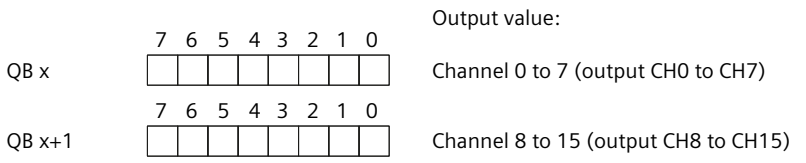


Figure 6-1 Address space for configuration as 1 x 16-channel DIQ 16x24VDC without value status

Value status (Quality Information, QI)

The value status is always returned with the following configuration options:

- DIQ 16x24VDC/0.5A/2A, QI
- DIQ 16x24VDC/0.5A/2A, MSI/MSO

Evaluating the value status

An additional 4 bytes are occupied in the input address space if you enable the value status for the I/O device. Bits 0 to 15 are assigned to a channel and provide information about the validity of the digital input/digital output value.

Bit = 1: No error on channel.

Bit = 0: Error on channel.

Address space for configuration as 1 x 16-channel DIQ 16x24VDC QI

The following figure shows the address space allocation for the configuration as 16-channel I/O device with digital inputs/digital outputs with value status. The addresses of the channels are derived from the start address.

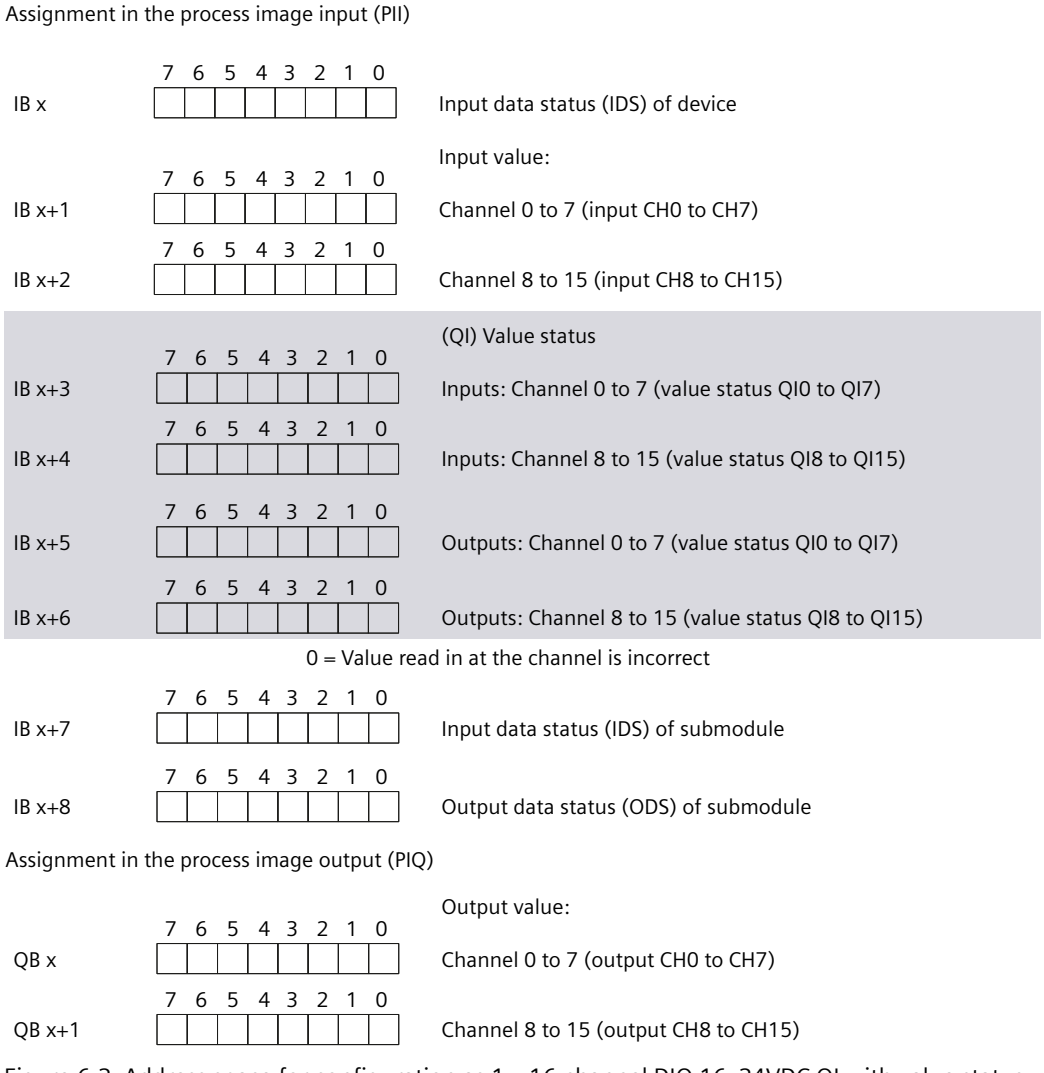


Figure 6-2 Address space for configuration as 1 x 16-channel DIQ 16x24VDC QI with value status

Address space for configuration as 1 x 16-channel DIQ 16x24VDC MSI/MSO

The 1st submodule (= basic submodule) behaves like a 1 x 16-channel DIQ 16x24VDC. The value status (Quality Information, QI) is always activated for the submodule. Diagnostics and hardware interrupts are signaled for this submodule.

The outputs and inputs of the 1st submodule are copied into the 2nd submodule (= MSI/MSO submodule). You cannot assign parameters to the 2nd submodule. No diagnostics or hardware interrupts are signaled for this submodule. Instead of diagnostics, the 2nd submodule always signals the value status (Quality Information, QI).

The submodules can be assigned to two IO controllers when the I/O device is used in a shared device:

- The IO controller to which submodule 1 is assigned has **read** and **write** access to inputs/outputs 0 to 15.
- The IO controller to which submodule 2 is assigned has **read** access to inputs/outputs 0 to 15.

Value status (Quality Information, QI)

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

For the 1st submodule (basic submodule)

- Configuration mode DI: The value status 0 indicates that the value is incorrect.
- Configuration mode DQ: The value status 0 indicates that the value is incorrect or that the IO controller of the basic submodule is in STOP state.

For the 2nd submodule (= MSI/MSO submodule), the value status 0 indicates that the value is incorrect or one of the following errors has occurred:

- The basic submodule is not yet assigned parameters or the parameter assignment is incorrect (not ready).
- The connection between the IO controller and the basic submodule has been interrupted.

The following figure shows the assignment of the address space with submodules 1 and 2 and the value status.

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

	7 6 5 4 3 2 1 0	
IB x		Input data status (IDS) of device
		Input value:
IB x+1		Channel 0 to 7 (input CH0 to CH7)
IB x+2		Channel 8 to 15 (input CH8 to CH15)
		(QI) Value status
IB x+3		Inputs: Channel 0 to 7 (value status QI0 to QI7)
IB x+4		Inputs: Channel 8 to 15 (value status QI8 to QI15)
IB x+5		Outputs: Channel 0 to 7 (value status QI0 to QI7)
IB x+6		Outputs: Channel 8 to 15 (value status QI8 to QI15)
IB x+7		Input data status (IDS) of submodule
IB x+17		Output data status (ODS) of submodule

Assignment in the process image output (PIQ) for 1st submodule (basic submodule)

	7 6 5 4 3 2 1 0	
		Output value:
QB x		Channel 0 to 7 (output CH0 to CH7)
QB x+1		Channel 8 to 15 (output CH8 to CH15)

Figure 6-3 Address space for configuration as 1 x 16-channel DIQ 16x24VDC QI with value status (basic submodule)

Assignment in the process image of the inputs (PII) for 2nd submodule (MSI/MSO submodule)

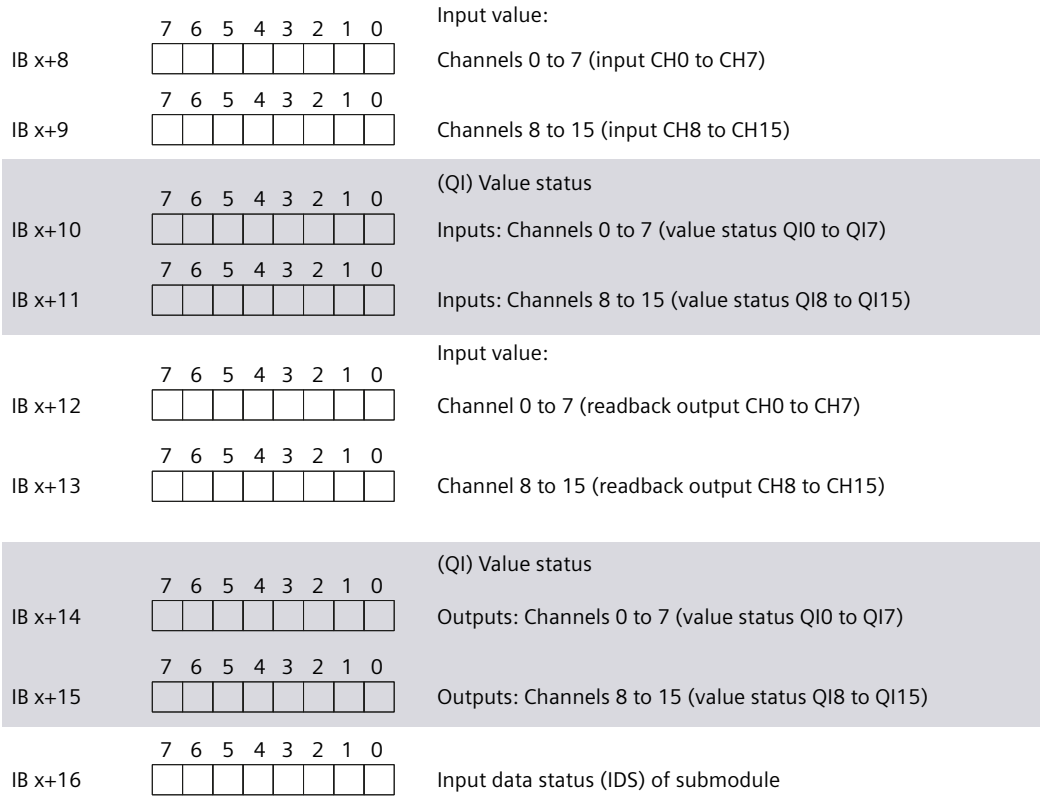


Figure 6-4 Address space for configuration as 1 x 16-channel DIQ 16x24VDC MSI/MSO with value status (MSI/MSO submodule)

Reference

You can find information about the **Module Internal Shared Input/Shared Output (MSI/MSO)** functionality in the MultiFieldbus (https://support.industry.siemens.com/cs/ww/en/view/109773209) Function Manual SIMATIC PROFINET with STEP 7 (https://support.industry.siemens.com/cs/ww/en/view/49948856).

Address space for configuration as 2 x 8-channel DIQ 16x24VDC S

The figure below shows the address space assignment for configuration as a 2 x 8-channel I/O device with digital inputs/digital outputs without value status.

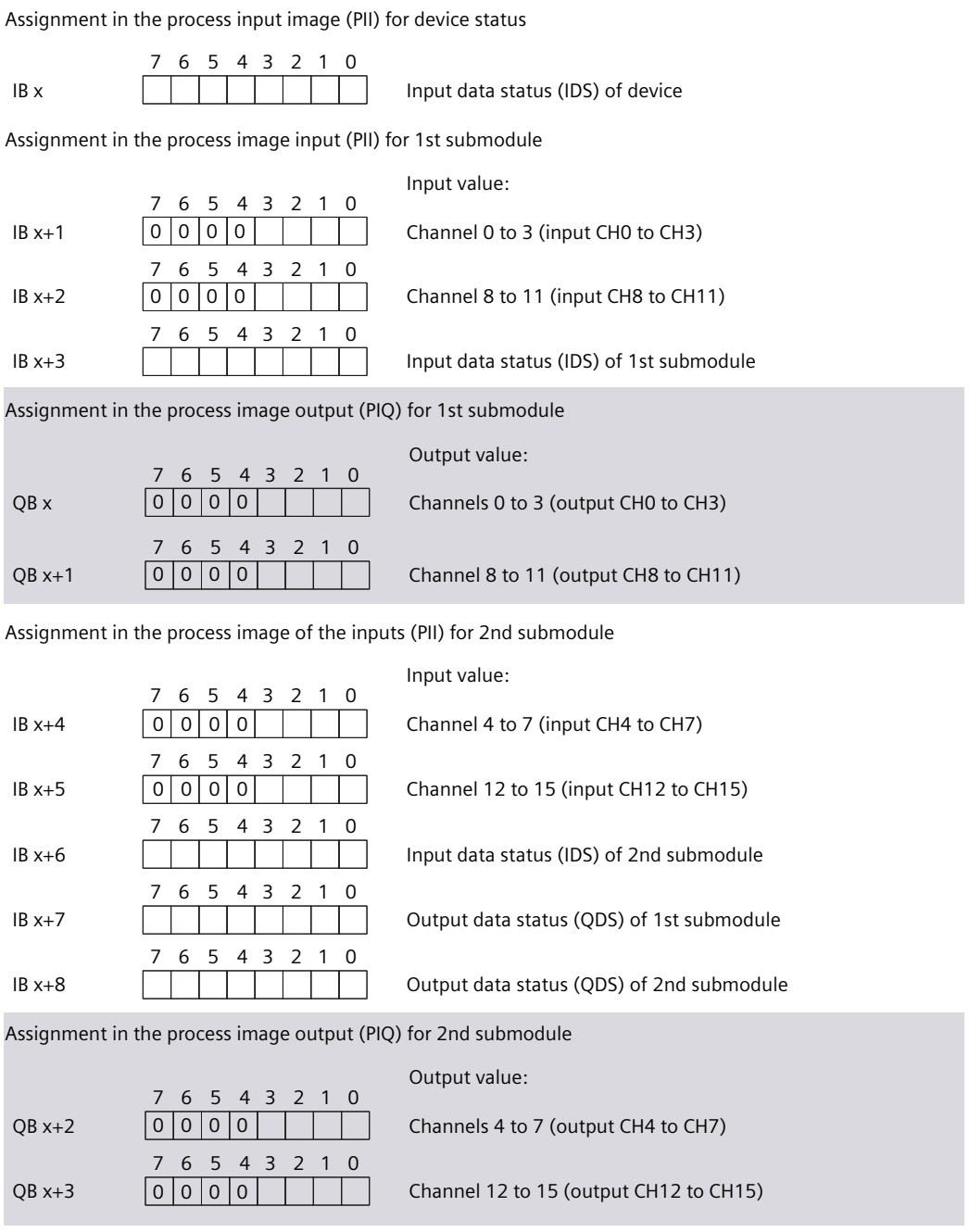


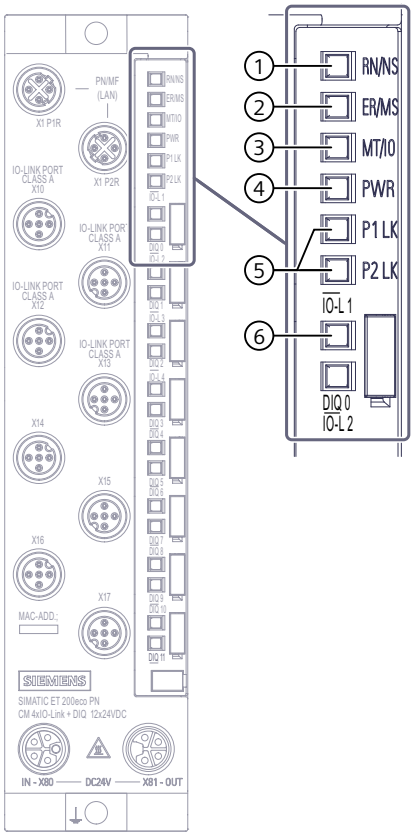
Figure 6-5 Address space for configuration as 2 x 8-channel DIQ 16x24VDC S without value status

6.2 Diagnostics

6.2.1 Status and error displays for Modbus TCP

LED displays

The figure below shows the LED displays (status and error displays) of the I/O device DIQ 16x24VDC/0.5A/2A M12-L 8xM12.



① RN/NS: RUN/network status LED
② ER/MS: ERROR/module status LED
③ MT/IO: MAINT/IO status LED
④ PWR: Power LED for load voltage 2L+
⑤ P1 LK/P2 LK: LINK port status LEDs
⑥ LED displays 0 to 15 for channel status/channel error

Figure 6-6 LED displays

Behavior of the LEDs RN/NS (RUN/network status), ER/MS (ERROR/module status) and MT/IO (MAINT/IO status) on modbus TCP

The LEDs display the status with the **highest priority** if there are different LED states due to overlaid events. (0 = off, 1 = green flashing, 2 = green, 3 = yellow, 4 = red flashing, 5 = red)

The following table shows the meaning of the RN/NS, ER/MS LEDs and MT/IO LEDs for Modbus TCP:

Table 6-3 Error display of the LEDs

LEDs			Meaning	Remedy
RN/ NS	ER/ MS	MT/ IO		
Off	Off	Off	Missing or insufficient supply voltage at the I/O device.	• Check the supply voltage.
Flashes	Off	Off	I/O device on, no data exchange	
On	Off	Off	The I/O device is exchanging data with any connection.	
Flashes	Flashes	Off	MultiFieldbus project is present in the I/O device, no data exchange	
On	On	Off	The I/O device exchanges data without errors via a modbus TCP connection	
On	Flashes	Off	The I/O device exchanges data. An error has occurred in the I/O device.	Check the following: • Configuration • Parameter settings • PNIO diagnostics
Flashes	Flashes	Off	The I/O device does not exchange data. An error has occurred in the I/O device.	
Flashes	Flashes	Off	An existing connection to modbus TCP was terminated by a timeout	
Flashes	Flashes	Off	An existing connection to modbus TCP was terminated by a timeout	Check the following: • Configuration • Parameter assignment
Flashes	Flashes	Flashes	Test of LEDs during startup: The three LEDs light up simultaneously for approximately 0.25 s in red. Then for approximately 0.25 s in green.	---
Flashes	Flashes	Flashes	Hardware or firmware defective.	• You can read out the service data with MFCT.
Flashes	Flashes	Flashes	The "Node flash test" is running (the P1 LK and P2 LK LEDs are also flashing).	

PWR LED

Table 6-4 Status display of the PWR LED

PWR LED	Meaning
□ Off	Load voltage 2L+ is missing or too low
■ On	Load voltage 2L+ present

P1 LK and P2 LK LEDs

Table 6-5 Error display of the P1 LK and P2 LK LEDs

LEDs		Meaning	Remedy
P1 LK	P2 LK		
□ Off		There is **no** Ethernet connection between the communications interface of your IO device and a communication partner (e.g. scanner).	Check whether the bus cable to the switch/communication partner is interrupted.
■ On		There is an Ethernet connection between the communications interface of your IO device and a communication partner (e.g. scanner).	---
☼ Flashes		The "Node flash test" is running (the RN/NS, ER/MS and MT/IO LEDs also flash).	---

Channel status/channel error LED

Table 6-6 Status and error display of the channel status/channel error LED

LEDs	Meaning
Channel status/channel error	
□ Off	Process value = 0
■ On	Process value = 1
■ On	Channel diagnostics

Technical specifications

7

Technical specifications of the I/O device DIQ 16x24VDC/0.5A/2A M12-L 8xM12

The following table shows the technical specifications as of the issue date. You can find a data sheet including daily updated technical specifications on the Internet (https://support.industry.siemens.com/cs/de/en/pv/6ES7143-6BH00-0BB0/td?dl=en).

Article number	6ES7143-6BH00-0BB0
General information	
HW functional status	FS04
Firmware version	V5.1.x
• FW update possible	Yes
Vendor identification (VendorID)	002AH
Device identifier (DeviceID)	0306H
Manufacturer ID according to ODVA (VendorID)	04E3H
Device ID according to ODVA (Product code)	0FA8H
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	No
• Prioritized startup	Yes
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	STEP 7 V17 or higher with HSP 0363
• PROFINET from GSD version/GSD revision	GSDML V2.3.x
• Multi Fieldbus Configuration Tool (MFCT)	from V1.3 SP1
Operating mode	
• DI	Yes
• Counter	No
• DQ	Yes
• MSI	Yes
• MSO	Yes
Supply voltage	
power supply according to NEC Class 2 required	No

Article number	6ES7143-6BH00-0BB0
Load voltage 1L+	
• Rated value (DC)	24 V
• permissible range, lower limit (DC)	20.4 V
• permissible range, upper limit (DC)	28.8 V
• Reverse polarity protection	Yes; Against destruction; encoder power supply outputs applied with reversed polarity, loads pick up
Load voltage 2L+	
• Rated value (DC)	24 V
• permissible range, lower limit (DC)	20.4 V
• permissible range, upper limit (DC)	28.8 V
• Reverse polarity protection	Yes; against destruction
Input current	
Current consumption (rated value)	90 mA; without load
from load voltage 1L+ (unswitched voltage)	12 A; Maximum value
from load voltage 2L+, max.	12 A; Maximum value
Encoder supply	
24 V encoder supply	
• Short-circuit protection	Yes; Group-by-group for 2 channels, electronic
• Output current, max.	100 mA; per output
Power loss	
Power loss, typ.	9.7 W
Address area	
Address space per module	
• Inputs	2 byte; + 4 bytes for QI information
• Outputs	2 byte
Hardware configuration	
Submodules	
• Number of configurable submodules, max.	2
Digital inputs	
Number of digital inputs	16; Parameterizable as DIQ
• in groups of	8
Digital inputs, parameterizable	Yes
Source/sink input	P-reading
Input characteristic curve in accordance with IEC 61131, type 3	Yes
Number of simultaneously controllable inputs	
all mounting positions	
– up to 60 °C, max.	16

Article number	6ES7143-6BH00-0BB0
Input voltage	
• Rated value (DC)	24 V
• for signal "0"	-3 to +5V
• for signal "1"	+11 to +30V
Input current	
• for signal "1", typ.	2.4 mA
Input delay (for rated value of input voltage)	
for standard inputs	
– parameterizable	Yes; 0.05 / 0.1 / 0.4 / 0.8 / 1.6 / 3.2 / 12.8 / 20 ms
Cable length	
• unshielded, max.	30 m
Digital outputs	
Number of digital outputs	16; Parameterizable as DIQ
• in groups of	8; 2 load groups for 8 outputs each
Current-sourcing	Yes
Short-circuit protection	Yes; per channel, electronic
• Response threshold, typ.	0.5 A: 1 A / 2 A: 3 A
Limitation of inductive shutdown voltage to	0.5 A: Type 1L+ (-70 V) / 2 A: Type (-18 V)
Controlling a digital input	Yes
Switching capacity of the outputs	
• with resistive load, max.	0.5 A / 2 A
• with inductive load, max.	0.5 A / 2 A
• on lamp load, max.	0.5 A: 5 W / 2 A 10 W
Load resistance range	
• lower limit	0.5 A: 48 ohms / 2 A: 12 ohms
• upper limit	4 kΩ
Output voltage	
• for signal "1", min.	1L+ (-0.8 V) / 2L+ (-0.8 V)
Output current	
• for signal "1" rated value	0.5 A / 2 A
• for signal "1" permissible range, max.	0.5 A / 2 A
• for signal "0" residual current, max.	0.1 mA
Output delay with resistive load	
• "0" to "1", max.	0.5 A: 100 µs / 2 A: 150 µs; at rated load
• "1" to "0", max.	0.5 A: 150 µs / 2 A: 2.5 ms; at rated load
Parallel switching of two outputs	
• for uprating	No
• for redundant control of a load	Yes

Article number	6ES7143-6BH00-0BB0
Switching frequency	
• with resistive load, max.	0.5 A: 100 Hz / 2 A: 40 Hz
• with inductive load, max.	0.5 Hz
• on lamp load, max.	1 Hz
Total current of the outputs	
• Current per group, max.	1L+: 2 A / 2L+: 6 A
• Current per module, max.	8 A
Cable length	
• unshielded, max.	30 m
Encoder	
Connectable encoders	
• 2-wire sensor	Yes
– permissible quiescent current (2-wire sensor), max.	1.5 mA
Interfaces	
Number of PROFINET interfaces	1
1. Interface	
Interface type	PROFINET with 100 Mbit/s full duplex (100BASE-TX)
Interface types	
• M12 port	Yes; 2x M12, 4-pin, D-coded
• Number of ports	2
• integrated switch	Yes
Protocols	
• PROFINET IO Device	Yes
• Open IE communication	Yes
Interface types	
M12 port	
• Autonegotiation	Yes
• Autocrossing	Yes
• Transmission rate, max.	100 Mbit/s
Protocols	
Supports protocol for PROFINET IO	Yes
PROFIsafe	No
EtherNet/IP	Yes
Modbus TCP	Yes

Article number	6ES7143-6BH00-0BB0
PROFINET IO Device	
Services	
– IRT	Yes; 250 µs to 4 ms in 125 µs frame
– Prioritized startup	Yes
– Shared device	Yes
– Number of IO Controllers with shared device, max.	2
Redundancy mode	
• PROFINET system redundancy (S2)	Yes
– on S7-1500R/H	Yes
– on S7-400H	Yes
• PROFINET system redundancy (R1)	No
• H-Sync forwarding	Yes
Media redundancy	
– MRP	Yes
EtherNet/IP	
Services	
– CIP Implicit Messaging	Yes
– CIP Explicit Messaging	Yes
– CIP Safety	No
– Shared device	Yes; 2x EtherNet/IP Scanner
– Number of scanners with shared device, max.	2
Updating times	
– Requested Packet Interval (RPI)	2 ms
Redundancy mode	
– DLR (Device Level Ring)	No
Address area	
– Address space per module, max.	20 byte
– LargeForwardOpen (Class3)	No

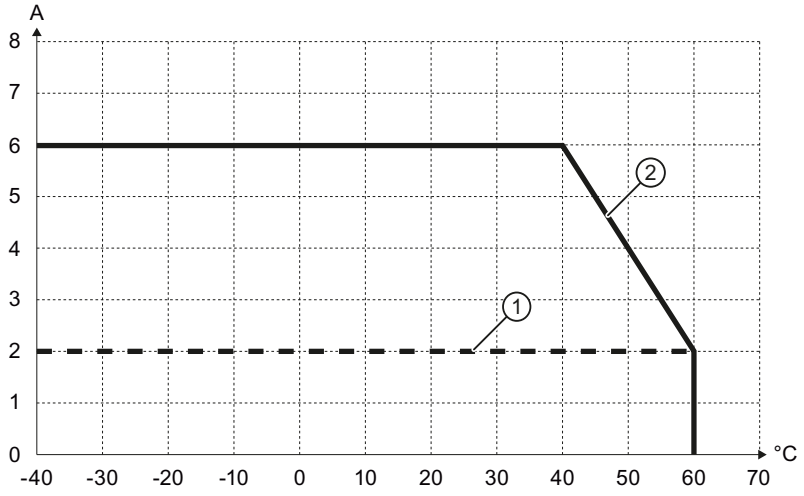
Article number	6ES7143-6BH00-0BB0
Modbus TCP	
Services	
– read coils (code=1)	Yes
– read discrete inputs (code=2)	Yes
– Read Holding Registers (Code=3)	Yes
– write single coil (code=5)	Yes
– write multiple coils (code=15)	Yes
– Write Multiple Registers (Code=16)	Yes
– Parameter change by master	No
– Modbus TCP Security Protocol	No
Address space per station	
– Address space per station, max.	20 byte
– Access-consistent address space	2 byte
Updating time	
– I/O request interval	2 ms
Connections	
– Number of connections per slave	12
Open IE communication	
• TCP/IP	Yes; (only EtherNet/IP or Modbus TCP)
• SNMP	Yes
• LLDP	Yes
• ARP	Yes
Interrupts/diagnostics/status information	
Substitute values connectable	Yes
Alarms	
• Diagnostic alarm	Yes; Parameterizable
• Maintenance interrupt	Yes; Parameterizable
• Hardware interrupt	Yes; Parameterizable
Diagnoses	
• Diagnostic information readable	Yes
• Monitoring the supply voltage	Yes
– parameterizable	Yes
• Wire-break	Yes; DI, input current < 0.3 mA, per channel
• Short-circuit	Yes; Outputs to M and P; channel by channel
• Short-circuit encoder supply	Yes; Per channel group

Article number	6ES7143-6BH00-0BB0
Diagnostics indication LED	
• RUN LED	Yes; green LED
• ERROR LED	Yes; red LED
• MAINT LED	Yes; Yellow LED
• NS LED	Yes; green/red LED
• MS LED	Yes; green/red LED
• IO LED	Yes; red/green/yellow LEDs
• Channel status display	Yes; green LED
• for channel diagnostics	Yes; red LED
• For load voltage monitoring	Yes; green LED
• Connection display LINK TX/RX	Yes; green LED, only link
Potential separation	
between the load voltages	Yes
between Ethernet and electronics	Yes
Potential separation channels	
• between the channels	Yes
• between the channels, in groups of	8
• between the channels and the power supply of the electronics	8 channels are non-isolated and 8 channels are isolated from supply voltage 1L+
Isolation	
tested with	
• 24 V DC circuits	707 V DC (type test)
• Test voltage for interface, rms value [Vrms]	1 500 V; According to IEEE 802.3
Degree and class of protection	
IP degree of protection	IP65/67/69K
Standards, approvals, certificates	
Suitable for safety-related tripping of standard modules	Yes; From FS01
Highest safety class achievable for safety-related tripping of standard modules	
• Performance level according to ISO 13849-1	PL d
• Category according to ISO 13849-1	Cat. 3
• SIL acc. to IEC 62061	SIL 2
• remark on safety-oriented shutdown	https://support.industry.siemens.com/cs/de/en/view/39198-632

Article number	6ES7143-6BH00-0BB0
Ambient conditions	
Ambient temperature during operation	
• min.	-40 °C
• max.	60 °C
Altitude during operation relating to sea level	
• Ambient air temperature-barometric pressure-altitude	Up to max. 5 000 m, at installation height > 2 000 m additional restrictions
connection method / header	
Design of electrical connection	4/5-pin M12 circular connectors
Design of electrical connection for the inputs and outputs	M12, 5-pin, A-coded
Design of electrical connection for supply voltage	M12, 4-pin, L-coded
Dimensions	
Width	45 mm
Height	200 mm
Depth	48 mm
Weights	
Weight, approx.	780 g

Derating trend

The following figure show the load current derating with mounting clearance observed, depending on the ambient temperature.
The minimum clearance of the I/O devices is 2 cm around the I/O device.



① Total current of 1L+

② Total current of 2L+

Figure 7-1 Derating load current ambient temperature

NOTE

Adherence to the minimum clearance

The I/O devices may be used at an installation distance of 2 cm up to max. 60 °C ambient temperature.

If the installation distance to other devices or objects is less than 2 cm, the ambient temperature must be reduced by 5 K (for example, 60 °C ⇒ 55 °C). This also applies to the derating trend.

Dimension drawing

A

A.1 Dimension drawing

The figure below shows the dimension drawing of the I/O device digital inputs/outputs DIQ 16x24VDC0.5A/2A M12-L 8xM12 in front and side views.

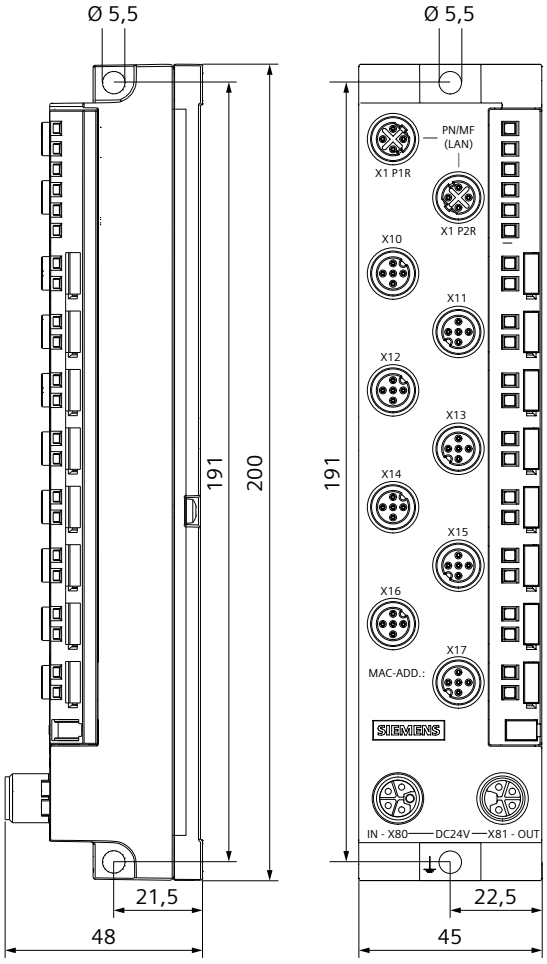


Figure A-1 Dimension drawing

Parameter data record

B

B.1 Dependencies for the configuration

The parameter settings are dependent on each other when configuring the I/O device. These dependencies must be considered when configuring with the latest HSP in STEP 7 TIA. When configuring with the GSD file or with data record 128, these dependencies must be observed.

Dependencies of the parameter settings

This table lists the parameters and their dependencies.

Table B-1 Dependencies of the parameter settings

Configuration mode	Diagnostics				Input delay	Hardware interrupt on rising edge	Hardware interrupt on falling edge	Reaction to CPU STOP
	Low voltage 1L+	Missing 2L+	Short-circuit	Wire break detection and alarm				
DI	x	x	x	x	• 0.05 ms • 0.1 ms • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms	x	x	*
DQ	x	x	x	*	*	*	*	• Shutdown • Keep last value • Output substitute value 1

x = property is allowed, – = property is **not allowed**, * = property is not relevant

B.2 Structure of data record 128 for I/O device parameter assignment

With data record 128, you can reconfigure the I/O device in your user program, regardless of your programming. This means that you can use all the functions of the I/O device even if you configured it with a GSD file.

Parameter assignment in the user program

You can reassign the parameters of the I/O device in RUN. For example, you can change the hardware interrupts of individual channels in RUN without this having an effect on the other channels.

Changing parameters in RUN

The "WRREC" instruction is used to transfer the parameters to the I/O device using data record 128. The parameters set with STEP 7 are not changed in the CPU by this action. After a restart, the parameters set in STEP 7 are still valid.

Output parameter STATUS

If errors occur during the transfer of parameters with the "WRREC" instruction, the I/O device continues operation with the previously valid parameter assignment. The STATUS output parameter contains a corresponding error code.

The instruction "WRREC" and the error codes are described in the online help of STEP 7.

Structure of data record 128

The figure below shows the structure of data record 128.
On the left, you can see the structure of data record 128 when it is configured as an 1 x 16-channel I/O device.
On the right, you can see the structure of data record 128 when it is configured as a 2 x 8-channel I/O device.

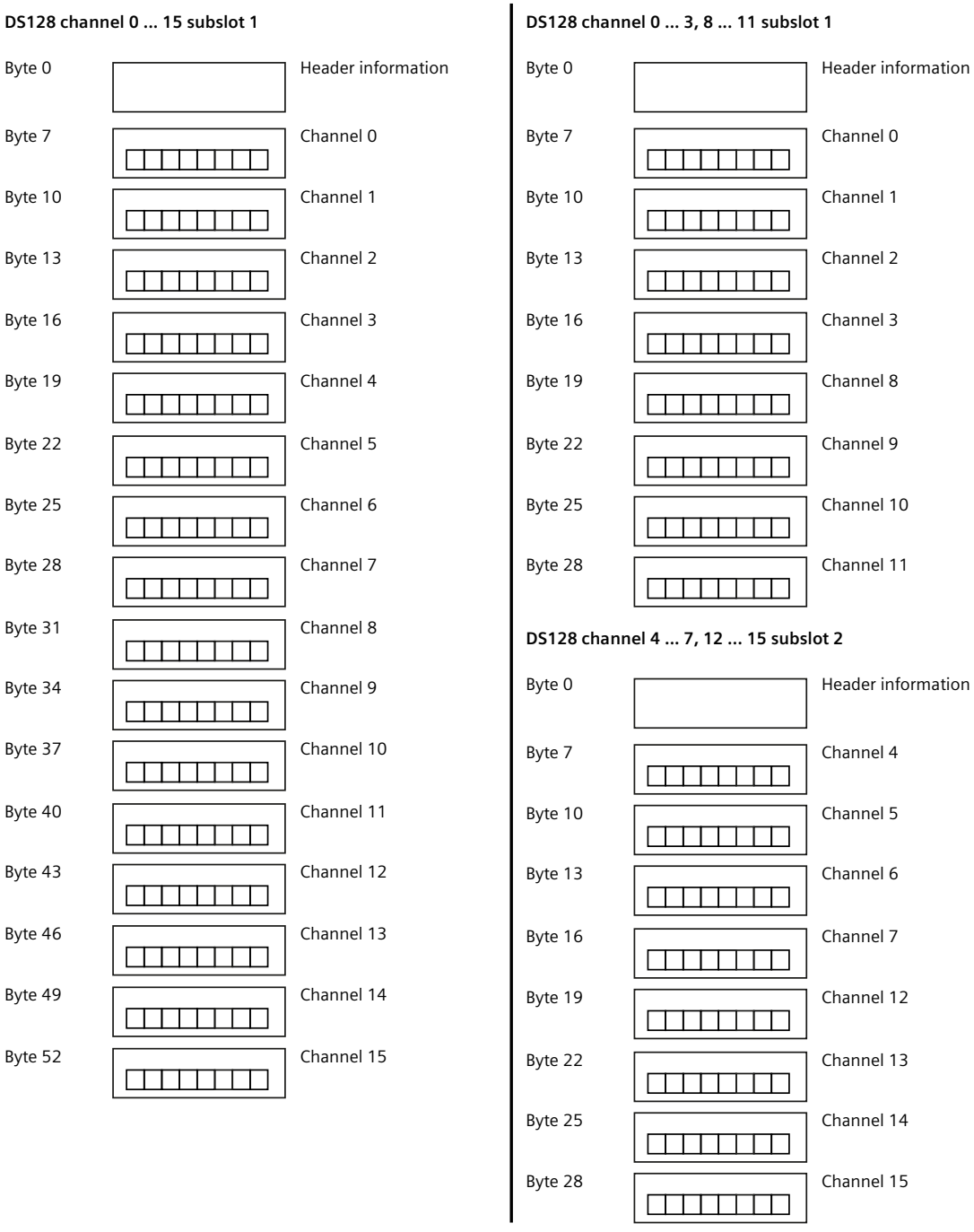


Figure B-1 Structure of data record 128

Header information

The figure below shows the structure of the header information.

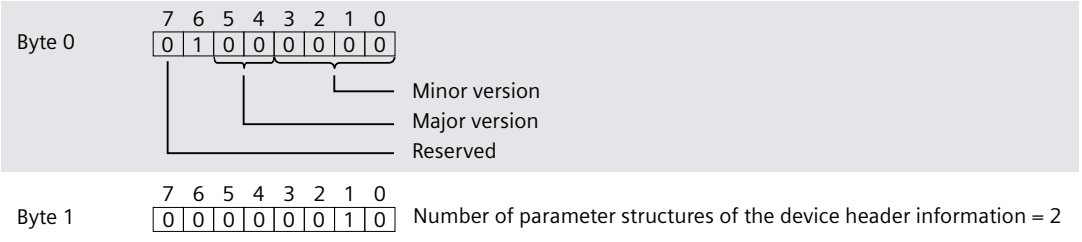


Figure B-2 Header information

Device header information

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

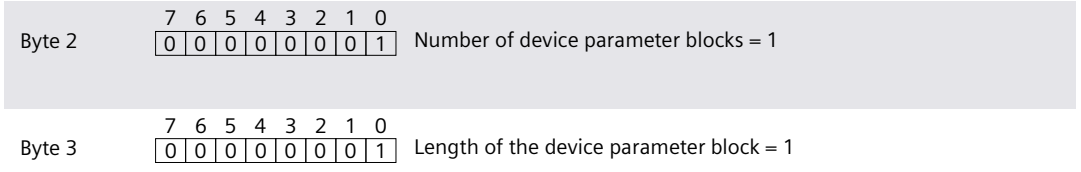


Figure B-3 Device header information

Device parameter block

The figure below shows the structure of the device parameter block.

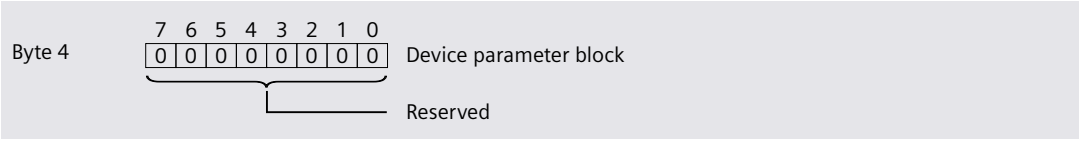


Figure B-4 Device parameter block

Channel header information

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

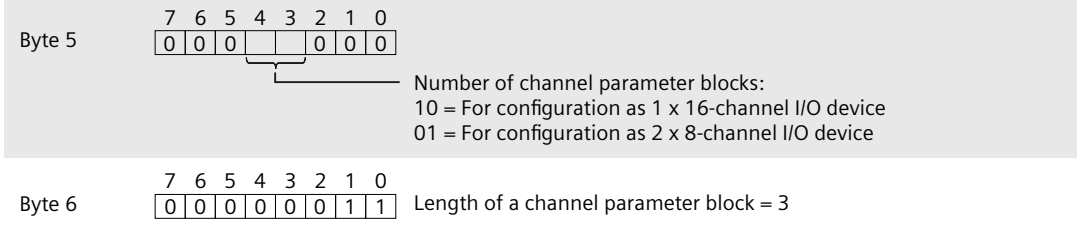
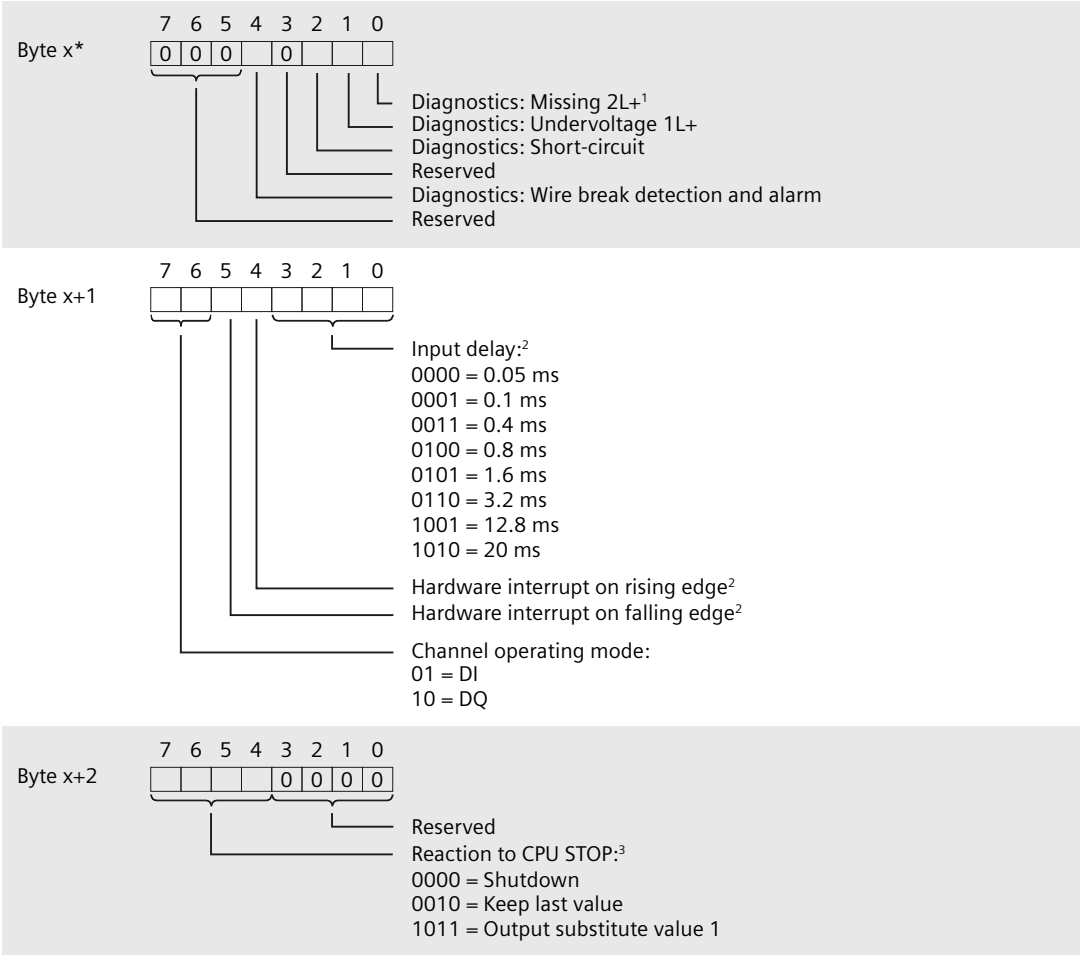


Figure B-5 Channel header information

Parameters

The following figure shows the structure of the parameters for a channel.
You activate a parameter by setting the corresponding bit to "1".
The channel number depends on the parameter assignment of the I/O device.

- Configuration as 1 x 16-channel I/O device:
  * x = 7 + (channel number * 3); channel number = 0 to 15
- Configuration as 2 x 8-channel I/O device:
  The assignment of the bytes * x to the channel is shown in the image "Structure of data record 128".



[1] Valid for channels 4 to 7 and 12 to 15.

[2] Valid for DI channel operating mode.

[3] Valid for DQ channel operating mode.

Figure B-6 Structure of byte x to x + 3

B.3 Error transferring the data record

Error transferring the data record

The I/O device checks the values of the transferred data record. Only if the values were transferred without errors does the I/O device apply the values from the data record.

The "WRREC" instruction for writing data records returns corresponding error codes in the "STATUS" parameter when errors occur. For STEP 7 you will also find the parameter description in the STEP 7 online help.

The Error codes table shows the following:

- The specific error codes of the I/O device
- The meaning of the error code
- A suggestion for correcting the error
- The data record at which the error may occur

Table B-2 Error codes

Error code in STATUS parameter (hexadecimal)				Meaning	Solution	DS128
Byte 0	Byte 1	Byte 2	Byte 3			
DF	80	B0	xx	Number of the data record unknown.	Enter a valid number for the data record.	✓
DF	80	B1	xx	Length of the data record incorrect.	Enter a valid value for the data record length.	✓
DF	80	B2	xx	I/O device cannot be accessed:	Check the assigned values for the parameters of the "WRREC" instruction.	✓
DF	80	E0	xx	Wrong version or error in the header information.	Correct the version, length and number of parameter blocks.	✓
DF	80	E1	01	Reserved bit set	Check the parameters of the I/O device.	✓
DF	80	E1	02	Invalid diagnostics enable bit set for operating mode.	Check the parameters of the I/O device.	✓
DF	80	E1	06	Invalid coding for substitute value reaction.	Check the parameters of the I/O device.	✓
DF	80	E1	07	Invalid coding for replacement filter time.	Check the parameters of the I/O device.	✓
DF	80	E1	11	Invalid output range set.	Check the parameters of the I/O device.	✓