

SIEMENS



Manual

SIMATIC

ET 200AL

Communication module CM 4xIO-Link 4xM12
(6ES7147-5JD00-0BA0)

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SIMATIC

ET 200AL CM 4xIO-Link 4xM12 (6ES7147-5JD00-0BA0)

Equipment Manual

Preface

Documentation guide

1

Product overview

2

Wiring

3

Parameters/address space

4

Diagnostics alarms

5

Technical specifications

6

Replacing modules

7

PROFInergy

8

Dimension drawing

A

Legal information

Warning notice system

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

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
indicates that minor personal injury can result if proper precautions are not taken.
NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

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

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Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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

Preface

Purpose of the documentation

This manual supplements the ET 200AL distributed I/O system (<http://support.automation.siemens.com/WW/view/en/89254965>) system manual. Functions that are generally applicable to the ET 200AL distributed I/O system are described there.

The information provided in the present manual, the system manual and the function manuals enables you to commission the ET 200AL distributed I/O system.

Conventions

Please also observe notes marked as follows:

Note

Indicates important product information to which particular attention should be paid.

Security information

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

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit (<https://www.siemens.com/industrialsecurity>).

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

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

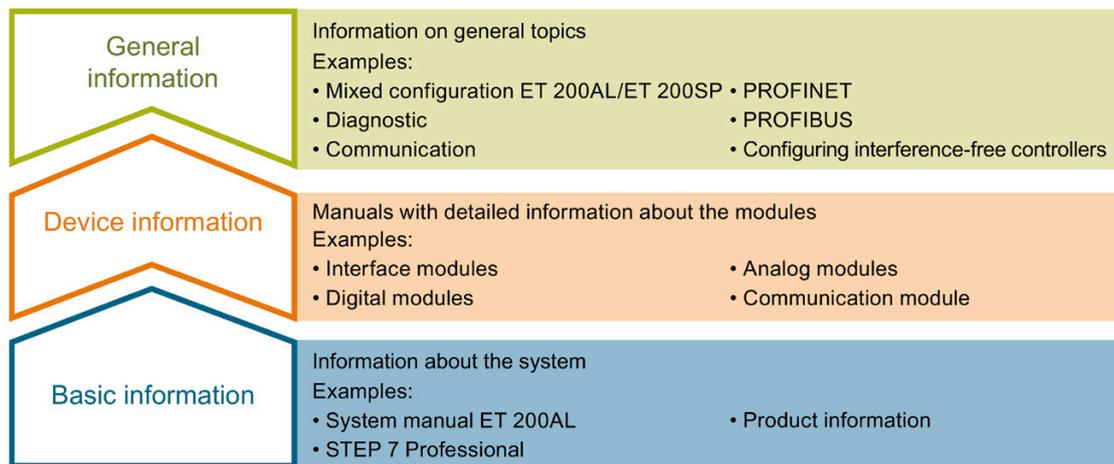
Table of contents

	Preface	3
1	Documentation guide	5
2	Product overview	9
2.1	Properties	9
2.2	Operator controls and display elements.....	12
2.3	Functions	13
2.4	Reset communication module to factory settings.....	13
3	Wiring	14
3.1	Terminal and block diagram	14
3.2	Pin assignment	15
4	Parameters/address space	18
4.1	Parameters	18
4.2	Explanation of the parameters	20
5	Diagnostics alarms	25
5.1	Status and error displays	25
5.2	Diagnostics alarms	28
6	Technical specifications	33
7	Replacing modules	33
8	PROFenergy	34
8.1	Pause function.....	34
8.2	DI operating mode.....	35
8.3	DQ operating mode	37
8.4	IO-Link operating mode	39
A	Dimension drawing	41

Documentation guide

The documentation for the SIMATIC ET 200AL distributed I/O system is arranged into three areas.

This arrangement enables you to access the specific content you require.



Basic information

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

Device information

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

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC ET 200AL distributed I/O system, e.g. diagnostics, communication, Motion Control, Web server.

You can download the documentation free of charge from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109742667>).

Manual Collection ET 200AL

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

You can find the Manual Collection on the Internet (<http://support.automation.siemens.com/WW/view/en/95242965>).

"mySupport"

With "mySupport", your personal workspace, you make the best out of your Industry Online Support.

In "mySupport", you can save filters, favorites and tags, request CAx data and compile your personal library in the Documentation area. In addition, your data is already filled out in support requests and you can get an overview of your current requests at any time.

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

You can find "mySupport" on the Internet (<https://support.industry.siemens.com/My/ww/en>).

"mySupport" - Documentation

In the Documentation area in "mySupport" you can combine entire manuals or only parts of these to your own manual.

You can export the manual as PDF file or in a format that can be edited later.

You can find "mySupport" - Documentation on the Internet (<http://support.industry.siemens.com/My/ww/en/documentation>).

"mySupport" - CAx data

In the CAx data area in "mySupport", you can access the current product data for your CAx or CAe system.

You configure your own download package with a few clicks.

In doing so you can select:

- Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files
- Manuals, characteristics, operating manuals, certificates
- Product master data

You can find "mySupport" - CAx data on the Internet (<http://support.industry.siemens.com/my/ww/en/CAxOnline>).

Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus on individual products.

You will find the application examples on the Internet (<https://support.industry.siemens.com/sc/ww/en/sc/2054>).

TIA Selection Tool

With the TIA Selection Tool, you can select, configure and order devices for Totally Integrated Automation (TIA).

This tool is the successor of the SIMATIC Selection Tool and combines the known configurators for automation technology into one tool.

With the TIA Selection Tool, you can generate a complete order list from your product selection or product configuration.

You can find the TIA Selection Tool on the Internet

(<http://w3.siemens.com/mcms/topics/en/simatic/tia-selection-tool>).

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to perform commissioning and maintenance activities simultaneously on different SIMATIC S7 stations as a bulk operation, independently of the TIA Portal.

General function overview:

- Network browsing and creation of a table showing the accessible devices in the network
- Flashing of device LEDs or HMI display to locate a device
- Downloading of addresses (IP, subnet, gateway) to a device
- Downloading the PROFINET name (station name) to a device
- Placing a CPU in RUN or STOP mode
- Setting the time in a CPU to the current time of your PG/PC
- Downloading a new program to a CPU or an HMI device
- Downloading from CPU, downloading to CPU or deleting recipe data from a CPU
- Downloading from CPU or deleting data log data from a CPU
- Backup/restore of data from/to a backup file for CPUs and HMI devices
- Downloading service data from a CPU
- Reading the diagnostics buffer of a CPU
- Performing a CPU memory reset
- Resetting devices to factory settings
- Downloading a firmware update to a device

You can find the SIMATIC Automation Tool on the Internet

(<https://support.industry.siemens.com/cs/ww/en/view/98161300>).

PRONETA

With SIEMENS PRONETA (PROFINET network analysis), you analyze the system network during commissioning. PRONETA features two core functions:

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

You can find SIEMENS PRONETA on the Internet

(<https://support.industry.siemens.com/cs/ww/en/view/67460624>).

SINETPLAN

SINETPLAN, the Siemens Network Planner, supports you in planning automation systems and networks based on PROFINET. The tool facilitates professional and predictive dimensioning of your PROFINET installation as early as in the planning stage. In addition, SINETPLAN supports you during network optimization and helps you to exploit network resources optimally and to plan reserves. This helps to prevent problems in commissioning or failures during productive operation even in advance of a planned operation. This increases the availability of the production plant and helps improve operational safety.

The advantages at a glance

- Network optimization thanks to port-specific calculation of the network load
- Increased production availability thanks to online scan and verification of existing systems
- Transparency before commissioning through importing and simulation of existing STEP 7 projects
- Efficiency through securing existing investments in the long term and optimal exploitation of resources

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

Product overview

2.1 Properties

Article number

6ES7147-5JD00-0BA0

View of the module

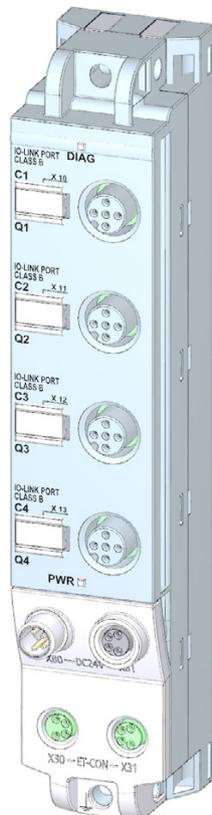


Figure 2-1 View of the CM 4xIO-Link 4xM12 communication module

Properties

The module has the following technical properties:

- IO-Link Master according to IO-Link specification V1.1
- 4 ports, type class B
- 4 M12 connectors
- SIO mode (standard IO mode)
- Supported data transmission rates:
 - COM1 (4.8 kBd)
 - COM2 (38.4 kBd)
 - COM3 (230.4 kBd)
- Configuration limits:
 - Max. 33 bytes of input data and 32 bytes of output data per port
 - Max. 132 bytes of input data and 128 bytes of output data per module
- Automatic backup of device parameters during replacement of the IO-Link device (only for V1.1 devices)
- Suitable for connection of IO-Link devices with 3-wire and 5-wire connection
- Configurable diagnostics can be set for each channel
- Dimensions 30 x 159 mm

The module supports the following functions:

Table 2-1 Version dependencies of the module functions

Function	Firmware version of the module
Firmware update	V1.0 or higher
Identification and maintenance data (I&M)	V1.0 or higher
PROFenergy	V1.0 or higher
IO-Link port configuration with S7-PCT (as of V3.2)	V1.0 or higher
IO-Link port configuration without S7-PCT	V1.1 or higher
Master backup with "IO_LINK_MASTER" function block	V1.1 or higher
Port Qualifier Information (PQI)	V1.1 or higher
Support of I/O data per module > 32 bytes	V1.2 or higher

Accessories

The following components are included in the module package:

- Identification labels
- Spacers

Other components

The following component can be ordered as spare part:

- Identification labels

The following components can be ordered as accessories:

- Connectors
- Cables
- Stripping Tool for ET-Connection
- M8 sealing cap
- M12 sealing cap

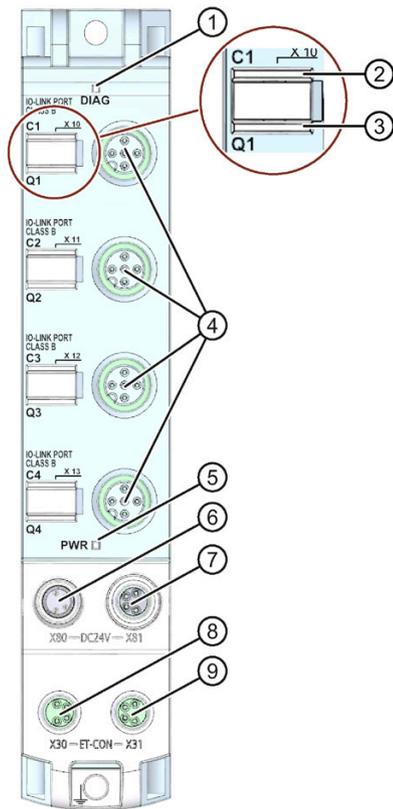
See also

You can find more information on accessories in the Accessories/spare parts section of the ET 200AL distributed I/O system

(<http://support.automation.siemens.com/WW/view/en/89254965>) system manual.

2.2 Operator controls and display elements

The following figure shows the operator controls and display elements of the CM 4xIO-Link 4xM12 communication module.



- ① DIAG: LED display for mode and diagnostic status
- ② C1 to C4: LED displays for port status
- ③ Q1 to Q4: LED displays for channel status in SIO mode
- ④ X10 to X13: Sockets for device connection
- ⑤ PWR: LED display for the load voltage 2L+
- ⑥ X80: Connector for infeed of the supply voltage (POWER input)
- ⑦ X81: Socket for loop-through of the supply voltage (POWER output)
- ⑧ X30: Socket for ET-Connection IN
- ⑨ X31: Socket for ET-Connection OUT

Figure 2-2 Operator controls and display elements

2.3 Functions

IO-Link is a point-to-point connection between an IO-Link master and an IO-Link device. On the IO-Link master, you can use IO-Link devices as well as conventional sensors/actuators with unshielded standard cables using proven 3-wire technology. IO-Link is backward compatible to conventional digital sensors or actuators. Switching status channel and data channel are in proven 24 V DC technology.

Reference

For more information on the IO-Link system, please see the IO-Link system (<http://support.automation.siemens.com/WW/view/en/65949252>) function manual.

2.4 Reset communication module to factory settings

Effects of resetting to the factory settings

Use the "Reset to factory settings" function to restore the parameter assignments of your CM 4xIO-Link 4xM12 communication module made with S7-PCT to the factory state.

After a "Reset to factory settings", the parameters of the CM 4xIO-Link 4xM12 communication module are assigned as follows:

- The ports are in DI mode
- The ports are mapped to the relative addresses 0.0 ... 0.3
- The PortQualifier is disabled
- The I&M data 1 ... 3 are deleted

Note

The device parameters are deleted and the factory state is restored.

You should reset a removed CM 4xIO-Link 4xM12 communication module to the factory settings before you place it in storage.

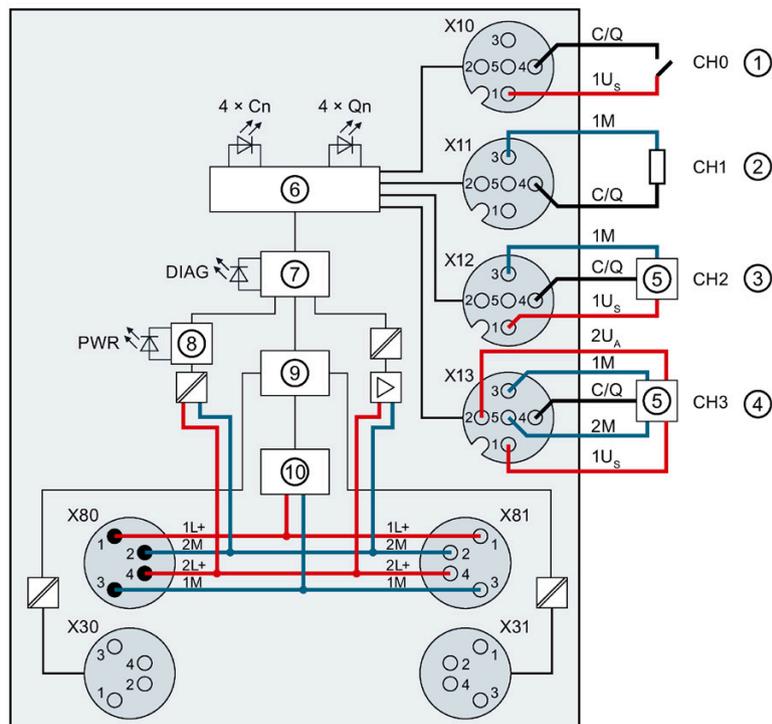
Procedure

To perform a "Reset to factory settings", proceed as described in the S7-PCT online help.

Wiring

3.1 Terminal and block diagram

The following figure shows an example of the pin assignment for Port Class A (Type A) and Port Class B (Type b).



①	SIO input	X31	Loop-through of the ET-Connection
②	SIO output	1L+	Supply voltage 1L+ (non-switched)
③	Port Class A (Type A)	1M	Ground 1M (non-switched)
④	Port Class B (Type B)	2L+	Load voltage 2L+ (switched)
⑤	IO-Link device	2M	Ground 2M (switched)
⑥	IO-Link switching	1Us	24 V encoder supply
⑦	Microcontroller	2Ua	24 V actuator supply
⑧	Monitoring	1M	Ground for encoder supply
⑨	ET-Connection interface	2M	Ground for actuator supply
⑩	Internal supply voltage	C/Q	Port n
X10 to X13	Channels 0 to 3	Cn	LEDs channel status (green)
X80	Infeed of supply voltages	Qn	LED status in SIO mode (green)
X81	Loop-through of supply voltages	DIAG	LED diagnostic status (red/green)
X30	Infeed of the ET-Connection	PWR	LED supply voltage 2L+ (green)

Figure 3-1 Terminal and block diagram

3.2 Pin assignment

Note

Color coding

The sockets for ET-Connection and the power supply of the modules are color-coded. These colors correspond to the colors of the offered cables.

Pin assignment of the IO-Link sockets

Note

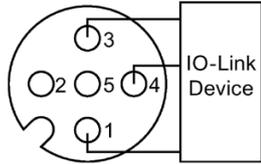
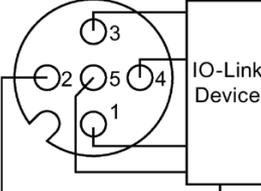
Port Class B

The pin assignment of the IO-Link interface corresponds to the IO-Link specification as per Port Class B. Port Class B is specially suited for the connection of actuators with additional supply (e.g. valve terminals).

To connect devices with Port Class A (e.g. sensors) to the communication module CM 4xIO-Link 4xM12, a 3-wire connection cable should be used (Port Class A compatibility).

The table below shows the pin assignments of the 4 sockets for the connection of IO-Link.

Table 3- 1 Pin assignment of the IO-Link

Pin	Assignment	Front view of the sockets
	X10 to X13 - sockets for IO-Link	
1	24 V encoder supply 1Us (from 1L+)	<p>Port Class A (Type A)*</p>  <p>Port Class B (Type B)</p> 
2	24 V actuator supply 2U _A (from 2L+)	
3	Encoder supply ground 1M	
4	Port 1 (C/Q): Connector X10 Port 2 (C/Q): Connector X11 Port 3 (C/Q): Connector X12 Port 4 (C/Q): Connector X13	
5	Ground for actuator supply 2M	
* If you use the sockets for IO-Link as Port Class A, you may not place any signals on pins 2 and 5.		

The M12 connectors are designed according to IO-Link specification as port type Class B. Pins 2 and 5 contain an additional power supply.

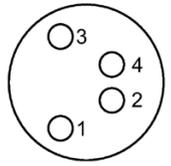
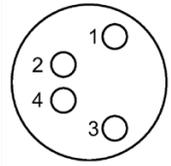
Reaction-free connection of devices with different port types (Class A and Class B) is possible using a 3-wire connecting cable (assignment of pins 1, 3 and 4).

NOTICE
24 V encoder supply 1Us
For the supply of devices, only use the 24 V 1Us encoder supply provided by the communication device.

Pin assignment of the sockets for ET-Connection

The table below shows the pin assignments of the 2 sockets for the connection of ET-Connection.

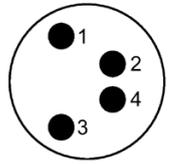
Table 3- 2 Pin assignment for ET-Connection

Pin	Assignment		Assignment of the wire color of the bus line cable for ET-Connection	Front view of the sockets	
	X30 socket (ET-Connection IN)	X31 socket (ET-Connection OUT)		X30	X31
1	TXP	RXP	Yellow		
2	RXP	TXP	White		
3	RXN	TXN	Blue		
4	TXN	RXN	Orange		
Shield	Functional earth FE		-		

Pin assignment of the connector for infeed of the supply voltage

The table below shows the pin assignment of the connector for infeed of the supply voltage.

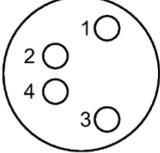
Table 3- 3 Pin assignment of the supply voltage connector

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

Pin assignment of the socket for loop-through of the supply voltage

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

Table 3-4 Pin assignment of the supply voltage socket

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

<p>NOTICE</p> <p>ET-Connection/supply voltage</p> <p>Observe the correct wiring of the M8 sockets for ET-Connection and the supply voltage.</p> <p>Mixing up the connector for ET-Connection and the connector for the supply voltage can destroy the module.</p>

Parameters/address space

4.1 Parameters

Parameters

The following table shows the general parameters for the communication module CM 4xIO-Link 4xM12.

Table 4- 1 General parameters

Parameters	Range of values	Default	Scope
Diagnostics			
Diagnostics: No supply voltage 2L+	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Module
Diagnostics port 1	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Channel
Diagnostics port 2	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Channel
Diagnostics port 3	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Channel
Diagnostics port 4	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Channel
Configuration			
Input / output type	See table in section Explanation of the parameters (Page 23)	32I/32O	Module
Port configuration without S7-PCT	<ul style="list-style-type: none"> • Disable • Enable 	Disable	Module
Port Qualifier Information (PQI)	<ul style="list-style-type: none"> • Disable • Enable 	Enable	Module

4.1 Parameters

The following table shows the port parameters for the communication module CM 4xIO-Link 4xM12 with firmware version V1.1.

Table 4-2 Port parameters

Parameters	Range of values	Default
Port configuration		
Operating mode	<ul style="list-style-type: none"> IO-Link autostart IO-Link manual DI DQ Disabled 	IO-Link autostart
Length of input data (without PQI)	Depending on the total length of the module*	Depending on the total length of the module*
Length of output data	Depending on the total length of the module*	Depending on the total length of the module*
Vendor ID**	Vendor ID of the connected IO-Link device	0
Device ID**	Device ID of the connected IO-Link device	0
Testing accuracy / data storage**	<ul style="list-style-type: none"> Same type (V1.0) without Backup&Restore Type compatible (V1.1) without Backup&Restore Type compatible (V1.1) with Backup&Restore Type compatible (V1.1) with Restore 	Type compatible (V1.1) with Backup&Restore

* Make sure that you do not exceed the maximum possible length of the input or output data for all ports that you selected.

Example:

You selected the 64I/64O configuration. You have assigned 16 bytes of input data to the first port. You can still assign a total of 48 bytes of input data for the remaining three ports.

** Only in effect when "IO-Link manual" port mode is used.

4.2 Explanation of the parameters

Diagnostics: No supply voltage 2L+

Enabling of the diagnostics for no or insufficient supply voltage 2L+.

Diagnostics port

This parameter enables the diagnostics for the selected port.

The diagnostics possible depends on the IO-Link device in use. Additional information about the diagnostic interrupts can be found in the description of the utilized IO-Link device.

Input / output type

This parameter sets the maximum length of the input and output data of the module.

Port configuration without S7-PCT

This parameter releases the port configuration without S7-PCT for the module.

Port Qualifier Information

This parameter releases the Port Qualifier Information (PQI).

The PQI provides information on the device status of the port and IO-Link.

Operating mode

This parameter determines the mode in which the selected port should be operated. You can select from the following options:

- IO-Link autostart
- IO-Link manual
- DI
- DQ
- Disabled

IO-Link autostart

The connected IO-Link device starts automatically (Plug&Play functionality). The IO-Link device is immediately ready for operation.

IO-Link manual

The connected IO-Link device is **not** started automatically. You must store the Vendor ID and Device ID of the connected IO-Link device in STEP 7. In addition, you can select the inspection severity for data storage:

- Identical type (V1.0) without Backup&Restore
- Type-compatible (V1.1) without Backup&Restore
- Type-compatible (V1.1) with Backup&Restore
- Type-compatible (V1.1) with Restore

You can find the Vendor ID and Device ID on the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109748852>).

DI

The port is operating as a standard digital input.

DQ

The port is operating as a standard digital output.

Disabled

The port is disabled.

Configuration options of the communication module CM 4xIO-Link 4xM12

The CM 4xIO-Link 4xM12 communication module supports a variable address space for I/O data.

The following table provides an overview of the configuration options for the supported address spaces for I/O data:

Table 4- 3 Configuration options of the communication module CM 4xIO-Link 4xM12

Module configuration/ supporting address space for I/O data	IO-Link Master with Firmware V1.0	IO-Link Master with Firmware V1.1	IO-Link master with firmware V1.2
1-byte input/1-byte output	X		
2-byte inputs/2-byte outputs	X		
4-byte inputs/4-byte outputs	X	X*	X*
8-byte inputs/0-byte outputs		X	X
8-byte inputs/8-byte outputs	X	X	X
12-byte inputs/8-byte outputs		X	X
16-byte inputs/16-byte outputs	X	X	X
20-byte inputs/16-byte outputs		X	X
32-byte inputs/32-byte outputs	X	X	X
36-byte inputs/32-byte outputs			X
48-byte inputs/48-byte outputs			X
52-byte inputs/48-byte outputs			X
64-byte inputs/64-byte outputs			X
68-byte inputs/64-byte outputs			X
80-byte inputs/80-byte outputs			X
84-byte inputs/80-byte outputs			X
96-byte inputs/96-byte outputs			X
100-byte inputs/96-byte outputs			X
112-byte inputs/112-byte outputs			X
116-byte inputs/112-byte outputs			X
128-byte inputs/128-byte outputs			X
132-byte inputs/128-byte outputs			X

* No PortQualifierInformation is transferred with this configuration.

Port configuration

You can use a CM 4xIO-Link 4xM12 communication module as of firmware version V1.1 to commission the IO-Link ports of the IO-Link master or the connected IO-Link devices in two different ways:

- Port configuration without S7-PCT
- Port configuration with S7-PCT

4.2 Explanation of the parameters

Port configuration without S7-PCT

Requirement

You have enabled the check box "Port configuration without S7-PCT" for the configuration of the IO-Link master in STEP 7.

Procedure

You configure the IO-Link master directly in STEP 7:

- Enabling of the diagnostics
- Configuration of the I/O data lengths per port
- Enabling of the Port Qualifier Information (PQI)
- Port mode:
 - Operation in "IO-Link autostart" mode (default)
 - Operation in "IO-Link manual" mode
 - Operated as DI
 - Operated as DQ
 - Disabled

Port configuration with S7-PCT

Requirement

You deselected the "Port configuration without S7-PCT" check box in the configuration of the IO-Link master in STEP 7.

Procedure

You configure the port configuration of the IO-Link master using the port configuration tool S7-PCT as of V3.2.

Port Qualifier Information (PQI)

You can enable the Port Qualifier Information (PQI) for your IO-Link master as of firmware version V1.1.

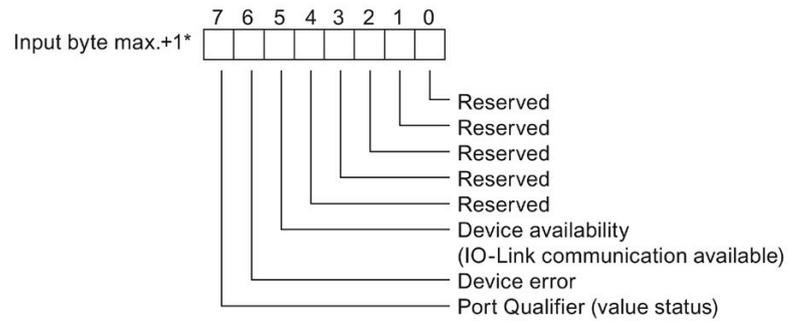
Note

Port Qualifier Information (PQI)

If you have enabled the Port Qualifier Information (PQI), this information is always sent with the size of 1 byte together with the input data of the IO-Link device.

The following figure show the structure of the PQI byte.
You enable a parameter by setting the corresponding bit to "1".

Port Qualifier Information (PQI)



* The PQI byte is always located after the last input byte of the port.

Figure 4-1 Structure of the PQI byte

Reference

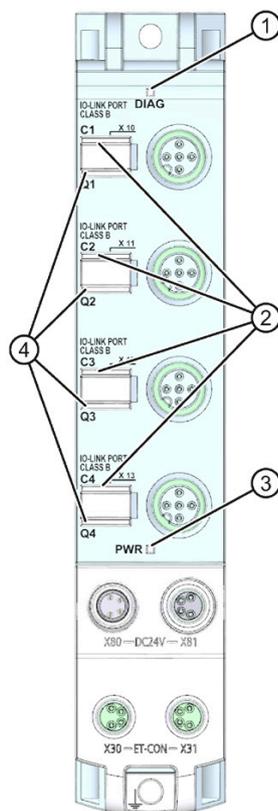
For more information, please refer to the IO-Link system
(<http://support.automation.siemens.com/WW/view/en/65949252>) function manual.

Diagnostics alarms

5.1 Status and error displays

LED displays

The following figure shows the LED display of the CM 4xIO-Link 4xM12 communication module.



- | | | |
|---|-----------------------------------|-------------|
| ① | Diagnostics (DIAG) | (green/red) |
| ② | Port status / IO-Link status (Cn) | (green) |
| ③ | Load voltage 2L+ (PWR) | (green) |
| ④ | Channel status in SIO mode (Qn) | (green) |

Figure 5-1 LED displays

Meaning of the LEDs

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

DIAG LED

Table 5-1 Error display of the DIAG LED

DIAG LED	Meaning
 Off	No supply voltage 1L+
 Flashes	<ul style="list-style-type: none"> Module parameters not assigned (after switching on the supply voltage 1L+) Loading firmware (while the firmware update is being performed, all LEDs retain their current status) No connection to the ET-Connection and/or the fieldbus
 On	Module parameters assigned and no module diagnostics
 Flashes	Module parameters assigned and module diagnostics

LEDs Cn

Valid for IO-Link port in IO-Link mode.

Table 5-2 Status displays of the C1, C2, C3, and C4 LEDs

C1, C2, C3, or C4 LED	Meaning
 Off	Port disabled or in SIO mode
 Flashes	Port in IO-Link mode, device not connected or port not connected with the configured device
 On	Port in IO-Link mode, device not connected

PWR LED

Table 5-3 Status display of the PWR LED

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

LEDs Qn

Valid for IO-Link port in SIO mode.

Table 5- 4 Status displays of the Q1, Q2, Q3, and Q4 LEDs

Q1, Q2, Q3, and Q4 LEDs	Meaning
□ Off	Process signal = 0 in SIO mode, deactivated or in IO-Link mode
■ On	Process signal = 1 in SIO mode

5.2 Diagnostics alarms

For each diagnostic event, a diagnostics alarm is issued and the DIAG LED flashes red on the communication module. You can read out the diagnostics alarms, for example, in the diagnostics buffer of the CPU. You can evaluate the error codes with the user program.

Table 5- 5 Error types

Diagnostics alarm	Error code	Meaning (IO-Link error code)	IO-Link master	IO-Link device
Short-circuit	1H	• Short-circuit at the process cables on the IO-Link device (1804H)	X	
		• Short-circuit on IO device (7710H)		X
Undervoltage	2H	• Supply voltage too low (5111H, 5112H)		X
Overvoltage	3H	• Supply voltage too high (5110H)		X
Overtemperature	5H	• Temperature exceeded on master (1805H)	X	
		• Temperature exceeded on device (4000H, 4210H)		X
Wire break	6H	• No IO-Link device connected • There is a break on the signal line to the IO-Link device • IO-Link device cannot communicate due to a different error (1800H)	X	
Overflow	7H	• Process tag range exceeded (8C10H) • Measuring range exceeded (8C20H)		X
Underflow	8H	• Process tag range too low (8C30H)		X
Error	9H	• All IO-Link error codes which are not listed here are mapped to this PROFIBUS DP error		X
Parameter assignment error	10H	• Incorrect device (1802H) • Vendor ID and Device ID not defined (1817H) • Process data length of the IO-Link device exceeded (1818H) • No cycle time configured (1819H) • IO-Link master could not be configured (1882H, 1883H) • Memory error (1886H) • Process data length exceeded (1887H) • PQI not supported (1889H)	X	
		• Device was not configured correctly (6320H, 6321H, 6350H)		X
Supply voltage missing	11H	• 24 V encoder supply 1Us (of 1L+) for device missing (1806H) • 24 V encoder supply 1Us (of 1L+) for device too low (<20 V) (1807H) • Load voltage 2L+ (switched) missing (1888H) • 24 V actuator supply 2 UA (of 2L+) for device missing (180EH)	X	
Defective fuse	12H	• Fuse on device is defective (5101H)		X

Diagnostics alarm	Error code	Meaning (IO-Link error code)	IO-Link master	IO-Link device
Safety shutdown	19H	<ul style="list-style-type: none"> • Serious error (master has to be replaced) (1880H) 	X	
External fault	1AH	<ul style="list-style-type: none"> • Error during data backup (1809H, 180AH, 180BH, 180CH, 180DH) • More than six errors are pending simultaneously on the IO-Link device (1808H) • Consistency error in electronic coding element (1885H) • Process data length exceeded (1887H) 	X	

Technical specifications

Technical specifications of the CM 4xIO-Link 4xM12 communication module

The following table shows the technical specifications as of 03/2021. You can find a data sheet including daily updated technical specifications on the Internet (<https://support.industry.siemens.com/cs/ww/en/pv/6ES7147-5JD00-0BA0/td?dl=en>).

Article number	6ES7147-5JD00-0BA0
General information	
Product type designation	CM 4x IO-Link
HW functional status	FS05
Firmware version	V1.2.x
Product function	
<ul style="list-style-type: none"> I&M data 	Yes; I&M0 to I&M3
Engineering with	
<ul style="list-style-type: none"> STEP 7 TIA Portal configurable/integrated from version 	STEP 7 V13 SP1 or higher
<ul style="list-style-type: none"> STEP 7 configurable/integrated from version 	From V5.5 SP4 Hotfix 3
<ul style="list-style-type: none"> PROFIBUS from GSD version/GSD revision 	GSD as of Revision 5
<ul style="list-style-type: none"> PROFINET from GSD version/GSD revision 	GSDML V2.3.1
Supply voltage	
Load voltage 1L+	
<ul style="list-style-type: none"> Rated value (DC) 	24 V
<ul style="list-style-type: none"> permissible range, lower limit (DC) 	20.4 V
<ul style="list-style-type: none"> permissible range, upper limit (DC) 	28.8 V
<ul style="list-style-type: none"> Reverse polarity protection 	Yes
Load voltage 2L+	
<ul style="list-style-type: none"> Rated value (DC) 	24 V
<ul style="list-style-type: none"> permissible range, lower limit (DC) 	20.4 V
<ul style="list-style-type: none"> permissible range, upper limit (DC) 	28.8 V
<ul style="list-style-type: none"> Reverse polarity protection 	Yes; against destruction; load increasing
Input current	
Current consumption (rated value)	40 mA; without load
from load voltage 1L+ (unswitched voltage)	4 A; Maximum value
from load voltage 2L+, max.	4 A; Maximum value
Encoder supply	
Number of outputs	4

Article number	6ES7147-5JD00-0BA0
24 V encoder supply	
<ul style="list-style-type: none"> Short-circuit protection Output current, max. 	<p>Yes; per module, electronic</p> <p>1.4 A; Total current of all ports</p>
Power loss	
Power loss, typ.	2.6 W
IO-Link	
Number of ports	4
<ul style="list-style-type: none"> of which simultaneously controllable 	4
IO-Link protocol 1.0	Yes
IO-Link protocol 1.1	Yes
Transmission rate	4.8 kBaud (COM1); 38.4 kBaud (COM2), 230 kBaud (COM3)
Size of process data, input per port	32 byte
Size of process data, input per module	132 byte
Size of process data, output per port	32 byte
Size of process data, output per module	128 byte
Memory size for device parameter	2 kbyte; for each port
Master backup	Possible with function block IO_LINK_MASTER
Configuration without S7-PCT	Possible; autostart/manual function
Cable length unshielded, max.	20 m
Operating modes	
<ul style="list-style-type: none"> IO-Link DI DQ 	<p>Yes</p> <p>Yes</p> <p>Yes; max. 100 mA</p>
Connection of IO-Link devices	
<ul style="list-style-type: none"> Port type A Port type B 	<p>Yes; via 3-core cable</p> <p>Yes; Additional device supply: 1.6 A total current of all ports</p>
Interrupts/diagnostics/status information	
Alarms	
<ul style="list-style-type: none"> Diagnostic alarm 	Yes; Parameterizable
Diagnoses	
<ul style="list-style-type: none"> Monitoring the supply voltage Wire-break Short-circuit 	<p>Yes</p> <p>Yes</p> <p>Yes</p>
Diagnostics indication LED	
<ul style="list-style-type: none"> Channel status display for module diagnostics For load voltage monitoring 	<p>Yes; green LED</p> <p>Yes; green/red LED</p> <p>Yes; green LED</p>
Potential separation	
between the load voltages	Yes
Potential separation channels	

Article number	6ES7147-5JD00-0BA0
<ul style="list-style-type: none"> • between the channels 	No
<ul style="list-style-type: none"> • between the channels and backplane bus 	Yes
<ul style="list-style-type: none"> • between the channels and the power supply of the electronics 	No
Isolation	
Isolation tested with	707 V DC (type test)
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	
<ul style="list-style-type: none"> • Performance level according to ISO 13849-1 	PL d
<ul style="list-style-type: none"> • Category according to ISO 13849-1 	Cat. 3
<ul style="list-style-type: none"> • SILCL according to IEC 62061 	SILCL 2
Ambient conditions	
Ambient temperature during operation	
<ul style="list-style-type: none"> • min. 	-30 °C
<ul style="list-style-type: none"> • max. 	55 °C
Connection method	
Design of electrical connection for the inputs and outputs	M12, 5-pole
Design of electrical connection for supply voltage	M8, 4-pole
ET-Connection	
<ul style="list-style-type: none"> • ET-Connection 	M8, 4-pin, shielded
Dimensions	
Width	30 mm
Height	159 mm
Depth	40 mm
Weights	
Weight, approx.	145 g

Replacing modules

What do you need to know when replacing modules?

When you replace the communication module CM 4xIO-Link 4xM12, you must transfer the IO-Link parameter settings (master/device) again. You can transfer the IO-Link configuration using S7-PCT or save it with the Master Backup function.

Master Backup

The "IO_LINK_MASTER" function block is used to read all relevant IO-Link device and IO-Link master parameters. These can be stored retentively at a central location, such as in a data block in the IO controller.

The status of the IO-Link devices or IO-Link ports stored in the IO-Link master can be restored with the "IO_LINK_MASTER" function block.

As a result, the IO-Link ports and the IO-Link master are configured with the values stored in the master backup.

A typical application is the restoration of parameters after replacement of the IO-Link master.

Note

Availability

Note that the Master Backup function is available only for IO-Link devices that are specified for the IO-Link Standard as of V1.1.

You will find information on the Master Backup and Master Restore functions in section "Master backup" of chapter "Integration into the automation system" of the IO-Link System (<https://support.industry.siemens.com/cs/ww/en/view/65949252>) function manual.

Reference

You will find additional information on replacing modules in the system manual ET 200AL distributed I/O system (<http://support.automation.siemens.com/WW/view/en/89254965>) in the "Module" section.

You will find additional information on replacing IO-Link masters in the S7-PCT online help.

PROFenergy

8.1 Pause function

Introduction

PROFenergy is a PROFINET-based data interface for switching off consumers centrally and in a coordinated manner during pause times regardless of the manufacturer or device type. This has the aim that the process is only provided with the energy that is absolutely required. In so doing, the majority of the energy savings come from the process itself; the PROFINET device contributes only a few watts to the possible savings. In PROFenergy, this operating state is referred to as a "pause".

Start and end of a pause

You enable and disable the pause function of the system at the beginning and end of pauses, respectively; the IO controller then sends the PROFenergy command "Start_Pause" or "End_Pause" to the modules.

Use the "Start_Pause" command to start a pause.

Use the "End_Pause" command to end a pause.

The following conditions will also cause a pause to be ended:

- Reconfiguration in RUN
- Controller failure
- Firmware update
- Station stop
- Restart of the interface module through:
 - POWER OFF/POWER ON of an interface module
 - POWER OFF/POWER ON of an I/O module
 - Termination of ET-Connection1 or ET-Connection2

The specific behavior of the communication module is explained in the following sections.

Additional information

You can find additional information on working with PROFenergy in the "PROFenergy" section of the manual IM 157-1 PN interface module (<http://support.automation.siemens.com/WW/view/en/89254863>) and the "Saving energy with PROFenergy" section of function manual PROFINET with STEP 7 V13 (<http://support.automation.siemens.com/WW/view/en/49948856>).

Application examples (<http://support.automation.siemens.com/WW/view/en/41986454>) are also available on the Internet.

8.2 DI operating mode

Display

If no external supply voltage is connected, switching off supply voltages 1Us and 2U_A also leads to switching off the associated channel status LED Q_n.

Response to error detection

All channels that are in pause mode on "PE_MODE_PROCEED" report their diagnostic status as in productive mode.

The following applies for all channels which switch to a different pause mode:

- During the "pause", error detection of "Load voltage 2L+" is not possible:
 - Alarms for errors already pending before the "pause" are retained.
 - After the "pause" is over, the error status is updated and incoming/outgoing errors are reported correspondingly.

Mode parameter

The following table shows the "Mode" parameter.

Table 8-1 Mode parameter

Element	Code	Explanation
Mode	0 _D : PE_MODE_PROCEED	Proceed at "pause" • Value status "GOOD"
	1 _D : PE_MODE_SHUTDOWN	Switch off at "pause" • Supply voltages 1Us and 2U _A off • Pause substitute value: 0 _B • Value status "BAD"
	3 _D : PE_MODE_LAST_VALUE	Last value at "pause" • Supply voltages 1Us and 2U _A off • Pause substitute value: Last input value • Value status "BAD"
	4 _D : PE_MODE_SUBST_VALUE	Substitute value at "pause" • Supply voltages 1Us and 2U _A off • Pause substitute value: Configured pause substitute value • Value status "BAD"

Note**Supply voltages 1U_S and 2U_A**

Supply voltages 1U_S and 2U_A can only be switched off separately for each module.

If all channels require switching off during the pause, all supply voltages are switched off if no channel is assigned in PE_MODE_PROCEED.

8.3 DQ operating mode

Display

The channel status LEDs Qn show the output value.

Response to error detection

All channels that are in pause mode on "PE_MODE_PROCEED" report their diagnostic status as in productive mode.

The following applies for all channels which switch to a different pause mode:

- During the "pause", error detection of "Load voltage 2L+ missing" is not possible:
 - Alarms for errors already pending before the "pause" are retained.
 - After the "pause" is over, the error status is updated and incoming/outgoing errors are reported correspondingly.

Mode parameter

The following table shows the "Mode" parameter.

Table 8-2 Mode parameter

Element	Code	Explanation
Mode	0 _D : PE_MODE_PROCEED	Proceed at "pause" <ul style="list-style-type: none"> • Value status "GOOD"
	1 _D : PE_MODE_SHUTDOWN	Switch off at "pause" <ul style="list-style-type: none"> • Supply voltages 1U_S and 2U_A off • Pause substitute value: 0_B • Value status "BAD"
	3 _D : PE_MODE_LAST_VALUE	Last value at "pause" <ul style="list-style-type: none"> • Pause substitute value: Last output value is maintained • Value status "BAD"
	4 _D : PE_MODE_SUBST_VALUE	Substitute value at "pause" <ul style="list-style-type: none"> • Pause substitute value: Configured pause substitute value is output • Value status "BAD"

Note**Supply voltages 1U_S and 2U_A**

Supply voltages 1U_S and 2U_A can only be switched off separately for each module.

If all channels require switching off in the pause, the supply voltages are switched off.

8.4 IO-Link operating mode

Display

Switching off the supply voltage 1Us also switches off the associated port status LED Cn.

Response to error detection

All channels which are set to "PE_MODE_PROCEED" and "PE_MODE_LAST_VALUE" in pause mode report errors as in productive operation.

The following conditions apply to all channels (ports) which switch to a different pause mode ("PE_MODE_SHUTDOWN" and "PE_MODE_SUBST_VALUE"):

- Switching off the supply voltage U_{Sn} (port) upon starting the "pause" does not lead to generation of the alarms "Wire break" and "Short circuit".
- Error detection is not possible during the "pause" (no IO-Link device communication):
 - Alarms for errors already pending before the "pause" are retained.
 - After the "pause" is over, the error status is updated and incoming/outgoing errors are reported correspondingly.

Mode parameter

The following table shows the "Mode" parameter.

Table 8-3 Mode parameter

Element	Code	Explanation
Mode	0D: PE_MODE_PROCEED	Proceed at "pause" <ul style="list-style-type: none"> • Value status "GOOD"
	1D: PE_MODE_SHUTDOWN	Switch off at "pause" <ul style="list-style-type: none"> • Supply voltages 1Us and 2UA off¹ • Pause substitute value (input): 0B • Value status "BAD"
	3D: PE_MODE_LAST_VALUE	Last value at "pause" <ul style="list-style-type: none"> • Pause substitute value: Last input value • Value status "BAD"
	4D: PE_MODE_SUBST_VALUE	Substitute value at "pause" <ul style="list-style-type: none"> • Supply voltages 1Us and 2UA off¹ • Pause substitute value (input): 0B • Value status "BAD"

¹ Supply voltage 1Us of the assigned port is switched off. Result: The IO-Link device is no longer supplied with voltage.

Note**Supply voltages 1U_S and 2U_A**

Supply voltages 1U_S and 2U_A can only be switched off separately for each module.

If all channels require switching off in the pause, the supply voltages are switched off.

Dimension drawing

The following figure shows the dimension drawing of the CM 4xIO-Link 4xM12 communication module in front and side view.

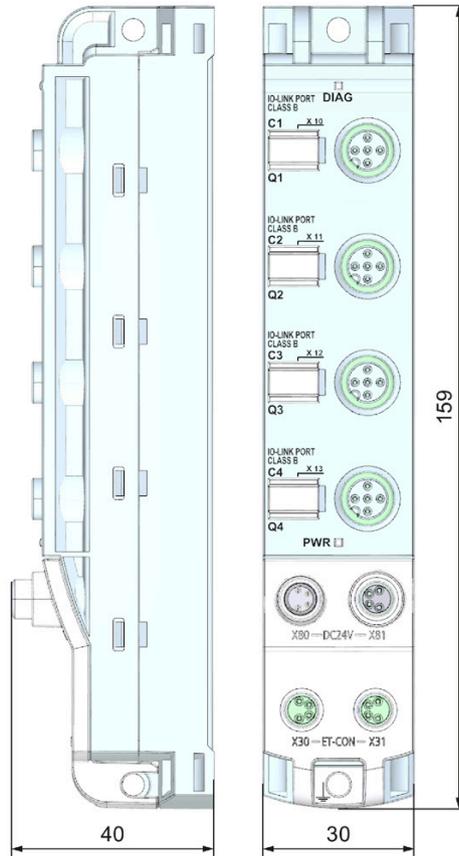


Figure A-1 Dimension drawing