



Manual

SIMATIC

ET 200AL

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

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SIMATIC

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

Manual

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Legal information

Warning notice system

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

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

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

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.

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

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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 (<u>https://www.siemens.com/industrialsecurity</u>).

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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

2.1 Properties

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. 32 bytes input and output data per port
 - Max. 32 bytes input and 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 |
| PROFlenergy | 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 |

Accessories

The following components are included in the module package:

- Identification labels
- Spacers

2.1 Properties

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)
- 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

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

Terminal and block diagram 3.1

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 2 SIO output 3
- Port Class A (Type A) (4)
- Port Class B (Type B) 5 **IO-Link device**
- 6 **IO-Link switching** $\overline{7}$
- Microcontroller (8) Monitoring
- 9
- ET-Connection interface 10 Internal supply voltage
- X10 to X13 Channels 0 to 3
- X80 Infeed of supply voltages
- X81 Loop-through of supply voltages
- X30 Infeed of the ET-Connection
- Figure 3-1 Terminal and block diagram

- X31 Loop-through of the ET-Connection 1L+ Supply voltage 1L+ (non-switched) 1M Ground 1M (non-switched)
- 2L+ Load voltage 2L+ (switched)
- 2M Ground 2M (switched)
- 1Us 24 V encoder supply
- 2UA 24 V actuator supply
- 1M Ground for encoder supply
- 2M Ground for actuator supply
- C/Q Port n
- Cn LEDs channel status (green)
- Qn LED status in SIO mode (green)
- DIAG LED diagnostic status (red/green)
- PWR LED supply voltage 2L+ (green)

Communication module CM 4xIO-Link 4xM12(6ES7147-5JD00-0BA0) Manual, 10/2017, A5E32352322-AE

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.

| Pin | Assignment | Front view of the sockets |
|------------------------|--|--|
| | X10 to X13 - sockets for IO-Link | |
| 1 | 24 V encoder supply 1Us (from 1L+) | Port Class A (Type A)* |
| 2 | 24 V actuator supply 2U _A (from 2L+) | |
| 3 | Encoder supply ground 1M | $\bigcirc 3$ |
| 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 | $\begin{array}{c} \bigcirc 2 \bigcirc 5 \bigcirc 4 \\ \bigcirc 2 \bigcirc 1 \\ \hline \end{array}$ |
| 5 | Ground for actuator supply 2M | |
| * If you u not plac | use the sockets for IO-Link as Port Class A, you may e any signals on pins 2 and 5. | $ \begin{array}{c} $ |

Table 3-1 Pin assignment of the IO-Link

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 $1U_{\rm S}$ 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.

| Pin | Assignment | | Assignment of the | Front view of | f the sockets |
|--------|-------------------------------------|--------------------------------------|--|--|--|
| | X30 socket (ET-Connection IN) | X31 socket (ET-Connection OUT) | wire color of the bus line cable for ET-Connection | X30 | X31 |
| 1 | TXP | RXP | Yellow | | |
| 2 | RXP | TXP | White | $\left(\begin{array}{c} O_{3} \\ O_{4} \end{array} \right)$ | $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$ |
| 3 | RXN | TXN | Blue | $\begin{pmatrix} 0 \\ 0 \\ 2 \end{pmatrix}$ | $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$ |
| 4 | TXN | RXN | Orange | $\left\langle O_{1}\right\rangle ^{2}$ | √ 30 / |
| Shield | Functional earth FE | | - | | |

Table 3-2 Pin assignment for ET-Connection

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 | Front view of the |
|-----|-----------------------------------|------------------------------|---|
| | X80 connector (POWER input) | of the power line cable | connector |
| 1 | Supply voltage 1L+ (non-switched) | Brown | |
| 2 | Ground 2M (switched) | White | $\begin{pmatrix} \bullet^1 \bullet_2 \end{pmatrix}$ |
| 3 | Ground 1M (non-switched) | Blue | |
| 4 | Load voltage 2L+ (switched) | Black | |

Wiring

3.2 Pin assignment

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.

| Pin | Assignment X81 socket (POWER output) | Assignment of the wire color of the power line cable | Front view of the socket |
|-----|---|--|--|
| 1 | Supply voltage 1L+ (non-switched) | Brown | |
| 2 | Ground 2M (switched) | White | $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$ |
| 3 | Ground 1M (non-switched) | Blue | |
| 4 | Load voltage 2L+ (switched) | Black | 30 |

| Table 3- 4 | Pin assignment | of the supply | voltage socket |
|------------|----------------|---------------|----------------|
| | | | |

NOTICE

ET-Connection/supply voltage

Observe the correct wiring of the M8 sockets for ET-Connection and the supply voltage.

Mixing up the connector for ET-Connection and the connector for the supply voltage can destroy the module.

Parameters/address space

4.1 Parameters

Parameters

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

| Parameters | Value range | Default | Scope |
|------------------------------------|---|---------|---------|
| Diagnostics | | | |
| Diagnostics: No supply voltage 2L+ | DisableEnable | Disable | Module |
| Diagnostics port 1 | DisableEnable | Disable | Channel |
| Diagnostics port 2 | DisableEnable | Disable | Channel |
| Diagnostics port 3 | DisableEnable | Disable | Channel |
| Diagnostics port 4 | DisableEnable | Disable | Channel |
| Configuration | | | |
| Input / output type | See table in section Explanation of the parameters (Page 21) | 321/320 | Module |
| Port configuration without S7-PCT | DisableEnable | Disable | Module |
| Port Qualifier Information (PQI) | DisableEnable | Enable | Module |

Table 4-1 General parameters

4.1 Parameters

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

| Parameters | Range of values | Default |
|---------------------------------------|---|---|
| Port configuration | | |
| Operating mode | IO-Link autostart IO-Link manual DI DQ | IO-Link autostart |
| | Disabled | |
| 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** | Same type (V1.0) without Backup&Restore Type compatible (V1.1) | Type compatible (V1.1) with Backup&Restore |
| | without Backup&Restore | |
| | Type compatible (V1.1) with Backup&Restore | |
| | Type compatible (V1.1) with Restore | |

Table 4-2 Port parameters

* Take care not to exceed the maximum possible length of the input or output data for all ports. Example:

You have selected the 32I/32O configuration. You have assigned the first port 16 bytes of input data.

You can still assign a total of 16 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:

| Module configuration/ supporting address space for I/O data | IO-Link Master with Firmware V1.0 | IO-Link Master with Firmware V1.1 |
|--|--------------------------------------|--------------------------------------|
| 1 byte input/1 byte output | Х | |
| 2 bytes inputs/2 bytes outputs | Х | |
| 4 bytes inputs/4 bytes outputs | Х | X* |
| 8 bytes inputs/0 bytes outputs | | Х |
| 8 bytes inputs/8 bytes outputs | Х | Х |
| 12 bytes inputs/8 bytes outputs | | Х |
| 16 bytes inputs/16 bytes outputs | Х | Х |
| 20 bytes inputs/16 bytes outputs | | Х |
| 32 bytes inputs/32 bytes outputs | X | X |

* No Port Qualifier Information 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

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 have **disabled** the check box "Port configuration without S7-PCT" for 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. Depending on the configuration, the PQI byte is therefore located in the process image of the inputs at byte 2, 3, 4, 5, 8, 9, 16, 17, 32 or 33.

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.



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

Figure 5-1 LED displays

(green/red) (green) (green) (green)

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 27).

5.1 Status and error displays

DIAG LED

| DIAG LED | Meaning |
|--------------|---|
| □ Off | No supply voltage 1L+ |
| 兴 Flashes | 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 |
| | Module parameters assigned and no module diagnostics |
| On | |
| <u> </u> | Module parameters assigned and module diagnostics |
| Flashes | |

Table 5-1 Error display of the DIAG LED

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 |
|--|---|
| | Port disabled or in SIO mode |
| Off | |
| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | Port in IO-Link mode, device not connected or |
| Flashes | port not connected with the configured device |
| | Port in IO-Link mode, device not connected |
| On | |

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 (| 21. | Q2. | Q3. | and | Q4 | LEDs |
|------------|--------|----------|----------|-----|------------|-----|-----|------|------|
| | oluluo | alopiayo | | ж, | α <u>,</u> | œ0, | unu | SC I | |

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

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 | 1 _H | • Short-circuit at the process cables on the IO-Link device (1804 $_{\rm H}$) | Х | |
| | | Short-circuit on IO device (7710 _H) | | Х |
| Undervoltage | 2н | • Supply voltage too low (5111 _H , 5112 _H) | | Х |
| Overvoltage | 3 _H | • Supply voltage too high (5110 _H) | | Х |
| Overtemperature | 5н | • Temperature exceeded on master (1805 _H) | Х | |
| | | • Temperature exceeded on device (4000 _H , 4210 _H) | | Х |
| Wire break | 6н | 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 (1800_H) | X | |
| Overflow | 7н | Process tag range exceeded (8C10_H) Measuring range exceeded (8C20_H) | | Х |
| Underflow | 8н | Process tag range too low (8C30_H) | | Х |
| Error | 9н | All IO-Link error codes which are not listed here are mapped to this PROFIBUS DP error | | х |

Diagnostics alarms

5.2 Diagnostics alarms

| Diagnostics alarm | Error code | Meaning (IO-Link error code) | IO-Link master | IO-Link device |
|----------------------|-----------------|--|-------------------|-------------------|
| Parameter | 10н | Incorrect device (1802 _H) | Х | |
| assignment error | | • Vendor ID and Device ID not defined (1817 _H) | | |
| | | • Process data length of the IO-Link device exceeded (1818 _H) | | |
| | | • No cycle time configured (1819 _H) | | |
| | | • IO-Link master could not be configured (1882 _H , 1883 _H) | | |
| | | • Memory error (1886 _H) | | |
| | | Process data length exceeded (1887_H) | | |
| | | • PQI not supported (1889 _H) | | |
| | | • Device was not configured correctly (6320 _H , 6321 _H , 6350 _H) | | Х |
| Supply voltage | 11 _H | • 24 V encoder supply $1U_S$ (of 1L+) for device missing (1806 _H) | Х | |
| missing | | • 24 V encoder supply $1U_S$ (of 1L+) for device too low (<20 V) (1807 _H) | | |
| | | • Load voltage 2L+ (switched) missing (1888 _H) | | |
| | | • 24 V actuator supply 2 UA (of 2L+) for device missing (180E _H) | | |
| Defective fuse | 12 _H | • Fuse on device is defective (5101 _H) | | х |
| Safety shutdown | 19н | • Serious error (master has to be replaced) (1880 _H) | Х | |
| External fault | 1A _H | • Error during data backup (1809н, 180Ан, 180Вн, 180Сн, 180Dн) | Х | |
| | | - More than six errors are pending simultaneously on the IO-Link device (1808_H) | | |
| | | • Consistency error in electronic coding element (1885 _H) | | |
| | | Process data length exceeded (1887_H) | | |

Technical specifications

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

| Article number | 6ES7147-5JD00-0BA0 | | |
|---|---|--|--|
| General information | | | |
| Product type designation | CM 4 x IO-Link | | |
| HW functional status | E03 | | |
| Firmware version | V1.1.x | | |
| Product function | | | |
| I&M data | Yes; I&M0 to I&M3 | | |
| Engineering with | | | |
| STEP 7 TIA Portal configurable/integrated as of version | STEP 7 V15 or higher | | |
| STEP 7 configurable/integrated as of version | From V5.5 SP4 Hotfix 3 | | |
| PROFIBUS as of GSD version/GSD revision | GSD as of Revision 5 | | |
| PROFINET as of GSD version/GSD revision | GSDML V2.3.1 | | |
| Supply voltage | | | |
| 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 | | |
| 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; 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 | | |

| Article number | 6ES7147-5JD00-0BA0 | |
|---|---|--|
| Encoder supply | | |
| Number of outputs | 4 | |
| 24 V encoder supply | | |
| Short-circuit protection | Yes; per module, electronic | |
| Output current, max. | 1.4 A; Total current of all ports | |
| Power loss | | |
| Power loss, typ. | 2.6 W | |
| IO-Link | | |
| Number of ports | 4 | |
| 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 | 32 byte | |
| Size of process data, output per port | 32 byte | |
| Size of process data, output per module | 32 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 | | |
| • IO-Link | Yes | |
| • DI | Yes | |
| • DQ | Yes; max. 100 mA | |
| Connection of IO-Link devices | | |
| Port type A | Yes; via 3-core cable | |
| Port type B | Yes; Additional device supply: 1.6 A total current of all ports | |
| Interrupts/diagnostics/status information | | |
| Alarms | | |
| Diagnostic alarm | Yes; Parameterizable | |
| Diagnostic messages | | |
| Monitoring the supply voltage | Yes | |
| • Wire-break | Yes | |
| Short-circuit | Yes | |

| Article number | 6ES7147-5JD00-0BA0 | |
|--|----------------------|--|
| Diagnostics indication LED | | |
| Channel status display | Yes; Green LED | |
| for module diagnostics | Yes; Green/red LED | |
| For load voltage monitoring | Yes; Green LED | |
| Potential separation | | |
| between the load voltages | Yes | |
| Potential separation channels | | |
| between the channels | No | |
| • between the channels and backplane bus | Yes | |
| between the channels and the power supply of the electronics | No | |
| Isolation | | |
| Isolation tested with | 707 V DC (type test) | |
| Degree and class of protection | | |
| IP degree of protection | IP65/67 | |
| Standards, approvals, certificates | | |
| Suitable for safety-oriented group deactivation | Yes | |
| Highest safety class achievable in safety mode | | |
| Performance level according to ISO 13849-1 | PL d | |
| • SIL acc. to IEC 61508 | SIL 2 | |
| Ambient conditions | | |
| Ambient temperature during operation | | |
| • min. | -25 °C | |
| • max. | 55 °C | |
| Connection method | | |
| Design of electrical connection for the inputs and outputs | M12, 5-pole | |
| Power supply | M8, 4-pole | |
| ET-Connection | | |
| 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 (<u>http://support.automation.siemens.com/WW/view/en/89254965</u>) in the "Module" section.

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

PROFlenergy

8.1 Pause function

Introduction

PROFlenergy 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 PROFlenergy, 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 PROFlenergy 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 PROFlenergy in the "PROFlenergy" section of the manual IM 157-1 PN interface module (<u>http://support.automation.siemens.com/WW/view/en/89254863</u>) and the "Saving energy with PROFlenergy" section of function manual PROFINET with STEP 7 V13 (<u>http://support.automation.siemens.com/WW/view/en/49948856</u>).

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

8.2 DI operating mode

Display

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

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 1U_S and 2U_A off |
| | | Pause substitute value: 0_B |
| | | Value status "BAD" |
| | 3D: PE_MODE_LAST_VALUE | Last value at "pause" |
| | | Supply voltages 1U_S and 2U_A off |
| | | Pause substitute value: Last input value |
| | | Value status "BAD" |
| | 4D: PE_MODE_SUBST_VALUE | Substitute value at "pause" |
| | | Supply voltages 1U_S and 2U_A off |
| | | Pause substitute value: Configured pause substitute value |
| | | Value status "BAD" |

Note

Supply voltages 1Us and 2UA

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.

| 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 $1U_S$ and $2U_A$ off |
| | | • Pause substitute value: 0 _B |
| | | Value status "BAD" |
| | 3 _D : PE_MODE_LAST_VALUE | Last value at "pause" |
| | | Pause substitute value: Last output value is maintained |
| | | Value status "BAD" |
| | 4 _D : PE_MODE_SUBST_VALUE | Substitute value at "pause" |
| | | Pause substitute value: Configured pause substitute value is output |
| | | Value status "BAD" |

Table 8- 2Mode parameter

Note

Supply voltages $1U_{\text{S}}$ and $2U_{\text{A}}$

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.

| 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 $1U_S$ and $2U_A$ off ¹ |
| | | • Pause substitute value (input): 0 _B |
| | | Value status "BAD" |
| | 3 _D : PE_MODE_LAST_VALUE | Last value at "pause" |
| | | Pause substitute value: Last input value |
| | | • Value status "BAD" |
| | 4 _D : PE_MODE_SUBST_VALUE | Substitute value at "pause" |
| | | • Supply voltages $1U_S$ and $2U_A$ off ¹ |
| | | • Pause substitute value (input): 0 _B |
| | | • Value status "BAD" |

Table 8- 3Mode parameter

¹ Supply voltage 1U_S 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