

User manual

**CIFX PCIE90-RE, CIFX LPCIE90-RE**  
PC cards PCI Express and Low Profile PCI Express Real-Time Ethernet



**Hilscher Gesellschaft für Systemautomation mbH**  
**[www.hilscher.com](http://www.hilscher.com)**

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# 1 Introduction

## 1.1 About the user manual

This user manual for the PC cards CIFX PCIE90-RE and CIFX LPCIE90-RE Real-Time Ethernet informs you about the topics:

- Hardware description,
- installation of the hardware and
- firmware download.

## 1.2 List of revisions

| Revision | Date       | Changes |
|----------|------------|---------|
| 1        | 2026-01-26 | Created |

*Table 1: List of revisions*

## 2 Devices

The PC cards CIFX PCIE90-RE and CIFX LPCIE90-RE are Hilscher communication interfaces based on the netX 90 communication controller.

| PC card         | Description  |
|-----------------|--|
| CIFX PCIE90-RE  | Communication Interface  |
| CIFX LPCIE90-RE | PCIe: CIFX PCIE90-RE and CIFX LPCIE90-RE                               |
|                 | Type (according to the PCI Express Card specification): PCI Express 1x |
|                 | PCI Express slot (3.3 V)   |

Table 2: PC cards CIFX PCIE90-RE and CIFX LPCIE90-RE

| Product family | Card format and type | netX | Network |
|----------------|----------------------|------|---------|
| CIFX           | PCIE                 | 90   | -RE     |
| CIFX           | LPCIE                | 90   | -RE     |

Table 3: Meaning of the device name

The use refers exclusively to Slave systems. Depending on the firmware loaded, the PC card cifX performs the protocol-specific communication of the selected Real-Time Ethernet system. Data is exchanged between the connected devices and the PC or connecting device via the Dual-Port Memory.

## 2.1 PC cards CIFX PCIE90-RE and CIFX LPCIE90-RE

The device elements that are important for installation and operation can be identified by a number in the following figure with legend.

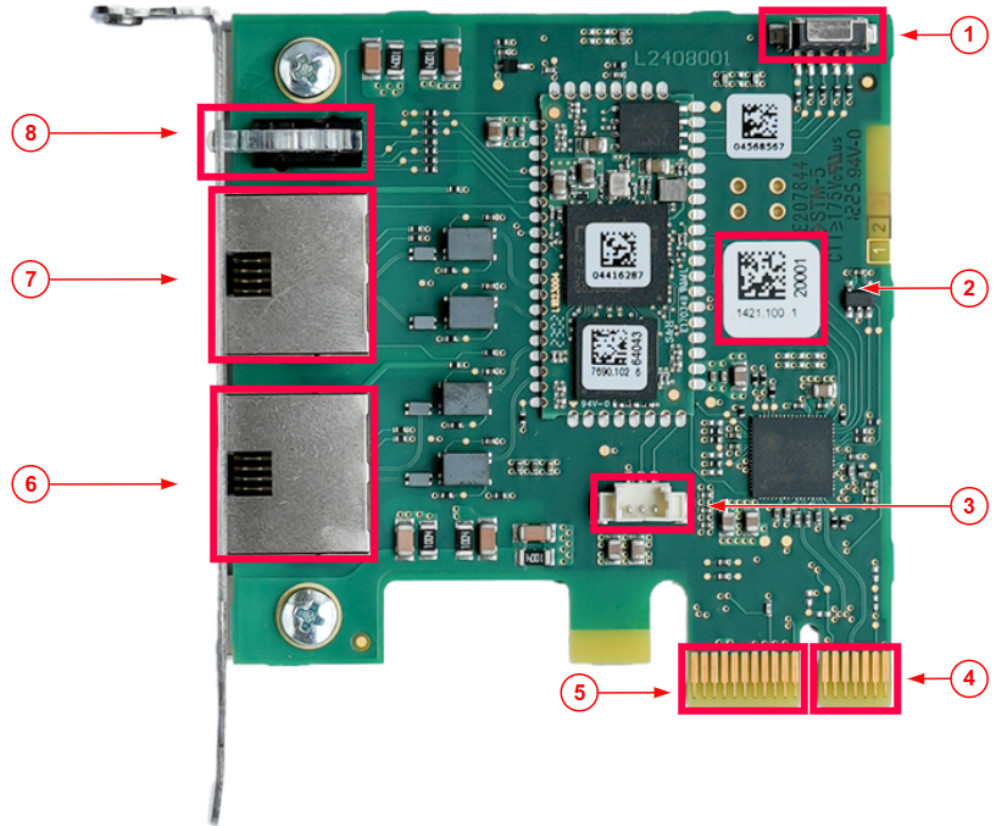


Figure 1: CIFX PCIE90-RE and CIFX LPCIE90-RE with position numbers

| No. | Description  |
|-----|--|
| (1) | Rotary switch for slot number (card ID) [▶ page 36]  |
| (2) | Matrix label [▶ page 9]  |
| (3) | SYNC connector [▶ page 37]   |
| (4) | PCI Express bus [▶ page 35] Mechanical key, pin 12 to pin 18<br>Top: Pin B12 ... pin B18, bottom: Pin A12 ... pin A18                    |
| (5) | PCI Express bus 1x [▶ page 35] Connector, pin 1 to pin 11<br>Top: Pin B1 ... pin B11, bottom: Pin A1 ... pin A11                         |
| (6) | Ethernet port channel 1, RJ45  |
| (7) | Ethernet port channel 0, RJ45  |
| (8) | System-LED [▶ page 21] (yellow/green),<br>Communication status 0 and 1 (green/red) (see section <i>Diagnosis with LEDs</i> [▶ page 20] ) |

Table 4: Position numbers of the PC cards CIFX PCIE90-RE and CIFX LPCIE90-RE

**Slot cover and LED positions**

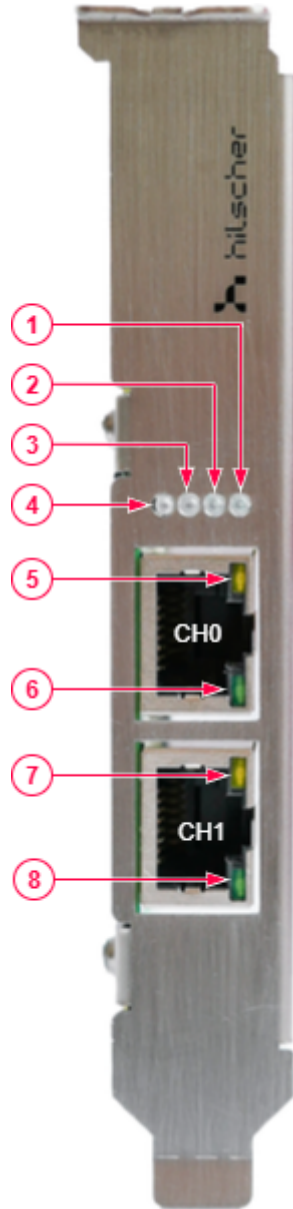


Figure 2: Slot cover and LED positions

| No. | Description                   |
|-----|-------------------------------|
| (1) | SYS (System LED)              |
| (2) | COM0 (communication status 0) |
| (3) | COM1 (communication status 1) |
| (4) | Not used                      |
| (5) | Ethernet channel 0 Activity   |
| (6) | Ethernet channel 0 Link       |
| (7) | Ethernet channel 1 Activity   |
| (8) | Ethernet channel 1 Link       |

Table 5: Legend for the slot cover of the PC cards CIFX PCIE90-RE and CIFX LPCIE90-RE



**Note:**

The status of the LEDs are described in chapter *Diagnosis with LEDs* [▶ page 20].

## 2.2 Revision or version status of hardware and software

The hardware revisions listed below, as well as the driver, software and firmware versions belong together functionally. If a hardware installation is available, the driver and the firmware must be updated according to these specifications.

| Name of device  | Description                     | Part no. | Hardware revision |
|-----------------|---------------------------------|----------|-------------------|
| CIFX PCIE90-RE  | PC card PCI Express             | 1420.100 | 1                 |
| CIFX LPCIE90-RE | PC card Low Profile PCI Express | 1421.100 | 1                 |

Table 6: Hardware revisions

| Drivers and software                  | Name                 | Version       |
|---------------------------------------|----------------------|---------------|
| Device driver                         | cifX Device Driver   | 2.3 or higher |
| Software for downloading the firmware | Device Explorer      | 1.4           |
| Configuration software                | Communication Studio | 1.4           |

Table 7: Versions for drivers and software

The following table lists the supported protocols. The firmware version column indicates the minimum version of the firmware.

| Protocol                     | File name    | Firmware version |
|------------------------------|--------------|------------------|
| PROFINET IO-Device           | X090D001.nxi | 5.7              |
| EtherNet/IP Adapter          | X090H001.nxi | 5.5              |
| EtherCAT SubDevice           | X090F001.nxi | 5.5              |
| Open Modbus/TCP              | X090L001.nxi | 5.3              |
| Sercos Slave                 | X090J001.nxi | 5.2              |
| POWERLINK Controlled Node    | X090K001.nxi | 5.3              |
| CC-Link IE Field Basic slave | X090Y001.nxi | 5.1              |

Table 8: Firmware (protocol and file name)

The following table lists the supported protocols with IoT function. The firmware version column indicates the minimum version of the firmware. Note that the firmware consists of two files.

| Protocol                  | File name                     | Firmware version |
|---------------------------|-------------------------------|------------------|
| PROFINET IO-Device (IoT)  | X096D001.nxi and X096D001.nxe | 2.4              |
| EtherNet/IP Adapter (IoT) | X096H001.nxi and X096H001.nxe | 2.4              |
| Open Modbus/TCP (IoT)     | X096L001.nxi and X096L001.nxe | 2.4              |

Table 9: Firmware with IoT function (protocol and file name)



### Note:

Unless otherwise specified, the firmware version in this manual is the same as the stack version.

## 2.3 Product software

All the information and software you need for your product can be downloaded free of charge at the web-link

<https://hilscher.atlassian.net/wiki/spaces/CARDS/overview>.

- Select the link for the current release for the Download Package Communication Solution 90.

After the download, you can start commissioning and configuring your device immediately.

- Check our website regularly for software updates for your product.

## 2.4 Device label with matrix code

You can identify your device by means of the device label.

**Note:**

The position of the device label on your device is indicated in the device overview.

The device label consists of a matrix code and the information contained therein in plain text.

The 2D code (Data Matrix Code) contains the following information:

- ① Part number: 1234.567
- ② Hardware revision: 1
- ③ Serial number: 20000



Figure 3: Example 2D label

## 3 Safety

### 3.1 General note

The documentation in the form of a user manual, an operating instruction manual or other manual types, as well as the accompanying texts, have been created for the use of the products by qualified personnel. When using the products, all Safety Messages, Integrated Safety Messages, Property Damage Messages and all valid legal regulations must be obeyed. Technical knowledge is presumed. The user has to assure that all legal regulations are obeyed.

### 3.2 Personnel qualification

The PC card may only be installed, configured, operated or uninstalled by qualified personnel. Job-specific technical skills for people professionally working with electricity must be present concerning the following topics:

- Safety and health at work
- Mounting and connecting of electrical equipment
- Measurement and Analysis of electrical functions and systems
- Evaluation of the safety of electrical systems and equipment
- Installing and configuring IT systems

### 3.3 Safety messages

#### 3.3.1 Hazardous voltage, electric shock

Danger to life or risk of injury by electric shock may occur if you open the housing of your PC (or connection device) to install your PC card.

- **Hazardous voltages** are present in the PC (or connection device) for mounting. Always read and observe the safety instructions of the PC manufacturer before installation.
- First disconnect the power plug of the PC (or connection device), before opening the housing.
- Make sure that the power supply is off at the PC (or connection device).
- Only then open the housing and install or remove the PC card.

#### 3.3.2 Personal injury, device damage due to hot swap/hot plug

The PC card is not designed or intended for a hot-swap or hot-plug connection. Performing hot-swap or hot-plug may pose a hazard to the PC card, the system platform and the person performing the action.

## 3.4 Property damage

### 3.4.1 Excessive supply voltage

The PC card may only be operated with the prescribed supply voltage, which corresponds to the tolerances specified in this manual. The limits of the permitted range must not be exceeded.

#### **Device damage, malfunctions**

- If the supply voltage is above the specified upper limit, this can lead to serious damage to the PC card!
- If the supply voltage is below the specified lower limit, malfunctions of the PC card may occur.

### 3.4.2 Excessive signaling voltage

All I/O signal pins on the PC card tolerate only the specified signal voltage, as specified in this manual.

#### **Device destruction**

Operating your PC card at a signal voltage that exceeds the specified signal voltage can cause serious damage to the PC card!

### 3.4.3 Electrostatic sensitive devices

This equipment is sensitive to electrostatic discharge which cause internal damage and affect normal operation. Therefore adhere to the necessary safety precautions for components that are vulnerable with electrostatic discharge if you install or replace your device. Follow the guidelines listed hereafter when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on the PC card.
- Do not touch circuit components inside the equipment.
- If available, use a static-safe workstation.
- When not in use, store the equipment in appropriate static-safe packaging.

### 3.4.4 Power drop during write and delete accesses in the file system

The FAT file system in the netX firmware is subject to certain limitations in its operation. Write and delete accesses in the file system (firmware update, configuration download etc.) can destroy the FAT (File Allocation Table) if the accesses cannot be completed if the power drops. Without a proper FAT, a firmware may not be found and cannot be started.

- Make sure that the power supply of the device does not drop during write and delete accesses in the file system (firmware update, configuration download etc.).

### 3.4.5 Exceeding the maximum number of permitted write and delete accesses

This device uses a serial flash chip to store remanent data such as firmware storage, configuration storage, etc. This device allows a maximum of 100,000 write/delete accesses that are sufficient for standard operation of the device. However, writing/deleting the chip excessively (e.g. changing the configuration or changing the name of station) leads to the maximum number of permitted write/delete accesses being exceeded and to device damage. For example, if the configuration is changed once an hour, the maximum number is reached after 11.5 years. If the configuration is changed even more frequently, for example once a minute, the maximum number is reached after approx. 69 days.

Avoid exceeding the maximum permitted write/delete accesses by writing too often.

## 3.5 Information and data security

Take all usual measures for information and data security, in particular, for PC cards with Ethernet technology. Hilscher explicitly points out that a device with access to a public network (Internet) must be installed behind a firewall or only be accessible via a secure connection such as an encrypted VPN connection. Otherwise, the integrity of the device, its data, the application or system section is not safeguarded.

Hilscher cannot assume any warranty or liability for damage due to neglected security measures or incorrect installation.

## 4 Installing the hardware

### 4.1 System Requirements

To install your cifX PC cards, you need a PC or a connection device with a PCI Express slot (host interface) for mounting the PC card.

#### Host interface

| PC card                           | Type                     | Supply voltage<br>(1) | Current<br>consumption<br>(2)                         | Signal voltage<br>(3) |
|-----------------------------------|--------------------------|-----------------------|---|-----------------------|
| CIFX PCIE90-RE<br>CIFX LPCIE90-RE | PCI Express slot (3.3 V) | +3.3 VDC<br>-5% / +9% | See section<br><i>Technical<br/>data</i> [▶ page 38]. | PCIe compatible       |

Table 10: Host interface requirements

Comments:

(1) Required or permissible supply voltage

(2) Typical current consumption at 3.3 V. The typical current consumption depends on the type of PC card. To ensure compatibility between different systems, it is recommended to supply a maximum of 1 A (at +3.3 VDC -5% / +9%).

(3) Required or tolerated signal voltage at the I/O signal pins on the PCIe bus of the PC card

#### Host system

For communication via PCI Express, the host system may only use the standard mode with a length of 5 bits for identification (tag field length). In the extended mode, i.e. at lengths of 8 bits for identification of the PCI-Express communication, communication errors occur. Note the errata "CIFX M223090AE and CIFX HPCIE90" (Hilscher DOC-ID DOC220201ERR02EN) and the solutions and workarounds given therein. The reference is listed in the section References .

#### Operating system

For Device Explorer and Communication Studio: Windows® 10, Windows® 11.

## 4.2 Requirements for operation

The following described requirements must be fulfilled when operating the PC card.

| Requirements          | Specification  | See section  |
|-----------------------|--|--|
| Communication         | <p>For communication of a PC card (device), a controller device is required for the communication system used.</p> <p>To configure the controller device, you need a device description file for the device used with the name for:</p> <ul style="list-style-type: none"> <li>• <b>EtherCAT Slave:</b><br/>Hilscher CIFX RE NETX90 ECS.xml</li> <li>• <b>EtherNet/IP Adapter:</b><br/>HILSCHER CIFX-RE NETX90 EIS V1.1.EDS,</li> <li>• <b>POWERLINK Controlled Node:</b><br/>00000044_NETX_90 RE PLS.xdd</li> <li>• <b>PROFINET IO-Device:</b><br/>GSDML-V2.35-HILSCHER-CIFX NETX_90 RE PNS-YYYYMMDD.xml.</li> <li>• <b>Open Modbus/TCP:</b> A device description file is not required for Open Modbus/TCP.</li> <li>• <b>SERCOS Slave:</b><br/>SDDML#v3.0#Hilscher#NETX_90_RE-FIXCFG_FSPIO#yyyy-mm-dd.xml</li> <li>• <b>CC-Link IE Field Basic Slave:</b><br/>0x0352_CIFX RE CCIEBS_1_en.cspp</li> </ul> <p>The settings in the used controller must match the settings in the device.</p> | -  |
| Software installation | <p><b>cifX Device Driver</b> as the driver for the host interface (latest version of the driver).</p> <p><b>Device Explorer</b> as software for downloading or updating the firmware and configuration, as well as for setting the device driver.</p> <p><b>Communication Studio</b> for configuring and diagnosing netX 90-based devices.</p>   | Revision or version status of hardware and software and References (Driver and software documentation) |
| Firmware Download     | The user must select the firmware using the software and download it to the PC card. The firmware contains a communication protocol.   |  |
| Configuration         | The PC card must be configured using the <b>Communication Studio</b> configuration software.   |  |

Table 11: Requirements for operation

## 4.3 Overview installation and firmware download

Below you find an overview of the steps to install the hardware, driver and firmware for your PC card PCIE90-RE or CIFX LPCIE90-RE:

| Step                                | Description  | See section  |
|-------------------------------------|--|--|
| Downloading installation files      | <ul style="list-style-type: none"> <li>Download the installation files from the Hilscher website for:               <ul style="list-style-type: none"> <li>- cifX Device Driver (atest version)</li> <li>- Device Explorer</li> <li>- Communication Studio</li> </ul> </li> <li>Save the installation files to the local hard disk of your PC.</li> </ul>                              | Revision or version status of hardware and software                  |
| Install drivers and software        | <ul style="list-style-type: none"> <li>Double-click the appropriate installation file to open the startup menu.</li> <li>Start the installation from the home screen and follow the instructions in the installation menu.</li> </ul>  |  |
| Install hardware                    | <ul style="list-style-type: none"> <li>Take the protective measures and safety precautions for the hardware installation.</li> <li>Open the housing of the PC or connecting device.</li> <li>Insert the PC card into the PCI Express slot and attach the PC card. Do not exert unnecessary force on the PC card.</li> <li>Close the housing of the PC or connecting device.</li> </ul> | Installing the hardware  |
| Firmware and configuration download | <ul style="list-style-type: none"> <li>Download the firmware according to the information in the "Device Explorer" user manual.</li> </ul> <p>The PC card cifX is now ready for operation and has yet to be configured.</p> <ul style="list-style-type: none"> <li>Then download the configuration.</li> </ul>   | Loading firmware and configuration in the device or making an update |

*Table 12: Overview for installation and firmware download*

For detailed descriptions of how to install and operate the software, refer to the relevant operating instruction manual, section References.

## 4.4 Installation warnings

When installing your device, observe the following warnings on possible personal injury, as well as the warnings on property damage.

### **WARNING!**



#### **Hazardous voltage! Danger to life, risk of injury by electric shock**

**Hazardous voltages** are present in the PC (or connection device).



- First disconnect the power plug of the PC (or connection device), before you open the housing.
- Make sure that the power supply is off at the PC (or connection device).

### *CAUTION*

#### **Personal injury, device damage due to hot swap/hot plug**



The PC card is not designed or intended for a hot-swap or hot-plug connection.

Performing hot-swap or hot-plug may pose a hazard to the PC card, the system platform and the person performing the action.

### *NOTICE*

#### **Electrostatically sensitive devices**



To prevent damage to the PC and PC card, make sure the PC card is grounded through the connection plate and PC, and make sure you are grounded when you install or uninstall the PC card.

### **Installation warnings (USA)**

When installing your device, observe the following warnings on possible personal injury, as well as the warnings on property damage.

## 4.5 Installing the hardware

Install the PC card CIFX PCIE90-RE or CIFX LPCIE90-RE in your PC or connecting device as described below.

### 1. Preparation

Note the requirements and prerequisites described in the sections System Requirements and Requirements for operation.

### 2. Protective measures and safety precautions

**⚠ CAUTION** Personal injury, device damage due to hot-plug/hot-swap

- Do not "plug" or "unplug" the PC card during operation.

**NOTICE** Electrostatic sensitive components

- Make sure that the device is grounded via the endplate and the PC, and make sure that you are discharged when you install/uninstall the device.

### 3. Installation

**⚠ WARNING** Hazardous voltage! Danger to life, risk of injury by electric shock

- Disconnect the power plug of the PC (or connection device).
- Make sure that the power supply is off at the PC (or connection device).
- Open the housing of the PC or connecting device.
- Insert the PC card into the PCI Express slot.
- Close the housing of the PC or connecting device.
- Reconnect the PC or the connection device to the mains.

## 4.6 Hints for problem solving

In case of an error or malfunction during operation of your PC card cifX, observe the following troubleshooting instructions:

### General

- Check that the requirements for operation of the PC card are met according to the information provided in this user manual.

### SYS and COM status LEDs

You can troubleshoot the system by checking the behavior of the LEDs.

- The SYS LED (yellow/green) on the device indicates the general device status and can be switched on, off or blinks.
- The LEDs COM0 (red/green) and COM1 (red/green) indicate the status of the communication and can be switched on or off permanently or in phases, flash or they blink cyclically or acyclically.

If the SYS LED lights static green and the COM LEDs behave as shown in the table below, the PC card cifX is in the "in operation" state. The PC card is in the state of cyclic communication with the connected controller. The communication between the controller and the PC card is operating normally.

| LED   | EtherCAT SubDevice | EtherNet/IP Adapter | Open Modbus/TCP | POWERLINK Controlled Node | PROFINET IO-Device | Sercos Slave | CC-Link IE Field Basic Slave |
|-------|--------------------|---------------------|-----------------|---------------------------|--------------------|--------------|------------------------------|
| COM 0 | RUN ● (green)      | MS ● (green)        | RUN ● (green)   | BS ● (green)              | SF ● (off)         | S ● (green)  | RUN ● (green)                |
| COM 1 | ERR ● (off)        | NS ● (green)        | ERR ● (off)     | BE ● (off)                | BF ● (off)         | ● (off)      | ERR ● (off)                  |

Table 13: Behavior of the communication status LEDs in the "in operation" status

### Ethernet LEDs

- Check the status of the Ethernet LEDs (LINK or L/A) to see if there is a connection to the Ethernet.

### Cable

- Check whether the pin assignment of the used cable is correct which you have connected from the PC card (device) to the controller.

Detailed descriptions of the behavior of the LEDs can be found in the chapter on LEDs in this manual. Information about the device diagnostics and its functions can be found in the user manual of the configuration software for your device.

## 4.7 Loading firmware and configuration in the device or making an update

- Download the firmware from the Hilscher website and save the firmware on the local hard disk of your PC.
- If necessary, transfer the configuration to the PC. You create the configuration using a suitable configuration software.
- Use **Device Explorer** to load the firmware and configuration into the device or update the firmware and configuration in your device.
- When downloading the firmware and configuration to your device or when performing an update, follow the instructions in the "Device Explorer" operating instruction manual.

For the "Device Explorer" operating instruction manual, see section References.

# 5 Diagnosis with LEDs

## 5.1 Overview



**Note:**

The communication status and Ethernet LEDs on the device are determined by the loaded protocol firmware.

| LED   |          | EtherCAT SubDevice      | EtherNet/IP Adapter                  | Open Modbus/TCP             | POWERLINK Controlled Node  | PROFINET IO-Device     | Sercos Slave  | CC-Link IE Field Basic Slave |
|---|----------|-------------------------|--------------------------------------|-----------------------------|----------------------------|------------------------|---|------------------------------|
| <b>SYS</b> System status<br>● Yellow ● Green Yellow/green |          | <b>SYS</b>              | <b>SYS</b>                           | <b>SYS</b>                  | <b>SYS</b>                 | <b>SYS</b>             | <b>SYS</b>  | <b>SYS</b>                   |
| <b>COM 0</b> Communication status                         | ● Green  | <b>RUN</b><br>Green     | <b>MS</b> ● Red ● Green<br>Red/green | <b>RUN</b> ● Green<br>Green | <b>BS</b> ● Green<br>Green | <b>SF</b> ● Red<br>Red | <b>S</b> ● Red ● Green ● Orange<br>Red/green/orange | <b>RUN</b> ● Green<br>Green  |
| <b>COM 1</b> Communication status                         |          | <b>ERR</b> ● Red<br>Red | <b>NS</b> ● Red ● Green<br>Red/green | <b>ERR</b> ● Red<br>Red     | <b>BE</b> ● Red<br>Red     | <b>BF</b> ● Red<br>Red | -   | <b>ERR</b> ● Red<br>Red      |
| <b>Ethernet Ch 0</b>                                      | ● Green  | <b>L/A IN</b>           | <b>LINK</b>                          | <b>LINK</b>                 | <b>LINK</b>                | <b>LINK</b>            | <b>L/A</b>  | <b>L/A</b>                   |
|   | ● Yellow | -                       | <b>ACT</b>                           | <b>ACT</b>                  | <b>RX/TX</b>               | <b>RX/TX</b>           | -   | -                            |
| <b>Ethernet Ch 1</b>                                      | ● Green  | <b>L/A OUT</b>          | <b>LINK</b>                          | <b>LINK</b>                 | <b>LINK</b>                | <b>LINK</b>            | <b>L/A</b>  | <b>L/A</b>                   |
|   | ● Yellow | -                       | <b>ACT</b>                           | <b>ACT</b>                  | <b>RX/TX</b>               | <b>RX/TX</b>           | -   | -                            |

Table 14: LEDs Real-Time Ethernet systems

| Category             | LED | Name                 | Category | LED     | Name              |
|----------------------|-----|----------------------|----------|---------|-------------------|
| System status        | SYS | System status        | Ethernet | LINK    | Link              |
| Communication status | COM | Communication status |          | ACT     | Activity          |
|                      | RUN | Run                  |          | L/A     | Link/Activity     |
|                      | ERR | Error                |          | L/A IN  | Link/Activity In  |
|                      | MS  | Module status        |          | L/A OUT | Link/Activity Out |
|                      | NS  | Network status       |          | RX/TX   | Receive/Transmit  |
|                      | BS  | Bus state            |          |         |                   |
|                      | BE  | Bus error            |          | -       | -                 |
|                      | SF  | System error         |          | -       | -                 |
|                      | BF  | Bus failure          |          | -       | -                 |
|                      | S   | Status / error       | -        | -       |                   |

Table 15: LED names

## 5.2 System LED

The system status LED **SYS** can assume the states described below.











| LED  | Color  | State  | Description   |
|--|--|--|---|
| SYS  | Duo-LED: yellow RDY / green RUN  |  |   |
|  |  (green)  | On   | The firmware is running.  |
|  |  (green)  | Blinking   | During the formatting of the file system  |
|  |  (yellow)   | On   | A system error has occurred.  |
|  |  (yellow)/<br> (green) | Blinking,<br>3x yellow,<br>3x green  | Firmware crash, unrecoverable (an internal exception occurred that cannot be handled) |
|  |  (yellow)/<br> (green) | Blinking, 1 Hz   | Firmware update mode active: The firmware is idle and waiting for the update file.    |
|  |  (yellow)/<br> (green) | Blinking, 4 Hz   | Firmware update mode active: A firmware update is being installed.                    |
|  (gray) | Off  | <ul style="list-style-type: none"> <li>No supply voltage: No supply voltage for the device or hardware defect.</li> <li>During a firmware reset</li> </ul> |   |

Table 16: States of the SYS-LED

| LED state                                | Definition  |
|--|---|
| Blinking                                 | The LED turns on and off in phases.   |
| Blinking,<br>3x yellow,<br>3x green      | The LED turns on and off, with a frequency of approx. 1 Hz: <ul style="list-style-type: none"> <li>3x yellow "On" for 500 ms and "Off" for 500 ms and</li> <li>3x green "On" for 500 ms and "Off" for 500 ms.</li> </ul>  |
| Blinking,<br>yellow/green,<br>1 Hz, 4 Hz | The LED turns on in phases yellow or green, with a frequency of approx.: <ul style="list-style-type: none"> <li>1 Hz: 1 x yellow "On" for 500 ms and 1 x green "On" for 500 ms,</li> <li>4 Hz: 1 x yellow "On" for 125 ms and 1 x green "On" for 125 ms.</li> </ul> |

Table 17: Definitions of the states of the SYS LED

### 5.3 EtherCAT SubDevice

For the EtherCAT SubDevice protocol, the communication LEDs **RUN** and **ERR** as well as the Ethernet LED **L/A IN** and **L/A OUT** can be in one of the states described below.

#### Communication status EtherCAT SubDevice

| LED   | Color                    | State             | Description   |
|---|--------------------------|-------------------|---|
| <b>RUN</b><br>Position on the slot cover: (2) | <b>Duo LED red/green</b> |                   |   |
|   | ● (off)                  | Off               | <b>INIT:</b> The device is in INIT state.   |
|   | ☀ (green)                | Blinking (2.5 Hz) | <b>PRE-OPERATIONAL:</b> The device is in PRE-OPERATIONAL state.   |
|   | ☀ (green)                | Single flash      | <b>SAFE-OPERATIONAL:</b> The device is in SAFE-OPERATIONAL state.   |
|   | ● (green)                | On                | <b>OPERATIONAL:</b> The device is in the OPERATIONAL state.   |
| <b>ERR</b><br>Position on the slot cover: (3) | <b>Duo LED red/green</b> |                   |   |
|   | ● (off)                  | Off               | <b>No error:</b> The EtherCAT communication of the device is in working condition.  |
|   | ☀ (red)                  | Blinking (2.5 Hz) | <b>Invalid configuration:</b> General Configuration Error<br>Possible reason: State change commanded by master is impossible due to register or object settings.  |
|   | ☀ (red)                  | Single flash      | <b>Local error:</b> Application has changed the EtherCAT state autonomously.<br>Possible reason 1: A host watchdog timeout has occurred.<br>Possible reason 2: Synchronization Error, device enters Safe-Operational automatically. |
|   | ☀ (red)                  | Double flash      | <b>Application watchdog timeout:</b> An application watchdog timeout has occurred. Possible reason: Sync Manager Watchdog timeout.  |

Table 18: Communication status EtherCAT SubDevice

| LED state         | Definition   |
|-------------------|--|
| Blinking (2.5 Hz) | The LED turns on and off with a frequency of 2.5 Hz: "On" for 200 ms, followed by "Off" for 200 ms.  |
| Single flash      | The LED shows one short flash (200 ms) followed by a long "Off" phase (1,000 ms).  |
| Double flash      | The LED shows a sequence of two short flashes (each 200 ms), separated by a short "Off" phase (200 ms). The sequence is finished by a long "Off" phase (1,000 ms). |

Table 19: Definition LED states communication status

**Ethernet status EtherCAT SubDevice**





| LED                                   | Color   | State                       | Description   |
|---------------------------------------|---|-----------------------------|---|
| L/A IN, L/A OUT<br>Ch0 (6) , Ch1: (8) | <b>LED green</b>  |                             |   |
|                                       |  (green) | On                          | <b>Link:</b> The device is linked to the Ethernet, but does not send/receive Ethernet frames. |
|                                       |  (green) | Flickering (load dependent) | <b>Activity:</b> The device is linked to the Ethernet and sends/receives Ethernet frames.     |
|                                       |  (off)   | Off                         | The device has no link to the Ethernet.   |
| Ch0 (5) , Ch1: (7)                    | <b>LED yellow</b>   |                             |   |
|                                       |  (off)   | Off                         | This LED is not used.   |

Table 20: Ethernet status EtherCAT SubDevice

| LED state                   | Definition   |
|-----------------------------|--|
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

Table 21: Definition LED states Ethernet status

## 5.4 EtherNet/IP Adapter

For the EtherNet/IP Adapter protocol, the communication LEDs **MS** and **NS** as well as the Ethernet LEDs **LINK** and **ACT** can assume the states described below.

### Communication status EtherNet/IP Adapter















| LED   | Color   | Status   | Description  |
|---|---|--|--|
| <b>MS</b><br>(Module status)<br>Position on the slot cover: (2)                           | <b>Duo-LED red/green</b>  |  |  |
|   |  (green)             | On   | <b>Device operational:</b> The device is operating correctly.  |
|   |  (green)             | Flashing (1 Hz)  | <b>Standby:</b> The device has not been configured.  |
|   |  (green/red/green)   | Flashing fast green/red/green  | <b>Self-test:</b> The device performs a self-test after power-on. The following sequence is displayed during the self-test: <ul style="list-style-type: none"> <li>• NS LED off.</li> <li>• MS LED turns green for approx. 250 ms, turns red for approx. 250 ms and turns green again (and holds this status until the test is completed).</li> <li>• NS LED turns green for approx. 250 ms, turns red for approx. 250 ms and then turns off (and holds this status until the test is completed).</li> </ul> |
|   |  (red/green/off)     | Flashing sequence red/green/off  | <b>Flashing sequence:</b> The flashing sequence is used to visually identify the device. The scanner can start the flashing sequence in Identity object 1 of the device. The MS LED and NS LED perform the flashing sequence simultaneously.   |
|   |  (red)             | Flashing (1 Hz)  | <b>Major recoverable fault:</b> The device has detected a major recoverable fault. E. g., an incorrect or inconsistent configuration can be considered a major recoverable fault.  |
|   |  (red)             | On   | <b>Major unrecoverable fault:</b> The device has detected a major unrecoverable fault.   |
|  (off) | Off   | <b>No power:</b> The device is powered off.  |  |
| <b>NS</b><br>(Network status)<br>Position on the slot cover: (3)                          | <b>Duo-LED red/green</b>  |  |  |
|   |  (green)           | On   | <b>Connected:</b> An IP address is configured, at least one CIP connection (any transport class) is established, and an Exclusive Owner connection has not timed out.  |
|   |  (green)           | Flashing (1 Hz)  | <b>No connections:</b> An IP address is configured, but no CIP connections are established, and an Exclusive Owner connection has not timed out.   |
|   |  (green/red/green) | Flashing fast green/red/green  | <b>Self-test:</b> The device performs a self-test after power-on. Refer to the description of the MS LED in the self-test status.  |
|   |  (red/green/off)   | Flashing sequence red/green/off  | <b>Flashing sequence:</b> The flashing sequence is used to visually identify the device. The scanner can start the flashing sequence in Identity object 1 of the device. The MS LED and NS LED perform the flashing sequence simultaneously.   |
|   |  (red)             | Flashing (1 Hz)  | <b>Connection timeout:</b> An IP address is configured, and an Exclusive Owner connection for which this device is the target has timed out.<br><br>The NS LED returns to steady green only when all timed out Exclusive Owner connections are reestablished.  |
|   |  (red)             | On   | <b>Duplicate IP:</b> The device has detected that its IP address is already in use.  |
|  (off) | Off   | <b>Not powered, no IP address:</b> The device does not have an IP address (or is powered off). |  |

Table 22: Communication status EtherNet/IP Adapter

| LED status                      | Definition   |
|---------------------------------|--|
| Flashing (1 Hz)                 | The LED turns on and off with a frequency of 1 Hz: "On" for 500 ms, followed by "Off" for 500 ms.  |
| Flashing fast green/red/green   | The MS LED or NS LED turns on green "On" for 250 ms, then red "On" for 250 ms, then green "On" (until the test is completed).                                |
| Flashing sequence red/green/off | The MS LED and NS LED each turn red "On" for 500 ms, then green "On" for 500 ms, then "Off" for 500 ms. This flashing sequence is repeated at least 6 times. |

Table 23: Definition of LED status of the communication status

### Ethernet status EtherNet/IP Adapter





| LED                                  | Color  | State                       | Description                                       |
|--------------------------------------|--|-----------------------------|---|
| <b>LINK</b><br>Ch0 (6)<br>, Ch1: (8) | <b>LED green</b>   |                             |   |
|                                      |  (green)  | On                          | The device is linked to the Ethernet.             |
|                                      |  (off)    | Off                         | The device has no link to the Ethernet.           |
| <b>ACT</b><br>Ch0 (5)<br>, Ch1: (7)  | <b>LED yellow</b>  |                             |   |
|                                      |  (yellow) | Flickering (load dependent) | The device sends/receives Ethernet frames.        |
|                                      |  (off)    | Off                         | The device does not send/receive Ethernet frames. |

Table 24: Ethernet status EtherNet/IP Adapter

| LED status                  | Definition   |
|-----------------------------|--|
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

Table 25: Definition of LED status of the Ethernet status

## 5.5 Open Modbus/TCP

For the OpenModbusTCP protocol, the communication LEDs **RUN** and **ERR** as well as the Ethernet LEDs **LINK** and **ACT** can assume the states described below.

### Communication status Open Modbus/TCP








| LED   | Color   | State                   | Description   |
|---|---|-------------------------|---|
| <b>RUN</b><br>Position on the slot cover: (2) | <b>Duo-LED red/green</b>  |                         |   |
|   |  (green) | On                      | <b>Connected:</b> OMB task has communication. At least one TCP connection is established. |
|   |  (green) | Blinking (1 Hz)         | <b>Ready, not configured yet:</b> OMB task is ready and not yet configured.               |
|   |  (green) | Blinking (5 Hz)         | <b>Waiting for Communication:</b> OMB task is configured.                                 |
|   |  (off)   | Off                     | <b>Not Ready:</b> OMB task is not ready.  |
| <b>ERR</b><br>Position on the slot cover: (3) | <b>Duo-LED red/green</b>  |                         |   |
|   |  (off)   | Off                     | No communication error  |
|   |  (red)   | Flashing (2 Hz, 25% on) | System error  |
|   |  (red)   | On                      | Communication error active  |

Table 26: Communication status Open Modbus/TCP

| LED status              | Definition  |
|-------------------------|---|
| Flashing (1 Hz)         | The LED turns on and off with a frequency of 1 Hz: "On" for 500 ms, followed by "Off" for 500 ms. |
| Flashing (5 Hz)         | The LED turns on and off with a frequency of 5 Hz: "On" for 100 ms, followed by "Off" for 100 ms. |
| Flashing (2 Hz, 25% on) | The LED turns on and off with a frequency of 2 Hz: "On" for 125 ms, followed by "Off" for 375 ms. |

Table 27: Definition of LED status of the communication status

### Ethernet status Open Modbus/TCP





| LED                                  | Color  | State                       | Description                                       |
|--------------------------------------|--|-----------------------------|---|
| <b>LINK</b><br>Ch0 (6)<br>, Ch1: (8) | <b>LED green</b>   |                             |   |
|                                      |  (green)  | On                          | The device is linked to the Ethernet.             |
|                                      |  (off)    | Off                         | The device has no link to the Ethernet.           |
| <b>ACT</b><br>Ch0 (5)<br>, Ch1: (7)  | <b>LED yellow</b>  |                             |   |
|                                      |  (yellow) | Flickering (load dependent) | The device sends/receives Ethernet frames.        |
|                                      |  (off)    | Off                         | The device does not send/receive Ethernet frames. |

Table 28: Ethernet status Open Modbus/TCP

| LED status                  | Definition   |
|-----------------------------|--|
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

Table 29: Definition of LED status of the Ethernet status

## 5.6 POWERLINK Controlled Node

For the POWERLINK Controlled Node protocol, the communication LEDs **BS** (Busstatus) and **BE** (Bus-Error) as well as the Ethernet LED L/A can assume the states described below.

### Communication status POWERLINK Controlled Node










| LED  | Color   | State              | Description                                 |
|--|---|--------------------|---|
| <b>BS</b> (Bus status)<br>Position on the slot cover:<br>(2) | <b>Duo LED red/green</b>  |                    |   |
|  |  (green) | On                 | Slave is in state <b>Operational</b> state. |
|  |  (green) | Triple flash       | Slave is in <b>ReadyToOperate</b> state.    |
|  |  (green) | Double flash       | Slave is in <b>Pre-Operational 2</b> state. |
|  |  (green) | Single flash       | Slave is in <b>Pre-Operational 1</b> state. |
|  |  (green) | Flickering (10 Hz) | Slave is in <b>Basic Ethernet</b> state.    |
|  |  (green) | Blinking (2.5 Hz)  | Slave is in <b>Stopped</b> state.           |
|  |  (off)   | Off                | Slave initializing                          |
| <b>BE</b> (Bus error)<br>Position on the slot cover:<br>(3)  | <b>Duo LED red/green</b>  |                    |   |
|  |  (off)   | Off                | Slave has no error                          |
|  |  (red)   | On                 | Slave has detected an error                 |

Table 30: Communication status POWERLINK Controlled Node

| LED state          | Definition   |
|--------------------|--|
| Triple flash       | The LED shows a sequence of three short flashes (each 200 ms), separated by a short "Off" phase (200 ms). The sequence is finished by a long "Off" phase (1,000 ms). |
| Double flash       | The LED shows a sequence of two short flashes (each 200 ms), separated by a short "Off" phase (200 ms). The sequence is finished by a long "Off" phase (1,000 ms).   |
| Single flash       | The LED shows one short flash (200 ms) followed by a long "Off" phase (1,000 ms).  |
| Flickering (10 Hz) | The LED turns on and off with a frequency of 10 Hz: "On" for 50 ms, followed by "Off" for 50 ms. The red LED and the green LED are switched on alternately.          |
| Blinking (2.5 Hz)  | The LED turns on and off with a frequency of 2.5 Hz: "On" for 200 ms, followed by "Off" for 200 ms. The red LED and the green LED are switched on alternately.       |

Table 31: Definition of LED states communication status

**Ethernet status POWERLINK Controlled Node**





| LED   | Color   | State                       | Description   |
|---|---|-----------------------------|---|
| L/A<br>Ch0 (6), Ch1: (8)<br>Ch0 (5), Ch1: (7) | <b>LED green</b>  |                             |   |
|   |  (green) | On                          | <b>Link:</b> The device is linked to the Ethernet, but does not send/receive Ethernet frames. |
|   |  (green) | Flickering (load dependent) | <b>Activity:</b> The device is linked to the Ethernet and sends/receives Ethernet frames.     |
|   |  (off)   | Off                         | The device has no link to the Ethernet.   |
|   | <b>LED yellow</b>   |                             |   |
|   |  (off)   | Off                         | This LED is not used.   |

Table 32: Ethernet status POWERLINK Controlled Node

| LED state                   | Definition   |
|-----------------------------|--|
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

Table 33: Definition of LED state Ethernet status

## 5.7 PROFINET IO-Device

For the PROFINET IO-Device protocol, the communication LEDs **SF** (System failure) and **BF** (Bus error) as well as the Ethernet LEDs **LINK** and **RX/TX** can be in one of the states described below.

### Communication status PROFINET IO-Device

| LED   | Color                    | State                | Description  |
|---|--------------------------|----------------------|--|
| <b>SF</b> (System Failure)<br>Position on the slot cover: (2) | <b>Duo LED red/green</b> |                      |  |
|   | ● (off)                  | Off                  | No error   |
|   | ☀ (red)                  | Flashing (1 Hz, 3 s) | DCP signal service is initiated via the bus.                                   |
|   | ● (red)                  | On                   | Watchdog timeout; channel, generic or extended diagnosis present; system error |
| <b>BF</b> (Bus Failure)<br>Position on the slot cover: (3)    | <b>Duo LED red/green</b> |                      |  |
|   | ● (off)                  | Off                  | No error   |
|   | ☀ (red)                  | Flashing (2 Hz)      | No data exchange   |
|   | ● (red)                  | On                   | No configuration; or low speed physical link; or no physical link              |

Table 34: Communication status PROFINET IO-Device

| LED state            | Definition  |
|----------------------|---|
| Flashing (1 Hz, 3 s) | The LED turns on and off for 3 seconds with a frequency of 1 Hz: "On" for 500 ms, followed by "Off" for 500 ms. |
| Flashing (2 Hz)      | The LED turns on and off with a frequency of 2 Hz: "On" for 250 ms, followed by "Off" for 250 ms.               |

Table 35: Definition LED states communication status

### Ethernet status PROFINET IO-Device

| LED                               | Color             | State                       | Description                                       |
|-----------------------------------|-------------------|-----------------------------|---|
| <b>LINK</b><br>Ch0 (6), Ch1: (8)  | <b>LED green</b>  |                             |   |
|                                   | ● (green)         | On                          | The device is linked to the Ethernet.             |
|                                   | ● (off)           | Off                         | The device has no link to the Ethernet.           |
| <b>RX/TX</b><br>Ch0 (5), Ch1: (7) | <b>LED yellow</b> |                             |   |
|                                   | ☀ (yellow)        | Flickering (load dependent) | The device sends/receives Ethernet frames.        |
|                                   | ● (off)           | Off                         | The device does not send/receive Ethernet frames. |

Table 36: Ethernet status PROFINET IO-Device

| LED status                  | Definition   |
|-----------------------------|--|
| Flickering (load-dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

Table 37: Definition of LED status of the Ethernet status

## 5.8 Sercos Slave

For the Sercos Slave protocol, the communication LED **S** as well as the Ethernet LED **L/A** can assume the states described below.

### Communication status Sercos Slave













| LED   | Color  | State  | Description  |
|---|--|--|--|
| <b>S</b><br>Position on the slot cover: (2)   | <b>Duo-LED red/green</b> (orange = red/green simultaneously)                                     |  |  |
|   |  (green)        | On   | <b>CP4: Communication phase 4:</b> Normal operation, no error  |
|   |  (green)        | Flashing (2 Hz)  | <b>Loopback:</b> The network state has changed from „fast-forward“ to „loopback“.                            |
|   |  (green/orange) | Flashing (1 x green/3s)  | <b>CP3: Communication phase 3</b>  |
|   |  | (2 x green/3s)   | <b>CP2: Communication phase 2</b>  |
|   |  | (1 x green/3s)   | <b>CP1: Communication phase 1</b>  |
|   |  (orange)       | On   | <b>CP2: Communication phase 0</b>  |
|   |  (orange/green) | Flashing (2 Hz)  | <b>HP0: Hot-plug mode</b>  |
|   |  | (1 x orange/3s)  | <b>HP1: Hot-plug mode</b>  |
|   |  | (2 x orange/3s)  | <b>HP2: Hot-plug mode</b>  |
|   |  (orange)       | Flashing (2 Hz)  | <b>Identification:</b><br>Invoked by (C-DEV.Bit15 in the Device Control)<br>Or<br>SIP Identification Request |
|   |  (green/red)   | Flashing (2 Hz, min. 2s)   | <b>MST losses ≥ (S-0-1003/2):</b> The communication warning (S-DEV.Bit 15) is present in the device status.  |
|   |  (red/orange) | Flashing (2 Hz)  | <b>Application error (C1D):</b> See GDP & FSP Status codes class error.                                      |
|  (red) | Flashing (2 Hz)  | <b>Watchdog error:</b> Application is not running.   |  |
|  (red) | On   | <b>Communication Error (C1D):</b> Error detected according to Sercos third generation Class 1 Diagnosis, see SCP Status codes class error. |  |
|  (off) | Off  | <b>NRT-Mode:</b> (Non Real-Time Mode) No Sercos Communication  |  |
| Position on the slot cover: (3)   | <b>Duo LED red/green</b>   |  |  |
|   |  (off)        | Off  | This LED is not used.  |

Table 38: Communication status Sercos Slave

| LED state                 | Definition   |
|---------------------------|--|
| Flashing (2 Hz)           | The LED turns on and off with a frequency of 2 Hz: <i>one color:</i> "On" for appr. 250 ms, followed by "Off" for appr. 250 ms.<br><i>two colors:</i> First color for appr. 250 ms, followed by the second color for appr. 250 ms. |
| Flashing (1 x green/3s)   | Flashing green for 250 ms, then orange on for 2 second and 750 ms.   |
| Flashing (2 x green/3s)   | Flashing green / orange / green, each for 250 ms, then orange on for 2 seconds and 250 ms.   |
| Flashing (3 x green/3s)   | Flashing green / orange / green / orange / green, each for 250 ms, then orange on for 1 second and 750 ms.   |
| Flashing (1 x orange /3s) | Flashing orange for 250 ms, then green on for 2 second an 750 ms.  |
| Flashing (2 x orange /3s) | Flashing orange / green / orange, each for 250 ms, then green on for 2 seconds and 250 ms.   |

Table 39: Definition of the LED states communication status

**Ethernet status Sercos Slave**





| LED                       | Color   | State                       | Description  |
|---------------------------|---|-----------------------------|--|
| L/A<br>Ch0 (6) , Ch1: (8) | <b>LED green</b>  |                             |  |
|                           |  (green) | On                          | <b>Link:</b> The device is linked to the Ethernet, but does not send/ receive Ethernet frames. |
|                           |  (green) | Flickering (load dependent) | <b>Activity:</b> The device is linked to the Ethernet and sends/ receives Ethernet frames.     |
|                           |  (off)   | Off                         | The device has no link to the Ethernet.  |
| Ch0 (5) , Ch1: (7)        | <b>LED yellow</b>   |                             |  |
|                           |  (off)   | Off                         | This LED is not used.  |

Table 40: Ethernet status Sercos Slave

| LED state                   | Definition   |
|-----------------------------|--|
| Flickering (load dependent) | The LED turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "On" for approximately 50 ms, followed by "Off" for 50 ms. The LED turns on and off in irregular intervals to indicate low Ethernet activity. |

Table 41: Definition of the LED state Ethernet status

## 5.9 CC-Link IE Field Basic Slave

For the CC-Link IE Field Basic slave protocol, the communication LEDs **RUN** and **ERR** as well as the Ethernet LED **L/A** can assume the states described below.











| LED   | Color   | State                       | Description  |
|---|---|-----------------------------|--|
| <b>RUN</b><br>Position on the slot cover: (2) | <b>Duo LED red/green</b>  |                             |  |
|   |  (green) | On                          | Station in operation and cyclic transmission in progress.                                      |
|   |  (green) | Blinking (2.5 Hz)           | Station in operation and cyclic transmission stopped.  |
|   | (green)   | Flickering (10 Hz)          | Station not configured.  |
|   |  (off)   | Off                         | Station is disconnected.   |
| <b>ERR</b><br>Position on the slot cover: (3) |  (red)   | On                          | Communication error.   |
|   |  (red)   | Triple Flash                | DPM watchdog has expired.  |
|   |  (off)   | Off                         | Station is disconnected.   |
| <b>L/A</b><br>Ch0 (6) , Ch1: (8)              | <b>LED green</b>  |                             |  |
|   |  (green) | On                          | <b>Link:</b> The station is linked to the Ethernet, but does not send/receive Ethernet frames. |
|   |  (grün)  | Flickering (load dependent) | <b>Activity:</b> The station is linked to the Ethernet and sends/receives Ethernet frames.     |
|   |  (off)  | Off                         | The station has no link to the Ethernet.   |
| Ch0 (5) , Ch1: (7)                            | <b>LED yellow</b>   |                             |  |
|   |  (off) | Off                         | This LED is not used.  |

Table 42: LED states for the CC-Link IE Field Basic slave

| LED state                   | Definition  |
|-----------------------------|---|
| Triple Flash                | The LED shows a sequence of three short flashes (each 200 ms), separated by a short "Off" phase (200 ms). The sequence is finished by a long "Off" phase (1,000 ms).  |
| Blinking (2.5 Hz)           | The LED turns on and off with a frequency of 2.5 Hz: "On" for 200 ms, followed by "Off" for 200 ms.   |
| Flickering (10 Hz)          | The LED turns on and off with a frequency of 10 Hz: "On" for 50 ms, followed by "Off" for 50 ms.  |
| Flickering (load dependent) | The LED turns on and off with a frequency of 10 Hz to indicate high Ethernet activity: "On" for 50 ms followed by "Off" for 50 ms. The LED turns on and off at irregular intervals to indicate low Ethernet activity. |

Table 43: LED state definitions for the CC-Link IE Field Basic slave protocol

## 6 Connectors and switch

### 6.1 Ethernet interface

#### 6.1.1 Ethernet RJ45 sockets

##### RJ45 sockets

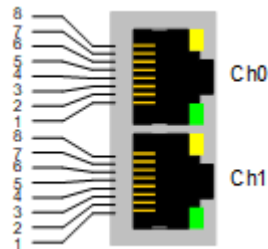


Figure 4: Pin assignment of the RJ45 sockets

The device supports the Auto Crossover function and can therefore switch RX and TX. The following table describes the RJ45 standard pin assignment.

| Pin | Signal | Description                              |
|-----|--------|--|
| 1   | TX+    | Send data positive channel               |
| 2   | TX-    | Send data negative channel               |
| 3   | RX+    | Receive data positive channel            |
| 4   | Term 1 | Bridged and terminated to PE via RC link |
| 5   | Term 1 |  |
| 6   | RX-    | Receive data negative channel            |
| 7   | Term 2 | Bridged and terminated to PE via RC link |
| 8   | Term 2 |  |

Table 44: Pin assignment of the RJ45 sockets



##### Note:

The RJ45 plug must only be used for LAN, not for telecommunication connectors.

#### 6.1.2 Data of the Ethernet connection

For the Ethernet interface use RJ45 plugs and twisted pair cable of category 5 (CAT5) or higher, which consists of 4 twisted cores and has a maximum transfer rate of 100 MBit/s (CAT5).

|                 | 100BASE-TX and 10BASE-T                             |
|-----------------|---|
| Medium          | 2 x 2 twisted pair copper cables, CAT5 (100 MBit/s) |
| Length of cable | Max. 100 m  |
| Transfer rate   | 10 MBit/s/100 MBit/s                                |

Table 45: Ethernet connection data 100BASE-TX and 10BASE-T

### 6.1.3 Usability of hubs and switches

The use of hubs or switches is prohibited or permitted for the respective communication systems. The following table shows the usability of hubs and switches per communication system:

| Communication system         | Hub       | Switch  |
|------------------------------|-----------|---|
| CC-Link IE Field Basic Slave | Forbidden | Star topology, with Layer 2 switch (must support 100 Mbit/s, 1 Gbit/s support is optional)        |
| EtherCAT                     | Forbidden | Only permitted between EtherCAT MainDevice and first EtherCAT SubDevice (100 MBit/s, full duplex) |
| EtherNet/IP                  | Allowed   | Allowed (10 MBit/s/100 MBit/s, full or half duplex, auto-negotiation)                             |
| Open Modbus/TCP              | Allowed   | Allowed (10 MBit/s/100 MBit/s, full or half duplex, auto-negotiation)                             |
| POWERLINK                    | Allowed   | Forbidden   |
| PROFINET IO                  | Forbidden | Only allowed if the switch supports 'priority tagging' and LLDP (100 MBit/s, full duplex)         |
| Sercos                       | Forbidden | Forbidden   |

Table 46: Usability of hubs and switches

## 6.2 PCI Express (1 lane)

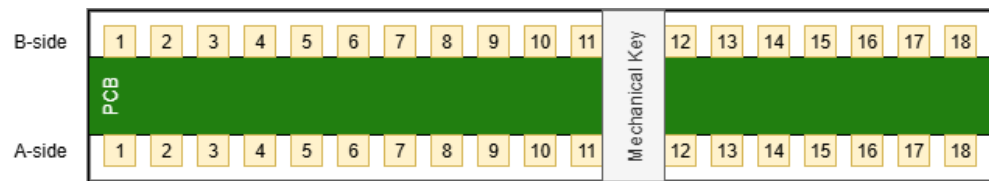


Figure 5: PCI Express (1 lane) pin assignment

The following table describes the pin assignment of the PCI Express (1 lane) of the PC card.

| Pin Number     | Pin (side B) |                                      | Pin (side A) |                          |
|----------------|--------------|--------------------------------------|--------------|--------------------------|
|                | Name         | Description                          | Name         | Description              |
| 1              | n.u.         | Not used                             | PRSENT#1     | Hot plug presence detect |
| 2              | n.u.         | Not used                             | n.u.         | Not used                 |
| 3              | n.u.         | Not used                             | n.u.         | Not used                 |
| 4              | GND          | Ground                               | GND          | Ground                   |
| 5              | n.u.         | Not used                             | JTAG2        | TCK                      |
| 6              | n.u.         | Not used                             | JTAG3        | TDI                      |
| 7              | GND          | Ground                               | JTAG4        | TDO                      |
| 8              | +3.3 V       | +3.3 volts power                     | JTAG5        | TMS                      |
| 9              | JTAG1        | +TRST#                               | +3.3V        | Power supply             |
| 10             | n.u.         | Not used                             | +3.3V        | Power supply             |
| 11             | WAKE#        | Link reactivation                    | PERST#       | PCI Express reset signal |
| Mechanical Key |              |                                      |              |                          |
| 12             | RSVD         | Reserved                             | GND          | Ground                   |
| 13             | GND          | Ground                               | REFCLK+      | Reference Clock          |
| 14             | HSOp(0)      | Transmitter Lane 0 differential pair | REFCLK-      | Differential pair        |
| 15             | HSOn(0)      |                                      | GND          | Ground                   |
| 16             | GND          | Ground                               | HSIp(0)      | Receiver Lane 0          |
| 17             | PRSENT#2     | Hot plug detection                   | HSIn(0)      | Differential pair        |
| 18             | GND          | Ground                               | GND          | Ground                   |

Table 47: Pin assignment PCI Express (1 lane)

## 6.3 Rotary switch for slot number (card ID)

The rotary switch **Slot number (card ID)** is used by the cifX Device Driver to identify the cifX PC card.



| Switch position | Description   | Example  |
|-----------------|---|--|
| 0               | <p>The cifX Device Driver identifies the cifX PC card based on its device number and serial number.</p> <p>Switch position 0 deactivates the function of the slot number. Switch position 0 is also used for backward compatibility and is equivalent to cifX PC cards that do not have a rotary switch slot number.</p> <p>If you use multiple cifX PC cards in one PC, you can use switch position 0 for multiple PC cards.</p> |  <p>Switch position 0</p> |
| 1 ... 9         | <p>The cifX Device Driver identifies the cifX PC card using the slot number set (1 ... 9)</p> <p>If you use multiple cifX PC cards in one PC, make sure that you use a different and unique slot number for each PC card.</p>   |  <p>Switch position 1</p> |

Table 48: Rotary switch for slot number (card ID)

### Note for replacing the device (replacement case)

Important: If you are replacing a cifX PC card, set the same slot number on the replacement card as on the previously used PC card. The same configuration is then loaded into the replacement card as in the previously used PC card.

## 6.4 SYNC connector, hardware and firmware

### Hardware

| Information       | Description  |
|-------------------|--|
| Sync signals      | 3.3 V (LVTTTL), maximum load 6 mA  |
| Connector plug    | Multipoint connector, 3-pole, 1.25 mm pitch (e.g. type Molex series 51021) and crimp contacts in socket version (e.g. type Molex series 50079/50058). Refer also to the information for pin assignment SYNC connector. |
| Connection socket | PCB Header 3-pole, pitch 1.25 mm (e.g. Molex 53398-0371 type). Refer also to the information for pin assignment SYNC connector.  |
| Max. cable length | Recommendation: Max. 50 mm<br><b>NOTICE!</b> Observe the necessary precautions for electrostatic sensitive components for the cable routing  |

Table 49: SYNC connector

| Pin | Signal   |
|-----|----------|
| 1   | GND      |
| 2   | IO_SYNC0 |
| 3   | IO_SYNC1 |

Table 50: Pin assignment SYNC connector

### Firmware

The firmware determines the input or output signals. The following table shows the assignment of the Sync signals per protocol.

| Protocol              | Signal<br>IO_SYNC0<br>Input/output  | Signal<br>IO_SYNC1<br>Input/output | From firmware<br>version | Remark       |
|-----------------------|---|------------------------------------|--------------------------|--------------|
| EtherCAT<br>SubDevice | SYNC 0 output   | SYNC 1 output                      | -                        | configurable |
| Sercos Master         | External trigger<br>for starting the<br>bus cycle<br>Input<br>rising edge | -                                  | 2.0.8.0                  | -            |
| Sercos Slave          | CON_CLK<br>output   | DIV_CLK<br>output                  | 3.0.10.0                 | configurable |

Table 51: Assignment of the SYNC signals per protocol

## 7 Technical data

### 7.1 Technical data CIFX PCIE90-RE

| CIFX PCIE90-RE               | Parameter                           | Value  |
|------------------------------|-------------------------------------|--|
| Product                      | Product name                        | CIFX PCIE90-RE   |
|                              | Part number                         | 1420.100   |
|                              | Brief description                   | PC card cifX PCI Express Real-Time Ethernet Device                           |
|                              | Function                            | Communication Interface with PCI Express and Ethernet interface              |
| Communication controller     | Type                                | netX 90  |
| Integrated Memory            | RAM                                 | 8 MB SDRAM   |
|                              | FLASH                               | 8 MB + 1 MB  |
| Power supply                 | Supply voltage                      | +3.3 V DC ±5 %   |
|                              | Typical current, maximum current    | 270 mA (at 3.3 V), 300 mA (at 3.3 V)   |
|                              | Connector                           | Via PCI Express Bus  |
| System interface             | Bus type                            | PCI Express, one-lane port   |
|                              | Data access                         | Dual-port memory   |
|                              | Connector type                      | PCI Express  |
|                              | Dual-port memory size               | 64 KB  |
|                              | Data width                          | 32 bit   |
|                              | Transmission rate                   | 2 GBit/s   |
| Communication interface      | Communication standard              | Ethernet   |
|                              | Interface type                      | 10BASE-T/100BASE-TX, isolated  |
|                              | Auto negotiation                    | Supported  |
|                              | Auto cross over                     | Supported  |
|                              | Connector                           | 2 x RJ45 socket  |
| Displays                     | LED display                         | SYS (System status)  |
|                              |                                     | COM 0 (Communication status)   |
|                              |                                     | COM 1 (Communication status)   |
|                              |                                     | Ethernet link status   |
|                              |                                     | Ethernet activity  |
| Operating element            | Rotary switch slot number (card ID) | To set the slot number (card ID)   |
| Permitted ambient conditions | Operating temperature range         | -25 °C ... +75 °C (air flow during measurement: 0.5 m/s)                     |
|                              | Storage temperature range           | -40 °C ... +85 °C  |
|                              | Humidity                            | 10 % ... 95 % relative humidity, no condensation permitted                   |
|                              | Environment                         | The device must be used only in a pollution degree 2 environment (or better) |
|                              | Altitude                            | 0 m ... 2000 m   |
| Device                       | Dimensions (L x W x H)              | 67 mm x 120 mm x 18.5 mm   |
|                              | Weight                              | 41 g   |
|                              | Mounting/Installation               | PCI Express x1 slot (3.3 V)  |

| CIFX PCIE90-RE                  | Parameter                           | Value                              |
|---------------------------------|-------------------------------------|------------------------------------|
| Configuration                   | Configuration software              | Communication Studio               |
|                                 | Download firmware and configuration | Device Explorer                    |
|                                 | API                                 | Yes                                |
| Conformity                      | RoHS                                | Yes                                |
| Conformance with EMC directives | CE sign                             | Yes                                |
|                                 | UKCA sign                           | Yes                                |
|                                 | Emission                            | DIN EN 61000-6-3 / BS EN 61000-6-3 |
|                                 | Immunity                            | DIN EN 61000-6-2 / BS EN 61000-6-2 |

Table 52: Technical data CIFX PCIE90-RE

## 7.2 Technical data CIFX LPCIE90-RE

| CIFX LPCIE90-RE              | Parameter                           | Value  |
|------------------------------|-------------------------------------|--|
| Product                      | Product name                        | CIFX LPCIE90-RE  |
|                              | Part number                         | 1421.100   |
|                              | Brief description                   | PC card cifX Low Profile PCI Express Real-Time Ethernet Device               |
|                              | Function                            | Communication Interface with Low Profile PCI Express and Ethernet interface  |
| Communication controller     | Type                                | netX 90  |
| Integrated Memory            | RAM                                 | 8 MB SDRAM   |
|                              | FLASH                               | 8 MB + 1 MB  |
| Power supply                 | Supply voltage                      | +3.3 V DC $\pm 5\%$  |
|                              | Typical current, maximum current    | 270 mA (at 3.3 V), 300 mA (at 3.3 V)   |
|                              | Connector                           | Via PCI Express Bus  |
| System interface             | Bus type                            | PCI Express, one-lane port   |
|                              | Data access                         | Dual-port memory   |
|                              | Connector type                      | PCI Express  |
|                              | Dual-port memory size               | 64 KB  |
|                              | Data width                          | 32 bit   |
|                              | Transmission rate                   | 2 GBit/s   |
| Communication interface      | Communication standard              | Ethernet   |
|                              | Interface type                      | 10BASE-T/100BASE-TX, isolated  |
|                              | Auto negotiation                    | Supported  |
|                              | Auto cross over                     | Supported  |
|                              | Connector                           | 2 x RJ45 socket  |
| Displays                     | LED display                         | SYS (System status)  |
|                              |                                     | COM 0 (Communication status)   |
|                              |                                     | COM 1 (Communication status)   |
|                              |                                     | Ethernet link status   |
|                              |                                     | Ethernet activity  |
| Operating element            | Rotary switch slot number (card ID) | To set the slot number (card ID)   |
| Permitted ambient conditions | Operating temperature range         | -25 °C ... +75 °C (air flow during measurement: 0.5 m/s)                     |
|                              | Storage temperature range           | -40 °C ... +85 °C  |
|                              | Humidity                            | 10 % ... 95 % relative humidity, no condensation permitted                   |
|                              | Environment                         | The device must be used only in a pollution degree 2 environment (or better) |
|                              | Altitude                            | 0 m ... 2000 m   |
| Device                       | Dimensions (L x W x H)              | 67 mm x 80 mm x 18.5 mm  |
|                              | Weight                              | 39 g   |
|                              | Mounting/Installation               | PCI Express x1 slot (3.3 V)  |
| Configuration                | Configuration software              | Communication Studio   |
|                              | Download firmware and configuration | Device Explorer  |
|                              | API                                 | Yes  |
| Conformity                   | RoHS                                | Yes  |

| CIFX LPCIE90-RE                 | Parameter | Value                              |
|---------------------------------|-----------|------------------------------------|
| Conformance with EMC directives | CE sign   | Yes                                |
|                                 | UKCA sign | Yes                                |
|                                 | Emission  | DIN EN 61000-6-3 / BS EN 61000-6-3 |
|                                 | Immunity  | DIN EN 61000-6-2 / BS EN 61000-6-2 |

Table 53: Technische Daten CIFX LPCIE90-RE

### 7.3 PCI identifiers on the PCI Express bus

The PC card CIFX (L)PCIE90-RE is a multifunction device on the PCI Express bus and requires two PCI identifiers. The following identifiers apply:

| PCI identifier      | Value  |
|---------------------|--|
| Vendor ID           | 0x15CF   |
| Device ID           | 0x0090   |
| Subsystem vendor ID | 0x15CF   |
| Subsystem device ID | 0x6001 (Flash-based device, SPM)<br>0x1002 (interrupt source, SPM) |

Table 54: PCI identifiers on the Mini PCI Express bus

## 7.4 Supported PCI bus commands

The following table lists the PCI bus commands supported by the Hilscher cifX PCI Express and Low Profile PCI Express PC cards.

| C/BE3# | C/BE2# | C/BE1# | C/BE0# | Type of bus command         | Supported  |
|--------|--------|--------|--------|-----------------------------|------------|
| 0      | 0      | 0      | 0      | Interrupt acknowledge       | no         |
| 0      | 0      | 0      | 1      | Special Cycle               | no         |
| 0      | 0      | 1      | 0      | I/O Read                    | <b>Yes</b> |
| 0      | 0      | 1      | 1      | I/O Write                   | <b>Yes</b> |
| 0      | 1      | 0      | 0      | Reserved                    | no         |
| 0      | 1      | 0      | 1      | Reserved                    | no         |
| 0      | 1      | 1      | 0      | Memory Read                 | <b>Yes</b> |
| 0      | 1      | 1      | 1      | Memory Write                | <b>Yes</b> |
| 1      | 0      | 0      | 0      | Reserved                    | no         |
| 1      | 0      | 0      | 1      | Reserved                    | no         |
| 1      | 0      | 1      | 0      | Configuration Read          | <b>Yes</b> |
| 1      | 0      | 1      | 1      | Configuration Write         | <b>Yes</b> |
| 1      | 1      | 0      | 0      | Memory Read Multiple        | no         |
| 1      | 1      | 0      | 1      | Dual Address Cycle          | no         |
| 1      | 1      | 1      | 0      | Memory Read Line            | no         |
| 1      | 1      | 1      | 1      | Memory Write and Invalidate | no         |

Table 55: Supported / unsupported PCI bus commands

**C/BE** = Bus Command and Byte Enable Signal of PCI

## 7.5 Technical data of the communication protocols

| Communication protocol       | Version | URL   |
|------------------------------|---------|---|
| CC-Link IE Field Basic Slave | 5       | <a href="https://hilscher.atlassian.net/wiki/x/hoPqB">https://hilscher.atlassian.net/wiki/x/hoPqB</a>   |
| EtherCAT SubDevice           | 5       | <a href="https://hilscher.atlassian.net/wiki/x/lwBiBw">https://hilscher.atlassian.net/wiki/x/lwBiBw</a> |
| EtherNet/IP Adapter          | 5       | <a href="https://hilscher.atlassian.net/wiki/x/ygxkBw">https://hilscher.atlassian.net/wiki/x/ygxkBw</a> |
| Open Modbus/TCP              | 5       | <a href="https://hilscher.atlassian.net/wiki/x/vocRbg">https://hilscher.atlassian.net/wiki/x/vocRbg</a> |
| POWERLINK Controlled Node    | 5       | <a href="https://hilscher.atlassian.net/wiki/x/_YbaBg">https://hilscher.atlassian.net/wiki/x/_YbaBg</a> |
| PROFINET IO-Device           | 5       | <a href="https://hilscher.atlassian.net/wiki/x/_wYYBw">https://hilscher.atlassian.net/wiki/x/_wYYBw</a> |
| Sercos Slave                 | 5       | <a href="https://hilscher.atlassian.net/wiki/x/ElzMC">https://hilscher.atlassian.net/wiki/x/ElzMC</a>   |

Table 56: Technical data: Protocols (URLs)

| Communication protocol | Version | URL   |
|------------------------|---------|---|
| EtherNet/IP Adapter    | 2.4     | <a href="https://hilscher.atlassian.net/wiki/x/bAScBg">https://hilscher.atlassian.net/wiki/x/bAScBg</a> |
| Open Modbus/TCP        | 2.4     |   |
| PROFINET IO-Device     | 2.4     |   |

Table 57: Technical data: Protocols with IoT function (URLs)

## 8 Removing the hardware

### 8.1 Removing the PC card

Removing the PC card CIFX from the PC or connecting device as described below.

#### 1. Protective measures and safety precautions

**CAUTION** Personal injury, device damage due to hot-plug/hot-swap

- Do not "plug" or "unplug" the PC card during operation.

**NOTICE** Electrostatic sensitive components

- Make sure that the device is grounded via the endplate and the PC, and make sure that you are discharged when you install/uninstall the device.

#### 2. Uninstallation

**WARNING** Hazardous voltage! Danger to life, risk of injury by electric shock

- Disconnect the power plug of the PC (or connection device).
- Make sure that the power supply is off at the PC (or connection device).
- Open the housing of the PC or connection device.
- If the PC card is screwed to the PC or the connection device, loosen this screw.
- Remove the PC card from the PCI Express slot.
- Close the housing of the PC or connecting device again.
- Reconnect the PC or the connection device to the mains.

## 8.2 Disposal and recycling of waste electronic equipment

Waste electronic equipment must be disposed of properly after the end of use.



---

### Waste electronic equipment

This product must not be disposed of with household waste.

Dispose of this product in accordance with local regulations in your country.

---

When disposing of the product, observe the following:

- Observe national and local regulations for the disposal of waste electronic equipment and packaging.
- Delete personal data stored in the waste electronic device.
- Dispose of this product in an environmentally friendly manner at a local collection point for waste electronic equipment.
- Dispose of packaging in such a way that a high level of recycling is possible.

Alternatively, you can return our products to us for disposal. The prerequisite is that no additional foreign substances are contained. Before returning, please contact us via the Return Merchandise Authorization (RMA) form on [www.hilscher.com](http://www.hilscher.com).

In Europe, the directive 2012/19/EU waste electrical and electronic equipment applies. Different policies and laws may apply nationally.

## 9 Appendix

### 9.1 References

#### **Documentation about software**

Hilscher Gesellschaft für Systemautomation mbH: Operating instruction manual, Device Explorer, Download firmware to the device, DOC190302OIxxEN, English, 2021-02.

Hilscher Gesellschaft für Systemautomation mbH: Operating instruction manual, Communication Studio, Tool for Configuration and Diagnostics, DOC190501OIxxEN, English, 2025-02.

#### **Errata for ASIX Ax99100**

Hilscher Gesellschaft für Systemautomation mbH: Errata, CIFX M223090AE, CIFX M224290BM and CIFX HPCIE90, Errata, DOC220201ERR03EN, English, 2022-03.

#### **PCI Express Electromechanical Specification**

PCI-SIG (Special interest Group), PCI Express® Base Specification, Revision 4.0, English, 2017-09

### 9.2 Legal notes

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It is hereby expressly agreed upon in particular that any use or utilization of the hardware and/or software in connection with

- Flight control systems in aviation and aerospace;
- Nuclear fission processes in nuclear power plants;
- Medical devices used for life support and
- Vehicle control systems used in passenger transport

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- For designing, engineering, maintaining or operating nuclear systems;
- In flight safety systems, aviation and flight telecommunications systems;
- In life-support systems;
- In systems in which any malfunction in the hardware and/or software may result in physical injuries or fatalities.

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