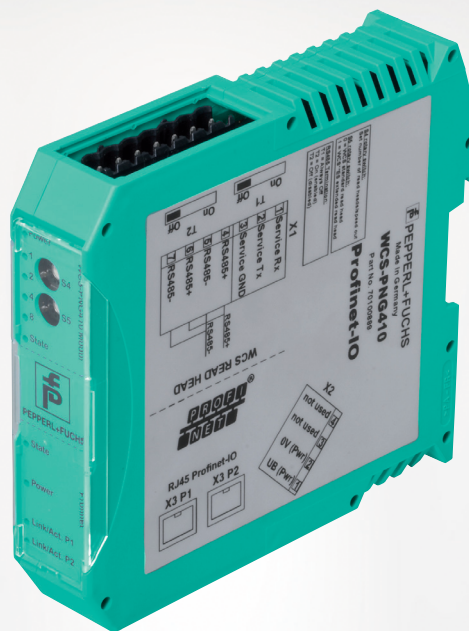


WCS-PNG410

Interface Module PROFINET

Manual



Your automation, our passion.

 **PEPPERL+FUCHS**

With regard to the supply of products, the current issue of the following document is applicable:
The General Terms of Delivery for Products and Services of the Electrical Industry, published
by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elek-
troindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause:
"Expanded reservation of proprietorship"

Worldwide

Pepperl+Fuchs Group
Lilienthalstr. 200
68307 Mannheim
Germany
Phone: +49 621 776 - 0
E-mail: info@de.pepperl-fuchs.com

North American Headquarters

Pepperl+Fuchs Inc.
1600 Enterprise Parkway
Twinsburg, Ohio 44087
USA
Phone: +1 330 425-3555
E-mail: sales@us.pepperl-fuchs.com

Asia Headquarters

Pepperl+Fuchs Pte. Ltd.
P+F Building
18 Ayer Rajah Crescent
Singapore 139942
Phone: +65 6779-9091
E-mail: sales@sg.pepperl-fuchs.com
<https://www.pepperl-fuchs.com>

| | | |
|----------|---|-----------|
| 1 | Introduction..... | 4 |
| 1.1 | Content of this Document..... | 4 |
| 1.2 | Target Group, Personnel | 4 |
| 1.3 | Symbols Used | 5 |
| 2 | Product description..... | 6 |
| 2.1 | Use and Application | 6 |
| 2.2 | Dimensions..... | 6 |
| 2.3 | Design of the Device..... | 7 |
| 3 | Installation..... | 10 |
| 3.1 | Mounting..... | 10 |
| 3.2 | Electrical Connection | 11 |
| 3.3 | Dismounting | 14 |
| 4 | Commissioning..... | 15 |
| 4.1 | Introduction | 15 |
| 4.2 | Connecting the WCS Read Head..... | 16 |
| 4.3 | Connection to the Network..... | 19 |
| 4.4 | Integrating the Interface Module into the Network..... | 20 |
| 4.5 | Data format for PROFINET input data..... | 28 |
| 5 | Appendix | 30 |
| 5.1 | Cable routing in the RS-485 bus | 30 |
| 5.2 | Behavior of the read head in the area of the WCS3 code rail extender (WCS3-CS70-E)33 | |
| 5.3 | Data Cable | 34 |

1 Introduction

1.1 Content of this Document

This document contains information required to use the product in the relevant phases of the product life cycle. This may include information on the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal



Note

For full information on the product, refer to the further documentation on the Internet at www.pepperl-fuchs.com.



Note

For specific device information such as the year of construction, scan the QR code on the device. As an alternative, enter the serial number in the serial number search at www.pepperl-fuchs.com.

The documentation comprises the following parts:

- This document
- Datasheet

In addition, the documentation may comprise the following parts, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Instruction manual
- Functional safety manual
- Other documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismantling lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismantling of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:



Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.



Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.



Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols



Note

This symbol brings important information to your attention.



Action

1. This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

2 Product description

2.1 Use and Application

The WCS-PNG410 interface module acts as an interface between the WCS read head and the PROFINET IO controller. The device has two PROFINET ports. The second port can be used as an outgoing PROFINET port. Data is transferred between the WCS read head and the interface module via an RS-485 interface. The data from the interface module to the controller is transferred via the PROFINET protocol.

You can connect a maximum of four LS221 (and/or LS121) WCS read heads to one WCS-PNG410 interface module. If you connect several WCS read heads, they must have different addresses. The number of connected WCS read heads is configured in the hardware project planning.

The interface module supports the operation of read heads with the Extended option (WCS3B-LS*E*), with distances of up to 629 meters.

2.2 Dimensions

The interface module housing has the following dimensions.

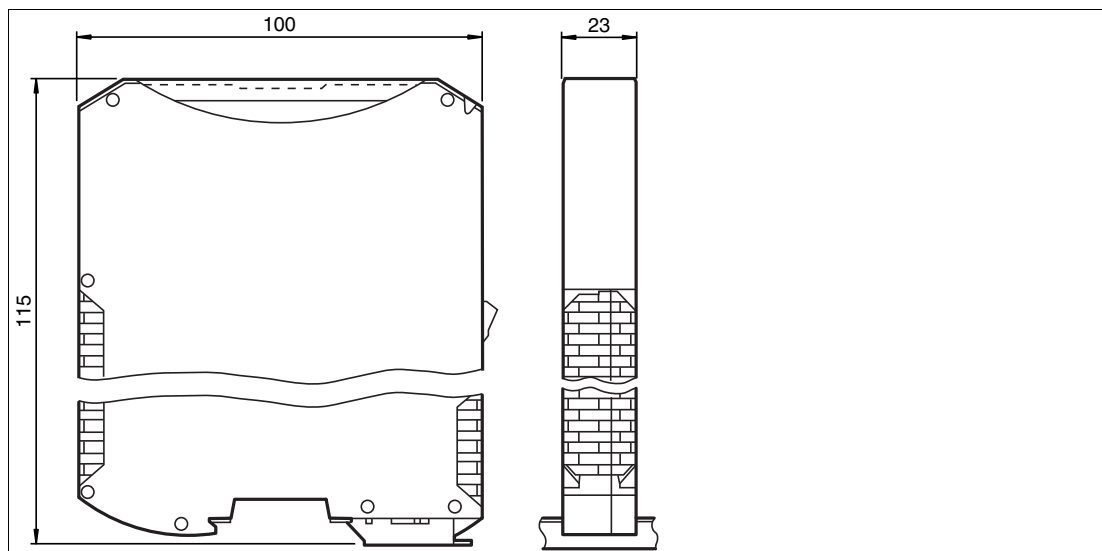


Figure 2.1 Dimensions

2.3 Design of the Device

Device Components

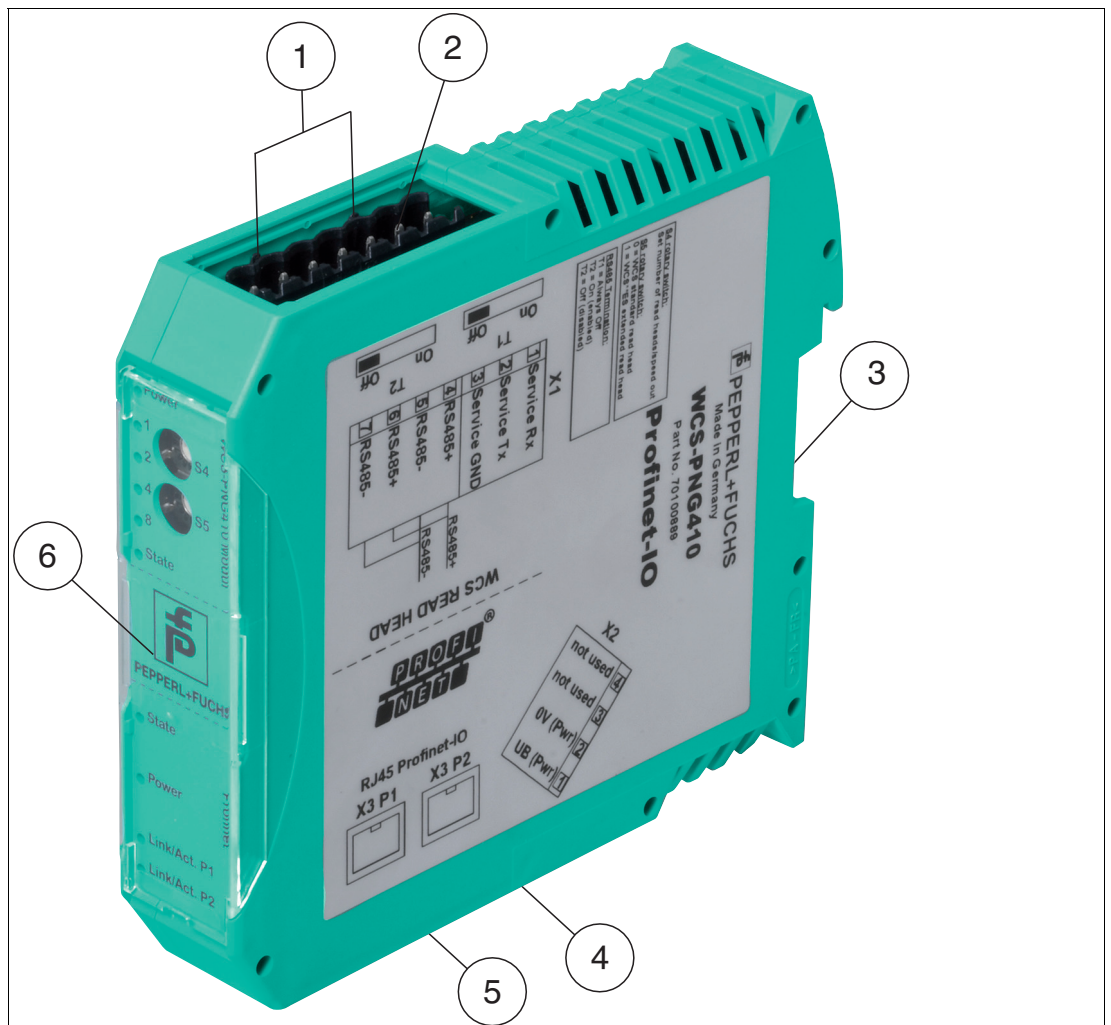


Figure 2.2 Interface module overview

- 1 RS-485 bus termination slide switch
- 2 X1: RS-485 interface
- 3 Mounting bracket
- 4 X2: Connection for power supply
- 5 X3: PROFINET IO communication interface
- 6 Front panel with rotary coding switch and LED status indicator

Front Panel

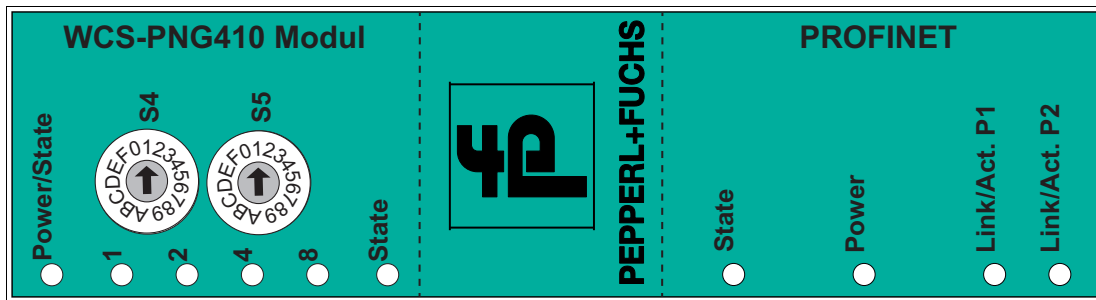


Figure 2.3 Front panel overview

WCS read head: LED status indicator and rotary coding switch

Power/State:

The "Power/State" LED lights up green: voltage supply is present.

State:

The "State" LED is green: Data is being exchanged with the WCS read heads. The four "Error No/Select ID" LEDs are used to display the number of the currently polled WCS read head.

| Error No/Select ID | | | | Read head address |
|--------------------|---|---|---|-------------------|
| 8 | 4 | 2 | 1 | |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 0 | 2 |
| 1 | 0 | 0 | 0 | 3 |

Table 2.1 Display via the four "ErrorNo/Select ID" LEDs when the "State" LED lights up green

The "State" LED lights up red: The interface module has detected an error or a warning. The interface module displays the binary-coded error and/or warning number via the "Error No/Select ID" LEDs.

Error (No. 1...5): Switch the interface module off and back on. If the error occurs again, the module must be replaced.

Warning (No. 6...15): The warning provides information. The interface module displays the warning for one minute and then resets automatically.

| LED ErrorNo/Select ID | | | | Error number | Error description |
|-----------------------|------|------|------|--------------|--|
| LED8 | LED4 | LED2 | LED1 | | |
| 0 | 0 | 0 | 0 | 0 | Reserved |
| 0 | 0 | 0 | 1 | 1 | Hardware error |
| 0 | 0 | 1 | 0 | 2 | EEPROM error |
| 0 | 0 | 1 | 1 | 3 | Internal memory error |
| 0 | 1 | 0 | 0 | 4 | Fieldbus hardware error or incorrect fieldbus ID |
| 0 | 1 | 0 | 1 | 5 | Script error |
| 0 | 1 | 1 | 0 | 6 | Reserved |
| 0 | 1 | 1 | 1 | 7 | WCS read head communication, RS send buffer overflow |

2024-09

| LED ErrorNo/Select ID | | | | Error number | Error description |
|-----------------------|------|------|------|--------------|---|
| LED8 | LED4 | LED2 | LED1 | | |
| 1 | 0 | 0 | 0 | 8 | WCS read head communication, RS receive buffer overflow |
| 1 | 0 | 0 | 1 | 9 | WCS read head communication, RS timeout |
| 1 | 0 | 1 | 0 | 10 | General fieldbus error |
| 1 | 0 | 1 | 1 | 11 | Parity error or frame check error |
| 1 | 1 | 0 | 0 | 12 | Reserved |
| 1 | 1 | 0 | 1 | 13 | Fieldbus configuration error |
| 1 | 1 | 1 | 0 | 14 | Fieldbus data buffer overflow |
| 1 | 1 | 1 | 1 | 15 | Reserved |

Table 2.2 Significance of the error codes (display via the four "Error No/Select ID" LEDs when the "State" LED lights up red and thus indicates an error or a warning)

Rotary Coding Switches S4 and S5

Rotary coding switch S4 has no function. Rotary coding switch S5 is used to determine the protocol used (WCS or WCS Extended); see chapter 4.2.

PROFINET: LED Status Indicator

State:

| "State" LED | PROFINET interface state |
|-----------------|--|
| Lights up green | Data exchange in progress |
| Flashes green | PROFINET is initialized, waiting for connection to IO controller |
| Lights up red | Error with PROFINET hardware |
| Flashes red | Error during PROFINET initialization |

Table 2.3 "State" LED display

Power:

The "Power" LED is green: The LED is connected directly to the electrically isolated supply voltage for the PROFINET side.

Link/Activity P1:

The "Link/Activity" LED on port 1 is controlled directly by the PROFINET processing unit and is green if Ethernet link pulses are found. When there is data traffic on the network, the LED flashes green at the same speed as the sent/received data.

Link/Activity P2:

The "Link/Activity" LED on port 2 is controlled directly by the PROFINET processing unit and is green if Ethernet link pulses are found. When there is data traffic on the network, the LED flashes green at the same speed as the sent/received data.

3 Installation

3.1 Mounting



Mounting the Modules

The module is fastened to a DIN mounting rail with a width of 35 mm using a snap-on fixing method.

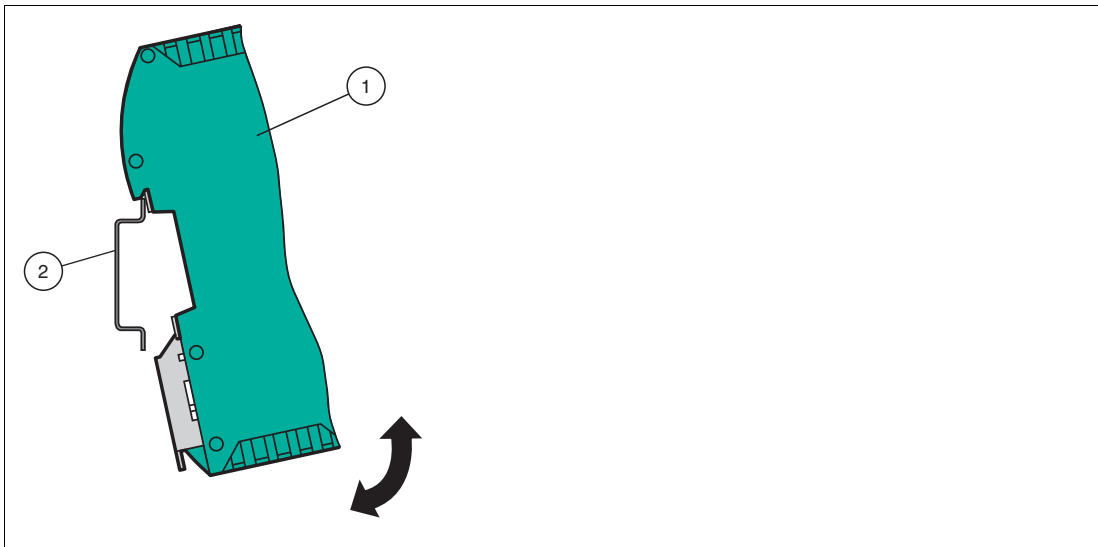


Figure 3.1 Mounting

1. Hook the module (1) onto the DIN mounting rail (2) from above and press it down until it snaps into place.

↳ The module is mounted.



Note

Heat Dissipation

You may place other modules to the left and right of the module. Above and below the modules, there must be at least 5 cm of free space for heat dissipation.

2. You must connect the DIN mounting rail to the switch cabinet's equipotential busbar. The connection wire must have a cross section of at least 10 mm².



Note

Vertical Installation

You can also install the DIN mounting rail vertically, so that the modules can be rotated by 90° for mounting.

3.2 Electrical Connection



Danger!

Device damage due to incorrect installation

Incorrect installation of cables and connection lines can endanger the function and the electrical safety of the device.

- Observe the permissible core cross section of the conductor.
- If you are using stranded conductors, crimp the stranded conductors with wire end ferrules.
- Make sure that conductors are insulated all the way up to the terminal.
- Observe the tightening torque for the screws on the terminal. The tightening torque is 0.5 Nm.
- Using an unsuitable tool may damage the screw heads. Use a slot-head screwdriver sized 3.5 x 0.5.
- Connecting an alternating current can damage the device or cause the device to malfunction. Connect the device to direct current (DC).

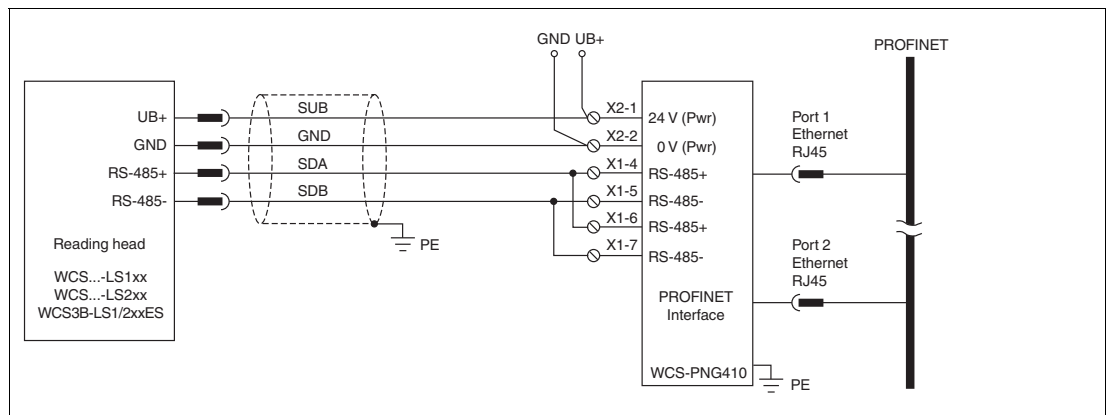


Figure 3.2 Electrical connection

Plug X1 is located on the top side of the interface module, and plug X2 is located on the underside.

Connection Technology

You must/may use the following connection technologies when wiring the assembly:

- Standard screw/plug connection (supply + RS)
- 8-pin RJ45 connector (PROFINET IO connection)

When using standard screw terminals, one cable per connection point can be clamped. To tighten the screws, use a screwdriver with a blade width of 3.5 mm.

Permissible cable cross section:

- Flexible cable with wire end ferrule: 1 x 0.25 ... 1.5 mm²
- Solid cable: 1 x 0.25 ... 1.5 mm²

The plug-in terminal strip combines a standard screw connection and a connector. The connector is coded and therefore cannot be plugged in incorrectly.



Connecting the Power Supply

1. Connect the operating voltage (10 VDC...30 VDC) to terminals 1 and 2 of the 4-pin plug X2 on the interface module. In addition, note the label on the module.

↳ The "Power" LED lights up green.

Terminal X2

| Terminal | | Description |
|----------|-----------|--|
| 1 | UB+ (Pwr) | Operating voltage for interface module/ operating voltage for WCS read head |
| 2 | 0 V (Pwr) | Ground for interface module/ground for WCS read head |
| 3 | not used | is not used |
| 4 | not used | is not used |

Equipotential Bonding Connection

The connection to equipotential bonding occurs automatically when attaching to the DIN mounting rail.



PROFINET IO Communication Interface

This interface can be found on the module in the form of two 8-pin RJ45 sockets on the bottom of the housing.

1. Insert the PROFINET connector into the RJ45 socket(s) labeled "RJ45 PROFINET IO."



Note

Ensure that the cable length to the neighboring Ethernet devices is at least 0.6 m.



Preparing for Operation on RS-485 Interface

For operation on an RS-485 interface, the terminal on plug X1 must be connected:

1. Connect the read head to the terminal. Use the enclosed jumper to connect the terminals to each other

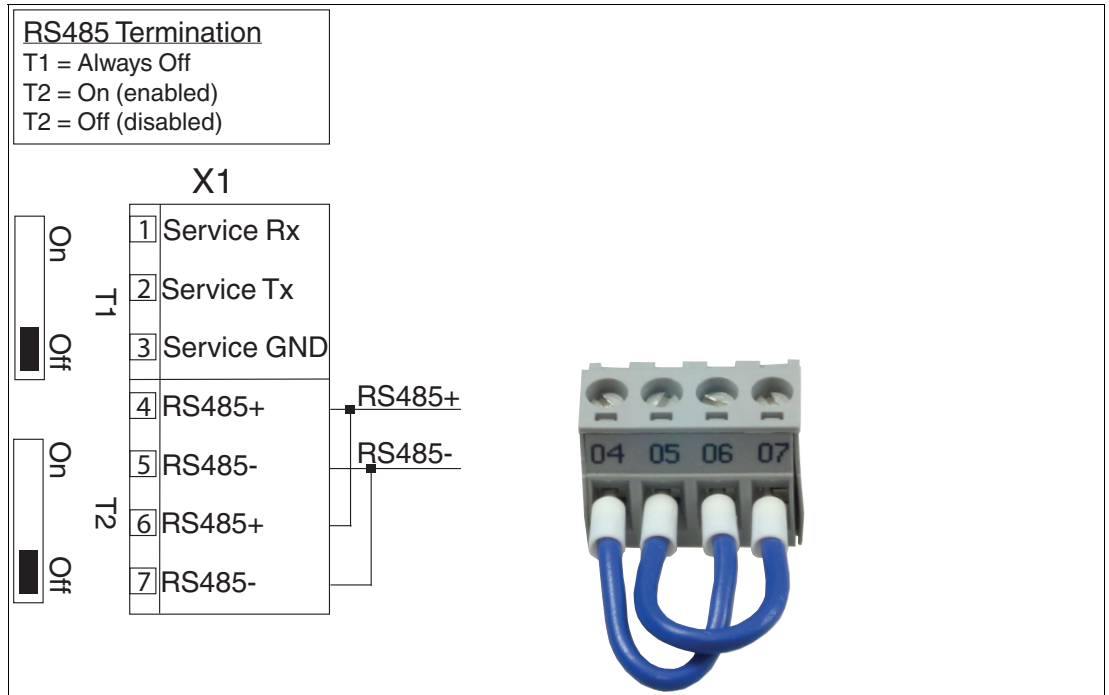


Figure 3.3 Terminal X1

3.3 Dismounting



Dismounting the modules

Use a suitable slot-head screwdriver for dismounting the module.

1. Disconnect all the supply and signal lines.

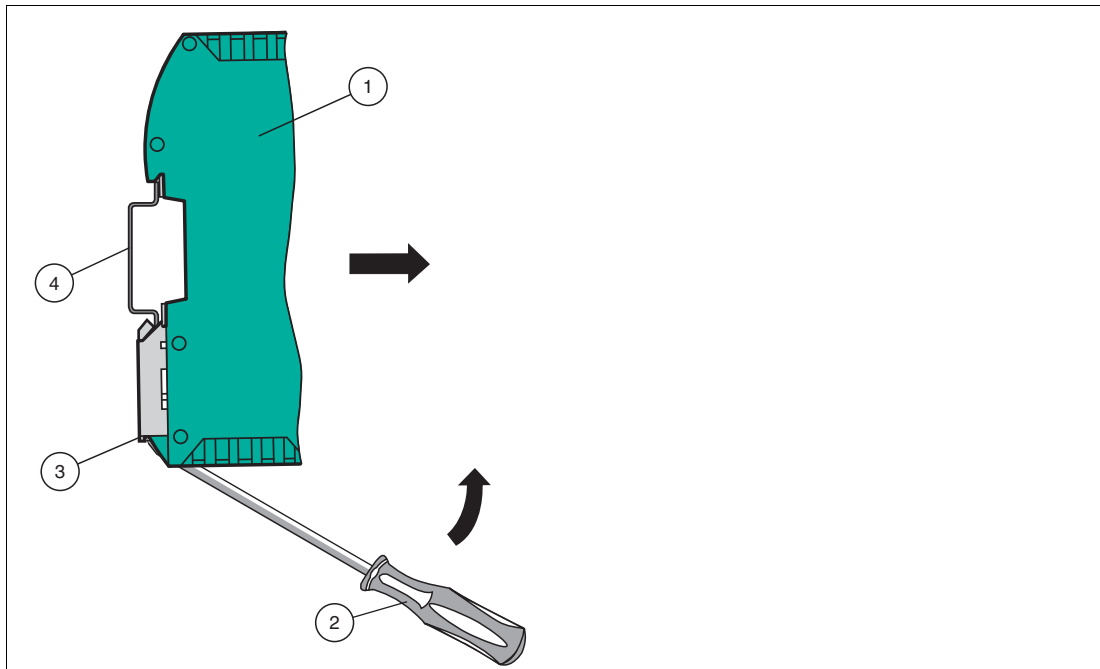


Figure 3.4 Dismounting

2. Insert the screwdriver (2) into the groove of the mounting bracket (3).
3. Press the screwdriver (2) in the specified direction until the lock on the DIN mounting rail (4) opens, see figure.
4. Then press the module (1) upwards and lift it out of the DIN mounting rail.

4 Commissioning

4.1 Introduction



Warning!

Danger to life due to defective work

Errors during installation and commissioning can cause life-threatening injuries and significant property damage.

- Installation and commissioning must be carried out only by trained personnel in accordance with safety regulations.

Components

To commission the module, you will require the following components:

- WCS-PNG410 interface module
- Cordset from the interface module to the read head
- Connector for the PROFINET connection to the interface module
- Ethernet cable
- 10 VDC...30 VDC voltage supply
- GSDML file (the GSDML file can be downloaded free of charge from our website www.pepperl-fuchs.com).



Connecting the Interface Module

To ensure that the assembly functions correctly, you must carry out the following steps during commissioning:

1. Assign a PROFINET address.



Note

On delivery, the module does not yet have an IP address. In normal operation, the IP address is usually assigned to the module by the PROFINET IO controller (PLC).

2. Assign a PROFINET device name.



Note

On delivery, the interface module does not yet have a device name. The device name is assigned to the interface module via the configuration software.

3. Connect the module to PROFINET using the interface labeled "RJ45 PROFINET IO."
4. For information on commissioning the process device (read head), please refer to its manual.
5. Ground the DIN mounting rail onto which the assembly is clipped.
6. Connect the direct current to the terminals provided.
7. Use any programming tool for project planning. The GSDML file can be downloaded from our website: www.pepperl-fuchs.com. Simply enter the product name or item number in the product/keyword field and click "Search."



Note

A more detailed description of the individual steps is provided on the following pages.

4.2 Connecting the WCS Read Head

If you connect several WCS read heads to one interface module, the WCS read heads must have different addresses. This will allow the programmable logic controller to allocate the data to the correct WCS read heads. If you connect only one WCS read head to an interface module, this WCS read head always receives the address 0. You can connect up to four WCS read heads to an interface module via an RS-485 cable. Each WCS read head is supplied with the default address of 0. Details of how to change the address of the WCS read head can be found in the configuration instructions for the WCS read head.

The number of connected read heads and their operating mode is configured in the hardware project planning. Use the GSDML file for the hardware project planning. This file can be downloaded from our website: <http://www.pepperl-fuchs.com>.

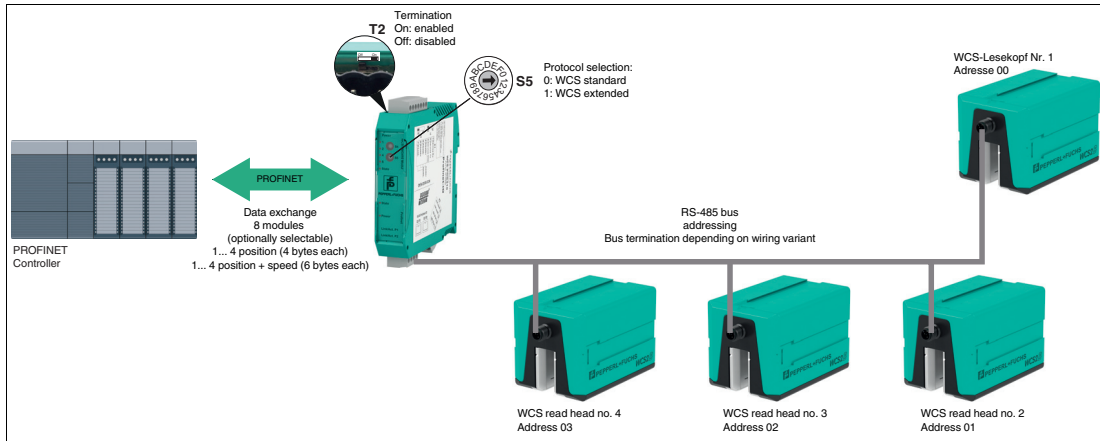


Figure 4.1 Communication structure

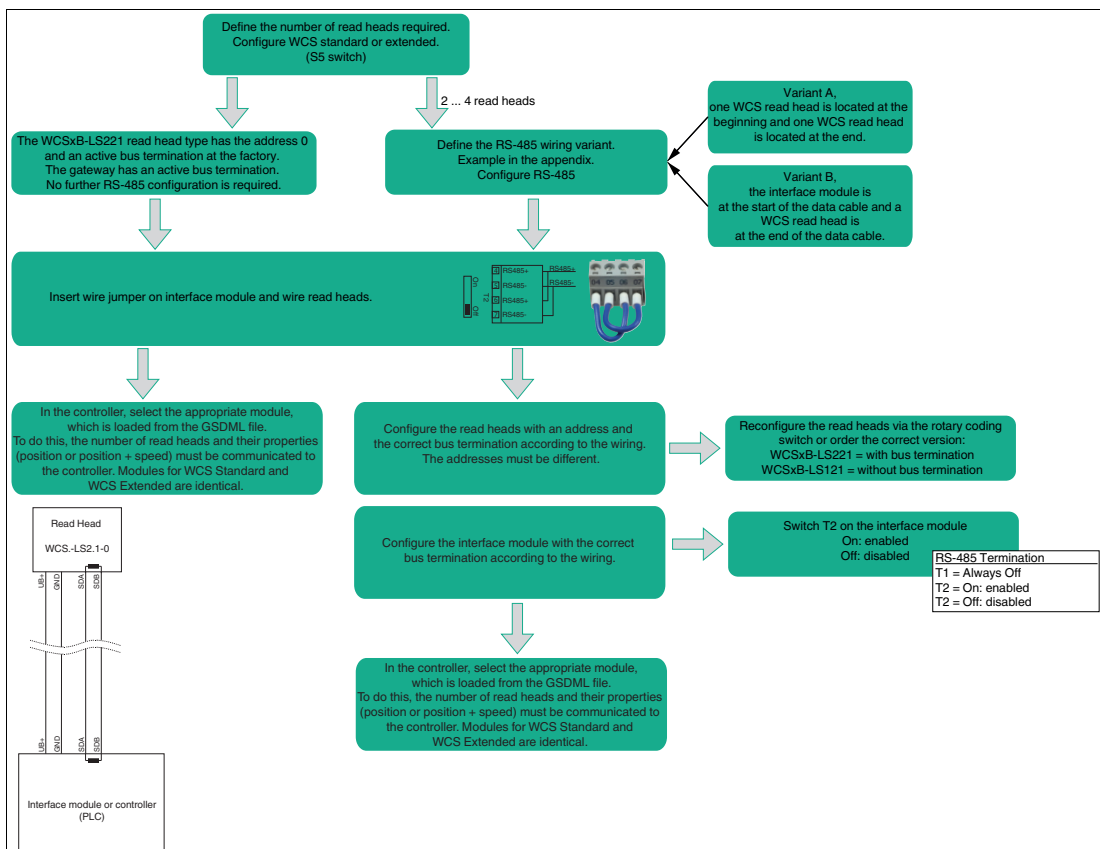


Figure 4.2 Flow chart

| Connection pin on read head | | | | Terminal on interface module |
|-----------------------------|-------|-------|-------|------------------------------|
| WCS2A | WCS2B | WCS3A | WCS3B | |
| 2 | 2 | 1 | 1 | X2-1 |
| 4 | 4 | 2 | 2 | X1-4 |
| 1 | 1 | 3 | 4 | X1-5 |
| 3 | 3 | 5 | 3 | X2-2 |

Table 4.1 Connections for the WCS read head(s)

Rotary Coding Switch S4

Rotary switch S4 has no function. Make sure that the rotary switch is in switch position 0.

Rotary Coding Switch S5

The Extended protocol (traverse distance 629.146 meters) is set on the interface module using rotary switch S5. The WCS read heads are addressed via a modified prompt bit. A total of one byte more is transferred in the response telegram of the WCS Extended protocol. For more information on the data format, refer to the WCS electrical manual (DOCT-5959).

Rotary switch S5 = switch position 0 for WCS standard (read head WCSxB-LS221*)

Rotary switch S5 = switch position 1 for WCS Extended 629.146 meters (read head WCS3B-LS221E*)

Other states/switch positions are not permitted.

Up to four RS-485 (Extended) read heads can still be connected to an interface module.



Connecting the WCS Read Head

1. Connect the voltage supply for the WCS read head to terminals 1 and 2 of the 4-pin plug X2 on the interface module.
2. Connect the RS-485 data cable to the WCS read head on terminals 4 and 5 of plug X1.



Activating the RS-485 Bus Termination

If the interface module is operated as the first or last physical device in an RS-485 bus or if you operate one read head on the interface module, a bus termination must be performed on this interface module.

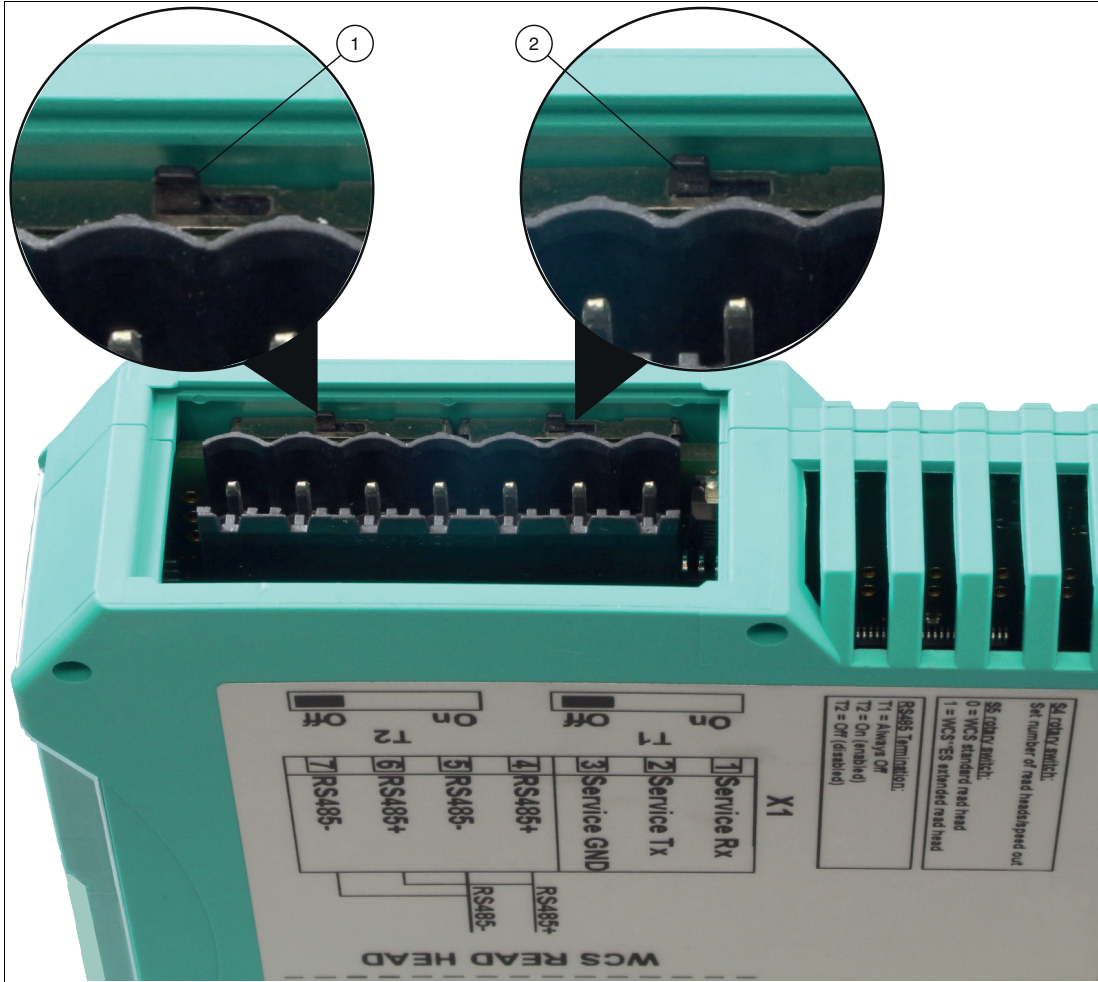


Figure 4.3 RS-485 bus termination

1. Set the T2 slide switch (1) to "On" to activate the bus termination (150 Ω).



Note

The T1 slide switch (2) has no function and remains in the "Off" switch position.

4.3 Connection to the Network

The connection to the PROFINET IO is made via the two "RJ45 PROFINET IO" sockets on the underside of the interface module. The front socket is labeled "X3 P1," and the rear socket is labeled "X3 P2."



Note

The cable to the surrounding Ethernet devices must be at least 0.6 m long.

Pinout X3 P1 & X3 P2

| Terminal | | Designation |
|----------|------|---------------------|
| 1 | TD+ | Transmission line + |
| 2 | TD- | Transmission line - |
| 3 | RD+ | Receive line + |
| 4 | n.c. | Not connected |
| 5 | n.c. | Not connected |
| 6 | RD- | Receive line - |
| 7 | n.c. | Not connected |
| 8 | n.c. | Not connected |

Table 4.2 Terminals of the 8-pin "RJ45 PROFINET IO" sockets



Connecting the Device to the Controller

1. Plug the PROFINET connector into the RJ45 socket. Use a data cable of at least Category 5.

4.4 Integrating the Interface Module into the Network



Warning!

Risk of injury due to incorrect configuration

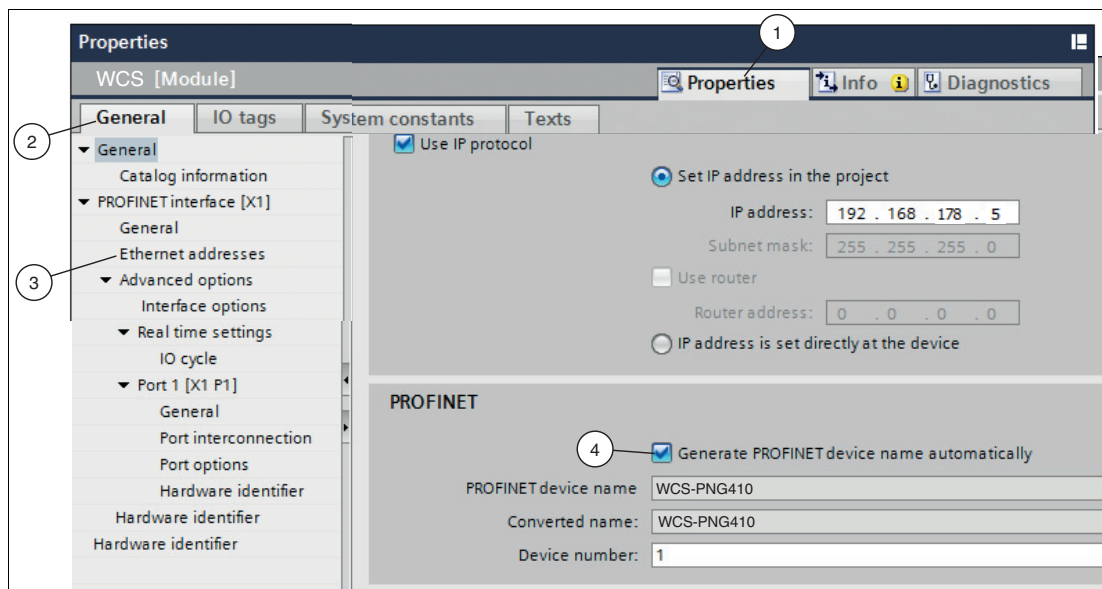
An error during the configuration of the device can override the fail-safe function, causing a danger to people and machinery.

- Ensure that the device is programmed exclusively by qualified personnel.
- Only put devices into operation after they have been configured correctly.

Device name

In the PROFINET system, each device is addressed via a unique device name (symbolic name). You can change the PROFINET device name in the TIA Portal under "Devices and networks" > "Device view" > "Properties" (1) > "General" (2) > "Ethernet addresses" (3). To do this, first remove the checkmark next to "Generate PROFINET device name automatically" (4). Then enter the device name.

If the 'Generate PROFINET device name automatically' field is activated, the device name is automatically assigned with the device name from the GSDML file and a running number.



IP Address

In normal operation (data exchange mode), the IP address is usually assigned to the module by the PROFINET controller (PLC). For this purpose, the module has a device name that is used to address it.



Note

Various configuration tools are available for configuring the interface module. In this manual, the configuration is described as an example for a Siemens controller using the TIA Portal. If you are using a programmable logic controller (PLC) from another manufacturer, the procedure is similar, but may differ in detail.



Note

The figures are provided to aid basic understanding and may deviate from the actual design.



Creating a Project

To create a project, proceed as follows:

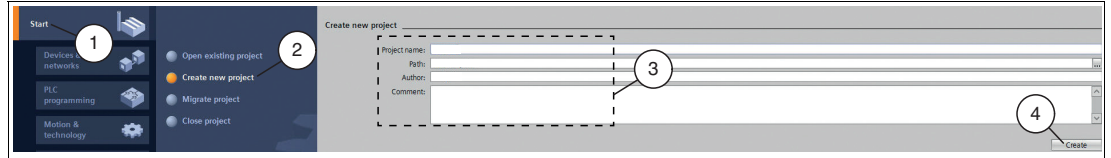


Figure 4.4 Creating a project

1. Launch the TIA Portal.
2. In the portal view, select **Start** (1) > **Create new project** (2).
3. Define fields for the project (3), e.g., by entering a name for the project in the **Project name** field.
4. Use the **Create** button (4) to confirm your entry.



Integrating the Control Panel

To integrate the control panel, proceed as follows:

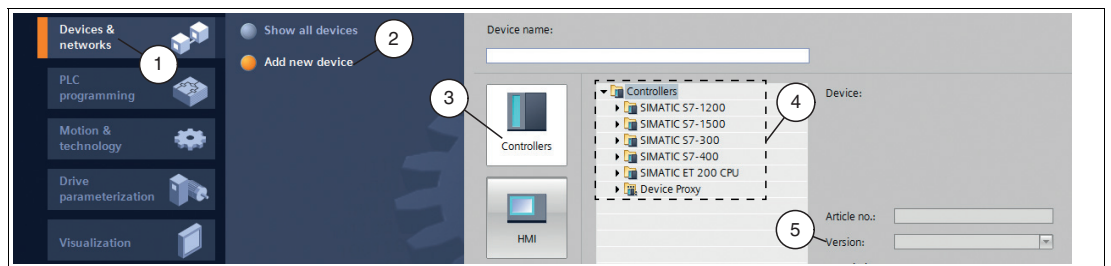


Figure 4.5 Integrating the Control Panel

1. In the portal view, select **Device & networks** (1) > **Add new device** (2). Alternatively, you can also go to **Add new device** via the project tree in your project.
2. Click the **Controllers** button (3).
3. Select your control panel from the hardware catalog (4). Make sure that you select the right firmware version of the control panel in the **Version** field (5).
4. Double-click on **Add** to add the control panel to the project.

↳ The project view opens.



Note

Now configure the control panel as required. For example, define settings for the PROFINET interface or startup/cycle behavior. Additional information can be found in the Siemens AG user documentation.



Download GSDML file

To operate the interface module, you need a device description file (GSDML file). The GSDML file can be downloaded from our website <http://www.pepperl-fuchs.com>.

1. Enter the product name or part number in the product/keyword search box and click the search button.
2. Select your product from the search results list and click the Software tab in the product information list.
3. Here is a list of all available downloads.



Installing the GSDML File

You require a GSDML file to operate the interface module. The GSDML file can be downloaded from our website: www.pepperl-fuchs.com. Enter the product name or item number in the Product/Keyword search box and click on Search. Select your product from the list of search results and click on the Software tab in the product information list. A list of all available downloads is displayed. To install the GSDML file, proceed as follows:

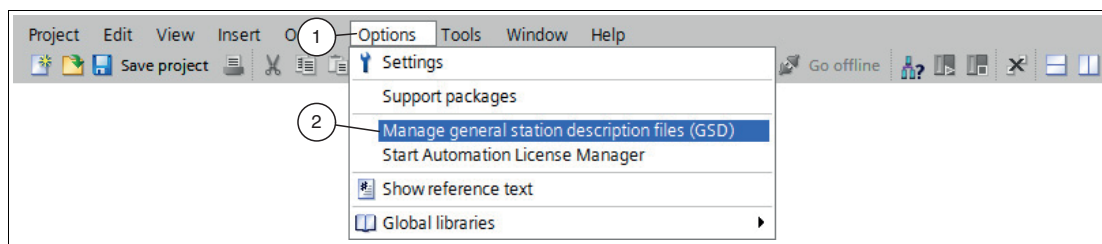


Figure 4.6 GSDML file

1. Select **Options** (1) > **Manage general station description files (GSD)** (2).

↳ The **Manage general station description files** window opens.

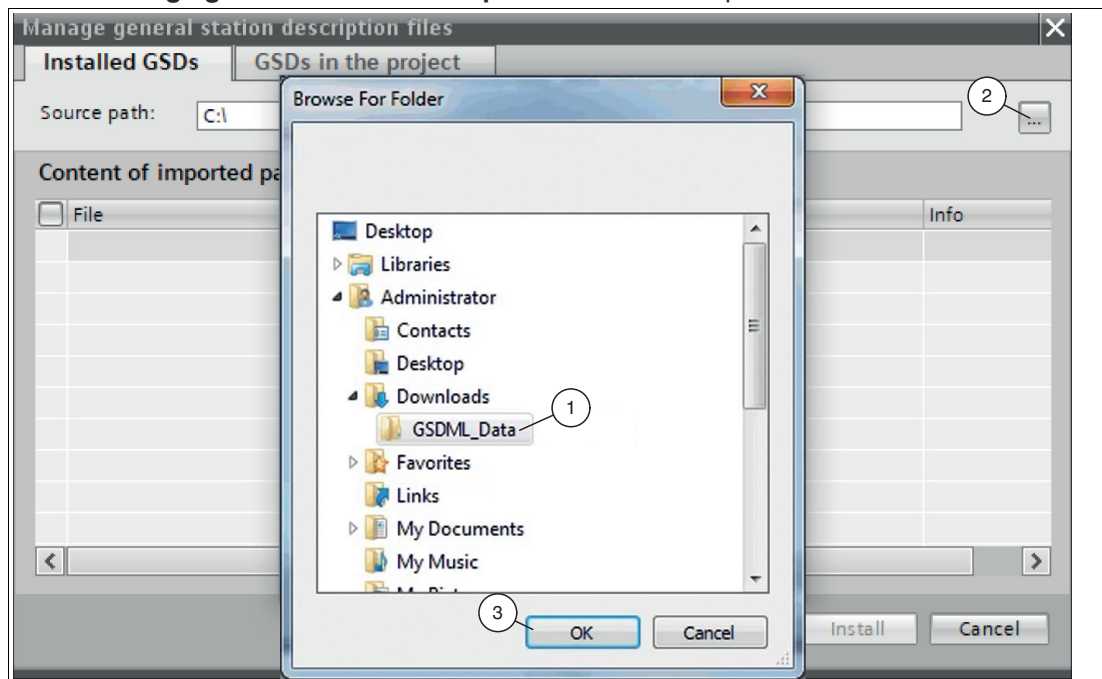


Figure 4.7 Searching for a GSDML file

2. Click the **Browse** button (2) to search for the GSDML file on your computer.
3. Select the folder containing the GSDML file (1).
4. Click **OK** (3) to confirm your selection.
 - ↳ All the GSDML files in the selected folder are displayed in the list.
5. Select the relevant GSDML file by checking the box to the left of the file name.
6. Click **Install**.
 - ↳ The installation process starts automatically.
 - Once the file is installed successfully, the system issues a notification that installation was successful. Close this window. The device data is added to the hardware catalog.



Integrating the Interface Module

To integrate the interface module and connect it to the control panel, proceed as follows:

1. In the project tree, right-click on the control panel and select **Go to network view**.

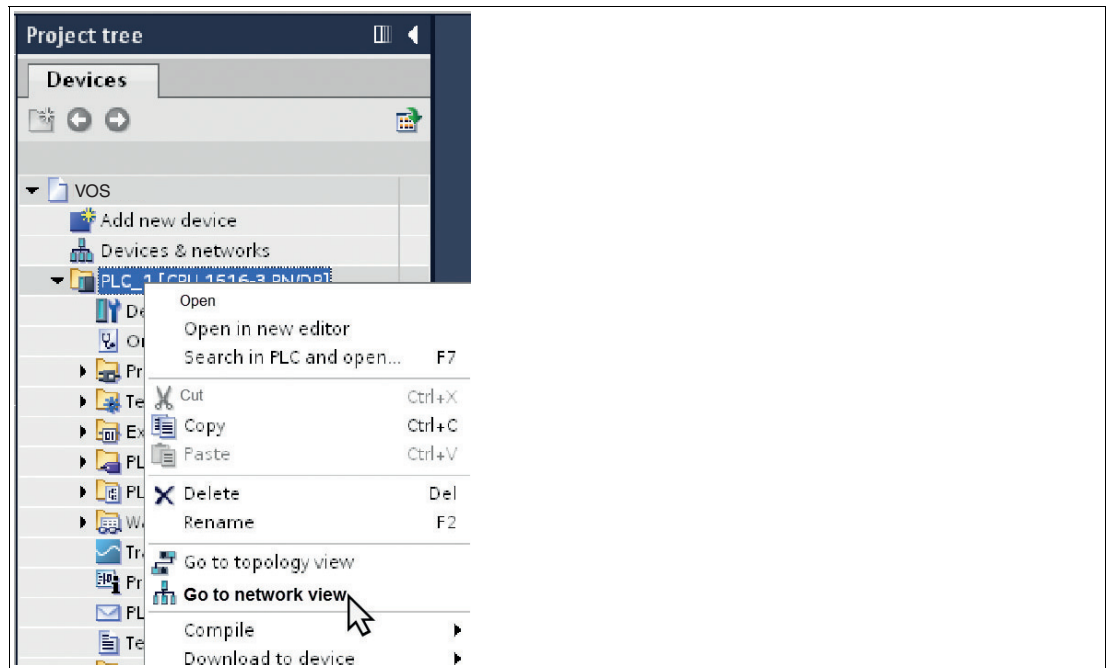


Figure 4.8 Selecting the network view

↳ The **Network view** opens in the work area.

2. Open the hardware catalog and navigate through the tree structure (1) to your interface module.



Note

Alternatively, you can search for the interface module using the search function. If you uncheck the "Filter" box, you can search for "Pepperl+Fuchs" in the search bar. Following the folder structure will take you directly to the correct module.

3. Select your interface module from the hardware catalog (1) and drag and drop it into the network view (4).

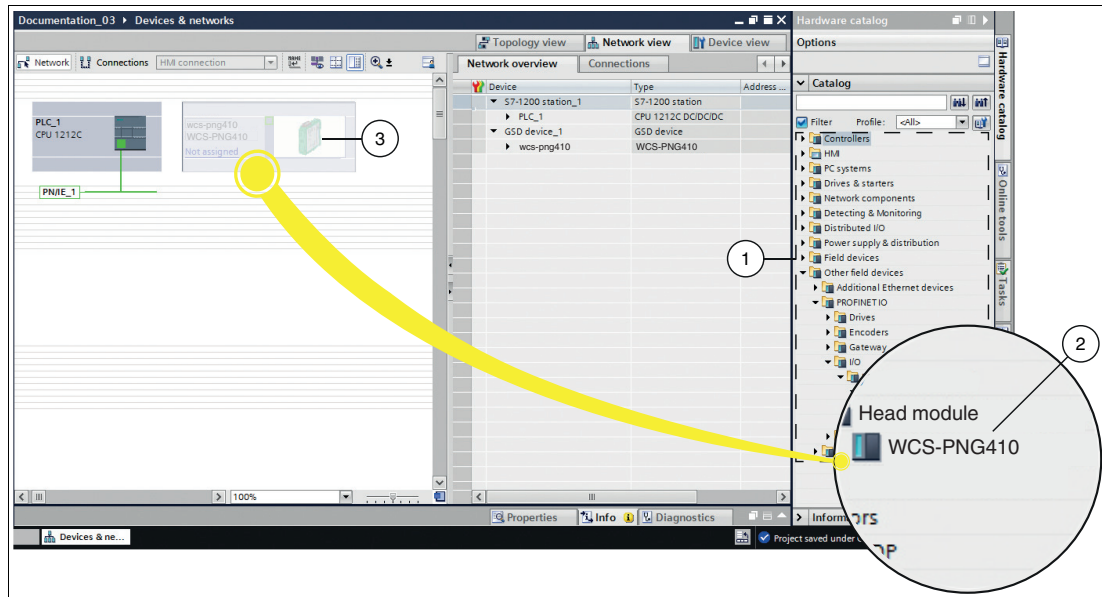


Figure 4.9 Integrating the interface module

↳ The interface module is displayed in the network view window (4).



Figure 4.10 Connecting the interface module to the control panel

4. To connect the interface module to the control panel, proceed as follows:
 1. Click the green PROFINET interface (1) for the control panel and do not let go of the mouse button.
 2. Drag the line to the PROFINET interface (2) on the gateway.
 3. Release the mouse button.

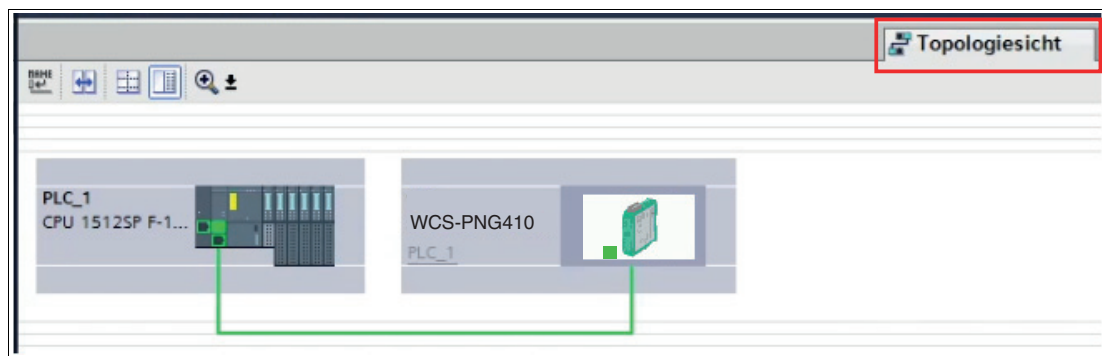


Figure 4.11

4. Switch to the "Topology view". This is the tab directly next to the network view. Connect the interface module to the control unit as described in the previous step.

**Note**

Ensure that the correct port is connected to the controller. If Ethernet is connected to port 2 on the physical controller, port 2 must also be connected to the interface module in the TIA portal. If the ports are not respected, an error message will appear and the interface module will not be controllable. If you move the mouse over the controller port, its name/number will appear and you can check that it is the correct port.

↳ The interface module is now connected to the control panel.

**Integrate additional modules into the project**

Up to 4 WCS read heads can be connected to the interface module. The controller must be informed of the number of read heads and their characteristics. The modules can be found in the hardware catalogue.

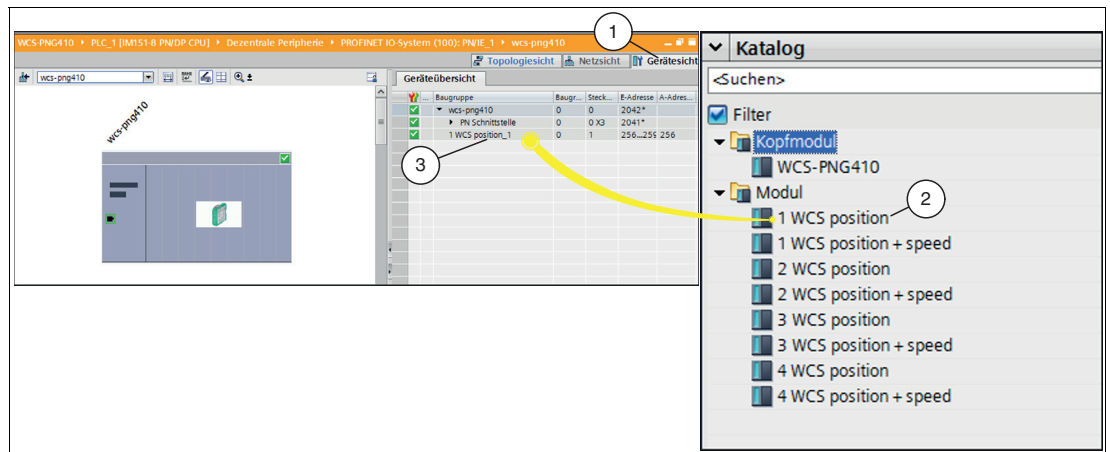


Figure 4.12 Integrate modules

1. Switch to the **"Device View"** (1) tab in the **"Devices and networks"** window.
2. Open the Hardware Catalogue. Select the module (2) with the appropriate number of read heads and operating mode and drag it into the **"Device View"** (1).

↳ A range of I/Q addresses is automatically assigned to the modules.

**Note**

In the "only position" mode, the WCS read heads output their respective position. In the "position and speed" mode, the WCS read heads output their position and the speed at which they are moving.

Irrespective of the number of WCS read heads, 1 byte is reserved for querying the diagnostics of the WCS read heads. For the response data, 4 bytes are reserved per WCS read head in position only operating mode. In "position and speed" mode, 6 bytes are reserved per WCS read head.



Integrate further Modules into the project

Up to 4 WCS read heads can be connected to the interface module. The controller must be informed of the number of read heads and their characteristics. The modules can be found in the hardware catalogue.

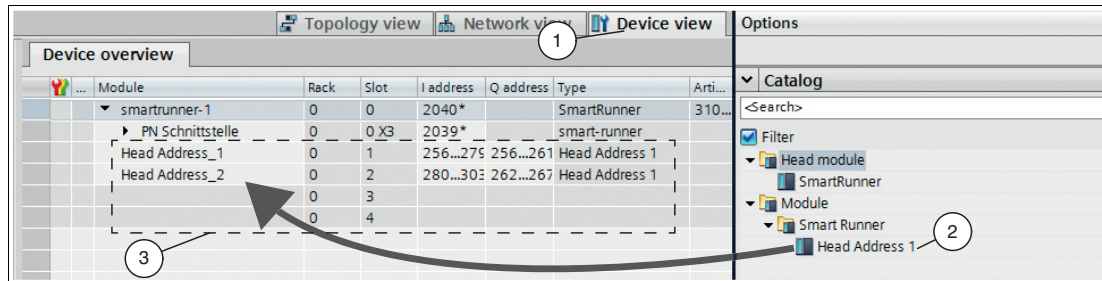


Figure 4.13 Integrating modules

1. Switch to the "Device view" tab (1) in the "Device and networks" window.
2. Open the hardware catalog. Select your module (2) from the hardware catalog and drag it into the device view (3).

↳ The modules will be automatically assigned an I and Q address range.



Note

In the "Position only" operating mode, the WCS read heads output their respective position. In the "Position and speed" operating mode, the WCS read heads output their position and the speed at which they are moving.

Regardless of the number of WCS read heads, 1 byte is reserved for querying the diagnostics of the WCS read heads. For the response data, 4 bytes are reserved per WCS read head in the "Position only" operating mode. In the "Position and Speed" operating mode, 6 bytes are reserved per WCS read head.



Transfer hardware configuration

After you have configured the hardware, you can transfer it to the controller.

1. Right-click on the controller in the project tree.
2. Select "Download to Device" and then "Hardware Configuration" from the context menu that appears.
 - ↳ The "Advanced charging" window opens.
3. Select your controller and load the hardware configuration by clicking the "Load" button (1).

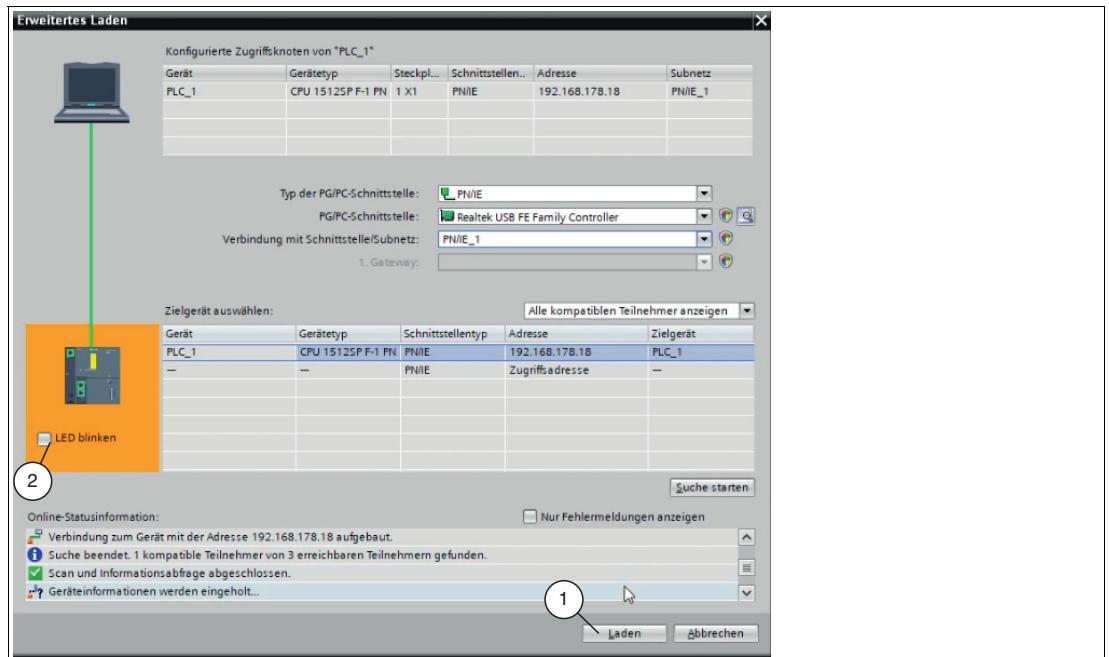


Figure 4.14



Tip

You can perform an LED flash test (2) on the selected interface module or controller in the PROFINET network. This function is useful, for example, if several interface modules or controllers are connected in the PROFINET network. In this way you can make sure that you have selected the correct interface module or controller.

The "State" LED flashes on the interface module mentioned.

4.5 Data format for PROFINET input data

In "only Position" operating mode, 4 bytes are reserved for each WCS reader.

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|-----|------|-----|-----|-----|-----|-----|-----|
| Byte 0 | 0 | 0 | 0 | 0 | P19 | P18 | P17 | P16 |
| Byte 1 | P15 | P14 | P13 | P12 | P11 | P10 | P09 | P08 |
| Byte 2 | P07 | P06 | P05 | P04 | P03 | P02 | P01 | P00 |
| Byte 3 | OVL | /VAL | SST | DB | ERR | OUT | A1 | A0 |

Table 4.3 Data format for each connected WCS reader in "only Position" operating mode, reader address = 0...3

In "Position and Speed" operating mode, 6 bytes are reserved for each WCS reader.

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|--------|-----|------|-----|-----|-----|-----|-----|-----|
| Byte 0 | 0 | 0 | 0 | 0 | P19 | P18 | P17 | P16 |
| Byte 1 | P15 | P14 | P13 | P12 | P11 | P10 | P09 | P08 |
| Byte 2 | P07 | P06 | P05 | P04 | P03 | P02 | P01 | P00 |
| Byte 3 | OVL | /VAL | SST | DB | ERR | OUT | A1 | A0 |
| Byte 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Byte 5 | 0 | S06 | S05 | S04 | S03 | S02 | S01 | S00 |

Table 4.4 Data format for each connected WCS reader in "Position and Speed" operating mode, reader address = 0...3

Description of the protocol data

| | | |
|--------------------|----|--|
| A1, A0 | | Address bits of the read head. Addresses 0 ... 3, binary coding |
| OVL | 0 | The read head is located in the readable area of the code rail |
| | 1 | The read head is located on WCS3 code rail extender (overlapping area of the code rail segments) |
| VAL | 0: | Position valid |
| | 1 | Position invalid; code rail area is not unique after the supply voltage has been connected |
| DB | 0 | By default, the diagnostic bit is not set |
| | 1 | Diagnostic bit, read head dirty |
| OUT ALL | 0 | Read head in code rail |
| | 1 | Read head completely outside of the code rail |
| OUT | 0 | Read head in code rail |
| | 1 | Read head partially outside the code rail No valid position available |
| ERR | 0 | No error |
| | 1 | Error message (possible errors in P00 ... P01 binary coding) |
| P00 ... P19 | | Current position value, binary coding |
| S00 ... S06 | | Current speed in 0.1 m/s, binary coding For example: |
| | | <ul style="list-style-type: none"> • 1: Speed = 0.1 m/s • 37: Speed = 3.7 m/s • 112: Speed = 11.2 m/s |
| SST | 0 | Speed valid |
| | 1 | Current speed unknown. Last valid speed in S00 ... S06 saved |

Start-up behavior of the read head

After the supply voltage has been connected, the X position is set to the last valid X position and the VAL bit is set to 1.

After the read head moves by approx. 5 mm, the VAL bit is set to 0 and the X position is assigned a new calculated X position. The last valid X position is stored in a non-volatile memory if it is detected that the voltage is switched off ($+U_b < 9.9 \text{ VDC}$).

5 Appendix

5.1 Cable routing in the RS-485 bus

The data cables must always form an in-line connection between the first and the last node. This in-line connection must end with a terminator.

The RS-485 terminators are integrated in the WCS readers and can be switched on and off with the interface module.

If only **one WCS reader** is connected, one device is connected at the beginning and one device is connected at the end of the data line.

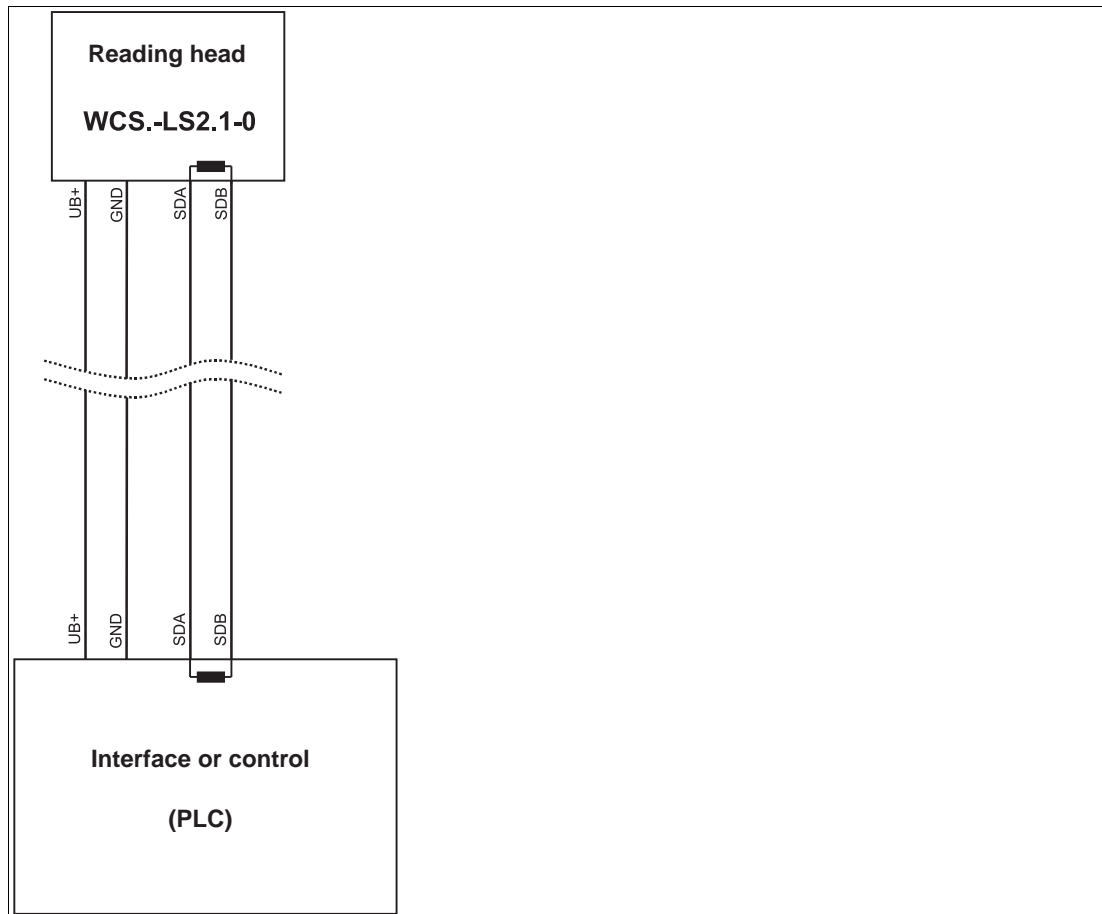


Figure 5.1 Connection of **one** reading head

If **two WCS readers** are connected to one interface module, there are two wiring versions:

- **Version A:**

One WCS reader is located at the beginning and one WCS reader at the end of the data line. For both WCS readers, the RS-485 terminator is activated. The interface module is located between these two readers and does not have an RS-485 terminator. Each WCS reader is connected to the interface module by a separate data cable.

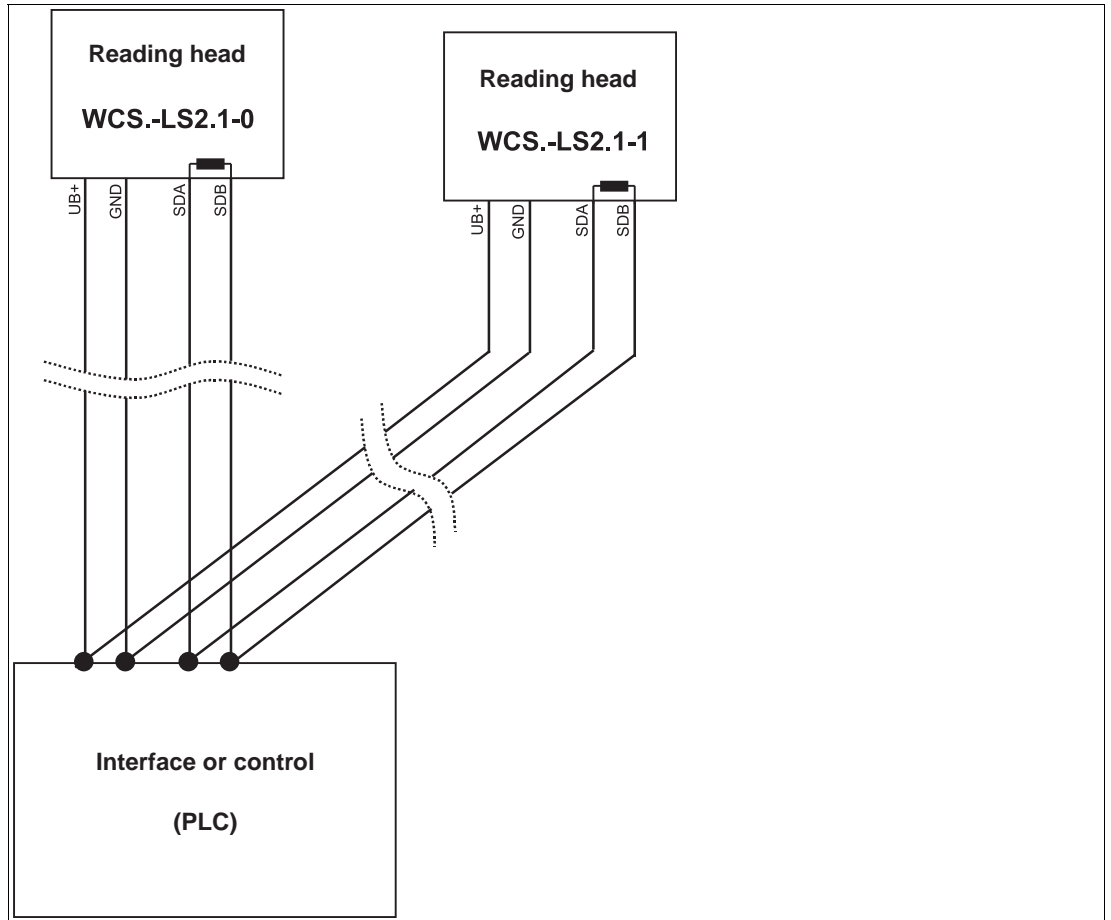


Figure 5.2 Connection of **two** reading heads, Version A

- **Version B:**

The interface module is located at the beginning of the data line; one WCS reader is located at the end of the data line. Both need the RS-485 terminator. The second WCS reader is connected to the line connection between the interface module and the first WCS reader through a short spur (length <1 m). Use a bus terminal to connect the spur.

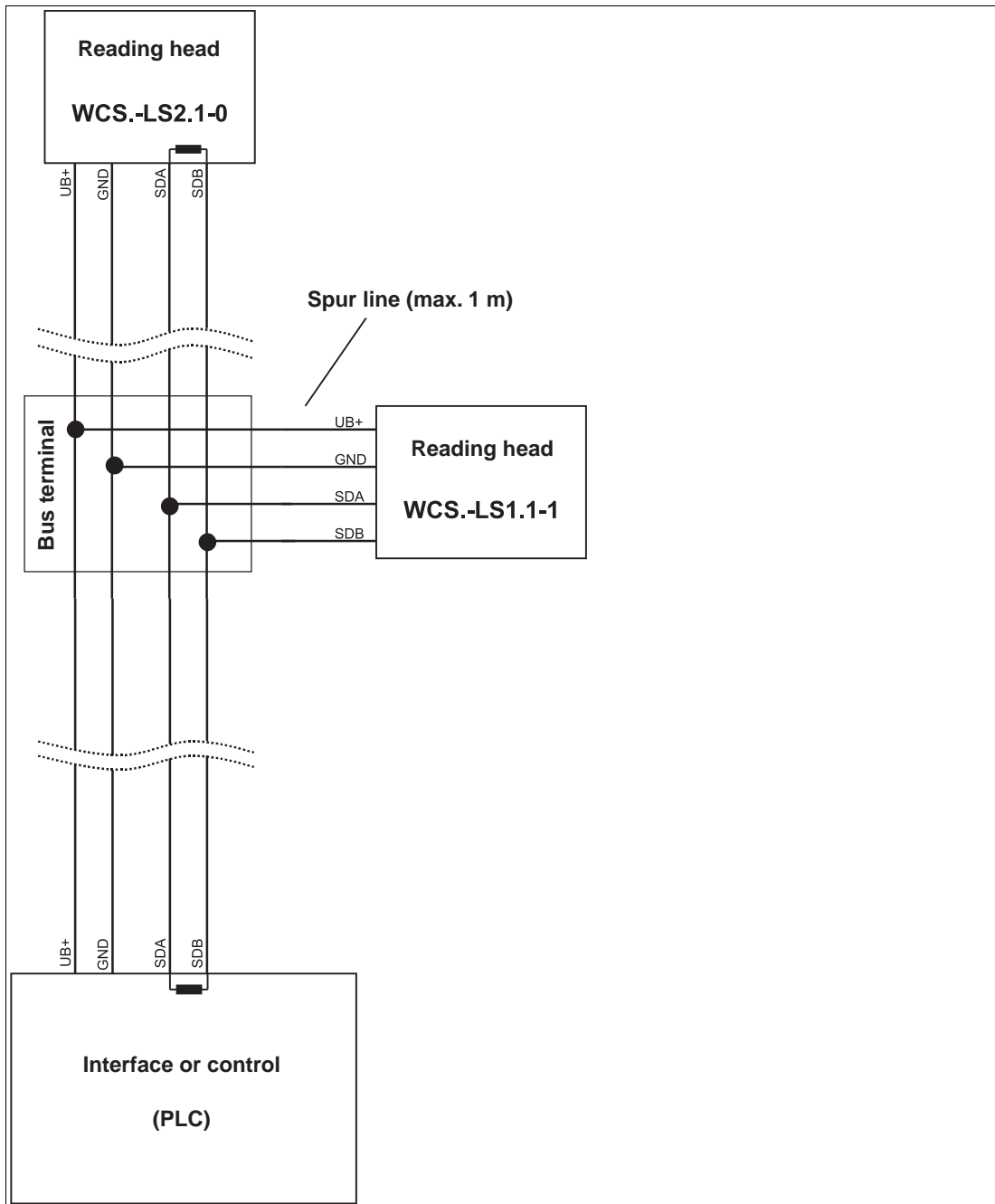
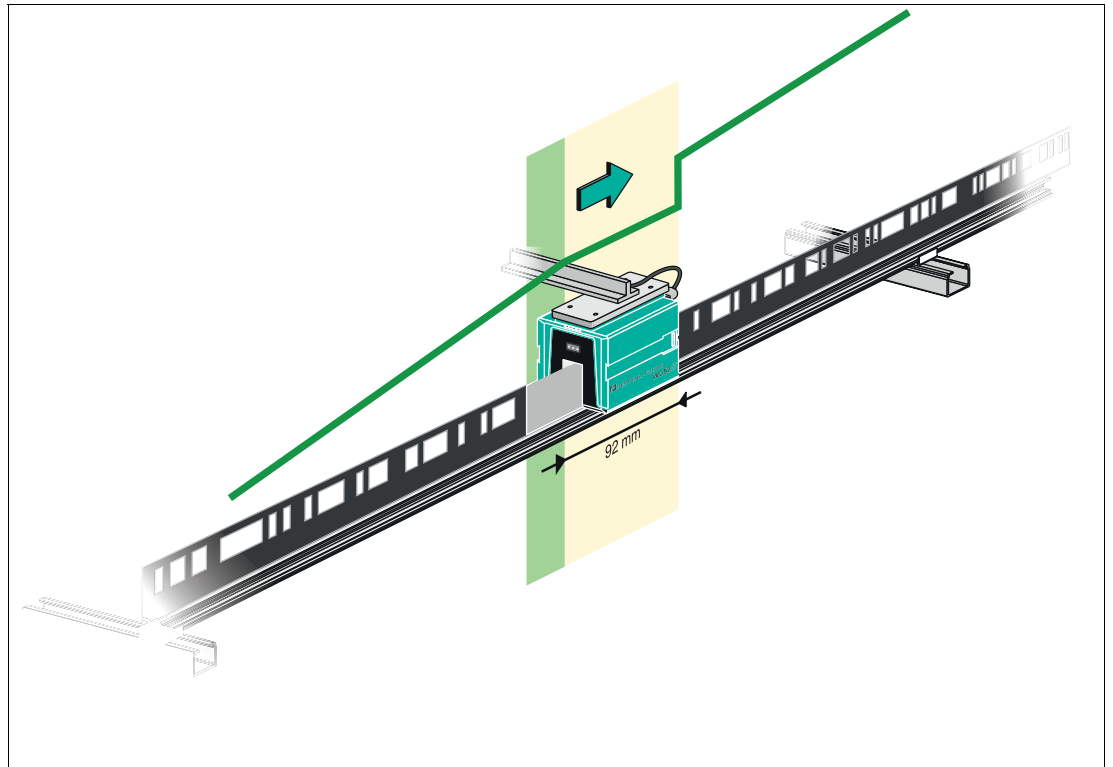


Figure 5.3 Connection of **two** reading heads, Version B

The wiring version used depends on which is best suited for the application. If **three** or **four WCS readers** are used on the same interface module, connect these using spurs as shown in variant B.

5.2 Behavior of the read head in the area of the WCS3 code rail extender (WCS3-CS70-E)

The read head retains the last measured end position of the first code rail segment (position = 393203) when traversing the WCS3 code rail extender. The OVL bit is set at the same time. As soon as the first valid position of the second code rail segment is read, the read head switches to the first valid position of the second code rail segment (position = 393318). The first valid position of the second code rail segment is dimensioned with an offset of approx. + 92 mm. (see area highlighted in yellow in the figure below.)



Caution!

Impermissible state

If you mount the WCS3 code rail extender in the wrong position, e.g., at an intermediate position of the code rail, the OUT bit is set when this code rail segment is crossed.



Note

Cycle time

Note that the cycle time for the extended variant differs from the standard variant by $t = 10$ ms.

5.3 Data Cable

A shielded data cable with twisted-pair cores is used for the electrical connection. Pepperl+Fuchs can supply suitable preassembled M12 single-ended female cordsets or field-attachable M12 female connectors and data cables.

Cable Routing

The basic prerequisite for uninterrupted data transfer is that the data cables are routed in such a way that any coupling of electromagnetic fields and interference is excluded. For EMC-compliant cable routing, it is necessary to divide the cables into cable groups and route these groups separately.

Group A

- Shielded data cable (including analog)
- Unshielded cable for DC and AC voltages 0 ... 60 V
- Shielded cable for DC and AC voltages 0 ... 230 V
- Coaxial cables for monitors

Group B

- Unshielded cable for DC and AC voltages 60 ... 400 V

Group C

- Unshielded cable for DC and AC voltages greater than 400 V

Shielding Cables

The shielding of cables is required to suppress electromagnetic interference. Establishing a low resistance or low impedance connection with the protective conductor is a particularly important factor in ensuring that these interference currents do not become a source of interference themselves.

The WCSB2B and WCS3B read heads have no connection option for the cable shield. The cable shield is connected to the plant potential in the switch cabinet with low resistance (large area). In the case of high electromagnetic interference, it is advisable to connect the shield of the data cable to the plant potential in the immediate vicinity of the read head with low resistance using a grounding clip.

Cable Length

For the RS-485 data transfer path, a four-wire, shielded, twisted pair data cable must be used. One core pair is used for the supply voltage, and one pair for the RS-485 data connection. The maximum length of the cable depends on the capacitance of the data cable—core-core—for data transfer, and on the cross section of the cables for voltage supply to the read heads. For data transfer, a small core cross section and thus a small cable capacitance is an advantage, whereas for the voltage supply, the largest possible cross section is required. The table below shows the possible cable lengths depending on the cable cross section.

| Cable cross section | AWG ¹ | Number of read heads without heater | | | | Number of read heads with heater | | | |
|--------------------------|------------------|-------------------------------------|-------|-------|-------|----------------------------------|------|------|------|
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 0.14 m m ² | ~ 26 | 200 m | 110 m | 70 m | 50 m | 15 m | 10 m | 7 m | 5 m |
| 0.22 m m ² | ~ 24 | 320 m | 170 m | 110 m | 80 m | 30 m | 15 m | 10 m | 7 m |
| 0.25 m m ² | - | 350 m | 190 m | 130 m | 90 m | 35 m | 17 m | 12 m | 8 m |
| 0.28 m m ² | - | 400 m | 220 m | 150 m | 110 m | 40 m | 20 m | 15 m | 10 m |

2024-09

| Cable cross section | AWG ¹ | Number of read heads without heater | | | | Number of read heads with heater | | | |
|--------------------------|------------------|-------------------------------------|-------|-------|-------|----------------------------------|------|------|------|
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 0.34 m m ² | ~ 22 | 500 m | 250 m | 180 m | 140 m | 50 m | 25 m | 17 m | 12 m |
| 0.50 m m ² | ~ 20 | 500 m | 400 m | 270 m | 200 m | 70 m | 35 m | 25 m | 17 m |

1. American Wire Gauge, a system commonly used in North America for the specification of wire diameters in electrical engineering.

In the calculations, the worst-case scenario was assumed: All read heads are located at the end of the data cable. In the case of large cable lengths, and when connecting multiple WCS2 read heads with a heater, 6-wire data cables (3 x 2) can be used. These data cables use two pairs for the voltage supply (doubling the cable cross section), and one pair for the RS-485 data line. The table below shows the possible cable lengths depending on the cable capacitance (core-core). The number of connected read heads is of no significance.

| Capacitance (core-core) | RS-485 interface | | |
|-------------------------|------------------|---------|----------|
| | 19.2 kb | 62.5 kb | 187.5 kb |
| 60 pF | 500 m | 500 m | 300 m |
| 90 pF | 500 m | 450 m | 275 m |
| 120 pF | 500 m | 400 m | 250 m |

Cable Overview

The cable types listed below represent a selection of the types available from Pepperl+Fuchs. You can find additional cable types on our website.



Note

For customizable cables, observe the cable length restrictions specified by the interface specifications. Refer to the relevant interface chapters for maximum cable length recommendations.

RS-485 (LS1xx*, LS2xx*)

| Cable | Description |
|---|--|
| Field attachable cable | |
| V15-G-2M-PUR-ABG | M12 single-ended female cordset, 5-pin, straight, 2 m PUR cable, shielded |
| V15-G-5M-PUR-ABG | M12 single-ended female cordset, 5-pin, straight, 5 m PUR cable, shielded |
| V15-G-10M-PUR-ABG | M12 single-ended female cordset, 5-pin, straight, 10 m PUR cable, shielded |
| Field attachable single-ended female cordsets and available by the meter | |
| V15-G-ABG-PG9 | M12 single-ended female cordset, 5-pin, straight, field attachable, shielded |
| V15-G-ABG-PG9-FE | M12 single-ended female cordset, 5-pin, straight, field attachable, shielded with grounding terminal |
| V15-G-PG9 | M12 single-ended female cordset, 5-pin, straight, field attachable |
| V15-W-PG9 | M12 single-ended female cordset, 5-pin, angled, field attachable |

Your automation, our passion.

Explosion Protection

- Intrinsic Safety Barriers
- Signal Conditioners
- FieldConnex® Fieldbus
- Remote I/O Systems
- Electrical Ex Equipment
- Purge and Pressurization
- Industrial HMI
- Mobile Computing and Communications
- HART Interface Solutions
- Surge Protection
- Wireless Solutions
- Level Measurement

Industrial Sensors

- Proximity Sensors
- Photoelectric Sensors
- Industrial Vision
- Ultrasonic Sensors
- Rotary Encoders
- Positioning Systems
- Inclination and Acceleration Sensors
- Fieldbus Modules
- AS-Interface
- Identification Systems
- Displays and Signal Processing
- Connectivity

Pepperl+Fuchs Quality

Download our latest policy here:

www.pepperl-fuchs.com/quality

