

MANUAL

# WCS-PG310 WCS PROFIBUS DP Interface Module



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 Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

<b>1</b>	<b>Introduction.....</b>	<b>4</b>
1.1	Content of this Document .....	4
1.2	Target Group, Personnel.....	4
1.3	Symbols Used .....	4
<b>2</b>	<b>Product Description .....</b>	<b>6</b>
2.1	Use and Application.....	6
2.2	Dimensions.....	6
2.3	Design of the Device.....	7
<b>3</b>	<b>Installation.....</b>	<b>10</b>
3.1	Mounting.....	10
3.2	Electrical Connection .....	11
3.3	Dismounting .....	14
<b>4</b>	<b>Commissioning.....</b>	<b>15</b>
4.1	Introduction .....	15
4.2	Connecting the WCS Reader .....	16
4.3	Connecting the WCS-PG310 to the Network.....	16
4.4	Integrating WCS-PG310 into the PROFIBUS System.....	17
4.5	Data Format for Modules .....	23
<b>5</b>	<b>Appendix .....</b>	<b>25</b>
5.1	Cable Routing in the RS-485 Bus .....	25
5.2	Data Cables and Accessories .....	28

# 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!**

Visit [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com) to access further documentation for full information about the product.

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
- Other documents

## 1.2 Target Group, Personnel

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

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting 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**

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-PG310 acts as an interface between the WCS reader and the PROFIBUS DP input card of the control panel. The data is transferred between the WCS reader(s) and the WCS-PG310 via the RS-485 interface, and from the WCS-PG310 to the control panel via the PROFIBUS DP protocol.

You can connect up to four WCS readers of type LS221 or LS121. If you connect several readers, they must have different addresses. The WCS-PG310 interface module constantly queries the position values of the readers and always has the current reader data. The update cycle for a reader is approximately 1 ms.

The WCS-PG310 interface module has the following configuration:

Baud rate:	Max. 12 MBaud (automatic detection)
Diagnostic data:	Max. 8 bytes
Sync:	Supported
Freeze	Supported
ID no.:	0x2079

### 2.2 Dimensions

The interface module housing has the following dimensions.

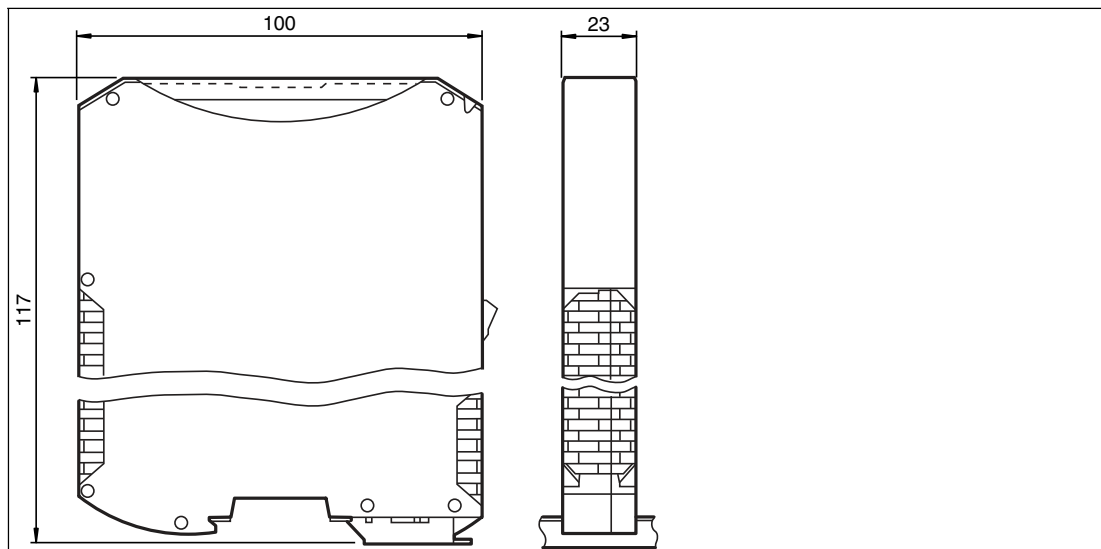


Figure 2.1 Dimensions

## 2.3 Design of the Device

### Device components

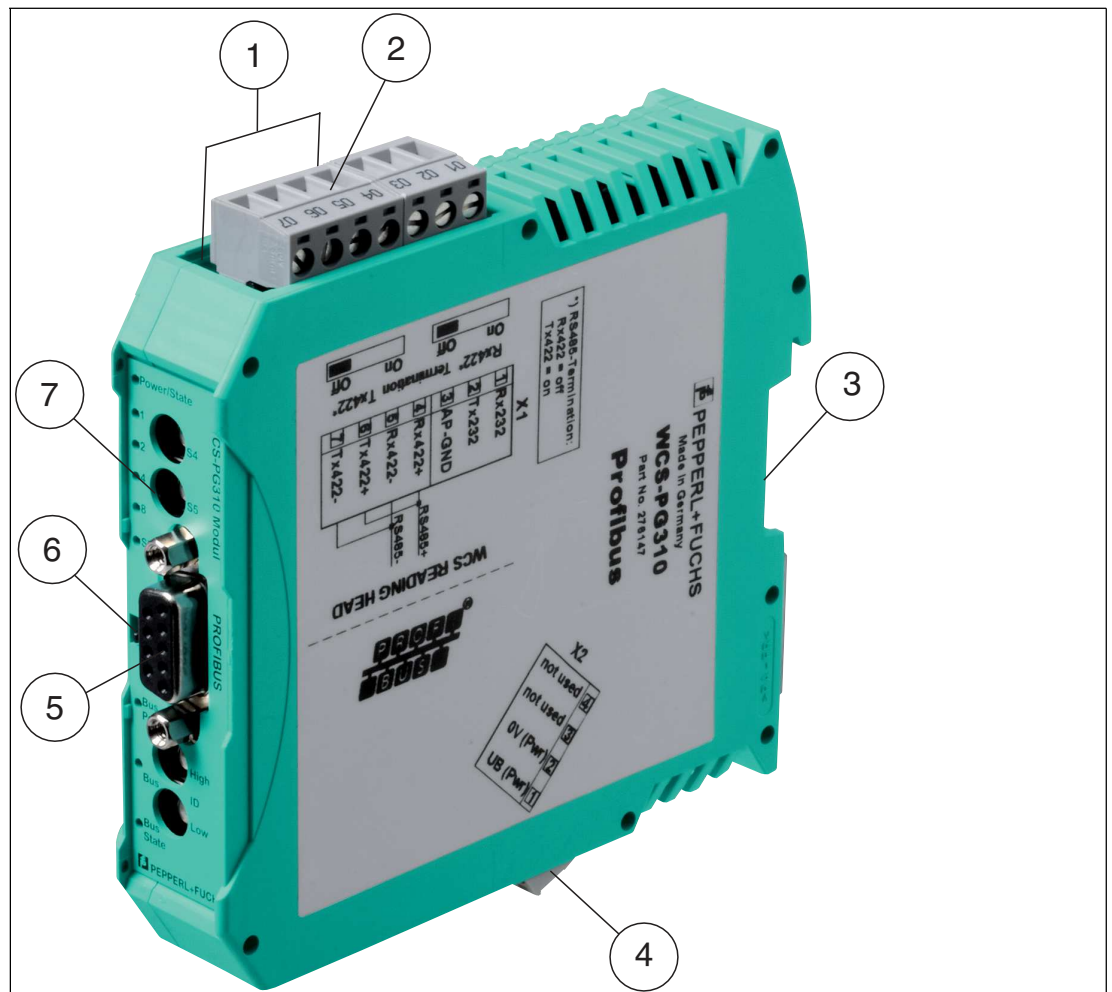


Figure 2.2 Interface module overview

- 1 Slide switch for RS-485 terminator
- 2 X1: RS-485 interface
- 3 Mounting bracket
- 4 X2: Connection for power supply
- 5 PROFIBUS communication interface
- 6 Slide switch for PROFIBUS DP terminator
- 7 Front panel with rotary coding switches and indicator lights

## Front panel

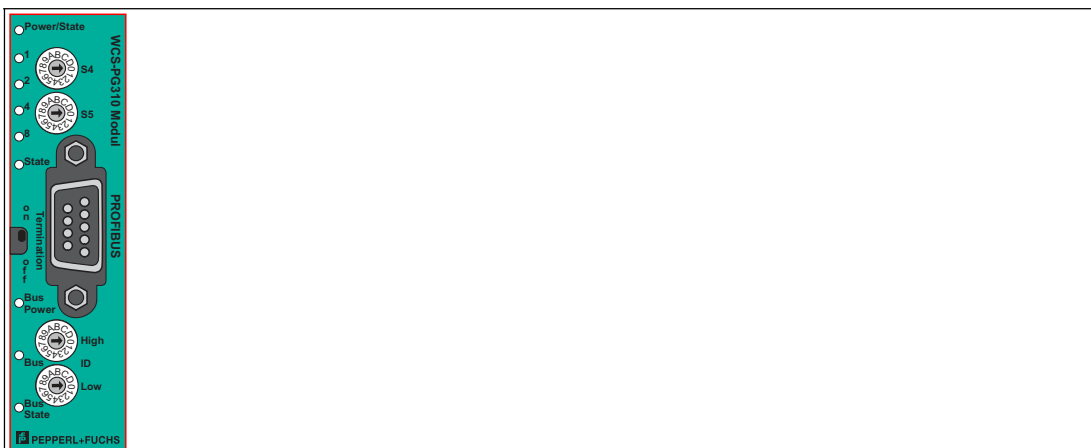


Figure 2.3 Front panel overview

### Power:

The "Power" LED is green: The WCS-PG310 interface module is correctly connected to the power supply.

### State:

The "State" LED is green: Data is being exchanged with the WCS readers. The four "ErrorNo/Select ID" LEDs are used to display the number of the currently polled reader.

ErrorNo/Select ID				Reader 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 is red: The interface module has detected an error or a warning. The interface module uses the "ErrorNo/Select ID" LEDs to display the binary coded error number or warning number, and sends the number to the PROFIBUS master via the external diagnostic byte.

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.

ErrorNo/Select ID LED				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

2018-03



ErrorNo/Select ID LED				Error number	Error description
LED8	LED4	LED2	LED1		
0	1	0	1	5	Script error
0	1	1	0	6	Reserved
0	1	1	1	7	WCS reader communication, RS send buffer overflow
1	0	0	0	8	WCS reader communication, RS receive buffer overflow
1	0	0	1	9	WCS reader 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 Meaning 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

The rotary switches S4 and S5 have no function. Ensure that the two switches are at **position 0** to enable the data exchange mode.

### Bus Power:

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

### Bus:

The "Bus" LED is red: The interface module cannot exchange any data on the PROFIBUS.

### Bus State:

"BusState" LED	PROFIBUS DP interface state
Lights up green	Data exchange on the PROFIBUS
Flashes red/green	Interface module is waiting for PROFIBUS parameter data
Lights up red	Error on the PROFIBUS
Flashes green	Interface module is waiting for configuration data

### ID High and ID Low rotary coding switches

You can set the PROFIBUS address with the two ID High and ID Low rotary switches. The digits selected via the two rotary switches together form the PROFIBUS address in hexadecimal format.

Example: To set the address 19 (= 13h), set the ID High rotary switch to position "1" and the ID Low rotary switch to position "3."

### 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.

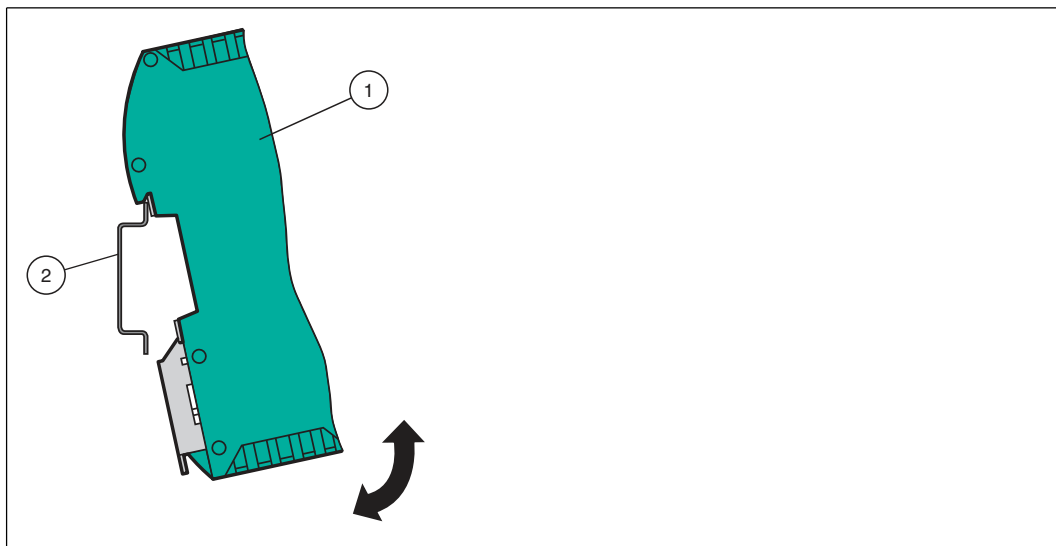


Figure 3.1 Mounting

1. Hook the module (1) into 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 mm<sup>2</sup>.



**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

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

- Note 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 the insulation on the conductors extends all the way to the terminal.
- Observe the tightening torque for the screws on the terminal. The tightening torque is 0.5 Nm.
- Using an inappropriate tool may damage the screw heads. Use a slot-head screwdriver of size 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).

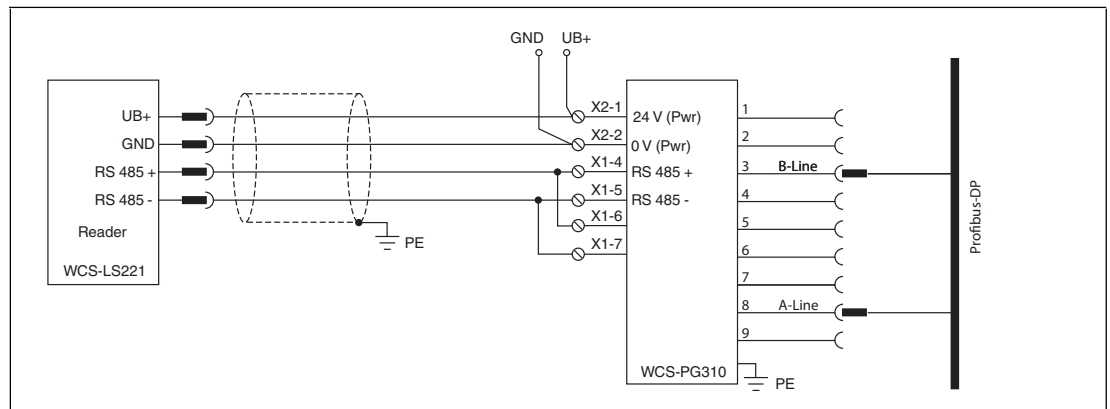


Figure 3.2 Electrical connection

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 technology when wiring the assembly:

- Standard screw/plug connection (supply + RS)
- 9-pin, D-SUB connector (PROFIBUS DP connection)

When using standard screw terminals, one line 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 mm<sup>2</sup>
- Solid cable: 1 x 0.25 ... 1.5 mm<sup>2</sup>

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

The 9-pin D-SUB connector is secured with two screws with a "4-40 UNC" thread. To tighten the screws, use a screwdriver with a blade width of 3.5 mm. Observe the maximum tightening torque of 0.4 Nm.



### Connecting the power supply

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		Description
1	UB (Pwr)	Operating voltage for interface module/ operating voltage for WCS reader
2	0 V (Pwr)	Ground for interface module/ground for WCS reader
3	Not used	Not used
4	Not used	Not used

Table 3.1 Terminal X2

### Equipotential bonding connection

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



### PROFIBUS DP communication interface

This interface can be found on the front of the housing in the form of a 9-pin D-SUB socket.

1. Connect the PROFIBUS connector to the D-SUB socket labeled "PROFIBUS."
2. Tighten the lock screws on the connector using a screwdriver.
3. If the assembly is at the beginning or at the end of the PROFIBUS cable, you must connect the terminator that is integrated in the interface module. To do this, slide the slide switch to the "on" position or to the upper end position.
4. If the assembly is not at the beginning or at the end, you must slide the slide switch to the "off" position or to the lower end position.



### Preparing for operation on the RS-485 interface

For operation on an RS-485 interface, the terminals on connector X1 must be connected as follows:

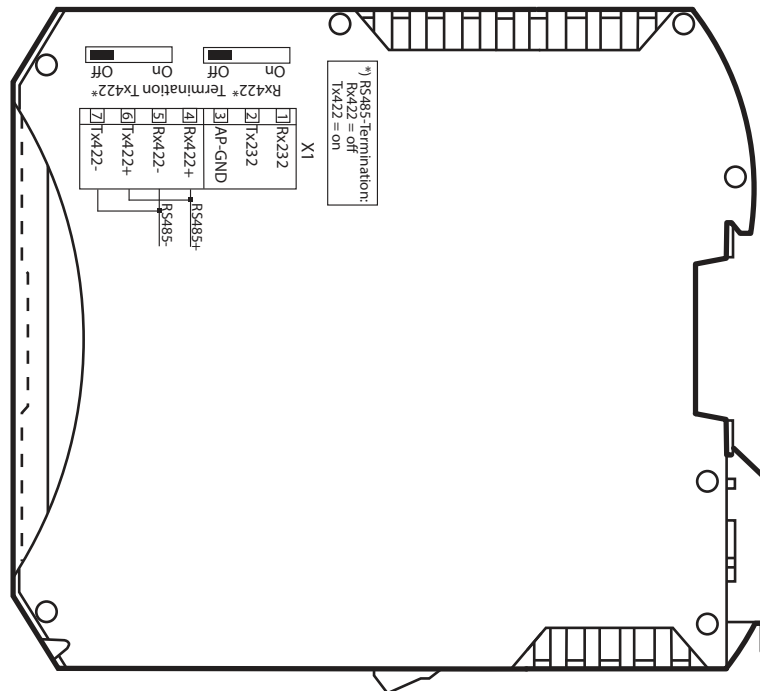
1. Connect terminal 4 "Rx 422+" to terminal 6 "Tx 422+."
2. Connect terminal 5 "Rx 422-" to terminal 7 "Tx 422-."

Terminal		Description
4	Rx 422+	RS-485+ data line to WCS reader
5	Rx 422-	RS-485- data line to WCS reader
6	Tx 422+	Connect terminal 6 "Tx 422+" to terminal 4 "Rx 422+"
7	Tx 422-	Connect terminal 7 "Tx 422-" to terminal 5 "Rx 422-"

Table 3.2 Terminal X1



**Note!**  
**RS-485 bus termination**

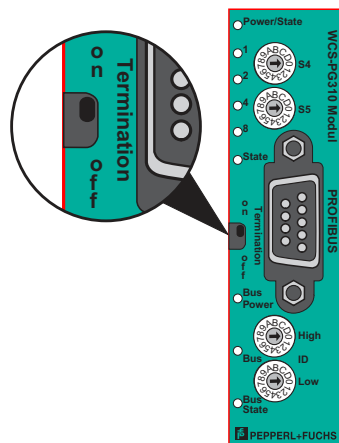


If the interface module is operated as the first or last physical device in an RS-485 bus, there must be a bus termination on this module. To do this, set the "Rx 422 Termination" slide switch to "Off" and the "Tx 422 Termination" slide switch to "On." This activates the RS-485 terminator (150 Ω) built into the interface module.

If you only connect one WCS reader to the interface module, you must always activate the RS-485 terminator; see also Cable routing in the RS-485 bus.



**Note!**  
**PROFIBUS termination**



If the interface module is located at the beginning or end of the data cable to the control panel, there must be a bus termination at this interface module. To do this, set the "Termination" (PROFIBUS) slide switch to "On." This activates the PROFIBUS terminator built into the interface module.

More information about bus termination can be found in the general fieldbus literature.

### 3.3

## Dismounting

### Dismounting the modules

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

1. Disconnect all the supply and signal lines.

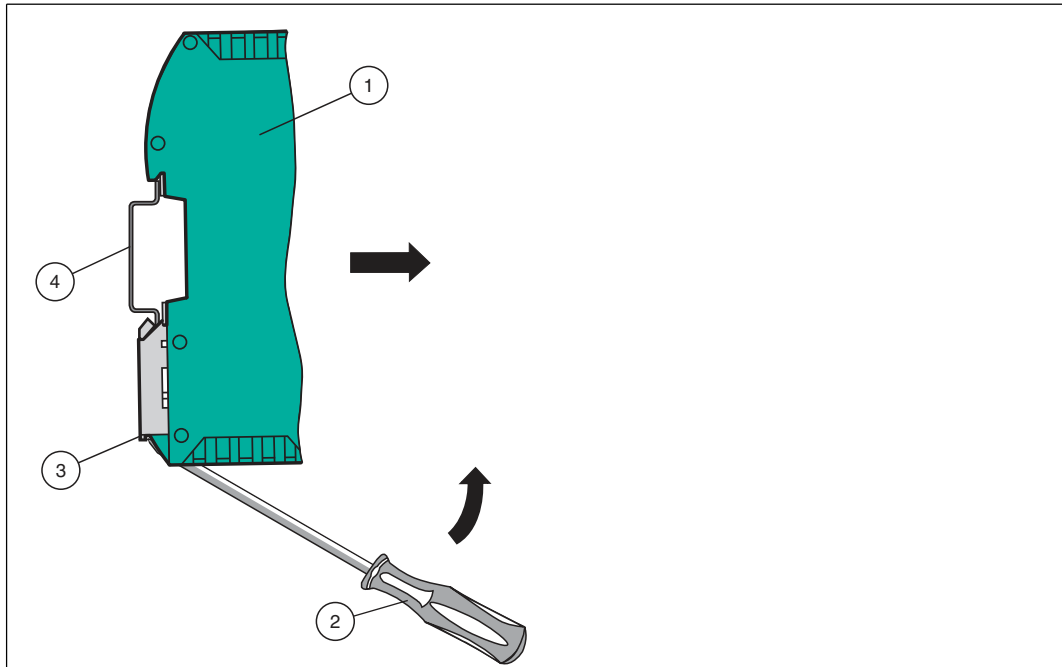


Figure 3.3 Dismounting

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 only be carried out by trained personnel in accordance with the safety regulations.

### Components

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

- WCS-PG310 interface module
- Connection cable from the interface module to the reader
- Connector for the PROFIBUS connection to the interface module
- PROFIBUS cable (this cable is usually already installed on site)
- 10 VDC...33 VDC power supply
- GSD file (the GSD file can be obtained free of charge from our website [www.pepperl-fuchs.com](http://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. Set the PROFIBUS address on the front side of the module, using the two rotary switches labeled "PROFIBUS ID High" and "PROFIBUS ID Low."



**Note!**

The PROFIBUS address that is set must match the configured address. It is only read in when the module is switched on.

2. Connect the module to PROFIBUS using the interface labeled "PROFIBUS."
3. Connect the process device (reader). For information on commissioning the process device (reader), please refer to its manual.
4. Ground the DIN mounting rail onto which the assembly is snapped.
5. Connect the direct current to the terminals provided.
6. Use any programming tool for configuration. The GSD file can be downloaded from our website: [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com). Simply enter the product name or item number in the Product/Keyword field and click the "Search" icon.



**Note!**

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

## 4.2 Connecting the WCS Reader

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

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

Connection pin on reader				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 Connecting the WCS reader(s)

## 4.3 Connecting the WCS-PG310 to the Network

A 9-pin connector is used to connect to the PROFIBUS DP, in accordance with the PROFIBUS standard. You therefore need a 9-pin D-sub connector that you can plug into the 9-pin D-sub socket on the device. This plug is not supplied with the interface module.

Pin	Designation
1	Protective earth
2	Not used
3	B line
4	Control signal/repeater
5	Ground
6	5 V <sub>DC</sub>
7	Not used
8	A line
9	Ground

Table 4.2 Pin assignment for the 9-pin connector



1. Connect the PROFIBUS connector to the D-SUB socket labeled "PROFIBUS."
2. Tighten the lock screws on the connector using a screwdriver.
3. If the assembly is at the beginning or at the end of the PROFIBUS cable, you must connect the terminator that is integrated in the gateway. To do this, slide the slide switch to the "on" position.
4. If the assembly is not at the beginning or at the end, you must slide the slide switch to the "off" position.
5. Set the PROFIBUS address on the fieldbus side of the assembly, using the two rotary switches labeled "PROFIBUS ID High" and "PROFIBUS ID Low." This setting uses hexadecimal format.





**Example!**

The PROFIBUS ID is 26 decimal = 1A hexadecimal. The "PROFIBUS ID High" switch must be set to 1 and the "PROFIBUS ID Low" switch must be set to A.

6. If the rotary switch on the PROFIBUS side (PROFIBUS ID) is set to "7E" (= 126), the gateway uses a PROFIBUS address that is stored in the EEPROM. This address is 126 by default and can only be changed by a PROFIBUS master via PROFIBUS itself. The address 126 is reserved for this purpose in PROFIBUS, i.e., a slave with this address can never exchange data, but can only be configured with a new ID.
7. If the rotary switch is set to a value between 0 and 125, the gateway uses this PROFIBUS ID and it is not possible to change the setting via a master.

#### 4.4 Integrating WCS-PG310 into the PROFIBUS System



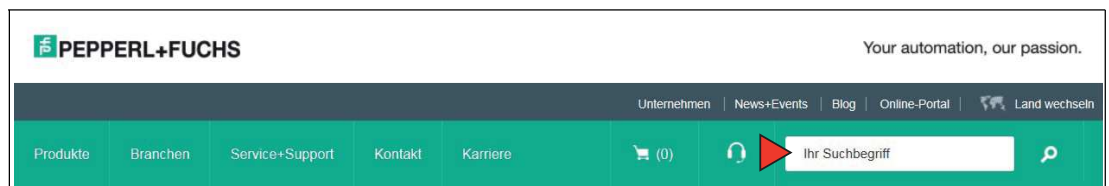
**Warning!**

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.

You will need a GSD file to operate the module described in this manual. The GSD file must be imported into the corresponding configuration tool before commissioning the module. The GSD file can be downloaded from our website: [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com). Simply enter the product name or item number in the Product/Keyword field and click the "Search" icon.



Select your product from the list of search results. Click on the information you require in the product information list, e.g., **Software**.

A list of all available downloads is displayed.



**Note!**

Various configuration tools are available to allow you to configure the interface module. By way of example, this manual describes the configuration of a Siemens control panel with the WCS-PG310 interface module using the TIA Portal V14. If you are using a programmable logic controller (PLC) from a different manufacturer, the process will be similar to the one described here.



## Installing the GSD file

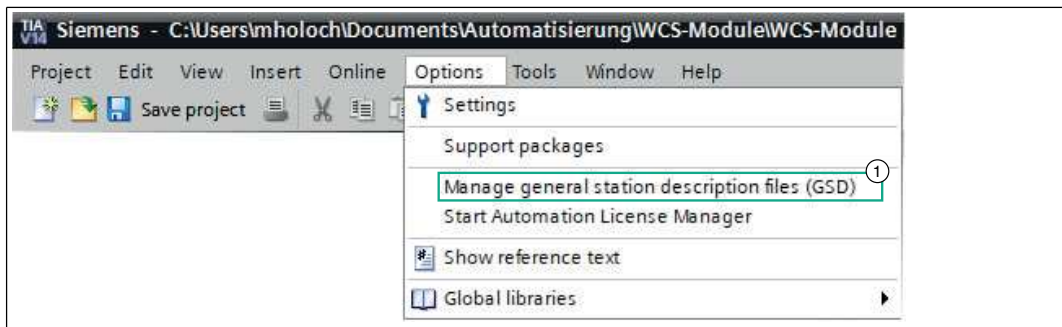


Figure 4.1 GSD file manage

1. In the menu bar, click the "Options" button and select the function "Install device description file (GSD)."

↳ The "Install device description file" window opens.

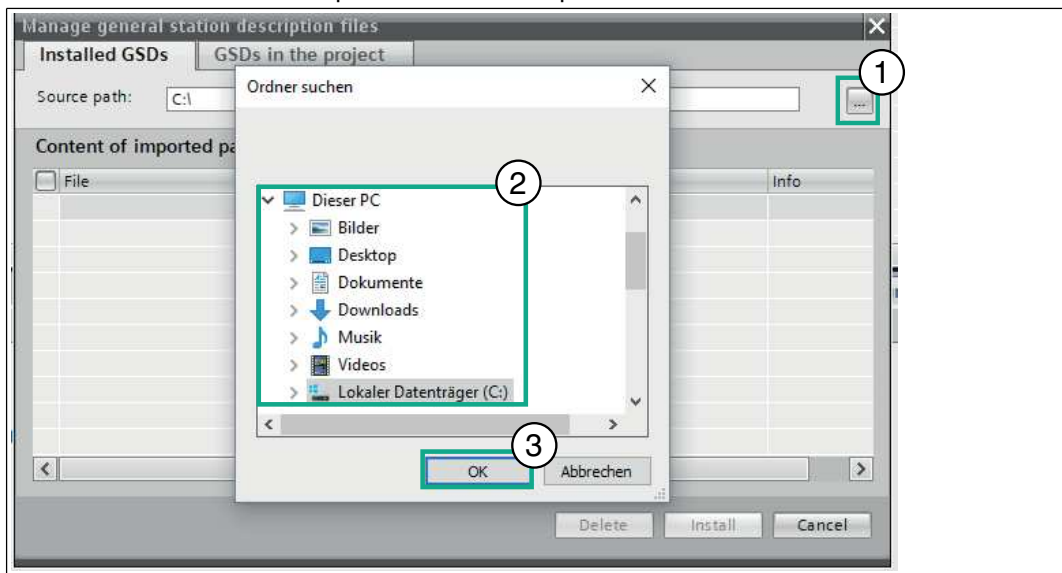


Figure 4.2 Search GSD file

2. Click the button with the three dots (1), which allows you to search for your GSD file on the storage medium.
3. Select the folder containing the GSD file (2) and click "OK" (3) to confirm your selection.

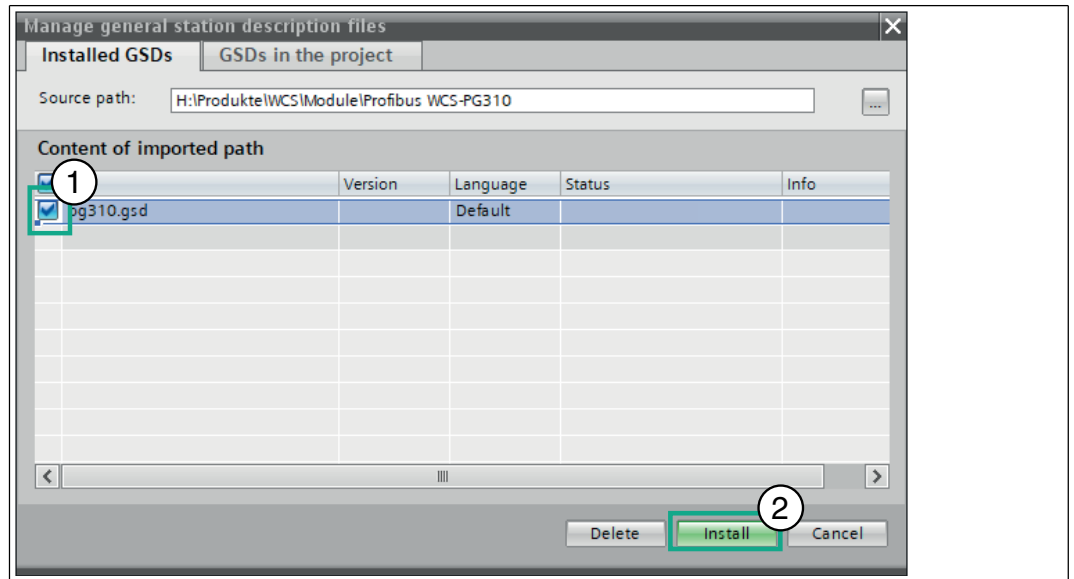


Figure 4.3 Install GSD file

4. Select the GSD file to install by checking the box (1) to the left of the filename.
  5. Click the "Install" button (2). The installation process may take a few minutes.
- ↳ Once the file is installed successfully, the system issues a notification that the installation was successful. Close this window. The device data is added to the hardware catalog.



## Integrating a module into the project

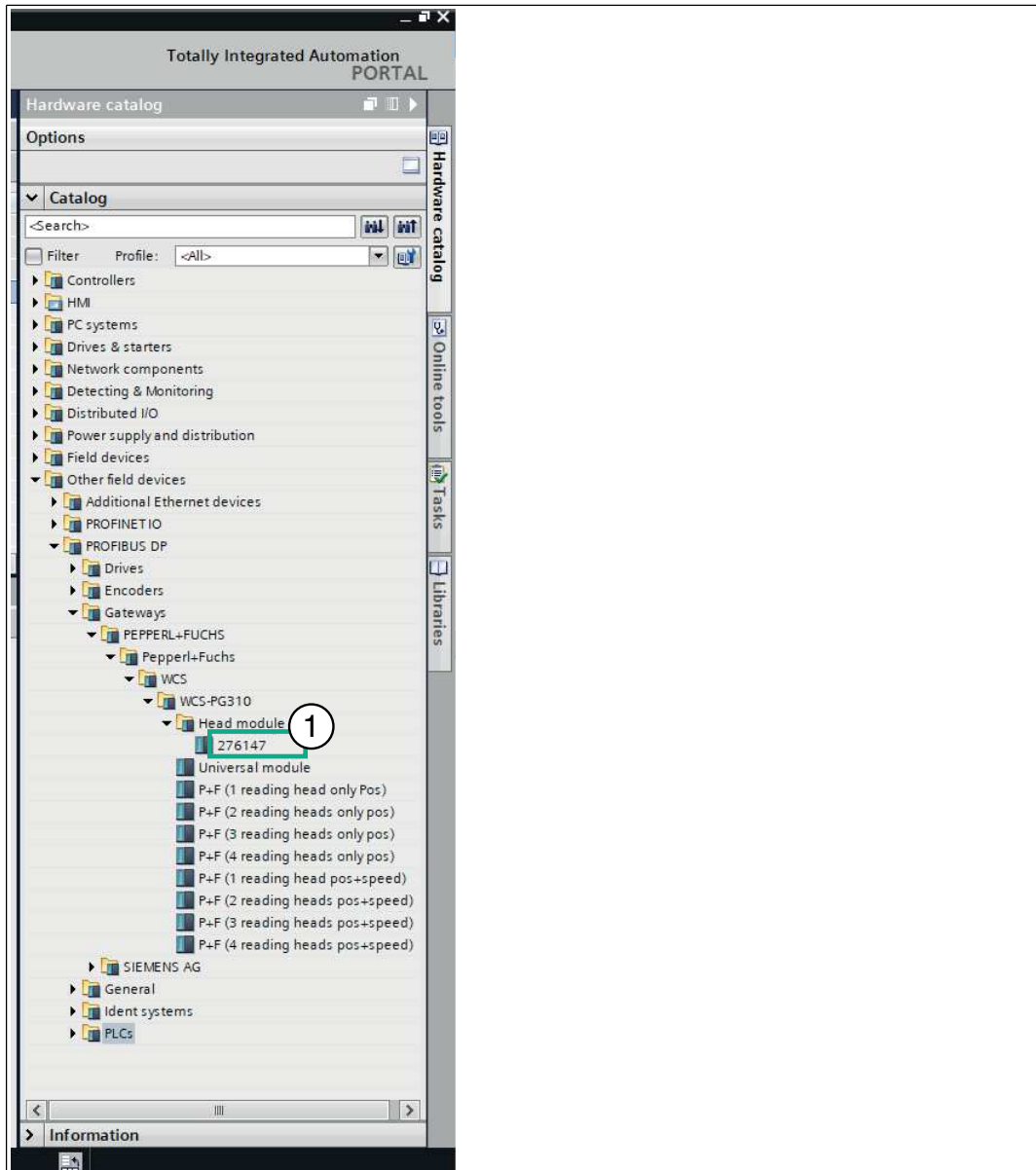


Figure 4.4 Hardware catalogue

1. Open the hardware catalog and browse through the tree structure until you see the icon labeled "276147" (1) (Other field devices > PROFIBUS DP > Gateways > PEPPERL+FUCHS > Pepperl+Fuchs > WCS > WCS-PG310 > Header module > 276147).

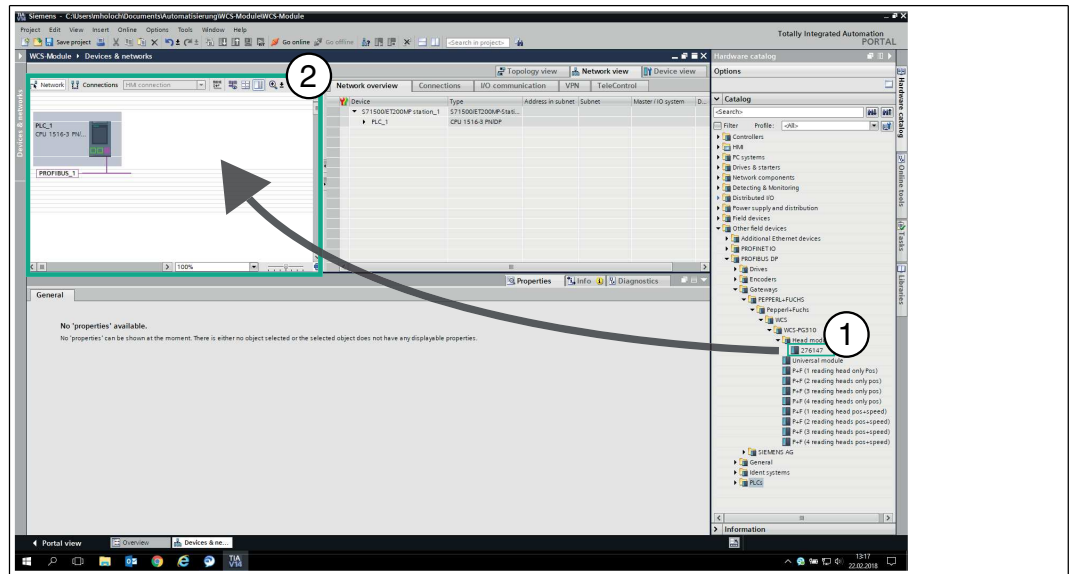


Figure 4.5 Integrating gsd file

2. Select module "276147" (1) from the hardware catalog and drag this module into the network view (2).
  - ↳ The selected module is displayed in the network view window (2).
3. Connect the module to the control panel. To do this, move the mouse onto the PROFIBUS interface that is highlighted in purple on the control panel, click the left mouse button, and drag the line shown to the PROFIBUS interface on the module. Once there, release the left mouse button again.
  - ↳ A PROFIBUS subsystem is created.



### Setting the number of readers, operating mode, and addresses

You have the option to connect up to four readers to the interface module. To do this, you must specify the number of modules and their properties in the control panel. Several selection options are available in the hardware catalog.



**Note!**

Do **not** use the "universal module" when configuring the device.

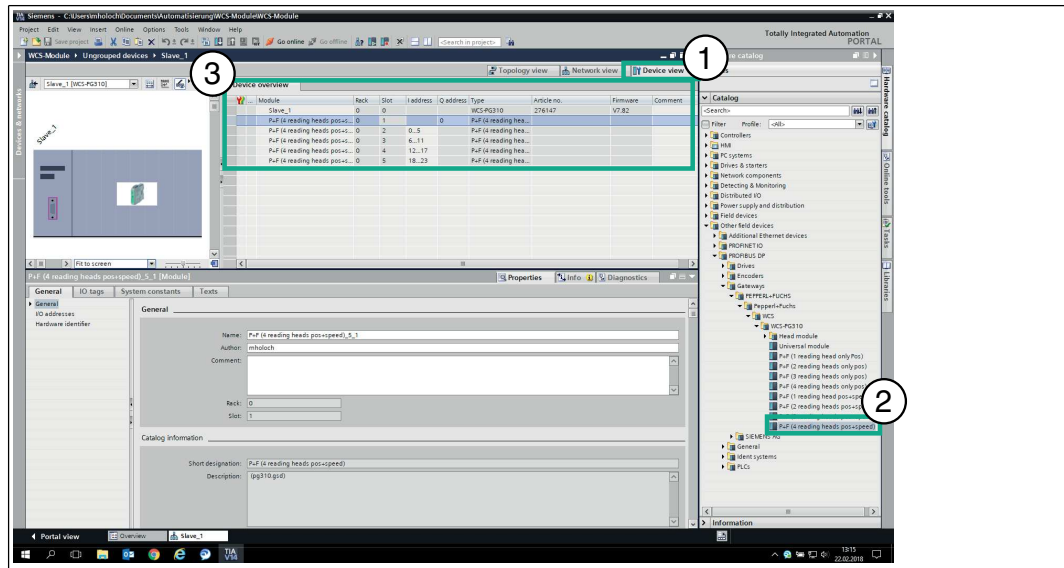


Figure 4.6 Device view

1. Switch to the "Device view" tab (1) in the "Devices & Networks" window.
2. Double-click to select the module with the appropriate number of readers and operating mode from the hardware catalog (2).



**Note!**

Depending on your application, select one, two, three, or four connected WCS readers and the operating mode. When in the "only Position" operating mode, the WCS readers output their position. In the "Position and Speed" operating mode, the WCS readers output their position and the speed at which they are currently moving.

Regardless of the number of WCS readers, 1 byte is reserved for querying the diagnostics for the WCS readers in the master. For the response data, 4 bytes are reserved for each WCS reader in the "only Position" operating mode (configuration data for four WCS readers: 0x20, 0xD1, 0xD1, 0xD1, 0xD1). In the "Position and Speed" operating mode, 6 bytes are reserved for each WCS reader (configuration data for four WCS readers: 0x20, 0xD2, 0xD2, 0xD2, 0xD2).

↳ The selected module is added to the device view (3).

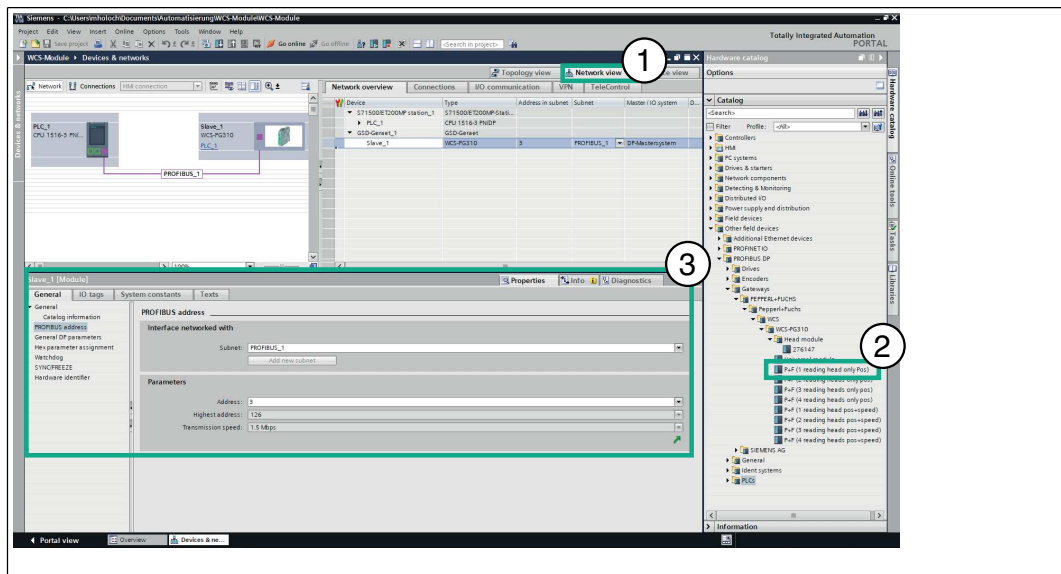


Figure 4.7 Network view

3. Switch to the "Network View" tab (1) in the "Devices & Networks" window.
4. To change the input and output address for the module, double-click on the module (2) in the hardware catalog.
5. Selecting the Properties > General tab displays the control panel properties (3) in the inspector window below the network view.
6. If necessary, enter the new address of the module in the input field under PROFIBUS address > Parameters > Address.



**Note!**

You must assign unique addresses for data communication between the module and the reader. If you connect several readers to one module, the readers must have different addresses. This will allow the control panel to allocate the data to the correct module and readers. If you only connect one reader to a module, this reader always receives the address 0. You can connect up to four readers to a module via an RS-485 cable. Each reader is supplied with the default address of 0. Details of how to change the address of the reader can be found in the configuration instructions for the reader.

## 4.5 Data Format for Modules

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	0	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	0	0	0	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	0	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	0	0	0	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

Pxx: position data, P00 = LSB

Sxx: speed (in multiples of 0.1 m/s), S00 = LSB

Example: Byte 5 = 00011011 = 27, corresponds to 2.7 m/s

A1, A0: reader address, 00 = WCS reader address #1

DB: pollution display, 1 = cleaning necessary

OUT: code rail loss, 0 = code rail recognized

ERR: error display, error code (LEDs)

#### Address bits A1 and A0

A1	A0	Reader address
0	0	Reader address 0
0	1	Reader address 1
1	0	Reader address 2
1	1	Reader address 3

#### Status bits

DB	ERR	OUT	Description	Optical state of WCS reader
0	0	0	Current position value binary coded in P00...P18	Good
0	0	1	WCS reader outside of the code rail, not a position value	Good
			P0...P18=0: WCS reader partly outside the code rail	
			P0=1, P2...P18=0: WCS reader completely outside of the code rail	
1	0	0	Current position value binary coded in P00...P18	Poor
1	0	1	No position value, WCS reader outside of the code rail	Poor
X	1	X	No position value, error message from WCS reader, error number binary coded in P00...P18	-



## 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.

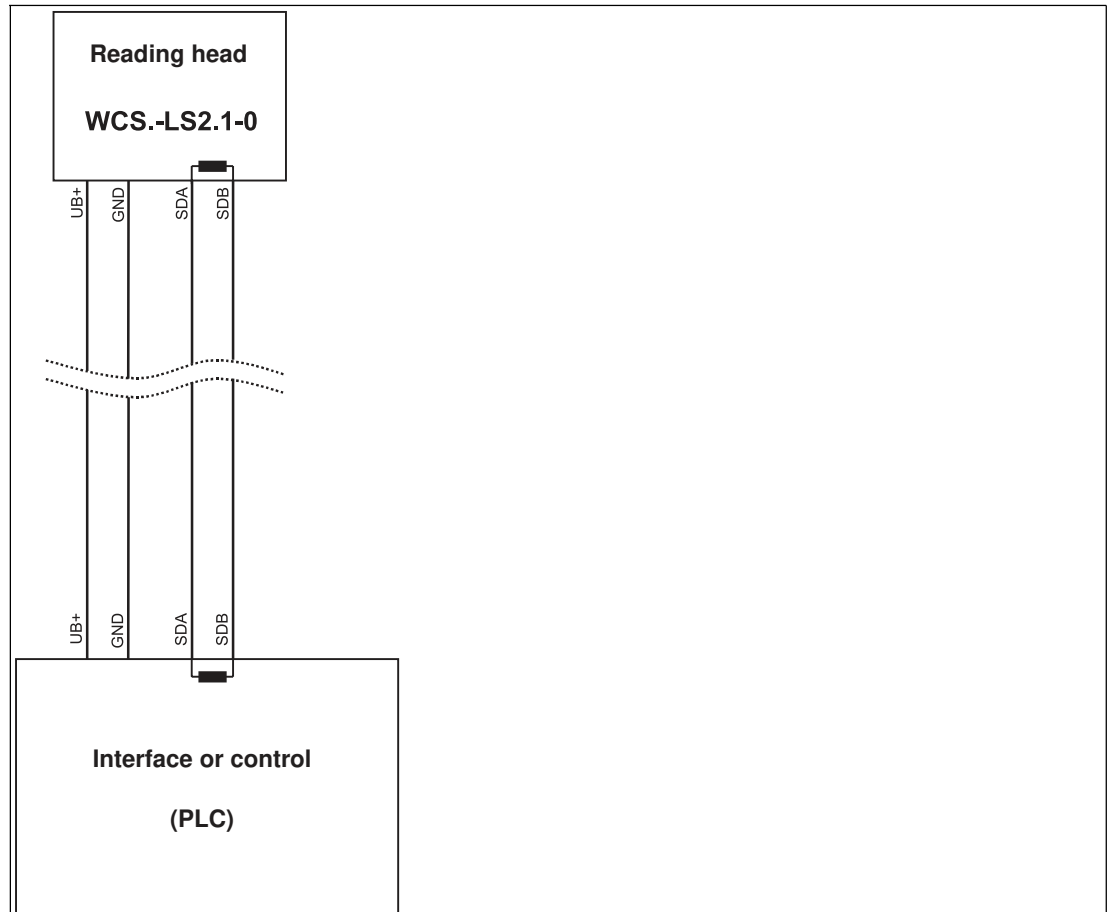


Figure 5.1 Connection of **one** reading head

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.

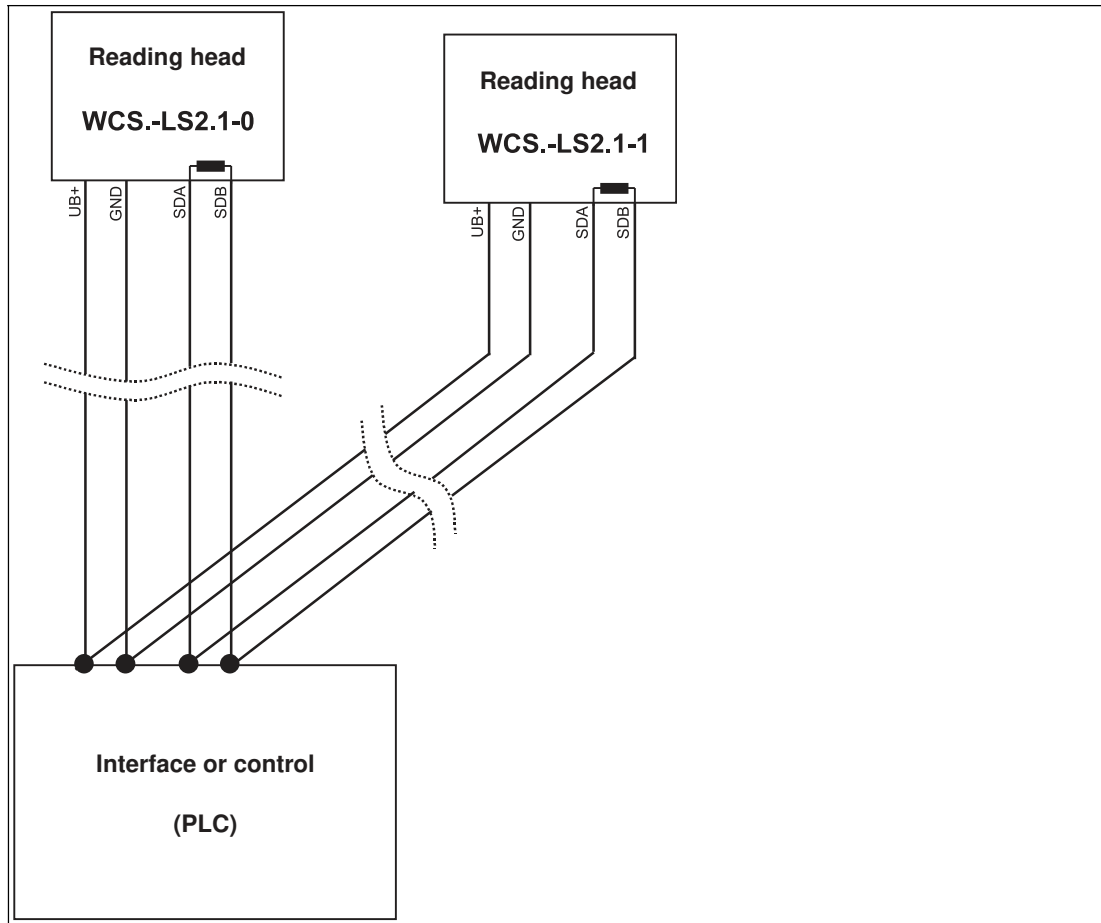


Figure 5.2 Connection of **two** reading heads, Version A

■ **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.

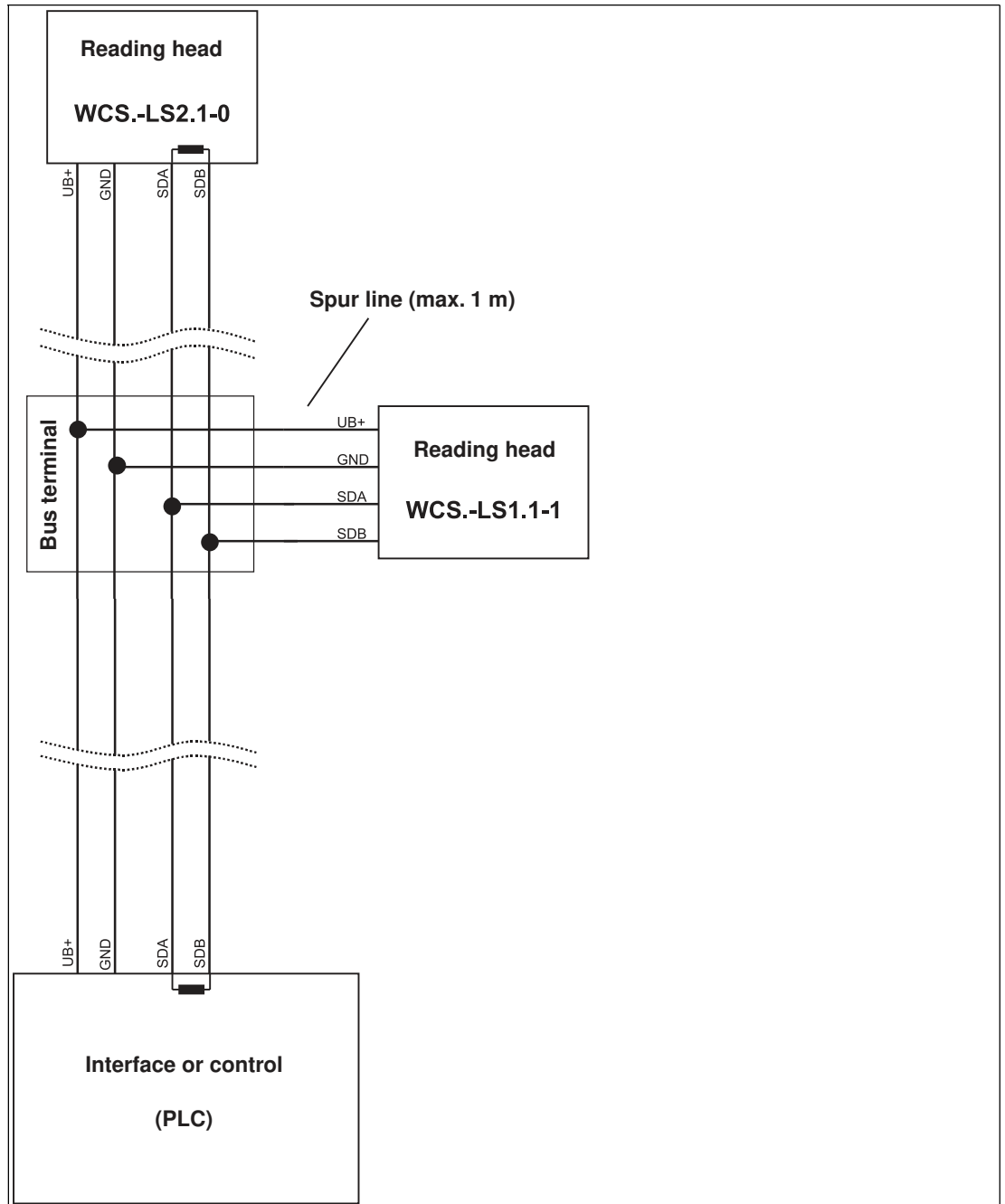


Figure 5.3 Connection of **two** reading heads, Version B

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 Data Cables and Accessories

### RS-485 data cable

For the RS-485 data transfer path, a four-wire, shielded, twisted pair data cable must be used. One wire 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 data transfer capacity of the data cable—core-core—and on the cross section of the cables for power supply of the WCS readers. For data transfer, a small core cross section, and thus small cable capacitance is an advantage, whereas for the power supply the largest possible cross section is required. The table below shows the possible cable lengths depending on the cable cross section.

In the calculations, the worst-case scenario was assumed: All WCS readers are located at the end of the data line. In the case of large cable lengths, and when connecting multiple WCS2 readers with heating, six-wire data cable (3 x 2) can be used. These data cables use two pairs for the power supply (doubling the cable cross section), and one pair for the RS-485 data line.

Capacitance (core-core)	RS-485 interface		
	19.2 KB (LS246)	62.5 KB (LS221)	187.5 KB (LS211)
60 pF	500 m	500 m	300 m
90 pF	500 m	450 m	275 m
120 pF	500 m	400 m	250 m

The table shows the possible cable lengths depending on the cable capacitance (core-core). The number of connected WCS readers is of no significance.

### WCS-DCS / WCS-DCF data cables

There are 2 types of data cable available:

- . WCS-DCS for stationary cable routing
- . WCS-DCF for trailing cable and drag chain installations.

The data cables are twisted pairs and have a tinned copper braided shield. The braided shield surrounds all wire pairs. The parameters of the data cable for RS-485 and SSI data transfer applications are listed in the table below.

	WCS-DCS	WCS-DCF
Capacitance (core-core)	95 pF/m	60 pF/m
Cross section	0.14 mm <sup>2</sup>	0.25 mm <sup>2</sup>
Number of wires	6 (3 x 2)	6 (3 x 2)
External diameter	5.8 mm	7.5 mm
Temperature range	-30 °C ... 70 °C	-40 °C ... 70 °C
Order designation	WCS-DCS	WCS-DCF

## Single-ended female cordsets and adapter cables

### Field-attachable female connectors M12 x 1

	Number of poles	Cable diameter	Order designation
straight	4	6 mm – 8 mm	V1-G-PG9
angled	4	6 mm – 8 mm	V1-W-PG9
straight	5	6 mm – 8 mm	V15-G-PG9
angled	5	6 mm – 8 mm	V15-W-PG9
straight	6	6 mm – 8 mm	V17-G-PG9
angled	6	6 mm – 8 mm	V17-W-PG9 *)

Table 5.1 \*) Cable outlet on top, not variable

### Shielded connection cable with molded single-ended female cordset

	Number of poles	Cable length	Order designation
straight	4	2 m	V1-G-2M-PUR-ABG
straight	4	5 m	V1-G-5M-PUR-ABG
angled	4	2 m	V1-W-2M-PUR-ABG
angled	4	5 m	V1-W-5M-PUR-ABG
straight	5	5 m	V15-G-5M-PU R-ABG
angled	5	5 m	V15-W-5M-PUR-ABG
straight	8	2 m	V19-G-2M-PU R-ABG
straight	8	5 m	V19-G-5M-PU R-ABG

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