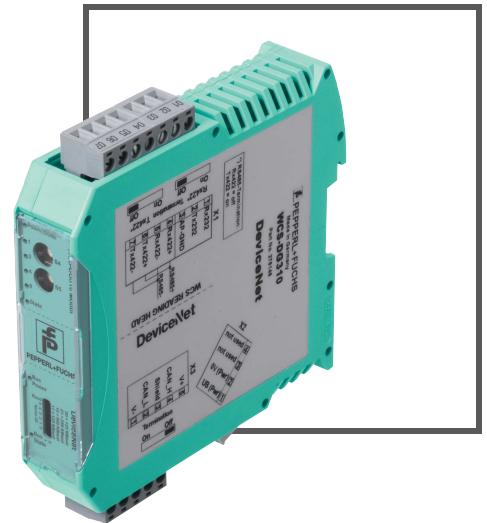


MANUAL

WCS DG310

WCS DeviceNet Interface Module



CE

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"

| | | |
|----------|---|-----------|
| 1 | Introduction..... | 4 |
| 1.1 | Content of this Document | 4 |
| 1.2 | Target Group, Personnel..... | 4 |
| 1.3 | Symbols Used | 4 |
| 2 | Product Description | 6 |
| 2.1 | Use and Application..... | 6 |
| 3 | Installation..... | 7 |
| 3.1 | Mounting | 7 |
| 3.2 | Electrical Connection | 7 |
| 4 | Commissioning..... | 9 |
| 4.1 | Meaning of LEDs | 9 |
| 4.2 | Meaning of Switches..... | 10 |
| 4.3 | Operating Modes..... | 11 |
| 4.4 | Connecting the WCS Reader | 12 |
| 4.5 | Connection to the Control Panel | 12 |
| 4.6 | Data Exchange in DeviceNet..... | 13 |
| 4.7 | EDS Configuration File | 14 |
| 5 | Appendix | 15 |
| 5.1 | Cable Routing in the RS-485 Bus | 15 |
| 5.2 | Meaning of F0 | 17 |
| 5.3 | Data Format for Connected WCS Readers | 18 |
| 5.4 | Data from WCS Reader | 18 |
| 5.5 | Data Cables and Accessories | 19 |

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 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-DG310 is used as an interface between the WCS reader and the DeviceNet bus. The data between the WCS reader(s) and the WCS-DG310 is transferred via the RS 485 interface, and from the WCS-DG310 to the control panel via the DeviceNet protocol.

You can connect up to four WCS readers of type LS221 or LS121. If you connect several WCS readers, they must have different addresses. The WCS-DG310 meets the conditions laid down in "DeviceNet Specification Release V2.0" and works as a DeviceNet "Group 2 only Slave." (Vendor ID:272, device type: 12). The interface module allows transfer rates up to 500 kBaud in DeviceNet.

3 Installation

3.1 Mounting

The dimensions of the WCS-DG310 interface module are:
23 x 116 x 115 mm (W x H x D).

The WCS-DG310 interface module is attached to a 35 mm wide DIN mounting rail (EN 50022-35) with a snap-on fixing method.

The device is grounded via the mounting rail.



Note!

Grounding of the mounting rail

The mounting rail must be grounded to the switch cabinet. The connection wire must have a cross section of at least 10 mm².

3.2 Electrical Connection

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

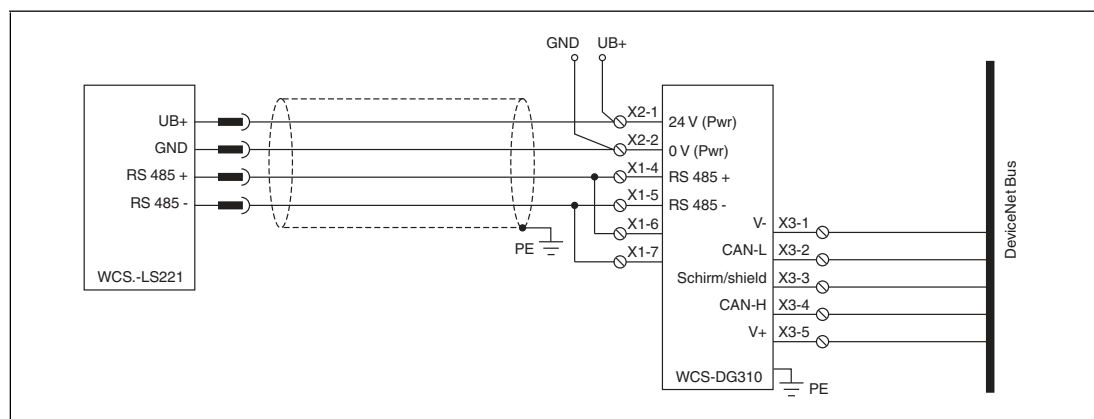


Figure 3.1 Electrical connection



Note!

To use with an RS 485 interface, terminal "Rx 422+" on plug X1 must be connected to terminal "Tx 422+", and terminal "Rx 422-" must be connected to terminal "Tx 422-".

| Terminal | | Designation |
|----------|---------|---------------------------------|
| 4 | Rx 422+ | RS 485+ data line to WCS reader |
| 5 | Rx 422- | RS 485- data line to WCS reader |
| 6 | Tx 422+ | |
| 7 | Tx 422- | |

Table 3.1 Terminal X1



Preparing to use the RS 485 interface

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

| Terminal | | Designation |
|----------|-----------|---|
| 1 | UB (Pwr) | Operating voltage interface module/ operating voltage WCS reader |
| 2 | 0 V (Pwr) | Ground interface module/ground WCS reader |

Table 3.2 Terminal X2



Caution!

Damage to the device

Connecting an alternating current can damage the device or result in it malfunctioning.

Connect interface module to direct current (DC).



Connecting the interface module to the voltage

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

↳ The "Power" LED lights up green.



Note!

Grounding of the mounting rail

The mounting rail must be grounded to the switch cabinet. The connection wire must have a cross section of at least 10 mm².

4 Commissioning

4.1 Meaning of LEDs

Power:

The "Power" LED is green: The WCS-DG310 interface module is correctly connected to the power supply.

BusPower:

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

BusState:

| "BusState" LED | DeviceNet interface state |
|-------------------|--|
| Lights up green | Connected to the DeviceNet master |
| Flashes green | No connection to the DeviceNet master |
| Lights up red | Serious error on DeviceNet bus (for example, duplicate MAC ID) |
| Flashes red | Recoverable error (e.g., timeout error) |
| Flashes red/green | Communication errors |

Table 4.1 "BusState" LED display

State:

The "State" LED is green: Data exchange is taking place with the WCS readers. Using the 4 "Error No/Select ID" LEDs, the number of the currently polled WCS reader is displayed.

| 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 4.2 Display of the 4 LEDs "Error No/Select ID" 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 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.

| ErrorNo/Select ID LED | | | | Error number | A description of the fault |
|-----------------------|------|------|------|--------------|---|
| 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 | Communication WCS reader, RS send buffer overflow |
| 1 | 0 | 0 | 0 | 8 | Communication WCS reader, receive buffer overflow |
| 1 | 0 | 0 | 1 | 9 | Communication WCS reader, RS timeout |
| 1 | 0 | 1 | 0 | 10 | General fieldbus error |
| 1 | 0 | 1 | 1 | 11 | Parity 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 4.3 Meaning of the error codes (4 LEDs display "Error No/Select ID", if the "State" is illuminated red and thus indicates an error or a warning)

4.2 Meaning of switches

The WCS-DG310 interface module has 6 switches with the following functions:

| Switch designation | Function |
|------------------------------|---|
| Rx 422 Termination | Switchable Rx 422 terminator for the serial interface |
| Tx 422 or RS 485 Termination | Switchable Tx 422 or RS 485 terminator for the serial interface |
| Termination (DeviceNet) | Switchable terminator for the DeviceNet bus |
| Rotary switch S4 | Set the number of connected WCS readers (see see chapter 4.4) |
| Rotary switch S5 | No function (always remains in position 0) |
| DIP switches | Set the node ID and baud rate (see see chapter 4.4) |

Table 4.4 Meaning of the switches on the WCS DG-310 interface module

Rx 422/Tx 422 Termination (serial interface)

If the interface module is operated as the first or last physical device in an RS485 bus, there must be a bus termination on this gateway. To do this, set the slide switch "Rx 422 Termination" to "Off" and the slide switch "Tx 422 Termination" to "On". This activates the RS 485 terminator (150 Ω) built into the interface module.

If you connect only one WCS reader to the WCS-DG310, you must always activate the RS 485 terminator.

If the interface module is operated as the first or last physical device as a 422, a bus termination must also occur. By moving the "Rx 422 Termination" or "Tx 422 Termination" slide switch to "On", the integrated terminators can be activated in the Rx or Tx direction.

DeviceNet 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 gateway. To do this, set the "Termination" (DeviceNet) sliding switch to "On". This activates the DeviceNet terminator (220 Ω) built into the interface module.

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



Note!

Rotary switch S4, rotary switch S5, DIP switch

For information on setting rotary switches S4 and S5 as well as the DIP switch, see see chapter 4.4.

4.3 Operating modes

Configuration mode

The configuration mode is used to configure the WCS-DG310 interfaces. The following settings are possible in this mode:

1. Install script
2. Update firmware
3. Configure the interface module

The interface module will start in this mode if the rotary switches S4 and S5 are both in position "F." The interface module sends its switch-on message immediately after it has been switched on in configuration mode. In configuration mode, the interface module always works with the settings 9600 baud, no parity bit, 8 data bits, and 1 stop bit. The RS state LED always flashes red, the "Error No/ Select ID" LEDs have no significance for the user. The configuration mode is included in all software revisions.

Test mode

Setting test mode

Test mode is set by putting both switches S4 and S5 into position "E." No other switches are considered when setting test mode. With these settings, the interface module must be restarted (by disconnecting it briefly from the power supply). In test mode, the interface module always works with the settings 9600 baud, no parity bit, 8 data bits, and 1 stop bit. Test mode can be useful to get the interface module to integrate into the specific environment, e.g., in order to test the parameters of the RS 485 interface.

Test mode functionality

After restarting in test mode, the gateway will send the values 0 - 15 in hexadecimal form ("0"... "F") in ASCII encoding to the serial side, in a 1-second rhythm. At the same time, the same values are sent on the DeviceNet side in binary form. The state LED on the RS 485 side will flash red in this mode, the "Error No/Select ID" LEDs will display the value currently being sent in binary form. In addition, each character received on one of the interfaces is sent back out on the same interface as a local echo. On the DeviceNet side, only the first byte is used for the local echo, i.e., only the first byte of the bus data is checked both when receiving and sending. The bus data does not change with respect to the previous data.

Data exchange mode

The interface module must be in data exchange mode, so that data exchange between the RS 485 side (the WCS readers) and the DeviceNet bus can occur. This mode is always active when the interface module is not in configuration or test mode. In data exchange mode, the interface module will run the installed script.

4.4 Connecting the WCS Reader

If you install several WCS readers together on 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 on an interface module, this WCS reader always receives the address 0. You can connect up to 4 WCS readers to an interface module via an RS 485 cable. The supplied default address of each WCS reader is 0. Refer to the configuration instructions for the WCS reader if you need to change the address of the WCS reader.

| WCS reader terminal pin | | | Interface module terminal |
|-------------------------|-------|-------|---------------------------|
| WCS2A | WCS3A | WCS3B | |
| 2 | 1 | 1 | X2-1 |
| 4 | 2 | 2 | X1-4 |
| 1 | 3 | 4 | X1-5 |
| 3 | 5 | 3 | X2-2 |

Table 4.5 Connecting the WCS reader(s)

Setting the number of connected WCS readers

Set the number of connected WCS readers with the rotary switch S4 in accordance with the table "Rotary switch S4".

Rotary switch S4

| Switch setting S4 | Number of WCS readers | Addresses |
|-------------------|-----------------------|--------------------|
| 1 | 1 WCS reader | Address 0 |
| 2 | 2 WCS readers | Address 0, 1 |
| 3 | 3 WCS readers | Address 0, 1, 2 |
| 4 | 4 WCS readers | Address 0, 1, 2, 3 |

Table 4.6 Position of rotary switch S4 for setting the number of WCS readers



Note!

Rotary switch S5

Rotary switch S5 has no function. Always set rotary switch S5 to position 0.

Set baud rate (DIP switch)

You can set the baud rate in DeviceNet with 2 switches on the 8-way DIP switch of the WCS-DG310. The location of the DIP switches is marked on the device label.

| DIP switches | | Baud rate |
|--------------|---|-----------|
| 7 | 6 | |
| 0 | 0 | 125 kBaud |
| 0 | 1 | 250 kBaud |
| 1 | 0 | 500 kBaud |
| 1 | 1 | 125 kBaud |

Table 4.7 Position of DIP switch for setting the baud rate

4.5 Connection to the Control Panel

Connect the WCS-DG310 interface module to DeviceNet via the 5-pin connector with X3 screw terminals.

Set the setting ID of the DeviceNet address via the 8-way DIP-switch "Node ID". MAC ID "0" is not allowed.

You can switch the terminator in the DeviceNet bus on and off via the "Termination" sliding switch.

Interface module - DeviceNet bus connection

| X3 terminal | | Designation |
|-------------|-----------|--------------------|
| X3-1 | V- (PWR) | 0 V |
| X3-2 | CAN-L | Dominant low |
| X3-3 | Shielding | Cable shield |
| X3-4 | CAN-H | Dominant high |
| X3-5 | V+ | 24 V _{DC} |

Table 4.8 WCS-DG310 terminals, bus side

4.6 Data Exchange in DeviceNet

In DeviceNet, the DG310 works as a "Group 2 Only Slave". The access methods "polling", "bit-strobe", and "change of state" are supported. If you connect more than 2 WCS readers to the WCS-DG310, you can only query the data from the master via polling access. The sending of a function byte is likewise only possible in polling mode.

Polling

In polling, a function byte is sent from the master to the WCS-DG310. The WCS-DG310 returns 16 data bytes. The 16 bytes contain the data of the four WCS readers (4 x 4 bytes). If fewer than 4 WCS readers are configured (via rotary switch S4), the 4 data bytes for the WCS readers not configured contain the value 0x00.

| Bit | WCS reader address 3 | | WCS reader address 2 | | WCS reader address 1 | | WCS reader address 0 | |
|-----|----------------------|----|----------------------|----|----------------------|----|----------------------|----|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| | 0 | F0 | 0 | F0 | 0 | F0 | 0 | F0 |

Table 4.9 Function byte for addressing the WCS reader(s) during polling

Notes on function F0 see chapter 5.2

Bit-strobe

With bit-strobe access, the "Bit-strobe" command is sent from the master without any further data. The master then always receives 8 data bytes from the interface module as a response. The 8 data bytes contain the data of the WCS readers with the address 0 and 1 (2 x 4 bytes). If the WCS reader with address 1 is not connected (rotary switch S4 is in position 1), the 4 data bytes for this WCS reader are 0x00.

Change of state

In this method, the WCS-DG310 sends 8 data bytes to the master without request as soon as the content of the data has changed. The data format corresponds to the data format for bit-strobe access. If the WCS reader data changes constantly, e.g., if the reader is moving quickly, the data is sent every 5 ms. In this case, the pause time is necessary to avoid overloading the DeviceNet bus.

Interface module data format for one WCS reader

| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Word n | 0 | 0 | 0 | 0 | 0 | P18 | P17 | P16 | P15 | P14 | P13 | P12 | P11 | P10 | P09 | P08 |
| Word n+1 | P07 | P06 | P05 | P04 | P03 | P02 | P01 | P00 | 0 | 0 | 0 | DB | ERR | OUT | A1 | A0 |

Table 4.10 Interface module data format for one reader (4 byte)



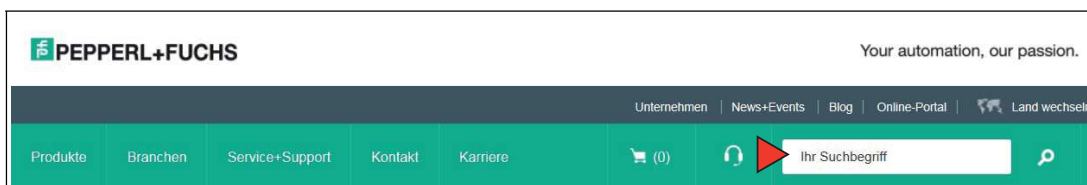
Note!

For some control panels, the position of the bytes in a word are swapped. For a description of the data bits, see chapter 5.4.

4.7

EDS configuration file

To assist with the configuration, you can download the EDS file from the download area of our Internet homepage <http://www.pepperl-fuchs.com>. Simply enter the product name or item number in the **Product/Keyword** search box and click **Search**.



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.

5 Appendix

5.1 Cable Routing in the RS-485 Bus

The data cable 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.

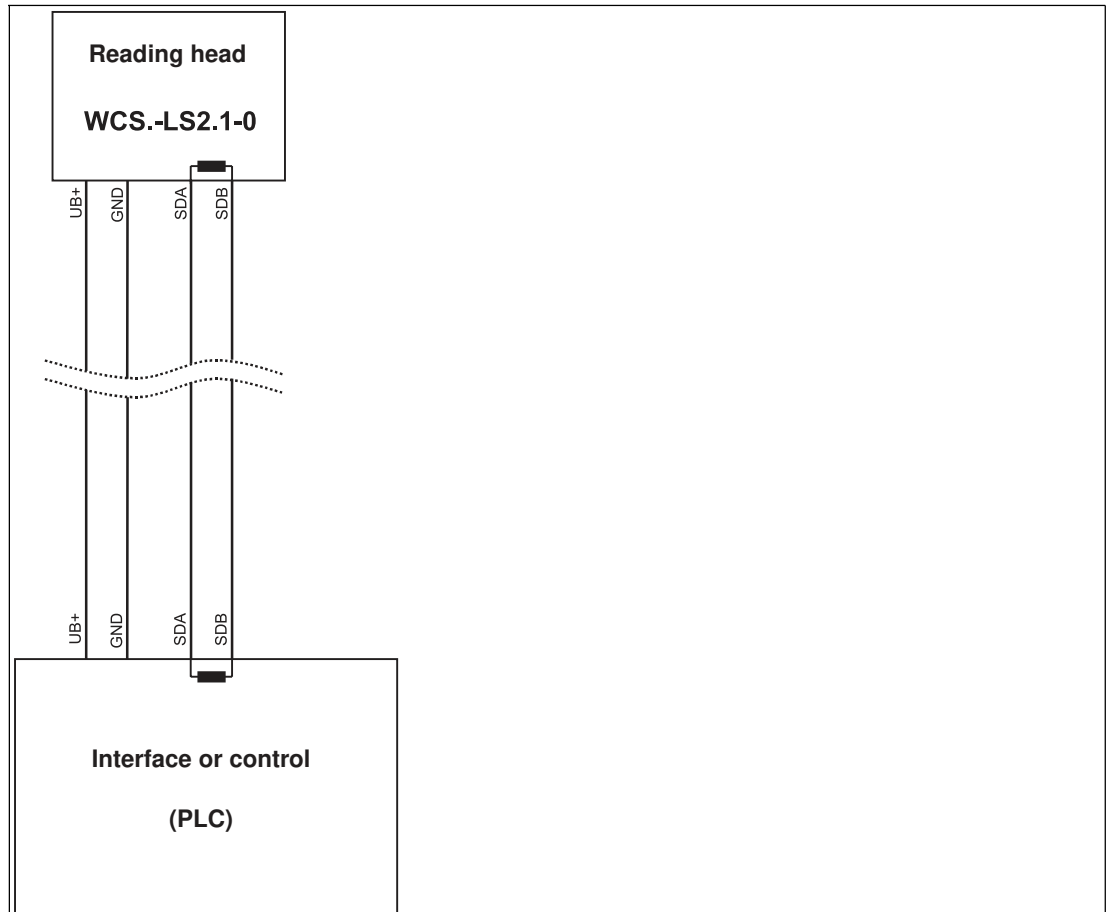


Figure 5.1 Connection of **one** reading head



If **two 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 heads and does not have an RS-485 terminator. Each WCS reader is connected to the interface module by a separate data cable.

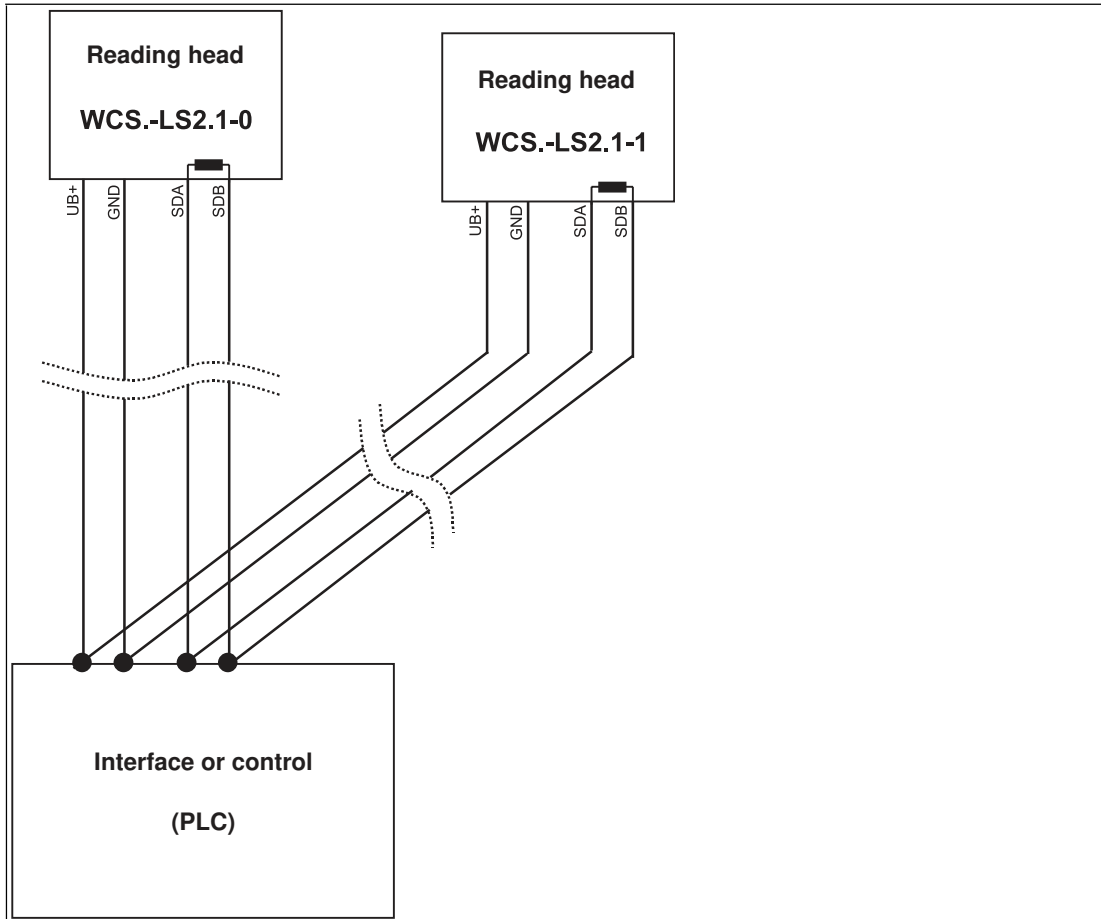


Figure 5.2 Connection of **two** reading heads, Version A

■ **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.

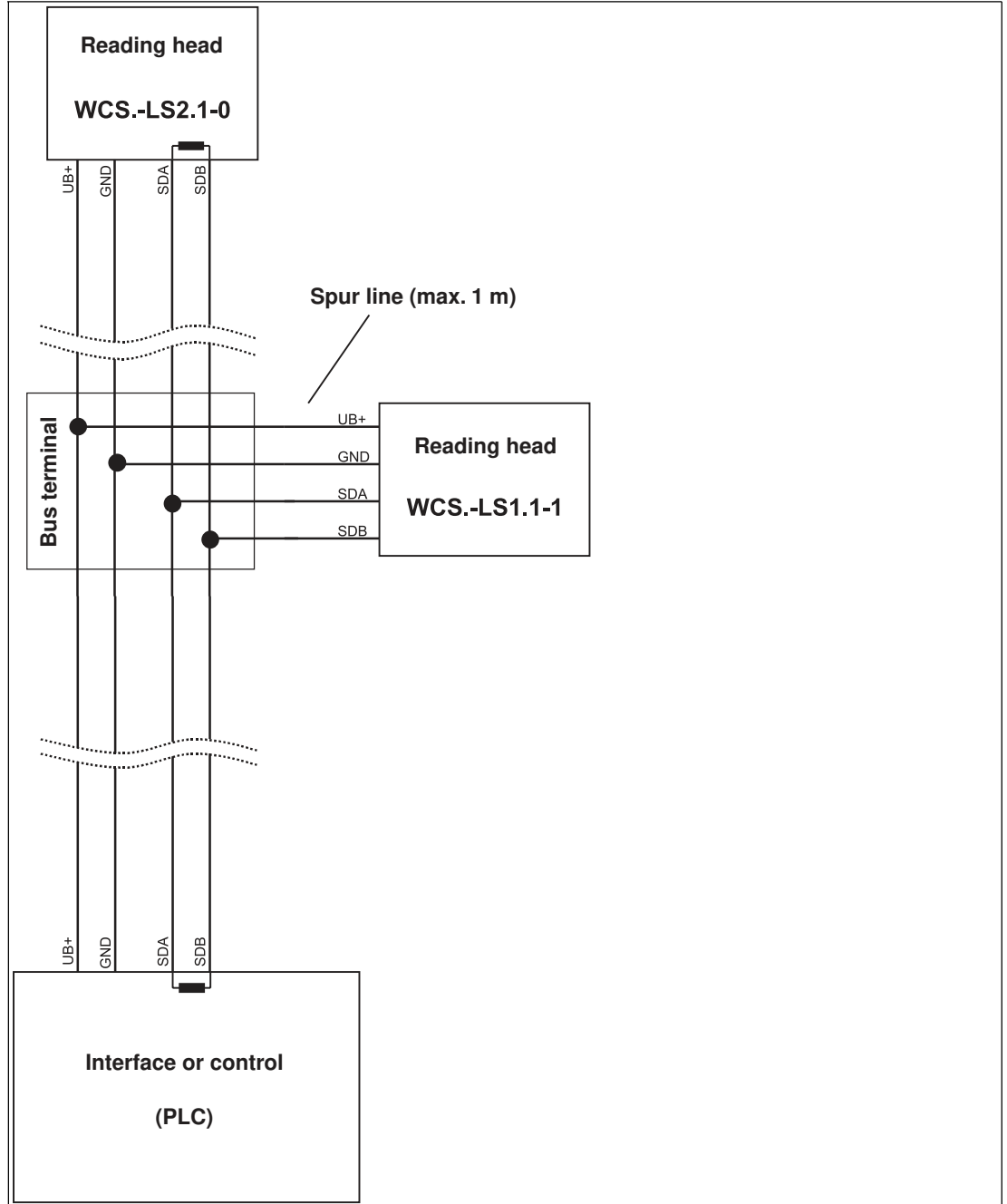


Figure 5.3 Connection of **two** reading heads, Version B

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 Meaning of F0

| F0 | Function number for WCS reader |
|----|--------------------------------|
| 0 | Send position value |
| 1 | Send diagnosis result |

Diagnostic function F0=1

The WCS reader can be requested to perform a diagnosis of the photoelectrics by means of the request byte. For this purpose, the WCS reader must be located outside of the code rail.

On the WCS2B and WCS3B readers, the degree of dirt accumulation on the photoelectrics is monitored automatically during operation and the diagnostic bit (DB) set if dirt accumulation is too high. Thus the request for diagnosis to the WCS reader via F0 in the request byte is no longer necessary. For reasons of downward compatibility, this function is also supported by the new WCS readers.

Diagnostic bit (DB)

Diagnostic bit (DB) displays the result of the integrated diagnostics of the WCS reader.

5.3 Data Format for Connected WCS Readers

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 5.1 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 5.2 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). For more information on data bits.

5.4 Data from WCS Reader

Meaning of A1 and A0

| A1 | A0 | Reader address |
|----|----|---------------------|
| 0 | 0 | Read head address 0 |
| 0 | 1 | Read head address 1 |
| 1 | 0 | Read head address 2 |
| 1 | 1 | Read head address 3 |

Function number for WCS reader F0=0 (send position value)

| 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 to 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 | - |

Function number for WCS reader F0=1 (send diagnosis result)

| DB | ERR | OUT | Description | Optical state of WCS reader | |
|----|-----|-----|--|-----------------------------|------|
| 1 | 0 | 0 | Diagnosis invalid, WCS reader not outside of the code rail | - | |
| 1 | 0 | 1 | Diagnosis result in P16...P18 | | |
| | | | P16...P18=0 | | Good |
| | | | P16...P18>0 | | Poor |
| X | 1 | X | Error message from WCS reader, error message binary coded in P00...P04 | - | |

5.5 Data Cables and Accessories

RS485 data cable

For the RS 485 data transfer path, a 4-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, 6-wire data cable (3 x 2) can be used. These data cables use 2 pairs for the power supply (doubling the cable cross section), and one pair for the RS 485 data line.

| Capacitance (core-core) | RS485 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.

SSI data cable

For SSI data transfer, a 6-wire, shielded, twisted pair data cable (3 x 2) must be used. One wire pair is used for the supply voltage, one pair for the CLK line, and one pair for the DATA line. The cable lengths that are technically possible can be determined from the T tables.

| Capacitance (core-core) | SSI Interface | | |
|-------------------------|---------------|---------|---------|
| | 125 kHz | 250 kHz | 500 kHz |
| 60 pF | 200 m | 100 m | 30 m |
| 90 pF | 150 m | 80 m | 25 m |
| 120 pF | 100 m | 60 m | 20 m |

| Cable cross section | AWG | Number of WCS readers without heating | | | | Number of WCS readers with heating | | | |
|----------------------|------|---------------------------------------|-------|-------|-------|------------------------------------|------|------|------|
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 0.14 mm ² | ~ 26 | 200 m | 110 m | 70 m | 50 m | 15 m | 10 m | 7 m | 5 m |
| 0.22 mm ² | ~ 24 | 320 m | 170 m | 110 m | 80 m | 30 m | 15 m | 10 m | 7 m |
| 0.25 mm ² | | 350 m | 190 m | 130 m | 90 m | 35 m | 17 m | 12 m | 8 m |
| 0.28 mm ² | | 400 m | 220 m | 150 m | 110 m | 40 m | 20 m | 15 m | 10 m |
| 0.34 mm ² | ~ 22 | 500 m | 250 m | 180 m | 140 m | 50 m | 25 m | 17 m | 12 m |
| 0.50 mm ² | ~ 20 | 500 m | 400 m | 270 m | 200 m | 70 m | 35 m | 25 m | 17 m |

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 pair, 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 ² | 0.25 mm ² |
| 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 5.3 *) 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 |

FACTORY AUTOMATION – SENSING YOUR NEEDS



Worldwide Headquarters

Pepperl+Fuchs GmbH
68307 Mannheim · Germany
Tel. +49 621 776-0
E-mail: info@de.pepperl-fuchs.com

USA Headquarters

Pepperl+Fuchs Inc.
Twinsburg, Ohio 44087 · USA
Tel. +1 330 4253555
E-mail: sales@us.pepperl-fuchs.com

Asia Pacific Headquarters

Pepperl+Fuchs Pte Ltd.
Company Registration No. 199003130E
Singapore 139942
Tel. +65 67799091
E-mail: sales@sg.pepperl-fuchs.com

www.pepperl-fuchs.com

 **PEPPERL+FUCHS**
SENSING YOUR NEEDS